DRAFT
INITIAL STUDY / MITIGATED NEGATIVE DECLARATION

Log Cabin and Our House Diversion Dams Sediment Management Plan

Yuba River Development Project
FERC No. 2246

Prepared For
Yuba County Water Agency
Marysville, California

Prepared By
HDR Engineering, Inc.
Sacramento, California

Date: December 17, 2019

To: Interested Parties

From: Yuba County Water Agency

Subject: Notice of Availability and Intent to Adopt a Mitigated Negative Declaration for the Log Cabin and Our House Diversion Dams Sediment Management Plan

The Yuba County Water Agency (YCWA) has prepared a Draft Initial Study/Mitigated Negative Declaration (IS/MND) to evaluate the potential environmental effects of implementing the updated *Log Cabin and Our House Diversion Dams Sediment Management Plan* (proposed project; Plan). The proposed project is located along Oregon Creek and the Middle Yuba River on YCWA, Tahoe National Forest (TNF), and private lands in Yuba County, Nevada County, and Sierra County. The specific locations are: 1) Disposal Site 1, located off of Marysville Road just south of the New Bullards Bar Dam; 2) Disposal Site 2, located off of Celestial Valley Road; 3) Disposal Site 3, located off of Camptonville Road; 4) Log Cabin Diversion Dam, located behind a gate off of State Route 49 approximately 0.25 mile northeast of the intersection with Marysville Road; 5) Our House Diversion Dam, located behind a gate off of Ridge Road; and 6) Celestial Valley Mitigation Site, located off of Celestial Valley Road. Sediment removal work would be conducted annually, as needed, between September 15 and November 15 after all permits and permissions are acquired. Sediment passage work would be conducted annually, in all years that triggers are met, between October 1 and March 21 after all permits and permissions are acquired.

YCWA has prepared this Draft IS/MND in accordance with the requirements of the California Environmental Quality Act (CEQA) Guidelines. The Draft IS/MND identifies potentially significant impacts related to biological resources, cultural resources, and hydrology and water quality. All impacts are reduced to less-than-significant levels with implementation of proposed mitigation measures.

The Draft IS/MND is being circulated for public review and comment for a 30-day period beginning on December 17, 2019 and ending on January 17, 2020. The Draft IS/MND may be reviewed at: 1) the office of YCWA at 1220 F Street, Marysville, CA 95901; 2) the Yuba County Library at 303 Second Street, Marysville, CA 95901; and 3) the Nevada County Public Library, Grass Valley Library – Royce Branch: 207 Mill Street, Grass Valley, CA 95945-6711. A public notice has been published on December 12, 2019 in the *Union*, and on December 17, 2019 in the *Appeal Democrat*, and *Mountain Messenger* newspapers describing the availability of this CEQA document for review. For questions regarding the Draft IS/MND and documents referenced in the Draft IS/MND, contact Robin Kent, HDR, at robin.kent@hdrinc.com.

Please send written comments on the Draft IS/MND to Robin Kent, c/o HDR, 2379 Gateway Oaks Drive, Suite 200, Sacramento, CA 95833. Comments may also be sent via e-mail to: robin.kent@hdrinc.com. For e-mailed comments, please include the project title (i.e., *Log Cabin and Our House Diversion Dams Sediment Management Plan*) in the subject line, attach comments in Microsoft Word or PDF format, and include the commenter's United States Postal Service mailing address.

Thank you,

Curt Aikens

Curt Aikens
General Manager, Yuba County Water Agency

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Attachment A	*National Best Management Practices for Water Quality Management on National Forest System Lands*- Forest Service Manual
Attachment B	Database Query Data – Special-status Species
Attachment C	Vegetation Community Mapbook
Attachment D	Special-status Species Tables
Attachment E	Aquatic Vertebrate Relocation and Exclusion Plan
Attachment F	Cultural Resources Investigation
Attachment G	Air Quality/Greenhouse Gas Emissions Modeling Output

GLOSSARY - DEFINITIONS OF TERMS, ACRONYMS AND ABBREVIATIONS

Term	Definition
A	
AB	Assembly Bill
ac-ft	acre feet
ADT	Average daily traffic
APN	Assessor's Parcel Nos.
B	
Basin Plan	Basin Plans provide the basis for protecting water quality in California. Basin Plans are mandated by both the Federal Clean Water Act and the State Porter-Cologne Water Quality Act. Sections 13240-13247 of Porter-Cologne specify the required contents of a regional basin plan. For a given region, each plan contains 1) the beneficial uses of each water body; and 2) water quality objectives to ensure the reasonable protection of beneficial uses.
BMP	Best Management Practices
B.P.	Before Present
C	
CalEEMod	California Emissions Estimator Model
CalTrans	California Department of Transportation
CARB	California Air Resources Board
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife; also referred to as Cal Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
Cfs	cubic feet per second. One cfs equals approximately 1.98 acre-feet per day.
CHRIS	California Historical Resources Information System
CHSC	California Health and Safety Code
CNDDB	California Natural Diversity Data Base
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CRHR	California Register of Historical Resources
CRLF	California red-legged frog
CRPR	California Rare Plant Rank
cu yd	cubic yard
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Federal Clean Water Act
D	
dB	Decibels
dBA	An A-weighted noise level
DBH	diameter at breast height
DO	dissolved oxygen
E	
EIR	Environmental Impact Report
EMFAC	On-road vehicle emission factors model
EPA	United States Environmental Protection Agency
ESA	Federal Endangered Species Act
F	
FERC	Federal Energy Regulatory Commission; also referred to as Commission
FERC Project	YCWA's Yuba River Development Project, FERC Project No. 2246. Specifically, the Project facilities and features identified in the existing FERC license.
FGC	Fish and Game Code
Forest Service	United States Department of Agriculture, Forest Service
FRAQMD	Feather River Air Quality Management District
FSS	Forest Service Sensitive
ft	foot or feet
FYLF	foothill yellow-legged frog
G	
GHG	Greenhouse gas
GLO	General Land Office

Glossary (continued)

H	
hp	Horsepower
I	
IEC	International Engineering Company, Inc.
in.	inch(es)
in/sec	Inches per second
IS	Initial Study
J	
K	
L	
LDTs	Light duty pick up trucks
LOS	level of service
LRMP	Land and Resource Management Plan
M	
mg/L	milligrams per second
mi	mile(s)
mm	Millimeter
MND	Mitigated Negative Declaration
MRL	Method reporting limit
MRZ	Yuba County’s Mineral Resource Zone
N	
NAHC	California Native American Heritage Commission
NCIC	North Central Information Center
NFS	National Forest System
NMFS	Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NRHP	National Register of Historical Places
NSAQMD	Northern Sierra Air Quality Management District
NTU	nephelometric turbidity unit
O	
OHP	State Office of Historic Preservation
P	
PAC	Protected Activity Center
Plan	Log Cabin and Our House Diversion Dams Sediment Management Plan
PRC	Public Resources Code
proposed project	Log Cabin and Our House Diversion Dams Sediment Management Plan
PPV	Peak Particle Velocity
Q	
R	
RM	River Mile as measured along the river course, from downstream to upstream, often beginning at a downstream confluence with another river reach.
S	
SE	State Endangered. A species or subspecies listed as endangered
SLF	Sacred land files
SRA	State Responsibility Area
SSC	Species of Special Concern
ST	State Threatened. A species or subspecies listed as threatened under the California Environmental Quality Act.
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
T	
TCR	Tribal Cultural Resources
TMDL	total maximum daily load
TNF	Tahoe National Forest
TTLC	total threshold limit concentration
U	
UAIC	United Auburn Indian Community
USACE	United States Department of Defense, Army Corps of Engineers
USFWS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
V	
VMT	Vehicle-miles traveled

Glossary (continued)

V (cont'd)	
VQO	Visual Quality Objective
VHFHSZ	Very high fire hazard severity zone
W	
WQC	Water Quality Certification
Y	
X	
YCWA	Yuba County Water Agency
YRDP	Yuba River Development Project
Z	

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SECTION 1.0 INTRODUCTION

This Initial Study (IS) was prepared for the implementation of the updated *Log Cabin and Our House Diversion Dams Sediment Management Plan* (proposed project; Plan), and to identify the potential environmental impacts associated with the proposed project. This IS was prepared in accordance with the California Environmental Quality Act (CEQA) Guidelines. Yuba County Water Agency (YCWA) is the lead agency under CEQA.

On November 5, 2013, the Federal Energy Regulatory Commission (FERC) ordered YCWA to implement a sediment management plan to control the buildup of sediment behind Log Cabin Diversion Dam on Oregon Creek and Our House Diversion Dam on the Middle Yuba River. The original Plan was developed in 2014 and then updated in 2018. The Log Cabin and Our House Diversion Dams are part of YCWA's Yuba River Development Project (YRDP), FERC Project Number 2246 (FERC Project).

The FERC Project is located in Yuba, Sierra, and Nevada counties, California, on the main stems of the Yuba River, the North Yuba River, and the Middle Yuba River, and on Oregon Creek, a tributary to the Middle Yuba River.

To satisfy CEQA requirements, this document includes the following:

- IS findings indicating that there is no substantial evidence that, with mitigation, the proposed project would cause a significant impact on the environment
- A proposed Mitigated Negative Declaration (MND)
- A Notice of Intent to Adopt an IS/MND for the proposed project

Pending public review of this document, YCWA intends to adopt the MND and the mitigation monitoring and reporting program, and to approve the proposed project.

1.1 Purposes of an Initial Study

This document is an IS prepared in accordance with CEQA (Public Resources Code [PRC] Section 21000 et seq.) and the CEQA Guidelines (Title 14, Section 15000 et seq. of the California Code of Regulations [CCR]). The purposes of an IS are to: 1) determine whether proposed project implementation would result in significant effects on the environment; 2) identify mitigation measures that could be incorporated into the design, as necessary, to eliminate the proposed project's significant effects, or reduce them to a less-than-significant level; and 3) provide the lead agency with information to use as the basis for deciding whether to prepare a Negative Declaration, an MND, or an Environmental Impact Report (EIR; Title 14, Section 15063). An IS presents the environmental analysis and substantial evidence supporting its conclusions regarding the significance of environmental impacts. Substantial evidence may include technical studies, expert opinion based on facts, or reasonable assumptions based on facts. An IS is neither intended nor required to include the level of detail used in an EIR.

CEQA requires that all state and local government agencies consider the environmental consequences of projects they propose to implement, or over which they have discretionary authority, before implementing or approving those projects. As specified in the CEQA Guidelines, Section 15367, the public agency that has the principal responsibility for carrying out or approving a project is the lead agency for CEQA compliance. YCWA has principal responsibility for carrying out the proposed project and is, therefore, the CEQA lead agency for this IS/MND.

As specified in the CEQA Guidelines, Section 15064(a), if there is substantial evidence, in light of a whole record before a lead agency (such as the results of an IS), that a project, either individually or cumulatively, may have a significant effect on the environment, the lead agency must prepare an EIR. Alternatively, the lead agency may prepare an IS if it determines that there is no substantial evidence that the project may cause a significant impact on the environment. Finally, the lead agency may prepare an MND if, in the course of the IS analysis, it is recognized that the proposed project may have a significant impact on the environment, but that implementing specific mitigation measures would reduce any such impacts to a less-than-significant level (CEQA Guidelines, Section 15064[f]).

YCWA has prepared this IS to document results of an evaluation of the proposed project's potential to affect the environment. Where necessary, mitigation measures have been incorporated to reduce or eliminate any potentially significant proposed project-related impacts. Therefore, an MND has also been prepared for the proposed project.

1.2 Summary of Findings

Section 3.0 of this IS/MND contains the analysis and discussion of potential environmental impacts of the proposed project. Based on the evidence evaluated in that section, YCWA determined that the proposed project would have no impact related to the following resource areas:

- Agriculture and forestry resources
- Land use and planning
- Mineral resources
- Population and housing
- Public services
- Utilities and service systems
- Wildfire

The proposed project would result in less-than-significant impacts on the following resource areas:

- Aesthetics
- Energy
- Geology and soils
- Greenhouse gas emissions
- Hazards and hazardous materials
- Noise
- Recreation
- Transportation

The proposed project would result in less-than-significant impacts, after mitigation is incorporated, on the following resource areas:

- Air quality
- Biological resources
- Cultural resources
- Hydrology and water quality
- Tribal cultural resources

Thus, with the incorporation of mitigation measures described in this IS/MND, the proposed project would have a less-than-significant effect on the environment.

1.3 Document Organization

This document is divided into the following sections:

- **Notice of Availability and Intent to Adopt an IS/MND.** The Notice of Availability and Intent to Adopt an IS/MND provides notice to the public, responsible and trustee agencies, and the county clerk of each county in which the project is located of the availability of this IS/MND, as well as YCWA's intent to adopt the IS/MND for the proposed project.

- **Section 1.0: Introduction.** This section briefly summarizes the proposed project, describes the purposes of the IS, summarizes the findings of this IS/MND, and describes the organization of this IS/MND.
- **Section 2.0: Project Description.** This section describes the purpose of and need for the proposed project, general background, and work elements.
- **Section 3.0: Environmental Checklist.** This section summarizes the analyses of environmental resources using the CEQA Environmental Checklist (CEQA Guidelines,

Appendix G) and presents findings as to whether implementation of the proposed project would result in no impact, a less-than-significant impact, a less-than-significant impact after mitigation, or a potentially significant impact on the environment in each of the resource areas. If any impacts had been determined to remain potentially significant with mitigation incorporated or immitigable, an EIR would have been required. For this proposed project, however, mitigation measures have been incorporated, where needed, to reduce all potentially significant impacts to a less-than-significant level.

- **Section 4.0: Report Authors/Contributors.** This section lists the individuals who prepared or participated in preparation of this IS/MND.
- **Section 5.0: References Cited.** This section lists the references used in preparation of this IS/MND.

SECTION 2.0

PROJECT DESCRIPTION

In 2014, the *Log Cabin and Our House Diversion Dams Sediment Management Plan* was developed by YCWA per a FERC order. The Plan was permitted and approved, with the first sediment removal work performed in 2014. Since then, there have been four sediment removal projects (three at Log Cabin Diversion Dam Impoundment [2014, 2017, and 2018] and one at Our House Diversion Dam Impoundment [2017]) and three sediment passage events at Our House Diversion Dam Impoundment (two in 2017 and one in 2019). The Log Cabin Diversion Dam Impoundment sediment removal events removed 11,000, 7,440, and 7,580 cubic yards (cu yd) of sediment in 2014, 2017, and 2018, respectively. The Our House Diversion Dam Impoundment sediment removal event in 2017 removed 41,100 cu yd of sediment. Additionally, an emergency sediment dredging event was allowed at Our House Diversion Dam Impoundment in winter 2017. In 2018, YCWA coordinated on an update to the Plan with the following resource agencies: United States Department of Agriculture, Forest Service (Forest Service), California Department of Fish and Wildlife (CDFW), State Water Resources Control Board (SWRCB), and United States Department of Fish and Wildlife (USFWS). This Plan update was submitted to FERC for approval on August 10, 2018. Because of this proposed update and the expiration of the majority of the original permits in 2019, YCWA submitted updated permit applications and amendments for the Plan, hereafter referred to as the proposed project. A list of specific permits anticipated to be required is provided in Section 2.8, Project Permitting.

The FERC Project is located in Yuba, Sierra, and Nevada counties on the North Fork, Middle Fork, and main stem of the Yuba River and on Oregon Creek. Major Project facilities, which range in elevation from 280 feet (ft) to 2,049 ft, include: 1) New Bullards Bar Reservoir, Dam, and Penstock; 2) Log Cabin and Our House Diversion Dams and Impoundments; 3) Lohman Ridge and Camptonville Diversion Tunnels; 4) New Colgate and Narrows 2 Powerhouse Tunnels and Penstocks; 5) New Colgate, New Bullards Minimum Flow (i.e., mini hydro), and Narrows 2 Powerhouses; and 6) appurtenant facilities and features (i.e., administrative buildings, switchyards, roads, trails, and gages). The existing YRDP does not include any aboveground open water conduits (i.e., canals or flumes) or any transmission lines. The FERC Project includes two undeveloped recreation sites at Log Cabin and Our House Diversion Dams, both located on Forest Service National Forest System (NFS) land managed by the Tahoe National Forest (TNF) and within the existing FERC Project boundary. The FERC Project boundary encompasses all of the areas under the jurisdiction of FERC associated with the FERC Project[1].

[1] The sites associated with the sediment management plan make up only a portion of the sites within the FERC Project Boundary.

2.1 Purpose of and Need for Project

The purpose of the proposed project is to prescribe procedures and guidelines for the management of sediment behind Log Cabin Diversion Dam and Our House Diversion Dam. The objectives of the proposed project are twofold: 1) to provide for dam safety and proper functioning of FERC Project facilities, especially the fish release and low level outlet valves; and 2) to maintain the health of the aquatic environment downstream of the dams by allowing the passage of sediments that occur behind the dams.

2.2 Project Sites

Activities under the proposed project would occur at six primary sites, described below: Disposal Site 1, Disposal Site 2, Disposal Site 3, Log Cabin Diversion Dam, Our House Diversion Dam, and Celestial Valley Mitigation Site.

The main features of the proposed project area are: Log Cabin Diversion Dam and Impoundment (3.57 acres); Our House Diversion Dam and Impoundment (10.10 acres); Disposal Site 1 (9.51 acres); Disposal Site 2 (11.60 acres); Disposal Site 3 (80.00 acres), Celestial Valley Mitigation Site (2.50 acres), Log Cabin Temporary Laydown area (0.34 acre), Our House Temporary Laydown area (0.28 acre), and access roads.

Figure 2.2-1 shows the general site locations.

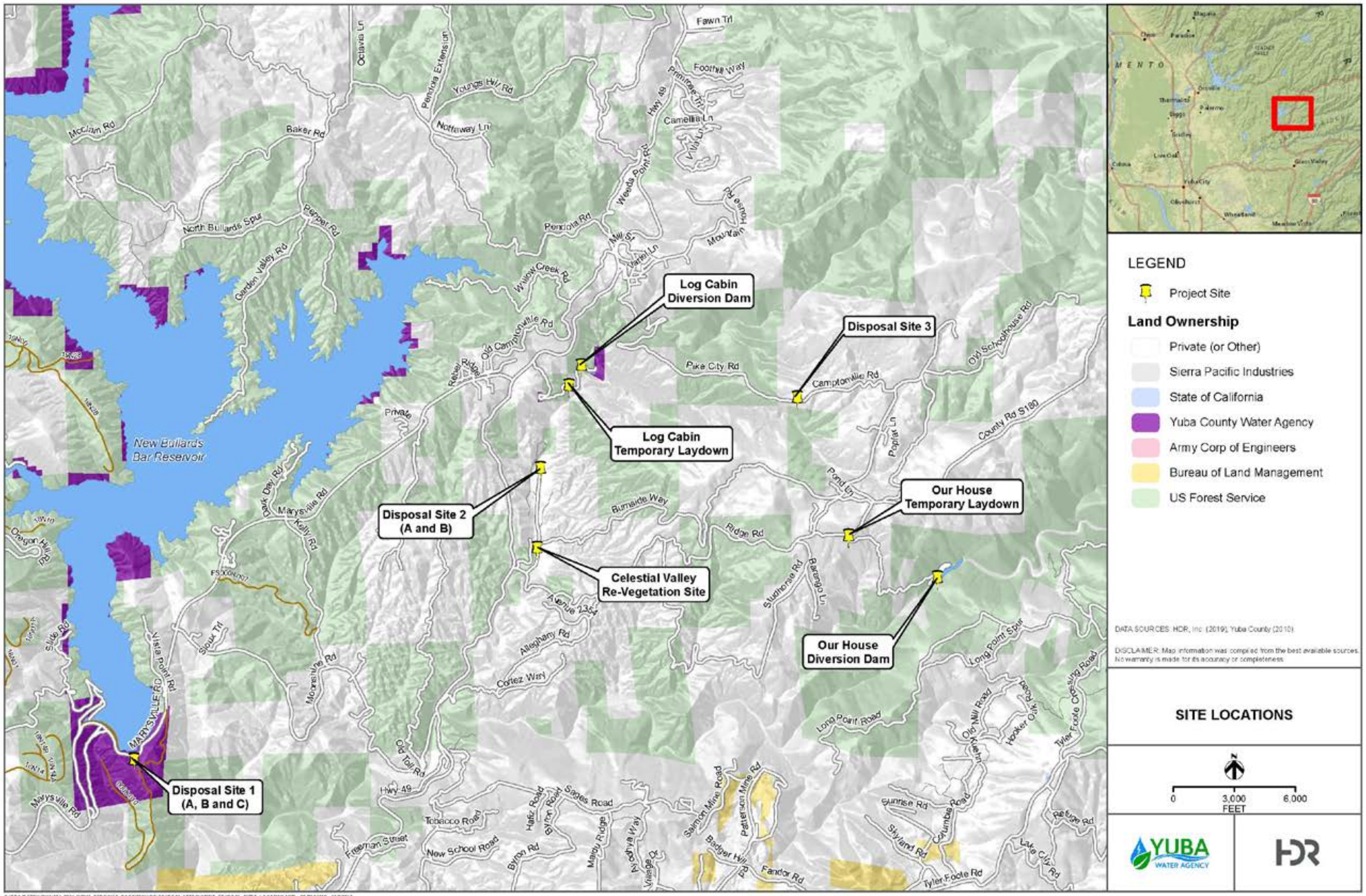

Figure 2.2-1. General site locations.

2.2.1 Disposal Site 1

Disposal Site 1 is on YCWA-owned land within the FERC Project boundary and is located behind a locked gate. Disposal Site 1 is approximately a 9-mile drive from Log Cabin Diversion Dam and a 15-mile drive from Our House Diversion Dam. There are three sub-areas at Disposal Site 1: A, B, and C. Figure 2.2-2 shows the survey map of Disposal Site 1, while Figures 2.2-3 through 2.2-5 are photographs of each of the sub-areas.

Disposal Site 1 has been used several times during past sediment removal events as a placement/disposal area for the removed sediment from Log Cabin and Our House Diversion Dam Impoundments. Sediment from removal at the two impoundments was deposited at Disposal Site 1 in 2014, 2017, and 2018, for a total of 67,020 cu yd. A 2018 land survey conducted by YCWA indicated that Sites 1A and 1B could hold up to an additional 40,000 cu yd of sediment. Site 1C is not planned for use at this time, but may be used in the future.

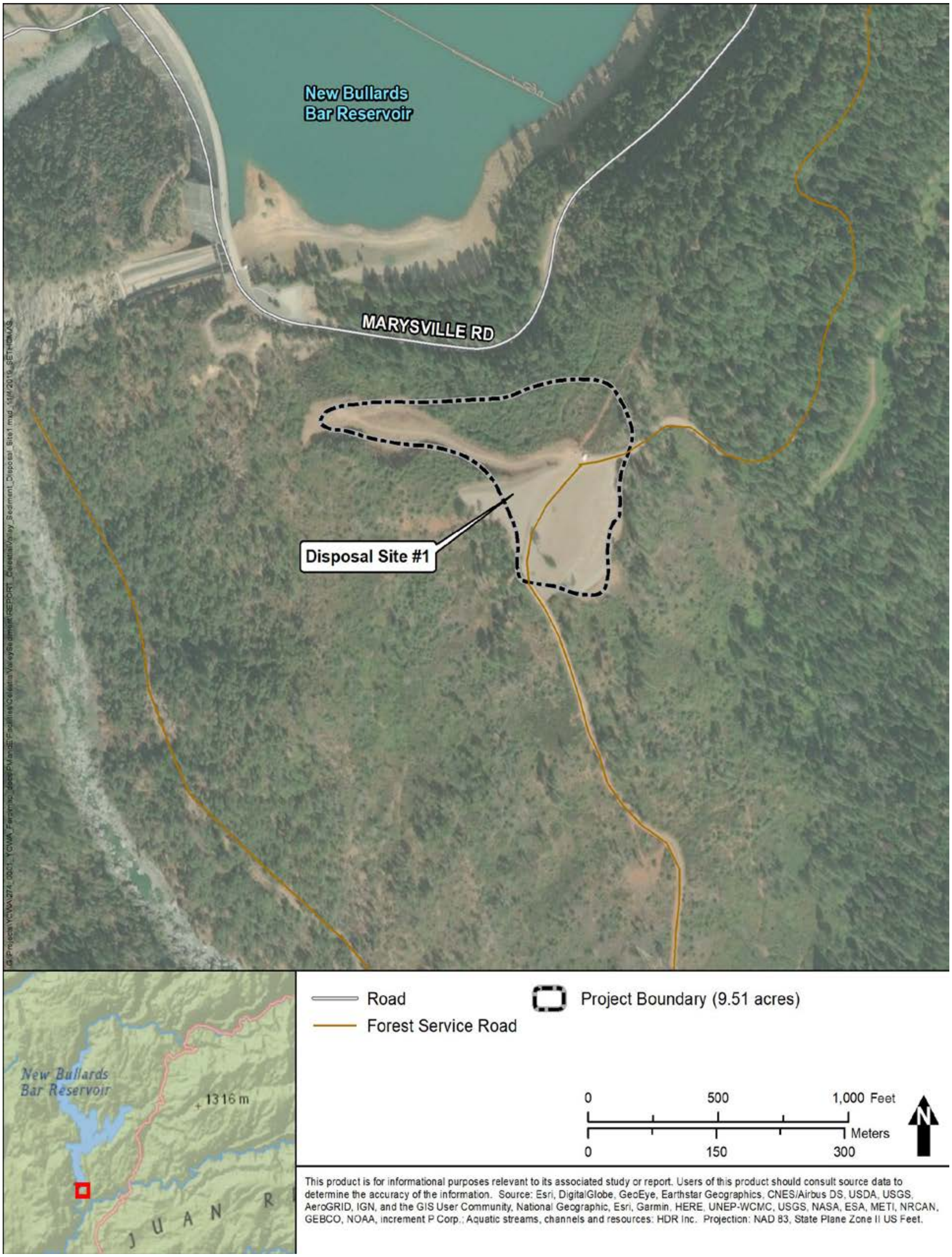

Figure 2.2-2. Disposal Site 1 map.

Figure 2.2-3. Disposal Site 1A post-sediment placement (2018).

Figure 2.2-4. Disposal Site 1B post-sediment placement (2018).

Figure 2.2-5. Disposal Site 1C (2014).

2.2.2 Disposal Site 2

Disposal Site 2 is located approximatey 5.1 miles (mi) northeast of North San Juan in Yuba County. The site is located on private property and requires special permission to access. Land use in the area is predominately rural residential and industrial. The site is generally flat and drains west into Oregon Creek. Annual grassland, riparian forest, and wetland features are the main biological communities present on the site. In total, the site is estimated to have a capacity of approximately 150,000 cu yd of sediment. There are two sub-areas at Disposal Site 2: A and B. The space between Sites 2A and 2B is used by a private land owner and is not available for disposal. Figure 2.2-6 is a map showing Disposal Sites 2A and 2B, while Figures 2.2-7 through 2.2-10 are photographs of the sub-areas.

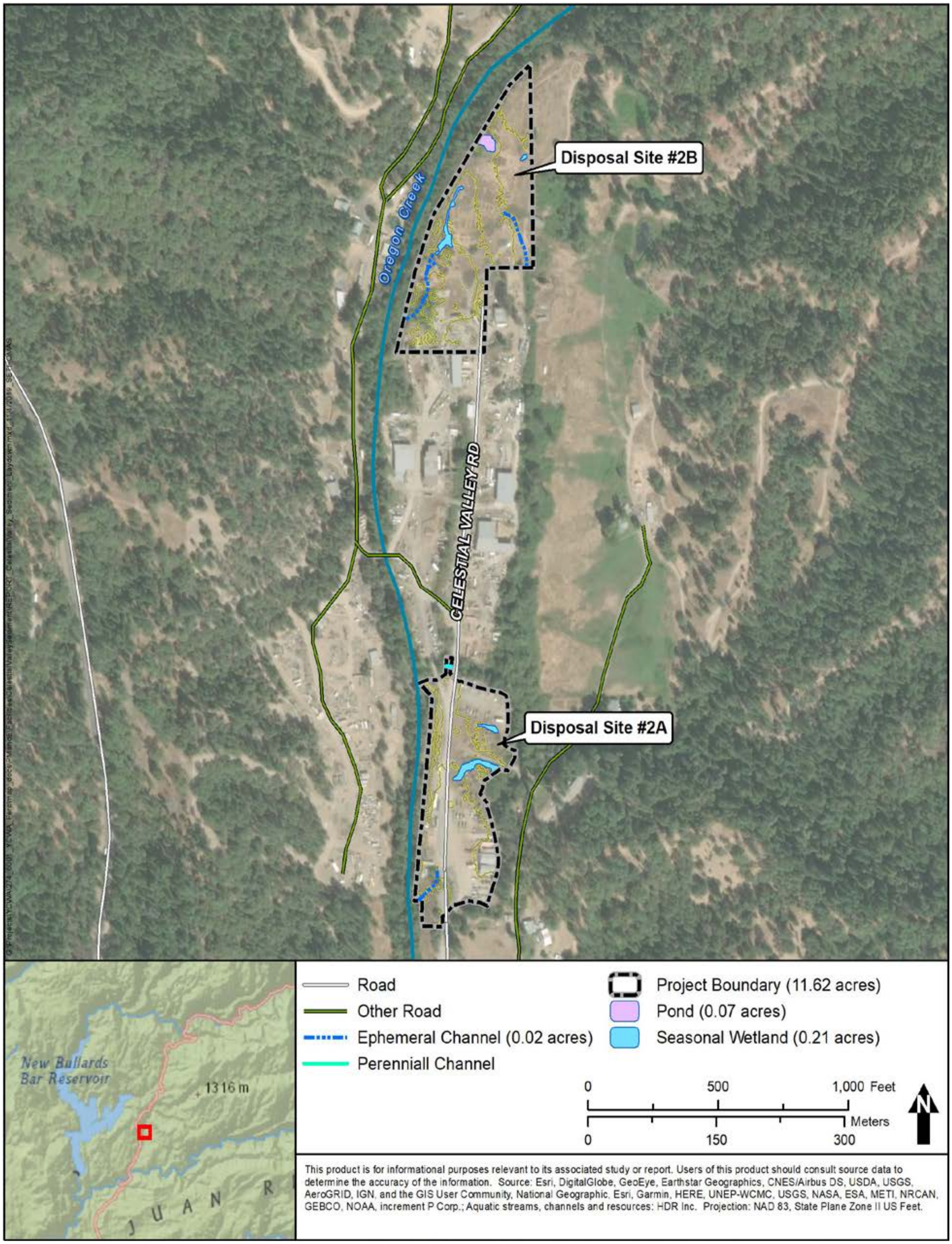

Figure 2.2-6. Disposal Site 2 map.

Figure 2.2-7. Disposal Site 2A looking toward edge of property.

Figure 2.2-8. Disposal Site 2A looking toward edge of property.

Figure 2.2-9. Disposal Site 2B looking west toward edge of property.

Figure 2.2-10. Disposal Site 2B looking north toward center of site.

2.2.3 Disposal Site 3

Disposal Site 3 is an 80-acre parcel just west of the community of Pike in Sierra County. The site is approximately 2 mi east of Log Cabin Diversion Dam and 2 mi northwest of Our House Diversion Dam. The land is currently privately owned, but will be owned by YCWA prior to placement of sediment. The primary land use in the area has been timber production. However, evidence of past hydraulic mining is present (i.e., hydraulic pits). The site generally slopes downward to the northwest, with ephemeral drainages flowing into Oregon Creek. Ponderosa pine (*Pinus ponderosa*) forest makes up the main biological community at the site. Currently, the site's exact capacity has not been estimated, but it is likely capable of storing several decades of future sediment disposal totaling at least 1.4 million cu yd. Figure 2.2-11 is a map of Disposal Site 3.

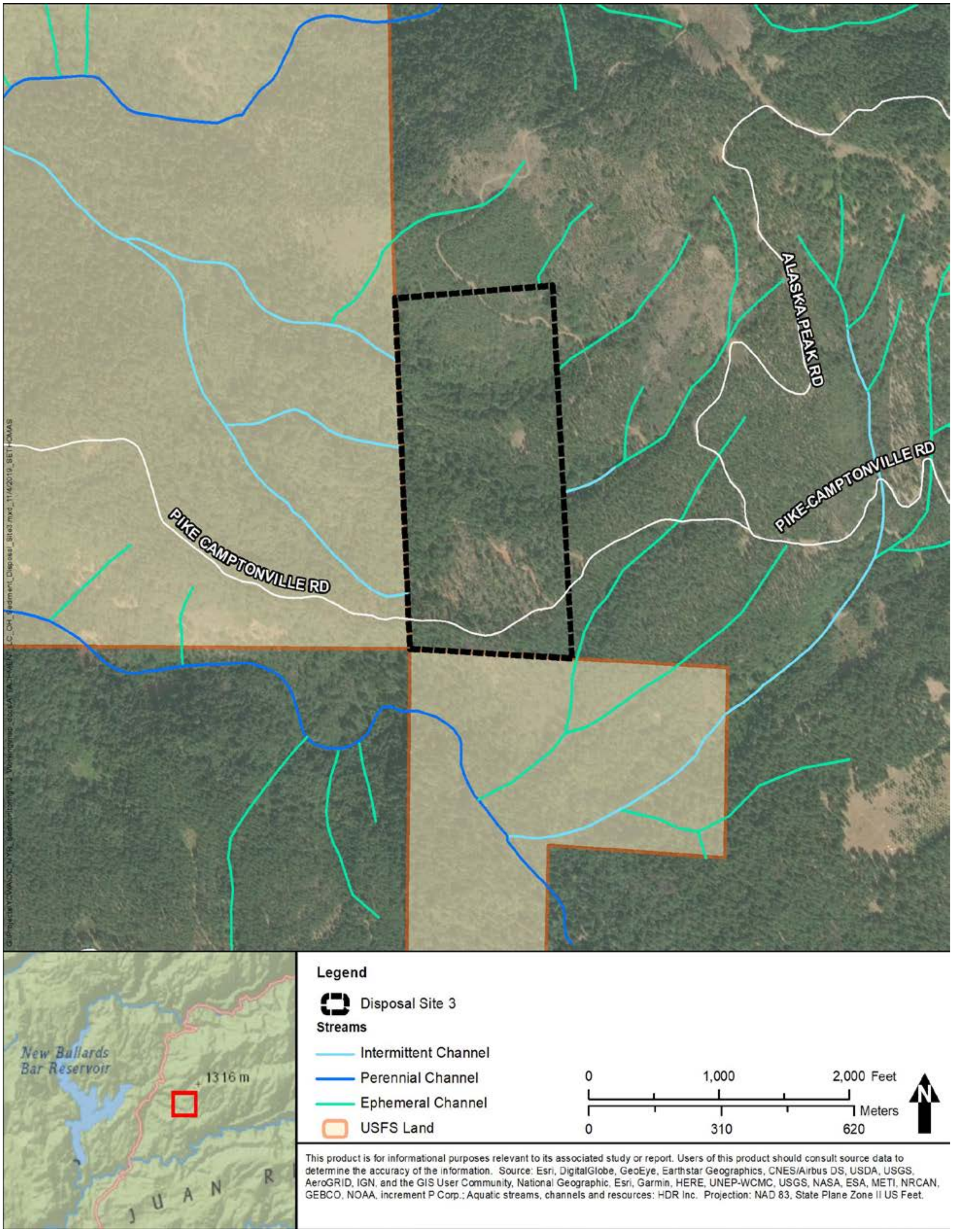

Figure 2.2-11. Disposal Site 3 map.

2.2.4 Log Cabin Diversion Dam

Log Cabin Diversion Dam is located on NFS land within TNF. Access to Log Cabin Diversion Dam is via a gated, paved road off of State Route 49, approximately 0.25 mile northeast of the intersection of State Route 49 and Marysville Road. The gate at the intersection of State Route 49 and the access road is normally closed and locked.

Log Cabin Diversion Dam is a 105-ft-radius, concrete arch dam located on Oregon Creek 4.3 mi upstream of the confluence with the Middle Fork Yuba River in Yuba County. At maximum pool, the dam can impound about 90 acre-feet (ac-ft) of water. The dam is 53 ft high with a crest length of 300 ft, a crest elevation of 1,979 ft, and a drainage area of 29.1 square miles. The dam has a spillway, a fish release outlet valve used for releasing FERC-mandated minimum instream flow requirements, and a low level (5-ft-diameter) outlet valve. The uncontrolled spillway, with the spillway crest at an elevation of 1,970 ft, is ungated and has a maximum capacity of 12,000 cubic feet per second (cfs). The fish release outlet valve has an invert elevation of 1,948 ft at the inlet and an engineer's estimated maximum capacity of 18 cfs. The outlet is controlled by a hand-operated, 18-inch valve on the downstream end of the outlet. The low level outlet has an invert elevation of 1,936 ft at the inlet, and an engineer's estimated maximum capacity of 348 cfs. The low level outlet is controlled by a slide gate on the upstream face of the dam that is operated by a two-person mobile gasoline powered engine. Figure 2.2-12 shows a map of the Log Cabin Diversion Dam Impoundment, while Figures 2.2-13 and 2.2-14 are photographs of the site.

YCWA has records of sediment removal operations at Log Cabin Diversion Dam occurring in 1972 (~40,000 cu yd), 1988 (~32,000 cu yd), and 1997 (unknown amount). In 2014, YCWA returned the impoundment to near original conditions by removing approximately 11,000 cu yd of sediment. In fall 2017 and fall 2018, YCWA removed an additional 7,440 and 7,580 cu yd of sediment, respectively, from the impoundment and deposited it at Disposal Site 1.

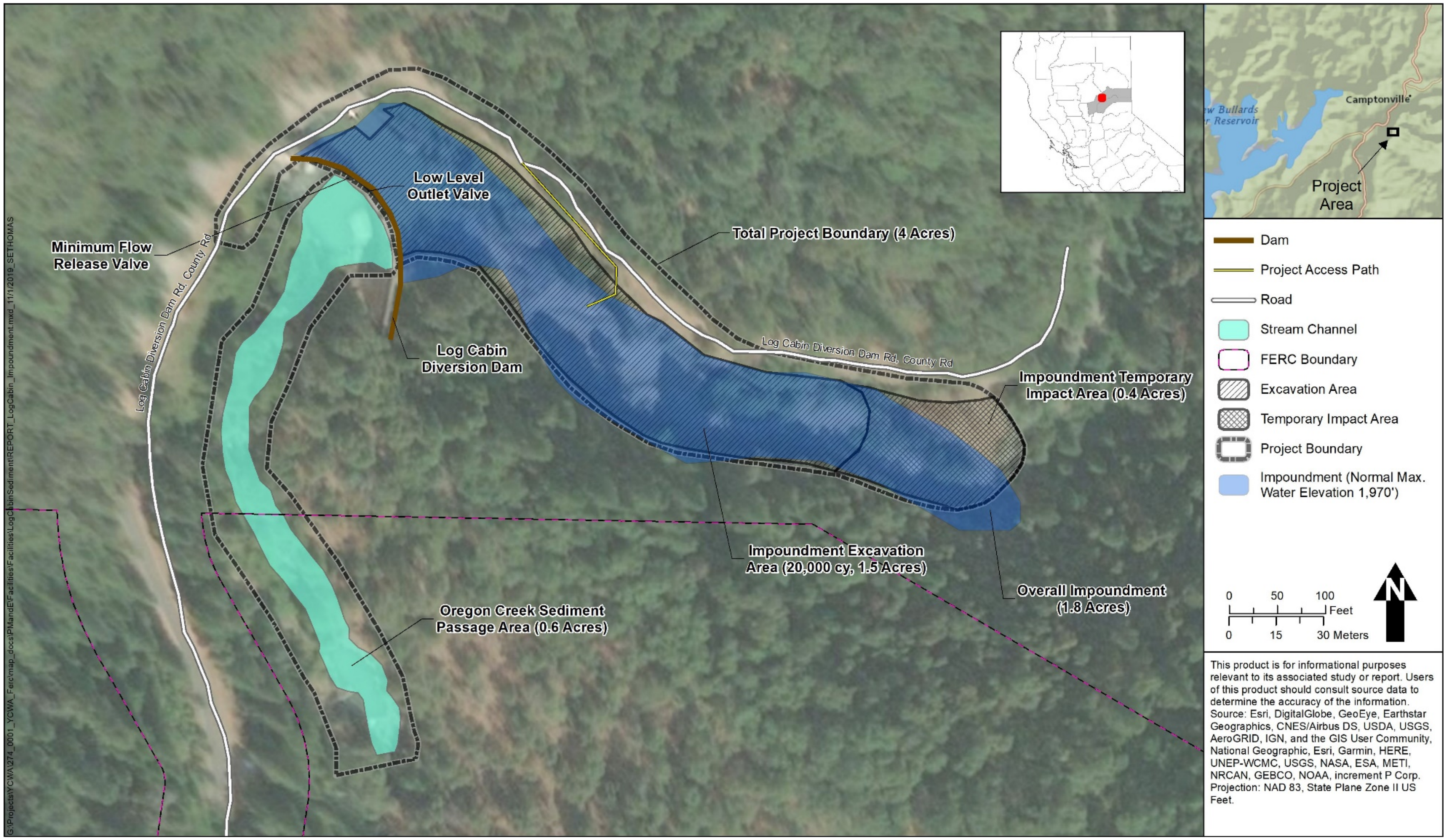

Figure 2.2-12. Log Cabin Impoundment map.

Figure 2.2-13. View to the east at downstream face of Log Cabin Diversion Dam. The majority of discharge shown in the photograph is through the fish release valve. The low level outlet valve is shown to the right of the fish release valve.

Figure 2.2-14. View to southwest at upstream face of Log Cabin Diversion Dam. The intake for the fish release valve is marked by an "A;" the location of the intake valve stem for the low level valve is marked with a "B."

2.2.5 Our House Diversion Dam

Our House Diversion Dam is located on NFS land within TNF. Access to Our House Diversion Dam is via Ridge Road off of State Route 49, approximately 2 mi south of the intersection of State Route 49 and Marysville Road. The entrance is accessed by traveling approximately 4.5 mi down Ridge Road to Our House Diversion Dam Road, and then traveling south and east on Our House Diversion Dam Road approximately 1.5 mi to the dam. Our House Diversion Dam Road is gated at a location on the access road about 500 ft uphill from the dam. The gate near the dam is normally closed and locked.

Our House Diversion Dam is a 130-ft-radius, double curvature, concrete arch dam straddling the border between Sierra County and Nevada County on the Middle Fork Yuba River 12.6 mi upstream of its confluence with the North Fork Yuba River. At maximum pool, the dam can impound about 280 ac-ft of water. The dam is 70 ft high with a crest length of 368 ft, a crest elevation of 2,049 ft, and a drainage area of 144.8 square miles. The dam has a spillway, a fish release outlet valve used for releasing FERC-mandated minimum flow requirements, and a low level (5-ft-diameter) outlet valve. The spillway, with a spill crest elevation of 2,030 ft, is ungated and has a maximum capacity of 60,000 cfs. The fish release outlet valve has an invert elevation of 1,999 ft at the inlet and an engineer's estimated maximum capacity of 59 cfs when the pool is at the invert (2,015 ft) of the Lohman Ridge Diversion Tunnel, which diverts water from the Middle Fork Yuba River to Oregon Creek. The fish release outlet is controlled by a hand-operated, 24-inch (in) valve on the downstream end of the outlet. The low level outlet has an invert elevation of 1,989.96 ft at the inlet and an engineer's estimated maximum capacity of 463 cfs when the pool is at the invert of the Lohman Ridge Diversion Tunnel. The low level outlet is controlled by a slide gate on the upstream face of the dam that is operated by a two-person mobile gasoline powered engine. Figure 2.2-15 shows a map of the Our House Diversion Dam Impoundment, while Figures 2.2-16 and 2.2-17 are photographs of the site.

YCWA has records of five sediment removal operations at Our House Diversion Dam. In 1986, an unquantified amount was removed, and the location of disposal was not specified; between 7,333 and 15,000 cu yd were estimated to have been passed downstream through the low level release valve, along with an additional unknown amount approximately 1 month later. In 1992, 27,595 cu yd of sediment were removed and disposed of at a site at Sierra Mountain Mills. In 1997, 67,894 cu yd of sediment were removed and sent to a disposal site on NFS land. On December 31, 2005, the removal of 80,000 cu yd of sediment was completed, and the sediment was disposed of in an old quarry site on Marysville Road on NFS land. In 2017, YCWA removed approximately 41,100 cu yd of sediment from the impoundment and placed the sediment at Disposal Site 1.

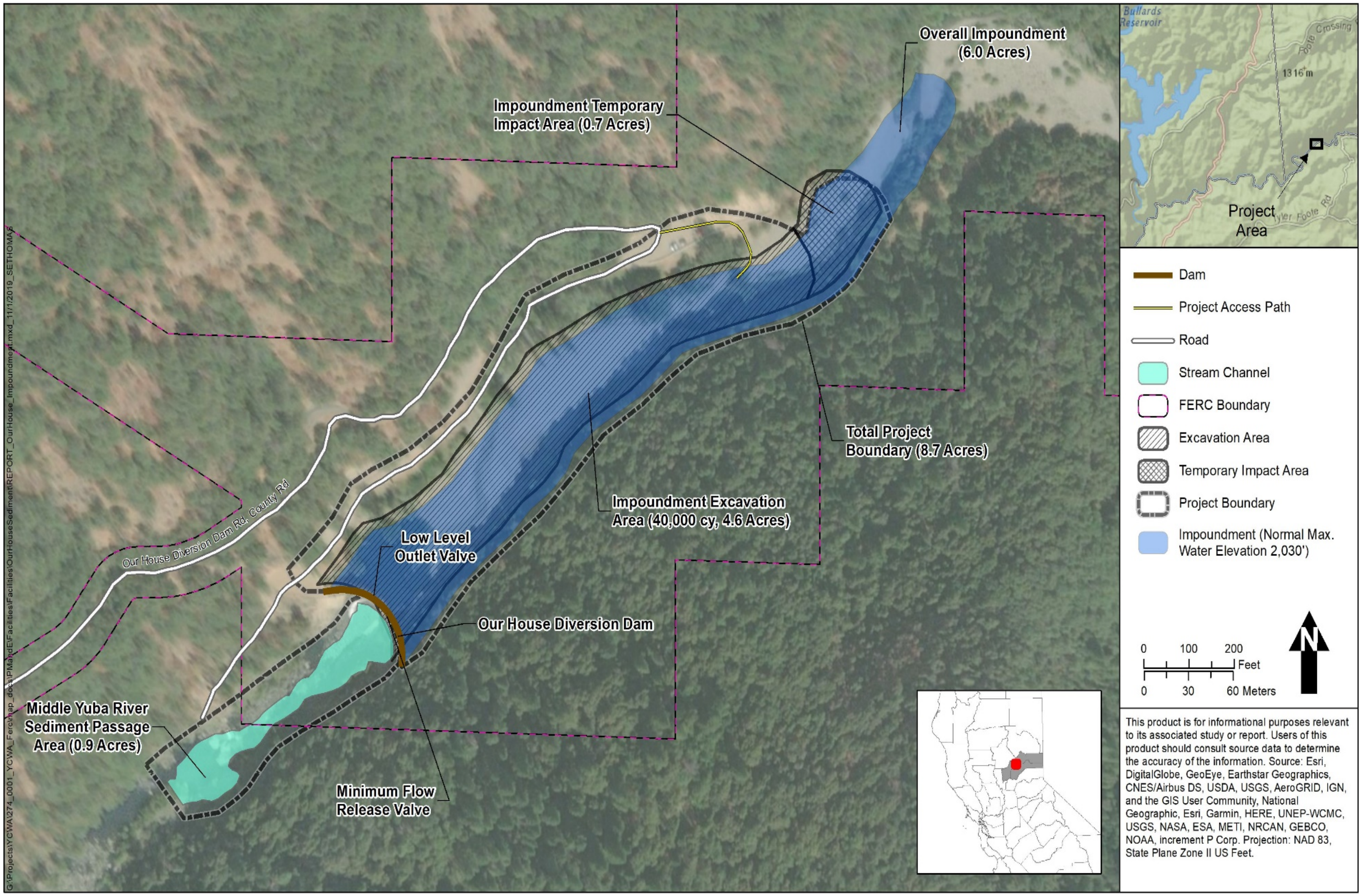

Figure 2.2-15. Our House Impoundment map.

Figure 2.2-16. View looking east at downstream face of Our House Diversion Dam. The majority of discharge shown in the photograph is through the fish release valve. A minor amount of gate leakage is occurring through the low level outlet valve, which is shown below the minimum flow release valve.

Figure 2.2-17. View looking south at upstream face of Our House Diversion Dam. The inlets for the low level valve and the fish release valve are located below the operator, as indicated by the arrow.

2.2.6 Celestial Valley Mitigation Site

As described further in Section 2.3.4.4.3, approximately 193 willows (*Salix* spp.) with a diameter at breast height (DBH) of less than 5 inches and 17 willows with a DBH of 5 inches or greater would require removal at Our House Diversion Dam Impoundment prior to removal of sediment. In addition, Fremont's cottonwood (*Populus fremontii*) could require removal. YCWA proposes to mitigate for all removed willow trees at a ratio of 2:1 and all removed Fremont's cottonwood at a ratio of 4:1. Willows would be mitigated per the cumulative DBH of trees removed that are above 4 inches. Fremont's cottonwood would also be mitigated per the cumulative DBH of trees removed that are above 4 inches. Cuttings are expected to be installed after being taken directly from the willow/cottonwood trees found within the vicinity of the work area at appropriate planting times (October to December or February to April in 2019 or 2020). Revegetation would be consistent with agency permits. Table 2.2-1 summarizes the total number of cuttings anticipated to be installed.

The proposed mitigation site is located along Celestial Valley Road approximately 3.6 mi northeast of the community of North San Juan in Yuba County. The area is approximately 800 feet in length, stretching from the center of Oregon Creek to the western edge of Celestial Valley Road, and owned by the Forest Service. Figure 2.2-18 provides a revegetation site map.

The mitigation site would be separated into two components, both of which are located on the east bank of Oregon Creek. The active planting area would be comprised of approximately 0.28 acre of space for all cuttings described in Table 2.2-1. A passive enhancement area of 0.18 acre would occur in areas where live native trees already occur in the mitigation site. Passive enhancement would consist of the removal of Himalayan blackberry (*Rubus armeniacus*) and periodic maintenance by the biological monitor to allow for the existing willow stand to spread. Revegetation criteria and maintenance activities would be consistent with agency permits. All Himalayan blackberry management would be performed without chemical control.

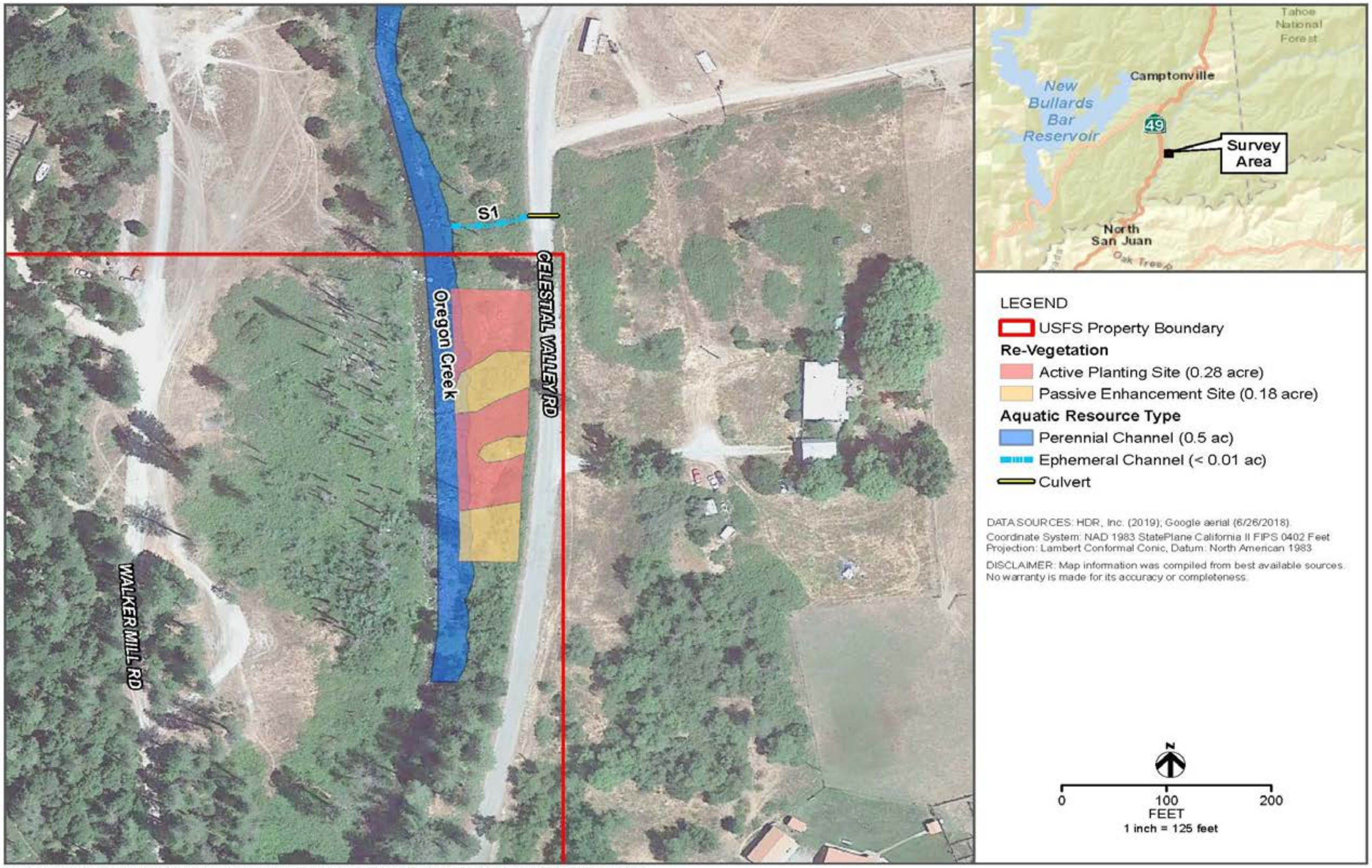

Figure 2.2-18. Celestial Valley Mitigation Site map.

Table 2.2-1 Cutting species and quantities.

Common Name	Scientific Name	Total Quantity
Willow	*Salix* spp.	430
Fremont's cottonwood	*Populus fremontii* ssp. *fremontii*	4
Note: The total number of cuttings of willows is expected to be equal to value of the following formula: [(2X/1.5) + 0.15X] where X is the cumulative DBH of willow trees removed above 4 inches DBH, 2 is the factor to apply the mitigation ratio, 1.5 is the expected diameter of all cuttings, and 0.15 is an additional amount to compensate for expected dieback. From application of this formula, it was determined that 430 cuttings of willows should be installed.		

2.3 Sediment Management Activities

Sediment management at both Log Cabin and Our House Diversion Dams includes five components: 1) maintenance of minimum pools; 2) passage of sediment; 3) remedial action required by blockage of outlets, as necessary; 4) planned mechanical removal of sediment, as necessary; and 5) emergency removal of sediment. Specific details for sediment management operations can be found in the 2018 Sediment Management Plan (YCWA 2018).

2.3.1 Maintenance of Minimum Pools

Currently, YCWA attempts to maintain a pool throughout the year at Our House Diversion Dam and would continue to do so. YCWA does not operate similarly at Log Cabin Diversion Dam. As a result, at Our House Diversion Dam, much of the sediment that enters the impoundment settles at the upstream end of that impoundment and never reaches the dam. At Log Cabin Diversion Dam, sediment tends to accumulate at the downstream end at or near the dam, which occasionally affects the proper operations of the Log Cabin Diversion Dam's low level outlet and fish release valves.

2.3.2 Passage of Sediment

Opening of low level outlet valves in diversion dams is an effective measure to pass sediment that otherwise would accumulate behind the dams, to the river downstream of the dam. The original operation and maintenance manuals for Log Cabin and Our House Diversion Dams recommended that "sluicing should be done periodically to prevent the buildup of gravel and silt below the sill of the tunnel intake. This should be done during a period of high flow to insure [sic] efficient sluicing" (YCWA 2018). The opening is generally scheduled for winter so that the high spring flows would continue to mobilize and redistribute moderate sized sediment below the dam.

At Log Cabin Diversion Dam, at least once between October 1 and March 21 when mean daily natural inflow to the Log Cabin Diversion Dam Impoundment is estimated to be 540 cfs,[2] YCWA would fully open the low level outlet valve to allow the passage of sediment. The valve would remain open to full capacity for at least 9 consecutive days. When the valve is being closed, it would occur over 2 days to gradually reduce flow and sediment as follows: YCWA would close the low level outlet valve to approximately 50 percent (by area) of the orifice opening for 1 day; by noon on the next day, YCWA would close the low level outlet valve entirely. YCWA may close the low level outlet valve during the 9-day period if mean daily natural inflow into the impoundment, measured as described above, is estimated to be less than 540 cfs or if significant reduction of flow through the valve indicates blockage. If YCWA does close the valve prematurely, it would notify the Forest Service, CDFW, and SWRCB of the reason for premature closure within one business day and provide YCWA's plans for further sediment passage or actions needed to restore the valve to full functionality. During periods when the valve is open, YCWA would inspect the valve at least once per day during business hours. The valve may be opened more than once in a given year under the conditions above between October 1 and March 21 to meet objectives of the Plan.

At Our House Diversion Dam, at least once between October 1 and March 21 when mean daily inflow into the Our House Diversion Dam Impoundment is estimated to be 1,500 cfs[3] or greater, YCWA would fully open the low level outlet valve. The valve would remain open to full capacity for at least 9 consecutive days. When the valve is being closed, it would occur over 2 days to gradually reduce flow and sediment as follows: YCWA would close the low level outlet valve to approximately 50 percent (by area) of the orifice opening for 1 day; by noon on the next day, YCWA would close the low level outlet valve entirely. YCWA may close the valve during the 9-day period if mean daily inflow into the impoundment is estimated to be less than 1,500 cfs or if significant reduction of flow through the valve indicates blockage. If YCWA does close the valve prematurely, it would notify the Forest Service, CDFW, and SWRCB of the reason for premature closure within one business day and provide YCWA's plans for further sediment passage or actions needed to restore the valve to full functionality. During periods when the valve is open, YCWA would inspect the valve at least once per day during business hours. The valve may be opened more than once in a given year under the conditions above between October 1 and March 21 to meet objectives of the Plan.

2.3.3 Remedial Action Required by Blockage of Outlets

If after October 1, YCWA determines that any one of the Log Cabin or Our House Diversion Dams' fish release valves or low level outlet valves has been partially or fully blocked by sediment, YCWA, consistent with existing permits, could take remedial actions at that valve prior to April 1 or April 10 of the following year (as described in the following paragraphs) to return that valve to proper functioning condition.

[2] Calculated by adding the flow at United States Geological Survey (USGS) streamflow gage 11409400 and the flow into the Camptonville Diversion Tunnel, and subtracting from that total the flow into the Lohman Ridge Diversion Tunnel.
[3] Calculated by adding the flow from Lohman Ridge Diversion Tunnel with the flow recorded at USGS streamflow gage 11400880.

This work would include one or both of two methods. The first method would be to use air and/or water nozzles to blow sediment out of the valves. The second method would be to use a suction dredge to remove, at each dam, up to 250 cu yd of accumulated sediment upstream of the fish release or low level outlet valve. This process is referred to as suction dredging. The sediment would be pumped around the dam and discharged directly to the river downstream of the dam. During these activities, YCWA would reduce flows over the spillway to ensure the safety of the divers working in the diversion pool and to maintain minimum flow requirements. Once sediment has been cleared from the outlet, YCWA would open the low level outlet to flush the outlet and distribute the deposited material farther downstream. The low level outlet would then be closed gradually over the course of 4 days, with the goal of avoiding any additional sediment buildup that could clog the outlets. YCWA could close the valve completely at any time during the 4 days if YCWA anticipated that the outlet was at risk of being reclogged.

All activities related to suction dredging would be completed by April 1 unless high flows preclude safe access, in which case suction dredging could continue until no later than April 10.

2.3.4 Planned Mechanical Removal of Sediment

Even with the benefits of maintaining a pool in the Our House Diversion Dam Impoundment and periodic opening of the low level outlet valves, YCWA is often required to remove sediment from either the Log Cabin or Our House Diversion Dam Impoundments. When sediment requires removal, mechanical removal may be necessary. However, when possible, YCWA would use handwork (i.e., shovels), as opposed to mechanical removal, as a remediation method for sediment buildup in front of the valves at the diversion dams.

Planned sediment removal, when necessary, would occur in summer or early fall when inflow into the impoundment is low (i.e., during drier months when inflow is less than or equal to the minimum instream flow requirement). If sediment removal were planned, YCWA would draw down the pool in the impoundment as low as possible immediately prior to the start of work and divert inflows around the diversion so that sediment could be excavated in the dry. The water would be drained in a way to avoid a seasonal increase to instream flow downstream of the dams, such as allowing it to drain naturally through the valve or pumping it into the diversion tunnels. YCWA does not propose to suction dredged sediment from the diversion pool.

YCWA estimates that the maximum amount of sediment that would be removed at any one event from the Log Cabin Diversion Dam Impoundment would be 40,000 cu yd; the maximum amount of sediment that would be removed at any one event from the Our House Diversion Dam Impoundment is estimated to be 100,000 cu yd. However, YCWA anticipates that any single sediment excavation would be much less than these estimates because the purpose of the proposed project is to manage sediment in the impoundments while minimizing mechanical excavation.

If mechanical excavation is needed, it would occur in eight steps: 1) notifying appropriate agencies about planned sediment removal; 2) testing sediment for metals; 3) mobilizing workers and equipment; 4) initiating the diversion and control of water; 5) removing sediment; 6) stockpiling sediment and stabilizing the stockpile; 7) demobilizing workers and equipment; and 8) issuing a final report. Each step is described in more detail in the following sections.

2.3.4.1 Notification of Appropriate Agencies

All work would occur in accordance with applicable local, state, and federal regulations. No later than 30 days prior to the date when the removal is scheduled to occur, YCWA would provide a written notification (maybe via e-mail) to FERC, the United States Army Corps of Engineers (USACE), USFWS, Forest Service, SWRCB, Central Valley Regional Water Quality Control Board (CVRWQCB), and CDFW stating that YCWA intends to mechanically remove sediment from the impoundment. All mitigation measures and best management practices (BMPs) would be implemented during all mechanical sediment removal activities as set forth in the associated permits and described in the resource sections in the Environmental Checklist. Additionally, any other parties required to be notified by regulatory permits would be included.

2.3.4.2 Sediment Testing for Metals

Prior to removing any sediment from an impoundment, YCWA would collect three to five bulk samples of the sediment and would transport the samples to a state-certified laboratory for determination of metals content. Sediments would be characterized as hazardous or nonhazardous based on the results of the sample testing. Sampling and handling procedures would be in accordance with the United States Environmental Protection Agency's (USEPA) *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods* (SW-846; SEPA 2014). Sediment samples would be placed in laboratory-quality sample containers and preserved in accordance with SW-846. Each sediment sample would be recorded and transported using an approved chain-of-custody form. The results of the testing would be forwarded to FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB, and CDFW prior to any ground-disturbing activities. If sediment testing results show hazardous amounts of metals, additional confirmatory samples may be taken, and an alternate plan for sediment stockpiling or disposal would be developed in accordance with the test results and appropriate regulations. No hazardous material would be removed from the impoundment until the alternate plan is in place and all necessary permits and approvals have been obtained.

2.3.4.3 Mobilization

At both Log Cabin and Our House Diversion Dams, mobilization of workers and equipment would start approximately 3 to 4 weeks prior to instream sediment removal (i.e., 3 to 4 weeks prior to September 15). Mobilization would involve flagging of any known or observed environmentally sensitive resources; worker environmental awareness training; staging of all contractor equipment; any necessary grading of staging areas and access roads; any upland vegetation removal required to complete the work; and installing and testing of the water bypass system pipes, generators, and controls. All mobilization activities would occur above the ordinary high water mark.

Prior to any other mobilization activities occurring, the onsite biologist would flag any known or unknown sensitive resources, including cultural resources, special-status species, sensitive habitats, target nonnative invasive plants, and other predetermined areas with significant sensitive resources to ensure that no activities are conducted in those areas. The onsite biologist would also present a worker environmental awareness training to all contractors prior to the start of any work.

The program would be given to any new contractors that come onto the site throughout the duration of the project.

Prior to any contractor vehicles and equipment entering the project site, the onsite biologist would inspect the site for invasive species. All visible soil, plant materials, animal remnants, or any other signs of invasives on vehicles and equipment would be removed prior to entering the project site. Additionally, all vehicles and equipment would be inspected for leaks. Vehicle and equipment maintenance and refueling areas would be designated by the Stormwater Pollution Prevention Plan (SWPPP). Proper spill clean-up materials and fire suppression equipment would be mobilized on site. As new vehicles and equipment arrive at the project site, they would be inspected. The practice of inspecting vehicles and equipment before they enter the project site would continue throughout the duration of the project.

All ingress and egress of vehicles would occur on access roads as shown in Figure 2.3-1; no off-road driving would be allowed outside of the excavation areas, disposal sites, or staging areas. No road or staging area grading is explicitly planned at this time. However, minor grading may be necessary to ensure both safe ingress and egress to and from the project site, and safe siting and operation of equipment (i.e., generators). No grading activities would occur until the SWPPP permit is active.

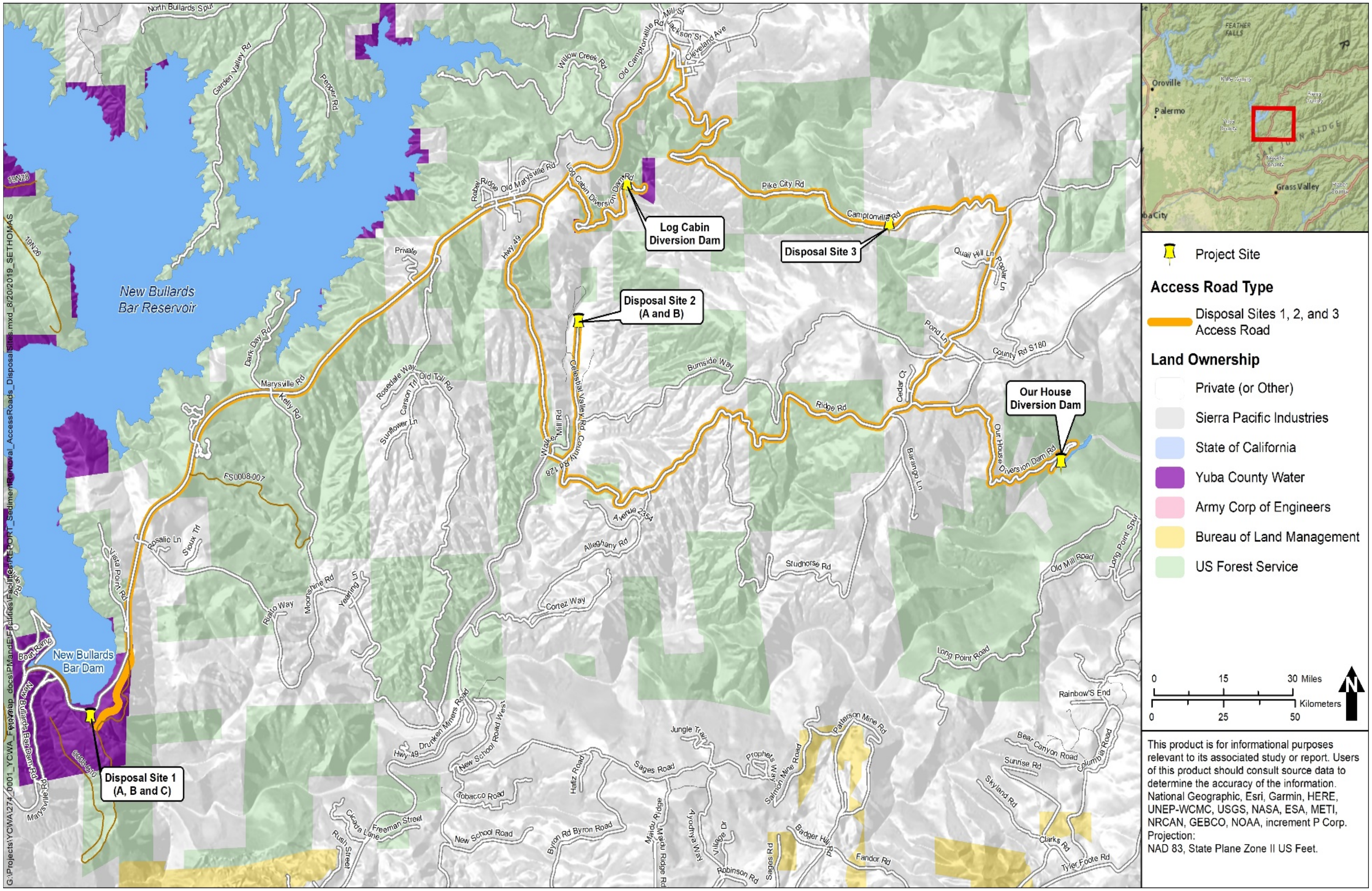

Figure 2.3-1. Access road map.

2.3.4.4 Diversion and Control of Water

Following the onsite biologist's resource flagging and trainings described in Section 2.3.4.3, a water bypass would be installed and tested before mechanical sediment removal would begin. This could include some ground disturbance along the diversion dam access roads for placement of water conveyance pipes (either temporary or permanent, underground) and a brief period of in-water work to place a cofferdam structure and bypass pumps. Some small amount of excavation may be necessary to properly site bypass pumps below the water to avoid cavitation and other problems that jeopardize reliablilty of the water bypass system.

2.3.4.4.1 Our House Diversion Dam

For the foreseeable future, mechanical sediment removal events would use temporary, aboveground water conveyance systems to bypass water around the planned excavation areas. However, YCWA is conducting investigations to evaluate permanent water conveyance systems that could be used in the future to bypass the water.

Diversion and control of water would consist of a temporary water conveyance system from upstream of the planned excavation area to just downstream of the dam. A small temporary catchment would be constructed upstream of the work area using a cofferdam (approximately 300 cu ft in size) made of super sacks, an inflatable bladder, or other similar method. Exclusionary block netting would be deployed, and an aquatic vertebrate rescue would take place in the area of the catchment before placement of the cofferdam. A temporary bank of pumps, powered by generators, would be placed inside the catchment. Some excavation of the catchment could be necessary to enable the proper submergence of the pumps and to avoid cavitation or other unsafe operating conditions. Temporary, heavy duty, pressure rated, rubber lay flat discharge hose would connect the pumps to a temporary metal manifold structure. The manifold structure would be attached to two temporary 24-inch pipes routed outside of the work area, along the access road, to discharge to a point below the dam.

The future development of a more permanent water conveyance system could consist of a similar layout as that just described, but the temporary, heavy duty, pressure rated, rubber lay flat discharge hose would connect the pumps to a permanent metal manifold above the ordinary high water mark. The manifold structure would be attached to two permanent, underground 24-inch pipes routed outside of the work area, beneath the access road. The permanent, underground pipes would then surface adjacent to the access road, just upstream of the Lohman Ridge Tunnel inlet. From the point where the permanent, underground pipes surface, temporary pipes would be attached to discharge water to a point below the dam.

Either water conveyance system would be designed to handle flows ranging from the FERC-mandated minimum flow to upward of 50 cfs. To meet these flows, the conveyance system would have 50 percent redundancy of instream pumps and 100 percent redundancy of generators used to power the pumps. All generators used would be positioned in portable spill containment. An external diesel fuel tank would also be placed in spill containment and would be plumbed directly to the primary generator's engine for extended run time. Flow through the pumps and conveyance pipes, as well as output of the generators, would be monitored electronically and by a full-time observer on site. The electronic monitor would sound an alarm to alert the observer of any pumping issues and would automatically transfer conveyance from the failed pump or generator to a redundant backup. Figure 2.3-2 shows the proposed layout of the conveyance system. All resources identified and flagged as sensitive by the biologist would be avoided during the installation of the diversion.

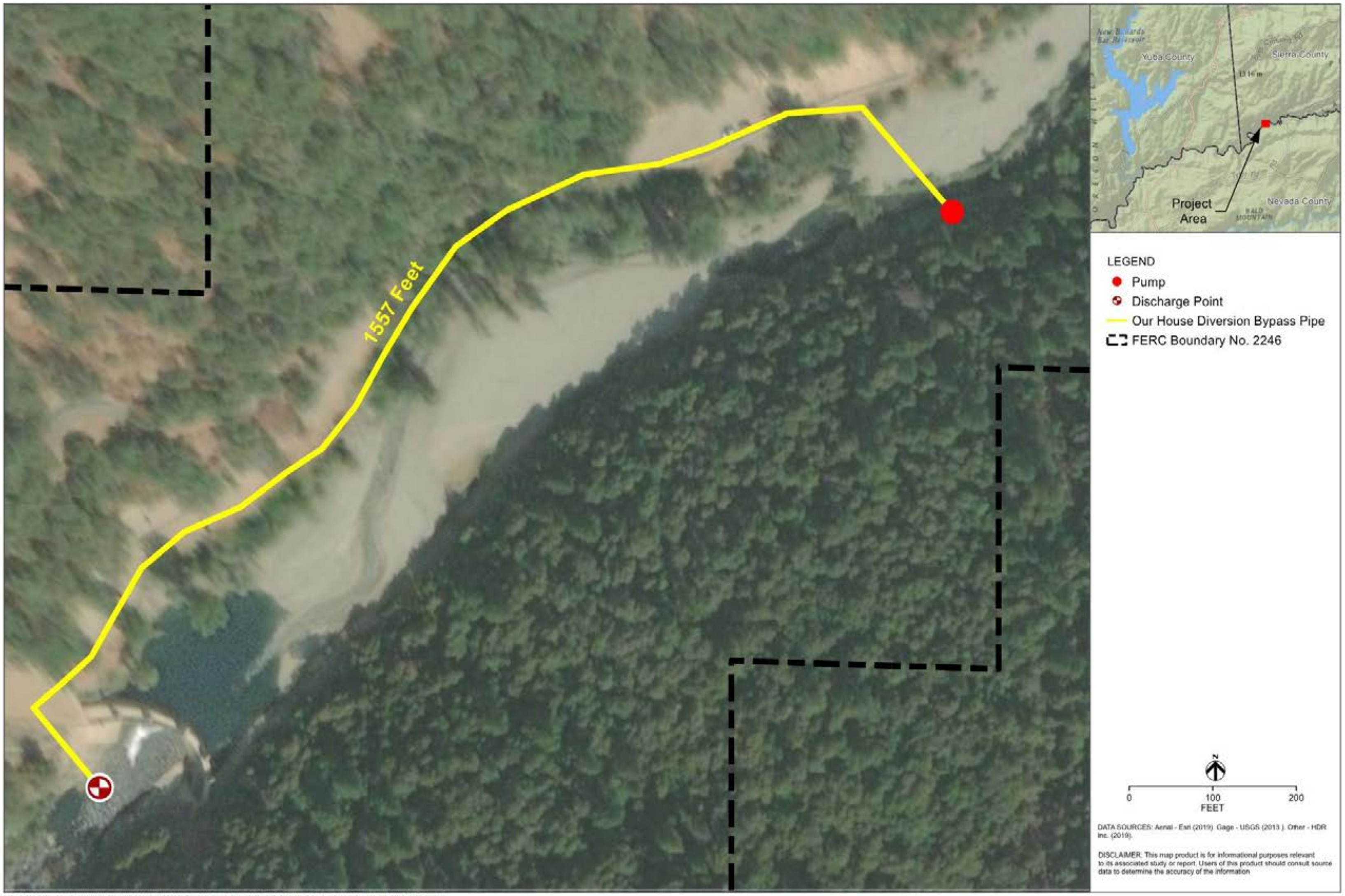

Figure 2.3-2. Proposed layout of pumps and pipes for the diversion at Our House Diversion Dam.

2.3.4.4.2 Log Cabin Diversion Dam

Configuration of the temporary and potential permanent water conveyance system at Log Cabin Diversion Dam would be similar to that described above for Our House Diversion Dam. However, at Log Cabin Diversion Dam, the natural streambed profile configuration would be used as the catchment basin, as shown in Figure 2.3-3. Additionally, the temporary, aboveground pipes and potential permanent, underground pipes would include two 12-inch pipes. For the permanent, underground layout, the pipes would surface adjacent to the access road just upstream of the Camptonville Tunnel inlet. Also, the water conveyance system at Log Cabin Diversion Dam would be designed to handle flows ranging from the FERC-mandated minimum flow to approximately 20 cfs. Temporary, aboveground piping would run approximately 1,000 linear ft.

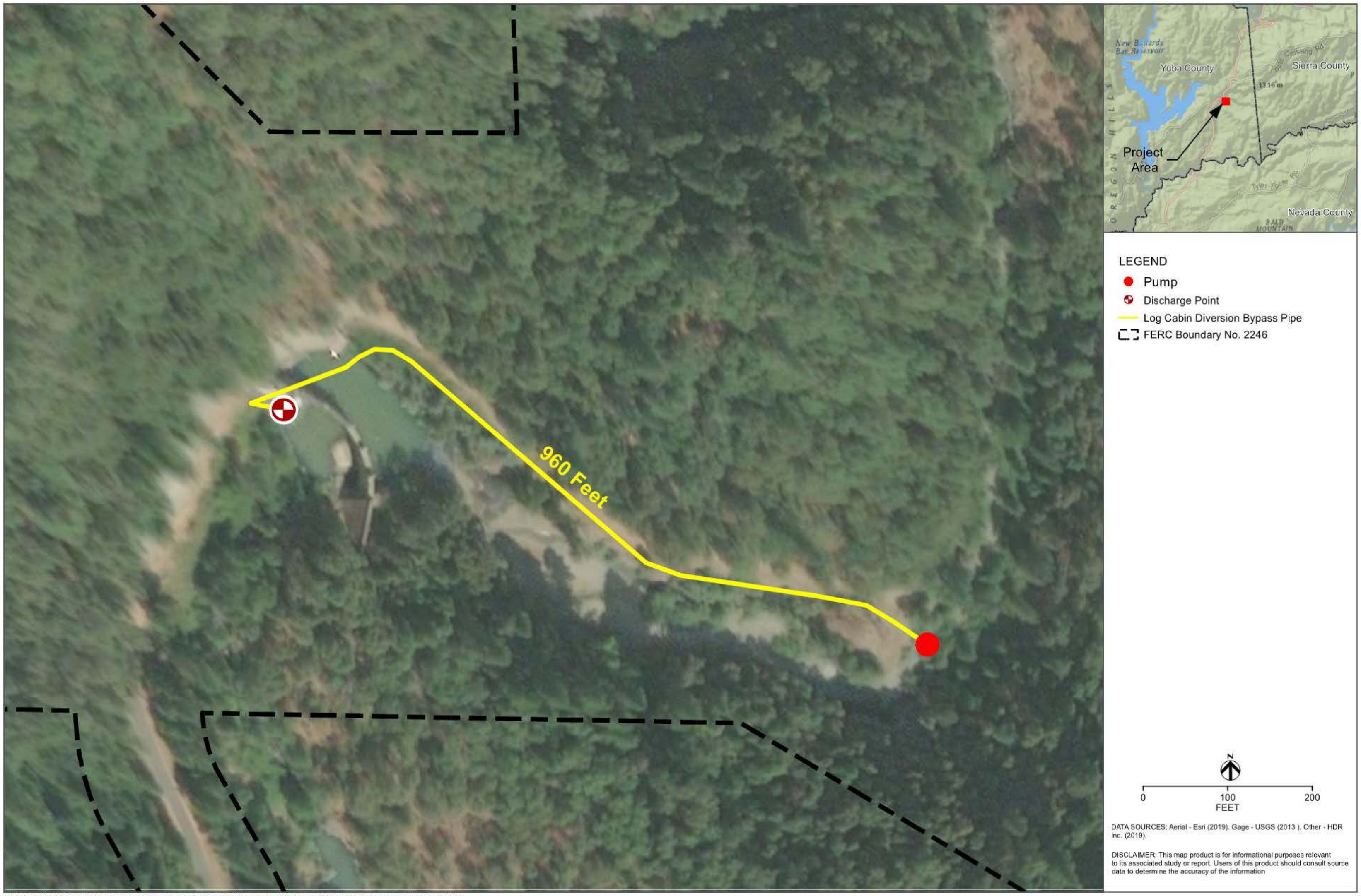

Figure 2.3-3. Proposed layout of pumps and pipes for the diversion at Log Cabin Diversion Dam.

Before mechanical sediment removal, the impoundments would be completely dewatered by allowing the water to drain naturally through the valve or pumping it into the diversion tunnels. Dewatering of the impoundments would coincide with an aquatic vertebrate rescue in accordance with the 2014 *Fish Rescue and Salvage Plan* (YCWA 2014).

2.3.4.4.3 Vegetation Removal

To the maximum extent possible, riparian vegetation removal will be avoided. However, any riparian vegetation removal that is necessary to complete the work will occur after the aquatic vertebrate species rescue and prior to mechanical sediment removal. YCWA will need to remove some riparian vegetation below the ordinary high water mark of the Our House Diversion Dam impoundment. Surveys of the area of proposed vegetation removal were conducted on May 14, 2018 and August 15, 2018 to count the numbers of trees to remove as part of sediment removal. The diameter at breast height (DBH) of approximately 210 willows (*Salix spp.*) within the impact area were measured. Approximately 193 willows had a DBH of five inches or less, along with 17 willows with a DBH greater than four inches. A total of 125.6 in. of DBH of willows above four inches DBH will be removed. Biological mitigation measures describe proposed mitigation to offset the removal of the willows and other riparian vegetation.

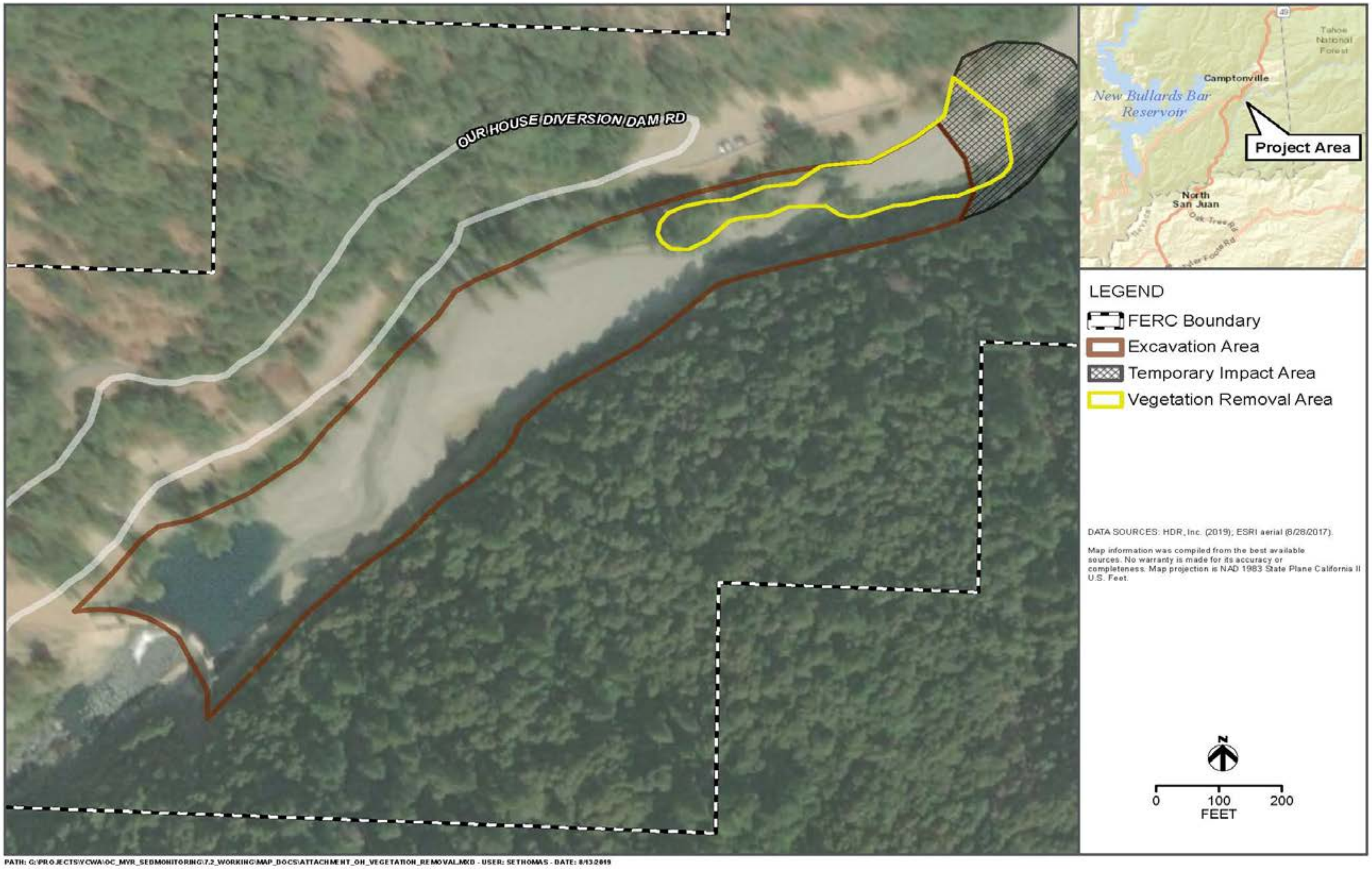

Figure 2.3-4. Vegetation removal area proposed for Our House Diversion Dam.

2.3.4.5 Removal of Sediment

The amount of material to be excavated from an impoundment would vary from event to event. However, YCWA estimates that the maximum amount of sediment to be removed during any one event is up to 100,000 cu yd from the Our House Diversion Dam Impoundment and up to 40,000 cu yd from the Log Cabin Diversion Dam Impoundment. Therefore, over the 10-year period, a total of no more than 1.4 million cu yd would be removed. This volume is likely a gross overestimate. Mechanical sediment removal is neither planned nor expected to be required every year.

The excavation would be accomplished with excavators staged within the impoundment. Excavated sediment would be loaded into large-capacity, off-road trucks, which would transport the material to temporary laydown areas outside of the impoundments. The material, which would be verified by testing to be clean and nonhazardous (see Section 2.3.4.2), would be temporarily (i.e., no more than 48 hours) stockpiled at the laydown areas for eventual loading onto street legal trucks for hauling to the final stockpile area. Any sediment tested and identified as hazardous would be transported immediately to an appropriate disposal site. After the last day of sediment removal from an impoundment, YCWA would have 72 business hours to clean up the temporary laydown area, including relocating the last of the removed sediment.[4] Appropriate BMPs from Volume 1 of the Forest Service *National Best Management Practices for Water Quality Management on National Forest System Lands* (Forest Service 2012), or latest version, as appropriate) would be instituted to prevent erosion. During impoundment excavation, the excavators and trucks would be removed from the impoundment at the end of each shift and stored temporarily at designated staging areas.

The temporary laydown area for Log Cabin Diversion Dam would be located adjacent to the paved dam access road, approximately 0.2 mile (mi) from the dam, and would consist of a cleared area. The area includes land owned by Sierra Pacific Industries and NFS land, and is within the FERC Project boundary. This temporary impact area is located at an upland clearing, away from any natural water features.

Figure 2.3-5 shows the temporary laydown area for Log Cabin Diversion Dam.

[4] An exception would be made in the case of inclement weather, which can make the material too wet and access unsafe to move material within the 48-hour timeline.

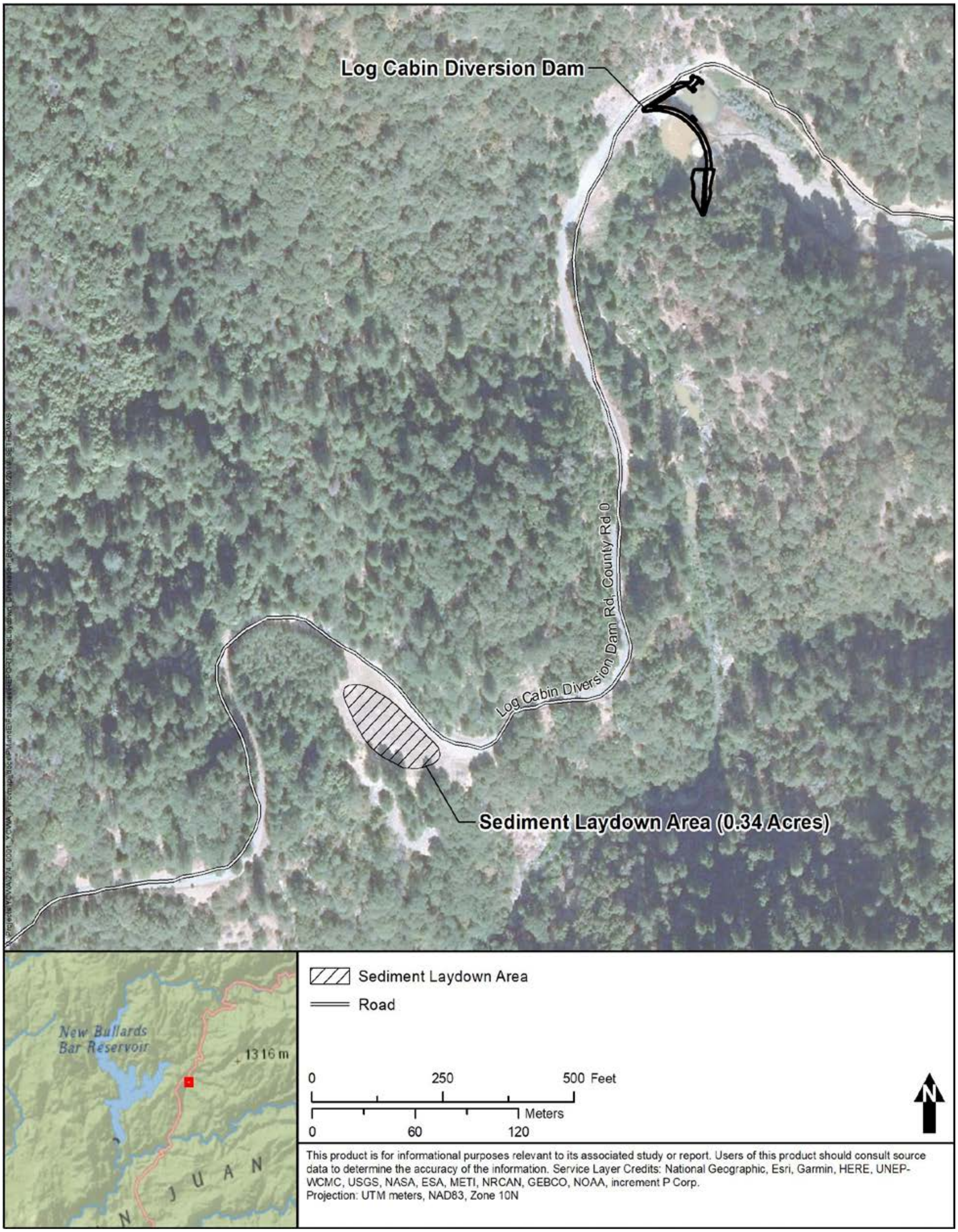

Figure 2.3-5. Log Cabin Diversion Dam temporary laydown area map.

The temporary laydown area for Our House Diversion Dam would be located on Sierra Pacific Industries property near the junction of Ridge Road and the Our House Diversion Dam access road. The laydown area was previously cleared of vegetation, is upland of any natural water features, and occurs within the FERC Project boundary.

Figure 2.3-6 shows the temporary laydown area for Our House Diversion Dam.

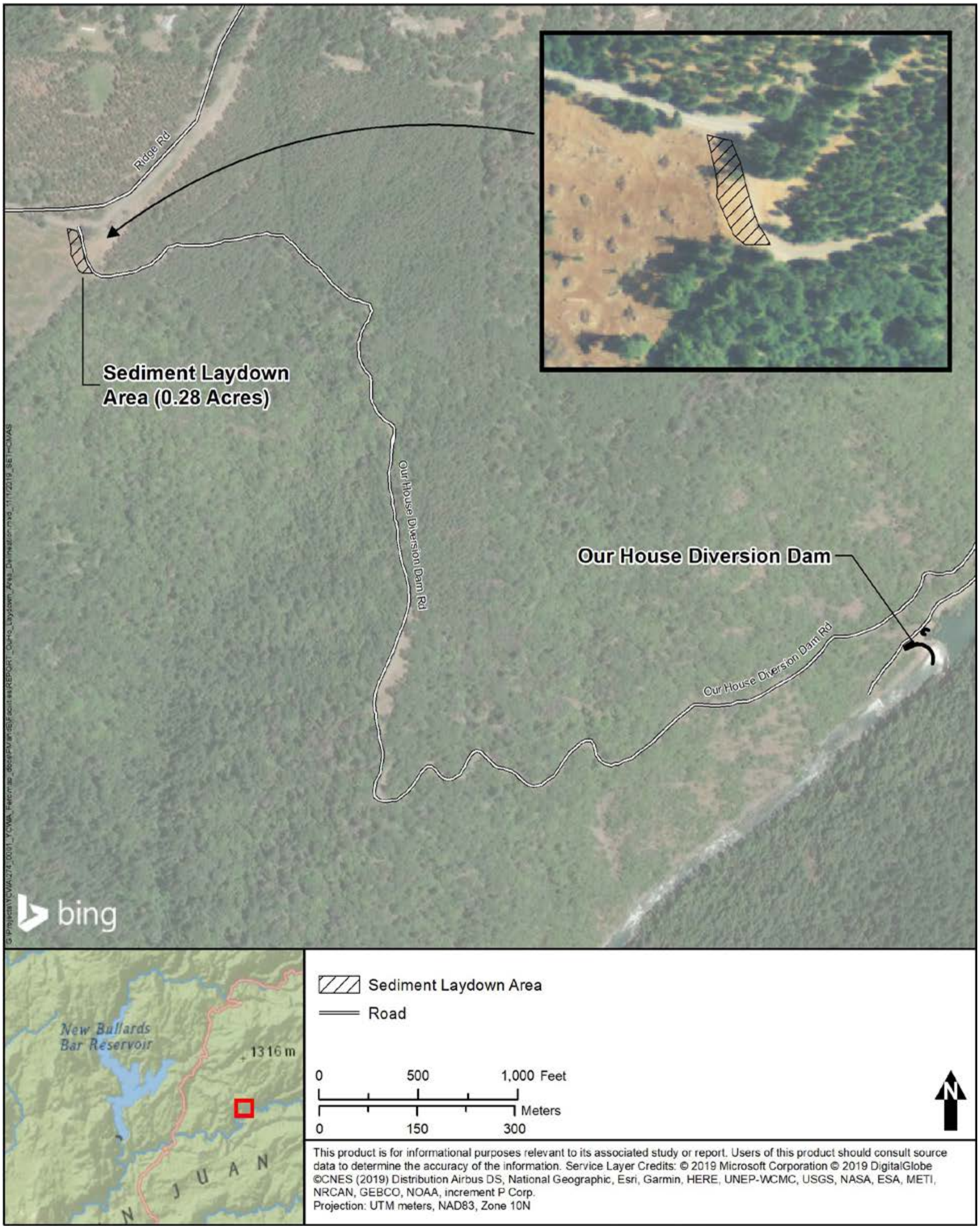

Figure 2.3-6. Our House Diversion Dam temporary laydown area map.

During mechanical sediment removal at either impoundment, testing of turbidity and dissolved oxygen would occur three times daily upstream of the construction activity and below the diversion dam at a point immediately downstream of the water discharge. If levels exceed established permit limits, all instream project work would cease and would not resume until levels return to within permit limits.

Additionally, when dewatered, natural seepage occurs within the Log Cabin and Our House Diversion Dam Impoundments. Depending on the flow from these seeps, YCWA could need to continue pumping minimal quantities of water (i.e., anticipated to be less than 1 cfs) from an impoundment into the diversion tunnels to keep the work areas dry for excavation. It is anticipated that depressions within the tunnels would capture the water and allow any suspended material to settle out.

2.3.4.6 Sediment Stockpiling and Stabilization

Removed sediment would be managed and disposed of in accordance with applicable local, state, and federal regulations, and in compliance with regulatory permits.

As stated in Section 2.3.4.5, the excavated sediment would be moved from temporary laydown areas in street legal trucks to sediment disposal areas on YCWA-owned land (Disposal Sites 1 and 3) or private land (Disposal Site 2). Both Disposal Sites 1 and 2 are generally flat, minimally vegetated, and have dirt road access with adequate space for large trucks to turn around. Disposal Site 3 is sloped, forested in areas outside of the hydraulic pits, and does not currently have an access road. For any road use on NFS land, the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (Forest Service 2012, or latest version) would be followed, as appropriate.

Spoils Site 1 is located within the FERC Project Boundary behind a locked gate. It is approximately 9 mi from Log Cabin Diversion Dam and 15 mi from Our House Diversion Dam. There are 3 sub-areas at Disposal Site 1: A, B and C. A 2018 land survey conducted by YCWA indicated that Site 1 A and B could hold up to an additional 40,000 cu yd of sediment. Site 1 C is not planned for use at this time but may be used in the future.

From Log Cabin Diversion Dam, the haul route to Disposal Site 1 would consist of the following: 1) an existing unimproved ramp from the impoundment up to the northern edge of the impoundment; 2) a gravel road along the northern edge of the impoundment to the right dam abutment; 3) a paved road, consisting of the lower portion of the dam access road to the laydown area; 4) the upper portion of the dam access road to State Route 49; 5) State Route 49 south to Marysville Road; 6) Marysville Road west to a point east of New Bullard Bar Dam; and 7) an unpaved road south to the stockpile area on YCWA property.

From Our House Diversion Dam, the haul route to Disposal Site 1 would consist of the following: 1) an existing unimproved, gravel ramp from the impoundment to the paved Our House Diversion Dam access road; 2) the dam access road to the temporary laydown area at the intersection of the dam access road and Ridge Road; 3) Ridge Road west to State Route 49; 4) State Route 49 north to Marysville Road; 5) Marysville Road west to a point east of New Bullards Bar Dam; and 6) an unpaved road south to the stockpile area on YCWA property.

Disposal Site 2 is on privately owned property approximately 4.7 mi from Log Cabin Diversion Dam and 6 mi from Our House Diversion Dam, and is not within the FERC Project Boundary. A wide gravel road would provide easy access into and out of the site. A 2018 survey conducted by YCWA estimates that approximately 150,000 cu yd of materials can be disposed of at Disposal Site 2.

From Log Cabin Diversion Dam, the haul route to Disposal Site 2 would consist of the following: 1) an existing unimproved ramp from the impoundment up to the northern edge of the impoundment; 2) a gravel road along the northern edge of the impoundment to the right dam abutment; 3) a paved road, consisting of the dam access road from the dam to State Route 49; 4) State Route 49 south to Ridge Road; 5) Ridge Road east to Celestial Valley Road; and 6) Celestial Valley Road north to the end of the road.

From Our House Diversion Dam, the haul route to Disposal Site 2 would consist of the following: 1) an existing unimproved, gravel ramp from the impoundment to the paved Our House Diversion Dam access road; 2) the dam access road to the temporary laydown area at the intersection of the dam access road and Ridge Road; 3) Ridge Road east to Celestial Valley Road; and 4) Celestial Valley Road north to the end of the road.

Disposal Site 3 is an 80-acre parcel just west of the community of Pike in Sierra County. The site is approximately 2 mi east of Log Cabin Diversion Dam and 2 mi northwest of Our House Diversion Dam, and is not within the FERC Project Boundary. Currently, the site's capacity has not been estimated, but it is likely capable of storing several decades of future sediment disposal.

From Log Cabin Diversion Dam, the haul route to Disposal Site 3 would consist of the following: 1) an existing unimproved ramp from the impoundment up to the northern edge of the impoundment; 2) a gravel road along the northern edge of the impoundment to the right dam abutment; 3) a paved road, consisting of the dam access road, from the dam to State Route 49; 4) State Route 49 south to Ridge Road; 5) Ridge Road east to Pike City Road; 6) Pike City Road north to Camptonville Road; and 7) Camptonville Road west to Disposal Site 3.

From Our House Diversion Dam, the haul route to Disposal Site 3 would consist of the following: 1) an existing unimproved, gravel ramp from the impoundment to the paved Our House Diversion Dam access road; 2) the dam access road to the temporary laydown area at the intersection of the dam access road and Ridge Road; 3) Ridge Road east to Pike City Road; 4) Pike City Road north to Camptonville Road; and 5) Camptonville Road west to Disposal Site 3.

The number of round trips between the impoundments and the sediment disposal areas would depend on the amount of material to be excavated. During hauling, YCWA would provide traffic control on the haul routes at intersections where the haul trucks enter and leave public roads. Traffic control personnel would also be responsible for keeping the general public from getting past the dam access road gates during sediment removal work hours.

2.3.4.7 Demobilization

At either diversion dam, after sediment removal has been completed, natural seepage and flow from two valve-controlled 6-inch pipes connected to the main water conveyance pipes would fill the impoundments to above the fish release outlet valves. Once the impoundments have been filled to above the fish release outlet valves, the FERC-mandated minimum instream flow would be transferred from the water conveyance system to the fish release outlet valves. Once the flow has been transferred, the water conveyance system pumps would be shut down and the system would be dismantled.

All construction-related vehicles, equipment, and debris would be removed from the site. Prior to exiting the site, the onsite biologist would perform an inspection for invasive species. All visible soil, plant material, animal remnants, or any other signs of invasive species on vehicles and equipment would be removed.

All disturbed areas within the work area and at the disposal sites would be stabilized with industry standard BMPs to reduce erosion potential. Planting and/or seeding with native species, a sterile seed mix, mulching, and use of non-erodible materials such as coconut fiber matting are potential methods for stabilization.

2.3.4.8 Issuance of Report(s)

Upon completion of all work and demobilization activities, all appropriate agencies would be notified, and any reports specified in the associated permits would be prepared and issued. By March 1 of each year, YCWA would provide a report with photographs that summarizes the work completed in the prior year under this proposed project to FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB, and CDFW.

2.4 Construction Equipment and Traffic Management

2.4.1 Construction Equipment

Table 2.4-1 provides a description of all equipment likely to be used during implementation of the proposed project over the next 10 years. Additional equipment could include communications and safety equipment, as well as vehicles that would be used to deliver and move equipment, materials, and personnel.

Table 2.4-1. Construction equipment.

Equipment	CalEEMod Equipment Category	Number of Units	Hours per Day	Horsepower	Number of Days Over the 10-Year Period per Unit
SEDIMENT PASSAGE					
None					
REMEDIAL ACTION					
Suction pump	Pump	1	10	172	10

Table 2.4-1. (continued)

Equipment	CalEEMod Equipment Category	Number of Units	Hours per Day	Horsepower	Number of Days Over the 10-Year Period per Unit
MECHANICAL REMOVAL OF SOIL[1]					
Street legal dump truck	Highway truck	8	10	300	600
Off-road dump truck	Off-highway truck	4	10	300	600
Dozer	Crawler tractor	2	10	305	600
Excavator	Other material handling equipment	4	10	196	600
Water diversion pump	Pump	4	24	84	600
Water truck	Off-highway truck	2	10	300	600
Hydroseeding truck	Off-highway truck	1	10	115	50
EMERGENCY ACTIVITIES					
Same as mechanical removal of soil, but none anticipated					

[1] Numbers are for work at one impoundment.

2.4.2 Construction Traffic

Personnel, equipment, and imported materials would reach the proposed project area primarily via State Route 49 and Ridge Road, which are paved, all-weather roads, and suitable for the anticipated loads. The construction labor force is estimated to average 10 workers per day, commuting separately, for each removal activity under the proposed project for the duration of the construction period. An additional 8 workers would drive the street legal dump trucks. For each mechanical removal action, mobilization of equipment listed in Table 2.4-1 to a project site would be completed using six to eight flatbed trucks that would bring equipment to the site over 2 days. A similar demobilization of equipment at the end of each mechanical removal action would also occur.

After initial mobilization of equipment to the proposed project site, construction-related traffic spread over the duration of the construction schedule would include street legal dump trucks capable of carrying 15 yds^3 of sediment each. The maximum amount of material that could be hauled from both impoundments over 1 year would be 140,000 yds^3--40,000 $yds^3$from the Log Cabin Diversion Dam Impoundment and 100,000 yds^3 from the Our House Diversion Dam Impoundment. With up to an estimated 2,667 truck trips per event at Log Cabin Diversion Dam, all sediment would be hauled 8.9 mi to Disposal Site 1 in the first year; 6.2 mi to Disposal Site 2 the second year; and 7.7 mi to Disposal Site 3 in all years thereafter. With an estimated 6,667 truck trips per event at Our House Diversion Dam, all sediment would be trucked 7.5 mi to Disposal Site 2 in the first year, and 5.0 mi to Disposal Site 3 in all years thereafter. Trucks would remain onsite overnight. The proposed project haul route would primarily use State Route 49, Ridge Road, and Marysville Road, as described in Section 2.3.4.6 and shown in Figure 2.3-1.

See Section 3.17, Transportation, for an analysis of potential construction-related traffic impacts.

2.5 Best Management Practices

The BMPs described as follows would be implemented during all mechanical sediment removal activities:

- Work below the ordinary high water mark will be timed during dry weather and limited to the period of September 15 through November 15. Work may begin earlier than September 15 if surveys conducted by a qualified biologist confirm that foothill yellow-legged frog (FYLF; *Rana boylii*) tadpoles are not present within the work area and concurrence is received from Forest Service and CDFW. FYLF surveys will be conducted in accordance with protocols recommended by the Forest Service.
- Excavation activities will be scheduled with consideration of precipitation forecasts and anticipated increases in stream flow. Excavation activities will cease and all reasonable erosion control measures, inside and outside of the floodplain, will be implemented prior to all storm events. No sediment removal work will occur during wet weather, which is defined as the accumulation of 0.25 inch of rain in a 24-hour period. However, revegetation, site restoration, and erosion control activities may occur during wet weather.
- If it is necessary to conduct work in a flowing portion of the stream, the entire stream flow will be diverted around the work area during work activities while maintaining flows required for aquatic species in the natural channel downstream of the work area. Flow will be diverted in a manner that minimizes turbidity, siltation, and pollution and provides flows to downstream reaches. YCWA will restore normal flows to the affected portion of the stream immediately upon completion of work at that location. Any temporary dam or other artificial obstruction constructed for stream diversion will be built from clean materials, such as sandbags, gravel bags, water dams, or clean/washed gravel, which will cause little or no siltation[5].
- A qualified biologist will visit the project site daily to ensure that impacts on fish and wildlife resources are minimized for the duration of activities that involve water diversion, grading, excavation, vegetation removal, or other ground disturbing activities. The biologist will be familiar with protected fish, plant, and wildlife species, and associated habitats found within and adjacent to the project site.
- Prior to performing any sediment removal activities onsite, a qualified biologist will conduct an education program for all persons working at the proposed project site. The program will consist of a presentation that describes the biology of the habitats and species that may be present within or adjacent to the work area, including the Endangered Species Act (ESA) listing statuses of the species. The training will include information on FYLF and proper methods for their avoidance.
- Prior to and during diversion of flow and dewatering of the stream channel and work area, a qualified biologist will remove all fish, frogs, turtles, and other aquatic vertebrate species in accordance with the *Fish Rescue and Salvage Plan* developed by YCWA in coordination

[5] The placement of the bypass pumps may require a little excavation to make sure the pumps are fully below the water line, to prevent cavitation and other problems that threaten the functionality of the bypass.

with Forest Service, CDFW, USFWS, and SWRCB in 2014. Electrofishing for aquatic species rescue will be restricted to areas that have been approved by CDFW and cleared of FYLF by a biologist. All species will be captured by hand or by using fine mesh nets (i.e., catch-and-release nets), or using another method approved by CDFW and USFWS. All species will be moved to an area upstream of sediment removal activities where they will not be likely to re-enter the work area. Handling of aquatic species will be minimized to the greatest extent feasible.

- A qualified biologist will inspect the work area for stranded aquatic life each day for the duration of dewatering and sediment removal activities. The inspections will be conducted prior to work beginning each morning and at least two additional times per day. If frogs are present, they will be removed by the qualified biologist, or the work area will be changed for the day to avoid the frogs.
- Exclusion devices (i.e., nets and screens) will be placed on any pumps or pipes within an impoundment and around the work area, as appropriate, to exclude aquatic species. Exclusion devices will be in place and maintained in working order at all times water is being diverted. Intake pumps will be fitted with fish screens meeting the “fry size” criteria of CDFW and the National Marine Fisheries Service (NMFS) before water is diverted. Round openings in the screen will not exceed 3/32 inch (approximately .094-inch) in diameter, square openings will not exceed 3/32 (approximately .094-inch) inch measured diagonally, and slotted openings will not exceed 0.069 inch in width. The onsite biologist will periodically inspect all exclusion devices to verify that they are functioning properly and are effectively protecting aquatic vertebrate species. Block nets sufficient to prevent frog movement through them will be erected at the upstream end of the sediment removal area to prevent relocated FYLF from (re-)entering the sediment removal area.
- Sediment removal work will start in the areas where sediment is currently elevated and dry because FYLFs are much less likely to be present at these locations.
- Suction dredging will be limited to the dam face and outlet features of the proposed project area. Suction dredging will not occur along the bed, bank, or channel of the streambed.
- As possible, work will be timed so that it does not coincide with sensitive ecological periods (i.e., breeding, nesting, migration, or blooming) of known special-status species within or near the proposed work area.
- Prior to work beginning, all known sensitive resources within or near the proposed work area will be flagged to ensure that no activities are conducted in those areas. These resources include, but are not limited to, cultural resources, special-status species, sensitive habitats, targeted nonnative invasive plants, and other areas predetermined to include significant sensitive resources.
- Disturbance or removal of vegetation will be kept to the minimum necessary to complete project-related activities. When feasible, branches and limbs extending over the river will not be pruned to avoid potential impacts on shaded riverine aquatic habitat. No native trees with a trunk DBH in excess of 4 inches will be removed without prior consultation and approval from CDFW. If vegetation removal cannot be avoided during project activities, YCWA will conduct a focused survey for active bird nests within the area proposed for

vegetation removal and a 500-ft buffer prior to, and within 5 days of, commencing vegetation removal activities. If no breeding raptors or special-status bird species and/or their nests are found within 500 ft of the work area, and no non-special-status breeding birds and/or their nests are found within 250 ft of the work area, vegetation removal may commence. If any breeding birds and/or their nests are found within the aforementioned survey areas, YCWA will consult with the Forest Service (for work on NFS land), CDFW, and USFWS, as appropriate, prior to any vegetation removal activities. Breeding bird survey results, if conducted, will be submitted to the Forest Service, CDFW, and USFWS for review via e-mail within 5 days of completion and prior to beginning work.

- All exposed/disturbed areas and access points to the stream left barren of vegetation as a result of construction activities, such as staging areas, will be restored and stabilized using a Forest Service-approved seed mix or grass or sedge plugs during periods of project inactivity greater than 14 days and upon completion of work. The revegetation should emphasize native species or approved sterile nonnative species. Seeded areas will be covered with broadcast straw or other mulch, and/or erosion control blankets and straw wattles. Revegetation is not considered complete until 70 percent uniform ground cover is achieved.
- No heavy equipment will operate, and no excavation will take place, in any portion of the stream where flowing water is present[6].
- Beginning during mobilization and continuing through demobilization, when work is being performed in an impoundment, turbidity will be monitored three times daily: before work starts, at noon, and at the end of the workday. Turbidity will be monitored at a point upstream of work disturbance and at a point immediately downstream of the dam. The following applies:
    - If natural turbidity is recorded upstream of the work area at less than one Nephelometric Turbidity Unit (NTU), controllable factors will not cause downstream turbidity of more than 2 NTU.
    - If natural turbidity is between 5 and 50 NTUs, increases from controllable factors will not exceed 20 percent.
    - If natural turbidity is between 50 and 100 NTUs, increases from controllable factors will not exceed an additional 10 NTUs.
    - If natural turbidity is greater than 100 NTUs, increases from controllable factors will not exceed 10 percent (SWRCB 2018).

  During in-water work, turbidity can increase by up to 500 NTU above background levels. If the difference in measured turbidity between upstream and downstream levels exceeds any of these limits, work would cease, and FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB, and CDFW would be contacted. Work would not resume until FERC approval is obtained.

[6] This BMP refers to excavation for sediment removal. A minor amount of excavation in flowing water may be required to replace bypass pumps for their safe use as explained in Section 2.3.4.4.

- Beginning during mobilization and continuing through demobilization, when work is being performed in an impoundment, dissolved oxygen (DO) levels will be monitored three times daily: before work starts, at noon, and at the end of the workday. DO will be monitored at a point upstream of work disturbance and at a point immediately downstream of the dam to ensure that proposed project activities do not cause DO to fall below 7.0 milligrams per liter (mg/L; SWRCB 2018). If the DO does fall below 7.0 mg/L downstream of proposed project activities, work would cease, and FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB, and CDFW will be contacted. Work would not resume until FERC approval is obtained.
- Work activities would be conducted in a manner that would prevent the introduction, transfer, and spread of aquatic, riparian, and terrestrial invasive species, including plants, animals, and microbes (e.g., algae, fungi, parasites, mussels, and bacteria), from one work area and/or waterbody to another. Prior to equipment entering an impoundment, YCWA will inspect the equipment to be used in the impoundment for invasive species, and if any signs of invasive species are found, the equipment will be cleaned to remove those species. All visible soil/mud, plant materials, and animal remnants on equipment will be removed prior to entering and exiting the work area and/or between each use in different waterbodies. YCWA will notify CDFW immediately if an invasive species not previously known to occur within the work area is discovered during work activities by submitting a completed suspect invasive species report.
- All disturbed soils within the work area will be stabilized to reduce erosion potential during mobilization and prior to soil disturbance, during periods of construction inactivity, and upon completion of work activities. Planting and/or seeding with native species, a sterile seed mix, and mulching are potential methods for stabilization. Where suitable vegetation cannot reasonably be expected to become established, non-erodible materials, such as coconut fiber matting, will be used for such stabilization.
- Erosion control measures will be used throughout all phases of the work, including sediment removal and placement on adjacent lands. Precautions to minimize turbidity/siltation could require the placement of silt fencing, coir logs, coir rolls, straw bale dikes, or other siltation barriers so that silt and/or other deleterious materials are not allowed to pass to downstream reaches. Water trucks will be used daily to wet the unpaved roads to prevent excess dust. All vegetative erosion control measures used within the work area will be free of nonnative plant materials.
- Leaks and spills into water bodies would be prevented by ensuring that all vehicles and equipment are in good working order (e.g., no leaks); placing drip pans or absorbent materials under vehicles and equipment when not in use; ensuring that all construction areas have proper spill clean-up materials (e.g., absorbent pads, sealed containers, and booms) to contain the movement of any spilled substances; preventing any other substances that could be hazardous to aquatic life from contaminating the soil and/or entering the waters of the state; and if maintenance or refueling of vehicles or equipment must occur on-site, using a designated area with a secondary containment to prevent the runoff of storm water and the runoff of spills.

- During the entire work period, standard fire equipment will be kept readily available, and an emergency plan, including specific contacts, will be established prior to implementation of the proposed project between the contractor and the TNF personnel to prevent the start and spread of fires.
- As of 2014, a California spotted owl (*Strix occidentalis occidentalis*) Protected Activity Center (PAC) borders the Our House Diversion Dam Impoundment. YCWA will determine the current status of this PAC through discussion with the TNF Yuba River District biologist prior to excavation and hauling activities. If recommended by the TNF biologist, excavation and hauling activities will occur outside of the limited operating period for the California spotted owl, which is March 1 through August 15.
- As of 2014, great gray owls (*Strix nebulosa*) are known to be active and forage along a section of the Ridge Road haul route. YCWA will determine the current status and location (i.e., specific road segment) of the great gray owl activity area through discussion with the TNF biologist. Prior to hauling sediment and after obtaining approval from the County Transportation Department, YCWA will install appropriate barriers along an approximately 400-ft segment of road where great gray owls are active, as determined by the TNF, to avoid collisions between owls and trucks. These barriers will be 6 ft high. Temporary construction fencing will be raised 18 inches off the ground to allow smaller animals to pass underneath, and will be installed on the downhill side of the road segment. Perching deterrents, such as snow poles, will be placed on metal road posts on the uphill side of the road segment. All YCWA contractor truck drivers will be informed of the presence of great gray owls, provided with species identification cards, and asked to report sightings to TNF and CDFW.
- The following key BMPs from the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (Forest Service 2012) will be used during all proposed mechanical sediment removal activities, from mobilization through demobilization:
  - **Fac-2. Facility Construction and Stormwater Control** - Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment:
    - Establish designated areas for equipment staging, stockpiling materials, and parking to minimize the area of ground disturbance (see BMP Road-9, Parking Sites and Staging Areas, and BMP Road-10, Equipment Refueling and Servicing, in subsequent bullets in this list).
    - Establish and maintain construction area limits to the minimum area necessary for completing the project and confine disturbance to within this area.
    - Develop and implement an erosion control and sediment plan that covers all disturbed areas, including borrow, stockpile, fueling, and staging areas used during construction activities.

- Calculate the expected runoff that would be generated using a suitable design storm to determine necessary stormwater drainage capacity using site conditions and local requirements. Include runon from any contributing areas, such as runoff from the Our House Diversion Dam access road, in calculations.
- Refer to state or local construction and stormwater BMP manuals, guidebooks, and trade publications for effective techniques to apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion during construction or before the next growing season; maintain the natural drainage pattern of the area wherever practicable; control, collect, detain, treat, and disperse stormwater runoff from the site; divert surface runoff around bare areas with appropriate energy dissipation and sediment filters; and stabilize steep excavated slopes.
- Develop and implement a post-construction site vegetation plan using suitable plant species and establishment techniques to revegetate the site in compliance with local direction and requirements per Forest Service Manual (FSM) 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Do not use snow or frozen soil material in facility construction.
- Schedule, to the extent practicable, construction activities to avoid direct soil and water disturbance during periods of the year when heavy precipitation and runoff are likely to occur. Limit the amount of exposed or disturbed soil at any one time to the minimum necessary to complete construction operations. Limit operation of equipment when ground conditions could result in excessive compaction, rutting, soil puddling, or runoff of sediments directly into waterbodies. Refer to the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands*, Attachment A (Forest Service 2012) for the field soil moisture test protocol.
- Install suitable stormwater and erosion control measures to stabilize disturbed areas and waterways before seasonal shutdown of project operations or when severe or successive storms are expected.
- Use low-impact development practices where practicable.
- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning. Prepare for unexpected failures of erosion control measures. Implement corrective actions without delay when failures are discovered to prevent pollutant discharge to nearby waterbodies.
- Routinely inspect construction sites to verify that erosion and stormwater controls are implemented and functioning during the wet season as

designed, and are appropriately maintained until the area is revegetated and stabilized.

- Use suitable measures in compliance with local direction to prevent and control invasive species.

- **Road-9. Parking and Staging Areas** - Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using state BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment:
  - Design and locate parking and staging areas of appropriate size and configuration to accommodate expected vehicles and avoid or minimize adverse effects to adjacent soil, water quality, and riparian resources. Consider the number and type of vehicles to determine parking or staging area size.
  - Use applicable practices of BMP Fac-2, Facility Construction and Stormwater Control, for stormwater management and erosion control when designing, constructing, reconstructing, or maintaining parking or staging areas.
  - Use suitable measures to harden and avoid or minimize damage to parking area surfaces that experience heavy use or are used during wet periods.
  - Use and maintain suitable measures to collect and contain oil and grease in larger parking lots with high use and where drainage discharges directly to streams.
  - Connect drainage system to existing stormwater conveyance systems where available and practicable.
  - Conduct maintenance activities commensurate with parking or staging area surfacing and drainage requirements as well as precipitation timing, intensity, and duration.
  - Limit the size and extent of temporary parking or staging areas. Take advantage of existing openings, sites away from waterbodies, and areas that are apt to be more easily restored to the extent practicable. Use temporary stormwater and erosion control measures as needed. Use applicable practices of BMP Fac-10, Facility Site Reclamation, to rehabilitate temporary parking or staging areas as soon as practicable following use.

- **Road-10. Equipment Refueling and Servicing** - Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using state BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment:
  - Plan for suitable equipment refueling and servicing sites during project design. Allow temporary refueling and servicing only at approved locations, located well away from the Aquatic Management Zone, groundwater recharge areas, and waterbodies.

- Develop or use existing fuel and chemical management plans (e.g., Spill Prevention Control and Countermeasures [SPCC], spill response plan, and emergency response plan) when developing the management prescription for refueling and servicing sites.
- Locate, design, construct, and maintain petroleum and chemical delivery and storage facilities consistent with applicable local, state, and federal regulations, as practicable.
- Use suitable measures around vehicle service, storage, and refueling areas; chemical storage and use areas; and waste dumps to fully contain spills and avoid or minimize soil contamination and seepage to groundwater.
- Provide training for all agency personnel handling fuels and chemicals in their proper use, handling, storage, and disposal. Ensure that contractors and permit holders provide documentation of proper training in handling hazardous materials.
- Use suitable measures to avoid spilling fuels, lubricants, cleaners, and other chemicals during handling and transporting.
- Prohibit excess chemicals or wastes from being stored or accumulated in the project area.
- Remove service residues, used oil, and other hazardous or undesirable materials from NFS land and properly dispose them as needed during and after completion of the project.
- Clean up and dispose of spilled materials according to specified requirements in the appropriate guiding document.
- Report spills and initiate suitable cleanup action in accordance with applicable state and federal laws, rules, and regulations. Remove contaminated soil and other material from NFS lands and dispose of this material in a manner consistent with controlling regulations.
- Prepare and implement a certified SPCC Plan for each facility, including mobile and portable facilities, as required by federal regulations.
- Use applicable practices of BMP Fac-10, Facility Site Reclamation, to reclaim equipment refueling and services sites when the need for them ends.

2.6 Project Permitting

In 2018 and 2019, environmental baselines were prepared for biological, cultural, and water resources to support the preparation of resource agency permits and consultations. A series of meetings were held in 2018 with CDFW, CVRWQCB, SWRCB, TNF, and USACE to develop the proposed project and determine which permits were required for implementation. Draft applications corresponding to the updated proposed project were submitted to agencies in September 2019, as shown in Table 2.6-1.

Table 2.6-1. Permit application status.

Permit	Agency	Permit ID #	Submission Date
CDFW Lake and Streambed Alteration Agreement (Fish and Game Code Section 1600)	California Department of Fish and Wildlife	1600-2014-0163	Original: September 8, 2014 Extension: August 29, 2019 Submitted September 18, 2019
CDFW Incidental Take Permit (Fish and Game Code Section 2081)	California Department of Fish and Wildlife	2081-2017-047-02	Current: September 13, 2018 New Incidental Take Permit will be applied for in December 2019
SWB Construction Stormwater General Permit Enrollment	State Water Board	--	Will be applied for prior to each event under the proposed project.
Yuba County Grading Permit	Yuba County	--	Will be applied for in mid-2020
Waste Discharge Permit	Central Valley Regional Water Quality Control Board	--	Submitted September 18, 2019
401 Water Quality Certification	State Water Resources Control Board	--	Submitted September 18, 2019
404 Letters of Permission	United States Army Corps of Engineers	SPK-2014-01187; SPK-2014-00703	Submitted September 18, 2019
Encroachment Permit	Yuba County	--	Will be applied for prior to each event requiring traffic along Ridge Road.

SECTION 3.0 ENVIRONMENTAL CHECKLIST

1. **Project Title**: Log Cabin and Our House Diversion Dams Sediment Management Plan; Yuba River Development Project, FERC No. 2246
2. **Lead Agency Name and Address**: Yuba County Water Agency; 1220 F Street, Marysville, CA 95901
3. **Contact Person and Phone Number**:[7] Jacob Vander Meulen, YCWA, (530) 740-7071
4. **Project Location**: Nevada County Assessor's Parcel Nos. (APN) 6101055000, Sierra County APN 006030018, 006010044 and Yuba County APN 641800020000, 642600130000, 64240001000, 64240008000, 64250029000, 64250030000, 1001001000, 64250031000, and 64250024000.
5. **Project Sponsor's Name and Address**: Yuba County Water Agency; 1220 F Street; Marysville, CA 95901
6. **General Plan Designation**: Log Cabin Diversion Dam: Agricultural/Rural Residential Zone 20/Timberland. Our House Diversion Dam: Rural/Residential and Forest 40. Disposal Site 1: Recreation. Disposal Site 2: Urban and Built-up. Disposal Site 3: Forest. Revegetation: Forest and Agricultural/Industrial District.
7. **Zoning**: Log Cabin Diversion Dam: Exclusive Agricultural 40 and Resource Preservation and Recreation (Yuba County 2016); Our House Diversion Dam: Rural/Residential (Sierra County 2012) and Forest-40 (Nevada County 2010); Disposal Site 1: Resource Preservation and Recreation (Yuba County 2016), Disposal Site 2: Agricultural and Industrial District (Yuba County 2016), Disposal Site 3: Forest (Sierra County 2009) and Celestial Valley Mitigation Site: Agricultural and Industrial District (Yuba County 2016).
8. **Description of Project**: The purpose of the proposed project is to prescribe procedures and guidelines for the management of sediment behind Log Cabin Diversion Dam and Our House Diversion Dam. The objectives of the proposed project are twofold: 1) to provide for dam safety and proper functioning of FERC Project facilities, especially the fish release and low level outlet valves; and 2) to maintain the health of the aquatic environment downstream of the dams by allowing the passage of sediments that occur behind the dams. The proposed project is located on TNF, YCWA, and private lands in Nevada, Sierra and Yuba counties. Log Cabin Diversion Dam is located in Yuba County, and Our House Diversion Dam is located in Nevada and Sierra counties. Sediment management at both Log Cabin and Our House diversion dams includes five components: 1) maintenance of minimum pools; 2) passage of sediment; 3) removal of outlet blockages; 4) planned mechanical removal of sediment, when needed; and 5) emergency removal of sediment. The main features of the proposed project area are: Log Cabin Diversion Dam and Impoundment (3.57 acres); Our House Diversion Dam and Impoundment (10.10 acres); Disposal Site 1 (9.51 acres); Disposal Site 2 (11.6 acres); Disposal Site 3 (80 acres),

[7] Per the Notice of Availability, all questions and comments on the IS/MND should be directed to Robin Kent, HDR Inc., robin.kent@hdrinc.com; 916-679-8733

Celestial Valley Mitigation Site (2.5 acres), Log Cabin Temporary Laydown area (0.34 acre), Our House Temporary Laydown area (0.28 acre), and access roads. Sediment passage would be done between October 31 and March 21, in the years when it is implemented. Sediment removal would be conducted in low flow conditions, September 15 through November 15 in a normal year, during years when it is necessary.

9. **Surrounding Land Use and Setting**: Log Cabin and Our House diversion dams and the Celestial Valley Mitigation Site are located on TNF lands. Disposal Site 1 and Disposal Site 3 are located on YCWA lands, while Disposal Site 2 is on private lands. Land use in the area is primarily forestry and natural, with areas of impounded water. There is some development around Disposal Site 2.

10. **Other Public Agencies Whose Approval is Required (e.g., permits, financing approval, or participation agreement)**: Permit applications and agency consultations for the proposed project are required from Nevada, Sierra and Yuba County, CDFW, FERC, TNF, SWRCB, CVRWQCB, SHPO, USFWS, and USACE.

11. **Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to PRC section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?** YCWA has received formal requests for consultation from the Shingle Springs Rancheria and the United Auburn Indian Community. Letter notifications and invitations to consult were distributed to these tribes, as well as other Native American tribal contacts that may have an interest in the proposed project, on December 12, 2018 and July 23, 2019. See Section 3.18 for a list of tribal contacts consulted for the proposed project and additional information on consultation efforts.

Environmental Factors Potentially Affected

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a *potentially significant impact* as indicated by the checklist on the following pages.

	Aesthetics		Agricultural Resources		Air Quality
	Biological Resources		Cultural Resources		Energy
	Geology / Soils		Greenhouse Gas Emissions		Hazards & Hazardous Materials
	Hydrology / Water Quality		Land Use / Planning		Mineral Resources
	Noise		Population / Housing		Public Services
	Recreation		Transportation		Tribal Cultural Resources
	Utilities / Service Systems		Wildfire		Mandatory Findings of Significance

DETERMINATION:

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment and a NEGATIVE DECLARATION would be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there would not be a significant effect in this case because revisions in the proposed project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION would be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures in the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

______________________________	______________________________
Signature	Date
______________________________	______________________________
Printed Name	Title

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3.1 Aesthetics

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
1. AESTHETICS *Except as provided in Public Resources Code Section 21099, would the project:*				
a. Have a substantial adverse effect on a scenic vista?	--	--	--	**X**
b. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	--	--	--	**X**
c. Substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publically accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	--	--	**X**	--
d. Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?	--	--	--	**X**

Environmental Setting

The proposed project is located on TNF and private lands in Nevada, Sierra and Yuba counties. Our House Diversion Dam is roughly 11 mi north of downtown Nevada City, and Log Cabin Diversion Dam is roughly 1 mile away from the area of Camptonville. The regional viewshed includes agriculture and large natural areas, as well as New Bullards Bar Dam. The term *vista* generally implies an expansive view, usually from an elevated point or open area.

A *scenic vista* is a view that possesses visual and aesthetic qualities of high value to the community, such as a natural or cultural resource that is indigenous to the area. There are no state-designated visual resources in the proposed project area; however, State Route 49, used as the haul route for the proposed project, is eligible to be included in the State Scenic Highway System, and from the Sierra-Yuba county line to Yuba Summit is officially designated as a scenic highway by the California Department of Transportation (CalTrans 2019). The upland areas, Oregon Creek, and the Middle Yuba River within the proposed project site have been highly altered from their natural state. At both Log Cabin Diversion Dam and Our House Diversion Dam, biological habitats consist primarily of ponderosa pine and Douglas fir (*Pseudotsuga menziesii*), as well as riparian communities and open water in the impoundments. Disposal Site 1 also consists of ponderosa pine and Douglas fir. Log Cabin Diversion Dam and Our House Diversion Dam Impoundments are both open to recreation, though a locked gate keeps the public from driving down to the impoundment at Log Cabin Diversion Dam. Disposal Site 1 is fenced off from public access and is a distance off any public roads, so there are no potential viewers; however, Disposal Site 2 and the Celestial Valley Mitigation Site are viewed by the public from Celestial Valley Road, and

Disposal Site 3 is viewed by the public from Camptonville Road. The proposed project would use public roads for the haul route, but the work areas are not on public roads.

Discussion

a) Have a substantial adverse effect on a scenic vista?

No Impact. Visual quality is a critical resource management concern on lands seen as middle ground from State Route 49. This highway, in the area of the proposed project, is included in the list of eligible and officially designated State Scenic Highways (CalTrans 2019). The only potential effect on the view from State Route 49 would be a temporary increase in vehicles entering and leaving the proposed project sites. There would be no alterations to the landscape on or around State Route 49. The remaining other public vantage points are not scenic vistas, but rather passing views primarily from vehicles on select abutting roads. As a result, no impact would occur, and no mitigation would be required.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

No Impact. State Route 49 is an eligible state scenic highway located in the proposed project vicinity (CalTrans 2019). The proposed project would not damage scenic resources, including, but not limited to, trees, outcroppings, and historic buildings within the eligible state scenic highway, as no work is proposed in the area with the exception of using the route to haul sediment. As a result, no impact would occur, and no mitigation would be required.

c) Substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publically accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?

Less Than Significant Impact. The only areas that would experience a change in existing visual character are the three proposed disposal sites, where the dredged sediments and sand would be deposited, and the Celestial Valley Mitigation Site, where native vegetation would be planted. There are no publically accessible vantage points of Disposal Site 1; however, Disposal Site 2, Disposal Site 3, and the Celestial Valley Mitigation Site are viewed by the public from abutting roads. Annual grassland, riparian forest, and wetland features are the main biological communites present at Disposal Site 2 and the Celestial Valley Mitigation Site. Ponderosa pine forest makes up the main biological community at Disposal Site 3. At Disposal Site 2 and 3, the vegetation would be expected to regrow after the laying of sediments, and the sites would be revegetated as part of the erosion control measures. At the Celestial Valley Mitigation Site, the revegetation measures would improve the aesthetics of the site by planting native vegetation in an area that was burned and by removing nonnative Himalayan blackberry. Thus, the proposed project would result in less than significant, short-term visual impacts at most sites, except at the mitigation site, where it would result in long-term positive visual impacts. No mitigation would be required.

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

No Impact. The proposed project's construction activities would be temporary when they occur. There is no planned night work that would require the use of lights, nor any construction planned that would affect views. As a result, no impact would occur, and no mitigation would be required.

<u>Mitigation</u>

None required.

3.2 Agriculture and Forestry Resources

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
2. AGRICULTURE AND FORESTRY RESOURCES				
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. *Would the Project:*				
a. Convert Prime Farmland, Unique Farmland or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	--	--	--	**X**
b. Conflict with existing zoning for agricultural use, or a Williamson Act contract?	--	--	--	**X**
c. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code [PRC] section 12220(g)), timberland (as defined by PRC section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	--	--	--	**X**
d. Result in the loss of forest land or conversion of forest land to non-forest use?	--	--	--	**X**
e. Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or Forest land to non-forest use?	--	--	--	**X**

Environmental Setting

The proposed project is located on TNF and private lands in Nevada, Sierra, and Yuba counties. Our House Diversion Dam is zoned Rural/Residential (Sierra County 2012) and Forest-40 (Nevada County 2010), and Log Cabin Diversion Dam is zoned Agricultural/Residential-20 and Timberland (Yuba County 2016). However, both dams are located on NFS lands managed by the TNF, so there is no development outside of the impoundments and NFS roads. Disposal Site 1 is located on YCWA-owned land within the FERC Project Boundary and zoned as Resource Preservation and Recreation, but has been used for sediment laydown since 2014 and is not open to the public (Yuba County 2016). Disposal Site 2 is zoned as Agricultural and Industrial (Yuba County 2016) and currently has assorted equipment and vehicles parked in the area of proposed sediment laydown. Disposal Site 3 is zoned as Forest, per the Sierra County General Plan (2012). The Celestial Valley Mitigation Site is zoned as Urban, but is within the TNF and is undeveloped and occurs along the bank of Oregon Creek (Yuba County 2016). The majority of the areas around the proposed project site are natural, undeveloped areas. There are no agricultural lands within the proposed project's sites.

Discussion

a) **Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?**

No Impact. There are no farmlands designated as prime, unique, or of statewide importance located within the proposed project area (California Department of Conservation 2019a). Therefore, the proposed project would not convert any farmlands designated as prime, unique, or of statewide importance to non-agricultural uses. As a result, no impact would occur, and no mitigation would be required.

b) **Conflict with existing zoning for agricultural use or a Williamson Act contract?**

No Impact. Sierra and Yuba counties have no mapped Williamson Act lands, but there is some in Nevada County. However, there are no Williamson Act contracts (California Department of Conservation 2019b) within the proposed project area, and the area is not specifically zoned for agricultural use, with the exception of a small portion of the Log Cabin Diversion Dam site (Nevada County 2010, Sierra County 2012, and Yuba County 2016). However, no agriculture is performed at Log Cabin Diversion Dam, which is primarily located on NFS lands. Therefore, the proposed project would not conflict with existing zoning for agricultural use or any Williamson Act contracts. As a result, no impact would occur, and no mitigation would be required

c) **Conflict with existing zoning for, or cause rezoning of, forest land (as defined in PRC section 12220(g)), timberland (as defined by PRC section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?**

No Impact. A small area of riparian trees are proposed for removal from Our House Diversion Dam Impoundment for the placement of the material. However, these trees are within the existing impoundment on NFS lands and their removal would not conflict with zoning. No other trees are slated for removal, nor are any activities planned that would conflict with the area zoned as Forest at Disposal Site 3. As a result, no impact would occur, and no mitigation would be required.

d) **Result in the loss of forest land or conversion of forest land to non-forest use?**

No Impact. The main work under the proposed project would occur within the impoundments and would not require any land conversions. Disposal Sites 1 and 2 are unforested and would be revegetated after use. Disposal Site 3 has previously been used for timber production, but there is also evidence of past hydraulic mining. The former land owner plans to retain the timber production rights on the land. Sediment would be strategically placed in areas without tree cover at Disposal Site 3; therefore, implementation of the project would not result in the loss of forest land or require conversion of forested areas to non-forest use. As a result, no impact would occur, and no mitigation would be required

e) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or Forest land to non-forest use?

No Impact. No project work would create changes in the existing environment that would result in conversion of land from one use to another. Additionally, while Disposal Site 3 is zoned as Forest, project work would be planned to prevent the removal of any trees on the site, and all current timber production rights on the property would be retained. As a result, no impact would occur, and no mitigation would be required.

Mitigation

None required.

3.3 Air Quality

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
3. AIR QUALITY *Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the Project:*				
a. Conflict with or obstruct implementation of the applicable air quality plan?	--	--	**X**	--
b. Result in cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard?	--	**X**	--	--
c. Expose sensitive receptors to substantial pollutant concentrations?	--	--	**X**	--
d. Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	--	--	**X**	--

Environmental Setting

The proposed project is located in Yuba, Sierra and Nevada counties. The dredging sites (dams) are both located on NFS land. Disposal Site 1 is located on YCWA-owned land, Disposal Site 2 is located on private property, and Disposal Site 3 is located on private property (YCWA will own the property prior to sediment disposal). Log Cabin Diversion Dam and Disposal Sites 1 and 2 are located in Yuba County, within the Feather River Air Quality Management District (FRAQMD). Our House Diversion Dam is located on the border between Sierra and Nevada Counties, and Disposal Site 3 is located in Sierra County, both within the Northern Sierra Air Quality Management District (NSAQMD). Table 3.3-1 provides the attainment status of the proposed project sites relative to federal and state ambient air quality standards.

Table 3.3-1. Ambient air quality attainment status

	Log Cabin Diversion Dam	Our House Diversion Dam	Disposal Site 1	Disposal Site 2	Disposal Site 3
County Where Located	Yuba	Sierra/Nevada	Yuba	Yuba	Sierra
Federal 8-hr Ozone	A	A/**NA**	A	A	A
Federal PM10	U	U	U	U	U
Federal PM2.5	A	A	A	A	A
Federal CO	A	A	A	A	A
State Ozone	**NA**	U/**NA**	**NA**	**NA**	U
State PM10	**NA**	**NA**	**NA**	**NA**	**NA**
State PM2.5	A	U/U	A	A	U

Table 3.3-1. (continued)

	Log Cabin Diversion Dam	Our House Diversion Dam	Disposal Site 1	Disposal Site 2	Disposal Site 3
State CO	U	U	U	U	U

Source: Area Designations Maps / State and National, http://www.arb.ca.gov/desig/adm/adm.htm Accessed 8/6/19
A = Attainment (or unclassified and assumed attainment)
NA = Nonattainment
NA-T = Nonattainment-Transitional (Calif standard area)
U = Unclassified (attainment)

Both FRAQMD and NSAQMD have published CEQA guidance documents listing significance thresholds for construction projects. Construction projects with estimated emissions above significance thresholds are not prohibited, but where estimated emissions exceed significance thresholds, mitigation measures must be applied to the construction project to limit emissions to the extent practicable. Tables 3.3-2 and 3.3-3 present the construction project CEQA significance thresholds for FRAQMD and NSAQMD, respectively.

Table 3.3-2. FRAQMD Thresholds of Significance

	NOx[1] (ton/yr)	ROG[1] (ton/yr)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)	GHG (lb/day)
Construction or Operation	4.5	4.5	80	Not Established	Not Established

Sources: 2010 FRAQMD Indirect Source Review Guidelines, https://www.fraqmd.org/files/658e76309/Chapter+3.pdf accessed 8/28/19 and Personal Communication with Sondra Spaethe of Feather River AQMD 11/4/2019
[1] Construction NOx and ROG may be averaged over the life of the project but may not exceed 4.5 tons per year each.

Table 3.3-3. NSAQMD Thresholds of Significance

	NOx (lb/day)	ROG (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)	GHG (lb/day)
Level A - Less than Significant	< 24	< 24	< 79	Not Established	Not Established
Level B - Potentially Significant	24 - 136	24 - 136	79 - 136	Not Established	Not Established
Level C - Mitigation Required	> 136	> 136	> 136	Not Established	Not Established

Sources: Guidelines for Assessing and Mitigating Air Quality Impacts of Land Use Projects, https://www.mynevadacounty.com/DocumentCenter/View/15131/NSAQMD-Attachment-Land-Use-Guidelines-PDF accessed 8/28/19 and Personal Communication with Sam Longmire of Northern Sierra AQD 11/2/2019

The NSAQMD guidance document suggests three tiers of construction mitigation measures corresponding to the three ranges of estimated emissions in the table above.

Modeled Unmitigated Project Emissions

Emissions from the proposed project were estimated using the California Emissions Estimator Model (CalEEMod) Version 2016.3.2. Table 3.3-4 presents the off-road equipment fleet used to estimate emissions from construction.

Table 3.3-4. Off-road Equipment Included in Emissions Estimate

Equipment	CalEEMod Eqpt. Type	Number of Units	Hours/Day	Horsepower	Tier	Days/Year/Unit
SEDIMENT PASSAGE						
None						
REMEDIAL ACTION						
Suction Pump	Pump	1	10	172	4F	1
MECHANICAL REMOVAL OF SOIL						
Off-road Dump Truck	Off-highway Truck	4	10	300	4F	60
Dozer	Crawler Tractor	2	10	305	4F	60
Excavator	Excavator	3	10	196	Footnote 1	60
Water Diversion Pump	Pump	4	24	84	4F	60
Water Truck	Off-highway truck	2	10	300	4F	60
Hydroseeding Truck	Off-highway truck	1	10	115	4F	5
Street Sweeper	Street Sweeper	1	1	64	4F	60
Front End Loader	Rubber Tired Loader	1	10	203	Footnote 1	60
EMERGENCY ACTIVITIES						
Could include same equipment as mechanical removal of soil, but no emergency activities are anticipated.						
[1]It is possible that Tier 4 Final equipment may not be available for all off-road equipment, but the specific equipment availability is not known at this time. Therefore, the Tier 4 Final constraint in CalEEMod was removed from 10% of the off-road equipment horsepower. One excavator and the front end loader were arbitrarily selected as these two devices equal 10% of off-road fleet horsepower						

Mobilization and demobilization would employ six to eight flatbed trucks to deliver and retrieve all off-road equipment for each dredging event; it is anticipated that there could be up to 20 events over 10 years.

Disposal Site 1 is approximately 7 mi from Log Cabin Diversion Dam and 13 mi from Our House Diversion Dam, but Disposal Site 1 has limited remaining capacity. Disposal Site 2 is approximately 4 mi from Log Cabin Diversion Dam and 7 mi from Our House Diversion Dam. Disposal Site 3 is approximately 11 mi from Log Cabin Diversion Dam and 9 mi from Our House Diversion Dam. For this analysis, a travel distance of 11 mi has been assumed to calculate both maximum daily and maximum annual emissions.

Maximum annual sediment volume for transport is estimated to be up to 140,000 yds^3 per year, to be dredged over a 60 day period. At 15 yds^3 per truck load, that totals 9,333 truck round trips per year, at 11 mi each way, or approximately 156 round trips per working day. Annual emissions include an additional 18 round trips for mobilization of off-road equipment.

Approximately 10 worker vehicles are expected, traveling approximately 45 mi each way (e.g., from Yuba City).

Daily emissions assume that the two dams would not be concurrently excavated. Although historically, dredging events have occurred approximately once per decade at each dam, this estimate assumes one dredging event per year at each dam.

Table 3.3-5 presents the estimate of unmitigated daily emissions from the proposed project.

Table 3.3-5. Unmitigated Daily Emissions from Proposed Sediment Removal Activities

Emissions Source	Unmitigated Daily Emissions (lb/day) From Excavation and Disposal				
	ROG	CO	NOx	PM_{10}	$PM_{2.5}$
SEDIMENT REMOVAL SITE					
Fugitive Dust				0.71	0.10
Off-road Equipment	9.95	76.67	90.89	4.96	4.23
Worker Commute	0.24	1.78	0.23	0.58	0.16
SEDIMENT DISPOSAL SITE					
Fugitive Dust				0.71	0.10
Off-road Equipment	1.88	12.78	22.12	1.57	0.89
On-road Transport	1.01	5.27	30.78	268.98	29.35
Worker Commute	0.05	0.34	0.04	0.66	0.16
Total Daily Emissions	**13.11**	**96.83**	**144.07**	**278.17**	**34.98**
Significance Thresholds	**136**		**136**	**80**	
Below Threshold	**Yes**	**N/A**	**No**	**No**	**Yes**

Table 3.3-6 presents the estimate of unmitigated annual emissions from the proposed action.

Table 3.3-6. Unmitigated Annual Emissions from Proposed Sediment Removal Activities

Emissions Source	Unmitigated Annual Emissions (ton/yr) From Excavation and Disposal				
	ROG	CO	NOx	PM_{10}	$PM_{2.5}$
SEDIMENT REMOVAL SITE					
Fugitive Dust				0.021	0.003
Off-road Equipment	0.275	2.054	2.527	0.118	0.115
Worker Commute	0.006	0.055	0.006	0.017	0.004
SEDIMENT DISPOSAL SITE					
Fugitive Dust				0.021	0.003
Off-road Equipment	0.056	0.384	0.664	0.026	0.024
On-road Transport	0.030	0.157	0.907	6.655	0.736
Worker Commute	0.001	0.010	0.001	0.019	0.005
Total Annual Emissions	**0.369**	**2.66**	**4.105**	**6.877**	**0.890**
Significance Thresholds	**4.5**	**N/A**	**4.5**	**N/A**	
Below Threshold	**Yes**	**N/A**	**Yes**	**N/A**	

Estimates of unmitigated daily emissions of NOx and PM_{10}, are well above applicable CEQA thresholds of significance. Therefore, all feasible mitigation measures have been incorporated in order to mitigate NOx and PM_{10}, and thus reduce the potential for significant impacts.

Off-road equipment is specified to be tier 4 final emission control level. Tier 4 final equipment is roughly 2014 model year or newer, depending upon the type of equipment. It may be that Tier 4 final equipment would not be available for every equipment type listed on Table 3.3-4, but the highest available tier equipment would be used. Emission estimates assume that 90% of the off-road equipment would be tier 4 final.

Haul trucks would be compliant with Title 13 CCR § 2025 (aka the "Truck and Bus Regulation") so that in 2020 there would be no trucks older than model year 2000 and many of the trucks would be 2015 or newer, due to mandatory retirement of older California trucks. In 2021 there would be no trucks older than 2005 model year, and in 2022 there would be no trucks older than 2010 model year.

Unpaved roads at the dams and disposal areas would be treated with chemical soil stabilizer to control PM_{10}. USEPA's AP-42 guidance document suggests that chemical stabilizers reduce PM_{10} emissions from unpaved roads by 80%.

Speed would be limited to 15 mi per hour (mph) on unpaved roads, in accordance with the FRAQMD Construction Phase Mitigation Measures (FRAQMD 2016).

Modeled Project Emissions with Mitigation Incorporated

Table 3.3-7 presents the modeled estimate of daily emissions from the proposed project with mitigation incorporated. The complete list of mitigation measures that were incorporated into modeling of emissions with mitigation are listed at the end of Section 3.3.

Table 3.3-7. Daily Emissions from Proposed Sediment Removal Activities with Mitigation Incorporated

Emissions Source	Mitigated Daily Emissions (lb/day) From Excavation and Disposal				
	ROG	CO	NOx	PM_{10}	$PM_{2.5}$
SEDIMENT REMOVAL SITE					
Fugitive Dust				0.119	0.016
Off-road Equipment	2.66	94.03	18.02	0.683	0.554
Worker Commute	0.24	1.78	0.23	0.311	0.090
SEDIMENT DISPOSAL SITE					
Fugitive Dust				0.119	0.016
Off-road Equipment	0.38	13.83	1.63	0.169	0.067
On-road Transport	1.01	5.27	30.78	38.919	5.233
Worker Commute	0.05	0.34	0.04	0.316	0.080
Total Daily Emissions	**4.33**	**115.25**	**50.71**	**40.63**	**6.06**
Significance Thresholds	**136**	**N/A**	**136**	**80**	
Below Threshold	**Yes**	**N/A**	**No**	**Yes**	

Table 3.3-8 presents the modeled estimate of annual emissions from the proposed project with mitigation incorporated.

Table 3.3-8. Annual Emissions from Proposed Sediment Removal Activities with Mitigation Incorporated

Emissions Source	Annual Mitigated Emissions (ton/yr) During Excavation/Disposal				
	ROG	CO	NOx	PM_{10}	$PM_{2.5}$
SEDIMENT REMOVAL SITE					
Fugitive Dust				0.0036	0.0005
Off-road Equipment	0.075	2.515	0.519	0.0163	0.0155
Worker Commute	0.006	0.055	0.006	0.0090	0.0026
SEDIMENT DISPOSAL SITE					
Fugitive Dust				0.0036	0.0005
Off-road Equipment	0.011	0.415	0.049	0.0015	0.0015
On-road Transport	0.030	0.157	0.907	0.9872	0.1376
Worker Commute	0.001	0.010	0.001	0.0091	0.0023
Total Annual Emissions	**0.124**	**3.152**	**1.483**	**1.030**	**0.160**
Significance Thresholds	**4.5**	**N/A**	**4.5**	**N/A**	
Below Threshold	**Yes**	**N/A**	**Yes**	**N/A**	

Note Regarding NOx Estimates for Street Legal Heavy Duty Trucks

Late-model heavy duty diesel trucks are equipped with selective catalytic reduction (SCR) devices to control NOx emissions. SCR devices function only when heated to operating temperature. These trucks therefore emit NOx at a higher rate during initial warmup. California Air Resources Board's (CARB) on-road vehicle emission factors model (EMFAC) suggests startup NOx emission factors for late model heavy duty trucks in units of grams per truck per day (EMFAC 2017). This assumes one cold start per day per truck. CalEEMod, however, assigns cold start NOx emissions to each one-way trip in calculating daily emissions. For this project, modeling truck hauling as a series of 312 one-way 11-mile trips results in an estimate of cold start NOx emissions that far exceed over-the-road working NOx emissions per the EMFAC model. Therefore, truck trips were modeled in CalEEMod as one long trip per truck per day. That is, as ten trucks each making one 344 mile trip per day.

Note Regarding Emission Estimates for Off-Road and Non-Road Equipment

In order to limit air emissions, particularly NOx, from off-road (e.g. excavators) and non-road (e.g. pumps) equipment to be used at the dams and disposal sites, Tier 4 final equipment has been specified. It is possible, however that it would not be feasible to procure Tier 4 final devices for every item in the fleet. Equipment availability is not known at this time, particularly for future years. Fleet-wide use of Tier 4 final equipment cannot be guaranteed. In an effort to generate a reasonable estimate of emissions, the Tier 4 final constraint was left off of 10% of the fleet in CalEEMod. In order to achieve this, the Tier 4 final constraint was left off from one excavator and one wheeled loader. These two vehicles combined represent 10% of the fleet horsepower.

Discussion

a) Conflict with or obstruct implementation of the applicable air quality plan?

No Impact. The proposed project would neither conflict with nor obstruct implementation of the air quality plan established by the FRAQMD or NSAQD. Therefore, no significant impact would occur.

b) Result in cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard?

Less Than Significant Impact with Mitigation Incorporated. The CalEEMod was run to estimate construction emissions for the proposed project. Tables 3.3-7 and 3.3-8 show the estimated daily and annual construction emissions for the proposed project with mitigation incorporated. The modeling results show that sediment removal emissions would be below the relevant significance thresholds. Daily NOx emissions would be in the 24-136 lb/day Potentially Significant category for Northern Sierra AQMD. For projects in this category, Northern Sierra requires that all project NOx sources be CARB compliant to satisfy CEQA.[8] Annual NOx emissions would be below the 4.5 ton/yr Feather River AQMD NOx significance threshold. Feather River policy for recurring projects such as this one is to use the annual significance threshold rather than the 25 lb/day significance threshold.[9] Therefore, proposed project-related impacts would be less than significant. It should also be noted that as the heavy duty truck fleet is replaced by newer model trucks, NOx emissions would decline through the 10 year period of this proposed action. .

c) Expose sensitive receptors to substantial pollutant concentrations?

No Impact. There are no sensitive receptors in the vicinity of the proposed project area. Therefore, no impact would occur and, no mitigation would be required.

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

No Impact. No unusual odors or other emissions are expected from the sediment or equipment to be used. Further, there are no private residences adjacent to any of the project-related sites. Therefore, no impact would occur and, no mitigation would be required.

[8] 11/1/19 Personal Communication with Sam Longmire of NSAQD.
[9] 11/4/19 Personal Communication with Sondra Spaethe of FRAQMD.

Mitigation

Air Quality impact mitigation measures proposed for this proposed project are:

- AQ-1 Water exposed areas two times per day
- AQ-2 Limit vehicle speed on unpaved roads to 15 mph
- AQ-3 Clean visible mud from paved road entrances at least once per day
- AQ-4 Hydroseed disposed sediment as soon as practical.
- AQ-5 Diesel idling time to be limited to 5 minutes per Title 13, Section 2485 of CCR. (note that this does not apply to USEPA certified "clean idle" vehicles)
- AQ-6 Diesels to be maintained per manufacturer recommendations
- AQ-7 Diesel off-road equipment to be tier 4 (where available)
- AQ-8 Apply chemical stabilizer to unpaved roads to control particulate emissions
- AQ-9 On-road heavy duty truck fleet to comply with California Title 13 CCR § 2025 which requires that older vehicles be replaced by modern, emission-controlled trucks.

3.4 Biological Resources

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
4. BIOLOGICAL RESOURCES *Would the Project:*				
a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	--	X	--	--
b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	--	X	--	--
c. Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	--	X	--	--
d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	--	X	--	--
e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	--	--	--	X
f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional or state habitat conservation plan?	--	--	--	X

This section describes potential effects on biological resources as a result of the proposed project, and recommends measures to reduce or avoid effects resulting from project-related activities. Additionally, it describes the environmental setting with regard to biological resources and evaluates the effects of the proposed project on biological resources.

Environmental Setting

This section describes the regional and local environmental setting with regard to biological resources. The biological study area matches the project site boundaries as defined in section 2.0 Project Description (Figures 2.2-2, 2.2-6, 2.2-11, 2.2-12, 2.2-17, 2.2-18, 2.3-1, 2.3-5 and 2.3-6).

Methodology

The following data reviews, reconnaissance-level and protocol-level surveys, and analyses, were performed to characterize the environmental setting of the project sites, and determine what potential effects project-related activities could have on biological resources.

Literature Review

The following sources were drawn upon to characterize the environmental setting at the project sites. Project-related documentation was reviewed for site-specific data regarding habitat suitability for special-status species. Secondly, preliminary database searches were performed of the following to identify special-status species and their habitats, as well as aquatic resources, with the potential to occur at the project sites:

- U.S. Fish and Wildlife Service's (USFWS) *Information for Planning and Consultation* (2019a)
- USFWS *Critical Habitat Mapper* (2019b)
- CDFW *California Natural Diversity Database* (CNDDB) QuickView Tool in BIOS 5 (2019a)
- California Native Plant Society (CNPS) *Inventory of Rare, Threatened, and Endangered Plants of California* (2019)
- Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) California species list tools (2019)
- Forest Service, *Region 5 Regional Forester's Sensitive Animal Species List for the Tahoe National Forest* (Forest Service 2013a)
- Forest Service, *Region 5 Regional Forester's Sensitive Plant Species List for the Tahoe National Forest* (Forest Service 2013b)
- *Google Earth* aerial imagery
- United States Geological Survey (USGS) topographic maps

The USFWS databases were queried to identify federally listed species and critical habitats that have the potential to be affected by the proposed project. A query of the CNDDB provided a list of processed and unprocessed occurrences for special-status species in the Challenge, Camptonville, Pike, Downieville, Alleghany, North Bloomfield, Nevada City, French Corral, Rackerby, Oregon House, Washington, Forbestown, Clipper Mills, Strawberry Valley, and Goodyears Bar, California, USGS 7.5-minute quadrangles. The CNPS database was queried to identify special-status plant species with the potential to occur in the aforementioned USGS quadrangles. The NMFS database was also queried in the USGS quadrangles that overlap with the project sites (Challenge, Camptonville, and Pike) to identify species and critical habitat under the jurisdiction of NMFS with the potential to occur at the project sites. Lastly, the Forest Service's sensitive species lists were reviewed to identify any plant and wildlife species that are recognized by the Forest Service as sensitive (FSS). Raw data from the database queries are provided in Attachment B.

Relicensing Studies

From 2011 to 2013, YCWA completed relicensing studies in support of the FERC Project including multiple studies assessing and inventorying biological resources. These biological resource studies included, special-status mollusks, amphibians, turtles, wildlife, bats, plants, wetlands, bald eagle, and valley elderberry longhorn beetle (YCWA 2019a). From 2014 to 2018, YCWA implemented the current Plan (YCWA 2014) as approved by FERC at both the Log Cabin Diversion Dam Impoundment and the Our House Diversion Dam Impoundment and disposal for sediment at Disposal Site 1. With the exception of Disposal Site 2, Disposal Site 3, and the Celestial Valley Mitigation Site, all sites covered by the Plan were part of the larger area included in these relicensing studies. Biological information gathered during these relicensing studies and associated monitoring during implementation of the sediment management plan was considered when defining the environmental setting for the proposed project. Results of these studies can be found on the YCWA relicensing site (YCWA 2019a).

Aquatic Resources Delineations

HDR biologists completed aquatic resources delineations at the following sites:

- Log Cabin Diversion Dam, Our House Diversion Dam, staging areas, and Disposal Site 1 – June 2014 (YCWA 2014)
- Disposal Site 2 – April 2018, July 2018 (YCWA 2018)
- Celestial Valley Mitigation Site – January 2019 (YCWA 2019b)
- Disposal Site 3 – August 2019 (YCWA 2019c)

The delineation for the Log Cabin and Our House Diversion Dams project areas, as well as Disposal Site 1, was submitted to the USACE for verification on July 15, 2014, and was verified by the USACE on September 25, 2014. The delineation for Disposal Site 2 was submitted to USACE for verification on December 13, 2018 and was verified by the USACE on August 13, 2019. The delineations for Disposal Site 3 and the Celestial Valley Mitigation Site were submitted to the USACE for verification on September 11, 2019 and verified on October 21, 2019. Previously delineated areas do not cover the area where aquatic species are released after rescues described below. However, there are no impacts to aquatic or other sensitive resources in the area of aquatic species release. Additionally, areas along proposed project access roads were not delineated unless there were plans to use these areas as staging, laydown, or parking areas. However, vehicles are not to drive off developed roads, except as described, so these areas would also not be impacted.

Special-Status Frog Surveys

HDR biologists completed habitat assessments for California red-legged frog (CRLF [*Rana draytonii*]), and foothill yellow-legged frog (FYLF [*Rana boylii*]), at the following project sites:

- Disposal Site 2 – November 2018 (YCWA 2019d)

- Disposal Site 3 – August 2019 (YCWA 2019d)

For both special-status frog assessments, habitat was evaluated for all accessible aquatic and upland features in the project sites and within a one-mile radius. All accessible locations with potentially suitable breeding habitat for CRLF and FYLF were visited in the field; whereas habitats within one mile of the project sites that were not accessible in the field were analyzed using aerial imagery.

Effects Evaluation

The effects evaluation is based on the project description; the environmental setting; and on federal, state, and local regulatory requirements regarding effects on biological resources. In addition, the effects evaluation utilized data collected from the literature review, relicensing studies, aquatic resources delineations, species-specific surveys, and vegetation mapping. When information about the presence of a particular special-status species was unknown, but suitable habitat was present, then the effects evaluation took a conservative approach by inferring presence of special-status species at the project sites until preconstruction surveys determine otherwise. Effects on specific biological resources are identified and appropriate avoidance, minimization, compensation, and/or mitigation measures are discussed further below.

Local Setting

The project sites are located in the Sierra Nevada foothills in Nevada, Sierra and Yuba counties, California. Project sites range in elevation from 1,500 ft to 3,200 ft above mean sea level. All project sites fall within the Middle Yuba River watershed (Hydrologic Unit Code 1802012505), with the exception of Disposal Site 1, which spans the Middle Yuba watershed and the Lower North Yuba River Watershed (Hydrologic Unit Code 1802012504;CDFW 2019b).

Vegetation Communities

Vegetation communities are assemblages of plant species that occur in the same area and are defined by species composition and relative abundance. The project sites are characterized by a combination of upland and aquatic vegetation communities. Upland communities include disturbed, annual grassland, montane chaparral, montane hardwood, montane hardwood-conifer, and montane riparian. Aquatic communities include ephemeral channel, perennial channel, pond, and seasonal wetland. For congruency, all previously defined upland vegetation communities were crosswalked to fit community descriptions from CDFW's *California Wildlife Habitat Relationships System* (CDFW 2019c). Aquatic vegetation community descriptions were derived from delineation reports overlapping the project sites. Each community is described below and is based on data collected from a combination of desktop analysis and in the field from previously completed delineations and studies. These descriptions include the dominant and common associate plant species found in each community. A mapbook of vegetation communities in the project sites can be found as Attachment C, and **Table 3.4-1** provides a summary of vegetation communities at each of the six project sites.

Table 3.4-1. Summary of Project Site Vegetation Communities

Vegetation Community	Project Site					
	Disposal Site 1	Disposal Site 2	Disposal Site 3	Celestial Valley Mitigation Site	Log Cabin	Our House
Upland Communities						
Annual Grassland		X				
Disturbed	X	X		X	X	X
Montane Chaparral			X			
Montane Hardwood			X			
Montane Hardwood - Conifer	X	X	X	X	X	X
Montane Riparian		X	X	X	X	X
Aquatic Communities						
Ephemeral Channel		X	X	X		
Perennial Channel		X	X	X	X	X
Pond		X				
Seasonal Wetland		X				

Upland Communities

Annual Grassland (AGS)

Annual grassland habitat is are dominated by nonnative annual grasses including Italian ryegrass (*Festuca perennis*), wild oats (*Avena barbata* and *A. fatua*), a variety of bromes (*Bromus* ssp.), silver hair grass (*Aira caryophyllea*) and bulbous blue grass (*Poa bulbosa*). Associates include weedy forbs such as longbeak stork's bill (*Erodium botrys*), tall sock-destroyer (*Torilis arvensis*), wooly mullein (*Verbascum thapsus*), English plantain (*Plantago lanceolata*), rose clover (*Trifolium hirtum*) and hairy vetch (*Vicia villosa*), with a sparse scattering of native species, such as blue dicks (*Dichelostemma capitatum*).

Disturbed (DIS)

Disturbed areas include existing access roads, human-made structures, hardscape, and semi-barren areas with sparse vegetation. Portions of Disposal Site 2 had previously been used as a lumber mill, and limited lumber activities still occur within these areas as evidenced by tree bark remnants scattered throughout. In addition to the industrial uses, there are several residential properties at Disposal Site 2 that have altered landscapes. Disposal Site 1 was previously cleared to make way for sediment laydown areas and a large majority of this area is now considered disturbed. FERC Project operations and maintenance, recreation, and vegetation management have occurred at both the Log Cabin and Our House diversion dams, resulting in disturbed areas at both sites.

Montane Chaparral (MCH)

Disposal Site 3 is the only project site with this vegetation community. Areas mapped as chaparral are dominated by manzanita (*Arctostaphylos* sp.), with very few tree species growing among the shrubs. These chaparral areas have small amounts of Pacific madrone (*Arbutus menziesii*), ponderosa pine, Douglas-fir (*Pseudotsuga menziesii*), and sugar pine (*Pinus lambertiana*) growing throughout, but no herbaceous understory. The two areas of chaparral in the north section of Disposal Site 3 are adjacent to a recently logged and replanted ponderosa pine forest, and there are some signs of human disturbance in these areas. The large chaparral community in the south section of Disposal Site 3 is much more disturbed, and appears to be growing on old tailing deposits. The soil is rocky and the topography consist of numerous berms and pits.

Montane Hardwood (MHW)

Areas mapped as montane hardwood consist of a variety of hardwood species that appear to have not been previously logged. This vegetation community acts as a transition between the mixed conifer forests along the ridge tops, and the bigleaf maple (*Acer macrophyllum*) woodlands that make up the riparian corridor at the bottom of the gullies. The overstory in this community includes California black oak (*Quercus kelloggii*), Pacific madrone, canyon live oak (*Quercus chrysolepis*), ponderosa pine, and Douglas-fir. This vegetation community also includes a mid-story consisting of manzanita and ceanothus (*Ceanothus* sp.), and an understory of California yerba santa (*Eriodictyon californicum*), Himalayan blackberry, poison oak (*Toxicodendron diversilobum*), rosinweed (*Calycadenia* sp.), vinegar weed (*Trichostema lanceolatum*), and barbed goat grass (*Aegilops triuncialis*).

Montane Hardwood-Conifer (MHC)

Montane hardwood-conifer habitat occurs throughout a majority of the project sites. The dominant tree species observed in this area was ponderosa pine. In addition to the ponderosa pine, the overstory includes Pacific madrone, incense cedar (*Calocedrus decurrens*), California black oak, Douglas-fir, canyon live oak, and tanbark oak (*Notholithocarpus densiflorus*). The understory varies throughout the project sites, but some dominant species include snowberry (*Symphoricarpos* sp.), mountain misery (*Chamaebatia foliolosa*), Himalayan blackberry, and bracken fern (*Pteridium* sp.).

Montane Riparian (MRI)

Montane riparian habitat occurs throughout the project sites with only minimal variations between them. The dominant species are Fremont's cottonwood (*Populus fremontii* ssp. *fremontii*), white alder (*Alnus rhombifolia*) and willows. Other trees species, including Northern California black walnut (*Juglans hindsii*) and nonnative black locust (*Robinia psuedoacacia*), are also present in this vegetation community. Understory vegetation includes poison oak, California wild grape (*Vitis californica*), Himalayan blackberry, and a mix of nonnative annual grasses. This riparian vegetation community is associated mainly with Oregon Creek and the Middle Yuba River, and provides shade and cover for these aquatic features in addition to ephemeral channels mapped at the project sites. Disposal Site 3 contains large, homogenous patches of Himalayan blackberry with areas of willow recruitment.

Aquatic Communities

Ephemeral Channel (ECH)

Ephemeral channels have flowing water for only a short duration after precipitation events during a normal water year. The beds of the ephemeral channels at the project sites are approximately 1 to 6 feet wide and located above the water table year-round; therefore, groundwater is not a source of water for these features, and runoff from rainfall and snowmelt are the primary water sources. Due to the short hydroperiod, the vegetation in ephemeral channels at the project sites is characteristic of the surrounding community types. The ephemeral channels at the project sites are a mix of scoured, unvegetated channel segments and segments characterized by dense Himalayan blackberry thickets. Some areas support scattered riparian vegetation such as dogwood (*Cornus* sp.) and California hazelnut (*Corylus cornuta* var. *californica*).

Perennial Channel (PCH)

Perennial channels at the project sites include the Middle Yuba River (Our House Diversion Dam), Oregon Creek (Log Cabin Diversion Dam, Disposal Site 2, and Celestial Valley Mitigation Site), and an unnamed tributary to Oregon Creek (Disposal Site 3). The banks of Oregon Creek can vary from gradual to steep and quickly slope up to upland areas supporting adjacent montane riparian areas; however, some herbaceous vegetation grows below the banks. The vegetation growing at the base of the creek banks is characterized by low growing, rooted herbaceous hydrophytes generally dominated by various sedge species (*Carex* spp. and *Cyperus* spp.). Areas along the Middle Yuba River can also vary from gradual to steep slopes with the banks being characterized by willow, alder, big leaf maple, Himalayan blackberry, and California grape.

Pond (PON)

Pond habitat was mapped at Disposal Site 2 and Disposal Site 3. It is thought that the ponding feature at Disposal Site 2 was built when the area was used as a lumber mill. The features consists of a vertical concrete wall and a sloped concrete bed. Silt and bioaccumulation are present along the bed of the man-made pond and wood planks control flow from the feature to Oregon Creek. This feature was documented to support juvenile bullfrogs (*Lithobates catesbeianus*). Willows and alders dominate the perimeter of this feature, while groundcover is composed of invasive weeds consistent with species found in annual grassland at the project sites.

The pond at Disposal Site 3 is irregularly shaped and approximately 20 ft by 35 ft in diameter, with an area of 450 square feet. The pond has nearly vertical slopes and is approximately 2 ft deep. It appears to be spring fed, with a downstream 18 in culvert that showed no recent signs of flow. Vegetation present includes pondweed (*Potamogeton* sp.) and sedges (Cyperaceae), with Himalayan blackberry along the edges. Canopy cover consists of Pacific madrone, ponderosa pine, Douglas-fir, and manzanita. Substrate consists of silt and sand and the pond appears to artificially excavated, perhaps at the site of a spring.

Seasonal Wetland (SWE)

Seasonal wetlands occur at Disposal Site 2 and are dominated mainly by a single hydrophytic herbaceous species intermixed with other non-dominant hydrophytic species. Plant species present include large-spiked spikerush (*Eleocharis macrostachya*), velvet grass (*Holcus lanatus*), common rush (*Juncus effusus*), and narrow-leaved cattail (*Typha angustifolia*). Seasonal wetland features at Disposal Site 2 receive hydrology from precipitation events as water flows downslope from the hillside into areas with concave topography. Wetlands at Disposal Site 2 may receive additional hydrology from flood irrigation techniques used by the adjacent landowners outside of the project site.

Special-Status Natural Communities and Aquatic Resources

Sensitive habitats included are those that are of special concern to resource agencies or those that are protected under CDFW, Section 1600-1603 of the Fish and Game Code (FGC), and/or Sections 401 and Section 404 of the Clean Water Act (CWA).

Aquatic resources provide a variety of habitat functions for plants and wildlife including foraging, cover, migration, and movement corridors for both special-status and common species. In addition to habitat functions, these features provide physical conveyance of surface water flows capable of handling large stormwater events. Large storms can produce extreme flows that cause bank cutting and sedimentation of open waters and streams. Aquatic resources can slow these flows and lessen the effects of large storm events, protecting habitat and other resources.

Several aquatic resources and vegetation communities at the project sites would be considered sensitive communities due to their unique hydrophytic vegetation and ability to support special-status species. These areas include, but are not limited to, ephemeral channel, montane riparian, perennial channel, pond, and seasonal wetland communities.

Wildlife Movement Corridors

Wildlife corridors refer to established migration routes commonly used by resident and migratory species for passage from one geographic location to another. Corridors are present in a variety of habitats and link otherwise fragmented habitats. Maintaining the continuity of established wildlife corridors is important to a) sustain species with specific foraging requirements, b) preserve a species' distribution potential, and c) retain diversity among many wildlife populations. Therefore, resource agencies consider wildlife corridors to be a sensitive resource.

Available data on movement corridors and linkages was accessed via the CDFW BIOS 5 Viewer (2019b). Data reviewed included the essential connectivity areas [ds623] layer, the natural landscape blocks [ds621] layer, and the missing linkages in California [ds420] layer. A natural landscape block (ID #191) covers portions of the project sites including Our House Diversion Dam and a few project access roads. An essential connectivity area occurs south and east of the project, overlapping with landscape block #191 near San Juan Ridge. Additionally, east of the project sites, a linkage for forest carnivores and spotted owl was identified in the missing linkages layer. Lastly, riparian corridors associated with Oregon Creek, the Middle Yuba River, and their tributaries, may facilitate local and regional wildlife movement. Oregon Creek is a permanent stream that flows through portions of Disposal Site 2, the Celestial Valley Mitigation Site, and Log Cabin Diversion Dam. Several tributaries to Oregon Creek bisect Disposal Site 3. The Middle Yuba River flows through the Our House Diversion Dam project site and acts as a major aquatic corridor for aquatic and terrestrial species. Additionally, the Log Cabin and Our House diversion dams act as existing aquatic barriers.

Special-status Species

Candidate, sensitive, or special-status species are commonly characterized as species that are at potential risk or actual risk to their persistence in a given area, or across their native habitat. These species have been identified and assigned a status ranking by governmental agencies such as CDFW, USFWS, and private organizations such as CNPS. The degree to which a species is at risk of extinction is the determining factor in the assignment of a status ranking. Some common threats to a species' or population's persistence include habitat loss, degradation, and fragmentation, as well as human conflict and intrusion. For the purposes of this biological review, special-status species are defined as follows:

Listed, proposed, or candidates for listing under the federal ESA (50 Code of Federal Regulations 17.11 **–** listed; 61 Federal Register 7591, February 28, 1996 candidates)

Listed or proposed for listing under the California Endangered Species Act (CESA;FGC 1992 Section 2050 et seq.; 14 CCR Section 670.1 et seq.)

Designated as a Species of Special Concern (SSC) by the CDFW

Designated as Fully Protected (FP) by the CDFW (FGC Sections 3511, 4700, 5050, 5515)

Species that meet the definition of rare or endangered under CEQA (14 CCR Section 15380) including CNPS List Rank 1b and 2

Species designated as sensitive by the Forest Service for the Tahoe National Forest under Forest Service Manual 2672.11, 2670.44 - 2670.5

The results of the USFWS, CDFW, CNPS, NMFS, and Forest Service queries identified several special-status species with the potential to be impacted by project-related activities. The tables provided in Attachment D provide descriptions of the habitat requirements for each species and conclusions regarding the potential for each species to be impacted by project-related activities. In cases where a determination was made that no suitable habitat for a given species was present at the project sites, that species is not analyzed further in this document (Attachment D). **Table 3.4-2** provides a summary of those species determined to have the potential to be affected by project-related activities (Attachment D), and their associated vegetation communities at the project sites.

Table 3.4-2. Special-status Species with the Potential to Occur at the Project Sites and Associated Vegetation Communities

Species	Special-status Designation	Project Site					
		Disposal Site 1	Disposal Site 2	Disposal Site 3	Celestial Valley Mitigation Site	Log Cabin	Our House
Plants							
Sierra arching sedge (*Carex cyrtostachya*)	CNPS 1B.2	--	MRI PCH PON SEW	MRI ECH PCH	MRI PCH	MRI, PCH	MRI, PCH
Mosquin's clarkia (*Clarkia mosquinii*)	CNPS 1B.1	DIS, MHC	DIS MHC	DIS MHC MHW	DIS MHC	DIS MHC	DIS MHC
mountain lady's-slipper (*Cypripedium montanum*)	FSS CNPS 4.2	MHC	MHC	MHC MHW	MHC	MHC	MHC
branched collybia (*Dendrocollybia racemosa*)	FSS	MHC	MHC	MHC	MHC	MHC	MHC
Cantelow's lewisia (*Lewisia cantelovii*)	FSS	--	MRI PCH PON SEW	MRI ECH, PCH	MRI PCH	MRI PCH	MRI, PCH
Shevock's copper moss (*Mielichhoferia shevockii*)	CNPS 1B.2	--	MHC MRI PCH PON SEW	MHC MRI ECH PCH	MHC MRI PCH	MHC MRI PCH	MHC MRI PCH
Sierra blue grass (*Poa sierra*)	FSS CNPS 1B.2	MHC	MHC AGS	MHC	MHC	MHC	MHC
brownish beaked-rush (*Rhynchospora capitellata*)	CNPS 2B.2	--	MRI ECH PCH PON SEW	MRI ECH PCH	MRI ECH PCH	MRI PCH	MRI PCH
True's mountain jewelflower (*Streptanthus tortuosus* ssp. *truei*)	CNPS 1B.1	MHC	MHC	MHC	MHC	MHC	MHC
Wildlife							
hardhead (*Mylopharodon conocephalus*)	SSC; FSS	--	PCH	PCH	PCH	PCH	PCH
foothill yellow-legged frog (*Rana boylii*)	ST (Candidate)	--	MRI PCH PON SEW	MRI PCH PON	MRI PCH	MRI PCH	MRI PCH
California red-legged frog (*Rana draytonii*)	FT SSC	--	MRI PCH PON SEW	MRI PCH PON	--	--	--
western pond turtle (*Emys marmorata*)	SSC	--	AGS MRI PCH PON SEW	MRI PCH PON	MRI PCH	MRI PCH	MRI PCH
coast horned lizard (*Phrynosoma blainvillii*)	SSC	MHC	MHC MRI AGS	MHC MRI MHW MCH	MHC MRI	MHC MRI	MHC MRI
northern goshawk (*Accipiter gentilis*)	SSC FSS	MHC	MHC	MHC MHW	MHC	MHC	MHC
golden eagle (*Aquila chrysaetos*)	FP FSS	MHC	MHC	MHC MHW	MHC	MHC	MHC PCH
olive-sided flycatcher (*Contopus cooperi*)	SSC	MHC	AGS MHC PON	MHC PON	MHC	MHC	MHC
American peregrine falcon (*Falco peregrinus anatum*)	FP	MHC PCH	--	--	--	--	MHC PCH

Table 3.4-2. (continued)

Species	Special-status Designation	Project Site					
		Disposal Site 1	Disposal Site 2	Disposal Site 3	Celestial Valley Mitigation Site	Log Cabin	Our House
Wildlife (cont'd)							
bald eagle (*Haliaeetus leucocephalus*)	SE FP	MHC	MHC PCH	MHC	MHC	MHC PCH	MHC PCH
purple martin (*Progne subis*)	SSC	MHC	AGS MRI MHC PCH PON SEW	MRI PCH PON MHC	MRI PCH MHC	MRI PCH MHC	MRI PCH MHC
great gray owl (*Strix nebulosa*)	SE FSS	MHC	MHC	MHC	MHC	MHC	MHC
California spotted owl (*Strix occidentalis occidentalis*)	SSC FSS	MHC	MHC	MHC	MHC	MHC	MHC
pallid bat (*Antrozous pallidus*)	SSC FSS	MHC	MHC	MHC MHW	MHC	MHC	MHC
ring-tailed cat (*Bassariscus astutus*)	FP	MHC	MHC MRI PCH PON	MHC MRI PCH MCH	MHC MRI PCH	MHC MRI PCH	MHC MRI PCH
Sierra Nevada mountain beaver (*Aplodontia rufa californica*)	SSC	MHC	MHC MRI	MHC MHW MRI	MHC MRI	MHC MRI	MHC MRI
Townsend's big-eared bat (*Corynorhinus townsendii*)	SSC FSS	MHC	MHC	MHC MHW	MHC	MHC	MHC
western red bat (*Lasiurus blossevillii*)	SSC	MHC	MHC	MHC MHW MCH	MHC	MHC	MHC
fringed myotis (*Myotis thysanodes*)	FSS	MHC	MHC	MHC MHW	MHC	MHC	MHC

Key: Special-status Designations

CNPS

1.B.1 = Plants rare, threatened, or endangered in California and elsewhere. California (over 80% of occurrences threatened / high degree and immediacy of threat)

1.B.2 = Plants rare, threatened, or endangered in California and elsewhere.

2.B.1 = Plants Rare, threatened, or endangered in California, but more common elsewhere. California (over 80% of occurrences threatened / degree and immediacy of threat).

2.B.2 = Plants Rare, threatened, or endangered in California, but more common elsewhere. Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)

4.2 = Watch List: Plants of limited distribution. Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)

FT = Federally Threatened
FP = State Fully Protected
SE = State Endangered
ST = State Threatened
SSC = State Species of Special Concern
FSS = Forest Service Sensitive

Associated Vegetation Communities

AGS = Annual Grassland
DIS = Disturbed
ECH = Ephemeral Channel
MCH = Mixed Chaparral
MHW = Montane Hardwood
MHC = Montane Hardwood – Conifer
MRI = Montane Riparian
PCH = Perennial Channel
PON = Pond
SEW = Seasonal Wetland

Discussion

Would the Project:

a) **Would the project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS?**

Less than Significant with Mitigation Incorporated. Based on the results of the literature review and previous surveys, several special-status plant and wildlife species are known to occur or have the potential to occur at the project sites. The species or species groups identified below were determined to have the potential to be substantially adversely affected by project-related activities, either directly or through habitat modifications or indirectly through effects that could occur post-construction. Mitigation measures are presented below to avoid, minimize, and/or mitigate for potential effects, as necessary. Species-specific measures only apply to those project sites and suitable habitat types identified in **Table 3.4-2**.

Special-status Plants

Suitable habitat for the following nine special-status plants occurs at the proposed project sites: Sierra arching sedge, Mosquin's clarkia, mountain lady's slipper, Cantelow's lewisia, Shevock's copper moss, Sierra blue grass, brownish beaked-rush, and True's mountain jewelflower. In addition, suitable habitat for one special-status mushroom, branched collybia, occurs at the proposed project sites. None of these species are state or federally listed. Seven of these species, all but branched collybia and mountain lady's slipper, have a CNPS rating of 1 or 2. Branched collybia and mountain lady's-slipper are FSS species and would be considered special-status if occurring on Forest Service land. Although none of the aforementioned species were observed during previous biological surveys, these rare plants could occur in the vegetation communities identified in **Table 3.4-2** above.

If any of the aforementioned special-status plants are present at the proposed project sites, individuals may be impacted by compaction, trampling, removal, or degradation of habitat. Although adverse effects on special-status plants and there habitat would be avoided to the greatest extent possible, implementation of proposed project-related activities may result in direct and/or indirect effects on these species should they be present in areas proposed for disturbance. In order to minimize potential adverse effects on special-status plant species, implementation of the following avoidance, minimization, and mitigation measures are recommended.

Implementation of **BIO-1** would reduce the area of disturbance to the smallest footprint feasible in order to avoid unnecessary encroachment into areas that may support special-status plants. Mitigation measure **BIO-2** would instruct workers on proper avoidance of special-status plants to minimize disturbance of these species and their habitat. Mitigation measure **BIO-3** and **BIO-4** will minimize adverse effects on special-status plants due to project-induced erosion and encroachment of invasive plants by requiring temporarily disturbed areas to be revegetated with native species and for vehicles and equipment to be inspected and decontaminated prior to entering a project-site. **BIO-5** would minimize impacts to special-status plants by mandating any sensitive resources located onsite or nearby prior to mechanical sediment removal activities would be flagged for avoidance prior to work beginning. **BIO-6** provides for the avoidance of the removal of as much vegetation as possible, leaving native vegetation in place. Finally, **BIO-7** requires the use of BMPs in any areas within 250 ft of sensitive resources, including special-status plants. As shown, implementation of the aforementioned mitigation measures would reduce effects to a less than significant level with mitigation incorporated.

Special-status Aquatic Species

The proposed project sites may provide suitable habitat for hardhead, foothill yellow-legged frog, California red-legged frog, and western pond turtle. Although hardhead have not been documented at the proposed project sites, suitable habitat is present, as well as known species associates: Sacramento pikeminnow and Sacramento sucker. Proposed project-related activities have the potential to result in direct effects on hardhead as a result of dewatering, sedimentation, inadvertent chemical releases, and aquatic species relocations activities. All effects to suitable aquatic habitat for this species would be temporary in nature and, therefore, no net loss of habitat would occur.

FYLF has been documented along Oregon Creek at Log Cabin Diversion Dam, Disposal Site 2, and the Celestial Valley Mitigation Site; the Middle Yuba River at Our House Diversion Dam; and in an unnamed tributary that runs through Disposal Site 3. CRLF has not been previously documented at any of the project sites, however, suitable habitat exists at Disposal Site 2. While there is a potentially suitable pond at Disposal Site 3, the likelihood of CRLF to occur at this site is considered extremely limited.[10] Western pond turtle is known from Log Cabin Diversion Dam and potential habitat occurs at Disposal Site 2, Disposal Site 3, the Celestial Valley Mitigation Site and Our House Diversion Dam. Project-related activities such as dewatering, aquatic species relocation, sediment removal and laydown, riparian vegetation removal, vehicular traffic, sedimentation, and the accidental release of chemicals have the potential to effect special-status frogs and western pond turtle and/or their associated habitat.

Although adverse effects on special-status aquatic species and their habitat would be avoided to the greatest extent possible, implementation of project-related activities may result in direct and/or indirect effects on these species should they be present in areas proposed for disturbance.

Implementation of **BIO-1** would reduce the area of disturbance to the smallest footprint feasible in order to avoid unnecessary encroachment into areas that may be utilized by special-status aquatic species. Mitigation measure **BIO-2** would instruct workers on proper identification and avoidance techniques of special-status aquatic species. Additionally, mitigation measures **BIO-3** and **BIO-4** would limit the degradation of aquatic habitat, allow for the restoration of disturbed habitats and limit the spread of invasive species into wetted areas. **BIO-5** would minimize impacts to special-status aquatic species by mandating any sensitive resources located onsite or nearby (and not previously identified as being impacted by the proposed project) prior to mechanical sediment removal activities would be flagged for avoidance prior to work beginning. **BIO-6** provides for the avoidance of the removal of as much vegetation as possible, leaving native

[10] In its X approval of the original Plan, FERC determined there would be no impact to California red-legged frog at Log Cabin Diversion Dam and impoundment, Our House Diversion Dam and impoundment and Disposal Site 1. Conditions have not changed for the species at these sites.

vegetation in place. Mitigation measures **BIO-7** and **BIO-8** would limit the effects on special-status aquatic species by restricting work in wetted areas and implementing standard BMPs, limiting the speeds and maintenance requirements of vehicular traffic in sensitive habitats, requiring clearance surveys, and rescue and salvage efforts, as well as additional clearance surveys if deemed appropriate by a qualified biologist for the duration of proposed project-related activities. **BIO-9** prevents injury and death of aquatic species in the work area by removing them from site prior to the full dewatering or removal of sediment. Additional protections for semi-aquatic species in **BIO-10** would make sure they are not present in areas not subject to aquatic species rescue and work would begin in areas with less likelihood to have frogs present. **BIO-11** would prevent aquatic species from getting entrained in pumps or entering pipes during work. Preventing the majority of work in flowing water, through **BIO-12**, would lessen the contact of equipment with aquatic species, and **BIO-13** would keep water flowing downstream and maintain flows for aquatic species present there. As shown, implementation of the aforementioned mitigation measures would reduce the effects of special-status aquatic species to a less than significant level with mitigation incorporated. As shown, implementation of the aforementioned mitigation measures would reduce the effects of special-status aquatic species to a less than significant level with mitigation incorporated.

Coast Horned Lizard

No occurrences of coast horned lizard were reported in the 2012 biological resource surveys associated directly with the Log Cabin or Our House diversion dams, the impoundments, Disposal Site 1, or the access roads, nor have any been seen during work at any of these sites. However, the species has the potential to occur throughout the project sites, based on habitat and range descriptions (CDFW 2019b). Effects on coast horned lizard would be minimized to a less than significant level through the implementation avoidance and minimization measures **BIO-1**, **BIO-2**, **BIO-6**, and **BIO-8**.

Special-status Birds and Raptors

The proposed project sites may provide nesting, wintering and/or foraging habitat for up to eight special-status bird and raptor species, as well as nesting, wintering and/or foraging habitat for other migratory birds and raptors not identified in **Table 3.4-2**. Special-status birds and raptors identified in **Table 3.4-2** include golden eagle, great gray owl, California spotted owl, northern goshawk, American peregrine falcon, bald eagle, purple martin, and olive-sided flycatcher. All native breeding birds (except game birds during the hunting season), regardless of their listing status, are protected under FGC 3503. Ground disturbance, as well as vegetation and tree clearing during the nesting season, could result in direct effects on nesting birds should they be present in construction or operations and maintenance impact areas. Furthermore, noise and other human activity may result in nest abandonment if nesting birds are present within 200 ft (500 ft for raptors) of a work area.

According to the TNF District Biologist, a pair of great gray owls has established a nesting territory within 1 mile of the Log Cabin Diversion Dam Impoundment. The owls have been documented near Ridge Road, which would be used as a haul route for sediment removal activities. Potential effects on great gray owl from proposed project-related activities would be collisions with haul trucks and/or flushing due to disturbance by passing haul trucks.

Multiple California spotted owl PACs border the proposed project sites. One PAC occurs near the Log Cabin Diversion Dam project site, just northwest of the intersection of Marysville Road and State Route 49 (DataBasin 2019). A second PAC is located south of the intersection of Marysville Road and Kelly Road, northeast of Disposal Site 1. A third PAC is known to border the Our House Diversion Dam Impoundment (DataBasin 2019). In addition to the known PAC's, there is a documented occurrence, not associated with an existing PAC, near Disposal Site 3. Occurrence YUB0006 is documented just south of the town of Pike (CDFW 2019c). Although there are documented occurrences of California spotted owl relatively close to the proposed project sites, all proposed project related activities would occur during the work window for the species. Potential effects on California spotted owl from proposed project-related activities would be collisions with haul trucks and/or flushing due to disturbance by passing haul trucks.

Proposed project-related work is not expected to occur during nesting season (February 1 – August 31), but if work needs to occur during nesting season, effects on migratory birds and raptors would be minimized to a less than significant level through the implementation of the following avoidance and minimization measures- **BIO-1**, **BIO-2**, **BIO-14, BIO-15**, and **BIO-16.** Implementation of **BIO-1** would reduce the area of disturbance to the smallest footprint feasible in order to avoid unnecessary encroachment into areas that may be utilized by special-status birds and raptors and their associated habitat. **BIO-2** would instruct workers on proper avoidance of techniques for owls. Implementation of **BIO-14** and **BIO-15** would minimize effects on nesting owls by requiring preconstruction nesting surveys and nest avoidance. Finally, implementation of **BIO-16** would fence off the side of the area on Ridge Road most likely to be the location of great gray owl flight, directing them out of the path of proposed project vehicles. Cumulatively implementation of these avoidance and minimization measures would reduce effects of birds and raptors to a less than significant level.

Special-status Roosting Bats

Suitable habitat for pallid bat, Townsend's big-eared bat, western red bat, and fringed myotis occurs at the proposed project sites. These species may utilize a variety of habitats and structures throughout the proposed project sites, as well as in adjacent areas, for roosting and foraging. Townsend's big-eared bats are cave or mine roost obligates, and may utilize the area for foraging. Pallid bats, fringed myotis, and western red bats may be found roosting in rock crevices, structures or hollow trees, and may utilize the area for roosting and foraging. Furthermore, acoustic data collected during the 2012 special-status bats focused surveys at Log Cabin Diversion Dam, Our House Diversion Dam, and Disposal Site 1 recorded the presence of the western red bat at both the Log Cabin and Our House diversion dams (YCWA 2019a). Log Cabin Diversion Dam has structures that contained evidence of bat use and appropriate habitat, but was noted as not utilized as a maternal roost. Our House Diversion Dam had suitable foraging habitat present, but had no signs of roosting on the dam. Disposal Site 1 did not have any reported sightings of western red bats (YCWA 2019a). Formal special-status bat surveys have not been completed for Disposal Site 2, Disposal Site 3, and the Celestial Valley Mitigation Site; however, suitable habitat is present.

Disturbance from proposed project-related activities such as noise, dust, sediment removal activity, sediment laydown activity, and any vegetation removal could affect maternity roosting sites should they be present. Effects on habitat would be considered a direct and significant impact if special-status bat species were taken or deterred from establishing maternity roosts. Effects on special-status bats would be minimized through the implementation of **BIO-**1, **BIO-2, and BIO-6.**

Implementation of **BIO-1** would reduce the area of disturbance to the smallest footprint feasible in order to avoid unnecessary encroachment into areas that may be utilized as roosting sites by special-status bats. Implementation of **BIO-2** would require that personnel are instructed on proper avoidance of techniques for bats. Additionally, implementation of **BIO-6** would minimize effects on special-status bats by by minimizing the removal of vegetation that may be used as habitat. As shown, implementation of the aforementioned mitigation measures would reduce effects on special-status bats to a less than significant level.

Other Terrestrial Mammal Species

Suitable foraging and denning habitat for the ringtail cat and Sierra Nevada mountain beaver occurs at the proposed project sites. Both are predominantly nocturnal species; closely associated with permanent water sources such as streams/rivers; occupy burrows (beaver), hollow snags, logs, trees, and cavities in talus and other rocky areas (ringtail). The only proposed project-related activities that would occur at night would include one to two personnel monitoring diversion piping throughout sediment removal activities. Furthermore, proposed project-related activities are anticipated to occur outside the reproductive season for both species (December 1 – June 30). As a result, effects of the proposed project on the Sierra Nevada mountain beaver and ringtail cat could occur as a result of ground disturbance and vegetation clearing during daytime hours that would result in the collapse of burrows and/or crevices occupied by these species. In order to minimize the potential effects of the proposed project on these species, implementation of the following measures is recommended- **BIO-1**, **BIO-2**, and **BIO-6.**

Implementation of **BIO-1** would reduce the area of disturbance to the smallest footprint feasible in order to avoid unnecessary disturbance to ringtail cat and Sierra Nevada mountain beaver. Implementation of **BIO-2** would instruct workers on proper avoidance of techniques for these species. Additionally, implementation of **BIO-6** would minimize effects on ringtail cat and Sierra Nevada mountain beaver by reducing the amount of habitat loss due to vegetation removal. As shown, implementation of the aforementioned mitigation measures would reduce effects on the species to a less than significant level.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?

Less than Significant with Mitigation Incorporated. All aquatic resources in the proposed project sites are considered sensitive natural communities. Effects on aquatic resources as a result of proposed project-related activities have not been quantified. The proposed project, specifically parking and staging areas, sediment removal, and sediment laydown, would be designed to avoid effects on these resources, where feasible; however, permanent adverse effects on ephemeral channel and seasonal wetland habitat at Disposal Site 2 may result from the placement of spoils. Additionally, removal of riparian vegetation at Disposal Site 2, the Celestial Valley Mitigation Site (only the nonnative Himalayan blackberry), and Our House Diversion Dam is anticipated as a result of project-related activities. Implementation of **BIO-1**, **BIO-2**, **BIO-3**, and **BIO-4, BIO-5**, **BIO-6, BIO-7** and **BIO-17** would fully mitigate project-related effects on sensitive communities.

Implementation of **BIO-1** would reduce the area of disturbance to the smallest footprint feasible in order to avoid unnecessary encroachment into sensitive habitat areas. Mitigation measure **BIO-2** would instruct workers on proper avoidance techniques of sensitive areas. Additionally, mitigation measures **BIO-3** and **BIO-4** would limit degradation by erosion, sedimentation, or other harmful materials in sensitive communities. This would be accomplished by restricting work in wetted areas, buffering and fencing off sensitive areas, and implementing standard BMPs. Sensitive communities would be flagged under **BIO-5** to keep equipment out. Native vegetation removal would also be reduced through implementation of **BIO-6.** **BIO-7** would minimize adverse effects on sensitive communities due to proposed project-induced erosion and encroachment of invasive plants by requiring temporarily disturbed areas to be revegetated with native species. Finally, mitigation measure **BIO-17** would fully mitigate for permanent effects on sensitive communities. As shown, implementation of the aforementioned mitigation measures would reduce effects on sensitive natural communities to a less than significant level with mitigation incorporated.

c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Less than Significant with Mitigation Incorporated. The proposed project would result in permanent adverse, permanent non-adverse, and temporary impacts on state and/or federally protected waters including ephemeral channels, perennial channels, riparian habitats that could meet wetland criteria, and seasonal wetlands. Dewatering, sediment removal, and sediment passage activities at Log Cabin and Our House diversion dams would result in permanent non-adverse and temporary effects on the Middle Yuba River and Oregon Creek; however, these activities would return the channel and impoundments to their historical state; therefore, no net loss of federally or state protected waters would occur. Sediment disposal activities at Disposal Site 2 may result in permanent impacts on ephemeral channels and seasonal wetlands. Implementation of **BIO-1**, **BIO-2**, **BIO-3**, **BIO-4** and **BIO-7** are recommended to minimize adverse effects on federal and state protected waters to the greatest extent feasible, and implementation of **BIO-17** would fully mitigate project-related effects on these resources.

Implementation of **BIO-1** would reduce the area of disturbance to the smallest footprint feasible in order to avoid unnecessary encroachment into sensitive habitat areas. Mitigation measure **BIO-2** would instruct workers on proper avoidance techniques of sensitive areas. Additionally, mitigation measures **BIO-3** and **BIO-4** would limit degradation by erosion, sedimentation, or other harmful materials in aquatic resources. This would be accomplished by restricting work in wetted areas, buffering and fencing off sensitive areas, and implementing standard BMPs. Finally, mitigation measure **BIO-17** would fully mitigate for permanent adverse effects on federally and/or state protected waters. As shown, implementation of the aforementioned mitigation measures would reduce effects on sensitive natural communities to a less than significant level with mitigation incorporated.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Less than Significant Impact. The Middle Fork of the Yuba River and Oregon Creek likely provide migratory corridors and nurseries for fish and wildlife species, even though the existing diversion dams preclude some movements and nursery habitat. Proposed project-related activities in these areas are largely temporary in nature and would not decrease the permeability of these movement corridors; therefore, proposed project-related activities would have a less-than-significant effect on established native resident or migratory wildlife corridors, or nursery sites would result from the proposed project. No additional mitigation is required.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

No Impact. The proposed project is consistent with the Yuba County 2030 General Plan Update and the Sierra County 2012 General Plan. Action NR 10.1 in the Natural Resources Element of the Yuba County General Plan Update states the County would adopt an Oak Woodland and Tree Preservation Ordinance by the year 2015. This ordinance, as proposed in the General Plan, would likely protect native oaks measuring 6 inches or more in diameter at breast height and all other trees greater than 30 inches diameter at breast height. The General Plan also states that tree mitigation could be accomplished though conservation easements, planting restoration, contribution to a conservation fund, or another equally effective mitigation. Although the General Plan states an ordinance should be adopted by 2015, no ordinance addressing tree protection had yet been adopted by Yuba County at the time this document was drafted. The proposed project may be subject to a County tree protection ordinance, should one be adopted prior to the start of construction. There would be no conflict with any local policies protecting biological resources and no impact is anticipated. No avoidance and minimization measures are proposed.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

No Impact. The proposed project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. The project sites are not within the bounds of the Yuba-Sutter Habitat Conservation Plan/Natural Community Conservation plan, as the planning area only covers the western portion of Yuba County (CDFW 2018). As a result, the proposed project would not conflict with the plan, and no impact is anticipated. No avoidance and minimization measure are proposed.

Mitigation

BIO-1: Minimizing Footprint. During construction, the work areas will be reduced to the smallest possible footprint. All project-related parking, storage areas, laydown sites, equipment storage, and any other surface-disturbing activities will be confined, to the greatest extent possible, to previously disturbed areas. Additionally, the project footprint/area will be clearly defined and marked to avoid working in areas outside of the approved project boundary.

BIO-2: Biological Monitoring and Worker Environmental Awareness Training. A qualified biologist(s) will be on-site daily to monitor sediment removal and laydown activities that could potentially cause adverse effects on sensitive biological resources. The duties of the qualified biologist will comply with all agency conditions outlined in the CDFW incidental take permit or other project-related permits. In addition, a qualified biologist will be retained to conduct mandatory contractor/worker awareness training for construction personnel. The awareness training would be provided to all construction personnel, or personnel entering the project sites, to brief them on the locations of sensitive biological resources, how to identify species (visual and auditory) most likely to be present, required avoidance and minimization measures for biological resources, and to brief them on the penalties for not complying with biological mitigation requirements. If new personnel are added to the project, the contractor would be required to receive the mandatory training before starting work.

BIO-3: Restoration of Temporarily Disturbed Areas. All exposed and/or disturbed areas resulting from project-related activities will be returned to their original contour and grade, and restored using locally native grass and forb seeds, plugs or a mix of the two. Areas will be seeded with species appropriate to their topographical and hydrological character. For example, temporarily disturbed seasonal wetlands will be seeded with native hydrophytic species typical to the region; whereas upland areas will be seeded with an upland grass and forb mix. Seeded areas will be covered with broadcast straw and/or jute netted, where appropriate.

BIO-4: Invasive Plant Species Control. Prior to any vehicles and equipment entering a project site, a qualified biologist would perform an inspection for invasive plant species. All visible soil, plant materials, animal remnants, or any other signs of invasive species on vehicles and equipment will be removed prior to entering the project site. Removal and decontamination requirements of vehicles and equipment will be up to the discretion of the qualified biologist. If an occurrence is small enough to be managed on-site, the qualified biologist may approve the decontamination of the vehicle or equipment at a proper staging area with adequate containment. Any materials removed at a containment site must be bagged and taken off-site. If an occurrence is large enough, the contractor may be required to take the vehicle or equipment to an off-site wash station. Additionally, if a vehicle or piece of equipment must leave the project site for any length of time and has been exposed to a different project site or location, it will be required to be re-inspected prior to re-entering the project site.

BIO-5: Flagging Sensitive Resources. Prior to any work occurring, any known sensitive resources (i.e., which include, but are not limited to: cultural resources, special-status species, sensitive habitats, target nonnative invasive plants and other predetermined areas with significant sensitive resources) within or near the proposed work area will be flagged to ensure that no activities are conducted in those areas.

BIO-6: Minimization of Vegetation Removal. Disturbance or removal of vegetation will be kept to the minimum necessary to complete project related activities. When feasible, branches and limbs extending over the river will not be pruned to avoid potential impacts to shaded riverine aquatic habitat. No native riparian trees with a trunk diameter at breast height in excess of 4 in. will be removed without prior consultation and approval from CDFW.

For work at the Celestial Valley Mitigation Site, cuttings are to be harvested by cutting horizontally from the branch, at a measurement of approximately 1.5 in. in diameter and 2.5 to 3 ft in length. The cuttings are to be placed in buckets filled up to 9 in. with water, or at a different depth at the discretion of the contractor and biologist. If the willows are flowering, the gender ratio of the cuttings should be as close to 70 percent pistilate and 30 staminate as possible to facilitate seed production at the mitigation site and improve long term viability. These cuttings will be installed at the mitigation site within two days of harvesting at a depth of approximately 1.5 to 2 ft, or at the direction of the monitor and restoration contractor. If the cuttings dieback in a manner that final performance criteria will not be met, then additional cuttings will be sourced from the Oregon Creek/Yuba River watershed to ensure satisfying final performance criteria.

Irrigation is not a component of this mitigation. The Celestial Valley Mitigation Site has been selected such that all cuttings are expected to survive due to natural systems, including the water in Oregon Creek, rainfall, and existing groundwater resources.

BIO-7: Construction Best Management Practices. Prior to initiation of project-related activities, within 250 ft of sensitive resources, construction BMPs will be employed on-site to prevent degradation to on- and off-site features. Methods will include the use of appropriate measures to intercept and capture sediment prior to entering aquatic resources, as well as erosion control measures along the perimeter of all work areas to prevent the displacement of fill material. Additionally, all proper spill prevention BMPs will be implemented. All BMPs will be in place prior to initiation of any construction activities and will remain until construction activities are completed. All erosion control methods will be maintained until all on-site soils are stabilized.

BIO-8: Vehicular Best Management Practices. All proposed project-related vehicle traffic will be confined to established roads, staging areas, and parking areas. Vehicle speeds will not exceed 15 miles per hour, on access roads with no posted speed limit, to avoid collision with special-status species or habitats. Additionally, maintenance or refueling of vehicles or equipment must occur in designated areas and/or a secondary containment, located away from wetted areas.

BIO-9: Stranded/Entrained Aquatic Species Rescue and Salvage. Prior to and during diversion of flow and dewatering of the stream channel and work area, as well as prior to sediment laydown at Disposal Site 2, a qualified biologist will remove all fish, frogs, turtles, and other aquatic vertebrate species in accordance with the *Fish Rescue and Salvage Plan* developed by YCWA in coordination with Forest Service, CDFW, USFWS, and SWRCB in 2014 (Attachment E). Electrofishing for aquatic species rescue will be restricted to areas clear of FYLF and approved onsite by the CDFW.

All species will be captured using fine mesh or soft material nets, or another method approved by the agencies listed above, and transported to release locations in a bucket, ice chest, or other carrying mechanism, with aeration devices for species that require oxygenated water. All species will be moved to an area upstream of sediment removal activities, or away from sediment laydown at Disposal Site 2, where they will not be likely to reenter the work area.

- Handling of aquatic species will be minimized to the greatest extent possible.
- Gloves will be worn at all times during rescue and salvage efforts to minimize effects of handling to the greatest extent possible.
- Prior to entering the stream or initiating any rescue and salvage activities, all gear and equipment will be decontaminated in a designated location where runoff can be contained.
- All species will be relocated to an area of Oregon Creek or the Middle Yuba River, upstream of project-related activities, to minimize the potential for reentry to the work area.
- Exclusionary devices (i.e., nets, screens, etc.) will be used on any equipment or project-related materials that have the potential to entrain aquatic species.
- A qualified biologist will check the work area daily for stranded aquatic life for the duration of dewatering and sediment removal activities. This includes prior to work beginning every morning, and at least two additional times per day. If stranded aquatic species are present, they will be removed by the qualified biologist or the work area will be changed for the day to avoid the species.

BIO-10: Special-status Semi-Aquatic Species Protections. Prior to the commencement of any project-related activities or utilization of any project facilities (e.g. staging or parking areas, sediment laydown areas, etc.) that may directly affect special-status semi-aquatic species or their associated habitat, a qualified biologist will perform clearance surveys to identify and relocate frogs outside of work areas. Sediment removal work will start in the areas where sediment is currently elevated and dry where FYLF are much less likely to be present.

BIO-11: Exclusion Devices. Exclusion devices (i.e., nets and screens) will be placed on any pumps or pipes within the impoundment and around the work area as appropriate to exclude aquatic species. Exclusion devices will be in place and maintained in working order at all times water is being diverted. Intake pumps will be fitted with a fish screens meeting the “fry size” criteria of CDFW and the NMFS before water is diverted. Round openings in the screen will not exceed 3/32-in. diameter, square openings will not exceed 3/32 in. measured diagonally, and slotted openings will not exceed 0.069 in. in width. The onsite biologist will periodically inspect all exclusion devices to verify that they are functioning properly and are effectively protecting aquatic vertebrate species. Block nets sufficient to prevent frog movement through them will be erected at the upstream end of the sediment removal area to prevent relocated FYLF from (re-)entering the sediment removal area.

BIO-12: Avoid Work in Flowing Water. No heavy equipment will operate, or any excavation take place, in the portion of the stream where flowing water is present, except to place the bypass pumps.

BIO-13: Water Diversion. If work in the flowing portion of the stream is unavoidable, the entire stream flow will be diverted around or through the work area during work activities, while maintaining required flows in the natural channel downstream of the work for aquatic species. Flow will be diverted in a manner that minimizes turbidity, siltation, and pollution and provides flows to downstream reaches. Normal flows will be restored to the affected stream immediately upon completion of work at that location. Any temporary dam or other artificial obstruction constructed will only be built from clean materials such as sandbags, gravel bags, water dams, or clean/washed gravel, which will cause little or no siltation. YCWA will restore normal flows to the effected stream immediately upon completion of work at that location.

BIO-14: Migratory Bird and Raptor Surveys. If clearing and/or construction activities occur during the migratory bird nesting season (February 1 – August 31), then preconstruction surveys to identify active migratory bird and/or raptor nests will be conducted by a qualified biologist within 7 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining presence/absence of active nest sites within the proposed impact area, including construction access routes and a 500 ft buffer, where feasible.

BIO-15: Nest Avoidance. If active nest sites are identified at the project sites, a no disturbance buffer should be established for all active nest sites prior to commencement of any project construction activities. A no disturbance buffer constitutes a zone in which project-related activities (i.e., vegetation removal, earth moving, and construction) cannot occur. The size of no disturbance buffers will be determined by a qualified biologist based on the species, activities proposed in the vicinity of the nest, and topographic and other visual barriers.

BIO-16: Great Gray Owl Collision Avoidance. Prior to hauling sediment, with approval from the County Transportation Department, appropriate barriers will be installed adjacent to documented nesting territories, or as deemed appropriate by the Forest Service. These barriers will be 6 ft high temporary construction fencing raised 18 in. off the ground to allow smaller animals to pass underneath, and installed on the downhill side of the road segment. Perching deterrents, such as snow poles, will be placed onto metal road posts on the uphill side of the road segment. Incidental sightings will be recorded by a qualified biological monitor and reported to the Forest Service and CDFW.

BIO-17: No Net Loss of Sensitive Communities. Mitigation for permanent adverse effects on sensitive communities (seasonal wetlands/riparian habitat) will be provided at a minimum 1:1 ratio. Mitigation can include on-site restoration, in-lieu fee payment, or purchase of mitigation credits at an agency approved mitigation bank. Mitigation as required in regulatory permits issued through CDFW, the USFWS, and/or USACE, as well as the revegetation described in the Project Description, may be applied to satisfy this measure.

3.5 Cultural Resources

Issue	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
5. CULTURAL RESOURCES: *Would the Project:*				
a. Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?	--	--	X	--
b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	--	--	X	--
c. Disturb any human remains, including those interred outside of formal cemeteries?	--	--	X	--

Regulatory Context

The proposed project must comply with CEQA, which requires that state and local agencies identify and consider the significant environmental impacts of their projects, including impacts to historical resources[11], unique archaeological sites[12], and tribal cultural resources (TCRs) (see additional discussion in Section 3.18 Tribal Cultural Resources). In accordance with CEQA guidelines, cultural resources investigations are necessary to identify historical resources and unique archaeological resources that may have significant impacts as a result of a project (14 CCR Part 15064.5[c]). The following steps are routinely implemented in a cultural resources investigation for CEQA compliance:

1. Identify cultural resources in the proposed project area;
2. Evaluate against the CEQA criteria of significance as listed below;
3. Evaluate the impacts of the proposed project on *all* resources; and
4. Develop and implement measures to mitigate proposed project impacts on historical resources.

For the purposes of this MND, cultural resources investigations were conducted in 2018 and 2019 for the proposed project with the objectives to (1) identify historical resources, unique archaeological resources, and TCRs, and (2) assess whether implementation of the proposed project would have significant impacts on historical resources or unique archaeological sites within the **newly added areas of the proposed project**. These newly added areas of the proposed project

[11] Historical resources are defined as resources listed, or determined to be eligible by the State Historical Resources Commission for listing, in the California Register of Historical Resources (CRHR) (PRC 5024.1, CCR Title 14, Section 4850 et seq.) or local registers of historical resources (PRC 5020.1[k]), or that are any object, building, structure, site, area, place, record, or manuscript determined by a lead agency to be historically significant or significant within any part of California history.

[12] "Unique archaeological resource" is a category of archaeological resources created by the CEQA statutes (CEQA Section 21083.2[g]). An archaeological resource is a unique archaeological resource if it meets any of one of three criteria: (1) contains information needed to answer important scientific research questions (and there is a demonstrable public interest in that information); (2) has a special and particular quality, such as being the oldest of its type or the best available example of its type; or (3) is directly associated with a scientifically recognized important prehistoric or historic event or person.

include: (1) an additional site to be used for off-site mitigation revegetation comprising roughly 1.0 acre of land located on TNF lands along Oregon Creek in Celestial Valley; (2) two discontiguous spoil disposal sites on privately owned lands along Oregon Creek totaling an additional 12 acres; and (3) approximately 80 acres on privately owned lands along Grizzly Gulch to be used for sediment disposal.

Under the CEQA Guidelines, even if a resource is not included on any local, state, or federal register, or identified in a qualifying historical resources survey, a lead agency may still determine that any resource is an historical resource for the purposes of CEQA, if there is substantial evidence supporting such a determination (CEQA Guidelines Section 15064.5(a)). A lead agency must consider a resource to be historically significant if it finds that the resource meets the criteria for listing in the California Register of Historical Resources (CRHR). The methods used to determine if resources are historical resources, unique archaeological sites, or TCRs, are presented below.

A resource may be eligible for inclusion in the CRHR if it:

- Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage (Criterion 1);
- Is associated with the lives of persons important in our past (Criterion 2);
- Embodies the distinctive characteristics of a type, period, region, or method of construction or represents the work of an important creative individual or possesses high artistic values (Criterion 3); or
- Has yielded, or may be likely to yield, information important in prehistory or history (Criterion 4).

According to CEQA, a project may have a significant impact on the environment if it could cause a substantial adverse change in the significance of a historical resource (14 CCR 15064.5[b]). CEQA further states that a substantial adverse change in the significance of a historical resource means the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings therefore effecting the physical characteristics of historical resources that convey their historical significance and qualify it for inclusion in the CRHR or in a local register that meet the requirements of Public Resource Code (PRC) 5020.01(k) and 5024.1(g).

<u>Prehistoric Setting</u>

The Clovis culture is the earliest well documented cultural expression in the Americas, occurring between approximately 13,500 to 13,000 years ago. No diagnostic Clovis artifacts, which are distinguished by "fluting" of the proximal portion of both faces of projectile points and possibly other tools, have been found in the proposed project area vicinity. Fluted point fragments and complete specimens, typically isolated, are, however, known from scattered locations throughout much of the Sierra Nevada (c.f., Rondeau and Dougherty 2009). By about 10,000 years ago, cultural evidence in the Sierra Nevada is scant, but comparatively well established. Lindstrom et al. (2007:6) note the Pre-Archaic/Tahoe Reach phase, marked by large stemmed points resembling weapons from the Great Basin from this era, occurred in the Truckee vicinity. Recently obtained obsidian hydration readings from throughout the Truckee vicinity provide evidence of human occupation during the Late Pleistocene to Early Holocene (Waechter and Bloomer 2009:3-6). By the Early Holocene, between about 10,000 and 8,000 years ago, evidence from numerous archaeological sites throughout the state show that California was fully explored by this time and supported a significant population.

The first well documented archaeological cultures in central and northern California occur in the Late Holocene, between 5,000 and 2,000 years ago. In the Truckee vicinity and portions of the neighboring western High Sierra, the Martis Complex-marked by typological affiliations with the Great Basin and a preference for locally abundant basalt-was identified by Heizer and Elsasser (1953), Elsasser (1960), and Moratto (2004). The Martis complex is visible primarily through a proliferation of large basalt bifacial tools, as well as a large distribution of lithic reduction debris (Kowta 1988:72; McGuire 2007:172). Sierran basalt was also being used farther west in the Central Valley, suggesting an east-west oriented settlement system that took advantage of lowland and upland resources (McGuire 2007:171-172). The Martis complex is well-represented near the proposed project area at sites such as CA-NEV-15, CA-NEV-67, CA-PLA-6, and CA-SIE-20 (Elsasser 1960). With the Late Archaic, the lack of discernible relations between archaeological complexes and the known material cultures of ethnographic Californian populations end. In the High Sierra, the Martis Complex gives way to the Kings Beach Complex. The bow appears as the preeminent weapon, marked archaeologically by an abrupt reduction in projectile point size and a significant increase in numbers of points in use. The preferred materials for weapon tips change from basalt to microcrystalline silicate materials, typically taking the form of Rose Spring and Gunther barbed arrow points (Moratto 2004:302-303; McGuire 2007:174). The Sierra Contracting Stem cluster is another Martis Complex point variant that emerges in the Late Archaic. This type is typically formed of local basalt sources, with a wide distribution throughout central California that is concentrated in the Sierras around Lake Tahoe (Justice 2002:277-283).

Moratto (2004:303), following arguments of earlier investigators (Elsasser 1978; Ritter 1970a, b; Ritter and Matson 1972), including studies for the proposed Auburn Dam and Bullards Bar reservoirs, suggests that Martis may reflect ancestral Maiduan prehistory. A three-stage Bullards Bar cultural complex was identified by Humphreys (1969), that appears to follow the same typological progression as the Martis to Kings Beach and Mesilla to Sweetwater cultural phases from Lake Tahoe and Lake Oroville, respectively. The Bullards Bar I-III phases are characterized by a shift from large to small projectile points (Moratto 2004:300-301). Based on obsidian hydration analysis, the earliest period, Bullards Bar I, dates from approximately 5,275 (+/- 342) B.P. to 3041 (+/-170) B.P. (Humphreys 1969:86). This period is represented primarily by use of handstones and milling slabs and a large number of projectile points and scrapers. Obsidian, basalt, chert, and petrified wood were the primary stones used for tool manufacture, with basalt the dominant material found in this period. Ochre is also prominent at this time. The Bullards Bar II period dates to 1000 B.P. to 434 B.P. (Humphreys 1969:90). Bullards Bar II is dated to 1000 B.P. to 434 B.P. (Humphreys 1969:90) and is expressed by the introduction of steatite artifacts into the archaeological record and a sparse number of projectile points, including Gunther series points, dominated by chert toolstone (Humphreys 1969:87). Ochre was still used, but to a lesser degree than encountered during the Bullards Bar I period (Humphreys 1969:89). Projectile points are represented by Desert Side-Notched and triangular series manufactured from cherts and petrified wood (Humphreys 1969:89). Scrapers are also a common flaked stone tool at this time and bedrock mortar technology is common (Humphreys 1969:90).

Ethnographic Setting

The proposed project area lies within the territory of the Nisenan, otherwise known as the Southern Maidu or Valley Maidu. Together with the northeastern Maidu and Konkow, they formed one of the three principal branches of the Maiduan linguistic group, which is part of the larger Penutian language family. At the time of the earliest historical nonnative contact, the Nisenan occupied a portion of northeastern California that, since Euro-American times, has traditionally been known as the "Gold Country," an area bordered by the Sacramento River to the west and the Sierra Nevada to the east. The region includes parts of the modern counties of Yuba, Nevada, Placer, Sacramento and El Dorado.

Like many native Californian groups, the Nisenan engaged in a seasonal round of food gathering, which included the exploitation of a wide range of natural occurring plants and animals. Edible resources were abundant in Nisenan territory year-round, though some (such as acorns and certain other plants) were acquired primarily during specific seasons. Beals (1933:346) notes that the Nisenan were exceedingly catholic in their choice of food, with very few edible resources avoided. Deer was a major staple for the Nisenan, usually stalked individually or in communal hunts (Beals 1933:346), the latter frequently involving the participation of several villages. Rabbits, another favored game, were typically hunted in large drives that took place in the spring. Fish formed a substantial part of the Nisenan diet, especially for those populations living along rivers and streams. Grasshoppers were considered a particular delicacy among the Nisenan (Wilson 1972), and, like rabbits, were obtained in large communal drives. Various nuts, seeds, roots, tubers, bulbs, acorns, berries, wild grapes, and other greens were gathered. However, the most important vegetal foods were acorns (Beals 1933:351; Wilson 1972:36-37). According to Beals (1933:351), between six or seven varieties of acorns were recognized by the Nisenan as suitable for consumption. The most prized acorn, however, belonged to the black oak (*Quercus kelloggii*). Acorn harvesting typically occurred during the fall when the acorns were ripe and the trees heavily laden. Trees that were known to provide lots of acorns were frequented over and over again and may have been owned by particular families (Wilson 1972:37, Beals 1933:363). When a crop was particularly abundant, the acorns were stockpiled in a granary and occasionally traded with other groups.

Like many native groups in California, the Nisenan were organized into what has been termed the "tribelet." Kroeber (1925) coined the term "tribelet" which was defined as a social aggregation consisting of one or more household groups that included immediate family members (parents and children) and any associated relatives (either collateral, lineal, or affinal) living together in a village or community. Small villages contained between 15 and 25 people, while large villages could contain over 500 people (Kroeber 1925:831). Dwellings were dome-shaped and made of brush or bark lashed over an oak pole frame. They were between 10 and 15 ft in diameter, and any village might contain between 7 and 50 houses. Estimates of pre-contact Nisenan population size have been notoriously difficult to define (Beals 1933; Kroeber 1925), as much of their population had been decimated prior to the twentieth century. Kroeber (1925) argues for a total pre-contact Maidu population of 9,000, though he admitted the figure was decidedly liberal. However, by the time Kroeber and other ethnographers began to study the Nisenan in the early twentieth century, there were only a reported 1,100 Nisenan and those of mixed-Nisenan heritage. This dramatic decline in population was largely the result of events unleashed primarily by the California Gold Rush. As whites settled on their lands, the few surviving Nisenan were forced to the margins of society, where many of them were eventually absorbed into the dominant economic system. Many Nisenan found work in agriculture, logging, ranching, and domestic pursuits (Wilson and Towne 1978:396).

Historic Setting

Principal historical themes applicable to the proposed project area and vicinity include: mining development, hydroelectric power, water control and distribution, and formation of the water districts. Early miners panned for gold in stream beds, but within decades, large-scale mining operations replaced individual miners. In 1853, hydraulic mining was introduced to California and rapid advances in technology provided greater flexibility and movement of hoses and efficiency for displacing dirt. Hydraulic mining became more common by the 1860s. The resulting debris and mine waste deposited in the Yuba River subsequently raised the riverbed up to 100 ft in some areas. Lawsuits by farmers curtailed hydraulic mining in 1883 with the Sawyer Decision, considered one of the seminal environmental laws in the United States (Baumgart 2002; Wagner 1970:37). However, the Caminetti Act allowed hydraulic mining to continue if the operators constructed debris dams, regulated under the California Debris Commission, established by the United States Congress in 1893. Though large-scale hydraulic mining in the Sierra Nevada was severely curtailed in 1884, it resumed on a limited basis until the 1930s.

Mining and hydroelectric power generation in California have had a symbiotic relationship from the beginning. The Yuba River has historically been used and managed for multiple purposes, ranging from hydraulic mining, irrigation, hydroelectric power generation and flood control. In many ways, the development of the New Bullards Bar system mirrored development of other hydroelectric facilities in the Sierra Nevada range. Yuba River water was first used for industrial scale mining operations. Many of the ditches and flumes built for the mining industry were reused in the burgeoning field of hydroelectricity with early developers of hydroelectric power plants purchasing the ditches and water rights to supply water to power plant sites (Ramsey Ford et al. 2012). The new industry used water power technology honed by the California miners who adapted to the seasonal water flows germane to the Sierra Nevada watershed. Furthermore, the parallel development of long-distance electrical transmission lines allowed such plants to be erected miles from cities that demanded electricity (Ramsey Ford et al. 2012).

John Martin and Eugene J. de Sabla, Jr. organized the Yuba Power Company in October 1897. The men were involved in the organization of the Nevada County Electric Power Company a few years earlier, which operated a dam and small power plant (Nevada Powerhouse) on the South Yuba River near Nevada City. In 1897, they began construction of a second power plant on Yuba River, the Yuba Powerhouse, to supply electricity for general use in the town of Marysville and to supply mines in the Browns Valley region (Fowler 1923:114). The powerhouse used a ditch system that diverted water from the North Fork of the Yuba River for irrigation purposes in Browns Valley. Browns Valley is located in the foothills along lower Dry Creek, near Smartsville. Due to the shallow soils of the area an agricultural industry was not possible, and even after the irrigation network was brought to the valley the primary crop was pasture (Pagenhart 1969:173). As soon as the Yuba plant was completed, Martin and de Sabla reorganized their corporation, forming the Yuba Electric Power Company, and began construction on a third hydroelectric power plant—the Colgate system (JRP and CalTrans 2000:59). The Colgate Powerhouse was built on the Middle Fork of the Yuba River, at the crossing of the historic Missouri Bar Trail, an access route to the gold country for early miners (Coleman 1952:140).

Construction of the Old Bullards Bar Dam (currently inundated by New Bullards Bar Reservoir) by Harry Payne Whitney and the Yuba Development Company began in 1922 and was completed in 1924. Mr. Whitney and the company originally constructed the dam for local hydraulic mining interests. Mr. Whitney owned mining properties upstream of Bullards Bar in Sierra County and planned to impound mining debris in the lake created by the dam (Coleman 1952). The Old Bullards Bar Dam served the community until the construction of the New Bullards Bar Dam in the 1960s. In November 1957, the Yuba County Council unanimously voted for the construction of a new dam at Bullards Bar to meet county flood control and water storage needs (Yuba County 1957). International Engineering Company, Inc. (IEC) designed New Bullards Bar Dam in 1965. IEC was a subsidiary of Morison-Knudson, known for building such monumental structures as the Golden Gate Bridge. On June 1, 1966, construction of the New Bullards Bar Dam began under the management of the Perini-Yuba Associates construction team. By late 1969, workers completed construction on New Bullards Bar Dam and water was being stored in the new reservoir. In early 1970, workers completed the New Colgate Powerhouse and began trial tests to produce electricity. On June 30, 1970, YCWA's construction of the project was complete, and New Bullards Bar Reservoir was opened to the public (Mountain Messenger 1970).

<u>Background Search</u>

In July 2018 and March 2019, YCWA conducted records searches at the North Central Information Center (NCIC) of the California Historical Resources Information System (CHRIS) at California State University, Sacramento to identify previous cultural investigations and recorded archaeological and historic period properties within or immediately adjacent to the three newly added areas of the proposed project and an additional 0.25-mile buffer. This research also served to obtain background information pertinent to understanding the archaeology, history, and ethnohistory of the proposed project vicinity. The purpose of the 0.25-mile buffer was to provide flexibility for proposed project planning, if needed. All relevant data on file at these repositories were examined, and included cultural resource records, site location maps, General Land Office (GLO) maps, other historic maps, National Register of Historic Places (NRHP) listings, CRHR, Office of Historic Preservation (OHP) Historic Property Directory, 1996 California State Historic Landmarks, 1976 California Inventory of Historic Resources, and the California Department of Transportation (CalTrans) Bridge Inventory. In July 2018 and March 2019, YCWA also made an inquiry to the TNF, Yuba River Ranger District office located in Camptonville, California.

Six previous cultural resource investigations were identified within a 0.25-mile buffer around the three newly added areas of the proposed project (Table 3.5-1); none of the previously conducted cultural resource investigations intersect directly with the three newly added areas of the proposed project. Many of the reports identified were prepared in support of timber harvesting plans.

Table 3.5-1. Previous cultural resources investigations within the newly added areas of the proposed project and a 0.25-mile buffer.

Count	Author	Year	NCIC report #	Report name and description	Within newly added areas of the proposed project (yes/no)
1	Andrew D. Funk	1992	826	*Archaeological and Historical Resources Survey and Impact Assessment.* Supplemental Report for a Timber Harvesting Plan. No features or artifacts observed.	No
2	Kathleen L. Hull	1993	8298	*Archaeological Reconnaissance of the Oregon Creek Analysis Area, Sierra and Yuba Counties, California, Volume I.* Survey of 5,150 acres. Identification of five prehistoric site, 16 historic sites, 5 multicomponent sites, and 88 isolates.	No
3	Lucky Gillett	2000	8308	*Confidential Archaeological Addendum for Timber Operations on Non-Federal Lands in California.* Survey of approximately 60 acres for timber harvest plan. Identification of one historic site.	No
4	Scott Leonhard	1996	8320	*Archaeological and Historical Resources Survey and Impact Assessment, A Supplemental report for a Timber Harvesting Plan.* Identification of one historic site.	No
5	Dennis Stevens	1993	8446	*Cultural Resource Inventory of the Oregon Creek Analysis Area, Yuba and Sierra Counties, Downieville Ranger District, Tahoe National Forest.* Survey of Tahoe National Forest, Downieville District. Identification of 23 prehistoric sites, 40 historic sites, and 13 multicomponent sites.	No
6	Laura Leach-Palm, Pat Mikkelsen, Paul Brandy, Jay King, Lindsay Hartman, and Bryan Larson	2008	9326	*Cultural Resources Inventory of CalTrans District 3 Rural Conventional Highways in Butte, Colusa, El Dorado, Glenn, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, and Yuba Counties.* Documentation of prehistoric and historic-period archaeological sites and historic-period architectural features along 710 mi of highway right-or-way.	No

Previously Recorded Cultural Resources

The records search identified no previously recorded cultural resources within the newly added areas of the proposed project and two previously documented cultural resources within a 0.25 mile (Table 3.5-2). The two archaeological sites are historic resources representing mining and logging features.

Table 3.5-2. Previous cultural resources within the newly added areas of the proposed project and a 0.25 mile buffer

Count	Site number (Primary no)	Associated report authors and Year	Description	NRHP/CRHR eligibility	Within newly added areas of the proposed project (yes/no)
1	P-58-1778	Lucky Gillett. 2000	**Historic site.** Well maintained irrigation canal established in 1887. Ditch is well maintained and in good condition.	Unevaluated	No
2	P-58-1779	Scott Leonhard. 1996	**Historic site**. Old trail most likely associated with logging.	Ineligible	No

Historic Sites and Features Identified on Historic Maps

Historic-period USGS topographic maps and GLO plats were reviewed during the record search to identify locations of potential historic-era sites and features within the newly added areas of the proposed project and within 0.25 mile of that (Table 3.5-3). This resulted in the identification of more than 20 locations where unrecorded historic-era sites or features may be present within the newly added areas of the proposed project and 0.25-mile buffer.

Historic period maps often provide a general idea of where resources may be located, but are not necessarily translatable to today's maps and mapping standards. Because of the disparity between historic-period maps and modern maps, it is not known if physical attributes associated with the potential sites and features listed in Table 3.5-3 are accessible (i.e., not on a steep inaccessible slope, under water, buried, and/or beneath thick vegetation), or if the remains are actually within the newly added areas of the proposed project (i.e., they may have been mis-mapped). In addition, the presence of cultural features on a historic map does not confirm that the features still exist. Many historic features, such as town sites, mines, and roads, often have continued use into present times that may obliterate any historic-era remains. Further, historic features can disappear over time through natural erosion or other weathering processes. Based on the inventory of previously recorded cultural resources within the newly added areas of the proposed project and the 0.25-mile buffer, it appears that many of the historic features identified on the historic maps have not been formally recorded as archaeological sites.

Table 3.5-3. Potential historic-period sites within the newly added areas of the proposed project and 0.25-mile buffer.

Map date	Legal description/ map source	Potential historic-era cultural resources		No. of potential features within the newly added areas of the proposed project
		Within the newly added areas of the proposed project	Within 0.25 mile of the newly added areas of the proposed project	
1861	Official Map of Yuba County, Scale Unknown	No features	No features	0
1876	T18N/R8E GLO Plat	No features	No features	0
1948	Camptonville, CA 1:24,000 Topographic Quad	"Tailings," unimproved road	Unimproved road, two unnamed structures	5
1950	Camptonville, CA 1:24,000 Topographic Quad	"Tailings," unimproved road	Unimproved road, two unnamed structures	5
1953	Nevada City, CA 1:62,500 Topographic Quad	"Tailings," unimproved road	Unimproved road, two unnamed structures	5
1956	Camptonville, CA 1:24,000 Topographic Quad	"Tailings," unimproved road	Unimproved road, two unnamed structures	5
1961	Nevada City, CA 1:62,500 Topographic Quad	"Tailings," unimproved road	Unimproved road, two unnamed structures	5
1963	T18N/R8E GLO Plat	Unimproved road	No features	1
1969	Camptonville, CA 1:24,000 Topographic Quad	"Tailings," unimproved road	Improved road, unimproved road, 17 unnamed structures	21

Field Investigations and Results

The purpose of this investigation was to examine all accessible lands within the newly added areas of the proposed project to identify and record previously unknown cultural resources within those areas only, to verify locations of any previously recorded cultural resources, and to assess the current condition of all resources encountered. The newly added areas of the proposed project were investigated through intensive pedestrian survey on October 2018, April 2019, and August 2019. A redacted and public version of the confidential cultural resources investigation report (Risse et al. 2019) is provided as Attachment F.

All cultural resources within or immediately adjacent to the project area, were documented to current professional standards on the appropriate Department of Parks and Recreation forms (DPR-523). The sites have been photographed using a digital format, and their locations plotted on the appropriate USGS topographic 7.5-minute topographic quadrangle by hand and with a Global Positioning System unit with sub-meter accuracy. Site sketch maps were prepared for each archaeological site, depicting site boundaries and features.

Based on the findings of the archival research, and fieldwork there are a total of five cultural resources within the newly added areas of the proposed project (Table 3.5-4). Of these five resources, four are archaeological sites, one is an archaeological site with a built environment component. All five sites were found to be ineligible for the CRHR as they did not meet any of the criteria for a historical resource.

Table 3.5-4. Cultural resources within the newly added areas of the proposed project.

Primary Number/ Trinomial/ Temporary number	Resource type	Age	Description	CRHR eligibility
P-46-1993 CA-SIE-1993H HDR-CV-03	Archaeological site	Historic	Historic mining site consisting of four features: two dirt road segments, a feature comprising hydraulic mining scars, and a feature comprising an area of earthen tailings	Ineligible
P-46-1994 CA-SIE-1994H HDR-CV-04	Archaeological site	Historic	Historic mining site in the Grizzly Gulch area, consisting of a large extensive placer and hard rock mining complex	Ineligible
P-46-1995 CA-SIE-1995H HDR-CV-05	Archaeological site	Historic	Historic dirt road appearing on historic maps as Camptonville Road	Ineligible
P-58-3182 CA-YUB-1981H HDR-CV-01	Archaeological site	Historic	Historic road segment known as Celestial Valley Road	Ineligible
P-58-3183 CA-YUB-1982H HDR-CV-02	Archaeological site/built environment resource	Historic	Historic industrial site of Sierra Mountain Mills and its ancillary features	Ineligible

Cultural Resources Impact Analysis

Though the proposed project area has been surveyed for historical and archaeological resources, with no potentially CRHR-eligible historical resource identified, there is still the potential for the existence of buried archaeological materials within the proposed project area. CEQA requires that lead agencies protect both known and unknown cultural resources; therefore, mitigation is recommended to ensure that previously identified and unidentified (if present) cultural resources are protected on the proposed project site during construction activities. If previously unidentified cultural resources are discovered, all work will be halted until a qualified archaeologist, who meets the Secretary of the Interior's Professional Qualifications Standards for archaeology, evaluates the resource(s) encountered and, if need be, implements mitigation measures. The Mitigation Measures described below would reduce impacts to cultural resources to a *less-than-significant* level. Potential impacts to cultural resources are discussed below.

Discussion

a) Would the Project cause a substantial adverse change in the significance of a historical resource as pursuant to Section 15064.5?

Less than significant with mitigation incorporated. The assessment of project impacts on "historical resources," as defined by CEQA Guidelines (Section 15064.5), is a two-step analysis: first, an analysis of whether a project may impact a resource that falls within the definition of "historical resource(s)" as defined under CEQA; and second, if the proposed project is found to impact historical resources, an analysis of whether the project would cause a substantial adverse change to the resource. A project that may cause a substantial adverse change in the significance of an historical resource is one that may have significant effect on the environment (PRC 21084.1). The significance of an historic architectural resource is considered to be "materially impaired" when a project demolishes or materially alters the physical characteristics that justify the inclusion of the resource in the CRHR, or that justify the inclusion of the resource in a local register, or that justify its eligibility for inclusion in the CRHR as determined by the lead agency for the purposes of CEQA (Section 15064.5[b][2]).

As determined above, all five cultural resources documented for this inventory effort were determined to be ineligible for the CRHR. Accordingly, none of these five resources or components of resources are considered to be historical resources and thus proposed project implementation would not cause a substantial adverse change in the physical characteristics of any historical resources and would result in a **less-than-significant** impact to historical resources.

Nonetheless, while unlikely, additional buried or previously unidentified cultural resources could exist within the newly added areas of the proposed plan. While much of the natural topography in the proposed project vicinity has been altered, prehistoric and historic period archaeological sites could occur in buried contexts. Thus, the potential exists that buried resources could be discovered during construction. Implementation of mitigation measure CULT-01 outlined below would reduce potential project impacts related to unknown historical resources to a less-than-significant level.

b) Would the Project cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?

Less than significant with mitigation incorporated. CEQA considers archaeological resources to be an intrinsic part of the physical environment and, thus, requires that the potential of any project to adversely affect archaeological resources be analyzed (CEQA Section 21083.2). Implementation of a project could have a potentially significant impact on archaeological resources if it were to cause a substantial adverse change in the significance pursuant to CEQA Guidelines (Section 15064.5). The present cultural resources inventory identified five archaeological resources within the newly added areas of the proposed project. Though implementation of the proposed project would likely impact several or all of these resources, none of these resources are considered unique archaeological resources that are significant, so impacting these resources would not cause a substantial adverse change in their significance. Thus, the proposed project would result in a **less than significant** impact to archaeological resources.

Mitigation Measure CULT-01 would be implemented if archaeological resources are revealed during proposed Project implementation, therefore reducing the impact to a less-than-significant level.

c) Would the Project disturb any human remains, including those interred outside of formal cemeteries?

Less than significant with mitigation incorporated. There are no known human burials or remains within the area of proposed disturbance. However, the remote possibility for encountering human remains during implementation of the proposed project does exist. Therefore, mitigation measure CULT-02 is required if human remains are found during implementation to reduce impact to a less-than-significant level.

Mitigation Measures

MM-CULT-01: Inadvertent Discovery of Historical and Archaeological Resources

In the event that buried cultural deposits (i.e., prehistoric stone tools, grinding stones, historic glass, bottles, foundations, cellars, privy pits, etc.) are encountered during proposed project implementation, work must stop immediately at the discovery site until a qualified, professional archaeologist can determine the nature of the resources and, as appropriate, assist in helping proposed project personnel avoid the resources or implement management measures to evaluate the significance and potential eligibility of the resources for listing on the CRHR, or any local registers, as appropriate.

MM- CULT-01 Implementation

YCWA and a qualified, professional archaeologist will ensure the appropriate management for any discovery of prehistoric or historic resources during construction. This will be implemented during all proposed project implementation activities. Any unexpected discovery will be avoided. If it cannot be avoided, it will be evaluated for potential listing on the CRHR. If there is a Native American component to the unexpected discovery, consultation with Native American tribes will be incorporated to determine the eligibility. If the find is determined to be eligible, representatives of YCWA and a qualified, professional archaeologist will meet to determine the appropriate mitigation measures to be implemented, as appropriate. All significant cultural materials recovered will be subject to scientific analysis, professional curation, and a report prepared by the qualified, professional archaeologist according to current professional standards. A report will be kept on file at YCWA. A copy of the report will be distributed to tribes, federal and state agencies, as appropriate. The proper recording, evaluation, consultation, and management of any newly identified cultural resources will indicate successful implementation.

MM- CULT-02: Inadvertent Discovery of Human Remains

In accordance with the California Health and Safety Code (CHSC), Section 7050.5, and the PRC 5097.98, regarding the discovery of human remains, if any such finds are encountered during proposed project implementation, all work within the vicinity of the find will cease immediately and a 100 foot-wide buffer surrounding the discovery will be established around it. YCWA, or its agent, will be immediately notified, and the TNF, if on TNF lands. The County coroner will be contacted immediately to examine and evaluate the find. If the coroner determines that the remains are not recent and are of Native American descent, the coroner will contact the Native American Heritage Commission (NAHC) in accordance with CHSC Section 7050.5, and PRC 5097.98. YCWA will work with the most likely descendant, as determined by the NAHC, to determine the most appropriate means of treating the remains. All proposed project personnel should be instructed that any human remains encountered are to be treated with sensitivity and respect, and that their discovery and location are to be kept confidential. Proposed project implementation personnel should be briefed prior to implementation activities regarding procedures to follow in the event buried human remains are encountered.

MM- CULT-02 Implementation

YCWA will insure all appropriate parties are contacted to ensure proper treatment and disposition of human remains. This will be implemented during all Project implementation activities. The recordation and disposition of any newly identified human remains will be conducted by a qualified, professional archaeologist in consultation with the most likely descendent, or landowner (YCWA) in the absence of an identified most likely descendant, and a report will be kept on file at YCWA. A copy of the report will be distributed to tribes, federal and state agencies, as appropriate. The proper recording, evaluation, consultation, and treatment of any newly identified human remains will indicate successful implementation.

3.6 Energy

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
6. ENERGY *Would the Project:*				
a. Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	--	--	X	--
b. Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	--	--	--	X

Environmental Setting

Construction and maintenance activities associated with the proposed project would result in short -term increases in energy consumption. Specifically, the construction activities would require the use of gasoline, diesel fuel, other fuels, and electricity. Energy use during construction typically involves the use of motor vehicles, both for transportation of workers and equipment but also for construction equipment such as excavators and dump trucks. Additional energy use would occur as power for tools and equipment used onsite, including but not limited to, gas generators, air compressors, and other typical construction equipment.

Discussion

a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

Less-than-Significant Impact. The proposed project would use generators and would not rely on electric power from local energy sources. Gas and diesel fuel is available in the community through a network of existing private distributors. The power and energy system is adequate to handle the demand during construction and during future maintenance activities. Because of the high cost of fuel, construction and maintenance activities would not result in wasteful, inefficient, or unnecessary use of energy, since construction contractors would purchase fuel from local suppliers and would conserve the use of their supplies to minimize the cost during construction. Therefore, the proposed project would have a less-than-significant impact on consumption of energy resources.

b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

No Impact. The proposed project would not conflict with a state or local plan for renewable energy or energy efficiency such as the State Climate Change Scoping Plan. Energy usage under the proposed project would be consistent with that of other facilities in the region and would implement energy conservation and efficiency measures to the extent feasible. Equipment requiring energy would also be turned off when not in use. As a result, impacts on a local or state renewable energy or energy plan would be less than significant.

Mitigation

None required.

3.7 Geology and Soils

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
7. GEOLOGY AND SOILS *Would the Project:*				
a. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:	--	--	X	--
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	--	--	X	--
ii. Strong seismic ground shaking?	--	--	X	--
iii. Seismic-related ground failure, including liquefaction?	--	--	X	--
iv. Landslides?	--	--	X	--
b. Result in substantial soil erosion or the loss of topsoil?	--	--	X	--
c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	--	--	X	--
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	--	--	--	X
e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	--	--	--	X
f. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	--	--	--	X

Environmental Setting

The proposed project is located on TNF and private lands in Nevada, Sierra and Yuba counties. The proposed project is located in rural natural areas along the Middle Yuba River and Oregon Creek.

Soils description

The soils at the Log Cabin Diversion Dam Project site are composed of the Deadwood-Rock outcrop-Hurlbut complex and consist of decomposed plant material on top of gravelly sandy loam, gravelly loam, and silt loam. Depth to lithic bedrock ranges from 14 to 79 in. (NRCS 2019).

At the Our House Diversion Dam site, soils in Sierra County and Nevada County are mainly made up of the Josephine-Mariposa complex and consist of gravelly loam to gravelly clay loam. Lithic bedrock is 20 to 54 in. below the surface. Staging and access to the Our House Diversion Dam Impoundment is from the north side in Sierra County, and the project would not disturb any soils on the Nevada County side of the impoundment (NRCS 2019).

At Disposal Site 1, the soils consist of clay and loam including the Sites-Jocal complex. Depth to lithic bedrock is 45 to 80 in. below the surface (NRCS 2019).

Disposal Site 2 is made up of mostly mine tailings. Some loam soils including the Chaix-Chawanakee-Hotaw complex and the Holland-Hoda-Hotaw complex exist on the outer perimeter of the site with a depth to bedrock of anywhere from 15 to 59 in. below the surface (NRCS 2019).

A portion of the southern part of Disposal Site 3 was historically used for hydraulic mining and remnants of hydraulic pits still exist. The rest of Disposal Site 3 consists of gravelly loam to clay loam soils including the Mariposa-Jocal complex and the Jocal-Sites-Mariposa complex. Depth to bedrock ranges from 21 to 80 in. below the surface (NRCS 2019).

Seismicity

The USGS does not have any faults documented in the area of the proposed project sites, (USGS 2017), nor covered under the Alquist-Priolo Earthquake Fault Zoning Act (California Department of Conservation [CDOC] 2019). However, per CDOC 2019, Disposal Site 2 and the Celestial Valley revegetation site are located roughly one mile west of the Big Bend Wolf Creek Fault Zone, and the Slate Creek Fault passes through Disposal Site 3. Neither of these faults have shown displacement within the last 1.6 million years (CDOC 2010).

Liquefaction

Liquefaction occurs when saturated sand and silt take on liquid-like characteristics during a seismic event. When soils undergo liquefaction, they lose the ability to support structures (USGS 2006). There are no soils on site that are made up entirely of sand or silt (NRCS 2019). The project areas are not in a zone of required investigation per the Alquist-Priolo Earthquake Fault Zoning Act (CDOC 2019).

Slope Instability

Slopes surrounding the Log Cabin Diversion Dam proposed project area vary from 30 to 75 percent; similarly, at Our House Diversion Dam in Sierra County, slopes range from 30 to 75 percent. At Disposal Site 1 slopes range from 2 to 30 percent, slopes at Disposal Site 2 range from 2 to 50 percent, and slopes at Disposal Site 3 range from 2 to 75 percent (NRCS 2019). According to the USGS, the proposed project areas have a low rate of incidence and susceptibility for landslides (USGS 1982).

Discussion:

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: i) rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42. ii) strong seismic ground shaking? iii) seismic-related ground failure, including liquefaction? iv) landslides?

Less-than-Significant Impact. Although faults run through or near to project sites, these faults are not considered seismically active (USGS 2017, California Geological Survey 2015). Because the faults in the vicinity of the proposed project area are no longer considered active, strong seismic ground shaking or seismic-related ground failure are not anticipated as a result of project construction. Although slopes in the proposed project area range from low to quite steep, steep slopes in the soil complex are generally limited to steeper areas of the river canyon and these areas would not be used during construction (NRCS 2019). Construction vehicles would stay on established roadways and relatively level ground at staging areas and away from the top edges of any steep slopes. Therefore, this impact would be less than significant, and no mitigation would be required.

b) Result in substantial soil erosion or the loss of topsoil?

Less-than-Significant Impact. Ground disturbance caused by proposed project construction activities and the storage of removed sediment at the Disposal Sites has the potential to increase erosion and sedimentation rates above existing conditions. However, construction activities for the proposed project would be temporary and short-term and are not likely to result in substantial soil erosion or loss of topsoil in the long term. The sediment placed at the Disposal Sites would be contoured and hydroseeded to prevent erosion. A SWPPP would be developed for sediment removal activities that take place to further reduce the potential for erosion and sedimentation. Therefore, impacts related to soil erosion or the loss of topsoil would be less than significant, and no mitigation would be required.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

Less-than-Significant Impact. The proposed project is mainly located on existing access roads, impoundments, and staging/laydown areas. Newly developed staging or access areas and sediment disposal at Disposal Sites 2 and 3 are located on a mix of gravelly and loamy soils. Because these soils are not a homogeneous sand or silt unit, there is a very low potential for landslides, lateral spreading, subsidence, liquefaction, or collapse with current conditions (NRCS 2019). Additionally, proposed project activities would not take place on steep slopes. Therefore, impacts related to unstable geologic units would be less than significant, and no mitigation is required.

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial direct or indirect risks to life or property?

No Impact. No structures for human occupancy would be constructed as part of the proposed project. Because no new risks to life or structures would be created, the proposed project would have no impacts related to structures located on expansive or unstable soils. Therefore, no impact would occur, and no mitigation would be required.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

No Impact. Soils at the proposed project sites are adequate to support the proposed activities and associated equipment. In addition, no septic tanks or alternative wastewater disposal systems are proposed as part of the proposed project. Therefore, no impact would occur, and no mitigation would be required.

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

No Impact. Based on cultural resource records searches that were performed for the proposed project area, no unique paleontological or geologic features were identified (see Attachment F). Log Cabin and Our House diversion dams are water impoundment sites. Disposal Site 2 and Disposal Site 3 are the only sites that were previously used for mining and subsurface work at these locations is limited to sediment removal. Excavated material will consist of late-Holocene redeposited fluvial sediments and has no potential to intersect with the underlying geological formation. Therefore, there is no potential to impact a unique paleontological resource or geologic feature.

3.8 Greenhouse Gas Emissions

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
8. GREENHOUSE GAS EMISSIONS *Would the Project:*				
a. Generate greenhouse gas emissions, either directly or indirectly, that may have significant impact on the environment?	--	--	X	--
b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	--	--	X	--

Environmental Setting

While climate change has been a concern since at least 1988, as evidenced by the establishment of the United Nations and World Meteorological Organization's Intergovernmental Panel on Climate Change, the efforts devoted to greenhouse gas (GHG) emissions reduction and climate change research and policy have increased dramatically in recent years. These efforts are primarily concerned with the emissions of GHGs related to human activity that include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perflurorocarbons (PFC), and Sulphur hexafluoride (SF_4).

In 2002, with the passage of Assembly Bill (AB) 1493, California launched an innovative and pro-active approach to dealing with GHG emissions and climate change at the state level. AB 1493 required the CARB to develop and implement regulations to reduce automobile and light truck GHG emissions.

On June 1, 2005, Governor Arnold Schwarzenegger signed Executive Order S-3-05. The goal of this Executive Order is to reduce California's GHG emissions to: 1) 2000 levels by 2010; 2) 1990 levels by the 2020; and 3) 80 percent below the 1990 levels by the year 2050.

In 2006, this goal was further reinforced with the passage of AB 32, the Global Warming Solutions Act of 2006. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction would be accomplished through an enforceable statewide cap on GHG emissions that was phased in starting in 2012. To effectively implement the cap, AB 32 directs CARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources. AB 32 specifies that regulations adopted in response to AB 1493 should be used to address GHG emissions from vehicles. However, AB 32 also includes language stating that if the AB 1493 regulations cannot be implemented, then CARB should develop new regulations to control vehicle GHG emissions under the authorization of AB 32. AB 32 requires that CARB adopt a quantified cap on GHG emissions representing 1990 emissions levels, as well as disclose how it arrives at the cap; institute a schedule to meet the emissions cap; and develop tracking, reporting, and enforcement mechanisms to ensure that the state achieves the reductions in GHG emissions necessary to meet the cap. AB 32 also includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.

In October 2008, CARB published its *Climate Change AB 32 Scoping Plan*, which is the State's plan to achieve GHG reductions in California required by AB 32. The scoping plan was approved by CARB on December 11, 2008.

Executive Order S-20-06, which builds on S-3-05, further directs state agencies to begin implementing AB 32, including the recommendations made by the state's Climate Action Team.

Public agencies use significance thresholds to indicate how they plan to evaluate and characterize the severity of various environmental impacts that could be associated with discretionary projects that they review. Significance thresholds are also used to help identify the level of mitigation needed to reduce a potentially significant impact to a less than significant level and to determine what type of an environmental document should be prepared for a project – a negative declaration, mitigated negative declaration, or an environmental impact report.

Although CEQA does not require that public agencies develop significance thresholds for construction, it does require that if they decide to develop thresholds, these thresholds must be adopted by ordinance, resolution, rule, or regulation through a public process. A lead agency is not restrained from adopting any significance threshold it sees as appropriate, as long as that threshold is based on substantial evidence.

CEQA Guidelines Section 15064.7 encourages public agencies to develop and publish significance thresholds that are identifiable, quantitative, and qualitative or performance level that the agency uses in the determination of the significance of environmental effects. The courts have ruled that a "threshold of significance" for a given environmental effect is simply that level at which the lead agency finds the effects of the project to be significant.

Although GHG thresholds of significance are being studied and discussed at numerous agencies throughout California, few agencies have, to date, adopted thresholds for construction emissions. The California Air Pollution Control Officer's Association presented a rationale for a 900 metric tonne per year CEQA threshold in their 2010 guidance document *Quantifying Greenhouse Gas Mitigation Measures* (ARB 2010). Bay Area Air Quality Management District has published a GHG significance threshold of 1,100 metric tonnes per year for land use projects. In other air districts where the topic is under consideration (e.g. Sacramento Metro Air Quality Management District), the proposed thresholds generally fall in the 900-1,100 metric tonne per year range.

As of the preparation of this document, neither FRAQMD or NSAQMD have defined CEQA GHG significance thresholds. Therefore, the 900-1,100 metric tonne per year range mentioned above would be used as a frame of reference.

Estimated Project Greenhouse Gas Emissions

Table 3.7-1 presents the estimate of GHG emissions from the proposed action. Note that GHG emissions are reported in metric tonnes (1,000 kilograms) rather than in tons (2,000 pounds). Total GHG emissions combine the mass of different emittants by weighting each chemical according to its global warming equivalent to express the total in terms of carbon dioxide equivalent tonnes (CO_2e).

Table 3.7-1. Greenhouse Gas Emissions from Proposed Sediment Removal Activities

Emissions Source	CO_2 (tonne/yr)	CH_4 (tonne/yr)	CO_2e (tonne/yr)
SEDIMENT REMOVAL SITE			
Off-road Equipment	430	0.085	432
Worker Commute	14	0.0004	14
SEDIMENT DISPOSAL SITE			
Off-road Equipment	81	0.026	82
On-road Transport	337	0.002	337
Worker Commute	3	0.0001	3
Total Annual Emissions	**864**	**0.114**	**867**
Significance Thresholds			**900-1100**
Below Threshold			**Yes**

Discussion

a) and b) Generate greenhouse gas emissions either directly or indirectly that may have a significant impact on the environment? Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Less-than-Significant Impact. GHG emissions generated by the proposed project would be primarily in the form of CO_2 and CH_4 from construction equipment and haul and commute vehicle exhaust. Although emissions of N_2O are important with respect to global climate change, the emissions of nitrous oxide from construction equipment are negligibly small compared with CO_2 emissions, even considering their higher global warming potential. CalEEMod Version 2013.2.2 does not estimate emissions of N_2O.

There would no increase in the amount of electricity, water, or operational GHG emissions as a result of implementation of the proposed project. Dredging-related GHG emissions would be associated with engine exhaust from construction equipment, haul trucks and worker commute trips. Although any increase in GHG emissions would add to the quantity of emissions that contribute to global climate change, and estimated annual emissions are below the lower end of the range considered to represent a significant impact, it is noteworthy that this estimate corresponds to dredging 140,000 cu. yd. in one year. A review of historical dredging volumes indicates that dredging does not necessarily occur in every year, and 140,000 cu yd is roughly five years' worth of dredging for the two dams combined. Therefore, typical/average annual GHG emissions are expected to be significantly less than the estimate in Table 3.7-1.

Mitigation

None required.

3.9 Hazards and Hazardous Materials

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
9. HAZARDS AND HAZARDOUS MATERIALS *Would the Project:*				
a. Create a significant hazard to the public or the environment through the routine transport, use or disposal of hazardous materials?	--	--	**X**	--
b. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	--	--	**X**	--
c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mi of an existing or proposed school?	--	--	--	**X**
d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	--	--	--	**X**
e. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	--	--	--	**X**
f. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	--	--	--	**X**
g. Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?	--	--	--	**X**

Environmental Setting

Hazards are defined as natural and man-made conditions that must be respected if life and property are to be protected as growth and development occur.

The proposed project is primarily located within the existing FERC Project in Nevada, Sierra and Yuba counties, California. Our House Diversion Dam is roughly 11 mi north of downtown Nevada City, and Log Cabin Diversion Dam is roughly 1 mi away from the downtown area of Camptonville. Disposal Site 1 is 4 mi northeast of Dobbins. Disposal Site 2 and the Celestial Valley revegetation site are located approximately 5.1 mi northeast of North San Juan. Disposal Site 3 is a few miles west of the community of Pike. All proposed project sites are accessible by vehicles on public or private roads with minimal environmental disturbance.

There are no schools within a 0.25-mi. radius of the proposed project sites (Google Maps 2019). The nearest school to any of the project sites is Camptonville Elementary, which is located roughly one mile northeast of Log Cabin Diversion Dam.

The nearest airports are located roughly 7.5 mi of Our House Diversion Dam (Milhous Ranch Airport), and 8.2 mi of Log Cabin Diversion Dam (Milhous Ranch Airport).

There are no army bases in Sierra, Yuba or Nevada counties.

Database Review

The Hazardous Waste and Substances Sites (Cortese) List is a planning document used by the State, local agencies, and developers to comply with CEQA requirements in providing information about the location of hazardous materials release sites. Government Code section 65962.5 requires the California Environmental Protection Agency to develop at least annually an updated Cortese List. Below are the data resources that provide information regarding facilities or sites that have been identified as meeting the "Cortese List" requirements; these were reviewed for references to the proposed project site (California Enviornmental Protection Agency 2019):

- List of Hazardous Waste and Substances sites from the Department of Toxic Substance Control EnviroStor database;
- List of Leaking Underground Storage Tank Sites from the SWRCB GeoTracker database;
- List of solid waste disposal sites identified by SWRCB with waste constituents above hazardous waste levels outside the waste management unit;
- List of "active" Cease and Desist Orders and Cleanup and Abatement Orders from SWRCB; and
- List of hazardous waste facilities subject to corrective action identified by the Department of Toxic Substance Control.

There were no Cortese sites located within 5 mi of proposed project sites (California Environmental Protection Agency 2019).

<u>Discussion</u>

a) **Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?**

Less-than-Significant Impact. During construction activities for the proposed project, it is anticipated that limited quantities of miscellaneous hazardous substances (such as petroleum-based products/fluids, solvents and oils) would be employed at the proposed project areas. Construction activities would incorporate BMPs and comply with all federal, State and local regulations to minimize hazards resulting from routine transport, use, or disposal of hazardous materials. Further, the proposed project would comply with all relevant federal, state, and local statutes and regulations related to transport, use, or disposal of hazardous materials. Therefore, impacts related to transport, use, or disposal of any hazardous materials would be less than significant, and no mitigation would be required.

b) **Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment?**

Less-than-Significant Impact. As described above, limited quantities of miscellaneous hazardous substances would be employed in the proposed project areas. Construction activities would incorporate BMPs and comply with all federal, State and local regulations to minimize hazards resulting from routine transport, use, or disposal of hazardous materials. Further, the proposed project would comply with all relevant federal, state, and local statutes and regulations related to transport, use, or disposal of hazardous materials. Therefore, the proposed project is not anticipated to create a hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment, and impacts related to accidental release of hazardous materials would be less than significant. No mitigation would be required.

c) **Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?**

No Impact. No schools exist within 0.25 mile of any of the proposed project sites (Google Maps 2019). Therefore, no impact would occur, and no mitigation would be required.

d) **Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?**

No Impact. No listed hazardous sites are located at the proposed project sites, according to lists of hazardous materials sites compiled pursuant to Government Code Section 65962.5. Therefore, the proposed project would not create a significant hazard to the public or the environment. Therefore, no impact would occur, and no mitigation would be required.

e) **For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?**

No Impact. The proposed project is not located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport (Google Maps 2019). The proposed project at Our House Diversion Dam is located roughly 7.5 mi from the nearest airport (Milhous Ranch Airport), and Log Cabin Diversion Dam is roughly 8.2 mi from Milhous Ranch Airport. From the same airport, Disposal Sites 1, 2, and 3 are located roughly 5.4 mi, 7.0 mi, and 8.41 mi from Milhous Ranch Airport, respectively. No uses are proposed that could affect the operations of any airport. Therefore, no impact would occur, and no mitigation would be required.

f) **Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?**

No Impact. The proposed project would not impair the implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. Therefore, no impact would occur, and no mitigation would be required.

g) **Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?**

No Impact. The proposed project area is located within a high fire hazard severity zone (CalFire 2012). However, there are no urbanized areas adjacent to or residences within wildlands in the proposed Project area. In addition, with implementation of all BMPs, none of the proposed project activities would significantly increase the risk of wildland fires. Therefore, no impact would occur and no mitigation would be required.

<u>Mitigation</u>

None required.

3.10 Hydrology and Water Quality

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
10. HYDROLOGY AND WATER QUALITY *Would the Project:*				
a. Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	--	X	--	--
b. Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	--	--	--	**X**
c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:	--	--	--	--
i. Result in substantial erosion or siltation on- or off-site;	--	--	X	--
ii. Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;	--	--	X	--
iii. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	--	--	X	--
d. In flood hazard, tsunami, or sieche zones, risk release of pollutants due to project inundation?	--	--	--	**X**
e. Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	--	--	**X**	--

Environmental Setting

Water quality objectives and beneficial use designations for both the Log Cabin and Our House diversion impoundments and downstream are established in CVRWQCB’s *Water Quality Control Plan* (Basin Plan) for the Sacramento and San Joaquin Rivers, the fifth edition of which was initially adopted in 1998 and most recently revised in 2018. Beneficial uses of surface water in the proposed project area as described in the Basin Plan include municipal and domestic supply; agricultural supply; hydropower generation; water contact and noncontact recreation; cold freshwater habitat; cold freshwater spawning habitat; and wildlife habitat (RWQCB 2018).

Pursuant to CWA Section 303(d), California has identified and published a list of waters and segments of water bodies that are “impaired” (i.e., not meeting one or more of the water quality standards established by the state). Based on a review of this list and its associated Total Maximum Daily Load (TMDL) Priority Schedule, the Middle Yuba River from Bear Creek to the North Yuba River was identified by the SWRCB as CWA §303(d) State Impaired for mercury in 2010 with

TMDL development scheduled to be complete by 2021. The Middle Yuba River was also listed as impaired for chromium in 2014 with TMDL development scheduled to be complete by 2027 (SWRCB 2017).

Flow

Flows into Log Cabin and Our House diversion dams exhibit the typical Sierra snowmelt pattern, dry season baseflows, wet season storm pulses, and springtime snowmelt. The springtime snowmelt recession limb occurs as flows drop from snowmelt to summer baseflow. The maximum monthly average streamflow in the Log Cabin Diversion Dam reach of Oregon Creek (USGS Gage 11409400) was 617 cfs, recorded during a flood event in February of 1986, and the maximum daily average stream flow was approximately 5,340 cfs, recorded during the height of an extreme flood in February 1986. The maximum monthly average streamflow in the Our House Diversion Dam reach of the Middle Yuba River (USGS Gage 11408880) was approximately 2,973 cfs, while the maximum daily average stream flow was 21,000 cfs, both recorded during the height of an extreme flood in January 1997. Flows into the Our House Diversion Dam pool are influenced by Nevada Irrigation District's Jackson Meadows Reservoir, Milton Diversion Dam, and diversions into the Bowman-Spaulding Canal at Milton. Minimum flow requirements, after June 16 each year are 30 cfs and 8 cfs or natural flow, whichever is less, downstream of Our House and Log Cabin, respectively, but both requirements are subject to reductions if extremely dry conditions exist (YCWA 2017).

Water and Sediment Quality

YCWA has characterized both water quality and sediments from the impoundments. In general, water quality is high, with most analytes reported at non-detect to just above reporting limit concentrations (YCWA 2013). Water quality sample results collected downstream of Our House Diversion Dam and Log Cabin Diversion Dam in August 2012 (summer low flow conditions) are provided in Table 3.9-1 and provide insight into potential impacts from proposed project's mechanical removal action. Of note is that surface water turbidity ranges between 0.5 and 3.4 NTU on Oregon Creek, with the highest turbidity observed upstream of Log Cabin Diversion Dam. The readings for turbidity for Our House Diversion Dam, ranged between 0 and 0.2 NTU, with the highest reading below the diversion dam. Likewise, sediment quality is found to be high, with most analytes non-detected or at trace quantities (YCWA 2013).

Table 3.9-1. Water Quality Testing Results Downstream of Our House Diversion Dam and Log Cabin Diversion Dam, August 2012.

Analyte	***River Name***	**Middle Yuba River**		**Middle Yuba River**		**Oregon Creek**		**Oregon Creek**	
	Sample Location	**Above Our House Dam Diversion**		**Below Our House Dam Diversion**		**Above Log Cabin Diversion Dam**		**Below Log Cabin Diversion Dam**	
	Sample ID	**166995-2-1**		**166995-2-2**		**166995-2-3**		**166995-2-4**	
	Sample Depth	**Surface**		**Surface**		**Surface**		**Surface**	
	Date	**8/28/2012**		**8/28/2012**		**8/28/2012**		**8/28/2012**	
	Sample Type	**Original**		**Original**		**Original**		**Original**	
	Units	**Result**	**Notes**	**Result**	**Notes**	**Result**	**Notes**	**Result**	**Notes**
UTM		672657	4364537	642382	4364331	667279	4367450	667027	4367295
In Situ Measurements									
Temperature	°C	19.7		19.3		16.4		16.4	
Specific Conductance	µSiemans/cm	162		161		139		188	
pH	standard units	7.6		7.5		7.6		7.6	
Dissolved Oxygen	mg/L	8.3		8.6		8.7		8.8	
Turbidity	NTU	0.0		0.2		0.5		3.4	
Basic Water Quality									
Alkalinity, Total (as $CaCO_3$)	mg/L	66		76		56		74	
Ammonia (as Nitrogen)	mg/L	ND		ND		ND		ND	
Calcium	mg/L	20.7		20.6		11.3		18.9	
Carbon, Dissolved Organic	mg/L	7.9	B	8	B	7.1	B	9.1	B
Carbon, Total Organic	mg/L	7	B	6.2	B	6.5	B	8.4	B
Chloride	mg/L	1		0.97	J	1		1.7	
Hardness, Total	mg/L	70		71		64		81	
Magnesium	mg/L	5.36		5.39		8.99		7.77	
Nitrate (as Nitrogen)	mg/L	ND		ND		ND		ND	
Nitrite (as Nitrogen)	mg/L	ND		ND		ND		ND	
o-Phosphate (as Phosphorus)	mg/L	ND		ND		ND		ND	
Phosphorus, Total	mg/L	ND		0.026	J	0.04	J	0.04	J
Potassium	mg/L	0.703		0.793		1.02		1.44	
Sodium	mg/L	4.73		4.79		5.08		6.18	
Solids, Total Dissolved	mg/L	93		90		77		107	
Solids, Total Suspended	mg/L	ND		1.1		ND		1.3	
Sulfate	mg/L	8.4		8		7.3		12	
Sulfide, Total	mg/L	ND		ND		ND		ND	
Total Kjeldahl Nitrogen	mg/L	ND		ND		ND		ND	
Total Metals Concentrations									
Aluminum	µg/L	49.4		7.1		8.3		20.1	
Arsenic	µg/L	5.42		5.71		1.08		3.65	
Cadmium	µg/L	0.010	J	0.007	J	0.010	J	0.016	J
Chromium	µg/L	0.44		0.27		0.34		0.19	
Copper	µg/L	0.51		0.33		0.31		0.28	
Iron	µg/L	83		83		21		1760	
Lead	µg/L	0.069		0.004	J	ND		0.013	J
Mercury	ng/L	0.76		0.73		0.60		0.89	
Methyl Mercury	ng/L	0.075		0.100		0.051		0.366	
Nickel	µg/L	1.45		0.91		2.47		2.96	
Selenium	µg/L	ND		ND		ND		0.63	

Table 3.9-1. (continued)

Analyte	*River Name*	Middle Yuba River		Middle Yuba River		Oregon Creek		Oregon Creek	
	Sample Location	Above Our House Dam Diversion		Below Our House Dam Diversion		Above Log Cabin Diversion Dam		Below Log Cabin Diversion Dam	
	Sample ID	166995-2-1		166995-2-2		166995-2-3		166995-2-4	
	Sample Depth	Surface		Surface		Surface		Surface	
	Date	8/28/2012		8/28/2012		8/28/2012		8/28/2012	
	Sample Type	Original		Original		Original		Original	
	Units	Result	Notes	Result	Notes	Result	Notes	Result	Notes
Silver	µg/L	ND		ND		ND		ND	
Zinc	µg/L	5.13		0.1	J	0.30		0.28	
Aluminum	µg/L	3.4	J	2.1	J	4.3		0.8	J
Dissolved Metals Concentrations									
Arsenic	µg/L	4.94		5.45		1.07		2.09	
Cadmium	µg/L	0.009	J	0.005	J	0.009	J	0.015	J
Chromium	µg/L	0.27		0.21		0.34		0.04	J
Copper	µg/L	0.35		0.37		0.31		0.20	
Iron	µg/L	5	J	41		13		194	
Lead	µg/L	ND		ND		ND		ND	
Methyl Mercury	ng/L	ND		0.069		0.038	J	0.276	
Nickel	µg/L	0.66		0.83		2.41		2.83	
Silver	µg/L	ND		ND		ND		ND	
Zinc	µg/L	ND		ND		ND		0.11	J

Source: YCWA 2013
UTM =
mg/L = milligrams per Liter; °C = degrees Centigrade; µSiemans/cm = microSiemans per centimeter; µg/L = micrograms per Liter;
B = also detected in associated blank
J = estimated concentration
ND = not detected. The analyte was not detected at this concentration.

Sediment samples were collected from the Our House Diversion Dam Impoundment in 2018 and analyzed for various metals (Table 3.9-2). Selenium was the only metal not detected in any sample above the laboratory's method reporting limit (MRL). Mercury was detected at only one location above the laboratory MRL, at site OH-1, closest to the dam (0.030 milligrams/kilogram [mg/kg]). The results of the sediment sampling were compared to the total threshold limit concentration (TTLC)[13] for each metal analyzed. No results from the sediment sampling exceeded the TTLC. Additional sediment samples collected in support of sediment removal from Our House Diversion Dam Impoundment in 1986, 1992, 1997, and 2005 all supported upland disposal of sediments.

Table 3.9-2. Dry-weight and percent moisture results from October 30, 2018 sediment sampling at Our House Diversion Dam Impoundment.

Analyte		Sampling Location				
		OH-1	OH-2	OH-3	OH-4	OH-5
PERCENT MOISTURE (%)						
Percent Moisture (%)		22.4	17.7	10.7	13.6	15.5
METALS, dry-weight (milligrams/kilogram)						
Antimony	Sb	0.360	0.272	0.309	0.240	0.373
Arsenic	As	25.9	11.3	18.4	34.5	14.0
Barium	Ba	49.1	40.7	67.9	46.3	43.4
Beryllium	Be	0.232	0.291	0.258	0.236	0.225

[13] California Code of Regulations, Title 22, Chapter 11, Article 3

Table 3.9-2. (continued)

Analyte		Sampling Location				
		OH-1	OH-2	OH-3	OH-4	OH-5
PERCENT MOISTURE (%)						
Percent Moisture (%)		22.4	17.7	10.7	13.6	15.5
METALS, dry-weight (milligrams/kilogram) cont'd						
Cadmium	Cd	0.090	0.191	0.103	0.091	0.099
Chromium	Cr	90.8	120	69.2	60.5	98.0
Cobalt	Co	10.7	12.3	11.3	11.7	11.5
Copper	Cu	20.5	27.6	22.2	23.2	29.9
Lead	Pb	4.09	2.82	4.48	3.69	4.51
Mercury	Hg	0.030	ND	ND	ND	ND
Molybdenum	Mo	0.460	0.584	0.460	0.855	0.419
Nickel	Ni	102	114	76.4	79.0	91.3
Selenium	Se	ND	ND	ND	ND	ND
Silver	Ag	0.030	0.038	0.032	0.023	0.027
Thallium	Tl	0.042	0.144	0.077	0.045	0.048
Vanadium	V	31.8	37.8	38.1	34.0	37.0
Zinc	Zn	34.8	32.5	34.3	36.7	36.4

Source: YCWA 2018

Sediment samples were collected from the Log Cabin Diversion Dam Impoundment in 2018 and analyzed for various metals (Table 3.9-3). Selenium was the only metal not detected in any sample above the laboratory's MRL. The highest concentration of Mercury found in the samples was 0.092 mg/kg at the location closest to the dam (Site LC-1). The results of the sediment sampling were compared to the TTLC for each metal analyzed. No results from the sediment sampling exceeded the TTLC.

Table 3.9-3. Dry-weight and percent moisture results from October 30, 2018 sediment sampling at Log Cabin Diversion Dam Impoundment

Analyte		Sampling Location				
		LC-1	LC-2	LC-3	LC-4	LC-5
PERCENT MOISTURE (%)						
Percent Moisture (%)		39.2	18.1	18.8	19.4	16.4
METALS, dry-weight (milligrams/kilogram)						
Antimony	Sb	0.330	0.270	0.156	0.237	0.273
Arsenic	As	21.4	12.9	8.60	10.1	70.0
Barium	Ba	212	130	75.0	99.6	121
Beryllium	Be	0.629	0.448	0.295	0.363	0.358
Cadmium	Cd	0.263	0.131	0.097	0.109	0.155
Chromium	Cr	90.2	78.5	95.5	83.2	126
Cobalt	Co	21.5	20.3	12.1	12.8	19.4
Copper	Cu	59.2	48.3	25.9	27.7	30.9
Lead	Pb	10.9	7.04	4.50	4.96	5.91
Mercury	Hg	0.092	0.037	ND	ND	0.024
Molybdenum	Mo	1.35	0.735	1.23	0.855	0.733
Nickel	Ni	128	123	107	94.4	144
Selenium	Se	ND	ND	ND	ND	ND
Silver	Ag	0.113	0.064	0.026	0.081	0.048
Thallium	Tl	0.156	0.096	0.055	0.067	0.101
Vanadium	V	91.8	68.6	48.5	60.5	63.3
Zinc	Zn	72.0	54.4	39.3	44.2	52.3

Source: YCWA 2018

In 2017, YCWA completed sediment passage at Our House Diversion Dam from February 3 to February 24. During each day of monitoring, turbidity measurements below the diversion dam were close to that of the inflow sample and within the parameters set forth in the CWA Section 401 water quality certification (WQC) issued to YCWA in 2016. Due to the overall high flows in the Middle Yuba River during the event (1,300 cfs to 13,450 cfs), turbidity values ranged between 5 NTU and 267 NTU upstream of Our House Diversion Dam and between 5 NTU and 279 NTU downstream of Our House Diversion Dam[14].

Discussion

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

Less Than Significant Impact with Mitigation Incorporated. The primary water quality concerns are: 1) downstream turbidity during sediment passage in conjunction with naturally occurring high flows; 2) downstream turbidity during mechanical removal of sediment during summer low flows; 3) hazardous material spills from equipment during sediment passage or mechanical removal, as well as subsequent spoil placement activities; and 4) runoff from sediment disposal stockpiles.

Downstream sediment passage would result in short term increased downstream turbidity during a time of already high turbidity[15], potentially temporarily degrading downstream water quality, but ultimately improving downstream aquatic habitat with transfer of the sediment load. All downstream sediment passage would be performed during high flow conditions under high naturally-turbid conditions as shown during YCWA's 2017 sediment passage at Our House Diversion Dam. Following its release, the sediment would settle and it is expected that natural geomorphic processes would take over. Therefore, no significant impact would occur, and no further mitigation would be required.

Mechanical removal could temporarily increase suspended sediment downstream of the proposed project. However, mechanical removals would be performed during the summer low flow season from dewatered areas of the impoundment. Nevertheless, monitoring would be performed upstream and downstream of the project, both before and during project implementation. If turbidity downstream of the impoundments is found to be outside of Basin Plan objectives or permit requirements, work would cease until the CDFW, CVRWQCB, SWRCB, and TNF have been consulted and a plan has been agreed upon (see Mitigation Measure WQ-1). Therefore, no significant impact would occur, with mitigiation incorporated.

Ground disturbance caused by the proposed project construction activities and the storage of removed sediment at disposal sites has the potential to increase erosion and sedimentation rates above existing conditions. However, construction activities for the proposed project would be temporary and short-term and are not likely to result in substantial soil erosion or loss of topsoil. In addition, the sediment at the disposal sites would be contoured to prevent erosion and a SWPPP would be developed for the proposed project. The proposed project SWPPP would designate

[14] Complete details of the 2017 sediment passage event and YCWA's compliance with the WQC were provided in a March 23, 2017 letter to the SWRCB.

[15] At least once between November 1 and March 15 of each year inclusive, YCWA would open the low level outlet valve to full capacity for at least 96 continuous hours when instantaneous flows are greater than 540 cfs (Log Cabin) or 600 cfs (Our House).

disposal reuqirements for hazardous materials and secondary containment methods to preserve water quality. Aditionally, BMPs would be designated to protect sediment stockpiles from mixing with rain water and creating polluted runoff. Therefore, impacts related to soil erosion or the loss of topsoil would be less than significant, and no mitigation would be required.

Implementation of the proposed project would comply with all state and federal laws pertaining to water quality. Proposed project activities would not impact the interaction of surface water and groundwater, and therefore would not impact ground water quality.

b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

No Impact. The proposed project would not affect groundwater supplies or interfere with recharge. Removed sediments are nonhazardous and potential leachate from the disposal area is nonhazardous. Proposed project activities would not impact the interaction of surface water and groundwater, and therefore, would not impact ground water supply or recharge. Therefore, no impact would occur, and no mitigation would be required.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would: i. result in substantial erosion or siltation on- or off-site; ii. substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site; iii. create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or iv. impede or redirect flood flows?

Less than Significant Impact. Implementation of the proposed project would follow SWPPP requirements to reduce erosion and siltation to less than significant levels. Stockpiles will be stabilized with a native seed mix to reduce future erosion at the sites.

The proposed project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces.

There are no stormwater drainage systems that exist on the sites.

Neither mechanical removal of sediment or stockpiling would alter the existing overall drainage pattern of the site or area, or change current water management in the proposed project area. Further, sand and sediment disposed in the upland disposal area would not change surface permeability.

Ground disturbance caused by proposed project construction activities and the storage of removed sediment at disposal sites has the potential to increase erosion and sedimentation rates above existing conditions. However, construction activities for the proposed project would be temporary and short-term and are not likely to result in substantial soil erosion or loss of topsoil. The sediment at Disposal Site 1 would be contoured to prevent erosion. A SWPPP would be developed. Therefore, impacts related to soil erosion or the loss of topsoil would be less than significant, and no mitigation would be required.

d) In flood hazard, tsunami, or sieche zones, risk release of pollutants due to project inundation?

No Impact. The potential for damage caused by tsunamis is considered low given that the counties included in the proposed project are not directly exposed to the open ocean. Seiches would be limited to the larger reservoirs in the counties, none of which are included in the proposed project. Thus, the potential for seiche, tsunami, or mudflow at the proposed project sites would be low. Therefore, no impact would occur and no mitigation would be required.

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

Less than Significant Impact. Sediment passage is expected to improve downstream aquatic habitat; sediment removal would improve functionality of the impoundment. The proposed project would not alter interactions between surface water and groundwater. Therefore, the proposed project would not obstruct the implementation of a water quality control plan or sustainable groundwater management plan.

Mitigation

Mitigation Measure WQ-1: Monitoring

Prior to each sediment passage event or mechanical removal of sediment, YCWA will collect water quality samples upstream and downstream of the diversion impoundment to establish baseline turbidity conditions. Samples will also be collected daily from the established sites during the sediment management activity. If the measured turbidity downstream of the impoundments is inconsistent with the Basin Plan’s water quality objective for turbidity or applicable permit requirements, the sediment passage event or mechanical removal of sediment will cease until YCWA consults with the CDFW, CVRWQCB, SWRCB, and TNF and a plan has been agreed upon.

3.11 Land Use and Planning

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
11. LAND USE AND PLANNING *Would the Project:*				
a. Physically divide an established community?	--	--	--	**X**
b. Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	--	--	--	**X**

Environmental Setting

Regional Context

The proposed project area is located predominantly in Yuba County (Log Cabin Diversion Dam, Disposal Site 1 and 2), with small portions in Nevada and Sierra counties (Our House Diversion Dam, Disposal Site 3). Yuba County shares borders with Butte and Plumas counties to the north; Nevada, Placer and Sutter counties to the south; Sutter County to the west; and Sierra and Nevada counties to the east.

The main land uses in Yuba County are agriculture, forested lands, extractive/industrial, commercial/research and development, park, public lands, military installation and urban/communities. Private land use is managed by the county in accordance with the 2030 Yuba County General Plan and county zoning ordinances. Yuba County is comprised of approximately 632 square miles (Yuba County 2011).

The main land uses in Nevada County are forested lands, agriculture, and urban/communities. Private land use is managed by the county in accordance with the 1996 Nevada County General Plan (the Land Use section is currently being updated) and county zoning ordinances. Nevada County is comprised of approximately 958 square miles (Nevada County 2016).

The main land uses in Sierra County are forested lands, agriculture, and urban/communities. Private land use is managed by the county in accordance with the 2012 Sierra County General Plan and county zoning ordinances. Sierra County is comprised of approximately 953 square miles (Sierra County 2012).

Project Area

Land Use, Ownership, and Jurisdiction

Portions of Oregon Creek and the Middle Yuba River are located within the proposed project sites. With a few small residential and agricultural areas, primarily natural areas are located adjacent to the proposed project in all directions. The nearest development is the small, unincorporated town of Camptonville, approximately a mile and a half northeast of Log Cabin Diversion Dam and 6 mi northwest of Our House Diversion Dam. The proposed project is mainly located on the FERC Project. To provide space for operation and maintenance of the proposed project, YCWA would utilize existing available space, and newly purchased land for Disposal Site 3.

Log Cabin Diversion Dam and Our House Diversion Dam are located on TNF lands within the proposed project area. Disposal Sites 1 and 3 are on YCWA lands within the proposed project area. Disposal Site 2 is located on private property and requires special permission to access. Disposal Site 3 was recently purchased by YCWA from a private entity.

Land Use Designations and Zoning

The proposed project is located on a mix of TNF and private lands in Nevada, Sierra and Yuba counties. County general plans and zoning ordinances describe the types of land uses for each County, and the permitted activities within each land use. Additionally, the TNF manages NFS lands according to the TNF Land and Resource Management Plan (LRMP; Forest Service 1990), as amended by the Sierra Nevada Forest Plan Amendment Record of Decision (Forest Service 2004). The Record of Decision amends existing national forest LRMPs by establishing, among other things, management goals and strategies for: 1) old forest ecosystems and associated species; 2) aquatic, riparian, and meadow ecosystems and associated species; 3) fire and fuels management; 4) noxious weeds; and 5) lower westside hardwood ecosystems (Forest Service 2004).

Land around Log Cabin Diversion Dam has been designated by Yuba County as Agricultural/Rural Residential Zone 20 and Timberland Preserve. The Agricultural/Rural Residential should preserve the rural character and amenities of lands best utilized for low-density residential development such as single-family residence, growing and harvesting agricultural crops or products, aquaculture, and game preserves. The Timberland Preserve designation is to implement the Forest Taxation Reform Act (1976) and the California Timberland Productivity Act (1982; Yuba County 2011). Land at Disposal Site 1 is designated as a Recreational zone (Yuba County 2016). Land at Disposal Site 2 is designated as "Urban and Built-Up Land" in the Yuba County General Plan (2011). Disposal Site 3 is designated as "Forest" in the Sierra County General Plan (2012).

According to the Sierra County Public Land Use map, Our House Diversion Dam is situated in an area designated as Rural/Residential (Sierra County 2009). Nevada County designated land around Our House Diversion Dam as Forest-40 (Nevada County 2016).

Both Log Cabin Diversion Dam and Our House Diversion Dam fall in the Oregon Management Area under the TNF LRMP. Management Area Standards and Guidelines, under the LRMP (Forest Service 1990, as amended 2004), include:

- **Recreation Opportunity Spectrum:** Roaded natural.
- **Visual Quality Objective (VQO)** - Partial retention for the immediate foreground along the Pliocene Ridge Road and middle ground of State Route 49, modification for the remainder of the area. Maximum modification would be allowed on a case-by-case basis in areas that have a modification or maximum modification initial VQO and have herein assigned the modification VQO.
- **Transportation Management Policy:** Forest wide Standards and Guidelines apply.
- **Off-Highway Vehicle Restrictions:** Designated routes only, except closed in wildlife areas such as Plum Valley, Lohman Ridge, and Studhorse Canyon (November 1 ~ May 1). This restriction can be amended if weather conditions are such that deer are not on the winter range.
- **Forest Wide Standards & Guidelines:** All apply.

Discussion

a) Physically divide an established community?

No Impact. The proposed project would not result in the physical division of a community, as none exist in the area. Therefore, no impact would occur and no mitigation would be required.

b) Cause a significant environmental impact due to a conflict with any applicable land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

No Impact. The proposed project would not conflict with any applicable land use plan, policy, or regulation of Nevada (2014) Sierra (2012) or Yuba (2010) counties, or the management standards of the TNF LRMP (Forest Service 1990, as amended 2004). Therefore, no impact would occur and no mitigation would be required.

Mitigation

None required.

3.12 Mineral Resources

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
12. MINERAL RESOURCES *Would the Project:*				
a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	--	--	--	X
b. Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	--	--	--	X

Environmental Setting

Sierra County and Nevada County have similar mineral resources under development (Sierra County 2012 and Nevada County 1995). The principal mineral resources under development in Yuba County include sand, gravel, clay, stone products, silica, silver, and gold (Yuba County 2011).

In compliance with the California Surface Mining and Reclamation Act, the California Division of Mines and Geology has established a classification system to denote both the location and significance of key extractive resources. Under the California Surface Mining and Reclamation Act, the State Mining and Geology Board may designate certain mineral deposits as being regionally significant to satisfy future needs. In Sierra County, no mineral mapping of the county by the State Division of Mines and Geology has been completed or scheduled (CDOC 2015). Yuba County's Mineral Resource Zone (MRZ) is primarily located at areas along the Yuba River, from Marysville upstream to Smartville (CDOC 2015). Significant MRZs in Nevada County are located in the middle of the county (CDOC 2015).

Log Cabin Diversion Dam does not contain areas that are designated for MRZs (CDOC 2015), and is not shown in the Yuba County General Plan as an area of mineral resources to be protected from further development (Yuba County 2011).

Our House Diversion Dam in Sierra County also does not contain areas designated for MRZs (no mapping has occurred) (CDOC 2015), and there are no active mines in the area (Sierra County 2012). The Nevada County area of the Our House Diversion Dam project area is classified as MRZ-4, which is an area of no known mineral occurrences where geologic information does not rule out either the presence or absence of significant mineral resources. Therefore, no known mineral resources would be affected (CDOC 2015).

Disposal Site 1 was a past producer of metallic mineral resources, but is currently not designated as a MRZ (CDOC 2015). Disposal Site 2 does not contain areas that are designated for MRZs, and is not shown in the Yuba County General Plan as an area of mineral resources (CDOC 2015). Finally, Disposal Site 3 is in Sierra County and does not contain areas mapped for MRZs and there are no active mines in the area (Sierra County 2012).

Discussion

a) Result in the loss of availability of a known mineral resource of value to the region and the residents of the state?

No Impact. As described above, implementation of the proposed project is not anticipated to result in a loss of known mineral resources. Therefore, no impact would occur, and no mitigation would be required.

b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

No Impact. Also described above, the proposed project areas are not shown in the Yuba County, Sierra County, and Nevada County General Plans as areas of mineral resources to be protected from further development. Implementation of the proposed project is not anticipated to result in a loss of mineral resources (Yuba County 2011, Sierra County 2012, and Nevada County 1995). Therefore, no impact would occur, and no mitigation would be required.

Mitigation

None required.

3.13 Noise

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
13. NOISE *Would the Project result in:*				
a. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	--	--	X	--
b. Generation of excessive ground-borne vibration or groundborne noise levels?	--	--	X	--
c. For a project located within the vicinity of a private airstrip or an airport land use plan, or where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	--	--	--	X

Environmental Setting

Noise is usually defined as "unwanted sound." It consists of any sound that may produce physiological or psychological damage and/or interfere with man's communication, work, rest, recreation and sleep. People recognize that noise has become an environmental pollutant.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect our ability to hear. Pitch is the number of complete vibrations (cycles per second) of a wave that results in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment. It is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the ear. The sound intensity refers to how hard the sound wave strikes objects, which, in turn, produces the sound's effect. This is a characteristic of sound, which can be precisely measured with instruments.

Sound intensity or acoustic energy is measured in decibels (dB) that are weighted to correct for the relative frequency response of the human ear. For example, an A-weighted noise level (dBA) includes a de-emphasis on high frequencies of sound that are heard by a dog's ear, but not by a human's ear. The zero on the decibel scale is based on the lowest level that the healthy, unimpaired human ear can detect. Unlike linear units (inches or pounds), decibels are measured on a logarithmic scale, representing points on a sharply rising curve.

Many noise rating schemes have been developed for various time periods, but an appropriate rating of ambient noise affecting human communities also needs to account for the annoying effects of sound. The predominant rating scales for human communities are the Noise Equivalent (Leq), the

Community Noise Equivalent Level, and the Day-Night Average Sound Level (Ldn), all of which are based on dBA. The Leq is the total sound energy of time-varying noise over a sample period. The Community Noise Equivalent Level is the time-varying noise over a 24-hour period with a weighting factor applied to noise occurring during the evening hours of 7:00 pm to 10:00 pm (relaxation hours) and at night from 10:00 pm to 7:00 am (sleeping hours) of 5 and 10, respectively.

Physical damage to human hearing begins at prolonged exposures to more than 85 dB. Exposure to high noise levels affects our entire system, with prolonged noise exposure in excess of 75 dB, increasing body tension, thereby affecting blood pressure, functions of the heart, and the nervous system. Extended periods of noise exposure above 90 dBA would result in permanent cell damage. A sound level of 190 dBA would rupture the eardrum and permanently damage the inner ear.

The ambient noise problem is widespread and generally more concentrated within urban areas than in outlying residential neighborhoods. Environmental sound levels in high-density urban areas are doubling every 10 years. Suburban areas are not experiencing such a significant increase in noise levels because of their relative distance from major noise sources.

According to Occupational Safety and Health Administration regulations, protection against the effects of noise exposure will be provided when the sound level exceeds those shown in Table 3.13-1 (California Department of Occupational Safety and Health Administration 2013). This table shows the maximum exposure in Ldn for various land use categories and locations (whether indoor or outdoor). This maximum is provided according to the health and psychological effects described above, with a reasonable margin of safety. Table 3.13-1 also identifies whether the threshold applies to activity interference, hearing loss consideration, or both effects.

Table 3.13-1. Yearly Average Equivalent Sound Identified to Protect the Public Health and Welfare.

Land Use Categories	Measure	Indoor		To Protect Against Both Effects(a)	Outdoor		To Protect Against Both Effects(a)
		Activity Interference	Hearing Loss Consideration		Activity Interference	Hearing Loss Consideration	
Residential with Outside Space and Farm Residences	Ldn Leq(24)	45	70	45	55	70	55
Residential with No Outside Space	Ldn Leq(24)	45	70	45	--	--	
Commercial	Leq(24)	(b)	70		(b)	70	70(c)
Inside Transportation	Leq(24)	(b)	70	70(c)	--	--	
Industrial	Leq(24) (d)	(b)	70	(b)	(b)	70	70(c)
Hospitals	Ldn Leq(24	45	70	70(c)	55	70	55
Educational	Ldn Leq(24)	45	70	45	55	70	55
Recreational Areas	Leq(24)	(b)	70	45	(b)	70	70(c)

Table 3.13-1. (continued)

Land Use Categories	Measure	Indoor		To Protect Against Both Effects(a	Outdoor		To Protect Against Both Effects(a)
		Activity Interference	Activity Interference		Activity Interference	Hearing Loss Consideration	
Farm Land and General Unpopulated Land	Leq(24)	--	70	70(c)	(b)	70	70(c)

Source: California Department of Occupational Safety and Health Administration 2013
Code:

a. Based on lowest level.
b. Because different types of activities appear to be associated with different levels, identification of a maximum level for activity interface may to difficult except in those circumstances where speech communication is a critical activity.
c. Based only on hearing loss.
d. An Leq(8) may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average (i.e., no greater than an Leq of 60 dB.

Note: Explanation of identified level for hearing loss: the exposure period which results in hearing loss at the identified level is a period of 40 years.

A maximum of 45 dB protects against indoor activity interference and hearing loss for residential, hospital, and educational land uses. Outdoor activity interference threshold levels are high for these land uses, at 55 dB. Commercial, transportation, industrial, and recreational activities are considered highly variable, so thresholds for these land uses have not been determined. Similarly, agricultural-related outdoor activities have no stated interference noise levels. Hearing loss consideration for all activities becomes an issue at 70 dB or greater, for both indoor and outdoor noises.

Noise sources may either be a "line source" (e.g., a heavily traveled roadway) or a "point source" (e.g., a stationary engine or compressor). Highway traffic noise on high volume roadways simulates a "line source" and the drop-off rate of sound with distance approaches 3 dBA drop with every doubling of distance between the noise source and the noise receiver. Environmental factors such as the wind direction and speed, temperature gradients, the characteristics of the ground (hard or soft) and the air (relative humidity), the presence of grass, shrubbery, and trees, often combine to increase the actual attenuation achieved outside laboratory conditions to a 4.5 dBA drop with every doubling of distance. Thus, a noise level of 74.5 dB at 50 ft from a highway centerline would attenuate to 70.0 dB at 100 ft, 65.5 dB at 200 ft, and so forth.

The ambient noise level of a region is the total noise generated within the specific environment and usually composed of sounds emanating from natural and manmade sources. Noise levels monitored in a region tend to have wide spatial and temporal variation due to the great diversity of contributing sources.

Construction activities have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and operations involved.

Discussion

a) **Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?**

Less-than-Significant Impact. Construction noise, although temporary, can be a source of concern for sensitive receptors, such as nearby residences. Implementation of the proposed project will require the use of heavy equipment that may be periodically audible at off-site locations. Received sound levels will fluctuate, depending on the construction activity, equipment type, and distance between noise source and receiver. Additionally, sound from construction equipment will vary dependent on the construction phase and the number and class of equipment at a location at any given time.

The closest sensitive receptors to any of the proposed project sites where heavy construction equipment would be used are located at a distance of approximately 300 ft. Construction noise will attenuate with increased distance from the noise sources.

Construction is performed in discrete steps, each of which has its own mix of equipment, and consequently its own noise characteristics. These various sequential phases would change the character of the noise generated on site. Therefore, the noise levels vary as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table 3.13-2 lists maximum noise levels recommended for noise impact assessments for typical construction equipment based on a distance of 50 ft between the equipment and a noise receptor. Typical maximum noise levels range up to 91 dBA Lmax at 50 ft during the noisiest construction phases. The site preparation phase, which includes excavation and grading of the site, tends to generate the highest noise levels, because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery such as backfillers, bulldozers, draglines, and front loaders. Earthmoving and compacting equipment includes compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may involve one or two minutes of full power operation followed by three or four minutes at lower power settings.

Table 3.13-2. Typical Maximum Construction Equipment Noise Levels (L_{max})

Type of Equipment	Range of Maximum Sound Levels Measured (dBA at 50 ft)	Suggested Maximum Sound Levels for Analysis (dBA at 50 ft)
Pile Drivers, 12,000 to 18,000 ft-lb/blow	81 – 96	93
Rock Drills	83 – 99	96
Jack hammers	75 – 85	82
Pneumatic Tools	78 – 88	85
Pumps	74 – 84	80
Dozers	77 – 90	85
Scrapers	83 – 91	87
Haul Trucks	83 – 94	88
Cranes	79 – 86	82
Portable Generators	71 – 87	80

Table 3.13-2. (continued)

Type of Equipment	Range of Maximum Sound Levels Measured (dBA at 50 ft)	Suggested Maximum Sound Levels for Analysis (dBA at 50 ft)
Rollers	75 – 82	80
Tractors	77 – 82	80
Front-End Loaders	77 – 90	86
Hydraulic Backhoe	81 – 90	86
Hydraulic Excavators	81 – 90	86
Graders	79 – 89	86
Air Compressors	76 – 89	86
Trucks	81 – 87	86

Source: Noise Control for Buildings and Manufacturing Plants, Bolt, Beranek & Newman 1987.

Earthmovers, bulldozers, loaders, water trucks, and pickup trucks are expected to be used on the project sites. Based on Table 3.13-2, the maximum noise level generated by each earthmover on the proposed project site is assumed to be 88 dBA Lmax at 50 ft from the earthmover. Each bulldozer would also generate 88 dBA Lmax at 50 ft. The maximum noise level generated by water and pickup trucks is approximately 86 dBA Lmax at 50 ft from these vehicles. Each doubling of a sound source with equal strength increases the noise level by 3 dBA. As each piece of construction equipment operates as an independent noise source, the combined noise level during construction would be 91 dBA Lmax at a distance of 50 ft. The proposed project would include construction activities within 300 ft of existing residences. Distance attenuation would reduce the construction noise by 16 dBA to 75 dBA Lmax.

For the proposed project, which would generate altered noise conditions only during construction, the Yuba County General Plan, Sierra County General Plan, and the Nevada County General Plan contain the applicable local noise standards (Yuba County 2018, Sierra County 2012, and Nevada County 2016). Limiting construction activities to the daytime hours permitted by the Counties would reduce the noise impacts to less than significant. No mitigation would be required.

b) **Generation of excessive groundborne vibration or groundborne noise levels?**

Less-than-Significant Impact.

Vibration associated with the on-site heavy equipment has the potential to be an annoyance to nearby land uses. Table 3.13-3 lists the vibration source amplitudes for construction equipment. The highest reference peak particle velocity (PPV) for the proposed project would be 0.089 inches per second (in/sec) associated with on-site heavy equipment.

Table 3.13-3. Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV at 25 feet (in/sec)
Vibration Roller	0.210
Large Bulldozer	0.089
Caisson Drilling	0.089

Table 3.13-3. (continued)

Equipment	Reference PPV at 25 feet (in/sec)
Loaded Trucks	0.076
Jackhammer	0.035
Small Bulldozer	0.003
Crack-and-seat Operations	2.4

Source: California Department of Transportation, Transportation and Construction Vibration Guidance Manual, September 2013

The closest sensitive receptors are within 300 ft of the on-site equipment. CalTrans vibration guidance provides the following equation to calculate PPV at sensitive receptors:

$$PPVequip = PPV_{Ref}\ (25/D)^{n}\ (in/sec)$$

Where:

PPV_{Ref} = reference PPV at 25 ft.

D = distance from equipment to the receiver in ft.

n = 1.1 is a value related to the vibration attenuation rate through ground

Distance attenuation would reduce the on-site equipment vibration levels from 0.089 in/sec at 25 ft to 0.006 in/sec at 300 ft. This level is much lower than the 0.04 in/sec level considered to be barely perceptible to humans for transient sources (CalTrans 2013). Therefore, vibration impacts associated with the proposed project would be less than significant. No mitigation would be required.

c) **For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?**

No Impact. There would be no generation of excessive groundborne vibration or groundborne noise levels during long term operations. The Nevada County Airport is the nearest airport to a project site. It is roughly 11 mi south of Our House Diversion Dam. Therefore, the proposed project would not expose people residing or working in the proposed project area to excessive noise levels resulting from aircraft noise and there is no impact. Further, the proposed project does not include the development of any noise-sensitive receptors and therefore, would not expose people new residents to excessive noise levels. Therefore, no impact would occur, and no mitigation would be required.

Mitigation

None required.

3.14 Population and Housing

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
14. POPULATION AND HOUSING *Would the Project:*				
a. Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	--	--	--	**X**
b. Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	--	--	--	**X**

Environmental Setting

Population

Log Cabin Diversion Dam is located in Yuba County, less than 1 mile from the downtown area of Camptonville. Camptonville's estimated population is 158, while Yuba County was estimated as 78,041 in 2018 (US Census 2018).

Our House Diversion Dam is located in Sierra and Nevada Counties. The area that resides in Nevada County is located on TNF land. The proposed project site is roughly 11 mi north of Nevada City's downtown area. Nevada County had an estimated population of 99,696 in 2018; Nevada City had an estimated population of 3,142 in 2018 (US Census 2018).

The portion of Our House Diversion Dam in Sierra County is roughly 9 mi away from the town of Alleghany. As of 2018, Sierra County had an estimated 2,987 residents; the town of Alleghany had 57 in 2018 (US Census 2018).

Disposal Site 1 is located in Yuba County, 4 mi northeast from the town of Dobbins. According to the 2018 United States Census, Dobbins has an estimated population of 624 individuals (US Census 2018).

Disposal Site 2 is located approximately 5 mi northeast of the town of North San Juan in Nevada County. North San Juan has an estimated population of 269 individuals (US Census 2018).

Disposal Site 3 is located less than 1 mi east of the town of Pike in Sierra County. Pike has an estimated population of 134 individuals (US Census 2018).

Housing

The town of Camptonville had a total of 81 housing units, with an average density of 92.7 individuals per square mile. Dobbins had 319 housing units, with an average density of 40.8 individuals per square mile. The town of Alleghany had 40 housing units with an average density of 114.6 individuals per square mile. The town of Pike had a total of 66 households units with a population density of 31.3 people per square mile (US Census 2018).

Yuba County had 28,698 housing units established in 2018 and a homeownership rate of 58.2 percent (US Census 2018). Sierra County had an estimated 2,361 housing units in 2018, and the home ownership rate was 79.7 percent. According to a 2018 estimates, Nevada County had 54,258 households and a homeownership rate of 74.2 percent (US Census 2018).

Discussion

a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

No Impact. The proposed project would not involve the construction of new homes or businesses or the extension of roads or infrastructure. Jobs generated by proposed project activity would be temporary; workers would be anticipated to be local and commute to the proposed project area. Proposed project-related jobs would not directly or indirectly induce substantial population growth. Therefore, no impact would occur, and no mitigation would be required.

b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

No Impact. The proposed project would not affect existing homes, as no homes exist in the project area. No people would be displaced, and no replacement housing would be necessary. Therefore, no impact would occur and no mitigation would be required.

Mitigation

None required.

3.15 Public Services

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
15. PUBLIC SERVICES				
a. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	--	--	--	**X**
i. Fire protection?	--	--	--	**X**
ii. Police protection?	--	--	--	**X**
iii. Schools?	--	--	--	**X**
iv. Parks?	--	--	--	**X**
v. Other public facilities?	--	--	--	**X**

Environmental Setting

There are no established public facilities or recreational sites in the proposed project area, and no parks are located near the proposed Plan. Recreational resources are discussed in Section 3.16.

Law Enforcement

The Yuba County Sheriff’s Department provides law enforcement services to the unincorporated portions of the County. Log Cabin Diversion Dam, Disposal Site 1, Disposal Site 2 and the Celestial Valley revegetation site all reside in Yuba County and are therefore, under Yuba County Sheriff’s Department jurisdiction. The Yuba County Sheriff’s Department office is located at 720 Yuba Street, Marysville, CA 95901, which is the closest office to Log Cabin Diversion Dam and Disposal Site 1.

Our House Diversion Dam resides on the border of Sierra and Nevada counties. Thus, both County Sheriff’s Departments have jurisdiction. Disposal Site 3 is in Sierra County and under the jurisdiction of the Sierra County Sheriff’s Department. The Sierra County Sheriff’s Office is located at 100 Courthouse Square, Downieville, CA 95936. The Nevada County Sheriff’s Office is located at 950 Maidu Avenue, Nevada City, CA 95959. Both Sheriff’s Department locations are the closest offices to Our House Diversion Dam in their respective counties, while the Downieville Sierra County Sheriff’s office is the closest to Disposal Site 3.

Fire Protection

Log Cabin Diversion Dam, Our House Diversion Dam and the Celestial Valley Revegetation Site are all on NFS lands and fire protection is provided by CALFIRE and the Forest Service.

Disposal Site 1 and Disposal Site 2 and the Celestial Valley Revegetation Site are provided fire protection services from the Dobbins/Oregon House Volunteer Fire Department (Yuba County 2019).

The Sierra County Alleghany Fire Department provide fire protection and emergency medical response to the area of Disposal Site 3 (Sierra County 2019).

School Facilities

The public school districts serving the Our House Diversion Dam area are the Twin Ridges School District (Nevada County) and Sierra-Plumas Joint Unified School District (Sierra County) (Nevada County 2019 and Sierra County 2019). The Camptonville School District (Yuba County) serves Log Cabin Diversion Dam, Disposal Site 1, Disposal Site 2 and Celestial Valley Revegetation Site areas (Yuba County 2019). The Sierra-Plumas Joint Unified School District (Sierra County) serves the Disposal Site 3 area. There are no schools located in the vicinity of the proposed project area.

Discussion

a) **Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services: fire protection, police protection, schools, parks, or other public facilities?**

No Impact. No new buildings or facilities would be created as part of the proposed project. Only a small amount of workers would be on site during temporary construction activities. Additionally, the proposed project would not generate population growth and therefore would not impact service ratios or generate any need for additional public facilities. No new parks would be created as part of the proposed project. Therefore, the proposed project would have no impact on current public facilities or services, nor would it create a need for any new public facilities or services.

Mitigation

None required.

3.16 Recreation

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
16. RECREATION				
a. Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	--	--	X	--
b. Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	--	--	--	X

Environmental Setting

The FERC Project includes 16 developed recreation facilities associated with the New Bullards Bar Reservoir and undeveloped recreation opportunities at New Bullards Bar Reservoir and at the Log Cabin and Our House Diversion Dam Impoundments. New Bullards Bar Reservoir facilities would not be impacted by implementation of the proposed project.

The Our House Diversion Dam Impoundment provides undeveloped day-use recreation opportunities. The site is located on NFS land along the Middle Yuba River (river mile 12.6) and does not have any developed recreation facilities. Informal parking for approximately 25 vehicles is available at the end of the Our House Dam Road, where visitors have foot access to the shoreline. Accessibility was not intended at this undeveloped area (YCWA 2013). Recreational use at Our House Diversion Dam was estimated at less than 1,000 visitors annually with most of that use (i.e., 730 visitors) occurring during the peak recreation season from Memorial Day through Labor Day holiday weekends. The remainder of the use (i.e., 250 visitors) was spread across the non-peak season from after early September through late May (nearly 9 months). The most common recreation activities are angling and swimming during the peak season and swimming, gold panning, and hiking/walking during the non-peak season (YCWA 2013).

The Log Cabin Diversion Dam Impoundment provides undeveloped day-use recreation opportunities. The site is located on NFS land along Oregon Creek (river mile 4.3) and does not have any developed recreation facilities. YCWA, with the permission of the Forest Service, has installed and keeps locked a vehicular gate on NFS land at the start of Log Cabin Road at State Route 49. Vehicle access to the diversion dam is restricted. Visitors may park their vehicles along the shoulder of State Route 49 and hike into the diversion dam (YCWA 2013). Recreational use at Log Cabin Diversion Dam was estimated at less than 100 visitors annually. The most common recreation activities are gold panning, angling, swimming, and picnicking during the peak season and hiking/walking during the non-peak season (YCWA 2013).

There is no recreation at any of the three Disposal Sites, as they are all on private lands and closed to the public. The Celestial Valley Revegetation Site is also not used for recreation.

There are no developed parks or other recreation facilities located in the proposed project area.

Discussion

a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Less-than-Significant Impact. The proposed project would not involve the construction of new housing or other facilities, and therefore, would not increase demand for recreational facilities. There are no developed recreational facilities in the proposed project area. The proposed project would not permanently add, remove, or alter recreational facilities. The mechanical removal of sediment as part of the proposed project would result in the closure of both the impoundments from September 15 through November 15 only in years when sediment removal was needed. However, the closures would occur during a short timeframe of the non-peak season (i.e., 2 months out of the nearly 9 month season) for recreational use when less than 100 visitors overall or less than 1 visitor per day would potentially be displaced due to the closures. Further, the common recreational activities at these impoundments (i.e., gold panning, swimming, angling, and hiking/walking) are not exclusive to these areas and numerous other areas along the Middle Yuba River and Oregon Creek exist both formally and informally that would provide a variety of options for the limited number of displaced users and these activities. There would be no noticeable increase in use of existing neighborhood and regional parks or other recreational facilities that substantial physical deterioration of the facility would occur or be accelerate. Therefore, less than significant, short-term impacts would occur, and no mitigation would be required.

b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

No Impact. As mentioned under item a) above, the proposed project does not include proposals for new housing or other facilities. Therefore, the proposed project would not generate new demand for recreation services or facilities. No impact would occur, and no mitigation would be required.

Mitigation

None required.

3.17 Transportation

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
17. TRANSPORTATION *Would the Project:*				
a. Conflict with a program plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	--	--	X	--
b. Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, Subdivision (b)?	--	--	X	--
c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	--	--	--	X
d. Result in inadequate emergency access?	--	--	--	X

Environmental Setting

The proposed project would utilize one state highway (State Route 49) and one major county road (Marysville Road). State Route 49 extends 9.5 mi from Nevada City through Yuba County to the Sierra County line (Yuba County 2008). Personnel, equipment, and imported materials would reach the proposed project areas primarily via State Route 49, Maryville Road, and Ridge Road, all of which are paved, all-weather roads, and suitable for the anticipated loads.

Discussion

a) Conflict with a program plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?

Less than Significant Impact. The Yuba County General Plan 2030 uses daily service volume (in Average Daily Traffic [ADT]) and peak hour volume to determine the roadway segment level of service (LOS) to evaluate circulations of traffic systems (Yuba County 2011).

Log Cabin and Our House diversion dams are regionally accessible through State Route 49 from the rest of Yuba County, Sierra County, Nevada County, and Placer County. Locally, from State Route 49, Log Cabin dam is accessible through Cleveland Avenue in Camptonville, and Our House dam through Ridge Road. Thus, State Route 49 segment operations from Cleveland Avenue to Ridge Road were evaluated (referred to herein as “study segment”). Yuba County General Plan 2030 designates this segment as a Conventional 2 Lane Highway – Rolling Terrain (Yuba County 2011). While the study segment is specified in the General Plan, other smaller rural roadways such as Ridge Road have no designations. Additionally, although both daily and peak hour volume increases are anticipated, these roadways currently carry low traffic volumes and no analysis was conducted. The General Plan also specifies Level of Service (LOS) D or better as an acceptable LOS, which equates to 12,400 or less ADT and 1,600 or less peak hour volume. The year 2020 (initial construction year) and the year 2030 (final construction year) ADT and peak hour volume were evaluated on the study segment.

The construction would require 18 workers per dam, and would occur over a maximum of 60-day span annually. A maximum of 100,000 yd^3 of sediments would be removed annually from Our House Dam, and 40,000 yd^3 from Log Cabin Dam. These sediment removal amounts are equivalent of 6,667 annual truckloads or 112 daily truckloads from Our House Dam, and 2,667 annual truckloads or 45 daily truckloads from Log Cabin Dam. **Table 3.17-1** summarizes the detailed information of the sediment removal construction.

Table 3.17-1: Sediment Removal Construction Operation Details

	Our House Dam	Log Cabin Dam
Annual Sediment Removal (yd^3)	100,000	40,000
Days of Operations (days)	60	60
Operating Truck Counts	8	8
Number of Employees	18	18
Truck Load Capacity (yd^3)	15	15
Annual Truckloads	6,667	2,667
Daily Truckloads	112	45

Table summarizes the No Construction and Construction Conditions ADT on the study segment. CalTrans Traffic Census data provides 2017 ADT and peak hour volume on the study segment. No Construction Condition ADT and peak hour volume for 2020 and 2030 were developed by applying growth rates projected in Sacramento Area Council of Governments 2016 Metropolitan Transportation Plan/Sustainable Communities Strategies (SACOG 2016) to the 2017 ADT. The ADT on the study segment was projected to be 2,281 in 2020 and 2,505 in 2030, both below the 12,400 ADT LOS D threshold.

The construction trip generation was developed based on the construction equipment, traffic, and routing information available in the project description (Section 2.5.2). All 36 construction workers (18 workers per dam) were anticipated to access the construction sites via the study segment. Highway trucks delivering sediments from Log Cabin Diversion Dam would travel through the study segment to reach Disposal Sites 1, 2, and 3. Highway trucks delivering sediments from Our House Diversion Dam to Disposal Site 2 and 3 would not travel through the study segment. Ridge Road and Celestial Valley Road would be used to access Disposal Site 2 and the Celestial Valley Revegetation Site. Ridge Road, Pike City Road, and Camptonville Road would be used to access Disposal Site 3.

The construction activity would generate 162 ADT on the study segment in both 2020 and 2030.The 2020 and 2030 ADT would be 2,443 and 2,667 vehicles, respectively, under the Construction Condition. The study segment would continue to operate at better than LOS D, and the proposed project would have a less-than-significant impact.

Table 3.17-2: No Construction and Construction Conditions ADT on State Route 49

Year	ADT				Impact?
	LOS D Threshold	No Construction	Construction Trips	Construction	
2020	12,400	2,281	162	2,443	N
2030	12,400	2,505	162	2,667	N

Table summarizes the No Construction and Construction Conditions peak hour volume on the study segment. The peak hour volume on the study segment was projected to be 238 in 2020 and 261 in 2030, both below the LOS D threshold of 1,600 vehicles per hour.

The construction peak hour volume on the study segment was conservatively assumed to include the maximum number of possible highway truck trips in one hour and all construction worker trips. There would be 50 peak hour construction trips in 2020 and 51 in 2030. In total, the peak hour volume would be 288 in 2020 and 312 in 2030. The study segment would continue to operate at better than LOS D, and the proposed project would have a less-than-significant impact.

Table 3.17-3: No Construction and Construction Conditions Peak Hour Volume on State Route 49

Year	Peak Hour Volume				Impact?
	LOS D Threshold	No Construction	Construction Trips	Construction	
2020	1,600	238	50	288	N
2030	1,600	261	51	312	N

Yuba County General Plan 2030 does not specify the study segment as either transit route or bikeway (bicycle path, lane, and route) (Yuba County 2011). The study segment is also not equipped with sidewalks. Due to the rural and mountainous characteristics of the study segment, transit, cyclist, and pedestrian activities would not be impacted. Thus, the proposed project would have a less-than-significant impact.

b) Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, Subdivision (b)?

Less Than Significant Impact. The proposed project would not cause a long-term increase in vehicle-miles traveled (VMT). The construction would cause a marginal VMT increase in Yuba County of 0.3% in 2020 and 0.2% in 2030 as summarized in **Table** . The increase in VMT would be due to sediment deliveries and workers' commute. However, the proposed project would be temporary and sediment removal would not be planned or expected every year. Furthermore, if expected, the sediment removal would last through the dry season and would result in a temporary short-term VMT increase. Therefore, the proposed project would have a less-than-significant impact.

Table 3.17-4: No Construction and Construction Conditions Yuba County Weekday VMT Comparison

Year	VMT		% Increase
	No Construction	Construction	
2020	1,907,000	1,912,259	0.3%
2030	2,094,000	2,098,658	0.2%

c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

No Impact. The proposed project would not change geometric design features or require incompatible uses. Off-road trucks would deliver sediment loads only from the dams to temporary laydown areas and highway trucks would deliver sediments from laydown areas to the disposal sites to avoid any incompatible uses of both types of trucks. Thus, the proposed project would have no impact.

d) Result in inadequate emergency access?

No Impact. The proposed project would not result in inadequate emergency access. The sediment deliveries and equipment deliveries would not cause any roadway closures or detours to impact the existing emergency access. Thus, the proposed project would have no impact.

Mitigation

None required.

3.18 Tribal Cultural Resources

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
18. TRIBAL CULTURAL RESOURCES *Would the Project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:*				
a. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	--	X	--	--
b. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency will consider the significance of the resource to a California Native American tribe.	--	X	--	--

Regulatory Context

As defined in PRC 21074, a TCR is a site, feature, place, cultural landscape, sacred place or object that is of cultural value to a California Native American tribe, and is either (1) on or eligible for the CRHR or a local historic register, or (2) the lead agency, at its discretion, chooses to treat the resource as a TCR. CEQA mandates that public agencies determine whether a project would have a significant impact on tribal cultural resources that are listed on or eligible for listing on the CRHR (i.e., a historical resource) or determined to be significant by the lead agency and to appropriately mitigate any such impacts.

In accordance with CEQA guidelines, cultural resources investigations are necessary to identify TCRs that may have significant impacts as a result of a project (14 CCR Part 15064.5[c]). The following steps are routinely implemented in a cultural resources investigation for CEQA compliance:

1. Identify cultural resources in the proposed Project area;
2. Evaluate against the CEQA criteria of significance as listed below;
3. Evaluate the impacts of the proposed Project on *all* resources; and
4. Develop and implement measures to mitigate proposed Project impacts on historical resources.

Additionally, the lead state or local agency (in this case YCWA) for CEQA is responsible for consultation under PRC 21080.3.1 regarding the potential for a project to impact TCRs, which can be identified **only through tribal consultation**. Accordingly, consultation with local Native American tribes and other interested parties is part of all four of these steps. As described above, a TCR necessarily has value to a California Native American tribe. As such, consultation with local Native American tribes to determine what tribal cultural resources may have value to them is a necessary component of TCR identification efforts. This recognizes that “tribes may have expertise with regard to their tribal history and practices, which concern the tribal cultural resources with which they are traditionally and culturally affiliated” (California State Assembly Bill 52, Gatto 2014). Consultation efforts with California Native American tribes, pursuant to TCR identification efforts, are described below.

As described above in Section 3.5 – Cultural Resources, a proposed project may induce a significant impact to a historical resource, unique archaeological resource, or a TCR if it causes a substantial adverse change (i.e., physical demolition, destruction, relocation, or alteration) to the resource or immediate surroundings (14 CCR 15064.5[b]), thereby demolishing or significantly altering the physical characteristics that qualify it for listing on the CRHR or local registers (PRC 5020.01[k] and 5024.1[g]). As such, consultation has begun for all cultural resources investigation efforts and is further detailed below.

As stated above in Section 3.5 Cultural Resources, cultural resources investigations were conducted in 2018 and 2019 with the objectives to (1) identify historical resources, unique archaeological resources, and TCRs, and (2) assess whether implementation of the proposed project would have significant impacts on historical resources, unique archaeological resources, and TCRs in the newly added areas of the proposed project.

Under the CEQA Guidelines, even if a resource is not included on any local, state, or federal register, or identified in a qualifying historical resources survey, a lead agency may still determine that any resource is an historical resource for the purposes of CEQA, if there is substantial evidence supporting such a determination (CEQA Guidelines Section 15064.5(a)). A lead agency must consider a resource to be historically significant if it finds that the resource meets the criteria for listing in the CRHR. The methods used to determine if resources are TCRs are presented below.

A resource may be eligible for inclusion in the CRHR if it:

- Is associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage (Criterion 1);
- Is associated with the lives of persons important in our past (Criterion 2);
- Embodies the distinctive characteristics of a type, period, region, or method of construction or represents the work of an important creative individual or possesses high artistic values (Criterion 3); or
- Has yielded, or may be likely to yield, information important in prehistory or history (Criterion 4).

According to CEQA, a project may have a significant impact on the environment if it could cause a substantial adverse change in the significance of a TCR (PRC 21084.2). Consultation with California Native American tribes would need to take place to determine if the significance of a TCR is subject to a substantial adverse change.

Methodology and Consultation

Pursuant to PRC 21080.3.1, consultation efforts with Native American tribal contacts have been incorporated in the cultural resources investigation of the newly added areas of the proposed project, as "California Native American tribes traditionally and culturally affiliated with a geographic area may have expertise concerning their tribal cultural resources" (PRC 21080.3.1[a]). In support of consultation under PRC 21080.3.1(c) and in response to modifications to the Plan, HDR contacted the NAHC on August 27, 2018 and March 18, 2019 to request a list of Native American tribes and organizations that may have an interest in the proposed project, as well as to request a search of the Sacred Lands File (SLF). The NAHC provided responses on August 29, 2018 and March 22, 2019, respectively, providing a list of Tribes that have cultural and traditional affiliation to the newly added areas of the proposed project. Both requests for searches the SLF were negative for results, however the NAHC informed YCWA that the area is sensitive for cultural resources. Per PRC 21080.3.1(b)(1), the Shingle Springs Rancheria and the United Auburn Indian Community have provided YCWA with formal requests to be notified of YCWA's CEQA projects. The tribal chairpersons and designated tribal representatives presently included in the list of contacts for consultation efforts for this cultural resources investigation are provided below in **Table 3.18-1**.

Table 3.18-1. Tribal contacts for consultation regarding Project Implementation.

Tribe	Primary tribal contact
Concow Maidu Tribe of Mooretown Rancheria	Guy Taylor, Director, Environmental Protection Office
Enterprise Rancheria of Maidu Indians	Glenda Nelson, Chairperson
Greenville Rancheria of Maidu Indians	Kyle Self, Chairperson
KonKow Valley Band of Maidu	Wallace Clark-Wilson, Chairperson
Mechoopda Indian Tribe of Chico Rancheria	Dennis Ramirez, Chairperson
Nevada City Rancheria	Richard Johnson, Chairperson Shelly Covert, Secretary
Pakan-Yani Band of Strawberry Valley Rancheria	Cathy Bishop, Chairperson
Shingle Springs Rancheria	Regina Cuellar, Chairwoman
Tsi-Akim Maidu	Don Ryberg, Chairperson Grayson Coney, Cultural Director
United Auburn Indian Community (UAIC)	Gene Whitehouse, Chairperson Melodi McAdams, Cultural Resources Supervisor
Washoe Tribe of Nevada and California	Darrel Cruz, Tribal Historic Preservation Officer

Consultation for the newly added areas of the proposed project began with formal notifications to all tribes listed in **Table 3.18-1** of the modifications to the Plan, including maps of the newly added areas of the proposed project, and invitations to consult sent on December 12, 2018 and July 23, 2019, as well as phone calls placed on March 27, 2019 to invite them to participate in the upcoming field efforts, (PRC 21080.3.1[d]). Per PRC 21080.3.1(b)(2), within 30 days of receiving formal notification of the proposed project the Greenville Rancheria provided a response letter, dated December 27, 2018, and stated that it has no comments or objections with the Project improvements (see Attachment F). The UAIC also responded to the formal notice for consultation within 30 days of receipt in a letter dated December 27, 2018 expressing that UAIC would like to consult on the proposed project, would like to receive copies of any archaeological reports that are completed for the proposed project as well as environmental documents for the proposed project so that they have the opportunity to comment on appropriate identification, assessment and mitigation related to cultural resources. The UAIC also requests and recommends that UAIC tribal representatives observe and participate in all cultural resource surveys. Cherilyn Neider, Tribal Historic Preservation Officer for UAIC, also e-mailed YCWA requesting consultation for the proposed project (see Attachment F), all existing cultural resource assessments, copies of requests for and results of records searches, and the GIS shapefiles for the Area of Potential Effect. On behalf YCWA, Danielle Risse with HDR responded to Ms. Neider to let her know that as requested, YCWA would continue to consult with the UAIC on this project and that YCWA would submit the cultural assessment materials to the UAIC for this project when they are completed, including a summary of the records search undertaken for the project. However, per the signed agreement with the California Historic Resources Information System, HDR cannot provide other entities copies of the original materials received from the information system. Ms. Risse provided the Area of Potential Effect shapefiles to Ms. Neider via e-mail shortly thereafter. All consultation is captured in the cultural resources investigation report in Attachment F (Risse et al. 2019).

Per UAIC's request to participate in all cultural resource surveys, HDR invited UAIC and all of the tribal participants to participate in the 2018 and 2019 fieldwork via e-mails and phone calls. No tribal participants attended fieldwork; notes on the consultation efforts for arranging fieldwork participation are captured in the cultural resources investigation report in Attachment F (Risse et al. 2019).

No consultation efforts to date have identified TCRs that are eligible for inclusion on the CRHR, though it has been made clear by Native American tribal contacts that the general vicinity of the proposed project, along with the Area of Potential Effect itself, have been used and occupied by Native Americans over a long period and the area is important to Native American groups today. In addition to these efforts, consultation with Native American tribal contacts also includes submittal of the recent cultural resources investigation report (Risse et al. 2019) to tribal contacts on November 1, 2019 for 30-day review and comment; no comments were received from tribes.

<u>Discussion</u>

No TCRs have been identified within the newly added areas of the proposed project or within the immediate vicinity. Cumulative impacts for the proposed project would be *less than significant*. As no TCR have been identified, no mitigation measures are necessary.

Would the Project cause a substantial adverse change in the significance of a TCR, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k).

Less than significant with mitigation incorporated. The cultural resources inventory effort, including consultation to date, has not determined any cultural resource to be eligible for or listed in the CRHR and accordingly, no resources are considered to be TCR. However, the remote possibility for encountering previously unidentified TCR during implementation of the proposed project does exist. In the case of inadvertent discoveries of cultural resources, Mitigation Measures CULT-01 and CULT-02 (see Section 3.5) would be implemented, therefore reducing the impact to a less-than-significant level.

b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency will consider the significance of the resource to a California Native American tribe.

Less than significant with mitigation incorporated. The cultural resources inventory effort, including consultation to date, has not determined any cultural resource to be eligible for or listed in the CRHR by the lead agency, and accordingly, no resources are considered to be TCR. However, the remote possibility for encountering previously unidentified TCR during implementation of the proposed project does exist. In the case of inadvertent discoveries of cultural resources, Mitigation Measures CULT-01 and CULT-02 (see Section 3.5) would be implemented, therefore reducing the impact to a less-than-significant level.

Mitigation

See Section 3.5

3.19 Utilities and Service Systems

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
19. UTILITIES AND SERVICE SYSTEMS *Would the Project:*				
a. Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	--	--	--	**X**
b. Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?	--	--	--	**X**
c. Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	--	--	--	**X**
d. Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	--	--	--	**X**
e. Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	--	--	--	**X**

Environmental Setting

Solid waste disposal, sewer, water supply, and gas or electric facilities do not exist at any of the proposed project sites. All solid waste would be removed from the site at the end of construction. Removed sediment would be deposited at the disposal sites with a Waste Discharge permit. Water used by project construction work, such as wash water and water collected in secondary containment systems, would be collected and trucked off site for disposal. Stormwater would be managed in compliance with a construction National Pollution Discharge Elimination System permit and SWPPP. Water needed for construction would be supplied by the contractor or taken from rivers on site. YCWA has rights to use water from the rivers on site. Finally, construction work requiring power would be supplied by a generator provided by the contractor; fuel for vehicles would also be provided by the contractor.

Discussion

a) Require or result in the construction or relocation of new or expanded water, wastewater treatment or storm water drainage, electrical power, natural gas, or telecommunications treatment facilities, the construction of or relocation which could cause significant

environmental effects?

No Impact. The proposed project is limited to sediment removal, sediment disposal, sediment passage, and revegetation. It would not result in the relocation or construction of permanent new or expanded water, wastewater treatment, or storm water drainage, electric power, natural gas, or telecommunications facilities during either construction or long-term operations. Therefore, the proposed project would not relocate or expand water or wastewater facilities or other utility facilities, and there would be no impact.

b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?

No impact. The proposed project would not create additional need for water supply in the future, nor would it reduce the water supply available to surrounding businesses and residents. By removing sediment that has accumulated in the Log Cabin and Our House impoundments, additional storage space for water would be restored in the impoundments for use. Therefore, the project has no negative impact on water supply.

c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?

No impact. No new wastewater would be generated as part of the proposed project. Water used during construction would be trucked off site for disposal or discharged in accordance with the project construction SWPPP. Therefore, the proposed project would not impact local wastewater treatment.

d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?

No Impact. All sediment removed from the impoundments would be transported to and stored at the disposal sites. A waste discharge permit would be obtained and sediment would be disposed of accordingly at the disposal sites. It is anticipated that the proposed project would not generate excess materials during construction that would require disposal. Therefore, the proposed project would have no impact on State or local solid waste standards or infrastructure.

e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?

No Impact. The proposed project would comply with all relevant federal, state, and local statutes and regulations related to solid waste. Therefore, no impact would occur and no mitigation would be required.

Mitigation

None required.

3.20 Wildfire

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
20. WILDFIRE ***If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:***				
a. Substantially impair an adopted emergency response plan or emergency evacuation plan?	--	--	--	**X**
b. Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	--	--	--	**X**
c. Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	--	--	--	**X**
d. Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff post-fire slope instability, or drainage changes?	--	--	--	**X**

Environmental Setting

The proposed project is located in heavily forested areas on TNF and private lands in Nevada, Sierra, and Yuba counties. In regards to fire management responsibility, Our House Diversion Dam is located within a “Federal Responsibility Area,” however it is immediately adjacent to “Very High Fire Hazard” State Responsibility Areas (SRAs). Log Cabin Dam and Disposal Sites 1, 2, and 3 are all located in “Very High Hazard” SRAs (CalFire 2007). Fire Hazard severity zones are a way to measure the physical fire behavior, and include measurements for the speed at which a wildfire moves, the amount of heat the fire produces, and the burning fire brands that the fire sends ahead of the flaming front (CalFire 2007).

The Nevada County Emergency Operations Plan does not include any guidance or language specific to wildfires, but discusses how the County should deal with disasters in a general sense (Nevada County 2011). The Sierra County Wildfire Protection Plan outlines a comprehensive, scientifically based assessment of the hazards and risks that wildfires provide (Sierra County 2014). The Yuba County Emergency Operations Plan discusses procedures for wildfire response (Yuba County 2015)

Discussion

a) Substantially impair an adopted emergency response plan or emergency evacuation plan?

No Impact. Nevada County has an Emergency Response Plan (2011), Sierra County has a Wildfire Protection Plan (2014), Yuba County has an Emergency Operations Plan (2015), and the TNF has a Land and Resources Management Plan (1990) that deal with wildfire emergencies. None of the proposed project activities would substantially impair the emergency plans for these counties or the TNF. Therefore, no impact would occur, and no mitigation would be required.

b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?

No Impact. The proposed project involves the movement and placement of sediment from the reservoirs which consists of non-flammable materials. These project activities would not exacerbate existing fire risks. Furthermore, there are no houses or occupants of the proposed project sites. Therefore, no impact would occur, and no mitigation would be required.

c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?

No Impact. The proposed project does not involve the installation or maintenance of any roads, fuel breaks, emergency water sources, power lines or other utilities. Therefore, no impact would occur, and no mitigation would be required.

d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff post-fire slope instability, or drainage changes?

No Impact. The proposed project involves the movement and placement of sediment from the reservoirs which consists of non-flammable materials. At the Disposal Sites, the material would be placed and packed so that it is stable. Additionally, hydroseed would be utilized after all material has been placed and erosion control measures kept in place until plant growth is established. This would reduce the risk of any landslides or erosion. Additionally there are no homes or structures (outside of the dams) on the proposed project sites. The proposed project work would not expose any people or structures to significant risk as a result of post-fire instability or drainage changes. Therefore, no impact would occur, and no mitigation would be required.

Mitigation

None required.

3.21 Mandatory Findings of Significance

Issue	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
21. MANDATORY FINDINGS OF SIGNIFICANCE				
a. Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	--	X	--	--
b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	--	X	--	--
c. Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	--	X	--	--

a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?

Less than Significant with Mitigation Incorporated. Development of the proposed project would not substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce or restrict the range of rare or endangered plants or animals, or eliminate important examples of the major periods of California history or prehistory. Biological and cultural mitigation measures would reduce any potential impacts to habitat, species, or cultural resources to a less than significant level. As discussed previously in this IS Checklist, mitigation measures are proposed to reduce potentially significant impacts on biological and cultural resources to a less-than-significant level.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

Less than Significant with Mitigation Incorporated. No past, current, or probable future projects were identified in the proposed project vicinity that, when added to project-related impacts, would result in cumulatively considerable impacts. No cumulatively considerable impacts would occur with development of the proposed project. As discussed previously in this IS Checklist, mitigation measures are proposed to reduce all potentially significant impacts to a less-than-significant level. The incremental effects of the proposed project are not cumulatively considerable when viewed in connection with the effects of past, current, and probable future projects.

c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

Less than Significant with Mitigation Incorporated. No project-related environmental effects were identified that would cause substantial adverse effects on human beings after mitigation is incorporated. As discussed herein, the proposed project has the potential to create temporary impacts related to biological and cultural resources during construction. However, with implementation of required mitigation measures, these impacts would be reduced to a less-than-significant level.

<u>Mitigation</u>

None required.

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SECTION 5.0
REFERENCES CITED

SECTION 1.0 INTRODUCTION

None.

SECTION 2.0 PROJECT DESCRIPTION

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SECTION 3.0 ENVIRONMENTAL CHECKLIST

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SECTION 3.1 AESTHETICS

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Mr. Henning explained that this is an MND for dredging sediment from behind dams. Mr. Longmire cited the three ranges of project NOx emissions in the District's CEQA guidance and explained how they are used in planning:
Less than 24 lb/day is Less than Significant
24-136 lb/day is potentially significant, but District will not object to MND if all vehicles will be CARB compliant. Other NOx mitigation should be applied as practical and appropriate.
Above 136 lb/day is significant and the District will require an EIR.

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SECTION 3.21 MANDATORY FINDINGS OF SIGNIFICANCE

None.

SECTION 4.0 REPORT AUTHORS/CONTRIBUTORS

None.

Attachment A

National Best Management Practices for Water Quality Management on National Forest system Lands – Forest Service Manual

USDA

United States Department of Agriculture

Forest Service

FS-990a

April 2012

National Best Management Practices for Water Quality Management on National Forest System Lands

Volume 1:

National Core BMP Technical Guide

USDA

United States
Department of
Agriculture

Forest Service

FS-990a

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National Best Management Practices for Water Quality Management on National Forest System Lands

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Front cover photo: *Taylor Fork Creek, Gallatin National Forest, near Big Sky, MT, by David Scovell, engineer, Rogue River-Siskiyou National Forest. Photo taken in August 2005 in the Madison Range, just west of Yellowstone National Park.*

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Preface

This technical guide is the first volume of guidance for the Forest Service, U.S. Department of Agriculture, National Best Management Practices (BMP) Program. The National BMP Program was developed to improve agency performance and accountability in managing water quality consistent with the Federal Clean Water Act (CWA) and State water quality programs. Current Forest Service policy directs compliance with required CWA permits and State regulations and requires the use of BMPs to control nonpoint source pollution to meet applicable water quality standards and other CWA requirements.

The Forest Service has a long history of working with States and other partners to carry out BMP programs, including agreements with the U.S. Environmental Protection Agency (EPA) and many States to use and monitor BMPs. Each Forest Service region has a BMP guidance document consistent with its respective State BMP programs. Most national forests and grasslands monitor and report on BMPs. The regional or forest BMP programs, however, are not standardized to allow efficient cross-regional application, evaluation, or reporting. The National BMP Program, which includes the National Core BMPs detailed in this guide, will enable the agency to readily document compliance with the nonpoint source management strategy at national or regional scales. The National BMP Program is modeled after a successful 20-year-old regional BMP program in the Forest Service Pacific Southwest Region (Region 5).

A standardized National BMP Program is needed as an effective tool for the agency to accomplish the following:

- ***Improve water quality to restore impaired waters***—National Forest System (NFS) lands in the United States contain 3,126 CWA 303(d) listed waterbodies; nearly every Forest Service administrative unit (96 percent) has at least one impaired waterbody within its boundaries. BMPs identified in Total Maximum Daily Load restoration plans will improve water quality conditions in impaired waters.
- ***Improve relationships with EPA, States, and the public***—Improved Forest Service BMP program performance and accountability will better demonstrate compliance with CWA permit requirements and State nonpoint source programs and build trust between the agency and our partners and stakeholders.
- ***Improve the agency's ability to demonstrate results in watershed management***—The Forest Service has made a commitment to implement several accountability tools, including a National BMP Program, to document improvements in watershed condition as a result of management and restoration actions.
- ***Improve the agency's ability to use adaptive management in land management plan implementation***—The National BMP Program will provide a consistent, credible, and affordable agencywide BMP monitoring program with coordinated data collection; monitoring information that can be aggregated at any scale; a database accessible to all Forest Service users; and reports that will be shared with EPA, States, and other partners. This type of monitoring program provides a continuous feedback loop for a successful adaptive management process.
- ***Improve National Environmental Policy Act analyses and compliance with other Federal laws***—Improved accountability for water quality management will lead to improved National Environmental Policy Act analysis and documentation and better demonstration of compliance with other Federal laws, such as Endangered Species Act habitat protections for aquatic threatened and endangered species. The agency's ability to respond successfully to water-quality-related appeals and lawsuits will be improved, and management flexibility in decisionmaking will be maintained.

The National BMP Program will provide consistency among Forest Service administrative units to efficiently administer the program and demonstrate improvements in performance and accountability at multiple scales. The National BMP Program consists of four main components: (1) a set of National Core BMPs, (2) a set of standardized monitoring protocols to evaluate implementation and effectiveness of those BMPs, (3) a data management and reporting structure, and (4) corresponding national direction.

The National Core BMPs integrate individual State and Forest Service regional BMPs under one umbrella to facilitate an agencywide BMP monitoring program. The national core set provides general, nonprescriptive BMPs for the broad range of activities that occur on NFS lands. Nearly every BMP in the national core set already exists in current regulations, guidance, or procedures. Adopting a standard national core set of BMPs may change what some national forests and grasslands refer to as their BMPs, but it will not change the substance of site-specific BMP prescriptions. Those prescriptions will continue to be based on State BMPs, regional Forest Service guidance, land management plan standards and guidelines, BMP monitoring information, and professional judgment. Standardization will improve consistency, ensure that Forest Service resource professionals use best available science to develop site-specific BMP prescriptions, and, ultimately, improve water quality on and downstream of NFS lands.

The national BMP monitoring protocols will be used to supplement existing national forest or grassland BMP monitoring programs for those units that already have programs and provide a foundation for those units that do not. Each national forest and grassland will complete a small number of national BMP monitoring evaluations each year for each of the national core BMPs implemented on the unit. This information will be aggregated over time to provide national- and regional-scale evaluations of BMP performance. Identified deficiencies in either BMP implementation or effectiveness will be used to adjust land and resource management activities and the BMPs to improve water quality protection.

In summary, the Forest Service National BMP Program is the agency's nonpoint source pollution control program for achieving and documenting water resource protection. The National BMP Program demonstrates the agency's commitment to land stewardship and protection of water quality consistent with the CWA, State regulations, and other requirements. The National BMP Program is not intended in any way to circumvent or interfere with State and tribal CWA programs, rather it is intended to support and assist the States and tribes in their efforts to ensure compliance on NFS lands. The ultimate goal is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters located within or near the national forests and grasslands.

List of Abbreviations

AMP—Allotment Management Plan

AMZ—Aquatic Management Zone

AOI—Annual Operating Instructions

BAER—Burned Area Emergency Response

BLM—Bureau of Land Management

BMP—Best Management Practice

CFR—Code of Federal Regulations

COE—U.S. Army Corps of Engineers

CWA—Clean Water Act

CWE—cumulative watershed effects

DSR—Damage Survey Report

EPA—U.S. Environmental Protection Agency

ERFO—emergency relief for federally owned roads

FERC—Federal Energy Regulatory Commission

FY—fiscal year

FSH—Forest Service Handbook

FSM—Forest Service Manual

IDT—interdisciplinary team

IMT—incident management team

MVUM—Motor Vehicle Use Map

NEPA—National Environmental Policy Act

NFS—National Forest System

NPDES—National Pollutant Discharge Elimination System

NRCS—Natural Resources Conservation Service

RMOs—Road Management Objectives

ROS—Recreation Opportunity Spectrum

SPCC—Spill Prevention Control and Countermeasures

TMDL—total maximum daily load

USDA—U.S. Department of Agriculture

USGS—U.S. Geological Survey

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Part 1. Introduction

High-quality water is one of the most important natural resources coming from the national forests and grasslands. National Forest System (NFS) lands, which represent about 8 percent of the land area of the contiguous United States, contribute 18 percent of the Nation's water supply (Brown et al. 2008; Sedell et al. 2000). About 124 million people rely on NFS lands as the primary source of their drinking water (USDA Forest Service 2008a). In addition to drinking water and other municipal needs, water on NFS lands is important to sustaining populations of fish and wildlife, providing various recreation opportunities, and providing supplies to meet agricultural and industrial needs across the country.

The national forests and grasslands were established to protect the land, secure favorable conditions of water flows, and provide a sustainable supply of goods and services (the Organic Administration Act of 1897). NFS lands are managed using a multiple-use approach with the goal of sustaining healthy terrestrial and aquatic ecosystems while addressing the need for resources, commodities, and services for the American people (USDA Forest Service 2008a). With a growing population and a finite fresh water resource, providing high-quality fresh water supplies is more critical than ever to the social and economic well-being of the United States.

Aquatic Management Zone (AMZ)

An AMZ is an administratively designated zone adjacent to stream channels and other waterbodies. Special management controls aimed at maintaining and improving water quality or other water- and riparian-dependent values, including groundwater-dependent ecosystems, should be applied in the delineated AMZ. The width of the AMZ is determined based on site-specific factors and local requirements. AMZ delineation may encompass the floodplain and riparian areas when present. AMZ designation can have synergistic benefits to other resources, such as maintaining and improving aquatic and riparian area-dependent resources, visual and aesthetic quality, wildlife habitat, and recreation opportunities.

A variety of names for the AMZ concept are used in the States and Forest Service regions: Water Influence Zone (WIZ), Rocky Mountain Region 2 (R2); Stream Environment Zones, Pacific Southwest Region (R5); Riparian Conservation Areas, R5; Riparian Reserves, R5 and Pacific Northwest Region (R6); Riparian Habitat Conservation Areas, R5 and R6; Streamside Management Unit (SMU), R6; Riparian Corridor, Southern Region (R8); Riparian Management Corridor (RMC), Eastern Region (R9); and Riparian Management Area, Alaska Region (R10). For purposes of the National Core BMPs, these areas will be referred to as AMZs.

Forests and grasslands generally produce high-quality water, especially when the ecosystems are healthy and functioning properly. Water quality is influenced by the pattern, magnitude, intensity, and location of land use and management activities. Some land uses can protect or restore water quality, while others may degrade or pose risks to clean water. Excess sediment (turbidity and bedload), nutrients, temperature, hazardous chemicals, and their resulting effects on water chemistry and aquatic habitats, are the most significant water quality issues resulting from land uses and management activities on NFS lands.

Preventing negative water quality impacts is more efficient and effective than attempting to restore the damage. To ensure water quality is protected, the Forest Service, an agency of the U.S. Department of Agriculture (USDA), has developed procedures, methods, and controls, consistent with Federal and State requirements, to address potential pollutants and pollution at their source. Implementation and monitoring of these Best Management Practices (BMPs) is the fundamental basis of the Forest Service water quality management program to protect, restore, or mitigate water quality impacts from activities on NFS lands.

National BMP Program Purpose and Objectives

The purpose of the National BMP Program is to provide a standard set of core BMPs and a consistent means to track and document the use and effectiveness of BMPs on NFS lands across the country. The objectives of the National BMP Program are as follows:

1. To establish uniform direction for BMP implementation to control nonpoint source pollution on all NFS lands to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that will meet the intent of the Federal and State water quality laws and regulations, Executive orders, and USDA and Forest Service directives.
2. To establish a consistent process to monitor and evaluate Forest Service efforts to implement BMPs and the effectiveness of those BMPs at protecting water quality at national, regional, and forest scales.
3. To establish a consistent and creditable process to document and report agency BMP implementation and effectiveness.

The National BMP Program has four components: a national core set of BMPs, a procedural guide for monitoring BMP implementation and effectiveness, a data management system, and corresponding national direction. This technical guide contains the national core set of BMPs to be used in the National BMP Program. The national BMP monitoring protocols will be contained in Volume 2 of this technical guide (FS-990b), which is currently being prepared.

Scope of Technical Guide

This technical guide provides information for implementing the National Core BMP portion of the Forest Service National BMP Program. The National Core BMPs were compiled from Forest Service manuals, handbooks, contract and permit provisions, and policy statements, as well as State or other organizations' BMP documents. The National Core BMPs are not intended to supersede or replace existing regional, State, forest, or grassland BMPs. Rather, the National Core BMPs provide a foundation for water quality protection on NFS lands and facilitate national BMP monitoring.

The National Core BMPs encompass the wide range of activities on NFS lands across the Nation. The primary intent of the National Core BMPs is to carry out one of the Clean Water Act (CWA) purposes to maintain the chemical, physical, and biological integrity of the Nation's waters. To that end, the National Core BMPs are focused on water pollution control. The National Core BMPs also address soil, aquatic, and riparian resources, but only to the extent that they contribute to maintenance of chemical, physical, and biological water quality.

The National Core BMPs in this technical guide are deliberately general and nonprescriptive. Because this document is national in scope, it cannot address all possible practices or practices specific to local or regional soils, climate, vegetation types, or State-specific requirements. The National Core BMPs require the development of site-specific BMP prescriptions based on local site conditions and requirements to achieve compliance with established State, tribal, or national water quality goals. It is expected that State requirements and BMP programs, Forest Service regional guidance, and the land management plan will provide the criteria for site-specific BMP prescriptions. The National Core BMPs provide direction on "what to do" and the local direction will provide direction on "how to do it." Table 1 contains two examples comparing the National Core BMP direction with Forest Service regional direction and State BMPs. Forest Service regions may supplement the National Core BMPs with additional practices or practices that are more specific to meet regional needs.

Table 1.—*Examples of how Forest Service regional direction and State BMPs fit within the National Core BMP framework*

National Core BMP	Region 2 WCP[1]	Region 5 BMP[2]	Montana BMP[3]	Wisconsin BMP[4]
BMP Plan-3 Aquatic Management Zone (AMZ) Planning • Determine width of AMZ for waterbodies in the project area that may be affected by the proposed activities. • Evaluate the condition of riparian habitat and estimated response to the activity to determine need for and width of AMZ. • Use stream class and type, channel condition, aspect, slope, and soils to determine appropriate AMZ width.	**Water Influence Zone (WIZ)** • The WIZ includes the geomorphic floodplain, riparian ecosystem, and inner gorge. • The minimum horizontal width is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most.	**Practice 1-8 Streamside Management Zone (SMZ) Designation** • Identify the SMZ requirements during environmental documentation process. Each forest's land and resource management plan identifies specific measures to protect these zones. At a minimum, forest requirements must be identified and implemented.	**Width of SMZ-Marking Boundary** • The SMZ width is a 50-foot slope distance on each side of streams, lakes, and other bodies of water measured from the ordinary high water mark. In all cases, except on Class 1 and 2 stream segments and lakes where the slope of the SMZ is greater than 35 percent, the SMZ width is 100 feet.	**Riparian Management Zone (RMZ)** • The RMZ for lakes, designated trout streams, and streams 3 feet wide or wider is a strip of land running along the shoreline of lakes and on each side of a stream. It begins at the ordinary high water mark and extends a minimum of 100 feet landward. • The RMZ for streams less than 3 feet wide is a strip of land on each side of a stream, beginning at the ordinary high water mark and extending a minimum of 35 feet.
BMP Veg-4 Ground-Based Skidding and Yarding Operations • Use ground-based yarding systems only where physical site characteristics are suitable to avoid, minimize, or mitigate adverse effects to soil and water quality. • Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for ground-based yarding systems.	**WCP Management Measure 9** • Limit roads and other disturbed sites to the minimum feasible number, width, and total length consistent with the purpose of specific operations, local topography, and climate. • Avoid new roads or heavy equipment use on unstable or highly erodible soils. • Avoid ground skidding on sustained slopes steeper than 40 percent and on moderate to severely burned sustained slopes greater than 30 percent.	**Practice 1-9 Determining Tractor Loggable Ground** • Avoid tractor logging where the predicted post-logging erosion hazard cannot be reduced to either "low" or "moderate."	**Timber Harvesting** • Use the logging system that best fits the topography, soil types, and season while minimizing soil disturbance and economically accomplishing silvicultural objectives. • Topography considerations for "cut-to-length harvesting"—limited to terrain less than 40 percent slope.	**Timber Harvesting** • Avoid operating equipment where excessive soil compaction and rutting may cause erosion that affects water quality. The use of low ground pressure equipment may allow logging to continue. • Where possible, keep skid trail grades less than 15 percent. Grades greater than 15 percent should not exceed 300 feet in length.

[1] *Rocky Mountain Region (Region 2) Watershed Conservation Practices (WCP), Forest Service Handbook 2509.25 (2006).*

[2] *Pacific Southwest Region (Region 5) Water Quality Management for National Forest System Lands in California—Best Management Practices (USDA Forest Service 2000).*

[3] *Water Quality Best Management Practices for Montana Forests. (Logan 2001).*

[4] *Wisconsin's Forestry Best Management Practices for Water Quality (Holaday and Wagner 2010).*

Part 2. Managing Water Quality on National Forest System Lands

Federal Clean Water Act

The Federal Clean Water Act (CWA) (33 U.S.C. § 1251 et seq.) is the foundation for surface water quality protection in the United States. The objective of the CWA, as articulated in section 101, is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. This law uses a variety of regulatory and nonregulatory tools to control direct pollutant discharges from point sources and manage polluted runoff from nonpoint sources to waters of the United States.

In the CWA, Congress gave States and tribes the option for taking primary responsibility for water pollution control. (States will be used in the rest of this report to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the CWA.) As a result, most States and many tribes have taken on that responsibility and, therefore, water quality standards, procedures, rules, and regulations differ from one State to another. The Forest Service, as an agency of the Federal Government, is required to comply with all Federal, State, and local requirements for water pollution control in the same manner and to the same extent as any nongovernmental entity (CWA section 313).

Water Quality Standards

Water quality standards translate the broad goals of the CWA into specific objectives for an individual waterbody. Each State designates uses to be protected for each jurisdictional waterbody within its boundaries. State water quality standards must provide for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water, unless those uses have been shown to be unattainable. States must also adopt water quality criteria to protect such designated uses. In addition, each State must adopt an antidegradation policy. This policy is designed to prevent deterioration of existing levels of water quality, and must, in part, maintain existing uses and the level of water quality necessary to protect such uses. States review their water quality standards periodically and, at a minimum, every 3 years. The EPA reviews and approves State water quality standards to ensure consistency with CWA requirements.

States are required to identify all waters that do not meet water quality standards even after mandatory pollution controls are in place. These waterbodies are considered to be impaired and are placed on the States' biennial 303(d) list. A Total Maximum Daily Load (TMDL) must be developed by the State for all waterbodies on its approved 303(d) list. The TMDL represents the maximum amount of a pollutant that can enter a waterbody without exceeding the water quality standards. The TMDL amount is distributed among all the pollutant sources (point sources, nonpoint sources, and natural background levels) contributing to that particular waterbody. A margin of safety factor is also considered. A TMDL analysis must clearly identify the links between the waterbody use impairment, the causes of the impairment, and the pollutant load reductions needed to meet the applicable water quality standards. EPA reviews and approves TMDLs and must complete the TMDL if it disapproves the State-developed TMDL. TMDLs are used as planning tools by States to develop specific methods or controls used to meet water quality standards in the impaired waterbody. The point source components of a TMDL are implemented through existing enforceable Federal programs (e.g., National Pollutant Discharge Elimination System [NPDES]). Nonpoint source controls (e.g., Best Management Practices [BMPs]) required by a TMDL can be implemented through a voluntary approach or some State and local regulations or other authorities. A specific TMDL implementation plan is not required by the CWA; however, some States require a TMDL implementation plan or watershed restoration plan.

Point Source Pollution Control

Point source pollution is regulated through a permitting program as outlined in CWA sections 401, 402, and 404. Section 401 provides an opportunity for States to ensure that a permit or license issued by the Federal Government meets applicable State water quality requirements. Federal agencies may not issue permits for activities that "may result in any discharge into navigable waters" until the agency obtains certification from the State that the authorized activity will comply with water quality standards. Each State has its own rules and procedures for 401 Certification. Certification generally applies to point source discharges where a 402 or 404 permit is issued by the EPA or the U.S. Army Corps of Engineers (COE) and for Federal Energy Regulatory Commission licenses. Certification may also be required for some Forest Service special use authorizations and mining plan of operations where there would be a point source discharge. Section 401 is a "condition precedent;" that is, 401 Certification must be obtained and proof provided to the Federal agency before the permit or license can be issued.

The NPDES program is described in CWA section 402. NPDES permits, or the State equivalent, regulate point source discharges. A point source discharge is defined as any addition of a pollutant to waters of the United States from a point source (e.g., a discrete conveyance such as pipes or manmade ditches). Aside from stormwater discharge permits, in general, few types of Forest Service administrative activities would require a NPDES permit. The project proponent is responsible for obtaining permit coverage. Section 402 is "condition subsequent" (i.e., the Forest Service can approve the activity before the 402 permit being obtained).

Stormwater discharges occur when runoff generated by rain or snowmelt events flows over land or impervious surfaces and is discharged to waters of the United States through discrete conveyances such as ditches or channels. Stormwater runoff does not percolate into the ground and may pick up and transport debris, chemicals, sediment, or other pollutants as it flows over the land or impervious surfaces. These pollutants could adversely affect water quality if the runoff is not treated before it is discharged into a surface waterbody. Stormwater discharge permits are required for certain categories of industrial activities and construction activities. The "operator," defined as the one who has operational control over the construction plans and specifications and has day-to-day operational control over activities at the site, is the party that should obtain stormwater permit coverage. The contractor or permittee and the Forest Service may be required to obtain permit coverage if either or both are considered the operator. Permits for industrial or construction activities or other temporary disturbances generally require BMPs as a primary method of controlling and containing stormwater runoff to protect water quality.

CWA section 404 regulates the discharge of dredge or fill materials into waters of the United States. EPA and the COE jointly administer the 404 program. Unless a State has assumed 404 permitting authority, the COE is responsible for issuing 404 permits. Typical Forest Service activities that could require a 404 permit include stream crossings, stream restoration, habitat improvements, activities in wetlands, and spring developments. Certain silviculture activities are exempt from 404 permits (CWA §404[f][1][A], 33 CFR 323.4[a] [1] and 40 CFR 232.3[c][1]). Forest roads, as defined by COE guidance, are exempt from needing 404 permits as long as the BMPs detailed in the regulations are used to ensure that flow and circulation patterns and chemical and biological characteristics of the waters of the United States are not impaired (CWA § 404[f][1][E], 33 CFR 323.4[a] [6] and 40 CFR 232.3[c] [6][i-xv]). General 404 permits (nationwide or regional) have been established for many categories of activities. If a proposed activity cannot be covered by a general 404 permit, an individual 404 permit is required. The project proponent or permittee is responsible for obtaining the 404 permit. Like section 402, section 404 is "condition subsequent," so the activity, either a Forest Service project or a third-party activity proposed on National Forest System (NFS) lands, can be approved by the Forest Service before the 404 permit coverage is obtained. The project cannot be implemented until permit coverage is acquired.

Nonpoint Source Pollution Control

The CWA does not regulate nonpoint source pollution. Instead, sections 208 and 319 require States to develop a process to identify, if appropriate, agricultural, silvicultural, and other categories of nonpoint sources of pollution and to set forth procedures and methods, including land use requirements, to control to the extent practicable such sources. Each State has a Nonpoint Source Management Program and Plan that directs how the State will control nonpoint source pollution. The Nonpoint Source Management Plan describes the process, including intergovernmental coordination and public participation, for identifying BMPs to control identified nonpoint sources and to reduce the level of pollution from such sources. States often use these same sets of BMPs as the best approach to control point source discharges, such as stormwater discharges.

After BMPs have been approved by a State, the BMPs may become the primary mechanism for meeting water quality standards from nonpoint source pollution sources in that State. Proper installation, operation, and maintenance of State approved BMPs are presumed to meet a landowner or manager's obligation for compliance with applicable water quality standards. If subsequent evaluation indicates that approved and properly installed BMPs are not achieving water quality standards, the State should take steps to revise the BMPs, evaluate and, if appropriate, revise water quality standards (designated uses and water quality criteria), or both. Through the iterative process of monitoring and adjusting BMPs and water quality standards, it is anticipated and expected that BMPs will lead to attainment of water quality standards (EPA 1987).

State Nonpoint Source Management Programs

Each State develops a set of BMPs as part of its Nonpoint Source Management Program. In many States, use of BMPs is voluntary; that is, it is encouraged but not required by regulation. Other States have a regulatory framework for nonpoint sources, either through their water quality laws and regulations or forest practices laws and regulations, where use of BMPs is required.

All national forests and grasslands have adopted BMPs consistent with or approved by State nonpoint source management programs. In some States, the Forest Service uses the State BMPs as written, in addition to land management plan direction. In some Forest Service regions, the Forest Service has established BMPs, and the States have agreed that those practices conform to State requirements. In a few instances, Forest Service BMPs have gone through a formal public review process, Forest Service BMPs have been approved by the State and EPA, and the Governor of the State has designated the Forest Service as the water quality management agency for NFS lands within the State. In many States, the Forest Service has entered into an agreement that outlines how the Forest Service will implement that particular State's Nonpoint Source Management Plan on NFS lands (see table 2).

Table 2.—*Forest Service water quality agreements with States as of November 2011*

MAA	MOA	MOU		LOC
AL (1990)	AK (1992)	AZ (2008)	NV (2009)	AR (1990)
CA (1981)	WA (2000)	GA (1991)	OR (2002)	FL (1990)
MS (1990)		ID (2008)	SC (1990)	MS (1990)
		KY (1990)	SD (2009)	OK (1991)
		LA (1993)	TN (1997)	VA (1990)
		MI (2011)	TX (1991)	
		MT (2008)	UT (2009)	
		NC (1992)	WV 2010	
		NM (2011)	WY (2011)	

LOC – Letter of Certification. MAA – Management Agency Agreement.
MOA – Memorandum of Agreement. MOU – Memorandum of Understanding.

Forest Service Policy for Water Quality Management

Forest Service Manual (FSM) Direction

Forest Service policy for watershed management is contained in FSM 2500. Watershed management activities on national forests and grasslands are to be implemented in accordance with the general objectives of multiple use and the specific objectives in the land management plan. All management activities of other resources are to be designed to minimize short-term impacts on the soil and water resources and to maintain or enhance long-term productivity, water quantity, and water quality (FSM 2503).

Forest Service policy for watershed management also includes monitoring to assess the degree to which planning, management operation, and maintenance of renewable resources meet established goals and standards (FSM 2525). Soil and water resource monitoring is to be designed and implemented to evaluate effects of each forest management activity or program on basic soil and water quality and productivity. The objectives of monitoring are to secure data sufficient to assist line officers and resource managers in evaluating the effects of management activities on the soil and water resources and to support changes in management activities to protect soil and water quality.

FSM 2532 provides policy and direction specific to water quality management on NFS lands. The objective of water quality management on NFS lands is to protect and, where needed, improve the physical, chemical, biological, and aesthetic quality of the water resource consistent with the purposes of the national forests and national water quality goals. BMPs are to be promoted and applied to all management activities as the method for control of nonpoint sources of water pollution to achieve established State or national water quality goals. BMPs applied should be based on site-specific conditions and political, social, economic, and technical feasibility. Application of the National BMP Program should constitute compliance with water quality standards. Monitoring methods that reflect nonpoint source conditions should be used to measure effectiveness of those BMPs.

Forest Service Nonpoint Source Strategy

The Forest Service strategy for control of nonpoint source pollution is to apply appropriate BMPs using adaptive management principles. This strategy involves applying approved BMPs, monitoring the implementation and effectiveness of the BMPs, and using the monitoring results to inform and improve management activities. This process is illustrated in figure 1 and outlined in the following list.

1. Approved BMPs are applied to all management activities to control nonpoint sources of water pollution and are used for compliance with established State or national water quality goals.
    a. Site-specific BMP prescriptions, consistent with the National Core BMPs, are developed using regional or State BMPs and land management plan direction.
    b. BMP prescriptions are properly installed and maintained to minimize impacts of current management activities to protect and maintain water quality.
2. BMP implementation and effectiveness are monitored using National Core BMP monitoring protocols and reporting systems.
    a. Field evaluations are used to monitor BMP implementation to determine whether appropriate site-specific BMP prescriptions were planned and implemented as intended.

b. Field evaluations of appropriate parameters or surrogates are used to monitor BMP effectiveness to determine if the applied practices met the desired objective(s).

c. BMP monitoring data is managed in the established corporate data system and analyzed at national, regional, and forest or grassland levels.

3. BMP monitoring results are used to inform and improve management activities.

   a. The results of BMP monitoring and best available science are used, in collaboration with Federal, State, and local agencies and partners as appropriate, to improve administrative procedures and BMP practices and applications.

   b. Corrective actions are initiated where implementation monitoring indicates that BMPs have been implemented, but effectiveness monitoring indicates that BMP objectives were not met.

   c. Changes in water quality designated uses and standards are recommended as necessary, in coordination with the appropriate agency.

4. Monitoring results and findings are documented and shared with appropriate Federal, State, and local agencies.

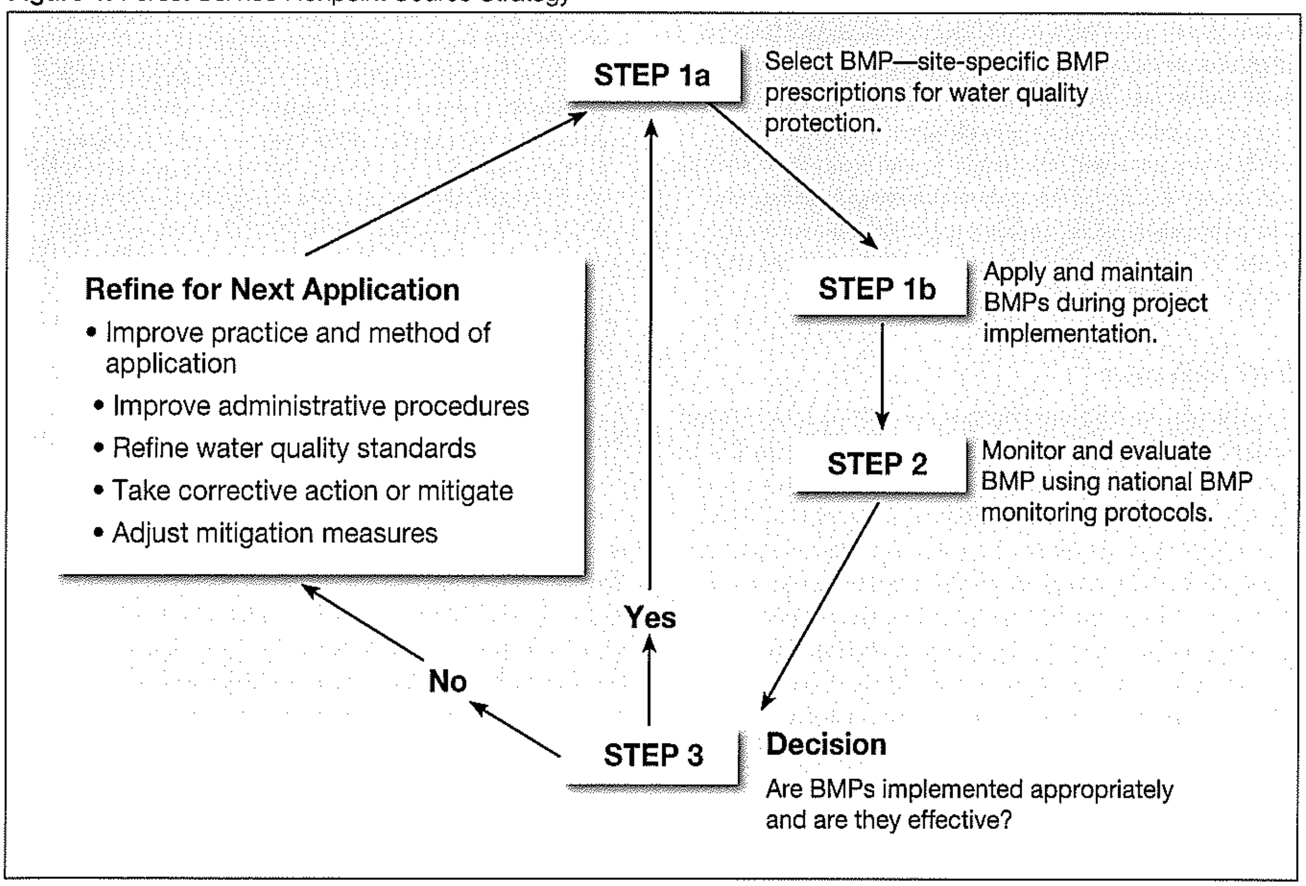
Plan to Project: Forest Service BMP Process

The Forest Service BMP Process consists of the following steps to incorporate BMPs into project planning and on-the-ground implementation to ensure water quality is protected.

BMP Selection and Design

Water quality goals and objectives are established in the land management plan (see BMP Plan-1 Forest and Grassland Planning). These goals are specific to each individual national forest or grassland and are intended to meet or exceed applicable legal requirements including the CWA and State water quality regulations. A land management plan may also specify BMPs as standards and guidelines to be used to meet those goals and objectives.

Figure 1. Forest Service Nonpoint Source Strategy



The project planning process starts when a project or resource management activity is proposed. A project may be initiated by the Forest Service to implement some aspect of the land management plan, or may be proposed by an outside party that wants to occupy or use NFS lands for a specific purpose, such as for mining, a commercial recreation development, or a utility facility. When a project is initiated, the responsible official, usually the local district ranger or forest supervisor, appoints an interdisciplinary team (IDT) to complete the appropriate environmental analysis as required by the National Environmental Policy Act (NEPA) to inform the decision on the project or activity.

In the project planning and environmental analysis process, the IDT selects appropriate or required BMPs to be used to achieve land management plan water quality goals and objectives (see BMP Plan-2 Project Planning and Analysis). BMPs are selected to fit local conditions, resource values, and designated uses of water. Site-specific BMP prescriptions are developed based on the proposed activity, water quality objectives, soils, topography, geology, vegetation, climate, and other site-specific factors and are designed to avoid, minimize, or mitigate potential adverse impacts to soil, water quality, and riparian resources. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are all used to develop site-specific BMP prescriptions. During the planning process, CWA or other State-required permits or certifications are also identified. The site-specific BMP prescriptions and other permit requirements are described and disclosed in the NEPA analysis document or project file. The responsible official considers the information provided by the IDT and makes a decision on which site-specific BMP prescriptions will be applied to the project.

BMP Application

The site-specific BMP prescriptions are translated into contract provisions, special use authorization requirements, project plan specifications, and other similar documents. This ensures that the operator or person responsible for applying the BMPs is required to do so. Implementation of projects or other management activities are supervised by Forest Service personnel to ensure the site-specific BMP prescriptions are implemented according to the contract, permit, or plan. During project or activity implementation, site-specific BMP prescriptions are adjusted as needed to better fit current site conditions. As part of project, contract, or permit administration, project or activity inspections are completed as needed to identify BMP deficiencies or maintenance needs. BMP application is documented in the appropriate project-related documents.

BMP Monitoring and Adjustment

Implementation and effectiveness of applied BMPs are monitored to inform and improve future management activities. BMP implementation monitoring asks the question: "Did we do what we said we were going to do?" BMP effectiveness monitoring evaluates whether the BMPs were effective in meeting management objectives and protecting designated uses.

Programmatic BMP Monitoring in The Pacific Southwest Region Best Management Practices Evaluation Program

The Forest Service Pacific Southwest Region has a Management Agency Agreement with the State of California requiring the Forest Service to incorporate BMPs into land and resource management activities and to monitor their implementation and effectiveness. Since 1992, the region has been monitoring BMPs using its BMP Evaluation Program. The Forest Service evaluates BMP implementation and effectiveness at randomly selected sites using 29 different monitoring protocols. Every year, the region assigns each national forest system unit a certain number of evaluations to complete. From fiscal year (FY) 2003 to FY 2007, the Forest Service completed 2,861 onsite evaluations; an average of 572 per year. The Forest Service rated BMPs as implemented on 86 percent of those evaluations and effective on 89 percent. Overall, 93 percent of the BMPs that were rated as implemented were also judged effective.

This monitoring has shown that BMPs are effective at protecting water quality when they are properly implemented. From this monitoring, the Pacific Southwest Region has concluded that the greatest opportunity for improving water quality is to improve implementation of the BMPs, particularly for recreation activities and mining. The region has planned steps to improve BMP implementation and effectiveness including BMP implementation checklists for projects, reviews of national forest staffing levels, and revision of BMPs that have relatively low effectiveness when implemented properly (USDA Forest Service 2009a).

The Forest Service Nonpoint Source Strategy uses "programmatic monitoring" to evaluate BMP implementation and effectiveness; that is, aside from project administration described above, BMPs are not monitored on every project or activity that occurs on NFS lands. Projects to monitor or specific monitoring sites are selected in a manner that results in objective and representative data on BMP implementation and effectiveness. Often, a random or systematic random selection procedure is used to choose monitoring locations across a forest or grassland where specific activities or BMPs are targeted. In some cases, a national forest or ranger district will choose a small number of projects to review using an IDT process. BMP monitoring results are summarized in land management plan monitoring reports.

Programmatic BMP monitoring is used for a variety of purposes. The adequacy of specific BMPs or management activities at protecting water quality can be evaluated. These results can be used to inform future environmental analysis of similar projects under similar conditions. For example, programmatic BMP monitoring on the Flathead and Kootenai National Forests in Montana has found that, since 1988, BMPs were effective 99.3 percent of the time when properly applied on glacial till soils (USDA Forest Service 2009b).

Programmatic BMP monitoring can assess administrative processes for selecting and applying appropriate BMPs over time or geographic area. After several years of BMP monitoring on silviculture activities, the Black Hills National Forest in South Dakota and Wyoming found that BMPs were generally being implemented and, when implemented, were effective in the timber sale units that were inspected. The BMP monitoring identified some issues with road drainage, however. As a result, the forest engineering and watershed staff together developed recommendations to improve their BMPs for road drainage (USDA Forest Service 2010a). In another example, the North Carolina National Forests compared BMP implementation and effectiveness on timber sales as monitored from 1992 to 2000 to BMP monitoring results in 2009 and 2010 (USDA Forest Service 2010b). Overall BMP implementation improved from 68 percent in the earlier monitoring period to 92 percent in 2009 and 2010. BMP effectiveness also improved from 73 percent in 1992 to 2000 to 93 percent in 2009 and 2010.

Montana's Forestry BMP Audits

The Montana Department of Natural Resources and Conservation, Forestry Division, has evaluated forest practices for BMP implementation and effectiveness every 2 years since 1990 (Ziesak 2010). The Forestry Division has evaluated timber harvest sites on Federal, State, and private lands. Over all ownerships, BMP implementation has improved from 78 percent rated as "meets or exceeds criteria" in 1990 to 97 percent in 2010. Similarly, BMP effectiveness has also improved, from 80 percent rated as providing "adequate protection" in 1990 to 98 percent in 2010. BMP implementation and effectiveness on timber harvest sites on NFS lands has been consistently rated high over the past few audit cycles.

	2010	2008	2006
BMP Implementation	96%	96%	93%
BMP Effectiveness	98%	96%	95%
Streamside Management Zone (SMZ) Implementation	94%	99%	100%
SMZ Effectiveness	95%	99%	100%

In addition to BMP monitoring by the Forest Service, many States monitor BMP implementation and effectiveness on timber sale projects on NFS lands. These State audits are generally completed every 3 to 5 years, or annually in some States. The audit teams are comprised of State employees, Forest Service and other Federal agency employees, representatives from the timber industry, and landowners. Selected timber sale projects on private and State lands are audited along with projects on NFS lands. In general, BMP implementation and effectiveness on NFS lands as rated by these State audit teams compares favorably with, and often exceeds, the BMP performance on private or State lands.

Summary

The Forest Service policy for control of nonpoint sources of pollution is to use BMPs, monitor the implementation and effectiveness of those BMPs, and adjust management practices using monitoring results. An administrative unit IDT identifies the appropriate BMPs for a project during the planning process and develops site-specific BMP prescriptions based on site conditions, State BMPs, and other local guidance or requirements. The responsible official considers the information provided by the IDT and makes a decision on which site-specific BMP prescriptions will be applied to the project. Unit staff monitor BMPs and summarize monitoring data at the forest or grassland level in either project documentation or the land management plan monitoring reports.

The National BMP Program provides core BMPs and BMP monitoring protocols for all activities on NFS lands. In the past, most of the BMP monitoring has focused on timber harvest sites and associated roads. The National BMP Program expands that to include all activities by providing consistent monitoring protocols for recreation, livestock grazing, fire and fuels, and minerals, in addition to vegetation management and roads. The National BMP Program will also have an associated data management system that will facilitate documentation and reporting of BMP monitoring results at national forest or grassland, regional, or national scales.

Part 3. National Core Best Management Practices

This part describes the Forest Service National Core Best Management Practices (BMPs). The National Core BMPs are intended for use on National Forest System (NFS) lands as part of the Forest Service strategy for water quality management. The National Core BMPs are grouped into the following resource categories:

- Plan General Planning Activities
- AqEco Aquatic Ecosystems Management Activities
- Chem Chemical Use Management Activities
- Fac Facilities and Nonrecreation Special Uses Management Activities
- Fire Wildland Fire Management Activities
- Min Minerals Management Activities
- Range Rangeland Management Activities
- Rec Recreation Management Activities
- Road Road Management Activities
- Veg Mechanical Vegetation Management Activities
- WatUses Water Uses Management Activities

With the exception of the General Planning Activities being listed first, the sequence in which these resource categories are presented has no intended significance. Planning is important to managing potential management activity impacts to achieve water quality goals and objectives and, therefore, is listed first.

Each BMP is organized according to the following format:

Title	Includes the sequential number of the BMP within the resource category and title of the BMP.
Reference	Identifies the Forest Service Manual or Handbook direction pertinent to the BMP.
Objective	Describes the desired results or attainment of the BMP as it relates to maintaining chemical, physical, and biological water quality.
Explanation	Provides background information to provide context for the BMP. Describes criteria or standards used when applicable.
Practices	Lists recommended methods to achieve the BMP objectives.

The National Core BMPs are deliberately general and nonprescriptive. Although some impacts may be thought of as characteristic of a management activity, the actual potential for a land use or management activity to impact water quality depends on:

1. The physical, biologic, meteorological, and hydrologic environment where the activity takes place (e.g., topography, physiography, precipitation, stream type, channel density, soil type, and vegetative cover).
2. The type of activity imposed on a given environment (recreation, mineral exploration, and vegetation management) and the proximity of the activity area to surface waters.
3. The magnitude, intensity, duration, and timing of the activity (grazing system used, types of silvicultural practices used, constant use as opposed to seasonal use, recurrent application, or one-time application).

4. The State designated beneficial uses of the water in proximity to the management activity and their relative sensitivity to the potential impacts associated with the activity.

These four factors vary throughout the lands administered by the Forest Service. It follows then, that the extent and kind of potential water quality impacts from activities on NFS lands are variable, as are the most appropriate mitigation and pollution control measures. No solution, prescription, method, or technique is best for all circumstances.

The National Core BMPs cannot include all possible practices or techniques to address the range of conditions and situations on all NFS lands. **Each BMP in this document has a list of recommended practices that should be used, as appropriate or when required, to meet the objective of the BMP. Not all recommended practices will be applicable in all settings, and there may be other practices not listed in the BMP that would work as well, or better, to meet the BMP objective in a given situation.** The specific practices or methods to be applied to a particular project should be determined based on site evaluation, past experience, monitoring results, new techniques based on new research literature, and other requirements. **State BMPs, Forest Service regional guidance, land management plans, BMP monitoring information, and professional judgment should be used to develop site-specific BMP prescriptions.**

For example, BMP Road-4 (Road Operations and Maintenance) dictates that roads should be correctly maintained to drain and disperse water runoff to minimize the erosive effects of concentrated water flow. Some methods for draining a road are to outslope the road prism, install dips, and lead out ditches or inslope the road to a ditch line and install culverts. It is during the onsite evaluation of a specific road project that the appropriate method or combination of methods to drain the road correctly is identified. The practice is, thereby, custom fit to the physical and biological environment of the project area.

After the site-specific BMP prescription is developed, it must then be included in the appropriate National Environmental Policy Act decision document and project contract or operation plan. For example, if roadwork is part of a timber harvest project, the timber sale contract is used to implement the methods for road drainage. For a hard rock mine operation, the roadwork BMP prescriptions would be included in the mining plan of operation. Roadwork BMP prescriptions would be implemented via a ski area's operation and maintenance plan for roads within a ski resort.

The National Core BMPs are grouped by resource category for ease of organization. The applicable BMPs should be used for an activity regardless of which resource grouping the BMP is listed in. For example, BMPs for Mechanical Vegetation Management Activities should be used, as appropriate, for tree removal activities in developed campgrounds. Likewise, Road Management Activity BMPs apply whether the road is for timber harvesting, mining, recreation access, or some other purpose. The specific implementing document and responsible individual will differ by resource area (e.g., recreation development plan and recreation staff officer for a recreation project, and a timber sale contract and timber sale administrator for a timber sale), but the responsibility to maintain and improve water quality is shared by all and not necessarily vested with a given resource functional area.

At the end of each resource category is a listing of additional BMP resources, including publications and Web sites, applicable to the subject resource category. The resources listed are not all inclusive; other technical resources should be consulted as needed and required.

General Planning Activities

Planning is an important Best Management Practice (BMP) for water quality management. In the planning process, potential impacts to water quality, and impacts to other resources like soils or riparian areas that may affect water quality, can be identified. In addition, requirements from laws or regulations, the land management plan, State BMPs, or other documents can be incorporated into the project design. This information can be used to shape the proposed action, develop alternatives to the proposed action, and determine appropriate site-specific BMP prescriptions to avoid, minimize, or mitigate impacts to meet water quality objectives.

Three National Core BMPs are in the General Planning Activities category. These planning BMPs are to be used during Forest Service planning processes for projects and activities on National Forest System (NFS) lands. BMP Plan-1 (Forest and Grassland Planning) contains guidance on what to include in a land management plan to provide direction for management of water quality within a plan area. BMP Plan-2 (Project Planning and Analysis) contains planning practices common to most Forest Service resource management activities. BMP Plan-2 should be used for all Forest Service activities and authorizations that could affect water quality. BMP Plan-3 (Aquatic Management Zone Planning) contains planning practices common to management of Aquatic Management Zones (AMZ).

In addition, each resource category section in this technical guide includes a planning BMP specific to the management activities addressed in that section. The activity-planning BMPs provide additional practices specific to those management activities.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

General Planning BMPs	
Plan-1	Forest and Grassland Planning
Plan-2	Project Planning and Analysis
Plan-3	Aquatic Management Zone Planning

Plan-1. Forest and Grassland Planning

Manual or Handbook Reference Forest Service Manual (FSM) 1900, FSM 1920, Forest Service Handbook (FSH) 1909.12, and FSM 2511.

Objective Use the land management planning and decisionmaking processes to incorporate direction for water quality management consistent with laws, regulation, and policy into land management plans.

Explanation The overall goal of managing NFS lands is to sustain the multiple uses of renewable resources in perpetuity while maintaining the long-term productivity of the land. Federal laws, such as the National Forest Management Act and the CWA, provide additional goals to protect or maintain and improve or restore the quality of soil and water on NFS lands. These goals are codified as policy in the Forest Service manuals and handbooks.

Forest Service planning is an integrated process composed of discrete parts—the strategic plan, land management plans, and project and activity plans. The Forest Service Strategic Plan identifies long-term strategic priorities and is the basis for integrated delivery of the agency's mission. The land management plan blends national and regional priorities from the strategic plan with local forest or grassland capability and needs. The land management plan establishes desired conditions to be achieved through management of NFS lands in the planning area to best meet the needs of the American people. The land management plan provides desired conditions, objectives, and guidance for site-specific project and activity decisions. Project-level plans describe on-the-ground projects and activities designed to achieve long-term objectives and desired conditions described in the land management plan while reflecting current local needs and issues.

The land management plan provides integrated direction for the management, protection, and use of all resources in the planning area under the principles of multiple use and sustained yield. In the land management plan, issues, concerns, and opportunities related to soil and water resources are resolved; desired conditions, goals, and objectives for soil, water, and riparian resources are established; and standards and guidelines for management of soil, water quality, and riparian resources are provided.

Practices

- Establish desired conditions, goals, and objectives for soil, water quality, and riparian resources that contribute to the overall sustainability of social, economic, and ecological systems in the plan area consistent with established State or national water quality goals for the plan area.
    - Consider the water quantity, quality, location, and timing of flows needed to provide water supplies for municipal, agricultural, commercial, and industrial uses; hydropower generation; water recreation, transportation, and spiritual uses; aesthetic appreciation; and tourism to contribute to social and economic sustainability.
    - Consider the water quantity, quality, location, and timing of flows needed to provide the ecological conditions to support diversity of native and desired nonnative plants and animal species in the plan area to contribute to ecological sustainability.
- Include plan objectives to maintain or, where appropriate, improve or restore watershed conditions to achieve desired conditions of soil, water quality, and riparian resources.
- Consider watershed characteristics, current and expected environmental conditions (including climate change), and potential effects of land uses when determining suitability of NFS lands within the planning area for various uses.
- Include standards and guidelines to maintain and, where appropriate, improve over time the quality of soil, water resources, and riparian areas when implementing site-specific projects and activities.
- Include monitoring questions and associated performance measures to address watershed condition and water quality goals and objectives.

Plan-2. Project Planning and Analysis

Manual or Handbook Reference FSM 1950, FSH 1909.15, and FSM 2524.

Objective Use the project planning, environmental analysis, and decisionmaking processes to incorporate water quality management BMPs into project design and implementation.

Explanation The project planning, environmental analysis, and decisionmaking process is the framework for incorporating water quality management BMPs into project design and implementation. The process should identify likely direct, indirect, or cumulative impacts from the proposed project or management activities on soils, water quality, and riparian resources in the project area. Project documents (plans, contracts, permits, etc.) should include site-specific BMP prescriptions to meet water quality objectives as directed by the environmental analysis. Project planning should ensure that activities are consistent with land management plan direction; State BMPs, floodplain, wetland, coastal zone; and other requirements including CWA 401 certification, CWA 402 permits, and CWA 404 permits; wilderness or wild and scenic river designations; and other Federal, State, and local rules and regulations.

Practices

- Include watershed specialists (hydrologist, soil scientist, geologist, and fish biologist) and other trained and qualified individuals on the interdisciplinary team for project planning, environmental analysis, and decisionmaking to evaluate onsite watershed characteristics and the potential environmental consequences of the proposed activity(s).
- Determine water quality management objectives for the project area.
    - Identify water quality management desired conditions and objectives from the land management plan.
    - Identify and evaluate the condition of water features in the project area (e.g., streams, lakes, ponds, reservoirs, wetlands, riparian areas, springs, groundwater-dependent ecosystems, recharge areas, and floodplains).
    - Identify State-designated beneficial uses of waterbodies and the water quality parameters that are critical to those uses.
    - Identify locations of dams and diversions for municipal or irrigation water supplies, fish hatcheries, stockwater, fire protection, or other water uses within the project area.
    - Identify any impaired (e.g., 303[d] listed) waterbodies in the project area and associated Total Maximum Daily Load (TMDL) analyses or other restoration plans that may exist.
    - Identify threatened, endangered, or sensitive species in or near water, wetlands, and riparian areas in the project area and their habitat needs related to water quality.
- Determine potential or likely direct and indirect impacts to chemical, physical, and biological water quality, and watershed condition from the proposed activity.
    - Always assume hydrological connections exist between groundwater and surface water in each watershed, unless it can reasonably be shown none exist in a local situation.
    - Consider the impacts of current and expected environmental conditions such as atmospheric deposition and climate change in the project area when analyzing effects of the proposed activities.
    - Evaluate sources of waterbody impairment, including water quantity, streamflows, and water quality, and the likelihood that proposed activities would contribute to current or future impairment or restoration to achieve desired watershed conditions.
    - Identify and delineate unstable areas in the project area.
    - Identify soil limitations and productivity impacts of proposed activities.
    - Verify preliminary findings by inspecting the sites in the field.
    - Develop site-specific BMP prescriptions, design criteria, and mitigation measures to achieve water quality management objectives. Consult local, regional, State, or other agencies' required or recommended BMPs that are applicable to the activity.
    - Consider enhanced BMPs identified in a TMDL or other watershed restoration plan to protect impaired waterbodies within the project area.

- Use site evaluations, professional experience, monitoring results, and land management plan standards, guidelines, and other requirements.
- Identify Federal, State, and local permits or requirements needed to implement the project. Examples include water quality standards, CWA 401 certification, CWA 402 permits (including stormwater permits), CWA 404 permits, and Coastal Zone Management Act requirements.
- Plan to limit surface disturbance to the extent practicable while still achieving project objectives.
- Designate specific AMZs around water features in the project area (see BMP Plan-3 [AMZ Planning]).
- Design activities on or near unstable areas and sensitive soils to minimize management-induced impacts.
- Use local direction and requirements for prevention and control of terrestrial and aquatic invasive species.

- Use suitable tools to analyze the potential for cumulative watershed effects (CWE) to occur from the additive impacts of the proposed project and past, present, and reasonably foreseeable future activities on NFS and neighboring lands within the project watersheds.
  - Consider the natural sensitivity or tolerance of the watershed based on geology, climate, and other relevant factors.
  - Consider the existing condition of the watershed and water quality as a reflection of past land management activities and natural disturbances.
  - Estimate the potential for adverse effects to soil, water quality, and riparian resources from current and reasonably foreseeable future activities on all lands within the watershed relative to existing watershed conditions.
  - Use land management plan direction; Federal, State, or local water quality standards; and other regulations to determine acceptable limits for CWE.
  - Modify the proposed project or activity as necessary by changing project design, location, and timing to reduce the potential for CWE to occur.
  - Consider including additional mitigation measures to reduce project effects.
  - Identify and implement opportunities for restoration activities to speed recovery of watershed condition before initiating additional anthropogenic disturbance in the watershed.
  - Coordinate and cooperate with other Federal, State, and private landowners in assessing and preventing CWE in multiple ownership watersheds.
- Integrate restoration and rehabilitation needs into the project plan.
  - Consider water quality improvement actions identified in a TMDL or other watershed restoration plan to restore impaired waterbodies within the project area.
- Identify project-specific monitoring needs.
- Document site-specific BMP prescriptions, design criteria, mitigation measures, and restoration, rehabilitation, and monitoring needs in the applicable National Environmental Policy Act (NEPA) documents, design plans, contracts, permits, authorizations, and operation and maintenance plans.
  - Delineate all protected or excluded areas, including, for example, AMZs and waterbodies, 303(d) listed and TMDL waterbodies, and municipal supply watersheds, on the project map.

Plan-3 Aquatic Management Zone Planning

Manual or Handbook Reference FSM 2526.

Objective To maintain and improve or restore the condition of land around and adjacent to waterbodies in the context of the environment in which they are located, recognizing their unique values and importance to water quality while implementing land and resource management activities.

Explanation The land around and adjacent to waterbodies plays an important ecologic role in maintaining the structure, function, and processes of the aquatic ecosystem. These areas provide shading, soil stabilization, sediment and water filtering, large woody debris recruitment, and habitat for a diversity of plants and animals. The quality and quantity of water resources and aquatic habitats may be adversely affected by ground-disturbing activities that occur on these areas. Because of the importance of these lands, various legal mandates have been established pertaining to management of these areas, including, but not limited to, those associated with floodplains, wetlands, water quality, endangered species, wild and scenic rivers, and cultural resources. Protection and improvement of soil, water, and vegetation are to be emphasized while managing these areas under the principles of multiple use and sustained yield. Riparian-dependent resources are to be given preferential consideration when conflicts among land use activities occur.

Designation of a zone encompassing these areas around and adjacent to a waterbody is a common BMP to facilitate management emphasizing aquatic and riparian-dependent resources. These management zones are known by several common terms such as streamside management area or zone, riparian management area, stream environment zone, and water influence zone. For purposes of the National Core BMPs, these areas will be referred to as AMZs.

AMZs are intended to be large enough to protect a waterbody and its associated beneficial uses and aquatic and riparian ecosystems. AMZs along streams and rivers may be linear swaths extending a prescribed distance from a bank, though widths are usually adjusted to include features such as riparian vegetation and unstable landforms as well as critical floodplain components necessary to sustain waterbody integrity and protect beneficial uses. AMZ areas around wetlands, lakes, and other nonlinear features may be irregular in shape to encompass sensitive riparian areas and other water-dependent features.

Local regulation often stipulates the area and extent of AMZs and may be listed in land management plans; biological opinions, evaluations, or assessments; and other regional or State laws, regulations, and policies. Virtually all States have BMPs that include AMZs, as do most land management plans.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Proactively manage the AMZ to maintain or improve long-term health and sustainability of the riparian ecosystem and adjacent waterbody consistent with desired conditions, goals, and objectives in the land management plan.
    - Balance short-term impacts and benefits with long-term goals and desired future conditions, considering ecological structure, function, and processes, when evaluating proposed management activities in the AMZ.
- Determine the width of the AMZ for waterbodies in the project area that may be affected by the proposed activities:

- Evaluate the condition of aquatic and riparian habitat and beneficial riparian zone functions and their estimated response to the proposed activity in determining the need for and width of the AMZ.
- Use stream class and type, channel condition, aspect, side slope steepness, precipitation and climate characteristics, soil erodibility, slope stability, groundwater features, and aquatic and riparian conditions and functions to determine appropriate AMZ widths to achieve desired conditions in the AMZ.
- Include riparian vegetation within the designated AMZ and extend the AMZ to include steep slopes, highly erodible soils, or other sensitive or unstable areas.
- Establish wider AMZ areas for waters with high resource value and quality.

- Design and implement project activities within the AMZ to:
  - Avoid or minimize unacceptable impacts to riparian vegetation, groundwater recharge areas, steep slopes, highly erodible soils, or unstable areas.
  - Maintain or provide sufficient ground cover to encourage infiltration, avoid or minimize erosion, and to filter pollutants.
  - Avoid, minimize, or restore detrimental soil compaction.
  - Retain trees necessary for shading, bank stabilization, and as a future source of large woody debris.
  - Retain floodplain function.
  - Restore existing disturbed areas that are eroding and contributing sediment to the waterbody.
- Mark the boundaries of the AMZ and sensitive areas like riparian areas, wetlands, and unstable areas on the ground before land disturbing activities.

Resources for General Planning Activities

NEPA

Holcomb, J. 1994. Guide for soil/water/air environmental effects analysis in NEPA documents. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 36 p. Available at http://fsweb.r8.fs.fed.us/nr/bio_phy_res/water/Literature.shtml.

U.S. Environmental Protection Agency, Office of Federal Activities. 1999. Considering ecological processes in environmental impact assessments, July 1999. Washington, DC. 90 p. Available at http://www.epa.gov/compliance/resources/policies/nepa/index.html.

Riparian Management

Committee on Riparian Zone Functioning and Strategies for Management, Water Science and Technology Board, National Research Council. 2002. Riparian areas: functions and strategies for management. ISBN: 0-309-12784-X. Washington, DC: National Academies Press. 444 p. Available at http://www.nap.edu/catalog/10327.html.

Everest, F.H.; Reeves, G.H. 2007. Riparian and aquatic habitats of the Pacific Northwest and southeast Alaska: ecology, management history and potential management strategies. Gen. Tech. Rep. PNW-GTR-692. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 130 p. Available at http://www.treesearch.fs.fed.us/pubs/27434.

Verry, E.S.; Hornbeck, J.W.; Dolloff, C.A., eds. 2000. Riparian management in forests of the continental Eastern United States. ISBN: 9781566705011. Boca Raton, FL: Lewis Publishers CRC Press. 432 p.

Aquatic Ecosystems Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from construction and maintenance activities in flowing and nonflowing aquatic ecosystems. Properly functioning streams, lakes, riparian areas, and wetlands are critical in maintaining water quality, water quantity, riparian habitat, aquatic fauna populations and diversity, and downstream beneficial uses. Common management activities in waterbodies include constructing ponds and wetlands, restoring streambanks or channels, and improving or restoring aquatic habitat.

Four National Core BMPs are in the Aquatic Ecosystems Management Activities category. These BMPs are to be used for projects and activities in or near waterbodies on National Forest System (NFS) lands. BMP AqEco-1 (Aquatic Ecosystem Improvement and Restoration Planning) is a planning BMP for improvement or restoration activities in aquatic ecosystems. BMP AqEco-2 (Operations in Aquatic Ecosystems) covers practices for working in or near waterbodies. Applicable practices of this BMP should be used whenever working in or near waterbodies, regardless of the resource activity; for example, when constructing a stream crossing (BMP Road-7 [Stream Crossings]) or mining instream gravel deposits (BMP Min-5 [In-Stream Sand and Gravel Mining]). BMP AqEco-3 (Ponds and Wetlands) is for constructing ponds and wetlands and constructing or maintaining structures in these aquatic ecosystems. BMP AqEco-4 (Stream Channels and Shorelines) is for construction and maintenance activities in stream channels and shorelines. Note BMP Road-7 (Stream Crossings) provides additional direction specific to road-stream crossings.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Aquatic Ecosystems BMPs	
AqEco-1	Aquatic Ecosystem Improvement and Restoration Planning
AqEco-2	Operations in Aquatic Ecosystems
AqEco-3	Ponds and Wetlands
AqEco-4	Stream Channels and Shorelines

AqEco-1. Aquatic Ecosystem Improvement and Restoration Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2020.

Objective Reestablish and retain ecological resilience of aquatic ecosystems and associated resources to achieve sustainability and provide a broad range of ecosystem services.

Explanation Every waterbody has unique characteristics that should be considered when developing a site-specific maintenance, improvement, or restoration strategy. Planning is critical to ensure that the project is conducted in a timely and cost-efficient manner and that the ecological and water quality goals are met. A rigorous approach that uses a combination of best available science and professional experience to inform planning is necessary to enhance the potential for long-term success. When planning aquatic ecosystem projects, it is important to understand all the factors that may affect the watershed currently and in the future. These factors include water quantity, quality, flow, or storage capacity; habitat suitability for native plants, fish, and wildlife; climate change; the primary uses of the watershed and waterbody by people, domestic animals, and wildlife; and past alterations to the waterbody.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use a watershed perspective and available watershed assessments when planning aquatic ecosystem improvement or restoration projects.
    - ❑ Consider how existing water quality and habitat conditions at the project site have been affected by past habitat alterations, hydrologic modification, and riparian area changes in the watershed.
    - ❑ Consider how past, current, and future land use patterns may affect the proposed project site.
    - ❑ Recognize that inhabitants and users at the site (beaver, deer, birds, and people) may change the current ecosystem state to suit their needs.
- Use desired future conditions to set project goals and objectives.
    - ❑ Establish desired future conditions that are consistent with the land management plan's goals and direction.
    - ❑ Use a reference condition to determine the natural potential water quality and habitat conditions of a waterbody.
    - ❑ Consider the potential for future changes in environmental conditions, such as changes in precipitation and runoff type, magnitude and frequency, community composition and species distribution, and growing seasons that may result from climate change.
    - ❑ Consider water quality and other habitat needs for sensitive aquatic or aquatic-dependent species in the project area.
- Favor project alternatives that correct the source of the degradation more than alternatives that mitigate, or treat symptoms of, the problem.
    - ❑ Consider the risk and consequences of treatment failure, such as the risk that design conditions could be exceeded by natural variability before the treatment measures are established, when analyzing alternatives.
    - ❑ Consider as a first priority treatment measures that are self-sustaining or that reduce requirements for future intervention.
- Use natural stabilization processes consistent with stream type and capability where practicable rather than structures when restoring damaged streambanks or shorelines.
- Prioritize sites to implement projects in a sequence within the watershed in such a way that they will be the most effective to achieve improvement or restoration goals.

AqEco-2. Operations in Aquatic Ecosystems

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse impacts to water quality when working in aquatic ecosystems.

Explanation Common construction or maintenance operations in waterbodies often involve ground disturbance. The close proximity to, and contact with, the waterbody increases the potential for introducing sediment and other pollutants that can affect water quality. This BMP includes practices for minimizing direct and indirect water quality impacts when working in or adjacent to waterbodies.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (AMZ Planning) when planning operations in aquatic ecosystems.
- Identify the aquatic and aquatic-dependent species that live in the waterbody, Aquatic Management Zone (AMZ), or on the floodplain and their life histories to determine protection strategies, such as timing of construction, sediment management, species relocation, and monitoring during construction.
- Coordinate stream channel, shoreline, lake, pond, and wetland activities with appropriate State and Federal agencies.
  - Incorporate Clean Water Act (CWA) 404 permit requirements and other Federal, State, and local permits or requirements into the project design and plan.
- Use suitable measures to protect the waterbody when preparing the site for construction or maintenance activities.
  - Clearly delineate the work zone.
  - Locate access and staging areas near the project site but outside of work area boundaries, AMZs, wetlands, and sensitive soil areas.
  - Refuel and service equipment only in designated staging areas (see BMP Road-10 [Equipment Refueling and Servicing]).
  - Develop an erosion and sediment control plan to avoid or minimize downstream impacts using measures appropriate to the site and the proposed activity (see BMP Fac-2 [Facility Construction and Stormwater Control]).
  - Prepare for unexpected failures of erosion control measures.
  - Consider needs for solid waste disposal and worksite sanitation.
  - Consider using small, low ground pressure equipment, and hand labor where practicable.
  - Ensure all equipment operated in or adjacent to the waterbody is clean of aquatic invasive species, as well as oil and grease, and is well maintained.
  - Use vegetable oil or other biodegradable hydraulic oil for heavy equipment hydraulics wherever practicable when operating in or near water.
- Schedule construction or maintenance operations in waterbodies to occur in the least critical periods to avoid or minimize adverse effects to sensitive aquatic and aquatic-dependent species that live in or near the waterbody.

- Avoid scheduling instream work during the spawning or migration seasons of resident or migratory fish and other important life history phases of sensitive species that could be affected by the project.
- Avoid scheduling instream work during periods that could be interrupted by high flows.
- Consider the growing season and dormant season for vegetation when scheduling activities within or near the waterbody to minimize the period of time that the land would remain exposed, thereby reducing erosion risks and length of time when aesthetics are poor.

- Use suitable measures to protect the waterbody when clearing the site.
  - Clearly delineate the geographic limits of the area to be cleared.
  - Use suitable drainage measures to improve the workability of wet sites.
  - Avoid or minimize unacceptable damage to existing vegetation, especially plants that are stabilizing the bank of the waterbody.
- Use suitable measures to avoid or minimize impacts to the waterbody when implementing construction and maintenance activities.
  - Minimize heavy equipment entry into or crossing water as is practicable.
  - Conduct operations during dry periods.
  - Stage construction operations as needed to limit the extent of disturbed areas without installed stabilization measures.
  - Promptly install and appropriately maintain erosion control measures.
  - Promptly install and appropriately maintain spill prevention and containment measures.
  - Promptly rehabilitate or stabilize disturbed areas as needed following construction or maintenance activities.
  - Stockpile and protect topsoil for reuse in site revegetation.
  - Minimize bank and riparian area excavation during construction to the extent practicable.
  - Keep excavated materials out of the waterbody.
  - Use only clean, suitable materials that are free of toxins and invasive species for fill.
  - Properly compact fills to avoid or minimize erosion.
  - Balance cuts and fills to minimize disposal needs.
  - Remove all project debris from the waterbody in a manner that will cause the least disturbance.
  - Identify suitable areas offsite or away from waterbodies for disposal sites before beginning operations.
  - Contour site to disperse runoff, minimize erosion, stabilize slopes, and provide a favorable environment for plant growth.
  - Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Use suitable measures to divert or partition channelized flow around the site or to dewater the site as needed to the extent practicable.
  - Remove aquatic organisms from the construction area before dewatering and prevent organisms from returning to the site during construction.

- Return clean flows to channel or waterbody downstream of the activity.
- Restore flows to their natural stream course as soon as practicable after construction or before seasonal closures.

- Inspect the work site at suitable regular intervals during and after construction or maintenance activities to check on quality of the work and materials and identify need for midproject corrections.
- Consider short- and long-term maintenance needs and unit capabilities when designing the project.
  - Develop a strategy for providing emergency maintenance when needed.
- Include implementation and effectiveness monitoring to evaluate success of the project in meeting design objectives and avoiding or minimizing unacceptable impacts to water quality.
- Consider long-term management of the site and nearby areas to promote project success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to allow for recovery of vegetation.

AqEco-3. Ponds and Wetlands

Manual or Handbook Reference None known.

Objective Design and implement pond and wetlands projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.

Explanation Ponds and wetlands are developed for a variety of reasons including recreation, water sources, stock ponds, gravel extraction, wetland mitigation, and wildlife improvement. The excavation of material and construction of berms, dikes, dams, channels, wildlife water sources, and waterfowl nesting islands have the potential to introduce sediment and other pollutants into adjacent waterbodies, alter flows, and cause physical damage to the ponds and adjacent stream channels both during and after construction. Constructing the projects to withstand potential overflow and flooding is a primary consideration during project planning and design.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.
- Obtain and manage water rights.
- Clearly define goals and objectives in the project plan appropriate to the site for desired hydrology, wetland plant community associations, intended purpose, and function of the pond or wetland and expected values.
- Select sites based on an analysis of landscape structure and associated ecological functions and values.
  - Construct ponds and wetlands on sites that have easy construction access where practicable.
  - Construct wetlands in landscape positions and soil types capable of supporting desired wetland functions and values.

- Construct ponds outside of active floodplain to minimize overflow of groundwater-fed ponds into adjacent streams and avoid or minimize erosion of pond embankments by floods, unless location in the floodplain is integral to achieving project objectives.
- Construct ponds with surface water supply off-channel rather than placing a dam across a stream.
- Construct ponds and wetlands on sites with soils suitable to hold water with minimal seepage loss and that provide a stable foundation for any needed embankments.
- Construct ponds and wetlands in locations where polluted surface water runoff or groundwater discharge do not reach the pond.
- Consider the consequences of dam or embankment failure and resulting damage from sudden release of water on potentially affected areas.

- Ensure that the natural water supply for the pond or wetland is sufficient to meet the needs of the intended use and that it will maintain the desired water levels and water quality.
  - Design the wetland to create hydrologic conditions (including the timing of inflow and outflow, duration, and frequency of water level fluctuations) that provide the desired wetland functions and values.
  - Avoid or minimize drawdown effects in a stream source by limiting timing and rate of water withdrawal to allow sufficient downstream water flow to maintain desired conditions in the source stream (see BMP WatUses-1 [Water Uses Planning]).
- Design the wetland project to create a biologically and hydrologically functional system.
  - Design for function, not form.
  - Keep the design simple and avoid over engineering.
  - Design the project for minimal maintenance needs.
  - Use natural energies, such as gravity flow, in the design.
  - Avoid use of hard engineering structures or the use of supplemental watering to support system hydrology.
  - Plan to allow wetland system time to develop after construction activities are complete.
- Design the pond or wetland to be of sufficient size and depth appropriate for the intended use and to optimize hydrologic regimes and wetland plant community development.
  - Size the pond or wetland appropriately for the contributing drainage area such that a desired water level can be maintained during drought conditions and that excess runoff during large storms can be reasonably accommodated without constructing large overflow structures.
  - Size the pond or wetland to an adequate depth to store sufficient amounts of water for the intended use and offset probable evaporation and seepage losses.
  - Integrate design with the natural topography of the site to minimize site disturbance.
  - Design the pond or wetland to have an irregular shape to reduce wind and wave impacts, disperse water flows, maximize retention times, and better mimic natural systems.
  - Create microtopography and macrotopography in wetlands to mimic natural conditions and achieve hydrologic and vegetative diversity.
  - Avoid creating large areas of shallow water to minimize excessive evaporation losses and growth of noxious aquatic plants.

- Avoid steep-sloped shorelines in areas with potential substrate instability problems to reduce erosion and sedimentation.

- Include water control structures to manage water levels as necessary.
  - Design spillway or outlet to maintain desired water level under normal inflows from snowmelt, groundwater flow, and precipitation.
  - Design discharge capacity using a suitable hydrologic analysis of the drainage area to be sufficient to safely pass the flow resulting from the design storm event.
  - Size the spillway to release floodwaters in a volume and velocity that do not erode the spillway, the area beyond the outlet, or the downstream channel.
  - Consider the need for suitable measures to drain the pond or wetland.
  - Return overflow back to the original source to the extent practicable.
  - Use suitable measures to maintain desired downstream temperatures, dissolved oxygen levels, and aquatic habitats when water is released from the pond or impoundment.
- Use materials appropriate for the purpose of the pond and site.
  - Select materials for a dam or embankment that will provide sufficient strength and, when properly compacted, will be tight enough to avoid or minimize excessive or harmful percolation of water through the dam or embankment.
  - Design the side slopes appropriately for the material being used to ensure stability of the dam or embankment.
- Use wetland vegetation species and establishment methods suitable to the project site and objectives, consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - Consider the timing of planting to achieve maximum survival, proposed benefit of each plant species, methods of planting, proposed use of mulch, potential soil amendment (organic material or fertilizer), and potential supplemental watering to help establish the plant community.
- Properly maintain dams, embankments, and spillways to avoid or minimize soil erosion and leakage problems.
  - Use suitable measures to avoid or minimize erosion of dams and shores due to wind and wave action.
  - Design sufficient freeboard to avoid or minimize overtopping by wave action or other causes.
  - Stabilize or armor spillways for ponds with continuous flow releases or overflow during heavy rainfall events.
- Manage uplands and surrounding areas to avoid or minimize unacceptable impacts to water quality in the pond or wetland.

AqEco-4. Stream Channels and Shorelines

Manual or Handbook Reference None known.

Objective Design and implement stream channel and lake shoreline projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.

Explanation Instream projects are often conducted for a variety of purposes, including improving fish and wildlife habitat, stabilizing streambanks, reconnecting the stream channel to the historic floodplain, and removing or replacing culverts. Lakeshores may be degraded by storm events; constant wave action from boats; onshore uses, including recreation, mining, vegetation management, and development; water diversions; freezing and thawing; floating ice; drought; or a fluctuating water table. A shoreline problem is often isolated and may require only a simple patch repair. Methods to stabilize or restore lakeshores differ from streambank measures because of wave action and littoral transport.

Two basic categories of stabilization and protection measures exist: those that work by reducing the force of water against a streambank or shoreline and those that increase their resistance to erosive forces. Appropriate selection and application of stream channel and shoreline protection measures depend on specific project objectives and site conditions.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.

Stream Channels

- Determine stream type and classification using suitable accepted protocols.
- Determine need to control channel grade to avoid or minimize erosion of channel bed and banks before selecting measures for bank stabilization or protection.
    - ❑ Incorporate grade control measures into project design as needed.
- Determine design flows based on the value or safety of area to be protected, repair cost, and the sensitivity and value of the ecological system involved.
    - ❑ Obtain peak flow, low flow, channel forming flow, and flow duration estimates.
    - ❑ Use these estimates to determine the best time to implement the project, as well as to select design flows.
- Determine design velocities appropriate to the site.
    - ❑ Limit maximum velocity to the velocity that is nonscouring on the least resistant streambed and bank material.
    - ❑ Consider needs to transport bedload through the reach when determining minimum velocities.
    - ❑ Maintain the depth-area-velocity relationship of the upstream channel through the project reach.
    - ❑ Consider the effects of design velocities on desired aquatic organism habitat and passage.

- Avoid changing channel alignment unless the change is to reconstruct the channel to a stable meander geometry consistent with stream type.
- Design instream and streambank stabilization and protection measures suitable to channel alignment (straight reach versus curves).
  - ❑ Consider the effects of ice and freeze and thaw cycles on streambank erosion processes.
  - ❑ Consider the effects that structures may have on downstream structures and stream morphology, including streambanks, in the maintenance of a natural streambed.
- Design channels with natural stream pattern and geometry and with stable beds and banks; provide habitat complexity where reconstruction of stream channels is necessary.
  - ❑ Consider sediment load (bedload and suspended load) and bed material size to determine desired sediment transport rate when designing channels.
  - ❑ Avoid relocating natural stream channels.
  - ❑ Return flow to natural channels, where practicable.
- Include suitable measures to protect against erosion around the edges of stabilization structures.
  - ❑ Design revetments and similar structures to include sufficient freeboard to avoid or minimize overtopping at curves or other points where high-flow velocity can cause waves.
  - ❑ Use suitable measures to avoid or minimize water forces undermining the toe of the structure.
  - ❑ Tie structures into stable anchorage points, such as bridge abutments, rock outcrops, or well-vegetated stable sections, to avoid or minimize erosion around the ends.
- Add or remove rocks, wood, or other material in streams only if such action maintains or improves stream condition, provides for safety and stability at bridges and culverts, is needed to avoid or minimize excessive erosion of streambanks, or reduces flooding hazard.
  - ❑ Leave rocks and portions of wood that are embedded in beds or banks to avoid or minimize channel scour and maintain natural habitat complexity.
- Choose vegetation appropriate to the site to provide streambank stabilization and protection adequate to achieve project objectives.
  - ❑ Use vegetation species and establishment methods suitable to the project site and objectives, consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Shorelines

- Use mean high- and low-water levels to determine the design water surface.
  - ❑ Consider the effects of fluctuating water levels, freeze or thaw cycles, and floating ice on erosion processes at the site.
- Design stabilization and protection measures suitable to the site.
  - ❑ Determine the shoreline slope configuration above and below the waterline.
  - ❑ Consider the effects of offshore depth, dynamic wave height, and wave action on shoreline erosion processes.
  - ❑ Determine the nature of the bank soil material to aid in estimating erosion rates.
  - ❑ Consider foundation material at the site when selecting structural measures.

- Use vegetation species and establishment methods suitable to the project site and objectives and consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

- Consider the rate, direction, supply, and seasonal changes in littoral transport when choosing the location and design of structural measures.
- Consider the effect structures may have on adjacent shoreline or other nearby structures.
  - Adequately anchor end sections to existing stabilization measures or terminate in stable areas.

Resources for Aquatic Ecosystems Management Activities

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Chemical Use Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid or minimize unacceptable impacts to water quality conditions that may result from application of chemicals used to manage biological and physical resources. Chemical treatments are applied to kill, attract, repel, defoliate, stimulate, or retard biologic growth with the intent to mitigate, control, grow, or kill the intended biota. They may also be applied to ameliorate, neutralize, or stabilize certain physical resources such as soil or water chemistry. Chemical treatments include application of pesticides such as insecticides, herbicides, fungicides, nematicides, rodenticides, and piscicides. Chemical treatments also include fertilizers, fire retardants (see BMP Fire-3 [Wildland Fire Control and Suppression]), dyes, or other materials used in tracer studies, aggregate additives like salt, magnesium chloride, and other substances used for dust abatement, roadbed stabilization, or de-icing of roadways, and other chemical products that can be used to fulfill specific Forest Service management objectives.

Six National Core BMPs are in the Chemical Use Management Activities category. These BMPs are to be used when chemicals are applied on National Forest System (NFS) lands. BMP Chem-1 (Chemical Use Planning) is a planning BMP for chemical applications. BMP Chem-2 (Follow Label Directions) specifies following label directions to meet legal requirements for chemical use. BMP Chem-3 (Chemical Use near Waterbodies) is for chemical applications on or over upland areas where chemicals may drift or runoff into waterbodies. BMP Chem-4 (Chemical Use in Waterbodies) is for chemical applications directly into waterbodies. BMP Chem-5 (Chemical Handling and Disposal) provides practices for proper transportation and storage of chemicals, cleaning equipment, and chemical containers and disposal of containers. BMP Chem-6 (Chemical Application Monitoring and Evaluation) provides guidance on designing and implementing monitoring plans to evaluate chemical applications.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Chemical Use BMPs	
Chem-1	Chemical Use Planning
Chem-2	Follow Label Directions
Chem-3	Chemical Use Near Waterbodies
Chem-4	Chemical Use in Waterbodies
Chem-5	Chemical Handling and Disposal
Chem-6	Chemical Application Monitoring and Evaluation

Chem-1. Chemical Use Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2153; Forest Service Handbook (FSH) 2109.14, chapter 10.

Objective Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.

Explanation Pollution risk from chemical use depends on chemical mobility and persistence, application mode and rate, and distance from water. Risk of entry to surface water is highest for broadcast and aerial treatments and for fine droplets. Risk to groundwater is highest over sandy soils, shallow water tables, and groundwater recharge areas. The planning process is the framework for incorporating measures to avoid or minimize impacts to soil and water resources into project design and management to reduce the risk of contamination from chemical use.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning activities that involve use of chemicals.
- Identify municipal supply watersheds; private domestic water supplies; fish hatcheries; and threatened, endangered, and sensitive aquatic dependent species and fish populations near or downstream of chemical treatment areas.
- Use Integrated Pest Management as the basis for all pesticide-use prescriptions in consultation with the unit Pesticide Use Coordinator.
- Select chemical products suitable for use on the target species or that meet project objectives.
    - Use chemicals that are registered for the intended uses.
- Consult the Materials Safety Data Sheet and product label for information on use, hazards, and safe handling procedures for chemicals products under consideration for use.
- Consider chemical solubility, absorption, breakdown rate properties, and site factors when determining which chemical products to use.
    - Use chemicals with properties such that soil residual activity will persist only as long as needed to achieve treatment objectives.
    - Consider soil type, chemical mobility, distance to surface water, and depth to groundwater to avoid or minimize surface water and groundwater contamination.
- Use a suitable pressure, nozzle size, and nozzle type combination to minimize off-target drift or droplet splatter.
- Use selective treatment methods for target organisms to the extent practicable.
- Specify management direction and appropriate site-specific response measures in project plans and safety plans (FSH 2109.14, chapter 60).
- Ensure that planned chemical use projects conform to all applicable local, State, Federal, and agency laws, regulations, and policies.
    - Obtain necessary permits, including Clean Water Act (CWA) 402 permit coverage.
    - Develop spill contingency plans.
    - Obtain or provide training and licensing as required by the label and State regulations.

Chem-2. Follow Label Directions

Manual or Handbook Reference FSH 2109.14, chapter 50.

Objective Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.

Explanation Directions found on the label of each chemical are detailed, specific, and include legal requirements for use. In brief, "...the label is the law..." with respect to chemical use. Not following label directions increases the risk of adverse effects to surface water or groundwater as a result of using chemicals inappropriate to the site, an inappropriate method of application, and an inappropriate application rate (too much or too little) to meet project objectives.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Incorporate constraints identified on the label and other legal requirements of application into project plans and contracts.
  - Be aware that States may have more restrictive requirements than the label instructions.
- Use fully trained individuals equipped with appropriate personal protective equipment to apply chemical treatments.
- Obtain State or Federal Pesticide Application Certification for staff supervising or applying chemical treatment application if required by law.
- Notify contractor's field supervisor when violations of label or project requirements have occurred.
- Stop operations that pose a safety hazard or when violations of project requirements have not been rectified.
- Report label violations to the appropriate enforcement agency.
- Respond to and report spills and other accidents.

Chem-3. Chemical Use Near Waterbodies

Manual or Handbook Reference FSH 2109.14 Chapters 10, 50.

Objective Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies.

Explanation Some chemicals used in terrestrial applications are toxic to aquatic flora and fauna, may overly enrich aquatic systems, and may pose a human health hazard if drinking water sources are contaminated during or after chemical applications. During application, chemicals may drift into waterbodies or other nontarget areas. After application, chemicals or chemical residues may enter surface water or groundwaters through runoff and leaching. Most State and local water quality standards include a general narrative standard that requires surface waters to be free from substances attributable to human-caused discharges in amounts, concentrations, or combinations that are toxic to humans, animals, plants, or aquatic life. To help protect surface waters and wetlands from contamination, a buffer zone of land and vegetation adjacent to the waterbody may need to be designated. Treatment within this zone may differ from that applied to upland areas or the buffer zone may be left untreated if necessary.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify during project planning those perennial and intermittent surface waters, wetlands, springs, riparian areas, and groundwater recharge areas that may be impacted by the chemical use.
  - ❑ Use field observations to verify the extent of these areas identified from aerial observations, maps, or geographic information system data, as needed.
- Determine the width of a buffer zone, if needed, based on a review of the project area, characteristics of the chemical to be used, and application method.
  - ❑ Consider the designated uses of water, adjacent land uses, expected rainfall, wind speed and direction, terrain, slope, soils, and geology.
  - ❑ Consider the persistence, mobility, toxicity profile, and bioaccumulation potential of any chemical formulation proposed for use.
  - ❑ Consider the type of equipment, spray pattern, droplet size, application height, and experience in similar projects.
- Prescribe chemicals and application methods in the buffer zone suitable to achieve project objectives while minimizing risk to water quality.
- Flag or otherwise mark or identify buffer zones as needed.
  - ❑ Clearly communicate to those applying the chemical what areas are to be avoided or where alternative treatments are to be used.
- Locate operation bases on upland areas, outside of wetlands or areas with channel or ditch connection to surface water and AMZs.
- Use clean equipment and personnel to collect water needed for mixing.
- Calibrate application equipment to apply chemicals uniformly and in the correct quantities.
- Evaluate weather conditions before beginning spray operations and monitor throughout each day to avoid or minimize chemical drift.
  - ❑ Apply chemicals only under favorable weather conditions as identified in the label instructions.
  - ❑ Avoid applying chemicals before forecasted severe storm events to limit runoff and ensure the chemical reaches intended targets.
  - ❑ Suspend operations if project prescription or weather limitations have been exceeded.
- Apply fertilizers during high nutrient-uptake periods to avoid or minimize leaching and translocation.
  - ❑ Base fertilizer type and application rate on soils and foliar analysis.
  - ❑ Use slow release fertilizers that deliver fertilizer to plants during extended periods in areas with long growing seasons when appropriate to meet project objectives.
- Monitor during chemical applications to determine if chemicals are reaching surface waters (see BMP Chem-6 [Chemical Application Monitoring and Evaluation]).
- Implement the chemical spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-4. Chemical Use in Waterbodies

Manual or Handbook Reference FSH 2109.14.

Objective Avoid, minimize, or mitigate unintended adverse effects to water quality from chemical treatments applied directly to waterbodies.

Explanation Chemicals may be used to improve the growth of aquatic fauna and flora within lakes and streams, control invasive or other undesirable aquatic species, restore native biota, or remediate adverse atmospheric deposition. Chemicals may also be used as tracers for time of travel studies, dispersion studies, discharge measurement, and calculation of stream re-aeration, as well as for determining circulation and stratification within reservoirs, tagging pollutants, or many other applications. Several factors affect the type and degree of impacts on aquatic resources, including chemical type, concentration, application rate, residence time, and decay rate; waterbody chemistry, volume, substrate, turnover, inflow, outflow, hydrograph, geology, geomorphology, designated uses, and other limnologic characteristics; and biologic species composition, habitat requirements, food web, population dynamics, and desired condition. Chemical treatments to surface waters may also affect groundwater through leaching, translocation, or interchange.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Coordinate project with State water quality and fish and wildlife agencies as necessary.
- Use chemicals registered for application in aquatic systems.
- Use the minimum concentration of chemicals required to be reasonably certain that treatment objectives would be met.
  - Consider physical attributes of the waterbody, water flow and turbulence, waterbody mixing time, water chemistry, target species, label directions, percentage of active ingredient in the formulation to be used, application method, and project objectives to determine chemical concentration to use.
  - Follow label directions near critical points such as water intakes or, if label is silent on this issue, consider using lower concentrations or nontreatment buffers.
  - Consider using pretreatment bioassay tests to determine if the recommended concentration will be effective to meet treatment objectives.
  - Adjust chemical concentration and application methods to account for the effect of thermal stratification in lakes or reservoirs to achieve treatment objectives.
  - Adjust chemical concentration and application methods in streams and flowing water to account for the effect that any barriers, diversion structures, beaver dams, seeps, springs, and tributaries may have on chemical dilution and mixing to achieve treatment objectives.
- Avoid applying chemicals in situations where they could enter nontarget waters.
- Determine the need to treat tributaries to standing waterbodies to meet treatment objectives.
  - Apply chemical treatment to tributaries before treating the standing waterbody.
- Determine the need for neutralization of chemicals applied directly to water.
  - Evaluate the environmental advantages and disadvantages of natural degradation compared to the use of neutralizing agents.

- Use neutralization agents when the chemical treatment effects would cause unacceptable downstream impacts without intervention.
- For neutralization of flowing water, determine a neutralization zone (e.g., mixing zone) based on time of travel below the application point where potential flora or fauna mortality can be expected before the chemical is completely neutralized.

- Determine the need for collecting dead flora or fauna.
  - Dispose of dead flora or fauna in an approved manner that does not adversely affect water quality.
- Monitor water quality and sediments pre- and post-chemical treatment at representative locations to evaluate relevant water chemistry and chemical concentrations (see BMP Chem-6 [Chemical Application Monitoring and Evaluation]).
- Implement the pesticide spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-5. Chemical Handling and Disposal

Manual or Handbook Reference FSH 2109.14, chapter 40.

Objective Avoid or minimize water and soil contamination when transporting, storing, preparing and mixing chemicals; cleaning application equipment; and cleaning or disposing chemical containers.

Explanation Handling chemicals, chemical containers, and equipment can lead to contamination of surface water or groundwater if not done carefully. Spills, leaks, or wash water can contaminate soil and leach into groundwater. Residue left on containers or equipment can wash off during precipitation events and enter surface waters. Preparing and mixing chemicals and cleaning and disposing of chemical containers must be done in accordance with Federal, State, and local laws, regulations, and directives. Specific procedures are documented in the Forest Service Pesticide Use Management and Coordination Handbook (FSH 2109.14, chapter 40) as well as in State and local laws.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Transport and handle chemical containers in a manner that minimizes the potential for leaks and spills.
  - Inspect containers for leaks or loose caps or plugs before loading.
  - Secure containers properly to avoid or minimize shifting in transport.
  - Check containers periodically enroute.
  - Ensure arrangements for proper storage are in place before transporting chemicals.
- Manage and store chemicals in accordance with all applicable Federal, State, or local regulations, including label directions.
  - Store chemicals in their original containers with labels intact.
  - Locate chemical storage facilities at sites that minimize the possibility of impacts to surface water or groundwater in case accidents or fires occur.
  - At a minimum, ensure that containment of a complete spill from the largest container being stored is possible with the spill-kit materials at the storage site.

- Check containers before storage and periodically during storage to ensure that they are properly sealed and not leaking.

- Locate operation bases in appropriate sites where possible spills would not enter surface waterbodies or groundwater aquifers.
- Ensure that mixing equipment, containers, and spill kits are in place and adequate for the project size and chemicals to be used.
- Follow label directions; applicable Federal, State, and local laws; and Forest Service direction for proper preparation and mixing of chemicals and cleaning and disposal of chemical materials and equipment.
  - When a contractor supplies the pesticide, the contractor is responsible for proper chemical preparation and mixing and container cleaning and disposal in accordance with label directions and Federal, State, and local laws.
  - Apply rinse water from empty chemical containers, mixing apparatus, and equipment clean up to the treatment area, not into the ground near streams.
  - Provide water from off site for cleaning equipment and application personnel rather than using onsite surface waters.
- Inspect application equipment to ensure that chemicals will not leak and the application prescription can be achieved.
- Implement the chemical spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-6. Chemical Application Monitoring and Evaluation

Manual or Handbook Reference FSM 2150.1; FSH 2109.14, chapter 50.

Objectives

1. Determine whether chemicals have been applied safely, have been restricted to intended targets, and have not resulted in unexpected nontarget effects.
2. Document and provide early warning of possible hazardous conditions resulting from potential contamination of water or other nontarget resources or areas by chemicals.

Explanation Monitoring of chemical applications is used to evaluate and document chemical application accuracy, amount, and effects on soils and water quality to reduce or eliminate hazards to nontarget biological or physical resources. Monitoring can occur before, during, and after chemical application depending on treatment objectives and monitoring questions. Monitoring methods may include any of the following: visual observations; vegetation surveys; use of spray cards; dye tracing (fluorometry); and sampling of water, soil, sediment, flora, or fauna to measure chemical presence in or near water. Monitoring needs and methods are determined in the project planning process and should consider treatment objectives; resource values at risk; chemical properties; potential for offsite movement; Federal, State, and local requirements; monitoring costs; and available project funding.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify the following elements in all water resource monitoring plans and specify the rationale for each:
  - What are the monitoring questions?

- Who will be involved and what are their roles and responsibilities?
- What parameters will be monitored and analyzed?
- When and where will monitoring take place?
- What methods will be used for sampling and analyses?
- How will Chain of Custody requirements for sample handling be met?
- What are the criteria for quality assurance and quality control?

- Consider the following factors when developing monitoring questions:
  - The physical or biological resource of concern, including human health.
  - Applicable Federal, State, and local laws and regulations.
  - Type of chemical.
  - Type of application equipment used and method of application.
  - Site-related difficulties that affect both application and monitoring.
  - Public concerns.
  - Potential benefits of the application.
  - Availability of analytic methods, detection limits, tools, and laboratories.
  - Costs of monitoring and resources available to implement monitoring plan.
- Choose monitoring methods and sample locations suitable to address the monitoring questions.
  - Consider the need to take random batch or tank samples for future testing in the event of treatment failure or an unexpected adverse effect.
- Monitor sensitive environments during and after chemical applications to detect and evaluate unanticipated events.
- Use U.S. Environmental Protection Agency-certified laboratories for chemical sample analysis.
  - Use appropriate containers, preservation, and transportation to meet Standard Methods requirements.
  - Implement proper Chain of Custody procedures for sample handling.
- Evaluate and interpret the results of monitoring in terms of compliance with, and adequacy of, treatment objectives and specifications.

Resources for Chemical Use Management Activities

Aquatic Pesticides

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Netherland, M.D. 2009. Chapter 11. Chemical control of aquatic weeds, pp. 65-78. In: Gettys, L.A.; Haller, W.T.; Bellaud, M., eds. Biology and control of aquatic plants: a best management practices handbook. Marietta, GA: Aquatic Ecosystem Restoration Foundation. 210 p. Available at http://www.aquatics.org/bmp.htm.

Dye Tracers

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Wilson, J.F. Jr.; Cobb, E.D.; Kilpatrick, F.A. 1986. Fluorometric procedures for dye tracing. TWI 03-A12. Reston, VA: U.S. Department of the Interior, USGS. p. 34. Available at http://smig.usgs.gov/SMIG/tracer_methods.html.

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Oregon Plan for Salmon and Watersheds, Water Quality Monitoring Team. 1999. Chapter 13—Pesticides and toxins protocol. P. 13-1 – 13-10. In: Water quality monitoring: technical guidebook version 2.0. Available at http://oregon.gov/OWEB/docs/pubs/wq_mon_guide.pdf.

Risk Assessments

U.S. Department of Agriculture, Forest Service, Forest Health Protection, Pesticide Management and Coordination. Human health and ecological risk assessments. Washington, DC. Available at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml.

Silvicultural Chemicals

Holaday, S. and Wagner, C. 2010. Chapter 10—Chemicals. In: Wisconsin's forestry best management practices for water quality: Field manual for loggers, landowners and land managers. Pub. FR-093. Madison, WI: Wisconsin Department of Natural Resources, Division of Forestry. 163 p. Available at http://dnr.wi.gov/topic/forestmanagement/bmp.html.

Michael, J.L. 2004. Best management practices for silvicultural chemicals and the science behind them. Water, Air and Soil Pollution: Focus 4: 95–117. Available at http://ncrs.fs.fed.us/fmg/nfmg/docs/bmp_chemical.pdf.

Newton, M.; Norgren, J.A. 1977. Silvicultural chemicals and protection of water quality. EPA 910/9-77-036. Seattle, WA: U.S. Environmental Protection Agency. Available at http://www.epa.gov/nscep/index.html.

U.S. Environmental Protection Agency, Office of Water. 2005. Chapter 3I: Forest chemical management. p. 3-99 – 3-106. In: National management measures to control nonpoint source pollution from forestry. EPA 841-B-05-001. Washington, DC. Available at http://www.epa.gov/owow/nps/forestrymgmt/.

Facilities and Nonrecreation Special Uses Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from development, use, maintenance, and reclamation of facilities located on National Forest System (NFS) lands. Facilities include buildings, camps, towers, pipelines, stream gauging stations, water storage and conveyance facilities, or other permanent or semipermanent structures and infrastructure associated with Forest Service-administered facilities. Forest Service facilities normally encountered on NFS lands include fire stations, work centers, permanent field camps, ranger stations, visitor centers, public water systems, and sanitation systems. Other facilities on NFS lands may be operated by the private sector through easements or special use authorizations. Examples of these third-party facilities include work and organizational camps, concession sites, electronic and communication sites, public water and sanitation systems, power transmission lines, pipelines, research equipment and structures, and access routes to private land in-holdings.

Ten National Core BMPs are in the Facilities and Nonrecreation Special Uses Management Activities category. These BMPs are to be used in all facilities and nonrecreation special use authorizations on NFS lands. BMP Fac-1 (Facilities and Nonrecreation Special Uses Planning) is a planning BMP for facilities and nonrecreation special uses projects. BMP Fac-2 (Facility Construction and Stormwater Control) provides direction for erosion control and stormwater management during construction activities. This BMP applies to any ground-disturbing activity, regardless of the resource category; for example, constructing a campground, operating a mine, or reconstructing a road. BMP Fac-3 (Potable Water Supply Systems), BMP Fac-4 (Sanitation Systems), and BMP Fac-5 (Solid Waste Management) provide practices for drinking water, human sanitation, and trash or garbage disposal at facilities. BMP Fac-6 (Hazardous Materials) covers management of hazardous materials and applies to any activity that involves hazardous materials, not just at facilities. BMP Fac-7 (Vehicles and Equipment Wash Water) covers vehicle washing, which usually takes place at a facility. BMP Fac-8 (Nonrecreation Special Use Authorizations) and BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Way) provide practices for third-party uses on NFS lands that are not related to recreation activities. BMP Fac-10 (Facility Site Reclamation) provides direction for reclamation of developed sites that are no longer needed for their developed purposes.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Facilities and Nonrecreation Special Uses BMPs	
Fac-1	Facilities and Nonrecreation Special Uses Planning
Fac-2	Facility Construction and Stormwater Control
Fac-3	Potable Water Supply Systems
Fac-4	Sanitation Systems
Fac-5	Solid Waste Management
Fac-6	Hazardous Materials
Fac-7	Vehicle and Equipment Wash Water
Fac-8	Nonrecreation Special Use Authorizations
Fac-9	Pipelines, Transmission Facilities, and Rights-of-Way
Fac-10	Facility Site Reclamation

Fac-1. Facilities and Nonrecreation Special Uses Planning

Manual or Handbook Reference Forest Service Handbook (FSH) 7309.11, chapter 20; FSH 7409.11, chapter 10; FSH 2709.11, chapter 50.

Objective Use the applicable special use authorization and administrative facilities planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during construction and operation of facilities and nonrecreation special uses activities.

Explanation Facilities may be developed on NFS lands by the Forest Service for a variety of administrative and recreational purposes. Potential effects of the proposed facility construction and operation on water quality should be considered when new sites are created or existing sites are improved and operated. In the planning process, site-specific BMP prescriptions are developed to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Facilities developed and operated by others on NFS lands are administered through special use authorizations issued by the Forest Service to public or private agencies, a group, or an individual. Special use permits must include terms and conditions to protect the environment and otherwise comply with the requirements of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1752). These environmental protection requirements include the use of appropriate BMPs to control nonpoint source pollution.

State and local governments regulate many activities associated with facility development and operation, such as public water supplies, sanitation systems, waste disposal, and control of stormwater discharges. State or local requirements applicable to these activities should be incorporated into facility design, construction, and operation plans, and terms and conditions during the planning process.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning facilities or nonrecreation special use projects.
- Consider the following design criteria in facility planning.
  - ❑ Locate the facility away from the immediate vicinity of surface waters, AMZs, wetlands, sandy soils, shallow water tables, groundwater recharge areas, floodplains, and other sensitive areas to the extent practicable.
  - ❑ Avoid unstable slopes and soils.
  - ❑ Minimize the disturbance footprint.
  - ❑ Use and maintain proper erosion and sediment control practices during and immediately after construction activities (See BMP Fac-2 [Facility Construction and Stormwater Control]).
  - ❑ Incorporate suitable stormwater controls in the project design (See BMP Fac-2 [Facility Construction and Stormwater Control]).
  - ❑ Use applicable Road Management BMPs for access roads associated with facility sites.
  - ❑ Incorporate requirements from applicable Federal, State, and local permits into facility construction and operation plans.

- Consider the time necessary to complete facility development activities.
  - Develop a contingency plan for implementing appropriate prestorm or winterization BMPs before the grading permit expires.
- Determine the design capacity, if applicable, of the site for public or administrative use, considering needs for protecting soil, water quality, and riparian resources.
  - Ensure that the capacity of the site matches the ability of the site to withstand the use.
- Conform to all applicable Federal, State, and local regulations and permits governing water supply, sanitation, and underground injection systems (see BMP Fac-3 [Potable Water Supply Systems] and BMP Fac-4 [Sanitation Systems]).
- Determine instream flow needs to minimize damage to scenic and aesthetic values; native plant, fish, and wildlife habitat; and to otherwise protect the environment where the operation of the facility would modify existing streamflow regimes (See BMP WatUses-1 [Water Uses Planning]).

Fac-2. Facility Construction and Stormwater Control

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling erosion and managing stormwater discharge originating from ground disturbance during construction of developed sites.

Explanation During construction and operation of facility sites, land may be cleared of existing vegetation and ground cover, exposing mineral soil that may be more easily eroded by water, wind, and gravity. Changes in land use and impervious surfaces can temporarily or permanently alter stormwater runoff that, if left uncontrolled, can affect morphology, stability, and quality of nearby streams and other waterbodies. Erosion and stormwater runoff control measures are implemented to retain soil in place and to control delivery of suspended sediment and other pollutants to nearby surface water. This practice is initiated during the planning phase and applied during project implementation and operation.

This BMP contains practices for managing erosion and stormwater discharge that are generally applicable for any project that involves ground disturbance, including developed recreation, mineral exploration and production sites, pipelines, water developments, etc., and should be used for all such projects.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Obtain Clean Water Act (CWA) 402 stormwater discharge permit coverage from the appropriate State agency or the U.S. Environmental Protection Agency (EPA) when more than 1 acre of land will be disturbed through construction activities.
- Obtain CWA 404 permit coverage from the U.S. Army Corps of Engineers when dredge or fill material will be discharged to waters of the United States.
- Establish designated areas for equipment staging, stockpiling materials, and parking to minimize the area of ground disturbance (see BMP Road-9 [Parking Sites and Staging Areas] and BMP Road-10 [Equipment Refueling and Servicing]).

- Establish and maintain construction area limits to the minimum area necessary for completing the project and confine disturbance to within this area.
- Develop and implement an erosion control and sediment plan that covers all disturbed areas, including borrow, stockpile, fueling, and staging areas used during construction activities.
- Calculate the expected runoff generated using a suitable design storm to determine necessary stormwater drainage capacity.
  - Use site conditions and local requirements to determine design storm.
  - Include run-on from any contributing areas.
- Refer to State or local construction and stormwater BMP manuals, guidebooks, and trade publications for effective techniques to:
  - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion during construction or before the next growing season.
  - Maintain the natural drainage pattern of the area wherever practicable.
  - Control, collect, detain, treat, and disperse stormwater runoff from the site.
  - Divert surface runoff around bare areas with appropriate energy dissipation and sediment filters.
  - Stabilize steep excavated slopes.
- Develop and implement a postconstruction site vegetation plan using suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per Forest Service Manual (FSM) 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Do not use snow or frozen soil material in facility construction.
- Schedule, to the extent practicable, construction activities to avoid direct soil and water disturbance during periods of the year when heavy precipitation and runoff are likely to occur.
  - Limit the amount of exposed or disturbed soil at any one time to the minimum necessary to complete construction operations.
  - Limit operation of equipment when ground conditions could result in excessive rutting, soil puddling, or runoff of sediments directly into waterbodies.
- Install suitable stormwater and erosion control measures to stabilize disturbed areas and waterways before seasonal shutdown of project operations or when severe or successive storms are expected.
- Use low-impact development practices where practicable.
- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning.
  - Prepare for unexpected failures of erosion control measures.
  - Implement corrective actions without delay when failures are discovered to prevent pollutant discharge to nearby waterbodies.
- Routinely inspect construction sites to verify that erosion and stormwater controls are implemented and functioning as designed and are appropriately maintained.
- Use suitable measures in compliance with local direction to prevent and control invasive species.

Fac-3. Potable Water Supply Systems

Manual or Handbook Reference Manual or Handbook Reference: FSM 7420 and FSH 7409.11, chapter 40.

Objective Provide potable water supplies of sufficient quality and quantity to support the use at facilities.

Explanation Many facilities provide potable water from a surface water or groundwater source. Water systems should supply an adequate volume of acceptably clean water as needed by the facility. A water system is comprised of collection, treatment, storage, and distribution facilities. Water systems are classified into categories (e.g., public versus nonpublic, community versus noncommunity, and transient versus nontransient) based on ownership, size, and permanence of the population served. Regulations are based on these different categories. Management requirements and controls to protect drinking water quality and provide potable water are incorporated into each facility's operation and maintenance plan (FSM 7410).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Develop water systems only in places where the water source can be protected.
- Develop groundwater wells and facilities in a manner that reduces the potential of groundwater aquifer contamination in accordance with BMP WatUses-2 (Water Wells for Production and Monitoring).
- Use applicable practices of BMP WatUses-3 (Administrative Water Developments) and BMP WatUses-4 (Water Diversions and Conveyances) to manage surface diversions.
- Operate, monitor, and manage Forest Service-owned (public and nonpublic) drinking water systems in accordance with direction in FSM 7420.
    - Design, construct, operate, and maintain water systems in a manner that provides for physical protection of the water source and system.
    - Treat water as necessary to achieve desired water quality.
    - Conduct sanitary and condition surveys per required schedules.
    - Implement follow-up actions identified in the sanitary and condition surveys.
    - Minimize possible contaminating activities within Wellhead Protection Areas and Source Water Assessment Areas to protect drinking water sources.
    - Conduct required system monitoring and follow-up actions as needed.
- Perform water supply and system disinfection activities in a manner such that disinfectant residuals and byproducts will not affect nearby surface water or groundwater.
- Ensure that permit holder-owned and other authorized drinking water systems on NFS lands are operated and maintained according to direction in FSM 7423.

Fac-4. Sanitation Systems

Manual or Handbook Reference FSM 2330; FSM 7430; and FSH 7409.11, chapter 50.

Objective Avoid, minimize, or mitigate adverse effects to soil and water quality from bacteria, nutrients, and other pollutants resulting from collection, transmission, treatment, and disposal of sewage and wastewater at facilities.

Explanation Sanitation systems at facilities vary from a portable toilet to a sophisticated treatment plant. Facilities also may have wastewater systems for showers and washbasins. The type of sanitation system at a facility depends on the purpose and capacity of the site, available and needed infrastructure, Forest Service policy, and State or local regulations. Bacteria, nutrients, and other contaminants from sanitation systems can enter surface water or groundwater if the system is not properly designed and operated. Facilities are required to comply with State and local public health and sanitation ordinances. Management requirements and controls to minimize the possibility of water contamination from wastewater collection, treatment, and disposal are incorporated into each facility's operation and maintenance plan (FSM 7410).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use qualified personnel to locate, design, inspect, operate, maintain, and manage sanitation systems.
- Coordinate all phases of sanitation system management (planning, design, installation, inspection, operation, and maintenance) with appropriate State and local agencies to ensure compliance with applicable regulations.
- Design and operate waste collection, treatment, and disposal systems appropriate for the type and volume of waste generated at the site consistent with direction in FSH 7409.11, chapter 50.
- Follow applicable regulations and guidelines when locating toilets, wastewater disposal, and leach fields.
    - Use suitable setback distances from water bodies or other sensitive areas when siting facilities.
    - Use proper field investigations and soil tests to determine suitable soils for onsite treatment and disposal systems.
- Prepare and maintain an operation and maintenance plan for all waste treatment or disposal facilities (FSM 7410).
    - Inspect vaults, septic tanks, and other wastewater systems at regular intervals to ensure that capacities are not exceeded and that the system is functioning properly and in compliance with applicable State and local regulations.
    - Implement follow-up actions identified in the inspections as needed to ensure that the system is working properly.
    - Include procedures in operation and maintenance plans to contain or avoid releases of pollutants in floods or other emergencies.
- Ensure that permit holder-owned and other authorized sanitation systems on NFS lands are operated and maintained according to applicable regulations and direction.

- ❑ Consider changes or improvements to existing sanitary systems that may be causing water quality impacts, such as poorly located pit toilets or drain fields, at opportune times such as facility remodeling or change in facility ownership or control.

Fac-5. Solid Waste Management

Manual or Handbook Reference FSM 2130; FSM 7460; and FSH 7409.11, chapter 80.

Objective Avoid, minimize, or mitigate adverse effects to water quality from trash, nutrients, bacteria, and chemicals associated with solid waste management at facilities.

Explanation Uncollected garbage and trash at developed facilities can contaminate water by introducing nutrients, bacteria, or chemicals to the water. Trash can be blown about by the wind or carried by runoff into waterbodies. In addition, uncollected garbage can attract wildlife, which are looking for an easy meal, to the facility.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Develop a Solid Waste System consistent with direction in FSM 7460 and FSH 7409.11, chapter 80 that defines and describes collection, transportation, storage, and final disposal methods for solid waste generated at facilities.
- Use suitable public relations and information tools and enforcement measures to encourage the public to use proper solid waste disposal measures.
    - ❑ Encourage recycling of materials where practicable.
    - ❑ Encourage the public to "pack it in-pack it out" in areas where practicable.
- Provide receptacles for trash at developed facilities.
    - ❑ Place trash and recycling receptacles in areas that are convenient to the facility's users.
    - ❑ Place trash and recycling receptacles in locations away from waterbodies.
    - ❑ Provide receptacles that discourage wildlife foraging as suitable for the area (e.g., bears, raccoons, birds) and suitably confine materials until collected.
    - ❑ Collect trash on a routine schedule to prevent the receptacles from overflowing.
- Dispose of collected garbage at properly designed and operated municipal-, county-, or State-authorized sanitary landfills or waste recycling sites where groundwater and surface water are adequately protected.
- Obtain necessary State or local permits for solid waste disposal sites.

Fac-6. Hazardous Materials

Manual or Handbook Reference 40 CFR 112; FSM 2160; and FSH 2109.14, chapter 60.

Objective Avoid or minimize short- and long-term adverse effects to soil and water resources by preventing releases of hazardous materials.

Explanation Constructing and operating facilities often involve the storage and use of hazardous materials. Improper storage and use can contaminate nearby soils and surface water or groundwater resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Ensure that all employees involved in the use, storage, transportation, and disposal of hazardous materials receive proper training.
- Limit the acquisition, storage, and use of hazardous, toxic, and extremely hazardous substances to only those necessary and consistent with mission requirements.
- Manage the use, storage, discharge, or disposal of pollutants and hazardous or toxic substances generated by the facility in compliance with applicable regulations and requirements.
- Monitor underground storage tanks and promptly address leaking tanks in consultation with the proper officials at State and Federal regulatory agencies.
- Construct and install new tanks in accordance with Federal, State, and local regulations.
    - Ensure that existing tanks meet performance standards for new tanks, meet upgrade requirements, or are taken out of service.
- Prepare a certified Spill Prevention Control and Countermeasure (SPCC) Plan for each facility as required by 40 CFR 112.
    - Install or construct the containment features or countermeasures called for in the SPCC Plan to ensure that spilled hazardous materials are contained and do not reach groundwater or surface water.
    - Ensure that cleanup of spills and leaking tanks is completed in compliance with Federal, State, and local regulations and requirements.
- Respond to hazardous materials releases or spills using the established site-specific contingency plan for incidental releases and the Emergency Response Plan for larger releases.
    - Train employees to understand these plans; the materials involved; and their responsibilities for safety, notification, containment, and removal.
    - Provide adequate communication to all downstream water users, such as municipal drinking water providers and fish hatcheries, as necessary.
- Ensure that hazardous spill kits are adequately stocked with necessary supplies and are maintained in accessible locations.

Fac-7. Vehicle and Equipment Wash Water

Manual or Handbook Reference None known.

Objective Avoid or minimize contamination of surface water and groundwater by vehicle or equipment wash water that may contain oil, grease, phosphates, soaps, road salts, other chemicals, suspended solids, and invasive species.

Explanation Washing vehicles and equipment is a common method used to maintain vehicles and minimize the spread of noxious and invasive species. Wash water and the resulting residue removed from vehicles and equipment may contain oils, chemicals, or sediment harmful to water and aquatic resources if not properly contained and treated. Work centers, ranger stations, fire stations, and other facilities may have washing equipment and locations designated for cleaning fleet or contracted vehicles and equipment. Temporary wash locations may also be installed during incident management or project work.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use commercial washing facilities that have proper wastewater treatment systems whenever possible.
  - Maintain a list of appropriate wash stations in the local area and provide the list to local offices, permit holders, and contractors.
- Install temporary wash sites only in areas where the water and residue can be adequately collected and either filtered on site or conveyed to an appropriate wastewater treatment facility.
  - Consider the use of a portable vehicle washer system, such as that designed by the Missoula Technology and Development System, to contain and filter the wash water.
  - Locate temporary wash sites out of AMZs, wetlands, groundwater recharge areas, floodplains, and other environmentally sensitive areas.
  - Use suitable measures to treat and infiltrate wash water to comply with applicable surface water and groundwater protection regulations.

Fac-8. Nonrecreation Special Use Authorizations

Manual or Handbook Reference FSM 2720 and FSH 2709.11, chapters 40 and 50.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from physical, chemical, and biological pollutants resulting from activities under nonrecreation special use authorizations.

Explanation This BMP covers all nonrecreation special use activities with the exceptions of pipelines; transmission facilities and other rights-of-ways; and water diversions, storage, and conveyance. BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Way), BMP WatUses-4 (Water Diversions and Conveyances), and BMP WatUses-5 (Dams and Impoundments) are provided for those activities.

The Forest Service role in defining and requiring the use of BMPs occurs during the development of the special use authorization and administration of the use. Discussions between the Forest Service and the permit holder concerning soil, water quality, and riparian resource impacts and appropriate BMPs to use should occur at the time of permit development or renewal. The special use authorization operation and maintenance plan details the conditions that must be met, including management requirements and mitigation measures to protect water quality. The permit holder will be required to conform to all applicable Federal, State, and local regulations and land management plan direction governing water resource protection and sanitation. State or Federal law may require that the permit holder obtain a pollution discharge permit or other authorization from a State, regional, or local government entity. Authorized uses often cover a wide range of activities and may require that BMPs from several management activity categories be included in the authorization.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Include in the authorization operation and maintenance plan the appropriate BMPs to control nonpoint source pollution from ground-disturbing activities, chemical use, and other activities that may adversely affect the physical, chemical, or biological integrity of surface water or groundwater.
- Update existing special use authorizations and operation and maintenance plans during annual renewal, or the next renewal, to be consistent with current requirements.
- Administer authorizations per the direction in FSM 2720 and FSH 2709.11 to ensure that water quality related terms and conditions are met.

Fac-9. Pipelines, Transmission Facilities, and Rights-of-Way

Manual or Handbook Reference FSM 2726 and FSH 2709.11, chapter 50.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during the construction and maintenance of pipelines, powerlines, transmission facilities, and other rights-of-way.

Explanation Powerlines and pipelines are constructed on NFS land by both public and private agencies under either an easement or special use authorization. Impacts to soil and water resources during transmission corridor and pipeline construction and maintenance include those originating from directional drilling, pipeline testing, soil disturbance, and erosion associated with vegetation removal and road construction. Other water quality impacts could occur from natural events, inappropriate or unauthorized activities, chemical spills, herbicide use, and other maintenance activities.

Measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources should be incorporated in the authorization terms and conditions, project plans for construction and design, and the right-of-way management plans for ongoing maintenance of vegetation along the corridor.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Consider soil and water impacts from factors such as stream head cutting and channel expansion, stream crossings, slope stability and steepness, and amount of riparian area, floodplain, and wetland acreage to be disturbed when determining corridor location.
  - ❑ Co-locate pipelines and transmission lines with roads or their rights-of-way where practicable.
  - ❑ Limit corridor disturbance, particularly in or near AMZs, surface waters, shallow groundwater, unstable areas, hydric soils, or wetlands.
- Consider service road location and standards, type of construction equipment (wheeled, tracked, and helicopter), size and location of footings and guy anchors, and revegetation requirements during project design.
  - ❑ Use applicable BMPs for Mechanical Vegetation Management Activities when using mechanical treatments to remove vegetation from the project corridor.
  - ❑ Use applicable practices of BMP Road-2 (Road Location and Design) for planning access roads.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control), BMP Road-3 (Road Construction and Reconstruction), and BMP Road-7 (Stream Crossings) when constructing pipelines, powerlines, and transmission facilities and associated roads.
- Use design and construction measures that sustain long-term wetland or stream function when a buried transmission line, pipeline, or tower support must be placed in a wetland or cross a stream (see BMP AqEco-2 [Operations in Aquatic Ecosystems]).
    - Use suitable measures for pipeline thickness, corrosion prevention, pipeline casing, cathodic protection and pipeline valves, and shut-off systems to prevent or minimize spills or leaks where pipelines cross waterbodies.
- Require suitable and regular inspections, testing, and leak detection systems to identify and mitigate pipeline deformities and leaks.
    - Use applicable practices of BMP WatUses-3 (Administrative Water Developments) and BMP Min-7 (Produced Water) when obtaining or disposing of water used for hydraulic testing of pipelines on NFS lands.
- Ensure that pipelines corridors, transmission lines, facilities, and other rights-of-ways are properly maintained to minimize damage to NFS resources in the event of an accident or natural disturbance.
    - Use applicable practices of BMP Fac-6 (Hazardous Materials), including preparation of an adequate Spill and Emergency Response Plan for pipelines carrying toxic or hazardous materials.
    - Use applicable BMPs for Mechanical Vegetation Management Activities when using mechanical treatments to manage vegetation within the corridor.
    - Use applicable BMPs for Chemical Use Activities when using chemicals for corridor maintenance or pipeline testing.
    - Use applicable practices of BMP Road-4 (Road Maintenance and Operations) for maintenance of access roads.
- Aggressively address unauthorized uses of the corridor, such as motorized vehicle use, that are exposing soils, increasing erosion, or damaging the facilities.

Fac-10. Facility Site Reclamation

Manual or Handbook Reference FSM 2020.

Objective Reclaim facilities and surrounding disturbed areas to as near to the predisturbed condition as is reasonably practicable following closure or completion of operations, or as necessary for mitigation purposes, to avoid, minimize, or mitigate long-term adverse effects to soil, water quality, and riparian resources.

Explanation Abandoned structures and wastes, particularly hazardous materials, at facility sites may pose a safety risk to the public. Lack of ongoing maintenance of facility sites can also threaten surface water and groundwater quality via erosion and chemical leaks as they fall into disrepair. Facility sites should be closed and reclaimed after the need for it ends or the recurrent impacts to resources indicate the site cannot be properly managed with available resources. Heavily used recreation sites will cause some areas to become denuded and compacted. These disturbed sites may become unstable and begin to erode at accelerated rates if not stabilized. Reestablishing stable grades, functional drainages, some level of site infiltration capacity, and effective ground cover on terrestrial sites and stabilizing substrates impacted by water flow or wave action are necessary to rehabilitate disturbed areas to avoid or minimize water quality and riparian resource degradation. Disturbances in and immediately adjacent to surface waters, riparian areas, and wetlands should be the highest priority for reclamation or rehabilitation.

Practices

Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Regularly review the need for and use of stockpiles, materials, supplies, and facilities.
- Surplus, repurpose, or recycle unneeded usable materials where practicable.
  - Dispose of unneeded materials through the appropriate solid waste handlers.
  - Consult the forest pollution prevention coordinator for proper disposal of hazardous materials.
- Develop and implement a reclamation plan to rehabilitate and restore, to the extent practicable, the natural ecological components, structures, and processes consistent with land management plan desired conditions, goals, and objectives at sites where structures or facilities have been permanently removed.
  - Remove unneeded structures.
  - Re-establish original slope contours, surface, and subsurface hydrologic pathways where practicable and as opportunities arise.
  - Improve infiltration capacity on compacted areas of the site.
  - Establish effective ground cover on disturbed sites to avoid or minimize accelerated erosion and soil loss.
  - Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - Stabilize disturbed streambed and banks (see BMP AqEco-4 [Stream Channels and Shorelines]).
  - Reconstruct or restore stream channels, wetlands, floodplains, and riparian areas to achieve desired conditions for aquatic ecosystem composition, structure, function, and processes (see BMP AqEco-3 [Ponds and Wetlands] and BMP AqEco-4 [Stream Channels and Shorelines]).
- Decommission unneeded roads, trails, and staging areas (see BMP Roads-6 [Road Storage and Decommissioning]).
- Consider long-term management of the site and nearby areas to promote project success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to allow for recovery of vegetation.

Resources for Facilities and Nonrecreation Special Uses Management Activities

Low Impact Development U.S. Environmental Protection Agency (EPA), Office of Water. Information and other resources on low impact development are available at http://water.epa.gov/polwaste/green/index.cfm.

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Otis, R.; Kreissl, J.; Frederick, R.; Goo, R.; Casey, P.; Tonning, B; et al. 2002. Onsite wastewater treatment systems manual. EPA 625-R-00-008. Washington, DC: EPA, Office of Water and Office of Research and Development. 367 p. Available at http://www.epa.gov/owm/septic/pubs/septic_2002_osdm_all.pdf.

Stormwater EPA, Office of Water. Website with national menu of stormwater BMPs. Available at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm.

EPA, Office of Water. Website with stormwater pollution prevention plans for construction activities. Available at http://cfpub.epa.gov/npdes/stormwater/swppp.cfm.

EPA, Region 10. Web site with State stormwater BMP manuals. Available at http://yosemite.epa.gov/R10/WATER.NSF/0/17090627a929f2a488256bdc007d8dee?OpenDocument.

Water Environment Research Foundation; American Society of Civil Engineers; EPA; U.S. Department of Transportation, Federal Highways Administration; American Public Works Association. International stormwater BMP Database. Available at http://www.bmpdatabase.org.

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Snodgrass, K. 2007. Water use in Forest Service recreation areas: Guidelines for water system designers. 0773-2326-MTDC. Missoula, MT: USDA Forest Service, Technology and Development Program. 10 p. Available at http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm07732326/index.htm.

Wildland Fire Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from wildland fire management activities. Common wildland fire management operations include using prescribed fire, managing wildfire using a wide range of strategies from monitoring to aggressive control and suppression, and rehabilitating fire and suppression damage.

Firefighter and public safety is always the first priority in wildland fire activities. Implementation of BMPs to protect soil, water quality, and riparian resources, though important, must not compromise public or firefighter safety in wildland fire situations.

Four National Core BMPs are in the Wildland Fire Management Activities category. These BMPs are to be used during all wildfire management activities on National Forest System (NFS) lands. BMP Fire-1 (Wildland Fire Management Planning) is a planning BMP for wildland fire management at the land management-plan scale and at the project scale. BMP Fire-2 (Use of Prescribed Fire) provides direction for water quality protection during prescribed fire treatments. BMP Fire-3 (Wildland Fire Control and Suppression) provides guidance for avoiding or minimizing effects to soil, water quality, and riparian resources to the extent practicable during wildland fire suppression activities. BMP Fire-4 (Wildland Fire Suppression Damage Rehabilitation) has practices for rehabilitating fire lines, fire camps, staging areas, and burned areas.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Wildland Fire Management BMPs	
Fire-1	Wildland Fire Management Planning
Fire-2	Use of Prescribed Fire
Fire-3	Wildland Fire Control and Suppression
Fire-4	Wildland Fire Suppression Damage Rehabilitation

Fire-1. Wildland Fire Management Planning

Manual or Handbook Reference Forest Service Manual (FSM) 5120; FSM 5150; and Forest Service Handbook (FSH) 5109.19, chapter 50.

Objective Use the fire management planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during wildland fire management activities.

Explanation Wildland fire is an essential ecological process and natural change agent for many vegetation communities and habitat types on NFS lands. The role of wildland fire is incorporated into the land management planning process through goals and objectives, desired conditions, standards, and guidelines in the land management plan. A forest or grasslands' fire management plan (FMP) describes the objectives and constraints to manage prescribed fires and wildfires within the context of the land management plan. The FMP is used to assist in developing the response to a wildland fire and is supplemented by operational plans.

Prescribed fire may be used to achieve a number of resource management objectives. These fires may occur across variously sized patches, from small slash piles to very large, landscape-scale broadcast burns. Properly planned and executed, these treatments can be very effective at managing natural resources while avoiding or minimizing adverse effects to soil, water quality, and riparian resources. A Prescribed Fire Burn Plan describes why the fire is needed, what the fire will accomplish, when conditions will permit achievement of desired effects, how specific fire application will occur, and how the progress and results will be monitored and evaluated. Soil and water protection objectives and measures should be written into the prescribed fire prescription.

Wildfires caused by natural ignition sources are managed to achieve a full range of land management plan objectives including protection and enhancement of resources. The decision to manage a wildfire for enhancement of resource objectives is made when the fire starts based on the objectives and constraints outlined in the land management plan. These fires cannot be planned beyond land management plan direction that determines areas where protection will be the only objective versus areas where enhancement of other resources may be considered as well. Watershed resource considerations may be incorporated into all wildfires, but objectives to manage the fire for beneficial effects may only be applied where authorized by the land management plan.

Practices

Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Land Management Plans

- Consider the beneficial and adverse effects of wildland fire on water quality and watershed condition when developing desired conditions and goals for the plan area.
  - Identify areas where the adverse effects of unplanned wildland fire to water quality and watershed condition outweigh the benefits.
- Include plan objectives and strategies that allow the use of wildland fire where suitable to restore watershed conditions.
- Include design criteria, standards, and guidelines for fire management activities to avoid or minimize adverse effects to soil, water quality, and riparian resources (see BMP Fire-2 [Use of Prescribed Fire] and BMP Fire-3 [Wildland Fire Control and Suppression]).
- Consider the need to establish a network of permanent water sources in the plan area for fire control and suppression (see BMP WatUses-3 [Administrative Water Developments]).

Prescribed Fire Plan

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning prescribed fire treatments.
- Consider prescription elements and ecosystem objectives at the appropriate watershed scale to determine the optimum and maximum burn unit size, total burn area, burn intensity, disturbance thresholds for local downstream water resources, area or length of water resources to be affected, and contingency strategies.
  - Consider the extent, severity, and recovery of fire disturbance a watershed has experienced in the past to evaluate cumulative effects and re-entry intervals.
- Identify environmental conditions favorable for achieving desired condition or treatment objectives of the site while minimizing detrimental mechanical and heat disturbance to soil and water considering the following factors.

- Existing and desired conditions for vegetation and fuel type, composition, structure, distribution, and density.
- Short- and long-term site objectives.
- Acceptable fire weather parameters.
- Desirable soil, duff, and fuel moisture levels.
- Existing duff and humus depths.
- Site factors such as slope and soil conditions.
- Expected fire behavior and burn severity based on past burn experience in vegetation types in the project area.
- Extent and condition of roads, fuel breaks, and other resource activities and values.

- Develop burn objectives that avoid or minimize creating water-repellent soil conditions to the extent practicable considering fuel load, fuel and soil moisture levels, fire residence times, and burn intensity.
  - Use low-intensity prescribed fire on steep slopes or highly erodible soils when prescribed fire is the only practicable means to achieve project objectives in these areas.
- Set target levels for desired ground cover remaining after burning based on slope, soil type, and risk of soil and hillslope movement.
- Plan burn areas to use natural or in-place barriers that reduce or limit fire spread, such as roads, canals, utility rights-of-way, barren or low fuel hazard areas, streams, lakes, or wetland features, where practicable, to minimize the need for fireline construction.
  - Identify the type, width, and location of firebreaks or firelines in the prescribed fire plan.
- Use fire initiation techniques, control methods, and access locations for ignition and control (holding versus escape conditions) that minimize potential effects to soil, water quality, and riparian resources.
- Use prescribed fire in the AMZ only when suitable to achieve long-term AMZ-desired conditions and management objectives (see BMP Plan-3 [AMZ Planning]).

Fire-2. Use of Prescribed Fire

Manual or Handbook Reference FSM 5140.

Objective Avoid, minimize, or mitigate adverse effects of prescribed fire and associated activities on soil, water quality, and riparian resources that may result from excessive soil disturbance as well as inputs of ash, sediment, nutrients, and debris.

Explanation Prescribed fire, while a useful tool to achieve resource management objectives, can affect watershed condition by consuming vegetation, dead woody debris, humus, and duff; removing protective ground cover; contributing to creation of water-repellent soil conditions; damaging physical and biological soil quality from excessive heat; and releasing nutrients and metals to runoff into nearby streams. A prescribed fire may burn at a range of intensities, leaving a mosaic of burn severities within the fire perimeter. Actions to control and contain the prescribed fire, such as fireline construction, can also adversely affect watershed condition by creating a ground disturbance.

A Prescribed Fire Burn Plan guides the management of a prescribed fire. This plan contains the technical specifications for managing the fire and protecting other resources. Fire managers review these plans before fire ignition, briefing field crewmembers on practices and locations prescribed to avoid or minimize adverse effects to soil, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Conduct the prescribed fire in such a manner as to achieve the burn objectives outlined in the Prescribed Fire Plan (see BMP Fire-1 [Wildland Fire Management Planning]).
- Locate access and staging areas near the project site but outside of AMZs, wetlands, and sensitive soil areas.
  - Keep staging areas as small as possible while allowing for safe and efficient operations.
  - Store fuel for ignition devices in areas away from surface water bodies and wetlands.
  - Install suitable measures to minimize and control concentrated water flow and sediment from staging areas.
  - Collect and properly dispose of trash and other solid waste.
  - Restore and stabilize staging areas after use (see BMP Veg-6 [Landings]).
- Conduct prescribed fires to minimize the residence time on the soil while meeting the burn objectives.
  - Manage fire intensity to maintain target levels of soil temperature and duff and residual vegetative cover within the limits and at locations described in the prescribed fire plan.
- Construct fireline to the minimum size and standard necessary to contain the prescribed fire and meet overall project objectives.
  - Locate and construct fireline in a manner that minimizes erosion and runoff from directly entering waterbodies by considering site slope and soil conditions, and using and maintaining suitable water and erosion control measures.
  - Consider alternatives to ground-disturbing fireline construction such as using wet lines, rock outcrops, or other suitable features for firelines.
  - Establish permanent fireline with suitable water and erosion control measures in areas where prescribed fire treatments are used on a recurring basis.
  - Maintain firebreaks in a manner that minimizes exposed soil to the extent practicable.
  - Rehabilitate or otherwise stabilize fireline in areas that pose a risk to water quality.
- Alter prescribed fire prescriptions and control actions in the AMZs as needed to maintain ecosystem structure, function, and processes and onsite and downstream water quality.
  - Pretreat AMZs and drainage ways to reduce excessive fuel loadings.
  - Avoid building firelines in or around riparian areas, wetlands, marshes, bogs, fens, or other sensitive water-dependent sites unless needed to protect life, property, or wetlands.
  - Construct any essential fireline in the AMZ in a manner that minimizes the amount of area and soil disturbed.
  - Keep high-intensity fire out of the AMZ unless suitable measures are used to avoid or minimize adverse effects to water quality.

- Avoid or minimize complete removal of the organic layer when burning in riparian areas or wetlands to maintain soil productivity, infiltration capacity, and nutrient retention.
- Rehabilitate fireline in the AMZ after prescribed fire treatment is completed.
- Remove debris added to stream channels as a result of the prescribed burning unless debris is prescribed to improve fisheries habitat.

- Conduct prescribed fire treatments, including pile burning, for slash disposal in a manner that encourages efficient burning to minimize soil impacts while achieving treatment objectives.
  - Pile and burn only the slash that is necessary to be disposed of to achieve treatment objectives.
  - Locate slash piles in areas where the potential for soil effects is lessened (meadows, rock outcrops, etc.) and that do not interfere with natural drainage patterns.
  - Remove wood products such as firewood or fence posts before piling and burning to reduce the amount of slash to be burned.
  - Minimize the amount of dirt or other noncombustible material in slash piles to promote efficient burning.
  - Construct piles in such a manner as to promote efficient burning.
  - Avoid burning large stumps and sections of logs in slash piles to reduce the amount of time that the pile burns.
  - Avoid burning when conditions will cause the fire to burn too hot and damage soil conditions.
  - Avoid piling and burning for slash removal in AMZs to the extent practicable.
  - Minimize effects on soil, water quality, and riparian resources by appropriately planning pile size, fuel piece size limits, spacing, and burn prescriptions in compliance with State or local laws and regulations if no practical alternatives for slash disposal in the AMZ are available.
- Evaluate the completed burn to identify sites that may need stabilization treatments or monitoring to minimize soil and site productivity loss and deterioration of water quality both on and off the site.
  - Provide for rapid revegetation of all denuded areas through natural processes supplemented by artificial revegetation where necessary.
  - Use suitable measures to promote water retention and infiltration or to augment soil cover where necessary.
  - Use suitable species and establishment techniques to stabilize the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - Clear streams and ditches of debris introduced by fire control equipment during the prescribed fire operation.
  - Consider long-term management of the site and nearby areas to promote project success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to allow for recovery of vegetation.

Fire-3. Wildland Fire Control and Suppression

Manual or Handbook Reference FSM 5130.

Objective Avoid or minimize adverse effects to soil, water quality, and riparian resources during fire control and suppression efforts.

Explanation Wildland fire control and suppression activities are aimed at stopping and extinguishing the fire and often occur without full knowledge of potential effects to soil, water quality, or riparian resources. Suppression activities include constructing fire line and temporary access roads, opening closed or access-limited system roads, clearing and grubbing safety zones, falling hazard trees, retrieving water and applying it to the fire, performing back-fire operations, and applying aerial or ground-based fire retardant. Soil disturbance and loss of ground cover from these activities can lead to accelerated erosion and sediment delivery to waterbodies. Certain fire retardant formulations are toxic to aquatic fauna, including fish. Water quality objectives are included in strategic and tactical fire management plans, but are secondary to firefighter and public safety during suppression activities.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Assign a watershed resource advisor, or team of watershed resource advisors, to work with incident management teams to minimize damage to soil, water quality, and riparian resources from fire and fire control and suppression activities.
- Locate Incident Command Post, air resource bases, staging areas, and other fire management support areas outside of the AMZ and at a suitable distance from waterbodies to minimize the potential for adverse effects to water quality.
  - ❑ Protect surface and subsurface water resources from nutrients, bacteria, and chemicals associated with solid waste and sewage disposal.
  - ❑ Collect and properly dispose of trash and other solid waste.
  - ❑ Use applicable practices of BMP Road-10 (Equipment Refueling and Servicing) when servicing, refueling, and cleaning vehicles and equipment.
  - ❑ Install suitable measures to minimize and control concentrated water flow and sediment from support areas.
- Use Minimum Impact Suppression Tactics during wildland fire control and suppression activities when and where practicable considering the appropriate management response and land management plan direction.
- Use preexisting features for safety zones as practicable to avoid unnecessary ground disturbance.
- Construct fireline to the minimum size and standard necessary to contain the fire and meet overall resource objectives.
  - ❑ Locate and construct fireline in a manner that minimizes erosion and runoff from directly entering waterbodies by considering site slope and soil conditions, and using and maintaining suitable water and erosion control measures.
  - ❑ Avoid building firelines in or around riparian areas, wetlands, marshes, bogs, fens, or other sensitive water-dependent sites unless needed to protect life or property.

- Use natural or in-place barriers that reduce or limit fire spread, such as roads, canals, utility rights-of-way, barren or low fuel hazard areas, streams, lakes, or wetland features as firelines where practicable, to minimize the need for fireline construction.

- Use suitable measures to prevent or minimize runoff, erosion, and sediment delivery to waterbodies when using water for fire suppression activities.
- Use suitable measures, consistent with current Forest Service policy, to minimize adverse effects to water quality when applying fire retardant or foam.
  - Use fire retardant formulations that are least toxic to aquatic flora and fauna and shift to less lethal formulations as they become available and affordable.
  - Avoid, to the extent practicable, aerial application of fire retardant or foam within a buffer area around waterbodies of sufficient size to minimize the potential for entry into the waterbody.
- Conduct water drafting at suitable locations and in a manner that avoids or minimizes adverse effects to water quality (see BMP WatUses-3 [Administrative Water Developments]).
- Evaluate the need to close or restrict use of surface and shallow groundwater resources following fire control activities that may have adversely affected water quality.

Fire-4. Wildland Fire Suppression Damage Rehabilitation

Manual or Handbook Reference FSM 2523.4.

Objective Rehabilitate watershed features and functions damaged by wildland fire control and suppression-related activities to avoid, minimize, or mitigate long-term adverse effects to soil, water quality, and riparian resources.

Explanation Fire suppression and related activities can damage watershed features and functions by removing vegetation, exposing soil, and disrupting flow pathways. Corrective treatments are used to stabilize soil, control surface runoff and erosion, reduce flood potential, and stabilize the drainage network in areas directly affected by fire suppression and related activities. Fire incident management teams (IMTs) are responsible for rehabilitation of fireline, spike camps, roads, and other sites created and used to control and suppress the fire, where necessary, to protect resources. Resource advisors may assist the IMT in determining the sites in need of treatment as well as suitable corrective actions. Areas affected by the fire itself may require additional rehabilitation, including emergency treatments, (e.g., Burned Area Emergency Response [BAER] program) to protect watershed resources. These activities may be initiated by the affected management unit immediately following the fire or during a period of years after the fire to achieve desired objectives.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Conduct emergency stabilization assessments of fire damage that produces hazards to life or property as needed in accordance with BAER policy (FSM 2523 and FSH 2509.13).
- Reclaim and stabilize disturbed areas including safety zones, fireline, and base camps that have increased erosion potential or drainage patterns altered by fire suppression activities.
  - Reshape the ground surface and install suitable drainage features to promote dispersed runoff from the site.

- Mitigate soil compaction to improve infiltration and revegetation conditions.
- Use suitable species and establishment techniques to stabilize the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

- Repair roads, trails, and other facilities damaged by suppression activities that may adversely affect water quality and riparian resources.
  - Repair damaged road and trail drainage structures and conveyances to a condition where they can function as designed (See BMP Road-3 [Road Construction and Reconstruction] and BMP Road-4 [Road Operations and Maintenance]).
  - Reconstruct roads damaged by mechanized equipment to stabilize the road prism and running surface (See BMP Road-3 [Road Construction and Reconstruction]).
  - Close or decommission roads opened for access in a condition that reduces the risk of adverse effects to hydrologic function and water quality (see BMP Road-6 [Road Storage and Decommissioning]).
  - Repair and clear debris from water conveyance structures, such as ditches, to reduce the potential for failures and subsequent erosion.
- Clear suppression-created debris from critical points in streams channels to reduce the potential for flooding or bank erosion.
  - Remove debris and sediment from existing drainage structures.
  - Remove debris introduced by fire control equipment during fire suppression activities.
  - Remove dams used to construct pools for water drafting into engines.
- Evaluate the burned area to identify sites that may need rehabilitation treatments or monitoring to minimize soil and site productivity loss and deterioration of water quality both on and off the site.
  - Provide for rapid revegetation of critical denuded areas through natural processes supplemented by artificial soil surface cover or revegetation where necessary.
  - Prioritize needed treatments to rehabilitate AMZ structure, function, and processes before treating uplands.
  - Use suitable measures in compliance with local direction to prevent and control invasive species.

Resources for Wildland Fire Management Activities

Fire Retardant

U.S. Department of Agriculture (USDA), Forest Service, Fire and Aviation Management. 2011. National aerial application of fire retardant 2011 final environmental impact statement and associated documents. Washington, DC. Available at http://www.fs.fed.us/fire/retardant/eis_info.html.

USDA Forest Service; U.S. Department of the Interior, Bureau of Land Management, National Park Service, and Fish and Wildlife Service. 2000. Guidelines for aerial delivery of retardant or foam near waterways. 2 p. Available at http://www.fs.fed.us/fire/retardant/references/US_Forest_Service_et_al_2000_Guidelines_for_Aerial_Delivery.pdf.

Minimum Impact Suppression Tactics

National Wildfire Coordinating Group. 2010. Incident response pocket guide. PMS 461, NFES 1077. 130 p. Available at http://www.nwcg.gov/pms/pubs/nfes1077/nfes1077.pdf.

Wildland Fire Lessons Learned Center. Minimum impact suppression tactics guidelines. Tucson, AZ. 12 p. Available at http://wildfirelessons.net/documents/GB_MIST_Guidelines.pdf.

Prescribed Fire

Arkansas Forestry Commission. 2002. Arkansas forestry best management practices for water quality protection. Little Rock, AR. 60 p. Available at http://forestry.arkansas.gov/Services/ManageYourForests/Pages/bestManagementPractices.aspx.

USDA Natural Resources Conservation Service. National conservation practice standards—338 prescribed burning. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

U.S. Environmental Protection Agency, Office of Water. 2005. Chapter 3G: Fire management. In: National management measures to control nonpoint source pollution from forestry. EPA 841-B-05-001. Washington, DC. p. 3-89–3-92. Available at http://www.epa.gov/owow/nps/forestrymgmt/.

Water Sources

Napper, C. 2006. Water-source toolkit. 0625 1806. San Dimas, CA: USDA Forest Service, Technology and Development Program. 74 p. Available at http://www.fs.fed.us/eng/pubs/pdf/WaterToolkit/lo_res.shtml.

Sicking, L.P. 2002. Water ejectors for use in wildland firefighting. 0251 1205P. San Dimas, CA: USDA Forest Service, Technology and Development Program. 52 p. Available at http://www.fs.fed.us/eng/pubs/pdf/02511205.pdf.

Minerals Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from various mineral exploration, development, operation, and reclamation activities. Minerals on National Forest System (NFS) lands fall into four categories described in table 3.

Table 3.—*Categories of minerals on NFS lands.*

Locatable minerals (Forest Service Manual [FSM] 2810)	Metals and rare earth elements such as uranium. Uncommon varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay.
Leasable minerals (FSM 2820)	Oil and gas, coal, phosphate, potassium, sodium, sulphur, gilsonite, oil shale, and geothermal resources. Hardrock minerals located on acquired lands.
Mineral materials (FSM 2850)	Common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay.
Mineral reservations and outstanding rights (FSM 2830)	Reserved rights—private mineral rights retained in private owner conveyance. Outstanding rights—private mineral rights in deed restrictions for some tracts of acquired forest land.

In general, the Forest Service's objective for managing mineral and energy resources on NFS lands is to encourage and facilitate the orderly exploration, development, and production of these resources in an environmentally sound manner integrated with the management of other national forest resources. In addition, NFS lands disturbed by mineral activities are to be reclaimed for other productive uses (FSM 2802). The extent to which the Forest Service has the authority to regulate mineral operations and require measures to avoid, minimize, mitigate, and reclaim surface disturbance varies with the mineral commodity in question and status of the land on which it is located. In all cases where there appears to be a conflict between applicable law, regulation, and suggested BMPs, the law or regulation takes precedence.

Eight National Core BMPs are in the Minerals Management Activities category. These BMPs are to be used during all minerals management activities on NFS lands, to the extent allowed by Federal and State minerals development laws and regulations. BMP Min-1 (Minerals Planning) is a planning BMP for minerals management at the land management plan scale and project scale. Mineral exploration and production activities are similar for many of the minerals managed by the Forest Service. Practices for exploration activities are in BMP Min-2 (Minerals Exploration) and practices for production activities are in BMP Min-3 (Minerals Production). BMP Min-4 (Placer Mining) provides direction for extracting metals from alluvial deposits in or near stream channels. BMP Min-5 (Minerals Materials Resource Sites) provides direction for extracting aggregate materials from waterbodies and upland sites. BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) covers onsite storage and disposal of solid and liquid mine wastes. BMP Min-7 (Produced Water) provides direction for treatment and disposal of water produced at drilling sites. BMP Min-8 (Minerals Site Reclamation) provides direction for reclamation of mines and drilling sites.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Minerals Activities BMPs	
Min-1	Minerals Planning
Min-2	Minerals Exploration
Min-3	Minerals Production
Min-4	Placer Mining
Min-5	Mineral Materials Resource Sites
Min-6	Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds
Min-7	Produced Water
Min-8	Minerals Site Reclamation

Min-1. Minerals Planning

Manual or Handbook Reference FSM 2810, FSM 2820, FSM 2830, and FSM 2850.

Objective Use the minerals planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during minerals exploration, production, operations, and reclamation activities.

Explanation When minerals activities are proposed for NFS lands, the Forest Service conducts or participates in an analysis as required by the National Environmental Policy Act (NEPA) and the applicable approval or authorization procedures to comply with laws governing mineral disposal and environmental protection and to ensure consistency with the land management plan. During this analysis and approval process, the Forest Service consults and cooperates with other State and Federal agencies to identify the environmental impacts that will occur; to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources; and to determine reclamation needs and formulate appropriate bonding. These measures are implemented through the approved plan, contract, or other authorization.

Through the Bureau of Land Management (BLM), the U.S. Department of the Interior has the primary role in issuing mineral leases and permits and supervising operations for many mineral activities. The Forest Service coordinates with the BLM to ensure that land management plan resource management desired conditions, goals, and objectives are achieved; impacts to land surface resources are minimized or mitigated; and the affected land is promptly rehabilitated. Through the NEPA process the Forest Service and BLM make a determination as to whether an authorization or lease will be issued and identify stipulations needed to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning minerals activities.
- Identify potential environmental risks of the proposed minerals activities and include measures in project plans to manage risk by removing or eliminating the source of risk, changing the mining plan, or removing the resource at risk from harm's way.

- Inform proponent that a Clean Water Act (CWA) 402 permit may be required if the minerals operation causes a point source or stormwater discharge of any pollutant to waters of the United States.
- Inform proponent that a CWA 404 permit may be required if the mining operations will result in a discharge of dredge or fill material to waters of the United States.
- Evaluate plan of operations to ensure that reasonable measures, including appropriate BMPs, are included to avoid and minimize adverse effects to soil, water quality, and riparian resources from the mining activities.
    - Require suitable geotechnical or stability analyses to ensure that facilities are constructed to acceptable factors of safety using standard engineering practices and considering foundation conditions and material; construction materials and techniques; the seismicity of the area; and the water-related resources at risk.
    - Require suitable characterization of ore, waste rock, and tailings using accepted protocols to identify materials that have the potential to release acidity or other contaminants when exposed during mining.
    - Require suitable characterization of mine site hydrology commensurate with the potential for impacts to surface water and groundwater resources, to include physical and chemical characteristics of surface and groundwater systems, as needed, for the range of expected seasonal variation in precipitation and potential stormflow events likely to occur at the site for the duration of the minerals activities.
    - Stipulate suitable requirements, including water treatment as needed, to avoid or minimize the development and release of acidic or other contaminants.
    - Use applicable practices from the Minerals Management Activities BMPs.
    - Evaluate the consumptive use of water in the mining operation and its effect on water-dependent ecosystems.
    - Evaluate the potential for direct and indirect impacts to morphology, stability, and function of waterbodies, riparian areas, and wetland habitats.
    - Identify suitable measures to avoid impacts to waterbodies, riparian areas, and wetland habitats through appropriate location, design, operation, and reclamation requirements.
    - Identify suitable interim and post-project surface water and groundwater monitoring where needed to confirm predictions of impacts, detect adverse changes at the earliest practicable time, and develop appropriate changes in operations or recommend closure where needed.
    - Request a copy of operator's CWA 401 Certification from designated Federal, State, or local entity before approving a plan of operations that may result in any discharge into waters of the United States.
- As outlined in the Forest Service Training Guide for Reclamation Bond Estimation and Administration for Minerals Plans of Operation, consider the direct and indirect costs of stabilizing, rehabilitating, and reclaiming the area of mineral operations to the appropriate standards for water quality and watershed condition as determined from the land management plan, State and Federal laws, regulations, plans, or permits when determining the reclamation bond amount. Include costs for:
    - Operation and maintenance of facilities designed to divert, convey, store, or treat water.
    - Decontaminating, neutralizing, disposing, treating, or isolating hazardous materials at the site to minimize potential for contamination of soil, surface water, and ground water.
    - Water treatment needs predicted during planning and discovered during operations to achieve applicable water quality standards.

- Earthwork to reclaim roads; waste rock dumps; tailings; backfilling water features (diversions, ditches, and sediment ponds); and construction of diversion channels and drains, stream channels, and wetlands.
- Revegetation to stabilize the site and minimize soil erosion.
- Mitigation to restore natural function and value of streams, wetlands, and floodplains.
- Long-term operations, monitoring, and maintenance of mineral production-related facilities that must perform as designed to avoid or minimize contamination of surface or groundwater resources, including roads, diversion ditches, dams, and water treatment systems.
- Protection of the reclaimed area until long-term stability, erosion control, and revegetation has been established.

Locatable Minerals

- Evaluate Notice of Intent to Operate proposal to determine if it will likely cause significant disturbance to soil, water quality, and riparian resources.
  - Require a plan of operation from the mineral operator, lessee, or purchaser as required by law and regulation if proposed activities might cause significant disturbance of surface resources including soil, water quality, or riparian resources.

Minerals Leasing

- Include in the land management plan, or other areawide decision document, direction for surface occupancy. Use lease stipulations to avoid riparian areas, wetlands, and areas subject to mass soil movement; to avoid or minimize erosion and sediment production; and to avoid or minimize adverse effects to water quality and municipal supply watersheds, if these issues are not adequately addressed by provisions in regulations at 36 CFR 228.108.
- Use the applicable practices from the Minerals Activities BMPs for recommendations on post-lease approval of operations.
- Require or work with BLM to require appropriate contingency plans to avoid or minimize adverse impacts to surface waters.
- Coordinate with BLM to ensure the reclamation bond required for operations will be sufficient to guarantee reclamation work on NFS lands to the appropriate standards for water quality and watershed condition as determined from the land management plan, State and Federal laws, regulations, plans, or permits.

Mineral Materials

- Include reasonable conditions and applicable practices of BMP Min-3 (Minerals Production) and BMP Min-5 (Mineral Materials Resource Sites) in the operating plan to ensure proper protection of soil, water quality, and riparian resources and timely reclamation of disturbed areas.
- Consider the direct and indirect costs of stabilizing, rehabilitating, and reclaiming the area of mineral materials operations to the appropriate standards for water quality and watershed condition as determined from the land management plan, State and Federal laws, regulations, plans, or permits when determining the reclamation bond amount.

Mineral Reservations and Outstanding Mineral Rights

- Evaluate the Operating Plan for Mineral Reservation Operations to ensure that reasonable measures, including appropriate BMPs, consistent with the terms of the deed, are included to minimize damage to NFS surface resources that could affect soil, water quality, and riparian resources and that provide for restoration and reclamation of disturbed lands.

- Evaluate the Operating Plan for Outstanding Mineral Rights to ensure that reasonable measures, including appropriate BMPs, are included to control erosion, avoid or minimize water pollution, and reclaim the site consistent with land management plan direction for water quality management.

Min-2. Minerals Exploration

Manual or Handbook Reference FSM 2810, FSM 2820, and FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources caused by physical and chemical pollutants during minerals exploration activities.

Explanation Minerals exploration is the process of determining the location, extent, composition, and quality of deposits of minerals and energy resources that can be commercially developed. Exploration methods may include remote sensing, geochemical analysis of water, rock and soil samples, geophysical analysis, and ground-disturbing activities including drilling, bulldozing, trenching, and excavating shallow pits, exploration shafts, or adits. During construction of drill pads, trenches, pits, or shafts, land may be cleared of existing vegetation and ground cover, exposing mineral soil that may be more easily eroded by water, wind, and gravity. Underground activities may intercept groundwater, exposing these aquifers to potential contaminants.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Avoid or minimize long-term impacts to soil, water quality, and riparian resources to the extent permitted by the geologic target when selecting locations for exploration activities.
    - Avoid waterbodies, sensitive areas, unstable slopes, and highly erosive soils to the extent practicable.
- Limit clearing, excavation, and other surface-disturbing activities to the minimum necessary for exploration needs.
    - Consider using exploration drilling and support vehicles that do not require road construction.
- Design and construct all new roads and drilling pads to a safe and appropriate standard, no higher than necessary to accommodate their intended use (see BMP Road-2 [Road Location and Design], BMP Road-3 [Road Construction and Maintenance], and BMP Road-4 [Road Operations and Maintenance]).
- Employ suitable design and construction practices to avoid, minimize, or mitigate surface disturbances as well as maintain the reclamation potential of the site.
    - Use directional drilling techniques when practicable to avoid or reduce surface disturbance.
    - Plan and construct, to the extent practicable, exploration roads to be recontoured when operations are complete.
- Limit the extent of open exploratory areas at one time and restore one site before moving on to the next one, to the extent practicable.
- Use applicable practices from BMP Fac-2 (Facility Construction and Stormwater Control) to minimize erosion and stormwater discharge from ground disturbance at exploration sites.

- Use applicable practices from BMP Fac-4 (Sanitation Systems) and BMP Fac-5 (Solid Waste Management) to avoid contaminating surface water or groundwater from sanitation or solid waste facilities.
- Use applicable practices of Chemical Use Management Activities BMPs when chemicals are used in exploration activities.
- Use applicable practices of BMP Fac-6 (Hazardous Materials) and BMP Road-10 (Equipment Refueling and Servicing) to manage petroleum products and other hazardous materials used in exploration activities.
    - Require a transportation spill response plan, where applicable, that describes the petroleum products or other hazardous materials or chemicals that will be used in the operations, including the routes, amount and frequency of shipments, and containers and vehicles used. Describe in this plan the procedures, equipment, and personnel that would be used to respond to a spill.
- Properly manage all exploration-related wastes, including drilling fluids, produced water, and potentially acid-generating rock materials, to minimize the risk of groundwater and surface water contamination and to meet State and Federal requirements.
    - Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water).
- Protect groundwater developments and groundwater-dependent ecosystems from the impacts of shock waves when using shot explosions to determine gas reserves or other energy development potential.
- Use applicable practices of BMP Min-8 (Minerals Site Reclamation) to reclaim the project site after exploration activities are completed.

Min-3. Minerals Production

Manual or Handbook Reference FSM 2810, FSM 2820, and FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources caused by physical and chemical pollutants resulting from mineral development, production, and associated activities.

Explanation Minerals production is the process of opening the mineral or oil and gas deposit; extracting the mineral resource (beneficiation); and processing the mineral resource to put it in a marketable condition. Minerals are extracted through surface mining (open pit or strip mining), underground mining (shafts or adits), or wells for fluid materials or solvent extraction. In addition to land clearing for mineral extraction, a minerals production site will also require clearing and ground disturbance for accessory buildings and facilities for minerals processing, storage, and transportation. Exposed soils may be subject to accelerated erosion if proper erosion controls are not used. Hazardous chemicals may be used in the process of extracting and processing minerals. Extraction and beneficiation operations associated with mining activities can generate acid mine drainage when sulfide rock materials are exposed to air and water. These materials may contaminate surface water or groundwater if not handled appropriately.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Avoid or minimize long-term impacts to soil, water quality, and riparian resources to the extent permitted by the geologic target when selecting locations for the mining operation, structures, roads, and ore and waste facilities.
    - ❑ Provide adequate buffers and setbacks from waterbodies to avoid or minimize impacts to water quality and aquatic ecosystems.
- Employ suitable design and construction measures to avoid, limit, or mitigate surface disturbances as well as maintain the reclamation potential of the site.
- Use applicable practices from BMP Fac-2 (Facility Construction and Stormwater Control) to minimize erosion and stormwater discharge from ground disturbance at minerals production sites and to keep production sites dry.
- Properly manage mining byproducts and wastes.
    - ❑ Minimize production of byproducts and wastes to the extent practicable.
    - ❑ Plan space to properly handle, store, and contain byproducts and wastes.
    - ❑ Find suitable onsite or offsite uses for mining byproducts.
    - ❑ Recycle or properly dispose of wastes (e.g., used petroleum products, site garbage, septic effluent, decommissioned equipment, and used barrels or containers).
    - ❑ Minimize handling of byproducts and wastes to the extent practicable.
- Use applicable Road Management Activity BMPs to manage roads and transportation at the project site.
- Use applicable practices from BMP Fac-4 (Sanitation Systems) and BMP Fac-5 (Solid Waste Management) to avoid contaminating surface water or groundwater from sanitation or solid waste facilities.
- Use applicable Chemical Use Management Activities BMPs, BMP Fac-6 (Hazardous Materials), and BMP Road-10 (Equipment Refueling and Servicing) to manage all chemicals, reagents, fuels, and other hazardous or toxic materials used for construction, operations, and beneficiation to avoid or minimize contaminating surface water or groundwater.
- Use applicable practices from BMP Min-8 (Minerals Site Reclamation) to reclaim the project site after minerals production operations are completed.
- Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water) to protect soil, water quality, and riparian resources in minerals extraction and processing, geothermal energy, and oil and gas production activities.
- Require a transportation spill response plan, where applicable, that describes the petroleum products or other hazardous materials or chemicals that will be used in the operations, including the routes, amount, and frequency of shipments, and the containers and vehicles that are to be used. Describe in this plan the procedures, equipment, and personnel that would be used to respond to a spill.
- Make adjustments in the plans, authorizations, and bonds if conditions develop that are outside the design criteria and conduct adequate notification, emergency stabilization, or other activities to avoid effects before proceeding with additional mining.

Mining-Related Surface Activities

- Limit clearing, excavation, and other surface-disturbing activities to the minimum necessary for mining needs.
    - Limit amount of exposed or disturbed soil at any one time to the minimum necessary for efficient operations during minerals production activities.
    - Clearly delineate the geographic limits of the area to be cleared.
    - Install suitable drainage measures to improve the workability of wet sites.
    - Avoid or minimize damage to existing vegetation, particularly the vegetation that is stabilizing the bank of a waterbody.
    - Stabilize mined areas and surface disturbance activities as soon as practicable before moving and opening up new areas.
- Reduce surface-disturbing activities to the minimum necessary for efficient minerals production activities during periods of heavy runoff or saturated soil conditions, to the extent practicable, to decrease the potential for soil compaction and erosion.
- Stockpile biologically active topsoil removed during excavation for use in reclamation.
    - Store stockpiled topsoil separately from other vegetative slash or soil and rock materials and protect from wind and water erosion, unnecessary compaction, and contaminants.
- Conduct operations in such a manner as to avoid or minimize the production and transport of fugitive dust from the site.
- Use suitable measures in compliance with local direction to prevent and control invasive species.

Mining-Related Subsurface Activities

- Develop the mine plan to suitably address surface stability and avoid or minimize the unnecessary diversion of runoff or surface waters into the subsurface.
- Use suitable water management and control measures to minimize water inflow, use inflow for mineral operations to the extent practicable, and manage inflow to minimize the accumulation of contaminants including blasting residuals.
- Manage ventilation systems to minimize deposition of airborne contaminants on the ground surface.

Geothermal, Oil, and Gas Activities

- Locate well sites on level locations that will accommodate the intended use to reduce the need for vertical cuts and steep fill slopes.
    - Use directional drilling techniques when practicable to avoid or reduce surface disturbance.
- Use suitable measures to stabilize fill slopes and minimize potential of slope failures.
- Use suitable measures to provide surface drainage and manage runoff from the work areas used for mud tanks, generators, mud storage, and fuel tanks in a manner that avoids or minimizes pollutant contamination of surface waters or groundwater.
- Use nontoxic, nonhazardous drilling fluids whenever practicable.
- Construct suitable impervious containment structures with sufficient volume and freeboard to avoid or minimize spills or leakages of oil, gas, salt water, toxic liquids, or waste materials from reaching surface waters or groundwater.

- Avoid mixing of geothermal fluids with surface water or groundwater where the chemical and thermal properties of the geothermal fluids would damage aquatic ecosystems and contaminate drinking water supplies.

Mining-Related Instream Activities

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when conducting mining in waterbodies.

Min-4. Placer Mining

Manual or Handbook Reference FSM 2810.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting placer mining operations in or near stream channels.

Explanation Placer mining involves mining and extracting gold or other heavy metals and minerals primarily from alluvial deposits. These deposits may be in existing streambeds or in ancient, often buried, stream deposits. Suction dredge placer mining is the most common in-channel operation and removes gold and other minerals from streambed substrates. All floating suction dredges are designed to work as a unit to dig, classify, and beneficiate ores and to dispose of waste within the stream channel. Placer mining operations can also occur adjacent to stream channels and other waterbodies. The essential components of placer mining include removing the overburden, mining the placer deposits, and processing the ore to recover the desired mineral. Overburden and placer deposits can be excavated by a variety of means ranging from hand tools to heavy equipment. Excavated placer pay gravels are typically processed using a variety of gravity separation techniques that yield gold or other heavy metal concentrates. Concentration of gold and other precious metals sometimes takes place onsite using mercury amalgamation or other techniques. Waste products from placer mining include tailings and process water. Effects to soil, water quality, and riparian resources from these operations include direct modification of the waterbody, release of contaminated waters, groundwater disruption, and increased levels of turbidity and sediment.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems), BMP AqEco-3 (Ponds and Wetlands), and BMP AqEco-4 (Stream Channels and Shorelines) when working in or near aquatic ecosystems to prevent or minimize adverse impacts to water quality.
- Use applicable practices of BMP Min-3 (Mineral Production) for sanitation, solid waste, and transport and storage of petroleum products or other hazardous materials.

Suction Dredge Mining

- Conduct dredging and excavation operations in such a manner as to avoid creating dams or diversions, including inadvertent damming caused by tailing placement.
- Conduct dredging and excavation operations only within the existing wetted perimeter (waterline) in the active stream channel and avoid mining or otherwise disturbing streambanks.

- Schedule dredging or excavation to avoid periods and locations where fish are spawning or where fish eggs or fry are known to exist at the time dredging occurs.
- Provide adequate passage for fish around and through the mining area.
- Provide space between current and recent dredging and excavation operations to avoid overlapping of water quality and habitat effects from concurrent or successive operations to provide areas of unimpacted substrate for fish and other aquatic organisms.
- Conduct dredging and excavation operations in such a manner as to retain large boulders, logs, or other natural obstructions in place to preserve large habitat-forming elements.
- Conduct dredging and excavation operations in such a manner as to avoid significant increases in downstream turbidity.

Mechanical Placer Mining in Riparian and Floodplain Areas

- Use applicable practices of BMP Min-3 (Minerals Production) in removing overburden to access placer deposits.
- Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water) to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when processing materials.
- Use suitable measures to avoid or minimize the entrainment of fish when obtaining water from a fish-bearing stream for placer mining operations.

Min-5. Mineral Materials Resource Sites

Manual or Handbook Reference FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when developing and using upland mineral materials resource sites or instream sand and gravel deposits.

Explanation Mineral materials resource sites include upland and instream sites that are mined to obtain minerals materials such as sand, gravels, cobbles, and boulders. Upland aggregate deposits also include finer materials such as sand, silt, clay, and organic debris that can be mobilized during or following desired material extraction operations. The principal pollutant generated at quarries is total suspended solids and, therefore, erosion and sediment control should be the major focus during all phases of the quarry operation. The size and location of the deposit, as well as the amount and duration of need for materials, are commonly the key factors to consider when evaluating and designing an appropriate strategy to remove the materials and stabilize the site following mining operations.

Deposits of sand and gravel, the unconsolidated granular materials resulting from the natural disintegration of rock or stone, are generally found in near-surface alluvial deposits and in subterranean and subaqueous beds. Instream sand and gravel mining operations consist of extracting sand and gravel deposits from the stream channel and processing and stockpiling aggregate materials at a nearby site on land. Instream extraction is accomplished by dredging underwater deposits; mining point bars, lateral bars, and islands that are above the low-water level; mining of temporarily or permanently dewatered channels; or by creating instream harvest pits by placement of rock vortex weirs. Effects to water quality and aquatic ecosystems from these operations can include direct physical modification of the waterbody and hydraulics, reduction in bedload and change in bedload transport, release of contaminated waters, groundwater disruption, and increased levels of turbidity.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Allow upland and instream sand and gravel mining where consistent with land management plan desired conditions, goals, and objectives for soils, aquatic and riparian habitats, and water quality.
- Use applicable practices of BMP Min-3 (Minerals Production) and BMP Fac-2 (Facility Construction and Stormwater Control) for sanitation, solid waste, and transport and storage of petroleum products or other hazardous materials and to control erosion, manage stormwater, keep the site dry, and protect the waterbody when clearing the extraction and processing areas.
- Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water) to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when processing materials.

Upland Gravel Pits

- Plan operations at the site in advance to minimize disturbance area and more effectively and efficiently open and operate the site.
    - ❑ Limit the area of the facility to the minimum necessary for efficient operations while providing sufficient area for materials processing and stockpiling.
    - ❑ Phase development where practicable.
    - ❑ Use suitable measures to avoid, mitigate, or treat metal leaching and formation of acid rock drainage.
- Conduct extraction activities in such a manner as to minimize the potential for slope failures, limit slope steepness and length, limit disturbed areas to those actively used for extraction, retain existing vegetation as long as possible, and allow for progressive reclamation of the site where practicable.

Instream Sand and Gravel Mining

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems), BMP AqEco-3 (Ponds and Wetlands), and BMP AqEco-4 (Stream Channels and Shorelines) when working in or near waterbodies to prevent or minimize adverse impacts to water quality.
- Consider channel type and effects of the proposed operation on channel morphology and function when approving instream sand and gravel mining operations.
- Limit access disturbance to designated areas on one streambank to reduce the effort required for site reclamation.
    - ❑ Use suitable measures to protect the streambank at access points to minimize bank erosion.
- Locate the material processing and stockpile site at a suitable distance from the active channel to leave a buffer zone along the waterbody to reduce risk of flooding.
    - ❑ Consider historic channel migration patterns and site elevation when locating mineral processing and stockpile sites.
    - ❑ Avoid or minimize disturbance to valuable riparian areas; wetlands; and aquatic-dependent threatened, endangered, and sensitive species habitat.
- Include suitable measures to protect channel morphology and function when extracting sand and gravel deposits.

- Specify the maximum depth of mining.
- Limit extraction depth to minimize slope changes along the stream, avoid or minimize channel and bank erosion, and retain existing natural channel armoring.
- Limit extraction amount to minimize upstream and downstream effects due to changes in bedload transport.
- Avoid modifying point bars to the extent where the resultant channel changes cause unacceptable reduced sinuosity or increased stream gradient, velocity, stream power, and bank instability.
- Schedule in-channel mining to occur during low-flow periods.
- Avoid or minimize changes to channel shape and reduce effects of mining on aquatic habitats by establishing a low-flow buffer.
- Avoid or minimize streambank erosion and instability during and after mining.
- Avoid or minimize headward erosion of the channel at the upstream end of the instream pit.

• Design and construct diversion channels to handle anticipated flow volumes and to minimize upstream and downstream effects of changes in stream grade, width, depth, bed characteristics, bank instability, and groundwater inflows when temporarily or permanently dewatering stream channels to extract sand and gravel.
  - Ensure barrier is able to adequately protect the dewatered mining area from flood flows.

• Conduct excavation operations in such a manner as to avoid significant increases in downstream turbidity.

Min-6. Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds

Manual or Handbook Reference FSM 2810, FSM 2820, and FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, surface water, groundwater, and riparian resources from physical and chemical contaminants originating from ore stockpiles, storage and disposal of mine waste, and construction and use of reserve pits and settling ponds.

Explanation Minerals production and processing generates large amounts of materials including ore stockpiles, waste rock, tailings, drilling muds and cuttings, and process water. These materials may contain minerals, hazardous chemicals, and other potential pollutants that can have severe impacts on water resources.

This practice addresses the management of ore and mine wastes as well as construction and operation of reserve pits, settling ponds, slime ponds, process water ponds, and tailings impoundments. Most operations divert surface water and groundwater around a site, collect waters after passing through or under a site, or employ a combination of both. When water and waste are diverted, implementation focuses on isolating the wastes to contain, settle, control, stabilize, or otherwise minimize contamination, whereas practices for flow-through systems focus on methods to collect, store, and treat contaminated waters.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Ore Stockpiles and Mine Waste Facilities

- Locate ore stockpiles and waste facilities on stable, level sites with adequate drainage, away from surface water, shallow groundwaters, and poorly drained soils where practicable.
    - Establish adequate buffers and setbacks between the facility footprint and waterbodies to avoid or minimize adverse effects to water quality and aquatic ecosystems.
- Divert, control, collect, detain, and disperse surface runoff before contact with ore stockpiles and mine wastes.
    - Use suitable measures to ensure that pollutants are removed from runoff that was in contact with ore stockpiles or waste facilities and are not discharged or released into surface waters or groundwater.
- Properly characterize ore and waste rock to identify materials that have the potential to release acidity or other contaminants when exposed by mining.
- Use suitable measures to minimize development and prevent release of acidity or other contaminants.
    - Segregate and isolate potentially problematic materials from air and water.
    - Install impermeable caps, liners, and surface water diversions.
    - Blend acid-consuming materials, such as limestone, with the waste.
    - Require water treatment as needed.
- Limit slope steepness and length to interrupt surface runoff and reduce soil erosion.
- Install suitable support structures, such as retaining walls, in conjunction with a drainage system to support facility berms while draining excess water.
- Construct waste facilities in successive lifts where practicable to promote long-term stability and post-reclamation land productivity.
- Use suitable measures to stabilize stockpiles not scheduled for immediate processing to avoid or minimize wind and water erosion, oxidation of reactive materials, and runoff of toxic waters.
- Monitor containment dams and water and sediment control features to ensure contaminants are not reaching streams or other sensitive resources.

Reserve Pits

- Locate reserve pits in stable areas on the drill pad to the extent practicable.
- Locate pits away from natural watercourses, riparian areas, wetlands, floodplains, and areas of shallow groundwater wherever practicable.
    - Use suitable measures to ensure full containment of drilling fluids where the reserve pit must be placed in a sensitive location or in porous material.
- Design the reserve pit to contain all anticipated drilling muds, cuttings, fracture fluids, and precipitation while maintaining a suitable amount of freeboard to avoid or minimize overtopping.
- Use suitable measures to avoid or minimize seepage from the reserve pit contaminating groundwater.
- Remove any visible or measurable layer of oil from the surface of the reserve pit after cessation of drilling and completion of operations, and continue to keep the pit free of oil.
- Use suitable measures to avoid or minimize surface waters and groundwater from entering open pits.

Tailings, Settling, Process Water, and Slime Ponds

- Use the minimum amount of water necessary for efficient materials processing to reduce the volume of water requiring treatment, maximize the capacity of settling ponds, and avoid contaminating nonprocess water.
  - Recycle treatment water or used closed loop systems where practicable.
- Use suitable measures to treat, store, and dispose of wastewater from mine inflows and leaching and milling operations in a manner that avoids or minimizes adverse effects to soil, water quality, and riparian resources.
- Use suitable measures to ensure that pollutant materials removed from the process water and wastewater streams are retained in storage areas and are not discharged or released into surface waters or groundwater.
  - Design, construct, operate, and maintain water control devices, such as diversion structures and berms, and all solids retention structures, such as berms, dikes, pond structures, and dams, to function effectively through the life of the project with reduced risk of failure.
  - Locate storage ponds and storage areas in places where they will not be washed out by reasonably predictable flooding or return of a relocated stream to its original streambed.
  - Place materials removed from settling ponds in locations where liquids from the materials cannot flow overland into surface waters.
  - Provide for contingencies to avoid or minimize failure and release of untreated wastes and wastewater into waters of the United States or waters of the State.
- Design tailings facilities, dams, and berms to acceptable factors of safety using standard geotechnical engineering practices and considering foundation conditions and materials; construction materials and practices; the seismicity of the area; and the human and environmental resources at risk.
- Design ponds to contain all sediment-laden process water as well as surface runoff, seepage, and expected precipitation.
  - Use suitable measures to ensure that water is kept below the crest of the dam or berm.
  - Size the spillway to release overflows in a volume and velocity that does not erode the spillway, the area beyond the outlet or the downstream channel.
  - Use suitable measures to ensure water meets applicable Federal, State, and local water quality standards before discharge to waters of the United States or waters of the State.
- Divert surface water around the impoundment area before construction and, where appropriate, construct a drain field below dams and berms to reduce the water levels to maintain structural integrity.
- Install monitoring devices to measure water levels and mass movement within tailings or water retaining structures where human and environmental resources are at risk.
- Use suitable measures to minimize groundwater seepage into impoundments and avoid or minimize leaching of contaminated waters into the groundwater.
- Construct watertight impoundments for containment of mill process water, cyanide solutions, sulfide tailings, or phosphate slimes.
- Use closed-system ponds when water contains potentially hazardous materials such as cyanide or other beneficiation chemicals.
  - Ensure that solutions containing chemicals used in beneficiation, such as floatation reagents or cyanide, are properly treated or removed from process ponds and disposed of in accordance with applicable State and Federal requirements.

- Install and seasonally monitor groundwater quality monitoring wells if a risk of groundwater pollution exists (see BMP WatUses-2 [Water Wells for Production and Monitoring]).
- Establish a suitable inspection schedule to ensure that water diversion structures, conveyances, and storage facilities are performing as designed and appropriately maintained.

Min-7. Produced Water

Manual or Handbook Reference FSM 2820.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by appropriately managing water produced during the extraction of minerals, geothermal energy, oil, and gas.

Explanation Produced water is often a byproduct of oil and gas, geothermal energy, and mineral exploration and production due to the dewatering of underground aquifers. Disposal of produced water is a critical environmental impact to consider because of the large quantities produced and the potential low quality of the water. Potential impacts of produced water disposal include groundwater contamination, increased turbidity, addition of nutrients (primarily nitrogen from blasting residuals), sedimentation, erosion, altered hydrology, loss of aquatic habitat, reduced water quality, and loss of soil productivity. The BLM, States, or the U.S. Environmental Protection Agency (EPA) regulate disposal of produced water. Where water treatment and disposal is allowed on NFS lands, the Forest Service regulates all surface-disturbing activities and determines the conditions that are necessary to protect surface resources including soil and water.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Prepare a water management plan that is consistent with land management plan desired conditions, goals, and objectives for water quality.
- Contain and limit the amount of produced water by recycling water through the mineral beneficiation process.
- Use produced water for a beneficial use, such as for mineral beneficiation or agriculture, where practicable.
- Discharge or otherwise dispose of produced water in compliance with the CWA and Safe Drinking Water Act, with appropriate approvals from the State and EPA.
- Re-inject produced water of suitable quality into acceptable underground reservoirs when authorized and appropriate.
- Avoid, minimize, or mitigate surface discharge effects including headcuts, stream crossing washouts, impoundments, channel stability, and flooding.
- Use applicable practices of BMP AqEco-3 (Ponds and Wetlands) when constructing ponds or impoundments to store produced water on the surface.

Min-8. Minerals Site Reclamation

Manual or Handbook Reference FSM 2840 and FSM 2522.14.

Objective Reclaim minerals exploration and production sites and surrounding disturbed areas to as near to the predisturbed condition as is reasonably practicable after completion of exploration; production; or operations to avoid, minimize, or mitigate long-term adverse effects to soil, water quality, and riparian resources.

Explanation All lands disturbed by minerals exploration and production are required to be reclaimed to a condition consistent with the land management plan and applicable State soil and water quality requirements after all mining activities are completed. This practice will help ensure a systematic approach to reclaiming mineral, geothermal energy, and oil and gas operations. Although reclamation is usually thought of as the final step in managing mineral operations, reclamation measures must be considered during project planning; included in the approved plan, permit, or other authorization; and implemented during operations, as well as closure, to reduce potential resource impacts and facilitate the final reclamation effort.

Reclamation of abandoned mined lands sites poses additional problems to those associated with active sites. Typically these historical mineral operations were developed with little if any planning or operational controls to reduce environmental impacts. As a result, data about the environmental baseline—as well as the project facilities, equipment, and materials that are left onsite—may be minimal or absent. This information must be developed during analysis of the site so that restoration efforts are cost effective and achieve the desired results.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Develop and implement a reclamation plan to rehabilitate and restore, to the extent practicable, the natural ecological components, structures, and processes consistent with land management plan desired conditions, goals, and objectives at minerals sites.
- Reclaim facilities, activities, and associated surface disturbance as soon as practicable after completion of their intended use.
- Establish the optimal timing and scheduling of reclamation operations.
    - Reclaim and stabilize facilities, disturbed areas, surface water diversion structures, and transport and storage areas before the end of seasonal shutdown so that they will function as designed to prevent adverse impacts to surface water from erosion and sedimentation.
- Sample and test the site to identify hazardous materials and associated areas that may be contaminated by petroleum products, reactive materials, or other chemicals.
- Use suitable measures to isolate, neutralize, remove, or treat hazardous or contaminated materials, including chemicals, reactive materials, acidic wastes, fuels, pit fluids, sediment, and human waste, consistent with applicable Federal, State, and local regulations to achieve applicable standards.
    - Remove or stabilize materials in settling ponds in a manner suitable for the volume, type, toxicity, and hazards of the materials.

- Require removal or encapsulation of waste material as necessary to avoid or minimize contaminating nearby waterbodies before operator abandons site or reclamation is accepted as final.

- Remove facilities, materials, and equipment (including septic system) from NFS lands.
- Use suitable measures to control or minimize erosion and sedimentation and ensure the stability of project components, including water drainage, diversion, conveyance, and storage facilities, as well as surface erosion and landslide control measures. (see BMP Veg-1 [Vegetation Management Planning], BMP Veg-2 [Erosion Prevention and Control], BMP Veg-3 [Aquatic Management Zones], BMP WatUses-4 [Water Diversions and Conveyances], BMP WatUses-5 [Dams and Impoundments], and BMP WatUses-6 [Dam Removal]).
- Use suitable measures to divert, convey, and store surface water and groundwater away from mine (open pits or adits) and mine waste (tailings, waste rock, ore, and spent ore) facilities to the extent practicable to ensure stability and prevent formation of contaminated leachate or drainage.
  - Intercept and collect groundwater flows as needed to minimize potential for groundwater contamination and to maintain stability of reclaimed areas.
- Install and seasonally monitor groundwater wells in areas where a risk of groundwater pollution exists (see BMP WatUses-2 [Water Wells for Production and Monitoring]).
- Properly abandon, plug, and cap all drill holes, cores, and wells per applicable State or Federal requirements.
- Stabilize or restore stream channels, wetlands, floodplains, and riparian areas to achieve desired conditions for aquatic ecosystem composition, structure, function, and processes and to re-establish or rehabilitate aquatic habitats to the extent practicable (see BMP AqEco-3 [Ponds and Wetlands] and BMP AqEco-4 [(Stream Channels and Shorelines]).
- Construct passive or active water treatment facilities as needed.
- Use suitable measures to control aquatic or wetland invasive species.
- Back-fill and recontour disturbed areas, including exploratory trenches, pits, adits, or holes to the original contour, where practicable, or to an acceptable post-mining contour that blends with the surrounding topography to re-establish surface and subsurface hydrologic pathways to the extent practicable.
  - Stabilize benches around an open pit when backfilling is not practical.
- Confirm physical stability of project components including design slopes and factors of safety.
- Reconstruct, maintain, or decommission roads, trails, and staging areas consistent with land management plan desired conditions, goals, and objectives for the area (see Road Management BMPs).
- Establish effective ground cover on disturbed sites to avoid or minimize accelerated erosion and soil loss.
  - Use suitable measures to prepare or treat subsoil and overburden to improve infiltration capacity on the site.
  - Spread topsoil or growth medium and woody material on the disturbed areas.
  - Test and use suitable measures to ameliorate topsoil or growth medium as necessary to achieve revegetation and ground cover objectives.
  - Use suitable measures to prepare the seedbed improve infiltration and roughen surface for seed catch.

- Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

- Perform mitigation required by the Operating Plan to protect water quality and quantity.
- Consider long-term management of the site and nearby areas to promote reclamation success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to protect reclaimed areas and allow for recovery of vegetation.
  - Monitor reclaimed areas for a period sufficient to demonstrate that measures to protect surface water and groundwater are functional and effective over the long term.
  - Implement interim operation, monitoring, and maintenance as required to protect reclaimed areas using suitable measures like fencing, road closure, or invasive species control until long-term stability, erosion control, and revegetation have been successfully established.
- Accept reclamation as complete when all reclamation measures are determined to be functional and effective.
- Implement long-term operation, monitoring, and maintenance activities as necessary for facilities, including roads, diversion ditches, dams, water treatment plants, fencing, gates, and signs, that must perform as designed for an indefinite period to prevent adverse impacts to water resources.

Geothermal Energy, Oil, and Gas Activities

- Reclaim well sites in a timely manner following well completion or plugging to avoid or minimize adverse effects to soil, water quality, and riparian resources.
- Permanently seal abandoned wells using appropriate protective measures in compliance with local and State requirements.
- Reclaim reserve pits to a condition that blends with the rest of the reclaimed pad area and restore the pit area to a safe and stable condition.

Resources for Minerals Management Activities

Aggregate Mining

British Columbia Ministry of Energy and Mines. 2002. Aggregate operators best management practices handbook for British Columbia, Volume 1—Introduction and planning and Volume 2—Best management practices. Victoria, BC. Available at http://142.32.76.167/mining/Aggregate/BMP/Pages/default.aspx.

Ecology and Environment, Inc. 2006. User's manual best management practices for gravel pits and the protection of surface water quality of Alaska. Anchorage, AK: Alaska Department of Environmental Conservation, Division of Water. 43 p. Available at http://www.dec.State.ak.us/water/wnpspc/pdfs/gravelpitbmp_guidance_final_063006.pdf.

Highland Engineering, Inc. 2009. Water quality best management practices for the aggregate mining industry. Duluth, GA: Georgia Construction Aggregate Association. 80 p. Available at http://gcaa.org/gcaaweb/bmpmanual.pdf.

Abandoned Mine Lands

Colorado Department of Natural Resources. Best practices in abandoned mine land reclamation: the remediation of past mining activities. Denver, CO: Colorado Department of Natural Resources, Division of Minerals & Geology. 42 p. Available at http://mining.state.co.us/pdfFiles/bmp.pdf.

Ferris, F., and others. 1996. Handbook of western reclamation techniques. Denver, CO: U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. 500 p. Available at http://www.techtransfer.osmre.gov/NTTMainSite/Library/hbmanual/westrecl.shtm.

Hutchison, I.; Ellison, R., eds. 1992. Mine Waste Management. ISBN 9780873717465. CA: California Mining Association. 672 p.

International Network for Acid Prevention Web site, particularly the Completed Projects page. http://www.inap.com.au/.

O'Kane Consultants, Inc. 2003. Evaluation of long term performance of dry cover systems. OKC Report No. 684-02. Salt Lake City, UT: International Network for Acid Prevention. 190 p. Available at http://www.inap.com.au/completed_research_projects.htm.

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U.S. Department of the Interior, Bureau of Land Management. 2001. Draft solid minerals reclamation handbook. 136 p. Available at http://www.fs.fed.us/geology/documents/blm.pdf.

U.S. Environmental Protection Agency (EPA). 2000. Abandoned mine site characterization and cleanup handbook. EPA 910-B-00-001. Denver, CO: EPA Region 8, San Francisco; CA: EPA Region 9; and Seattle, WA: EPA Region 10. 120 p. Available at http://www.epa.gov/superfund/policy/remedy/pdfs/amscch.pdf.

Bonding

Marks, M.B.; Buchta, T.; Newman, C.; Lentz, R.; and others. 2004. Training guide for reclamation bond estimation and administration for mineral plans of operation. Washington, DC: U.S. Department of Agriculture (USDA), Forest Service, Minerals and Geology. 133 p. Available at http://www.fs.fed.us/geology/mgm_minerals.html.

General

Idaho Department of Lands. 1992. Best management practices for mining in Idaho. Boise, ID: Idaho Department of Lands. 150 p. Available at http://www.idl.idaho.gov/Bureau/Minerals/bmp_manual1992/bmp_index.htm.

Hard Rock Mining

EPA, Region 10. 1999. EPA and hardrock mining—A sourcebook for industry in the Northwest and Alaska. EPA-910-R-99-016, draft. Seattle, WA.

USDA Natural Resources Conservation Service. National conservation practice standards—457 mine shaft and adit closing. Available at http://www.nrcs.usda.gov/technical /standards/nhcp.html.

Instream/Riparian (Placer) Mining

Greystone. 1998. In-stream aggregate extraction and reclamation guidance document. Denver, CO: Colorado Department of Natural Resources, Division of Minerals and Geology. 99 p. Available at http://mining.State.co.us/Policies.htm.

McCulloch, R.B.; Ihie, B.; Ciliberti, V.; Williams. M. M. 1993. Montana Placer Mining BMPs: Guidelines for planning, erosion control, and reclamation. Special Publication 106. Butte, MT: Montana Bureau of Mines and Geology. 32 p. Available at http://www.mbmg.mtech.edu/gmr/gmr-mines_exploration.asp or http://www.mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=11696&.

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Rangeland Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from rangeland management activities. Rangeland use includes grazing by cattle, sheep, goats, horses, and saddle stock used to manage the range and recreational stock. A primary purpose of the rangeland management program is to provide forage for commercial livestock operations. Grazing can also be a means of managing vegetation to meet other resource management objectives, such as fuels management, invasive species management, wildlife habitat improvement, and reduction of competing vegetation in plantations.

Three National Core BMPs are for Rangeland Management Activities. These BMPs are to be used when managing livestock grazing on National Forest System (NFS) lands. Each BMP is based on administrative directives that guide and direct the Forest Service planning and permitting of livestock grazing activities on NFS land. BMP Range-1 (Rangeland Management Planning) is a planning BMP for management of grazing allotments. BMP Range-2 (Rangeland Permit Administration) provides practices to be used when administering rangeland permits, including controlling overall livestock numbers, distribution, and season of use. BMP Range-3 (Rangeland Improvements) provides guidance for construction and maintenance of structural and nonstructural improvements and improvement of deteriorated rangeland soil and water resources.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Rangeland Management BMPs	
Range-1	Rangeland Management Planning
Range-2	Rangeland Permit Administration
Range-3	Rangeland Improvements

Range-1. Rangeland Management Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2200 and Forest Service Handbook (FSH) 2209.13, chapter 90.

Objective Use the project-level National Environmental Policy Act (NEPA) planning process to develop measures to include in the Allotment Management Plan (AMP) to avoid, minimize, or mitigate adverse impacts to soil, water quality, and riparian resources from rangeland management activities.

Explanation Analysis of existing rangeland conditions and other resource values is conducted for each allotment as part of the project-level NEPA analysis and decision process for authorizing livestock grazing on NFS lands. The AMP is derived from the NEPA document and decision and is the primary document that guides implementation of land management plan direction for rangeland resources at the allotment (project) level. The AMP is included as part of the grazing permit and provides special management provisions, instructions, and terms and conditions for that permit.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when completing allotment management planning and analysis.
- Validate land management plan grazing suitability decisions for the allotment.
- Establish desired conditions for the allotment consistent with land management plan goals and objectives for water quality and AMZs.
    - Consider linkages between rangelands and soils, water quality, and riparian and aquatic systems when determining rangeland desired conditions.
    - Consider the ecological potential of riparian and aquatic systems when determining AMZ desired conditions.
- Evaluate current rangeland condition and trends using accepted protocols.
    - Review past management within the allotment.
- Determine management objectives and needs for livestock grazing and water resources affected by livestock grazing from management direction in the land management plan, biological opinions, or other binding direction and comparison of desired conditions with existing conditions.
- Identify potential management strategies and rangeland and riparian improvement needs to maintain or move resources in the allotment toward achieving desired conditions.
    - Establish management requirements such as the season of use, number, kind, class of livestock, and the grazing systems.
- Establish annual endpoint indicators of use (e.g., forage utilization, stubble height, streambank alteration, woody browse use) related to the desired conditions and triggers (thresholds) for management actions, such as modifying intensity, frequency, duration, and timing or excluding livestock use.
    - Set the indicator thresholds at levels suitable to maintain or achieve desired conditions for uplands, riparian areas, and aquatic ecosystems.
- Develop a monitoring strategy and plan for adaptive management of the allotment.
    - Use accepted protocols to evaluate compliance with annual indicators of use and other land management plan standards.
    - Use accepted protocols to evaluate ecological status and trend, including water quality, aquatic habitats, and beneficial uses.
- Document the following items from the project-level NEPA decision and analysis in the AMP, grazing permit, and Annual Operating Instructions (AOI):
    - Management objectives for livestock grazing and all resources affected by livestock grazing.
    - Management requirements for livestock grazing in the allotment.
    - Monitoring requirements to implement adaptive management in the allotment.
    - Schedules for rehabilitating rangelands that do not meet land management plan objectives, initiating range improvements, and maintaining existing improvements (see BMP Range-3 [Rangeland Improvements]).

Range-2. Rangeland Permit Administration

Manual or Handbook Reference FSH 2209.13.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when managing rangeland vegetation and livestock grazing through administration and monitoring of grazing permits and AOI.

Explanation Improper grazing can adversely affect the watershed condition in several ways. Loss of effective ground cover in the uplands leads to increases in overland flow and peak runoff. Soil compaction, loss of ground cover, and reduced plant vigor in riparian areas decreases the ability of the riparian area to filter pollutants and function as a floodplain. Streambank trampling increases stream channel width/depth ratio, resulting in a change in stream type and a lowering of the water table. Wider and shallower streams have higher stream temperatures and lower dissolved oxygen content and are often unable to move the sediment load effectively, resulting in increased flooding and bank stress. Introducing sediment, nutrients, and pathogens into waterbodies from grazing can lower water quality. Managing livestock numbers, distribution, timing, and season of use can reduce the potential for these impacts.

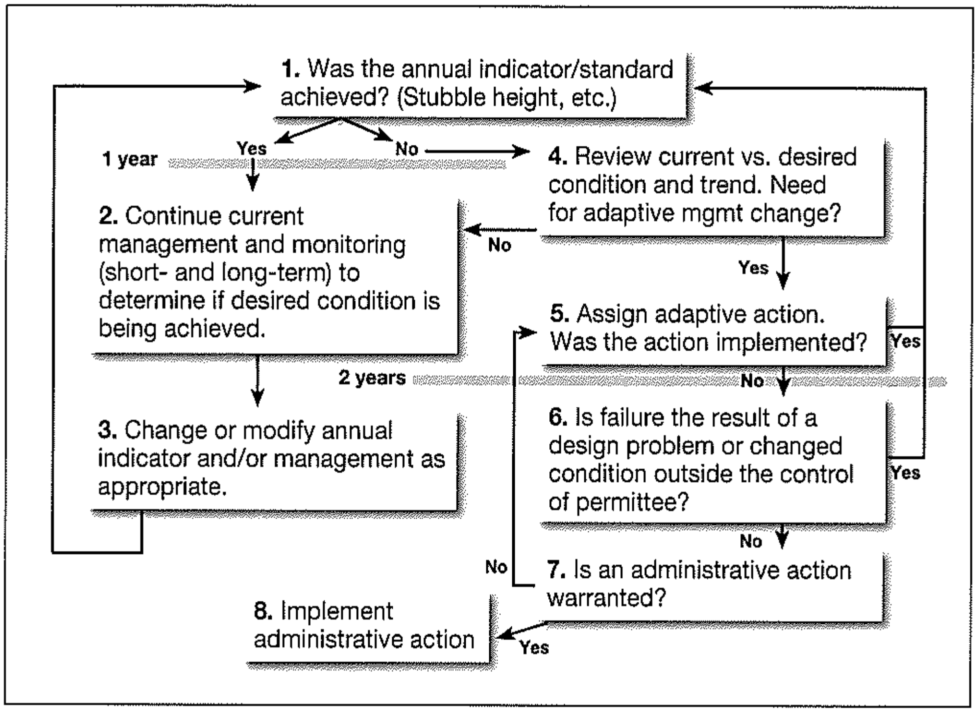
A grazing permit is used to authorize livestock grazing on NFS lands. The permit delineates the area to be grazed and defines the number, kind, and class of livestock to be grazed and the season of use. The special terms and conditions in the permit contain required management practices from the project-level NEPA decision to avoid, minimize, or mitigate effects to water quality and other resource values. The permit and AMP also include monitoring requirements to evaluate compliance with standards and determine long-term trends in range condition.

AOI issued to the grazing permittee specify those annual actions needed to implement the management direction set forth in the project-level NEPA-based decision. The AOI identify the obligations of the permittee and the Forest Service and clearly articulate annual grazing management requirements, standards, and monitoring necessary to document compliance. The permittee carries out the terms and conditions of the permit under the immediate direction and supervision of the district ranger.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Conduct implementation and effectiveness monitoring as specified in the AMP.
- Monitor water quality, habitat, or other designated beneficial uses of water as necessary (e.g., 303(d) listed streams, required terms of Biological Opinions).
- Use monitoring results as an adaptive management feedback loop to revise, if necessary, annual grazing requirements in the AOI to account for current allotment conditions and trends (figure 2).
- Use results of annual compliance monitoring and periodic trend monitoring, as well as forage utilization by wildlife and recreational livestock, to determine allowable annual amount of livestock use to meet rangeland and AMZ desired conditions.
- Adjust livestock numbers, season of use, and distribution when monitoring and periodic assessments indicate consistent noncompliance with permit provisions.
    - Use suitable range management tools to alter livestock distribution.

Figure 2. Adaptive Management Process for management of range allotments.



- Consider resting (placing an area in nonuse status for a period of time) a pasture or an allotment to allow for natural recovery of resource conditions.

- Document adaptive management actions such as allowable use, the planned sequence of grazing on the allotment, and any other operational changes in the AOI.
  - Modify the AMP and terms and conditions in the grazing permit for adaptive management actions that become consistent over a period of years or grazing rotations.
- Modify, cancel, or suspend the permit in whole or in part, as needed, to ensure proper use of the rangeland resource and protection of water quality.
  - Use permit authorities to change operations to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when special circumstances (e.g., drought) occur.

Range-3. Rangeland Improvements

Manual or Handbook Reference FSM 2240.

Objective Implement range improvements to maintain or improve soil, water quality, and riparian resources.

Explanation Rangeland improvements targeted at soil, water quality, and riparian resources are designed to protect or improve conditions of sensitive areas, streams, riparian areas, and wetlands and move these resources toward desired conditions. Improvements should emphasize protecting the beneficial uses in these areas. Improvements may supplement changes in annual use levels, seasonal use, distribution, and number, or other administrative actions.

Development and maintenance of rangeland improvements can be the responsibility of either the permittee or the Forest Service. The district ranger will ensure that the permittee is involved as a cooperator in rangeland improvements. The permittee may construct or maintain improvements under Forest Service direction, or Forest Service crews or contractors may construct or maintain improvements.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify and evaluate range improvement needs for soil, water quality, and riparian resources during watershed analysis, watershed condition assessment, project-level rangeland NEPA, or other assessment efforts.
- Include and schedule improvement actions and maintenance in the AMP and grazing permit.
- Design, implement, and maintain structural and nonstructural range improvements to achieve or sustain desired conditions for the rangeland, soils, water quality, and riparian resources in the allotment as determined in the project-level NEPA decision.
  - ❑ Use rangeland vegetation species and establishment techniques suitable to the project site and objectives and consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - ❑ Use applicable Chemical Use Activities BMPs when using chemicals to treat rangeland vegetation and control invasive species.
  - ❑ Use applicable practices of BMP Veg-8 (Mechanical Site Treatment) when implementing mechanical treatments of rangeland vegetation.
  - ❑ Use applicable practices of BMP Fire-2 (Use of Prescribed Fire) when using prescribed fire to improve rangeland vegetation and conditions.
  - ❑ Use applicable practices of BMP AqEco-3 (Ponds and Wetlands) and BMP AqEco-4 (Stream Channels and Shorelines) for improvement activities that involve waterbodies.
  - ❑ Use applicable practices of BMP WatUses-3 (Administrative Water Developments) when developing water sources for livestock watering.

Resources for Rangeland Management Activities

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Ecological Site Description

USDA NRCS. Ecological site description (ESD) system for rangeland and forestland. Database. Available at http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx

Proper Functioning Condition

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Rangeland Health Assessment

Pellant, M.; Shaver, P.; Pyke, D.A.; Herrick, J.E. 2005. Interpreting indicators of rangeland health, version 4. Technical Guide 1734-6. Denver, CO: U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center. Available at http://www.blm.gov/nstc/library/techref.htm.

Riparian Area Grazing Management

Clary, W.P.; Webster, B.F. 1989. Managing grazing of riparian areas in the Intermountain Region. Gen. Tech. Rep. INT-263. Ogden, UT: USDA Forest Service, Intermountain Research Station. 11 p. Available at http://www.fs.fed.us/rm/pubs_int/int_gtr263.pdf.

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Riparian Area Monitoring

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Stubble Height

University of Idaho, Stubble Height Review Team. 2004. Stubble height study report Contribution No. 986. Moscow, ID: University of Idaho, Forest, Wildlife and Range Experiment Station. Available at http://www.cnrhome.uidaho.edu/documents/Stubble_Height_Report.pdf?pid=74895&doc=1.

Recreation Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from recreation activities. An objective of the Forest Service recreation program is to provide nonurbanized outdoor recreation opportunities in natural appearing forest and rangeland settings. Recreation activities on National Forest System (NFS) lands take place at developed and undeveloped sites or are dispersed across broad areas.

Twelve National Core BMPs are in the Recreation Management Activities category. These BMPs are to be used when managing recreation use and facilities on NFS lands. BMP Rec-1 (Recreation Planning) is a planning BMP for recreation activities at the land management plan scale and project scale. BMP Rec-2 (Developed Recreation Sites) provides practices for sites that are designed and constructed to provide facilities for users. BMP Rec-3 (Dispersed Use Recreation) covers dispersed recreation, including user-created sites and frequently used areas. BMP Rec-4 (Motorized and Nonmotorized Trails) provides practices for construction, operation, and maintenance of the designated trail system. BMP Rec-5 (Motorized Vehicle Use Areas) covers areas designated for cross-country motor vehicle use. BMP Rec-6 (Pack and Riding Stock Use Areas) has practices for trailheads, corrals, and other areas where pack and riding stock use is concentrated. BMP Rec-7 (Over-Snow Vehicle Use) has direction for snowmobile trails and other over-snow vehicle uses. BMP Rec-8 (Watercraft Launches) is for boat launches on lakes and rivers. BMP Rec-9 (Recreation Special Use Authorizations) provides direction for recreation residences, outfitters and guides, and other recreation activities operated under special use authorizations. BMP Rec-10 (Ski Runs and Lifts), BMP Rec-11 (Ski Area Snowmaking), and BMP Rec-12 (Ski Area Facilities) provide practices for ski areas.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Recreation Activities BMPs	
Rec-1	Recreation Planning
Rec-2	Developed Recreation Sites
Rec-3	Dispersed Use Recreation
Rec-4	Motorized and Nonmotorized Trails
Rec-5	Motorized Vehicle Use Areas
Rec-6	Pack and Riding Stock Use Areas
Rec-7	Over-Snow Vehicle Use
Rec-8	Watercraft Launches
Rec-9	Recreation Special Use Authorizations
Rec-10	Ski Runs and Lifts
Rec-11	Ski Area Snowmaking
Rec-12	Ski Area Facilities

Rec-1. Recreation Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2310; FSM 2332; FSM 2333; FSM 2341; and Forest Service Handbook (FSH) 2309.18, chapter 10.

Objective Use the applicable recreation planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during recreation activities.

Explanation Recreation activities occur in a variety of settings and intensities on NFS lands, including at developed or undeveloped recreation sites or dispersed across broad areas. The objective of recreation planning is to provide for the current and future outdoor recreation demands while integrating recreation use with other resource concerns. The Recreation Opportunity Spectrum (ROS) system provides a framework for stratifying and defining classes of outdoor recreation opportunities along a continuum that combines physical, biological, social, and management conditions for providing a variety of recreational experiences across an array of settings. ROS is management tool that integrates social considerations and biophysical components of a landscape to achieve multiple social and natural resource objectives. ROS classes, and standards and guidelines, are established in the land management plan. ROS class primarily guides management of recreation use.

Recreation facilities on NFS lands are constructed and maintained by the Forest Service or others under a Forest Service authorization. These facilities include developed recreation sites, organization camps, recreation residence tracts, motorized and nonmotorized trails and facilities, dispersed recreation sites, and winter sports centers such as alpine ski areas. Some small facilities are constructed and managed by Forest Service personnel using agency design criteria and management guidelines as incorporated into project plans. Facilities developed by others on NFS lands are administered through special use authorizations issued by the Forest Service to public or private agencies, groups, or individuals. Special use authorizations must include terms and conditions to protect the environment and otherwise comply with the requirements of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1752).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Land Management Plans

- Consider the beneficial and adverse effects of recreation use on water quality and watershed condition when developing desired conditions, ROS classes, and management direction for the plan area.
  - Identify areas where the adverse effects of recreational use to water quality and watershed condition outweigh the benefits.
- Include design criteria, standards, and guidelines for recreational use to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Project or Activity Planning

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning recreation projects.
- Select site locations for recreation facilities that avoid or minimize the potential for adverse effects to water quality and riparian resources.
- Design the capacity and layout of the recreation site to be consistent with land management plan desired conditions, goals, and objectives for soil, water quality, and riparian resources.

- Consider capacity and patterns of use at a site when determining measures to avoid, minimize, or mitigate adverse effects from recreational use to soil, water quality, and riparian resources.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to incorporate suitable erosion and stormwater controls in the project design.
- Use applicable practices of BMPs for access roads and water, sanitation, and solid waste systems at recreation sites (see Roads Management Activities BMPs and Facilities and Nonrecreation Special Uses Management Activities BMPs) as needed.
- Use applicable practices of BMP Road-10 (Equipment Refueling and Servicing) for recreation sites where vehicles or other equipment will be stored and maintained.
- Use applicable practices of BMP Fac-6 (Hazardous Materials) for management of hazardous materials at recreation sites.
- Determine instream flow needs to minimize damage to scenic and aesthetic values, fish and wildlife habitat, and to otherwise protect the environment where the operation of the recreation site would modify existing streamflow regimes (see BMP WatUses-1 [Water Uses Planning]).

Rec-2. Developed Recreation Sites

Manual or Handbook Reference FSM 2332, FSM 2333, and FSM 2334.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at developed recreation sites by maintaining desired levels of ground cover, limiting soil compaction, and minimizing pollutants entering waterbodies.

Explanation Developed recreation sites provide amenities for user comfort and can be located in motorized or nonmotorized settings. Oftentimes these areas concentrate high volumes of use into relatively small areas and may be located on or near waterbodies, thereby increasing the potential for water quality degradation. Potential pollutants generated by use at developed recreation sites include, but are not limited to, human and animal waste; solid wastes (trash); petroleum products; and other hazardous substances. In addition, continuous or recurring use at one site can cause excessive soil compaction; damage to vegetation, wetlands, and riparian areas; and erosion and sediment transport from the site.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to construct and maintain appropriate erosion control and stormwater management measures to avoid or minimize adverse effects to water quality from pollutant runoff at the site.
- Use applicable practices of Roads Management Activities BMPs for construction and maintenance of access roads.
- Use applicable practices of BMP Roads-9 (Parking and Staging Areas) for trailheads and other parking areas at develop recreation sites.
- Use applicable practices of BMP Fac-3 (Potable Water Supply Systems), BMP Fac-4 (Sanitation Systems), and BMP Fac-5 (Solid Waste Management) for water, sanitation, and solid waste systems at developed recreation sites.

- Evaluate and adjust design capacity of the site when recreation use is causing adverse effects to water quality or riparian resources.
- Provide hardened campsites located sufficiently far from surface waterbodies to provide an adequate vegetative filter strip to avoid or minimize sediment delivery (see BMP Plan-3 [AMZ Planning]).
- Consider potential impacts to soils, water quality, and riparian resources when establishing recreation site use periods.
- Use suitable measures to avoid or minimize overuse on sensitive areas.
- Use suitable public relations, information, and enforcement tools to encourage the public to conduct their activities in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Provide information on the location of the nearest RV (recreational vehicle) wastewater disposal station.
- Periodically evaluate the condition of soil, water quality, and riparian resources at and near developed sites to identify signs of insufficient ground cover, detrimental soil compaction, excessive runoff, sedimentation, or chemical or pollutant release by recreationists.
  - Relocate trails, parking areas, campsites, play areas, or water distribution points that are causing offsite resource damage.
  - Redesign and reconstruct, or close and rehabilitate, areas of recreation sites that exhibit signs of overuse.
  - Use suitable measures to restrict access, when necessary, to nearby wetlands and riparian areas that show signs of excessive damage from recreation use to allow for vegetative recovery.
- Rehabilitate unwanted user-created trails and sites within the developed recreation site and employ suitable measures to discourage their creation and use (see BMP Fac-10 [Facility Site Reclamation]).
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim the developed recreation site after the need for it ends.

Rec-3. Dispersed Use Recreation

Manual or Handbook Reference FSM 2330.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by managing dispersed activities and undeveloped sites to maintain ground cover, maintain soil quality, control runoff, and provide needed sanitary facilities to minimize the discharge of nonpoint source pollutants and maintain streambank and riparian area integrity.

Explanation Dispersed recreation use takes many forms, both motorized and nonmotorized, across a range of forest and grassland settings. Many dispersed uses and user-created undeveloped sites are located adjacent to or provide easy access to lakes and rivers and lack the design and amenities offered at developed sites to mitigate effects of use. As a result, the impacts of dispersed recreation use on soils, water quality, and riparian resources can be greater than impacts at developed sites. Nonpoint source pollution from dispersed recreation use includes human and animal wastes, petroleum products, other hazardous substances, streambank disturbance, stream channel alteration, and sediment eroded from the site.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct dispersed recreation activities in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Designate locations and crossings for allowable motorized vehicle use within the AMZ as part of travel management (see BMP Plan-3 [AMZ Planning] and BMP Road-1 [Travel Management and Analysis]).
    - Use suitable measures to limit crossings and restrict motorized use within the AMZ to the extent practicable.
- Manage use to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - Develop and designate campsites in appropriate locations.
    - Limit group size and periods of use (numbers of consecutive days, time of day, etc.).
- Consider providing primitive sanitation facilities in areas where perpetual concentrated dispersed recreation use is causing adverse effects to soil, water quality, or riparian resources (see BMP Fac-4 [Sanitation Systems]).
- Close and rehabilitate dispersed or undeveloped sites that are causing unacceptable adverse effects on soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).
    - Manage site to mitigate adverse effects of use when closure is not practicable.

Rec-4. Motorized and Nonmotorized Trails

Manual or Handbook Reference FSM 2353, FSH 2309.18, FSM 7715.5, FSM 7723, and EM (Engineering Management) 7720-104.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling soil erosion, erosion of trail surface materials, and water quality problems originating from construction, maintenance, and use of motorized and nonmotorized trails.

Explanation The Forest Service manages about 133,000 miles of trails that are part of the designated transportation system. Only portions of these trails are open to motorized vehicle use. Almost all NFS trails serve nonmotorized users, including hikers, bicyclists, and equestrians, alone or in some combination with motorized uses.

Trail construction, maintenance, and use by motorized vehicles and human or stock traffic can adversely affect water quality by increased sediment delivery and contamination from vehicle fluids and human and animal wastes to nearby waterbodies. Compaction of the trail surface limits water infiltration, which can lead to concentrated runoff on the trail surface. Concentrated runoff on trails lacking adequate drainage causes erosion of the trail surface and can transport sediment and other pollutants directly into waterbodies if not filtered. Heavy tread, foot, or hoof traffic can loosen some trail surface materials, making them more susceptible to erosion.

Trails open to motorized use are designated during the travel management process and depicted on the Motor Vehicle Use Map (MVUM). Motorized use is designated by allowed vehicle class and, if appropriate, time of year, with the objective of minimizing damage to soil and water resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable Road Management Activities BMPs for construction, operation, and maintenance of motorized trails.
- Locate or relocate trails to conform to the terrain, provide suitable drainage, provide adequate pollutant filtering between the trail and nearby waterbodies, and reduce potential adverse effects to soil, water quality, or riparian resources.
    - Avoid sensitive areas, such as riparian areas, wetlands, stream crossings, inner gorges, and unstable areas to the extent practicable.
    - Use suitable measures to mitigate trail impacts to the extent practicable where sensitive areas are unavoidable.
    - Use suitable measures to hydrologically disconnect trails from waterbodies to the extent practicable.
- Design, construct, and maintain trail width, grades, curves, and switchbacks suitable to the terrain and designated use.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for control of erosion and stormwater when constructing trails.
- Install and maintain suitable drainage measures to collect and disperse runoff and avoid or minimize erosion of trail surface and adjacent areas.
- Use and maintain surfacing materials suitable to the trail site and use to withstand traffic and minimize runoff and erosion.
    - Pay particular attention to areas where high wheel slip (curves, acceleration, and braking) during motorized use generates loose soil material.
- Design stream crossings to use the most cost-efficient structure consistent with resource protection, facility needs, and types of use and safety obligations (see BMP Road-2 [Road Location and Design] and BMP Road-7 [Stream Crossings]).
- Designate season of use to avoid periods when trail surfaces are particularly prone to unacceptable erosion, rutting, or compaction.
- Designate class of vehicle and type of nonmotorized uses (e.g., hiking, bicycling, and equestrian uses) suitable for the trail width, location, waterbody crossings, and trail surfaces to avoid or minimize adverse effects to soil, water quality, or riparian resources.
- Monitor trail condition at regular intervals to identify drainage and trail surface maintenance needs to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Manage designated trails to mitigate adverse effects to soil, water quality, and riparian resources from over-use when closure and rehabilitation is not practicable or desired.
    - Change designated vehicle class and season-of-use period as necessary.
- Close and rehabilitate unauthorized trails that are causing adverse effects on soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).

Equestrian Trails

- Plan trails so that equestrian users will go slower in sensitive areas to protect trail tread.
- Use a trail design that constricts equestrian users to a designated tread, where practicable, to minimize the tendency of stock to create braided or multiple trail treads.
- Provide reasonable access to stock water at suitable intervals along designated equestrian trails where practicable.

Rec-5. Motorized Vehicle Use Areas

Manual or Handbook Reference FSM 2353.28, FSH 2309.18 23.22, and FSM 7716.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at motorized vehicle use areas by managing activities to maintain ground cover, maintain soil quality, and control runoff to minimize discharge of nonpoint source pollutants and maintain streambank and riparian area integrity.

Explanation Forest Service policy recognizes that motor vehicles are a legitimate and appropriate way for people to use the national forests and grasslands—in the right places and with proper management. Unrestricted cross-country travel by motor vehicles increases soil erosion and adversely affects water quality. The first vehicle driving across a particular piece of ground may not harm the land. After many more vehicles have crossed the same path, however, the result may be a user-created route and lasting impacts to soil, water quality, and riparian resources. The proliferation of user-created roads and trails is a major challenge on many national forests and grasslands. User-created routes, in general, are not located, designed, or maintained to avoid, minimize, or mitigate adverse effects to soil, water quality, or riparian resources. The Travel Management Rule adopted in 2005 restricts motor vehicle use to designated roads, trails, and areas on NFS lands to better manage motor vehicle use and protect NFS resources.

Limited areas on NFS lands open to cross-country motorized use may be designated during the travel management process and, if designated, are depicted on the MVUM. These areas should have natural resource characteristics that are suitable for motor vehicle use, or should be so altered by past actions that motor vehicle use might be appropriate. Motorized use is designated by allowed vehicle class and, if appropriate, by time of year, with the objective of minimizing damage to soil and watershed resources. Limited cross-country use of motorized vehicles within a specified distance from designated routes may be allowed for purposes of dispersed camping and big game retrieval. After motor vehicle use areas are established on a national forest or grassland, motor vehicle use outside of these designated areas is prohibited.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct motorized vehicle use activities within designated areas in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Locate and maintain designated motor vehicle use areas to avoid or minimize adverse effects on soil, water quality, and riparian resources.

- Consider suitability of slopes, access points, vegetation cover and similar features, and soil characteristics such as erodibility and texture, for motor vehicle use.
- Favor areas that are naturally barren or have been significantly altered by past motorized vehicle use or land use (e.g., gravel pits, reservoir bathtub rings, or lake bottoms).
- Avoid areas of sensitive soils and floodplains.
- Manage hillclimb areas to minimize length and steepness.
- Avoid concentration of motor vehicle use in bowl-shaped areas above draws that are susceptible to erosion.

- Designate season-of-use periods to avoid periods when soils are particularly prone to unacceptable erosion, rutting, or compaction.
- Designate class of vehicle suitable for the soil and terrain of the designated motor vehicle use area to avoid or minimize adverse effects to soil, water quality, or riparian resources.
- Clearly delineate and mark designated motor vehicle use areas in the field where practicable.
- Monitor designated motor vehicle use areas at regular intervals to identify drainage and soil cover maintenance needs to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Manage designated motor vehicle use areas, particularly hillclimb areas, to mitigate adverse effects to soil, water quality, and riparian resources from over-use when closure and rehabilitation is not practicable or desired.
  - Change designated vehicle class and season-of-use period as necessary.
  - Schedule use periods of hillclimbs to allow for rehabilitation.
  - Rotate hillclimb areas to extend the lifespan of a hillclimb.
- Close and rehabilitate designated motor vehicle use areas that are causing unacceptable adverse effects to soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).
- Place suitable restrictions on motor vehicle use off designated routes for dispersed camping and big game retrieval to avoid, minimize, or mitigate adverse effects on soil, water quality, and riparian resources.
  - Avoid riparian, wetland, or other identified sensitive resource areas where practicable.
  - Designate stream-crossing sites to the extent practicable.

Rec-6. Pack and Riding Stock Use Areas

Manual or Handbook Reference FSH 2309.18 22.43 and 23.12.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at pack and riding stock use areas by managing activities to maintain ground cover, maintain soil quality, control runoff, and provide needed sanitary facilities to minimize discharge of nonpoint source pollutants and maintain streambank and riparian area integrity.

Explanation Pack and riding stock can affect soil, water quality, and riparian resources while on trails and at campsites, watering areas, and loading areas. The level of use at a site can range from single-day use by one or more riders at a remote site to large developed campsites and trails used repeatedly by outfitter and guide operations, commercial stock operators, and other recreational users. Use may take place in the general forest area or in designated wilderness areas. Access areas, in general, are used for loading and unloading, parking, and turning around vehicles and stock trailers. Potential impacts include loss of ground cover, soil compaction, rutting, or puddling, and increased erosion, streambank trampling, spread of weeds, and water contamination from animal waste.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct activities on trails and at stock use areas in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Provide information on proper stock tethering, watering, and manure handling and disposal techniques.
- Use applicable practices of BMP Rec-2 (Developed Recreation Sites) when designing, constructing, and maintaining developed areas for pack and riding stock use.
- Install simple temporary holding facilities in both wilderness and nonwilderness areas.
  - Evaluate soils and vegetation for vulnerability of damage or disruption from stock use when choosing holding facility sites.
  - Locate corrals and tethering areas at a suitable distance from waterbodies to avoid or minimize adverse effects to soil, water quality, and riparian resources.
- Designate specific watering locations on streams, ponds, and lakes to avoid or minimize general use along streambanks or shorelines.
- Provide designated watering areas at developed stock use areas where practicable.
  - Surface the areas around water hydrants, troughs, and stock tanks using suitable materials to mitigate trampling effects.
  - Locate designated watering areas at a suitable distance from waterbodies to avoid or minimize adverse effects to soil, water quality, and riparian resources.
- Provide manure disposal bins at developed pack and riding stock use areas.
  - Locate manure receptacles on level ground at a suitable distance to provide adequate pollutant filtering between the accumulated manure and nearby waterbodies.
  - Provide positive drainage to prevent puddles from forming within and around the manure receptacle.
  - Provide tools (e.g., wheelbarrows, rakes, and bags) to facilitate manure cleanup.
  - Periodically remove or treat accumulated animal waste to avoid or minimize contaminating waterbodies.
- Monitor pack and riding stock use areas at regular intervals to identify drainage and ground surface maintenance needs to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Manage pack and riding stock use areas to mitigate adverse effects to soil, water quality, and riparian resources from over-use when closure and rehabilitation is not practicable or desired.
- Close and rehabilitate pack and riding stock use areas that are causing adverse effects on soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).

Rec-7. Over-Snow Vehicle Use

Manual or Handbook Reference FSM 7718.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from over-snow vehicle use.

Explanation An over-snow vehicle is a motor vehicle that is designed for use over snow and that runs on a track or tracks and a ski or skis, while in use over snow. Over-snow vehicles include snowmobiles, snow cats, and snow grooming machines. Snowmobiles and snow cats are used for access and for recreational activities. Snow grooming machines are used to prepare snow on trails for downhill or cross-country skiing or snowmobile use.

An over-snow vehicle traveling over snow results in different impacts to soil and water resources than do motor vehicles traveling over the ground. Unlike other motor vehicles traveling cross-country, over-snow vehicles generally do not create a permanent trail or have direct impact on soil and ground vegetation when snow depths are sufficient to protect the ground surface. Emissions from over-snow vehicles, particularly two-stroke engines on snowmobiles, release pollutants like ammonium, sulfate, benzene, polycyclic aromatic hydrocarbons, and other toxic compounds that are stored in the snowpack. During spring snowmelt runoff, these accumulated pollutants are released and may be delivered to surrounding waterbodies. In addition, over-snow vehicles that fall through thin ice can pollute waterbodies.

Use of NFS lands and trails by over-snow vehicles may be allowed, restricted, or prohibited at the discretion of the local line officer.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct cross-country over-snow vehicle use on trails in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - ❑ Provide information on the hazards of running over-snow vehicles on thin ice.
  - ❑ Provide information on effects on over-snow vehicle emissions on air quality and water quality.
- Use applicable practices of BMP Rec-4 (Motorized and Nonmotorized Trails) when locating, designing, constructing, and maintaining trails for over-snow vehicle use.
- Allow over-snow vehicle use cross-country or on trails when snow depths are sufficient to protect the underlying vegetative cover and soil or trail surface.
  - ❑ Specify the minimum snow depth for each type or class of over-snow vehicle to protect underlying resources as part of any restrictions or prohibitions on over-snow use.
  - ❑ Specify season of use to be at times when the snowpack is expected to be of suitable depth.
  - ❑ Specify over-snow vehicle class suitable for the expected snowpack and terrain or trail conditions.
- Use and enforce closure orders to mitigate effects when adverse effects to soil, water quality, or riparian resources are occurring.

- Use applicable practices of BMP Rec-2 (Developed Recreation Sites) when constructing and operating over-snow vehicle trailheads, parking, and staging areas.
  - Use suitable measures to trap and treat pollutants from over-snow vehicle emissions in snowmelt runoff or locate the staging area at a sufficient distance from nearby waterbodies to provide adequate pollutant filtering.

Rec-8. Watercraft Launches

Manual or Handbook Reference FSM 2334.24 and FSM 2335.1.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from facilities at locations used to launch and retrieve watercraft.

Explanation Facilities related to the use and enjoyment of watercraft (nonpowered boats, powerboats, personal watercraft, etc.) can affect water quality. These facilities include boat ramps, roads, and parking facilities, sanitation facilities, marinas, and other infrastructure. The immediate proximity and connection of the facility to the water's edge provides a direct pathway for pollutants to enter the waterbody.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct boating and related activities in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Provide information on measures for preventing the spread of aquatic invasive species, proper fish cleaning and disposal of fish waste, proper disposal of solid waste while boating, and preventing wake damage to shorelines.
- Locate and design watercraft launch sites to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Avoid excessive impacts to aquatic or riparian vegetation and fish spawning or rearing habitat.
  - Minimize the effect of boat wakes on adjacent shoreline and reduce the potential for sediment accumulation on the ramp.
  - Minimize the required amount of cut and fill below the waterline in the submerged or submersible zone.
- Establish suitable ramp elevation and slope to minimize ramp size while providing a ramp that is usable throughout the normal range of water elevations.
  - Use average high- and low-water elevations for each month of the intended use period over a suitable period of record to determine design high-water and design low-water elevations.
  - Extend ramp toe to a sufficient depth below the design low-water elevation to provide adequate water depth to float the average boat from its trailer while providing a hard surface for the trailer to travel on during launch and retrieval.
  - Minimize the distance of the top of the ramp above the design high-water elevation consistent with local topography.
  - Design the launch ramp slope to minimize erosion from water and vehicle tire disturbance.

- Design ramp width to provide adequate space for boaters of varying ability to maneuver the boat trailers down the ramp.
- Use surfacing material suitable for the ramp location and character of use to provide sufficient traction to discourage wheel spin and damage to the ramp or surrounding soil and water resources.
- Use suitable measures along both sides and across the lower end of the launch ramp to protect the structure from externally generated forces such as current, waves, and boat wakes.
- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) and BMP Fac-2 (Facility Construction and Stormwater Control) when constructing, reconstructing, or maintaining watercraft launch facilities.
- Use applicable practices of BMP Rec-2 (Developed Recreation Sites) when constructing and operating parking and staging areas at watercraft launch facilities.
- Use applicable practices of BMP Road-10 (Equipment Refueling and Servicing) at fuel dispensing facilities.
- Manage boating activities where necessary to decrease turbidity and physical destruction of shallow water habitats.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim watercraft launch sites when discontinuing their use.

Rec-9. Recreation Special Use Authorizations

Manual or Handbook Reference FSM 2343, FSM 2721, and FSH 2709.11.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from physical, chemical, and biological pollutants resulting from activities under recreation special use authorizations.

Explanation This BMP covers all recreation special use activities with the exceptions of ski areas. BMP Rec-10 (Ski Runs and Lifts), BMP Rec-11 (Ski Area Snowmaking), and BMP Rec-12 (Ski Area Facilities) provide direction specific to ski areas.

The Forest Service role in defining and requiring the implementation of BMPs occurs during the development of the recreation special use authorization and administration of the use. Discussions between the Forest Service and the permit holder concerning soil, water quality, and riparian resource impacts and appropriate BMP use should occur at the time of permit development and renewal. The special use authorization details the conditions that must be met, including management requirements and mitigation measures to protect water quality. The permit holder will be required to conform to all applicable Federal, State, and local regulations governing water resource protection and sanitation. State water quality law may require that the permit holder obtain a pollution discharge permit, water quality certification, or other authorization from a State, regional, or local government entity.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to provide erosion and stormwater controls when constructing facilities.

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working around waterbodies.

- Use applicable practices of Road Management Activities BMPs for access for authorized activities.
- Use applicable practices of Chemical Use Management Activities BMPs for use of chemicals in authorized activities.
- Use applicable practices of BMP Fac-3 (Potable Water Supply Systems), BMP Fac-4 (Sanitation Systems), BMP Fac-5 (Solid Waste Management), and BMP Fac-6 (Hazardous Materials) for public water supplies, sanitation systems, solid waste management, and hazardous materials for authorized activities.
- Administer the permit to appropriate standards to avoid, minimize, or mitigate adverse effects of permitted activities to soil, water quality, and riparian resources.

Rec-10. Ski Runs and Lifts

Manual or Handbook Reference FSM 2342.1 and FSH 2709.11 41.6.

Objective Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during the construction, operation, and maintenance of ski runs and lifts.

Explanation A ski area and its operation are complex and can result in a variety of adverse effects to soil, water quality, and riparian resources. These adverse effects can be particularly true for ski runs and lifts. Because good ski runs tend to be steep, extra precautions are needed to avoid or minimize accelerated erosion and resulting sedimentation. Ski run clearing, slope grading, and developing access routes, ski lift and towline facilities, and similar actions can expose and compact soils, resulting in accelerated runoff and erosion. Increased runoff can alter water yield and runoff regimes, augment peakflows, and increase instream sediment from channel erosion. Appropriate soil and water protection measures should be included in the ski area's operation and maintenance plan.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate ski runs and lifts on stable geology and soils to minimize risk of slope failures.
- Avoid wetlands and riparian areas when locating ski runs and lifts wherever practicable.
- Incorporate suitable measures in the design and construction of ski runs, including consideration of runoff of additional water from snowmaking, to avoid or minimize undesirable increases in runoff.
- Use applicable practices of Mechanical Vegetation Management Activities BMPs when clearing vegetation for ski runs and lift lines.
  - Use yarding equipment suitable to the steepness of the terrain to avoid or minimize adverse effects to soil and water quality (see BMP Veg-1 [Vegetation Management Planning]).
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to provide erosion and stormwater controls when constructing ski runs and lifts.
  - Clear and construct ski runs and lift lines in sections to limit the area of exposed disturbed soil at any one time.
  - Stabilize a completed section before beginning work on the next section.

- Avoid diverting streams and minimize disrupting swales, ephemeral channels, and wetlands.
- Minimize grading or recontouring of hill slopes to maintain intact soil horizons and infiltrative properties.
- Cut stumps flush with soil surface or grind in place instead of grubbing when clearing trees from ski runs wherever practicable.
- Use applicable practices of BMP Road-7 (Stream Crossings) to design and construct stream crossings to minimize riparian and channel disturbance and pass anticipated flood flows and associated debris, while allowing desired aquatic organism passage.
  - Maintain normal stream patterns, geometry, and habitat features to the extent practicable.
- Use low-pressure construction and maintenance equipment whenever practicable to reduce surface impact on steep slopes.
- Stockpile biologically active topsoil removed during excavation for use in reclamation.
  - Store stockpiled topsoil separately from other vegetative slash, soil, or rock and protect from wind and water erosion, unnecessary compaction, and contaminants.
- Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Maintain desired ground cover with irrigation, fertilization, or other treatments as necessary.
- Use suitable measures to direct overland flow on slopes into areas with intact soil horizons to encourage infiltration and disconnect overland flow from waterbodies.
- Treat disturbed soil to promote onsite water capture and infiltration.
- Prohibit traffic on disturbed areas during periods of excessive soil moisture, precipitation, or runoff.
- Monitor revegetation response (height, root growth, ground coverage, etc.) in terms of its capacity to avoid or minimize erosion during runoff.
  - Perform additional revegetation or erosion control as needed to protect water quality and soil integrity.

Rec-11. Ski Area Snowmaking

Manual or Handbook Reference FSM 2343.1 and FSH 2709.11 41.6.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at all stages of the snowmaking process, including diversions, conveyance, storage, application, and return of applied waters.

Explanation All phases of snowmaking at a ski area can affect the watershed and water quality. Construction of diversion, conveyance, storage, and delivery structures can create ground disturbance leading to erosion and sedimentation. Water withdrawal from rivers and streams can create or exacerbate stream dewatering and adversely affect overwintering habitat for fish and other aquatic-dependent species. Transfer of water from one basin to another for snowmaking can lead to an annual water supply outside the natural range of variation in the receiving watershed. This additional water in spring runoff can cause changes in stream channel morphology including streambank erosion and headward extension of the channel.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Manage snowmaking and snow farming to avoid or minimize slope failures and gully erosion on the hillslopes and excessive bank erosion and sediment in receiving streams.
    - ❑ Limit snowmaking on graded terrain to the extent practicable to minimize surface runoff and subsequent erosion from reduced infiltration capacity.
- Use applicable practices of BMP WatUses-1 (Water Uses Planning) when authorizing snowmaking.
- Use applicable practices of BMP AqEco-3 (Ponds and Wetlands), BMP WatUses-4 (Water Diversions and Conveyances), and BMP WatUses-5 (Dams and Impoundments) when obtaining water and developing water storage facilities for snowmaking.
- Transport water to the slopes in the least disruptive manner.
    - ❑ Use applicable practices of BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Ways) when constructing, maintaining, and operating pipelines.
- Design snowmaking systems to return runoff water to the source from which it was removed.
    - ❑ Avoid interbasin transfer of waters, where practicable, to maintain original duration, magnitude, and patterns of runoff in affected watersheds.
- Avoid contaminating return water with chemicals or other pollutants.
- Monitor all aspects of the process and correct problems as they occur to avoid or minimize long-term effects.
    - ❑ Regularly inspect snowmaking lines and equipment to prevent accidental discharges and erosion due to equipment failure.

Rec-12. Ski Area Facilities

Manual or Handbook Reference FSM 2343.1 and FSH 2709.11 41.6.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources originating from design, construction, operation, and maintenance of ski area facilities.

Explanation Ski area facilities include buildings, sanitary facilities, parking lots, and other infrastructure. These facilities can be located at the base of the ski area, mid-slope, or at the top of the ski hill. During construction and operation of facility sites, land may be cleared of existing vegetation and ground cover, exposing mineral soil that may be more easily eroded by water, wind, and gravity. Changes in land use and impervious surfaces can alter temporarily or permanently stormwater runoff that, if left uncontrolled, can affect morphology, stability, and quality of nearby streams and other waterbodies. Receiving waters can be contaminated by oil, grease, anti-freeze, sewage, trash, sediment, and salt. Construction and operation of these facilities should include measures that will avoid, minimize, or mitigate effects to water quality.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate ski area facilities on stable geology and soils to minimize risk of slope failures.
- Avoid wetlands and riparian areas to the extent practicable when locating ski area facilities.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to provide erosion and stormwater controls when constructing and operating ski area facilities.
- Use applicable practices of BMP Road-2 (Road Location and Design), BMP Road-3 (Road Construction and Reconstruction), BMP Road-4 (Road Operations and Maintenance), BMP Road-8 (Snow Storage and Removal), and BMP Road-9 (Parking Sites and Staging Areas) for designing, constructing, maintaining, and operating roads and parking areas at ski area facilities.
- Use applicable practices of BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Way) for managing power and utility lines at the ski area facilities.
- Use applicable practices of BMP Fac-6 (Hazardous Materials), BMP Fac-7 (Vehicle and Equipment Wash Water), and BMP Road-10 (Equipment Refueling and Servicing) for activities related to storage and maintenance of ski area vehicles and equipment.
- Use applicable practices of BMP Fac-3 (Potable Water Supply Systems) for drinking water, BMP Fac-4 (Sanitation Systems) for managing human waste, and BMP Fac-5 (Solid Waste Management) for managing solid waste at ski area facilities.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) when discontinuing use at ski area facilities.

Resources for Recreation Management Activities

Marinas and Recreational Boating

Oregon State Marina Board. 2002. Best management practices for environmental and habitat protection in design and construction of recreational boating facilities. Oregon State Marina Board. 9 p. Available at http://www.boatoregon.com/OSMB/library/docs/BoatingFacBMP2002-1.pdf.

U.S. Environmental Protection Agency (EPA), Office of Water. 2005. National management measures to control nonpoint source pollution from marinas and recreational boating. EPA-841-B-05-003. Washington, DC: U.S. Environmental Protection Agency, Office of Water. Available at http://www.epa.gov/owow/NPS/mmsp/index.html.

Off-Highway Vehicles

McCullah, J.; Sloan, R.; Dettman, K.; Jacobson, N.; and others. 2007. OHV BMP manual for erosion and sediment control. Sacramento, CA: State of California, Department of Parks and Recreation, Off-Highway Motor Vehicle Recreation Division. 317 p. Available at http://www.watchyourdirt.com/erosion-control-files/.

Shooting Ranges

EPA. 2005. Best management practices for lead at outdoor shooting ranges. EPA 902-B-01-001. New York, NY. Available at http://www.epa.gov/region02/waste/leadshot/epa_bmp.pdf.

Site Restoration

Therrell, L.; Cole, D.; Claassen, V.; Ryan, C.; Davies, M.A. 2006. Wilderness and backcountry site restoration guide. 0623-2815-MTDC. Missoula, MT: U.S. Department of Agriculture (USDA), Forest Service, Technology and Development Program. 394 p. Available at http://www.treesearch.fs.fed.us/pubs/26795.

Ski Areas

USDA Forest Service. 2000. Ski area BMPs—(Best management practices) guidelines for planning, erosion control, and reclamation. Salt Lake City, UT: U.S. Department of Agriculture, Forest Service, Wasatch-Cache National Forest, in cooperation with Sun Valley Corporation and Snowbasin Ski Area. 28 p.

Trails Davies, M.A.; Outka-Perkins, L. 2006. Building mountain bike trails: Sustainable singletrack. 0623-2314-MTDC (DVD). Missoula, MT: USDA Forest Service, Technology and Development Program. Available at http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm06232341/index.htm.

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State of New Hampshire, Department of Resources and Economic Development. 2004. Best management practices for erosion control during trail maintenance and construction. Concord, NH: State of New Hampshire, Department of Resources and Economic Development, Division of Parks and Recreation, Bureau of Trails. 27 p. Available at http://atfiles.org/files/pdf/BMPmanual2004.pdf.

Steinholz, R.T.; Vachowski, B. 2007. Wetland trail design and construction. 0723-2804-MTDC. Missoula, MT: USDA Forest Service, Technology and Development Program. 90 p. Available at http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm07232804/index.htm

Road Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and instream riparian resources that may result from road management activities. Road management activities include travel route planning, design, construction, operation, maintenance, reconstruction, storage, and decommissioning. Other transportation-system-related activities include stream and waterbody crossings, snow removal, parking areas, and equipment refueling and servicing areas.

Eleven National Core BMPs are in the Road Management Activities Category. These BMPs are to be used when managing roads on National Forest System (NFS) lands. BMP Road-1 (Travel Management Planning and Analysis) is a planning BMP for transportation systems. BMP Road-2 (Road Location and Design), BMP Road-3 (Road Construction and Reconstruction), and BMP Road-4 (Road Operations and Maintenance) provide project-level direction for road construction and operations. BMP Road-5 (Temporary Roads) provides direction for construction and use of temporary roads. BMP Road-6 (Road Storage and Decommissioning) provides direction for roads that will not be needed for 1 year or more, or that are no longer needed. BMP Road-7 (Stream Crossings) provides practices for fords, bridges, culverts, and other crossings of flowing or standing water. BMP Road-8 (Snow Removal and Storage) provides direction for snowplowing. BMP Road-9 (Parking Areas and Staging Areas) provides direction for constructing and operating permanent and temporary parking areas. BMP Road-10 (Equipment Refueling and Servicing) provides practices for vehicle refueling and servicing areas. BMP Road-11 (Road Storm-Damage Surveys) provides direction for monitoring of roads after major storms. Each BMP draws on administrative directives that guide agency management of roads on NFS land (Forest Service Manual [FSM] 7710).

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Road BMPs	
Road-1	Travel Management Planning and Analysis
Road-2	Road Location and Design
Road-3	Road Construction and Reconstruction
Road-4	Road Operations and Maintenance
Road-5	Temporary Roads
Road-6	Road Storage and Decommissioning
Road-7	Stream Crossings
Road-8	Snow Removal and Storage
Road-9	Parking and Staging Areas
Road-10	Equipment Refueling and Servicing
Road-11	Road Storm-Damage Surveys

Road-1. Travel Management Planning and Analysis

Manual or Handbook Reference Forest Service Manual (FSM) 7710; Forest Service Handbook (FSH) 7709.55; and FSH 7709.59, chapter 10.

Objective Use the travel management planning and analysis processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during road management activities.

Explanation Road management related planning includes travel analyses as well as consideration of road management objectives and maintenance levels to address access needs and adjustments for projects. Planning occurs at scales that range from forestwide assessments and plans, to watershed scale or project-level analyses, to individual road activities. Effects to soil, water quality, and riparian resources are evaluated during planning and balanced with the social, economic, and land management needs of the area. Appropriate protection and mitigation measures are considered when soil, water quality, and riparian resources may be adversely impacted.

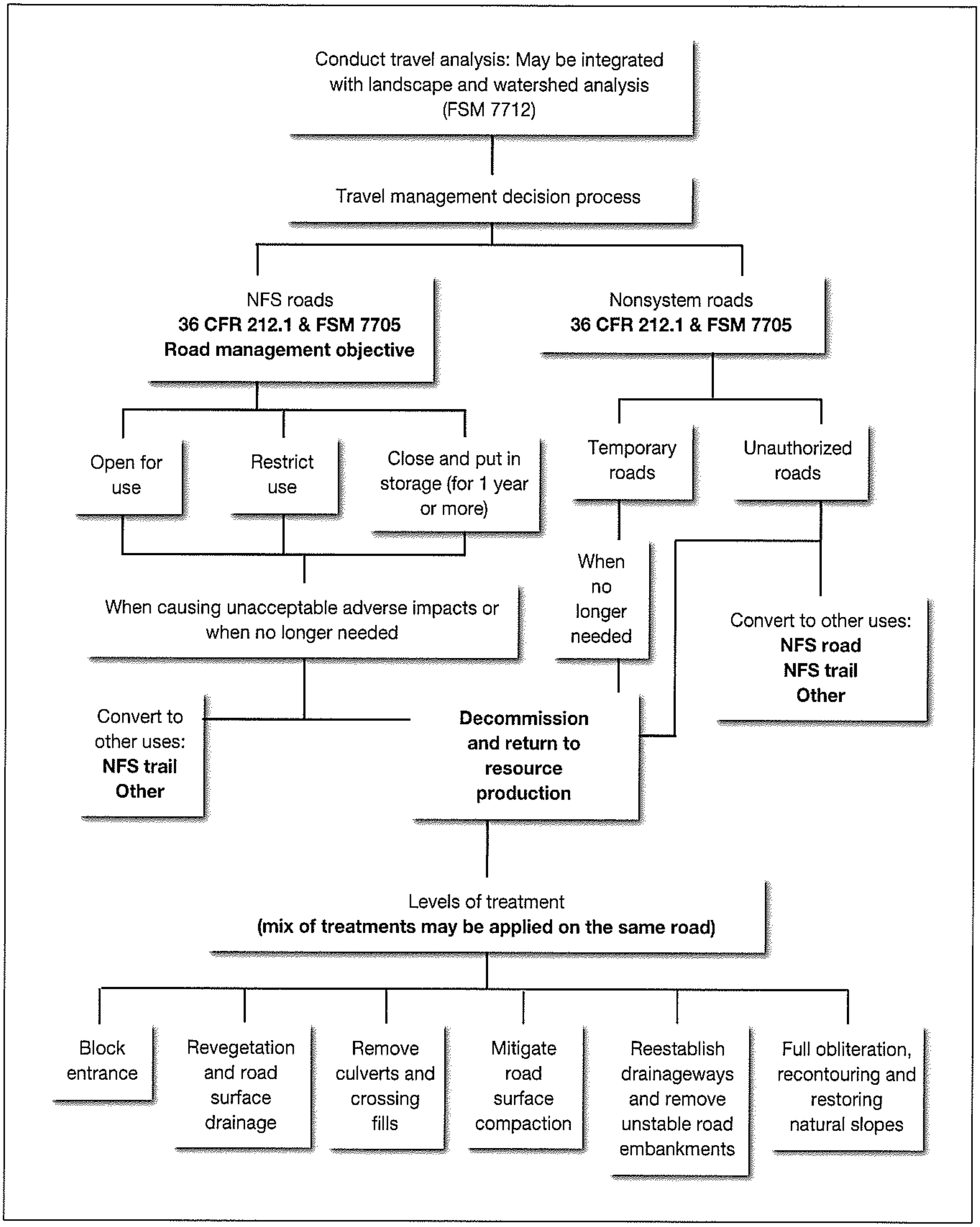
Travel analysis is conducted at a scope and scale determined by the line officer and used to inform future project decisions on the benefits and risks of, as well as the ongoing need for, the transportation system. Project-level travel analyses are conducted to inform decisions and facilitate vegetation, fire and fuels, rangeland, recreation, minerals, or other management actions. Such analyses contain detail on the condition of individual roads. Options for road management are shown in figure 3.

Road Management Objectives (RMOs) are developed and documented for each system road and include the intent and purpose in providing access to implement the land management plan. In addition to considering route needs at the site scale, RMOs also document the purpose of the road (access needs) along with operational maintenance levels and objectives.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when conducting travel management planning and analysis.
- Use interdisciplinary coordination for travel planning and project-level transportation analysis, including engineers, hydrologists, soil scientists, and other resource specialists as needed, to balance protection of soil, water quality, and riparian resources with transportation and access needs.
- Design the transportation system to meet long-term land management plan desired conditions, goals, and objectives for access rather than to access individual sites.
- Limit roads to the minimum practicable number, width, and total length consistent with the purpose of specific operations, local topography, geology, and climate to achieve land management plan desired conditions, goals, and objectives for access and water quality management.
  - Use existing roads when practicable.
  - Use system roads where access is needed for long-term management of an area or where control is needed in the location, design, or construction of the road to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Figure 3. Road Options



- Use temporary roads for short-term access needs if the road can be constructed, operated, and obliterated without specific control of techniques to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources (See BMP Road-5 [Temporary Roads]).
    - Decommission temporary roads and return to resource production when the access is no longer needed (See BMP Road-6 [Road Storage and Decommissioning]).
    - Consider placing roads in storage (Maintenance Level 1) when the time between intermittent uses exceeds 1 year and the costs of annual maintenance (both economic and potential disturbance) or potential failures due to lack of maintenance exceed the benefits of keeping the road open in the interim (See BMP Road-6 [Road Storage and Decommissioning]).
    - Consider decommissioning unneeded existing roads within a planning area when planning new system roads to reduce cumulative impacts to soil, water quality, and riparian resources (See BMP Road-6 [Road Storage and Decommissioning]).
- Plan road networks to have the minimum number of waterbody crossings as is practicable and necessary to achieve transportation system desired conditions, goals, and objectives.
- Develop or update RMOs for each system road to include design criteria, operation criteria, and maintenance criteria to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - Use applicable practices of BMP Road-2 (Road Location and Design) to establish design elements and standards.
    - Use applicable practices of BMP Road-4 (Road Operations and Maintenance) to establish criteria on how the road is to be operated and maintained.
    - Revise RMOs as needed to meet changing conditions.
- Identify and evaluate road segments causing, or with the potential to cause, adverse effects to soil, water quality, and riparian resources.
    - Identify and prioritize suitable mitigation measures to avoid, minimize, or mitigate adverse effects (see BMPs Road-2 (Road Location and Design), Road-3 (Road Construction and Reconstruction), Road-4 (Road Operations and Maintenance), Road-6 (Road Storage and Decommissioning), and Road-7 (Stream Crossings) for potential mitigation measures).

Road-2. Road Location and Design

Manual or Handbook Reference FSM 7720 and FSH 7709.56.

Objective Locate and design roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Explanation Roads are located according to standards and specifications to meet their use objectives while protecting other resources. Well-defined project objectives are needed to locate and design roads that will best address environmental and resources issues as well as road use, safety, and traffic requirements.

New roads can be designed to avoid or minimize adverse effects to soil, water quality, and riparian resources, while existing roads may need to be redesigned or relocated to mitigate such effects. Management needs have changed considerably since most NFS roads were constructed. Influences of roads on aquatic and riparian systems are currently better understood. Designs for improvements to existing roads often revise the original design to change location, drainage, crossing type or size, or surfacing. Improvements to the road system are made on a priority basis that considers road and resource condition, values at risk, available funding, and cost.

In addition, some situations may require adherence to special conditions associated with Clean Water Act (CWA) 401 certification, CWA 402 permits, and CWA 404 permits. State and local entities may also provide guidance and regulations such as a Forest Practices Act or a Stream Alteration Act. Land management plans often contain direction on location of roads relative to streams, wetlands, and unstable landforms.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Location

- Locate roads to fit the terrain, follow natural contours, and limit the need for excavation.
  - ❑ Avoid locations that require extended steep grades, sharp curves, or switchbacks.
- Locate roads on stable geology with well-drained soils and rock formations that dip into the slope.
  - ❑ Avoid hydric soils, inner gorges, overly steep slopes, and unstable landforms to the extent practicable.
- Locate roads as far from waterbodies as is practicable to achieve access objectives, with a minimum number of crossings and connections between the road and the waterbody.
  - ❑ Avoid sensitive areas such as riparian areas, wetlands, meadows, bogs, and fens, to the extent practicable.
  - ❑ Provide an AMZ of suitable width between the road and a waterbody to maintain desired conditions, goals, and objectives for structure, function, and processes of the AMZ and associated waterbody when a road must parallel a waterbody (See BMP Plan-3 [AMZ Planning]).
- Relocate existing routes or segments that are causing, or have the potential to cause, adverse effects to soil, water quality, and riparian resources, to the extent practicable.
  - ❑ Obliterate the existing road or segment after the relocated section is completed (see BMP Road-6 [Road Storage and Decommissioning]).

Predesign

- Consider design criteria relative to soil, water quality, and riparian resources from the decision document and associated National Environmental Policy Act (NEPA) analysis document.
- Consider the road RMOs and likely future maintenance schedule in the initial design.
- Conduct suitable site investigations, data collection, and evaluations commensurate with the anticipated design and sensitivity of the area to soil, water quality, and riparian resource impacts.
  - ❑ Consider subsurface conditions and conduct suitable investigations and stability analyses for road and bridge locations where slope instability can occur due to road construction.
  - ❑ Conduct a suitable soils and geotechnical evaluation to identify susceptibility to erosion and stable angles of repose.

Design

- Design the road to fit the ground and terrain with the least practicable impacts to soil, water quality, and riparian resources considering the purpose and life of the road, safety, and cost.
  - ❑ Use road standards that minimize impacts for grade and alignment (e.g., width, turning radius, and maximum slope).
  - ❑ Use low impact development treatments that reduce long-term maintenance needs wherever practicable.
- Design the road to maintain stable road prism, cut, and fill slopes.
  - ❑ Design cut and fill slope ratios to reduce soil loss from mass failures.
  - ❑ Use structural or nonstructural measures as necessary to stabilize cut and fill slopes.
- Design the road surface drainage system to intercept, collect, and remove water from the road surface and surrounding slopes in a manner that minimizes concentrated flow in ditches, culverts, and over fill slopes and road surfaces.
  - ❑ Use structural or nonstructural measures suitable to the road materials, road gradient, and expected traffic levels.
  - ❑ Use an interval between drainage features that is suitable for the road gradient, surface material, and climate.
  - ❑ Use suitable measures to avoid or minimize erosion of ditches.
- Design the road subsurface drainage system to intercept, collect, and remove groundwater that may flow into the base course and subgrade, lower high-water tables, and drain water pockets.
  - ❑ Use suitable subsurface dispersion or collection measures to capture and disperse locally shallow groundwater flows intercepted by road cuts.
  - ❑ Use suitable measures to release groundwater into suitable areas without causing erosion or siltation.
- Design the road for minimal disruption of natural drainage patterns and to minimize the hydrologic connection of the road segment or network with nearby waterbodies.
  - ❑ Use suitable structural or nonstructural measures to avoid or minimize gully formation and erosion of fill slopes at outfalls of road surface drainage structures.
  - ❑ Use suitable measures to avoid, to the extent practicable, or minimize direct discharges from road drainage structures to nearby waterbodies.
  - ❑ Provide sufficient buffer distance at the outfalls of road surface drainage structures for water to infiltrate before reaching the waterbody.
  - ❑ Use applicable practices of BMP Road-7 (Stream Crossings) to limit the number and length of water crossing connected areas to the extent practicable.
- Design road surface treatment to support wheel loads, stabilize the roadbed, reduce dust, and control erosion consistent with anticipated traffic and use.
  - ❑ Consider whether road closures or roadway surface drainage and erosion protection can adequately mitigate adverse effects to soil, water quality, and riparian resources.
- Design roads within the AMZ (when no practicable alternative exists outside of the AMZ to achieve access objectives) to maintain desired conditions, goals, and objectives for AMZ structure, function, and processes (See BMP Plan-3 [AMZ Planning]).

- Use suitable measures to minimize or mitigate effects to waterbodies and other sensitive areas when adverse impacts cannot be practicably avoided.

- Design waterbody crossings to avoid or minimize adverse effects to soil, water quality, and riparian resources to the extent practicable consistent with road use, legal requirements, and cost considerations (See BMP Road-7 [Stream Crossings]).
- Design a post-construction site vegetation plan, including short- and long-term objectives, using suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Road-3. Road Construction and Reconstruction

Manual or Handbook Reference FSM 7720, FSH 7709.56, and FSH 7709.57.

Objective Avoid or minimize adverse effects to soil, water quality, and riparian resources from erosion, sediment, and other pollutant delivery during road construction or reconstruction.

Explanation During road construction and reconstruction activities, vegetation and ground cover is removed exposing soil to erosion. Temporary and long-term erosion control and stormwater management measures are necessary to reduce erosion and maintain overall slope stability. These erosion control measures may include vegetative and structural practices to ensure long-term stability of the area.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when constructing or reconstructing system roads.
- Use suitable construction techniques to create stable fills.
  - Use full bench construction techniques or retaining walls where stable fill construction is not possible.
  - Avoid incorporating woody debris in the fill portion of the road prism.
  - Leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill.
  - Avoid use of road fills for water impoundment dams unless specifically designed for that purpose.
- Identify and locate waste areas before the start of operations.
  - Deposit and stabilize excess and unsuitable materials only in designated sites.
  - Do not place such materials on slopes with a risk of excessive erosion, sediment delivery to waterbodies, mass failure, or within the AMZ.
  - Provide adequate surface drainage and erosion protection at disposal sites.
- Do not permit sidecasting within the AMZ.
  - Avoid or minimize excavated materials from entering waterbodies or AMZs.
- Develop and follow blasting plans when necessary.
  - Use restrictive blasting techniques in sensitive areas and in sites that have high landslide potential.

- Avoid blasting when soils are saturated.

- Remove slash and cull logs to designated sites outside the AMZ for storage or disposal.
  - Consider using cull logs in aquatic ecosystem projects to achieve aquatic resource management objectives as opportunities arise.
- Use suitable measures in compliance with local direction to prevent and control invasive species.
- Construct pioneer roads using suitable measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Confine construction of pioneer roads to the planned roadway limits unless otherwise specified.
  - Locate and construct pioneering roads to avoid or minimize undercutting of the designated final cut slope.
  - Avoid deposition of materials outside the designated roadway limits.
  - Use suitable crossing structures, or temporarily dewater live streams, where pioneer roads intersect streams.
  - Use suitable erosion and stormwater control measures as needed (see BMP Fac-2 [Facility Construction and Stormwater Control]).
- Reconstruct existing roads to the degree necessary to provide adequate drainage and safety.
  - Avoid disturbing stable road surfaces.
  - Use suitable measures to avoid, to the extent practicable, or minimize direct discharges from road drainage structures to nearby waterbodies.

Road-4. Road Operations and Maintenance

Manual or Handbook Reference FSM 7732 and FSH 7709.59, chapter 60.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling road use and operations and providing adequate and appropriate maintenance to minimize sediment production and other pollutants during the useful life of the road.

Explanation Control of road use and operations and appropriate maintenance can protect road investment and soil, water quality, and riparian resources. Periodic inventory and assessment that determine road condition are used to determine operational controls and maintenance needs.

Operational objectives and activities are documented in the RMOs. In travel management decisions, roads open to motorized vehicle use are designated by allowed vehicle class and, if appropriate, by time of year. Road operations include administering permits, contracts, and agreements, controlling allowed use, maintaining roads in closed status, and revising maintenance levels and seasonal closures as needed. Road closures and restrictions are necessary because many forest roads are designed for dry season use. Many local roads are not surfaced; while others have some surfacing but little to no base. Such roads can be damaged by use during wet periods or by loads heavier than the road was designed to convey.

Properly maintained road surfaces and drainage systems can reduce adverse effects to water resources by encouraging natural hydrologic function. Roads and drainage systems normally deteriorate because of traffic, weather, and age. In addition, roads occasionally become saturated by groundwater springs and seeps after a wildfire or unusually wet periods. Many such conditions can be corrected by timely maintenance. While routine maintenance is needed to ensure the road performs as designed, however, it can also be a source of soil disturbance, concentrated flow, sediment production, and slope instability if done improperly. Lower impact maintenance techniques may be desired to minimize disturbance of stable sites.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Operations

- Designate season of use to avoid or restrict road use during periods when use would likely damage the roadway surface or road drainage features.
- Designate class of vehicle and type of uses suitable for the road width, location, waterbody crossings, and road surfaces to avoid or minimize adverse effects to soil, water quality, or riparian resources to the extent practicable.
- Use suitable measures to communicate and enforce road use restrictions.
- Use suitable measures to avoid or minimize adverse effects to soil, water quality, or riparian resources when proposed operations involve use of roads by traffic and during periods for which the road was not designed.
  - ❑ Strengthen the road surface in areas where surfaces are vulnerable to movement such as corners and steep sections.
  - ❑ Upgrade drainage structures to avoid, to the extent practicable, or minimize direct discharges into nearby waterbodies.
  - ❑ Restrict use to low-ground-pressure vehicles or frozen ground conditions.
  - ❑ Strengthen the road base if roads are tending to rut.
  - ❑ Adjust maintenance to handle the traffic while minimizing excessive erosion and damage to the road surface.
- Ensure that drainage features are fully functional on completion of seasonal operations.
  - ❑ Shape road surfaces to drain as designed.
  - ❑ Construct or reconstruct drainage control structures as needed.
  - ❑ Ensure that ditches and culverts are clean and functioning.
  - ❑ Remove berms unless specifically designed for erosion control purposes.
- Consider potential for water quality effects from road damage when granting permits for oversize or overweight loads.
- Use suitable road surface stabilization practices and dust abatement supplements on roads with high or heavy traffic use (See FSH 7709.56 and FSH 7709.59).
- Use applicable practices of Chemical Use Management Activities BMPs when chemicals are used in road operations.

Inspection

- Periodically inspect system travel routes to evaluate condition and assist in setting maintenance and improvement priorities.

- Give inspection priority to roads at high risk of failure to reduce risk of diversions and cascading failures.

- Inspect drainage structures and road surfaces after major storm events and perform any necessary maintenance (see BMP Road-11 [Road Storm-Damage Surveys]).
  - Repair and temporarily stabilize road failures actively producing and transporting sediment as soon as practicable and safe to do so.
- Inspect roads frequently during all operations.
  - Restrict use if road damage such as unacceptable surface displacement or rutting is occurring.

Maintenance Planning

- Develop and implement annual maintenance plans that prioritize road maintenance work for the forest or district.
  - Increase priority for road maintenance work on road sections where road damage is causing, or potentially would cause, adverse effects to soil, water quality, and riparian resources.
  - Consider the risk and consequence of future failure at the site when prioritizing repair of road failures.
- Develop and implement annual road maintenance plans for projects where contractors or permittees are responsible for maintenance activities.
  - Define responsibilities and maintenance timing in the plan.

Maintenance Activities

- Maintain the road surface drainage system to intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces.
  - Clean ditches and catch basins only as needed to keep them functioning.
  - Do not undercut the toe of the cut slope when cleaning ditches or catch basins.
  - Use suitable measures to avoid, to the extent practicable, or minimize direct discharges from road drainage structures to nearby waterbodies.
- Identify diversion potential on roads and prioritize for treatment.
  - Minimize diversion potential through installation and maintenance of dips, drains, or other suitable measures.
- Maintain road surface treatments to stabilize the roadbed, reduce dust, and control erosion consistent with anticipated traffic and use.
- Grade road surfaces only as necessary to meet the smoothness requirements of the assigned operational maintenance level and to provide adequate surface drainage.
  - Do not undercut the toe of the cut slope when grading roads.
  - Do not permit sidecasting of maintenance-generated debris within the AMZ to avoid or minimize excavated materials entering waterbodies or riparian areas.
  - Avoid overwidening of roads due to repeated grading over time, especially where sidecast material would encroach on waterbodies.
  - Use potential sidecast or other waste materials on the road surface where practicable.
  - Dispose of unusable waste materials in designated disposal sites.

- Remove vegetation from swales, ditches, and shoulders, and cut and fill slopes only when it impedes adequate drainage, vehicle passage, or obstructs necessary sight distance to avoid or minimize unnecessary or excessive vegetation disturbance.
- Maintain permanent stream crossings and associated fills and approaches to reduce the likelihood that water would be diverted onto the road or erode the fill if the structure becomes obstructed.
- Identify waterbody-crossing structures that lack sufficient capacity to pass expected flows, bedload, or debris, or that do not allow for desired aquatic organism passage, and prioritize for treatment.
    - Use applicable practices of BMP Road-7 (Stream Crossings) to improve crossings.
- Use applicable practices of BMP Road-6 (Road Storage and Decommissioning) for maintenance and management of Maintenance Level 1 roads.
- Ensure the necessary specifications concerning prehaul maintenance, maintenance during haul, and posthaul maintenance (putting the road back in storage) are in place when maintenance level 1 roads are opened for use on commercial resource management projects or other permitted activities.
    - Require the commercial operator or responsible party to leave roads in a satisfactory condition when project is completed.

Road-5. Temporary Roads

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of temporary roads.

Explanation Temporary roads may be used in situations where access needs are short-term and the roads can be constructed without requiring advanced engineering design or construction practices to avoid, minimize, or mitigate adverse effects to resources. Practices related to road location and stormwater and erosion control should be applied to temporary roads. Temporary roads are to be decommissioned and the area returned to resource production after the access is no longer needed.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Road-2 (Road Location and Design) to locate temporary roads.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when constructing temporary roads.
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Schedule construction activities to avoid direct soil and water-disturbance during periods of the year when heavy precipitation and runoff are likely to occur.
- Routinely inspect temporary roads to verify that erosion and stormwater controls are implemented, functioning, and appropriately maintained.

- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning.
- Use suitable measures in compliance with local direction to prevent and control invasive species.
- Use temporary crossings suitable for the expected uses and timing of use (See BMP Road-7 [Stream Crossings]).
- Use applicable practices of BMP Road-6 (Road Storage and Decommissioning) to obliterate the temporary road and return the area to resource production after the access is no longer needed.

Road-6. Road Storage and Decommissioning

Manual or Handbook Reference FSH 7709.59, chapter 60 and FSM 7734.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by storing closed roads not needed for at least 1 year (Intermittent Stored Service) and decommissioning unneeded roads in a hydrologically stable manner to eliminate hydrologic connectivity, restore natural flow patterns, and minimize soil erosion.

Explanation Roads not needed for access for long periods (greater than 1 year) may be put into storage (Intermittent Stored Service—Maintenance Level 1) to reduce maintenance costs. Level 1 roads receive basic custodial maintenance focusing on maintaining drainage facilities and runoff patterns to avoid or minimize damage to adjacent resources and to perpetuate the road for future use. The integrity of the roadway is retained to the extent practicable and measures are implemented to reduce sediment delivery from the road surface and fills and reduce the risk of crossing failure and stream diversion.

Roads no longer needed are identified during transportation planning activities at the forest, watershed, or project level. The former road may be decommissioned or converted to a trail as appropriate. Decommissioned roads are stabilized and restored to a more natural state to protect and enhance NFS lands. Temporary roads constructed for a specific short-term purpose (e.g., ski area development, minerals exploration, or timber harvesting) are decommissioned at the completion of their intended use.

Road decommissioning includes a variety of treatments to block the road, revegetate the road surface, restore surface drainage, remove crossing structures and fills, mitigate road surface compaction, re-establish drainageways, remove unstable road embankments, and recontour the surface to restore natural slopes. One or more treatments are applied to decommission the road depending on resource objectives and cost.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Implement suitable measures to close and physically block the road entrance so that unauthorized motorized vehicles cannot access the road.
    - ❑ Remove the road from the Motor Vehicle Use Map (MVUM) to include the change in the annual forestwide order associated with the MVUM.
- Establish effective ground cover on disturbed sites to avoid or minimize accelerated erosion and soil loss.

- Use suitable species and establishment techniques to stabilize and revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Road Storage

- Evaluate all stream and waterbody crossings for potential for failure or diversion of flow if left without treatment.
  - Use suitable measures to reduce the risk of flow diversion onto the road surface.
  - Consider leaving existing crossings in low-risk situations where the culvert is not undersized, does not present an undesired passage barrier to aquatic organisms, and is relatively stable.
  - Remove culverts, fill material, and other structures that present an unacceptable risk of failure or diversion.
  - Reshape the channel and streambanks at the crossing-site to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site.
  - Use suitable measures to avoid or minimize scour and downcutting.
- Use suitable measures to ensure that the road surface drainage system will intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces without frequent maintenance.
- Use suitable measures to stabilize unstable road segments, seeps, slumps, or cut or fill slopes where evidence of potential failure exists.

Road Conversion to Trail

- Reclaim unneeded road width, cut, and fill slopes when converting a road for future use as a trail.
- Use suitable measures to stabilize reclaimed sections to avoid or minimize undesired access and to restore desired ecologic structures or functions.
- Use suitable measures to ensure that surface drainage will intercept, collect, and remove water from the trail surface and surrounding slopes in a manner that minimizes concentrated flow and erosion on the trail surfaces without frequent maintenance.
- Use applicable practices of BMP Road-7 (Stream Crossings) to provide waterbody crossings suitable to the expected trail uses.

Road Decommissioning

- Use existing roads identified for decommissioning as skid roads in timber sales or land stewardship projects before closing the road, where practicable, as the opportunity arises.
- Evaluate risks to soil, water quality, and riparian resources and use the most practicable, cost-effective treatments to achieve long-term desired conditions and water quality management goals and objectives.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when obliterating system roads.
- Implement suitable measures to re-establish stable slope contours and surface and subsurface hydrologic pathways where necessary to the extent practicable to avoid or minimize adverse effects to soil, water quality, and riparian resources.
  - Remove drainage structures.

- Recontour and stabilize cut slopes and fill material.
- Reshape the channel and streambanks at crossing sites to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site.
- Restore or replace streambed materials to a particle size distribution suitable for the site.
- Restore floodplain function.

- Implement suitable measures to promote infiltration of runoff and intercepted flow and desired vegetation growth on the road prism and other compacted areas.
- Use suitable measures in compliance with local direction to prevent and control invasive species.

Road-7. Stream Crossings

Manual or Handbook Reference Manual or Handbook Reference: FSM 7722 and FSH 7709.56b.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing, reconstructing, or maintaining temporary and permanent waterbody crossings.

Explanation Forest and grassland management activities often occur in areas that require surface waters to be crossed. Depending on the activity type and duration, crossings may be needed permanently or temporarily. Permanent crossings, in general, are more durable and are designed by an engineer to meet applicable standards while also protecting water quality and riparian resources.

Examples of crossings include culverts, bridges, arched pipes, low-water crossings, vented fords, and permeable fills. Crossing materials and construction will vary based on the type of access required, duration of need, and volume of use expected. Crossings should be designed and installed to provide for flow of water, bedload, and large woody debris, desired aquatic organism passage, and to minimize disturbance to the surface and shallow groundwater resources.

Construction, reconstruction, and maintenance of a crossing usually requires heavy equipment to be in and near streams, lakes, and other aquatic habitats to install or remove culverts, fords, and bridges, and their associated fills, abutments, piles, and cribbing. Such disturbance near the waterbody can increase the potential for accelerated erosion and sedimentation by altering flow paths and destabilizing streambanks or shorelines, removing vegetation and ground cover, and exposing or compacting the soil. Use of heavy equipment has a potential for contaminating the surface water from vehicle fluids or introducing aquatic nuisance species.

Some crossings may require adherence to special conditions associated with CWA 401 certification or CWA 404 permits. State and local entities may also provide guidance and regulations such as a Forest Practices Act or a Stream Alteration Act.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Crossings

- Plan and locate surface water crossings to limit the number and extent to those that are necessary to provide the level of access needed to meet resource management objectives as described in the RMOs.

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.
- Use crossing structures suitable for the site conditions and the RMOs.
- Design and locate crossings to minimize disturbance to the waterbody.
- Use suitable measures to locate, construct, and decommission or stabilize bypass roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Use suitable surface drainage and roadway stabilization measures to disconnect the road from the waterbody to avoid or minimize water and sediment from being channeled into surface waters and to dissipate concentrated flows.
- Use suitable measures to avoid, minimize, or mitigate damage to the waterbody and banks when transporting materials across the waterbody or AMZ during construction activities.

Stream Crossings

- Locate stream crossings where the channel is narrow, straight, and uniform, and has stable soils and relatively flat terrain to the extent practicable.
  - Select a site where erosion potential is low.
  - Orient the stream crossing perpendicular to the channel to the extent practicable.
  - Keep approaches to stream crossings to as gentle a slope as practicable.
  - Consider natural channel adjustments and possible channel location changes over the design life of the structure.
- Design the crossing to pass a normal range of flows for the site.
  - Design the crossing structure to have sufficient capacity to convey the design flow without appreciably altering streamflow characteristics.
  - Install stream crossings to sustain bankfull dimensions of width, depth, and slope and maintain streambed and bank resiliency and continuity through the structure.
- Bridge, culvert, or otherwise design road fill to prevent restriction of flood flows.
  - Use site conditions and local requirements to determine design flood flows.
  - Use suitable measures to protect fill from erosion and to avoid or minimize failure of the crossing at flood flows.
  - Use suitable measures to provide floodplain connectivity to the extent practicable.
- Use suitable measures to avoid or minimize scour and erosion of the channel, crossing structure, and foundation to maintain the stability of the channel and banks.
- Design and construct the stream crossing to maintain the desired migration or other movement of fish and other aquatic life inhabiting the waterbody.
  - Consider the use of bottomless arch culverts where appropriate to allow for natural channel migration and desired aquatic organism passage.
  - Install or maintain fish migration barriers only where needed to protect endangered, threatened, sensitive, or unique native aquatic populations, and only where natural barriers do not exist.
  - Use stream simulation techniques where practicable to aid in crossing design.

- Bridges
  - ❑ Use an adequately long bridge span to avoid constricting the natural active flow channel and minimize constriction of any overflow channel.
  - ❑ Place foundations onto nonscour-susceptible material (e.g., bedrock or coarse rock material) or below the expected maximum depth of scour.
  - ❑ Set bridge abutments or footings into firm natural ground (e.g., not fill material or loose soil) when placed on natural slopes.
  - ❑ Use suitable measures as needed in steep, deep drainages to retain approach fills or use a relatively long bridge span.
  - ❑ Avoid placing abutments in the active stream channel to the extent practicable.
  - ❑ Place in-channel abutments in a direction parallel to the streamflow where necessary.
  - ❑ Use suitable measures to avoid or minimize, to the extent practicable, damage to the bridge and associated road from expected flood flows, floating debris, and bedload.
  - ❑ Inspect the bridge at regular intervals and perform maintenance as needed to maintain the function of the structure.
- Culverts
  - ❑ Align the culvert with the natural stream channel.
  - ❑ Cover culvert with sufficient fill to avoid or minimize damage by traffic.
  - ❑ Construct at or near natural elevation of the streambed to avoid or minimize potential flooding upstream of the crossing and erosion below the outlet.
  - ❑ Install culverts long enough to extend beyond the toe of the fill slopes to minimize erosion.
  - ❑ Use suitable measures to avoid or minimize water from seeping around the culvert.
  - ❑ Use suitable measures to avoid or minimize culvert plugging from transported bedload and debris.
  - ❑ Regularly inspect culverts and clean as necessary.
- Low-Water Crossings
  - ❑ Consider low-water crossings on roads with low traffic volume and slow speeds, and where water depth is safe for vehicle travel.
  - ❑ Consider low-water crossings to cross ephemeral streams, streams with relatively low baseflow and shallow water depth or streams with highly variable flows or in areas prone to landslides or debris flows.
  - ❑ Locate low-water crossings where streambanks are low with gentle slopes and channels are not deeply incised.
  - ❑ Select and design low-water crossing structures to maintain the function and bedload movement of the natural stream channel.
  - ❑ Locate unimproved fords in stable reaches with a firm rock or gravel base that has sufficient load-bearing strength for the expected vehicle traffic.
  - ❑ Construct the low-water crossing to conform to the site, channel shape, and original streambed elevation and to minimize flow restriction, site disturbance, and channel blockage to the extent practicable.
  - ❑ Use suitable measures to stabilize or harden the streambed and approaches, including the entire bankfull width and sufficient freeboard, where necessary to support the design vehicle traffic.

- Use vented fords with high vent area ratio to maintain stream function and aquatic organism passage.
- Construct the roadway-driving surface with material suitable to resist expected shear stress or lateral forces of water flow at the site.
- Consider using temporary crossings on roads that provide short-term or intermittent access to avoid, minimize, or mitigate erosion, damage to streambed or channel, and flooding.
- Design and install temporary crossings suitable for the expected users, loads, and timing of use.
- Design and install temporary crossing structures to pass a design storm determined based on local site conditions and requirements.
- Install and remove temporary crossing structures in a timely manner as needed to provide access during use periods and minimize risk of washout.
- Use suitable measures to stabilize temporary crossings that must remain in place during high runoff seasons.
- Monitor temporary crossings regularly while installed to evaluate condition.
- Remove temporary crossings and restore the waterbody profile and substrate when the need for the crossing no longer exists.

Standing Water and Wetland Crossings

- Disturb the least amount of area as practicable when crossing a standing waterbody.
- Provide for sufficient cross drainage to minimize changes to, and avoid restricting, natural surface and subsurface water flow of the wetland under the road to the extent practicable.
  - Locate and design roads or road drainage to avoid dewatering or polluting wetlands.
  - Avoid or minimize actions that would significantly alter the natural drainage for flow patterns on lands immediately adjacent to wetlands.
- Use suitable measures to increase soil-bearing capacity and reduce rutting from expected vehicle traffic.
- Construct fill roads only when necessary.
  - Construct fill roads parallel to water flow and to be as low to natural ground level as practicable.
  - Construct roads with sufficient surface drainage for surface water flows.

Road-8. Snow Removal and Storage

Manual or Handbook Reference FS-7700-41 and FSH 7709.59, chapter 24.11.

Objective Avoid or minimize erosion, sedimentation, and chemical pollution that may result from snow removal and storage activities.

Explanation Snow removal from roads and parking areas may adversely affect water quality and riparian resources in several ways. Plowing may physically displace native or engineered surfaces on roads, damage drainage structures, or alter drainage patterns. Plowing may also remove protective soil cover (e.g., vegetation or mulch). These changes can result in concentrated flow, increased erosion, and greater risk of sediment delivery to waterbodies.

Snow piled in large mounds or berms, or in sensitive areas, may contribute to increased run-off, hill slope erosion, mass slope instability, and in-channel erosion from snowmelt. Snow stored in riparian areas and floodplains may compact soils, break or stunt vegetation, or channel runoff in undesirable patterns, thereby weakening the buffering capacity of these areas. Additionally, both snow removal and storage may result in additions of salts or fine aggregates used for de-icing or traction control and other vehicle pollutants directly to surface water and indirectly to both surface water and groundwater during runoff.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Develop a snow removal plan for roads plowed for recreation, administrative, or other access to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Use existing standard contract language (C5.316# or similar) for snow removal during winter logging operations to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Limit use of approved deicing and traction control materials to areas where safety is critical (e.g., intersections, steep segments, and corners).
  - ❑ Use site-specific characteristics such as road width and design, traffic concentration, and proximity to surface waters to determine suitable amount of de-icing material to apply.
  - ❑ Use effective plowing techniques to optimize chemical de-icer use.
  - ❑ Consider use of alternative materials to chemical de-icers, such as sand or gravel, in sensitive areas.
  - ❑ Use properly calibrated controllers to ensure material application rates are accurately regulated.
  - ❑ Limit spray distribution of chemical de-icers when near surface waters.
  - ❑ Design paved roads and parking lots to facilitate sand removal (e.g., curbs or paved ditches).
- Use suitable measures when storing de-icing materials to avoid or minimize mobility of the materials.
  - ❑ Store de-icing materials on a flat, upland, impervious area of adequate size to accommodate material stockpiles and equipment movement.
  - ❑ Stockpile de-icing materials under cover and provide runoff collection, containment, and treatment, as necessary, to avoid or minimize offsite movement.
- Move snow in a manner that will avoid or minimize disturbance of or damage to road surfaces and drainage structures.
  - ❑ Mark drainage structures to avoid damage during plowing.
  - ❑ Conduct frequent inspections to ensure road drainage is not adversely affecting soil or water resources.
- Control areas where snow removal equipment can operate to avoid or minimize damage to riparian areas, floodplains, and stream channels.
- Install snow berms where such placement will preclude concentration of snowmelt runoff and will serve to dissipate melt water.
  - ❑ Provide frequent drainage through snow berms to avoid concentration of snowmelt runoff on fillslopes and other erosive areas, to dissipate melt water, and to avoid or minimize sediment delivery to waterbodies.

- Store snow in clearly delineated pre-approved areas where snowmelt runoff will not cause erosion or deliver snow, road de-icers, or traction-enhancing materials directly into surface waters.
  - ❑ Store or dispose of snow adjacent to or on pervious surfaces in upland areas away from waterbodies to the extent practicable.
  - ❑ Do not store or dispose of snow in riparian areas, wetlands, or streams unless no other practicable alternative exists.
- Manage discharge of meltwater to avoid or minimize runoff of pollutants into surface waterbodies or groundwater.
  - ❑ Use suitable measures to filter and treat meltwater before reaching surface water or groundwater.
  - ❑ Use suitable measures to disperse meltwater to avoid creating concentrated overland flow.
  - ❑ Collect and properly dispose of onsite litter, debris, and sediment from meltwater settling areas.
- Discontinue road use and snow removal when use would likely damage the roadway surface or road drainage features.
  - ❑ Modify snow removal procedures as necessary to meet water quality concerns.
- Replace lost road surface materials with similar quality material and repair structures damaged in snow removal operations as soon as practicable.

Road-9. Parking and Staging Areas

Manual or Handbook Reference FSM 7710, FSM 7720, and FSM 7730.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing and maintaining parking and staging areas.

Explanation Parking and staging areas on NFS lands may be permanent or temporary and are associated with a variety of uses including administrative buildings, developed recreation sites, trailheads, and forest management projects. These parking facilities sometimes constitute large areas with little or no infiltration capacity. Runoff from these areas can create rills or gullies and carry sediment, nutrients, and other pollutants to nearby surface waters.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Design and locate parking and staging areas of appropriate size and configuration to accommodate expected vehicles and avoid or minimize adverse effects to adjacent soil, water quality, and riparian resources.
  - ❑ Consider the number and type of vehicles to determine parking or staging area size.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when designing, constructing, reconstructing, or maintaining parking or staging areas.
- Use suitable measures to harden and avoid or minimize damage to parking area surfaces that experience heavy use or are used during wet periods.

- Use and maintain suitable measures to collect and contain oil and grease in larger parking lots with high use and where drainage discharges directly to streams.
- Connect drainage system to existing stormwater conveyance systems where available and practicable.
- Conduct maintenance activities commensurate with parking or staging area surfacing and drainage requirements as well as precipitation timing, intensity, and duration.
- Limit the size and extent of temporary parking or staging areas.
  - Take advantage of existing openings, sites away from waterbodies, and areas that are apt to be more easily restored to the extent practicable.
  - Use temporary stormwater and erosion control measures as needed.
  - Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to rehabilitate temporary parking or staging areas as soon as practicable following use.

Road-10. Equipment Refueling and Servicing

Manual or Handbook Reference FSM 2160 and FSH 7109.19, chapter 40.

Objective Avoid or minimize adverse effects to soil, water quality, and riparian resources from fuels, lubricants, cleaners, and other harmful materials discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources during equipment refueling and servicing activities.

Explanation Many activities require the use and maintenance of petroleum-powered equipment in the field. For example, mechanical vegetation management activities may employ equipment that uses or contains gasoline, diesel, oil, grease, hydraulic fluids, antifreeze, coolants, cleaning agents, and pesticides. These petroleum and chemical products may pose a risk to contaminating soils, surface water, and groundwaters during refueling and servicing the equipment. BMP Fac-6 (Hazardous Materials) provides additional guidance for handling hazardous materials.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Plan for suitable equipment refueling and servicing sites during project design.
  - Allow temporary refueling and servicing only at approved locations, located well away from the AMZ, groundwater recharge areas, and waterbodies.
- Develop or use existing fuel and chemical management plans (e.g., Spill Prevention Control and Countermeasures [SPCC], spill response plan, and emergency response plan) when developing the management prescription for refueling and servicing sites.
- Locate, design, construct, and maintain petroleum and chemical delivery and storage facilities consistent with applicable local, State, and Federal regulations.
- Use suitable measures around vehicle service, storage and refueling areas, chemical storage and use areas, and waste dumps to fully contain spills and avoid or minimize soil contamination and seepage to groundwater.
- Provide training for all agency personnel handling fuels and chemicals in their proper use, handling, storage, and disposal.

- Ensure that contractors and permit holders provide documentation of proper training in handling hazardous materials.

- Use suitable measures to avoid spilling fuels, lubricants, cleaners, and other chemicals during handling and transporting.
- Prohibit excess chemicals or wastes from being stored or accumulated in the project area.
- Remove service residues, used oil, and other hazardous or undesirable materials from NFS land and properly dispose them as needed during and after completion of the project.
- Clean up and dispose of spilled materials according to specified requirements in the appropriate guiding document.
- Report spills and initiate suitable cleanup action in accordance with applicable State and Federal laws, rules, and regulations.
    - Remove contaminated soil and other material from NFS lands and dispose of this material in a manner consistent with controlling regulations.
- Prepare and implement a certified SPCC Plan for each facility, including mobile and portable facilities, as required by Federal regulations.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim equipment refueling and services site when the need for them ends.

Road-11. Road Storm-Damage Surveys

Manual or Handbook Reference FSM 7730 and FSM 2350.

Objective Monitor road conditions following storm events to detect road failures; assess damage or potential damage to waterbodies, riparian resources, and watershed functions; determine the causes of the failures; and identify potential remedial actions at the damaged sites and preventative actions at similar sites.

Explanation Large storms stress road systems in multiple ways: large volumes of water are transported on road surfaces and through its drainage systems; significant volumes of water and debris are transported through stream crossings; and elevated pore pressures on unstable hillslopes, road cutslopes, and fillslopes sometimes generate mass failures. All road drainage systems, stream crossings with culverts, and unstable slopes have the potential to fail during periods of high runoff. The probabilities of failure differ greatly, and the potential consequences to water quality and designated uses vary dramatically from no impacts to severe and long-term impacts to aquatic systems.

Surveying roads during or soon after storms is critical to timely detection of these problems. Observation of problems caused by storm runoff is of great value in understanding both the causes of failure and in adapting designs and prescriptions that reduce both the probability and consequences of future road failures. Over time, this kind of monitoring illustrates how and where roads can fail and points readily to practice modifications that can reduce adverse effects to water quality and watershed function.

The Emergency Relief for Federally Owned Roads (ERFO) Program is intended to help assess and fund the unusually heavy expenses associated with repairing and reconstructing Federal roads and bridges seriously damaged by a natural disaster over a wide area or catastrophic failure. To qualify for this type of funding, applications for repair must be submitted to the Federal Highways Administration through the ERFO program (FSM 7700).

Practices ***ERFO-Related Damage Surveys***

- Complete a Damage Survey Report (DSR) at damaged sites potentially eligible for ERFO funds.
- Complete the Forest Service-developed supplemental form DSR+ in the field to more thoroughly describe, in categorical terms, the cause(s) and consequences of the damage.
    - The DSR+ form and instructions may be found at http://www.stream.fs.fed.us/bmp/damagesurveys.
- Record the following information from damage sites that have been documented on the DSR and DSR+ forms in appropriate corporate database(s), including geographic information systems:
    - The geographic locations (points or road segments) where damage occurred.
    - The date of occurrence (year and month, if available).
    - The type of failure and its cause.

Special Storm Damage Surveys

- Determine the need to do more comprehensive surveys and analysis of road damage after particularly large storm events.
    - Survey all roads in the area, typically an entire watershed, ranger district, or national forest or grassland, affected by the storm or those roads that may be particularly susceptible to failure.

All Damage Surveys

- Analyze results from EFRO surveys, routine damage reconnaissance, and special surveys for patterns of damage and causes.
- Use these patterns of road damage to formulate recommendations of practice changes to reduce the incidence of future damage. Consider practice changes such as—
    - Locating or relocating roads to more stable terrain (see BMP Road-2 [Road Location and Design]);
    - Disconnecting road surface drainage from crossings and channels (see BMP Road-3 [Road Construction and Reconstruction]);
    - Using special protections in locations on unstable landforms or areas with high erosion potential (see BMP Road-3 [Road Construction and Reconstruction]);
    - Increasing the capacity of stream-crossing structures to pass water, debris, and sediment to reduce the probabilities of failure (see BMP Road-7 [Stream Crossings]);
    - Building or rebuilding stream crossings to eliminate or reduce diversion potential (see BMP Road-7 [Stream Crossings]);
    - Building or rebuilding stream crossings to improve aquatic species passage (see BMP Road-7 [Stream Crossings]); or
    - Decommissioning or storing roads in a hydrologically benign condition (see BMP Road-6 [Road Storage and Decommissioning]).
- Enter and store the results of data analysis in corporate data management systems to facilitate sharing among units that have similar terrain and road practices.

Resources for Road Management Activities

Aquatic Passage

Clarkin, K.; et al. 2008. Stream simulation: An ecological approach to providing passage for aquatic organisms at road-stream crossings. 0877 1801-SDTDC. San Dimas, CA: USDA Forest Service, Technology and Development Program. Available at http://www.fs.fed.us/eng/pubs/pdf/StreamSimulation/index.shtml.

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Crossings

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Cafferata, P.; Spittler, T.; Wopat, M.; Bundros, G.; Flanagan, S. 2004. Designing watercourse crossings for passage of 100-year flood flows, wood and sediment. California Forestry Report 1. Sacramento, CA: State of California, The Resources Agency, Department of Forestry and Fire Prevention. 34 p. Available at http://www.fire.ca.gov/resourcemanagement/pdf/100yr32links.pdf.

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USDA Natural Resources Conservation Service (NRCS). National conservation practice standards—396 fish passage, 578 stream crossing. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

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California Department of Transportation. 2003. Construction sites best management practices (BMP) field manual and troubleshooting guide. 147 p. Available at http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm.

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General

Male, P. 2010. The basics of a good road. CLRP Report No. 08-06. Ithaca, NY: Cornell University Local Roads Program. 96 p. Available at http://www.clrp.cornell.edu/workshops/pdf/basics_of_a_good_road-2010-web.pdf.

Meitl, J.; Maguire, T. (Eds.). 2003. Compendium of best management practices to control polluted runoff: A source book. Boise, ID: Idaho Department of Environmental Quality. Available at http://www.deq.State.id.us/water/data_reports/surface_water/nps/reports.cfm#bmps.

USDOT Federal Highways Administration. 2003. Standard specifications for construction of roads and bridges on Federal highway projects. FP-03. Washington, DC. 699 p. Available at http://flh.fhwa.dot.gov/resources/pse/specs/.

USDA Forest Service. Water/road interaction series. San Dimas, CA: USDA Forest Service, Technology and Development Program. Available at http://www.fs.fed.us/eng/pubs/.

U.S. Environmental Protection Agency (EPA), Office of Water. 2005. National management measures to control nonpoint source pollution from forestry. EPA 841-B-05-001. Washington, DC. Available at http://www.epa.gov/owow/nps/forestrymgmt/.

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Keller, G.; Sherar, J. 2003. Low-volume roads engineering—Best management practices field guide. Washington, DC: USDA Forest Service, Office of International Programs, and U.S. Agency for International Development. 158 p. Available at http://www.fs.fed.us/global/topic/welcome.htm#12.

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State Forestry BMP Documents

See Appendix B.

Mechanical Vegetation Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from mechanical treatments to manage vegetation. Mechanical treatments are used to manage vegetation for a variety of purposes including timber harvest, site preparation, vegetation type conversion, fire or fuels treatment, forest health and rangeland improvement, and wildlife habitat improvement. Authorizing documents for mechanical treatments are timber sale contracts, stewardship contracts, or project plans.

Eight National Core BMPs are in the Mechanical Vegetation Management Activities category. These BMPs are to be used in all mechanical vegetation management projects on National Forest System (NFS) lands. BMP Veg-1 (Vegetation Management Planning) is a planning BMP for vegetation management projects. BMP Veg-2 (Erosion Prevention and Control) provides direction for erosion control measures for mechanical vegetation treatment projects. BMP Veg-3 (Aquatic Management Zones) provides direction for mechanical vegetation treatments in the areas adjacent to waterbodies. BMP Veg-4 (Ground-Based Skidding and Yarding Operations) and BMP Veg-5 (Cable and Aerial Yarding Operations) provide direction for yarding activities in timber management projects. BMP Veg-6 (Landings) provides direction for construction and use of landings. BMP Veg-7 (Winter Logging) provides additional direction for skidding and yarding operations in winter. BMP Veg-8 (Mechanical Site Treatment) provides practices for other mechanical vegetation treatments for site preparation, fuel treatment, and habitat improvements.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Mechanical Vegetation Management BMPs	
Veg-1	Vegetation Management Planning
Veg-2	Erosion Prevention and Control
Veg-3	Aquatic Management Zones
Veg-4	Ground-Based Skidding and Yarding Operations
Veg-5	Cable and Aerial Yarding Operations
Veg-6	Landings
Veg-7	Winter Logging
Veg-8	Mechanical Site Treatment

Veg-1. Vegetation Management Planning

Manual or Handbook Reference Forest Service Manual (FSM) 1921.12.

Objective Use the applicable vegetation management planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during mechanical vegetation treatment activities.

Explanation Vegetation on NFS lands is managed for a variety of purposes to achieve land management plan desired conditions, goals, and objectives for many resources. Planning for vegetation management generally follows a sequence of steps. The gathering and assessment of data involves evaluating the current condition of the vegetation compared to land management plan desired conditions, goals, and objectives. Potential vegetation treatment options to move the site towards desired conditions are developed and compared. Detailed treatment prescriptions are prepared to implement the preferred treatment option. The project is subjected to the National Environmental Policy Act (NEPA) analysis process where alternatives are developed and effects are analyzed. A decision is made and implemented. During the development of vegetation treatment prescriptions and alternatives, site specific measures consistent with BMP guidance to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resource are identified and included in the project as design criteria or mitigation measures. These BMP prescriptions are incorporated into the timber sale contract, stewardship contract, or project plan.

Vegetation management for scheduled timber harvest on NFS lands has additional specific requirements from the National Forest Management Act that are incorporated into the project in the planning process. Scheduled timber harvest can occur only where watershed conditions will be maintained, lands can be adequately restocked within 5 years after final regeneration harvest, and water quality will be protected.

Practices

Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone (AMZ) Planning) when planning vegetation management projects.
    - Evaluate opportunities to use proposed mechanical vegetation treatment projects to achieve AMZ desired conditions, goals, and objectives in the project area.
- Evaluate and field verify site conditions in the project area to design mechanical vegetation treatment prescriptions that avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - Validate land management plan timber suitability decisions for the project area.
    - Design mechanical vegetation treatment prescriptions to limit site disturbance, soil exposure, and displacement to acceptable levels as determined from the land management plan desired conditions, standards, and guidelines or other local direction or requirements.
    - Evaluate direct, indirect, and cumulative effects of vegetation alteration on streamflow regimes and consequent channel responses at suitable watershed scales.
    - Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for ground-based, cable, and aerial yarding systems (see BMP Veg-4 [Ground-Based Skidding and Yarding Operations] and BMP Veg-5 [Cable and Aerial Yarding Operations]).
    - Use the most economically practicable yarding system that will minimize road densities.
    - Consider site preparation and fuel treatment needs and options.
    - Use applicable practices of BMP Veg-8 (Mechanical Site Treatment) to determine areas suitable for mechanical treatments for site preparation, fuels treatment, habitat improvements, or other vegetation management purposes.
    - Evaluate the capabilities of the machinery likely to operate in the landscape under consideration.
    - Use preplanning to schedule entry or timing of mechanical and other vegetation treatments (e.g., prescribed fire or chemical treatments) when needed for large projects.

- Evaluate and field verify site conditions in the project area to design a transportation plan associated with the mechanical vegetation treatments to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - ❑ Use the logging system that best fits the topography, soil types, and season, while minimizing soil disturbance and road densities and that economically achieves silvicultural objectives.
    - ❑ Use applicable practices of BMP Road-2 (Road Location and Design), BMP Veg-4 (Ground-Based Skidding and Yarding Operations), BMP Veg-5 (Cable and Aerial Yarding Operations), and BMP Veg-6 (Landings) to determine proposed location and size of roads, landings, skid trails, and cable corridors.
    - ❑ Use applicable practices of BMP Road-1 (Travel Management Planning and Analysis) and BMP Road-5 (Temporary Roads) to determine the need for specified roads and temporary roads.
    - ❑ Evaluate the condition of system roads, including roads in storage, and unauthorized roads in the project area to determine their suitability for use in the project and any reconstruction or prehaul maintenance needs.
    - ❑ Evaluate the Road Management Objective of system roads to determine where log hauling should be prohibited or restricted.
- Identify sources of rock for roadwork, riprapping, and borrow materials (see BMP Min-6 [Mineral Materials Resource Sites]).
- Identify water sources available for purchasers' use (see BMP WatUses-3 [Administrative Water Developments]).
- Ensure the timber sale contract, stewardship contract, or other implementing document includes BMPs from the decision document to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - ❑ Use appropriate standard B and C provisions and regional or local provisions to address measures and responsibilities consistent with the BMPs in the decision document in the timber sale or stewardship contract.
    - ❑ Delineate all protected or excluded areas, including AMZs and waterbodies, on the sale area map or project map.
    - ❑ Delineate approved water locations, staging areas, and borrow areas on the sale area map or project map.
    - ❑ Ensure that the final unit location, layout, acreage, and logging system or mechanical treatment and Knutson-Vandenberg Act plans are consistent with the decision document.
- Use contract modification procedures to the extent practicable to modify unit design, treatment methods, or other project activities where necessary to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources based on new information or changed conditions discovered during project implementation.

Veg-2. Erosion Prevention and Control

Manual or Handbook Reference Forest Service Handbook (FSH) 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.

Explanation Prevention and control of erosion on areas undergoing mechanical vegetation treatments is critical to maintaining water quality. The process of erosion control has three basic phases: planning, implementation, and monitoring. During planning, areas subject to excessive erosion, detrimental soil damage and mass failure can be identified and avoided. Also during planning, treatments can be designed and units laid out to minimize or mitigate damage to soils, streambanks, shorelines, wetlands, riparian areas, and water quality. Planning for erosion control is addressed in BMP Plan-2 (Project Planning and Analysis) and BMP Veg-1 (Vegetation Management Planning). Suitable erosion control measures are implemented while the mechanical vegetation treatment is ongoing and following project completion. Inspection and maintenance of implemented measures will ensure their function and effectiveness over their expected design period.

The potential for accelerated erosion or other soil damage during or following mechanical treatments depends on climate, soil type, site conditions, and type of equipment and techniques used at the site. Erosion control measures are grouped into two general categories: structural measures to control and treat runoff and increase infiltration and nonstructural measures to increase ground cover. Many erosion control handbooks, technical guides, and commercial products are available. Both structural and nonstructural measures require onsite expertise to ensure proper design and implementation to conform to local site characteristics.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Establish designated areas for equipment staging and parking to minimize the area of ground disturbance (see BMP Road-9 [Parking Sites and Staging Areas]).
- Use provisions in the timber sale contract or land stewardship contract to implement and enforce erosion control on the project area.
  - Work with the contractor to locate landings, skid trails, and slash piles in suitable sites to avoid, minimize, or mitigate potential for erosion and sediment delivery to nearby waterbodies.
- Develop an erosion control and sediment plan that covers all disturbed areas including skid trails and roads, landings, cable corridors, temporary road fills, water source sites, borrow sites, or other areas disturbed during mechanical vegetation treatments.
- Refer to State or local forestry or silviculture BMP manuals, guidebooks, and trade publications for effective structural and nonstructural measures to—
  - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion before the next growing season.
  - Maintain the natural drainage pattern of the area wherever practicable.
  - Control, collect, detain, treat, and disperse stormwater runoff from disturbed areas.
  - Divert surface runoff around bare areas with appropriate energy dissipation and sediment filters.
  - Stabilize steep excavated slopes.

- Use suitable species and establishment techniques to cover or revegetate disturbed areas in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Use suitable measures in compliance with local direction to prevent and control invasive species.
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Operate equipment when soil compaction, displacement, erosion, and sediment runoff would be minimized.
    - Avoid ground equipment operations on unstable, wet, or easily compacted soils and on steep slopes unless operation can be conducted without causing excessive rutting, soil puddling, or runoff of sediments directly into waterbodies.
    - Evaluate site conditions frequently to assess changing conditions.
    - Adjust equipment operations as necessary to protect the site while maintaining efficient project operations.
- Install suitable stormwater and erosion control measures to stabilize disturbed areas and waterways on incomplete projects before seasonal shutdown of operations or when severe storm or cumulative precipitation events that could result in sediment mobilization to waterbodies are expected.
- Routinely inspect disturbed areas to verify that erosion and stormwater controls are implemented and functioning as designed and are suitably maintained.
- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning.
    - Prepare for unexpected failures of erosion control measures.
- Implement mechanical treatments on the contour of sloping ground to avoid or minimize water concentration and subsequent accelerated erosion.

Veg-3. Aquatic Management Zones

Manual or Handbook Reference FSM 2526, FSM 2527.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting mechanical vegetation treatment activities in the AMZ.

Explanation Designation of an AMZ around and adjacent to waterbodies is a typical BMP to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. Mechanical vegetation treatments are a tool that can be used within the AMZ to achieve a variety of resource-desired conditions and objectives when implemented with suitable measures to maintain riparian and aquatic ecosystem structure, function, and processes. Depending on site conditions and resource-desired conditions and objectives, mechanical vegetation treatments in the AMZ could range from no activity or equipment exclusion to purposely using mechanical equipment to create desired disturbances or conditions. When treatments are to be used in the AMZ, a variety of measures can be employed to avoid, minimize, or mitigate soil disturbance, damage to the waterbody, loss of large woody debris recruitment, and shading, and impacts to floodplain function.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-3 (AMZ Planning) to determine the need for and width of the AMZ considering the proposed mechanical vegetation treatments.
  - Modify AMZ width as needed to provide assurance of leave-tree wind firmness where high windthrow risk is identified.
- Clearly delineate AMZ locations and boundaries in the project area using suitable markings and structures.
  - Maintain or reestablish these boundaries as necessary during project implementation or operation.
  - Specify AMZ layout, maintenance, and operating requirements in contracts, design plans, and other necessary project documentation.
- Use mechanical vegetation treatments in the AMZ only when suitable to achieve long-term AMZ-desired conditions and management objectives (see BMP Plan-3 [AMZ Planning]).
- Modify mechanical vegetation treatment prescriptions and operations in the AMZs as needed to maintain ecosystem structure, function, and processes.
  - Design silvicultural or other vegetation management prescriptions to maintain or improve the riparian ecosystem and adjacent waterbody.
  - Use yarding systems or mechanical treatments that avoid or minimize disturbance to the ground and vegetation consistent with project objectives.
  - Conduct equipment operations in a manner that maintains or provides sufficient ground cover to meet land management plan desired conditions, goals, and objectives to minimize erosion and trap sediment.
  - Use suitable measures to avoid or minimize soil disturbance from equipment operations to stay within acceptable disturbance levels when conducting mechanical vegetation treatment operations.
  - Prescribe mechanical site preparation techniques and fuels and residual vegetation treatments that avoid or minimize excessive erosion, sediment delivery to nearby waterbodies, or damage to desired riparian vegetation.
  - Conduct operations in a manner that avoids or minimizes introduction of excess slash or other vegetative debris into the AMZ and waterbodies; damage to streambanks, shorelines, and edges of wetlands; and adverse effects to floodplain functioning.
  - Retain trees as necessary for canopy cover and shading, bank stabilization, and as a source of large woody debris within the AMZ.
  - Avoid felling trees into streams or waterbodies, except as planned to create habitat features.
- Locate transportation facilities for mechanical vegetation treatments, including roads, landings, and main skid trails, outside of the AMZ to the extent practicable.
  - Minimize the number of stream crossings to the extent practicable.
  - Evaluate options for routes that must cross waterbodies and choose the one (e.g., specified road vs. temporary road vs. skid road or trail) that avoids or minimizes adverse effects to soil, water quality, and riparian resources to the greatest extent practicable.
  - Do not use drainage bottoms as turn-around areas for equipment during mechanical vegetation treatments.
- Use suitable measures to disperse concentrated flows of water from road surface drainage features to avoid or minimize surface erosion, gully formation, and mass failure in the AMZ and sediment transport to the waterbody.

- Monitor the AMZ during mechanical operations to evaluate compliance with prescription and mitigation requirements in the authorizing document.
  - Adjust operations in the AMZ to avoid, minimize, or mitigate detrimental soil impacts where they are occurring.
  - Use suitable mitigation or restoration measures on areas in the AMZ that show signs of unacceptable erosion or those with high potential for erosion due to mechanical operations in the AMZ.
  - Remove unauthorized debris from waterbodies using techniques that will limit disturbance to bed and banks, riparian areas, aquatic-dependent species, and the waterbody unless significant damage would occur during its removal or leaving it in meets desired conditions for the waterbody.

Veg-4. Ground-Based Skidding and Yarding Operations

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during ground-based skidding and yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Explanation Ground-based yarding systems include an array of equipment from horses, rubber-tired skidders, and bulldozers, to feller or bunchers, forwarders, and harvesters. Each method can compact soil and cause soil disturbance, though the amount of impact depends on the specific type of equipment used, the operator, unit design, and site conditions. Ground-based yarding systems can be designed and implemented to avoid, minimize, or mitigate potential adverse effects to soils, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use ground-based yarding systems only where physical site characteristics are suitable to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for ground-based yarding systems.
- Use existing roads and skid trail networks to the extent practicable.
  - Create new roads and skid trail where re-use of existing ones would exacerbate soil, water quality, and riparian resource impacts.
- Design and locate skid trails and skidding operations to minimize soil disturbance to the extent practicable.
  - Designate skid trails to the extent practicable to limit site disturbance.
  - Locate skid trails outside of the AMZ to the extent practicable.
  - Locate skid trails to avoid concentrating runoff and provide breaks in grade.
  - Limit the grade of constructed skid trails on geologically unstable, saturated, highly erodible, or easily compacted soils.
  - Avoid long runs on steep slopes.

- Use suitable measures during felling and skidding operations to avoid or minimize disturbance to soils and waterbodies to the extent practicable.
  - Perform skidding or yarding operations when soil conditions are such that soil compaction, displacement, and erosion would be minimized.
  - Suspend skidding or yarding operations when soil moisture levels could result in unacceptable soil damage.
  - Avoid skidding logs in or adjacent to a stream channel or other waterbody to the extent practicable.
  - Skid across streams only at designated locations.
  - Use suitable measures at skid trail crossings to avoid or minimize damage to the stream channel and streambanks.
  - Directionally fell trees to facilitate efficient removal along predetermined yarding patterns with the least number of passes and least amount of disturbed area (e.g., felling-to-the-lead).
  - Directionally fell trees away from streambanks, shorelines, and other waterbody edges.
  - Remove logs from wet meadows or AMZs using suitable techniques to minimize equipment operations in the sensitive area and minimize dragging the logs on the ground.
  - Winch or skid logs upslope, away from waterbodies.
  - Use low ground pressure equipment when practicable, particularly on equipment traveling over large portions of units with sensitive soils or site conditions.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion to the extent practicable.
- Use suitable measures to stabilize and restore skid trails after use.
  - Reshape the surface to promote dispersed drainage.
  - Install suitable drainage features.
  - Mitigate soil compaction to improve infiltration and revegetation conditions.
  - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion before the next growing season.
  - Use suitable measures to promote rapid revegetation.
  - Use suitable measures in compliance with local direction to prevent and control invasive species.

Veg-5. Cable and Aerial Yarding Operations

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during cable and aerial yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Explanation Cable and aerial yarding systems partially or fully suspend logs off the ground when yarding logs to the landing. They include skyline cable, helicopter, and balloon systems that typically are used in steep, erodible, and unstable areas where ground-based systems should not operate. Soil disturbance and erosion risks from these systems are primarily confined to cable corridors and landings.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use cable or aerial yarding systems on steep slopes where ground-based equipment cannot operate without causing unacceptable ground disturbance.
  - ❑ Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for cable or aerial yarding systems.
  - ❑ Consider slope shape, potential barriers, lift and deflection requirements, and availability of suitable landing locations when selecting cable-yarding systems.
- Identify areas requiring cable or aerial yarding during project planning and in the contract.
- Identify necessary equipment capabilities in the contract.
- Locate cable corridors to efficiently yard materials with the least soil damage.
  - ❑ Use suitable measures to minimize soil disturbance when yarding over breaks in slope.
- Fully suspend logs to the extent practicable when yarding over AMZs and streams.
- Postpone yarding operations when soil moisture levels are high if the specific type of yarding system results in unacceptable soil disturbance and erosion within cable corridors.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion in cable corridors to the extent practicable.

Veg-6. Landings

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of log landings.

Explanation Log landings, in general, are the site of intense activity, serving as the endpoint of yarding operations, the setup location of large equipment (such as skyline yarders), loading areas for log trucks, and fueling and maintenance locations for heavy equipment. To accommodate all this activity, landings tend to be large, and their soils generally become compacted, rutted, and disturbed much more than the rest of the project area. Thus, landings have a high probability of being a source of concentrated overland flow containing sediment and other pollutants.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Minimize the size and number of landings as practicable to accommodate safe, economical, and efficient operations.
- Locate landings to limit the potential for pollutant delivery to waterbodies.
  - ❑ Locate landings outside the AMZ and as far from waterbodies as reasonably practicable based on travel routes and environmental considerations.
  - ❑ Avoid locating landings near any type of likely flow or sediment transport conduit during storms, such as ephemeral channels and swales, where practicable.
  - ❑ Locate landings to minimize the number of required skid roads.

- Avoid locating landings on steep slopes or highly erodible soils.
    - Avoid placing landings where skidding across drainage bottoms is required.
- Design roads and trail approaches to minimize overland flow entering the landing.
- Re-use existing landings where their location is compatible with management objectives and water quality protection.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion as needed during construction and use of log landings.
    - Install and maintain suitable temporary erosion control and stabilization measures when the landing will be reused within the same year.
- Use applicable practices of BMP Fac-6 (Hazardous Materials) and BMP Road-10 (Equipment Refueling and Servicing) when managing fuels, chemicals, or other hazardous materials on the landing.
- Use suitable measures as needed to restore and stabilize landings after use.
    - Remove all logging machinery refuse (e.g., tires, chains, chokers, cable, and miscellaneous discarded parts) and contaminated soil to a proper disposal site.
    - Reshape the surface to promote dispersed drainage.
    - Install suitable drainage features.
    - Mitigate soil compaction to improve infiltration and revegetation conditions.
    - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion before the next growing season.
    - Use suitable measures to promote rapid revegetation.
    - Use suitable species and establishment techniques to cover or revegetate disturbed areas in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Veg-7. Winter Logging

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from winter logging activities.

Explanation Winter logging on frozen or snow-covered ground is a common BMP in the colder regions of the country to avoid or minimize soil, watershed, riparian, and wetland impacts. Winter logging is not without risks of watershed effects. Unknowingly operating in wetland or riparian areas when the snow cover is inadequate can cause damage to soil and vegetation. Skidding or hauling on roads when the roadbed or the soil is not sufficiently frozen can cause soil compaction and rutting. Inadequate installation and maintenance of erosion controls before snowmelt and spring runoff can cause accelerated erosion and damage to roads.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Consider using snow-roads and winter harvesting in areas with high-water tables, sensitive riparian conditions, or other potentially significant soil erosion and compaction hazards.
    - Use snow roads for single-entry harvests or temporary roads.
- Mark existing culvert locations before plowing, hauling, or yarding operations begin to avoid or minimize damage from plowing or logging machinery.
- Ensure all culverts and ditches are open and functional during and after logging operations.
- Plow any snow cover off roadways to facilitate deep-freezing of the road grade before hauling.
    - Manage hauling to avoid or minimize unacceptable damage to the road surface.
- Use suitable measures to cross streams (see BMP Road-7 [Stream Crossings]).
    - Restore crossings to near preroad conditions to avoid or minimize ice dams when use of the snow-road is no longer needed.
- Conduct winter logging operations when the ground is frozen or snow cover and depth is adequate to avoid or minimize unacceptable rutting or displacement of soil.
- Suspend winter operations if ground and snow conditions change such that unacceptable soil disturbance, compaction, displacement, or erosion becomes likely.
- Compact the snow on skid trail locations when adequate snow depths exist before felling or skidding trees.
- Avoid locating skid trails on steep areas where frozen skid trails may be subject to soil erosion the next spring.
- Mark AMZ boundaries and stream courses before the first snow in a manner that will be clearly visible in heavy snows.
- Avoid leaving slash in streams or AMZs to the extent practicable.
- Install and maintain suitable erosion control on skid trails before spring runoff (see BMP Veg-2 [Erosion Prevention and Control]).
    - Install erosion control measures during the dry season if needed.

Veg-8. Mechanical Site Treatment

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling the introduction of sediment, nutrients, chemical, or other pollutants to waterbodies during mechanical site treatment.

Explanation Mechanical treatments are used to remove or reduce the amount of live and dead vegetation on a site to meet management objectives, such as site preparation for reforestation, fuel treatments to reduce fire hazards, wildlife habitat improvement, recreation access, utility corridor maintenance, and other activities that require removing vegetation from specified areas on a periodic and repeated basis. Mechanical treatments include cutting and piling; chipping or mulching; roller chopping or masticating using heavy equipment; and pushing over vegetation. Disturbance from mechanical site treatments can expose and compact soils, resulting in accelerated runoff and erosion.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Evaluate multiple site factors, including soil conditions, slope, topography, and weather, to prescribe the most suitable mechanical treatment and equipment to avoid or minimize unacceptable impacts to soil while achieving treatment objectives.
  - ❑ Consider the condition of the material and the site resulting from the treatment in comparison to desired conditions, goals, and objectives for the site when analyzing treatment options (e.g., a mastication treatment will result in a very different condition than a grapple pile and burn treatment).
  - ❑ Use land management plan direction, or other local guidance, to establish residual ground cover requirements and soil disturbance limits suitable to the site to minimize erosion.
  - ❑ Consider offsite use options for the biomass material to reduce onsite treatment and disposal.
- Use applicable practices of BMP Veg-3 (Aquatic Management Zones) when conducting mechanical treatments in the AMZ.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion.
  - ❑ Conduct mechanical activities when soil conditions are such that unacceptable soil disturbance, compaction, displacement, and erosion would be avoided or minimized.
  - ❑ Consider using low ground-pressure equipment, booms, or similar equipment to minimize soil disturbance.
- Operate mechanical equipment so that furrows and soil indentations are aligned on the contour.
- Scarify the soil only to the extent necessary to meet reforestation objectives.
  - ❑ Use site-preparation equipment that produces irregular surfaces.
  - ❑ Avoid or minimize damage to surface soil horizons to the extent practicable.
- Conduct machine piling of slash in such a manner to leave topsoil in place and to avoid displacing soil into piles.
- Re-establish vegetation as quickly as possible.
  - ❑ Evaluate the need for active and natural revegetation of exposed and disturbed sites.
  - ❑ Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Resources for Mechanical Vegetation Management Activities

BMP Effectiveness

Lynch, J.A.; Corbett, S. 1990. Evaluation of best management practices for controlling nonpoint pollution from silvicultural operations. Journal American Water Resources Association. 26(1): 41–52.

Rashin, E.B.; Clishe, C.J.; Loch, A.T.; Bell, J.M. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal American Water Resources Association. 42(5): 1307–1327.

General U.S. Environmental Protection Agency, Office of Water. 2005. National management measures to control nonpoint source pollution from forestry. EPA 841-B-05-001. Washington, DC. Available at http://www.epa.gov/owow/nps/forestrymgmt/.

Planning Grant, G.E.; Lewis, S.L.; Swanson, F.J.; Cissel, J.H.; McDonnell, J.J. 2008. Effects of forest practices on peak flows and consequent channel response: a state-of-the-science report for western Oregon and Washington. Gen. Tech. Rep. PNW- 760. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 76 p. Available at http://www.fs.fed.us/pnw/publications/gtrs2008.shtml.

Riparian Areas Goodwin, C.N.; Hawkins, C.P.; Kershner, J.L. 1997. Riparian restoration in the Western United States: Overview and perspective. Restoration Ecology. 5(s4): 4–14. Available at http://www.wiley.com/WileyCDA/WileyTitle/productCd-REC.html.

Vermont Agency of Natural Resources. 2005. Riparian buffers and corridors Technical papers. Waterbury, VT: Vermont Agency of Natural Resources. 39 p. Available at http://www.anr.state.vt.us/site/html/buff/anrbuffer2005.htm.

Selected State Forestry BMP Documents See Appendix B.

Water Uses Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from development and operation of infrastructure to collect, impound, store, transmit, and distribute water for uses on and off National Forest System (NFS) lands. Water use infrastructure includes wells for public or private water supply or groundwater monitoring; water source developments for Forest Service uses; water diversions and conveyances for uses off of NFS lands; and dams and impoundments for water supply storage, flood control, power generation, recreation, and wildlife habitat.

States govern the allocation of water for beneficial use. State laws and programs for water allocation vary widely across the country, from riparian rights systems to administrative permits to court-adjudicated water rights systems. The Forest Service responsibility when authorizing water use infrastructure projects is to avoid or minimize damage to NFS resources in compliance with environmental laws and land management plan direction.

Six National Core BMPs are in the Water Uses Management Activities category. These BMPs are to be used in all water use projects on NFS lands to the extent allowed by State laws and regulations pertaining to water allocation. Each BMP was formulated to reflect administrative directives that guide the Forest Service's development and administration of water uses on NFS lands. BMP WatUses-1 (Water Uses Planning) is a planning BMP for water uses projects. BMP WatUses-2 (Water Wells for Production and Monitoring) provides practices for drilling, operating, and abandoning water production and monitoring wells. BMP WatUses-3 (Administrative Water Developments) provides direction for development of water sources to be used for NFS land management purposes such as stock watering, potable water at campgrounds, or fire protection. BMP WatUses-4 (Water Diversions and Conveyances) provides direction for diversion and conveyance of surface water for third-party uses on or off NFS lands. BMP WatUses-5 (Dams and Impoundments) provides direction for construction and operation of dams and impoundments for flood control, hydroelectric power generation, water supplies, and recreation on NFS lands. BMP WatUses-6 (Dam Removal) provides direction for removal of dams and impoundments to restore streams and rivers.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Water Uses BMPs	
WatUses-1	Water Uses Planning
WatUses-2	Water Wells for Production and Monitoring
WatUses-3	Administrative Water Developments
WatUses-4	Water Diversions and Conveyances
WatUses-5	Dams and Impoundments
WatUses-6	Dam Removal

WatUses-1. Water Uses Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2540.

Objective Use the applicable authorization and administrative planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during construction, operation, maintenance, and restoration of water use infrastructure.

Explanation Development and operation of infrastructure for water uses involve ground disturbance for construction of the facility and changes to water levels and flow regimes in source and receiving waterbodies and aquifers during operations. During planning, site conditions are evaluated and water levels and flow needs of the aquatic ecosystem are assessed to determine site-specific measures to avoid, minimize, or mitigate adverse effects to soil, water quality, groundwater, and riparian resources.

Infrastructure for water uses may be developed on NFS lands by the Forest Service for a variety of administrative and resource management purposes. As new sites are created and existing sites are expanded or rehabilitated, potential effects of the proposed development and operation on soil, water quality, groundwater, and riparian resources are considered in the project National Environmental Policy Act (NEPA) analysis and decision. Site-specific BMP prescriptions are included in the project plan, contract, or other authorizing document as appropriate.

Infrastructure developed by others on NFS lands are administered through authorizations issued by the Forest Service to a public or private agency, group, or individual. Authorization documents include terms and conditions to protect the environment and comply with the requirements of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1752) and other laws. Control of nonpoint sources of water pollution using appropriate BMPs is included in these environmental protection requirements.

Facilities on lands withdrawn under authority of the Federal Energy Regulatory Commission (FERC) are exempt from Forest Service administrative control through the NFS permit system. When a FERC permit is issued or renewed, however, the Forest Service may provide FERC with recommended requirements and mitigation measures under which the permittee should operate to protect NFS resources. Such recommendations may include any BMPs necessary to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone (AMZ) Planning) when planning water use projects.
- Encourage reuse of water, to the extent practicable, to minimize withdrawals from surface water or groundwater sources.
- Determine the water quality, water quantity, flow regimes, and water levels necessary to maintain land management plan desired conditions, goals, and objectives, including applicable water quality standards for waterbodies and aquatic and groundwater-dependent ecosystems that are affected by the proposed project.
    - Specify a range of flows and levels to support desired uses and values.
- Obtain surface water (e.g., instream flow rights) and groundwater under appropriate Federal and State legal and regulatory authorities to avoid, minimize, or mitigate adverse effects to stream

processes, aquatic and riparian habitats and communities, groundwater-dependent ecosystems, and recreation and aesthetic values.

    - Prioritize protection of imperiled native species.

- Evaluate water levels, flows, and water quality of the affected waterbody or aquifer to ensure that the source can provide an adequate supply and quality of water for the intended purpose(s) and avoid or minimize damage to NFS resources.
    - Consider how the collection, diversion, storage, transmission, and use of the water would directly, indirectly, and cumulatively affect streamflow, water level, channel morphology and stability, groundwater, and aquatic and riparian habitats in source and receiving waterbodies at a watershed scale(s) suitable for the project area and impacts.
    - Consider the potential impacts of current and expected environmental conditions such as climate change on precipitation type, magnitude, frequency, and duration and related effects on runoff patterns and water yield.
- Develop a strategic plan for the development of a suitable number of durable long-term water sources for Forest Service administrative and resource management uses to achieve land management plan desired conditions, goals, and objectives.
    - Obtain necessary water rights, allocations, or permits and water quality permits and certifications from applicable Federal, State, and local agencies for Forest Service administrative or resource management water uses.
- Include permit conditions at the point of diversion, withdrawal, or storage to minimize damage to water-dependent resources and values consistent with land management plan desired conditions, goals, and objectives in authorizations for new or existing water use facilities.
    - Consider the water needs for physical stream processes, water quality, aquatic biota and their habitat, riparian habitat and communities, aesthetic and recreational values, and special designations such as Federal and State wild or scenic rivers.

WatUses-2. Water Wells for Production and Monitoring

Manual or Handbook Reference Forest Service Handbook (FSH) 7409.11, chapter 41.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, groundwater, and riparian resources from excessive withdrawals and contamination transmitted from or by water-well and monitoring-well developments.

Explanation Construction and operation of production wells, monitoring wells, and associated facilities have the potential to alter water levels and flow paths; contaminate surface water and groundwater; expose soil to accelerated erosion; and threaten the viability of aquatic and terrestrial species dependent on local surface water and groundwater. Properly designed wells and aboveground well-casing collars minimize the risk of aquifer contamination from the well-casing, animal and human activities, and accidental or intentional placement of materials into wells. Well uses should be within sustainable levels to avoid onsite and offsite effects to groundwater levels, streamflows, and riparian-dependent resources. States regulate water well drilling, and requirements vary.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate water production wells on high or well-drained ground at a sufficient distance away from potential contamination sources to avoid or minimize contamination.
- Locate monitoring wells according to a monitoring plan to minimize the number of wells needed to achieve monitoring objectives.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to control stormwater and erosion during construction of drill pads and associated facilities for well operation.
- Construct and complete wells consistent with applicable Federal and State regulations.
  - Use licensed well drilling contractors.
  - Use suitable measures to avoid or minimize well contamination, inter-aquifer exchange of water, floodwaters from contaminating the aquifer, and infiltration of surface water.
- Operate wells in such a manner as to avoid excessive withdrawals, maintain suitable groundwater levels, and minimize effects to groundwater-dependent ecosystems.
- Permanently seal abandoned wells consistent with applicable Federal, State, and local regulations and requirements.
  - Use licensed well drilling contractors.
  - Use suitable measures to avoid or minimize contaminating the aquifer or surface waters and interaquifer exchange and mixing of water.
  - Use suitable measures to preserve hydrogeologic conditions of the ground and aquifers.

WatUses-3. Administrative Water Developments

Manual or Handbook Reference FSM 2540.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when developing and operating water sources for Forest Service administrative and resource management purposes.

Explanation Water source developments are needed to supply water for a variety of Forest Service administrative and resource management purposes, including road construction and maintenance, dust control, fire control, recreation facilities, and livestock and wildlife watering. Water sources may be developed and used permanently or temporarily based on the needs of the management activity. Permanent water source development should be aimed toward the construction of a limited number of durable, long-term water sources. Piped and impounded diversions such as wells, spring developments, hydrants, supply lines, drains, ponds, cisterns, tanks, and dams are examples of permanent structures. Temporary water sources may be needed to support one-time or emergency projects such as watershed restoration and fire suppression.

Water source developments include the access road, turnaround, and drafting area. Soil, water quality, and riparian resources may be impacted by permanent or temporary water source construction and use. Potential impacts include erosion and sediment delivery to waterbodies; streambank and streambed alterations; contamination from equipment leaks or spills; changes in water temperatures; reduction in streamflows; loss of riparian vegetation; direct injury to aquatic species from pumping equipment; and transportation of eggs, larvae, and adults out of the aquatic system. Proper location and design of water sources or upgrading existing water source facilities can avoid, minimize, or mitigate adverse these impacts.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Design, construct, maintain, and monitor permanent waters sources in compliance with Federal, State, and local requirements.

Drafting From Streams or Standing Waterbodies

- Locate water source developments, including access roads, in such a manner as to avoid or minimize disturbance to the riparian area and streambanks and erosion and sedimentation to the extent practicable.
    - Draft from existing roads and bridges to the extent practicable to avoid creating new access roads.
    - Use existing hardened facilities, such as boat launches and campground access roads, for emergency or other short-term uses rather than native surface areas prone to erosion.
    - Locate facilities to minimize potential damage from streamflows.
    - Locate permanent storage tanks, dry hydrants, and standpipes outside of the AMZ to the extent practicable.
    - Locate off-channel ponds in areas where they will not be inundated with sediment at high flows.
    - Locate ponds or storage tanks as close to the major water use as practicable when water must be conveyed for use at a distance from the source.
- Design source developments, including access roads, in such a manner as to avoid or minimize disturbance to the riparian area and streambanks and to avoid or minimize erosion, sediment, and other pollutants to the extent practicable.
    - Design permanent facilities to maintain long-term stream function and processes.
    - Limit the size of the facility development footprint (area of bare soil with reduced infiltration capacity) to the minimum necessary for efficient operations to the extent practicable.
    - Design facility to minimize hydrologic connectivity with the waterbody to the extent practicable by providing a suitable vegetated filter strip, and designing access road slope and length, or using other suitable measures, to direct flow away from the waterbody (see BMP Road-2 [Road Location and Design]).
    - Modify vehicle access and turnaround areas to reduce the size of the facility within the most sensitive areas of the AMZ.
    - Install hardened facilities where an adequate streamflow exists throughout the drafting season.
- Construct water source developments, including access roads, in such a manner as to avoid or minimize disturbance to the riparian area and streambanks and erosion, sediment, and other pollutants to the extent practicable.
    - Use applicable practices of BMP Road-3 (Road Construction and Maintenance) when constructing access roads to control stormwater runoff and erosion.
    - Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.
    - Use applicable practices of BMP AqEco-3 (Ponds and Wetlands) when constructing off-channel ponds.

- Use suitable measures to minimize streambank alteration and excavation activity within the streambed to the extent practicable while providing an adequate area for water drafting.

- Conduct operations at water source developments in such a manner as to avoid, minimize, or mitigate adverse effects to aquatic species and habitats from water drafting.
    - Obtain and maintain water rights for administrative use and resource needs.
    - Avoid or minimize effects to the waterbody or aquifer by withdrawing only the minimum amount of water sufficient to achieve administrative or resource management needs.
    - Establish limits or guidelines for water withdrawals from a lake, pond, or reservoir source based on evaluation of storage capacity and recharge and potential impacts to habitat from drafting and drawdown.
    - Establish limits or guidelines for absolute pumping rates and pumping rate in relation to streamflow.
    - Limit drafting operations to daylight hours to avoid attracting fish to the drafting pool.
    - Use suitable screening devices to avoid or minimize transport of aquatic organisms out of the source waterbody.
    - Use suitable measures to avoid or minimize contamination from spills or leaks.
    - Use applicable practices of BMP Fac-6 (Hazardous Materials) to manage contamination from spills or leaks.
- Maintain sources and facilities such that diversion, drainage, and erosion control features are functional.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim water use sites when no longer needed.
    - Repair or restore temporary sources to their pre-use condition to the extent practicable before project completion.
    - Apply suitable seasonal protection measures to temporary sources if use extends past a single season.

Spring Developments

- Locate the water trough, tank, or pond at a suitable distance from the spring to avoid or minimize adverse effects to the spring and wetland vegetation from livestock trampling or vehicle access.
- Locate the spring box to allow water to flow by gravity from the spring to the spring box to eliminate disturbance from pumps and auxiliary equipment.
- Design the collection system to avoid, minimize, or mitigate adverse effects to the spring development and downstream waters from excessive water withdrawal, freezing, flooding, sedimentation, contamination, vehicular traffic, and livestock as needed.
    - Collect no more water than is sufficient to meet the intended purpose of the spring development.
    - Ensure that enough water remains in the spring to support the source groundwater-dependent ecosystem and downstream aquatic ecosystems.
    - Avoid or minimize sediment or bacteria from entering the water supply system.
    - Trap and remove sediment that does enter the system.
    - Intercept the spring flow below the ground surface upslope of where the water surfaces.

- Size the spring box sufficient to store expected volume of sediment generated between maintenance intervals and enough water for efficient operation of the system, and to provide access for maintenance and cleaning.
- Avoid or minimize backing up of spring flow by providing overflow relief sized to carry the maximum flow expected from the spring during periods of wet weather.
- Use suitable measures to avoid or minimize erosion at the overflow outlet.
- Maintain fish and wildlife access to water released below the spring development to the extent practicable.

- Construct the spring development in such a manner to avoid or minimize erosion, damage to vegetation, and contamination.
  - Use applicable practices from BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in springs.
  - Divert all surface water away from the spring to the extent practicable to avoid or minimize flooding near the spring development.
  - Use suitable species and establishment techniques for wet conditions to cover or revegetate disturbed areas near springs in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Operate and maintain the spring development and associated water storage in such a manner as to provide water of sufficient quantity and quality for the intended uses and avoid or minimize failure of infrastructure causing concentrated runoff and erosion.
  - Disinfect the spring water as needed to maintain water quality sufficient for intended uses in such a manner as to avoid or minimize adverse effects to the spring source.
  - Use suitable measures to manage uses such as livestock grazing and vehicle traffic around the spring development to avoid or minimize erosion and sedimentation affecting the spring.
  - Avoid heavy vehicle traffic over the uphill water-bearing layer to avoid or minimize compaction that may reduce water flow.
  - Use suitable measures to avoid or minimize overflow of water trough, tank, or pond.
  - Periodically monitor the spring development and promptly take corrective action for sediment buildup in the spring box, clogging of outlet and overflow pipes, diversion of surface water from the collection area and spring box, erosion from overflow pipes, and damage from animals.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim spring development sites when no longer needed.

WatUses-4. Water Diversions and Conveyances

Manual or Handbook Reference FSM 2729 and FSM 7510.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from construction, operation, and maintenance of water diversion and conveyance structures.

Explanation Water may be diverted from waterbodies on NFS lands by third parties and delivered to sites on or off of NFS lands for a variety of purposes, including agriculture, mining, domestic water supply, hydroelectric power generation, or other uses. Water delivery systems consist of a diversion structure and some type of conduit. Conduits can be ditches, open canals, flumes, tunnels, pipelines, or even natural channels. Structures to regulate flow, dispose of excess water, or trap sediment and debris may also be part of the water delivery system.

The construction, operation, and maintenance of water diversions and conveyances can have adverse direct and indirect effects on soil, water quality, and riparian resources. The construction or presence of access routes, head gates, storage tanks, reservoirs, and other facilities can alter water quality, water yield, runoff regimes, natural channel geomorphic processes, and fish and wildlife habitats. Altered flow regimes can result in elevated water temperatures, proliferating algal blooms, and invasive aquatic flora and fauna. Water yield and runoff changes can change sediment dynamics and affect channel shape and substrate composition. Regular maintenance of diversions and conveyances can result in contamination from pesticide applications, vegetation damage, and continued soil disturbance leading to increased erosion; however, lack of regular maintenance can increase the potential for even greater effects from failures of ditches and diversions.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate water conveyance structures in stable areas where they are not susceptible to damage from side drainage flooding.
- Design diversion and conveyance structures to efficiently capture and carry design flows in such a manner as to avoid or minimize erosion of streambanks, ditches, and adjacent areas.
    - ❑ Design intake and outflow structures to minimize streambank and streambed damage and minimize disruption of desired aquatic organism movement.
    - ❑ Design water conveyance structure to have sufficient capacity to carry the design volume of water with appropriate freeboard to avoid or minimize damage or overtopping.
    - ❑ Consider velocity of the water, horizontal and vertical alignment of the ditch or canal, amount of stormwater that may be intercepted, and change in water surface elevation at any control structures when determining appropriate freeboard needed.
    - ❑ Use suitable measures in the design to control velocity and slope to avoid or minimize erosion of the ditch.
    - ❑ Use suitable measures in the design to minimize water loss to evaporation and leakage.
    - ❑ Mitigate water imports and water disposal (including reservoir releases) so that the extent of stable banks, channel pattern, profile and dimensions are maintained in each receiving stream reach to meet applicable instream water quality standards.
- Construct diversion and conveyance structures to perform as intended in the most efficient manner and in such a way as to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - ❑ Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when constructing diversion structures in waterbodies.
    - ❑ Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to control stormwater and erosion when constructing diversion or conveyance structures.
    - ❑ Use suitable measures to stabilize the banks of the diversion channel or conveyance structure to avoid or minimize resulting erosion and instream sedimentation.

- ❑ Construct or install structures such as inlets, outlets, turnouts, checks, and crossings in such a manner as to maintain the capacity or freeboard of the ditch and the effectiveness of any lining or other channel stabilization measure.
- ❑ Use suitable measures at outlets to avoid or minimize erosion downstream of the structure when design flows are released.
- ❑ Use suitable measures on inlet structures to avoid or minimize debris entering the water conveyance structure.

- Operate diversion structures in such a manner as to leave desired or required flows and water levels in the source waterbody as determined in project planning (see BMP WatUses-1 [Water Uses Planning]).
- Operate and maintain diversion and conveyance structures in such a manner as to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from failures.
  - ❑ Limit operation of the diversion and conveyances to the established period of use.
  - ❑ Regularly inspect diversion and conveyance structures at suitable intervals to identify maintenance needs and situations that could lead to future overtopping or failures.
  - ❑ Do not flush or otherwise move sediment from behind diversion structures downstream.
  - ❑ Deposit and stabilize sediment removed from behind a diversion structure in a suitable designated upland site.
  - ❑ Maintain suitable vegetative cover near canal and ditch banks to stabilize bare soils and minimize erosion.
  - ❑ Harden or reroute breach-prone segments of ditches to minimize potential for failure and erosion of fill slopes.
  - ❑ Maintain and operate water conveyance structures to carry their design volumes of water with appropriate freeboard.
  - ❑ Keep water conveyance structures clear of vegetation, debris and other obstructions to minimize potential for failures.
  - ❑ Use applicable Chemical Use Activities BMPs when using chemicals to treat vegetation as a part of water conveyance structure maintenance.
- Use applicable measures of BMP AqEco-4 (Stream Channels and Shorelines) and BMP Fac-10 (Facility Site Reclamation) to restore the stream channel and surrounding areas after the diversion or conveyance structure is no longer needed.

WatUses-5. Dams and Impoundments

Manual or Handbook Reference FSM 7500, FSH 7509.11, FSM 2770, and FSH 2709.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from construction, operation, and maintenance of dams and impoundments.

Explanation The physical presence and operation of dams can result in changes in water quality, water quantity, sediment routing, channel morphology, stability, and habitat. Water quality can be impacted by changes in erosion, sedimentation, temperature, dissolved gases, and water chemistry. Resulting biologic and habitat impacts that may result include loss of habitat for existing or desirable fish, amphibian, and invertebrate species; shift from cold water to warm water species (or conversely, shift from warm-water to cold-water species); blockage of fish passage; or loss of spawning or other necessary habitat.

The operation of dams can result in diverse impacts on water quality. The area and depth of the impoundment, as well as the timing and volume of releases, determines the extent and complexity of the upstream and downstream impacts. For example, impacts of low-head dams with small impounded areas will involve sedimentation and fish passage; larger storage dams may have those issues as well as temperature, flow regulation, and water quality considerations. Impacts from dams are different above (upstream) and below (downstream) the dam. Upstream impacts occur primarily in the impoundment or reservoir created by the presence and operation of the dam. Downstream impacts result from changes in sediment load, water quantity, chemistry and the timing and magnitude of water releases.

Federal laws provide the Forest Service the authority to require or recommend BMPs to avoid, minimize, or mitigate adverse effects to soil, water quality, riparian and other resources from new or existing hydroelectric projects and associated infrastructure on or adjacent to NFS lands. The specific regulations and procedures that apply vary depending on project-specific circumstances (see FSM 2770 and FSH 2709.15).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Select a design and location such that the benefits of the dam are maximized and the disturbances to the environment or hazards to downstream inhabitants are minimized.
    - ❑ Implement applicable practices of BMP AqEco-3 (Ponds and Wetlands) to locate and design dams and impoundments.
    - ❑ Complete a geotechnical review of the dam site using established protocols for stability issues.
- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies to construct dams and impoundments.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to control stormwater and erosion when constructing dams and impoundments.
- Operate and maintain dams and impoundments in such a manner as to avoid, minimize, or mitigate adverse impacts to soil, water quality, and riparian resources.
    - ❑ Work with dam operators, and Federal and State regulatory agencies, to ensure that water chemistry; temperature; dissolved oxygen; nutrient levels; and hydrologic conditions, including the timing, duration and magnitude of flows, meet land management plan desired conditions, goals, and objectives (see BMP WatUses-1 [Water Uses Planning]).
- Decommission dams and impoundments that are no longer needed for mission purposes (see BMP WatUses-6 [Dam Removal]).

WatUses-6. Dam Removal

Manual or Handbook Reference FSM 7500 and FSH 7509.11.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during and after removal of dams.

Explanation Many existing dams no longer serve their originally intended purposes or are in varying stages of disrepair and in need of significant repair and maintenance to meet modern dam safety standards. Removal of outdated dams, where the negative impacts outweigh their benefits, is a critical mechanism in achieving restoration of natural river ecology, re-establishing river continuity, and maintaining public safety.

The most important positive outcomes of dam removal are the reconnection of river reaches so that they can operate as an integrated system and the increased accessibility to upstream habitat and spawning areas for migratory and anadromous fish. Dam removal can cause short-term impacts to the river environment from released water and sediment and exposure of previously inundated land to achieve long-term desired conditions. Careful planning can limit the effects of released sediment and toxic pollutants on aquatic life, prevent extensive erosion in the restored stream channel, and limit the potential intrusion of exotic plant species in the former impoundment.

Restoring a river by removing a dam often implies that the physical and biological components will return to the same level that existed before the dam was built. Dam removal can restore some, but not all, of the characteristics of the predam river, however. The removal of a dam has the effect of reversing some undesirable changes subject to the limits imposed by many other human influences in the watershed. Productive, useful ecosystems can result from dam removal, but predictions of outcomes are sometimes difficult because of the many interrelated changes in physical and biological systems caused by placement of the dam and other physical stresses on the river. Dam removal often results in the replacement of one aquatic community with another that is partly natural and partly artificial. Reservoirs create wetland areas in some cases; the removal of a dam and draining of a reservoir may create some wetlands downstream but at the expense of some wetlands upstream. The ultimate goal for a dam removal project is to restore the channel and its biological function to the best long-term sustainable state possible to achieve desired conditions within the context of other community issues and location within the watershed.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Planning

- Use applicable practices of BMP AqEco-1 (Aquatic Ecosystem Improvement and Restoration Planning) when planning dam decommissioning or removal projects.
- Evaluate system hydrology and hydraulics to assess how dam removal would affect aquatic species passage, potential flood impacts at various flows, and potential impacts to surrounding infrastructure.
- Develop a sediment management plan (e.g., natural erosion, dredging, stabilization in place, relocation on or off site, or a combination of methods) that best suits sediment quality, quantity, and physical characteristics, as well as the sensitivity of downstream reaches and the river's ability to transport sediment.

- Quantitatively determine sediment volume and physical parameters, including grain size distribution, density, shear strength, cohesion, stratification, natural armoring potential, organic content, and moisture content.
- Evaluate potential for contaminants trapped behind the dam by considering current and past upstream land uses, such as industrial activity and road density, and by adequately sampling and analyzing sediments to determine the contamination level, if any, and graduation and distribution.
- Estimate sediment transport to address fate of released sediment and potential contaminants.
- Evaluate potential disposal sites for long-term viability and stability of relocated sediments.

- Identify the various aquatic and aquatic-dependent species that live in the river or on the floodplain and their life histories to determine protection strategies, including timing of dam removal, sediment management, species relocation, and monitoring during construction.
- Evaluate floodplain and instream infrastructure to determine whether bridges, culverts, utility pipes, or other infrastructure might be affected, particularly by the drop of water level in the impoundment.
- Develop a channel and vegetation restoration plan (see BMP AqEco-4 [Stream Channels and Shorelines] and BMP Fac-10 [Facility Site Reclamation]).
  - Evaluate the need for active and natural channel and bank reconstruction.
  - Evaluate the need for active and natural revegetation of exposed and disturbed sites.
- Determine necessary Federal, State, and local permits needed for dam removal.

Construction

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when removing dams.
- Remove or otherwise mitigate the sediment stored behind the impoundment before dismantling the structure.
- Drain the impoundment before removing structures to avoid downstream flooding and channel erosion.
  - Drain the impoundment slowly to minimize release of sediment downstream, allow bed of impoundment and stream to drain and stabilize, and avoid a sudden release of water that could unnecessarily damage downstream infrastructure or habitat.
  - Consider drawing down the impoundment during a time when exposed sediments would have an opportunity to stabilize and revegetate before structural removal of the dam.
- Demolish the structure in an efficient manner that avoids or minimizes adverse environmental effects to the extent practicable.
  - Remove entire vertical extent of the dam structure and as much of the lateral extent as practicable so as to not impinge on streamflow.
  - Consider phasing a project to minimize short-term impacts on the environment, beginning with out-of-channel work early in the phasing to accelerate and facilitate the removal process.
- Stabilize or relocate affected floodplain and instream infrastructure as needed to avoid, minimize, or mitigate adverse effects.

Restoration

- Use applicable practices of BMP AqEco-4 (Stream Channels and Shorelines) to restore streams when dams are removed.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim dam and associated infrastructure sites, such as temporary access roads, landings, and work areas, when dams are decommissioned.
- Simulate natural portions of surrounding stream or other nearby habitat to restore habitat more effectively.

Resources for Water Uses Management Activities

Dams U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). National conservation practice standards—348 dam diversion, 402 dam. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

Dam Removal Hoffert-Hay, D. 2008. Small dam removal in Oregon—A guide for project managers. Salem, OR: Oregon Watershed Enhancement Board. 70 p. Available at http://www.oregon.gov/OWEB/docs/pubs/SmallDamRemovalGuide.pdf?ga=t.

Massachusetts Executive Office of Energy and Environmental Affairs. 2007. Dam removal in Massachusetts, a basic guide for project proponents Boston, MA. 32 p. Available at http://www.ma.gov/envir/water/publications/eea_dam_removal_guidance.pdf.

Groundwater Glasser, S.; Gauthier-Warinner, J.; Gurrieri, J.; Keely, J.; and others. 2007. Technical guide to managing groundwater resources. FS-881. Washington, DC: USDA Forest Service, Minerals and Geology Management. 281 p. Available at http://www.fs.fed.us/publications/.

Hydrologic Modification U.S. Environmental Protection Agency, Office of Water. 2007. National management measures to control nonpoint source pollution from hydromodification. EPA-841-B-07-002. Washington, DC. 287 p. Available at http://www.epa.gov/owow/nps/hydromod/index.htm.

Ponds USDA NRCS. National conservation practice standards—378 pond. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

Spring Developments Jennings, G.D. 1996. Protecting water supply springs. Pub. No. AG 473-15. Raleigh, NC: North Carolina State University, Cooperative Extension Service. Available at http://www.ces.ncsu.edu/Publications/environment.php.

USDA NRCS. National conservation practice standards—574 spring development. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

Water Sources Napper, C. 2006. Water-source toolkit. 0625 1806. San Dimas, CA: USDA Forest Service, Technology and Development Program. 74 p. Available at http://www.fs.fed.us/eng/pubs/pdf/WaterToolkit/lo_res.shtml.

Wells USDA NRCS. National conservation practice standards—353 monitoring well, 642 water well, 351 well decommissioning. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

Glossary

adverse effects to soil, water quality, and riparian resources: Direct, indirect, and cumulative impacts to soil quality, surface water, and groundwater resources and riparian structure, function, and processes that prevent achievement of land management plan desired conditions, goals, and objectives for water resources; attainment of applicable Federal, State, or local water quality standards; or other water quality related requirements.

aquatic ecosystem: The stream channel, lake, or estuary bed, water, and biotic communities and the habitat features that occur therein (Forest Service Manual [FSM] 2526.05).

Aquatic Management Zone (AMZ): An administratively designated zone adjacent to stream channels and other waterbodies. The AMZ is delineated for applying special management controls aimed at maintaining and improving water quality or other water- and riparian-dependent values, including groundwater-dependent ecosystems. The width of the AMZ is determined based on site-specific factors and local requirements. AMZ delineation may encompass the floodplain and riparian areas when present. AMZ designation can have synergistic benefits to other resources, such as maintaining and improving aquatic and riparian area-dependent resources, visual and aesthetic quality, wildlife habitat, and recreation opportunities. A variety of names for the AMZ concept are used in the States and Forest Service regions: Water Influence Zone (WIZ), Rocky Mountain Region 2 (R2); Stream Environment Zones, Pacific Southwest Region (R5); Riparian Conservation Areas, R5; Riparian Reserves, R5 and Pacific Northwest Region (R6); Riparian Habitat Conservation Areas, R5 and R6; Streamside Management Unit (SMU), R6; Riparian Corridor, Southern Region (R8); Riparian Management Corridor (RMC), Eastern Region (R9); and Riparian Management Area, Alaska Region (R10). For purposes of the National Core BMPs, these areas will be referred to as AMZs.

bankfull or bankfull discharge: The bankfull stage corresponds to the discharge at which channel maintenance is the most effective; that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work results in the average morphologic characteristics of channels. Bankfull discharge is associated with a momentary maximum flow that, on the average, has a recurrence interval of 1.5 years as determined using a flood frequency analysis. (Dunne and Leopold 1978). In stable rivers, bankfull is reached when the water cannot be contained within its banks and flooding begins. In entrenched streams, bankfull width is restricted, and more difficult to determine, but the top of depositional features is typically bankfull. On aggrading streams, the bankfull discharge is no longer contained within the banks during a bankfull event, often causing excessive flooding. A stream's bankfull discharge may increase or decrease with hydrologic modifications, changes in impervious land surfaces, or vegetative cover types that alter the rates of water movement through the watershed (Rosgen 1996).

beneficial use (designated use): Use specified in water quality standards for each waterbody or segment whether or not it is being attained. Types of uses include public water supplies; protection and propagation of fish, shellfish, and wildlife; recreation; agriculture; industry; navigation; marinas; groundwater recharge; aquifer protection; and hydroelectric power (EPA 2007).

Best Management Practices (BMPs) for water quality: Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (36 CFR 219.19).

buffer zone: (See Aquatic Management Zone.) (1) A protective, neutral area between distinct environments. (2) An area that acts to minimize the impact of pollutants on the environment or public welfare.

Burned Area Emergency Response (BAER) Program: A program initiated after a wildfire to determine the need for and to prescribe and implement emergency treatments to minimize threats to life or property or to stabilize and avoid or minimize unacceptable degradation to natural and cultural resources resulting from the effects of the wildfire. Such treatments are identified in an approved BAER report and funded under the BAER funding authority (FSM 2523).

chain of custody: A legal term that refers to the ability to guarantee the identity and integrity of the sample (or data) from collection through reporting of the test results. It is a process used to maintain and document the chronological history of the sample (or data). Chain of custody documents should include the name or initials of the person collecting the sample (or data), each person or entity subsequently having custody of it, dates the items were collected or transferred, the collection location, a brief description of the item, and a sample identification number.

Clean Water Act (CWA) 401 Certification: Certification by a State that a permit or license issued by the Federal Government meets applicable State water quality and pollution control requirements. Under section 401(a) (1) of the CWA, Federal agencies may not issue permits for activities that "may result in any discharge into navigable waters" until the State or tribe where the discharge would originate has granted or waived section 401 certification.

CWA 402 Permit: (See National Pollutant Discharge Elimination System.) Permit issued by a State or the U.S. Environmental Protection Agency that authorizes point source discharges to waters of the United States, including certain stormwater discharges from development, industrial, or construction activities (33 U.S.C. § 1342) (see Stormwater Permit). These permits often regulate the amount, timing, and composition of discharges.

CWA 404 Permit: Permit issued by the U.S. Army Corps of Engineers to regulate the discharge of dredge and fill materials to waters of the United States, including wetlands (33 U.S.C. § 1344).

cumulative watershed effects (CWE): Cumulative watershed effects (CWE) are a change in watershed condition or water quality caused by the accumulation and interaction of multiple individual impacts of land and resource management activities within a watershed over time and space. CWE may occur at locations far distances away from the sites of actual disturbance and later in time after the disturbance has occurred.

effectiveness monitoring: Monitoring to evaluate whether the specified BMPs had the desired effect (MacDonald et al. 1991).

ephemeral stream: A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all times above the zone of saturation (Briggs 1996).

fen: Ancient wetland ecosystem dependent on nutrient-rich local or regional groundwater flow systems maintaining perennial soil saturation and supporting continuous organic soil (i.e., peat) accumulation (Bedford and Godwin 2003, Chimner et al. 2010, Clymo 1983, Cooper and Andrus 1994, Gorham 1953). Groundwater controls fen type, distribution, plant community composition, pH, water chemistry, and microtopography.

floodplain: The lowland and relatively flat areas adjoining inland streams and standing bodies of water and coastal waters, including debris cones and flood-prone areas of offshore islands, including at a minimum, that area subject to a 1-percent chance of flooding in any given year (FSM 2527.05).

ground cover: Material on the soil surface that impedes raindrop impact and overland flow of water. Ground cover consists of all living and dead herbaceous and woody materials in contact with the ground and all rocks greater than 0.75 inches in diameter.

groundwater-dependent ecosystem: Community of plants, animals, and other organisms whose extent and life processes depend on groundwater. Examples include many wetlands, groundwater-fed lakes and streams, cave and karst systems, aquifer systems, springs, and seeps (USDA Forest Service 2007).

implementation monitoring: Monitoring to evaluate whether BMPs were carried out as planned and specified in the environmental assessment, environmental impact statement, other planning document, permit, or contract (MacDonald et al. 1991).

inner gorge: A geomorphic feature that consists of the area of channel side slope situated immediately adjacent to the stream channel and below the first break in slope above the stream channel. Debris sliding and avalanching are the dominant mass wasting processes associated with the inner gorge (USDA Forest Service 2000).

intermittent stream: A stream or reach of stream channel that flows, in its natural condition, only during certain times of the year or in several years. Characterized by interspersed, permanent surface water areas containing aquatic flora and fauna adapted to the relatively harsh environmental conditions found in these types of environments (Briggs 1996).

lake: An inland body of standing water, perennial or intermittent, that occupies a depression in the Earth's surface and is too deep to permit vegetation to take root completely across the expanse of water.

land management plan: An individual planning document adopted under the National Forest Management Act and 36 CFR 219 that provides direction for management of a Forest Service administrative unit.

low impact development: A comprehensive stormwater management and site design technique to create a hydrologically functional site that mimics predevelopment conditions by using design techniques that infiltrate, filter, evaporate, and store runoff close to its source.

meadow: Low-level grassland near a stream, lake, or other waterbody.

municipal supply watershed: A watershed that serves a public water system as defined in the Safe Drinking Water Act of 1974, as amended (42 U.S.C. §§ 300f, et seq.), or as defined in State safe drinking water statutes or regulations (FSM 2542.05).

National Core Best Management Practices (BMPs): The nationally standardized set of general, nonprescriptive BMPs for the broad range of activities that occur on National Forest System lands as specified in the National Core BMP Technical Guide (FS-990a). The National Core BMPs require development of site-specific BMP prescriptions based on site conditions and local and regional requirements to achieve compliance with established State, tribal, and national water quality goals. (FSM 2532.05).

National Core BMPs Monitoring Protocols: The nationally standardized set of procedures for monitoring the implementation and effectiveness of the National Core BMPs as specified in the National Core BMP Monitoring Technical Guide (FS-990b) (FSM 2532.05).

National Pollutant Discharge Elimination System (NPDES): (See CWA 402 Permit.) The system for regulating the point source discharge of pollutants to waters of the United States through the issuance of permits by State water quality regulatory authorities or EPA. Section 402 of the CWA established this system.

navigable waters: Waters of the United States, including the territorial seas (CWA section 502[7]).

nonpoint source pollution: Any source of water pollution that does not meet the legal definition of "point source" in Section 502(14) of the Clean Water Act. Nonpoint sources of water pollution generally originate at indefinable or diffuse sources, and do not discharge at specific locations (FSM 2532.05).

perennial stream: A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in areas adjacent to the stream (Briggs 1996).

pesticide: A general term applied to a variety of chemical pest controls, including insecticides for insects, herbicides for plants, fungicides for fungi, and rodenticides for rodents.

point source: Any discernible, confined, and discrete conveyance, such as pipes, ditches, or channels, from which pollutants are or may be discharged (CWA section 502(14); 40 CFR 122.2).

pollutant: Dredged spoil; solid waste; incinerator residue; filter backwash; sewage; garbage; sewage sludge; munitions; chemical wastes; biological materials; radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended [42 U.S.C. 2001 *et seq.*]); heat, wrecked, or discarded equipment; rock, sand, and cellar dirt; and industrial, municipal, and agricultural waste discharged into water (CWA section 502[6], 40 CFR 122.2).

pollution: The manmade or man-induced alteration of the chemical, physical, biological, or radiological integrity of water (CWA section 502[19]; 40 CFR 130.2 [c]).

pond: An inland body of standing water, perennial or intermittent, that occupies a depression in the Earth's surface and is shallow enough to permit vegetation to take root completely across the expanse of water. A pond may be natural or manmade.

practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR 230.3). Resource objectives should also be considered when determining practicable alternatives to meet a project's overall purposes.

practice: The recommended means for achieving the Best Management Practice (BMP) objective. Not all recommended practices will be applicable in all settings; other practices may not be listed in the BMP that would work as well, or better, to meet the BMP objective in a given situation. State or local rules or regulations may require some recommended practices in some locations. The practices are written in general, nonprescriptive terms. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are used to develop site-specific BMP prescriptions to apply the recommended practices on the ground.

reclamation: Returning disturbed land to as near to its predisturbed condition as is reasonably practical.

reference condition: The set of selected measurements and conditions used as representative of the natural potential condition of a stream or waterbody. The selected measurements and conditions describe a minimally impaired watershed or reach characteristic of a stream type in an ecoregion. Minimally impaired sites are those with the least anthropogenic influences and represent the best range of conditions that can be achieved by similar streams within an ecoregion. Reference conditions can be established using a combination of methods: a single site or multiple reference sites; historical data; simulation models; and expert opinion or professional judgment (EPA 1996).

rehabilitation: A putting back into good condition, re-establishing on a firm, sound basis.

restoration: A putting or bringing back into a former, normal, or unimpaired state or condition.

riparian area: A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem that is identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

site-specific BMP prescriptions: Site-specific techniques implemented on the ground to control nonpoint source pollution. Site-specific BMP prescriptions are determined during the project planning process and described in decision documents to apply the National Core BMPs to the ground based on local site conditions. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are used to develop site-specific BMP prescriptions.

stormwater permit: A form of CWA 402 permit regulating stormwater discharges from industrial activities, including construction activities disturbing areas of 1 acre or larger (40 CFR 122.26).

stream simulation: A method of designing crossing structures (usually culverts) with the aim of creating within the structure a channel as similar as possible to the natural channel in both structure and function (USDA Forest Service 2008b).

swale: A landform feature lower in elevation than adjacent hillslopes, usually present in headwater areas of limited areal extent, generally without display of a defined watercourse or channel, which may or may not flow water in response to snowmelt or rainfall. Swales exhibit little evidence of surface runoff and may be underlain by porous soils and bedrock that readily accept infiltrating water. These areas are where soil moisture concentrates but often do not exhibit pedalogic or botanical evidence of saturated conditions (Dunne and Leopold 1978).

underground injection system: Any manmade design, structure, or activity that places fluids, mainly stormwater, but also septic effluent, treated drinking water, and other fluids, below the ground.

unstable soils: Those soils that have properties that make them susceptible to dislodgement and downslope transport of soil and rock material under direct gravitational stress. The process includes slow displacement such as creep and rapid movements, such as landslides.

waterbody: Features such as rivers, streams, reservoirs, lakes, ponds, wet meadows, fens, bogs, marshes, and wetlands. A waterbody may be perennial, intermittent, or ephemeral.

water quality: The chemical, physical, and biological integrity of surface water and groundwater.

water right: A property right granted by a State for the use of a portion of the public's surface water resource obtained under applicable legal procedures.

Waters of the United States: (1) All waters that are currently used, were used in the past, or may be susceptible to be used in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; (2) all interstate waters, including interstate wetlands; (3) all other waters, such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds that the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including any such waters (a) that are or could be used by interstate or foreign travelers for recreational or other purposes, (b) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce, or (c) that are used or could be used for industrial purposes by industries in interstate commerce; and (4) all impoundments of waters otherwise defined as waters of the United States under this definition, including (a) tributaries of waters identified in paragraphs 1 through 4 of this definition, (b) the territorial sea, and (c) wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (7) of this definition (40 CFR 122.2).

wetlands: Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that, under normal circumstances, do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 122.2).

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Appendix A. Forest Service Regional Best Management Practices Guidance Documents

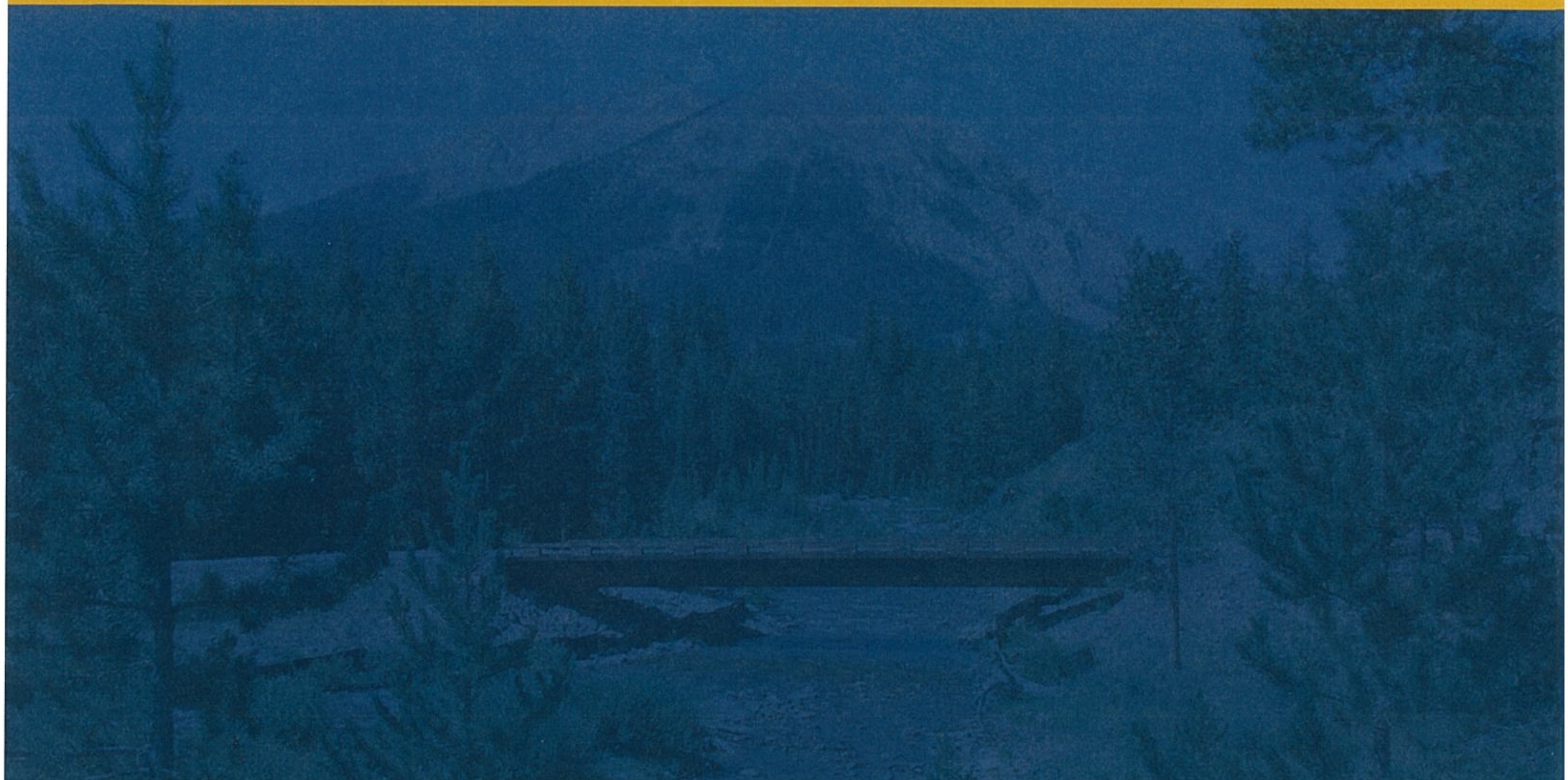
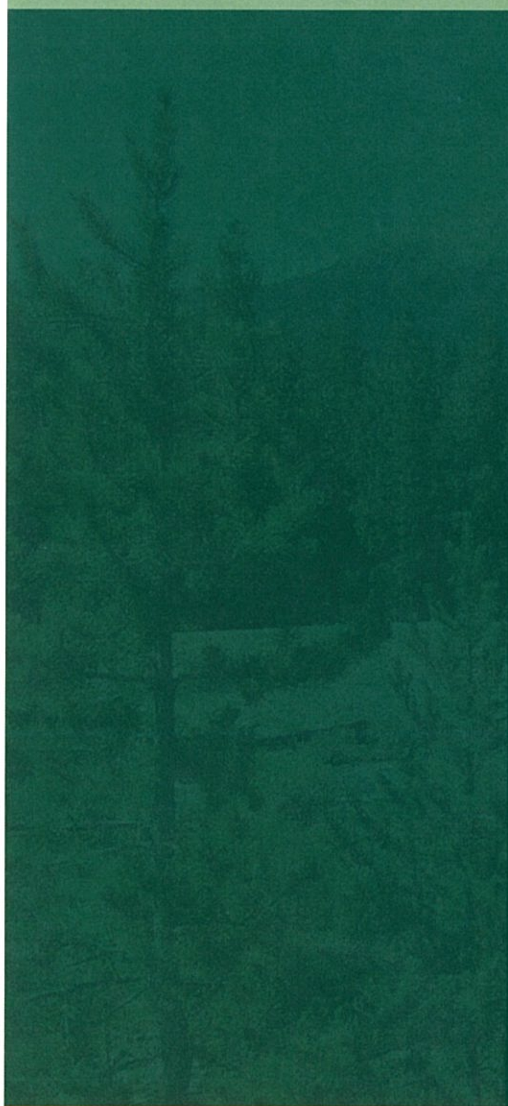
Forest Service Region	Best Management Practices Document	Available at:
Northern Region (Region 1)	FSH 2509.22, Soil and Water Conservation Practices (1988)	http://www.fs.fed.us/publications/
Rocky Mountain Region (Region 2)	FSH 2509.25, Watershed Conservation Practices Handbook (2006)	http://www.fs.fed.us/publications/
Southwest Region (Region 3)	FSH 2509.22, Soil and Water Conservation Practices	http://www.fs.fed.us/publications/
Intermountain Region (Region 4)	FSH 2509.22, Soil and Water Conservation Practices (1988)	http://www.fs.fed.us/publications/
Pacific Southwest Region (Region 5)	Water Quality Management for National Forest System Lands in California (2000)	http://www.fs.fed.us/r5/publications/water_resources/waterquality/index.html
Pacific Northwest Region (Region 6)	General Water Quality Best Management Practices (1988)	—
Southern Region (Region 8)	Soil and Water Conservation Practices Guide (2002)	http://fsweb.r8.fs.fed.us/nr/bio_phy_res/water/Literature.shtml
Eastern Region (Region 9)	—	—
Alaska Region (Region 10)	FSH 2509.22 Soil and Water Conservation Practices (2006)	http://www.fs.fed.us/publications/

Appendix B. Selected State Forestry Best Management Practices Documents[a]

State	Best Management Practices Document	Available at:
Alabama	Alabama's Best Management Practices for Forestry	http://www.forestry.state.al.us/publications/BMPs/2007_BMP_Manual.pdf
Alaska	Implementing Best Management Practices for Timber Harvest Operations from the Alaska Forest Resources and Practices Regulations	http://forestry.alaska.gov/forestpractices.htm#acts
Arkansas	Best Management Practices for Water Quality Protection	http://forestry.arkansas.gov/Services/ManageYourForests/Documents/bmpbookrevise.pdf
Colorado	Forestry Best Management Practices to Protect Water Quality in Colorado	http://www.csfs.colostate.edu/pdfs/ForestryBMP-CO-2010.pdf
Florida	Silviculture Best Management Practices	http://www.fl-dof.com/forest_management/index.html
Georgia	Georgia's Best Management Practices for Forestry	http://www.gfc.state.ga.us/ForestManagement/bmp.cfm
Idaho	Compendium of Best Management Practices to Control Polluted Runoff: A Source Book	http://www.deq.State.id.us/water/data_reports/surface_water/nps/reports.cfm#bmps
Illinois	Forestry Best Management Practices	http://coas.siu.edu/docs/BMPbooklet2.pdf
Indiana	Indiana Forestry BMPs—protecting the woods while harvesting	http://www.in.gov/dnr/forestry/files/BMP.pdf Additional BMPs at http://www.in.gov/dnr/forestry
Kentucky	Kentucky Forest Practice Guidelines for Water Quality Protection	http://www.ca.uky.edu/forestryextension/publications_BMPs.pdf
Louisiana	Recommended Forestry Best Management Practices for Louisiana	http://www.ldaf.state.la.us/portal/offices/Forestry/ForestManagement/BestManagementPractices/tabid/232/Default.asp
Maine	Best Management Practices for Forestry: Protecting Maine's Water Quality	http://www.maine.gov/doc/mfs/pubs/bmp_manual.htm
Michigan	Sustainable Soil and Water Quality Practices on Forest Land	http://michigan.gov/documents/dnr/IC4011_SustainableSoilandWaterQualityPracticesonForestLand_268417_7.pdf
Minnesota	Sustaining Minnesota Forest Resources: Voluntary Site-level Forest Management Guidelines for Landowners, Loggers and Resource Managers	http://www.frc.state.mn.us/resources_documents_management.html
Mississippi	Mississippi's BMPs—Best Management Practices for Forestry in Mississippi	http://www.mfc.ms.gov/water-quality.php
Missouri	Missouri Watershed Protection Practice—2006 Management Guidelines for Managing Forested Watersheds to Protect Streams	http://mdc.gov/landwater-care/stream-and-watershed-management
Montana	Water Quality BMPs for Montana Forests	http://www.dnrc.mt.gov/forestry/Assistance/Practices/Documents/2001WaterQualityBMPGuide.pdf
Nevada	Best Management Practices Handbook	http://www.cicacenter.org/pdf/NVBMPHandbook.pdf
New Hampshire	Best Management Practices for Forestry: Protecting New Hampshire's Water Quality	http://extension.unh.edu/resources/248/Best_Management_Practices_for_Forestry_Protecting_NH's_Water_Quality
New Mexico	New Mexico Forest Practices Guidelines	http://www.emnrd.state.nm.us/FD/Publications/documents/NM_ForestPracticesGuidelines2008.pdf
New York	New York State Forestry Best Management Practices for Water Quality, BMP Field Guide, 2011 Edition.	http://www.nysbmpguidelines.com

State	Best Management Practices Document	Available at:
North Carolina	North Carolina Forestry Best Management Practices Manual to Protect Water Quality	http://www.ncforestservice.gov/water_quality/bmp_manual.htm
North Dakota	North Dakota Forestry Best Management Practices	http://www.ndsu.edu/fileadmin/ndfs/docs/r_forestry/BMP_2010_FINAL_DOC_11_12_10.pdf
Ohio	BMPs for Erosion Control for Logging Practices in Ohio	http://ohioline.osu.edu/b916/index.html
Oregon	Forest Practices Act Rulebook	http://oregon.gov/ODF/privateforests/fpaguidance.shtml
Pennsylvania	Best Management Practices for Pennsylvania's Forests—promoting forest stewardship through education, cooperation, and voluntary action	http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr_005564.pdf
South Carolina	South Carolina's BMPs for Forestry	http://www.state.sc.us/forest/bmpmanual.pdf
South Dakota	Forestry Best Management Practices for South Dakota	http://sdda.sd.gov/Forestry/publications.PDF/Forestry-BMP.pdf
Tennessee	Guide to Forestry Best Management Practices in Tennessee	http://www.tn.gov/agriculture/publications/forestry/BMPs.pdf
Texas	Texas Forestry Best Management Practices	http://texasforestservice.tamu.edu/main/article.aspx?id=75&terms=bmps
Utah	Utah's Forest Water Quality Guidelines—A Technical Manual for Landowners, Loggers and Resource Managers	http://forestry.usu.edu/htm/rural-forests/forest-management/best-management-practices-bmps-and-water-quality
Vermont	Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont	http://www.vtfpr.org/watershed/ampprog.cfm
Virginia	Virginia's Forestry Best Management Practices for Water Quality Technical Manual	http://www.dof.virginia.gov/wq/index-BMP-Guide
Washington	Title 222 WAC – Forest Practices Rules	http://www.dnr.wa.gov/BusinessPermits/Topics/ForestPracticeRules/Pages/fs_rules.aspx
West Virginia	West Virginia Silvicultural Best Management Practices for Controlling Soil Erosion and Sedimentation from Logging Operations.	http://www.wv.forestry.com/BMP%20Book%Complete.pdf
Wisconsin	Wisconsin's forestry best management practices for water quality: Field manual for loggers, landowners and land managers	http://dnr.wi.gov/forestry/Usesof/bmp/bmpfieldmanual.htm
Wyoming	Wyoming Forestry Best Management Practices—Forestry BMPs, Water Quality Protection Guidelines	http://slf-web.state.wy.us/oldsite/forestry/bmp2.aspx

[a] *Forestry BMP documents for States that contain NFS lands.*

Attachment B

Database Query Data – Special-status Species

CNDDB 9-Quad Species List 166 records.

Element Type	Scientific Name	Common Name	Element Code	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Quad Code	Quad Name	Data Status	Taxonomic Sort
Animals - Amphibians	Ambystoma macrodactylum sigillatum	southern long-toed salamander	AAAAA01085	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ambystomatidae - Ambystoma macrodactylum sigillatum
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912152	Clipper Mills	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912142	Challenge	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912038	North Bloomfield	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912048	Pike	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912058	Goodyears Bar	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana draytonii	California red-legged frog	AAABH01022	Threatened	None	SSC	-	3912038	North Bloomfield	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana draytonii
Animals - Amphibians	Rana draytonii	California red-legged frog	AAABH01022	Threatened	None	SSC	-	3912142	Challenge	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana draytonii
Animals - Amphibians	Rana sierrae	Sierra Nevada yellow-legged frog	AAABH01340	Endangered	Threatened	WL	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ranidae - Rana sierrae
Animals - Amphibians	Rana sierrae	Sierra Nevada yellow-legged frog	AAABH01340	Endangered	Threatened	WL	-	3912152	Clipper Mills	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana sierrae
Animals - Amphibians	Rana sierrae	Sierra Nevada yellow-legged frog	AAABH01340	Endangered	Threatened	WL	-	3912058	Goodyears Bar	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana sierrae
Animals - Birds	Accipiter cooperii	Cooper's hawk	ABNKC12040	None	None	WL	-	3912038	North Bloomfield	Mapped	Animals - Birds - Accipitridae - Accipiter cooperii
Animals - Birds	Accipiter gentilis	northern goshawk	ABNKC12060	None	None	SSC	-	3912038	North Bloomfield	Mapped and Unprocessed	Animals - Birds - Accipitridae - Accipiter gentilis
Animals - Birds	Accipiter gentilis	northern goshawk	ABNKC12060	None	None	SSC	-	3912048	Pike	Mapped	Animals - Birds - Accipitridae - Accipiter gentilis
Animals - Birds	Accipiter gentilis	northern goshawk	ABNKC12060	None	None	SSC	-	3912152	Clipper Mills	Mapped	Animals - Birds - Accipitridae - Accipiter gentilis

Animals - Birds	Aquila chrysaetos	golden eagle	ABNKC22010	None	None	FP , WL	-	3912038	North Bloomfield	Unprocessed	Animals - Birds - Accipitridae - Aquila chrysaetos
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912038	North Bloomfield	Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912132	French Corral	Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912142	Challenge	Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Ardea herodias	great blue heron	ABNGA04010	None	None	-	-	3912038	North Bloomfield	Mapped	Animals - Birds - Ardeidae - Ardea herodias
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912132	French Corral	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912142	Challenge	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912141	Camptonville	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Strix nebulosa	great gray owl	ABNSB12040	None	Endangered	-	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Birds - Strigidae - Strix nebulosa
Animals - Birds	Strix nebulosa	great gray owl	ABNSB12040	None	Endangered	-	-	3912131	Nevada City	Unprocessed	Animals - Birds - Strigidae - Strix nebulosa
Animals - Birds	Strix occidentalis occidentalis	California spotted owl	ABNSB12013	None	None	SSC	-	3912131	Nevada City	Unprocessed	Animals - Birds - Strigidae - Strix occidentalis occidentalis
Animals - Birds	Strix occidentalis occidentalis	California spotted owl	ABNSB12013	None	None	SSC	-	3912038	North Bloomfield	Unprocessed	Animals - Birds - Strigidae - Strix occidentalis occidentalis
Animals - Insects	Bombus occidentalis	western bumble bee	IIHYM24250	None	None	-	-	3912038	North Bloomfield	Mapped and Unprocessed	Animals - Insects - Apidae - Bombus occidentalis
Animals - Insects	Bombus occidentalis	western bumble bee	IIHYM24250	None	None	-	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Insects - Apidae - Bombus occidentalis
Animals - Insects	Bombus occidentalis	western bumble bee	IIHYM24250	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Insects - Apidae - Bombus occidentalis
Animals - Mammals	Aplodontia rufa californica	Sierra Nevada mountain beaver	AMAFA01013	None	None	SSC	-	3912058	Goodyears Bar	Mapped	Animals - Mammals - Aplodontiidae - Aplodontia rufa californica
Animals - Mammals	Vulpes vulpes necator	Sierra Nevada red fox	AMAJA03012	Candidate	Threatened	-	-	3912038	North Bloomfield	Mapped	Animals - Mammals - Canidae - Vulpes vulpes necator
Animals - Mammals	Vulpes vulpes necator	Sierra Nevada red fox	AMAJA03012	Candidate	Threatened	-	-	3912048	Pike	Mapped	Animals - Mammals - Canidae - Vulpes vulpes necator
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912132	French Corral	Mapped	Animals - Mammals - Erethizontidae - Erethizon dorsatum

Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Martes caurina sierrae	Sierra marten	AMAJF01014	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Mustelidae - Martes caurina sierrae
Animals - Mammals	Martes caurina sierrae	Sierra marten	AMAJF01014	None	None	-	-	3912058	Goodyears Bar	Mapped	Animals - Mammals - Mustelidae - Martes caurina sierrae
Animals - Mammals	Martes caurina sierrae	Sierra marten	AMAJF01014	None	None	-	-	3912141	Camptonville	Mapped	Animals - Mammals - Mustelidae - Martes caurina sierrae
Animals - Mammals	Pekania pennanti	fisher - West Coast DPS	AMAJF01021	None	Threatened	SSC	-	3912142	Challenge	Mapped	Animals - Mammals - Mustelidae - Pekania pennanti
Animals - Mammals	Antrozous pallidus	pallid bat	AMACC10010	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Antrozous pallidus
Animals - Mammals	Corynorhinus townsendii	Townsend's big-eared bat	AMACC08010	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Corynorhinus townsendii
Animals - Mammals	Corynorhinus townsendii	Townsend's big-eared bat	AMACC08010	None	None	SSC	-	3912132	French Corral	Mapped	Animals - Mammals - Vespertilionidae - Corynorhinus townsendii
Animals - Mammals	Corynorhinus townsendii	Townsend's big-eared bat	AMACC08010	None	None	SSC	-	3912038	North Bloomfield	Mapped	Animals - Mammals - Vespertilionidae - Corynorhinus townsendii
Animals - Mammals	Lasionycteris noctivagans	silver-haired bat	AMACC02010	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Lasionycteris noctivagans
Animals - Mammals	Lasiurus blossevillii	western red bat	AMACC05060	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Lasiurus blossevillii
Animals - Mammals	Myotis evotis	long-eared myotis	AMACC01070	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Myotis evotis
Animals - Mammals	Myotis lucifugus	little brown bat	AMACC01010	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis lucifugus
Animals - Mammals	Myotis lucifugus	little brown bat	AMACC01010	None	None	-	-	3912141	Camptonville	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis lucifugus
Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Myotis thysanodes
Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis thysanodes
Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912048	Pike	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis thysanodes

Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912038	North Bloomfield	Mapped	Animals - Mammals - Vespertilionidae - Myotis thysanodes
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912132	French Corral	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912141	Camptonville	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912058	Goodyears Bar	Mapped	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912048	Pike	Mapped and Unprocessed	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912048	Pike	Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912038	North Bloomfield	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912132	French Corral	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912141	Camptonville	Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Phrynosoma blainvillii	coast horned lizard	ARACF12100	None	None	SSC	-	3912131	Nevada City	Mapped	Animals - Reptiles - Phrynosomatidae - Phrynosoma blainvillii
Community - Terrestrial	Darlingtonia Seep	Darlingtonia Seep	CTT51120CA	None	None	-	-	3912058	Goodyears Bar	Mapped	Community - Terrestrial - Darlingtonia Seep
Community - Terrestrial	Darlingtonia Seep	Darlingtonia Seep	CTT51120CA	None	None	-	-	3912151	Strawberry Valley	Mapped	Community - Terrestrial - Darlingtonia Seep
Plants - Bryophytes	Buxbaumia viridis	buxbaumia moss	NBMUS1B040	None	None	-	2B.2	3912151	Strawberry Valley	Mapped	Plants - Bryophytes - Buxbaumiaceae - Buxbaumia viridis
Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus

Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus
Plants - Bryophytes	Mielichhoferia elongata	elongate copper moss	NBMUS4Q022	None	None	-	4.3	3912141	Camptonville	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia elongata
Plants - Bryophytes	Mielichhoferia elongata	elongate copper moss	NBMUS4Q022	None	None	-	4.3	3912131	Nevada City	Mapped and Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia elongata
Plants - Bryophytes	Mielichhoferia shevockii	Shevock's copper moss	NBMUSA1010	None	None	-	1B.2	3912141	Camptonville	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia shevockii
Plants - Bryophytes	Mielichhoferia shevockii	Shevock's copper moss	NBMUSA1010	None	None	-	1B.2	3912151	Strawberry Valley	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia shevockii
Plants - Bryophytes	Pohlia flexuosa	flexuose threadmoss	NBMUS5S1D0	None	None	-	2B.1	3912151	Strawberry Valley	Mapped and Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Pohlia flexuosa
Plants - Lichens	Peltigera gowardii	western waterfan lichen	NLVER00460	None	None	-	4.2	3912151	Strawberry Valley	Mapped and Unprocessed	Plants - Lichens - Peltigeraceae - Peltigera gowardii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912132	French Corral	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912131	Nevada City	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Sanicula tracyi	Tracy's sanicle	PDAPI1Z0K0	None	None	-	4.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Apiaceae - Sanicula tracyi
Plants - Vascular	Erigeron lassenianus var. deficiens	Plumas rayless daisy	PDAST3M262	None	None	-	1B.3	3912058	Goodyears Bar	Mapped	Plants - Vascular - Asteraceae - Erigeron lassenianus var. deficiens
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912132	French Corral	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis

Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Pyrrocoma lucida	sticky pyrrocoma	PDASTDT0E0	None	None	-	1B.2	3912141	Camptonville	Mapped	Plants - Vascular - Asteraceae - Pyrrocoma lucida
Plants - Vascular	Cardamine pachystigma var. dissectifolia	dissected-leaved toothwort	PDBRA0K1B1	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Brassicaceae - Cardamine pachystigma var. dissectifolia
Plants - Vascular	Streptanthus longisiliquus	long-fruit jewelflower	PDBRA2G400	None	None	-	4.3	3912038	North Bloomfield	Unprocessed	Plants - Vascular - Brassicaceae - Streptanthus longisiliquus
Plants - Vascular	Streptanthus tortuosus ssp. truei	True's mountain jewelflower	PDBRA2G108	None	None	-	1B.1	3912048	Pike	Mapped and Unprocessed	Plants - Vascular - Brassicaceae - Streptanthus tortuosus ssp. truei
Plants - Vascular	Pseudostellaria sierrae	Sierra starwort	PDCAR13020	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Caryophyllaceae - Pseudostellaria sierrae
Plants - Vascular	Carex cyrtostachya	Sierra arching sedge	PMCYP03M00	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Carex cyrtostachya
Plants - Vascular	Carex cyrtostachya	Sierra arching sedge	PMCYP03M00	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Cyperaceae - Carex cyrtostachya
Plants - Vascular	Carex xerophila	chaparral sedge	PMCYP03M60	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Carex xerophila
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912048	Pike	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912038	North Bloomfield	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912131	Nevada City	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Arctostaphylos mewukka ssp. truei	True's manzanita	PDERI040Q2	None	None	-	4.2	3912038	North Bloomfield	Unprocessed	Plants - Vascular - Ericaceae - Arctostaphylos mewukka ssp. truei
Plants - Vascular	Arctostaphylos mewukka ssp. truei	True's manzanita	PDERI040Q2	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Ericaceae - Arctostaphylos mewukka ssp. truei
Plants - Vascular	Vaccinium coccineum	Siskiyou Mountains huckleberry	PDERI181N0	None	None	-	3.3	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Ericaceae - Vaccinium coccineum
Plants - Vascular	Lupinus dalesiae	Quincy lupine	PDFAB2B1A0	None	None	-	4.2	3912142	Challenge	Mapped	Plants - Vascular - Fabaceae - Lupinus dalesiae

Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912132	French Corral	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912142	Challenge	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912038	North Bloomfield	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912131	Nevada City	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912152	Clipper Mills	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912048	Pike	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912132	French Corral	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lycopodiella inundata	inundated bog-clubmoss	PPLYC03060	None	None	-	2B.2	3912048	Pike	Mapped	Plants - Vascular - Lycopodiaceae - Lycopodiella inundata
Plants - Vascular	Lycopodiella inundata	inundated bog-clubmoss	PPLYC03060	None	None	-	2B.2	3912038	North Bloomfield	Mapped	Plants - Vascular - Lycopodiaceae - Lycopodiella inundata
Plants - Vascular	Fremontodendron decumbens	Pine Hill flannelbush	PDSTE03030	Endangered	Rare	-	1B.2	3912132	French Corral	Mapped	Plants - Vascular - Malvaceae - Fremontodendron decumbens
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912058	Goodyears Bar	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912058	Goodyears Bar	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912131	Nevada City	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii

Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912048	Pike	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912038	North Bloomfield	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912151	Strawberry Valley	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912038	North Bloomfield	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912048	Pike	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912131	Nevada City	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912132	French Corral	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912141	Camptonville	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	PDONA050Q1	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Onagraceae - Clarkia mildrediae ssp. lutescens
Plants - Vascular	Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	PDONA050Q1	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Onagraceae - Clarkia mildrediae ssp. lutescens
Plants - Vascular	Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	PDONA050Q1	None	None	-	4.2	3912058	Goodyears Bar	Unprocessed	Plants - Vascular - Onagraceae - Clarkia mildrediae ssp. lutescens
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912151	Strawberry Valley	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912152	Clipper Mills	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912142	Challenge	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia virgata	Sierra clarkia	PDONA05160	None	None	-	4.3	3912141	Camptonville	Unprocessed	Plants - Vascular - Onagraceae - Clarkia virgata
Plants - Vascular	Cypripedium californicum	California lady's-slipper	PMORC0Q040	None	None	-	4.2	3912038	North Bloomfield	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium californicum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912038	North Bloomfield	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912058	Goodyears Bar	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912131	Nevada City	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum

Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Piperia colemanii	Coleman's rein orchid	PMORC1X080	None	None	-	4.3	3912058	Goodyears Bar	Unprocessed	Plants - Vascular - Orchidaceae - Piperia colemanii
Plants - Vascular	Erythranthe filicifolia	fern-leaved monkeyflower	PDPHR01150	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Phrymaceae - Erythranthe filicifolia
Plants - Vascular	Eriogonum umbellatum var. ahartii	Ahart's buckwheat	PDPGN086UY	None	None	-	1B.2	3912058	Goodyears Bar	Mapped	Plants - Vascular - Polygonaceae - Eriogonum umbellatum var. ahartii
Plants - Vascular	Eriogonum umbellatum var. ahartii	Ahart's buckwheat	PDPGN086UY	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Polygonaceae - Eriogonum umbellatum var. ahartii
Plants - Vascular	Eriogonum umbellatum var. ahartii	Ahart's buckwheat	PDPGN086UY	None	None	-	1B.2	3912152	Clipper Mills	Mapped and Unprocessed	Plants - Vascular - Polygonaceae - Eriogonum umbellatum var. ahartii
Plants - Vascular	Darlingtonia californica	California pitcherplant	PDSAR01010	None	None	-	4.2	3912058	Goodyears Bar	Unprocessed	Plants - Vascular - Sarraceniaceae - Darlingtonia californica
Plants - Vascular	Darlingtonia californica	California pitcherplant	PDSAR01010	None	None	-	4.2	3912038	North Bloomfield	Unprocessed	Plants - Vascular - Sarraceniaceae - Darlingtonia californica
Plants - Vascular	Darlingtonia californica	California pitcherplant	PDSAR01010	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Sarraceniaceae - Darlingtonia californica
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912131	Nevada City	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912132	French Corral	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Viola tomentosa	felt-leaved violet	PDVIO04280	None	None	-	4.2	3912058	Goodyears Bar	Mapped and Unprocessed	Plants - Vascular - Violaceae - Viola tomentosa
Plants - Vascular	Viola tomentosa	felt-leaved violet	PDVIO04280	None	None	-	4.2	3912048	Pike	Unprocessed	Plants - Vascular - Violaceae - Viola tomentosa

CNDDB 9-Quad Species List 154 records.

Element Type	Scientific Name	Common Name	Element Code	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Quad Code	Quad Name	Data Status	Taxonomic Sort
Animals - Amphibians	Ambystoma macrodactylum sigillatum	southern long-toed salamander	AAAAA01085	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ambystomatidae - Ambystoma macrodactylum sigillatum
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912143	Rackerby	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912152	Clipper Mills	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912153	Forbestown	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912142	Challenge	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana draytonii	California red-legged frog	AAABH01022	Threatened	None	SSC	-	3912142	Challenge	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana draytonii
Animals - Amphibians	Rana sierrae	Sierra Nevada yellow-legged frog	AAABH01340	Endangered	Threatened	WL	-	3912152	Clipper Mills	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana sierrae
Animals - Amphibians	Rana sierrae	Sierra Nevada yellow-legged frog	AAABH01340	Endangered	Threatened	WL	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ranidae - Rana sierrae
Animals - Birds	Accipiter gentilis	northern goshawk	ABNKC12060	None	None	SSC	-	3912152	Clipper Mills	Mapped	Animals - Birds - Accipitridae - Accipiter gentilis
Animals - Birds	Accipiter gentilis	northern goshawk	ABNKC12060	None	None	SSC	-	3912153	Forbestown	Mapped	Animals - Birds - Accipitridae - Accipiter gentilis
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912153	Forbestown	Mapped and Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912142	Challenge	Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912132	French Corral	Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912133	Oregon House	Mapped and Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus

Animals - Birds	Falco peregrinus anatum	American peregrine falcon	ABNKD06071	Delisted	Delisted	FP	-	3912153	Forbestown	Unprocessed	Animals - Birds - Falconidae - Falco peregrinus anatum
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912133	Oregon House	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912132	French Corral	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912142	Challenge	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912141	Camptonville	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912153	Forbestown	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Laterallus jamaicensis coturniculus	California black rail	ABNME03041	None	Threatened	FP	-	3912133	Oregon House	Mapped	Animals - Birds - Rallidae - Laterallus jamaicensis coturniculus
Animals - Birds	Strix nebulosa	great gray owl	ABNSB12040	None	Endangered	-	-	3912131	Nevada City	Unprocessed	Animals - Birds - Strigidae - Strix nebulosa
Animals - Birds	Strix nebulosa	great gray owl	ABNSB12040	None	Endangered	-	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Birds - Strigidae - Strix nebulosa
Animals - Birds	Strix occidentalis occidentalis	California spotted owl	ABNSB12013	None	None	SSC	-	3912131	Nevada City	Unprocessed	Animals - Birds - Strigidae - Strix occidentalis occidentalis
Animals - Fish	Mylopharodon conocephalus	hardhead	AFCJB25010	None	None	SSC	-	3912153	Forbestown	Unprocessed	Animals - Fish - Cyprinidae - Mylopharodon conocephalus
Animals - Insects	Bombus occidentalis	western bumble bee	IIHYM24250	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Insects - Apidae - Bombus occidentalis
Animals - Insects	Bombus occidentalis	western bumble bee	IIHYM24250	None	None	-	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Insects - Apidae - Bombus occidentalis
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912132	French Corral	Mapped	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912133	Oregon House	Mapped and Unprocessed	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912153	Forbestown	Mapped	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Martes caurina sierrae	Sierra marten	AMAJF01014	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Mustelidae - Martes caurina sierrae
Animals - Mammals	Martes caurina sierrae	Sierra marten	AMAJF01014	None	None	-	-	3912141	Camptonville	Mapped	Animals - Mammals - Mustelidae - Martes caurina sierrae

Animals - Mammals	Pekania pennanti	fisher - West Coast DPS	AMAJF01021	None	Threatened	SSC	-	3912142	Challenge	Mapped	Animals - Mammals - Mustelidae - Pekania pennanti
Animals - Mammals	Antrozous pallidus	pallid bat	AMACC10010	None	None	SSC	-	3912153	Forbestown	Mapped	Animals - Mammals - Vespertilionidae - Antrozous pallidus
Animals - Mammals	Antrozous pallidus	pallid bat	AMACC10010	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Antrozous pallidus
Animals - Mammals	Corynorhinus townsendii	Townsend's big-eared bat	AMACC08010	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Corynorhinus townsendii
Animals - Mammals	Corynorhinus townsendii	Townsend's big-eared bat	AMACC08010	None	None	SSC	-	3912132	French Corral	Mapped	Animals - Mammals - Vespertilionidae - Corynorhinus townsendii
Animals - Mammals	Lasionycteris noctivagans	silver-haired bat	AMACC02010	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Lasionycteris noctivagans
Animals - Mammals	Lasiurus blossevillii	western red bat	AMACC05060	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Lasiurus blossevillii
Animals - Mammals	Lasiurus blossevillii	western red bat	AMACC05060	None	None	SSC	-	3912133	Oregon House	Mapped	Animals - Mammals - Vespertilionidae - Lasiurus blossevillii
Animals - Mammals	Lasiurus cinereus	hoary bat	AMACC05030	None	None	-	-	3912133	Oregon House	Mapped	Animals - Mammals - Vespertilionidae - Lasiurus cinereus
Animals - Mammals	Myotis evotis	long-eared myotis	AMACC01070	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Myotis evotis
Animals - Mammals	Myotis lucifugus	little brown bat	AMACC01010	None	None	-	-	3912141	Camptonville	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis lucifugus
Animals - Mammals	Myotis lucifugus	little brown bat	AMACC01010	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis lucifugus
Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis thysanodes
Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Myotis thysanodes
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912153	Forbestown	Mapped	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912141	Camptonville	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis

Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912132	French Corral	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912133	Oregon House	Mapped	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912141	Camptonville	Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912133	Oregon House	Mapped	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912132	French Corral	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Phrynosoma blainvillii	coast horned lizard	ARACF12100	None	None	SSC	-	3912131	Nevada City	Mapped	Animals - Reptiles - Phrynosomatidae - Phrynosoma blainvillii
Community - Terrestrial	Darlingtonia Seep	Darlingtonia Seep	CTT51120CA	None	None	-	-	3912151	Strawberry Valley	Mapped	Community - Terrestrial - Darlingtonia Seep
Plants - Bryophytes	Buxbaumia viridis	buxbaumia moss	NBMUS1B040	None	None	-	2B.2	3912151	Strawberry Valley	Mapped	Plants - Bryophytes - Buxbaumiaceae - Buxbaumia viridis
Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912153	Forbestown	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus
Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus
Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus
Plants - Bryophytes	Mielichhoferia elongata	elongate copper moss	NBMUS4Q022	None	None	-	4.3	3912141	Camptonville	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia elongata
Plants - Bryophytes	Mielichhoferia elongata	elongate copper moss	NBMUS4Q022	None	None	-	4.3	3912131	Nevada City	Mapped and Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia elongata
Plants - Bryophytes	Mielichhoferia shevockii	Shevock's copper moss	NBMUSA1010	None	None	-	1B.2	3912141	Camptonville	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia shevockii

Plants - Bryophytes	Mielichhoferia shevockii	Shevock's copper moss	NBMUSA1010	None	None	-	1B.2	3912151	Strawberry Valley	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia shevockii
Plants - Bryophytes	Pohlia flexuosa	flexuose threadmoss	NBMUS5S1D0	None	None	-	2B.1	3912151	Strawberry Valley	Mapped and Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Pohlia flexuosa
Plants - Lichens	Peltigera gowardii	western waterfan lichen	NLVER00460	None	None	-	4.2	3912151	Strawberry Valley	Mapped and Unprocessed	Plants - Lichens - Peltigeraceae - Peltigera gowardii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912143	Rackerby	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912131	Nevada City	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912132	French Corral	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912143	Rackerby	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Sanicula tracyi	Tracy's sanicle	PDAPI1Z0K0	None	None	-	4.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Apiaceae - Sanicula tracyi
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912132	French Corral	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Helianthus exilis	serpentine sunflower	PDAST4N1J0	None	None	-	4.2	3912143	Rackerby	Unprocessed	Plants - Vascular - Asteraceae - Helianthus exilis
Plants - Vascular	Packera layneae	Layne's ragwort	PDAST8H1V0	Threatened	Rare	-	1B.2	3912143	Rackerby	Mapped	Plants - Vascular - Asteraceae - Packera layneae
Plants - Vascular	Pyrrocoma lucida	sticky pyrrocoma	PDASTDT0E0	None	None	-	1B.2	3912141	Camptonville	Mapped	Plants - Vascular - Asteraceae - Pyrrocoma lucida

Plants - Vascular	Plagiobothrys glyptocarpus var. modestus	Cedar Crest popcornflower	PDBOR0V0C2	None	None	-	3	3912133	Oregon House	Unprocessed	Plants - Vascular - Boraginaceae - Plagiobothrys glyptocarpus var. modestus
Plants - Vascular	Cardamine pachystigma var. dissectifolia	dissected-leaved toothwort	PDBRA0K1B1	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Brassicaceae - Cardamine pachystigma var. dissectifolia
Plants - Vascular	Pseudostellaria sierrae	Sierra starwort	PDCAR13020	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Caryophyllaceae - Pseudostellaria sierrae
Plants - Vascular	Bulbostylis capillaris	thread-leaved beakseed	PMCYP02020	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Cyperaceae - Bulbostylis capillaris
Plants - Vascular	Carex cyrtostachya	Sierra arching sedge	PMCYP03M00	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Cyperaceae - Carex cyrtostachya
Plants - Vascular	Carex cyrtostachya	Sierra arching sedge	PMCYP03M00	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Carex cyrtostachya
Plants - Vascular	Carex xerophila	chaparral sedge	PMCYP03M60	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Carex xerophila
Plants - Vascular	Carex xerophila	chaparral sedge	PMCYP03M60	None	None	-	1B.2	3912143	Rackerby	Mapped	Plants - Vascular - Cyperaceae - Carex xerophila
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912131	Nevada City	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Arctostaphylos mewukka ssp. truei	True's manzanita	PDERI040Q2	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Ericaceae - Arctostaphylos mewukka ssp. truei
Plants - Vascular	Arctostaphylos mewukka ssp. truei	True's manzanita	PDERI040Q2	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Ericaceae - Arctostaphylos mewukka ssp. truei
Plants - Vascular	Vaccinium coccineum	Siskiyou Mountains huckleberry	PDERI181N0	None	None	-	3.3	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Ericaceae - Vaccinium coccineum
Plants - Vascular	Lupinus dalesiae	Quincy lupine	PDFAB2B1A0	None	None	-	4.2	3912143	Rackerby	Mapped	Plants - Vascular - Fabaceae - Lupinus dalesiae
Plants - Vascular	Lupinus dalesiae	Quincy lupine	PDFAB2B1A0	None	None	-	4.2	3912142	Challenge	Mapped	Plants - Vascular - Fabaceae - Lupinus dalesiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912131	Nevada City	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912132	French Corral	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912142	Challenge	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae

Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912152	Clipper Mills	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912132	French Corral	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Fremontodendron decumbens	Pine Hill flannelbush	PDSTE03030	Endangered	Rare	-	1B.2	3912132	French Corral	Mapped	Plants - Vascular - Malvaceae - Fremontodendron decumbens
Plants - Vascular	Fremontodendron decumbens	Pine Hill flannelbush	PDSTE03030	Endangered	Rare	-	1B.2	3912143	Rackerby	Mapped	Plants - Vascular - Malvaceae - Fremontodendron decumbens
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912131	Nevada City	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912151	Strawberry Valley	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912131	Nevada City	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912132	French Corral	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912133	Oregon House	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912141	Camptonville	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae

Plants - Vascular	Clarkia gracilis ssp. albicaulis	white-stemmed clarkia	PDONA050J1	None	None	-	1B.2	3912153	Forbestown	Mapped	Plants - Vascular - Onagraceae - Clarkia gracilis ssp. albicaulis
Plants - Vascular	Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	PDONA050Q1	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Onagraceae - Clarkia mildrediae ssp. lutescens
Plants - Vascular	Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	PDONA050Q1	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Onagraceae - Clarkia mildrediae ssp. lutescens
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912151	Strawberry Valley	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912152	Clipper Mills	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912142	Challenge	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia virgata	Sierra clarkia	PDONA05160	None	None	-	4.3	3912141	Camptonville	Unprocessed	Plants - Vascular - Onagraceae - Clarkia virgata
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912131	Nevada City	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Erythranthe filicifolia	fern-leaved monkeyflower	PDPHR01150	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Phrymaceae - Erythranthe filicifolia
Plants - Vascular	Poa sierrae	Sierra blue grass	PMPOA4Z310	None	None	-	1B.3	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Poaceae - Poa sierrae
Plants - Vascular	Eriogonum umbellatum var. ahartii	Ahart's buckwheat	PDPGN086UY	None	None	-	1B.2	3912152	Clipper Mills	Mapped and Unprocessed	Plants - Vascular - Polygonaceae - Eriogonum umbellatum var. ahartii
Plants - Vascular	Eriogonum umbellatum var. ahartii	Ahart's buckwheat	PDPGN086UY	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Polygonaceae - Eriogonum umbellatum var. ahartii
Plants - Vascular	Darlingtonia californica	California pitcherplant	PDSAR01010	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Sarraceniaceae - Darlingtonia californica
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912143	Rackerby	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912153	Forbestown	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae

Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912131	Nevada City	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912132	French Corral	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae

CNDDB 9-Quad Species List 154 records.

Element Type	Scientific Name	Common Name	Element Code	Federal Status	State Status	CDFW Status	CA Rare Plant Rank	Quad Code	Quad Name	Data Status	Taxonomic Sort
Animals - Amphibians	Ambystoma macrodactylum sigillatum	southern long-toed salamander	AAAAA01085	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ambystomatidae - Ambystoma macrodactylum sigillatum
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912143	Rackerby	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912152	Clipper Mills	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912153	Forbestown	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana boylii	foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	SSC	-	3912142	Challenge	Mapped	Animals - Amphibians - Ranidae - Rana boylii
Animals - Amphibians	Rana draytonii	California red-legged frog	AAABH01022	Threatened	None	SSC	-	3912142	Challenge	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana draytonii
Animals - Amphibians	Rana sierrae	Sierra Nevada yellow-legged frog	AAABH01340	Endangered	Threatened	WL	-	3912152	Clipper Mills	Mapped and Unprocessed	Animals - Amphibians - Ranidae - Rana sierrae
Animals - Amphibians	Rana sierrae	Sierra Nevada yellow-legged frog	AAABH01340	Endangered	Threatened	WL	-	3912151	Strawberry Valley	Mapped	Animals - Amphibians - Ranidae - Rana sierrae
Animals - Birds	Accipiter gentilis	northern goshawk	ABNKC12060	None	None	SSC	-	3912152	Clipper Mills	Mapped	Animals - Birds - Accipitridae - Accipiter gentilis
Animals - Birds	Accipiter gentilis	northern goshawk	ABNKC12060	None	None	SSC	-	3912153	Forbestown	Mapped	Animals - Birds - Accipitridae - Accipiter gentilis
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912153	Forbestown	Mapped and Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912142	Challenge	Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912132	French Corral	Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus
Animals - Birds	Haliaeetus leucocephalus	bald eagle	ABNKC10010	Delisted	Endangered	FP	-	3912133	Oregon House	Mapped and Unprocessed	Animals - Birds - Accipitridae - Haliaeetus leucocephalus

Animals - Birds	Falco peregrinus anatum	American peregrine falcon	ABNKD06071	Delisted	Delisted	FP	-	3912153	Forbestown	Unprocessed	Animals - Birds - Falconidae - Falco peregrinus anatum
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912133	Oregon House	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912132	French Corral	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Progne subis	purple martin	ABPAU01010	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Birds - Hirundinidae - Progne subis
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912142	Challenge	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912141	Camptonville	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Pandion haliaetus	osprey	ABNKC01010	None	None	WL	-	3912153	Forbestown	Unprocessed	Animals - Birds - Pandionidae - Pandion haliaetus
Animals - Birds	Laterallus jamaicensis coturniculus	California black rail	ABNME03041	None	Threatened	FP	-	3912133	Oregon House	Mapped	Animals - Birds - Rallidae - Laterallus jamaicensis coturniculus
Animals - Birds	Strix nebulosa	great gray owl	ABNSB12040	None	Endangered	-	-	3912131	Nevada City	Unprocessed	Animals - Birds - Strigidae - Strix nebulosa
Animals - Birds	Strix nebulosa	great gray owl	ABNSB12040	None	Endangered	-	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Birds - Strigidae - Strix nebulosa
Animals - Birds	Strix occidentalis occidentalis	California spotted owl	ABNSB12013	None	None	SSC	-	3912131	Nevada City	Unprocessed	Animals - Birds - Strigidae - Strix occidentalis occidentalis
Animals - Fish	Mylopharodon conocephalus	hardhead	AFCJB25010	None	None	SSC	-	3912153	Forbestown	Unprocessed	Animals - Fish - Cyprinidae - Mylopharodon conocephalus
Animals - Insects	Bombus occidentalis	western bumble bee	IIHYM24250	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Insects - Apidae - Bombus occidentalis
Animals - Insects	Bombus occidentalis	western bumble bee	IIHYM24250	None	None	-	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Insects - Apidae - Bombus occidentalis
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912132	French Corral	Mapped	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912133	Oregon House	Mapped and Unprocessed	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Erethizon dorsatum	North American porcupine	AMAFJ01010	None	None	-	-	3912153	Forbestown	Mapped	Animals - Mammals - Erethizontidae - Erethizon dorsatum
Animals - Mammals	Martes caurina sierrae	Sierra marten	AMAJF01014	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Mustelidae - Martes caurina sierrae
Animals - Mammals	Martes caurina sierrae	Sierra marten	AMAJF01014	None	None	-	-	3912141	Camptonville	Mapped	Animals - Mammals - Mustelidae - Martes caurina sierrae

Animals - Mammals	Pekania pennanti	fisher - West Coast DPS	AMAJF01021	None	Threatened	SSC	-	3912142	Challenge	Mapped	Animals - Mammals - Mustelidae - Pekania pennanti
Animals - Mammals	Antrozous pallidus	pallid bat	AMACC10010	None	None	SSC	-	3912153	Forbestown	Mapped	Animals - Mammals - Vespertilionidae - Antrozous pallidus
Animals - Mammals	Antrozous pallidus	pallid bat	AMACC10010	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Antrozous pallidus
Animals - Mammals	Corynorhinus townsendii	Townsend's big-eared bat	AMACC08010	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Corynorhinus townsendii
Animals - Mammals	Corynorhinus townsendii	Townsend's big-eared bat	AMACC08010	None	None	SSC	-	3912132	French Corral	Mapped	Animals - Mammals - Vespertilionidae - Corynorhinus townsendii
Animals - Mammals	Lasionycteris noctivagans	silver-haired bat	AMACC02010	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Lasionycteris noctivagans
Animals - Mammals	Lasiurus blossevillii	western red bat	AMACC05060	None	None	SSC	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Lasiurus blossevillii
Animals - Mammals	Lasiurus blossevillii	western red bat	AMACC05060	None	None	SSC	-	3912133	Oregon House	Mapped	Animals - Mammals - Vespertilionidae - Lasiurus blossevillii
Animals - Mammals	Lasiurus cinereus	hoary bat	AMACC05030	None	None	-	-	3912133	Oregon House	Mapped	Animals - Mammals - Vespertilionidae - Lasiurus cinereus
Animals - Mammals	Myotis evotis	long-eared myotis	AMACC01070	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Myotis evotis
Animals - Mammals	Myotis lucifugus	little brown bat	AMACC01010	None	None	-	-	3912141	Camptonville	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis lucifugus
Animals - Mammals	Myotis lucifugus	little brown bat	AMACC01010	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis lucifugus
Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis thysanodes
Animals - Mammals	Myotis thysanodes	fringed myotis	AMACC01090	None	None	-	-	3912151	Strawberry Valley	Mapped	Animals - Mammals - Vespertilionidae - Myotis thysanodes
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912153	Forbestown	Mapped	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912142	Challenge	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912141	Camptonville	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis

Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912132	French Corral	Unprocessed	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mammals	Myotis yumanensis	Yuma myotis	AMACC01020	None	None	-	-	3912133	Oregon House	Mapped	Animals - Mammals - Vespertilionidae - Myotis yumanensis
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912141	Camptonville	Mapped and Unprocessed	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Mollusks	Margaritifera falcata	western pearlshell	IMBIV27020	None	None	-	-	3912151	Strawberry Valley	Mapped and Unprocessed	Animals - Mollusks - Margaritiferidae - Margaritifera falcata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912141	Camptonville	Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912142	Challenge	Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912133	Oregon House	Mapped	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912132	French Corral	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3912131	Nevada City	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Animals - Reptiles	Phrynosoma blainvillii	coast horned lizard	ARACF12100	None	None	SSC	-	3912131	Nevada City	Mapped	Animals - Reptiles - Phrynosomatidae - Phrynosoma blainvillii
Community - Terrestrial	Darlingtonia Seep	Darlingtonia Seep	CTT51120CA	None	None	-	-	3912151	Strawberry Valley	Mapped	Community - Terrestrial - Darlingtonia Seep
Plants - Bryophytes	Buxbaumia viridis	buxbaumia moss	NBMUS1B040	None	None	-	2B.2	3912151	Strawberry Valley	Mapped	Plants - Bryophytes - Buxbaumiaceae - Buxbaumia viridis
Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912153	Forbestown	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus
Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus
Plants - Bryophytes	Fissidens pauperculus	minute pocket moss	NBMUS2W0U0	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Bryophytes - Fissidentaceae - Fissidens pauperculus
Plants - Bryophytes	Mielichhoferia elongata	elongate copper moss	NBMUS4Q022	None	None	-	4.3	3912141	Camptonville	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia elongata
Plants - Bryophytes	Mielichhoferia elongata	elongate copper moss	NBMUS4Q022	None	None	-	4.3	3912131	Nevada City	Mapped and Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia elongata
Plants - Bryophytes	Mielichhoferia shevockii	Shevock's copper moss	NBMUSA1010	None	None	-	1B.2	3912141	Camptonville	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia shevockii

Plants - Bryophytes	Mielichhoferia shevockii	Shevock's copper moss	NBMUSA1010	None	None	-	1B.2	3912151	Strawberry Valley	Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Mielichhoferia shevockii
Plants - Bryophytes	Pohlia flexuosa	flexuose threadmoss	NBMUS5S1D0	None	None	-	2B.1	3912151	Strawberry Valley	Mapped and Unprocessed	Plants - Bryophytes - Mielichhoferiaceae - Pohlia flexuosa
Plants - Lichens	Peltigera gowardii	western waterfan lichen	NLVER00460	None	None	-	4.2	3912151	Strawberry Valley	Mapped and Unprocessed	Plants - Lichens - Peltigeraceae - Peltigera gowardii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912143	Rackerby	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912131	Nevada City	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Allium sanbornii var. sanbornii	Sanborn's onion	PMLIL02212	None	None	-	4.2	3912132	French Corral	Unprocessed	Plants - Vascular - Alliaceae - Allium sanbornii var. sanbornii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Perideridia bacigalupii	Bacigalupi's yampah	PDAPI1N020	None	None	-	4.2	3912143	Rackerby	Unprocessed	Plants - Vascular - Apiaceae - Perideridia bacigalupii
Plants - Vascular	Sanicula tracyi	Tracy's sanicle	PDAPI1Z0K0	None	None	-	4.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Apiaceae - Sanicula tracyi
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Erigeron petrophilus var. sierrensis	northern Sierra daisy	PDAST3M351	None	None	-	4.3	3912132	French Corral	Unprocessed	Plants - Vascular - Asteraceae - Erigeron petrophilus var. sierrensis
Plants - Vascular	Helianthus exilis	serpentine sunflower	PDAST4N1J0	None	None	-	4.2	3912143	Rackerby	Unprocessed	Plants - Vascular - Asteraceae - Helianthus exilis
Plants - Vascular	Packera layneae	Layne's ragwort	PDAST8H1V0	Threatened	Rare	-	1B.2	3912143	Rackerby	Mapped	Plants - Vascular - Asteraceae - Packera layneae
Plants - Vascular	Pyrrocoma lucida	sticky pyrrocoma	PDASTDT0E0	None	None	-	1B.2	3912141	Camptonville	Mapped	Plants - Vascular - Asteraceae - Pyrrocoma lucida

Plants - Vascular	Plagiobothrys glyptocarpus var. modestus	Cedar Crest popcornflower	PDBOR0V0C2	None	None	-	3	3912133	Oregon House	Unprocessed	Plants - Vascular - Boraginaceae - Plagiobothrys glyptocarpus var. modestus
Plants - Vascular	Cardamine pachystigma var. dissectifolia	dissected-leaved toothwort	PDBRA0K1B1	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Brassicaceae - Cardamine pachystigma var. dissectifolia
Plants - Vascular	Pseudostellaria sierrae	Sierra starwort	PDCAR13020	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Caryophyllaceae - Pseudostellaria sierrae
Plants - Vascular	Bulbostylis capillaris	thread-leaved beakseed	PMCYP02020	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Cyperaceae - Bulbostylis capillaris
Plants - Vascular	Carex cyrtostachya	Sierra arching sedge	PMCYP03M00	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Cyperaceae - Carex cyrtostachya
Plants - Vascular	Carex cyrtostachya	Sierra arching sedge	PMCYP03M00	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Carex cyrtostachya
Plants - Vascular	Carex xerophila	chaparral sedge	PMCYP03M60	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Carex xerophila
Plants - Vascular	Carex xerophila	chaparral sedge	PMCYP03M60	None	None	-	1B.2	3912143	Rackerby	Mapped	Plants - Vascular - Cyperaceae - Carex xerophila
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912142	Challenge	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Rhynchospora capitellata	brownish beaked-rush	PMCYP0N080	None	None	-	2B.2	3912131	Nevada City	Mapped	Plants - Vascular - Cyperaceae - Rhynchospora capitellata
Plants - Vascular	Arctostaphylos mewukka ssp. truei	True's manzanita	PDERI040Q2	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Ericaceae - Arctostaphylos mewukka ssp. truei
Plants - Vascular	Arctostaphylos mewukka ssp. truei	True's manzanita	PDERI040Q2	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Ericaceae - Arctostaphylos mewukka ssp. truei
Plants - Vascular	Vaccinium coccineum	Siskiyou Mountains huckleberry	PDERI181N0	None	None	-	3.3	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Ericaceae - Vaccinium coccineum
Plants - Vascular	Lupinus dalesiae	Quincy lupine	PDFAB2B1A0	None	None	-	4.2	3912143	Rackerby	Mapped	Plants - Vascular - Fabaceae - Lupinus dalesiae
Plants - Vascular	Lupinus dalesiae	Quincy lupine	PDFAB2B1A0	None	None	-	4.2	3912142	Challenge	Mapped	Plants - Vascular - Fabaceae - Lupinus dalesiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912131	Nevada City	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912132	French Corral	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912142	Challenge	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae

Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912152	Clipper Mills	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Fritillaria eastwoodiae	Butte County fritillary	PMLIL0V060	None	None	-	3.2	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Liliaceae - Fritillaria eastwoodiae
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912153	Forbestown	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912142	Challenge	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912132	French Corral	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Lilium humboldtii ssp. humboldtii	Humboldt lily	PMLIL1A071	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Liliaceae - Lilium humboldtii ssp. humboldtii
Plants - Vascular	Fremontodendron decumbens	Pine Hill flannelbush	PDSTE03030	Endangered	Rare	-	1B.2	3912132	French Corral	Mapped	Plants - Vascular - Malvaceae - Fremontodendron decumbens
Plants - Vascular	Fremontodendron decumbens	Pine Hill flannelbush	PDSTE03030	Endangered	Rare	-	1B.2	3912143	Rackerby	Mapped	Plants - Vascular - Malvaceae - Fremontodendron decumbens
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Sidalcea gigantea	giant checkerbloom	PDMAL110T0	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Malvaceae - Sidalcea gigantea
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912131	Nevada City	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Lewisia cantelovii	Cantelow's lewisia	PDPOR04020	None	None	-	1B.2	3912151	Strawberry Valley	Mapped	Plants - Vascular - Montiaceae - Lewisia cantelovii
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912131	Nevada City	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912132	French Corral	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912133	Oregon House	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae
Plants - Vascular	Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	PDONA05053	None	None	-	4.2	3912141	Camptonville	Mapped	Plants - Vascular - Onagraceae - Clarkia biloba ssp. brandegeeae

Plants - Vascular	Clarkia gracilis ssp. albicaulis	white-stemmed clarkia	PDONA050J1	None	None	-	1B.2	3912153	Forbestown	Mapped	Plants - Vascular - Onagraceae - Clarkia gracilis ssp. albicaulis
Plants - Vascular	Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	PDONA050Q1	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Onagraceae - Clarkia mildrediae ssp. lutescens
Plants - Vascular	Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	PDONA050Q1	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Onagraceae - Clarkia mildrediae ssp. lutescens
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912151	Strawberry Valley	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912152	Clipper Mills	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia mosquinii	Mosquin's clarkia	PDONA050S0	None	None	-	1B.1	3912142	Challenge	Mapped	Plants - Vascular - Onagraceae - Clarkia mosquinii
Plants - Vascular	Clarkia virgata	Sierra clarkia	PDONA05160	None	None	-	4.3	3912141	Camptonville	Unprocessed	Plants - Vascular - Onagraceae - Clarkia virgata
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912141	Camptonville	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912131	Nevada City	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Cypripedium fasciculatum	clustered lady's-slipper	PMORC0Q060	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Orchidaceae - Cypripedium fasciculatum
Plants - Vascular	Erythranthe filicifolia	fern-leaved monkeyflower	PDPHR01150	None	None	-	1B.2	3912152	Clipper Mills	Mapped	Plants - Vascular - Phrymaceae - Erythranthe filicifolia
Plants - Vascular	Poa sierrae	Sierra blue grass	PMPOA4Z310	None	None	-	1B.3	3912153	Forbestown	Mapped and Unprocessed	Plants - Vascular - Poaceae - Poa sierrae
Plants - Vascular	Eriogonum umbellatum var. ahartii	Ahart's buckwheat	PDPGN086UY	None	None	-	1B.2	3912152	Clipper Mills	Mapped and Unprocessed	Plants - Vascular - Polygonaceae - Eriogonum umbellatum var. ahartii
Plants - Vascular	Eriogonum umbellatum var. ahartii	Ahart's buckwheat	PDPGN086UY	None	None	-	1B.2	3912142	Challenge	Mapped	Plants - Vascular - Polygonaceae - Eriogonum umbellatum var. ahartii
Plants - Vascular	Darlingtonia californica	California pitcherplant	PDSAR01010	None	None	-	4.2	3912151	Strawberry Valley	Unprocessed	Plants - Vascular - Sarraceniaceae - Darlingtonia californica
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912143	Rackerby	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912142	Challenge	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912152	Clipper Mills	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912153	Forbestown	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae

Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912131	Nevada City	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae
Plants - Vascular	Brodiaea sierrae	Sierra foothills brodiaea	PMLIL0C0J0	None	None	-	4.3	3912132	French Corral	Unprocessed	Plants - Vascular - Themidaceae - Brodiaea sierrae

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

47 matches found. *Click on scientific name for details*

Search Criteria

Found in Quads 3912142, 3912141, 3912048, 3912057, 3912047, 3912038, 3912131, 3912132, 3912143, 3912133, 3912037, 3912153, 3912152 3912151 and 3912058;

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Allium sanbornii var. congdonii	Congdon's onion	Alliaceae	perennial bulbiferous herb	Apr-Jul	4.3	S3	G4T3
Allium sanbornii var. sanbornii	Sanborn's onion	Alliaceae	perennial bulbiferous herb	May-Sep	4.2	S3S4	G4T3T4
Antennaria flagellaris	stoloniferous pussy-toes	Asteraceae	perennial stoloniferous herb	(Apr)May-Aug	4.2	S3	G4
Arctostaphylos mewukka ssp. truei	True's manzanita	Ericaceae	perennial evergreen shrub	Feb-Jul	4.2	S3	G4?T3
Brodiaea sierrae	Sierra foothills brodiaea	Themidaceae	perennial bulbiferous herb	May-Aug	4.3	S3	G3
Bulbostylis capillaris	thread-leaved beakseed	Cyperaceae	annual herb	Jun-Aug	4.2	S3	G5
Buxbaumia viridis	buxbaumia moss	Buxbaumiaceae	moss		2B.2	S1	G4G5
Cardamine pachystigma var. dissectifolia	dissected-leaved toothwort	Brassicaceae	perennial rhizomatous herb	Feb-May	1B.2	S2	G3G5T2Q
Carex cyrtostachya	Sierra arching sedge	Cyperaceae	perennial herb	May-Aug	1B.2	S2	G2
Carex xerophila	chaparral sedge	Cyperaceae	perennial herb	Mar-Jun	1B.2	S2	G2
Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	Onagraceae	annual herb	May-Jul	4.2	S4	G4G5T4
Clarkia gracilis ssp. albicaulis	white-stemmed clarkia	Onagraceae	annual herb	May-Jul	1B.2	S3	G5T3
Clarkia mildrediae ssp. lutescens	golden-anthered clarkia	Onagraceae	annual herb	Jun-Aug	4.2	S3	G3T3
Clarkia mosquinii	Mosquin's clarkia	Onagraceae	annual herb	May-Jul(Sep)	1B.1	S2	G2
Clarkia virgata	Sierra clarkia	Onagraceae	annual herb	May-Aug	4.3	S3	G3
Cypripedium californicum	California lady's-	Orchidaceae	perennial	Apr-	4.2	S4	G4

	slipper		rhizomatous herb	Aug(Sep)			
Cypripedium fasciculatum	clustered lady's-slipper	Orchidaceae	perennial rhizomatous herb	Mar-Aug	4.2	S4	G4
Cypripedium parviflorum var. makasin	northern yellow lady's-slipper	Orchidaceae	perennial herb	May-Aug	3.1	S1	G5T4T5
Darlingtonia californica	California pitcherplant	Sarraceniaceae	perennial rhizomatous herb (carnivorous)	Apr-Aug	4.2	S4	G4
Erigeron lassenianus var. deficiens	Plumas rayless daisy	Asteraceae	perennial herb	Jun-Sep	1B.3	S2S3	G3G4T2T3
Erigeron petrophilus var. sierrensis	northern Sierra daisy	Asteraceae	perennial rhizomatous herb	Jun-Oct	4.3	S4	G4T4
Eriogonum umbellatum var. ahartii	Ahart's buckwheat	Polygonaceae	perennial herb	Jun-Sep	1B.2	S3	G5T3
Erythranthe filicifolia	fern-leaved monkeyflower	Phrymaceae	annual herb	Apr-Jun	1B.2	S2	G2
Fissidens pauperculus	minute pocket moss	Fissidentaceae	moss		1B.2	S2	G3?
Frangula purshiana ssp. ultramafica	Caribou coffeeberry	Rhamnaceae	perennial deciduous shrub	May-Jul	1B.2	S2S3	G4T2T3
Fremontodendron decumbens	Pine Hill flannelbush	Malvaceae	perennial evergreen shrub	Apr-Jul	1B.2	S1	G1
Fritillaria eastwoodiae	Butte County fritillary	Liliaceae	perennial bulbiferous herb	Mar-Jun	3.2	S3	G3Q
Lewisia cantelovii	Cantelow's lewisia	Montiaceae	perennial herb	May-Oct	1B.2	S3	G3
Lewisia kelloggii ssp. hutchisonii	Hutchison's lewisia	Montiaceae	perennial herb	(Apr)May-Aug	3.2	S3	G3G4T3Q
Lilium humboldtii ssp. humboldtii	Humboldt lily	Liliaceae	perennial bulbiferous herb	May-Jul(Aug)	4.2	S3	G4T3
Lupinus dalesiae	Quincy lupine	Fabaceae	perennial herb	May-Aug	4.2	S3	G3
Lycopodiella inundata	inundated bog club-moss	Lycopodiaceae	perennial rhizomatous herb	Jun-Sep	2B.2	S1?	G5
Mielichhoferia elongata	elongate copper moss	Mielichhoferiaceae	moss		4.3	S4	G5
Packera layneae	Layne's ragwort	Asteraceae	perennial herb	Apr-Aug	1B.2	S2	G2
Peltigera gowardii	western waterfan lichen	Peltigeraceae	foliose lichen (aquatic)		4.2	S3	G3G4
Perideridia bacigalupii	Bacigalupi's yampah	Apiaceae	perennial herb	Jun-Aug	4.2	S3	G3
Plagiobothrys glyptocarpus var. modestus	Cedar Crest popcornflower	Boraginaceae	annual herb	Apr-Jun	3	SH	G3THQ
Poa sierrae	Sierra blue grass	Poaceae	perennial rhizomatous herb	Apr-Jul	1B.3	S3	G3
Pohlia flexuosa	flexuose threadmoss	Mielichhoferiaceae	moss		2B.1	S1	G5
Pyrrocoma lucida	sticky pyrrocoma	Asteraceae	perennial herb	Jul-Oct	1B.2	S3	G3
Rhynchospora capitellata	brownish beaked-rush	Cyperaceae	perennial herb	Jul-Aug	2B.2	S1	G5
Sanicula tracyi	Tracy's sanicle	Apiaceae	perennial herb	Apr-Jul	4.2	S4	G4

Sidalcea gigantea	giant checkerbloom	Malvaceae	perennial rhizomatous herb	(Jan-Jun)Jul-Oct	4.3	S3	G3
Streptanthus longisiliquus	long-fruit jewelflower	Brassicaceae	perennial herb	Apr-Sep	4.3	S3	G3
Streptanthus tortuosus ssp. truei	True's mountain jewelflower	Brassicaceae	perennial herb	Jun-Jul(Sep)	1B.1	S1S2	G5T1T2
Vaccinium coccineum	Siskiyou Mountains huckleberry	Ericaceae	perennial deciduous shrub	Jun-Aug	3.3	S2S3	G3Q
Viola tomentosa	felt-leaved violet	Violaceae	perennial herb	(Apr)May-Oct	4.2	S3	G3

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USDA Forest Service, Pacific Southwest Region

Sensitive Animal Species by Forest

6/30/2013; Updated 9/9/2013

Scientific Name	Common Name	Angeles	Cleveland	Eldorado	Inyo	Klamath	Lassen	Los Padres	Mendocino	Modoc	Plumas	San Bernardino	Sequoia	Shasta-Trinity	Sierra	Six Rivers	Stanislaus	Tahoe	Lake Tahoe Basin
BIRDS (12)																			
Accipiter gentilis	Northern goshawk	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Campylorhynchus brunneicapillus sandiegensis	San Diego cactus wren		X									X							
Centrocercus urophasianus	Greater sage-grouse				X					X									
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	X	X		X							X	X			X			
Coturnicops noveboracensis	Yellow rail						X							X					
Empidonax traillii	Willow flycatcher			X	X	X	X	X	X		X	X	X	X	X		X	X	X
Grus canadensis tabida	Greater sandhill crane					X	X			X	X							X	
Haliaeetus leucocephalus	Bald eagle	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pelicanus occidentalis	Brown pelican		X					X				X							
Strix nebulosa	Great gray owl			X	X	X	X			X	X		X		X		X	X	X
Strix occidentalis occidentalis	California spotted owl	X	X	X	X		X	X		X	X	X	X		X		X	X	X
Vireo vicinior	Gray vireo	X	X									X							
MAMMALS (13)																			
Antrozous pallidus	Pallid bat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brachylagus idahoensis	Pygmy rabbit				X					X									
Corynorhinus townsendii	Townsend's big-eared bat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Glaucomys sabrinus californicus	San Bernardino flying squirrel											X							
Gulo gulo luscus	North American wolverine			X	X	X	X		X	X	X		X	X	X	X	X	X	X
Martes caurina	Pacific marten			X	X	X	X		X	X	X		X	X	X	X	X	X	X
Pekania pennanti	Fisher			X	X	X	X		X		X		X	X	X	X	X	X	
Myotis thysanodes	Fringed myotis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ovis canadensis nelsoni	San Gabriel Mountains bighorn sheep	X										X							
Perognathus alticolus alticolus	White-eared pocket mouse											X							
Perognathus alticolus inexpectatus	Tehachapi pocket mouse	X						X											
Tamias speciosus callipeplus	Mount Pinos lodgepole chipmunk							X											
Vulpes vulpes necator	Sierra Nevada red fox				?		X										X		
AMPHIBIANS (21)																			
Anaxyrus canorus	Yosemite toad			X	X										X		X		
Anaxyrus exsul	Black toad				X														
Batrachoseps bramei	Fairview slender salamander												X						
Batrachoseps campi	Inyo Mountain salamander				X														
Batrachoseps gabrieli	San Gabriel Mountains slender salamander	X										X							
Batrachoseps incognitus	San Simeon slender salamander							X											
Batrachoseps minor	Lesser slender salamander							X											
Batrachoseps regius	Kings River slender salamander														X				
Batrachoseps relictus	Relictual slender salamander												X						
Batrachoseps simatus	Kern Canyon slender salamander												X						
Ensatina eschscholtzii croceater	Yellow-blotched salamander	X						X					X						
Ensatina eschscholtzii klauberi	Large-blotched salamander		X									X							

Scientific Name	Common Name	Angeles	Cleveland	Eldorado	Inyo	Klamath	Lassen	Los Padres	Mendocino	Modoc	Plumas	San Bernardino	Sequoia	Shasta-Trinity	Sierra	Six Rivers	Stanislaus	Tahoe	Lake Tahoe Basin
Hydromantes brunus	Limestone salamander														X		X		
Hydromantes shastae	Shasta salamander													X					
Plethodon stormi	Siskiyou Mountain salamander					X													
Rana aurora aurora	Northern red-legged frog													X		X			
Rana boylii	Foothill yellow-legged frog			X		X	X	X	X		X		X	X	X	X	X	X	
Rana cascadae	Cascade frog					X	X							X					
Rana muscosa	Mountain yellow-legged frog: Southern Sierra DPS				X								X						
Rana sierrae	Sierra Nevada yellow-legged frog			X	X		X				X				X		X	X	X
Rhyacotriton variegatus	Southern torrent salamander					X								X		X			
REPTILES (12)																			
Emys marmorata	Western pond turtle	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Anniella pulchra	California legless lizard	X	X					X				X	X						
Aspidoscelis hyperythra	Orange-throated whiptail		X									X							
Charina umbratica	Southern rubber boa											X							
Crotalus ruber ruber	Red diamond rattlesnake		X									X							
Diadophis punctatus modestus	San Bernardino ringneck snake	X						X				X							
Diadophis punctatus similus	San Diego ringneck snake		X									X							
Elgaria panamintina	Panamint alligator lizard				X														
Lampropeltis zonata parvirubra	San Bernardino Mountain kingsnake	X										X							
Lampropeltis zonata pulchra	San Diego Mountain kingsnake		X																
Lichanura orcutti	Coastal rosy boa or 3-lined boa	X	X									X							
Thamnophis hammondii	Two-striped garter snake	X	X					X				X							
INVERTEBRATES, TERRESTRIAL (24)																			
Bombus occidentalis	Western bumble bee			X		X	X			X	X			X		X		X	X
Danaus plexippus	Monarch butterfly							X											
Euphilotes baueri (battoides) vernalis	Vernal blue butterfly											X							
Euphilotes enoptes cryptorufes	Pratt's blue butterfly											X							
Euphilotes enoptes nr. *Dammersi*	Dammer's blue butterfly											X							
Euphydryas editha bingi	Bing's checkerspot butterfly									X									
Euphydryas editha ehrlichi	Ehrlich's checkerspot butterfly											X							
Euphydryas editha karinae	Karin's checkerspot butterfly								X										
Euphydryas editha monoensis	Mono Lake checkerspot butterfly				X														
Glaucopsyche piasus nr. *sagittegera*	Arrowhead blue butterfly											X							
Hermelyceana hermes	Hermes copper butterfly		X																
Incisalia mossii hidakupa	San Gabriel Mountains elfin											X							
Monadenia troglodytes troglodytes	Shasta sideband snail													X					
Monadenia troglodytes wintu	Wintu sideband snail													X					
Plebejus saepiolus aureolus	San Gabriel Mountains blue butterfly	X										X							
Plebulina emigdionis	San Emigdio blue butterfly	X			X							X							
Polites mardon	Mardon skipper															X			
Rothelix warnerfontis	Warner Spring shoulderband snail		X																
Speyeria egleis tehachapina	Tehachapi fritillary butterfly												X						
Speyeria nokomis apacheana	Apache silverspot butterfly				X														

Scientific Name	Common Name	Angeles	Cleveland	Eldorado	Inyo	Klamath	Lassen	Los Padres	Mendocino	Modoc	Plumas	San Bernardino	Sequoia	Shasta-Trinity	Sierra	Six Rivers	Stanislaus	Tahoe	Lake Tahoe Basin
Trilobopsis roperi	Shasta chaparral snail													X					
Trilobopsis tehamana	Tehama chaparral snail					X								X					
Vespericola pressleyi	Big Bar hesperian snail													X					
Vespericola shasta	Shasta hesperian snail						X							X					
INVERTEBRATES, AQUATIC - Mollusks (13)																			
Anodonta californiensis	California floater (freshwater mussel)						X			X				X		X		X	
Fluminicola seminalis	Nugget pebblesnail						X							X					
Helisoma newberryi newberryi	Great Basin rams-horn (snail)						X											X	X
Juga (Calibasis) acutifilosa	Topaz juga (snail)						X			X									
Juga chacei	Chace juga (snail)															X			
Juga nigrina	Black juga (snail)						X			X				X				X	
Juga (Calibasis) occata	Scalloped juga (snail)						X							X					
Lanx patelloides	Kneecap lanx (limpet)						X							X					
Pisidium (Cyclocalyx) ultramontanum	Montane peaclam						X							X					
Pristinicola hemphilli	Pristine springsnail															X			
Pyrgulopsis lasseni	Willow Creek pyrg (springsnail)									X									
Pyrgulopsis owensensis	Owen's Valley springsnail				X														
Pyrgulopsis wongi	Wong's springsnail				X														
FISHES (22)																			
Catostomus occidentalis lacusanserinus	Goose Lake sucker									X									
Entosphenus similis	Klamath River lamprey					X													
Entosphenus tridentatus	Pacific lamprey			X		X	X	X	X	X				X		X			
Gila bicolor pectinifer	Lahontan Lake tui chub																	X	X
Gila bicolor thallassina	Goose Lake tui chub									X									
Gila orcutti	Arroyo chub	X	X					X				X							
Lampetra hubbsi	Kern brook lamprey												X		X				
Lampetra richardsoni	Western brook lamprey					X			X							X			
Lampetra tridentata ssp.	Goose Lake lamprey									X									
Lavinia exilicauda chi	Clear Lake hitch								X										
Mylopharodon conocephalus	Hardhead			X			X		X	X	X		X	X	X		X	X	
Oncorhynchus clarkii	Coastal run cutthroat trout															X			
Oncorhynchus mykiss	Steelhead - Klamath Mountains Province ESU					X								X		X			
Oncorhynchus mykiss aguabonita	California golden trout				X								X						
Oncorhynchus mykiss aquilarum (pop 5)	Eagle Lake rainbow trout						X												
Oncorhynchus mykiss gilberti	Kern River rainbow trout												X						
Oncorhynchus mykiss pop 4	Warner Valley redband trout									X									
Oncorhynchus mykiss pop 6	Goose Lake redband trout						X			X									
Oncorhynchus mykiss pop 7	McCloud River redband trout													X					
Oncorhynchus tshawytscha	Upper Klamath-Trinity chinook ESU					X								X		X			
Oncorhynchus tshawytscha ssp.	SONCC Chinook salmon															X			
Rhinichthys osculus ssp 8	Santa Ana speckled dace	X	X									X							
R5 Total Sensitive Animals = 124	Total # Sensitive Animals per Forest	**22**	**22**	**18**	**27**	**23**	**32**	**21**	**16**	**26**	**17**	**36**	**25**	**34**	**19**	**24**	**18**	**21**	**14**
		ANG	CLE	ELD	INY	KNF	LAS	LP	MEN	MOD	PLU	SB	SEQ	S-T	SIE	6R	STAN	TAH	LTB

Scientific Name	Common Name	Angeles	Cleveland	Eldorado	Inyo	Klamath	Lassen	Los Padres	Mendocino	Modoc	Plumas	San Bernardino	Sequoia	Shasta-Trinity	Sierra	Six Rivers	Stanislaus	Tahoe	Lake Tahoe Basin

Note: Common names may not always meet official standards used by various scientific organizations, but have been edited for document consistency.
Only the first letter of the common name has been capitalized unless referring to a personal or geographic name.

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Scientific Name (Common Name)																		
Abies bracteata (bristlecone fir)																	X	
Abronia alpina (Ramshaw Meadows abronia)									X									
Abronia nana var. covillei (Coville's dwarf abronia)									X									X
Abronia villosa var. aurita (chaparral sand-verbena)																X		X
Acanthoscyphus parishii var. abramsii (Abrams' oxytheca)															X		X	
Acanthoscyphus parishii var. cienegensis (Cienega Seca oxytheca)																		X
Agrostis hooveri (Hoover's bentgrass)																	X	
Allium hickmanii (Hickman's onion)																	X	
Allium howellii var. clokeyi (Mt. Pinos onion)																	X	
Allium jepsonii (Jepson's onion)							X							X				
Allium marvinii (Yucaipa onion)																		X
Allium tribracteatum (three-bracted onion)								X						X				
Allium yosemitense (Yosemite onion)													X	X				
Anisocarpus scabridus (scabrid alpine tarplant)		X	X	X														
Antennaria marginata (white-margined everlasting)																		X
Antirrhinum subcordatum (dimorphic snapdragon)		X																
Arabis rigidissima var. demota (Galena Creek rockcress)										X	X							
Arctostaphylos cruzensis (Arroyo de la Cruz manzanita)																	X	
Arctostaphylos edmundsii (Little Sur manzanita)																	X	
Arctostaphylos glandulosa ssp. gabrielensis (San Gabriel manzanita)															X			X
Arctostaphylos hooveri (Hoover's manzanita)																	X	
Arctostaphylos luciana (Santa Lucia manzanita)																	X	
Arctostaphylos nissenana (Nissenan manzanita)								X						X				
Arctostaphylos obispoensis (Bishop manzanita)																	X	
Arctostphylos parryana ssp. tumescens (interior manzanita)															X			X
Arctostaphylos pilosula (Santa Margarita manzanita)																	X	
Arctostaphylos rainbowensis (Rainbow manzanita)																X		
Arctostaphylos refugioensis (Refugio manzanita)																	X	
Arenaria lanuginosa ssp. saxosa (rock sandwort)																		X
Astragalus anxius (Ash Valley milk-vetch)						X												
Astragalus bernardinus (San Bernardino milk-vetch)																		X
Astragalus bicristatus (crested milk-vetch)															X			X
Astragalus cimae var. sufflatus (inflated Cima milk-vetch)									X									
Astragalus deanei (Dean's milk-vetch)																X		

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Astragalus douglasii var. perstrictus (Jacumba milk-vetch)																X		
Astragalus ertterae (Walker Pass milk-vetch)												X						
Astragalus johannis-howellii (Long Valley milk-vetch)									X									
Astragalus lemmonii (Lemmon's milk-vetch)						X	X		X		X							
Astragalus lentiformis (lens-pod milk-vetch)							X											
Astragalus lentiginosus var. antonius (San Antonio milk-vetch)															X			X
Astragalus lentiginosus var. kernensis (Kern Plateau milk-vetch)									X			X						
Astragalus lentiginosus var. sierrae (Big Bear Valley milk-vetch)																		X
Astragalus monoensis (Mono milk-vetch)									X									
Astragalus oocarpus (San Diego milk-vetch)																X		
Astragalus pachypus var. jaegeri (Jaeger's milk-vetch)																X		X
Astragalus pulsiferae var. coronensis (Modoc Plateau milk-vetch)						X	X				X							
Astragalus pulsiferae var. pulsiferae (Pulsifer's milk-vetch)							X											
Astragalus pulsiferae var. suksdorfii (Suksdorf's milk-vetch)					X													
Astragalus ravenii (Raven's milk-vetch)									X									
Astragalus tidestromii (Tidestrom's milk-vetch)																		X
Astragalus webberi (Webber's milk-vetch)							X				X							
Atriplex parishii (Parish's bristlescale)																X		X
Baccharis plummerae ssp. glabrata (San Simeon baccharis)																	X	
Balsamorhiza macrolepis (big-scale balsamroot)		X					X	X						X				
Bensoniella oregona (bensoniella)				X														
Bloomeria humilis (dwarf goldenstar)																	X	
Boechera bodiensis (Bodie Hills rockcress)									X									
Boechera constancei (Constance's rockcress)					X		X											
Boechera evadens (hidden rockcress)									X			X		X				
Boechera johnstonii (Johnston's rockcress)																		X
Boechera koehleri (Koehler's rockcress)				X														
Boechera parishii (Parish's rockcress)																		X
Boechera peirsonii (San Bernardino rockcress)																		X
Boechera pinzliae (Pinzl's rockcress)									X									
Boechera shevockii (Shevock's rockcress)												X						
Boechera shockleyi (Shockley's rockcress)									X									X
Boechera tiehmii (Tiehm's rockcress)									X	X								
Boechera tularensis (Tulare rockcress)									X	X		X	X					
Boletus pulcherrimus (red-pored bolete)	X		X	X							X							

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Botrychium ascendens (upswept moonwort)					X	X	X	X	X	X	X		X	X				
Botrychium crenulatum (scalloped moonwort)	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X
Botrychium lineare (slender moonwort)									X	X			X	X				
Botrychium lunaria (common moonwort)	X				X	X	X	X	X	X	X		X	X				
Botrychium minganense (mingan moonwort)	X		X		X	X	X	X	X	X	X	X	X	X				
Botrychium montanum (western goblin)	X				X	X	X	X		X	X	X	X	X				
Botrychium paradoxum (paradox moonwort)								X	X				X					
Botrychium pedunculosum (stalked moonwort)					X			X						X				
Botrychium pinnatum (northwestern moonwort)	X		X		X	X	X							X				
Botrychium pumicola (pumice moonwort)	X		X															
Botrychium tunux (moosewort)									X				X	X				
Botrychium yaaxudakeit (giant moonwort)									X				X	X				
Brodiaea insignis (Kaweah brodiaea)												X						
Brodiaea orcuttii (Orcutt's brodiaea)																X		
Brodiaea rosea (Indian Valley brodiaea)		X																
Brodiaea santarosae (Santa Rosa basalt brodiaea)																X		
Bruchia bolanderi (Bolander's bruchia)					X	X	X	X	X	X	X	X	X	X				
Buxbaumia viridis (buxbaumia moss)	X		X	X	X	X	X											
Calicium adspersum (stubble lichen)				X														
Calochortus clavatus var. avius (Pleasant Valley mariposa-lily)								X						X				
Calochortus clarvatus var. clavatus (club-haired mariposa-lily)															X		X	
Calochortus clavatus var. gracilis (slender mariposa-lily)															X		X	
Calochortus dunnii (Dunn's mariposa-lily)																X		
Calochortus excavatus (Inyo County star-tulip)									X									
Calochortus fimbriatus (late-flowered mariposa-lily)															X		X	
Calochortus greenei (Greene's mariposa-lily)	X		X															
Calochortus longebarbatus var. longebarbatus (long-haired star-tulip)			X		X	X												
Calochortus obispoensis (San Luis mariposa-lily)																	X	
Calochortus palmeri var. munzii (San Jacinto mariposa-lily)																		X
Calochortus palmeri var. palmeri (Palmer's mariposa-lily)												X			X		X	X
Calochortus persistens (Siskiyou mariposa-lily)	X																	
Calochortus simulans (La Panza mariposa-lily)																	X	
Calochortus striatus (alkali mariposa-lily)												X			X			X
Calochortus weedii var. intermedius (intermediate mariposa-lily)																X		
Calochortus westonii (Shirley Meadows star-tulip)												X						

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Calycadenia micrantha (small-flowered calycadenia)		X		X													X	
Calycadenia oppositifolia (Butte County calycadenia)							X											
Calycadenia villosa (dwarf calycadenia)																	X	
Calyptridium pygmaeum (pygmy pussypaws)									X			X	X					X
Camissonia sierrae ssp. alticola (Mono Hot Springs evening-primrose)													X					
Camissoniopsis hardhamiae (Hardham's evening-primrose)																	X	
Campanula shetleri (Castle Crags harebell)			X															
Campanula wilkinsiana (Wilkin's harebell)	X		X															
Canbya candida (white pygmy-poppy)												X			X			X
Carex obispoensis (San Luis Obispo sedge)																	X	
Carex tiogana (Tioga Pass sedge)									X									
Carlquista muirii (Muir's tarplant)												X	X				X	
Carpenteria californica (tree-anemone)													X					
Castilleja gleasonii (Mt. Gleason paintbrush)															X			
Castilleja lasiorhyncha (San Bernardino Mountains owl's-clover)																X		X
Castilleja plagiotoma (Mojave paintbrush)															X		X	X
Caulanthus amplexicaulis var. barbarae (Santa Barbara jewel-flower)																	X	
Caulanthus lemmonii (Lemmon's jewel-flower)																	X	
Caulanthus simulans (Payson's jewel-flower)																X		X
Ceanothus cyaneus (Lakeside ceanothus)																X		
Chaenactis suffrutescens (Shasta chaenactis)	X		X															
Chlorogalum pomeridianum var. minus (dwarf soaproot)																	X	
Chorizanthe blakleyi (Blakley's spineflower)																	X	
Chorizanthe breweri (Brewer's spineflower)																	X	
Chorizanthe parryi var. fernandina (San Fernando Valley spineflower)															X		X	
Chorizanthe parryi var. parryi (Parry's spineflower)															X	X		X
Chorizanthe rectispina (straight-awned spineflower)																	X	
Chorizanthe xanti var. leucotheca (white-bracted spineflower)																		X
Cinna bolanderi (Bolander's woodreed)												X	X					
Cladium californica (California saw-grass)									X						X		X	X
Clarkia australis (Small's southern clarkia)														X				
Clarkia biloba ssp. australis (Mariposa clarkia)													X	X				
Clarkia borealis ssp. borealis (northern clarkia)			X															
Clarkia gracilis ssp. albicaulis (white-stemmed clarkia)					X		X											
Clarkia jolonensis (Jolon clarkia)																	X	

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Clarkia lingulata (Merced clarkia)													X	X				
Clarkia mildrediae ssp. mildrediae (Mildred's clarkia)					X		X											
Clarkia mosquinii (Mosquin's clarkia)							X											
Claytonia lanceolata var. peirsonii (Peirson's spring beauty)															X			X
Clinopodium chandleri (San Miguel savory)																X		
Collomia larsenii (talus collomia)			X		X	X												
Collomia rawsoniana (Rawson's flaming trumpet)													X					
Cordylanthus eremicus ssp. kernensis (Kern Plateau bird's beak)									X			X						
Cordylanthus tenuis ssp. pallescens (pallid bird's-beak)			X															
Cryptantha circumscissa var. rosulata (rosette cushion cryptantha)									X			X						
Cryptantha crinita (silky cryptantha)					X													
Cryptantha incana (Tulare cryptantha)									X			X						
Cryptantha roosiorum (bristlecone cryptantha)									X									
Cudonia monticola (mountain cudonia)	X		X	X														
Cypripedium fasciculatum (clustered lady's-slipper)	X	X	X	X	X		X				X							
Cypripedium montanum (mountain lady's-slipper)	X	X	X	X	X	X	X	X			X		X	X				
Dacrophyllum falcifolium (tear drop moss)																	X	
Dedeckera eurekensis (July gold)									X									
Deinandra floribunda (Tecate tarplant)																X		
Deinandra mohavensis (Mojave tarplant)												X			X	X		X
Delphinium hesperium ssp. cuyamacae (Cuyamaca larkspur)																X		X
Delphinium hutchinsoniae (Hutchinson's larkspur)																	X	
Delphinium inopinum (unexpected larkspur)												X	X					
Delphinium parryi ssp. purpureum (Mt. Pinos larkspur)																	X	
Delpinium purpusii (rose-flowered larkspur)												X						
Delphinium umbraculorum (umbrella larkspur)																	X	
Dendrocollybia racemosa (branched collybia)	X		X	X			X			X	X			X				
Dicentra nevadensis (Tulare County bleeding heart)												X	X					
Dieteria asteroides var. lagunensis (Mount Laguna aster)																X		
Dieteria canescens var. ziegleri (Ziegler's aster)																		X
Draba asterophora var. asterophora (Tahoe draba)								X	X	X				X				
Draba asterophora var. macrocarpa (Cup Lake draba)								X		X				X				
Draba carnosula (Mt. Eddy draba)	X		X	X														
Draba cruciata (Mineral King draba)									X	X		X						
Draba incrassata (Sweetwater Mountains draba)									X									

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Draba monoensis (White Mountains draba)									X									
Draba saxosa (Southern California rock draba)																		X
Draba sharsmithii (Mt. Whitney draba)									X				X					
Drymocallis cuneifolia var. cuneifolia (wedgeleaf woodbeauty)																		X
Drymocallis cuneifolia var. ewanii (Ewan's cinquefoil)															X			X
Dudleya abramsii ssp. affinis (San Bernardino Mountains dudleya)																		X
Dudleya cymosa ssp. costatifolia (Pierpoint Springs dudleya)												X						
Dudleya cymosa ssp. crebrifolia (San Gabriel River dudleya)															X			
Dudleya densiflora (San Gabriel Mountains dudleya)															X			
Dudleya multicaulis (many-stemmed dudleya)															X	X		
Dudleya viscida (sticky dudleya)																X		
Eleocharis torticulmis (California twisted spikerush)							X											
Epilobium nivium (Snow Mountain willowherb)		X																
Epilobium oreganum (Oregon fireweed)	X		X	X														
Eremogone cliftonii (Clifton's eremogone)					X		X											
Eremogone macradenia var. arcuifolia (Forest Camp sandwort)															X			
Eriastrum luteum (yellow-flowered eriastrum)																	X	
Eriastrum tracyi (Tracy's eriastrum)		X	X		X							X	X					
Ericameria gilmanii (Gilman's goldenbush)									X									
Ericameria parryi var. imula (low rabbitbrush)																		X
Erigeron aequifolius (Hall's daisy)									X			X	X					
Erigeron maniopotamicus (Mad River fleabane daisy)				X														
Erigeron miser (starved daisy)										X	X							
Erigeron multiceps (Kern River daisy)									X			X						
Erigeron uncialis var. uncialis (limestone daisy)									X									
Eriogonum alpinum (Trinity buckwheat)	X		X															
Eriogonum breedlovei var. breedlovei (Breedlove's buckwheat)												X						
Eriogonum butterworthianum (Butterworth's buckwheat)																	X	
Eriogonum evanidum (vanishing wild buckwheat)																X		X
Eriogonum hirtellum (Klamath Mountain buckwheat)	X			X														
Eriogonum kennedyi var. alpigenum (southern alpine buckwheat)															X		X	X
Eriogonum luteolum var. saltuarium (Jack's wild buckwheat)								X		X				X				
Eriogonum microthecum var. johnstonii (Johnston's buckwheat)															X			X
Eriogonum microthecum var. lacus-ursi (Bear Lake buckwheat)																		X
Eriogonum microthecum var. schoolcraftii (Schoolcraft's wild buckwheat)							X											

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Eriogonum nervulosum (Snow Mountain buckwheat)		X																
Eriogonum nudum var. regirivum (Kings River buckwheat)												X	X					
Eriogonum ovalifolium ssp. monarchense (Monarch buckwheat)												X	X					
Eriogonum prociduum (prostrate buckwheat)					X	X												
Eriogonum spectabile (Barron's buckwheat)					X													
Eriogonum tripodum (tripod buckwheat)		X						X										
Eriogonum twisselmannii (Twisselmann's buckwheat)												X						
Eriogonum umbellatum var. ahartii (Ahart's buckwheat)							X											
Eriogonum umbellatum var. glaberrimum (Warner Mountains buckwheat)						X												
Eriogonum umbellatum var. torreyanum (Donner Pass buckwheat)										X	X							
Eriogonum ursinum var. erubescens (blushing wild buckwheat)	X		X															
Eriogonum wrightii var. olanchense (Olancha Peak buckwheat)									X									
Eriophyllum congdonii (Congdon's woolly sunflower)													X	X				
Eriophyllum lanatum var. hallii (Fort Tejon woolly sunflower)																	X	
Eriophyllum nubigenum (Yosemite woolly sunflower)														X				
Erythronium hendersonii (Henderson's fawn lily)	X			X														
Erythronium pluriflorum (Shuteye Peak fawn lily)													X					
Erythronium pusaterii (Kaweah Lakes fawn lily)												X						
Erythronium taylori (Pilot Ridge fawn lily)														X				
Erythronium tuolumnense (Tuolumne fawn lily)														X				
Eucephalis vialis (wayside aster)	X		X	X														
Fissidens aphelotaxifolius (brook pocket moss)	X						X						X	X				
Fissidens pauperculus (minute pocket moss)				X			X										X	
Frangula purshiana ssp. ultramafica (Caribou coffeeberry)					X		X											
Frasera umpquaensis (Umpqua greeen-gentian)	X		X	X														
Fritillaria brandegeei (Greenhorn fritillary)												X						
Fritillaria eastwoodiae (Butte County fritillary)			X		X		X				X							
Fritillaria falcata (talus fritillary)																	X	
Fritillaria liliacea (fragrant fritillary)																	X	
Fritillaria ojaiensis (Ojai fritillary)																	X	
Fritillaria striata (striped adobe-lily)												X						
Fritillaria viridea (San Benito fritillary)																	X	
Galium angustifolium ssp. jacinticum (San Jacinto Mountains bedstraw)																X		X
Galium californicum ssp. luciense (Cone Peak bedstraw)																	X	
Galium californicum ssp. primum (Alvin Meadow bedstraw)																		X

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Galium clementis (Santa Lucia bedstraw)																	X	
Galium glabrescens ssp. modocense (Modoc bedstraw)						X												
Galium grande (San Gabriel bedstraw)															X			
Galium hardhamiae (Hardham's bedstraw)																	X	
Galium serpenticum ssp. warnerense (Warner Mountains bedstraw)						X												
Gentiana fremontii (Fremont's gentian)																		X
Gentiana setigera (Mendocino gentian)				X														
Gilia leptantha ssp. leptantha (San Bernardino gilia)																		X
Gilia yorkii (Monarch gilia)												X	X					
Githopsis diffusa ssp. filicaulis (Mission Canyon bluecup)																X		
Harmonia doris-nilesiae (Niles' harmonia)			X															
Harmonia stebbinsii (Stebbins' harmonia)		X	X															
Helodium blandowii (Blandow's bog moss)	X				X	X	X	X	X	X	X	X	X	X				
Hesperidanthus jaegeri (Jaeger's hesperidanthus)									X									
Hesperocyparis forbesii (Tecate cypress)																X		
Hesperocyparis stephensonii (Cuyamaca cypress)																X		
Hesperolinon drymarioides (drymaria-like western flax)		X																
Heterotheca monarchensis (Monarch golden-aster)												X	X					
Heterotheca shevockii (Shevock's golden-aster)												X						
Heuchera abramsii (Abrams' alumroot)															X	X	X	X
Heuchera caespitosa (urn-flowered alumroot)															X		X	X
Heuchera hirsutissima (shaggy-haired alumroot)																		X
Heuchera parishii (Parish's alumroot)																		X
Horkelia cuneata ssp. puberula (mesa horkelia)															X	X	X	X
Horkelia cuneata ssp. sericea (Kellogg's horkelia)																	X	
Horkelia hendersonii (Henderson's horkelia)	X																	
Horkelia hispidula (White Mountains horkelia)									X									
Horkelia parryi (Parry's horkelia)								X					X	X				
Horkelia truncata (Ramona horkelia)																X		
Horkelia tularensis (Kern Plateau horkelia)												X						
Horkelia wilderae (Barton Flats horkelia)																		X
Horkelia yadonii (Santa Lucia horkelia)																	X	
Hulsea brevifolia (short-leaved hulsea)									X	X		X	X	X				
Hulsea vestita ssp. gabrielensis (San Gabriel Mountains hulsea)															X		X	X
Hulsea vestita ssp. pygmaea (pygmy hulsea)									X			X			X			X

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Iliamna latibracteata (California globe mallow)			X	X														
Imperata brevifolia (California satintail)															X		X	X
Iris hartwegii ssp. columbiana (Tuolumne iris)														X				
Iris munzii (Munz's iris)												X						
Ivesia aperta var. aperta (Sierra Valley ivesia)							X				X							
Ivesia aperta var. canina (Dog Valley ivesia)											X							
Ivesia argyrocoma var. argyrocoma (silver-haired ivesia)																		X
Ivesia callida (Tahquitz ivesia)																		X
Ivesia longibracteata (Castle Crags ivesia)			X															
Ivesia paniculata (Ash Creek ivesia)						X												
Ivesia pickeringii (Pickering's ivesia)	X		X															
Ivesia sericoleuca (Plumas ivesia)							X			X	X							
Ivesia webberi (Webber's ivesia)							X				X							
Juncus leiospermus var. leiospermus (Red Bluff dwarf rush)					X													
Juncus luciensis (Santa Lucia dwarf rush)					X		X				X						X	
Lathyrus biflorus (two-flowered pea)				X														
Layia heterotricha (pale-yellow layia)																	X	
Layia jonesii (Jones' layia)																	X	
Lepechinia cardiophylla (heart-leaved pitcher sage)																X		
Lepechinia fragrans (fragrant pitcher sage)															X			X
Lepechinia rossii (Ross' pitcher sage)															X		X	
Leptosiphon floribundus ssp. hallii (Santa Rosa Mountains leptosiphon)																		X
Leptosiphon nuttallii ssp. howellii (Mt. Tedoc leptosiphon)		X	X															
Leptosiphon serrulatus (Madera leptosiphon)												X	X					
Lessingia glandulifera var. tomentosa (Warner Springs lessingia)																X		
Lewisia brachycalyx (short-sepaled lewisia)															X	X		X
Lewisia cantelovii (Cantelow's lewisia)			X				X				X							
Lewisia congdonii (Congdon's lewisia)												X	X	X				
Lewisia disepala (Yosemite lewisia)												X	X					
Lewisia kelloggii ssp. hutchisonii (Hutchison's lewisia)			X		X		X	X		X	X			X				
Lewisia kelloggii ssp. kelloggii (Kellogg's lewisia)				X			X	X		X	X		X	X				
Lewisia longipetala (long-petaled lewisia)								X		X	X							
Lewisia oppositifolia (opposite-leaved lewisia)				X														
Lewisia serrata (saw-toothed lewisia)								X			X							
Lewisia stebbinsii (Stebbins' lewisia)		X																

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Lilium parryi (lemon lily)															X	X		X
Limnanthes alba var. parishii (Parish's meadowfoam)																X		X
Limnanthes floccosa ssp. bellingeriana (Bellinger's meadowfoam)					X													
Linanthus concinnus (San Gabriel linanthus)															X			X
Linanthus jaegeri (San Jacinto linanthus)																		X
Linanthus killipii (Baldwin Lake linanthus)																		X
Linanthus orcuttii (Orcutt's linanthus)																X		
Lomatium roseanum (adobe lomatium)					X	X	X											
Lomatium stebbinsii (Stebbins' lomatium)														X				
Lonicera subspicata var. subspicata (Santa Barbara honeysuckle)																	X	
Lupinus antoninus (Anthony Peak lupine)		X																
Lupinus citrinus var. citrinus (orange lupine)													X					
Lupinus constancei (The Lassics lupine)				X														
Lupinus duranii (Mono Lake lupine)									X									
Lupinus latifolius var. barbatus (bearded lupine)						X												
Lupinus lepidus var. ashlandensis (Mt. Ashland lupine)	X																	
Lupinus lepidus var. culbertsonii (Hockett Meadows lupine)									X			X	X					
Lupinus ludovicianus (San Luis Obispo County lupine)																	X	
Lupinus padre-crowleyi (Father Crowley's lupine)									X									
Lupinus peirsonii (Peirson's lupine)															X			
Malacothamnus palmeri var. involucratus (Carmel Valley bush-mallow)																	X	
Malacothamnus palmeri var. lucianus (Arroyo Seco bush-mallow)																	X	
Malacothamnus palmeri var. palmeri (Santa Lucia bush-mallow)																	X	
Malacothrix saxatilis var. arachnoidea (Carmel Valley malocothrix)																	X	
Malaxis monophyllos ssp. brachypoda (white bog adder's-mouth)																		X
Marina orcuttii var. orcuttii (California marina)																		X
Matelea parviflora (spear-leaf matelea)																		X
Meesia uliginosa (broad-nerved hump-moss)	X		X		X	X	X	X	X	X	X	X	X	X				X
Mentzelia inyoensis (Inyo blazing star)									X									
Mielichhoferia elongata (elongate copper moss)	X	X	X	X			X				X	X	X	X				
Mielichhoferia shevockii (Shevock's copper moss)												X	X	X		X	X	
Mimulus discolor (two-colored monkeyflower)												X						
Mimulus evanescens (ephemeral monkeyflower)	X				X	X												
Mimulus exiguus (San Bernardino Mountains monkeyflower)																		X
Mimulus filicaulis (slender-stemmed monkeyflower)													X	X				

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Mimulus gracilipes (slender-stalked monkeyflower)												X	X					
Mimulus norrisii (Kaweah monkeyflower)												X	X					
Mimulus pulchellus (yellow-lip pansy monkeyflower)													X	X				
Mimulus purpureus (little purple monkeyflower)																		X
Mimulus shevockii (Kelso Creek monkeyflower)												X						
Minuartia decumbens (The Lassics sandwort)				X														
Minuartia rosei (peanut sandwort)			X															
Minuartia stolonifera (Scott Mountain sandwort)	X		X															
Monardella australis ssp. jokerstii (Jokerst's monardella)															X			X
Monardella beneolens (sweet-smelling monardella)									X			X						
Monardella follettii (Follett's monardella)					X		X				X							
Monardella hypoleuca ssp. lanata (flat-leaved monardella)																X		
Monardella linoides ssp. oblonga (Tehachapi monardella)								X				X					X	
Monardella macrantha ssp. hallii (Hall's monardella)															X	X		X
Monardella nana ssp. leptosiphon (San Felipe monardella)																X		X
Monardella palmeri (Palmer's monardella)																	X	
Monardella stebbinsii (Stebbins' monardella)							X											
Monardella saxicola (rock monardella)															X			X
Navarretia ojaiensis (Ojai navarretia)																	X	
Navarretia peninsularis (Baja navarretia)												X			X	X	X	X
Navarretia prolifera ssp. lutea (yellow bur navarretia)								X										
Navarretia setiloba (Piute Mountains navarretia)												X						
Nemacladus calcaratus (Chimney Creek nemacladus)												X						
Nemacladus secundiflorus var. robbinsii (Robbins' nemacladus)															X		X	
Nemacladus twisselmannii (Twisselmann's nemacladus)												X						
Neviusia cliftonii (Shasta snow-wreath)			X															
Nolina cismontana (chaparral nolina)																X	X	
Ophioglossum pusillum (northern adder's tongue)		X	X					X										
Opuntia basilaris var. brachyclada (short-joint beavertail)															X			X
Oreonana purpurascens (purple mountain-parsley)												X						
Oreonana vestita (woolly mountain-parsley)												X			X			X
Oreostemma elatum (tall alpine-aster)					X		X											
Orobanche valida ssp. valida (Rock Creek broomrape)															X		X	X
Orthotrichum kellmanii (Kellman's bristle moss)																	X	
Orthotrichum praemorsum (No common name)										X								

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Otidea smithii (Smith's otidea)				X														
Oxytropis oreophila var. oreophila (rock-loving oxytrope)															X			X
Packera bernardina (San Bernardino ragwort)																		X
Packera eurycephala var. lewisrosei (Lewis Rose's ragwort)					X		X											
Packera ganderi (Gander's ragwort)																X		
Packera hesperia (western ragwort)				X														
Parnassia cirrata var. cirrata (San Bernardino grass-of-Parnassus)															X			X
Parnassia cirrata var. intermedia (Cascade grass-of-Parnassus)	X		X															
Pedicularis dudleyi (Dudley's lousewort)																	X	
Pedicularis howellii (Howell's lousewort)	X			X														
Peltigera gowardii (veined water lichen)	X	X	X	X	X		X	X	X	X	X	X	X	X				
Penstemon californicus (California beardtongue)																X		X
Penstemon personatus (closed-throated beardtongue)					X		X				X							
Penstemon sudans (Susanville beardtongue)					X		X											
Penstemon tracyi (Tracy's beardtongue)			X															
Pentachaeta exilis ssp. aeolica (San Benito pentachaeta)																	X	
Petrophyton caespitosum ssp. acuminatum (marble rockmat)									X			X	X					
Phacelia cookei (Cooke's phacelia)	X		X															
Phacelia greenei (Scott Valley phacelia)	X		X															
Phacelia inundata (playa phacelia)	X				X	X												
Phacelia inyoensis (Inyo phacelia)									X									
Phacelia keckii (Santiago Peak phacelia)																X		
Phacelia monoensis (Mono County phacelia)									X									
Phacelia novenmillensis (Nine Mile Canyon phacelia)									X			X						
Phacelia stebbinsii (Stebbins' phacelia)								X			X							
Phaeocollybia olivacea (olive phaeocollybia)	X		X	X			X				X							
Phlox dolichantha (Big Bear Valley phlox)																		X
Pinus albicaulis (whitebark pine)	X		X		X	X		X	X	X	X	X	X	X				
Plagiobothrys collinus var. ursinus (Cooper's popcornflower)																		X
Plagiobothrys parishii (Parish's popcornflower)									X									
Plagiobothrys uncinatus (hooked popcornflower)																	X	
Platanthera yosemitensis (Yosemite bog orchid)													X					
Poa sierrae (Sierra blue grass)					X		X	X			X							
Polemonium chartaceum (Mason's sky pilot)	X		X						X									
Polyctenium williamsiae (Williams' combleaf)									X									

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Potentilla basaltica (Black Rock potentilla)						X												
Potentilla morefieldii (Morefield's cinquefoil)									X									
Potentilla rimicola (cliff cinquefoil)																		X
Prosartes parvifolia (Siskiyou bells)				X														
Pyrrocoma lucida (sticky pyrrocoma)					X		X				X							
Pyrrocoma uniflora var. gossypina (Bear Valley pyrrocoma)																		X
Quercus dumosa (Nuttall's scrub oak)																	X	
Raillardella pringlei (showy raillardella)	X		X															
Ramalina thrausta (angelhair)				X														
Ribes canthariforme (Moreno currant)																X		
Rorippa columbiae (Columbia yellow cress)	X		X		X	X												
Rorippa subumbellata (Tahoe yellow cress)										X								
Rupertia hallii (Hall's rupertia)					X													
Saltugilia latimeri (Latimer's woodland-gilia)												X						X
Sanicula maritima (adobe sanicle)																	X	
Sanicula tracyi (Tracy's sanicle)				X														
Scheuchzeria palustris (American scheuchzeria)					X													
Schoenus nigricans (black bog-rush)																		X
Scutellaria bolanderi ssp. austromontana (southern mountains skullcap)															X	X		X
Sedum albomarginatum (Feather River stonecrop)					X		X											
Sedum niveum (Davidson's stonecrop)																		X
Sedum obtusatum ssp. paradisum (Canyon Creek stonecrop)			X	X														
Senecio pattersonensis (Mount Patterson senecio)									X									
Sibaropsis hammittii (Hammitt's clay-cress)																X		
Sidalcea hickmanii ssp. anomala (Cuesta Pass checkerbloom)																	X	
Sidalcea hickmanii ssp. hickmanii (Hickman's checkerbloom)																	X	
Sidalcea hickmanii ssp. parishii (Parish's checkerbloom)															X		X	X
Sidalcea hickmanii ssp. pillsburiensis (Lake Pillsbury checkerbloom)		X																
Sidalcea malviflora ssp. dolosa ((Bear Valley checkerbloom)																		X
Sidalcea neomexicana (Salt Spring checkerbloom)															X		X	X
Sidotheca caryophylloides (chickweed oxytheca)												X			X		X	X
Sidotheca emarginata (white-margined oxytheca)																		X
Silene occidentalis ssp. longistipitata (long-stiped campion)					X													
Silene salmonacea (Klamath Mountain catchfly)			X															
Silene serpentinicola (serpentine catchfly)				X														

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Sisyrinchium longipes (timberland blue-eyed grass)																		X
Streptanthus albidus ssp. peramoenus (most beautiful jewel-flower)																	X	
Streptanthus campestris (southern jewel-flower)															X	X	X	X
Streptanthus cordatus var. piutensis (Piute Mountains jewel-flower)												X						
Streptanthus fenestratus (Tehipite Valley jewel-flower)												X	X					
Streptanthus gracilis (alpine jewel-flower)									X									
Streptanthus howellii (Howell's jewel-flower)				X														
Streptanthus oblanceolatus (Trinity River jewel-flower)			X	X														
Streptanthus oliganthus (Masonic Mountain jewel-flower)									X									
Stylocline masonii (Mason's neststraw)												X			X		X	
Sulcaria badia (bay horsehair lichen)		X	X	X														
Symphyotrichum defoliatum (San Bernardino aster)												X			X	X	X	X
Tauschia howellii (Howell's tauschia)	X			X							X		X					
Tetracoccus dioicus (Parry's tetracoccus)																X		
Thelypodium howellii ssp. howellii (Howell's thelypodium)					X	X												
Thelypteris puberula var. sonorensis (Sonoran maiden fern)															X		X	X
Thermopsis californica var. semota (velvety false lupine)																X		
Thermopsis macrophylla (Santa Ynez false lupine)																	X	
Thermopsis robusta (robust false lupine)	X			X														
Thysanocarpus rigidus (rigid fringepod)															X	X		X
Tracyina rostrata (beaked tracyina)		X		X														
Tricholomopsis fulvescens (tawny tricholomopsis)	X	X		X														
Trifolium bolanderi (Bolander's clover)													X					
Trifolium dedeckerae (Dedecker's clover)									X			X						
Triquetrella californica (coastal triquetrella)																	X	
Triteleia ixioides ssp. cookii (Cook's triteelia)																	X	
Tropidocarpum capparideum (caper-fruited tropidocarpum)																	X	
Viola primulifolia ssp. occidentalis (western white bog violet)				X														

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Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: August 20, 2019
Consultation Code: 08ESMF00-2019-SLI-2810
Event Code: 08ESMF00-2019-E-08974
Project Name: YCWA Sediment 2019 Update

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2019-SLI-2810

Event Code: 08ESMF00-2019-E-08974

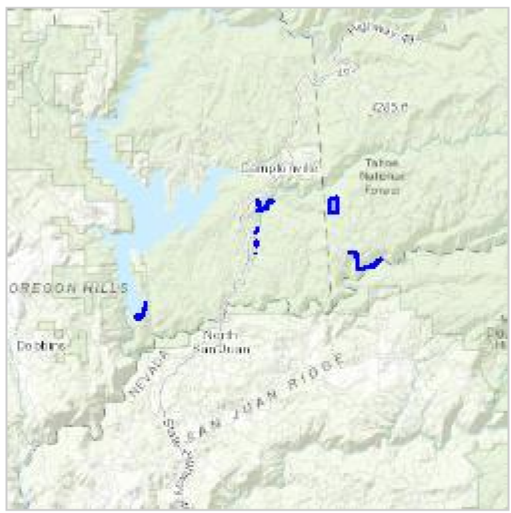
Project Name: YCWA Sediment 2019 Update

Project Type: ** OTHER **

Project Description: Sediment removal and sediment disposal sites for 2019 YCWA CEQA.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/39.43838331984816N121.02111803619115W



Counties: Nevada, CA | Sierra, CA | Yuba, CA

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened
Sierra Nevada Yellow-legged Frog *Rana sierrae* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9529	Endangered

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Flowering Plants

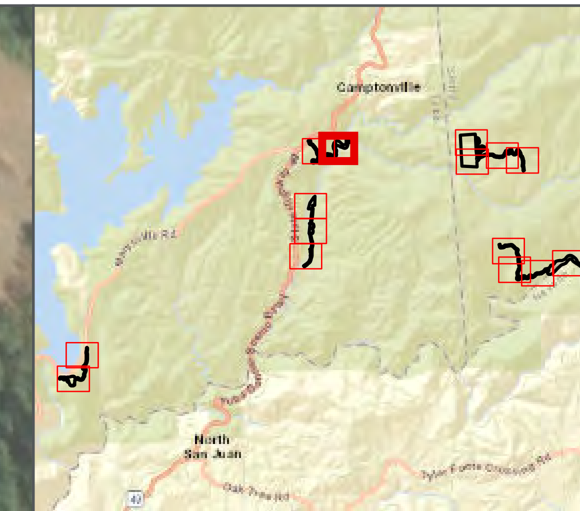
NAME	STATUS
Layne's Butterweed *Senecio layneae* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4062	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Attachment C

Vegetation Community Mapbook



LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

Montane Riparian

Perennial Channel

NOTE: Not all aquatic resources shown have been delineated. Some may vary from the extent shown, and there may be additional aquatic resources not shown on the map.

DATA SOURCES: HDR, Inc. (2019); USFS (2019); Esri aerial.

DISCLAIMER: Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.

Project Site: Log Cabin

0 200 400
FEET

YUBA WATER AGENCY

HDR

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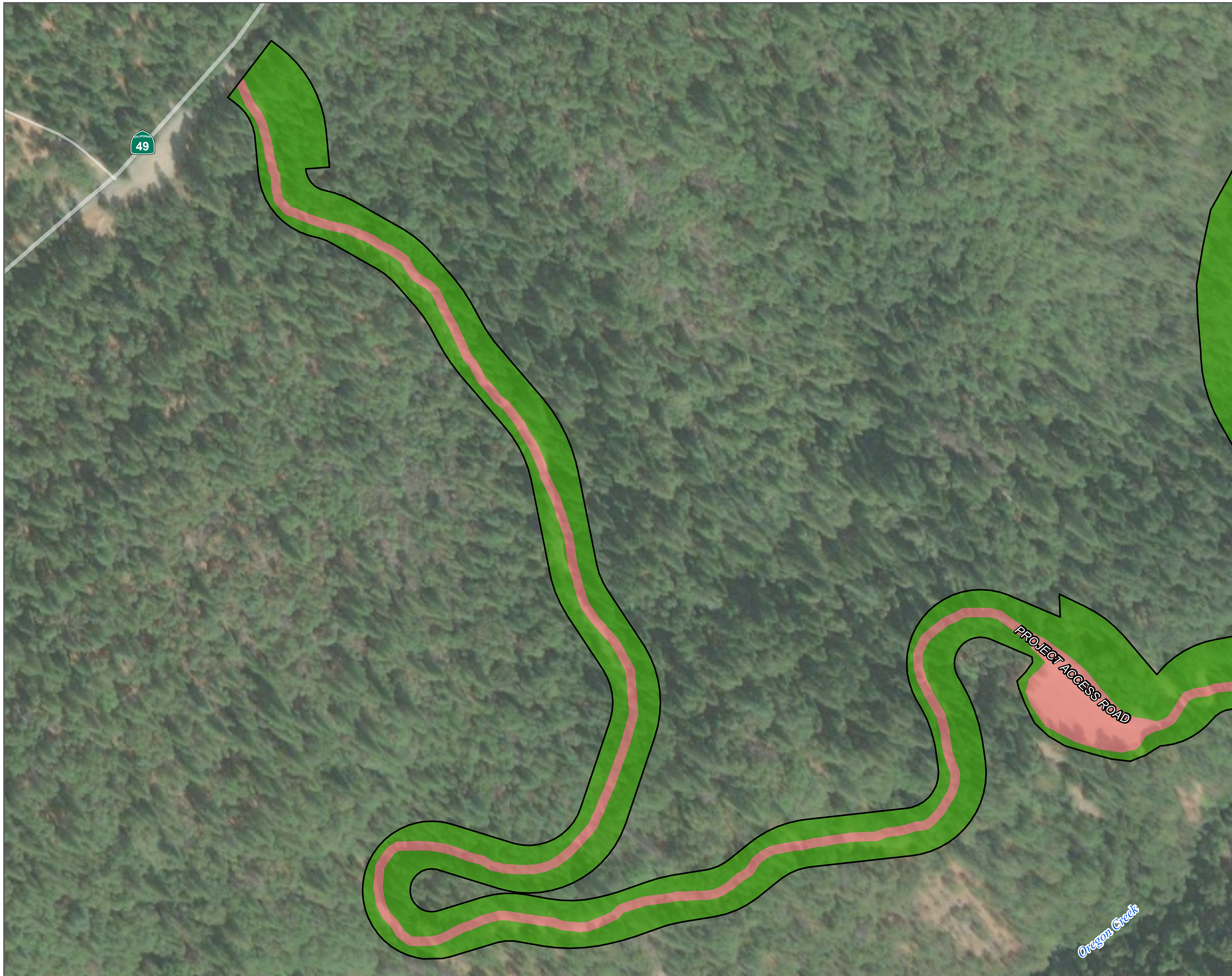

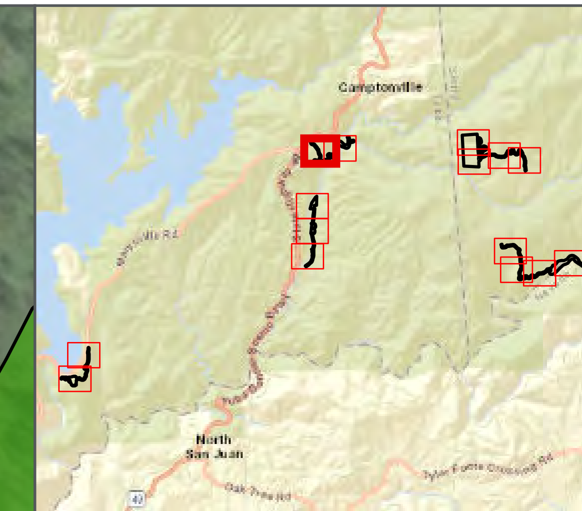

LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

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Project Site: Log Cabin

N

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YUBA WATER AGENCY

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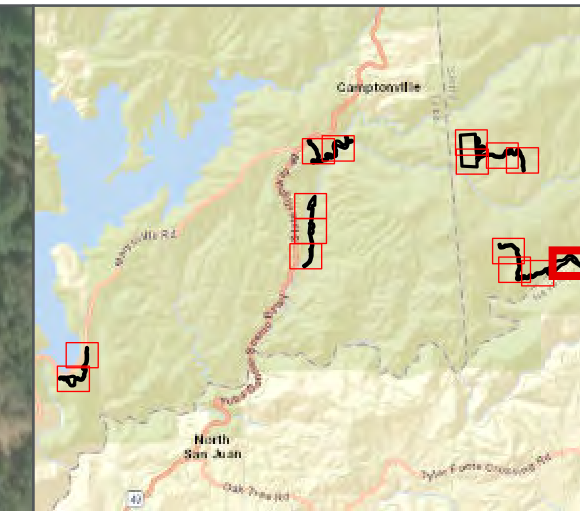

LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

Montane Riparian

Perennial Channel

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Project Site: Our House

N

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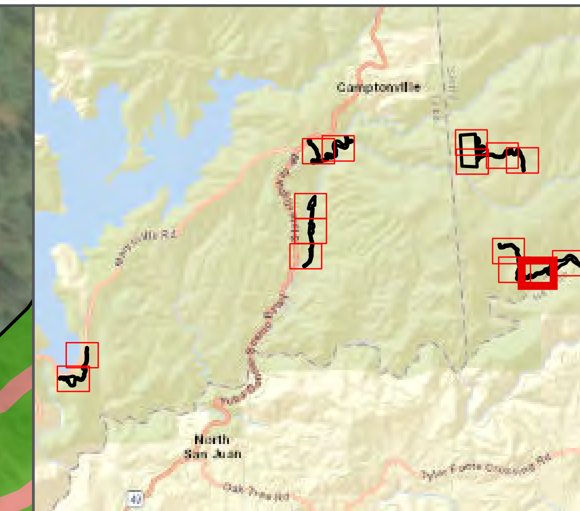

LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

Perennial Channel

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Project Site: Our House

N

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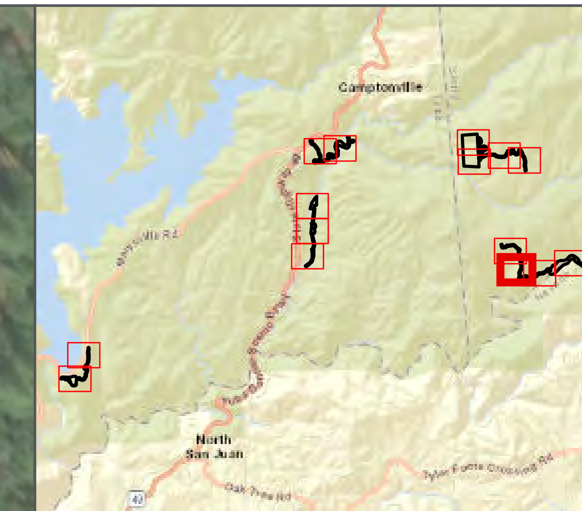
YUBA WATER AGENCY

HDR



LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

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Project Site: Our House

N

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YUBA WATER AGENCY

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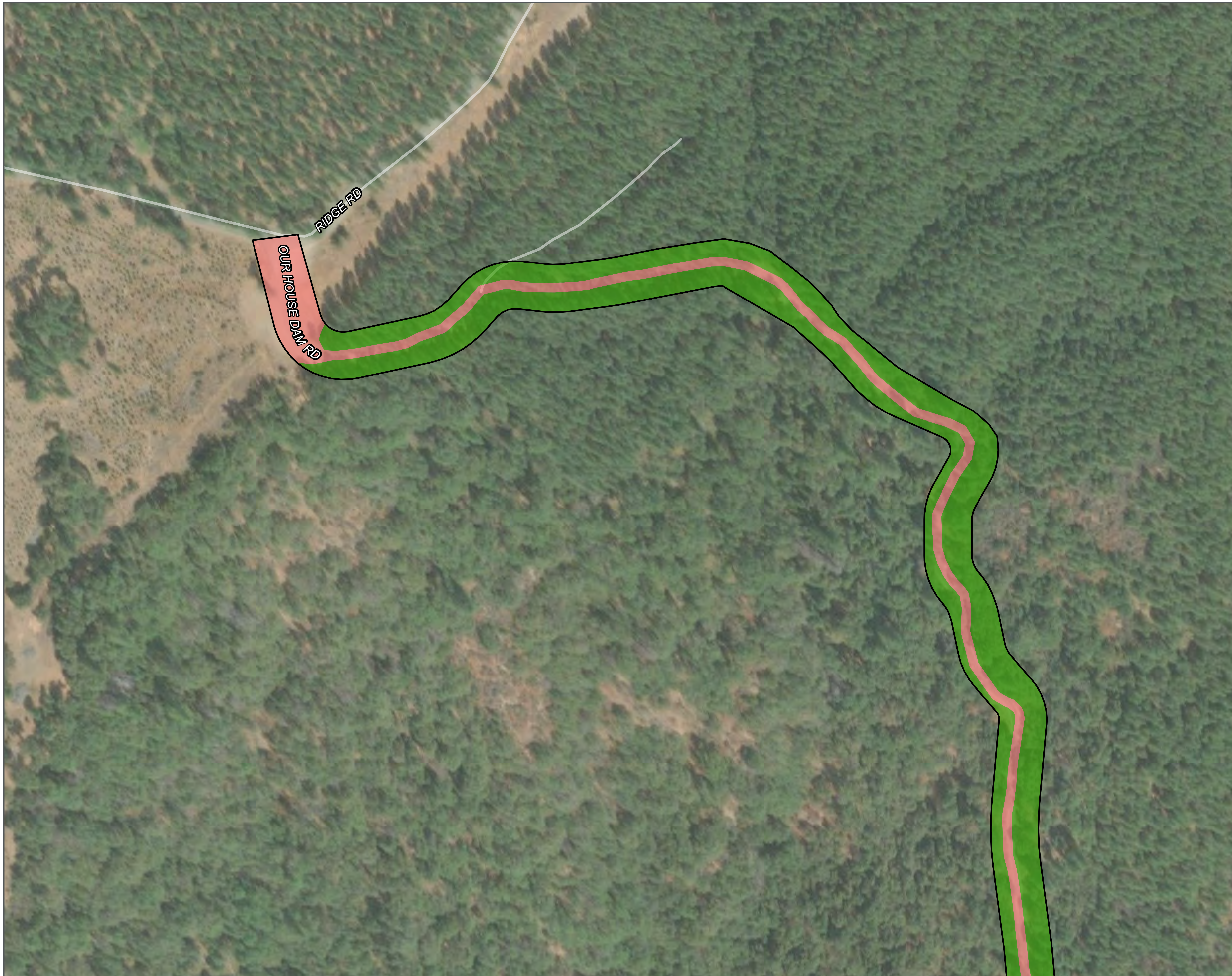

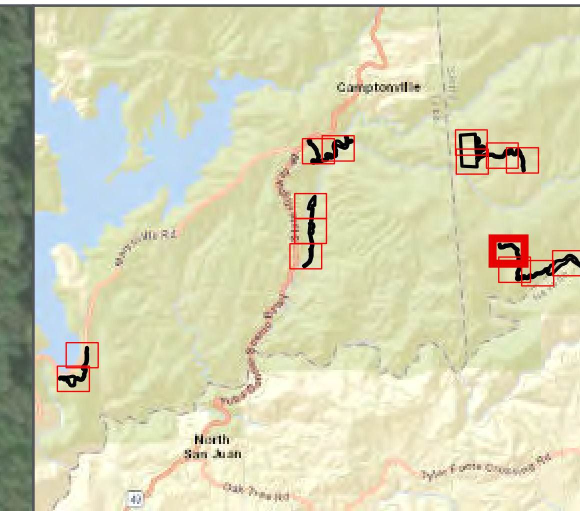

LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

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Page 6 of 15

Project Site: Our House

N

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YUBA WATER AGENCY

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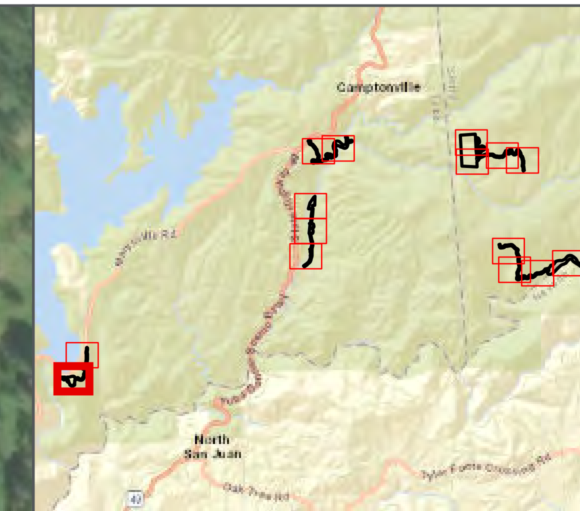

LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

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Project Site: Disposal Site 1

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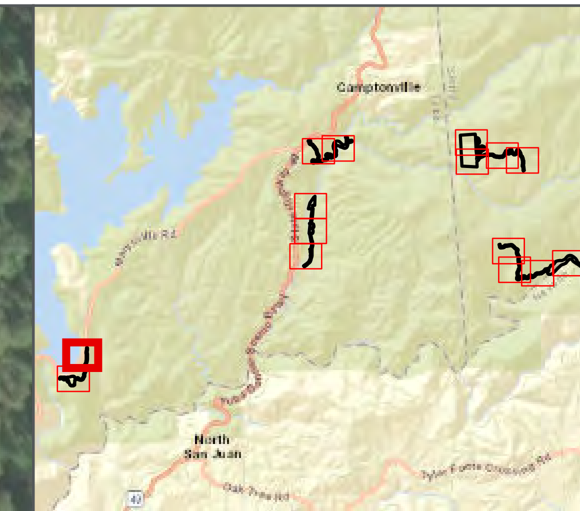
YUBA WATER AGENCY

HDR



LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

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Project Site: Disposal Site 1

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YUBA WATER AGENCY

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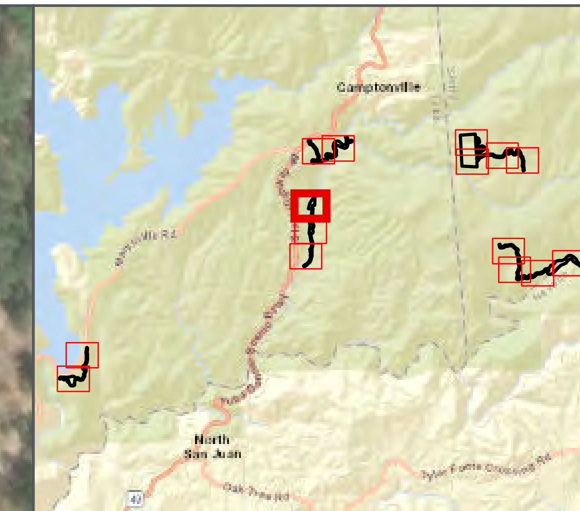

LEGEND

Project Site

Vegetation Community

Annual Grassland

Disturbed

Ephemeral Channel

Montane Hardwood Conifer

Montane Riparian

Pond

Seasonal Wetland

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Project Site: Disposal Site 2

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YUBA WATER AGENCY

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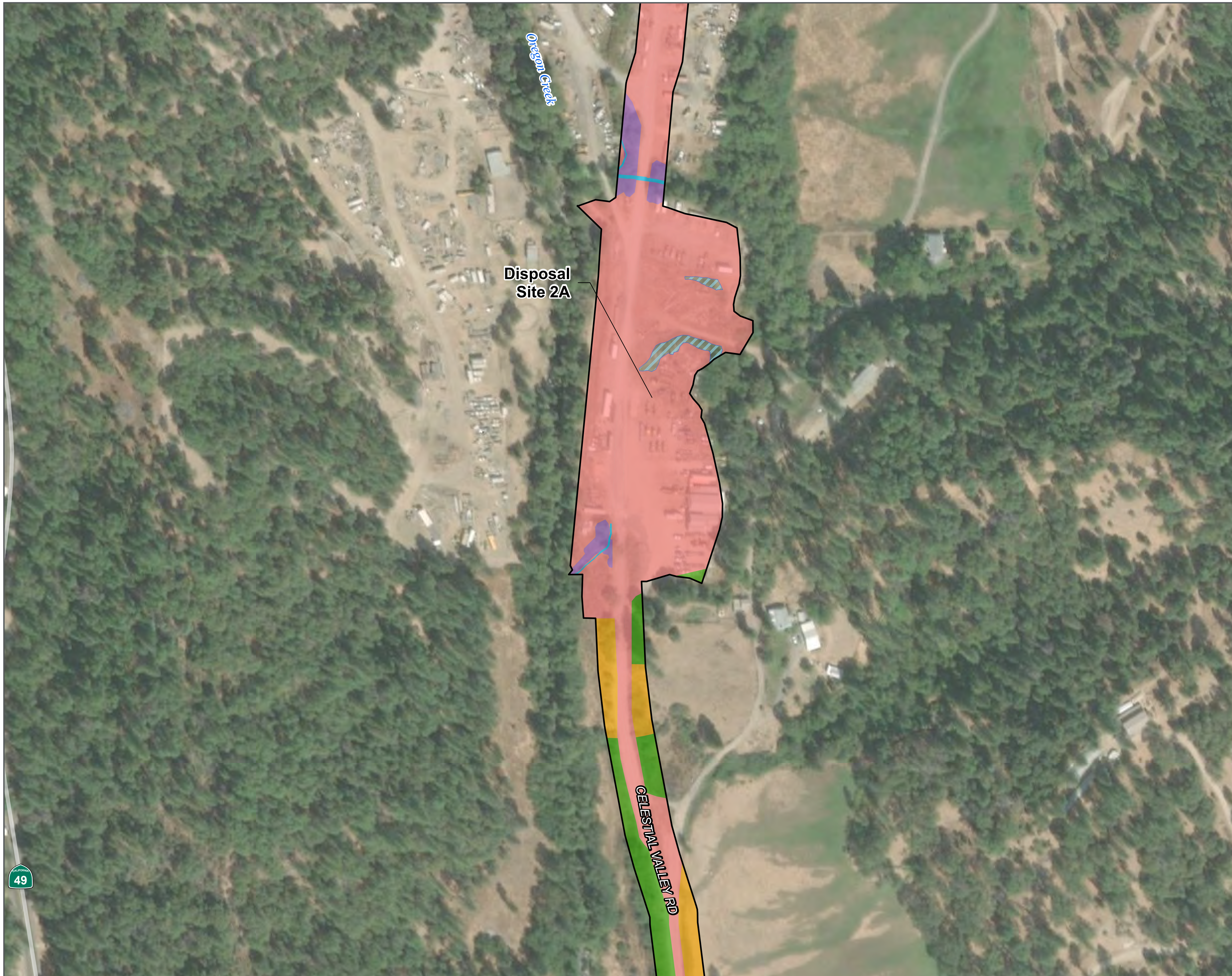

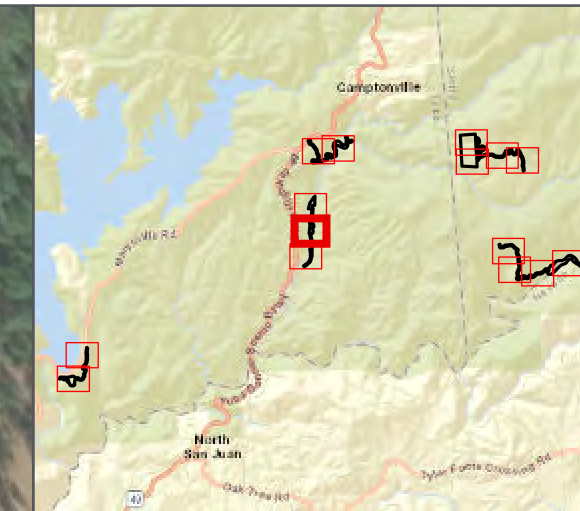

LEGEND

- Project Site

Vegetation Community

- Annual Grassland
- Disturbed
- Ephemeral Channel
- Montane Hardwood Conifer
- Montane Riparian
- Seasonal Wetland

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Project Site: Disposal Site 2

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YUBA WATER AGENCY

HDR

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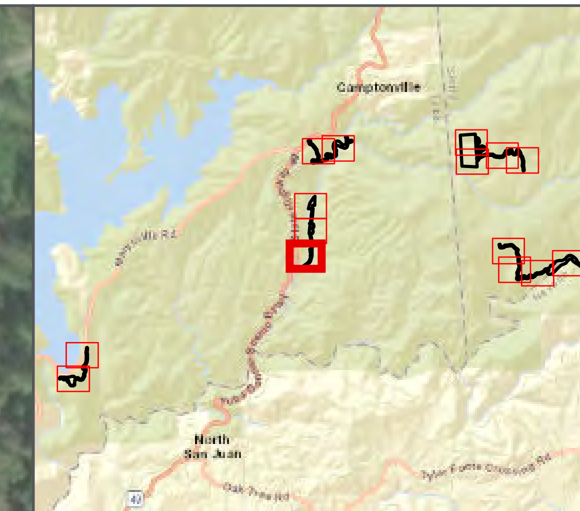

LEGEND

Project Site

Vegetation Community

- Annual Grassland
- Disturbed
- Ephemeral Channel
- Montane Hardwood Conifer
- Montane Riparian
- Perennial Channel

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Project Site: Revegetation Site & Disposal Site 2

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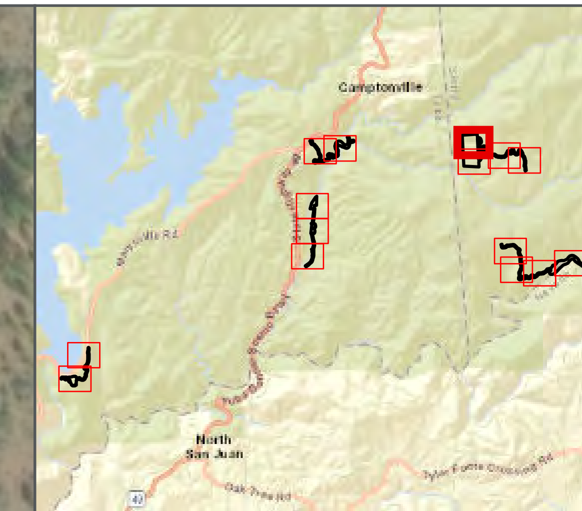

LEGEND

Project Site

Vegetation Community

- Disturbed
- Ephemeral Channel
- Montane Chaparral
- Montane Hardwood
- Montane Hardwood Conifer
- Montane Riparian
- Perennial Channel

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Project Site: Disposal Site 3

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FEET

YUBA WATER AGENCY

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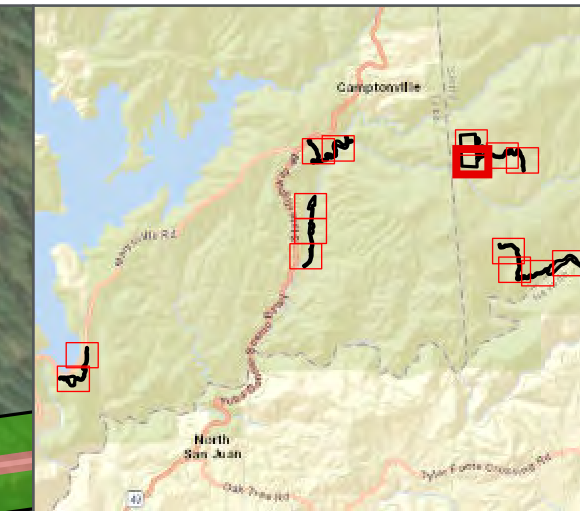

LEGEND

Project Site

Vegetation Community

- Disturbed
- Ephemeral Channel
- Montane Chaparral
- Montane Hardwood
- Montane Hardwood Conifer
- Montane Riparian
- Perennial Channel

NOTE: Not all aquatic resources shown have been delineated. Some may vary from the extent shown, and there may be additional aquatic resources not shown on the map.

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Page 13 of 15

Project Site: Disposal Site 3

N

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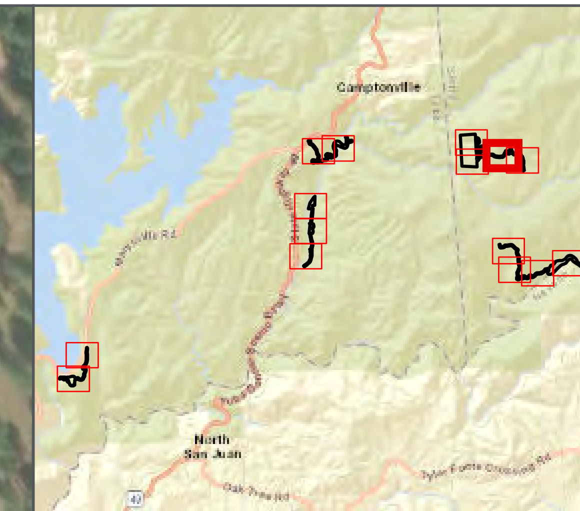
FEET

YUBA WATER AGENCY

HDR



LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

Pond

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Project Site: Disposal Site 3

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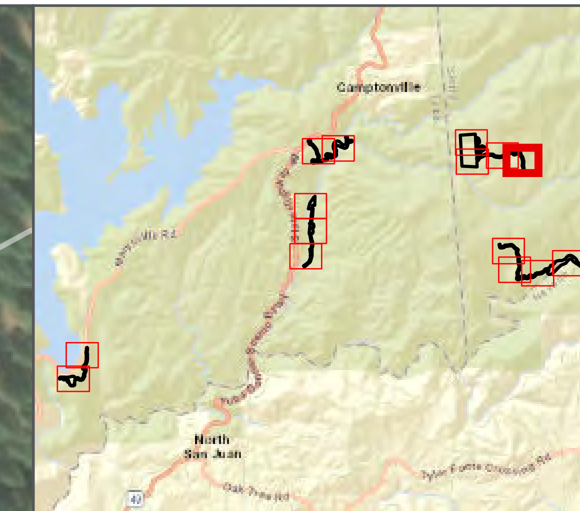
YUBA WATER AGENCY

HDR



LEGEND

Project Site

Vegetation Community

Disturbed

Montane Hardwood Conifer

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Project Site: Disposal Site 3

N

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FEET

Attachment D

Special-status Species Tables

Table 1. Special-status Plants with the Potential to Occur at the Project Sites

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Arabis rigidissima var. *demota*	Galena Creek rockcress	None	None	FSS	1B.2	Perennial herb found in rocky areas within broad-leafed upland forest and upper montane coniferous forests. Elevation: 7,398-8,398 ft. Blooming period: July-August (CNPS 2019).	N	Project sites occur below species elevation range.
Astragalus lemmonii	Lemmon's milk-vetch	None	None	FSS	1B.2	Perennial herb occurring within Great Basin scrub, marshes, meadows, and seeps. Elevation: 3,303-7,217 ft. Blooming period: May-August (CNPS 2019).	N	Suitable habitat absent from all project sites.
Astragalus pulsiferae var. *coronensis*	Modoc Plateau milk-vetch	None	None	FSS	4.2	Perennial herb occurring in sandy, volcanic soils within Great Basin scrub and lower montane coniferous habitat. Elevation: 4,412-6,200 ft. Blooming period: May-July (CNPS 2019).	N	Project sites occur below species elevation range.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Astragalus webberi	Webber's milk-vetch	None	None	FSS	1B.2	Found in broad-leafed upland forests, meadows and seeps, or lower montane coniferous forests. Elevation: 2,400-4,101 ft. Blooming period: May-July (CNPS 2019).	N	Suitable habitat may be present at all project sites except Disposal Site 1. However, nearby occurrences date over 150 years old (CCH 2019).
Boletus pulcherrimus	red-pored bolete	None	None	FSS	None	Solitary and found within mineral soil or humus and closely associated with conifers and hardwoods, mainly white fir and mountain hemlock. Fruits: July-December (Forest Service 2014).	N	Suitable habitat present at all project sites. However, common associates not present.
Botrychium ascendens	upswept moonwort	None	None	FSS	2B.3	Species found in mesic habitats within montane coniferous forests, seeps, and meadows. Elevation: 3,658-9,990 ft. Blooming period: July-August (CNPS 2019).	N	Project sites occur below species elevation range.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Botrychium crenulatum	scalloped moonwort	None	None	FSS	2B.2	Known in fens, bogs, lower montane coniferous forests, freshwater marshes, and upland montane coniferous forests. Elevation: 4,160-10,761 ft. Blooming period: June-September (CNPS 2019).	N	Project sites occur below species elevation range.
Botrychium lunaria	common moonwort	None	None	FSS	2B.3	Meadows, seeps, subalpine coniferous forest, and upper montane coniferous forests. Elevation: 6,496-11,154 ft. Blooming period: August (CNPS 2019).	N	Project sites occur below species elevation range.
Botrychium minganense	mingan moonwort	None	None	FSS	2B.2	Found in mesic bogs and fens, lower and upper montane coniferous forests, and along the edges of seeps and meadows. Elevation: 4,773-7,152 ft. Blooming period: July-September (CNPS 2019).	N	Project sites occur below species elevation range.
Botrychium montanum	western moonwort	None	None	FSS	2B.1	Mesic soil in meadows, seeps, and montane coniferous forest. Elevation: 4,805–7,150 ft. Sporing period: July–September (CNPS 2019).	N	Project sites occur below species elevation range.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Bruchia bolanderi	Bolander's bruchia	None	None	FSS	None	Damp soil in meadows, seeps, and montane coniferous forests. Elevation: 5,575–9,185 ft (CNPS 2019).	N	Project sites occur below species elevation range.
Buxbaumia viridis	buxbaumia moss	None	None	None	2B.2	Decorticated wood/humus, subalpine coniferous forest, and lower and upper montane coniferous forest. Elevation: 3,200-7,215 ft. Blooming period: unknown (CNPS 2019).	N	Suitable habitat absent from all project sites.
Cardamine pachystigma var. *dissectifolia*	dissected-leaved toothwort	None	None	None	1B.2	Serpentine rocky soils in chaparral and lower montane coniferous forest. Elevation: 835–6,890 ft. Blooming period: February–May (CNPS 2019).	N	Suitable soils absent from all project sites.
Carex cyrtostachya	Sierra arching sedge	None	None	None	1B.2	Mesic lower montane coniferous forests, meadows, seeps, marshes, swamps, and the margins of riparian forests. Elevation: 2,000–4,460 ft. Blooming period: May–August (CNPS 2019).	Y	Suitable habitat present at all project sites except Disposal Site 1.
Carex xerophila	chaparral sedge	None	None	None	1B.2	Serpentine and gabbro soils in chaparral, cismontane woodland, and lower montane coniferous forest. Elevation: 1,440–2,525 ft. Blooming period: March–June (CNPS 2019).	N	Suitable soils absent from all project sites.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Clarkia gracilis ssp. *albicaulis*	white-stemmed clarkia	None	None	None	1B.2	Sometimes on serpentine soils in chaparral and cismontane woodland. Elevation: 800–3,560 ft. Blooming period: May–July (CNPS 2019).	N	Suitable soils absent from all project sites.
Clarkia mosquinii	Mosquin's clarkia	None	None	None	1B.1	Rocky soils and roadsides in cismontane woodland and lower montane coniferous forest. Elevation: 605–4,890 ft. Blooming period: May–July (September) (CNPS 2019).	Y	Suitable habitat present at all project sites.
Cypripedium fasciculatum	clustered lady's-slipper	None	None	FSS	4.2	Serpentine seeps and streambanks in lower montane and north coast coniferous forest. Elevation: 325–7,990 ft. Blooming period: March–August (CNPS 2019).	N	Suitable soils absent from all project sites.
Cypripedium montanum	mountain lady's-slipper	None	None	FSS	4.2	Cismontane woodland, broad-leafed, lower montane and north coast coniferous forests. Elevation: 605–7,300 ft. Blooming period: March–August (CNPS 2019).	Y	Suitable habitat present at all project sites.
Cypripedium parviflorum var. *makasin*	northern yellow lady's-slipper	None	None	None	3.1	Bogs, fens, meadows, and seeps. Elevation: 0–4,920 ft. Blooming period: May–August (CNPS 2019).	N	Suitable habitat absent from all project sites.
Dendrocollybia racemosa	branched collybia	None	None	FSS	None	Solitary and found growing from decayed remains of other mushrooms or in duff of mixed hardwood-conifer habitat. Fruit: late fall - mid-winter (MykoWeb 2019).	Y	Suitable habitat present at all project sites.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Erigeron lassenianus var. *deficiens*	Plumas rayless daisy	None	None	None	1B.3	Usually gravelly but sometimes serpentine soils in disturbed areas of lower montane coniferous forest. Elevation: 4,460–6,495 ft. Blooming period: June–September (CNPS 2019).	N	Project sites occur below species elevation range.
Erigeron miser	starved daisy	None	None	FSS	1B.3	Upper montane coniferous forest. Elevation: 6,035–8,595 ft. Blooming period: June–October (CNPS 2019).	N	Project sites occur below species elevation range.
Eriogonum umbellatum var. *ahartii*	Ahart's buckwheat	None	None	None	1B.2	Serpentine soils on slopes in openings of chaparral and cismontane woodland. Elevation: 1,310–6,560 ft. Blooming period: June–September (CNPS 2019).	N	Suitable soils absent from all project sites.
Eriogonum umbellatum var. *torreyanum*	Donner Pass buckwheat	None	None	FSS	1B.2	Rocky and volcanic soils in meadows, seeps, and upper montane coniferous forest. Elevation: 6,085–8,595 ft. Blooming period: July–September (CNPS 2019).	N	Project sites occur below species elevation range.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Erythranthe filicifolia	fern-leaved monkeyflower	None	None	None	1B.2	Usually in slow–draining ephemeral seeps that are among exfoliating granitic slabs in meadows. chaparral, and lower montane coniferous forest. Elevation: 1,360–5,610 ft. Blooming period: April–June (CNPS 2019).	N	All occurrences are north of the South Fork Feather River (CCH 2019).
Fissidens pauperculus	minute pocket moss	None	None	None	1B.2	Damp soil in north coast coniferous forest. Elevation: 30–3,360 ft (CNPS 2019).	N	Suitable habitat absent from all project sites.
Frangula purshiana ssp. *ultramafica*	Caribou coffeeberry	None	None	None	1B.2	Serpentine soils in chaparral, montane coniferous forests, meadows, and seeps. Elevation: 2,705–6,330 ft. Blooming period: May–July (CNPS 2019).	N	Suitable soils absent from all project sites.
Fremontodendron decumbens	Pine Hill flannelbush	FE	SR	None	1B.2	Rocky gabbro or serpentine soils in chaparral and cismontane woodland. Elevation: 1,390–2,495 ft. Blooming period: April–July (CNPS 2019).	N	Suitable soils absent from all project sites.
Fritillaria eastwoodiae	Butte County fritillary	None	None	FSS	3.2	Sometimes serpentine soils in chaparral, cismontane woodland, and lower montane coniferous forest. Elevation: 160–4,920 ft. Blooming period: March–June (CNPS 2019).	N	Suitable soils absent from all project sites.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Helodium blandowii	Blandow's bog moss	None	None	FSS	2B.3	Damp soil in meadows, seeps, and subalpine coniferous forest. Elevation: 6,105–8,860 ft (CNPS 2019).	N	Project sites occur below species elevation range.
Ivesia aperta var. *aperta*	Sierra Valley ivesia	None	None	FSS	1B.2	Vernally mesic soils that are usually volcanic in Great Basin scrub, lower montane coniferous forest, meadows, seeps, vernal pools, and pinyon and juniper woodland. Elevation: 4,855–7,545 ft. Blooming period: June–September (CNPS 2019).	N	Project sites occur below species elevation range.
Ivesia aperta var. *canina*	Dog Valley ivesia	None	None	FSS	1B.1	Volcanic and rocky soils in openings of lower montane coniferous forest and xeric conditions of meadows and seeps. Elevation: 5,245–6,560 ft. Blooming period: June–August (CNPS 2019).	N	Project sites occur below species elevation range.
Ivesia sericoleuca	Plumas ivesia	None	None	FSS	1B.2	Vernally mesic soils that are usually volcanic in Great Basin scrub, veral pools, meadows seeps, and lower montane coniferous forest. Elevation: 4,295–7,220 ft. Blooming period: May–October (CNPS 2019).	N	Project sites occur below species elevation range.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Ivesia webberi	Webber's ivesia	FT	None	FSS	1B.1	Sandy or gravelly soils in volcanic ashy Great Basin scrub, lower montane coniferous forest, and pinyon and juniper woodland. Elevation: 3,280–6,810 ft. Blooming period: May–July (CNPS 2019).	N	Project is outside of known species range. All known occurrences are east of the Sierra Crest (CCH 2019).
Juncus luciensis	Santa Lucia dwarf rush	None	None	FSS	1B.2	Chaparral, Great Basin scrub, lower montane coniferous forest, meadows and seeps, and vernal pools. Elevation: 984–6,693 ft. Blooming period: April–July (CNPS 2019).	N	Project is outside of known species range. All known occurrences are east of the Sierra Crest (CCH 2019).
Lewisia cantelovii	Cantelow's lewisia	None	None	FSS	1B.2	Mesic and granitic soils and occasionally serpentine seeps in broad-leafed upland and lower montane coniferous forests, chaparral, and cismontane woodland. Elevation: 1,080–4,495 ft. Blooming period: May–October (CNPS 2019).	Y	Suitable habitat present at all project sites except Disposal Site 1.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Lewisia kelloggii ssp. *hutchisonii*	Hutchison's lewisia	None	None	FSS	3.2	Often in slate soils or sometimes rhyolite tuff in openings and ridgetops of upper montane coniferous forest. Elevation: 2,505–7,760 ft. Blooming period: April–August (CNPS 2019).	N	Suitable soils absent from all project sites.
Lewisia kelloggii ssp. *kelloggii*	Kellogg's lewisia	None	None	FSS	3.2	Often in slate soils or sometimes rhyolite tuff in openings and ridgetops of upper montane coniferous forest. Elevation: 4,805–7,760 ft. Blooming period: April–August (CNPS 2019).	N	Project sites occur below species elevation range.
Lewisia longipetala	long-petaled lewisia	None	None	FSS	1B.3	Granitic soils in mesic subalpine coniferous forests and alpine boulder and rock fields. Elevation: 8,200–9,595 ft. Blooming period: July–September (CNPS 2019).	N	Project sites occur below species elevation range.
Lewisia serrata	saw-toothed lewisia	None	None	FSS	1B.1	Mesic soils and rocky slopes in broad-leafed upland, riparian, and lower montane coniferous forests. Elevation: 2,525–4,710 ft. Blooming period: May–June (CNPS 2019).	N	Nearest documented occurrences are over 30 miles away (CCH 2019).

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Lycopodiella inundata	inundated bog club-moss	None	None	None	2B.2	Coastal bogs and fens, mesic lower montane coniferous forest, and lake margins of swamps and marshes. Elevation: 15–3,280 ft. Blooming period: June–September (CNPS 2019).	N	Suitable habitat not present. Project below species elevation range.
Meesia uliginosa	broad-nerved hump-moss	None	None	FSS	2B.2	Damp soil in bogs, fens, meadows seeps, and upper montane and subalpine coniferous forests. Elevation: 3,965–9,200 ft. Sporing period: July and October (CNPS 2019).	N	Suitable habitat absent from all project sites.
Mielichhoferia elongata	elongate copper moss	None	None	FSS	4.3	Metamorphic rock and carbonate soils, often along roadsides, that are usually vernally mesic and acidic in chaparral, meadows, seeps, coastal scrub, cismontane woodland, and broad-leafed upland and lower montane and subalpine coniferous forests. Elevation: 2,460-4,593 ft (CNPS 2019).	N	Suitable soils absent from all project sites.
Mielichhoferia shevockii	Shevock's copper moss	None	None	None	1B.2	Cismontane woodland with mesic, metamorphic rock. Elevation range: 2,460 -4,593 ft. Bloom period: unknown (CNPS 2019).	Y	Suitable habitat present at all project sites except Disposal Site 1.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Monardella follettii	Follett's mondardella	None	None	FSS	1B.2	Rocky and serpentine soils in lower montane coniferous forest. Elevation: 1,965–6,560 ft. Blooming period: June–September (CNPS 2019).	N	Suitable soils absent from all project sites.
Packera layneae	Layne's ragwort	FT	SR	None	1B.2	Rocky serpentine or gabbro soils in chaparral and cismontane woodland. Elevation: 655–3,560 ft. Blooming period: April–August (CNPS 2019).	N	Suitable soils absent from all project sites.
Peltigera gowardii	veined water lichen	None	None	FSS	4.2	On rocks in cold water creeks with little to no sediment or disturbance in riparian forests. Elevation: 3,490–8,595 ft (CNPS 2019).	N	Suitable habitat absent from all project sites.
Penstemon personatus	closed-throated beartongue	None	None	FSS	1B.1	Metavolcanic soils in chaparral and montane coniferous forests. Elevation: 3,490–6,955 ft. Blooming period: June–October (CNPS 2019).	N	Suitable soils absent from all project sites.
Phacelia stebbinsii	Stebbins' phacelia	None	None	FSS	1B.2	Cismontane woodland, lower montane coniferous forest, meadows and seeps. Elevation: 2,000–6,595 ft. Blooming period: May–July (CNPS 2019).	N	Project sites outside of known species range. Additionally, known occurrences are documented south of I-80 (CCH 2019).
Phaeocollybia olivacea	olive phaeocollybia	None	None	FSS	None	Known to be associate in mixed forests with Fagaceae or Pinaceae in coastal lowlands (Forest Service 2019).	N	Suitable habitat absent from all project sites.

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Pinus albicaulis	whitebark pine	FC	None	FSS	None	Subalpine forests. Elevation: 6,560–12,140 ft. Cone production: July–September (CCH 2019).	N	Project sites occur below species elevation range.
Poa sierrae	Sierra blue grass	None	None	FSS	1B.3	Openings in lower montane coniferous forest. Elevation: 1,195–4,920 ft. Blooming period: April–July (CNPS 2019).	Y	Suitable habitat present at all project sites.
Pohlia flexuosa	flexuose threadmoss	None	None	None	2B.1	Roadsides, rocky seeps, and lower montane coniferous forests. Elevation: 3,116 - 3,365 ft. Bloom period: unknown (CNPS 2019).	N	Suitable habitat absent from all project sites.
Pyrrocoma lucida	sticky pyrrocoma	None	None	FSS	1B.2	Alkaline clay soils in Great Basin scrub, lower montane coniferous forest, meadows, and seeps. Elevation: 2,295–6,400 ft. Blooming period: July–October (CNPS 2019).	N	Project sites outside of known population ranges. All recent occurrences are documented southeast of the project near Sierraville (CCH 2019).

Table 1. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	CRPR	Habitat Characteristics	Impacts Analyzed	Rationale
Rhynchospora capitellata	brownish beaked-rush	None	None	None	2B.2	Mesic soils in meadows, seeps, marshes, swamps, and montane coniferous forests. Elevation: 145–6,560 ft. Blooming period: July–August (CNPS 2019).	Y	Suitable habitat present at all project sites except Disposal Site 1.
Streptanthus tortuosus ssp. *truei*	True's mountain jewelflower	None	None	None	1B.1	Partially shaded on steep rocky slopes in lower montane coniferous forest. Elevation: 2,505–2,820 ft. Blooming period: June–July (September) (CNPS 2019).	Y	Suitable habitat present at all project sites.
Tauschia howellii	Howell's tauschia	None	None	FSS	1B.3	Granitic and gravelly soils in upper montane and subalpine coniferous forests. Elevation: 5,590–8,200 ft. Blooming period: June–August (CNPS 2019).	N	Project sites occur below species elevation range.

Key	
Federal and State Status	
(FC) Federal Candidate	(SCE) State Candidate Endangered
(FE) Federally Endangered	(SCT) State Candidate Threatened
(FT) Federally Threatened	(SE) State Endangered
(FD) Federally Delisted	(SR) State Rare
	(SSC) State Species of Special Concern
	(ST) State Threatened
	(FP) Fully Protected

Table 1. (continued)

Key(cont'd)
California Rare Plant Rank (CRPR)
Rareness Ranks
(1A) Presumed extinct in California
(1B) Rare, Threatened, or Endangered in California and elsewhere
(2) Rare, Threatened, or Endangered in California, but more common elsewhere
(3) More species information needed
(4) Limited distribution
Threat Ranks
(0.1) Seriously threatened in California
(0.2) Fairly threatened in California
(0.3) Not very threatened in California

Table 2. Special-status Wildlife with the Potential to Occur at the Project Sites

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Invertebrates							
Anodonta californiensis	California floater (freshwater mussel)	None	None	FSS	Species known to occur in low elevation slow moving rivers and lakes with muddy or sandy substrates (Jepson 2009).	N	Suitable habitat absent from all project sites.
Bombus occidentalis	western bumblebee	None	None	FSS	Historically widespread throughout the western United States and western Canada; however, populations of the western bumblebee in central California, Oregon, Washington and southern British Columbia have mostly disappeared. In Alaska and east of the Cascades in the Canadian and U.S. Rocky Mountains, viable populations still exist. This species does not prefer a specific flowering plant and is a generalist pollinator (Xerces 2017).	N	Suitable habitat absent from all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Invertebrates (cont'd)							
Helisoma newberryi newberryi	Great Basin rams-horn (snail)	None	None	FSS	Species known in on the northern edges of the Great Basin, mainly in Oregon and Washington. In California, the species is known to occur in Screwdriver Creek in Shasta County and Eagle Lake in Lassen County in California. Associated with cold, larger lakes and slow moving rivers including spring fed sources. Individuals characteristically burrow in soft mud (Forest Service 2010).	N	Project sites are outside of known species range.
Juga nigrina	Black juga (snail)	None	None	FSS	Known in wetland habitats, seeps, springs, and slow moving perennial waters (Taylor 1981).	Y	Suitable habitat present at all project sites except Disposal Site 1 and Our House Diversion Dam.
Fishes							
Siphateles bicolor pectinifer	Lahontan Lake tui chub	None	None	FSS	Large, deep lakes for schooling and algal beds in shallow, inshore areas for successful spawning, embryo hatching, and larval survival (Moyle 2002). Found in Lake Tahoe and Pyramid Lake, Nevada, and in nearby Walker Lake, Nevada (Moyle et al. 1989, 1995).	N	Suitable habitat absent from all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Fishes (cont'd)							
Hypomesus transpacificus	delta smelt	FT	SE	None	Endemic to open waters of San Francisco Bay and Sacramento-San Joaquin River Delta. Distribution includes San Pablo Bay up through Suisun Bay, upstream through the delta to the Sacramento River below Isleton, and the San Joaquin River below Mossdale. Spawning has not been observed in the wild, but is thought to take place in sloughs and shallow edge-water channels in the upper Delta and in Montezuma Slough near Suisun Bay. (USFWS 2010).	N	Suitable habitat absent from all project sites.
Mylopharodon conocephalus	hardhead	None	SSC	FSS	The species is associated with low to mid-elevation ranges with an optimum temperate of around 20 °C, but have been found in cooler waters. They prefer pools and runs with deep, slow moving, clear water with gravel, sand, or boulder substrates. Species is often closely associated with Sacramento pikeminnow (*Ptychocheilus grandis*) and Sacramento sucker (*Catostomus occidentalis*) (CDFW 2019a).	Y	Suitable habitat present at all project sites except Disposal Site 1 and Disposal Site 3. Oregon Creek and the Middle Yuba River may provide suitable habitat. None have been seen at either Log Cabin Diversion Dam or Our House Diversion Dam impoundment during aquatic species rescues.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Amphibians							
Ambystoma macrodactylum sigillatum	southern long-toed salamander	None	SSC	None	Species known to inhabit high mountain lakes, ponds, and meadows. Females utilize shallow water with debris for attachment of egg masses. In California, the southern sub-population is known in the Northeast and along the northern Sierra Nevada Mountains, south to Spicer Reservoir, and in the Trinity Alps (Nafis 2019).	N	Suitable habitat absent from all project sites.
Rana boylii	foothill yellow-legged frog	None	SCT, SSC	None	Ranges in the northern half of California except for the Central Valley, Modoc Plateau, and eastern side of the Sierra Nevada Mountains. Generally found in shallow flowing streams and rivers with at least cobble sized substrate. Breeding generally occurs at the margins of wide shallow channels with reduced flow variation near tributary confluences (Thomson et al. 2016).	Y	Suitable habitat present at all project sites, except Disposal Site 1. Additionally, species documented in Oregon Creek above and below Log Cabin Diversion Dam, in Oregon Creek near Proposed Site 2, at Disposal Site 3, and along the edges of the Yuba River above and below Our House Diversion Dam.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Amphibians (cont'd)							
Rana draytonii	California red-legged frog	FT	SSC	None	Ponds/streams in humid forests, woodlands, grasslands, coastal scrub, and streamside with plant cover in lowlands or foothills. Breeding habitat includes permanent or ephemeral water sources; lakes, ponds, reservoirs, slow streams, marshes, bogs, and swamps. Ephemeral wetland habitats are required animal burrows or other moist refuges for estivation when the wetlands are dry. From sea level to 5,000 feet. Occurs along the Coast Ranges from Mendocino County south to northern Baja California, and inland across the northernmost reaches of the Sacramento Valley and locally south through portions of the Sierra Nevada foothills as far south as northern Tulare County (Nafis 2019).	Y	Suitable habitat present at Disposal Site 2, limited potential at Disposal Site 3. No suitable habitat all other sites.
Rana sierrae	Sierra Nevada yellow-legged frog	FE	ST	FSS	Inhabits lakes, ponds, meadow streams, isolated pools, and sunny riverbanks in the Sierra Nevada mountains. Open stream and lake edges with a gentle slope up to a depth of 2-3 in seem to be preferred. Waters that do not freeze to the bottom and which do not dry up are required. From 984-12,000 feet (Nafis 2019).	N	All documented occurrences of the species occur east of the project sites further into the Sierra Nevada Mountain Range (CDFW 2019a).

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Amphibians (cont'd)							
Taricha torosa	Coast Range newt	None	SSC	None	Coastal drainages from Mendocino County to San Diego County. Found in wet forests, oak forests, chaparral, and rolling grasslands. In southern California, drier chaparral, oak woodland, and grasslands are used (Nafis 2019)	N	The project sites are outside of the species known range.
Reptiles							
Emys marmorata	western pond turtle	None	SSC	None	The species is diurnal, active through February to November and can usually be found basking on protrusions in the water. Individuals can be found in ponds, lakes, creeks, rivers, and irrigation ditches with heavy vegetation and muddy or rocky bottoms in habitats ranging from woodlands to grasslands. Exposed material such as logs, cattails (*Typha* spp.), and rocks can be used for basking (Nafis 2019).	Y	Suitable habitat present at all project sites. Species documented in Oregon Creek above Log Cabin Diversion Dam and the Middle Yuba above Our House Diversion Dam.
Phrynosoma blainvillii	coast horned lizard	None	SSC	None	The species is known to occur in valley-foothill hardwood, riparian, and conifer habitats, and occasionally grasslands. They range from the Sierra Nevada foothills and throughout the central California coast. Individuals utilize loose soils for burrowing, forage in open areas or between shrubs, and do not require permanent water (CDFW 2019a).	Y	Suitable habitat present at all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Birds							
Accipiter gentilis	northern goshawk	None	SSC	FSS	Mature and old-growth forests including Pacific Ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), mixed conifer, Douglas-fir (*Pseudotsuga menziesii*), mixed Redwood-Doulas-fir hardwood, and quaking aspen (*Populus tremuloides*). Occurs in North Coast Ranges through Sierra Nevada, Klamath, Cascade, and Warner Mountains, in Mount Pinos and San Jacinto, San Bernardino, and White Mountains. (Shuford and Gardali 2008).	Y	Suitable habitat present at all project sites.
Aquila chrysaetos	golden eagle	None	FP	FSS	Rolling foothills, mountain areas, sage-juniper flats, and desert. Ranges from sea level to roughly 12,575 feet. Species requires open terrain for foraging (deserts, grasslands, early stages of forests). Known to nest on cliffs and in large trees of varying heights (CDFW 2019a)	Y	Suitable habitat present at all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Birds (cont'd)							
Contopus cooperi	olive-sided flycatcher	None	SSC	None	Breeds in open woodlands on the edges of montane and coniferous forests such as meadows and ponds. Winters in snags and tall trees at forest edges (Shuford and Gardali 2008).	Y	Suitable habitat present at all project sites.
Empidonax traillii	willow flycatcher	None	None	FSS	Summer resident in wet meadows and montane riparian habitats from 2,000 - 8,000 feet elevation in the Sierra Nevada and Cascade Ranges. Most often found in open river valleys or large mountain meadows with lush shrubby willows (CDFW 2019a). A large majority of the remaining breeding populations occur in isolated mountain meadows of the Sierra Nevada and Cascades (Craig and Williams 1998).	N	Suitable habitat absent from all project sites. Known breeding populations are limited to mountain meadows.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Birds (cont'd)							
Falco peregrinus anatum	American peregrine falcon	None	FP	None	Active nesting sites are known in the Sierra Nevada Mountains. During winter months, individuals can be seen throughout the Central Valley. Species known to breed in forests, woodlands, and coastal habitats. Inland wetlands and riparian areas are key habitats yearlong. Species requires adequate cliffs and ledges for cover and nesting. Known to nest near lakes, rivers, wetlands, or other water bodies (CDFW 2019a).	Y	Suitable habitat present at Disposal Site 1 and Our House Diversion Dam. Recorded possible nest on the east side of New Bullards Bar Dam near Disposal Site 1.
Grus canadensis tabida	greater sandhill crane	None	None	FSS	Breeds in and near wet meadow, shallow lacustrine, and fresh emergent wetland habitats. Winters in annual and perennial grassland habitats, moist croplands with rice or corn stubble, and open, emergent wetlands. Prefers treeless plains. Nests in remote portions of extensive wetlands or sometimes shortgrass prairies. In California, breeds only in Siskiyou, Modoc, and Lassen Counties, and in Sierra Valley in Plumas and Sierra Counties. Winters primarily in the Sacramento and San Joaquin Valleys from Tehama County south to Kings County (CDFW 2019a).	N	Suitable habitat absent from all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Birds (cont'd)							
Haliaeetus leucocephalus	bald eagle	None	SE, FP	None	Nests in large, old-growth, or dominant live tree with open branchwork, especially ponderosa pine. Requires large bodies of water or rivers with abundant fish, and adjacent snags. Permanent resident, and uncommon winter migrant, now restricted to breeding mostly in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties. About half of the wintering population is in the Klamath Basin (CDFW 2017).	Y	Suitable habitat present at all project sites.
Laterallus jamaicensis coturniculus	California black rail	None	CT, FP	None	Yearlong resident of saline, brackish, and fresh emergent wetlands (CDFW 2019a).	N	Outside of species range. All known occurrences are in lower elevation foothills (CDFW 2019b).
Progne subis	purple martin	None	SSC	None	Inhabits woodlands, low elevation coniferous forest of Douglas-fir, ponderosa pine, and Monterey pine (*Pinus radiata*) (Shuford and Gardali 2008).	Y	Suitable habitat present at all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Birds (cont'd)							
Strix nebulosa	great gray owl	None	SE	FSS	Breeds in red fir (*Abies magnifica*), mixed conifer, or lodgepole pine habitats, always near wet meadows. Nests in large, broken-topped snags usually 26-75 feet above the ground. A rarely seen resident at 4,593 to 7,545 feet in the Sierra Nevada from the vicinity of Quincy, Plumas counties south to the Yosemite region. (CDFW 2019a).	Y	Suitable habitat present at all project sites.
Strix occidentalis occidentalis	California spotted owl	None	SSC	FSS	The species is known to breed and roost in forests and woodlands with large old trees and snags, high basal areas of trees and snags, dense canopy layers, and downed woody debris. Large, old trees are the key component; they provide nest sites and cover from inclement weather and add structure to the forest canopy and wood debris to the forest floor (Shuford and Gardali 2008).	Y	Suitable habitat present at all project sites.
Mammals							
Antrozous pallidus	pallid bat	None	SSC	FSS	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Day roosts are in caves, crevices, mines, and occasionally in hollow trees and buildings. Roost must protect bats from high temperatures. (CDFW 2019a)	Y	Suitable habitat present at all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Mammals (cont'd)							
Aplodontia rufa californica	Sierra Nevada mountain beaver	None	SSC	None	In the Sierra Nevada, habitat includes wet/boggy areas near springs in canyons and on mountainsides, shrubby/mossy ravines, and seasonally wet thickets shaded by oaks and firs (CDFW 2019a)	Y	Suitable habitat present at both Log Cabin and Our House Diversion Dam.
Bassariscus astutus	ring-tailed cat	None	FP	None	The species is known to occur near riparian habitats and stands of shrubs within forested areas at low to mid-elevations. Individuals are known to forage among rocky outcrops and within stands of trees near water sources (CDFW 2019a).	Y	Suitable habitat present at all project sites.
Corynorhinus townsendii	Townsend's big-eared bat	None	SSC	FSS	Throughout California in a wide variety of habitats. Most common in mesic sites. Population concentrations occur in areas with substantial surface exposures of cavity forming rocks (e.g. limestone, sandstone, gypsum, and volcanic) and in old mining districts (CDFW 2019a).	Y	Suitable habitat present at all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Mammals (cont'd)							
Gulo gulo luscus	North American wolverine	None	None	FSS	Species is a scarce resident of North Coast mountains and Sierra Nevada. In the northern Sierra Nevada, individuals are known in mixed conifer, red fir, and lodgepole habitats, subalpine conifer, wet meadow, and montane riparian habitats. Preferred elevation range in northern Sierra Nevada 4,300-7,300 feet. Species known to prefer areas with minimal human disturbance and utilizes cliffs, caves, large rocks, or pre-existing dens and lodges. Individuals are known to hunt in more open areas and use dense canopy for reproduction (CDFW 2019a).	N	Suitable habitat is absent from all project sites.
Lasiurus blossevillii	western red bat	None	SSC	None	Roosts primarily in trees, 3-40 feet above ground, from sea level up through mixed conifer forests (CDFW 2019a).	Y	Suitable habitat present at all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Mammals (cont’d)							
Martes caurina	Pacific marten	None	None	FSS	Species is uncommon in the North Coast regions and Sierra Nevada. Preferred habitat includes mixed evergreen forests with large trees and snags within mixed conifer, Jeffrey pine, and lodgepole pine habitats. Species prefers areas with minimal human influence and disturbance (CDFW 2019a)	N	Suitable habitat is absent from all project sites.
Myotis thysanodes	fringed myotis	None	None	FSS	Widespread in California, occurring in all but the Central Valley and Colorado and Mojave deserts. It occurs in a wide variety of habitats; records range in elevation from sea level to 9,350 feet in New Mexico (Barbour and Davis 1969). Optimal habitats are pinyon-juniper, valley foothill hardwood and hardwood-conifer, generally at 4,000-7,000 feet. (CDFW 2019a).	Y	Suitable habitat present at all project sites.

Table 2. (continued)

Scientific Name	Common Name	Federal Status	State Status	Forest Service Status	Habitat Characteristics	Impacts Analyzed	Rationale
Mammals (cont'd)							
Pekania pennanti	fisher	FCT	ST, SSC	None	Large areas of mature, dense forest stands with snags and greater than 50% canopy closure. Uncommon permanent resident of the Sierra Nevada, Cascades, and Klamath Mountains; also found in a few areas in the North Coast Ranges (USFWS 2014). There are three distinct populations of fishers in California: Sierra, Cascade, and coastal. The Sierra population appears is restricted to the western side of the Sierra Nevada Mountains just south of Yosemite National Park (Allen et. al. 2015).	N	Project area is outside of known species range.
Vulpes vulpes necator	Sierra Nevada red fox	FC	ST	None	Found in a variety of habitats including meadows, subalpine conifer, lodgepole pine, red fir, aspen, montane chaparral, montane riparian, mixed conifer, montane hardwood-conifer, and ponderosa pine. Most sightings above 7,000 feet, ranging from 3,900-11,900 feet. Species typically dens in rocky outcrops, hollow logs and stumps, and burrows in friable soil (USFWS 2015).	N	Suitable habitat is absent from all project sites.

Key

Federal and State Status	
(FC) Federal Candidate	(SCE) State Candidate Endangered
(FE) Federally Endangered	(SCT) State Candidate Threatened
(FT) Federally Threatened	(SE) State Endangered

Table 2. (continued)

Key(cont'd)	
Federal and State Status	
(FD) Federally Delisted	(SR) State Rare
	(SSC) State Species of Special Concern
	(ST) State Threatened
	(FP) Fully Protected
(FSS) Forest Service Sensitive	

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Attachment E

Aquatic Vertebrate Relocation and Exclusion Plan

AQUATIC VERTEBRATE RELOCATION AND EXCLUSION PLAN

Introduction

In 2014, at the direction of the Federal Energy Regulatory Commission (FERC), the Yuba County Water Agency (YCWA) wrote and filed, with FERC, a Sediment Management Plan for Log Cabin and Our House Diversion Dams (the Plan). These facilities are part of YCWA's Yuba River Development Project (FERC Project # 2246). Amongst the provisions of the Plan is a 5-10 year permit package to mimic natural sediment flushing for downstream habitat improvement and for the mechanical removal of up to 100,000 cubic yards (yd^3) of sediment from the two impoundments in order to keep the inlets for the low level outlet valves free of blockage. Sediment removal will occur in late summer/early fall when inflow into the impoundments is low. Immediately prior to the start of work, YCWA will draw down the pool in the impoundments as low as possible and divert inflows around the excavation area so that sediment can be excavated in the dry. The water will be drained in a way to avoid unseasonal increases to instream flow downstream of the dams, such as allowing it to drain naturally through the valve or pumping it into the diversion tunnels. YCWA does not propose to perform mechanical excavation work below the waterline.

Prior to and during all diversion and dewatering of the stream channel a qualified aquatic biologist will capture and relocate all fish, frogs, turtles and other aquatic vertebrate species to safe and suitable habitat using methods approved by the California Department of Fish and Wildlife (CDFW). Additionally, the biologist shall monitor dewatered areas for stranded aquatic species and relocate them as well. Handling of aquatic species will be minimized to the greatest extent feasible.

The qualified biologist will be onsite during all project activities that involve excavation, grading, vegetation removal, or other ground disturbing activities to ensure impacts to fish and wildlife resources are minimized. The biologist shall be familiar with fish, plant, wildlife, and habitats found within and adjacent to the work site.

This plan describes the methods of relocation and exclusion to be used in conjunction with any mechanical sediment removal at Log Cabin or Our House diversion dams.

Species Likely to be Encountered

All aquatic vertebrates will be captured and relocated out of the sediment removal area. Of primary concern are all fish species, foothill yellow-legged frogs and western pond turtles. FYLF are a Bureau of Land Management (BLM) sensitive species, a United States Department of Agriculture's Forest Service (USFS) sensitive species, a CDFW species of special concern, an International Union for Conservation of Nature (IUCN) near threatened species and as of June 2017, a Candidate Species under CESA. WPT are a BLM sensitive species, a USFS sensitive species, a CDFW species of special concern, and an IUCN vulnerable species (BLM 2010, CDFW 2018, USFS 2013).

The list of fish species likely to be encountered during the sediment removal project is based on a recent stream fish population study completed by YCWA in 2012 and 2013 and the fish rescues performed in 2014 and 2017. A total of four species were observed in Oregon Creek (Table 1) and five in the Middle Yuba River (Table 2).

Table 1. Overview of fish species captured during electrofishing surveys on Oregon Creek in 2012 and 2013 and 2014 and 2017 fish rescue.

Species		Oregon Creek Upstream of Log Cabin Diversion Dam (RM 4.5)	Oregon Creek Upstream of Middle Yuba River (RM 0.3)
Common Name	Scientific Name		
Rainbow trout	*Oncorhynchus mykiss*	•	•
Sacramento pikeminnow	*Ptychocheilus grandis*	•	–
Sacramento sucker	*Catostomus occidentalis*	•	•
Smallmouth bass	*Micropterus dolomieu*	--	•

• = species was captured.

Table 2. Overview of fish composition collected or observed during electrofishing and snorkeling in the Middle Yuba River Sub-basin in 2012 and 2013 and fish rewcue in 2017.

Species		Middle Yuba River Upstream of Our House Diversion Dam (RM 13.3)	Middle Yuba River Downstream of Our House Diversion Dam (RM 12.5)	Middle Yuba River Upstream of Oregon Creek (RM 5.0)
Common Name	Scientific Name			
Rainbow trout	*Oncorhynchus mykiss*	•	•	•
Brown trout	*Salmo trutta*	•[1]	--	--
Sacramento pikeminnow	*Ptychocheilus grandis*	•	--	--
Sacramento sucker	*Catostomus occidentalis*	•	•	•
Smallmouth bass	*Micropterus dolomieu*	--	•	•

[1] Incidental collection during entrainment sampling.
• = species was captured or observed.

In 2011 and 2012 YCWA performed VES for foothill yellow-legged frogs at sites on stream reaches that may potentially be affected by Yuba River Development Project flows. Results from the VES as well as historical records reveal that foothill yellow-legged frogs are present at both Log Cabin and Our House Diversion Dam impoundments (YCWA 2012a). Results from the aquatic species recue in 2014 and 2017 reveal that FYLF are present at both Log Cabin and Our House Diversion Dam impoundments.

Similarly, in 2012, YCWA mapped potentially suitable habitat for western pond turtles, assembled information associated with incidental observations of western pond turtles reported during various YCWA relicensing studies, and performed surveys for basking western pond turtles at nine sites inside the Yuba River Development Project's FERC Project Boundary (YCWA 2012b). Survey results at Log Cabin Diversion Dam impoundment indicated the presence of one adult western pond turtle repeatedly observed in 2012. Two adult western pond turtles were also trapped ~0.4 river miles upstream of the impoundment during efforts conducted under a YCWA entrainment study (YCWA 2012c). Combined with historical sightings by USFS employees (USFS 2011), and an incidental observation of a juvenile western pond turtle in a puddle near the impoundment, this information suggests that small numbers of western pond turtles may occur with regularity in the vicinity of the impoundment. There are no historical records of western pond turtles at Our House Diversion Dam impoundment and no western pond turtles were detected during YCWA's 2012 surveys. Two adult WPT were relocated from Log Cabin during aquatic species rescue in 2017.

METHODS

Fish Relocation and Exclusion

The relocation and exclusion of fish in Oregon Creek and the Middle Yuba River will occur at Log Cabin Diversion Dam and Our House Diversion Dam respectively. In general the following steps will be followed: (1) identify project extent, (2) install block nets, (3) complete fish relocation, (4) monitor and maintain block nets and (5) remove block nets upon Project completion. Each of the steps is discussed in additional detail below.

Identify Project Extent

Prior to the start of sediment removal, YCWA will identify the upstream extent of Project impacts, including the location of any equipment used to divert the flow of Oregon Creek or the Middle Yuba River. The upstream extent of the Project will extend approximately another 25 yards upstream or at a location where block nets will be most effective at excluding fish from entering the Project area.

The downstream extent of the Project will be the area where flows are being reintroduced into the channel or the diversion dam, whichever is further downstream.

Install Block Nets

Block nets will span the full width and depth of Oregon Creek or the Middle Yuba River and be installed in such a way to limit debris loading and possible failure. The location of block nets will be identified prior to the start of sediment removal. GPS coordinates and photographs will document the location and setup of each block net.

Complete Fish Relocation

Fish relocation in the riverine portions of Oregon Creek and the Middle Yuba River from the upper Project extent to the diversion pool will occur using standard backpack electrofishing methods. Prior to electrofishing at a site that has been previously selected; biologists will walk the stream-bank to directly observe the presence of any western pond turtles (WPT) or foothill yellow-legged frog (FYLF). Due to the narrow channel and low flows expected during the sediment removal it is anticipated that a single backpack electrofishing crew will be sufficient to complete this work. The team will begin at the downstream extent of the Project and electrofish to the upstream extent of the Project. Captured fish will be held in an aerated bucket or holding pen until the pass is complete. Following each pass, captured fish will be released in suitable habitat at a safe distance, upstream of the Project. This process should be repeated until no fish are captured or observed for 2 electrofishing passes.

If pooling areas persist, fish relocation will occur using multiple methods. Prior to fish relocation, the diversion pool will be dewatered until the entire pool can safely be waded. As the diversion pool water surface elevation decreases, biologists will monitor for any fish being stranded and immediately relocate these fish upstream in an aerated bucket. Once the diversion pool reaches a level suitable for backpack electrofishing, Biologists will make multiple passes through the pool to ensure all fish have been captured and removed. Dip netting and seining will be used if turbidity or depth reduces the effectiveness of backpack electrofishing. All fish will be held in aerated buckets and released upstream of the Project as soon as possible.

Fish will be relocated to an area that encourages recolonization once the sediment removal is complete. In the case of Log Cabin and Our House Diversion dams, these locations are upstream of the Project site.

Table 3. Approximate location of fish relocation areas.

Project Location	Coordinates for Approximate Start to Relocation	
	Latitude	Longitude
Our House Diversion Sediment Removal	39.414121	-120.993228
Log Cabin Diversion Sediment Removal	39.441604	-121.056549

Working in an upstream direction, fish will be dispersed into pool habitats beginning at the first pool encountered at a minimum of 0.2 mile from project activities. No more than five fish greater than 10 inches, will be released in each pool to avoid crowding related stress and resource competition. Fish less than 10 inches in length will be relocated to pool habitats upstream of the project extent in densities determined to be appropriate by on-site biologists.

Monitor and Maintain Block Nets

Once the block nets have been installed, biologists will inspect the net at a minimum of three times daily in order to ensure it is functioning properly. In particular, biologists will remove sticks and other debris as well as ensuring the net spans the full width and depth of the stream. Additional weights or support will be added as needed.

Remove Block Nets

Upon completion of the sediment removal, YCWA will remove the block nets only after flow has been returned to the dewatered channel and the diversion pool has sufficient water. Any natural products used in the construction of the block nets (i.e. rocks and sticks) will be returned to the area.

FYLF and WPT Relocation and Exclusion

Qualified biologists will survey the area prior to the removal of sediment. In addition, biologists will survey the area each morning prior to the start of work activities and again at the end of the work day for the duration of the Project.

All fish, frogs, turtles, and other aquatic vertebrates will be captured and relocated to suitable habitat outside of the sediment removal area. Techniques for locating frogs, turtles, and other aquatic vertebrates will be adopted from the VES standard protocols developed by Pacific Gas & Electric Company (PG&E) for hydroelectric project applications (PG&E and NID 2009), which were modified from Seltenrich and Pool (2002). Specifically, a surveyor walks slowly and searches for aquatic species continuously along stream margins, back channel areas, and potential instream habitats, scanning the immediate area and ahead. In water too deep to be surveyed by wading or where swift flow, substrate configuration, or other factors render viewing from above the water's surface ineffective, snorkeling will be employed to search safely accessible habitats.

When aquatic species such as frogs and turtles are located, disinfected fine mesh dip nets will be used to capture the animal. When necessary, sterile gloves will be used for hand capture techniques and other handling. Sterile gloves should prevent the spread of diseases such as chytrid fungus (*Batrachochytrium dendrobatidis*). Upon capture, organisms will be placed in disinfected five-gallon buckets and relocated out of the work area to their predetermined locations (Table 3).

FYLF will only be relocated once the Incidental Take Permit has been issued for the project. For the Log Cabin and Our House Sediment Removal, all captured FYLF will be dispersed at least 0.2 mile upstream from the project extent, into suitable habitats or at areas agreed to onsite with the CDFW. Under supervision of qualified biologists, areas with ample suitable habitat will be used to minimize the potential that relocations will attract predators or exceed the carrying capacity of any one location. Additional relocation sites will be located if possible, to help avoid exceeding the carrying capacity of relocation sites. All captured adult and post metamorph FYLF will be released within one foot of the waters' edge. Release sites will be located in riffle and run habitats to avoid predation by released fish in pool habitats. Any captured tadpole FYLF will be released in appropriate calm, edgewater habitats. No tadpoles are anticipated to be captured at this time of year.

For the Log Cabin Sediment Removal all captured FYLF will be released in Grizzly Creek. Grizzly Creek is a small perennial tributary to Oregon Creek with the confluence being located approximately 50 meters upstream of the upper extent of the work area. Due to the smaller size of Grizzly Creek only one adult or post metamorph will be released per habitat unit. FYLF will be dispersed starting at least 50 meters upstream of the confluence with Oregon Creek (total of approximately 100 meters from project activities). All adult and post metamorph FYLF will be released on shore within one foot of the waters edge. Tadpole FYLF (if found) will be released in calm pools with available cover.

When WPT are located, disinfected fine mesh dip nets will be used to capture the animal. When necessary, sterile gloves will be used for hand capture techniques and other handling. Sterile gloves should prevent the spread of diseases. Upon capture, organisms will be placed in disinfected five-gallon buckets and released at the water's edge into the nearest suitable pool habitat with instream cover and appropriate basking habitat. This pool will be located at least 0.2-mi from all project activities.

Reporting and Monitoring

YCWA will adhere to all monitoring and reporting required as part of the permitted Project. Specifically, biologists will record the number of each species of fish, amphibian and turtle removed during the initial relocation event and during each day of sediment removal. Any individuals found to be injured or deceased will also be documented. A final report will be provided to CDFW within 30 days of the end of sediment removal.

QUALIFICATIONS

YCWA's consultant for this work, HDR, has many years of experience with the methodologies described above and in the specific watersheds. The aquatics team has performed studies at both Log Cabin and Our House diversion dams in support of the relicensing of the YRDP (FERC No, 2246) as well as additional experience in the Yuba Watershed working on the Yuba-Bear and Drum-Spaulding relicensings. The proposed staff is well qualified and currently holds or has held in the past a CDFW scientific collecting permit.

Kelly Bartron – Primary Designated Biologist
Kelly Barton has 7 years of experience working in the field of terrestrial biology and other related resource management programs. Kelly holds a Bachelor's of Science degree in Environmental Biology from Humboldt State University and a Masters Degree in Rangeland Ecology from Colorado State University. Ms. Bartron has worked on an assortment of local, state, federal, and private projects throughout the United States including CO, MT, NV, ID, CA, and UT. Although her experience is broad, she specializes in conducting and leading biological surveys and assessments across the western United States in the high mountain desert and rangeland in relation to the greater sage-grouse. She joined the terrestrial team at HDR four years ago and has participated in numerous biological monitoring and survey efforts including, but not limited to, fuels treatment, large woody debris removal, raptor activity, special-status plants, sediment removal, and hazard tree removal pre-construction surveys. In addition, she has aided the aquatics team on several studies, including BMI, water profiles, bullfrog surveys, redd surveys and eDNA sampling. Kelly is proficient with the identification and handling of western North American herptiles, birds, mammals and plants. She is also covered under the HDR Scientific Collecting Permit (SCP).

Brian Poxon- Lead of Aquatic Species Rescue
Brian Poxon has 14 years of experience working with freshwater fish assemblages in California and Oregon. After he received a Bachelor's of Science in Fisheries Biology from Humboldt State University in 2005, he went on to pursue graduate education at Humboldt State University and received his Master's of Science in Natural Resources with an emphasis in Fisheries Biology in 2012. Brian has worked extensively with all life stages of ESA-listed populations of Chinook and coho salmon and steelhead trout in California (North Coast and Central Valley) and Oregon (Mid-Columbia River region). He held positions with USGS (California Cooperative Fish and Wildlife Research Unit, Humboldt State University), Oregon Department of Fish and Wildlife, and Pacific States Marine Fisheries Commission before joining HDR, Inc. in 2018 as a Fisheries Biologist Lead. Brian has participated in California Department of Fish and Wildlife-lead fish

rescue and salvage operations in the Sacramento River bypass systems, has years of experience conducting electrofishing surveys for sensitive and listed fish species, and is proficient with identification of all fish species present in Central Valley main-stem and tributary river ecosystems. He works under the HDR SCP.

Chuck Vertucci

Charles Vertucci has 10 years of experience working as an aquatic biologist and holds a Master's Degree in Environmental and Forest Biology. In that time, he has served on the field crew of multiple stream fish studies and FYLF visual encounter surveys. He is proficient in boat and backpack electrofishing, spending hundreds of hours in the field as well as completing both the Smith-Root and NWETC electrofishing courses. He is comfortable identifying freshwater fishes, amphibians and turtles likely to be encountered. In addition, most of his experience has come in the Yuba River watershed including site specific work at both Log Cabin and Our House diversion dams. He held a California Scientific Collecting Permit from 2008 to 2012 in support of these studies and now works under the HDR SCP.

Nickolas Hood

Nickolas Hood has over 5 years of experience in fisheries and aquatic biology. With a Bachelors of Science in Aquatic Biology from the University of California Santa Barbara, he has applied his knowledge and field experience to projects involving aquatic resource management, conservation, and research. Nick previously worked for the California Department of Fish and Wildlife working on various projects and conducting a variety of different survey methods, including backpack and boat electrofishing on a regular basis. Before joining HDR, Nick worked for Pacific States Marine Fisheries Commission capturing, handling, and tagging Central Valley Steelhead on the Sacramento River and is well versed in safe handling practices of listed species. In addition, he has performed high profile fish rescues of North American green sturgeon and spring and winter run Chinook salmon. Nick is proficient with the identification and handling or western North American fish, herptiles, birds, mammals and plants.

Benjamin Onanian

Benjamin Onanian has 5 years of experience in fisheries and aquatic biology. Ben holds a Bachelors of Science degree in Marine Biology from the University of California Santa Cruz. Upon graduation, Ben worked for the California Department of Fish and Wildlife utilizing his knowledge and experience on various projects and management issues while conducting a variety of different fisheries surveys, including backpack and boat electrofishing, gill netting, seining and snorkeling on a regular basis. Prior to joining HDR, Ben worked for Pacific States Marine Fisheries Commission capturing, handling, and tagging Central Valley Steelhead on the Sacramento River and is well versed in safe handling practices and protocols for listed anadromous species. As a CDFW employee, he has performed high profile fish rescues of North American green sturgeon, spring and winter run Chinook salmon and various trout species. As an HDR employee, Ben has continued to apply his fisheries knowledge and experience in addition to participating in frequent water quality studies. Ben is proficient with the identification and handling or western North American fish, herptiles, birds, mammals and plants.

Sheila Pitts

Sheila Pitts has over 15 years of experience in the environmental consulting field, primarily working on protocol-level and general biological surveys, report writing, and the preparation of documents in support of hydropower relicensing and permitting. Sheila currently is a field lead for raptor, non-native plant and aquatic invasive species studies and regularly assists with botanical and aquatic surveys. She has been an environmental monitor, conducted worker environmental training seminars, developed construction mitigation measures, and participated in numerous environmental monitoring efforts including large woody material removal, general construction monitoring, utility pipeline installation, as well as large- and small-scale fiber optic installations throughout the San Francisco Bay Area.

Scott Tidball
Scott Tidball has 6 years of experience working in the biological field. Scott holds a Bachelor's of Arts degree in Environmental Resources from Sacramento State University. Scott has previously worked for the California State Parks and Placer County Water Agency as a botanist and GIS technician. Since joining HDR 5 years ago, Scott has conducted surveys throughout California, including wetland delineations, general habitat delineations, invasive species identification, treatment, and monitoring, special-status plant surveys and monitoring, special-status invertebrate, amphibian, reptile, avian, and mammal surveys, in addition to construction monitoring.

If any changes are made to the list of qualified biologists, YCWA will provide updated qualifications to CDFW prior to changing staff in the field.

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Log Cabin and Our House Sediment Management Plan
Yuba River Development Project
FERC Project No. 2246

Aquatic Vertebrate Rescue

Attachment A
Aquatic Vertebrate Rescue Datasheet

Log Cabin and Our House Sediment Management:
Aquatic Vertebrate Rescue Data

GENERAL INFORMATION

Site Name: ________________________________ **Date:** __________ **Time:** ______________

Crew Members: ____

Site Description: ____

____

HERPTILE RESCUE INFORMATION

Date: __________ **Start Time:** ____________ **End Time:** ___________ **# Surveyors:** ____________

Species:	# Observed:	# Captured and Relocated:	# Mortalities:
FYLF			
WPT			
OTHER:			

Release Location (WGS84; Decimal Degrees):
Latitude:______________________________ **Longitude:**______________________________

Pictures:
#(s) ________ **Description:** ____
#(s) ________ **Description:** ____
#(s) ________ **Description:** ____
#(s) ________ **Description:** ____
#(s) ________ **Description:** ____
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#(s) ________ **Description:** ____
#(s) ________ **Description:** ____
#(s) ________ **Description:** ____

Comments: ____

____

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____

FISH RESCUE INFORMATION

Block Nets (circle one):
None Both Upper Lower

Electro-fishing Settings: ______Hz/_____mS **Volts:** ______

 # Passes:___________________ **# Shockers:** ____________________ **# Netters:** ___________________

Shock Time (seconds):
Pass #1: ______ **Pass #2:** ______ **Pass #3:** ______ **Pass #4:** _____ **Pass #5:** _____ **Total:** _____

Species:	# Observed:	# Captured and Relocated:	# Mortalities:
RBT			
SPM			
SS			
SMB			
SCULPIN			
OTHER:			

Release Location (WGS84;Decimal Degrees):
Latitude:________________________________ **Longitude:**________________________________

Pictures:
#(s) ________ **Description:** ____
#(s) ________ **Description:** ____
#(s) ________ **Description:** ____
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Comments: ____
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Log Cabin and Our House Sediment Management Plan
Yuba River Development Project
FERC Project No. 2246

Aquatic Vertebrate Rescue

Attachment B
Reply to Comments

Table B-1. Reply to Comments.

Commentor Name	Page No.	Comment	Reply
Tanya Sheya	4	I understand that field conditions are not constant, but we will need a description/ more information about the relocation site. See Sean's comment below.	Working in an upstream direction (downstream for Log Cabin Apron Work), fish will be dispersed into pool habitats beginning at the first pool encountered at a minimum of 0.2 miles from project activities. No more than five fish will be released in each pool to avoid crowding related stress and resource competition.
Sean Hoobler	5	What distance and where specifically (i.e., along the riparian zone, bank, pool, riffle). We don't what to relocate frogs into the same place we are releasing fish due to predation risks.	For the Log Cabin Apron and Our House Sediment Removal all captured FYLF will be dispersed at least 0.2 miles from the project extent (upstream for Our House Sediment Removal and downstream for the Log Cabin Apron). No more than five individuals will be released at each habitat site to avoid crowding and competition. All captured adult and post metamorph FYLF will be released within one foot of the waters edge. Release sites will be located in riffle and run habitats to avoid predation by released fish in pool habitats. Any captured tadpole FYLF will be released in appropriate calm edgewater habitats. No tadpoles are anticipated to be captured at this time of year. For the Log Cabin Sediment Removal all captured FYLF will be released in Grizzly Creek. Grizzly Creek is a small perennial tributary to Oregon Creek with the confluence being located approximately 50 meters upstream of the upper extent of the work area. Due to the smaller size of Grizzly Creek only one adult or post metamorph will be released per habitat unit. FYLF will be dispersed starting at least 50 meters upstream of the confluence with Oregon Creek (total of approximately 100 meters from project activities). All adult and post metamorph FYLF will be released on shore within one foot of the waters edge. Tadpole FYLF (if found) will be released in calm pools with available cover. Any WPT captured will be released at the waters edge into the nearest suitable pool habitat with instream cover and appropriate basking habitat. This pool will be located at least 0.2 miles from all project activities.

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Attachment F

Cultural Resources Investigation

CULTURAL RESOURCES INVESTIGATION FOR THE

MODIFICATION TO THE LOG CABIN AND OUR HOUSE DIVERSION DAMS SEDIMENT MANAGEMENT PLAN

FOR THE
YUBA RIVER DEVELOPMENT PROJECT
(FERC PROJECT NO. 2246)
NEVADA, YUBA, AND SIERRA COUNTIES, CALIFORNIA

[redacted]

PREPARED FOR:
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December 2019

7.5' Topographic Quadrangles (California): Challenge 1995, Camptonville 1995, Pike 1975
Key Words: Tahoe National Forest, FERC, Section 106, Yuba River Development Project, Yuba County, Nevada County, Sierra County

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MANAGEMENT SUMMARY

The Yuba County Water Agency (YCWA) is the owner and operator of the Yuba River Development Project (YRDP), a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) as FERC Project No. 2246, the license for which expired on April 30, 2016. Currently, YCWA is operating the YRDP under an annual license issued by FERC until a new operating license can be issued. In late 2013, YCWA proposed to FERC to conduct dredging operations to alleviate sediment build-up at Log Cabin Diversion Dam, a YRDP facility. In a letter dated November 5, 2013, FERC directed YCWA to develop a plan for the permanent, long-term solution for sediment control at Log Cabin Diversion Dam, and to file the plan with FERC for approval. To be proactive and because sediment issues have been a problem in the past at Our House Diversion Dam in addition to Log Cabin Diversion Dam, YCWA drafted the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan) to address sedimentation management at both Log Cabin Diversion Dam and Our House Diversion Dam. The Plan was filed with FERC on May 5, 2014.

As the Plan required approval from FERC prior to implementation, it is defined as a federal undertaking and therefore required compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966 (Section 106), as amended, at Code of Federal Regulations (CFR) Title 36 Part 800. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties (i.e., cultural resources listed in or eligible for listing in the National Register of Historic Places [NRHP]) within the Area of Potential Effects (APE). As the Plan also required approvals by state agencies, it also required compliance with the California Environmental Quality Act (CEQA) of 1970, as amended. CEQA requires state agencies to identify the significant environmental impacts of their projects, including impacts to historical resources[1], unique archaeological sites[2], and tribal cultural resources[3] (TCRs). Accordingly, in 2014, HDR, Inc. (HDR) conducted a cultural resources investigation (Ramsey Ford 2014) on behalf of YCWA to identify any cultural resources within the APE pursuant to Section 106 and CEQA compliance. YCWA completed formal NRHP and CEQA evaluations of identified cultural resources affected or potentially affected by Plan implementation activities in consultation with appropriate tribes, federal agencies, and the State Historic Preservation Officer (SHPO). YCWA concluded that the implementation of the Plan would result in no adverse effect to historic properties pursuant to the regulations at 36 CFR Part 800.5(d)(1) for Section 106 compliance and

[1] Historical resources are defined as resources listed, or determined to be eligible by the State Historical Resources Commission for listing, in the California Register of Historical Resources (CRHR) (Public Resources Code [PRC] 5024.1, California Code of Regulations [CCR] Title 14, Section 4850 et seq.) or local registers of historical resources (PRC 5020.1[k]), or that are any object, building, structure, site, area, place, record, or manuscript determined by a lead agency to be historically significant or significant within any part of California history.

[2] "Unique archaeological resource" is a category of archaeological resources created by the CEQA statutes (CEQA Section 21083.2[g]). An archaeological resource is a unique archaeological resource if it meets any of one of three criteria: (1) contains information needed to answer important scientific research questions (and there is a demonstrable public interest in that information); (2) has a special and particular quality, such as being the oldest of its type or the best available example of its type; or (3) is directly associated with a scientifically recognized important prehistoric or historic event or person.

[3] As defined in PRC Section 21074, a TCR is a site feature, place, cultural landscape, sacred place or object, that is of cultural value to a tribe, and is either on or eligible for the CRHR or a local historic register, or the lead agency, at its discretion, chooses to treat the resource as a TCR.

would result in a less-than-significant impact to historical resources under the provisions of CEQA, and there was no objection by the SHPO (letter dated August 20, 2014, OHP Ref #FERC_2013_1002_001).

Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. Accordingly, YCWA is proposing several changes to the Plan, among which are the additions of two new sediment disposal sites and a re-vegetation site (see Section 1.0 for details on the Plan changes). These new sites are located outside of the previously defined APE and require an expansion of the APE and a cultural resources investigation of these areas to identify any historic properties, historical resources, unique archaeological resources, or TCRs that could be affected by the updated Plan implementation. Accordingly, YCWA contracted HDR to conduct a cultural resources investigation of the newly added areas to the Plan in partial fulfillment of Section 106 and CEQA requirements. The present report documents the efforts undertaken for this investigation and the results of this investigation.

The present investigation identified five cultural resources within the newly added areas of the APE: four historic archaeological sites (P-46-1993/CA-SIE-1993H, P-46-1994/CA-SIE-1994H, P-46-1995/CA-SIE-1995H, and P-58-3182/CA-YUB-1981H), and one historic resource with both archaeological and built environment components (P-58-3813/CA-YUB-1982H). All five of these cultural resources have been evaluated as ineligible for inclusion on the NRHP and the California Register of Historical Resources (CRHR), pending consultation with the SHPO. Additionally, none of these resources appear to be unique archaeological resources or TCRs.

As no historic properties, historical resources, unique archaeological resources, or TCRs have been identified within the newly added areas of the APE, implementation of the Plan will not adversely affect (Section 106) or significantly impact (CEQA) any of these resources types. Consequently, no further cultural resources management consideration prior to the implementation of the Plan is recommended.

However, there is always the possibility that unanticipated cultural resources will be encountered during ground-disturbing activities. In the event that buried cultural deposits (i.e., prehistoric stone tools, grinding stones, human remains or grave goods, historic glass, bottles, foundations, cellars, privy pits, etc.), are encountered during Plan implementation, work must stop immediately at the discovery site until a professional archaeologist can determine the nature of the resources discovered and FERC and the federal land managing agency, if the find is made on federally managed lands, can be notified and consulted regarding the discovery. As appropriate, the archaeologist will assist personnel in avoiding the newly discovered resources or in implementing management measures to evaluate the significance and potential eligibility of the resources for listing on the NRHP and the CRHR, as appropriate. Should previously unidentified cultural resources be discovered during the implementation of this undertaking, YCWA will follow the post-review discovery process as outlined in the regulations at 36 CFR Part 800.13 and consult with the tribes, federal agencies, and SHPO as required. It is recommended that prior to Plan implementation activities, personnel should be briefed on procedures to follow in the event that buried human remains or unanticipated cultural resources are encountered.

In accordance with Section 7050.5 of the California Health and Safety Code (CHSC), and Public Resources Code (PRC) 5097.98, the discovery of human remains, if encountered during Plan implementation, requires that all work within the vicinity of the find cease immediately and a 50-foot-wide buffer surrounding the discovery be established. YCWA or its representative shall immediately notify the county coroner, FERC and the federal land managing agency, if the find is made on federally managed lands. The county coroner will examine and evaluate the find. If the coroner determines that the remains are not recent and are of Native American descent, he/she will contact the Native American Heritage Commission in accordance with CHSC Section 7050.5, and PRC 5097.98, which will identify and contact the Most Likely Descendant (MLD). YCWA shall ensure that the discovery site and buffer zone are not further disturbed or damaged. For discoveries on private lands, YCWA will protect the discovery site and buffer zone until it has consulted with the land owner (if not on YCWA lands), FERC and the MLD and concluded treatment and management of the remains. For discoveries on federally managed lands, the federal land managing agency is responsible for compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) and will be the responsible party to consult with the appropriate tribe and MLD, and to determine when/if the discovery site and buffer may be disturbed following the discovery. All Plan implementation personnel will be instructed that any human remains encountered are to be treated with sensitivity and respect, and their discovery and location are to be kept confidential.

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List of Abbreviations

ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effects
B.P.	before present
BMP	best management practice
ca.	circa
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic foot/feet per second
CHSC	California Health and Safety Code
CNNDB	California Natural Diversity Database
CRHR	California Register of Historical Resources
CWHR	California Wildlife Habitat Relationships
DPR	(California) Department of Parks and Recreation
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
GLO	General Land Office
GPS	Global Positioning System
HDR	HDR Engineering, Inc.
IEC	International Engineering Company, Inc.
MLD	Most Likely Descendant
NAHC	Native American Heritage Commission
NCIC	North Central Information Center
NEIC	Northeast Information Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NID	Nevada Irrigation District
NRHP	National Register of Historic Places
OHP	Office of Historic Preservation
PG&E	Pacific Gas and Electric Company
Plan	*Log Cabin and Our House Diversion Dams Sediment Management Plan*
PRC	Public Resources Code
Section 106	Section 106 of the National Historic Preservation Act of 1966
SHPO	State Historic Preservation Officer
TCR	tribal cultural resource
TNF	Tahoe National Forest
USACE	United States Army Corps of Engineers
USDOI	United States Department of Interior
USGS	Unites States Geological Survey
YCWA	Yuba County Water Agency
YRDP	Yuba River Development Project

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1.0 INTRODUCTION

The Yuba County Water Agency (YCWA) is the owner and operator of the Yuba River Development Project (YRDP), a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) as FERC Project No. 2246, the license for which expired on April 30, 2016. Currently, YCWA is operating the YRDP under an annual license issued by FERC until a new operating license can be issued. In late 2013, YCWA proposed to FERC to conduct dredging operations to alleviate sediment build-up at Log Cabin Diversion Dam, a YRDP facility. In a letter dated November 5, 2013, FERC directed YCWA to develop a plan for the permanent, long-term solution for sediment control at Log Cabin Diversion Dam, and to file the plan with FERC for approval. To be proactive and because sediment issues have been a problem in the past at Our House Diversion Dam in addition to Log Cabin Diversion Dam, YCWA drafted the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan) to address sedimentation management at both Log Cabin Diversion Dam and Our House Diversion Dam. The Plan was filed with FERC on May 5, 2014.

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would result in a less-than-significant impact to historical resources under the provisions of CEQA, and there was no objection by the SHPO (letter dated August 20, 2014, OHP Ref #FERC_2013_1002_001).

Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. Accordingly, YCWA is proposing several changes to the Plan, among which are the additions of two new sediment disposal sites and a re-vegetation site (see Section 1.1 for details on the Plan changes). These new sites are located outside of the previously defined APE and require an expansion of the APE and a cultural resources investigation of these areas to identify any historic properties, historical resources, unique archaeological resources, or TCRs that could be affected by the updated Plan implementation. Accordingly, YCWA contracted HDR to conduct a cultural resources investigation of the newly added areas to the Plan in partial fulfillment of Section 106 and CEQA requirements. The present report documents the efforts undertaken for this investigation and the results of this investigation.

1.1 Updates to Plan Description

Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. These improvements include the following items. A draft updated Plan was filed with FERC on August 10, 2018. A copy of the materials filed with FERC, including the updated Plan is provided in Appendix A.

- **Difference in period, length, and flows for sediment passage at both Log Cabin and Our House dams:** change from November 1 through March 15 to October 1 through March 21; instead of being open for 96 hours, the valves will be left open for 9 days and closed over a period of 2 days; the Our House flow was changed from 600 cubic feet per second (cfs) to 1,500 cfs to trigger passage; valves may also now be opened more than once under the proper conditions. This change was made to improve the sediment passage through the dam. Widening the period would allow for higher chances of the correct triggers, and longer terms would increase the amount of sediment that goes through the valve.

- **Blockage of outage dredging:** If after October 1, YCWA determines that any one of the Our House Diversion Dam's or Log Cabin Diversion Dam's fish release valves or low level outlet valves has been partially or fully blocked by sediment, then YCWA may take remedial actions at that valve by the following April 1 or 10 (as described below), consistent with existing permits, to return that valve to proper functioning condition. All of this is new to the Plan, but within the existing footprint of the sediment removal work. No additional ground disturbance will result from this work. The equipment will be staged and used at the area right of the dam, which is where the dredge would be set up (similar to the pumps for the dewatering of the pool at the base of the dam). The air/water nozzles will also be positioned from the side of the dam. They do not dewater the area. The suction dredge would pump water over the dam directly as it pulls away material and water from the valves. All equipment would be brought down the existing roads by truck, no larger than the flatbeds that carry the pumps down for sediment removal work. This work could include, one or both of the following:

- Using air and/or water nozzles to blow sediment out of the valves.
- Employing a suction dredge to remove, at each dam, up to 250 cubic yards of accumulated sediment upstream of the valve. The sediment would be pumped around the dam and discharged directly to the river downstream of the dam. During these activities, YCWA would reduce flows over the spillway to ensure the safety of the divers working in the diversion pool and to maintain minimum flow requirements. Once sediment has been cleared from the outlet, YCWA would open the low level outlet to flush the outlet and distribute the deposited material farther downstream. The low level outlet would then be closed gradually over the course of 4 days, with the goal of avoiding any additional sediment buildup that could clog the outlets. YCWA may close the valve completely at any time during the 4 days if YCWA anticipates the outlet is at risk of being reclogged.

All activities related to the above described suction-dredging (dredging and opening of the low level outlet as described above) shall be completed by April 1, unless high flows preclude safe access, in which case suction dredging may continue until no later than April 10.

- **Increase of amount of sediment removed at one time from impoundments:** from 20,000 to 40,000 cubic yards at Log Cabin and from 40,000 to 100,000 cubic yards at Our House. This change was precipitated in part by the 2017 storms, which swept large amounts of sediment into both impoundments, but also by experience, which demonstrated that more sediment than previously expected can be removed from an impoundment during a single removal event.

- **Best management practices (BMPs)** have been more clearly formalized in the Plan, following the Forest Service handbook BMPs.

- **Disposal of sediment:** In the original version of the Plan, there was a footnote saying the Celestial Valley spoils pile sites were not planned for use at the time and would be permitted later, if they were to be used. That footnote has been removed, the Celestial Valley spoils piles will be used for disposal sites, and permitting does apply. In addition to the Celestial Valley spoils sites (designated Disposal Site 2) that will be used for sediment disposal, an area of 80 acres located at Grizzly Gulch in Sierra County (designated Disposal Site 3) is planned for an additional disposal location. See Figures 1.3-1 through 1.3-3 for the APE map including these spoils piles locations.

- **Off-site mitigation re-vegetation:** As part of the Plan implementation improvements, all riparian vegetation being removed during Plan implementation with a diameter at breast height over 4 inches must be restored at an off-site mitigation location. An area of roughly 1.0 acre located in Celestial Valley will be used for this effort. Some of this area will need to be cleared (currently much of the area is covered with blackberry bushes) to provide access for planting willows and cottonwood. See Figures 1.3-1 through 1.3-3 for the APE map including this location.

1.2 Regulatory Context

As stated above, Plan implementation must comply with CEQA, which requires that state and local agencies identify and consider the significant environmental impacts of their projects, including impacts to historical resources, unique archaeological sites, and TCRs. In accordance with CEQA guidelines, cultural resources investigations are necessary to identify historical resources, unique archaeological resources, and TCRs that may have significant impacts as a result of a project (14 CCR Part 15064.5[c]). The following steps are routinely implemented in a cultural resources investigation for CEQA compliance:

1. Identify cultural resources in the project area
2. Evaluate the importance of resources
3. Evaluate the effects of the project on *all* resources identified in a project area
4. Develop and implement measures to mitigate project effects on historical resources

Additionally, the lead state or local agency (in this case YCWA) for CEQA is responsible for consultation under PRC 21080.3.1 regarding the potential for a project to impact TCRs, which can be identified only through tribal consultation. Accordingly, consultation with local Native American tribes and other interested parties is part of all four of these steps. As described above, a TCR necessarily has value to a California Native American tribe. As such, consultation with local Native American tribes to determine what tribal cultural resources may have value to them is a necessary component of TCR identification efforts. This recognizes that “tribes may have expertise with regard to their tribal history and practices, which concern the tribal cultural resources with which they are traditionally and culturally affiliated” (California State Assembly Bill 52, Gatto 2014). Consultation efforts with California Native American tribes, pursuant to TCR identification efforts, are described below. A project may induce a significant impact to a historical resource, unique archaeological resource, or a TCR if it causes a substantial adverse change (i.e., physical demolition, destruction, relocation, or alteration) to the resource or immediate surroundings (14 CCR 15064.5[b]), thereby demolishing or significantly altering the physical characteristics that qualify it for listing on the CRHR or local registers (PRC 5020.01[k] and 5024.1[g]).

In addition to complying with CEQA, the plan implementation is a federal undertaking[7] subject to compliance with Section 106 of the NHPA and its implementing regulations found at 36 CFR Part 800. As described above, Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties. In this case, FERC is the lead federal agency responsible for compliance with Section 106. This report has been completed in partial fulfillment of Section 106 requirements and CEQA requirements, and documents the results of a cultural resources inventory conducted by HDR, for YCWA, to identify any historic properties, historical resources, unique archaeological resources, or TCRs within the APE.

[7] Pursuant to 36 CFR Part 800.16, a federal undertaking is defined as a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including …those requiring a federal permit, license, or approval. In this case, FERC approval of the Plan is considered a federal undertaking (36 CFR Part 800.16[y]) and therefore must comply with Section 106 and its implementing regulations found at 36 CFR Part 800.

1.3 Area of Potential Effects

Under 36 CFR Part 800.16(d), the APE is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist.” The APE for the implementation of the Plan is located in Yuba, Sierra, and Nevada counties, California, on the main stems of the Yuba River, the Middle Yuba River, and Oregon Creek, a tributary to the Middle Yuba River (Figure 1.3-1 through Figure 1.3-4). As described above, the present investigation covers areas newly added to the APE, while a previous report covers the original APE (Ramsey Ford 2014).

Areas newly added to the APE include: (1) an additional site to be used for off-site mitigation re-vegetation comprising roughly 1.0 acre of land located on both Tahoe National Forest (TNF) (roughly 0.6 acre) and privately owned (roughly 0.4 acre) lands along Oregon Creek in Celestial Valley; (2) two discontiguous spoil disposal sites on privately owned lands along Oregon Creek totaling an additional 12 acres; and (3) approximately 80 acres on privately owned lands along Grizzly Gulch to be used for sediment disposal (Figure 1.3-2 and Figure 1.3-3). The entire revised APE totals approximately 171 acres and includes all lands previously identified for the footprint of potential disturbance areas associated with the planned mechanical sediment removal and covers a total of seven discontiguous areas that incorporate the Log Cabin and Our House diversion dams and their existing impoundments, access roads, staging areas, potential catchment areas, laydown areas, sediment disposal sites, and the off-site re-vegetation mitigation site. The APE falls within portions of Sierra, Nevada, and Yuba counties, and is to the south and east of New Bullards Bar Reservoir. The APE includes private lands and lands administered by the TNF. The APE is depicted on the Challenge, California (1995), the Camptonville, California (1995), and the Pike, California (1975) Unites States Geological Survey (USGS) 7.5-minute quadrangle maps and has the following legal description: Section 25 of Township 18 North, Range 7 East; Sections 10, 11, 12, 13, 15, 22, and 30 of Township 18 North, Range 8 East; Sections 7, 18, 19 and 20 of Township 18 North, Range 9 East.

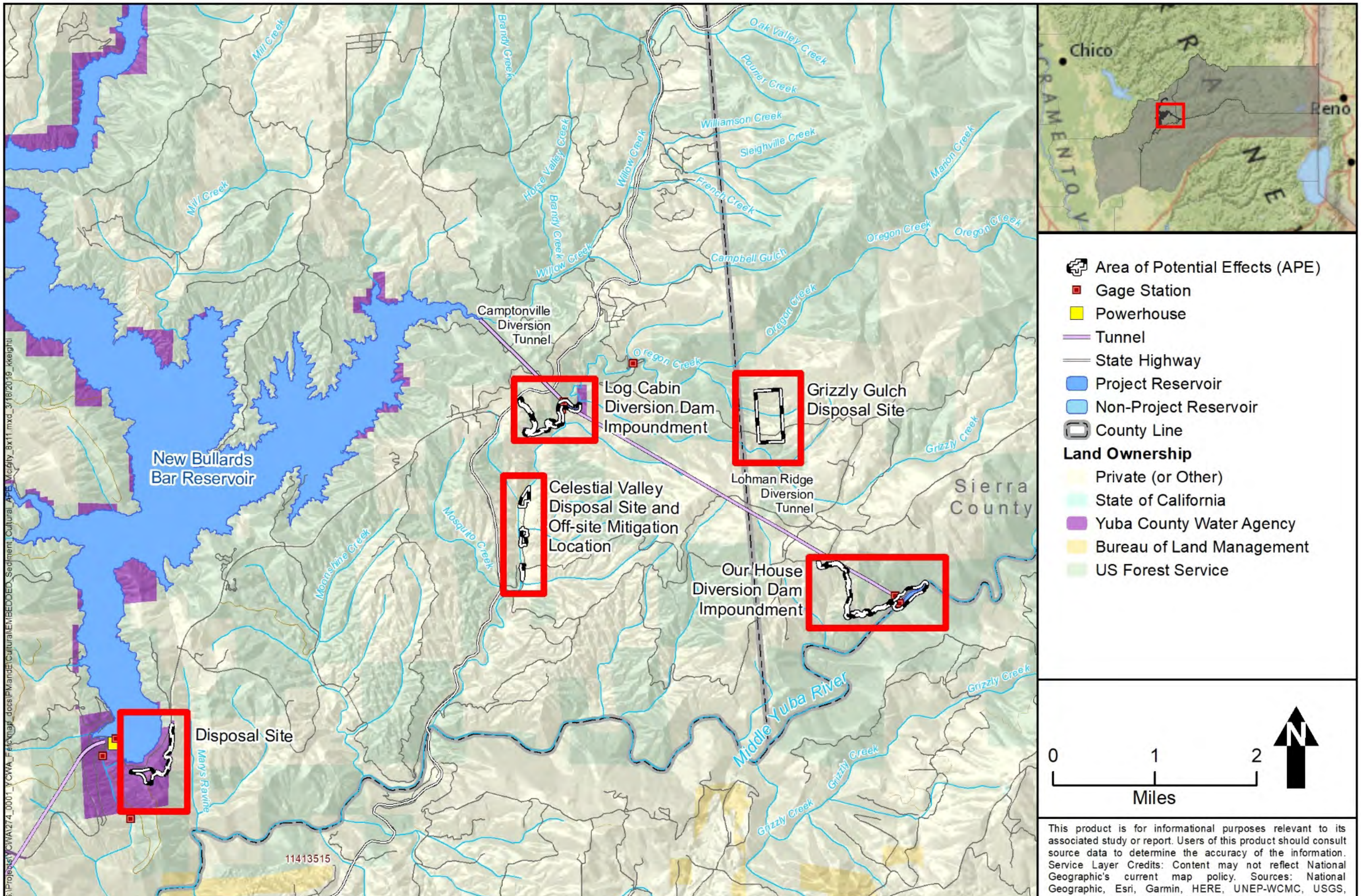

Figure 1.3-1. Log Cabin and Our House Diversion Dams Sediment Management Plan vicinity and APE.

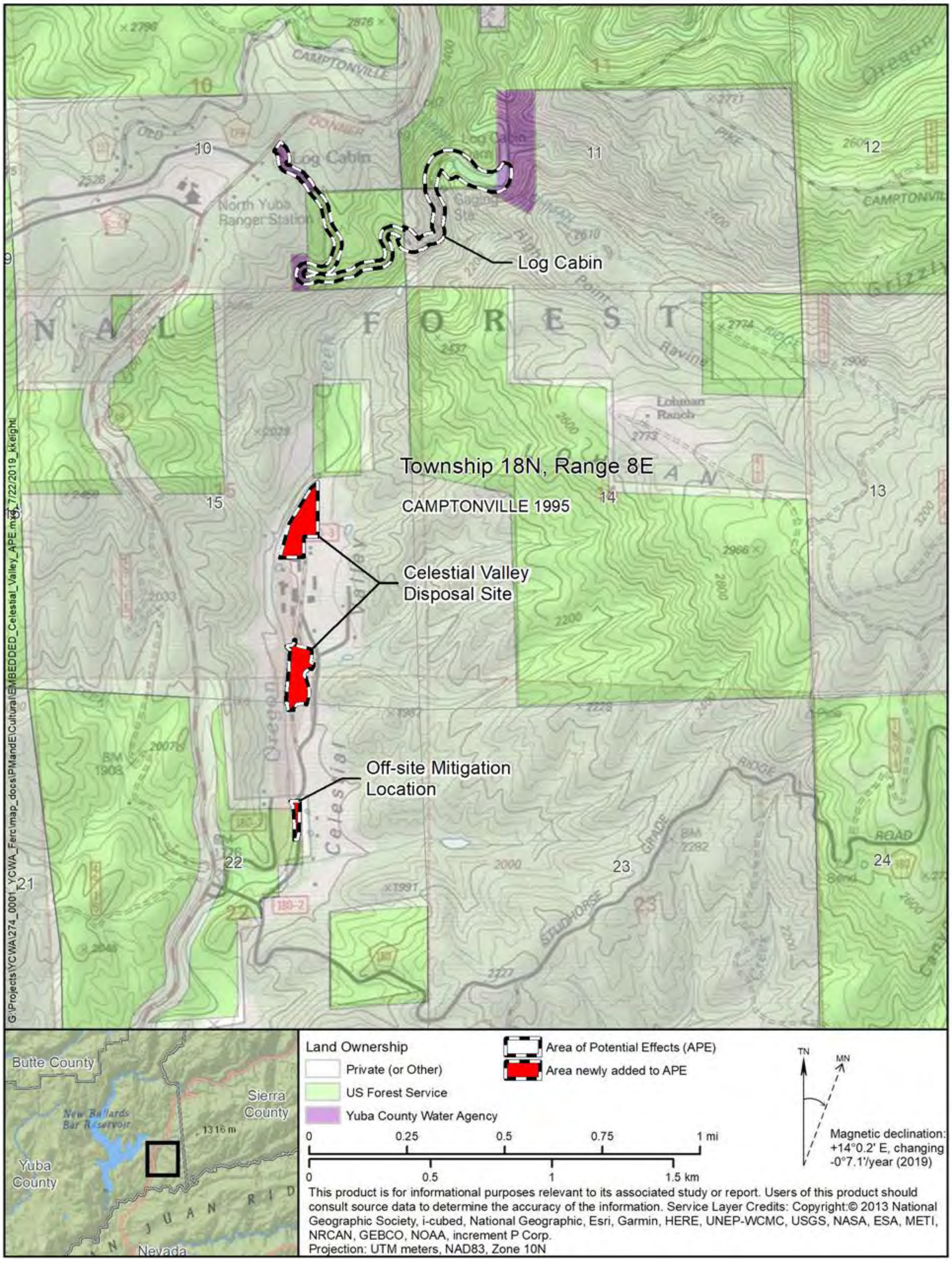

Figure 1.3-2. APE areas including newly added Celestial Valley disposal sites, the off-site mitigation location, and Log Cabin Diversion Dam area.

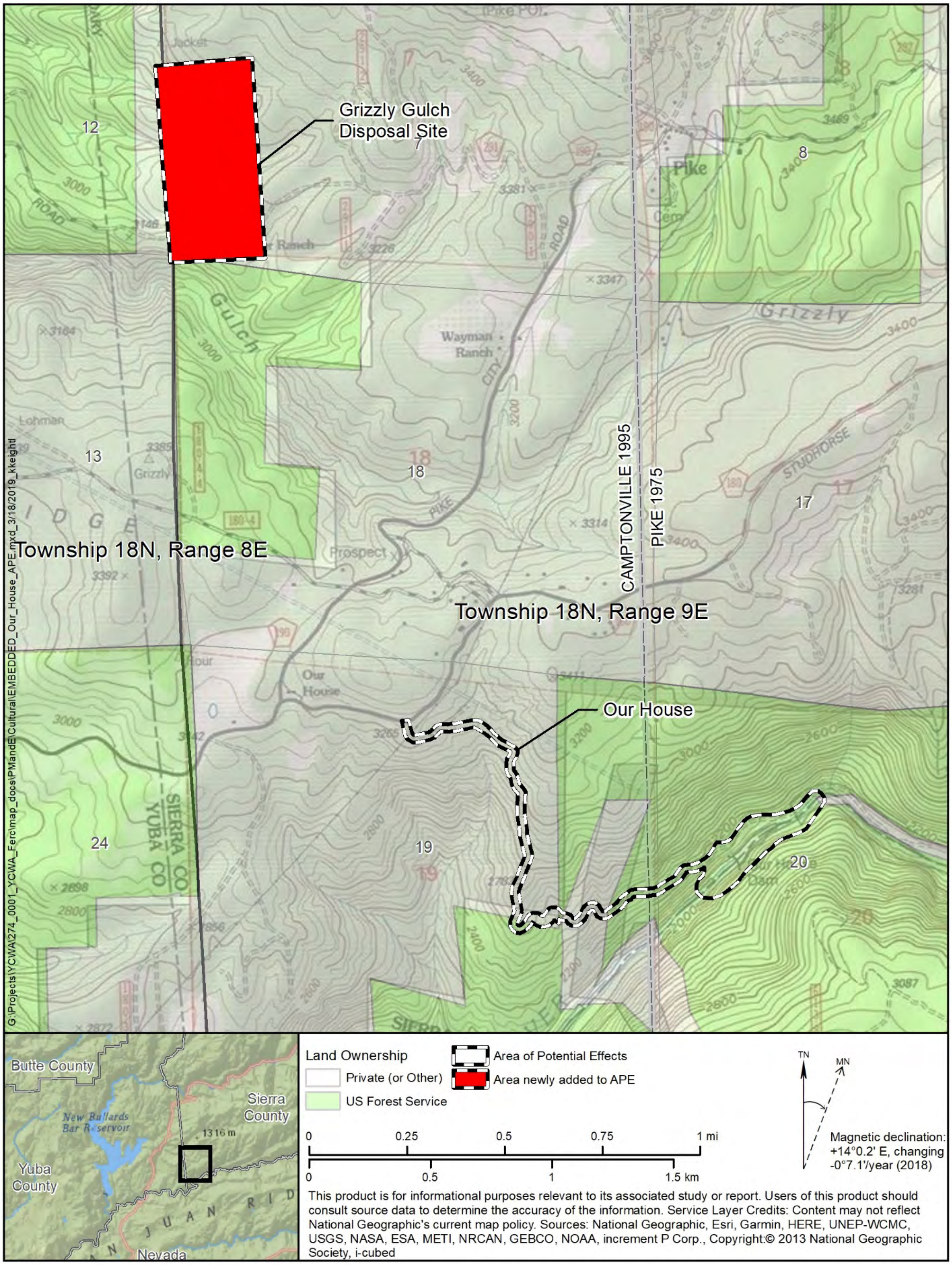

Figure 1.3-3. APE areas for the newly added Grizzly Gulch disposal site and Our House Diversion Dam area.

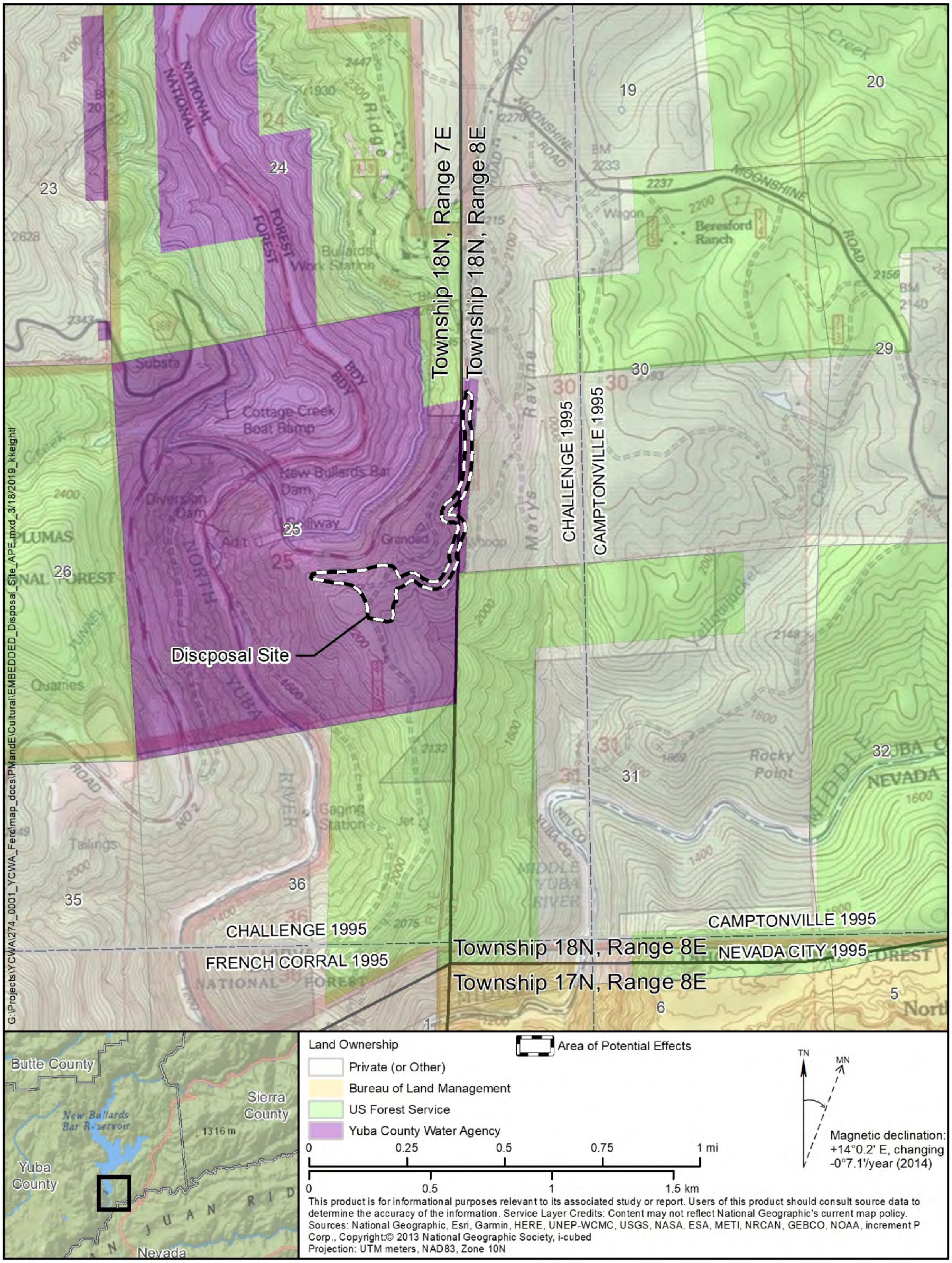

Figure 1.3-4. APE area for disposal (not part of the current investigation).

1.4 Key Personnel

YCWA retained HDR to implement the present investigation. HDR Senior Cultural Resources Specialist, Danielle Risse, (MA, Anthropology) served as the Principal Investigator for the present work and meets the Secretary of Interior's *Professional Qualifications Standards* for archaeology. The field survey was led by Danielle Risse and HDR Archaeologist Owen Ford (BA Anthropology), Cultural Resources Specialists Monica Ruth (BA, Anthropology) and Kamil Rochon (BS, Archaeology), and Architectural Historian Leesa Greatreak (MS, Historic Preservation).

The technical report was prepared by Monica Ruth, Owen Ford, Leesa Gratreak, and Danielle Risse. Maps were produced by HDR Geographic Information Systems (GIS) Specialist Keir Keightley (PhD, Geography). Resumes for key personnel are included in Appendix B.

1.5 Report Contents

This cultural resources report has been organized into seven sections. Section 1.0 provides the updates to the Plan description, regulatory context, APE description, key personnel, and an overview of the report contents. Section 2.0 provides a brief overview of the natural and cultural setting of the APE and vicinity. Section 3.0 describes the methods used to implement the present investigation. The results of the present investigation are provided in Section 4.0. Section 5.0 presents the evaluations for resources identified during this inventory. Section 6.0 provides the report summary and management recommendations. Bibliographic references cited throughout this report are provided in Section 7.0.

Additional materials are appended to this report and include the FERC filing of the updated Plan in Appendix A. Resumes of key personnel are found in Appendix B. Copies of consultation with tribes and agencies for the present investigation are provided in Appendix C. A table showing comments and responses to comments for this report are included in Appendix D. Maps showing survey coverage of the newly added areas of the APE are provided in Appendix E. Appendix F is a map with confidential resource locations in the newly added areas of the APE. Appendix G consists of State of California Department of Parks and Recreation (DPR) 523 Series forms documenting the cultural resources identified in the newly added areas of the APE.

2.0 ENVIRONMENTAL SETTING AND CULTURAL SETTING

This section provides a brief overview of the natural environment, local prehistory, ethnography, and history of the APE and vicinity and has been excerpted from previous investigations related to the YRDP and conducted for YCWA by HDR (Ramsey Ford et al. 2014 and Ramsey Ford 2014). The discussion of the natural environment and paleoenvironment focuses primarily on conditions and resources that directly influenced human occupation and resource utilization. The archaeological overview discusses previous studies that have defined the temporal-cultural divisions of prehistoric occupation in the area. The ethnographic section describes the native people who occupied the area during the late prehistoric and early historic eras, whereas the historic section provides specific details about non-Native American activities in the APE and vicinity. Understanding local cultural history is critical in defining important local, state, and/or regional events, trends, or patterns in prehistory and history by which the significance of prehistoric and historical cultural resources may be evaluated and their eligibility for inclusion on the NRHP may be established.

2.1 Natural Setting

This section describes the natural setting of the APE, including climate, paleoclimate, geology and soils, hydrology, vegetation, and fauna.

2.1.1 Climate

The annual climatic cycle of the APE and vicinity is typified by warm, dry summers and cold, wet winters. During the summer, heated valley air rises eastward across the Sierra Nevada, creating windy afternoon conditions (Schoenherr 1992:72). Annual temperatures vary with latitude and elevation, becoming colder at upper elevations. Substantial snowfall can occur at high elevations, generally in areas over 4,000 to 5,000 feet, which occurs in the North, South, and Middle Yuba River watersheds. At Camptonville, near the APE, average annual temperatures range from the mid-80s (degrees Fahrenheit) for the high and mid-30s for the low.

The western slopes of the Sierra Nevada are noted for their “rain-shadow effect,” a process that results from tall, steep peaks, preventing precipitation from moving eastward into the Great Basin (Schoenherr 1992:69). The western Sierra Nevada, therefore, receives substantially more moisture than the eastern slope. Precipitation occurs primarily as winter rain and snow, and typically falls between October and April. The snowline extends down to approximately 3,000 feet elevation.

2.1.2 Paleoclimate

Since 1980, shifting research priorities, including an examination of the relationship between environment and culture, have yielded a substantial body of literature on Sierra Nevada paleoenvironments. This literature has indicated that regional climatic conditions, as well as floral and faunal communities, have varied considerably over the past 12,000 years. Hull and Moratto

(1999) provide a thorough review of regional paleoenvironmental studies and climatic reconstructions, which are summarized herein.

In general, these studies indicate that postglacial conditions were cooler and drier than at present. A Great Basin–like sagebrush (*Artemisia* spp.) steppe was the dominant western Sierran plant community until around 7,000 years ago, when sagebrush began giving way to pine (*Pinus* spp.) forests (Davis and Moratto 1988). Xeric postglacial conditions persisted until around 6,000 years ago. Between 5,000 and 2,500 years ago, ecosystem productivity and species diversity increased, likely stimulating an intensified settlement of the Sierra Nevada (Hull and Moratto 1999: xii–xiii).

A series of neoglacial advances occurred principally between 4,000 and 2,000 years ago. The temperature declines apparently ceased after about 2,000 years before present (B.P.)[8]. The past 2,500 years have witnessed a marked climatic instability, with unpredictable drought and flood cycles, punctuated by neoglacial advances and dramatic declines in mean annual temperature. A late Holocene increase in winter precipitation likely resulted in an increased water table height and concomitant meadow development within the forest habitat (Wood 1975). While the timing of initial meadow development and subsequent expansion is variable, it likely occurred between 2,500 and 1,200 years ago (Hull and Moratto 1999:33).

Stine (1994) documented several ancient droughts between about 1,000 and 600 years ago, a period referred to as the “Medieval Warm Interval.” This climatic anomaly witnessed several droughts of much greater magnitude than any in recent history. Mean annual temperatures decreased thereafter until about 100 years ago.

2.1.3 Geology and Soils

The Sierra Nevada geomorphic province extends 400 miles from the southern Cascades to the Tehachapi Mountains, measures 40 to 100 miles wide, and ranges in elevation from 400 feet (120 meters) to 14,505 feet (4,421 meters) (Norris and Webb 1990:63). The APE vicinity bedrock geology includes Paleozoic metasediments and metavolcanics (Shoofly and Calaveras Formations), Paleozoic and Mesozoic granitics (Valley, Cascade, and Yuba River pluton), and Mesozoic ophiolite (Smartsville Complex). While eocene auriferous sediments (Tertiary river gravels) occur in the basins and drainages, Miocene-Pliocene rhyolites and sediments (Valley Springs Formation) and andesitic lahars (Mehrten Formation) cap the ridgetops (Curtis et al. 2005).

The local soil is heavily influenced by the underlying bedrock and includes alfisols, andisols, entisols, inceptisols, mollisols, and ultisols, in combination with mesic or frigid soil temperature regimes and zeric, udic, aridic, or aquic soil moisture regimes (Nevada Irrigation District [NID] 2008:7.1.6). Frigid soils are found in the upper elevations (above 5,000 feet) and are derived from granitic, glacial-alluvial, metasedimentary, or volcanic origin (andesitic tuffs and midflows). Between 2,000 and 5,000 feet, the soils follow the andesitic mudflow parent materials that remain on the ridges, and are influenced by, and appear to track, the fault zones. The fault soils are derived from ultrabasic volcanic material and often have a high component of serpentine minerals. Lower

[8] Before present (B.P.) is a time scale used in archaeology, geology, and other scientific disciplines to specify when events in the past occurred. Because the "present" time changes, standard practice is to use the year 1950 as the arbitrary origin of the age scale.

in the midsection, soils are derived from acid igneous (granitic, granodiorite) parent material with significant influence from metasedimentary rock, tuff breccia, schists, and shales (NID 2008:7.1.6).

2.1.4 Hydrology

The northwestern Sierra Nevada is traversed by numerous drainages that carry more than half the annual runoff in California (approximately 3.5 billion cubic meters of water) (Moratto 2004:13). The APE and vicinity is drained by the Yuba River basin. The modern Yuba River began incising foothill channels 5 million years ago (Curtis et al. 2005), a process that left the paleochannel deposits as upland gravels. The basin was also affected by extensive Quaternary glacial erosion.

The current Yuba River basin consists of deep canyons cut by mountain channels and is separated by high, steep sided ridges and a parallel drainage network. The drainage network results in narrow interfluves, small tributary contributing areas, and low tributary sediment loads under natural conditions (James and Davis 1994). Stratigraphic evidence indicates the presence of stepped Quaternary terraces similar to piedmont channels flowing out of the Sierra, yet these terraces are generally buried by mining sediment (James 1988). The history of hydraulic mining in the Yuba River has led to vast amounts of sediment build-up in the river channel, especially near the confluence with the Feather River near Marysville.

2.1.5 Vegetation

Throughout the Sierra Nevada, plant distribution is determined principally by elevation, with vegetative communities progressing from grasslands at the lower levels, to pine and fir forests in the upper reaches. These communities run lengthwise across the western Sierra in a north-south direction, perpendicular to major prehistoric cultural boundaries (Moratto 2004:286). Prehistoric cultural boundaries typically trended west to east, encompassing all environments from the foothills to the Sierra Nevada crest therein, providing each group access to the varied biotic resources of the area.

The APE lies predominantly within the Douglas-Fir-Pine and Mixed Conifer-Pine Forest vegetative communities around New Bullards Bar Reservoir. The Log Cabin and Our House diversion dams are in areas represented mostly by the Canyon Live Oak vegetative community. Species common to the Douglas-Fir-Pine Forest vegetative community include bigleaf maple (*Acer macrophyllum*), white alder (*Alnus rhombifolia*), gray pine (*Pinus sabiniana*), California black oak (*Quercus kelloggii*), interior live oak (*Quercus wislizenii*), whiteleaf manzanita (*Arctostaphylos viscida*) and poison oak (*Toxicodendron diversilobum*). Species common to the Mixed Conifer-Pine Forest vegetative community include ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), Douglas fir (*Pseudotsuga menziessii*), white fir (*Abies concolor*), and sugar pine (*Pinus lambertiana*). The Canyon Live Oak Forest vegetative community includes ponderosa pine, gray pine, Jeffrey pine (*Pinus jeffreyi*), black oak, interior live oak, wedgeleaf ceanothus (*Ceanothus cuneatus*), and whiteleaf manzanita (USFS 2004).

2.1.6 Fauna

The Douglas-Fir-Pine Forest and Mixed Conifer-Pine Forest vegetative communities support a variety of birds and mammals. Common birds include the California quail (*Callipepla californica*), mountain quail (*Oreortyx pictus*), wood duck (*Aix sponsa*), American crow (*Corvus brachyrhynchos*), Northern goshawk (*Accipiter gentilis*), Northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*), purple martin (*Progne subis*), common yellowthroat (*Geothlypis trichas*), Hutton's vireo (*Vireo huttoni*), olive-sided flycatcher (*Contopus cooperi*), and black swift (*Cypseloides niger*). Large mammals include mule deer (*Odocoileus hemionus*) and black bear (*Ursus americanus*), as well as coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), and wild pig (*Sus scrofa*). Smaller species, such as chickaree, or Douglas's squirrels (*Tamiasciurus douglasii)*, northern flying squirrel (*Glaucomys sabrinus*), black-tailed jackrabbit (*Lepus californicus bennettii*), American badger (*Taxidea taxus*), broad-footed mole (*Scapanus latimanus*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and western gray squirrel (*Sciurus griseus*) also live within the APE and vicinity. While the Canyon Live Oak Forest vegetative community also supports many of these same animals, it also provides habitat for different species, including Sierra Nevada mountain beaver (*Aplodontia rufa californica*), fox sparrow (*Passerella iliaca*), and wild turkey (*Meleagris gallopavo*) (CDFG 2009a, 2009b).

Several fish species have long been common to the major waterways in the Sierra Nevada. Major species include golden trout (*Oncorhynchus aguabonita*), rainbow trout (*O. mykiss*), Chinook salmon (*O. tshawytscha*), lamprey (*Petromyzontidae* sp.), Sacramento pikeminnow (*Ptychocheilus grandis*), suckerfish (*Catostomidae* sp.), and white sturgeon (*Acipenser transmontanus*).

2.2 Cultural Setting

This section presents information on the local prehistory, ethnography, and history of the APE and vicinity and has been excerpted from previous investigations related to the YRDP and conducted for YCWA by HDR (Ramsey Ford et al. 2014 and Ramsey Ford 2014).

2.2.1 Prehistoric Overview

2.2.1.1 Late Pleistocene/Younger Dryas/Recess Peak Advance–Paleoindian (15,000 to 10,000 B.P.)

The Clovis culture, which is the earliest well documented cultural expression in the Americas, is linked to the medial part of this time period, circa (ca.) 13,500 to 13,000 B.P. The acquisition of date ranges for the Clovis culture from current literature is fraught with confusion due to a plethora of alternative dating schemes and dating methods. The cultural pattern is distinguished by "fluted" projectile points, percussion blades, and other distinctive artifacts. Very few Clovis sites have been identified in North America. No diagnostic Clovis artifacts have been found in the APE vicinity. However, a fluted point was found at Lake Almanor, located approximately 100 miles north in Plumas County (Kowta 1988:57). Fluted point fragments and complete specimens, typically isolated, are, however, known from scattered locations throughout much of the Sierra Nevada (c.f., Rondeau and Dougherty 2009). Unfortunately, few are from dated contexts.

2.2.1.2 Terminal Pleistocene/Initial Holocene (ca. 10,000 B.P)

The transition between the Pleistocene and Holocene occurred 10,000 years ago during a climatic warming period that peaked 9,000 years ago. The Holocene represents the latest interglacial event, marked by the retreat of Pleistocene glaciers (West et al. 2007:15-17). Complete glacial retreat had likely occurred in the Sierra Nevada by 12,000 to 13,000 years ago, leading to increased aridity and lower lake levels. Climatic conditions led to a change in the vegetative composition of the area, with incense cedar and oak species dominating the forests previously composed of pines (West et al. 2007:27). Cultural evidence from this era in the Sierra Nevada is scant, but comparatively well established. Lindstrom et al. (2007:6) note the "Pre-Archaic/Tahoe Reach phase," marked by large stemmed points resembling weapons from the Great Basin from this era, which occurred in the Truckee vicinity. Recently obtained obsidian hydration readings from throughout the Truckee vicinity provide evidence of human occupation during the Late Pleistocene to Early Holocene (Waechter and Bloomer 2009:3-6).

2.2.1.3 Early Holocene–Late Paleoindian (ca. 10,000 to 8,000 B.P)

By the Early Holocene, evidence from numerous archaeological sites throughout the state shows that California was fully explored by this time and supported a significant population. The regional climate was distinguished by a steady warming and drying trend, or a period of "relative warming..." (c.f. Lindstrom et al. 2007). In the Truckee area, the Alder Hill basalt quarry was actively used to procure toolstone. McGuire et al. (2006) recovered Great Basin stemmed points, datable carbon and obsidian that indicate the Alder Hill Quarry was being visited by the Early Holocene for the procurement of toolstone. Lindstrom et al. (2007:5) also note that at site CA-ELD-180, Great Basin stemmed points were recovered, some of which likely had their origins in the western Sierra foothills, which had been manufactured from a broad range of materials, indicating considerable mobility of at least portions of the human population. In yet other areas, such as the western Sierra foothills in Calaveras County, there is evidence of extremely stable land use. For example, evidence shows continued use of the Skyrocket site over a span of approximately 2,500 years during the Early Holocene (Fagan 2003:88).

2.2.1.4 Middle Holocene–Early Archaic (ca. 8,000 to 5,000 B.P)

The Middle Holocene is poorly represented archaeologically throughout California. Lindstrom et al. (2007:8) remark on this issue, speculating that several factors may obscure middle Holocene contexts. Warming conditions arising during the early Holocene evidently continued into the mid-Holocene. In the Tahoe region, Lindstrom et al. (2007:7) cite an extensive list of studies, all of which have concluded that the mid-Holocene was the warmest period in recent geological history and, at least in North America, one of the driest periods. Levels in Lake Tahoe may at times have fallen sufficiently low to isolate the lake from the Truckee River. Lindstrom et al. (2007) note evidence of a drought period estimated to have lasted approximately 350 years between about 6,300 and 4,850 B.P. Effects of these changes farther west are not well documented. Again, at the Skyrocket site in Calaveras County, evidence of occupation diminishes but is never fully interrupted (Fagan 2003:99). McGuire (2007: 171) notes that Early Archaic deposits may be more difficult to recognize, due to a large degree of variability in local traits and the lack of a single projectile point chronology that can be used to identify temporally diagnostic artifacts.

2.2.1.5 Late Holocene–Middle Archaic (5,000 to 2,000 B.P.)

The beginning of the Late Holocene is marked by climatic shifts toward a more temperate regime and the first well documented archaeological cultures in central and northern California. In the Sacramento-San Joaquin Delta region, the Windmiller culture emerged with unique traits, including an unusual mortuary pattern marked by prone interments with crania oriented in a westerly direction (Moratto 2004:201-207). In the Truckee vicinity and portions of the neighboring western High Sierra, the Martis Complex—marked by typological affiliations with the Great Basin and a preference for locally abundant basalt—was identified by Heizer and Elsasser (1953), Elsasser (1960), and Moratto (2004). The Martis complex is visible primarily through a proliferation of large basalt bifacial tools, as well as a large distribution of lithic reduction debris (Kowta 1988:72; McGuire 2007:172). Sierran basalt was also being used farther west in the Central Valley, suggesting an east-west oriented settlement system that took advantage of lowland and upland resources (McGuire 2007:171–172). Less prolifically utilized materials include local metamorphic rock, chert, slate, and schist. Several Sierran sites have also yielded obsidian materials that have been sourced to a wide range of areas including North Coast Range and Bodie Hills obsidians (Justice 2002: 221–222). The Martis complex is well-represented near the APE at sites such as CA-NEV-15, CA-NEV-67, CA-PLA-6, and CA-SIE-20 (Elsasser 1960).

To the west and north of the APE, the Messilla Complex was defined at three sites in Butte County (Moratto 2004:297-299). Moratto (2004:303), following arguments of earlier investigators (Elsasser 1978; Ritter 1970a, 1970b; Ritter and Matson 1972), including studies for the proposed Auburn Dam and Bullards Bar reservoirs, suggests that Martis may reflect ancestral Maiduan prehistory. A three-stage Bullards Bar cultural complex was identified by Humphreys (1969), that appears to follow the same typological progression as the Martis to Kings Beach and Mesilla to Sweetwater cultural phases from Lake Tahoe and Lake Oroville respectively. The Bullards Bar I–III phases are characterized by a shift from large to small projectile points (Moratto 2004:300–301). Based on obsidian hydration analysis, the earliest period, Bullards Bar I, dates from approximately 5,275 (+/- 342) B.P. to 3041 (+/-170) B.P. (Humphreys 1969:86). This period is represented primarily by use of handstones and milling slabs and a large number of projectile points and scrapers. Obsidian, basalt, chert, and petrified wood were the primary stones used for tool manufacture, with basalt the dominant material found in this period. Ochre is also prominent at this time. The Bullards Bar II period defined by Humphreys (1969:88) also occurs at this time, based on obsidian hydration dates of 2400 B.P. Bullards Bar II is expressed by the introduction of steatite artifacts into the archaeological record and a sparse number of projectile points, including Gunther series points, dominated by chert toolstone (Humphreys 1969:87). Ochre was still used, but to a lesser degree than encountered during the Bullards Bar I period (Humphreys 1969:89).

What is evident from the available archaeological information is that by the Middle Archaic, people of the Sierra Nevada show clear influences from both the Great Basin and central California. However, the archaeological remains cannot as yet be reliably attributed to historically encountered ethnographic groups.

2.2.1.6 Late Holocene–Late Archaic and Emergent (2,000 to 200 B.P)

With the Late Archaic, the lack of discernible relations between archaeological complexes and the known material cultures of ethnographic Californian populations end. In the High Sierra, the Martis Complex gives way to the Kings Beach Complex, and in the west, analogous changes occur as the Middle Horizon is replaced by early Augustine Pattern settlements. In the west, important subsistence changes take place, as the acorn emerges as a clearly important staple—a process marked by a proliferation of the use of bedrock mortars. The bow appears as the preeminent weapon, marked archaeologically by an abrupt reduction in projectile point size and a significant increase in numbers of points in use. In the High Sierra, the bow also appears in the Kings Beach Complex, and preferred materials for weapon tips change from basalt to microcrystalline silicate materials, typically taking the form of Rose Spring and Gunther barbed arrow points (Moratto 2004:302–303; McGuire 2007:174). The Sierra Contracting Stem cluster is another Martis Complex point variant that emerges in the Late Archaic. This type is typically formed of local basalt sources, with a wide distribution throughout central California that is concentrated in the Sierras around Lake Tahoe (Justice 2002:277–283).

Typologically, the projectile points of the western slope differentiate themselves from the east. To the west, the arrow tip is characteristically dominated by a small contracting-stemmed or corner-notched point, manufactured of local materials and harking typologically back in time to Martis contracting-stemmed points and perhaps west and north to the Gunther Series points of northwest California (Dougherty 1990; Jackson and Ballard 1999; Ritter 1970a). In contrast, the functionally equivalent chipped stone artifacts of the Kings Beach Complex associate typologically with Great Basin forms, including Eastgate and Rose Springs (Moratto 2004:295–298).

The Bullards Bar II period occurs at this time and is dated to 1000 B.P. to 434 B.P. (Humphreys 1969:90). Projectile points are represented by Desert Side-Notched and triangular series manufactured from cherts and petrified wood (Humphreys 1969:89). Scrapers are also a common flaked stone tool at this time and bedrock mortar technology is common (Humphreys 1969:90).

2.2.2 Ethnography and Ethnohistory

The APE lies within the territory of the Nisenan, otherwise known as the Southern Maidu or Valley Maidu. Together with the northeastern Maidu and Konkow, they formed one of the three principal branches of the Maiduan linguistic group, which is part of the larger Penutian language family. The Nisenan spoke the southernmost branch of the Maiduan language. According to Kroeber (1925:393), these three languages (Nisenan, Maidu, and Konkow) were of sufficient divergence as to constitute three separate languages, though languages sharing many word similarities.

At the time of the earliest historical non-native contact, the Nisenan occupied a portion of northeastern California that, since Euro-American times, has been known as the “Gold Country,” an area bordered by the Sacramento River to the west and the Sierra Nevada to the east. The region includes parts of the modern counties of Yuba, Nevada, Placer, Sacramento, and El Dorado. From north to south, their territory encompassed an area from either the North Yuba River or the southern fork of the Feather River down to the Cosumnes River (Wilson and Towne 1978:388; Littlejohn 1928:23). The northern boundary has traditionally been difficult to define as it appears to have been a zone where the Nisenan's northern neighbors, the Konkow, mingled linguistically and culturally with the Nisenan. On the southern bank of the Cosumnes River lived the eastern branch of the Miwok, while just to the west were the Patwin. Ecologically, Nisenan territory encompassed a region characterized by flat river bottomland along the Sacramento River to the 10,000 and 12,000-foot elevation Sierra Nevada divide. Between these two extremes were the gradually ascending Sierra foothills, an environment consisting of—among others—scattered oaks (especially interior live oak and blue oak [*Quercus douglasii*]) and California buckeye (*Aesculus californica*). These species are eventually superseded by gray pine and Ceanothus (*Ceanothus* spp.) in the higher elevations. At even higher elevations, sugar pine (*Pinus lambertiana*) and ponderosa pine are the dominant hardwood species. This region experienced dramatic fluctuations in climate and temperature. Summer months along the Sacramento River, for example, routinely reach into the high 90s and even 100s, while the winter months in the high elevations experience snow, frost, and below-freezing temperatures.

Estimates of pre-contact Nisenan population size have been notoriously difficult to define (Beals 1933; Kroeber 1925), as much of their population had been decimated prior to the twentieth century. Kroeber (1925) argues for a total pre-contact Maidu population of 9,000, though he admitted the figure was decidedly liberal. However, by the time Kroeber and other ethnographers began to study the Nisenan in the early twentieth century, there were only a reported 1,100 Nisenan and those of mixed-Nisenan heritage. This dramatic decline in population was largely the result of events unleashed primarily by the California Gold Rush. The discovery of gold in the lands of the Nisenan and the subsequent contact between whites and Indians, much of which was of a violent nature, played a significant role not only in reducing overall Nisenan population numbers but also destroying the Nisenan as a viable culture. By the latter half of the nineteenth century, Nisenan population numbers were in dramatic decline

The primary ethnographic sources on the Nisenan include Powers (1877), Faye (1923), Kroeber (1925, 1929), Littlejohn (1928), Gifford (1927), Beals (1933), Voegelin (1942), Uldall and Shipley (1966), Merriam (1967), and Wilson (1972). Collectively, these writers describe a hunter-gatherer society organized into the characteristic Californian "tribelet" (*sensu* Kroeber 1925) and living in small, semi-permanent villages within a more or less specified geographic territory. Like many native Californian groups, the Nisenan engaged in a seasonal round of food gathering, which included the exploitation of a wide range of natural occurring plants and animals. Edible resources were abundant in Nisenan territory year round, though some (such as acorns and certain other plants) were acquired primarily during specific seasons. Beals (1933:346) notes that the Nisenan were exceedingly catholic in their choice of food, with very few edible resources avoided.

In general, the division of labor in Nisenan society followed a pattern whereby men hunted and fished and women gathered, though both sexes were apparently involved in acorn and pine nut gathering. Terrestrial game such as deer, elk, antelope, bear, wildcat, rabbit, and a wide variety of small and medium animals were consumed. Deer was a major staple for the Nisenan, usually stalked individually or in communal hunts (Beals 1933:346), the latter frequently involving the participation of several villages. Bears were also hunted, an activity that usually occurred in the mountains. Rabbits, another favored game, were typically hunted in large drives that took place in the spring. Fish formed a substantial part of the Nisenan diet, especially for those populations living along rivers and streams. They were acquired in a variety of ways—from hook and line to the use of natural poisons. Insects such as grasshoppers, larvae, pupae, and ants were also eaten. Grasshoppers were considered a particular delicacy among the Nisenan (Wilson 1972), and, like rabbits, were obtained in large communal drives. These were gathered primarily in the summer when they were particularly abundant in meadows or similar areas with flat ground.

Vegetal foods provided the most important sources of calories and carbohydrates for the Nisenan. Various nuts, seeds, roots, tubers, bulbs, acorns, berries, wild grapes, and other greens were gathered. However, the most important vegetal foods were acorns (Beals 1933:351; Wilson 1972:36–37). According to Beals (1933:351), between six or seven varieties of acorns were recognized by the Nisenan as suitable for consumption. The most prized acorn, however, belonged to the black oak. Acorn harvesting typically occurred during the fall when the acorns were ripe and the trees were heavily laden. Trees that were known to provide lots of acorns were frequented repeatedly and may have been owned by particular families (Wilson 1972:37, Beals 1933:363). Men climbed the trees and shook the branches, thereby dropping the acorns to the ground. The women gathered them up and put them in baskets. The acorns were shelled and then ground into a flour, the latter process facilitated by the use of either bedrock or portable mortars and pestles. The flour was winnowed in trays with the finer flour segregated from the coarser. After being ground and winnowed, the flour was leached with warm water to remove the toxic tannic acid. The meal was then stored in baskets, and eventually made into soup or bread. When a crop was particularly abundant, the acorns were stockpiled in a granary and occasionally traded with other groups.

Like many native groups in California, the Nisenan were organized into what has been termed the "tribelet." Kroeber coined the term "tribelet," which was defined as a social aggregation consisting of one or more household groups that included immediate family members (parents and children) and any associated relatives (collateral, lineal, or affinal) living together in a village or community. Small villages contained between 15 and 25 people, while large villages could contain more than 500 people (Kroeber 1925:831). Dwellings were dome-shaped and made of brush or bark lashed over an oak pole frame. They were between 10 and 15 feet in diameter, and any village might contain between 7 and 50 houses.

Though some early expeditions into Nisenan territory by Euro-Americans occurred in the first half of the nineteenth century, and surely diseases brought by Euro-Americans had already taken their toll, killing an untold number of Native Americans in California, before and during this period, the first Euro-American immigrant to settle in Nisenan territory was John Sutter. John Sutter had been granted permission to settle there by the Mexican Governor Juan Bautista Alvarado in 1841. Sutter established a fort, ranch, and mill near present-day Sacramento. He recruited numerous Nisenan in his enterprises and used them as laborers on many of his various projects. His relations with the Nisenan, as well as other native groups, were complex; while he could at times be generous and benevolent, he could also be harsh and brutal (Peterson 1977:9–11).

The annexation of California by the United States in 1849–1850 resulted in continued woes for the Nisenan and neighboring groups in the area. In fact, the ensuing years were tumultuous for the Indians of the region. Not only did disease take a massive toll on their population, but the violence unleashed by miners and settlers who entered their territory in the 1840s and 1850s also had a significant and devastating effect on their population. After the discovery of gold at Sutter's Mill in 1848, miners and settlers flooded into northern California, gradually expropriating native lands. Many of the streams and creeks the various Indian groups had used and relied upon for generations became polluted and befouled as the prospectors overran the area in their mad search to find the elusive mineral. This prompted angry responses from the region's native inhabitants, and hostilities between the two groups became commonplace. Many of the miners, for their part, viewed the Indians as little better than wild beasts (calling them by the derogatory term "Diggers"), and thus dealt with them harshly. There were numerous violent incidents—raids, retaliatory killings, rapes, and outright massacres—between the two opposing groups during this time.

Despite resistance on the part of the Nisenan, the eventual outcome of this clash between white and native culture was inevitable. The Nisenan were simply no match for the superior numbers, technology, and organization of the American invaders. During the latter half of the nineteenth century, the native groups that had occupied the area were gradually and inexorably displaced, killed off by disease or violence, or forced into hiding and seclusion. As whites settled on their lands, the few surviving Nisenan were forced to the margins of society, where many of them were eventually absorbed into the dominant economic system. Many Nisenan found work in agriculture, logging, ranching, and domestic pursuits (Wilson and Towne 1978:396).

The issue of landless Indians (i.e., those not living on reservations) in California soon became a problem that aroused the interest of the Federal government at the beginning of the twentieth century. To ascertain the number of Native Americans living outside the reservation system, a San Jose attorney named Charles E. Kelsey was appointed by the Bureau of Indian Affairs to conduct a comprehensive survey. He was tasked with enumerating the numbers of landless Indians in California and investigating their need for land. Between 1905 and 1906, Kelsey traveled throughout California, gathering a long list of names, ages, and locations or residences of living Native Californians (Kelsey 1971). Kelsey's work in Yuba County yielded a depressingly small number of Native Californians living in the region. Altogether, he counted a total of 50 landless Indians and three mixed-blood Indians (Kelsey 1971:2).

The late nineteenth and early twentieth centuries proved to be an extremely difficult period for California's Native American communities. The unratified treaties of the early 1850s left virtually the entire Native population without a land base, forcing surviving tribes into refuge enclaves, often living as laborers on ranches or in other rural settings. The Dawes Act, or General Allotment Act, of 1887 began the long process of forced self-sufficiency and acculturation that was to become the overriding federal government policy well into the 1950s. The Dawes Act provided homestead-like land allotments to Native Americans, without the trust relationship with the federal government common to treaty-based reservations. The Dawes Act is seen generally as a failure, and by the early twentieth century the "plight of the landless Indian" had become a moral crisis. The federal government and charitable organizations began to examine the situation with an eye to providing some form of land base through which the surviving tribes could sustain themselves. This effort led to the establishment of some 50 rancherias in California, usually small tracts of land, often lacking resources and employment or agricultural opportunities. Some rancheria communities maintained their populations although many saw a decline as residents were forced to move away to earn livings in urban environments.

The federal government maintained an active legislative program of acculturation during the first half of the twentieth century. Indian schools, such as those at Carson City, Nevada, and Riverside, California, trained Indian children in domestic service and the trades, usually separating them from their tribes and natal families for the majority of their childhood years. The drive to acculturate Native Americans and end their trust relationship with the federal government came to a head in California with the California Rancheria Termination Act of 1958. Rancheria lands were offered to residents in what were to be privately owned parcels, while at the same time the government terminated any trust responsibilities to the rancherias, including assistance with health care, education, or subsistence. The Act was seen as a failure largely because the rancheria communities were unprepared for the change. Privately owned parcels were quickly lost because of unpaid taxes and sales to non-Indians. Many rancherias fought the act and many were able to "unterminate" their rancherias, and reestablish trust status with the federal government. Of particular importance was the judgment rendered in the Tillie Hardwick class action suit begun in 1978, which held that 17 rancherias had been wrongfully terminated. Many of the rancherias in the case remained in terminated status, often because there were no longer tribal members living on private parcels on the former rancheria lands.

The result of this tangled history is that many tribal communities have maintained or reclaimed their lands under trust status with the federal government and many have not. Those tribes that are "federally recognized" have access to the benefits of that trust status, including opportunities for economic improvement, and in some cases gaming. So-called "unrecognized tribes" have taken many paths to reclaim or establish their status with the federal government, although the various processes may take years, with questionable chances of success. The economic disparity between recognized and unrecognized has become stark as recognized realize the rewards of casino gaming and its attendant opportunities for education and health care, and economic and political influence.

2.2.3 Historic Overview

Principal historical themes applicable to the APE and vicinity include mining development, hydroelectric power, water control and distribution, formation of the water districts, and the logging industry. Each of these themes is discussed below.

2.2.3.1 Mining in the Sierra Nevada

Early miners panned for gold in stream beds, but within decades, large-scale mining operations replaced individual miners. In 1853, hydraulic mining was introduced to California and rapid advances in technology provided greater flexibility and movement of hoses and efficiency for displacing dirt. Hydraulic mining which became more common by the 1860s, is a process whereby water is delivered to a site through a high pressure hose and sprayed onto the hillsides, washing away tons of boulders, gravel, dirt, and ounces of gold. After extracting gold from long wooden sluices, miners dumped remaining gravel and debris into the mountain valleys. Rivers and streams carried the resulting flood of sediment (slickens) down into the Sacramento Valley. A total of 685 million cubic feet of debris were deposited in the Yuba River and mine waste carried by the river subsequently raised the riverbed by up to 100 feet in some areas. This resulted in raised riverbeds of the Feather and Yuba rivers so that, by 1874, at a point 12 miles above the city of Marysville, the Yuba River was reportedly flowing 60 feet above its original bed. The resultant floods buried farms near Marysville under gravel and mud. Lawsuits by farmers curtailed hydraulic mining in 1883 with the Sawyer Decision, considered one of the seminal environmental laws in the United States (Baumgart 2002). However, the Caminetti Act allowed hydraulic mining to continue if the operators constructed debris dams, regulated under the California Debris Commission, established by the U.S. Congress in 1893.

Though large-scale hydraulic mining in the Sierra Nevada was severely curtailed in 1884, it resumed on a limited basis until the 1930s. The Daguerre Point Dam, located along the Yuba River approximately 9 miles northwest of Marysville, was constructed by the California Debris Commission in 1906. The dam was rebuilt in 1964, following damage from floods to prevent hydraulic mining debris from the Yuba River watershed from flowing into the Feather and Sacramento rivers. During the 1920s, the California Debris Commission undertook studies that determined hydraulic mining could take place if well-placed debris dams (hydraulic mining had continued unabated in the Klamath Mountains) were constructed. The Yuba, American, and Bear rivers were identified as locations where this could be achieved, and the Englebright Dam (Narrows) on the Yuba River, constructed from 1935 to 1941, using an United States Army Corps of Engineers (USACE) design is an example of a dam associated with this 1920s study (JRP and Caltrans 2000:49–50). A review of existing dams on the three rivers suggests that few, if any, of these specific debris-related dams are extant on the American and Bear rivers.

A portion of the areas newly added to the APE is adjacent to Grizzly Gulch. Grizzly Gulch is known historically as a mining region within the Pike gold mining district, named after the town of Pike located just to the northeast of Grizzly Gulch. Pike was originally settled by miners from Pike, Missouri during the late 1840s, with continued regional mining activity occurring through the early 1900s. Prominent mines in the district include the Alaska Mine, the Pleasant View Hydraulic Mine and Grizzly Gulch Mine (Clark 1970; The Diggings 2019; USGS 2019).

Just to the west of the Pike gold mining district is the Camptonville district. The district is named for the town of Camptonville, which acquired its name from Robert Campton, a local blacksmith, in 1854 (Clark 1970:33). The district was first worked in 1850-51, and soon hydraulic mining took hold and became prominent in the area. The deposits at Young’s Hill, Weed’s Point, and Galena Hill were subjected to hydraulic mining in this district. The Camptonville district is best known for Lester Pelton, who invented the Pelton wheel here (see below for further detail on the Pelton wheel).

2.2.3.2 Early Hydroelectric Development

Mining and hydroelectric power generation in California have had a symbiotic relationship from the beginning. California placer miners harnessed water power for water wheels. As California mining shifted from placer to hard rock gold mining, engineers searched for new sources of water power to hoist elevators and drive machinery as a lower-cost energy source than coal and fire wood. Several innovations surfaced; however, Lester Pelton designed a split-cup water wheel in 1879 at Camptonville, a Yuba County Gold Rush town located just north of the APE (JRP and Caltrans 2000:55). Pelton’s design proved to be the most efficient for California’s hydrology and was adopted around the world. His design can be considered one of the most important technological developments from California, one that was employed on an international basis and is reflected in the massive Pelton wheels installed in the New Colgate Powerhouse located to the southwest of the APE on the Yuba River.

The Yuba River has historically been utilized and managed for multiple purposes, including hydraulic mining, irrigation, hydroelectric power generation, and flood control. In many ways, the development of the YRDP system mirrored development of other hydroelectric facilities in the Sierra Nevada range. Yuba River water was first used for industrial scale mining operations. Many of the ditches and flumes built for the mining industry were reused in the burgeoning field of hydroelectricity with early developers of hydroelectric power plants purchasing the ditches and water rights to supply water to power plant sites (Ramsey Ford et al. 2012). The new industry used water power technology honed by the California miners who adapted to the seasonal water flows germane to the Sierra Nevada watershed. Furthermore, the parallel development of long-distance electrical transmission lines allowed such plants to be erected miles away from cities that demanded electricity (Ramsey Ford et al. 2012). This Western regional style of hydroelectric development was characterized by “extremely high heads, remote powerhouse locations, and sophisticated point-to-point transmission” (Hay 1991:28). The YRDP facilities reflect these characteristics. The development and refinement of power generation by water wheels in the Sierra Nevada gold mines also influenced the YRDP infrastructure. Lester Pelton worked in the Camptonville, mines east of the Yuba River during the 1860s. Pelton developed and patented a split cup water wheel design in 1880, and began production at the Miners’ Foundry in Nevada City. By 1888, the Pelton Water Wheel Company operated out of San Francisco to meet consumer demand. The Risdon Iron Works and Joshua Hendy Foundry also made Pelton wheels and produced their own refined versions. These California mining developments had a major impact on waterpower engineering and were later used at Bullards Bar for hydroelectric power generation (Kraft and Samay 2004:95–96).

Pioneering hydropower efforts were characterized by the construction of single power plants per watershed, to service a single location. Both the Folsom and Colgate power plants conform to this pattern (JRP and Caltrans 2000:54). The Folsom Powerhouse, constructed on the American River by the Sacramento Electric Power and Light Company, was the first constructed in the Central California region. It opened in 1895 and provided electricity to the city of Sacramento and its many burgeoning industries (JRP and Caltrans 2000:58).

John Martin and Eugene J. de Sabla, Jr. organized the Yuba Power Company in October 1897. The men were involved in the organization of the Nevada County Electric Power Company a few years earlier, which operated a dam and small power plant (Nevada Powerhouse) on the South Yuba River near Nevada City. In 1897, they began construction of a second power plant on the Yuba River, the Yuba Powerhouse, to supply electricity for general use in the town of Marysville and to supply mines in the Browns Valley region (Fowler 1923:114). The powerhouse used a ditch system that diverted water from the North Fork of the Yuba River for irrigation purposes in Browns Valley is located in the foothills along lower Dry Creek, near Smartsville. Because of the shallow soils of the area an agricultural industry was not possible, and even after the irrigation network was brought to the valley the primary crop was pasture (Pagenhart 1969:173).

As soon as the Yuba plant was completed, Martin and de Sabla reorganized their corporation, forming the Yuba Electric Power Company, and began construction on a third hydroelectric power plant—the Colgate system (JRP and Caltrans 2000:59). The Colgate Powerhouse (Figure 2.2-1) was built on the Middle Fork of the Yuba River, at the crossing of the historic Missouri Bar Trail, an access route to the gold country for early miners (Coleman 1952:140).

The Colgate system, constructed in 1899 had trestle wood flumes, and wood stave, cast iron, and riveted steel pipes. Most California hydroelectric facilities of this period had pipes of lap-riveted steel. The system ran for a total of 10 miles, bringing water from the Browns Valley Irrigation District flume to the new powerhouse (Coleman 1952:140; JRP and Caltrans 2000:61-62). The new, larger Colgate flume was constructed above the old Browns Valley flume and operated from 1899 to 1941 (Coleman 1952:208). Although the Colgate plant is located on the Middle Yuba River, its water supply is diverted from the North Yuba. The original timber crib head dam was washed out in 1904, and a stone-and-mortar dam was constructed to replace it in December of that same year (Fowler 1923:156). An auxiliary water supply was provided to the Colgate forebay by a flume of wood stave pipe connected to Lake Francis, a reservoir formed by a dam on nearby Dobbins Creek. The water was brought to the powerhouse from the forebay through two 30-inch penstocks, which were later increased to five penstocks (JRP and Caltrans 2000:59).

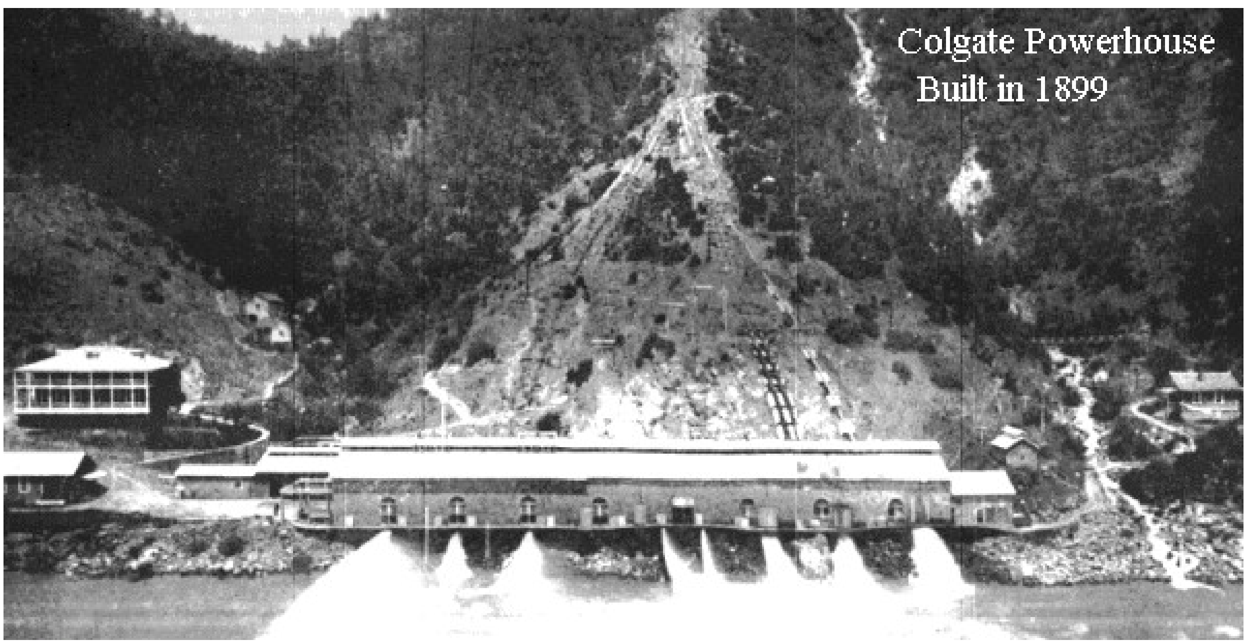

Figure 2.2-1 The original Colgate Powerhouse.
Source: YCWA

Although the Colgate location was isolated, the employees were housed at the Hotel Martin, a thoroughly modern dormitory facility that even included an ice machine (Low 1901).

A drought lasting from 1897 to 1898 lowered the flow of the American River, resulting in the Sacramento Electric Power and Light Company, owners of the Folsom Powerhouse, contracting with the Yuba Power Company to receive power from the partially completed Colgate plant. When the plant began operation in 1899, it supplied electricity to local mines in the vicinity of Nevada City, as originally intended, and also sent power to Sacramento, where the energy shortage was in particular impacting the street railway system (Coleman 1952:140; JRP and Caltrans 2000). The transmission line from Colgate to Sacramento was constructed over a distance of 61 miles. This was just one of 41 total transmission lines that were built to transmit power from Colgate to surrounding counties and the Bay Area (Low 1901). Colgate was unusual in that it provided power to multiple transmission lines of varying types and voltages and because it provided power to a wide service area (Hancock 1904:251).

In addition to the Yuba Power Company, de Sabla and Martin created the Bay Counties Power Company, which became part of California Gas and Electric Company in 1903 in a company merger. California Gas and Electric Company became a main component of Pacific Gas and Electric Company (PG&E) when it was incorporated in 1905 (JRP and Caltrans 2000:62).

In 1901, a transmission line was built from Colgate to provide electricity to the city of Oakland. At 142 miles in length and a long section spanning 4,427 feet across the Carquinez Straits, this transmission line was the longest in the world at the time (Coleman 1952:146-147; Fowler 1923:270; JRP and Caltrans 2000:60). The transmission line consisted of parallel cedar poles carrying a circuit of hard-drawn copper on one line and a circuit of seven-stranded aluminum cable on the other line (Coleman 1952:146; Fowler 1923:270;). This was a pioneering effort as little knowledge was available about the long distance transmission of high voltage at the time. Most of the work was completed by hand, with assistance from dynamite and teams of horses (Coleman 1952:145). The line transmitted 60,000 volts, an unprecedentedly high amount for the time. In fact, that was double the voltage recommended by General Electric and Westinghouse (Hughes 1983:274). This set the precedent for high-voltage transmission lines, which were widespread across the Western states by 1912 (Rose 1987:5).

Construction of the Old Bullards Bar Dam (currently inundated by New Bullards Bar Reservoir, a facility of the YRDP) by Harry Payne Whitney and the Yuba Development Company began in 1922 and was completed in 1924 (Figure 2.2-2). Mr. Whitney and the company originally constructed the dam for local hydraulic mining interests. Mr. Whitney owned mining properties upstream of Bullards Bar in Sierra County and planned to impound mining debris in the lake created by the dam (Coleman 1952). The 273-foot-tall dam impounded 12,000 acre-feet of water and replaced a 40-foot earthen debris structure. The dam cost approximately $600,000 to build and included a $300,000 powerhouse with a 6,000-horsepower capacity. The Yuba Development Company worked with the County to reroute existing roads that would be flooded by construction of the new reservoir. The Yuba Development Company spent approximately $40,000 on roads. PG&E leased the powerhouse from the Yuba Development Company until 1928 when PG&E purchased the dam and powerhouse (Hoover et al. 1966; Marysville Appeal 1922; Pagenhart 1969). Later descriptions of the dam vary in height. Ellis (1939) described the dam:

> This dam is at elevation 1500 feet; is 188 feet in height; length 440 feet; sub-base 80 feet; base 43 feet; crest 6 feet. Water behind the dam can be drawn down only to the penstock; with 10-foot gates installed on top, the total water available for use is 16,000 acre feet; below the penstock, there is left available for storage for mining debris, 40,000,000 cubic yards which, in my opinion, it is exceedingly doubtful will ever be stored from that fork of the Yuba River. The drainage area above the dam is 540 square miles. With a head of 13 feet over the dam crest, the anticipated discharge was estimated to be 65,000 second feet but in March 1928, it actually reached 70,000 second feet, the maximum daily discharge during the period of the

> flood being 56,000 second feet. The dam was designed to carry its load purely as an arch, no consideration was given to gravity or cantilever action; no consideration was given for uplift under the foundation, which latter consists of a hard greenstone [sic].

The Old Bullards Bar Dam served the community until the construction of the New Bullards Bar Dam in the 1960s.

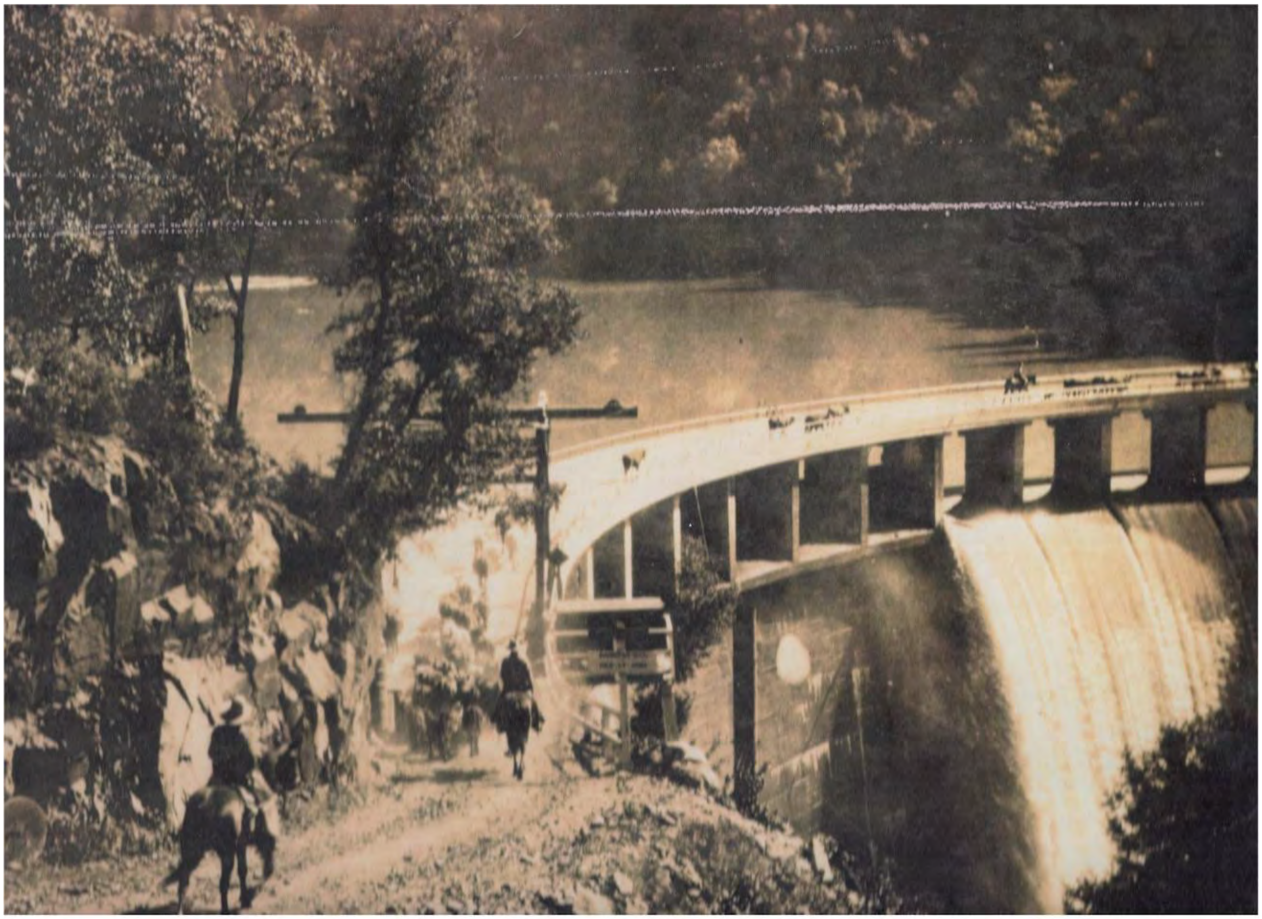

Figure 2.2-2 Old Bullards Bar Dam.
Source: YCWA

PG&E started replacing old power plants in the 1940s and 1950s (JRP and Caltrans 2000:67). In 1946, the original Colgate Powerhouse—which helped provide counties north and south of Oakland and San Francisco with power for street railways, manufacturing, and agriculture—suffered major fire damage and was shut down in 1948. In 1949, it was completely rebuilt with a state-of-the-art single generator unit.

The 1950s witnessed the culmination of earlier efforts to establish multi-purpose water systems in California. Dams no longer were only for supplying agricultural and domestic water—they became part of an integrated system. They embraced the earlier Progressive Era's (1890–1913) multiple use ethic embodied by the Hetch Hetchy Project approach of "the greatest good for the greatest number." Dams and watershed management evolved to provide flood control and irrigation and potable water, helped reclaim swampy land, delivered recreational opportunities, and generated hydroelectric power. The Central Valley Project initiated in 1951 focused on the Shasta and Friant dams, with their associated Delta-Mendota and Friant-Kern canals. The subsequent State Water Project (1957) included the California Aqueduct and Feather River Project (JRP and Caltrans, 2000: 73-75; 80-83).

In December 1955, excessive winter rain and snow in northern California resulted in devastating floods in the Central Valley that overpowered local levees and flood control. Flooding inundated more than 100,000 acres, resulted in 40 deaths, and cost millions of dollars in property damage. This resulted in both state and local initiatives to manage flood control, resulting in the construction of numerous levees, canals, and reservoirs throughout the state.

During the mid-1950s, the Yuba County Council began discussion for proposed expansion of the reservoir and hydroelectric facilities at Bullards Bar. In addition to flood control, an expanded reservoir was viewed as a means of increasing water availability for irrigation within Yuba and Sutter counties, providing electric power to the growing local population, and subsequently encouraging development within the area (Yuba County 1956). In November 1957, the Yuba County Council unanimously voted for the construction of a new dam at Bullards Bar to meet county flood control and water storage needs (Yuba County 1957). In May 1961, Yuba County voters approved, by an 11-1 margin, the $185 million in revenue bonds needed to fund the YRDP. After several years of planning and negotiation, the YCWA reached an agreement with PG&E, along with the contractor and engineer, to jointly purchase sufficient Series B subordinate lien revenue bonds to close the actual funding gap at completion of construction. Series A Bonds were sold to a single bidder on May 24, 1966—Blyth & Co. and Smith-Barney Inc. of San Francisco (YCWA n.d.).

International Engineering Company, Inc. (IEC) designed New Bullards Bar Dam in 1965. IEC was a subsidiary of Morrison-Knudson, known for building such monumental structures as the Golden Gate Bridge. The origins of Morrison-Knudson go back to 1912, when Morris Knudson and Harry Morrison collaborated on a small pump station project on the Snake River in Idaho. They soon made a name for themselves on hydrology projects, especially dams. Another company milestone was the construction of Hoover Dam. The scale of the project led to the incorporation of Morrison-Knudson Company, Inc. in 1932. By the 1950s the company had become so large it began to develop specialized subsidiaries, including IEC (Funding Universe n.d.). On June 1, 1966, construction of New Bullards Bar Dam began under the management of the Perini-Yuba Associates construction team. Perini-Yuba Associates hired approximately 3,000 workers, including several local firms: The Perini-portion of Yuba-Perini was Perini Corporation of Framingham, Massachusetts, founded in 1892 by Italian immigrant, and stonemason, Bonfiglio Perini. During the 1960s the company was under the management of Bonfiglio's son Louis. Perini Corporation had made a name for itself building landmark structures including the Prudential Center, the tallest building outside New York when it was completed. As a side note, Louis Perini was posthumously honored by the USACE Historical Foundation as "one of the top contractors in engineering and construction industry" (Funding Universe n.d.). Also involved were H. Earl Parker, Baldwin Contracting Co. and Tenco. Parker was a local contractor based in Marysville. His company was involved mostly in roadwork, and did some work cutting and grading for the penstock (Earle H. Parker, Jr., personal communication 2013). For more than 2 years, teams of men worked 24 hours per day to complete construction of the dam and related facilities (YCWA n.d.). IEC civil engineer G.S. Sarkaria designed the YRDP facilities; however, he did not gain recognition in the construction of these resources or others in the United States.

After several more years of planning and negotiation, the YCWA reached an agreement with PG&E (along with the contractor and engineer) to jointly purchase sufficient Series B subordinate lien revenue bonds to close the actual funding gap at completion of construction. The revised plan eliminated the proposed New Bullards Bar Power Plant, and proposed replacing the old PG&E Colgate Power Plant and tunnel with larger facilities. To save additional money, an irrigation diversion dam and canals, the New Narrows afterbay, and other project amenities were eliminated (YCWA n.d.). Irrigation diversions and the canals would be left for a later stage of construction.

By late 1969, workers completed construction on New Bullards Bar Dam and water was being stored in the new reservoir. In early 1970, workers completed the New Colgate Powerhouse and began trial tests to produce electricity. Workers installed two 18-foot Pelton water wheels in the powerhouse, which are among the largest in the world (YCWA 1996). The Pelton wheel was one of several different types used in California, where low-head turbines were not practical as they operated on high volumes of water. Because of California's hydrographic setting, the high volumes of water necessary to operate low-head turbines were not present (JRP and Caltrans 2000:51). After traveling through the penstock, a spigot directs water at the wheel, which is attached to a generator. One benefit of this design is its wide range of applications, as the wheels can be made in any size to generate power through the application of very small to very large amounts of water (Hubbard 2007:20–25). Within a month, cracks in the stainless-steel runner resulted in the need to shut down the number 2 unit. Crews working 24 hours per day made the repairs, and within 3 weeks, the powerhouse was once again in use. On June 30, 1970, YCWA's construction of the YRDP was complete, and New Bullards Bar Reservoir was opened to the public (Mountain Messenger 1970).

2.2.3.3 Logging Industry

In 1844, lumbering in the Sierra Nevada was initiated by John Sutter, a Swiss immigrant and the first European-American to establish a settlement in California's Central Valley. The need for building materials and milled lumber spurred the rapid establishment of many logging and milling sites, including an early water-powered mill at Coloma, California. Shortly thereafter, gold was found at Coloma, greatly adding to the demand for milled lumber. Mining operations and camps required lumber for flumes, wing dams and ditches, rockers, sluices, tunnels, mills, and towns. This growth in both population and the lumbering industry continued through the 1850s.

By the late 1860s, mining activity related to the gold rush had waned as did the market for lumber. The small communities that had been established in the Sierra Nevada region could not absorb current production levels, creating stockpiles of unused product. Logging railroads were established in the 1870s that allowed the excess timber to be shipped to large cities outside of the region and eventually to foreign markets from major shipping ports (McDonald and Lahore 1984:19–20).

Logging operations changed as technology evolved. Early loggers used horses and oxen with skids to haul logs to a small milling site, shipping the lumber by wagon to market. Eventually, these small-scale operations began to expand with the introduction of steam engines, electricity, and narrow-gauge railroads. Some railroads were temporary and remained in place only long enough to log the area and were then moved to new areas for continued use. Others became mainlines that hauled logs to mill towns for processing. By the 1930s, technology shifted again to tractor skidding and truck logging, and was occasionally supplemented by railroads to deliver the timber to market. With improved transportation, more distant markets proved far more profitable. During World War II, many planing mills and factories were converted for military use and commercial production greatly decreased. After the war, increased housing demands led to a major boom in the lumber market.

Operations like the Sierra Mountain Mills (Figure 2.2-3.) in Celestial Valley, south of Camptonville, and within the areas newly added to the APE, were economically viable. According to the current landowner, Nick Whittlesey, the mill was originally established by Al Nutting in 1953 and operated until the mid-1990s (personal communication). However, post-war growth could not be sustained and pressure from foreign markets as well as advancements in building technologies led to a lumber recession in the 1970s that many smaller mills were unable to recover from (PAR 2011).

Figure 2.2-3 Sierra Mountain Mills aerial photo from the 1950s or 1960s with a southwest view.
Source: Nick and Cathy Whittlesey

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3.0 METHODS

This section follows the Secretary of the Interior's Guidelines for Identification (United States Department of Interior [USDOI] 1983), which specifies that a research design include: (1) objectives of the identification activities, (2) methods to be used to obtain the information, and (3) the expected results and the reason for those expected results. The research design presented here also incorporates, as appropriate, the *Guidelines for Archaeological Research Designs* (Office of Historic Preservation [OHP] 1991).

3.1 Objectives

The objectives of this cultural resources investigation are to (1) identify cultural resources within the newly added areas of the APE, (2) assess Plan implementation-related effects on those resources, (3) evaluate for potential listing on the NRHP and the CRHR any resources that will potentially be affected by the Plan if possible at this investigative level, (4) determine if Plan implementation-related effects to any identified NRHP and CRHR eligible resources are adverse, and (5) provide management recommendations for each cultural resource identified, that may include treatment measures to mitigate adverse effects, if identified. The investigation goal is to help meet the requirements of CEQA and Section 106, as specified in Section 1.2, above. Information gathered to fulfill the investigation objectives includes locational data, a description to characterize any resource in the newly added areas of the APE, including an assessment of each resource's condition and integrity, and background information to understand each identified resource's historical context. The APE, including areas newly added to the APE, is defined in detail in Section 1.3.

3.2 Background Research

A records search and archival research were performed to gather pertinent and reasonably available information regarding cultural resources. Archival research was performed during previous investigations related to the YRDP and conducted for YCWA by HDR (Ramsey Ford et al. 2014 and Ramsey Ford 2014). This previous data was reviewed and assessed for the present investigation. The previous archival research was performed at several data repositories, including offices with the Plumas National Forest and TNF; the Yuba County Library California Room in Marysville; the Doris Foley Library for Historical Research in Nevada City; the California State Library, Sacramento; the Center for Sacramento History in Sacramento; the Firehouse Museum in Nevada City; the Special Collections Room of the Meriam Library; the Camptonville Historical Society; the USACE's office in Sacramento; as well as files maintained in the YCWA archives. The previous archival research was supplemented with additional research conducted online and through HDR's in-house library for the specific areas newly added to the APE. The archival research consisted of acquiring background information pertinent to understanding the prehistoric, historic, and ethnohistoric/ethnographic contexts for the APE and vicinity. Local, state, and online repositories were visited for this effort. The prehistoric and historic contexts prepared as a result of the archival research are presented in Section 2.2, above. The results of the archival research served as the basis for preparing the prehistoric and historic contexts against which archaeological and historic-era properties are evaluated.

In addition to the archival research, a record search was conducted during July 2018 and March 2019 at the North Central Information Center (NCIC) and during March 2019 at the Northeast Information Center (NEIC). Both centers are part of the California Historical Resources Information System (CHRIS). Information investigated for this effort included previously conducted cultural resources investigations, previously recorded cultural resources, and potential historic-era resources as identified on historic maps. The area investigated for the record search included the areas newly added to the APE and a 0.25-mile buffer around these areas to assure adequate coverage. In addition to the NCIC and NEIC records search, inquiries were made with the TNF in July 2018 and March 2019 for the same areas (i.e., areas newly added to the APE and a 0.25-mile buffer around these areas) for the same type of information. The results of the records search are presented in Section 4.1.

3.3 Tribal and Agency Consultation

As specified under 36 CFR Part 800.16(f): "*Consultation* means the process of seeking, discussing, and considering the views of other participants and where feasible, seeking agreement with them regarding matters arising in the section 106 process." Section 106 requires that the lead federal agency responsible for complying with Section 106 seek concurrence from the SHPO on any determinations of NRHP eligibility and findings of effect to historic properties, and allow the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on any finding of adverse effects. Section 106 also requires that the lead federal agency consult with interested Native American tribes that might attach religious or cultural significance to resources within the APE. All consultation efforts are captured in Appendix C.

On January 16, 2019, FERC designated YCWA as its non-federal representative for purposes of Section 106 consultation as related to the Plan. As FERC's non-federal representative, YCWA has consulted with potentially affected tribes, agencies, and SHPO regarding the Plan, including obtaining SHPO's concurrence on the APE.

As required under Section 106 (36 CFR Part 800.4[a][1]), maps depicting the updated APE were submitted to the SHPO in a letter dated July 23, 2019 for formal review, comment, and concurrence. By letter dated August 26, 2019 SHPO concurred with YCWA's proposed APE. Copies of these letters are provided in Appendix C, which includes a consultation log and consultation letters for all tribal and agency consultation, including SHPO consultation.

In support of consultation under Section 106 and pursuant to PRC 21080.3.1, consultation efforts with Native American tribal contacts have been incorporated in the cultural resources investigation of the newly added areas of the APE. In support of consultation under Section 106 and PRC 21080.3.1(c) and in response to modifications to the Plan, HDR contacted the Native American Heritage Commission (NAHC) on August 27, 2018 and March 18, 2019 to request a list of Native American tribes and organizations that may have an interest in the Plan, as well as to request a search of the Sacred Lands File (SLF). The NAHC provided responses on August 29, 2018 and March 22, 2019, respectively, providing a list of tribes that have cultural and traditional affiliation to the areas newly added to the APE. Both requests for searches of the SLF were negative for results, however the NAHC informed YCWA that the area is sensitive for cultural resources. Per PRC 21080.3.1(b)(1), the Shingle Springs Rancheria and the United Auburn Indian Community have provided YCWA with formal requests to be notified of YCWA's CEQA projects. The tribal chairpersons and designated tribal representatives presently included in the list of contacts for consultation efforts for this cultural resources investigation are provided below in Table 3.3-1.

Table 3.3-1. Tribal contacts for consultation regarding Plan Implementation.

Tribe	Primary tribal contact
Concow Maidu Tribe of Mooretown Rancheria	Guy Taylor, Director, Environmental Protection Office
Enterprise Rancheria of Maidu Indians	Glenda Nelson, Chairperson
Greenville Rancheria of Maidu Indians	Kyle Self, Chairperson
KonKow Valley Band of Maidu	Wallace Clark-Wilson, Chairperson
Mechoopda Indian Tribe of Chico Rancheria	Dennis Ramirez, Chairperson
Nevada City Rancheria	Richard Johnson, Chairperson Shelly Covert, Secretary
Pakan-Yani Band of Strawberry Valley Rancheria	Cathy Bishop, Chairperson
Shingle Springs Rancheria	Regina Cuellar, Chairwoman
Tsi-Akim Maidu	Don Ryberg, Chairperson Grayson Coney, Cultural Director
United Auburn Indian Community	Gene Whitehouse, Chairperson Melodi McAdams, Cultural Resources Supervisor
Washoe Tribe of Nevada and California	Darrel Cruz, Tribal Historic Preservation Officer

Consultation efforts with Native American tribal contacts for the current cultural resources investigation have included letter notifications and invitations to consult sent on December 12, 2018 and July 23, 2019, as well as phone calls to all contacts on March 27, 2019 to invite them to participate in the upcoming field efforts.

The Greenville Rancheria provided a response letter dated December 27, 2018 and stated that it has no comments or objections with the Plan improvements. The UAIC also responded to the notice for consultation in a letter dated December 27, 2018 expressing that UAIC would like to consult on the project, would like to receive copies of any archaeological reports that are completed for the project as well as environmental documents for the project so that they have the opportunity to comment on appropriate identification, assessment and mitigation related to cultural resources. The UAIC also requests and recommends that UAIC tribal representatives observe and participate in all cultural resource surveys. Cherilyn Neider, Administrative Assistant for the Tribal Historic Preservation Office for UAIC, also emailed YCWA requesting consultation for the proposed project, all existing cultural resource assessments, copies of requests for and results of records searches, and the GIS shapefiles for the APE. On behalf of YCWA, Danielle Risse with HDR responded to Ms. Neider to let her know that as requested, YCWA will continue to consult with the UAIC on the Plan updates and that YCWA will submit the cultural assessment materials to the UAIC for the Plan updates when they are completed, including a summary of the records search undertaken for the project. However, per HDR's signed agreement with the California Historic Resources Information System, HDR cannot provide other entities copies of the original materials received from the information system. Ms. Risse provided the APE shapefiles to Ms. Neider via email shortly thereafter.

Per UAIC's request to participate in all cultural resource surveys, HDR invited UAIC and all of the tribal participants to participate in the 2018 and 2019 fieldwork[9] via emails and phone calls. No tribal participants attended the fieldwork; notes on the consultation efforts for arranging fieldwork participation are captured in Appendix C.

Native American tribal contacts were also provided copies of the present report for 30-day review and comment on November 1, 2019. The UAIC provided a response letter dated December 10, 2019 saying the project is not likely to affect resources of importance to the UAIC and requested to continue to receive documents related to the project in order to have the opportunity to comment. No consultation efforts to date have identified TCRs that are eligible for inclusion on the CRHR, though it has been made clear by Native American tribal contacts that the general vicinity of the APE, along with the APE itself, have been used and occupied by Native Americans over a long period and the area is important to Native American groups today.

The TNF was also contacted for background materials as identified in Section 3.2, and permission was requested by HDR and granted by TNF to conduct archaeological investigations on TNF managed lands prior to conducting the fieldwork on TNF lands in March 2018. The TNF was also provided a copy of this report on November 1, 2019 for review and comment. All comments have been addressed in this report. Comments and responses to comments from the TNF are included in Appendix D.

3.4 Field Surveys and Identification of Resources

Original areas of the APE were surveyed and reported on in 2014 (Ramsey Ford 2014). For purposes of this investigation, surveys took place in October 2018, April 2019, and August 2019 to examine all accessible lands within the newly added areas of the APE to identify and record previously unknown cultural resources within those areas only, to verify locations of any previously recorded cultural resources, and to assess the current condition of all resources encountered. Lands surveyed included private lands and lands administered by the TNF (see Table 3.4-1). As described in the section above, TNF provided permissions prior to the field survey of these lands. Field crews were supervised by qualified professionals, as defined in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (USDOI 1983), as described in Section 1.4.

Table 3.4-1. Land ownership for areas newly added to the APE.

APE location	Acres privately owned	Acres on TNF lands	Total
Celestial Valley Off-Site Re-Vegetation Mitigation Location	0.4	0.6	1
Celestial Valley Spoils Pile Locations	12	0	12
Grizzly Gulch	80	0	80
TOTAL	92.4	0.6	93

The intensive survey consisted of archaeologists walking parallel transects at intervals less than 15 meters apart. Topographical features encountered in such areas and considered to be sensitive for cultural resources (i.e., springs and drainages) were closely inspected. Survey results were

[9] Tribal participants were not invited to attend the August 2019 fieldwork at the proposed Grizzly Gulch sediment disposal site because the current land owner of that parcel did not want entities, other than YCWA and YCWA's contractors, to enter their property.

documented in field notes, digital photographs, and feature drawings and the finds were plotted onto the relevant USGS, 7.5-minute topographic quadrangle maps. Sub-meter accuracy Global Positioning System (GPS) points were taken to record features and specific site locations.

Sites were fully documented on California DPR forms 523A–523L, following the procedures outlined in *Instructions for Recording Historical Resources* (OHP 1995). The locations of all previously recorded and newly identified sites and associated features were recorded using a Trimble handheld, sub-meter GPS unit, and the data were uploaded into a GIS database. Digital photographs were taken of each site and include the environmental setting, artifacts, and cultural features. All artifacts encountered during the archaeological investigations were examined and left in place; no artifacts were collected. Photographs and GPS data were recorded and compiled onto log sheets. GIS data were also used to generate site sketch maps for the DPR forms. Photographic records, digital photographs, and GIS data are on file at HDR's office in Sacramento, California.

3.5 Framework for National Register of Historic Places Evaluations

One purpose of this investigation is to assist the lead federal agency in meeting its compliance requirements under Section 106, as amended. To this end, the objectives are to (1) identify cultural resources within the newly added areas of the APE and evaluate their eligibility for listing on the NRHP and (2) assess adverse effects that implementation of the Plan might have on historic properties. The methods used to evaluate NRHP eligibility in the present report are presented below.

3.5.1 National Register of Historic Places Criteria for Evaluation

The NRHP is the inventory of the nation's significant cultural resources, the significance for which is determined through a resource's integrity, its association with an important historic context, and through assessment against the NRHP criteria for evaluation. This section and the following sections describe how a resource is determined to be significant and found to be eligible for inclusion on the NRHP.

> For a property to qualify for the National Register it must meet one of the National Register Criteria for Evaluation by:
>
> - Being associated with an important historic context and
> - Retaining historic integrity of those features necessary to convey its significance (USDOI 2006:3).
>
> The significance of a historic property can be judged and explained only when it is evaluated within its historic context. Historic contexts are those patterns or trends in history by which a specific occurrence, property, or site is understood and its meaning (and ultimately its significance) within history or prehistory is made clear (USDOI 2006:7).

3.5.1.1 Significance

In the context of a federal undertaking, the significance of cultural resources is evaluated with respect to the NRHP eligibility criteria (Moratto 2009:23–25). The NRHP criteria for evaluating a "district, site, building, structure, or object," as defined at 36 CFR Part 60.4, states that

> the quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:
>
> A. that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. that are associated with the lives of persons significant in our past; or
>
> C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D. that have yielded, or may be likely to yield, information important in prehistory or history (USDOI 1997:2).

These four criteria are essential for identifying and managing historic properties because they "indicate what properties should be considered for protection from destruction or impairment" (36 CFR Part 60.2). Any action, as part of an undertaking, that could affect an NRHP-listed or -eligible property is subject to review and comment under Section 106. In pragmatic terms, properties listed or eligible for listing on the NRHP must be considered and treated in accordance with the ACHP regulations (36 CFR Part 800) and any applicable Programmatic Agreements. Ineligible cultural resources normally do not require special treatment beyond identification and evaluation unless they possess qualities identified by the National Environmental Policy Act (NEPA) of 1969, as amended, or other state or federal law(s) (Moratto 2009:23).

Eligibility under Criterion "A" (36 CFR Part 60.4[a])

To qualify under NRHP Criterion "A" a property can be associated with either (or both) of two kinds of events:

- A specific event marking an important moment in American prehistory or history and
- A pattern of events or a historic trend that made a significant contribution to the development of a community, the State, or the nation (USDOI 2006:12).

Eligibility under Criterion "B" (36 CFR Part 60.4[b])

Under Criterion "B" a property is deemed NRHP-eligible if it is unequivocally associated with the life of an identified individual whose activities:

> are demonstrably important within a local, State, or national historic context. The criterion is generally restricted to those properties that illustrate (rather than commemorate) a person's important achievements (USDOI 2006:14).

Eligibility under Criterion "C" (36 CFR Part 60.4[c])

A property is NRHP-eligible under Criterion "C" if it is significant for its "physical design or construction, including such elements as architecture, landscape architecture, engineering, and artwork" (USDOI 2006:17). In addition, the property must meet at least one of the four requirements (e.g., represent the work of a master, possess high artistic values, etc.) specified in 36 CFR 60.4(c).

Eligibility under Criterion "D" (36 CFR Part 60.4[d])

Eligibility under Criterion "D" has two requirements that must *both* be met for a property to qualify:

- The property must have, or have had, information to contribute to our understanding of human history or prehistory
- The information must be considered important

Under the first requirement, a property is eligible if it has been demonstrated to contain data and also retains additional data potential. A property is also eligible if it has not yet yielded information but, through testing or research, is determined a likely source of those data.

Under the second requirement, the information must be carefully evaluated within an appropriate context to determine its importance. Information is considered to be "important" when it is shown to have a significant bearing on a research design that addresses such areas as (1) current data gaps or alternative theories that challenge existing ones or (2) priority areas identified under a state or federal agency management plan (USDOI 2006:21). Criterion "D" most commonly applies to properties "that contain or are likely to contain information on important archaeological research questions" (USDOI 2006:21).

The importance of information is measured by its relevance to identified research questions that can be addressed through study of particular kinds of data. A cultural property is thus evaluated in terms of its potential or confirmed yield of specific classes of data necessary to answer such questions.

Lastly, cultural properties less than 50 years old normally are not eligible for the NRHP:

> Properties that have achieved significance within the last 50 years may be listed in the National Register of Historic Places, according to the National Register Criteria for Evaluation [USDOI 2006], only if they are of "exceptional importance," or if they are integral parts of districts that are eligible for listing in the National Register (Sherfy and Luce 1998.:1)].

3.5.1.2 Integrity

In addition to being significant with respect to one or more of the four criteria enumerated above (i.e., 36 CFR Part 60.4[a-d]), a cultural property must possess integrity to qualify for the NRHP. Seven types of integrity are defined in *National Register Bulletin* 15 (USDOI 2006):

- Location is the place where the historic property was constructed or the place where the historic event occurred;
- Design is the combination of elements that create the form, plan, space, structure, and style of a property;
- Setting is the physical environment of a historic property;
- Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property;
- Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory;
- Feeling is a property's expression of the aesthetic or historic sense of a particular period of time; and
- Association is the direct link between an important historic event or person and a historic property (USDOI 2006:44–45).

The integrity of historic properties may be classified as "retained," "impaired," or "lacking." Properties in the first class are largely undisturbed (Moratto 2009:25). Typically, retained integrity indicates original location, intact setting, and data potentials not significantly reduced by post-construction or post-depositional factors. Cultural properties with impaired integrity are disturbed (e.g., partly removed, plowed, eroded, excavated, covered, etc.) but not entirely destroyed. Their locations are original, although settings may be considerably altered. Original research values may have been diminished to some extent; nonetheless, some important data potentials may remain. Because research potentials may exist even at severely disturbed sites (Talmage et al. 1977), careful assessment of integrity is required. Finally, a property lacking integrity is one whose removal or complete destruction has eliminated the context essential for interpretation. Properties lacking integrity have lost all potential to yield important information. To qualify for the NRHP, a historic property must have retained or impaired integrity and satisfy at least one of the significance criteria (36 CFR Part 60.4[a-d]) (Moratto 2009:25).

3.6 Framework for Resource Evaluations under CEQA

In addition to meeting the compliance requirements of Section 106, another purpose of this investigation is to meet the compliance requirements of CEQA. To this end, the objectives were to (1) identify historical resources, TCRs, and unique archaeological resources and (2) assess whether implementation of the Plan will have significant impacts on historical resources, unique archaeological sites, or TCRs.

Historical resources are defined as resources listed, or determined to be eligible by the State Historical Resources Commission for listing, in the CRHR (PRC 5024.1, Title 14 CCR, Section 4850 et seq.) or local registers of historical resources (PRC 5020.1[k]), or that are any object, building, structure, site, area, place, record, or manuscript determined by a lead agency to be historically significant or significant within any part of California history.

As defined in PRC Section 21074, a TCR is a site feature, place, cultural landscape, sacred place, or object that is of cultural value to a tribe, and is either on or eligible for the CRHR or a local historic register, or the lead agency, at its discretion, chooses to treat the resource as a TCR.
“Unique archaeological resource” is a category of archaeological resources created by the CEQA statutes (CEQA Section 21083.2[g]). An archaeological resource is a unique archaeological resource if it meets any of three criteria: (1) contains information needed to answer important scientific research questions (and there is a demonstrable public interest in that information); (2) has a special and particular quality, such as being the oldest of its type or the best available example of its type; or (3) is directly associated with a scientifically recognized important prehistoric or historic event or person.

Under the CEQA Guidelines, even if a resource is not included on any local, state, or federal register, or identified in a qualifying historical resources survey, a lead agency may still determine that any resource is an historical resource for the purposes of CEQA, if there is substantial evidence supporting such a determination (CEQA Guidelines Section 15064.5(a)). A lead agency must consider a resource to be historically significant if it finds that the resource meets the criteria for listing in the CRHR. The methods used in this report to determine if resources are historical resources, TCRs, or unique archaeological sites are presented below.

3.6.1 California Register of Historical Resources Criteria

A resource that meets at least one of the eligibility criteria for inclusion in the CRHR is considered an historical resource for the purposes of CEQA. A resource is eligible for listing in the CRHR if it meets any of the following four qualifications:

1. Is associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage (Events)
2. Is associated with the lives of persons important in our past (Persons)
3. Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values (Design/Construction)

4. Has yielded, or may be likely to yield, information important in prehistory or history (Information Potential)

In addition to qualifying for listing under at least one of the CRHR criteria, a property must possess sufficient integrity to be considered eligible for the CRHR. National Park Service guidance on determining eligibility under the NRHP informs the determination of eligibility for inclusion in the CRHR. According to the *National Register Bulletin: How to Apply the National Register Criteria for Evaluation* (USDOI 2006:53), integrity is defined as “the unimpaired ability of a property to convey its historical significance.” The National Register Bulletin defines seven characteristics of integrity as follows:

- Location is the place where the historic property was constructed.
- Design is the combination of elements that create the form, plans, space, structure and style of the property.
- Setting addresses the physical environment of the historic property inclusive of the landscape and spatial relationships of the buildings.
- Materials refer to the physical elements that were combined or deposited during a particular period of time and in a particular pattern of configuration to form the historic property.
- Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history.
- Feeling is the property’s expression of the aesthetic or historic sense of a particular period of time.
- Association is the direct link between an important historic event or person and an historic property (USDOI 2006:44–45).

3.6.2 Significance

Cultural resource impacts are considered to be significant if implementation of the project considered would result in a substantial adverse change in the significance of an archaeological resource, TCRs, or a historical resource, as defined in PRC Section 21083.2 and CEQA Guidelines Section 15064.5, respectively. CEQA Guidelines Section 15064.5 defines “substantial adverse change” as physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings, such that the significance of a historical resource is materially impaired. The significance of an historical resource is materially impaired when a project has any of the following impacts:

- Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the CRHR;
- Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical resources, pursuant to section 5020.1(k) of the PRC, or its identification in an historical resources’ survey, which meets

the requirements of Section 5024.1(g) of the PRC, unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or

- Demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its eligibility for inclusion in the CRHR, as determined by a lead agency for purposes of CEQA.

Similarly, Section 15064.5 of the CEQA Guidelines notes that "a project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment." Agencies are expected to identify potentially feasible measures to mitigate significant adverse changes in the significance of a historical resource, TCRs, or unique archaeological site before they approve such projects.

3.6.2.1 Historical Resources and Unique Archaeological Resources

An archaeological resource can be significant as either a "unique" archaeological resource or an "historical resource" or both, but the process by which the resource is identified under CEQA as one or the other is distinct (CEQA Section 21083.2(g); CEQA Guidelines 15064.5[a][2]). The procedures for determining if an archaeological resource is an historical resource under CEQA are provided in the above sections. Generally, an archaeological resource is determined to be an historical resource because of its eligibility for listing to the CRHR (Criterion 4) or the NRHP (Criterion D) because of the potential scientific value of the resource, that is, it "has yielded, or may be likely to yield, information important in prehistory or history" (CEQA Guidelines Section 15064.5[a][3]). An archaeological resource may be CRHR-eligible under other evaluation criteria, such as Criterion 1, association with events that have made a significant contribution to the broad patterns of history; Criterion 2, association with the lives of historically important persons; or Criterion 3, association with the distinctive characteristics of a type, period, region, or method of construction. Appropriate treatment for archaeological properties that are CRHR-eligible under criteria other than Criterion 4 may be different from that for a resource that is significant exclusively for its scientific value.

Under CEQA, evaluation of an archaeological resource as an historical resource is privileged over the evaluation of the resource as a unique archaeological resource in that CEQA requires that "when a project will impact an archaeological site, a lead agency shall first determine whether the site is an historical resource" (CEQA Guidelines Section 15064.5[c][l]).

In requiring that a potentially affected archaeological resource be evaluated as an historical resource—that is, as an archaeological site of sufficient scientific value to be CRHR-eligible—CEQA presupposes that the published guidance of the California OHP for CEQA providers will serve as the methodological standard by which the scientific, and thus the CRHR-eligibility, of an archaeological resource is to be evaluated. As guidance for the evaluation of the scientific value of an archaeological resource, the OHP has issued two guidelines: *Archaeological Resource Management Reports* (1990) and the *Guidelines for Archaeological Research Designs (1991).*

Integrity is an essential criterion in determining if a potential resource, including an archaeological resource, is an historical resource. In terms of CEQA, "integrity" can, in part, be expressed in the requirement that an historical resource must retain "the physical characteristics that convey its historical significance" (CEQA Guidelines Section 15064.5[b]).

For an archaeological resource that is evaluated for CRHR-eligibility under evaluation Criterion 4, "has yielded or may be likely to yield information important to prehistory or history," the word "integrity" has a different meaning from how it usually applies to the built environment. For an historic building, possessing integrity means that the building retains the defining characteristics from the period of significance of the building. In archaeology, an archaeological deposit or feature may have undergone substantial physical change from the time of its deposition, but it may yet have sufficient integrity to qualify as a historical resource. The integrity test for an archaeological resource is whether the resource can yield sufficient data (in type, quantity, quality, diagnosticity) to address significant research questions. Thus, in archaeology "integrity" is often closely associated with the development of a research design that identifies the types of physical characteristics ("data needs") that must be present in the archaeological resource and its physical context to adequately address research questions appropriate to the archaeological resource.

3.6.2.2 Tribal Cultural Resources

As defined in PRC Section 21074, a TCR is a site, feature, place, cultural landscape, sacred place or object that is of cultural value to a California Native American tribe, and is either on or eligible for the CRHR or a local historic register, or the lead agency, at its discretion, chooses to treat the resource as a TCR. CEQA mandates that public agencies determine whether a project will have a significant impact on tribal cultural resources that are listed on or eligible for listing on the CRHR (i.e., a historical resource) or determined to be significant by the lead agency and to appropriately mitigate any such impacts. As described above, a TCR necessarily has value to a California Native American tribe. As such, consultation with local Native American tribes to determine what tribal cultural resources may have value to them is a necessary component of TCR identification efforts. This recognizes that "tribes may have expertise with regard to their tribal history and practices, which concern the tribal cultural resources with which they are traditionally and culturally affiliated" (California State Assembly Bill 52, Gatto 2014). Consultation efforts with California Native American tribes, pursuant to TCR identification efforts, are described above.

According to CEQA, a project may have a significant impact on the environment if it could cause a substantial adverse change in the significance of a TCR (PRC Section 21084.2). Consultation with California Native American tribes would need to take place to determine if the significance of a TCR is subject to a substantial adverse change.

4.0 RESULTS

This section includes the results of the background records search and the survey coverage of the areas newly added to the APE. Additionally, it includes a discussion of the cultural resources identified within the areas newly added to the APE, as well as an assessment of Plan implementation-related effects to the resources identified.

4.1 Background Research

As described in Section 3.2, a records search was performed at the NCIC and the NEIC. A review of historic maps covering the areas newly added to the APE was also conducted. In addition to the NCIC and NEIC records searches, inquiries were made with the TNF in July 2018 and March 2019 for previously conducted cultural resources investigations and previously recorded cultural resources located within the areas newly added to the APE and a 0.25-mile buffer around these areas. The results of the records search, for both the NCIC and NEIC, and the TNF, along with the historic map review are provided in this section.

4.1.1 Previous Cultural Resources Investigations

Seven previous cultural resources investigations have been conducted within a 0.25-mile buffer of the areas newly added to the APE (Table 4.1-1). Of these seven previous investigations, one falls within one of the areas newly added to the APE. This investigation was conducted for a timber harvesting plan and only areas with a high potential for cultural resources were surveyed for this investigation, which includes roughly one third of the APE parcel for the Grizzly Gulch spoils site. This investigation does not comply with current professional standards for archaeological field survey or documentation of cultural resources. Of the seven previous investigations, four were conducted for timber harvesting plans, two were conducted in preparation for Forest Service ecological management activities along Oregon Creek, and one was conducted for Caltrans for a rural highway analysis.

Table 4.1-1. Previous cultural resources investigations within the areas newly added to the APE and a 0.25-mile buffer around these areas

Count	Author	Year	NCIC/ NEIC/ FS report #	Report name and description	Within APE (yes/no)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Count	Author	Year	NCIC/ NEIC/ FS report #	Report name and description	Within APE (yes/no)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

4.1.2 Previously Recorded Cultural Resources

The records search identified no previously recorded cultural resources within the areas newly added to the APE. The search did identify five previously documented cultural resources within 0.25-mile of the areas newly added to the APE (Table 4.1-2). The five cultural resources consist of three historic archaeological sites [redacted] one historic period isolated find (a ditch segment), and one multicomponent archaeological site with historic mining features and a prehistoric lithic scatter. In addition to these formally recorded resources, a cultural resources investigation conducted for a timber harvesting plan (NEIC #3769), as described in the section above, identified two prehistoric sites [redacted], one of the areas newly added to the APE, that were not formally recorded. This investigation also notes historic roads and evidence of historic mining but does not identify the locations of these area, which could be within or around the Grizzly Gulch spoils pile location. None of these informally documented/noted resources are accounted for in Table 4.1-2, below.

Table 4.1-2. Previous cultural resources within areas newly added to the APE and a 0.25-mile buffer around these areas

Count	Site number (Primary no/ Trinomial no/ FS no)	Associated report authors and Year	Description	NRHP evaluation	Within APE (Yes/No)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

4.1.3 Historic Sites and Features Identified on Historic Maps

Historic-period USGS topographic maps and GLO plats were reviewed to identify locations of potential historic-era sites and features within the areas newly added to the APE and within 0.25 mile of these areas (Table 4.1-3). This resulted in the identification of more than 20 locations where unrecorded historic-era sites or features may be present within the areas newly added to the APE and 0.25-mile buffer.

Historic period maps often provide a general idea of where resources may be located, but are not necessarily translatable to today's maps and mapping standards. Because of the disparity between historic-period maps and modern maps, it is not known if physical attributes associated with the potential sites and features listed in Table 4.1-3 are accessible (i.e., not on a steep inaccessible slopes, under water, buried, and/or beneath thick vegetation), or if the remains are actually within the APE (i.e., they may have been mis-mapped). In addition, the presence of cultural features on a historic map does not confirm that the features still exist. Many historic features, such as town sites, mines, and roads, often have continued use into present times that may obliterate any historic-era remains. Further, historic features can disappear over time through natural erosion or other weathering processes. Based on the inventory of previously recorded cultural resources within the areas newly added to the APE and the 0.25-mile buffer around these areas, it appears that many of the historic features identified on the historic maps have not been formally recorded as archaeological sites.

Table 4.1-3. Potential historic-period sites within the areas newly added to the APE and 0.25-mile buffer.

Map date	Legal description/ map source	Potential historic-era cultural resources		No. of potential features within the APE
		Within the APE	Within 0.25 mile of the APE	
1861	Official Map of Yuba County, Scale Unknown	No features	No features	0
1876	T18N/R8E GLO Plat	"Old Gold Diggings", "Trail"	"Trail"	2
1887	T18N/R9E GLO Plat	"Old Gold Diggings", unimproved road	Unimproved road	2
1948	Camptonville, CA 1:24,000 USGS Topographic Quadrangle	"Tailings," improved road, unimproved road	"Porter Ranch", improved road, unimproved road, five unnamed structures	3
1950	Camptonville, CA 1:24,000 USGS Topographic Quadrangle	"Tailings," unimproved road	"Porter Ranch", improved road, unimproved road, five unnamed structures	2
1953	Nevada City, CA 1:62,500 USGS Topographic Quadrangle	"Tailings," unimproved road	"Porter Ranch", improved road, unimproved road, five unnamed structures	2
1956	Camptonville, CA 1:24,000 USGS Topographic Quadrangle	"Tailings," unimproved road	"Porter Ranch", improved road, unimproved road, five unnamed structures	2
1961	Nevada City, CA 1:62,500 USGS Topographic Quadrangle	"Tailings," unimproved road	"Porter Ranch", improved road, unimproved road, five unnamed structures	2
1963	T18N/R8E GLO Plat	Unimproved road	Improved road, and unimproved road	1

Map date	Legal description/ map source	Potential historic-era cultural resources		No. of potential features within the APE
		Within the APE	Within 0.25 mile of the APE	
1969	Camptonville, CA 1:24,000 USGS Topographic Quadrangle	“Tailings,” unimproved road	“Porter Ranch”, improved road, unimproved road, 17 unnamed structures	2

4.2 Survey Coverage

As stated in Section 3.4 above, the purpose of this investigation was to examine all accessible lands within the areas newly added to the APE, to identify and record previously unknown cultural resources within those areas, to verify locations of any previously recorded cultural resources, and to assess the current condition of all resources encountered.[10] The newly added areas to the APE were investigated through intensive pedestrian survey in October 2018, April 2019, and August 2019. Portions of these areas could not be surveyed due to dense vegetation and/or steep slopes (Table 4.2-1). A map showing the survey coverage of the newly added areas to the APE is provided in Appendix E.

Table 4.2-1. Summary of survey coverage for the areas newly added to the APE.

APE Location	Acres
Celestial Valley Off-Site Re-Vegetation Mitigation Location	**1 (0.6 TNF lands)**
Not Surveyed - too vegetated	0.6 (0.3 TNF lands)
Surveyed	0.4 (0.3 TNF lands)
Celestial Valley Spoils Pile Locations	**12**
Surveyed	12
Grizzly Gulch	**80**
Not Surveyed - too steep	5
Not Surveyed - too steep/vegetated	19
Not Surveyed - too vegetated	1
Surveyed	55
Grand Total	**93**

The October 2018 survey investigated the two spoils piles locations in Celestial Valley that, together, total roughly 12 acres and consist only of privately owned lands. Both of these survey areas lie directly east of the Oregon Creek waterway. No previously identified sites were located within the survey areas, therefore no resources were relocated or updated. [redacted] The northern Celestial Valley spoils pile survey area (Figure 4.2-1) was primarily a leveled grass field that was used in historic photos to stack felled trees (see Figure 4.2-3). A portion of the western boundary of this northern area has a 6 to 10 foot berm (Figure 4.2-2) that is sediment dredged from Our House Dam (communication with landowner Nick Whittlesey). This is the location of the sediment discussed in YCWA documents as 27,595 cubic yards of material disposed of on the Sierra Mountain Mills site in 1992 (YCWA 2018). At the time of the survey, a small portion of the northern survey area was partially inundated with water from flooding irrigation lines (communication with landowner Nick Whittlesey). Despite the water, the area was surveyed in its entirety. [redacted]

[10] Original areas of the APE were surveyed and reported on in 2014 (Ramsey Ford 2014).

[redacted]

Figure 4.2-1. Overview of the northern Celestial Valley spoils pile survey area, looking south. Photo taken 10/28/2018.

Figure 4.2-2. Crew member atop berm from Our House Dam sediment deposit, view towards north. Photo taken 10/28/2018.

The southern Celestial Valley spoils piles survey area (Figure 4.2-3) is traversed from north to south by a county road, Celestial Valley Road (P-58-3182/CA-YUB-1981H/HDR-CV-01). The area has been previously cleared and leveled for various industrial purposes associated with the abandoned millworks. Current area use includes parking vehicles and trailers, stacking materials, and three connected structures used as maintenance workshops. The southern survey area was surveyed in its entirety.

Figure 4.2-3. Overview of the southern Celestial Valley spoils pile survey area, looking northeast. Photo taken 10/28/2018.

In April 2019, field survey consisted of intensive pedestrian survey of the Celestial Valley off-site re-vegetation mitigation location of the newly added areas to the APE (see Appendix E). This location is on TNF and privately owned lands and consists of roughly 1.0 acre. The survey area is long and thin and located immediately between Celestial Valley Road and Oregon Creek. The area was densely vegetated with blackberry and poison oak (see Figure 4.2-4), obscuring approximately 95 percent of the ground surface. Only the northern end of this area could be surveyed. No previously identified sites were located within the survey area, therefore no resources were relocated or updated. No newly identified cultural resource sites were identified in this area.

Figure 4.2-4. Overview of off-site vegetation area in Celestial Valley with dense vegetation obscuring the ground (photo on the left facing 200°, photo on the right facing 305°). Photos taken 4/1/2019.

The additional sediment disposal area of the APE in Grizzly Gulch was surveyed by intensive pedestrian survey in August 2019 and consists of roughly 80 acres on privately owned lands. The area consists of several ridges, drainages, mining cuts, amorphous ground disturbance, and large piles of tailings and waste rock. Much of the area is covered with dense vegetation including pine, oak, madrone, poison oak, manzanita, and mountain misery. Dense vegetation and steep slopes prevented survey in some areas (see Figure 4.2-5), as shown in Appendix E. Approximately 70 percent of this area was surveyed. No previously identified sites were located within the survey area, therefore, no resources were relocated or updated. [redacted] This newly added area of the APE is just north of Grizzly Gulch and west of the small community of Pike, California.

Figure 4.2-5. Dense vegetation and steep slopes during survey near Grizzly Gulch.

4.3 Field Survey Results

The present field survey of the areas newly added to the APE resulted in the identification of five cultural resources: four archaeological sites and one resource with both archaeological and built environment components. This section describes each of these resources in detail. These resources are depicted on resource location maps in Appendix F and DPR 523 forms for each of these resources are provided in Appendix G.

Consultation with local Native American tribes, as described in Section 3.0, did not identify any of these resources, or any other resources, that may be potential TCRs.

4.3.1 Archaeological Sites

A total of four archaeological sites were identified within the areas newly added to the APE, all of which are newly identified (see Table 4.3-1). All four are historic-era sites and include two historic roads and two mining complexes. The rest of this section presents detailed descriptions of each archaeological site identified.

Table 4.3-1. Archaeological sites identified during the field survey within the newly added areas of the APE.

Primary Number/ Trinomial/Temporary Number	Age	Description
P-46-1993/CA-SIE-1993H/HDR-CV-03	Historic	Historic mining site [redacted]
P-46-1994/CA-SIE-1994H/HDR-CV-04	Historic	Historic mining site [redacted]
P-46-1995/CA-SIE-1995H/HDR-CV-05	Historic	Historic dirt road [redacted]
P-58-3182/CA-YUB-1981H/HDR-CV-01	Historic	Historic road [redacted]

4.3.1.1 P-46-1993 (CA-SIE-1993H, HDR-CV-03)

P-46-1993 (CA-SIE-1993H, HDR-CV-03; Figure 4.3-1) is a historic mining site on privately-owned lands, with four features: two road segments, one feature comprising hydraulic mining scars, and one feature comprising an area of earthen tailings. No artifacts were observed. [redacted] The site is being impacted by natural slope erosion and vegetation re-grown (trees are growing out of the features). Logging activities to the north may also have impacted the site, but it is hard to tell due to the thick vegetation and duff cover. The site is in poor condition. [redacted], may be associated with this early mining activity, which appears to pre-date 1876 and thus likely dates sometime between 1848 (the start of the Gold Rush) and 1876. [redacted] ike was originally settled by miners from Pike, Missouri during the late 1840s, with continued regional mining activity occurring through the early 1900s (Clark

1970:105). Prominent mines in the district include the Alaska Mine, Pleasant View Hydraulic Mine and Grizzly Gulch Mine, [redacted]

Figure 4.3-1. Overview of hydraulic mining cuts (Feature 2) of site P-46-1993; view toward 120°.

4.3.1.2 P-46-1994 (CA-SIE-1994H, HDR-CV-04)

P-46-1994 (CA-SIE-1994H, HDR-CV-04) is a large extensive placer and hard rock mining complex. [redacted] This site is located atop an east/west trending ridge and extends down the northern slope of the ridgeline towards an unnamed drainage. [redacted] ocumented features include one mine shaft, one earthen ditch-like feature, one mining pit/collapsed adit, and seven hydraulic cuts (Figure 4.3-2). In addition to these specific features, the entire area was covered with other mining cuts, amorphous ground disturbance, and large piles of tailings and waste rock (including a couple stacked rock piles). The mining cuts that were not recorded in detail vary in size from small to large, with the larger cuts similar to those recorded in detail. Those features recorded in detail are representative examples of the cuts observed and were relatively easily accessible, as much of the area is covered with dense manzanita and other vegetation. The tailings and waste rock piles general merge and surround these cuts throughout the area and vary in size from small (6 feet in diameter by 3 to 4 feet tall) to large (60 to 80 feet in diameter or long by 20 feet tall). Limited historic and early-modern refuse, primarily food and beverage containers and a couple cooking containers, was also observed at this site, though this debris appeared to be secondary discard and not associated with any sort of habitation location.

Figure 4.3-2. Overview of hydraulic mining cut (Feature 2) of site P-46-1994; view toward 350°.

A single, complete obsidian projectile point that is likely a modernly produced projectile point that can be bought in a store was also identified at P-46-1994 (CA-SIE-1994H, HDR-CV-04) (Figure 4.3-3). The projectile point was discovered next to other modern debris that has been dumped on the side of a road that traverses through the site. The determination that this projectile point is likely modern and not prehistoric is based on: (1) its location amongst other modern debris; and (2) the morphology of the artifact. The projectile point was made from a single thick primary flake with no secondary flake scaring on the ventral or dorsal surfaces. Additionally, the projectile point had very crude corner notches, along with serrated notches along both margins that exhibited little to no pressure flaking for sharpening. In fact, the notches along the margin appear to be drilled or “punched" in. Overall, the flaked stone tool manufacturing for this item is not consistent with prehistoric flaked stone tool manufacturing techniques or products.

Figure 4.3-3. Modern obsidian projectile point identified amongst other modern debris at P-46-1994.

The site is in fair condition. The site is primarily comprised of earthen features, which are being eroded by natural erosion. Also the vegetation growth is obscuring features and is undoubtedly also contributing to the erosion and wearing down of the earthen features. The use and maintenance of two roads through the site and possible logging of portions of the site are also impacting the site integrity.

The site appears to be the remains of hydraulic mining activity [redacted] that historic mining activity occurred in the vicinity of the site prior to that time. The notation on the map [redacted] indicating that the mining activity occurred sometime before 1876. There is no record of a land patent for the property and it is currently owned by Sierra Pacific Industries. Though indicated [redacted] no additional USGS maps [redacted] show any indication of prior mining activity on the property. Beginning in 1948 and into the present, maps indicate [redacted] Research on [redacted] did not find any connections to mining or development in greater Sierra County. The property is [redacted] which is known historically as a mining region within the [redacted] gold mining district, named after the town of [redacted]. The prominent mines in the district are [redacted] this site as with P-46-1993 (CA-SIE-1993H, HDR-CV-03). Based on the [redacted] it appears likely that this site was mined between 1848 and the 1870s and may have been an early hydraulic gold mining site.

[redacted] City Directory and public records research did not show any indication that anyone with the surname Garlock or Fortin has ever lived in Sierra County (Ancestry.com 2005, 2010, 2015).

The site appears to have not been in use for more than 100 years, and no additional information could be located regarding the history of the site, which likely dates between 1848 and 1870.

4.3.1.3 P-46-1995 (CA-SIE-1995H, HDR-CV-05, Camptonville Road)

This site is an historic dirt road [redacted] (Figure 4.3-4). It appears to serve as a local transportation corridor between the small communities [redacted]. The road, which is still in use, appeared at the time of survey to have been recently graded. The road is a single lane wide and is in fair condition. No artifacts or features were observed in direct association with this historic road. The road continues both to the east and west of the APE. Only the portion within the APE was observed and is recorded here. This historic road appears on historic maps [redacted] also show Camptonville Road as an improved dirt road, [redacted]

Figure 4.3-4. Overview of west end of Camptonville Road. View toward 92°.

4.3.1.4 P-58-3182 (CA-YUB-1981H, HDR-CV-01, Celestial Valley Road)

P-58-3182 (CA-YUB-1981H, HDR-CV-01) is Celestial Valley Road (Figure 4.3-5), a county road, a portion of which graded and covered with gravel and a portion of which is paved with cracked asphalt. The road is still actively maintained and in current use. The site is in fair condition. [redacted]. At this time, the road appears to serve as a local transportation route used to access local residences in the area and linking these residences to the more improved transportation routes that traveled through the area, like Highway 49 [redacted] The Sierra Mountain Mills was established in 1952 and was an active lumbering and planing facility until 1994 when it closed. [redacted] The alignment of road recorded here represents [redacted] and includes earlier sections [redacted] that were in place in 1948. The latter sections where the road was realigned to access [redacted] epict mining tailings throughout Celestial Valley, [redacted]. These mine tailings are likely the result of late nineteenth century mining that is common to the area. The road, millworks and other outlier structures that have been developed most likely cleared and leveled the tailings because they are no longer visible. This assumption was verified by the current landowner, Nick Whittlesey.

Figure 4.3-5. P-58-3182, Celestial Valley Road, looking south.

4.3.2 Resource with Archaeological and Built Environment Components

One resource was identified within the areas newly added to the APE that includes both archaeological and built environment components. This resource is HDR-CV-02 and is described below.

4.3.2.1 P-58-3183 (CA-YUB-1982H, HDR-CV-02)

P-58-3183 (CA-YUB-1982H, HDR-CV-02) (Figures 4.3-6 and 4.3-7) represents the remains of the Sierra Mountain Mills, a historic lumber mill. The site is currently owned and occupied by a private land owner who primarily uses the property as a storage facility, though it appears that several mobile homes and recreational vehicles around the property may sometimes be occupied. The only components remaining of the historic lumber mill include several standing buildings and structures, and various concrete foundations and concrete pads, along with staging/work areas consisting only of flattened earthen pads cleared of vegetation. Sierra Mountain Mills is a dissolved lumber company that operated from 1952 to 1994. The buildings located on the property date to that period, except for a building cluster located at the southern end of the property that appears to date to ca. 1920 and may have been moved to the property. [redacted] The property includes 12 buildings and structures that are either abandoned or used for storage. Four features and four loci have also been delineated and documented within the site. Many vehicles and trailers, along with numerous other debris and machinery, are located on the property that are not in use.

The site is in overall poor condition. Several of the original lumber mill buildings/structures have been completely removed and the facility has been added onto over the years and maintained with modern materials. Any machinery or other materials that were once on site and related to the lumber mill have been removed and are no longer present.

The Sierra Mountain Mills property was originally acquired in 1909 by Peter Joseph Butz. [redacted] The 1910 and 1930 U.S. Census indicates that a Peter Butz was living within the TNF in Yuba County and the 1930 census specifically states that the Butz family (including wife Jennie and two sons) lived [redacted]

Thus, it appears likely that a portion of the property was being used by the Butz family from 1909 until at least 1930. The 1930 census states that Peter Butz was working at that time for the California Highway Department as a laborer (Ancestry.com 2002, 2006). The California Death index indicates that a Peter J. Butz died in Yuba County in 1934 at the age of 68 (Ancestry.com 2013). There is no record of the Butz family living on the property in the 1940 census. No residential housing is located within the Sierra Mountain Mills property surveyed for this recordation. [redacted] children of Peter and Jennie Butz, states that the family lived on a ranch in Celestial Valley and that Merle Butz worked at Sierra Mountain Mills until his retirement in 1983 (*The Union* 2007).

Figure 4.3-6. Overview of P-58-3183, Feature 1, concrete foundation remains, facing northwest.

Figure 4.3-7 Left: buildings 5 and 3, left to right, facing south; right: building 3 facing north.

Ownership of the property from ca. 1930 until 1952 is unknown. Sierra Mountain Mills was established in October 1952 by John and Margaret Casey (California Secretary of State 2017). Mill operations were taken over by John T. Casey, Jr. in 1960 after he moved to North San Juan with his wife Claire. John T. Casey, Jr. had a long career in the lumber business, including serving as president of Western Wood Products, a professional lumbering association. In the 1980s, John T. Casey, Jr. and a few other men from the mill began to sell lumber from the mill site and the venture was termed Caseywood (Duane 1999:159; The Union 2016).

The mill property includes two clusters of facilities at its southern and northern ends. The southern terminus of the property includes two buildings that were later joined into one building cluster and a large, steel truck loading hoist. The building cluster likely dates to ca. 1920 based on materials and design and the hoist to ca. 1970. The southern end of the property appears to have historically been associated with logging in the vicinity and includes an office and vehicle maintenance building. It is unknown who owned or operated the original logging endeavor and no additional buildings or structures associated with that portion of the property remain. The building cluster is not indicated on historic topographic maps and may have been moved to the property after 1952 when Sierra Mountain Mills was established. The ca. 1970 hoist correlates with expansion of lumber milling operations and would have aided in the transfer of logs for processing. A sign located on the office door reads “Frank Dial Logging.” Frank Dial Logging is located in North San Juan, California and has not been active on the property since the 1990s. It appears that the property was once used by the logging company as a transfer location and office. A mobile home is currently attached to the rear of the office building and the office building is not in active use. The hoist does not currently function (wiring has been stripped) and has not been in use since the 1990s.

Most of the buildings and structures located on the property are clustered [redacted] The cluster within the northern portion of the property dates from ca. 1953 through ca. 1990 and includes 10 buildings and structures. The northern end of the property was not developed until 1953 according to the current owner Nick Whittlesey, which is supported by historic topographic maps and aerial imagery (HistoricAerials.com 2019; USGS 1948, 1956, 1969). Of note, these same topographic maps depict mining tailings throughout Celestial Valley, [redacted]. These mine tailings are likely the result of late nineteenth century mining that is common to the area. Roads, the millworks and other outlier structures that have been developed most likely cleared and leveled the tailings because they are no longer visible. This assumption was verified by the current landowner, Nick Whittlesey. According to Mr. Whittlesey, those tailings were bulldozed and either removed or used as fill for the mill property when construction began in 1953. Only two buildings remain on the property that date to ca. 1953. The mill was added to over time with a major expansion occurring in the mid-1970s and again ca. 1990. The logging industry in Northern California was in a recession in the 1970s; however, optimism over growth and renewed logging activities triggered Sierra Mountain Mills to re-invest in construction at the facility after coming back from near total closure in 1973 (*Santa Cruz Sentinel* 1975).

By 1981 there were strong indications that the market would not be recovering to its pre-recession levels (*Santa Cruz Sentinel* 1981). The mill remained active through the 1980s and closed in 1994. At the time of closure, the sawmill was supporting 75 jobs (Pulp & Paperworkers’ Resource Council 2003).

5.0 RESOURCE EVALUATIONS

One of the goals for this cultural resources inventory is to evaluate for eligibility for inclusion on the NRHP and CRHR those cultural resources that can be evaluated at the inventory level. This section presents the NRHP/CRHR evaluations of resources identified during the inventory using the framework provided in Section 3.0, above, and is organized into two parts: one that addresses the NRHP/CRHR evaluations for archaeological resources and one that addresses the NRHP/CRHR evaluation for the resource containing archaeological and built environment components.

5.1 Archaeological Sites

As described in Section 4.0, a total of four archaeological sites were identified within the newly added areas of the APE (Table 5.2-1). All four sites identified are historic in affiliation. All four sites are evaluated as ineligible for the NRHP and CRHR as described below. Because all four of these archaeological sites are not eligible for either the NRHP or the CRHR, they are not considered to be unique archaeological resources. Detailed eligibility justifications for each resource are provided below.

Table 5.1-1. Summary of NRHP/CRHR evaluations for archaeological sites identified in the areas newly added to the APE.

Primary number/Trinomial/ Temporary number	Age	Description	NRHP/CRHR eligibility
P-46-1993/CA-SIE-1993H/ HDR-CV-03	Historic	Historic mining site [redacted]	Ineligible
P-46-1994/CA-SIE-1994H/ HDR-CV-04	Historic	Historic mining site [redacted]	Ineligible
P-46-1995/CA-SIE-1995H/ HDR-CV-05	Historic	Historic dirt road [redacted]	Ineligible
P-58-1382/CA-YUB-1981H/ HDR-CV-01	Historic	Historic road [redacted]	Ineligible

5.1.1 P-46-1993 (CA-SIE-1993H, HDR-CV-03)

Site P-46-1993 (CA-SIE-1993H, HDR-CV-03) is a historic mining site with four features consisting of two road segments, hydraulic mining scars, and earthen tailings. The site appears to represent a typical hydraulic mining site with two unremarkable dirt roads used to access the mining activity and is likely associated with early mining activity dating sometime between 1848 and 1876, based on the initial Gold Rush period and when “old” mining activity is depicted on a historic map of the area. This site could not be tied to a specific mining event or to specific persons that might be important to the history of the area. This site has no notable association with events that have made a significant contribution to the broad patterns of history and cultural heritage (Criterion 1/A), and in fact cannot be associated with any discernible historic activity other than transportation and mineral prospecting. The site also is not associated with the lives of persons significant in our past (Criterion 2/B). The site does not embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess artistic value (Criterion 3/C). In addition, the site does not represent a significant and distinguishable entity whose components may lack individual distinction. The site has not yielded, nor is likely to yield, information important in history (Criterion 4/D) given its lack of a specific historic context and limited components that appear restricted to only a few earthen features with no potential for depth.

Because this site does not meet any of the NRHP or CRHR eligibility criteria, it is evaluated as ineligible for listing in the CRHR and the NRHP.

5.1.2 P-46-1994 (CA-SIE-1994H, HDR-CV-04)

Site P-46-1994 (CA-SIE-1994H, HDR-CV-04) is an extensive placer and hard rock mining complex likely associated with the Pike gold mining district. The site includes a mine shaft, one earthen ditch-like feature, one mining pit/collapsed adit, and seven hydraulic cuts, as well as several other mining cuts, amorphous ground disturbance, and large piles of tailings and waste rock (including a couple stacked rock piles). Limited historic and early-modern refuse, primarily food and beverage containers and a couple cooking containers, was also observed at this site, though this debris appears to be secondary discard and not associated with any sort of habitation location. As with P-46-1993 (CA-SIE-1993H, HDR-CV-03), this site is likely associated with early mining activity dating sometime between 1848 and 1876, based on the initial Gold Rush period and when "old" mining activity is depicted on a historic map of the area. No mining claim or another information on this site could be located. Though this site seems relatively substantial in size, the fact that it is not well documented in the mining history of the area and was quickly abandoned, since it was identified on historic maps as "old," indicates that it likely did not have high yields or a substantial local or regional impact on the economy.

Though this site appears to be associated with the Gold Rush era, it cannot be assigned to a specific mining event during that time period or to specific person that might have been important to the mining development of the area. As such, this mining complex site does not meet the significance requirements under Criterion 1/A or Criterion 2/B for either the NRHP or the CRHR. The site components are typical of hydraulic and placer mining and hard rock mining and do not embody the distinctive characteristics of a specific type, period, or method of construction; represent the work of a master; or possess artistic value (Criterion 3/C). Finally, this site does not contain potential to further our understanding of the history of the area (Criterion 4/Criterion D), such as providing data to answer research questions related to the development of mining in the area, changing mining technologies, or living conditions of the miners.

Because this site does not meet any of the NRHP or CRHR eligibility criteria, it is evaluated as ineligible for listing in the CRHR and the NRHP.

5.1.3 P-46-1995 (CA-SIE-1995H, HDR-CV-05, Camptonville Road)

P-46-1993 (CA-SIE-1993H, HDR-CV-05) is an historic dirt road appearing on historic maps of the area as Camptonville Road as early as 1876. The road is still used and maintained, but modern grading and other maintenance activities have likely impacted the historic integrity of the road, which once likely started out as a wagon road and was later modified for automobile use. There are also warning signs for a buried cable on the north side of the recorded road segment, suggesting that the road was once disturbed to bury cable.

This road served and still serves as a local transportation route between the communities [redacted] It's construction and use does not appear to be an important event or related to an important event or person. As such, this road is not representative of any one event or person important in the history in the area. As such, this road does not meet the significance requirements under Criterion 1 or 2/Criterion A or B for either the NRHP or the CRHR.

When applying Criterion 3/C for engineering or design significance, this road is found to exhibit features typical of road construction common to the area and indistinctive and as such does not represent a unique type, period, or method of construction; represent the work of a master; or possess artistic value. Thus, this site does not meet CRHR Criterion 3 or NRHP Criterion C.

Finally, this site does not contain potential to further our understanding of the history of the area—it appears likely to contain no subsurface component, and many of these types of transportation routes already appear on historic maps of the area (Criterion 4/Criterion D).

Because this site does not meet any of the NRHP or CRHR eligibility criteria, it is evaluated as ineligible for listing in the CRHR and the NRHP.

5.1.4 P-58-3182 (CA-YUB-1981H, HDR-CV-01)

P-58-3182 (CA-YUB-1981H, HDR-CV-01) consists of an approximately 1 mile-long improved (graded and gravel covered, and paved along one portion) road. Portions of this road first appear [redacted]. At that time this road appears to have served as a local transportation route used to access local residences in the area and linking these residences to the more improved transportation routes that traveled through the area, like Highway 49 [redacted]. One section of the road was subsequently realigned to access Sierra Mountain Mills, [redacted] This realignment was likely built when the mill was established in 1952, suggesting that the entirety of this road dates between the 1940s and 1950s. P-58-3182 (CA-YUB-1981H, HDR-CV-01) is heavily used by locals and the northern half has been graded and maintained by the current land owner, while the southern half is paved. No features or artifacts were observed in association with this road segment, however, this road does travel through site P-58-3183 (CA-YUB-1982H, HDR-CV-02), which consists of the remains of Sierra Mountain Mills and was recorded separately.

This road is not representative of any one event or person important in the transportation, mining, hydroelectric development, or logging history in the area. This road was first used as a secondary transportation route for local residents of the area and later served as access to a lumber mill. As such, this road does not meet the significance requirements under Criterion 1 or 2/Criterion A or B for either the NRHP or the CRHR.

When applying Criterion 3/C for engineering or design significance, this road is found to exhibit features typical of road construction common to the area and indistinctive and as such does not represent a unique type, period, or method of construction; represent the work of a master; or possess artistic value. Thus, this site does not meet CRHR Criterion 3 or NRHP Criterion C.

Finally, this site does not contain potential to further our understanding of the history of the area —it appears likely to contain no subsurface component, and many of these types of transportation routes already appear on historic maps of the area (Criterion 4/Criterion D).

Because this site does not meet any of the NRHP or CRHR eligibility criteria, it is evaluated as ineligible for listing in the CRHR and the NRHP.

5.2 Resources with Archaeological and Built Environment Components

One resource was identified within the areas newly added to the APE that includes both archaeological and built environment components. This resource is P-58-3183 (CA-YUB-1982H, HDR-CV-02) and its NRHP/CRHR evaluation is described below.

5.2.1 P-58-3183 (CA-YUB-1982H, HDR-CV-02)

P-58-3183 (CA-YUB-1982H, HDR-CV-02) represents the remains of the Sierra Mountain Mills, a historic lumber mill. The site is currently owned and occupied by a private land owner who primarily uses the property as a storage facility, though it appears that several mobile homes and recreational vehicles around the property may sometimes be occupied. The only components remaining of the historic lumber mill include several standing buildings and structures, and various concrete foundations and concrete pads, along with staging/work areas consisting only of flattened earthen pads cleared of vegetation. Sierra Mountain Mills was established in 1952 and was an active lumbering and planing facility until 1994 when it closed and changed use. Historically, multiple buildings were located on the property that no longer remain and the property was developed over time. The oldest known building dates to ca. 1920 and was likely moved to the property ca. 1952 after the mill was established. The oldest buildings constructed for the mill date to ca. 1952 with alterations occurring in the mid-1970s and early 1990s. The property is associated with lumbering in the Sierra Nevada, as well as greater Yuba County. The mill was a significant local employer of more than 75 persons while active and had an impact in the development of nearby Camptonville. Thus, the mill and its buildings have significant association with the statewide trend of lumbering as well as local significance for its association with local industry and economic development.

Though the property has demonstrated significance for its historical associations (Criterion 1/A), its integrity has been greatly diminished, obscuring those associations. Alterations including building demolition, additions, and non-historic new construction have all compromised the integrity of the property. Historic aerial imagery and topographic maps indicate that more than a dozen buildings have been removed and no substantial mill buildings remain intact from the historic period. In addition, eight of the buildings and structures documented date from ca. 1975 to 1993. Thus, the mill property as a whole retains poor integrity of materials, workmanship, design, setting, feeling, and association, with good integrity of location. Therefore, P-58-3183

(CA-YUB-1982H, HDR-CV-02) is recommended ineligible under Criterion 1/A because of a lack of sufficient integrity.

John T. Casey, Jr., who owned and operated the mill during much of its operating life, was involved in the Camptonville/North San Juan community and he and his wife, Claire, were both active in the Empire Club for 40 years and served on many local boards and committees (*The Union* 2016). Though the Casey family was active in the community, it was not integral to the history of the area, nor was its association with the community based on its ownership and operation of the mill. As such, research did not reveal the mill to be associated with any persons significant within the context of local, regional, or statewide history, nor does it appear to represent an important or distinctive work of an individual involved in mill planning, design, or construction. The property developed over time as needed and no single individual had a significant impact on the design or significance of the property. The resource, both the built environment components and the archaeological components, also does not appear to provide any information potential to answer important research questions, such as those related to the history and development of logging in the area, or related to changes in logging technology. Therefore, P-58-3183 (CA-YUB-1982H, HDR-CV-02) is not considered to possess significance under Criterion 2/B or Criterion 4/D.

The mill property does not embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction. All of the buildings are typical designs using common industrial materials and no buildings or structures displayed unique engineering or design components. In addition, the archaeological features and overall layout of the property also do not reflect unique engineering or design elements. Thus, it does not have significance under Criterion 3/C.

Because this site does not meet any of the NRHP or CRHR eligibility criteria, it is evaluated as ineligible for listing in the CRHR and the NRHP.

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6.0 SUMMARY AND MANAGEMENT RECOMMENDATIONS

YCWA drafted the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan) to address sedimentation management at both Log Cabin Diversion Dam and Our House Diversion Dam in 2014. The Plan was filed with FERC on May 5, 2014.

As the Plan required approval from FERC prior to implementation, it is defined as a federal undertaking and therefore required compliance with Section 106. As the Plan also required approvals by state agencies, it also required compliance with CEQA. Accordingly, in 2014 HDR conducted a cultural resources investigation (Ramsey Ford 2014) on behalf of YCWA to identify any cultural resources within the APE pursuant to Section 106 and CEQA compliance. YCWA completed formal NRHP and CEQA evaluations of identified cultural resources affected or potentially affected by Plan implementation activities in consultation with appropriate tribes, federal agencies, and SHPO. YCWA concluded that the implementation of the Plan would result in no adverse effect to historic properties pursuant to the regulations at 36 CFR Part 800.5(d)(1) for Section 106 compliance and would result in a less-than-significant impact to historical resources or unique archaeological sites under the provisions of CEQA, and there was no objection by the SHPO (letter dated August 20, 2014, OHP Ref #FERC_2013_1002_001).

Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. Accordingly, YCWA is proposing several changes to the Plan, among which are the additions of two new sediment disposal sites and a re-vegetation site (see Section 1.0 for details on the Plan changes). These new sites are located outside of the previously defined APE and require an expansion of the APE and a cultural resources investigation of these areas to identify any historic properties, historical resources, unique archaeological resources, or TCRs that could be affected by the updated Plan implementation. Accordingly, YCWA contracted HDR to conduct a cultural resources investigation of the newly added areas to the Plan in partial fulfillment of Section 106 and CEQA requirements. The present report documents the efforts undertaken for this investigation and the results of this investigation.

The remainder of this section includes a summary of the cultural resources inventory documented herein, along with an assessment of effects from the updated Plan implementation and subsequent cultural resources management recommendations. This report has been submitted to tribes and agencies for review and will be submitted to SHPO for review and concurrence on the report findings. After SHPO concurrence is received, the final report and consultation materials will be filed with FERC in its privileged/confidential files.

6.1 Summary of Findings

The present investigation identified five cultural resources within the newly added areas of the APE (Table 6.1-1): four historic archaeological sites (P-46-1993, P-46-1994, P-46-1995, and P-58-3182) and one historic-era resource with both archaeological and built environment components (P-58-3183). All five of these resources are newly identified and as provided in

Section 5.0, all five have been evaluated as ineligible for inclusion on the NRHP and the CRHR and are therefore, not historic properties or historical resources. Additionally, none of these resources appear to be unique archaeological resources or TCRs.

Table 6.1-1. Summary of cultural resources identified within the areas newly added to the APE.

Primary number/ Trinomial/Temporary number	Resource Type	Description	NRHP/CRHR eligibility
P-46-1993/ CA-SIE-1993H/ HDR-CV-03	Archaeological site	Historic mining site [redacted]	Ineligible
P-46-1994/ CA-SIE-1994H/ HDR-CV-04	Archaeological site	Historic mining site [redacted]	Ineligible
P-46-1995/CA-SIE-1995H/ HDR-CV-05	Archaeological site	Historic dirt road [redacted]	Ineligible
P-58-3182/CA-YUB-1981H/ HDR-CV-01	Archaeological site	Historic road segment [redacted]	Ineligible
P-58-3183/CA-YUB-1982H/ HDR-CV-02	Archaeological and built environment resource	Historic industrial site [redacted]	Ineligible

6.2 Project Effects and Management Recommendations

This section summarizes the effects of the proposed Plan updates on historic properties, historical resources, TCRs, and unique archaeological resources and presents proposed cultural resources management recommendations, including recommendations to address inadvertent finds of previously unidentified cultural resources or human remains should such discoveries be made during Plan implementation.

6.2.1 Section 106: Assessment of Effects

In order to comply with Section 106 regulations, an assessment of any adverse effects on historic properties resulting from a federal undertaking must be completed, as required under 36 CFR § 800.5. Adverse Effects are defined as follows:

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative (36 CFR § 800.5[a][1]).

Of the five cultural resources documented for this inventory effort within the areas newly added to the APE, all five were determined to be ineligible for the NRHP. Accordingly, none of these five resources or components of resources are considered historic properties and thus the proposed Plan updates will not affect any historic properties (pending SHPO concurrence).

6.2.2 CEQA: Assessment of Impacts

CEQA considers archaeological resources to be an intrinsic part of the physical environment and, thus, requires that the potential of any project to adversely affect archaeological resources be analyzed *(*CEQA Section 21083.2). Implementation of a project could have a potentially significant impact on cultural resources if it were to cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guidelines (Section 15064.5). The present cultural resources inventory identified five archaeological resources (four historic archaeological sites consisting of two roads and two mining sites, and one resource with both archaeological and built environment components consisting of an industrial mill site) within the newly added areas for the APE. Though implementation of the Plan would likely impact several or all of these resources, none of these resources are considered unique archaeological resources that are significant, so impacting these resources would not cause a substantial adverse change in their significance. Thus, the updated Plan would result in a **less than significant** impact to archaeological resources.

The assessment of project impacts on "historical resources," as defined by CEQA Guidelines (Section 15064.5), is a two-step analysis: first, an analysis of whether a project may impact a resource that falls within the definition of "historical resource(s)" as defined under CEQA; and second, if the project is found to impact historical resources, an analysis of whether the project would cause a substantial adverse change to the resource. A project that may cause a substantial adverse change in the significance of an historical resource is one that may have significant effect on the environment (PRC Section 21084.1). The CEQA Guidelines define "substantial adverse change in the significance of an historical resource" as a "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired" (Section 15064.5[b][1]). The significance of an historic architectural resource is considered to be "materially impaired" when a project demolishes or materially alters the physical characteristics that justify the inclusion of the resource in the CRHR, or that justify the inclusion of the resource in a local register, or that justify its eligibility for inclusion in the CRHR as determined by the lead agency for the purposes of CEQA (Section 15064.5[b][2]).

As determined in Section 5.0, all five cultural resources documented for this inventory effort were determined to be ineligible for the CRHR/NRHP. Additionally, none of these resources are considered to be TCRs. Accordingly, none of these five resources are considered to be historical resources and thus Plan implementation would not cause a substantial adverse change in the physical characteristics of any historical resources and would result in a **less than significant** impact to historical resources.

6.2.3 Cultural Resources Management Recommendations

As no historic properties, historical resources, unique archaeological resources, or TCRs have been identified within the newly added areas of the APE, the implementation of the revised Plan would not adversely affect (Section 106) or significantly impact (CEQA) any of these resource types. As a result, YCWA has determined that the proposed undertaking (i.e., FERC approval of the revised Plan) will result in *no historic properties affected* pursuant to the regulations at 36 CFR Part 800.4(d)(1) and will result in a *less than significant* impact to historical resources, unique archaeological resources, and TRCs under the provisions of CEQA. Consequently, no further cultural resources management consideration prior to the implementation of the revised Plan is recommended.

However, there is always the possibility that unanticipated cultural resources will be encountered during ground-disturbing activities. In the event that unanticipated buried cultural deposits (e.g., prehistoric stone tools, grinding stones, human remains or grave goods, historic glass, bottles, foundations, cellars, privy pits, etc.), are encountered during Plan implementation, work must stop immediately at the discovery site until a professional archaeologist can determine the nature of the resources discovered and FERC and the TNF, if the find is made on TNF lands, can be notified and consulted regarding the discovery. As appropriate, the archaeologist will assist personnel in avoiding the newly discovered resources or in implementing management measures to evaluate the significance and potential eligibility of the resources for listing on the NRHP and the CRHR, as appropriate. Should previously unidentified cultural resources be discovered during the implementation of this undertaking, YCWA will follow the post-review discovery process as outlined in the regulations at 36 CFR Part 800.13 and consult with the tribes, federal agencies, and SHPO as required. It is recommended that prior to Plan implementation activities, personnel should be briefed on procedures to follow in the event that buried human remains or unanticipated cultural resources are encountered.

In accordance with Section 7050.5 of the California Health and Safety Code (CHSC), and PRC 5097.98, the discovery of human remains, if encountered during Plan implementation, requires that all work within the vicinity of the find cease immediately and a 50-foot-wide buffer surrounding the discovery be established. YCWA or its representative shall immediately notify the county coroner, FERC and the TNF, if on TNF lands. The county coroner will examine and evaluate the find. If the coroner determines that the remains are not recent and are of Native American descent, he/she will contact the Native American Heritage Commission in accordance with CHSC Section 7050.5, and PRC 5097.98, which will identify and contact the Most Likely Descendant (MLD). YCWA shall ensure that the discovery site and buffer zone are not further disturbed or damaged. For discoveries on private lands, YCWA will protect the discovery site and buffer zone until it has consulted with the land owner (if not on YCWA lands), FERC and the MLD and concluded treatment and management of the remains. For discoveries on TNF lands, the TNF is responsible for compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) and will be the responsible party to consult with the appropriate tribe and MLD, and to determine when/if the discovery site and buffer may be disturbed following the discovery. All Plan implementation personnel will be instructed that any human remains encountered are to be treated with sensitivity and respect, and their discovery and location are to be kept confidential.

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Cultural Resources Investigation for the

Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan

for the
Yuba River Development Project
(FERC Project No. 2246)
Nevada, Yuba, and Sierra Counties, California

[redacted]

Appendix A

FERC Filing of Updated Log Cabin and Our House Diversion Dams Sediment Management Plan

August 10, 2018

Via Electronic Submittal (eFile)

Kimberly D. Bose, Secretary
FEDERAL ENERGY REGULATORY COMMISSION
888 – 1st Street, N.E.
Washington, D.C. 20426-0001

Subject: Yuba River Development Project
FERC Project No. 2246 – California
Updated *Our House and Log Cabin Diversion Dams Sediment Management Plan*

Dear Secretary Bose:

This letter provides to the Federal Energy Regulatory Commission (FERC or Commission) an updated *Our House and Log Cabin Diversion Dams Sediment Management Plan* (Plan) for FERC's approval.

BACKGROUND

The Yuba County Water Agency (YCWA) is the owner and operator and holds the existing license from FERC for the Yuba River Development Project, FERC Project Number 2246 (Project). The Project is located in Yuba, Nevada and Sierra counties, California and includes Our House Diversion Dam on the Middle Yuba River and Log Cabin Diversion Dam on Oregon Creek, a tributary to the Middle Yuba River.

In a letter dated November 5, 2013, FERC directed YCWA to develop a plan for sediment management at Log Cabin Diversion Dam, and to file the plan with FERC for approval. YCWA, in collaboration with the United States Department of Agriculture, Forest Service (Forest Service), United States Department of the Interior, Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), State Water Resources Control Board (SWRCB) and other interested parties developed the *Log Cabin and Our House Diversion Dams Sediment Management Plan.* YCWA filed the Plan with FERC on May 20, 2014. FERC approved the mechanical sediment removal and emergency sediment removal portions of the Plan on September 23, 2014, and the sediment passage portions of the Plan on March 4, 2016. YCWA implemented the mechanical sediment removal portion of the Plan in October 2014 upon FERC's approval, after obtaining all necessary permits and approvals.

Section 6 of the Plan states that the Plan may be updated as needed by YCWA after consultation with the Forest Service, USFWS, CDFW, SWRCB, Central Valley Regional Water Quality Control Board (CVRWQCB) and United States Army Corps of Engineers (USACE). The section requires that YCWA file the updated Plan with FERC, including relevant documentation of coordination and consultation with the above agencies, for FERC's approval, and YCWA implement the updated Plan as approved by FERC.

UPDATED PLAN

Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during plan implementation. The substantive improvements include: 1) removal of sediment due to blockage of the dam outlets; and 2) update sediment passage triggers and implementation. YCWA, working with agencies and other interested parties, have collaboratively updated the Plan to include these improvements. The result of this collaboration is the attached updated *Log Cabin and Our House Diversion Dams Sediment Management Plan.*

CONSULTATION DOCUMENTATION

The attached updated *Log Cabin and Our House Diversion Dams Sediment Management Plan* and this transmittal letter were provided to the Forest Service, USFWS, CDFW, SWRCB, CVRWQCB, USACE and other interested parties for review and comment. As evidenced by correspondences in Attachment 2 to this letter, YCWA understands the following parties support the attached updated Plan: Forest Service, CDFW, and USFWS.

REQUEST

YCWA requests that FERC approve the attached updated *Log Cabin and Our House Diversion Dams Sediment Management Plan*, which would replace YCWA's May 2014 Plan. YCWA would implement the updated plan upon FERC approval and obtaining any agency permits and approvals to do so. YCWA will continue to implement the existing Plan until that time.

If you have any questions regarding this letter, please contact me.

Sincerely,

Curt Aikens

Curt Aikens
General Manager

Attachment 1: Updated *Our House and Log Cabin Diversion Dams Sediment Management Plan*
Attachment 2: Support for Attached Updated Plan

cc: John Aedo, FERC San Francisco
Amy Lind, Forest Service
Stephanie Millsap, USFWS
Amy Kennedy, CDFW
Philip Choy, SWRCB
Stephanie Tadlock, CVRWQCB
Doug Grothe, USACE
Robert Chase, USACE

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary of the Federal Energy Regulatory Commission in this proceeding (Yuba River Development Project, FERC Project No. 2246).

Dated in Sacramento, CA this 10th day of August 2018.

James Lynch, Senior Vice President
HDR Engineering, Inc.
Hydropower Services
2379 Gateway Oaks, Suite 200
Sacramento, CA 95833
(916) 679-8740

ATTACHMENT 1

Updated
Our House and Log Cabin Diversion Dams Sediment Management Plan

Log Cabin and Our House Diversion Dams Sediment Management Plan

Security Level: Public

Yuba River Development Project
FERC Project No. 2246

June 2018

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Attachment B	Channel Morphology Field Data Sheet
Attachment C	Geomorphology Photo Point Data Sheet
Attachment D	Suspect Invasive Species Report
Attachment E	Field Soil Moisture Test

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GLOSSARY - DEFINITION OF TERMS, ACRONYMS AND ABBREVIATIONS

Term	Definition
Cal Fish and Wildlife	California Department of Fish and Wildlife
cfs	cubic feet per second
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
DO	Dissolved Oxygen
FERC or Commission	Federal Energy Regulatory Commission
FERC Project Boundary	The area Licensee uses for normal Project operations and maintenance, and is shown on Exhibits G, J, and K of the current license.
Forest Service	United States Department of Agriculture, Forest Service
ft	foot or feet
in	inch
invert	an arch constructed in an upside-down position to provide lateral support
mi	mile
NFS	National Forest System
NTU	Nephelometric Turbidity Unit
Plan	Log Cabin and Our House Diversion Dam Sediment Management Plan
PNF	Plumas National Forest
Project	Yuba River Development Project, FERC Project No. 2246
Project Vicinity	The area surrounding the Project on the order of a United States Geological Survey 1: 24,000 topographic quadrangle.
SPCC	Spill Prevention Control and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TNF	Tahoe National Forest
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
USFWS	United States Department of Interior, Fish and Wildlife Service
valve	slide gate that controls the low level outlets at Log Cabin and Our House Diversion Dams
work	Any activities described in the Plan
YCWA	Yuba County Water Agency
yd^3	cubic yard

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SECTION 1.0

INTRODUCTION

In a letter dated November 5, 2013, the Federal Energy Regulatory Commission (FERC or Commission) directed the Yuba County Water Agency (YCWA) to develop a Plan for the permanent, long-term solution for sediment control at Log Cabin Diversion Dam, and to file the Plan with FERC for approval. This Log Cabin and Our House Diversion Dams Sediment Management Plan (Plan) provides the information required by FERC in its November 5, 2013 letter.

The Log Cabin Diversion Dam and Our House Diversion Dam are part of YCWA's Yuba River Development Project, FERC Project Number 2246 (Project). The initial license for the Project was issued by the Federal Power Commission (FERC's predecessor) to YCWA on May 16, 1963, effective on May 1, 1963. The Federal Power Commission's May 6, 1966 Order Amending License changed the license's effective date to May 1, 1966 for a term ending on April 30, 2016.

In a letter dated December 27, 2013, YCWA advised FERC that it intended to consult with the appropriate agencies and Indian tribes in the development of the Plan. Furthermore, to be proactive, besides sediment control in the Log Cabin Diversion Dam, YCWA intended to address sediment control in Our House Diversion Dam, another Project dam which has had sediment issues in the past. YCWA intended to file the Plan, including evidence of consultation, with FERC by May 1, 2014, and upon FERC's approval of the Plan, obtain the necessary agency approvals and permits to implement the Plan as soon as reasonably possible.

After consulting with agencies, YCWA filed the Plan with FERC on May 24, 2014, and FERC approved the full Plan on March 4, 2016. YCWA obtained all necessary permits and approvals to implement the Plan, and fully implemented the Plan beginning on March 4, 2016.

This June 2018 Log Cabin and Our House Diversion Dam's Sediment Management Plan (Plan) replaces the May 2014 Plan and has been developed in consultation with appropriate agencies.

The United States Department of Agriculture, Forest Service's (Forest Service) Federal Power Act Section 4(e) authority only applies in this Plan to Project Facilities on National Forest System (NFS) land. The Forest Service administers the Plumas National Forest (PNF) in conformance with the PNF Land and Resource Management Plan (USDA Forest Service 1988), as subsequently amended, and administers the Tahoe National Forest (TNF) in conformance with TNF Land and Resource Management Plan (USDA Forest Service 1990), as subsequently amended. When the TNF or PNF Forest Plan revisions occur, those revised plans will supersede the 1990 TNF and 1988 PNF plans.

1.1 Background

1.1.1 Yuba River Development Project

The Project is located in Yuba, Sierra and Nevada counties, California, on the main stems of the Yuba River, the North Yuba River and the Middle Yuba River, and on Oregon Creek, a tributary to the Middle Yuba River. Major Project Facilities, which range in elevation from 280 feet (ft) to 2,049 ft, include: 1) New Bullards Bar Dam and Reservoir; 2) Our House and Log Cabin diversion dams; 3) Lohman Ridge and Camptonville diversion tunnels; 4) New Colgate and Narrows 2 power tunnels and penstocks; 5) New Colgate, New Bullards Minimum Flow and Narrows 2 powerhouses; and 6) appurtenant facilities and features (e.g., administrative buildings, switchyards, roads, trails and gages). The existing Project does not include any aboveground open water conduits (e.g., canals or flumes) or any transmission lines.

In addition, the Project includes 16 developed recreation facilities. These include: 1) Hornswoggle Group Campground; 2) Schoolhouse Campground; 3) Dark Day Campground; 4) Cottage Creek Campground;[1] 5) Garden Point Boat-in Campground; 6) Madrone Cove Boat-in Campground; 7) Frenchy Point Boat-in Campground; 8) Dark Day Picnic Area; 9) Sunset Vista Point; 10) Dam Overlook; 11) Moran Road Day Use Area; 12) Cottage Creek Boat Launch;[2] 13) Dark Day Boat Launch, including the Overflow Parking Area; 14) Schoolhouse Trail; 15) Bullards Bar Trail; and 16) floating comfort stations.[3] All of the recreation facilities are located on NFS land, with the exception of the Dam Overlook, Cottage Creek Boat Launch and small portions of the Bullards Bar Trail, which are located on land owned by YCWA. All of the developed recreation facilities are located within the existing FERC Project Boundary, except for a few short segments of the Bullards Bar Trail to the east of the Dark Day Boat Launch. In addition, the Project includes two undeveloped recreation sites at Our House and Log Cabin diversion dams, both located on NFS land and within the existing FERC Project Boundary.

Figure 1.1-1 shows the Project Vicinity,[4] proposed Project, and proposed FERC Project Boundary.[5]

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[1] Cottage Creek Campground was burned in 2010 and has not been rebuilt. YCWA is in discussions with the United States Department of Agriculture, Forest Service (Forest Service) regarding rebuilding the burned campground.

[2] Emerald Cove Marina provides visitor services at Cottage Creek Boat Launch, including houseboat and boat rentals, boat slips and moorings, fuel and a general store. The marina is operated under a lease from YCWA by a private company.

[3] The Project recreation facilities included one campground that is no longer part of the Project. Burnt Bridge Campground was closed initially by the Forest Service in 1979 due to low use levels. FERC, in an August 19, 1993 Order, which approved YCWA's Revised Recreation Plan, directed YCWA to remove all improvements and restore the Burnt Bridge Campground to the condition it was in prior to development of the facility. YCWA consulted with the Forest Service and all that remains of Burnt Bridge Campground today is the circulation road and vehicle spurs; all other facilities were removed.

[4] For the purpose of this Plan, "Project Vicinity" refers to the area surrounding the proposed Project on the order of United States Geological Survey (USGS) 1:24,000 quadrangles.

[5] The FERC Project Boundary is the area that YCWA uses for normal Project operations and maintenance. The Boundary is shown in Exhibit G of YCWA's Amended FLA, and may be changed by FERC with cause from time to time during the term of the new license.

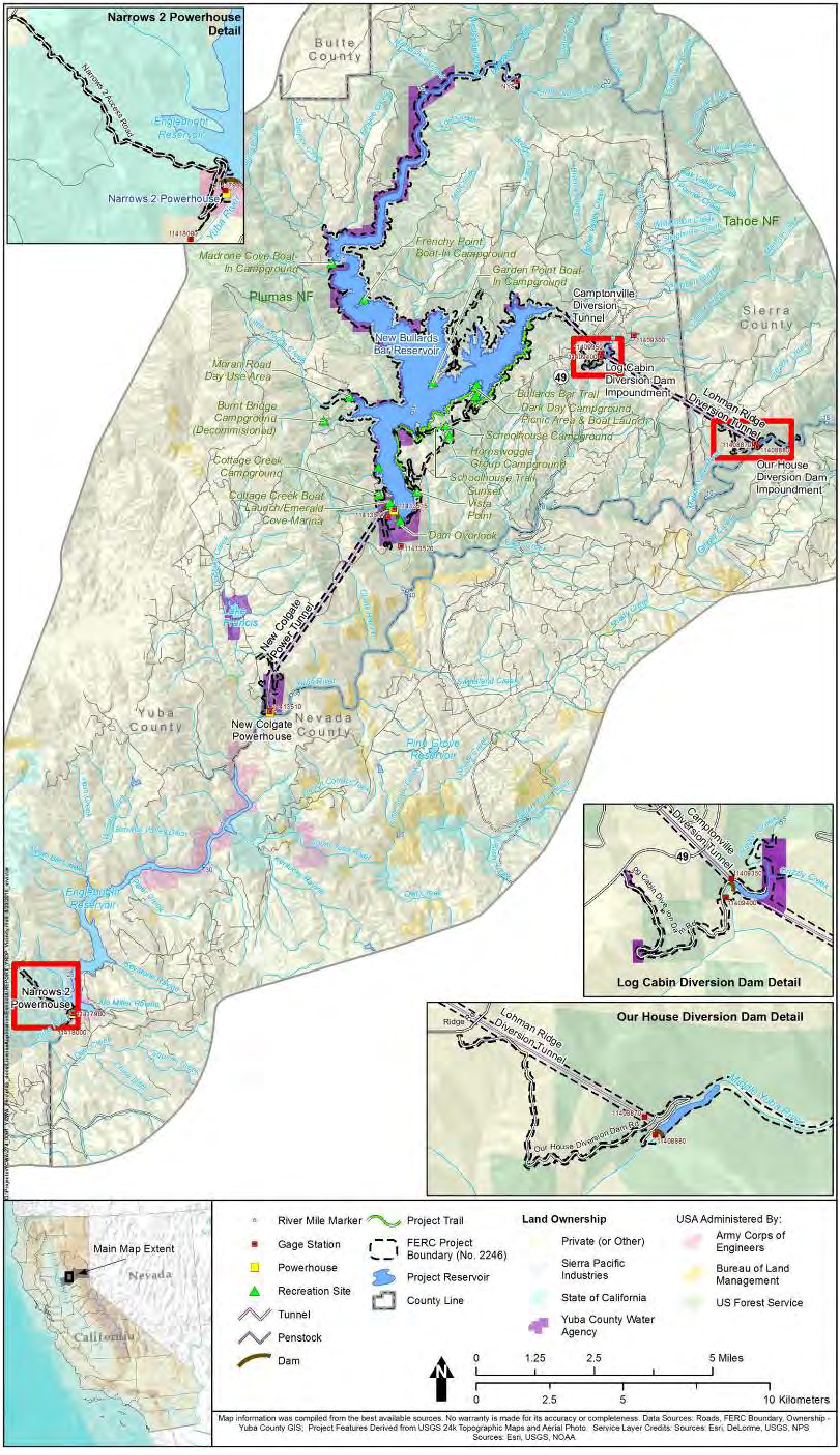

Figure 1.1-1. Yuba County Water Agency's Yuba River Development Project and Project Vicinity.

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1.2 Purpose of the Log Cabin and Our House Diversion Dams Sediment Management Plan

The purpose of this Plan is to prescribe procedures and guidelines for the management of sediment behind Log Cabin Diversion Dam and Our House Diversion Dam. The objectives of the Plan are twofold: 1) to provide for dam safety and proper functioning of Project Facilities, especially the fish release and low level outlet valves; and 2) to maintain the health of the aquatic environment downstream of the dams by allowing the passage of sediments that occur behind the dams.

YCWA will coordinate, to the extent appropriate, the efforts required under this Plan with other Project resource efforts, including implementation of other resource management plans and measures included in the FERC Project license.

1.3 Goals and Objectives of the Log Cabin and Our House Diversion Dams Sediment Management Plan

The goal of the Plan is to ensure that YCWA's management of sediment in Log Cabin Diversion Dam and Our House Diversion Dam is fully protective of facility safety, operations and environmental resources.

The objective of the Plan is to provide necessary guidelines to meet the Plan goal.

1.4 Contents of the Log Cabin and Our House Diversion Dams Sediment Management Plan

This Plan includes the following:

- Section 1.0. Introduction. This section includes introductory information, including the purpose, objectives and contents of the Plan.
- Section 2.0. Description of Log Cabin and Our House Diversion Dams. This section describes Log Cabin Diversion Dam and Our House Diversion Dam, including access to the dams, and recent sediment management activities at each dam.
- Section 3.0. Sediment Management. This section describes the methods for managing sediment, which occurs behind the dams over the course of their operation under the Project license.
- Section 4.0. Monitoring. This section describes monitoring related to the activities described in the Plan.
- Section 5.0. Best Management Practices and Permits. This section describes Best Management Practices (BMP) that will be used during mechanical sediment removal, and necessary permits to implement the Plan.

- Section 6.0. Reporting and Plan Revisions. This section describes how Plan revisions will be made.
- Section 7.0. References Cited. This section lists references cited in this Plan.

SECTION 2.0

DESCRIPTION OF LOG CABIN AND OUR HOUSE DIVERSION DAMS

This section describes the Log Cabin Diversion Dam and the Our House Diversion Dam, access to the dams, and recent sediment removal activities at each dam.

2.1 Log Cabin Diversion Dam

2.1.1 Vehicular Access

Access to Log Cabin Diversion Dam is via a gated, paved road off State Route 49, approximately 0.25 mile (mi) northeast of the intersection with Marysville Road. A gate at the intersection of Highway 49 and the access road is normally closed and locked. No other gates occur along the access road.

2.1.2 Facility Description

Log Cabin Diversion Dam, which is located on NFS land within the TNF, is a 105-ft radius, concrete arch dam located in Yuba County on Oregon Creek, 4.3 mi upstream of the confluence with the Middle Yuba River. At maximum pool, the dam can impound about 90 acre-feet (ac-ft) of water. The dam is 53 ft high with a crest length of 300 ft, a crest elevation of 1,979 ft, and a drainage area of 29.1 square miles. The dam has a spillway, a fish release outlet valve used for releasing minimum instream flow requirements in the FERC license, and a low level (5-ft diameter) outlet valve.[6] The uncontrolled spillway, with the spillway crest at elevation of 1,970 ft, is ungated and has a maximum capacity of 12,000 cubic feet per second (cfs). The fish release outlet valve has an invert elevation of 1,947.7 ft at the inlet and an engineer's estimated maximum capacity of 18 cfs, when the pool is at the invert (1,952 ft) of the Camptonville Diversion Tunnel, which diverts water from Oregon Creek, and water previously diverted from the Middle Yuba River via the Lohman Ridge Tunnel, to New Bullards Bar Reservoir on the North Yuba River. The outlet is controlled by a hand-operated, 18-inch valve on the downstream end of the outlet. The low level outlet has an invert elevation of 1,936.42 ft at the inlet, and an engineer's estimated maximum capacity of 348 cfs[7] when the pool surface elevation is at the invert of the Camptonville Diversion Tunnel. The low level outlet is controlled by a slide gate on the upstream face of the dam, which is operated by a two-person mobile gasoline powered engine.

Figures 2.1-1 and 2.1-2 show the downstream and upstream faces, respectively, of Log Cabin Diversion Dam.

---

[6] For the purpose of this Plan, the slide gate that controls the Log Cabin Diversion Dam low level (5-ft diameter) outlet is referred to as a "valve."

[7] YCWA plans to rate the Log Cabin Diversion Dam low level outlet valve as soon as reasonably possible, depending on hydrologic conditions and agency approvals.

Figure 2.1-1. View to the east of the downstream face of Log Cabin Diversion Dam. The majority of discharge shown in the photograph is through the fish release valve. The low level outlet valve is to the right of the fish release valve.

Figure 2.1-2. View to southwest of the upstream face of Log Cabin Diversion Dam. The intake for the fish release valve is marked by an "A;" the location of the intake valve stem for the low level valve is marked with a "B."

2.1.3 Typical Operations of the Dam Valves

As described above, the Log Cabin Diversion Dam fish release valve is operated continuously and adjusted manually to provide minimum streamflow downstream of the dam. The low level outlet valve, which would only be opened in case of an emergency or consistent with this Plan, is tested (i.e., rapidly opening and closing the valve) annually as required by the California Division of Safety of Dams (DSOD), who view the test every 3 years. YCWA will make a good faith effort to conduct these tests during winter or spring high flows to reduce impacts to aquatic species.

2.1.4 Past Sediment Removal

YCWA has records of sediment removals at Log Cabin Diversion Dam occurring in 1972 (approximately 40,000 cubic yards [yd^3]), 1988 (approximately 32,000 yd^3), and in 1997 (unknown amount). In 2014, YCWA returned the impoundment to near original conditions by removing approximately 11,000 yd^3 of sediment. In October 2017, YCWA removed an additional 7,440 yd^3 of sediment from the impoundment and placed at Disposal Site 1 (Section 3.4).

2.2 Our House Diversion Dam

2.2.1 Vehicular Access

Access to Our House Diversion Dam is from State Route 49 via Ridge Road (approximately 2 mi south of the intersection of State Route 49 and Marysville Road), east on Ridge Road, approximately 4.5 mi to Our House Diversion Dam Road, and south and east on Our House Diversion Dam Road, approximately 1.5 mi to the dam. Our House Diversion Dam Road is gated at the intersection with the Ridge Road and the access road and at a location on the access road about 500 ft uphill from the dam. The gate at Ridge Road is normally kept open, and the gate near the dam is normally closed and locked.

2.2.2 Facility Description

Our House Diversion Dam, which is located on NFS land within the TNF, is a 130-ft radius, double curvature, concrete arch dam straddling the border between Sierra County and Nevada County on the Middle Yuba River, 12.6 mi upstream of its confluence with the North Yuba River. At maximum pool, the dam can impound about 280 ac-ft of water. The dam is 70 ft high with a crest length of 368 ft, a crest elevation of 2,049 ft, and has a drainage area of 144.8 square miles. The dam has a spillway, a fish release outlet valve used for releasing minimum flow requirements in the existing FERC license, and a low level (5-ft diameter) outlet valve.[8] The spillway, with a spill crest elevation of 2,030 ft, is ungated and has a maximum capacity of 60,000 cfs. The fish release outlet valve has an invert elevation of 1,999 ft at the inlet, and an engineer's estimated maximum capacity of 59 cfs,[9] when the pool is at the invert (2,015 ft) of the Lohman Ridge Diversion Tunnel, which diverts water from the Middle Yuba River to Oregon Creek. The fish release outlet is controlled by a hand-operated 24-in valve on the downstream end of the outlet. The low level outlet has an invert elevation of 1,989.96 ft at the inlet and an engineer's estimated maximum capacity of 463 cfs[10] when the pool is at the invert of the Lohman Ridge Diversion Tunnel. The low level outlet is controlled by a slide gate on the upstream face of the dam, which is operated by a two-person mobile gasoline powered engine.

Figures 2.2-1 and 2.2-2 show the downstream and upstream faces, respectively, of Our House Diversion Dam.

[8] For the purpose of this Plan, the slide gate that controls the Our House Diversion Dam low level outlet is referred to as a "valve."

[9] YCWA plans to rate the Our House Diversion Dam fish release valve as soon as reasonably possible, depending on hydrologic conditions and agency approvals.

[10] YCWA plans to rate the Our House Diversion Dam low level outlet valve as soon as reasonably possible, depending on hydrologic conditions and agency approvals.

Figure 2.2-1. View to east of downstream face of Our House Diversion Dam. The majority of discharge shown in the photograph is through the fish release valve. A minor amount of gate leakage is occurring through the low level outlet valve, which is below the minimum flow release valve.

Figure 2.2-2. View to the south of upstream face of Our House Diversion Dam. The inlets for the low level valve and the fish release valve are located below the operator for the Low Level Valve, as indicated by the arrow above.

2.2.3 Typical Operations of the Dam Valves

As described above, the Our House Diversion Dam fish release valve is operated continuously and adjusted manually to provide minimum streamflow downstream of the dam. The low level outlet valve, which would only be opened in case of an emergency or consistent with this Plan, is tested (i.e., rapidly opening and closing the valve) annually, as required by the DSOD, who view the tests every 3 years. YCWA will make a good faith effort to conduct these tests during winter or spring high flows to reduce impacts to aquatic species.

2.2.4 Past Sediment Removal

YCWA has records of five sediment removal operations at Our House Diversion Dam.

In 1986, following floods in February, YCWA implemented a two-phased dredging activity at Our House Diversion Dam. Phase I dredging began sediment removal on August 1, 1986; an unquantified amount was removed and location of disposal was not specified. Necessary permits and approvals were obtained for dredging and sediment disposal. On August 20, 1986, between 7,333 and 15,000 yd^3 were estimated to have been passed downstream through the low level release valve, along with an additional unknown amount approximately one month later. YCWA discontinued sluicing in the fall of 1986, though an additional 15,000 yd^3 remained to be removed. In 1986, approximately 9,000 yd^3 were subsequently removed from the Middle Yuba River channel downstream of Our House Diversion Dam (EBASCO Environmental 1989).

In 1992, 27,595 yd^3 of sediment was excavated between August 3 and September 5. Sediments were disposed of at a site at the Sierra Mountain Mills, approximately 8 mi away from the dam (PG&E 1992). Necessary permits and approvals were obtained for dredging and sediment disposal.

In 1997, 67,894 yd^3 of sediment was excavated between September 10 and October 30. Prior to removal, sediments were tested for mercury and found to be at natural background levels. Sediments were sent to a spoil disposal site on NFS land approximately 18 mi west of Our House Diversion Dam (PG&E 1997). Necessary permits and approvals were obtained for excavation and sediment disposal.

On December 31, 2005, an intense storm event carried sediments from the upstream reaches of the Middle Yuba River that partially blocked the low level outlet, tunnel intake structure, and fish release outlet. 80,000 yd^3 of sediment were excavated between August 10 and September 15, 2006. Sediments were disposed of in an old quarry site on Marysville Road on NFS land, approximately 1 mi south of New Bullards Bar Dam (YCWA 2006). Necessary permits and approvals were obtained for excavation and sediment disposal.

During September through November 2017, and under the May 2014 version of this Plan, YCWA removed approximately 41,100 yd^3 of sediment from the impoundment and placed the sediment at Disposal Site 1 (Section 3.4).

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SECTION 3.0
SEDIMENT MANAGEMENT

Sediment management at both Log Cabin and Our House Diversion dams includes five components: 1) maintenance of minimum pools; 2) passage of sediment; 3) removal of sediment due to blockage of outlets (when needed); 4) planned mechanical removal of sediment (when needed); and 5) emergency removal of sediment. Each of these components is described below. This section also describes, for each component, some specific environmental protection measures that would be taken. Additional environmental protection measures are described in Section 4.

3.1 Maintenance of Minimum Pool at Our House Diversion Dam

Currently, YCWA attempts to maintain a pool throughout the year at Our House Diversion Dam and will continue to do so. However, YCWA is not able to operate similarly at Log Cabin Diversion Dam. As a result, at Our House Diversion Dam, much of the sediment that enters the impoundment settles at the upstream end of the impoundment, whereas at Log Cabin Diversion Dam, sediment tends to accumulate at the dam, which occasionally affects the proper operations of the low level outlet and fish release valves.

3.2 Passage of Sediment

Opening of low level outlet valves in diversion dams is an effective measure to pass sediment that otherwise would accumulate behind the dams to the river downstream of the dam. The original Operation and Maintenance Manuals for Log Cabin and Our House dams recommended that, "*sluicing should be done periodically to prevent the buildup of gravel and silt below the sill of the tunnel intake. This should be done during a period of high flow to insure [sic] efficient sluicing.*" The event is best scheduled for winter so that the high spring flows will continue to mobilize and redistribute moderate size sediment below the dam.

At Log Cabin Diversion Dam, at least once between October 1 and March 21 when mean daily natural inflow to the Log Cabin Diversion Dam impoundment is estimated to be 540 cfs (as calculated by adding the flow at the USGS streamflow gage 11409400 and the flow into the Camptonville Diversion Tunnel, and subtracting from that total the flow into the Lohman Ridge Diversion Tunnel), YCWA will fully open the low level outlet valve to allow the passage of sediment. The valve will remain open to full capacity for at least nine consecutive days. When the valve is closed, it will be closed over 2 days to gradually reduce flow and sediment as follows: YCWA will close the low-level outlet valve for one day to approximately 50 percent (by area) of the orifice opening, and by noon on the next day, YCWA will close the low-level outlet valve entirely. YCWA may close the low level outlet valve during the 9 day period if mean daily natural inflow into the impoundment, measured as described above, is estimated to be less than 540 cfs or significant reduction of flow through the valve indicates blockage. If YCWA does close the valve prematurely, it will notify the Forest Service, Cal Fish and Wildlife, and the State Water Resources

Control Board (SWRCB) within 1 business day of the reason for premature closure and of YCWA's plans for further sediment passage or actions needed to restore the valve to full functionality. During periods when the valve is open, YCWA will inspect the valve at least once a day during business hours. The valve may be opened more than once under the conditions above during the period between October 1 and March 21 to meet objectives of the Plan.

At Our House Diversion Dam, at least once between October 1 and March 21 when mean daily inflow into the Our House Diversion Dam impoundment is estimated to be 1,500 cfs (Lohman Ridge Tunnel plus downstream USGS gage 11400880) or greater, YCWA will fully open the low level outlet valve. The valve will remain open to full capacity for at least 9 consecutive days. When the valve is closed, it will be closed over 2 days to gradually reduce flow and sediment as follows: YCWA will close the low-level outlet valve for 1 day to approximately 50 percent (by area) of the orifice opening, and by noon on the next day, YCWA will close the low-level outlet valve entirely. YCWA may close the valve during the 9 day period if mean daily inflow into the impoundment is estimated to be less than 1,500 cfs or significant reduction of flow through the valve indicates blockage. If YCWA does close the valve prematurely, it will notify the Forest Service, Cal Fish and Wildlife, and the SWRCB within 1 business day describing the reason for premature closure and of YCWA's plans for further sediment passage or actions needed to restore the valve to full functionality. During periods when the valve is open, YCWA will inspect the valve at least once a day during business hours. The valve may be opened more than once under the conditions above during the period between October 1 and March 21 to meet objectives of the Plan.

3.3 Blockage of Outlets

If after October 1, YCWA determines that any one of the Our House Diversion Dam's or the Log Cabin Diversion Dam's fish release valves or low level outlet valves has been partially or fully blocked by sediment, then YCWA may take remedial actions at that valve by the following April 1 or 10 (as described below), consistent with existing permits, to return that valve to proper functioning condition.

This work could include:

- Using air and/or water nozzles to blow sediment out of the valves; and/or
- Employing a suction dredge to remove, at each dam, up to 250 yds^3 of accumulated sediment upstream of the valve. The sediment would be pumped around the dam and discharged directly to the river downstream of the dam. During these activities, YCWA would reduce flows over the spillway to ensure the safety of the divers working in the diversion pool and to maintain minimum flow requirements. Once sediment has been cleared from the outlet, YCWA would open the low level outlet to flush the outlet and distribute the deposited material further downstream. The low level outlet would then be closed gradually over the course of 4 days, with the goal of avoiding any additional sediment buildup that could clog the outlets. YCWA may close the valve completely at any time during the 4 days if YCWA anticipates the outlet is at risk of being reclogged.

All activities related to above suction-dredging (dredging and opening of the low level outlet as described above) shall be completed by April 1, unless high flows preclude safe access, in which case suction dredging may continue until no later than April 10.

3.4 Planned Mechanical Removal of Sediment

Even with the benefits of maintaining a pool in Our House impoundment and periodic opening of the low level outlet valves, it is likely that YCWA may need to remove sediment from the Our House Diversion Dam impoundment or the Log Cabin Diversion Dam impoundment, or both. In those cases, mechanical sediment removal may be necessary.

When possible, YCWA may use handwork (i.e., shovels), as opposed to mechanical removal, as a remediation method for sediment buildup in front of the valves at the diversion dams.

Planned sediment removal, when needed, will occur in summer/early fall (i.e., drier months) when inflow into the impoundment is low (i.e., inflow less than or equal to minimum instream flow requirement). If sediment removal is planned, YCWA would draw down the pool in the impoundment (Section 3.1) as low as possible immediately prior to the start of work and divert inflows around the diversion so that sediment can be excavated in the dry[11]. The water will be drained in a way to avoid a seasonal increase to instream flow downstream of the dams, such as allowing it to drain naturally through the valve or pumping it into the diversion tunnels. YCWA does not propose to suction dredge sediments in the diversion pool.

YCWA estimates that the maximum amount of sediment that would be removed at any one time from Log Cabin Diversion Dam impoundment is 40,000 yd^3 and the maximum amount of sediment that would be removed at any one time from Our House Diversion Dam impoundment is 100,000 yds^3. However, YCWA anticipates that any sediment excavation would be much less than this since the purpose of this Plan is to manage sediment in the impoundments while minimizing mechanical excavation.

If mechanical excavation is needed, it would occur in nine steps: 1) notification of appropriate agencies about planned sediment removal; 2) sediment testing for metals; 3) mobilization; 4) diversion/control of water; 5) removal of sediment; 6) stockpiling of sediment; 7) stabilization of the stockpile; 8) demobilization; and 9) issuance of a report. Each step is described below, regardless of the impoundment in which the work would occur.

All work will occur in accordance with applicable local, state, and federal regulations.

BMPs detailed in Section 4.2 will be followed during all activities associated with mechanical removal of sediment.

[11] "Excavating in the dry" means that running water will not be present when sediment is removed.

3.4.1 Notification of Agencies for Planned Sediment Removal

YCWA routinely inspects the Log Cabin Diversion Dam and Our House Diversion Dam impoundments. Though no quantification of sedimentation is done, YCWA routinely makes and notes qualitative assessments of the sediment deposit extent and levels and, in particular, any potential blockage or clogging of the fish release valve and low level outlet valve.

If YCWA determines that sedimentation in any of the impoundments warrants implementing mechanical removal, no later than 30 days prior to when the removal is scheduled to take place, YCWA will provide a written notification (i.e., may be via e-mail) to FERC, United States Army Corps of Engineers (USACE), United States Department of Interior, Fish and Wildlife Service (USFWS), Forest Service, State Water Resources Control Board (SWRCB), Central Valley Regional Water Quality Control Board (CVRWQCB) and California Department of Fish and Wildlife (Cal Fish and Wildlife) that YCWA intends to mechanically remove sediment from the impoundment. To the extent possible, the notification will provide: 1) a schedule that includes an estimated start and end date for major activities, including mobilization, clearing activities, in-channel work, fish and other aquatic species relocation, demobilization and monitoring; 2) if a water diversion and/or pumping of water will be necessary; and 3) if the work will require removal of or disturbance to any riparian vegetation. YCWA will also include: 1) reasons why mechanical removal is warranted; 2) information on the method selected for providing flows below the construction site; 3) estimates on how much excavated material will be removed; 4) if any deviations from this Plan are anticipated; and 5) results from the hazardous metal tests described in Section 3.3.2, if the results have not already been provided to the permitting agencies.

3.4.2 Sediment Testing for Metals

Prior to removing any sediment from an impoundment, YCWA will collect three to five bulk samples of the sediment to be removed from the impoundment and transport the samples to a state-certified laboratory for determination of metals[12] content. Sediments will be characterized as hazardous[13] or non-hazardous, based on the results of the sampling. Sampling and handling procedures shall be in accordance with the United States Environmental Protection Agency's *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods* (SW-846) (USEPA 2007). Sediment samples will be transferred to laboratory-quality sample containers and preserved in accordance with SW-846. Each sediment sample will be recorded and transported using an approved chain-of-custody form. The results of the testing will be forwarded to FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB and Cal Fish and Wildlife prior to any ground-disturbing activities. If sediment testing results are hazardous, additional confirmatory samples may be taken and an alternate plan for sediment stockpiling or disposal will be developed in accordance with the test results and appropriate regulations. No hazardous material will be

[12] C.C.R. Title 22 Section 66261.24 specifies the 17 metals that can qualify waste as hazardous.

[13] Soil or liquid will be characterized as Resource Conservation and Recovery Act hazardous waste, per 40 C.F.R. Parts 260 – 265, a Toxic Substances Control Act Polychlorinated Biphenyl hazardous waste, per 40 C.F.R. Part 761, or a non- Resource Conservation and Recovery Act, California hazardous waste Section 25117 of the California Health and Safety Code, pursuant to Section 25141 of the California Health and Safety Code.

removed from the impoundment until the alternate plan is in place and all necessary permits and approvals have been obtained.

3.4.3 Mobilization

Once sediment testing and agency notifications and permitting, as described in Section 4.3, have been completed, mobilization will include delivery of equipment to the site, establishing laydown areas, and creating stable pads for equipment, as needed (e.g., if YCWA plans to use a mobile crane with a clam shell on the bank). At the Our House Diversion Dam Impoundment, rock vehicle barriers may be relocated, if necessary, to allow access for sediment removal. Mobilization will also include the following, which YCWA anticipates will be developed by the contractor YCWA selects to perform the sediment removal:

- Work schedule describing start and completion dates of tasks required to complete the work
- Job site security plan describing measures that will be taken to provide adequate job site security that protects the contractor's, the Forest Service's, and YCWA's property from damage and/or theft during working and non-working hours
- Medical emergency response plan describing procedures to be followed in the event of a medical emergency and location of nearest medical facility
- Fire prevention and protection plan describing measures that will be taken to reduce the potential for fire and the procedures to be followed in the event of fire
- Hazardous materials management plan describing measures that will be taken to reduce the potential and control spills of hazardous materials
- Completion of erosion control plan (as described in the Stormwater Pollution Prevention Plan [SWPPP]) and installation of all appropriate erosion control measures in all areas that will be disturbed

3.4.4 Diversion/Control or Water

Diversion and control of water may consist of one or two methods. One approach would be to channel natural inflow into the impoundment around the planned work area and through the dam via the fish release valve or low level outlet valve, or both. The diversion would consist of installation of temporary piping to deliver the required flow of water continuously to the valve. Flow would be intercepted upstream of the planned excavation and diverted into a pipe. The pipe would be routed away from the planned excavation. The pipe would be installed in a buried trench and/or protected by steel plates to allow for movement of equipment in the impoundment without damage to the pipe.

The second approach would be pumping water around the work area. In this approach, a small temporary catchment would be constructed upstream of the work area and pumps would actively pass the water through one or more pipes routed around the outside of the work area and discharge into the stream below the dam.

3.4.5 Removal of Sediment

The amount of material to be excavated from the impoundment will vary from event to event. However, the maximum amount of sediment that YCWA estimates will be removed is 40,000 yd^3 from Log Cabin Diversion Dam and 100,000 yd^3 from Our House Diversion Dam.

The excavation will be accomplished with track-mounted excavators located within the impoundment, or with larger mobile cranes working from the access roads above the impoundments. Stable pads will be constructed for equipment working in the impoundment. Excavated sediment will be loaded into large-capacity off-road trucks, which will deliver the material to laydown areas outside the impoundments. The material, which will be clean and nonhazardous, will be temporarily (no more than 48 hours) stockpiled at the laydown area for eventual loading onto street legal trucks for hauling to the final stockpile area. After the last day of sediment removal, YCWA will have 72 business hours to clean up the laydown area, including removing the last of the sediment. Appropriate BMPs from Volume 1 of the Forest Service *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012, or latest version as appropriate; see Section 5.0 of this Plan) will be instituted to prevent erosion. During the work, the excavators and trucks will be removed from the impoundment at the end of each shift.

The laydown area for Log Cabin Diversion Dam is located adjacent to the paved dam access road, approximately 0.2-mi from the dam, and consists of a semi-cleared area (i.e., no trees, but covered with nonnative low brush and grasses). The area consists of land owned by Sierra Pacific Industries and NFS land and is within the FERC Project Boundary. The laydown area is upland, away from any water.

The laydown area for Our House Diversion Dam is located just north of the impoundment on NFS lands. The laydown area is upland, away from any water, along the Our House Diversion Dam Road and consists of a cleared area within the FERC Project Boundary.

3.4.6 Disposal of Sediment

Removed sediment will be managed and disposed of in accordance with applicable local, state, and federal regulations.

The excavated sediment will be moved from the transfer areas in the street legal trucks to a sediment disposal area on YCWA-owned land (Site 1) or private land (Site 2) property.[14] YCWA is currently working to permit the use of Site 2. Site 2 is included in the Plan at this time, assuming YCWA will obtain all applicable permits.

Disposal Site 1 is located within the FERC Project Boundary behind a locked gate. It is approximately 9 mi from Log Cabin Diversion Dam and 15 mi from Our House Diversion Dam. A 2018 land survey conducted by YCWA indicated that Site 1 could hold up to 246,000 yd^3. There

[14] Large quantities of dredged material may require the use of other areas for stockpiling. At this time, YCWA anticipates using the sites described above for sediment disposal, but may use other options in the future.

are 3 sub-areas at Disposal Site 1: A, B and C, which are pictured in Figures 3.4-1, to 3.4-5. Portions of Site 1 are vegetated, though the majority of the vegetation is non-native. Access to Disposal Site 1C would require the reopening of an old road.

Figure 3.4-1. Disposal Site 1A pre-sediment placement (2014).

Figure 3.4-2. Disposal Site 1A post-sediment placement (2018).

Figure 3.4-3. Disposal Site 1B pre-sediment placement (2014).

Figure 3.4-4. Disposal Site 1B post-sediment placement (2018).

Figure 3.4-5. Disposal Site 1C (2014).[15]

[15] Disposal Site 1C has not had any sediment placed as of May 2018.

Disposal Site 2 is on privately owned property, approximately 4.7 mi from Log Cabin Diversion Dam and 6 mi from Our House Diversion Dam, and is not within the FERC Project Boundary. A wide gravel road provides easy access into and out of the site. Within the property, a minimal dirt road would most likely need to be watered down during Project activities.

A 2018 survey conducted by YCWA estimates that approximately 50,000 yd^3 of materials can be disposed of at Site 2.

Figures 3.4-6 and 3.4-7 show Disposal Site 2.

Figure 3.4-6. Disposal Site 2 looking toward edge of property.

Figure 3.4-7. Disposal Site 2 looking toward center of site.

Figure 3.4-8 shows the location of Log Cabin Diversion Dam, and the routes that will be used to haul the sediment to Disposal Site 1 or Disposal Site 2. From the Log Cabin Diversion Dam, the haul route to the Site 1 sediment disposal location area will consist of the following: 1) an existing unimproved ramp from the impoundment up to the northern edge; 2) a gravel road along the northern edge of the impoundment to the right dam abutment; 3) a paved road, consisting of the lower portion of the dam access road to the laydown area; 4) the upper portion of the dam access road to State Route 49; 5) south on State Route 49 to Marysville Road; 6) west on Marysville Road to a point east of New Bullard Bar Dam; and 7) south on an unpaved road to the stockpile area on YCWA property. From the Log Cabin Diversion Dam, the haul route to the Site 2 sediment disposal location area will consist of the following: 1) an existing unimproved ramp from the impoundment up to the northern edge; 2) a gravel road along the northern edge of the impoundment to the right dam abutment; 3) a paved road, consisting of the dam access road, from the dam to State Route 49; 4) south on State Route 49 to Ridge Road; 5) Ridge Road to north on Celestial Valley Road; and 6) north to the end of Celestial Valley Road. For any road use on NFS land, including "existing unimproved ramp from impoundment up to the northern edge," Forest Service *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012, or latest version as appropriate) will be followed (see Attachment A).

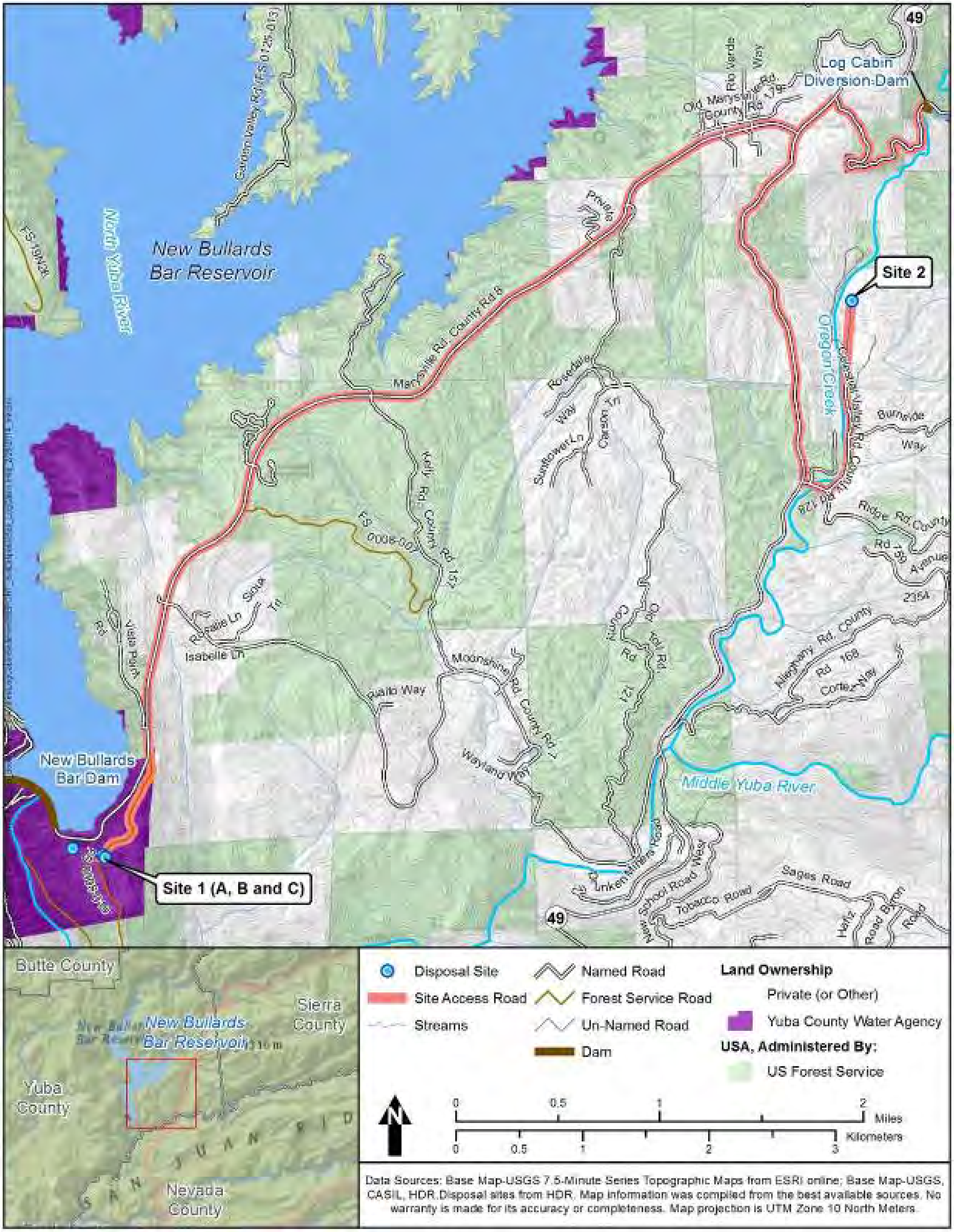

Figure 3.4-8. Location of Log Cabin Diversion Dam and haul route to Site 1 and Site 2.

Figure 3.4-9 shows the location of Our House Diversion Dam, the route that will be used to haul the sediment to Site 1, and the area where the sediment will be deposited. From the Our House Diversion Dam, the haul route to the Site 1 sediment disposal location area will consist of the following: 1) an existing unimproved, gravel ramp from the impoundment to the laydown area; 2) paved roads, consisting of Our House Dam access road, from the laydown area north of the impoundment to Ridge Road; 3) Ridge Road to State Route 49; 4) North on State Route 49 to west on Marysville Road to a point east of New Bullards Bar Dam; and 5) south on an unpaved road to the stockpile area on YCWA property. From the Our House Diversion Dam, the haul route to the Site 2 sediment disposal location area will consist of the following: 1) an existing unimproved, gravel ramp from the impoundment; 2) paved roads, consisting of Our House Dam access road, from the dam to Ridge Road; 3) Ridge Road to Celestial Valley Road; and 4) north to the end of Celestial Valley Road. For any road use on NFS land, including “existing unimproved ramp from impoundment up to the northern edge,” Forest Service *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012, or latest version as appropriate) will be followed, as appropriate (see Attachment A).

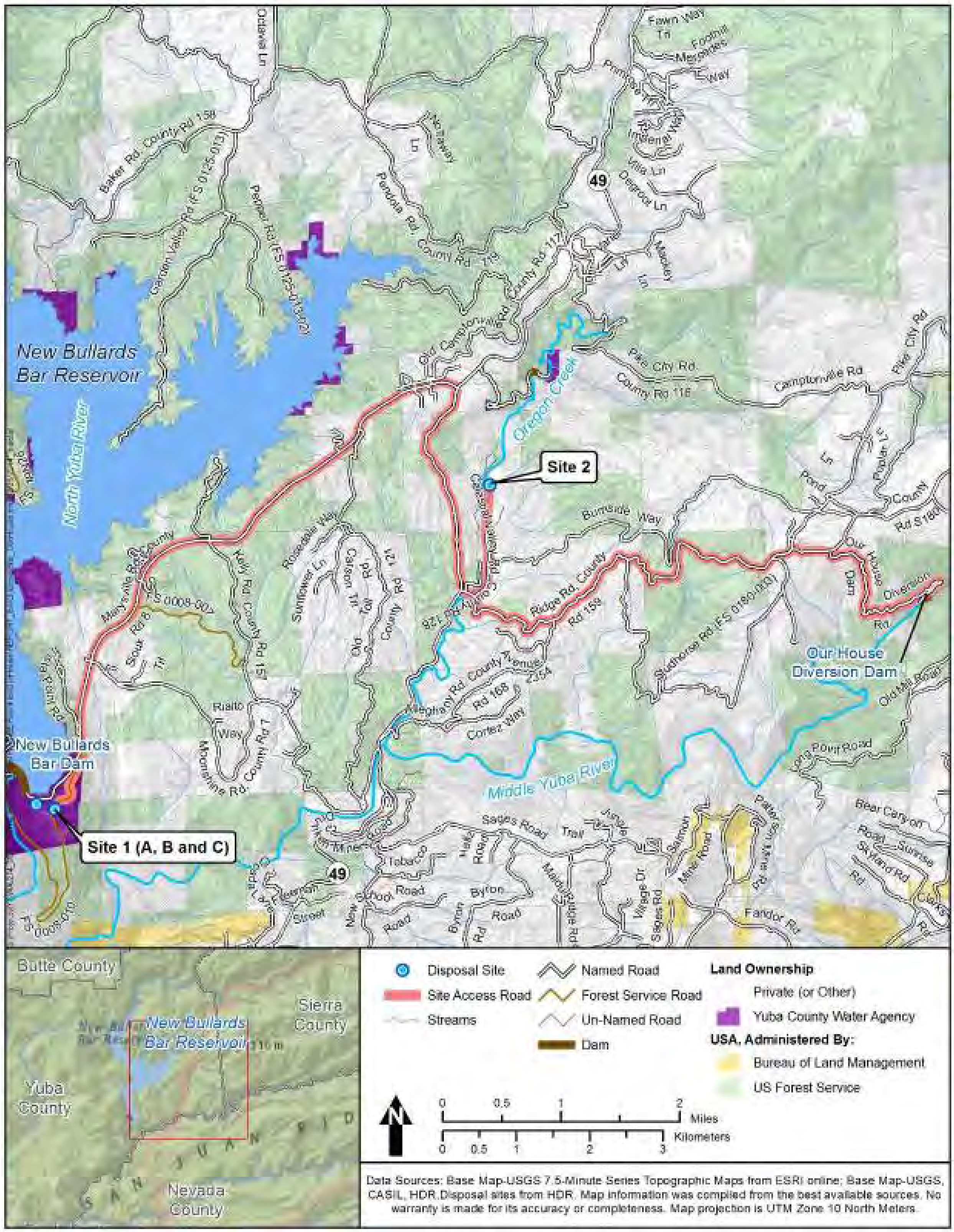

Figure 3.4-9. Location of Our House Diversion Dam and haul route to Site 1 and Site 2.

The number of round trips between the impoundment and the sediment disposal area will depend on the amount of material to be excavated. During hauling, YCWA will provide traffic control on the haul route at intersections where the haul trucks enter and leave public roads. Traffic control personnel will also be responsible for keeping the general public from getting past the diversion access road gates during work hours.

Signs will be posted during the work at the top of the access road to the impoundment, warning the general public about the work underway, associated dangers, and that they may access the site only by means other than a vehicle using caution.

3.4.7 Stockpile Stabilization

Both the Site 1 and Site 2 sediment disposal areas are generally flat with either minimal or nonnative vegetation. Access to the disposal areas is on dirt roads with adequate space for turnaround by large trucks.

The excavated material will be placed as engineered fill in accordance with generally accepted geotechnical engineering practices; it will be dumped and spread out in loose lifts not exceeding 12 inches (in.) in depth and compaction will be based on a maximum lift thickness (12 in.) and a two passes with a Cat D6 or equivalent. The need for ground surface preparation prior to material placement, such as stripping and grubbing of existing vegetation, excavation of benches into sloping ground, and subsurface and surface drainage, will be determined after the material volume is known and the specific sediment disposal area is selected for stockpiling. The final stockpile dimensions will also be dependent on the volume of material excavated. The stockpile slope inclinations will not exceed 2 to 1 (horizontal to vertical).

Silt fencing will be installed at the perimeter of the stockpile area to mitigate the potential for migration of sediment. At the completion of the stockpiling, the surface of the stockpile will be compacted and hydroseeded for long term erosion control.

3.4.8 Demobilization

Once removal of sediment is complete, the work will demobilize by removing all equipment from the site (including the laydown areas); restoring minimum flow by gravity[16] through the impoundment to the fish release valve; removing sediment control measures within the impoundment; and removing all water control (diversion) measures. Erosion control measures will be placed on all disturbed sites on the staging area and the slopes/river banks down to the water surface. The disturbed area will be returned to the agreed upon conditions (as described in Exhibit R). The erosion control will stay in place until the disturbed areas have re-vegetated sufficiently to not produce active erosion (i.e. rills and gullies) during rainstorm events.

[16] YCWA will make a good faith effort not to disrupt flow, but short periods of interruption may occur when the diversion of inflows is established and removed.

At Our House Diversion Dam Impoundment, YCWA will reinstall any rock or other vehicle barriers that were removed to allow temporary access for the work. The barriers will be restored to the same condition they were in prior to work (see Exhibit R).

YCWA will invite FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB and Cal Fish and Wildlife to inspect the work area when the work is complete.

3.5 Emergency Mechanical Removal of Sediment

In the event of the need for emergency activities,[17] YCWA will apply for and follow the terms of the appropriate permits and approvals from the responsible agencies. These may include the USACE Regional General Permit for repair and protection activities in an emergency situation, which includes a Clean Water Act (CWA) Section 401 certification as part of its parameters, or other appropriate permitting.

Pursuant to California Fish and Game Code Section 1610(a) (1) and (2), notification of lake or streambed alteration to Cal Fish and Wildlife is not necessary prior to performing: 1) immediate emergency work necessary to protect life or property; and 2) immediate emergency repairs to public service facilities necessary to maintain service as a result of a disaster in an area in which a state of emergency has been proclaimed by the Governor. Although notification is not required before beginning emergency work, notification of the emergency work must be submitted within 14 days after beginning the work (Fish and Game Code §1610(b)).

The Forest Service (TNF Yuba River District Ranger and Forest Hydroelectric Coordinator or Public Services Staff Officer) will be notified by email or phone of the emergency activities prior to beginning work and in writing within 14 business days after beginning work.

Where possible, the nature of the emergency activities, with the exception of permitting, will follow those described in this Plan, under Mechanical Removal of Sediment.

[17] Defined by the USACE (2009) and Cal Fish and Wildlife (CDFW n.d.) as "*clear, sudden, unexpected, and imminent threat to life or property demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property or essential public services*." This definition may be subject to change.

SECTION 4.0

MONITORING

4.1 Sediment in Our House and Log Cabin Diversion Dams

4.1.1 Field Methods

Monitoring in Our House and Log Cabin Diversion Dam impoundments and the pool downstream of Our House Diversion Dam will occur once between the end of spring runoff and November 1.

Three cross-sections in the Log Cabin Diversion Dam impoundment and four cross-sections in the Our House Diversion Dam impoundment that were previously established will continue to be used. YCWA will use original rebar or headpins, or GPS coordinates of headpins to measure cross-sections at each of the transects. YCWA established permanent cross-sections by monumenting ends of the cross-section with bedrock headpins or rebar. Each cross-section incorporates the width of the impoundment at full pool (i.e., up to an elevation of 2,030 ft at Our House Diversion Dam and up to an elevation of 1,970 ft at Log Cabin Diversion Dam).

YCWA will survey the bottom topography along each cross-section to a precision of ±2 to 10 centimeters (cm) using standard differential survey techniques such as a total station instrument (e.g., Harrelson et al. 1994), an acoustic Doppler current profiler (ADCP), single beam echo sounder or a combination of these. Every break in slope will form a vertical point on the graph, and what the breaks represent will be noted (e.g., top of bank, extent of right or left bank). The top of the rock elevation for bedrock within the impoundment, and the thalweg will be included. Surveyors will record positions approximately every 3 ft, being sure to capture any significant changes in slope. Where an echo sounder is used, a point will be recorded every 3 seconds along each cross-section. Bathymetric methods may be considered in the future if it is collaboratively agreed to among YCWA, the Forest Service, Cal Fish and Wildlife, USFWS, and SWRCB that the objectives for this monitoring can be met.

Additionally, sedimentation in the pool below the weir downstream of Our House Diversion Dam will be monitored via bathymetry. YCWA will use a remote controlled vessel (or small manned boat), an echosounder, and a GPS to measure water depths with precise horizontal and vertical positioning throughout the pool. Surveyors will record positions approximately every 3 ft to get an accurate record of all changes in slope.

4.1.2 Quality Assurance/Quality Control

Prior to use, each piece of equipment will be calibrated to manufacturer's recommended specifications. Any variances will be noted in the final report and recalibration or repair done as necessary.

YCWA will subject all data to quality assurance and quality control (QA/QC) procedures including, but not limited to, spot-checking data. If any datum seems inconsistent during the

QA/QC procedures, YCWA will investigate the problem. Values that are determined to be anomalous will be removed from the database if the reason for the reading cannot be identified.

For all monitoring sites, following the QA/QC review, field data will be entered into and organized in a Microsoft™ Excel spreadsheet, or a similar spreadsheet format, and will have an additional QA/QC review to assure data have been transcribed accurately.

4.1.3 Data Analysis

Data analysis will include:

- Tabular and graphical summary of each cross-section and comparison to the previous monitoring events at that cross-section for the impoundments, and tabular and graphical summary of the pool with comparison to the previous monitoring events
- A description of implementation of sediment passage events, since the last monitoring report, including periods that the low level outlet valve was opened and flows prior to, during and after the valve opening as measured at the nearest downstream flow gage

4.2 Stream Channel Morphology

4.2.1 Field Methods

Stream channel morphology monitoring will occur once between spring runoff and November.

4.2.2 Monitoring Sites

Each monitoring site will generally be 20 bankfull widths in length, but may have to be truncated slightly due to major changes in morphology (e.g., major break in slope or long, deep pool), and will have the same beginning and ending locations as that established during YCWA's relicensing Channel Morphology Upstream of Englebright Dam Study (YCWA 2013), if the monitoring site is located at the same location. Unless otherwise stated below, each monitoring site will include the flood prone zone. The flood prone zone is the width of the water level at twice the maximum bankfull. Bankfull, though difficult to define in regulated streams, uses evidence from:

1) topographic break from vertical bank to flat floodplain, 2) topographic break from steep bank to more gentle slope, 3) change in vegetation from bare to grass, from moss to grass, from grass to sage, from trees to grass, or from no trees to trees, 4) change of texture of deposited material from clay to sand, or sand to pebbles, or boulders to pebbles, 5) highest elevation below which no fine debris of needles, leaves, pine cones, or seeds occur; in some instances is the upper limit of such fine debris; and 6) change in texture (size) of fine material lodged between cobbles or rocks. This change is often from fine sand to fine gravel (Dunne and Leopold 1978).

4.2.2.1 To-Scale Study Site Map

For each monitoring site, YCWA will establish a to-scale study site map identifying locations of cross-sections, bedrock, bankfull flow, facies (i.e., areas with collections of like-particles), pools as defined below for the length and width of each monitoring site, Large Woody Material, and spawning gravel. The base map will be loaded onto a mobile device (e.g., tablet or laptop) and utilized along with data collection software that can collect features (e.g., polygons, lines, areas, points) from an external GPS source. All data will be collected with a differential GPS antenna capable of 1 meter or better accuracy.

Facies will be defined by dominant and sub-dominant particle type (e.g., boulder, cobble and gravel) according to the modified Wentworth scale. YCWA will perform a Wolman pebble count on each facies. A minimum of 100 pebbles will be measured for each facies and particles may be counted from several patches that represent the textural facies. Particles will be measured using a gravel template, also known as a gravelometer (i.e., a square grain-size template), and a particle size distribution by number, not weight, will be created. If particles cannot be lifted to pass through the gravelometer, size class will be estimated using a ruler along what is perceived as the intermediate axis (also known as the b-axis). When facies are composed of uniform sand or boulders, D_{50} (i.e., median particle size, or the particle size at which 50% of the particles are finer) will be assumed based on the particle size (e.g., 1 millimeter [mm] for sand and 512 mm for boulders). The percentage of the reach composed of 512 mm particles or larger will be estimated based on bedrock and particles greater than 512 mm from the pebble counts, as well as an estimate of the area composed of boulders and bedrock within the bankfull width as characterized and mapped upon the study site map. Areas of gravels within the bankfull channel, which are a suitable size for rainbow trout spawning, will be identified where rainbow trout spawning gravel is defined as a relatively homogeneous patch of particles 0.5 to 7.6 cm in diameter with a minimum area of 1 m.

4.2.2.2 Residual Depth in Pools

For each monitoring site, YCWA will measure residual depth for pools that meet the minimum criteria for a pool as set forth by Pleus et al. (1999). These criteria are provided in Figure 4.2-1. Each pool will be drawn as a polygon onto the base map using a mobile device as stated above.

Table 2. Minimum surface area and residual pool depth criteria by segment mean bankfull width - metric units.

Mean Segment Bankfull Width (m)	Minimum Unit Size (m^2)	Minimum Residual Pool Depth (m)
0 to < 2.5	0.5	0.10
≥ 2.5 to < 5.0	1.0	0.20
≥ 5.0 to < 10.0	2.0	0.25
≥ 10.0 to < 15.0	3.0	0.30
≥ 15.0 to < 20	4.0	0.35
≥ 20	5.0	0.40

Table 3. Minimum surface area and residual pool depth criteria by segment mean bankfull width - English units.

Mean Segment Bankfull Width (feet/tenths)	Minimum Unit Size (feet/tenths^2)	Minimum Residual Pool Depth (feet/tenths)
> 0 to 8.2	5.4	0.33
≥ 8.2 to 16.4	10.8	0.66
≥ 16.4 to 32.8	21.5	0.82
≥ 32.8 to 49.2	32.3	0.98
≥ 49.2 to 65.6	43.1	1.15
≥ 65.6	53.8	1.31

Figure 4.2-1. Minimum surface area and residual pool depth criteria by mean bankfull width (FROM: Pleus et al. 1999)

4.2.2.3 Residual Fine Sediment in Pools

For each pool, as defined above in three monitoring sites, YCWA will measure residual fine sediment (i.e., fine gravel and sand less than 4 mm in diameter) using V* as set out in Hilton and Lisle (1993). V* is a ratio of the volume of residual fine sediment deposited in a pool divided by the total residual pool volume. "Residual" refers to the pool dimensions at the point of zero flow. The monitoring sites include only the sites named 1) Middle Yuba upstream of Oregon Creek, 2) Middle Yuba downstream of Oregon Creek, and 3) Oregon Creek upstream of Log Cabin.

A rough sketch map of the pool will also be made showing the grid used to measure the residual fine sediment, riffle crest, pool head, pool margins, and sediment accumulations. If the residual fine sediment depth is determined to be only a thin coating over coarser material that cannot be accurately measured with a probe, then it will be described as "<0.1 foot" average thickness in the field notes. Because a calculated volume of residual fine sediment is not possible with such thin layers of sediment, the results will be described as "trace" amounts of residual fine sediment.

4.2.2.4 Rainbow Trout Spawning-Size Gravel

For each monitoring site, particle size distribution and fine sediment content of rainbow trout spawning gravels will be determined using bulk sampling techniques (McNeil and Ahnell 1960). Trout spawning gravel will be defined as particles 0.5 to 7.6 cm measured along the intermediate axis that encompass a minimum area of 1 square m at a minimum water depth at time of monitoring of 10 – 15 cm, and will be sampled from locations drawn as polygons on the to-scale site map, if accessible (e.g., in less than 2 ft of water). Three bulk samples will be collected within suitable gravel patches using a modified McNeil sampler (i.e., bottomless bucket; based on design presented by Watschke and McMahon [2005]). Samples will be taken to a depth of 10 to 15 cm, which approximates the depth of a rainbow trout egg pocket in a redd (Watschke and McMahon

2005). All sampled sediments will be placed in a woven plastic bag that allows drainage of water and a slight amount of the wash load (i.e., particles less than 2 mm), and delivered to a lab for dry-sieve analysis.

4.2.3 Cross-Sections

Cross sections at each of the monitoring sites have been agreed to and are presented in Figure 4.7-1. Where cross sections are not those established during YCWA's relicensing Channel Morphology Upstream of Englebright Dam Study or Instream Flow Upstream of Englebright Dam (YCWA 2013), new cross sections must be established at or near the locations in Figure 4.4-1. If cross sections had been measured previously, YCWA will identify original rebar or headpins, or GPS coordinates of headpins used to measure cross-sections, to the extent possible. If "permanent" cross-sections were not established, YCWA will establish permanent cross-sections by monumenting ends of the cross-section with bedrock headpins or rebar and taking a GPS coordinate of each headpin. In addition, YCWA will establish a benchmark for each cross-section so that if headpins or tailpins are lost, elevations can still be reestablished.

The cross-sections established during the initial setup and monitoring may be used during subsequent monitoring.

4.2.3.1 Bottom Topography

Data collected at each cross-section will include: 1) water surface elevation; 2) thalweg; 3) breaks in slope; 4) bankfull location; 5) flood prone location; and 6) at least 30 locations between bankfull and every 4-ft beyond bankfull to the edge of the alluvial valley, unless there is a restriction that inhibits the extent of the survey (e.g., private land). Attachment B is the form that will be used to document cross-section data in the field.

4.2.3.2 Pebble Counts

YCWA will measure at least 100 particles within the bankfull channel at each cross-section using methods described in Wolman (1954). Particles will be measured using a gravel template, as with the pebble counts for facies.

4.2.3.3 Photographs

YCWA will take digital photographs from each endpoint of each cross-section (i.e., from valley wall and near-channel endpoints) from downstream looking upstream, and from upstream looking downstream. During the initial monitoring event, YCWA will take the GPS location of each photo point and photo point markers (e.g., stakes or pins) will be placed. Markers will be as inconspicuous as possible to minimize the potential for vandalism. Additional photo points will be established at features particularly likely to change over time, such as mid-channel or lateral bars composed of 64 mm diameter or less particles. For those locations where more than one view is taken from the same photo point location, all the views can be recorded on the same datasheet. Attachment C is a field datasheet that will be filled out for each photo point location.

During the initial monitoring, the following procedures will be followed:

- The photographer will stand immediately over the photo point site marker, if possible. If this is not possible, the location of the photographer relative to the marker will be recorded on the datasheet (distance and angle from the marker).
- The time of the photograph, camera type, height of the camera above the ground, and compass bearing and vertical angle of the view will be recorded on the datasheet.
- At least one reference point will be established for each photo point marker. The reference point will be within 200 ft of the photo point marker. A reference point could be a large tree outside of the flood zone or a large rock. The distance, compass bearing, and vertical angle will be measured and recorded from the reference point to the photo point marker. The reference point will be described on the datasheet and a monitoring site sketch will be drawn showing major landmarks and the locations of the photo points markers. The information from the initial sketch with the reference and photo point locations identified will be recorded on the study site map using the mobile device as above, and transferred to a GIS for display over a high resolution aerial image and stored electronically.
- Additional photographs will be taken of the reference point and the photo point marker. The locations of each will be marked and labeled on the photographs for future use in the field. All information on the location of the photo points and reference points will be stored electronically.
- Each photo point marker will be given an identification number, which will be used through the duration of the monitoring.

During subsequent monitoring, the following procedures will be used:

- The field crew will take copies of the original photo point documentation on the locations of the photo and reference point markers, and take copies of the photographs and maps. The type(s) of cameras used to take the photos will be noted on the datasheet.
- The photographer will stand at the same place and height as that which the first photographs were taken. The camera will be aligned with the view at the same compass bearing as recorded during the initial photographs. The view will be compared with the previous photographs to ensure that it is as close as possible to the original.
- The time of the photograph, camera type, focus distance, height of the camera above the ground, compass bearing and vertical angle of the view will be recorded for this monitoring period.
- If the photo point marker cannot be located, an attempt will be made to locate a new photo point as close as possible to the original location using the reference point documentation, maps and previous photographs.

All photographs will be catalogued and stored electronically.

4.2.4 Quality Assurance/Quality Control Review Methods

YCWA will use the same QA/QC procedures described in Section 4.1.2.

4.2.5 Data Analysis

The area that is contained within each monitoring site facies will be quantified using the to-scale site map. Reach-average pebble size D_{50} and D_{50} of each facies and cross-section will be estimated, along with a particle size distribution. Monitoring site-averaged D_{50} will be calculated by estimating the area for each facies, multiplying the fractional area of the facies by the D_{50} of that facies, and summing the products for the monitoring site. The average D_{50} of the bankfull channel will also be calculated from the pebble count information collected for each cross-section.

Particle size composition of rainbow trout spawning-size gravel samples will be plotted as cumulative distribution curves and frequency histogram. Particle size composition as represented by the D_{16}, D_{50}, and D_{84} will be determined from the frequency histogram and cumulative distribution curve. Raw data results for each sample will be presented in the graphs and tables.

Photographs will be organized into a Microsoft™ Word document.

Each monitoring site will be compared with prior monitoring results for that monitoring site, and comparisons will not be made among monitoring sites. The comparison will focus on changes in cross-section, channel location and orientation, substrate/facies, pool depth, fine material in rainbow trout spawning-sized gravel, or other pertinent Project-related factors that affect the monitoring site.

4.3 Monitoring Area

The Study Area includes: 1) the Middle Yuba River from Our House Diversion Dam Impoundment to the confluence with the North Yuba River; 2) Oregon Creek from the Log Cabin Diversion Dam Impoundment to the confluence with the Middle Yuba River; (Figure 4.4-1).

4.4 Monitoring Locations

Monitoring locations, to some extent, will use the same monitoring locations as the pre-license issuance sampling locations. The location of all monitoring sites are included in Figure 4.4-1 in relation to Project facilities and features.

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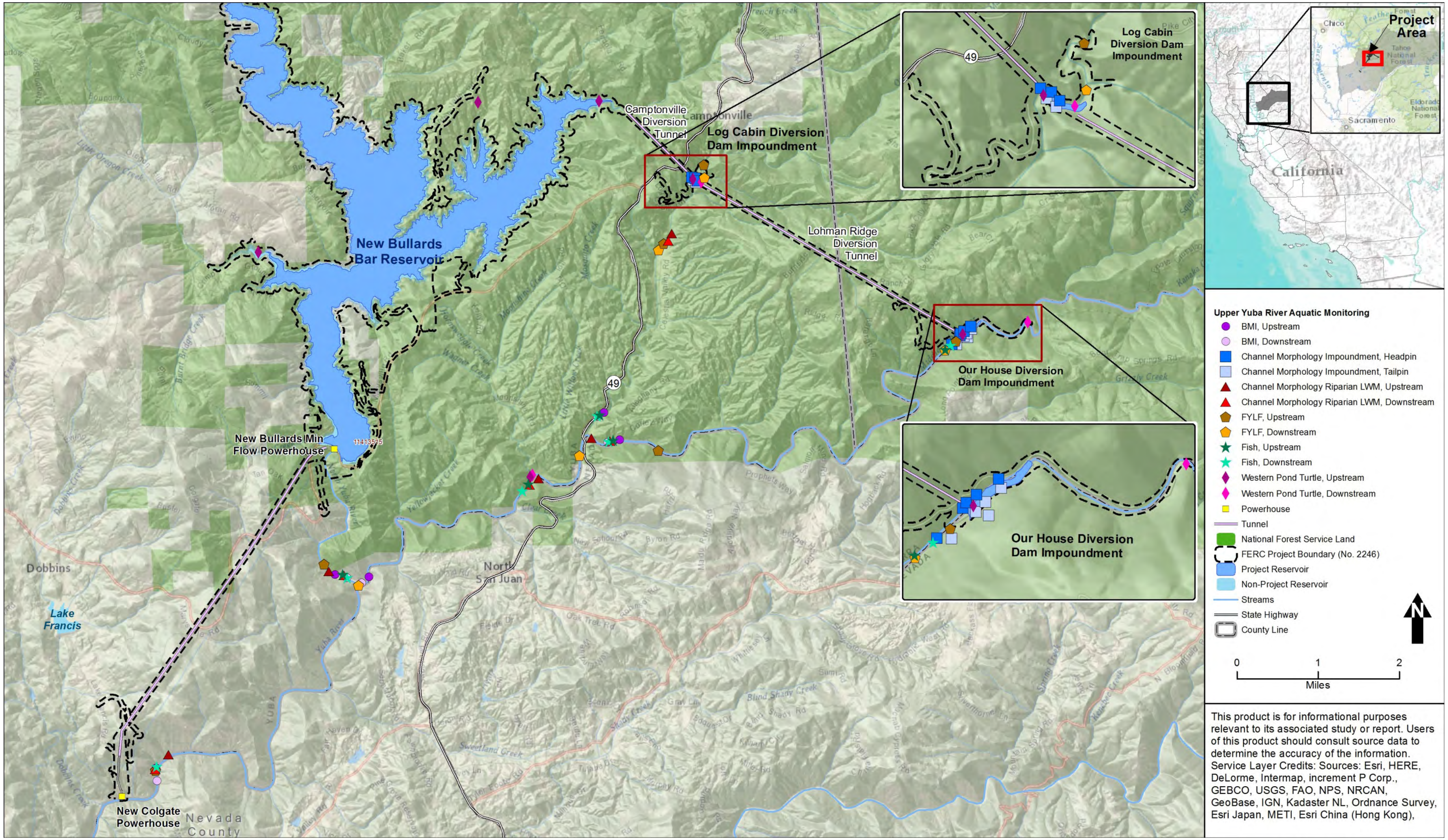

Figure 4.4-1. Monitoring Sites in Relation to Project Facilities and Features.

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4.5 Monitoring Frequency

Monitoring under this Plan is intended to cover the period until the time FERC issues a new license.

Monitoring of channel morphology and sediment in the project impoundments for the Our House and Log Cabin Diversion Dam's would occur in the, third, fifth, seventh, and ninth sediment pass through events[18]. Monitoring will also occur at the pool downstream of the streamflow gage weir below Our House Diversion Dam at the same time as the Our House impoundment. Should the FERC license be issued beyond the assumed period of 30 years, monitoring will continue beyond the above described frequency at the rate of every odd numbered sediment pass through event.

Monitoring of channel morphology and sediment within stream systems would occur in the Middle Yuba River and Oregon Creek following the first year after license issuance. Afterward, monitoring will occur based on triggering events within a 10 year span of time. A monitoring event will occur after triggering event no more than a total of two times within a 10 year period. If a second triggering event does not occur in a 10 year period, then monitoring will occur at the end of that 10 year period. The triggering events are as follows:

- A sediment pass through event at Our House Diversion Dam
- YCWA closes the Lohman Ridge Diversion Tunnel from April to September in compliance with the *Lohman Ridge Tunnel Closure Condition* in the license
- A flow of 5,720 cfs is recorded at the gage downstream of Our House Dam

[18] Monitoring of channel morphology and sediment within the Our House diversion Dam impoundment in the Middle Yuba River occurred in 2017 following sediment pass-through events.

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SECTION 5.0
BEST MANAGEMENT PRACTICES AND PERMITS

This section describes BMPs that will be used during mechanical sediment removal, and necessary permits to implement this Plan.

5.1 Best Management Practices

The BMPs described below will be used during all mechanical sediment removal described in Section 3.3:

- Work will be timed during dry weather and limited to the period of September 15 through November 15. Work may begin earlier than September 15 if surveys conducted by a qualified biologist confirm that foothill yellow-legged frog (*Rana boylii*) (FYLF) tadpoles are not present within the work area and concurrence is received from Forest Service and Cal Fish and Wildlife. FYLF surveys will be conducted in accordance with protocols recommended by the Forest Service.
- Excavation activities shall be timed with awareness of precipitation forecasts and likely increases in stream flow. Excavation activities shall cease and all reasonable erosion control measures, inside and outside of the floodplain, will be implemented prior to all storm events. No work shall occur during wet weather. Wet weather is defined as the accumulation of 0.25 in of rain in a 24-hour period. Re-vegetation, restoration and erosion control work is not confined to this time period.
- If work in the flowing portion of the stream is unavoidable, the entire stream flow will be diverted around or through the work area during work activities, while maintaining required flows in the natural channel downstream of the work for aquatic species. Flow will be diverted in a manner that minimizes turbidity, siltation, and pollution and provides flows to downstream reaches. Normal flows shall be restored to the affected stream immediately upon completion of work at that location. Any temporary dam or other artificial obstruction constructed will only be built from clean materials such as sandbags, gravel bags, water dams, or clean/washed gravel, which will cause little or no siltation. YCWA will restore normal flows to the effected stream immediately upon completion of work at that location.
- A qualified biologist will visit the site daily for the duration of activities that involve water diversion, grading, excavation, vegetation removal, or other ground disturbing activities to ensure impacts to fish and wildlife resources are minimized. The biologist shall be familiar with fish, plant, wildlife and habitats found within and adjacent to the work site.
- A qualified biologist will conduct an education program for all persons employed or otherwise working at the Project site prior to performing any work onsite. The program will consist of a presentation that includes a discussion of the biology of the habitats and species that may be present within or adjacent to the work site. The training will include information on FYLF and proper methods for their avoidance.

- Prior to and during diversion of flow and dewatering of the stream channel and work area, a qualified biologist shall remove all fish, frogs, turtles, and other aquatic vertebrate species in accordance with the Fish Rescue and Salvage Plan developed by YCWA in coordination with Forest Service, Cal Fish and Wildlife, USFWS, and SWRCB in 2014.[19] Electrofishing for aquatic species rescue will be restricted to areas clear of FYLF and approved onsite by the CDFW. All species shall be captured using fine mesh, soft material nets (e.g., catch-and-release nets), or another method approved by the agencies listed above. All species shall be moved to an area upstream of sediment removal activities where they will not reenter the work area.
- The qualified biologist shall check the work area daily for stranded aquatic life for the duration of dewatering and sediment removal activities. This includes prior to work beginning every morning, and at least two additional times per day. If frogs are present, they will be removed by the qualified biologist or the work area will be changed for the day to avoid the frogs, if possible. Handling of aquatic species shall be minimized to the greatest extent feasible.
- Exclusion devices (e.g., nets and screens) will be placed on any pumps or pipes within the impoundment and around the work area as appropriate to exclude aquatic species. Exclusion devices shall be in place and maintained in working order at all times water is being diverted. Intake pumps shall be fitted with a fish screens meeting the “fry size” criteria of Cal Fish and Wildlife and the National Marine Fisheries Service before water is diverted. Round openings in the screen shall not exceed 3/32” diameter, square openings shall not exceed 3/32” measured diagonally, and slotted openings shall not exceed 0.069 inch in width. The Licensee shall periodically inspect all exclusion devices to verify that they are functioning properly and are effectively protecting salmonids and other fish species. Block nets sufficient to prevent frog movement through them will be erected at the upstream end of the sediment removal area to prevent FYLF from (re-)entering the sediment removal area.
- Sediment removal work will start in the areas where sediment is currently elevated and dry where FYLFs are much less likely to be present.
- Work requiring suction dredging will be limited to an area of the dam face and outlet features of the Project. At no time will suction dredging occur along the bed, bank, or channel of the streambed.
- Where possible, work will be timed to occur so as not to coincide with sensitive ecological times (e.g. breeding, nesting, migration or blooming) of known special-status species within or near the proposed work area.
- Prior to any work occurring, any known sensitive resources (i.e., which include, but are not limited to: cultural resources, special-status species, sensitive habitats, target nonnative invasive plants and other predetermined areas with significant sensitive resources) within or near the proposed work area will be flagged to ensure that no activities are conducted in those areas.

[19] This rescue plan may be updated in consultation with the Forest Service and CDFW from time-to-time through the conditions of the Lake and Streambed Alteration Agreement.

- Disturbance or removal of vegetation will be kept to the minimum necessary to complete Project related activities. When feasible, branches and limbs extending over the river will not be pruned to avoid potential impacts to shaded riverine aquatic habitat. No native trees with a trunk diameter at breast height in excess of 4 in. will be removed without prior consultation and approval from Cal Fish and Wildlife. If vegetation removal cannot be avoided during project activities, YCWA will conduct a focused survey for active bird nests within the area proposed for vegetation removal, plus a 500-ft buffer, within 5 days of commencement of vegetation removal activities. If no breeding raptors or special-status bird species and/or their nests are found within 500 ft of the work area and no other breeding birds (non-special status species) and/or their nests are found within 250 ft of the work area, vegetation removal may proceed. If any breeding birds and/or their nests are found within the survey areas described above, YCWA will consult with the Forest Service (for work on NFS land), Cal Fish and Wildlife, and USFWS, as appropriate, prior to commencing any vegetation removal activities. Breeding bird survey results, if conduced, will be submitted to the above agencies for review via electronic mail within 5 days of completion and prior to commencing work.
- All exposed/disturbed areas and access points to the stream left barren of vegetation as a result of the construction activities, such as staging areas, shall be restored and stabilized using a Forest Service approved seed mix or grass or sedge plugs during periods of project inactivity greater than 14 days and upon completion of work. The re-vegetation should emphasize native species or approved sterile non-native species. Seeded areas shall be covered with broadcast straw or other mulch and/or erosion control blankets and straw wattles. Re-vegetation is not considered complete until 70% uniform ground cover is achieved.
- No heavy equipment shall operate, or any excavation take place, in the portion of the stream where flowing water is present.
- Beginning during mobilization and through demobilization, when work is being performed in the impoundment, turbidity will be monitored thrice daily: before work starts, at noon, and at the end of the day. Turbidity will be monitored at a point upstream of work disturbance and at a point immediately downstream of the dam. The following applies: if natural turbidity is less than one Nephelometric Turbidity Unit (NTU), controllable factors shall not cause downstream turbidity of more than 2 NTU, if natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent, if natural turbidity is between 50 and 100 NTUs, increases shall not exceed an additional 10 NTUs, and if natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent (SWRCB 2011) If the difference in measured turbidity exceeds any of these limits, work will cease, and FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB and Cal Fish and Wildlife will be contacted. Work will not resume until FERC approval is obtained.
- Beginning during mobilization and through demobilization, when work is being performed in the impoundment, dissolved oxygen (DO) will be also monitored thrice daily: before work starts, at noon, and at the end of the day. DO will be monitored at a point upstream of work disturbance and at a point immediately downstream of the dam to ensure that Project activities do not cause DO to fall below 7.0 mg/L (SWRCB 2011). If the DO falls below 7.0 mg/L downstream of Project activities, work will cease, and FERC, USACE,

USFWS, Forest Service, SWRCB, CVRWQCB and Cal Fish and Wildlife will be contacted. Work will not resume until FERC approval is obtained.

- Work activities will be conducted in a manner that prevents the introduction, transfer, and spread of aquatic, riparian, and terrestrial invasive species, including plants, animals, and microbes (e.g., algae, fungi, parasites, mussels and bacteria), from one work site and/or waterbody to another. Prior to entering the impoundment, YCWA will inspect the equipment to be used in the impoundment for invasive species and, if any signs of invasive species are found, the equipment shall be cleaned to remove those species. All visible soil/mud, plant materials, and animal remnants on equipment will be removed prior to entering and exiting the work site and/or between each use in different waterbodies. YCWA will notify Cal Fish and Wildlife immediately if an invasive species not previously known to occur within the work site is discovered during work activities by submitting a completed Suspect Invasive Species Report (Attachment D).

- All disturbed soils within the work site will be stabilized to reduce erosion potential: during mobilization and prior to soil disturbance, during periods of construction inactivity, and upon completion of work activities. Planting and/or seeding with native species, sterile seed mix, and mulching are potential methods for stabilization. Where suitable vegetation cannot reasonably be expected to become established, non-erodible materials, such as coconut fiber matting, shall be used for such stabilization.

- Erosion control measures will be utilized throughout all phases of the work, including sediment removal and placement on adjacent lands. Precautions to minimize turbidity/siltation may require the placement of silt fencing, coir logs, coir rolls, straw bale dikes, or other siltation barriers so that silt and/or other deleterious materials are not allowed to pass to downstream reaches. Water trucks will be used to wet the unpaved roads to prevent excess dust. All vegetative erosion control measures utilized within the work site shall be free of non-native plant materials.

- Leaks and spills into water bodies will be prevented by ensuring that all vehicles and equipment are in good working order (no leaks); placing drip pans or absorbent materials under vehicles and equipment when not in use; ensuring that all construction areas have proper spill clean-up materials (e.g., absorbent pads, sealed containers and booms) to contain the movement of any spilled substances; preventing any other substances which could be hazardous to aquatic life from contaminating the soil and/or entering the waters of the state; and if maintenance or refueling of vehicles or equipment must occur on-site, using a designated area and/or a secondary containment, located away from drainage courses, to prevent the runoff of storm water and the runoff of spills.

- During the entire work period, standard fire equipment will be kept readily available and an emergency contact will be established between the contractor and the TNF to prevent the start and spread of fires.

- A California spotted owl (*Strix occidentalis occidentalis*) Protected Activity Center (PAC) borders Our House Diversion Dam Impoundment (as of 2014). YCWA shall determine the current status of this PAC through discussion with the TNF, Yuba River District Biologist, prior to excavation and hauling activities. If recommended by the TNF biologist, excavation and hauling activities shall occur outside of the limited operating period (LOP) for the California spotted owl, which is March 1 through August 15.

- Great gray owls (*Strix nebulosa*) are known to be active and forage along a section of the Ridge Road haul route (as of 2014). YCWA shall determine the current status and location (specific road segment) of the great gray owl activity area through discussion with the TNF, Yuba River District Biologist. Prior to hauling sediment, to avoid collisions between owls and trucks, and if YCWA obtains approval from the County Transportation Department, YCWA shall install appropriate barriers along an approximate 400 ft the segment of road where this species is active as determined by the TNF. These barriers shall be 6 ft high and temporary construction fencing raised 18 in. off the ground to allow smaller animals to pass underneath, and installed on the downhill side of the road segment. Perching deterrents, such as snow poles, shall be placed onto metal road posts on the uphill side of the road segment. All YCWA contractor truck drivers shall be informed of the presence of great gray owls, provided with identification cards, and asked to report sightings to the TNF and Cal Fish and Wildlife.

- Key Forest Service *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012):[20]
    - ***Fac-2. Facility Construction and Stormwater Control -*** Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.
        - Establish designated areas for equipment staging, stockpiling materials, and parking to minimize the area of ground disturbance (see BMP Road-9 [Parking Sites and Staging Areas] and BMP Road-10 [Equipment Refueling and Servicing]).
        - Establish and maintain construction area limits to the minimum area necessary for completing the project and confine disturbance to within this area.
        - Develop and implement an erosion control and sediment plan that covers all disturbed areas, including borrow, stockpile, fueling, and staging areas used during construction activities.
        - Calculate the expected runoff generated using a suitable design storm to determine necessary stormwater drainage capacity,
            - Use site conditions and local requirements to determine design storm.
        - Include run-on from any contributing areas, such as run-off from the Our House access road. Refer to State or local construction and stormwater BMP manuals, guidebooks, and trade publications for effective techniques to:

[20] With the exceptions noted below, it is anticipated that the SWPPP, which will be provided to the RWQCB prior to any ground-disturbing activities (mobilization of mechanical sediment removal), will address all of the following Forest Service BMPs. A copy of the SWPPP will be provided to the Forest Service prior to submitting it to the RWQCB.

- ➢ Apply soil protective cover on disturbed areas where natural re-vegetation is inadequate to prevent accelerated erosion during construction or before the next growing season.
- ➢ Maintain the natural drainage pattern of the area wherever practicable.
- ➢ Control, collect, detain, treat, and disperse stormwater runoff from the site.
- ➢ Divert surface runoff around bare areas with appropriate energy dissipation and sediment filters.
- ➢ Stabilize steep excavated slopes.

- Develop and implement a post construction site vegetation plan using suitable species and establishment techniques to re-vegetate the site in compliance with local direction and requirements per Forest Service Manual (FSM) 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.[21]
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Do not use snow or frozen soil material in facility construction.
- Schedule, to the extent practicable, construction activities to avoid direct soil and water disturbance during periods of the year when heavy precipitation and runoff are likely to occur.[22]
  - ➢ Limit the amount of exposed or disturbed soil at any one time to the minimum necessary to complete construction operations.
  - ➢ Limit operation of equipment when ground conditions could result in excessive compaction, rutting, soil puddling, or runoff of sediments directly into waterbodies. Refer to Attachment E for the field soil moisture test protocol.
- Install suitable stormwater and erosion control measures to stabilize disturbed areas and waterways before seasonal shutdown of project operations or when severe or successive storms are expected.
- Use low-impact development practices where practicable.
- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning.
  - ➢ Prepare for unexpected failures of erosion control measures.

[21] The SWPPP requirement for re-vegetation of disturbed areas up to 70 percent uniform groundcover. Re-vegetation will follow the procedures of the Integrated Vegetation Management Plan, as included in YCWA's Amended FLA, per Section 4.0.

[22] The period for mechanical removal will be included in the SWPPP, as prescribed by the Plan in Section 5.1, with in-water activities occurring between September 15 and November 15 of any given year. Work may proceed after November 15th, if dry conditions persist; however, when the NWS forecasts a 30% chance of precipitation or greater, work activities will stop and erosion control measures will be installed.

- Implement corrective actions without delay when failures are discovered to prevent pollutant discharge to nearby waterbodies.

- Routinely inspect construction sites to verify that erosion and stormwater controls are implemented and functioning during the wet season as designed and are appropriately maintained until the area is re-vegetated and stabilized.
- Use suitable measures in compliance with local direction to prevent and control invasive species.

- ***Road-9. Parking and Staging Areas*** **-** Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.
  - Design and locate parking and staging areas of appropriate size and configuration to accommodate expected vehicles and avoid or minimize adverse effects to adjacent soil, water quality, and riparian resources.
    - Consider the number and type of vehicles to determine parking or staging area size.
  - Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when designing, constructing, reconstructing, or maintaining parking or staging areas.
  - Use suitable measures to harden and avoid or minimize damage to parking area surfaces that experience heavy use or are used during wet periods.
  - Use and maintain suitable measures to collect and contain oil and grease in larger parking lots with high use and where drainage discharges directly to streams.
  - Connect drainage system to existing stormwater conveyance systems where available and practicable.
  - Conduct maintenance activities commensurate with parking or staging area surfacing and drainage requirements as well as precipitation timing, intensity, and duration.
    - Limit the size and extent of temporary parking or staging areas.
    - Take advantage of existing openings, sites away from waterbodies, and areas that are apt to be more easily restored to the extent practicable.
    - Use temporary stormwater and erosion control measures as needed.
    - Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to rehabilitate temporary parking or staging areas as soon as practicable following use.
- ***Road-10. Equipment Refueling and Servicing*** **-** Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using

State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Plan for suitable equipment refueling and servicing sites during project design.
  - Allow temporary refueling and servicing only at approved locations, located well away from the AMZ [Aquatic Management Zone], groundwater recharge areas, and waterbodies.
- Develop or use existing fuel and chemical management plans (e.g., Spill Prevention Control and Countermeasures [SPCC], spill response plan, and emergency response plan) when developing the management prescription for refueling and servicing sites.[23]
- Locate, design, construct, and maintain petroleum and chemical delivery and storage facilities consistent with applicable local, State, and Federal regulations, as practicable.
- Use suitable measures around vehicle service, storage and refueling areas, chemical storage and use areas, and waste dumps to fully contain spills and avoid or minimize soil contamination and seepage to groundwater.
- Provide training for all agency personnel handling fuels and chemicals in their proper use, handling, storage, and disposal.
  - Ensure that contractors and permit holders provide documentation of proper training in handling hazardous materials.[24]
- Use suitable measures to avoid spilling fuels, lubricants, cleaners, and other chemicals during handling and transporting.
- Prohibit excess chemicals or wastes from being stored or accumulated in the project area.
- Remove service residues, used oil, and other hazardous or undesirable materials from NFS land and properly dispose them as needed during and after completion of the project.
- Clean up and dispose of spilled materials according to specified requirements in the appropriate guiding document.
- Report spills and initiate suitable cleanup action in accordance with applicable State and Federal laws, rules, and regulations.
  - Remove contaminated soil and other material from NFS lands and dispose of this material in a manner consistent with controlling regulations.

[23] The requirement for a SPCC will be met per this Plan's requirements for a Hazardous Materials Management Plan in Section 3.4.3. A SPCC per SWPPP requirements is not necessary for this Plan.

[24] YCWA will include in the contract documents that the contractor must train all site personnel and provide documentation to YCWA prior to mobilization. Documentation will be maintained onsite during the duration of the work.

- Prepare and implement a certified SPCC Plan for each facility, including mobile and portable facilities, as required by Federal regulations.[25]
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim equipment refueling and services site when the need for them ends.

5.2 Permits and Approvals

YCWA obtained the following permits and approvals for the 2014 FERC-approved *Log Cabin and Our House Diversion Dams Sediment Management Plan*, which covers similar work as covered by this Plan. YCWA intends to revise the following permits and approvals, as needed, to include activities in Section 3.2 (e.g., timing, triggers, and length of sediment passage) and Section 3.3 (e.g., remedial actions for blockage of outlets):

- USACE CWA Section 404 Individual Permit for mechanical sediment removal (SPK-2014-00703, issued September 25, 2014)
- USACE CWA Section 404 Letter of Permission for sediment passage at Log Cabin (SPK-2014-00703, issued October 21, 2016)
- USACE CWA Section 404 Letter of Permission for sediment passage at Our House (SPK-2014-00703, issued October 21, 2016, as amended and January 27, 2017 and April 4, 2017)
- CVRWQB CWA Section 401 Certification for mechanical sediment removal (WDID#5A58CR00113, issued September 17, 2014, as amended April 4, 2017)
- CVRWQB Waste Discharge Requirement (Notice of Applicability No. R5-2009-0085-15, issued August 1, 2014)[26]
- SWRCB Section 401 Certification for sediment passage (issued February 10, 2016, as amended April 5, 2017)
- SWRCB Construction General NPDES Permit and SWPPP (WQO 2009-0009-DWQ as amended by 2010-0014-DWQ and 2012-0006-DWQ)[27]
- Cal Fish and Wildlife Fish and Game Code section 1605 Lake or Streambed Alteration Agreement –Long-term Routine Maintenance (Notification No. 1600-2014-0163-R2, issued September 8, 2014)
- Cal Fish and Wildlife Incidental Take Permit for FYLF- Candidate Species under CESA
- USFWS Endangered Species Act Section 7 consultation (completed as part of the USACE permit applications)
- State Historic Preservation Officer National Historic Properties Act Section 106 consultation (completed as part of USACE permit applications)

[25] See footnote 22.
[26] YCWA may apply under Order No. R5-2009-0085 for a long-term permit for Waste Discharge.
[27] SWPPPs will be obtained separately for each sediment removal effort that will require more than one acre of ground disturbance.

- TNF, Forest Supervisor approval (Tahoe National Forest Letter of Concurrence, issued September 10, 2014)
- YCWA, California Environmental Quality Act compliance (update to Initial Study/Mitigated Negative Declaration, adopted by YCWA Board on September 2, 2014)
- County permits – grading, etc. (required for each mechanical sediment removal event)

To effectively implement this Plan, YCWA intends to obtain the above permits and approvals, and maintain the permits and approvals through the term of the new license.

SECTION 6.0

REPORTING AND PLAN REVISIONS

By March 1 of each year, YCWA will provide to FERC, USACE, USFWS, Forest Service, SWRCB, CVRWQCB, and Cal Fish and Wildlife a report with photographs that summarizes the work completed in the prior year under this Plan. For sediment passage, the report will include the purpose of the monitoring; methods; a description of implementation of sediment passage since the last monitoring report, including periods that the low level outlet valve was opened and flows prior to, during and after the valve opening as measured at the nearest downstream flow gage; results; and discussion. For blockage of outlets, the report will include a description of the work performed, including the dates of the work and how much sediment we removed during work. For mechanical sediment removal, this will include the amount of material excavated, the results of field density tests, and a description of measures implemented to avoid and minimize impacts to fish, wildlife, plants, habitat, and water quality.

YCWA, in consultation with USACE, USFWS, Forest Service, SWRCB, CVRWQCB and Cal Fish and Wildlife will review the monitoring information after 3 years in which sediment pass-through events occurred. Upon this review, YCWA, in consultation with USACE, USFWS, Forest Service, SWRCB, CVRWQCB and Cal Fish and Wildlife will determine the effectiveness of the operations at moving sediment through the system, or if revisions to the Plan are warranted.[28]Additionally, the Plan may be updated, or revised as needed when significant changes in existing conditions occur, or if monitoring results demonstrate that additional monitoring can be reduced in scope or frequency. Any updates to the Plan will be prepared in coordination and consultation with the above agencies. Sixty days will be allowed for the above agencies to comment and make recommendations before YCWA files the updated plan with FERC, including relevant documentation of coordination and consultation with the above agencies, for FERC's approval. If YCWA does not adopt a particular recommendation by the above agencies, the filing will include the reasons for not doing so. YCWA will implement the Plan as approved by the Commission.[29]

If the Plan is revised, YCWA understands that it may need to obtain or modify existing permits and approvals to implement the Plan as revised. For example, if alternate sediment disposal sites (Section 3.4.6) are proposed on or may affect NFS lands outside of the FERC Project Boundary, a Forest Service Special Use Permit (SUP) may also be needed.

[28] This May 2018 Plan represents the first revision to the original FERC-approved May 2014 Plan.
[29] The Plan will not be considered revised until FERC issues its formal approval.

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SECTION 7.0

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Log Cabin and Our House Diversion Dams
Sediment Management Plan

Attachment A

Forest Service *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012)

Yuba River Development Project

FERC Project No. 2246

June 2018

USDA

United States
Department of
Agriculture

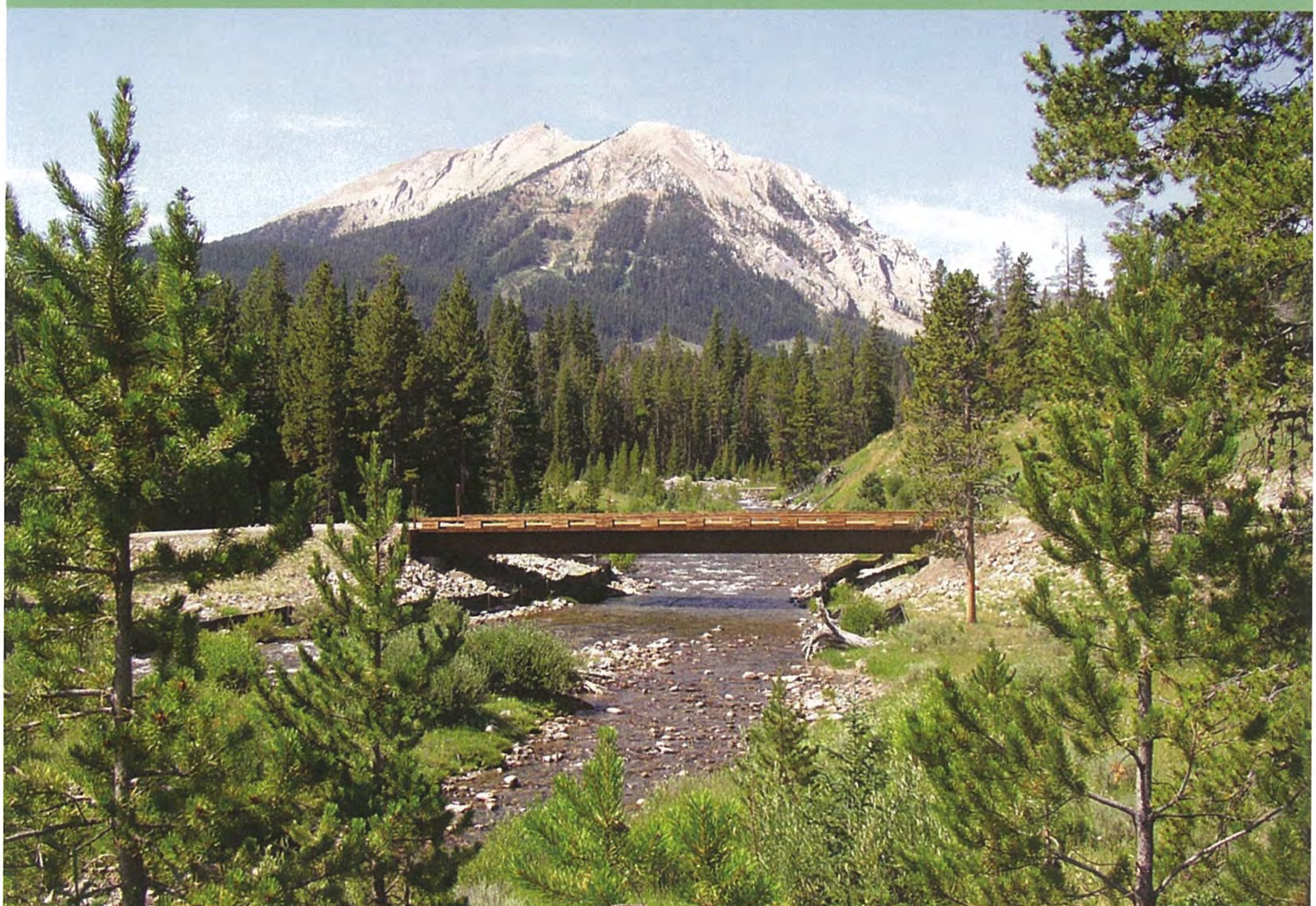
Forest Service

FS-990a

April 2012

National Best Management Practices for Water Quality Management on National Forest System Lands

Volume 1:
National Core BMP Technical Guide



United States
Department of
Agriculture

Forest Service

FS-990a

April 2012

National Best Management Practices for Water Quality Management on National Forest System Lands

Volume 1:
National Core BMP Technical Guide

Front cover photo: *Taylor Fork Creek, Gallatin National Forest, near Big Sky, MT, by David Scovell, engineer, Rogue River-Siskiyou National Forest. Photo taken in August 2005 in the Madison Range, just west of Yellowstone National Park.*

Acknowledgments

This document is the culmination of an effort that has spanned many years. Countless numbers of Forest Service, U.S. Department of Agriculture, resource personnel at all levels of the agency, including National Forest System, State and Private Forestry, and Research and Development, have participated to make the vision of a National Best Management Practices (BMP) Program a reality. Thank you to all those who provided guidance as part of the steering committee, those who participated in the teams that drafted the initial version of the BMPs, those who developed the BMP monitoring protocols, and the many people across the agency who reviewed drafts of this document and provided comments. Particular thanks goes to Joan Carlson of the Rocky Mountain Regional Office for her dedication to the development and completion of this document.

Thank you also to our partners—the Association of Clean Water Administrators (formerly the Association of State and Inter-State Water Pollution Control Administrators), the Intertribal Timber Council, the National Association of State Foresters, the National Congress of American Indians, and the U.S. Environmental Protection Agency—who reviewed the document and provided helpful comments.

Preface

This technical guide is the first volume of guidance for the Forest Service, U.S. Department of Agriculture, National Best Management Practices (BMP) Program. The National BMP Program was developed to improve agency performance and accountability in managing water quality consistent with the Federal Clean Water Act (CWA) and State water quality programs. Current Forest Service policy directs compliance with required CWA permits and State regulations and requires the use of BMPs to control nonpoint source pollution to meet applicable water quality standards and other CWA requirements.

The Forest Service has a long history of working with States and other partners to carry out BMP programs, including agreements with the U.S. Environmental Protection Agency (EPA) and many States to use and monitor BMPs. Each Forest Service region has a BMP guidance document consistent with its respective State BMP programs. Most national forests and grasslands monitor and report on BMPs. The regional or forest BMP programs, however, are not standardized to allow efficient cross-regional application, evaluation, or reporting. The National BMP Program, which includes the National Core BMPs detailed in this guide, will enable the agency to readily document compliance with the nonpoint source management strategy at national or regional scales. The National BMP Program is modeled after a successful 20-year-old regional BMP program in the Forest Service Pacific Southwest Region (Region 5).

A standardized National BMP Program is needed as an effective tool for the agency to accomplish the following:

- ***Improve water quality to restore impaired waters***—National Forest System (NFS) lands in the United States contain 3,126 CWA 303(d) listed waterbodies; nearly every Forest Service administrative unit (96 percent) has at least one impaired waterbody within its boundaries. BMPs identified in Total Maximum Daily Load restoration plans will improve water quality conditions in impaired waters.
- ***Improve relationships with EPA, States, and the public***—Improved Forest Service BMP program performance and accountability will better demonstrate compliance with CWA permit requirements and State nonpoint source programs and build trust between the agency and our partners and stakeholders.
- ***Improve the agency's ability to demonstrate results in watershed management***—The Forest Service has made a commitment to implement several accountability tools, including a National BMP Program, to document improvements in watershed condition as a result of management and restoration actions.
- ***Improve the agency's ability to use adaptive management in land management plan implementation***—The National BMP Program will provide a consistent, credible, and affordable agencywide BMP monitoring program with coordinated data collection; monitoring information that can be aggregated at any scale; a database accessible to all Forest Service users; and reports that will be shared with EPA, States, and other partners. This type of monitoring program provides a continuous feedback loop for a successful adaptive management process.
- ***Improve National Environmental Policy Act analyses and compliance with other Federal laws***—Improved accountability for water quality management will lead to improved National Environmental Policy Act analysis and documentation and better demonstration of compliance with other Federal laws, such as Endangered Species Act habitat protections for aquatic threatened and endangered species. The agency's ability to respond successfully to water-quality-related appeals and lawsuits will be improved, and management flexibility in decisionmaking will be maintained.

The National BMP Program will provide consistency among Forest Service administrative units to efficiently administer the program and demonstrate improvements in performance and accountability at multiple scales. The National BMP Program consists of four main components: (1) a set of National Core BMPs, (2) a set of standardized monitoring protocols to evaluate implementation and effectiveness of those BMPs, (3) a data management and reporting structure, and (4) corresponding national direction.

The National Core BMPs integrate individual State and Forest Service regional BMPs under one umbrella to facilitate an agencywide BMP monitoring program. The national core set provides general, nonprescriptive BMPs for the broad range of activities that occur on NFS lands. Nearly every BMP in the national core set already exists in current regulations, guidance, or procedures. Adopting a standard national core set of BMPs may change what some national forests and grasslands refer to as their BMPs, but it will not change the substance of site-specific BMP prescriptions. Those prescriptions will continue to be based on State BMPs, regional Forest Service guidance, land management plan standards and guidelines, BMP monitoring information, and professional judgment. Standardization will improve consistency, ensure that Forest Service resource professionals use best available science to develop site-specific BMP prescriptions, and, ultimately, improve water quality on and downstream of NFS lands.

The national BMP monitoring protocols will be used to supplement existing national forest or grassland BMP monitoring programs for those units that already have programs and provide a foundation for those units that do not. Each national forest and grassland will complete a small number of national BMP monitoring evaluations each year for each of the national core BMPs implemented on the unit. This information will be aggregated over time to provide national- and regional-scale evaluations of BMP performance. Identified deficiencies in either BMP implementation or effectiveness will be used to adjust land and resource management activities and the BMPs to improve water quality protection.

In summary, the Forest Service National BMP Program is the agency's nonpoint source pollution control program for achieving and documenting water resource protection. The National BMP Program demonstrates the agency's commitment to land stewardship and protection of water quality consistent with the CWA, State regulations, and other requirements. The National BMP Program is not intended in any way to circumvent or interfere with State and tribal CWA programs, rather it is intended to support and assist the States and tribes in their efforts to ensure compliance on NFS lands. The ultimate goal is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters located within or near the national forests and grasslands.

List of Abbreviations

AMP—Allotment Management Plan

AMZ—Aquatic Management Zone

AOI—Annual Operating Instructions

BAER—Burned Area Emergency Response

BLM—Bureau of Land Management

BMP—Best Management Practice

CFR—Code of Federal Regulations

COE—U.S. Army Corps of Engineers

CWA—Clean Water Act

CWE—cumulative watershed effects

DSR—Damage Survey Report

EPA—U.S. Environmental Protection Agency

ERFO—emergency relief for federally owned roads

FERC—Federal Energy Regulatory Commission

FY—fiscal year

FSH—Forest Service Handbook

FSM—Forest Service Manual

IDT—interdisciplinary team

IMT—incident management team

MVUM—Motor Vehicle Use Map

NEPA—National Environmental Policy Act

NFS—National Forest System

NPDES—National Pollutant Discharge Elimination System

NRCS—Natural Resources Conservation Service

RMOs—Road Management Objectives

ROS—Recreation Opportunity Spectrum

SPCC—Spill Prevention Control and Countermeasures

TMDL—total maximum daily load

USDA—U.S. Department of Agriculture

USGS—U.S. Geological Survey

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Part 1. Introduction

High-quality water is one of the most important natural resources coming from the national forests and grasslands. National Forest System (NFS) lands, which represent about 8 percent of the land area of the contiguous United States, contribute 18 percent of the Nation's water supply (Brown et al. 2008; Sedell et al. 2000). About 124 million people rely on NFS lands as the primary source of their drinking water (USDA Forest Service 2008a). In addition to drinking water and other municipal needs, water on NFS lands is important to sustaining populations of fish and wildlife, providing various recreation opportunities, and providing supplies to meet agricultural and industrial needs across the country.

The national forests and grasslands were established to protect the land, secure favorable conditions of water flows, and provide a sustainable supply of goods and services (the Organic Administration Act of 1897). NFS lands are managed using a multiple-use approach with the goal of sustaining healthy terrestrial and aquatic ecosystems while addressing the need for resources, commodities, and services for the American people (USDA Forest Service 2008a). With a growing population and a finite fresh water resource, providing high-quality fresh water supplies is more critical than ever to the social and economic well-being of the United States.

Aquatic Management Zone (AMZ)

An AMZ is an administratively designated zone adjacent to stream channels and other waterbodies. Special management controls aimed at maintaining and improving water quality or other water- and riparian-dependent values, including groundwater-dependent ecosystems, should be applied in the delineated AMZ. The width of the AMZ is determined based on site-specific factors and local requirements. AMZ delineation may encompass the floodplain and riparian areas when present. AMZ designation can have synergistic benefits to other resources, such as maintaining and improving aquatic and riparian area-dependent resources, visual and aesthetic quality, wildlife habitat, and recreation opportunities.

A variety of names for the AMZ concept are used in the States and Forest Service regions: Water Influence Zone (WIZ), Rocky Mountain Region 2 (R2); Stream Environment Zones, Pacific Southwest Region (R5); Riparian Conservation Areas, R5; Riparian Reserves, R5 and Pacific Northwest Region (R6); Riparian Habitat Conservation Areas, R5 and R6; Streamside Management Unit (SMU), R6; Riparian Corridor, Southern Region (R8); Riparian Management Corridor (RMC), Eastern Region (R9); and Riparian Management Area, Alaska Region (R10). For purposes of the National Core BMPs, these areas will be referred to as AMZs.

Forests and grasslands generally produce high-quality water, especially when the ecosystems are healthy and functioning properly. Water quality is influenced by the pattern, magnitude, intensity, and location of land use and management activities. Some land uses can protect or restore water quality, while others may degrade or pose risks to clean water. Excess sediment (turbidity and bedload), nutrients, temperature, hazardous chemicals, and their resulting effects on water chemistry and aquatic habitats, are the most significant water quality issues resulting from land uses and management activities on NFS lands.

Preventing negative water quality impacts is more efficient and effective than attempting to restore the damage. To ensure water quality is protected, the Forest Service, an agency of the U.S. Department of Agriculture (USDA), has developed procedures, methods, and controls, consistent with Federal and State requirements, to address potential pollutants and pollution at their source. Implementation and monitoring of these Best Management Practices (BMPs) is the fundamental basis of the Forest Service water quality management program to protect, restore, or mitigate water quality impacts from activities on NFS lands.

National BMP Program Purpose and Objectives

The purpose of the National BMP Program is to provide a standard set of core BMPs and a consistent means to track and document the use and effectiveness of BMPs on NFS lands across the country. The objectives of the National BMP Program are as follows:

1. To establish uniform direction for BMP implementation to control nonpoint source pollution on all NFS lands to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that will meet the intent of the Federal and State water quality laws and regulations, Executive orders, and USDA and Forest Service directives.
2. To establish a consistent process to monitor and evaluate Forest Service efforts to implement BMPs and the effectiveness of those BMPs at protecting water quality at national, regional, and forest scales.
3. To establish a consistent and creditable process to document and report agency BMP implementation and effectiveness.

The National BMP Program has four components: a national core set of BMPs, a procedural guide for monitoring BMP implementation and effectiveness, a data management system, and corresponding national direction. This technical guide contains the national core set of BMPs to be used in the National BMP Program. The national BMP monitoring protocols will be contained in Volume 2 of this technical guide (FS-990b), which is currently being prepared.

Scope of Technical Guide

This technical guide provides information for implementing the National Core BMP portion of the Forest Service National BMP Program. The National Core BMPs were compiled from Forest Service manuals, handbooks, contract and permit provisions, and policy statements, as well as State or other organizations' BMP documents. The National Core BMPs are not intended to supersede or replace existing regional, State, forest, or grassland BMPs. Rather, the National Core BMPs provide a foundation for water quality protection on NFS lands and facilitate national BMP monitoring.

The National Core BMPs encompass the wide range of activities on NFS lands across the Nation. The primary intent of the National Core BMPs is to carry out one of the Clean Water Act (CWA) purposes to maintain the chemical, physical, and biological integrity of the Nation's waters. To that end, the National Core BMPs are focused on water pollution control. The National Core BMPs also address soil, aquatic, and riparian resources, but only to the extent that they contribute to maintenance of chemical, physical, and biological water quality.

The National Core BMPs in this technical guide are deliberately general and nonprescriptive. Because this document is national in scope, it cannot address all possible practices or practices specific to local or regional soils, climate, vegetation types, or State-specific requirements. The National Core BMPs require the development of site-specific BMP prescriptions based on local site conditions and requirements to achieve compliance with established State, tribal, or national water quality goals. It is expected that State requirements and BMP programs, Forest Service regional guidance, and the land management plan will provide the criteria for site-specific BMP prescriptions. The National Core BMPs provide direction on "what to do" and the local direction will provide direction on "how to do it." Table 1 contains two examples comparing the National Core BMP direction with Forest Service regional direction and State BMPs. Forest Service regions may supplement the National Core BMPs with additional practices or practices that are more specific to meet regional needs.

Table 1.—*Examples of how Forest Service regional direction and State BMPs fit within the National Core BMP framework*

National Core BMP	Region 2 WCP[1]	Region 5 BMP[2]	Montana BMP[3]	Wisconsin BMP[4]
BMP Plan-3 Aquatic Management Zone (AMZ) Planning • Determine width of AMZ for waterbodies in the project area that may be affected by the proposed activities. • Evaluate the condition of riparian habitat and estimated response to the activity to determine need for and width of AMZ. • Use stream class and type, channel condition, aspect, slope, and soils to determine appropriate AMZ width.	**Water Influence Zone (WIZ)** • The WIZ includes the geomorphic floodplain, riparian ecosystem, and inner gorge. • The minimum horizontal width is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most.	**Practice 1-8 Streamside Management Zone (SMZ) Designation** • Identify the SMZ requirements during environmental documentation process. Each forest's land and resource management plan identifies specific measures to protect these zones. At a minimum, forest requirements must be identified and implemented.	**Width of SMZ-Marking Boundary** • The SMZ width is a 50-foot slope distance on each side of streams, lakes, and other bodies of water measured from the ordinary high water mark. In all cases, except on Class 1 and 2 stream segments and lakes where the slope of the SMZ is greater than 35 percent, the SMZ width is 100 feet.	**Riparian Management Zone (RMZ)** • The RMZ for lakes, designated trout streams, and streams 3 feet wide or wider is a strip of land running along the shoreline of lakes and on each side of a stream. It begins at the ordinary high water mark and extends a minimum of 100 feet landward. • The RMZ for streams less than 3 feet wide is a strip of land on each side of a stream, beginning at the ordinary high water mark and extending a minimum of 35 feet.
BMP Veg-4 Ground-Based Skidding and Yarding Operations • Use ground-based yarding systems only where physical site characteristics are suitable to avoid, minimize, or mitigate adverse effects to soil and water quality. • Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for ground-based yarding systems.	**WCP Management Measure 9** • Limit roads and other disturbed sites to the minimum feasible number, width, and total length consistent with the purpose of specific operations, local topography, and climate. • Avoid new roads or heavy equipment use on unstable or highly erodible soils. • Avoid ground skidding on sustained slopes steeper than 40 percent and on moderate to severely burned sustained slopes greater than 30 percent.	**Practice 1-9 Determining Tractor Loggable Ground** • Avoid tractor logging where the predicted post-logging erosion hazard cannot be reduced to either "low" or "moderate."	**Timber Harvesting** • Use the logging system that best fits the topography, soil types, and season while minimizing soil disturbance and economically accomplishing silvicultural objectives. • Topography considerations for "cut-to-length harvesting"—limited to terrain less than 40 percent slope.	**Timber Harvesting** • Avoid operating equipment where excessive soil compaction and rutting may cause erosion that affects water quality. The use of low ground pressure equipment may allow logging to continue. • Where possible, keep skid trail grades less than 15 percent. Grades greater than 15 percent should not exceed 300 feet in length.

[1] *Rocky Mountain Region (Region 2) Watershed Conservation Practices (WCP), Forest Service Handbook 2509.25 (2006).*

[2] *Pacific Southwest Region (Region 5) Water Quality Management for National Forest System Lands in California—Best Management Practices (USDA Forest Service 2000).*

[3] *Water Quality Best Management Practices for Montana Forests. (Logan 2001).*

[4] *Wisconsin's Forestry Best Management Practices for Water Quality (Holaday and Wagner 2010).*

Part 2. Managing Water Quality on National Forest System Lands

Federal Clean Water Act

The Federal Clean Water Act (CWA) (33 U.S.C. § 1251 et seq.) is the foundation for surface water quality protection in the United States. The objective of the CWA, as articulated in section 101, is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. This law uses a variety of regulatory and nonregulatory tools to control direct pollutant discharges from point sources and manage polluted runoff from nonpoint sources to waters of the United States.

In the CWA, Congress gave States and tribes the option for taking primary responsibility for water pollution control. (States will be used in the rest of this report to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the CWA.) As a result, most States and many tribes have taken on that responsibility and, therefore, water quality standards, procedures, rules, and regulations differ from one State to another. The Forest Service, as an agency of the Federal Government, is required to comply with all Federal, State, and local requirements for water pollution control in the same manner and to the same extent as any nongovernmental entity (CWA section 313).

Water Quality Standards

Water quality standards translate the broad goals of the CWA into specific objectives for an individual waterbody. Each State designates uses to be protected for each jurisdictional waterbody within its boundaries. State water quality standards must provide for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water, unless those uses have been shown to be unattainable. States must also adopt water quality criteria to protect such designated uses. In addition, each State must adopt an antidegradation policy. This policy is designed to prevent deterioration of existing levels of water quality, and must, in part, maintain existing uses and the level of water quality necessary to protect such uses. States review their water quality standards periodically and, at a minimum, every 3 years. The EPA reviews and approves State water quality standards to ensure consistency with CWA requirements.

States are required to identify all waters that do not meet water quality standards even after mandatory pollution controls are in place. These waterbodies are considered to be impaired and are placed on the States' biennial 303(d) list. A Total Maximum Daily Load (TMDL) must be developed by the State for all waterbodies on its approved 303(d) list. The TMDL represents the maximum amount of a pollutant that can enter a waterbody without exceeding the water quality standards. The TMDL amount is distributed among all the pollutant sources (point sources, nonpoint sources, and natural background levels) contributing to that particular waterbody. A margin of safety factor is also considered. A TMDL analysis must clearly identify the links between the waterbody use impairment, the causes of the impairment, and the pollutant load reductions needed to meet the applicable water quality standards. EPA reviews and approves TMDLs and must complete the TMDL if it disapproves the State-developed TMDL. TMDLs are used as planning tools by States to develop specific methods or controls used to meet water quality standards in the impaired waterbody. The point source components of a TMDL are implemented through existing enforceable Federal programs (e.g., National Pollutant Discharge Elimination System [NPDES]). Nonpoint source controls (e.g., Best Management Practices [BMPs]) required by a TMDL can be implemented through a voluntary approach or some State and local regulations or other authorities. A specific TMDL implementation plan is not required by the CWA; however, some States require a TMDL implementation plan or watershed restoration plan.

Point Source Pollution Control

Point source pollution is regulated through a permitting program as outlined in CWA sections 401, 402, and 404. Section 401 provides an opportunity for States to ensure that a permit or license issued by the Federal Government meets applicable State water quality requirements. Federal agencies may not issue permits for activities that "may result in any discharge into navigable waters" until the agency obtains certification from the State that the authorized activity will comply with water quality standards. Each State has its own rules and procedures for 401 Certification. Certification generally applies to point source discharges where a 402 or 404 permit is issued by the EPA or the U.S. Army Corps of Engineers (COE) and for Federal Energy Regulatory Commission licenses. Certification may also be required for some Forest Service special use authorizations and mining plan of operations where there would be a point source discharge. Section 401 is a "condition precedent;" that is, 401 Certification must be obtained and proof provided to the Federal agency before the permit or license can be issued.

The NPDES program is described in CWA section 402. NPDES permits, or the State equivalent, regulate point source discharges. A point source discharge is defined as any addition of a pollutant to waters of the United States from a point source (e.g., a discrete conveyance such as pipes or manmade ditches). Aside from stormwater discharge permits, in general, few types of Forest Service administrative activities would require a NPDES permit. The project proponent is responsible for obtaining permit coverage. Section 402 is "condition subsequent" (i.e., the Forest Service can approve the activity before the 402 permit being obtained).

Stormwater discharges occur when runoff generated by rain or snowmelt events flows over land or impervious surfaces and is discharged to waters of the United States through discrete conveyances such as ditches or channels. Stormwater runoff does not percolate into the ground and may pick up and transport debris, chemicals, sediment, or other pollutants as it flows over the land or impervious surfaces. These pollutants could adversely affect water quality if the runoff is not treated before it is discharged into a surface waterbody. Stormwater discharge permits are required for certain categories of industrial activities and construction activities. The "operator," defined as the one who has operational control over the construction plans and specifications and has day-to-day operational control over activities at the site, is the party that should obtain stormwater permit coverage. The contractor or permittee and the Forest Service may be required to obtain permit coverage if either or both are considered the operator. Permits for industrial or construction activities or other temporary disturbances generally require BMPs as a primary method of controlling and containing stormwater runoff to protect water quality.

CWA section 404 regulates the discharge of dredge or fill materials into waters of the United States. EPA and the COE jointly administer the 404 program. Unless a State has assumed 404 permitting authority, the COE is responsible for issuing 404 permits. Typical Forest Service activities that could require a 404 permit include stream crossings, stream restoration, habitat improvements, activities in wetlands, and spring developments. Certain silviculture activities are exempt from 404 permits (CWA §404[f][1][A], 33 CFR 323.4[a] [1] and 40 CFR 232.3[c][1]). Forest roads, as defined by COE guidance, are exempt from needing 404 permits as long as the BMPs detailed in the regulations are used to ensure that flow and circulation patterns and chemical and biological characteristics of the waters of the United States are not impaired (CWA § 404[f][1][E], 33 CFR 323.4[a] [6] and 40 CFR 232.3[c] [6][i-xv]). General 404 permits (nationwide or regional) have been established for many categories of activities. If a proposed activity cannot be covered by a general 404 permit, an individual 404 permit is required. The project proponent or permittee is responsible for obtaining the 404 permit. Like section 402, section 404 is "condition subsequent," so the activity, either a Forest Service project or a third-party activity proposed on National Forest System (NFS) lands, can be approved by the Forest Service before the 404 permit coverage is obtained. The project cannot be implemented until permit coverage is acquired.

Nonpoint Source Pollution Control

The CWA does not regulate nonpoint source pollution. Instead, sections 208 and 319 require States to develop a process to identify, if appropriate, agricultural, silvicultural, and other categories of nonpoint sources of pollution and to set forth procedures and methods, including land use requirements, to control to the extent practicable such sources. Each State has a Nonpoint Source Management Program and Plan that directs how the State will control nonpoint source pollution. The Nonpoint Source Management Plan describes the process, including intergovernmental coordination and public participation, for identifying BMPs to control identified nonpoint sources and to reduce the level of pollution from such sources. States often use these same sets of BMPs as the best approach to control point source discharges, such as stormwater discharges.

After BMPs have been approved by a State, the BMPs may become the primary mechanism for meeting water quality standards from nonpoint source pollution sources in that State. Proper installation, operation, and maintenance of State approved BMPs are presumed to meet a landowner or manager's obligation for compliance with applicable water quality standards. If subsequent evaluation indicates that approved and properly installed BMPs are not achieving water quality standards, the State should take steps to revise the BMPs, evaluate and, if appropriate, revise water quality standards (designated uses and water quality criteria), or both. Through the iterative process of monitoring and adjusting BMPs and water quality standards, it is anticipated and expected that BMPs will lead to attainment of water quality standards (EPA 1987).

State Nonpoint Source Management Programs

Each State develops a set of BMPs as part of its Nonpoint Source Management Program. In many States, use of BMPs is voluntary; that is, it is encouraged but not required by regulation. Other States have a regulatory framework for nonpoint sources, either through their water quality laws and regulations or forest practices laws and regulations, where use of BMPs is required.

All national forests and grasslands have adopted BMPs consistent with or approved by State nonpoint source management programs. In some States, the Forest Service uses the State BMPs as written, in addition to land management plan direction. In some Forest Service regions, the Forest Service has established BMPs, and the States have agreed that those practices conform to State requirements. In a few instances, Forest Service BMPs have gone through a formal public review process, Forest Service BMPs have been approved by the State and EPA, and the Governor of the State has designated the Forest Service as the water quality management agency for NFS lands within the State. In many States, the Forest Service has entered into an agreement that outlines how the Forest Service will implement that particular State's Nonpoint Source Management Plan on NFS lands (see table 2).

Table 2.—*Forest Service water quality agreements with States as of November 2011*

MAA	MOA	MOU		LOC
AL (1990)	AK (1992)	AZ (2008)	NV (2009)	AR (1990)
CA (1981)	WA (2000)	GA (1991)	OR (2002)	FL (1990)
MS (1990)		ID (2008)	SC (1990)	MS (1990)
		KY (1990)	SD (2009)	OK (1991)
		LA (1993)	TN (1997)	VA (1990)
		MI (2011)	TX (1991)	
		MT (2008)	UT (2009)	
		NC (1992)	WV 2010	
		NM (2011)	WY (2011)	

LOC – Letter of Certification. MAA – Management Agency Agreement. MOA – Memorandum of Agreement. MOU – Memorandum of Understanding.

Forest Service Policy for Water Quality Management

Forest Service Manual (FSM) Direction

Forest Service policy for watershed management is contained in FSM 2500. Watershed management activities on national forests and grasslands are to be implemented in accordance with the general objectives of multiple use and the specific objectives in the land management plan. All management activities of other resources are to be designed to minimize short-term impacts on the soil and water resources and to maintain or enhance long-term productivity, water quantity, and water quality (FSM 2503).

Forest Service policy for watershed management also includes monitoring to assess the degree to which planning, management operation, and maintenance of renewable resources meet established goals and standards (FSM 2525). Soil and water resource monitoring is to be designed and implemented to evaluate effects of each forest management activity or program on basic soil and water quality and productivity. The objectives of monitoring are to secure data sufficient to assist line officers and resource managers in evaluating the effects of management activities on the soil and water resources and to support changes in management activities to protect soil and water quality.

FSM 2532 provides policy and direction specific to water quality management on NFS lands. The objective of water quality management on NFS lands is to protect and, where needed, improve the physical, chemical, biological, and aesthetic quality of the water resource consistent with the purposes of the national forests and national water quality goals. BMPs are to be promoted and applied to all management activities as the method for control of nonpoint sources of water pollution to achieve established State or national water quality goals. BMPs applied should be based on site-specific conditions and political, social, economic, and technical feasibility. Application of the National BMP Program should constitute compliance with water quality standards. Monitoring methods that reflect nonpoint source conditions should be used to measure effectiveness of those BMPs.

Forest Service Nonpoint Source Strategy

The Forest Service strategy for control of nonpoint source pollution is to apply appropriate BMPs using adaptive management principles. This strategy involves applying approved BMPs, monitoring the implementation and effectiveness of the BMPs, and using the monitoring results to inform and improve management activities. This process is illustrated in figure 1 and outlined in the following list.

1. Approved BMPs are applied to all management activities to control nonpoint sources of water pollution and are used for compliance with established State or national water quality goals.
    a. Site-specific BMP prescriptions, consistent with the National Core BMPs, are developed using regional or State BMPs and land management plan direction.
    b. BMP prescriptions are properly installed and maintained to minimize impacts of current management activities to protect and maintain water quality.
2. BMP implementation and effectiveness are monitored using National Core BMP monitoring protocols and reporting systems.
    a. Field evaluations are used to monitor BMP implementation to determine whether appropriate site-specific BMP prescriptions were planned and implemented as intended.

b. Field evaluations of appropriate parameters or surrogates are used to monitor BMP effectiveness to determine if the applied practices met the desired objective(s).

c. BMP monitoring data is managed in the established corporate data system and analyzed at national, regional, and forest or grassland levels.

3. BMP monitoring results are used to inform and improve management activities.

   a. The results of BMP monitoring and best available science are used, in collaboration with Federal, State, and local agencies and partners as appropriate, to improve administrative procedures and BMP practices and applications.

   b. Corrective actions are initiated where implementation monitoring indicates that BMPs have been implemented, but effectiveness monitoring indicates that BMP objectives were not met.

   c. Changes in water quality designated uses and standards are recommended as necessary, in coordination with the appropriate agency.

4. Monitoring results and findings are documented and shared with appropriate Federal, State, and local agencies.

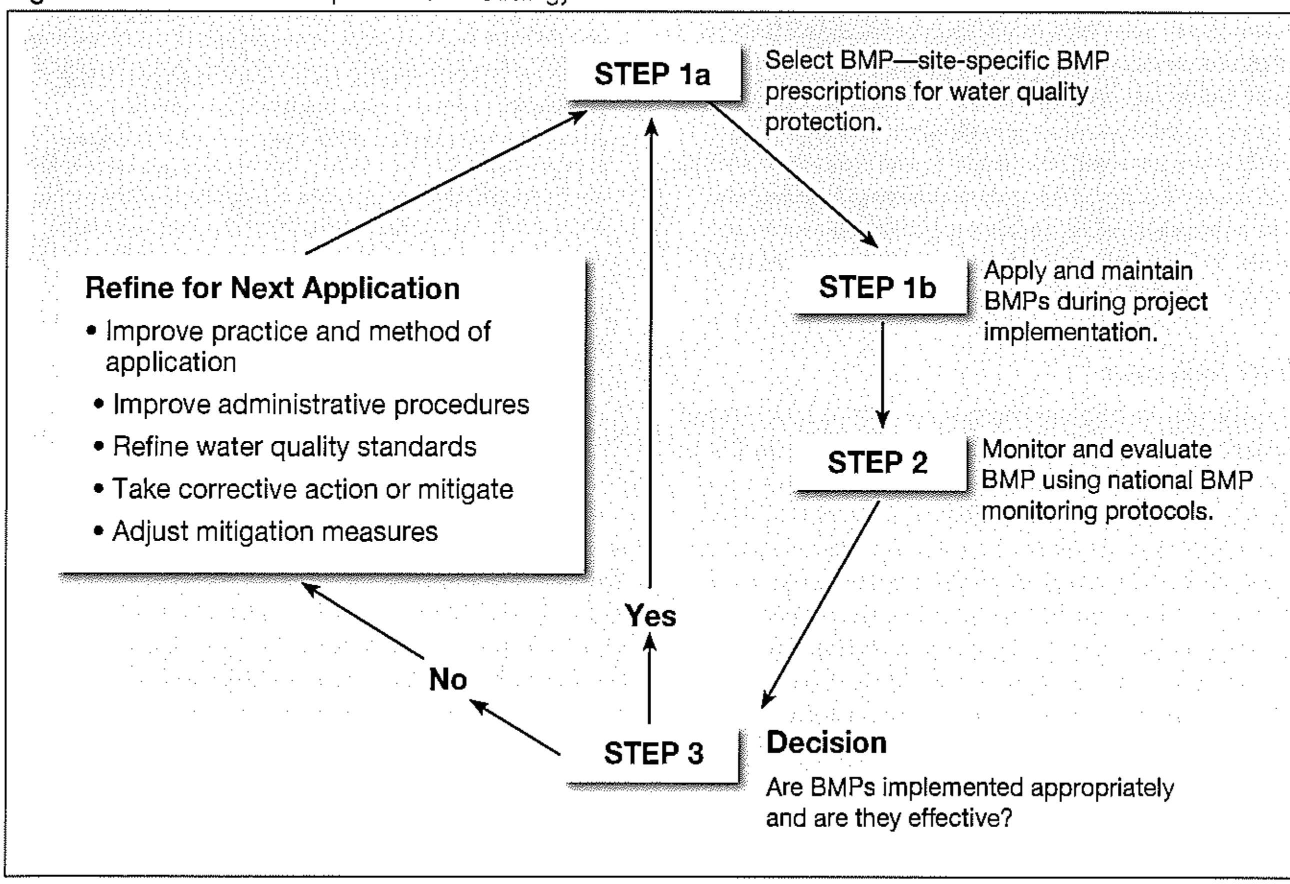
Plan to Project: Forest Service BMP Process

The Forest Service BMP Process consists of the following steps to incorporate BMPs into project planning and on-the-ground implementation to ensure water quality is protected.

BMP Selection and Design

Water quality goals and objectives are established in the land management plan (see BMP Plan-1 Forest and Grassland Planning). These goals are specific to each individual national forest or grassland and are intended to meet or exceed applicable legal requirements including the CWA and State water quality regulations. A land management plan may also specify BMPs as standards and guidelines to be used to meet those goals and objectives.

Figure 1. Forest Service Nonpoint Source Strategy



The project planning process starts when a project or resource management activity is proposed. A project may be initiated by the Forest Service to implement some aspect of the land management plan, or may be proposed by an outside party that wants to occupy or use NFS lands for a specific purpose, such as for mining, a commercial recreation development, or a utility facility. When a project is initiated, the responsible official, usually the local district ranger or forest supervisor, appoints an interdisciplinary team (IDT) to complete the appropriate environmental analysis as required by the National Environmental Policy Act (NEPA) to inform the decision on the project or activity.

In the project planning and environmental analysis process, the IDT selects appropriate or required BMPs to be used to achieve land management plan water quality goals and objectives (see BMP Plan-2 Project Planning and Analysis). BMPs are selected to fit local conditions, resource values, and designated uses of water. Site-specific BMP prescriptions are developed based on the proposed activity, water quality objectives, soils, topography, geology, vegetation, climate, and other site-specific factors and are designed to avoid, minimize, or mitigate potential adverse impacts to soil, water quality, and riparian resources. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are all used to develop site-specific BMP prescriptions. During the planning process, CWA or other State-required permits or certifications are also identified. The site-specific BMP prescriptions and other permit requirements are described and disclosed in the NEPA analysis document or project file. The responsible official considers the information provided by the IDT and makes a decision on which site-specific BMP prescriptions will be applied to the project.

BMP Application

The site-specific BMP prescriptions are translated into contract provisions, special use authorization requirements, project plan specifications, and other similar documents. This ensures that the operator or person responsible for applying the BMPs is required to do so. Implementation of projects or other management activities are supervised by Forest Service personnel to ensure the site-specific BMP prescriptions are implemented according to the contract, permit, or plan. During project or activity implementation, site-specific BMP prescriptions are adjusted as needed to better fit current site conditions. As part of project, contract, or permit administration, project or activity inspections are completed as needed to identify BMP deficiencies or maintenance needs. BMP application is documented in the appropriate project-related documents.

BMP Monitoring and Adjustment

Implementation and effectiveness of applied BMPs are monitored to inform and improve future management activities. BMP implementation monitoring asks the question: "Did we do what we said we were going to do?" BMP effectiveness monitoring evaluates whether the BMPs were effective in meeting management objectives and protecting designated uses.

Programmatic BMP Monitoring in The Pacific Southwest Region
Best Management Practices Evaluation Program

The Forest Service Pacific Southwest Region has a Management Agency Agreement with the State of California requiring the Forest Service to incorporate BMPs into land and resource management activities and to monitor their implementation and effectiveness. Since 1992, the region has been monitoring BMPs using its BMP Evaluation Program. The Forest Service evaluates BMP implementation and effectiveness at randomly selected sites using 29 different monitoring protocols. Every year, the region assigns each national forest system unit a certain number of evaluations to complete. From fiscal year (FY) 2003 to FY 2007, the Forest Service completed 2,861 onsite evaluations; an average of 572 per year. The Forest Service rated BMPs as implemented on 86 percent of those evaluations and effective on 89 percent. Overall, 93 percent of the BMPs that were rated as implemented were also judged effective.

This monitoring has shown that BMPs are effective at protecting water quality when they are properly implemented. From this monitoring, the Pacific Southwest Region has concluded that the greatest opportunity for improving water quality is to improve implementation of the BMPs, particularly for recreation activities and mining. The region has planned steps to improve BMP implementation and effectiveness including BMP implementation checklists for projects, reviews of national forest staffing levels, and revision of BMPs that have relatively low effectiveness when implemented properly (USDA Forest Service 2009a).

The Forest Service Nonpoint Source Strategy uses "programmatic monitoring" to evaluate BMP implementation and effectiveness; that is, aside from project administration described above, BMPs are not monitored on every project or activity that occurs on NFS lands. Projects to monitor or specific monitoring sites are selected in a manner that results in objective and representative data on BMP implementation and effectiveness. Often, a random or systematic random selection procedure is used to choose monitoring locations across a forest or grassland where specific activities or BMPs are targeted. In some cases, a national forest or ranger district will choose a small number of projects to review using an IDT process. BMP monitoring results are summarized in land management plan monitoring reports.

Programmatic BMP monitoring is used for a variety of purposes. The adequacy of specific BMPs or management activities at protecting water quality can be evaluated. These results can be used to inform future environmental analysis of similar projects under similar conditions. For example, programmatic BMP monitoring on the Flathead and Kootenai National Forests in Montana has found that, since 1988, BMPs were effective 99.3 percent of the time when properly applied on glacial till soils (USDA Forest Service 2009b).

Programmatic BMP monitoring can assess administrative processes for selecting and applying appropriate BMPs over time or geographic area. After several years of BMP monitoring on silviculture activities, the Black Hills National Forest in South Dakota and Wyoming found that BMPs were generally being implemented and, when implemented, were effective in the timber sale units that were inspected. The BMP monitoring identified some issues with road drainage, however. As a result, the forest engineering and watershed staff together developed recommendations to improve their BMPs for road drainage (USDA Forest Service 2010a). In another example, the North Carolina National Forests compared BMP implementation and effectiveness on timber sales as monitored from 1992 to 2000 to BMP monitoring results in 2009 and 2010 (USDA Forest Service 2010b). Overall BMP implementation improved from 68 percent in the earlier monitoring period to 92 percent in 2009 and 2010. BMP effectiveness also improved from 73 percent in 1992 to 2000 to 93 percent in 2009 and 2010.

Montana's Forestry BMP Audits

The Montana Department of Natural Resources and Conservation, Forestry Division, has evaluated forest practices for BMP implementation and effectiveness every 2 years since 1990 (Ziesak 2010). The Forestry Division has evaluated timber harvest sites on Federal, State, and private lands. Over all ownerships, BMP implementation has improved from 78 percent rated as "meets or exceeds criteria" in 1990 to 97 percent in 2010. Similarly, BMP effectiveness has also improved, from 80 percent rated as providing "adequate protection" in 1990 to 98 percent in 2010. BMP implementation and effectiveness on timber harvest sites on NFS lands has been consistently rated high over the past few audit cycles.

	2010	2008	2006
BMP Implementation	96%	96%	93%
BMP Effectiveness	98%	96%	95%
Streamside Management Zone (SMZ) Implementation	94%	99%	100%
SMZ Effectiveness	95%	99%	100%

In addition to BMP monitoring by the Forest Service, many States monitor BMP implementation and effectiveness on timber sale projects on NFS lands. These State audits are generally completed every 3 to 5 years, or annually in some States. The audit teams are comprised of State employees, Forest Service and other Federal agency employees, representatives from the timber industry, and landowners. Selected timber sale projects on private and State lands are audited along with projects on NFS lands. In general, BMP implementation and effectiveness on NFS lands as rated by these State audit teams compares favorably with, and often exceeds, the BMP performance on private or State lands.

Summary

The Forest Service policy for control of nonpoint sources of pollution is to use BMPs, monitor the implementation and effectiveness of those BMPs, and adjust management practices using monitoring results. An administrative unit IDT identifies the appropriate BMPs for a project during the planning process and develops site-specific BMP prescriptions based on site conditions, State BMPs, and other local guidance or requirements. The responsible official considers the information provided by the IDT and makes a decision on which site-specific BMP prescriptions will be applied to the project. Unit staff monitor BMPs and summarize monitoring data at the forest or grassland level in either project documentation or the land management plan monitoring reports.

The National BMP Program provides core BMPs and BMP monitoring protocols for all activities on NFS lands. In the past, most of the BMP monitoring has focused on timber harvest sites and associated roads. The National BMP Program expands that to include all activities by providing consistent monitoring protocols for recreation, livestock grazing, fire and fuels, and minerals, in addition to vegetation management and roads. The National BMP Program will also have an associated data management system that will facilitate documentation and reporting of BMP monitoring results at national forest or grassland, regional, or national scales.

Part 3. National Core Best Management Practices

This part describes the Forest Service National Core Best Management Practices (BMPs). The National Core BMPs are intended for use on National Forest System (NFS) lands as part of the Forest Service strategy for water quality management. The National Core BMPs are grouped into the following resource categories:

- Plan General Planning Activities
- AqEco Aquatic Ecosystems Management Activities
- Chem Chemical Use Management Activities
- Fac Facilities and Nonrecreation Special Uses Management Activities
- Fire Wildland Fire Management Activities
- Min Minerals Management Activities
- Range Rangeland Management Activities
- Rec Recreation Management Activities
- Road Road Management Activities
- Veg Mechanical Vegetation Management Activities
- WatUses Water Uses Management Activities

With the exception of the General Planning Activities being listed first, the sequence in which these resource categories are presented has no intended significance. Planning is important to managing potential management activity impacts to achieve water quality goals and objectives and, therefore, is listed first.

Each BMP is organized according to the following format:

Title	Includes the sequential number of the BMP within the resource category and title of the BMP.
Reference	Identifies the Forest Service Manual or Handbook direction pertinent to the BMP.
Objective	Describes the desired results or attainment of the BMP as it relates to maintaining chemical, physical, and biological water quality.
Explanation	Provides background information to provide context for the BMP. Describes criteria or standards used when applicable.
Practices	Lists recommended methods to achieve the BMP objectives.

The National Core BMPs are deliberately general and nonprescriptive. Although some impacts may be thought of as characteristic of a management activity, the actual potential for a land use or management activity to impact water quality depends on:

1. The physical, biologic, meteorological, and hydrologic environment where the activity takes place (e.g., topography, physiography, precipitation, stream type, channel density, soil type, and vegetative cover).
2. The type of activity imposed on a given environment (recreation, mineral exploration, and vegetation management) and the proximity of the activity area to surface waters.
3. The magnitude, intensity, duration, and timing of the activity (grazing system used, types of silvicultural practices used, constant use as opposed to seasonal use, recurrent application, or one-time application).

4. The State designated beneficial uses of the water in proximity to the management activity and their relative sensitivity to the potential impacts associated with the activity.

These four factors vary throughout the lands administered by the Forest Service. It follows then, that the extent and kind of potential water quality impacts from activities on NFS lands are variable, as are the most appropriate mitigation and pollution control measures. No solution, prescription, method, or technique is best for all circumstances.

The National Core BMPs cannot include all possible practices or techniques to address the range of conditions and situations on all NFS lands. **Each BMP in this document has a list of recommended practices that should be used, as appropriate or when required, to meet the objective of the BMP. Not all recommended practices will be applicable in all settings, and there may be other practices not listed in the BMP that would work as well, or better, to meet the BMP objective in a given situation.** The specific practices or methods to be applied to a particular project should be determined based on site evaluation, past experience, monitoring results, new techniques based on new research literature, and other requirements. **State BMPs, Forest Service regional guidance, land management plans, BMP monitoring information, and professional judgment should be used to develop site-specific BMP prescriptions.**

For example, BMP Road-4 (Road Operations and Maintenance) dictates that roads should be correctly maintained to drain and disperse water runoff to minimize the erosive effects of concentrated water flow. Some methods for draining a road are to outslope the road prism, install dips, and lead out ditches or inslope the road to a ditch line and install culverts. It is during the onsite evaluation of a specific road project that the appropriate method or combination of methods to drain the road correctly is identified. The practice is, thereby, custom fit to the physical and biological environment of the project area.

After the site-specific BMP prescription is developed, it must then be included in the appropriate National Environmental Policy Act decision document and project contract or operation plan. For example, if roadwork is part of a timber harvest project, the timber sale contract is used to implement the methods for road drainage. For a hard rock mine operation, the roadwork BMP prescriptions would be included in the mining plan of operation. Roadwork BMP prescriptions would be implemented via a ski area's operation and maintenance plan for roads within a ski resort.

The National Core BMPs are grouped by resource category for ease of organization. The applicable BMPs should be used for an activity regardless of which resource grouping the BMP is listed in. For example, BMPs for Mechanical Vegetation Management Activities should be used, as appropriate, for tree removal activities in developed campgrounds. Likewise, Road Management Activity BMPs apply whether the road is for timber harvesting, mining, recreation access, or some other purpose. The specific implementing document and responsible individual will differ by resource area (e.g., recreation development plan and recreation staff officer for a recreation project, and a timber sale contract and timber sale administrator for a timber sale), but the responsibility to maintain and improve water quality is shared by all and not necessarily vested with a given resource functional area.

At the end of each resource category is a listing of additional BMP resources, including publications and Web sites, applicable to the subject resource category. The resources listed are not all inclusive; other technical resources should be consulted as needed and required.

General Planning Activities

Planning is an important Best Management Practice (BMP) for water quality management. In the planning process, potential impacts to water quality, and impacts to other resources like soils or riparian areas that may affect water quality, can be identified. In addition, requirements from laws or regulations, the land management plan, State BMPs, or other documents can be incorporated into the project design. This information can be used to shape the proposed action, develop alternatives to the proposed action, and determine appropriate site-specific BMP prescriptions to avoid, minimize, or mitigate impacts to meet water quality objectives.

Three National Core BMPs are in the General Planning Activities category. These planning BMPs are to be used during Forest Service planning processes for projects and activities on National Forest System (NFS) lands. BMP Plan-1 (Forest and Grassland Planning) contains guidance on what to include in a land management plan to provide direction for management of water quality within a plan area. BMP Plan-2 (Project Planning and Analysis) contains planning practices common to most Forest Service resource management activities. BMP Plan-2 should be used for all Forest Service activities and authorizations that could affect water quality. BMP Plan-3 (Aquatic Management Zone Planning) contains planning practices common to management of Aquatic Management Zones (AMZ).

In addition, each resource category section in this technical guide includes a planning BMP specific to the management activities addressed in that section. The activity-planning BMPs provide additional practices specific to those management activities.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

General Planning BMPs	
Plan-1	Forest and Grassland Planning
Plan-2	Project Planning and Analysis
Plan-3	Aquatic Management Zone Planning

Plan-1. Forest and Grassland Planning

Manual or Handbook Reference Forest Service Manual (FSM) 1900, FSM 1920, Forest Service Handbook (FSH) 1909.12, and FSM 2511.

Objective Use the land management planning and decisionmaking processes to incorporate direction for water quality management consistent with laws, regulation, and policy into land management plans.

Explanation The overall goal of managing NFS lands is to sustain the multiple uses of renewable resources in perpetuity while maintaining the long-term productivity of the land. Federal laws, such as the National Forest Management Act and the CWA, provide additional goals to protect or maintain and improve or restore the quality of soil and water on NFS lands. These goals are codified as policy in the Forest Service manuals and handbooks.

Forest Service planning is an integrated process composed of discrete parts—the strategic plan, land management plans, and project and activity plans. The Forest Service Strategic Plan identifies long-term strategic priorities and is the basis for integrated delivery of the agency's mission. The land management plan blends national and regional priorities from the strategic plan with local forest or grassland capability and needs. The land management plan establishes desired conditions to be achieved through management of NFS lands in the planning area to best meet the needs of the American people. The land management plan provides desired conditions, objectives, and guidance for site-specific project and activity decisions. Project-level plans describe on-the-ground projects and activities designed to achieve long-term objectives and desired conditions described in the land management plan while reflecting current local needs and issues.

The land management plan provides integrated direction for the management, protection, and use of all resources in the planning area under the principles of multiple use and sustained yield. In the land management plan, issues, concerns, and opportunities related to soil and water resources are resolved; desired conditions, goals, and objectives for soil, water, and riparian resources are established; and standards and guidelines for management of soil, water quality, and riparian resources are provided.

Practices

- Establish desired conditions, goals, and objectives for soil, water quality, and riparian resources that contribute to the overall sustainability of social, economic, and ecological systems in the plan area consistent with established State or national water quality goals for the plan area.
  - Consider the water quantity, quality, location, and timing of flows needed to provide water supplies for municipal, agricultural, commercial, and industrial uses; hydropower generation; water recreation, transportation, and spiritual uses; aesthetic appreciation; and tourism to contribute to social and economic sustainability.
  - Consider the water quantity, quality, location, and timing of flows needed to provide the ecological conditions to support diversity of native and desired nonnative plants and animal species in the plan area to contribute to ecological sustainability.
- Include plan objectives to maintain or, where appropriate, improve or restore watershed conditions to achieve desired conditions of soil, water quality, and riparian resources.
- Consider watershed characteristics, current and expected environmental conditions (including climate change), and potential effects of land uses when determining suitability of NFS lands within the planning area for various uses.
- Include standards and guidelines to maintain and, where appropriate, improve over time the quality of soil, water resources, and riparian areas when implementing site-specific projects and activities.
- Include monitoring questions and associated performance measures to address watershed condition and water quality goals and objectives.

Plan-2. Project Planning and Analysis

Manual or Handbook Reference FSM 1950, FSH 1909.15, and FSM 2524.

Objective Use the project planning, environmental analysis, and decisionmaking processes to incorporate water quality management BMPs into project design and implementation.

Explanation The project planning, environmental analysis, and decisionmaking process is the framework for incorporating water quality management BMPs into project design and implementation. The process should identify likely direct, indirect, or cumulative impacts from the proposed project or management activities on soils, water quality, and riparian resources in the project area. Project documents (plans, contracts, permits, etc.) should include site-specific BMP prescriptions to meet water quality objectives as directed by the environmental analysis. Project planning should ensure that activities are consistent with land management plan direction; State BMPs, floodplain, wetland, coastal zone; and other requirements including CWA 401 certification, CWA 402 permits, and CWA 404 permits; wilderness or wild and scenic river designations; and other Federal, State, and local rules and regulations.

Practices

- Include watershed specialists (hydrologist, soil scientist, geologist, and fish biologist) and other trained and qualified individuals on the interdisciplinary team for project planning, environmental analysis, and decisionmaking to evaluate onsite watershed characteristics and the potential environmental consequences of the proposed activity(s).
- Determine water quality management objectives for the project area.
    - Identify water quality management desired conditions and objectives from the land management plan.
    - Identify and evaluate the condition of water features in the project area (e.g., streams, lakes, ponds, reservoirs, wetlands, riparian areas, springs, groundwater-dependent ecosystems, recharge areas, and floodplains).
    - Identify State-designated beneficial uses of waterbodies and the water quality parameters that are critical to those uses.
    - Identify locations of dams and diversions for municipal or irrigation water supplies, fish hatcheries, stockwater, fire protection, or other water uses within the project area.
    - Identify any impaired (e.g., 303[d] listed) waterbodies in the project area and associated Total Maximum Daily Load (TMDL) analyses or other restoration plans that may exist.
    - Identify threatened, endangered, or sensitive species in or near water, wetlands, and riparian areas in the project area and their habitat needs related to water quality.
- Determine potential or likely direct and indirect impacts to chemical, physical, and biological water quality, and watershed condition from the proposed activity.
    - Always assume hydrological connections exist between groundwater and surface water in each watershed, unless it can reasonably be shown none exist in a local situation.
    - Consider the impacts of current and expected environmental conditions such as atmospheric deposition and climate change in the project area when analyzing effects of the proposed activities.
    - Evaluate sources of waterbody impairment, including water quantity, streamflows, and water quality, and the likelihood that proposed activities would contribute to current or future impairment or restoration to achieve desired watershed conditions.
    - Identify and delineate unstable areas in the project area.
    - Identify soil limitations and productivity impacts of proposed activities.
    - Verify preliminary findings by inspecting the sites in the field.
    - Develop site-specific BMP prescriptions, design criteria, and mitigation measures to achieve water quality management objectives. Consult local, regional, State, or other agencies' required or recommended BMPs that are applicable to the activity.
    - Consider enhanced BMPs identified in a TMDL or other watershed restoration plan to protect impaired waterbodies within the project area.

- Use site evaluations, professional experience, monitoring results, and land management plan standards, guidelines, and other requirements.
- Identify Federal, State, and local permits or requirements needed to implement the project. Examples include water quality standards, CWA 401 certification, CWA 402 permits (including stormwater permits), CWA 404 permits, and Coastal Zone Management Act requirements.
- Plan to limit surface disturbance to the extent practicable while still achieving project objectives.
- Designate specific AMZs around water features in the project area (see BMP Plan-3 [AMZ Planning]).
- Design activities on or near unstable areas and sensitive soils to minimize management-induced impacts.
- Use local direction and requirements for prevention and control of terrestrial and aquatic invasive species.

- Use suitable tools to analyze the potential for cumulative watershed effects (CWE) to occur from the additive impacts of the proposed project and past, present, and reasonably foreseeable future activities on NFS and neighboring lands within the project watersheds.
  - Consider the natural sensitivity or tolerance of the watershed based on geology, climate, and other relevant factors.
  - Consider the existing condition of the watershed and water quality as a reflection of past land management activities and natural disturbances.
  - Estimate the potential for adverse effects to soil, water quality, and riparian resources from current and reasonably foreseeable future activities on all lands within the watershed relative to existing watershed conditions.
  - Use land management plan direction; Federal, State, or local water quality standards; and other regulations to determine acceptable limits for CWE.
  - Modify the proposed project or activity as necessary by changing project design, location, and timing to reduce the potential for CWE to occur.
  - Consider including additional mitigation measures to reduce project effects.
  - Identify and implement opportunities for restoration activities to speed recovery of watershed condition before initiating additional anthropogenic disturbance in the watershed.
  - Coordinate and cooperate with other Federal, State, and private landowners in assessing and preventing CWE in multiple ownership watersheds.
- Integrate restoration and rehabilitation needs into the project plan.
  - Consider water quality improvement actions identified in a TMDL or other watershed restoration plan to restore impaired waterbodies within the project area.
- Identify project-specific monitoring needs.
- Document site-specific BMP prescriptions, design criteria, mitigation measures, and restoration, rehabilitation, and monitoring needs in the applicable National Environmental Policy Act (NEPA) documents, design plans, contracts, permits, authorizations, and operation and maintenance plans.
  - Delineate all protected or excluded areas, including, for example, AMZs and waterbodies, 303(d) listed and TMDL waterbodies, and municipal supply watersheds, on the project map.

Plan-3 Aquatic Management Zone Planning

Manual or Handbook Reference FSM 2526.

Objective To maintain and improve or restore the condition of land around and adjacent to waterbodies in the context of the environment in which they are located, recognizing their unique values and importance to water quality while implementing land and resource management activities.

Explanation The land around and adjacent to waterbodies plays an important ecologic role in maintaining the structure, function, and processes of the aquatic ecosystem. These areas provide shading, soil stabilization, sediment and water filtering, large woody debris recruitment, and habitat for a diversity of plants and animals. The quality and quantity of water resources and aquatic habitats may be adversely affected by ground-disturbing activities that occur on these areas. Because of the importance of these lands, various legal mandates have been established pertaining to management of these areas, including, but not limited to, those associated with floodplains, wetlands, water quality, endangered species, wild and scenic rivers, and cultural resources. Protection and improvement of soil, water, and vegetation are to be emphasized while managing these areas under the principles of multiple use and sustained yield. Riparian-dependent resources are to be given preferential consideration when conflicts among land use activities occur.

Designation of a zone encompassing these areas around and adjacent to a waterbody is a common BMP to facilitate management emphasizing aquatic and riparian-dependent resources. These management zones are known by several common terms such as streamside management area or zone, riparian management area, stream environment zone, and water influence zone. For purposes of the National Core BMPs, these areas will be referred to as AMZs.

AMZs are intended to be large enough to protect a waterbody and its associated beneficial uses and aquatic and riparian ecosystems. AMZs along streams and rivers may be linear swaths extending a prescribed distance from a bank, though widths are usually adjusted to include features such as riparian vegetation and unstable landforms as well as critical floodplain components necessary to sustain waterbody integrity and protect beneficial uses. AMZ areas around wetlands, lakes, and other nonlinear features may be irregular in shape to encompass sensitive riparian areas and other water-dependent features.

Local regulation often stipulates the area and extent of AMZs and may be listed in land management plans; biological opinions, evaluations, or assessments; and other regional or State laws, regulations, and policies. Virtually all States have BMPs that include AMZs, as do most land management plans.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Proactively manage the AMZ to maintain or improve long-term health and sustainability of the riparian ecosystem and adjacent waterbody consistent with desired conditions, goals, and objectives in the land management plan.
    - Balance short-term impacts and benefits with long-term goals and desired future conditions, considering ecological structure, function, and processes, when evaluating proposed management activities in the AMZ.
- Determine the width of the AMZ for waterbodies in the project area that may be affected by the proposed activities:

- Evaluate the condition of aquatic and riparian habitat and beneficial riparian zone functions and their estimated response to the proposed activity in determining the need for and width of the AMZ.
- Use stream class and type, channel condition, aspect, side slope steepness, precipitation and climate characteristics, soil erodibility, slope stability, groundwater features, and aquatic and riparian conditions and functions to determine appropriate AMZ widths to achieve desired conditions in the AMZ.
- Include riparian vegetation within the designated AMZ and extend the AMZ to include steep slopes, highly erodible soils, or other sensitive or unstable areas.
- Establish wider AMZ areas for waters with high resource value and quality.

- Design and implement project activities within the AMZ to:
  - Avoid or minimize unacceptable impacts to riparian vegetation, groundwater recharge areas, steep slopes, highly erodible soils, or unstable areas.
  - Maintain or provide sufficient ground cover to encourage infiltration, avoid or minimize erosion, and to filter pollutants.
  - Avoid, minimize, or restore detrimental soil compaction.
  - Retain trees necessary for shading, bank stabilization, and as a future source of large woody debris.
  - Retain floodplain function.
  - Restore existing disturbed areas that are eroding and contributing sediment to the waterbody.
- Mark the boundaries of the AMZ and sensitive areas like riparian areas, wetlands, and unstable areas on the ground before land disturbing activities.

Resources for General Planning Activities

NEPA

Holcomb, J. 1994. Guide for soil/water/air environmental effects analysis in NEPA documents. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 36 p. Available at http://fsweb.r8.fs.fed.us/nr/bio_phy_res/water/Literature.shtml.

U.S. Environmental Protection Agency, Office of Federal Activities. 1999. Considering ecological processes in environmental impact assessments, July 1999. Washington, DC. 90 p. Available at http://www.epa.gov/compliance/resources/policies/nepa/index.html.

Riparian Management

Committee on Riparian Zone Functioning and Strategies for Management, Water Science and Technology Board, National Research Council. 2002. Riparian areas: functions and strategies for management. ISBN: 0-309-12784-X. Washington, DC: National Academies Press. 444 p. Available at http://www.nap.edu/catalog/10327.html.

Everest, F.H.; Reeves, G.H. 2007. Riparian and aquatic habitats of the Pacific Northwest and southeast Alaska: ecology, management history and potential management strategies. Gen. Tech. Rep. PNW-GTR-692. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 130 p. Available at http://www.treesearch.fs.fed.us/pubs/27434.

Verry, E.S.; Hornbeck, J.W.; Dolloff, C.A., eds. 2000. Riparian management in forests of the continental Eastern United States. ISBN: 9781566705011. Boca Raton, FL: Lewis Publishers CRC Press. 432 p.

Aquatic Ecosystems Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from construction and maintenance activities in flowing and nonflowing aquatic ecosystems. Properly functioning streams, lakes, riparian areas, and wetlands are critical in maintaining water quality, water quantity, riparian habitat, aquatic fauna populations and diversity, and downstream beneficial uses. Common management activities in waterbodies include constructing ponds and wetlands, restoring streambanks or channels, and improving or restoring aquatic habitat.

Four National Core BMPs are in the Aquatic Ecosystems Management Activities category. These BMPs are to be used for projects and activities in or near waterbodies on National Forest System (NFS) lands. BMP AqEco-1 (Aquatic Ecosystem Improvement and Restoration Planning) is a planning BMP for improvement or restoration activities in aquatic ecosystems. BMP AqEco-2 (Operations in Aquatic Ecosystems) covers practices for working in or near waterbodies. Applicable practices of this BMP should be used whenever working in or near waterbodies, regardless of the resource activity; for example, when constructing a stream crossing (BMP Road-7 [Stream Crossings]) or mining instream gravel deposits (BMP Min-5 [In-Stream Sand and Gravel Mining]). BMP AqEco-3 (Ponds and Wetlands) is for constructing ponds and wetlands and constructing or maintaining structures in these aquatic ecosystems. BMP AqEco-4 (Stream Channels and Shorelines) is for construction and maintenance activities in stream channels and shorelines. Note BMP Road-7 (Stream Crossings) provides additional direction specific to road-stream crossings.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Aquatic Ecosystems BMPs	
AqEco-1	Aquatic Ecosystem Improvement and Restoration Planning
AqEco-2	Operations in Aquatic Ecosystems
AqEco-3	Ponds and Wetlands
AqEco-4	Stream Channels and Shorelines

AqEco-1. Aquatic Ecosystem Improvement and Restoration Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2020.

Objective Reestablish and retain ecological resilience of aquatic ecosystems and associated resources to achieve sustainability and provide a broad range of ecosystem services.

Explanation Every waterbody has unique characteristics that should be considered when developing a site-specific maintenance, improvement, or restoration strategy. Planning is critical to ensure that the project is conducted in a timely and cost-efficient manner and that the ecological and water quality goals are met. A rigorous approach that uses a combination of best available science and professional experience to inform planning is necessary to enhance the potential for long-term success. When planning aquatic ecosystem projects, it is important to understand all the factors that may affect the watershed currently and in the future. These factors include water quantity, quality, flow, or storage capacity; habitat suitability for native plants, fish, and wildlife; climate change; the primary uses of the watershed and waterbody by people, domestic animals, and wildlife; and past alterations to the waterbody.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use a watershed perspective and available watershed assessments when planning aquatic ecosystem improvement or restoration projects.
  - ❑ Consider how existing water quality and habitat conditions at the project site have been affected by past habitat alterations, hydrologic modification, and riparian area changes in the watershed.
  - ❑ Consider how past, current, and future land use patterns may affect the proposed project site.
  - ❑ Recognize that inhabitants and users at the site (beaver, deer, birds, and people) may change the current ecosystem state to suit their needs.
- Use desired future conditions to set project goals and objectives.
  - ❑ Establish desired future conditions that are consistent with the land management plan's goals and direction.
  - ❑ Use a reference condition to determine the natural potential water quality and habitat conditions of a waterbody.
  - ❑ Consider the potential for future changes in environmental conditions, such as changes in precipitation and runoff type, magnitude and frequency, community composition and species distribution, and growing seasons that may result from climate change.
  - ❑ Consider water quality and other habitat needs for sensitive aquatic or aquatic-dependent species in the project area.
- Favor project alternatives that correct the source of the degradation more than alternatives that mitigate, or treat symptoms of, the problem.
  - ❑ Consider the risk and consequences of treatment failure, such as the risk that design conditions could be exceeded by natural variability before the treatment measures are established, when analyzing alternatives.
  - ❑ Consider as a first priority treatment measures that are self-sustaining or that reduce requirements for future intervention.
- Use natural stabilization processes consistent with stream type and capability where practicable rather than structures when restoring damaged streambanks or shorelines.
- Prioritize sites to implement projects in a sequence within the watershed in such a way that they will be the most effective to achieve improvement or restoration goals.

AqEco-2. Operations in Aquatic Ecosystems

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse impacts to water quality when working in aquatic ecosystems.

Explanation Common construction or maintenance operations in waterbodies often involve ground disturbance. The close proximity to, and contact with, the waterbody increases the potential for introducing sediment and other pollutants that can affect water quality. This BMP includes practices for minimizing direct and indirect water quality impacts when working in or adjacent to waterbodies.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (AMZ Planning) when planning operations in aquatic ecosystems.
- Identify the aquatic and aquatic-dependent species that live in the waterbody, Aquatic Management Zone (AMZ), or on the floodplain and their life histories to determine protection strategies, such as timing of construction, sediment management, species relocation, and monitoring during construction.
- Coordinate stream channel, shoreline, lake, pond, and wetland activities with appropriate State and Federal agencies.
    - Incorporate Clean Water Act (CWA) 404 permit requirements and other Federal, State, and local permits or requirements into the project design and plan.
- Use suitable measures to protect the waterbody when preparing the site for construction or maintenance activities.
    - Clearly delineate the work zone.
    - Locate access and staging areas near the project site but outside of work area boundaries, AMZs, wetlands, and sensitive soil areas.
    - Refuel and service equipment only in designated staging areas (see BMP Road-10 [Equipment Refueling and Servicing]).
    - Develop an erosion and sediment control plan to avoid or minimize downstream impacts using measures appropriate to the site and the proposed activity (see BMP Fac-2 [Facility Construction and Stormwater Control]).
    - Prepare for unexpected failures of erosion control measures.
    - Consider needs for solid waste disposal and worksite sanitation.
    - Consider using small, low ground pressure equipment, and hand labor where practicable.
    - Ensure all equipment operated in or adjacent to the waterbody is clean of aquatic invasive species, as well as oil and grease, and is well maintained.
    - Use vegetable oil or other biodegradable hydraulic oil for heavy equipment hydraulics wherever practicable when operating in or near water.
- Schedule construction or maintenance operations in waterbodies to occur in the least critical periods to avoid or minimize adverse effects to sensitive aquatic and aquatic-dependent species that live in or near the waterbody.

- Avoid scheduling instream work during the spawning or migration seasons of resident or migratory fish and other important life history phases of sensitive species that could be affected by the project.
- Avoid scheduling instream work during periods that could be interrupted by high flows.
- Consider the growing season and dormant season for vegetation when scheduling activities within or near the waterbody to minimize the period of time that the land would remain exposed, thereby reducing erosion risks and length of time when aesthetics are poor.

- Use suitable measures to protect the waterbody when clearing the site.
  - Clearly delineate the geographic limits of the area to be cleared.
  - Use suitable drainage measures to improve the workability of wet sites.
  - Avoid or minimize unacceptable damage to existing vegetation, especially plants that are stabilizing the bank of the waterbody.
- Use suitable measures to avoid or minimize impacts to the waterbody when implementing construction and maintenance activities.
  - Minimize heavy equipment entry into or crossing water as is practicable.
  - Conduct operations during dry periods.
  - Stage construction operations as needed to limit the extent of disturbed areas without installed stabilization measures.
  - Promptly install and appropriately maintain erosion control measures.
  - Promptly install and appropriately maintain spill prevention and containment measures.
  - Promptly rehabilitate or stabilize disturbed areas as needed following construction or maintenance activities.
  - Stockpile and protect topsoil for reuse in site revegetation.
  - Minimize bank and riparian area excavation during construction to the extent practicable.
  - Keep excavated materials out of the waterbody.
  - Use only clean, suitable materials that are free of toxins and invasive species for fill.
  - Properly compact fills to avoid or minimize erosion.
  - Balance cuts and fills to minimize disposal needs.
  - Remove all project debris from the waterbody in a manner that will cause the least disturbance.
  - Identify suitable areas offsite or away from waterbodies for disposal sites before beginning operations.
  - Contour site to disperse runoff, minimize erosion, stabilize slopes, and provide a favorable environment for plant growth.
  - Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Use suitable measures to divert or partition channelized flow around the site or to dewater the site as needed to the extent practicable.
  - Remove aquatic organisms from the construction area before dewatering and prevent organisms from returning to the site during construction.

- Return clean flows to channel or waterbody downstream of the activity.
- Restore flows to their natural stream course as soon as practicable after construction or before seasonal closures.

- Inspect the work site at suitable regular intervals during and after construction or maintenance activities to check on quality of the work and materials and identify need for midproject corrections.
- Consider short- and long-term maintenance needs and unit capabilities when designing the project.
  - Develop a strategy for providing emergency maintenance when needed.
- Include implementation and effectiveness monitoring to evaluate success of the project in meeting design objectives and avoiding or minimizing unacceptable impacts to water quality.
- Consider long-term management of the site and nearby areas to promote project success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to allow for recovery of vegetation.

AqEco-3. Ponds and Wetlands

Manual or Handbook Reference None known.

Objective Design and implement pond and wetlands projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.

Explanation Ponds and wetlands are developed for a variety of reasons including recreation, water sources, stock ponds, gravel extraction, wetland mitigation, and wildlife improvement. The excavation of material and construction of berms, dikes, dams, channels, wildlife water sources, and waterfowl nesting islands have the potential to introduce sediment and other pollutants into adjacent waterbodies, alter flows, and cause physical damage to the ponds and adjacent stream channels both during and after construction. Constructing the projects to withstand potential overflow and flooding is a primary consideration during project planning and design.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.
- Obtain and manage water rights.
- Clearly define goals and objectives in the project plan appropriate to the site for desired hydrology, wetland plant community associations, intended purpose, and function of the pond or wetland and expected values.
- Select sites based on an analysis of landscape structure and associated ecological functions and values.
  - Construct ponds and wetlands on sites that have easy construction access where practicable.
  - Construct wetlands in landscape positions and soil types capable of supporting desired wetland functions and values.

- Construct ponds outside of active floodplain to minimize overflow of groundwater-fed ponds into adjacent streams and avoid or minimize erosion of pond embankments by floods, unless location in the floodplain is integral to achieving project objectives.
- Construct ponds with surface water supply off-channel rather than placing a dam across a stream.
- Construct ponds and wetlands on sites with soils suitable to hold water with minimal seepage loss and that provide a stable foundation for any needed embankments.
- Construct ponds and wetlands in locations where polluted surface water runoff or groundwater discharge do not reach the pond.
- Consider the consequences of dam or embankment failure and resulting damage from sudden release of water on potentially affected areas.

- Ensure that the natural water supply for the pond or wetland is sufficient to meet the needs of the intended use and that it will maintain the desired water levels and water quality.
  - Design the wetland to create hydrologic conditions (including the timing of inflow and outflow, duration, and frequency of water level fluctuations) that provide the desired wetland functions and values.
  - Avoid or minimize drawdown effects in a stream source by limiting timing and rate of water withdrawal to allow sufficient downstream water flow to maintain desired conditions in the source stream (see BMP WatUses-1 [Water Uses Planning]).
- Design the wetland project to create a biologically and hydrologically functional system.
  - Design for function, not form.
  - Keep the design simple and avoid over engineering.
  - Design the project for minimal maintenance needs.
  - Use natural energies, such as gravity flow, in the design.
  - Avoid use of hard engineering structures or the use of supplemental watering to support system hydrology.
  - Plan to allow wetland system time to develop after construction activities are complete.
- Design the pond or wetland to be of sufficient size and depth appropriate for the intended use and to optimize hydrologic regimes and wetland plant community development.
  - Size the pond or wetland appropriately for the contributing drainage area such that a desired water level can be maintained during drought conditions and that excess runoff during large storms can be reasonably accommodated without constructing large overflow structures.
  - Size the pond or wetland to an adequate depth to store sufficient amounts of water for the intended use and offset probable evaporation and seepage losses.
  - Integrate design with the natural topography of the site to minimize site disturbance.
  - Design the pond or wetland to have an irregular shape to reduce wind and wave impacts, disperse water flows, maximize retention times, and better mimic natural systems.
  - Create microtopography and macrotopography in wetlands to mimic natural conditions and achieve hydrologic and vegetative diversity.
  - Avoid creating large areas of shallow water to minimize excessive evaporation losses and growth of noxious aquatic plants.

- Avoid steep-sloped shorelines in areas with potential substrate instability problems to reduce erosion and sedimentation.

- Include water control structures to manage water levels as necessary.
  - Design spillway or outlet to maintain desired water level under normal inflows from snowmelt, groundwater flow, and precipitation.
  - Design discharge capacity using a suitable hydrologic analysis of the drainage area to be sufficient to safely pass the flow resulting from the design storm event.
  - Size the spillway to release floodwaters in a volume and velocity that do not erode the spillway, the area beyond the outlet, or the downstream channel.
  - Consider the need for suitable measures to drain the pond or wetland.
  - Return overflow back to the original source to the extent practicable.
  - Use suitable measures to maintain desired downstream temperatures, dissolved oxygen levels, and aquatic habitats when water is released from the pond or impoundment.
- Use materials appropriate for the purpose of the pond and site.
  - Select materials for a dam or embankment that will provide sufficient strength and, when properly compacted, will be tight enough to avoid or minimize excessive or harmful percolation of water through the dam or embankment.
  - Design the side slopes appropriately for the material being used to ensure stability of the dam or embankment.
- Use wetland vegetation species and establishment methods suitable to the project site and objectives, consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - Consider the timing of planting to achieve maximum survival, proposed benefit of each plant species, methods of planting, proposed use of mulch, potential soil amendment (organic material or fertilizer), and potential supplemental watering to help establish the plant community.
- Properly maintain dams, embankments, and spillways to avoid or minimize soil erosion and leakage problems.
  - Use suitable measures to avoid or minimize erosion of dams and shores due to wind and wave action.
  - Design sufficient freeboard to avoid or minimize overtopping by wave action or other causes.
  - Stabilize or armor spillways for ponds with continuous flow releases or overflow during heavy rainfall events.
- Manage uplands and surrounding areas to avoid or minimize unacceptable impacts to water quality in the pond or wetland.

AqEco-4. Stream Channels and Shorelines

Manual or Handbook Reference None known.

Objective Design and implement stream channel and lake shoreline projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.

Explanation Instream projects are often conducted for a variety of purposes, including improving fish and wildlife habitat, stabilizing streambanks, reconnecting the stream channel to the historic floodplain, and removing or replacing culverts. Lakeshores may be degraded by storm events; constant wave action from boats; onshore uses, including recreation, mining, vegetation management, and development; water diversions; freezing and thawing; floating ice; drought; or a fluctuating water table. A shoreline problem is often isolated and may require only a simple patch repair. Methods to stabilize or restore lakeshores differ from streambank measures because of wave action and littoral transport.

Two basic categories of stabilization and protection measures exist: those that work by reducing the force of water against a streambank or shoreline and those that increase their resistance to erosive forces. Appropriate selection and application of stream channel and shoreline protection measures depend on specific project objectives and site conditions.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.

Stream Channels

- Determine stream type and classification using suitable accepted protocols.
- Determine need to control channel grade to avoid or minimize erosion of channel bed and banks before selecting measures for bank stabilization or protection.
    - ❑ Incorporate grade control measures into project design as needed.
- Determine design flows based on the value or safety of area to be protected, repair cost, and the sensitivity and value of the ecological system involved.
    - ❑ Obtain peak flow, low flow, channel forming flow, and flow duration estimates.
    - ❑ Use these estimates to determine the best time to implement the project, as well as to select design flows.
- Determine design velocities appropriate to the site.
    - ❑ Limit maximum velocity to the velocity that is nonscouring on the least resistant streambed and bank material.
    - ❑ Consider needs to transport bedload through the reach when determining minimum velocities.
    - ❑ Maintain the depth-area-velocity relationship of the upstream channel through the project reach.
    - ❑ Consider the effects of design velocities on desired aquatic organism habitat and passage.

- Avoid changing channel alignment unless the change is to reconstruct the channel to a stable meander geometry consistent with stream type.
- Design instream and streambank stabilization and protection measures suitable to channel alignment (straight reach versus curves).
  - Consider the effects of ice and freeze and thaw cycles on streambank erosion processes.
  - Consider the effects that structures may have on downstream structures and stream morphology, including streambanks, in the maintenance of a natural streambed.
- Design channels with natural stream pattern and geometry and with stable beds and banks; provide habitat complexity where reconstruction of stream channels is necessary.
  - Consider sediment load (bedload and suspended load) and bed material size to determine desired sediment transport rate when designing channels.
  - Avoid relocating natural stream channels.
  - Return flow to natural channels, where practicable.
- Include suitable measures to protect against erosion around the edges of stabilization structures.
  - Design revetments and similar structures to include sufficient freeboard to avoid or minimize overtopping at curves or other points where high-flow velocity can cause waves.
  - Use suitable measures to avoid or minimize water forces undermining the toe of the structure.
  - Tie structures into stable anchorage points, such as bridge abutments, rock outcrops, or well-vegetated stable sections, to avoid or minimize erosion around the ends.
- Add or remove rocks, wood, or other material in streams only if such action maintains or improves stream condition, provides for safety and stability at bridges and culverts, is needed to avoid or minimize excessive erosion of streambanks, or reduces flooding hazard.
  - Leave rocks and portions of wood that are embedded in beds or banks to avoid or minimize channel scour and maintain natural habitat complexity.
- Choose vegetation appropriate to the site to provide streambank stabilization and protection adequate to achieve project objectives.
  - Use vegetation species and establishment methods suitable to the project site and objectives, consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Shorelines

- Use mean high- and low-water levels to determine the design water surface.
  - Consider the effects of fluctuating water levels, freeze or thaw cycles, and floating ice on erosion processes at the site.
- Design stabilization and protection measures suitable to the site.
  - Determine the shoreline slope configuration above and below the waterline.
  - Consider the effects of offshore depth, dynamic wave height, and wave action on shoreline erosion processes.
  - Determine the nature of the bank soil material to aid in estimating erosion rates.
  - Consider foundation material at the site when selecting structural measures.

- Use vegetation species and establishment methods suitable to the project site and objectives and consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

- Consider the rate, direction, supply, and seasonal changes in littoral transport when choosing the location and design of structural measures.
- Consider the effect structures may have on adjacent shoreline or other nearby structures.
  - Adequately anchor end sections to existing stabilization measures or terminate in stable areas.

Resources for Aquatic Ecosystems Management Activities

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Chemical Use Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid or minimize unacceptable impacts to water quality conditions that may result from application of chemicals used to manage biological and physical resources. Chemical treatments are applied to kill, attract, repel, defoliate, stimulate, or retard biologic growth with the intent to mitigate, control, grow, or kill the intended biota. They may also be applied to ameliorate, neutralize, or stabilize certain physical resources such as soil or water chemistry. Chemical treatments include application of pesticides such as insecticides, herbicides, fungicides, nematicides, rodenticides, and piscicides. Chemical treatments also include fertilizers, fire retardants (see BMP Fire-3 [Wildland Fire Control and Suppression]), dyes, or other materials used in tracer studies, aggregate additives like salt, magnesium chloride, and other substances used for dust abatement, roadbed stabilization, or de-icing of roadways, and other chemical products that can be used to fulfill specific Forest Service management objectives.

Six National Core BMPs are in the Chemical Use Management Activities category. These BMPs are to be used when chemicals are applied on National Forest System (NFS) lands. BMP Chem-1 (Chemical Use Planning) is a planning BMP for chemical applications. BMP Chem-2 (Follow Label Directions) specifies following label directions to meet legal requirements for chemical use. BMP Chem-3 (Chemical Use near Waterbodies) is for chemical applications on or over upland areas where chemicals may drift or runoff into waterbodies. BMP Chem-4 (Chemical Use in Waterbodies) is for chemical applications directly into waterbodies. BMP Chem-5 (Chemical Handling and Disposal) provides practices for proper transportation and storage of chemicals, cleaning equipment, and chemical containers and disposal of containers. BMP Chem-6 (Chemical Application Monitoring and Evaluation) provides guidance on designing and implementing monitoring plans to evaluate chemical applications.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Chemical Use BMPs	
Chem-1	Chemical Use Planning
Chem-2	Follow Label Directions
Chem-3	Chemical Use Near Waterbodies
Chem-4	Chemical Use in Waterbodies
Chem-5	Chemical Handling and Disposal
Chem-6	Chemical Application Monitoring and Evaluation

Chem-1. Chemical Use Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2153; Forest Service Handbook (FSH) 2109.14, chapter 10.

Objective Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.

Explanation Pollution risk from chemical use depends on chemical mobility and persistence, application mode and rate, and distance from water. Risk of entry to surface water is highest for broadcast and aerial treatments and for fine droplets. Risk to groundwater is highest over sandy soils, shallow water tables, and groundwater recharge areas. The planning process is the framework for incorporating measures to avoid or minimize impacts to soil and water resources into project design and management to reduce the risk of contamination from chemical use.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning activities that involve use of chemicals.
- Identify municipal supply watersheds; private domestic water supplies; fish hatcheries; and threatened, endangered, and sensitive aquatic dependent species and fish populations near or downstream of chemical treatment areas.
- Use Integrated Pest Management as the basis for all pesticide-use prescriptions in consultation with the unit Pesticide Use Coordinator.
- Select chemical products suitable for use on the target species or that meet project objectives.
  - Use chemicals that are registered for the intended uses.
- Consult the Materials Safety Data Sheet and product label for information on use, hazards, and safe handling procedures for chemicals products under consideration for use.
- Consider chemical solubility, absorption, breakdown rate properties, and site factors when determining which chemical products to use.
  - Use chemicals with properties such that soil residual activity will persist only as long as needed to achieve treatment objectives.
  - Consider soil type, chemical mobility, distance to surface water, and depth to groundwater to avoid or minimize surface water and groundwater contamination.
- Use a suitable pressure, nozzle size, and nozzle type combination to minimize off-target drift or droplet splatter.
- Use selective treatment methods for target organisms to the extent practicable.
- Specify management direction and appropriate site-specific response measures in project plans and safety plans (FSH 2109.14, chapter 60).
- Ensure that planned chemical use projects conform to all applicable local, State, Federal, and agency laws, regulations, and policies.
  - Obtain necessary permits, including Clean Water Act (CWA) 402 permit coverage.
  - Develop spill contingency plans.
  - Obtain or provide training and licensing as required by the label and State regulations.

Chem-2. Follow Label Directions

Manual or Handbook Reference FSH 2109.14, chapter 50.

Objective Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.

Explanation Directions found on the label of each chemical are detailed, specific, and include legal requirements for use. In brief, "...the label is the law..." with respect to chemical use. Not following label directions increases the risk of adverse effects to surface water or groundwater as a result of using chemicals inappropriate to the site, an inappropriate method of application, and an inappropriate application rate (too much or too little) to meet project objectives.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Incorporate constraints identified on the label and other legal requirements of application into project plans and contracts.
    - Be aware that States may have more restrictive requirements than the label instructions.
- Use fully trained individuals equipped with appropriate personal protective equipment to apply chemical treatments.
- Obtain State or Federal Pesticide Application Certification for staff supervising or applying chemical treatment application if required by law.
- Notify contractor's field supervisor when violations of label or project requirements have occurred.
- Stop operations that pose a safety hazard or when violations of project requirements have not been rectified.
- Report label violations to the appropriate enforcement agency.
- Respond to and report spills and other accidents.

Chem-3. Chemical Use Near Waterbodies

Manual or Handbook Reference FSH 2109.14 Chapters 10, 50.

Objective Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies.

Explanation Some chemicals used in terrestrial applications are toxic to aquatic flora and fauna, may overly enrich aquatic systems, and may pose a human health hazard if drinking water sources are contaminated during or after chemical applications. During application, chemicals may drift into waterbodies or other nontarget areas. After application, chemicals or chemical residues may enter surface water or groundwaters through runoff and leaching. Most State and local water quality standards include a general narrative standard that requires surface waters to be free from substances attributable to human-caused discharges in amounts, concentrations, or combinations that are toxic to humans, animals, plants, or aquatic life. To help protect surface waters and wetlands from contamination, a buffer zone of land and vegetation adjacent to the waterbody may need to be designated. Treatment within this zone may differ from that applied to upland areas or the buffer zone may be left untreated if necessary.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify during project planning those perennial and intermittent surface waters, wetlands, springs, riparian areas, and groundwater recharge areas that may be impacted by the chemical use.
    - Use field observations to verify the extent of these areas identified from aerial observations, maps, or geographic information system data, as needed.
- Determine the width of a buffer zone, if needed, based on a review of the project area, characteristics of the chemical to be used, and application method.
    - Consider the designated uses of water, adjacent land uses, expected rainfall, wind speed and direction, terrain, slope, soils, and geology.
    - Consider the persistence, mobility, toxicity profile, and bioaccumulation potential of any chemical formulation proposed for use.
    - Consider the type of equipment, spray pattern, droplet size, application height, and experience in similar projects.
- Prescribe chemicals and application methods in the buffer zone suitable to achieve project objectives while minimizing risk to water quality.
- Flag or otherwise mark or identify buffer zones as needed.
    - Clearly communicate to those applying the chemical what areas are to be avoided or where alternative treatments are to be used.
- Locate operation bases on upland areas, outside of wetlands or areas with channel or ditch connection to surface water and AMZs.
- Use clean equipment and personnel to collect water needed for mixing.
- Calibrate application equipment to apply chemicals uniformly and in the correct quantities.
- Evaluate weather conditions before beginning spray operations and monitor throughout each day to avoid or minimize chemical drift.
    - Apply chemicals only under favorable weather conditions as identified in the label instructions.
    - Avoid applying chemicals before forecasted severe storm events to limit runoff and ensure the chemical reaches intended targets.
    - Suspend operations if project prescription or weather limitations have been exceeded.
- Apply fertilizers during high nutrient-uptake periods to avoid or minimize leaching and translocation.
    - Base fertilizer type and application rate on soils and foliar analysis.
    - Use slow release fertilizers that deliver fertilizer to plants during extended periods in areas with long growing seasons when appropriate to meet project objectives.
- Monitor during chemical applications to determine if chemicals are reaching surface waters (see BMP Chem-6 [Chemical Application Monitoring and Evaluation]).
- Implement the chemical spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-4. Chemical Use in Waterbodies

Manual or Handbook Reference FSH 2109.14.

Objective Avoid, minimize, or mitigate unintended adverse effects to water quality from chemical treatments applied directly to waterbodies.

Explanation Chemicals may be used to improve the growth of aquatic fauna and flora within lakes and streams, control invasive or other undesirable aquatic species, restore native biota, or remediate adverse atmospheric deposition. Chemicals may also be used as tracers for time of travel studies, dispersion studies, discharge measurement, and calculation of stream re-aeration, as well as for determining circulation and stratification within reservoirs, tagging pollutants, or many other applications. Several factors affect the type and degree of impacts on aquatic resources, including chemical type, concentration, application rate, residence time, and decay rate; waterbody chemistry, volume, substrate, turnover, inflow, outflow, hydrograph, geology, geomorphology, designated uses, and other limnologic characteristics; and biologic species composition, habitat requirements, food web, population dynamics, and desired condition. Chemical treatments to surface waters may also affect groundwater through leaching, translocation, or interchange.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Coordinate project with State water quality and fish and wildlife agencies as necessary.
- Use chemicals registered for application in aquatic systems.
- Use the minimum concentration of chemicals required to be reasonably certain that treatment objectives would be met.
    - ❑ Consider physical attributes of the waterbody, water flow and turbulence, waterbody mixing time, water chemistry, target species, label directions, percentage of active ingredient in the formulation to be used, application method, and project objectives to determine chemical concentration to use.
    - ❑ Follow label directions near critical points such as water intakes or, if label is silent on this issue, consider using lower concentrations or nontreatment buffers.
    - ❑ Consider using pretreatment bioassay tests to determine if the recommended concentration will be effective to meet treatment objectives.
    - ❑ Adjust chemical concentration and application methods to account for the effect of thermal stratification in lakes or reservoirs to achieve treatment objectives.
    - ❑ Adjust chemical concentration and application methods in streams and flowing water to account for the effect that any barriers, diversion structures, beaver dams, seeps, springs, and tributaries may have on chemical dilution and mixing to achieve treatment objectives.
- Avoid applying chemicals in situations where they could enter nontarget waters.
- Determine the need to treat tributaries to standing waterbodies to meet treatment objectives.
    - ❑ Apply chemical treatment to tributaries before treating the standing waterbody.
- Determine the need for neutralization of chemicals applied directly to water.
    - ❑ Evaluate the environmental advantages and disadvantages of natural degradation compared to the use of neutralizing agents.

- Use neutralization agents when the chemical treatment effects would cause unacceptable downstream impacts without intervention.
- For neutralization of flowing water, determine a neutralization zone (e.g., mixing zone) based on time of travel below the application point where potential flora or fauna mortality can be expected before the chemical is completely neutralized.

- Determine the need for collecting dead flora or fauna.
  - Dispose of dead flora or fauna in an approved manner that does not adversely affect water quality.
- Monitor water quality and sediments pre- and post-chemical treatment at representative locations to evaluate relevant water chemistry and chemical concentrations (see BMP Chem-6 [Chemical Application Monitoring and Evaluation]).
- Implement the pesticide spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-5. Chemical Handling and Disposal

Manual or Handbook Reference FSH 2109.14, chapter 40.

Objective Avoid or minimize water and soil contamination when transporting, storing, preparing and mixing chemicals; cleaning application equipment; and cleaning or disposing chemical containers.

Explanation Handling chemicals, chemical containers, and equipment can lead to contamination of surface water or groundwater if not done carefully. Spills, leaks, or wash water can contaminate soil and leach into groundwater. Residue left on containers or equipment can wash off during precipitation events and enter surface waters. Preparing and mixing chemicals and cleaning and disposing of chemical containers must be done in accordance with Federal, State, and local laws, regulations, and directives. Specific procedures are documented in the Forest Service Pesticide Use Management and Coordination Handbook (FSH 2109.14, chapter 40) as well as in State and local laws.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Transport and handle chemical containers in a manner that minimizes the potential for leaks and spills.
  - Inspect containers for leaks or loose caps or plugs before loading.
  - Secure containers properly to avoid or minimize shifting in transport.
  - Check containers periodically enroute.
  - Ensure arrangements for proper storage are in place before transporting chemicals.
- Manage and store chemicals in accordance with all applicable Federal, State, or local regulations, including label directions.
  - Store chemicals in their original containers with labels intact.
  - Locate chemical storage facilities at sites that minimize the possibility of impacts to surface water or groundwater in case accidents or fires occur.
  - At a minimum, ensure that containment of a complete spill from the largest container being stored is possible with the spill-kit materials at the storage site.

- Check containers before storage and periodically during storage to ensure that they are properly sealed and not leaking.

- Locate operation bases in appropriate sites where possible spills would not enter surface waterbodies or groundwater aquifers.
- Ensure that mixing equipment, containers, and spill kits are in place and adequate for the project size and chemicals to be used.
- Follow label directions; applicable Federal, State, and local laws; and Forest Service direction for proper preparation and mixing of chemicals and cleaning and disposal of chemical materials and equipment.
    - When a contractor supplies the pesticide, the contractor is responsible for proper chemical preparation and mixing and container cleaning and disposal in accordance with label directions and Federal, State, and local laws.
    - Apply rinse water from empty chemical containers, mixing apparatus, and equipment clean up to the treatment area, not into the ground near streams.
    - Provide water from off site for cleaning equipment and application personnel rather than using onsite surface waters.
- Inspect application equipment to ensure that chemicals will not leak and the application prescription can be achieved.
- Implement the chemical spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-6. Chemical Application Monitoring and Evaluation

Manual or Handbook Reference FSM 2150.1; FSH 2109.14, chapter 50.

Objectives

1. Determine whether chemicals have been applied safely, have been restricted to intended targets, and have not resulted in unexpected nontarget effects.
2. Document and provide early warning of possible hazardous conditions resulting from potential contamination of water or other nontarget resources or areas by chemicals.

Explanation Monitoring of chemical applications is used to evaluate and document chemical application accuracy, amount, and effects on soils and water quality to reduce or eliminate hazards to nontarget biological or physical resources. Monitoring can occur before, during, and after chemical application depending on treatment objectives and monitoring questions. Monitoring methods may include any of the following: visual observations; vegetation surveys; use of spray cards; dye tracing (fluorometry); and sampling of water, soil, sediment, flora, or fauna to measure chemical presence in or near water. Monitoring needs and methods are determined in the project planning process and should consider treatment objectives; resource values at risk; chemical properties; potential for offsite movement; Federal, State, and local requirements; monitoring costs; and available project funding.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify the following elements in all water resource monitoring plans and specify the rationale for each:
    - What are the monitoring questions?

- ❑ Who will be involved and what are their roles and responsibilities?
- ❑ What parameters will be monitored and analyzed?
- ❑ When and where will monitoring take place?
- ❑ What methods will be used for sampling and analyses?
- ❑ How will Chain of Custody requirements for sample handling be met?
- ❑ What are the criteria for quality assurance and quality control?

- Consider the following factors when developing monitoring questions:
  - ❑ The physical or biological resource of concern, including human health.
  - ❑ Applicable Federal, State, and local laws and regulations.
  - ❑ Type of chemical.
  - ❑ Type of application equipment used and method of application.
  - ❑ Site-related difficulties that affect both application and monitoring.
  - ❑ Public concerns.
  - ❑ Potential benefits of the application.
  - ❑ Availability of analytic methods, detection limits, tools, and laboratories.
  - ❑ Costs of monitoring and resources available to implement monitoring plan.
- Choose monitoring methods and sample locations suitable to address the monitoring questions.
  - ❑ Consider the need to take random batch or tank samples for future testing in the event of treatment failure or an unexpected adverse effect.
- Monitor sensitive environments during and after chemical applications to detect and evaluate unanticipated events.
- Use U.S. Environmental Protection Agency-certified laboratories for chemical sample analysis.
  - ❑ Use appropriate containers, preservation, and transportation to meet Standard Methods requirements.
  - ❑ Implement proper Chain of Custody procedures for sample handling.
- Evaluate and interpret the results of monitoring in terms of compliance with, and adequacy of, treatment objectives and specifications.

Resources for Chemical Use Management Activities

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Facilities and Nonrecreation Special Uses Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from development, use, maintenance, and reclamation of facilities located on National Forest System (NFS) lands. Facilities include buildings, camps, towers, pipelines, stream gauging stations, water storage and conveyance facilities, or other permanent or semipermanent structures and infrastructure associated with Forest Service-administered facilities. Forest Service facilities normally encountered on NFS lands include fire stations, work centers, permanent field camps, ranger stations, visitor centers, public water systems, and sanitation systems. Other facilities on NFS lands may be operated by the private sector through easements or special use authorizations. Examples of these third-party facilities include work and organizational camps, concession sites, electronic and communication sites, public water and sanitation systems, power transmission lines, pipelines, research equipment and structures, and access routes to private land in-holdings.

Ten National Core BMPs are in the Facilities and Nonrecreation Special Uses Management Activities category. These BMPs are to be used in all facilities and nonrecreation special use authorizations on NFS lands. BMP Fac-1 (Facilities and Nonrecreation Special Uses Planning) is a planning BMP for facilities and nonrecreation special uses projects. BMP Fac-2 (Facility Construction and Stormwater Control) provides direction for erosion control and stormwater management during construction activities. This BMP applies to any ground-disturbing activity, regardless of the resource category; for example, constructing a campground, operating a mine, or reconstructing a road. BMP Fac-3 (Potable Water Supply Systems), BMP Fac-4 (Sanitation Systems), and BMP Fac-5 (Solid Waste Management) provide practices for drinking water, human sanitation, and trash or garbage disposal at facilities. BMP Fac-6 (Hazardous Materials) covers management of hazardous materials and applies to any activity that involves hazardous materials, not just at facilities. BMP Fac-7 (Vehicles and Equipment Wash Water) covers vehicle washing, which usually takes place at a facility. BMP Fac-8 (Nonrecreation Special Use Authorizations) and BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Way) provide practices for third-party uses on NFS lands that are not related to recreation activities. BMP Fac-10 (Facility Site Reclamation) provides direction for reclamation of developed sites that are no longer needed for their developed purposes.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Facilities and Nonrecreation Special Uses BMPs	
Fac-1	Facilities and Nonrecreation Special Uses Planning
Fac-2	Facility Construction and Stormwater Control
Fac-3	Potable Water Supply Systems
Fac-4	Sanitation Systems
Fac-5	Solid Waste Management
Fac-6	Hazardous Materials
Fac-7	Vehicle and Equipment Wash Water
Fac-8	Nonrecreation Special Use Authorizations
Fac-9	Pipelines, Transmission Facilities, and Rights-of-Way
Fac-10	Facility Site Reclamation

Fac-1. Facilities and Nonrecreation Special Uses Planning

Manual or Handbook Reference Forest Service Handbook (FSH) 7309.11, chapter 20; FSH 7409.11, chapter 10; FSH 2709.11, chapter 50.

Objective Use the applicable special use authorization and administrative facilities planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during construction and operation of facilities and nonrecreation special uses activities.

Explanation Facilities may be developed on NFS lands by the Forest Service for a variety of administrative and recreational purposes. Potential effects of the proposed facility construction and operation on water quality should be considered when new sites are created or existing sites are improved and operated. In the planning process, site-specific BMP prescriptions are developed to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Facilities developed and operated by others on NFS lands are administered through special use authorizations issued by the Forest Service to public or private agencies, a group, or an individual. Special use permits must include terms and conditions to protect the environment and otherwise comply with the requirements of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1752). These environmental protection requirements include the use of appropriate BMPs to control nonpoint source pollution.

State and local governments regulate many activities associated with facility development and operation, such as public water supplies, sanitation systems, waste disposal, and control of stormwater discharges. State or local requirements applicable to these activities should be incorporated into facility design, construction, and operation plans, and terms and conditions during the planning process.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning facilities or nonrecreation special use projects.
- Consider the following design criteria in facility planning.
    - Locate the facility away from the immediate vicinity of surface waters, AMZs, wetlands, sandy soils, shallow water tables, groundwater recharge areas, floodplains, and other sensitive areas to the extent practicable.
    - Avoid unstable slopes and soils.
    - Minimize the disturbance footprint.
    - Use and maintain proper erosion and sediment control practices during and immediately after construction activities (See BMP Fac-2 [Facility Construction and Stormwater Control]).
    - Incorporate suitable stormwater controls in the project design (See BMP Fac-2 [Facility Construction and Stormwater Control]).
    - Use applicable Road Management BMPs for access roads associated with facility sites.
    - Incorporate requirements from applicable Federal, State, and local permits into facility construction and operation plans.

- Consider the time necessary to complete facility development activities.
  - Develop a contingency plan for implementing appropriate prestorm or winterization BMPs before the grading permit expires.
- Determine the design capacity, if applicable, of the site for public or administrative use, considering needs for protecting soil, water quality, and riparian resources.
  - Ensure that the capacity of the site matches the ability of the site to withstand the use.
- Conform to all applicable Federal, State, and local regulations and permits governing water supply, sanitation, and underground injection systems (see BMP Fac-3 [Potable Water Supply Systems] and BMP Fac-4 [Sanitation Systems]).
- Determine instream flow needs to minimize damage to scenic and aesthetic values; native plant, fish, and wildlife habitat; and to otherwise protect the environment where the operation of the facility would modify existing streamflow regimes (See BMP WatUses-1 [Water Uses Planning]).

Fac-2. Facility Construction and Stormwater Control

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling erosion and managing stormwater discharge originating from ground disturbance during construction of developed sites.

Explanation During construction and operation of facility sites, land may be cleared of existing vegetation and ground cover, exposing mineral soil that may be more easily eroded by water, wind, and gravity. Changes in land use and impervious surfaces can temporarily or permanently alter stormwater runoff that, if left uncontrolled, can affect morphology, stability, and quality of nearby streams and other waterbodies. Erosion and stormwater runoff control measures are implemented to retain soil in place and to control delivery of suspended sediment and other pollutants to nearby surface water. This practice is initiated during the planning phase and applied during project implementation and operation.

This BMP contains practices for managing erosion and stormwater discharge that are generally applicable for any project that involves ground disturbance, including developed recreation, mineral exploration and production sites, pipelines, water developments, etc., and should be used for all such projects.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Obtain Clean Water Act (CWA) 402 stormwater discharge permit coverage from the appropriate State agency or the U.S. Environmental Protection Agency (EPA) when more than 1 acre of land will be disturbed through construction activities.
- Obtain CWA 404 permit coverage from the U.S. Army Corps of Engineers when dredge or fill material will be discharged to waters of the United States.
- Establish designated areas for equipment staging, stockpiling materials, and parking to minimize the area of ground disturbance (see BMP Road-9 [Parking Sites and Staging Areas] and BMP Road-10 [Equipment Refueling and Servicing]).

- Establish and maintain construction area limits to the minimum area necessary for completing the project and confine disturbance to within this area.
- Develop and implement an erosion control and sediment plan that covers all disturbed areas, including borrow, stockpile, fueling, and staging areas used during construction activities.
- Calculate the expected runoff generated using a suitable design storm to determine necessary stormwater drainage capacity.
  - Use site conditions and local requirements to determine design storm.
  - Include run-on from any contributing areas.
- Refer to State or local construction and stormwater BMP manuals, guidebooks, and trade publications for effective techniques to:
  - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion during construction or before the next growing season.
  - Maintain the natural drainage pattern of the area wherever practicable.
  - Control, collect, detain, treat, and disperse stormwater runoff from the site.
  - Divert surface runoff around bare areas with appropriate energy dissipation and sediment filters.
  - Stabilize steep excavated slopes.
- Develop and implement a postconstruction site vegetation plan using suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per Forest Service Manual (FSM) 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Do not use snow or frozen soil material in facility construction.
- Schedule, to the extent practicable, construction activities to avoid direct soil and water disturbance during periods of the year when heavy precipitation and runoff are likely to occur.
  - Limit the amount of exposed or disturbed soil at any one time to the minimum necessary to complete construction operations.
  - Limit operation of equipment when ground conditions could result in excessive rutting, soil puddling, or runoff of sediments directly into waterbodies.
- Install suitable stormwater and erosion control measures to stabilize disturbed areas and waterways before seasonal shutdown of project operations or when severe or successive storms are expected.
- Use low-impact development practices where practicable.
- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning.
  - Prepare for unexpected failures of erosion control measures.
  - Implement corrective actions without delay when failures are discovered to prevent pollutant discharge to nearby waterbodies.
- Routinely inspect construction sites to verify that erosion and stormwater controls are implemented and functioning as designed and are appropriately maintained.
- Use suitable measures in compliance with local direction to prevent and control invasive species.

Fac-3. Potable Water Supply Systems

Manual or Handbook Reference Manual or Handbook Reference: FSM 7420 and FSH 7409.11, chapter 40.

Objective Provide potable water supplies of sufficient quality and quantity to support the use at facilities.

Explanation Many facilities provide potable water from a surface water or groundwater source. Water systems should supply an adequate volume of acceptably clean water as needed by the facility. A water system is comprised of collection, treatment, storage, and distribution facilities. Water systems are classified into categories (e.g., public versus nonpublic, community versus noncommunity, and transient versus nontransient) based on ownership, size, and permanence of the population served. Regulations are based on these different categories. Management requirements and controls to protect drinking water quality and provide potable water are incorporated into each facility's operation and maintenance plan (FSM 7410).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Develop water systems only in places where the water source can be protected.
- Develop groundwater wells and facilities in a manner that reduces the potential of groundwater aquifer contamination in accordance with BMP WatUses-2 (Water Wells for Production and Monitoring).
- Use applicable practices of BMP WatUses-3 (Administrative Water Developments) and BMP WatUses-4 (Water Diversions and Conveyances) to manage surface diversions.
- Operate, monitor, and manage Forest Service-owned (public and nonpublic) drinking water systems in accordance with direction in FSM 7420.
    - ❑ Design, construct, operate, and maintain water systems in a manner that provides for physical protection of the water source and system.
    - ❑ Treat water as necessary to achieve desired water quality.
    - ❑ Conduct sanitary and condition surveys per required schedules.
    - ❑ Implement follow-up actions identified in the sanitary and condition surveys.
    - ❑ Minimize possible contaminating activities within Wellhead Protection Areas and Source Water Assessment Areas to protect drinking water sources.
    - ❑ Conduct required system monitoring and follow-up actions as needed.
- Perform water supply and system disinfection activities in a manner such that disinfectant residuals and byproducts will not affect nearby surface water or groundwater.
- Ensure that permit holder-owned and other authorized drinking water systems on NFS lands are operated and maintained according to direction in FSM 7423.

Fac-4. Sanitation Systems

Manual or Handbook Reference FSM 2330; FSM 7430; and FSH 7409.11, chapter 50.

Objective Avoid, minimize, or mitigate adverse effects to soil and water quality from bacteria, nutrients, and other pollutants resulting from collection, transmission, treatment, and disposal of sewage and wastewater at facilities.

Explanation Sanitation systems at facilities vary from a portable toilet to a sophisticated treatment plant. Facilities also may have wastewater systems for showers and washbasins. The type of sanitation system at a facility depends on the purpose and capacity of the site, available and needed infrastructure, Forest Service policy, and State or local regulations. Bacteria, nutrients, and other contaminants from sanitation systems can enter surface water or groundwater if the system is not properly designed and operated. Facilities are required to comply with State and local public health and sanitation ordinances. Management requirements and controls to minimize the possibility of water contamination from wastewater collection, treatment, and disposal are incorporated into each facility's operation and maintenance plan (FSM 7410).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use qualified personnel to locate, design, inspect, operate, maintain, and manage sanitation systems.
- Coordinate all phases of sanitation system management (planning, design, installation, inspection, operation, and maintenance) with appropriate State and local agencies to ensure compliance with applicable regulations.
- Design and operate waste collection, treatment, and disposal systems appropriate for the type and volume of waste generated at the site consistent with direction in FSH 7409.11, chapter 50.
- Follow applicable regulations and guidelines when locating toilets, wastewater disposal, and leach fields.
    - ❑ Use suitable setback distances from water bodies or other sensitive areas when siting facilities.
    - ❑ Use proper field investigations and soil tests to determine suitable soils for onsite treatment and disposal systems.
- Prepare and maintain an operation and maintenance plan for all waste treatment or disposal facilities (FSM 7410).
    - ❑ Inspect vaults, septic tanks, and other wastewater systems at regular intervals to ensure that capacities are not exceeded and that the system is functioning properly and in compliance with applicable State and local regulations.
    - ❑ Implement follow-up actions identified in the inspections as needed to ensure that the system is working properly.
    - ❑ Include procedures in operation and maintenance plans to contain or avoid releases of pollutants in floods or other emergencies.
- Ensure that permit holder-owned and other authorized sanitation systems on NFS lands are operated and maintained according to applicable regulations and direction.

- ❑ Consider changes or improvements to existing sanitary systems that may be causing water quality impacts, such as poorly located pit toilets or drain fields, at opportune times such as facility remodeling or change in facility ownership or control.

Fac-5. Solid Waste Management

Manual or Handbook Reference FSM 2130; FSM 7460; and FSH 7409.11, chapter 80.

Objective Avoid, minimize, or mitigate adverse effects to water quality from trash, nutrients, bacteria, and chemicals associated with solid waste management at facilities.

Explanation Uncollected garbage and trash at developed facilities can contaminate water by introducing nutrients, bacteria, or chemicals to the water. Trash can be blown about by the wind or carried by runoff into waterbodies. In addition, uncollected garbage can attract wildlife, which are looking for an easy meal, to the facility.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Develop a Solid Waste System consistent with direction in FSM 7460 and FSH 7409.11, chapter 80 that defines and describes collection, transportation, storage, and final disposal methods for solid waste generated at facilities.
- Use suitable public relations and information tools and enforcement measures to encourage the public to use proper solid waste disposal measures.
  - ❑ Encourage recycling of materials where practicable.
  - ❑ Encourage the public to "pack it in-pack it out" in areas where practicable.
- Provide receptacles for trash at developed facilities.
  - ❑ Place trash and recycling receptacles in areas that are convenient to the facility's users.
  - ❑ Place trash and recycling receptacles in locations away from waterbodies.
  - ❑ Provide receptacles that discourage wildlife foraging as suitable for the area (e.g., bears, raccoons, birds) and suitably confine materials until collected.
  - ❑ Collect trash on a routine schedule to prevent the receptacles from overflowing.
- Dispose of collected garbage at properly designed and operated municipal-, county-, or State-authorized sanitary landfills or waste recycling sites where groundwater and surface water are adequately protected.
- Obtain necessary State or local permits for solid waste disposal sites.

Fac-6. Hazardous Materials

Manual or Handbook Reference 40 CFR 112; FSM 2160; and FSH 2109.14, chapter 60.

Objective Avoid or minimize short- and long-term adverse effects to soil and water resources by preventing releases of hazardous materials.

Explanation Constructing and operating facilities often involve the storage and use of hazardous materials. Improper storage and use can contaminate nearby soils and surface water or groundwater resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Ensure that all employees involved in the use, storage, transportation, and disposal of hazardous materials receive proper training.
- Limit the acquisition, storage, and use of hazardous, toxic, and extremely hazardous substances to only those necessary and consistent with mission requirements.
- Manage the use, storage, discharge, or disposal of pollutants and hazardous or toxic substances generated by the facility in compliance with applicable regulations and requirements.
- Monitor underground storage tanks and promptly address leaking tanks in consultation with the proper officials at State and Federal regulatory agencies.
- Construct and install new tanks in accordance with Federal, State, and local regulations.
    - Ensure that existing tanks meet performance standards for new tanks, meet upgrade requirements, or are taken out of service.
- Prepare a certified Spill Prevention Control and Countermeasure (SPCC) Plan for each facility as required by 40 CFR 112.
    - Install or construct the containment features or countermeasures called for in the SPCC Plan to ensure that spilled hazardous materials are contained and do not reach groundwater or surface water.
    - Ensure that cleanup of spills and leaking tanks is completed in compliance with Federal, State, and local regulations and requirements.
- Respond to hazardous materials releases or spills using the established site-specific contingency plan for incidental releases and the Emergency Response Plan for larger releases.
    - Train employees to understand these plans; the materials involved; and their responsibilities for safety, notification, containment, and removal.
    - Provide adequate communication to all downstream water users, such as municipal drinking water providers and fish hatcheries, as necessary.
- Ensure that hazardous spill kits are adequately stocked with necessary supplies and are maintained in accessible locations.

Fac-7. Vehicle and Equipment Wash Water

Manual or Handbook Reference None known.

Objective Avoid or minimize contamination of surface water and groundwater by vehicle or equipment wash water that may contain oil, grease, phosphates, soaps, road salts, other chemicals, suspended solids, and invasive species.

Explanation Washing vehicles and equipment is a common method used to maintain vehicles and minimize the spread of noxious and invasive species. Wash water and the resulting residue removed from vehicles and equipment may contain oils, chemicals, or sediment harmful to water and aquatic resources if not properly contained and treated. Work centers, ranger stations, fire stations, and other facilities may have washing equipment and locations designated for cleaning fleet or contracted vehicles and equipment. Temporary wash locations may also be installed during incident management or project work.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use commercial washing facilities that have proper wastewater treatment systems whenever possible.
    - Maintain a list of appropriate wash stations in the local area and provide the list to local offices, permit holders, and contractors.
- Install temporary wash sites only in areas where the water and residue can be adequately collected and either filtered on site or conveyed to an appropriate wastewater treatment facility.
    - Consider the use of a portable vehicle washer system, such as that designed by the Missoula Technology and Development System, to contain and filter the wash water.
    - Locate temporary wash sites out of AMZs, wetlands, groundwater recharge areas, floodplains, and other environmentally sensitive areas.
    - Use suitable measures to treat and infiltrate wash water to comply with applicable surface water and groundwater protection regulations.

Fac-8. Nonrecreation Special Use Authorizations

Manual or Handbook Reference FSM 2720 and FSH 2709.11, chapters 40 and 50.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from physical, chemical, and biological pollutants resulting from activities under nonrecreation special use authorizations.

Explanation This BMP covers all nonrecreation special use activities with the exceptions of pipelines; transmission facilities and other rights-of-ways; and water diversions, storage, and conveyance. BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Way), BMP WatUses-4 (Water Diversions and Conveyances), and BMP WatUses-5 (Dams and Impoundments) are provided for those activities.

The Forest Service role in defining and requiring the use of BMPs occurs during the development of the special use authorization and administration of the use. Discussions between the Forest Service and the permit holder concerning soil, water quality, and riparian resource impacts and appropriate BMPs to use should occur at the time of permit development or renewal. The special use authorization operation and maintenance plan details the conditions that must be met, including management requirements and mitigation measures to protect water quality. The permit holder will be required to conform to all applicable Federal, State, and local regulations and land management plan direction governing water resource protection and sanitation. State or Federal law may require that the permit holder obtain a pollution discharge permit or other authorization from a State, regional, or local government entity. Authorized uses often cover a wide range of activities and may require that BMPs from several management activity categories be included in the authorization.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Include in the authorization operation and maintenance plan the appropriate BMPs to control nonpoint source pollution from ground-disturbing activities, chemical use, and other activities that may adversely affect the physical, chemical, or biological integrity of surface water or groundwater.
- Update existing special use authorizations and operation and maintenance plans during annual renewal, or the next renewal, to be consistent with current requirements.
- Administer authorizations per the direction in FSM 2720 and FSH 2709.11 to ensure that water quality related terms and conditions are met.

Fac-9. Pipelines, Transmission Facilities, and Rights-of-Way

Manual or Handbook Reference FSM 2726 and FSH 2709.11, chapter 50.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during the construction and maintenance of pipelines, powerlines, transmission facilities, and other rights-of-way.

Explanation Powerlines and pipelines are constructed on NFS land by both public and private agencies under either an easement or special use authorization. Impacts to soil and water resources during transmission corridor and pipeline construction and maintenance include those originating from directional drilling, pipeline testing, soil disturbance, and erosion associated with vegetation removal and road construction. Other water quality impacts could occur from natural events, inappropriate or unauthorized activities, chemical spills, herbicide use, and other maintenance activities.

Measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources should be incorporated in the authorization terms and conditions, project plans for construction and design, and the right-of-way management plans for ongoing maintenance of vegetation along the corridor.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Consider soil and water impacts from factors such as stream head cutting and channel expansion, stream crossings, slope stability and steepness, and amount of riparian area, floodplain, and wetland acreage to be disturbed when determining corridor location.
  - ❑ Co-locate pipelines and transmission lines with roads or their rights-of-way where practicable.
  - ❑ Limit corridor disturbance, particularly in or near AMZs, surface waters, shallow groundwater, unstable areas, hydric soils, or wetlands.
- Consider service road location and standards, type of construction equipment (wheeled, tracked, and helicopter), size and location of footings and guy anchors, and revegetation requirements during project design.
  - ❑ Use applicable BMPs for Mechanical Vegetation Management Activities when using mechanical treatments to remove vegetation from the project corridor.
  - ❑ Use applicable practices of BMP Road-2 (Road Location and Design) for planning access roads.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control), BMP Road-3 (Road Construction and Reconstruction), and BMP Road-7 (Stream Crossings) when constructing pipelines, powerlines, and transmission facilities and associated roads.
- Use design and construction measures that sustain long-term wetland or stream function when a buried transmission line, pipeline, or tower support must be placed in a wetland or cross a stream (see BMP AqEco-2 [Operations in Aquatic Ecosystems]).
    - Use suitable measures for pipeline thickness, corrosion prevention, pipeline casing, cathodic protection and pipeline valves, and shut-off systems to prevent or minimize spills or leaks where pipelines cross waterbodies.
- Require suitable and regular inspections, testing, and leak detection systems to identify and mitigate pipeline deformities and leaks.
    - Use applicable practices of BMP WatUses-3 (Administrative Water Developments) and BMP Min-7 (Produced Water) when obtaining or disposing of water used for hydraulic testing of pipelines on NFS lands.
- Ensure that pipelines corridors, transmission lines, facilities, and other rights-of-ways are properly maintained to minimize damage to NFS resources in the event of an accident or natural disturbance.
    - Use applicable practices of BMP Fac-6 (Hazardous Materials), including preparation of an adequate Spill and Emergency Response Plan for pipelines carrying toxic or hazardous materials.
    - Use applicable BMPs for Mechanical Vegetation Management Activities when using mechanical treatments to manage vegetation within the corridor.
    - Use applicable BMPs for Chemical Use Activities when using chemicals for corridor maintenance or pipeline testing.
    - Use applicable practices of BMP Road-4 (Road Maintenance and Operations) for maintenance of access roads.
- Aggressively address unauthorized uses of the corridor, such as motorized vehicle use, that are exposing soils, increasing erosion, or damaging the facilities.

Fac-10. Facility Site Reclamation

Manual or Handbook Reference FSM 2020.

Objective Reclaim facilities and surrounding disturbed areas to as near to the predisturbed condition as is reasonably practicable following closure or completion of operations, or as necessary for mitigation purposes, to avoid, minimize, or mitigate long-term adverse effects to soil, water quality, and riparian resources.

Explanation Abandoned structures and wastes, particularly hazardous materials, at facility sites may pose a safety risk to the public. Lack of ongoing maintenance of facility sites can also threaten surface water and groundwater quality via erosion and chemical leaks as they fall into disrepair. Facility sites should be closed and reclaimed after the need for it ends or the recurrent impacts to resources indicate the site cannot be properly managed with available resources. Heavily used recreation sites will cause some areas to become denuded and compacted. These disturbed sites may become unstable and begin to erode at accelerated rates if not stabilized. Reestablishing stable grades, functional drainages, some level of site infiltration capacity, and effective ground cover on terrestrial sites and stabilizing substrates impacted by water flow or wave action are necessary to rehabilitate disturbed areas to avoid or minimize water quality and riparian resource degradation. Disturbances in and immediately adjacent to surface waters, riparian areas, and wetlands should be the highest priority for reclamation or rehabilitation.

Practices

Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Regularly review the need for and use of stockpiles, materials, supplies, and facilities.
- Surplus, repurpose, or recycle unneeded usable materials where practicable.
  - Dispose of unneeded materials through the appropriate solid waste handlers.
  - Consult the forest pollution prevention coordinator for proper disposal of hazardous materials.
- Develop and implement a reclamation plan to rehabilitate and restore, to the extent practicable, the natural ecological components, structures, and processes consistent with land management plan desired conditions, goals, and objectives at sites where structures or facilities have been permanently removed.
  - Remove unneeded structures.
  - Re-establish original slope contours, surface, and subsurface hydrologic pathways where practicable and as opportunities arise.
  - Improve infiltration capacity on compacted areas of the site.
  - Establish effective ground cover on disturbed sites to avoid or minimize accelerated erosion and soil loss.
  - Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - Stabilize disturbed streambed and banks (see BMP AqEco-4 [Stream Channels and Shorelines]).
  - Reconstruct or restore stream channels, wetlands, floodplains, and riparian areas to achieve desired conditions for aquatic ecosystem composition, structure, function, and processes (see BMP AqEco-3 [Ponds and Wetlands] and BMP AqEco-4 [Stream Channels and Shorelines]).
- Decommission unneeded roads, trails, and staging areas (see BMP Roads-6 [Road Storage and Decommissioning]).
- Consider long-term management of the site and nearby areas to promote project success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to allow for recovery of vegetation.

Resources for Facilities and Nonrecreation Special Uses Management Activities

Low Impact Development U.S. Environmental Protection Agency (EPA), Office of Water. Information and other resources on low impact development are available at http://water.epa.gov/polwaste/green/index.cfm.

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Wildland Fire Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from wildland fire management activities. Common wildland fire management operations include using prescribed fire, managing wildfire using a wide range of strategies from monitoring to aggressive control and suppression, and rehabilitating fire and suppression damage.

Firefighter and public safety is always the first priority in wildland fire activities. Implementation of BMPs to protect soil, water quality, and riparian resources, though important, must not compromise public or firefighter safety in wildland fire situations.

Four National Core BMPs are in the Wildland Fire Management Activities category. These BMPs are to be used during all wildfire management activities on National Forest System (NFS) lands. BMP Fire-1 (Wildland Fire Management Planning) is a planning BMP for wildland fire management at the land management-plan scale and at the project scale. BMP Fire-2 (Use of Prescribed Fire) provides direction for water quality protection during prescribed fire treatments. BMP Fire-3 (Wildland Fire Control and Suppression) provides guidance for avoiding or minimizing effects to soil, water quality, and riparian resources to the extent practicable during wildland fire suppression activities. BMP Fire-4 (Wildland Fire Suppression Damage Rehabilitation) has practices for rehabilitating fire lines, fire camps, staging areas, and burned areas.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Wildland Fire Management BMPs	
Fire-1	Wildland Fire Management Planning
Fire-2	Use of Prescribed Fire
Fire-3	Wildland Fire Control and Suppression
Fire-4	Wildland Fire Suppression Damage Rehabilitation

Fire-1. Wildland Fire Management Planning

Manual or Handbook Reference Forest Service Manual (FSM) 5120; FSM 5150; and Forest Service Handbook (FSH) 5109.19, chapter 50.

Objective Use the fire management planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during wildland fire management activities.

Explanation Wildland fire is an essential ecological process and natural change agent for many vegetation communities and habitat types on NFS lands. The role of wildland fire is incorporated into the land management planning process through goals and objectives, desired conditions, standards, and guidelines in the land management plan. A forest or grasslands' fire management plan (FMP) describes the objectives and constraints to manage prescribed fires and wildfires within the context of the land management plan. The FMP is used to assist in developing the response to a wildland fire and is supplemented by operational plans.

Prescribed fire may be used to achieve a number of resource management objectives. These fires may occur across variously sized patches, from small slash piles to very large, landscape-scale broadcast burns. Properly planned and executed, these treatments can be very effective at managing natural resources while avoiding or minimizing adverse effects to soil, water quality, and riparian resources. A Prescribed Fire Burn Plan describes why the fire is needed, what the fire will accomplish, when conditions will permit achievement of desired effects, how specific fire application will occur, and how the progress and results will be monitored and evaluated. Soil and water protection objectives and measures should be written into the prescribed fire prescription.

Wildfires caused by natural ignition sources are managed to achieve a full range of land management plan objectives including protection and enhancement of resources. The decision to manage a wildfire for enhancement of resource objectives is made when the fire starts based on the objectives and constraints outlined in the land management plan. These fires cannot be planned beyond land management plan direction that determines areas where protection will be the only objective versus areas where enhancement of other resources may be considered as well. Watershed resource considerations may be incorporated into all wildfires, but objectives to manage the fire for beneficial effects may only be applied where authorized by the land management plan.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Land Management Plans

- Consider the beneficial and adverse effects of wildland fire on water quality and watershed condition when developing desired conditions and goals for the plan area.
    - Identify areas where the adverse effects of unplanned wildland fire to water quality and watershed condition outweigh the benefits.
- Include plan objectives and strategies that allow the use of wildland fire where suitable to restore watershed conditions.
- Include design criteria, standards, and guidelines for fire management activities to avoid or minimize adverse effects to soil, water quality, and riparian resources (see BMP Fire-2 [Use of Prescribed Fire] and BMP Fire-3 [Wildland Fire Control and Suppression]).
- Consider the need to establish a network of permanent water sources in the plan area for fire control and suppression (see BMP WatUses-3 [Administrative Water Developments]).

Prescribed Fire Plan

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning prescribed fire treatments.
- Consider prescription elements and ecosystem objectives at the appropriate watershed scale to determine the optimum and maximum burn unit size, total burn area, burn intensity, disturbance thresholds for local downstream water resources, area or length of water resources to be affected, and contingency strategies.
    - Consider the extent, severity, and recovery of fire disturbance a watershed has experienced in the past to evaluate cumulative effects and re-entry intervals.
- Identify environmental conditions favorable for achieving desired condition or treatment objectives of the site while minimizing detrimental mechanical and heat disturbance to soil and water considering the following factors.

- Existing and desired conditions for vegetation and fuel type, composition, structure, distribution, and density.
- Short- and long-term site objectives.
- Acceptable fire weather parameters.
- Desirable soil, duff, and fuel moisture levels.
- Existing duff and humus depths.
- Site factors such as slope and soil conditions.
- Expected fire behavior and burn severity based on past burn experience in vegetation types in the project area.
- Extent and condition of roads, fuel breaks, and other resource activities and values.

- Develop burn objectives that avoid or minimize creating water-repellent soil conditions to the extent practicable considering fuel load, fuel and soil moisture levels, fire residence times, and burn intensity.
  - Use low-intensity prescribed fire on steep slopes or highly erodible soils when prescribed fire is the only practicable means to achieve project objectives in these areas.
- Set target levels for desired ground cover remaining after burning based on slope, soil type, and risk of soil and hillslope movement.
- Plan burn areas to use natural or in-place barriers that reduce or limit fire spread, such as roads, canals, utility rights-of-way, barren or low fuel hazard areas, streams, lakes, or wetland features, where practicable, to minimize the need for fireline construction.
  - Identify the type, width, and location of firebreaks or firelines in the prescribed fire plan.
- Use fire initiation techniques, control methods, and access locations for ignition and control (holding versus escape conditions) that minimize potential effects to soil, water quality, and riparian resources.
- Use prescribed fire in the AMZ only when suitable to achieve long-term AMZ-desired conditions and management objectives (see BMP Plan-3 [AMZ Planning]).

Fire-2. Use of Prescribed Fire

Manual or Handbook Reference FSM 5140.

Objective Avoid, minimize, or mitigate adverse effects of prescribed fire and associated activities on soil, water quality, and riparian resources that may result from excessive soil disturbance as well as inputs of ash, sediment, nutrients, and debris.

Explanation Prescribed fire, while a useful tool to achieve resource management objectives, can affect watershed condition by consuming vegetation, dead woody debris, humus, and duff; removing protective ground cover; contributing to creation of water-repellent soil conditions; damaging physical and biological soil quality from excessive heat; and releasing nutrients and metals to runoff into nearby streams. A prescribed fire may burn at a range of intensities, leaving a mosaic of burn severities within the fire perimeter. Actions to control and contain the prescribed fire, such as fireline construction, can also adversely affect watershed condition by creating a ground disturbance.

A Prescribed Fire Burn Plan guides the management of a prescribed fire. This plan contains the technical specifications for managing the fire and protecting other resources. Fire managers review these plans before fire ignition, briefing field crewmembers on practices and locations prescribed to avoid or minimize adverse effects to soil, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Conduct the prescribed fire in such a manner as to achieve the burn objectives outlined in the Prescribed Fire Plan (see BMP Fire-1 [Wildland Fire Management Planning]).
- Locate access and staging areas near the project site but outside of AMZs, wetlands, and sensitive soil areas.
    - Keep staging areas as small as possible while allowing for safe and efficient operations.
    - Store fuel for ignition devices in areas away from surface water bodies and wetlands.
    - Install suitable measures to minimize and control concentrated water flow and sediment from staging areas.
    - Collect and properly dispose of trash and other solid waste.
    - Restore and stabilize staging areas after use (see BMP Veg-6 [Landings]).
- Conduct prescribed fires to minimize the residence time on the soil while meeting the burn objectives.
    - Manage fire intensity to maintain target levels of soil temperature and duff and residual vegetative cover within the limits and at locations described in the prescribed fire plan.
- Construct fireline to the minimum size and standard necessary to contain the prescribed fire and meet overall project objectives.
    - Locate and construct fireline in a manner that minimizes erosion and runoff from directly entering waterbodies by considering site slope and soil conditions, and using and maintaining suitable water and erosion control measures.
    - Consider alternatives to ground-disturbing fireline construction such as using wet lines, rock outcrops, or other suitable features for firelines.
    - Establish permanent fireline with suitable water and erosion control measures in areas where prescribed fire treatments are used on a recurring basis.
    - Maintain firebreaks in a manner that minimizes exposed soil to the extent practicable.
    - Rehabilitate or otherwise stabilize fireline in areas that pose a risk to water quality.
- Alter prescribed fire prescriptions and control actions in the AMZs as needed to maintain ecosystem structure, function, and processes and onsite and downstream water quality.
    - Pretreat AMZs and drainage ways to reduce excessive fuel loadings.
    - Avoid building firelines in or around riparian areas, wetlands, marshes, bogs, fens, or other sensitive water-dependent sites unless needed to protect life, property, or wetlands.
    - Construct any essential fireline in the AMZ in a manner that minimizes the amount of area and soil disturbed.
    - Keep high-intensity fire out of the AMZ unless suitable measures are used to avoid or minimize adverse effects to water quality.

- Avoid or minimize complete removal of the organic layer when burning in riparian areas or wetlands to maintain soil productivity, infiltration capacity, and nutrient retention.
- Rehabilitate fireline in the AMZ after prescribed fire treatment is completed.
- Remove debris added to stream channels as a result of the prescribed burning unless debris is prescribed to improve fisheries habitat.

- Conduct prescribed fire treatments, including pile burning, for slash disposal in a manner that encourages efficient burning to minimize soil impacts while achieving treatment objectives.
  - Pile and burn only the slash that is necessary to be disposed of to achieve treatment objectives.
  - Locate slash piles in areas where the potential for soil effects is lessened (meadows, rock outcrops, etc.) and that do not interfere with natural drainage patterns.
  - Remove wood products such as firewood or fence posts before piling and burning to reduce the amount of slash to be burned.
  - Minimize the amount of dirt or other noncombustible material in slash piles to promote efficient burning.
  - Construct piles in such a manner as to promote efficient burning.
  - Avoid burning large stumps and sections of logs in slash piles to reduce the amount of time that the pile burns.
  - Avoid burning when conditions will cause the fire to burn too hot and damage soil conditions.
  - Avoid piling and burning for slash removal in AMZs to the extent practicable.
  - Minimize effects on soil, water quality, and riparian resources by appropriately planning pile size, fuel piece size limits, spacing, and burn prescriptions in compliance with State or local laws and regulations if no practical alternatives for slash disposal in the AMZ are available.
- Evaluate the completed burn to identify sites that may need stabilization treatments or monitoring to minimize soil and site productivity loss and deterioration of water quality both on and off the site.
  - Provide for rapid revegetation of all denuded areas through natural processes supplemented by artificial revegetation where necessary.
  - Use suitable measures to promote water retention and infiltration or to augment soil cover where necessary.
  - Use suitable species and establishment techniques to stabilize the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - Clear streams and ditches of debris introduced by fire control equipment during the prescribed fire operation.
  - Consider long-term management of the site and nearby areas to promote project success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to allow for recovery of vegetation.

Fire-3. Wildland Fire Control and Suppression

Manual or Handbook Reference FSM 5130.

Objective Avoid or minimize adverse effects to soil, water quality, and riparian resources during fire control and suppression efforts.

Explanation Wildland fire control and suppression activities are aimed at stopping and extinguishing the fire and often occur without full knowledge of potential effects to soil, water quality, or riparian resources. Suppression activities include constructing fire line and temporary access roads, opening closed or access-limited system roads, clearing and grubbing safety zones, falling hazard trees, retrieving water and applying it to the fire, performing back-fire operations, and applying aerial or ground-based fire retardant. Soil disturbance and loss of ground cover from these activities can lead to accelerated erosion and sediment delivery to waterbodies. Certain fire retardant formulations are toxic to aquatic fauna, including fish. Water quality objectives are included in strategic and tactical fire management plans, but are secondary to firefighter and public safety during suppression activities.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Assign a watershed resource advisor, or team of watershed resource advisors, to work with incident management teams to minimize damage to soil, water quality, and riparian resources from fire and fire control and suppression activities.
- Locate Incident Command Post, air resource bases, staging areas, and other fire management support areas outside of the AMZ and at a suitable distance from waterbodies to minimize the potential for adverse effects to water quality.
    - ❑ Protect surface and subsurface water resources from nutrients, bacteria, and chemicals associated with solid waste and sewage disposal.
    - ❑ Collect and properly dispose of trash and other solid waste.
    - ❑ Use applicable practices of BMP Road-10 (Equipment Refueling and Servicing) when servicing, refueling, and cleaning vehicles and equipment.
    - ❑ Install suitable measures to minimize and control concentrated water flow and sediment from support areas.
- Use Minimum Impact Suppression Tactics during wildland fire control and suppression activities when and where practicable considering the appropriate management response and land management plan direction.
- Use preexisting features for safety zones as practicable to avoid unnecessary ground disturbance.
- Construct fireline to the minimum size and standard necessary to contain the fire and meet overall resource objectives.
    - ❑ Locate and construct fireline in a manner that minimizes erosion and runoff from directly entering waterbodies by considering site slope and soil conditions, and using and maintaining suitable water and erosion control measures.
    - ❑ Avoid building firelines in or around riparian areas, wetlands, marshes, bogs, fens, or other sensitive water-dependent sites unless needed to protect life or property.

- Use natural or in-place barriers that reduce or limit fire spread, such as roads, canals, utility rights-of-way, barren or low fuel hazard areas, streams, lakes, or wetland features as firelines where practicable, to minimize the need for fireline construction.

- Use suitable measures to prevent or minimize runoff, erosion, and sediment delivery to waterbodies when using water for fire suppression activities.
- Use suitable measures, consistent with current Forest Service policy, to minimize adverse effects to water quality when applying fire retardant or foam.
    - Use fire retardant formulations that are least toxic to aquatic flora and fauna and shift to less lethal formulations as they become available and affordable.
    - Avoid, to the extent practicable, aerial application of fire retardant or foam within a buffer area around waterbodies of sufficient size to minimize the potential for entry into the waterbody.
- Conduct water drafting at suitable locations and in a manner that avoids or minimizes adverse effects to water quality (see BMP WatUses-3 [Administrative Water Developments]).
- Evaluate the need to close or restrict use of surface and shallow groundwater resources following fire control activities that may have adversely affected water quality.

Fire-4. Wildland Fire Suppression Damage Rehabilitation

Manual or Handbook Reference FSM 2523.4.

Objective Rehabilitate watershed features and functions damaged by wildland fire control and suppression-related activities to avoid, minimize, or mitigate long-term adverse effects to soil, water quality, and riparian resources.

Explanation Fire suppression and related activities can damage watershed features and functions by removing vegetation, exposing soil, and disrupting flow pathways. Corrective treatments are used to stabilize soil, control surface runoff and erosion, reduce flood potential, and stabilize the drainage network in areas directly affected by fire suppression and related activities. Fire incident management teams (IMTs) are responsible for rehabilitation of fireline, spike camps, roads, and other sites created and used to control and suppress the fire, where necessary, to protect resources. Resource advisors may assist the IMT in determining the sites in need of treatment as well as suitable corrective actions. Areas affected by the fire itself may require additional rehabilitation, including emergency treatments, (e.g., Burned Area Emergency Response [BAER] program) to protect watershed resources. These activities may be initiated by the affected management unit immediately following the fire or during a period of years after the fire to achieve desired objectives.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Conduct emergency stabilization assessments of fire damage that produces hazards to life or property as needed in accordance with BAER policy (FSM 2523 and FSH 2509.13).
- Reclaim and stabilize disturbed areas including safety zones, fireline, and base camps that have increased erosion potential or drainage patterns altered by fire suppression activities.
    - Reshape the ground surface and install suitable drainage features to promote dispersed runoff from the site.

- Mitigate soil compaction to improve infiltration and revegetation conditions.
- Use suitable species and establishment techniques to stabilize the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

- Repair roads, trails, and other facilities damaged by suppression activities that may adversely affect water quality and riparian resources.
  - Repair damaged road and trail drainage structures and conveyances to a condition where they can function as designed (See BMP Road-3 [Road Construction and Reconstruction] and BMP Road-4 [Road Operations and Maintenance]).
  - Reconstruct roads damaged by mechanized equipment to stabilize the road prism and running surface (See BMP Road-3 [Road Construction and Reconstruction]).
  - Close or decommission roads opened for access in a condition that reduces the risk of adverse effects to hydrologic function and water quality (see BMP Road-6 [Road Storage and Decommissioning]).
  - Repair and clear debris from water conveyance structures, such as ditches, to reduce the potential for failures and subsequent erosion.
- Clear suppression-created debris from critical points in streams channels to reduce the potential for flooding or bank erosion.
  - Remove debris and sediment from existing drainage structures.
  - Remove debris introduced by fire control equipment during fire suppression activities.
  - Remove dams used to construct pools for water drafting into engines.
- Evaluate the burned area to identify sites that may need rehabilitation treatments or monitoring to minimize soil and site productivity loss and deterioration of water quality both on and off the site.
  - Provide for rapid revegetation of critical denuded areas through natural processes supplemented by artificial soil surface cover or revegetation where necessary.
  - Prioritize needed treatments to rehabilitate AMZ structure, function, and processes before treating uplands.
  - Use suitable measures in compliance with local direction to prevent and control invasive species.

Resources for Wildland Fire Management Activities

Fire Retardant

U.S. Department of Agriculture (USDA), Forest Service, Fire and Aviation Management. 2011. National aerial application of fire retardant 2011 final environmental impact statement and associated documents. Washington, DC. Available at http://www.fs.fed.us/fire/retardant/eis_info.html.

USDA Forest Service; U.S. Department of the Interior, Bureau of Land Management, National Park Service, and Fish and Wildlife Service. 2000. Guidelines for aerial delivery of retardant or foam near waterways. 2 p. Available at http://www.fs.fed.us/fire/retardant/references/US_Forest_Service_et_al_2000_Guidelines_for_Aerial_Delivery.pdf.

Minimum Impact Suppression Tactics

National Wildfire Coordinating Group. 2010. Incident response pocket guide. PMS 461, NFES 1077. 130 p. Available at http://www.nwcg.gov/pms/pubs/nfes1077/nfes1077.pdf.

Wildland Fire Lessons Learned Center. Minimum impact suppression tactics guidelines. Tucson, AZ. 12 p. Available at http://wildfirelessons.net/documents/GB_MIST_Guidelines.pdf.

Prescribed Fire

Arkansas Forestry Commission. 2002. Arkansas forestry best management practices for water quality protection. Little Rock, AR. 60 p. Available at http://forestry.arkansas.gov/Services/ManageYourForests/Pages/bestManagementPractices.aspx.

USDA Natural Resources Conservation Service. National conservation practice standards—338 prescribed burning. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

U.S. Environmental Protection Agency, Office of Water. 2005. Chapter 3G: Fire management. In: National management measures to control nonpoint source pollution from forestry. EPA 841-B-05-001. Washington, DC. p. 3-89–3-92. Available at http://www.epa.gov/owow/nps/forestrymgmt/.

Water Sources

Napper, C. 2006. Water-source toolkit. 0625 1806. San Dimas, CA: USDA Forest Service, Technology and Development Program. 74 p. Available at http://www.fs.fed.us/eng/pubs/pdf/WaterToolkit/lo_res.shtml.

Sicking, L.P. 2002. Water ejectors for use in wildland firefighting. 0251 1205P. San Dimas, CA: USDA Forest Service, Technology and Development Program. 52 p. Available at http://www.fs.fed.us/eng/pubs/pdf/02511205.pdf.

Minerals Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from various mineral exploration, development, operation, and reclamation activities. Minerals on National Forest System (NFS) lands fall into four categories described in table 3.

Table 3.—*Categories of minerals on NFS lands.*

Locatable minerals (Forest Service Manual [FSM] 2810)	Metals and rare earth elements such as uranium. Uncommon varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay.
Leasable minerals (FSM 2820)	Oil and gas, coal, phosphate, potassium, sodium, sulphur, gilsonite, oil shale, and geothermal resources. Hardrock minerals located on acquired lands.
Mineral materials (FSM 2850)	Common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay.
Mineral reservations and outstanding rights (FSM 2830)	Reserved rights—private mineral rights retained in private owner conveyance. Outstanding rights—private mineral rights in deed restrictions for some tracts of acquired forest land.

In general, the Forest Service's objective for managing mineral and energy resources on NFS lands is to encourage and facilitate the orderly exploration, development, and production of these resources in an environmentally sound manner integrated with the management of other national forest resources. In addition, NFS lands disturbed by mineral activities are to be reclaimed for other productive uses (FSM 2802). The extent to which the Forest Service has the authority to regulate mineral operations and require measures to avoid, minimize, mitigate, and reclaim surface disturbance varies with the mineral commodity in question and status of the land on which it is located. In all cases where there appears to be a conflict between applicable law, regulation, and suggested BMPs, the law or regulation takes precedence.

Eight National Core BMPs are in the Minerals Management Activities category. These BMPs are to be used during all minerals management activities on NFS lands, to the extent allowed by Federal and State minerals development laws and regulations. BMP Min-1 (Minerals Planning) is a planning BMP for minerals management at the land management plan scale and project scale. Mineral exploration and production activities are similar for many of the minerals managed by the Forest Service. Practices for exploration activities are in BMP Min-2 (Minerals Exploration) and practices for production activities are in BMP Min-3 (Minerals Production). BMP Min-4 (Placer Mining) provides direction for extracting metals from alluvial deposits in or near stream channels. BMP Min-5 (Minerals Materials Resource Sites) provides direction for extracting aggregate materials from waterbodies and upland sites. BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) covers onsite storage and disposal of solid and liquid mine wastes. BMP Min-7 (Produced Water) provides direction for treatment and disposal of water produced at drilling sites. BMP Min-8 (Minerals Site Reclamation) provides direction for reclamation of mines and drilling sites.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Minerals Activities BMPs	
Min-1	Minerals Planning
Min-2	Minerals Exploration
Min-3	Minerals Production
Min-4	Placer Mining
Min-5	Mineral Materials Resource Sites
Min-6	Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds
Min-7	Produced Water
Min-8	Minerals Site Reclamation

Min-1. Minerals Planning

Manual or Handbook Reference FSM 2810, FSM 2820, FSM 2830, and FSM 2850.

Objective Use the minerals planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during minerals exploration, production, operations, and reclamation activities.

Explanation When minerals activities are proposed for NFS lands, the Forest Service conducts or participates in an analysis as required by the National Environmental Policy Act (NEPA) and the applicable approval or authorization procedures to comply with laws governing mineral disposal and environmental protection and to ensure consistency with the land management plan. During this analysis and approval process, the Forest Service consults and cooperates with other State and Federal agencies to identify the environmental impacts that will occur; to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources; and to determine reclamation needs and formulate appropriate bonding. These measures are implemented through the approved plan, contract, or other authorization.

Through the Bureau of Land Management (BLM), the U.S. Department of the Interior has the primary role in issuing mineral leases and permits and supervising operations for many mineral activities. The Forest Service coordinates with the BLM to ensure that land management plan resource management desired conditions, goals, and objectives are achieved; impacts to land surface resources are minimized or mitigated; and the affected land is promptly rehabilitated. Through the NEPA process the Forest Service and BLM make a determination as to whether an authorization or lease will be issued and identify stipulations needed to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning minerals activities.
- Identify potential environmental risks of the proposed minerals activities and include measures in project plans to manage risk by removing or eliminating the source of risk, changing the mining plan, or removing the resource at risk from harm's way.

- Inform proponent that a Clean Water Act (CWA) 402 permit may be required if the minerals operation causes a point source or stormwater discharge of any pollutant to waters of the United States.
- Inform proponent that a CWA 404 permit may be required if the mining operations will result in a discharge of dredge or fill material to waters of the United States.
- Evaluate plan of operations to ensure that reasonable measures, including appropriate BMPs, are included to avoid and minimize adverse effects to soil, water quality, and riparian resources from the mining activities.
    - ❑ Require suitable geotechnical or stability analyses to ensure that facilities are constructed to acceptable factors of safety using standard engineering practices and considering foundation conditions and material; construction materials and techniques; the seismicity of the area; and the water-related resources at risk.
    - ❑ Require suitable characterization of ore, waste rock, and tailings using accepted protocols to identify materials that have the potential to release acidity or other contaminants when exposed during mining.
    - ❑ Require suitable characterization of mine site hydrology commensurate with the potential for impacts to surface water and groundwater resources, to include physical and chemical characteristics of surface and groundwater systems, as needed, for the range of expected seasonal variation in precipitation and potential stormflow events likely to occur at the site for the duration of the minerals activities.
    - ❑ Stipulate suitable requirements, including water treatment as needed, to avoid or minimize the development and release of acidic or other contaminants.
    - ❑ Use applicable practices from the Minerals Management Activities BMPs.
    - ❑ Evaluate the consumptive use of water in the mining operation and its effect on water-dependent ecosystems.
    - ❑ Evaluate the potential for direct and indirect impacts to morphology, stability, and function of waterbodies, riparian areas, and wetland habitats.
    - ❑ Identify suitable measures to avoid impacts to waterbodies, riparian areas, and wetland habitats through appropriate location, design, operation, and reclamation requirements.
    - ❑ Identify suitable interim and post-project surface water and groundwater monitoring where needed to confirm predictions of impacts, detect adverse changes at the earliest practicable time, and develop appropriate changes in operations or recommend closure where needed.
    - ❑ Request a copy of operator's CWA 401 Certification from designated Federal, State, or local entity before approving a plan of operations that may result in any discharge into waters of the United States.
- As outlined in the Forest Service Training Guide for Reclamation Bond Estimation and Administration for Minerals Plans of Operation, consider the direct and indirect costs of stabilizing, rehabilitating, and reclaiming the area of mineral operations to the appropriate standards for water quality and watershed condition as determined from the land management plan, State and Federal laws, regulations, plans, or permits when determining the reclamation bond amount. Include costs for:
    - ❑ Operation and maintenance of facilities designed to divert, convey, store, or treat water.
    - ❑ Decontaminating, neutralizing, disposing, treating, or isolating hazardous materials at the site to minimize potential for contamination of soil, surface water, and ground water.
    - ❑ Water treatment needs predicted during planning and discovered during operations to achieve applicable water quality standards.

- Earthwork to reclaim roads; waste rock dumps; tailings; backfilling water features (diversions, ditches, and sediment ponds); and construction of diversion channels and drains, stream channels, and wetlands.
- Revegetation to stabilize the site and minimize soil erosion.
- Mitigation to restore natural function and value of streams, wetlands, and floodplains.
- Long-term operations, monitoring, and maintenance of mineral production-related facilities that must perform as designed to avoid or minimize contamination of surface or groundwater resources, including roads, diversion ditches, dams, and water treatment systems.
- Protection of the reclaimed area until long-term stability, erosion control, and revegetation has been established.

Locatable Minerals

- Evaluate Notice of Intent to Operate proposal to determine if it will likely cause significant disturbance to soil, water quality, and riparian resources.
  - Require a plan of operation from the mineral operator, lessee, or purchaser as required by law and regulation if proposed activities might cause significant disturbance of surface resources including soil, water quality, or riparian resources.

Minerals Leasing

- Include in the land management plan, or other areawide decision document, direction for surface occupancy. Use lease stipulations to avoid riparian areas, wetlands, and areas subject to mass soil movement; to avoid or minimize erosion and sediment production; and to avoid or minimize adverse effects to water quality and municipal supply watersheds, if these issues are not adequately addressed by provisions in regulations at 36 CFR 228.108.
- Use the applicable practices from the Minerals Activities BMPs for recommendations on post-lease approval of operations.
- Require or work with BLM to require appropriate contingency plans to avoid or minimize adverse impacts to surface waters.
- Coordinate with BLM to ensure the reclamation bond required for operations will be sufficient to guarantee reclamation work on NFS lands to the appropriate standards for water quality and watershed condition as determined from the land management plan, State and Federal laws, regulations, plans, or permits.

Mineral Materials

- Include reasonable conditions and applicable practices of BMP Min-3 (Minerals Production) and BMP Min-5 (Mineral Materials Resource Sites) in the operating plan to ensure proper protection of soil, water quality, and riparian resources and timely reclamation of disturbed areas.
- Consider the direct and indirect costs of stabilizing, rehabilitating, and reclaiming the area of mineral materials operations to the appropriate standards for water quality and watershed condition as determined from the land management plan, State and Federal laws, regulations, plans, or permits when determining the reclamation bond amount.

Mineral Reservations and Outstanding Mineral Rights

- Evaluate the Operating Plan for Mineral Reservation Operations to ensure that reasonable measures, including appropriate BMPs, consistent with the terms of the deed, are included to minimize damage to NFS surface resources that could affect soil, water quality, and riparian resources and that provide for restoration and reclamation of disturbed lands.

- Evaluate the Operating Plan for Outstanding Mineral Rights to ensure that reasonable measures, including appropriate BMPs, are included to control erosion, avoid or minimize water pollution, and reclaim the site consistent with land management plan direction for water quality management.

Min-2. Minerals Exploration

Manual or Handbook Reference FSM 2810, FSM 2820, and FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources caused by physical and chemical pollutants during minerals exploration activities.

Explanation Minerals exploration is the process of determining the location, extent, composition, and quality of deposits of minerals and energy resources that can be commercially developed. Exploration methods may include remote sensing, geochemical analysis of water, rock and soil samples, geophysical analysis, and ground-disturbing activities including drilling, bulldozing, trenching, and excavating shallow pits, exploration shafts, or adits. During construction of drill pads, trenches, pits, or shafts, land may be cleared of existing vegetation and ground cover, exposing mineral soil that may be more easily eroded by water, wind, and gravity. Underground activities may intercept groundwater, exposing these aquifers to potential contaminants.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Avoid or minimize long-term impacts to soil, water quality, and riparian resources to the extent permitted by the geologic target when selecting locations for exploration activities.
    - ❑ Avoid waterbodies, sensitive areas, unstable slopes, and highly erosive soils to the extent practicable.
- Limit clearing, excavation, and other surface-disturbing activities to the minimum necessary for exploration needs.
    - ❑ Consider using exploration drilling and support vehicles that do not require road construction.
- Design and construct all new roads and drilling pads to a safe and appropriate standard, no higher than necessary to accommodate their intended use (see BMP Road-2 [Road Location and Design], BMP Road-3 [Road Construction and Maintenance], and BMP Road-4 [Road Operations and Maintenance]).
- Employ suitable design and construction practices to avoid, minimize, or mitigate surface disturbances as well as maintain the reclamation potential of the site.
    - ❑ Use directional drilling techniques when practicable to avoid or reduce surface disturbance.
    - ❑ Plan and construct, to the extent practicable, exploration roads to be recontoured when operations are complete.
- Limit the extent of open exploratory areas at one time and restore one site before moving on to the next one, to the extent practicable.
- Use applicable practices from BMP Fac-2 (Facility Construction and Stormwater Control) to minimize erosion and stormwater discharge from ground disturbance at exploration sites.

- Use applicable practices from BMP Fac-4 (Sanitation Systems) and BMP Fac-5 (Solid Waste Management) to avoid contaminating surface water or groundwater from sanitation or solid waste facilities.
- Use applicable practices of Chemical Use Management Activities BMPs when chemicals are used in exploration activities.
- Use applicable practices of BMP Fac-6 (Hazardous Materials) and BMP Road-10 (Equipment Refueling and Servicing) to manage petroleum products and other hazardous materials used in exploration activities.
  - Require a transportation spill response plan, where applicable, that describes the petroleum products or other hazardous materials or chemicals that will be used in the operations, including the routes, amount and frequency of shipments, and containers and vehicles used. Describe in this plan the procedures, equipment, and personnel that would be used to respond to a spill.
- Properly manage all exploration-related wastes, including drilling fluids, produced water, and potentially acid-generating rock materials, to minimize the risk of groundwater and surface water contamination and to meet State and Federal requirements.
  - Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water).
- Protect groundwater developments and groundwater-dependent ecosystems from the impacts of shock waves when using shot explosions to determine gas reserves or other energy development potential.
- Use applicable practices of BMP Min-8 (Minerals Site Reclamation) to reclaim the project site after exploration activities are completed.

Min-3. Minerals Production

Manual or Handbook Reference FSM 2810, FSM 2820, and FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources caused by physical and chemical pollutants resulting from mineral development, production, and associated activities.

Explanation Minerals production is the process of opening the mineral or oil and gas deposit; extracting the mineral resource (beneficiation); and processing the mineral resource to put it in a marketable condition. Minerals are extracted through surface mining (open pit or strip mining), underground mining (shafts or adits), or wells for fluid materials or solvent extraction. In addition to land clearing for mineral extraction, a minerals production site will also require clearing and ground disturbance for accessory buildings and facilities for minerals processing, storage, and transportation. Exposed soils may be subject to accelerated erosion if proper erosion controls are not used. Hazardous chemicals may be used in the process of extracting and processing minerals. Extraction and beneficiation operations associated with mining activities can generate acid mine drainage when sulfide rock materials are exposed to air and water. These materials may contaminate surface water or groundwater if not handled appropriately.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Avoid or minimize long-term impacts to soil, water quality, and riparian resources to the extent permitted by the geologic target when selecting locations for the mining operation, structures, roads, and ore and waste facilities.
  - Provide adequate buffers and setbacks from waterbodies to avoid or minimize impacts to water quality and aquatic ecosystems.
- Employ suitable design and construction measures to avoid, limit, or mitigate surface disturbances as well as maintain the reclamation potential of the site.
- Use applicable practices from BMP Fac-2 (Facility Construction and Stormwater Control) to minimize erosion and stormwater discharge from ground disturbance at minerals production sites and to keep production sites dry.
- Properly manage mining byproducts and wastes.
  - Minimize production of byproducts and wastes to the extent practicable.
  - Plan space to properly handle, store, and contain byproducts and wastes.
  - Find suitable onsite or offsite uses for mining byproducts.
  - Recycle or properly dispose of wastes (e.g., used petroleum products, site garbage, septic effluent, decommissioned equipment, and used barrels or containers).
  - Minimize handling of byproducts and wastes to the extent practicable.
- Use applicable Road Management Activity BMPs to manage roads and transportation at the project site.
- Use applicable practices from BMP Fac-4 (Sanitation Systems) and BMP Fac-5 (Solid Waste Management) to avoid contaminating surface water or groundwater from sanitation or solid waste facilities.
- Use applicable Chemical Use Management Activities BMPs, BMP Fac-6 (Hazardous Materials), and BMP Road-10 (Equipment Refueling and Servicing) to manage all chemicals, reagents, fuels, and other hazardous or toxic materials used for construction, operations, and beneficiation to avoid or minimize contaminating surface water or groundwater.
- Use applicable practices from BMP Min-8 (Minerals Site Reclamation) to reclaim the project site after minerals production operations are completed.
- Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water) to protect soil, water quality, and riparian resources in minerals extraction and processing, geothermal energy, and oil and gas production activities.
- Require a transportation spill response plan, where applicable, that describes the petroleum products or other hazardous materials or chemicals that will be used in the operations, including the routes, amount, and frequency of shipments, and the containers and vehicles that are to be used. Describe in this plan the procedures, equipment, and personnel that would be used to respond to a spill.
- Make adjustments in the plans, authorizations, and bonds if conditions develop that are outside the design criteria and conduct adequate notification, emergency stabilization, or other activities to avoid effects before proceeding with additional mining.

Mining-Related Surface Activities

- Limit clearing, excavation, and other surface-disturbing activities to the minimum necessary for mining needs.
    - ❑ Limit amount of exposed or disturbed soil at any one time to the minimum necessary for efficient operations during minerals production activities.
    - ❑ Clearly delineate the geographic limits of the area to be cleared.
    - ❑ Install suitable drainage measures to improve the workability of wet sites.
    - ❑ Avoid or minimize damage to existing vegetation, particularly the vegetation that is stabilizing the bank of a waterbody.
    - ❑ Stabilize mined areas and surface disturbance activities as soon as practicable before moving and opening up new areas.
- Reduce surface-disturbing activities to the minimum necessary for efficient minerals production activities during periods of heavy runoff or saturated soil conditions, to the extent practicable, to decrease the potential for soil compaction and erosion.
- Stockpile biologically active topsoil removed during excavation for use in reclamation.
    - ❑ Store stockpiled topsoil separately from other vegetative slash or soil and rock materials and protect from wind and water erosion, unnecessary compaction, and contaminants.
- Conduct operations in such a manner as to avoid or minimize the production and transport of fugitive dust from the site.
- Use suitable measures in compliance with local direction to prevent and control invasive species.

Mining-Related Subsurface Activities

- Develop the mine plan to suitably address surface stability and avoid or minimize the unnecessary diversion of runoff or surface waters into the subsurface.
- Use suitable water management and control measures to minimize water inflow, use inflow for mineral operations to the extent practicable, and manage inflow to minimize the accumulation of contaminants including blasting residuals.
- Manage ventilation systems to minimize deposition of airborne contaminants on the ground surface.

Geothermal, Oil, and Gas Activities

- Locate well sites on level locations that will accommodate the intended use to reduce the need for vertical cuts and steep fill slopes.
    - ❑ Use directional drilling techniques when practicable to avoid or reduce surface disturbance.
- Use suitable measures to stabilize fill slopes and minimize potential of slope failures.
- Use suitable measures to provide surface drainage and manage runoff from the work areas used for mud tanks, generators, mud storage, and fuel tanks in a manner that avoids or minimizes pollutant contamination of surface waters or groundwater.
- Use nontoxic, nonhazardous drilling fluids whenever practicable.
- Construct suitable impervious containment structures with sufficient volume and freeboard to avoid or minimize spills or leakages of oil, gas, salt water, toxic liquids, or waste materials from reaching surface waters or groundwater.

- Avoid mixing of geothermal fluids with surface water or groundwater where the chemical and thermal properties of the geothermal fluids would damage aquatic ecosystems and contaminate drinking water supplies.

Mining-Related Instream Activities

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when conducting mining in waterbodies.

Min-4. Placer Mining

Manual or Handbook Reference FSM 2810.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting placer mining operations in or near stream channels.

Explanation Placer mining involves mining and extracting gold or other heavy metals and minerals primarily from alluvial deposits. These deposits may be in existing streambeds or in ancient, often buried, stream deposits. Suction dredge placer mining is the most common in-channel operation and removes gold and other minerals from streambed substrates. All floating suction dredges are designed to work as a unit to dig, classify, and beneficiate ores and to dispose of waste within the stream channel. Placer mining operations can also occur adjacent to stream channels and other waterbodies. The essential components of placer mining include removing the overburden, mining the placer deposits, and processing the ore to recover the desired mineral. Overburden and placer deposits can be excavated by a variety of means ranging from hand tools to heavy equipment. Excavated placer pay gravels are typically processed using a variety of gravity separation techniques that yield gold or other heavy metal concentrates. Concentration of gold and other precious metals sometimes takes place onsite using mercury amalgamation or other techniques. Waste products from placer mining include tailings and process water. Effects to soil, water quality, and riparian resources from these operations include direct modification of the waterbody, release of contaminated waters, groundwater disruption, and increased levels of turbidity and sediment.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems), BMP AqEco-3 (Ponds and Wetlands), and BMP AqEco-4 (Stream Channels and Shorelines) when working in or near aquatic ecosystems to prevent or minimize adverse impacts to water quality.
- Use applicable practices of BMP Min-3 (Mineral Production) for sanitation, solid waste, and transport and storage of petroleum products or other hazardous materials.

Suction Dredge Mining

- Conduct dredging and excavation operations in such a manner as to avoid creating dams or diversions, including inadvertent damming caused by tailing placement.
- Conduct dredging and excavation operations only within the existing wetted perimeter (waterline) in the active stream channel and avoid mining or otherwise disturbing streambanks.

- Schedule dredging or excavation to avoid periods and locations where fish are spawning or where fish eggs or fry are known to exist at the time dredging occurs.
- Provide adequate passage for fish around and through the mining area.
- Provide space between current and recent dredging and excavation operations to avoid overlapping of water quality and habitat effects from concurrent or successive operations to provide areas of unimpacted substrate for fish and other aquatic organisms.
- Conduct dredging and excavation operations in such a manner as to retain large boulders, logs, or other natural obstructions in place to preserve large habitat-forming elements.
- Conduct dredging and excavation operations in such a manner as to avoid significant increases in downstream turbidity.

Mechanical Placer Mining in Riparian and Floodplain Areas

- Use applicable practices of BMP Min-3 (Minerals Production) in removing overburden to access placer deposits.
- Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water) to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when processing materials.
- Use suitable measures to avoid or minimize the entrainment of fish when obtaining water from a fish-bearing stream for placer mining operations.

Min-5. Mineral Materials Resource Sites

Manual or Handbook Reference FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when developing and using upland mineral materials resource sites or instream sand and gravel deposits.

Explanation Mineral materials resource sites include upland and instream sites that are mined to obtain minerals materials such as sand, gravels, cobbles, and boulders. Upland aggregate deposits also include finer materials such as sand, silt, clay, and organic debris that can be mobilized during or following desired material extraction operations. The principal pollutant generated at quarries is total suspended solids and, therefore, erosion and sediment control should be the major focus during all phases of the quarry operation. The size and location of the deposit, as well as the amount and duration of need for materials, are commonly the key factors to consider when evaluating and designing an appropriate strategy to remove the materials and stabilize the site following mining operations.

Deposits of sand and gravel, the unconsolidated granular materials resulting from the natural disintegration of rock or stone, are generally found in near-surface alluvial deposits and in subterranean and subaqueous beds. Instream sand and gravel mining operations consist of extracting sand and gravel deposits from the stream channel and processing and stockpiling aggregate materials at a nearby site on land. Instream extraction is accomplished by dredging underwater deposits; mining point bars, lateral bars, and islands that are above the low-water level; mining of temporarily or permanently dewatered channels; or by creating instream harvest pits by placement of rock vortex weirs. Effects to water quality and aquatic ecosystems from these operations can include direct physical modification of the waterbody and hydraulics, reduction in bedload and change in bedload transport, release of contaminated waters, groundwater disruption, and increased levels of turbidity.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Allow upland and instream sand and gravel mining where consistent with land management plan desired conditions, goals, and objectives for soils, aquatic and riparian habitats, and water quality.
- Use applicable practices of BMP Min-3 (Minerals Production) and BMP Fac-2 (Facility Construction and Stormwater Control) for sanitation, solid waste, and transport and storage of petroleum products or other hazardous materials and to control erosion, manage stormwater, keep the site dry, and protect the waterbody when clearing the extraction and processing areas.
- Use applicable practices of BMP Min-6 (Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds) and BMP Min-7 (Produced Water) to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when processing materials.

Upland Gravel Pits

- Plan operations at the site in advance to minimize disturbance area and more effectively and efficiently open and operate the site.
    - ❑ Limit the area of the facility to the minimum necessary for efficient operations while providing sufficient area for materials processing and stockpiling.
    - ❑ Phase development where practicable.
    - ❑ Use suitable measures to avoid, mitigate, or treat metal leaching and formation of acid rock drainage.
- Conduct extraction activities in such a manner as to minimize the potential for slope failures, limit slope steepness and length, limit disturbed areas to those actively used for extraction, retain existing vegetation as long as possible, and allow for progressive reclamation of the site where practicable.

Instream Sand and Gravel Mining

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems), BMP AqEco-3 (Ponds and Wetlands), and BMP AqEco-4 (Stream Channels and Shorelines) when working in or near waterbodies to prevent or minimize adverse impacts to water quality.
- Consider channel type and effects of the proposed operation on channel morphology and function when approving instream sand and gravel mining operations.
- Limit access disturbance to designated areas on one streambank to reduce the effort required for site reclamation.
    - ❑ Use suitable measures to protect the streambank at access points to minimize bank erosion.
- Locate the material processing and stockpile site at a suitable distance from the active channel to leave a buffer zone along the waterbody to reduce risk of flooding.
    - ❑ Consider historic channel migration patterns and site elevation when locating mineral processing and stockpile sites.
    - ❑ Avoid or minimize disturbance to valuable riparian areas; wetlands; and aquatic-dependent threatened, endangered, and sensitive species habitat.
- Include suitable measures to protect channel morphology and function when extracting sand and gravel deposits.

- Specify the maximum depth of mining.
- Limit extraction depth to minimize slope changes along the stream, avoid or minimize channel and bank erosion, and retain existing natural channel armoring.
- Limit extraction amount to minimize upstream and downstream effects due to changes in bedload transport.
- Avoid modifying point bars to the extent where the resultant channel changes cause unacceptable reduced sinuosity or increased stream gradient, velocity, stream power, and bank instability.
- Schedule in-channel mining to occur during low-flow periods.
- Avoid or minimize changes to channel shape and reduce effects of mining on aquatic habitats by establishing a low-flow buffer.
- Avoid or minimize streambank erosion and instability during and after mining.
- Avoid or minimize headward erosion of the channel at the upstream end of the instream pit.

• Design and construct diversion channels to handle anticipated flow volumes and to minimize upstream and downstream effects of changes in stream grade, width, depth, bed characteristics, bank instability, and groundwater inflows when temporarily or permanently dewatering stream channels to extract sand and gravel.
  - Ensure barrier is able to adequately protect the dewatered mining area from flood flows.

• Conduct excavation operations in such a manner as to avoid significant increases in downstream turbidity.

Min-6. Ore Stockpiles, Mine Waste Storage and Disposal, Reserve Pits, and Settling Ponds

Manual or Handbook Reference FSM 2810, FSM 2820, and FSM 2850.

Objective Avoid, minimize, or mitigate adverse effects to soil, surface water, groundwater, and riparian resources from physical and chemical contaminants originating from ore stockpiles, storage and disposal of mine waste, and construction and use of reserve pits and settling ponds.

Explanation Minerals production and processing generates large amounts of materials including ore stockpiles, waste rock, tailings, drilling muds and cuttings, and process water. These materials may contain minerals, hazardous chemicals, and other potential pollutants that can have severe impacts on water resources.

This practice addresses the management of ore and mine wastes as well as construction and operation of reserve pits, settling ponds, slime ponds, process water ponds, and tailings impoundments. Most operations divert surface water and groundwater around a site, collect waters after passing through or under a site, or employ a combination of both. When water and waste are diverted, implementation focuses on isolating the wastes to contain, settle, control, stabilize, or otherwise minimize contamination, whereas practices for flow-through systems focus on methods to collect, store, and treat contaminated waters.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Ore Stockpiles and Mine Waste Facilities

- Locate ore stockpiles and waste facilities on stable, level sites with adequate drainage, away from surface water, shallow groundwaters, and poorly drained soils where practicable.
  - Establish adequate buffers and setbacks between the facility footprint and waterbodies to avoid or minimize adverse effects to water quality and aquatic ecosystems.
- Divert, control, collect, detain, and disperse surface runoff before contact with ore stockpiles and mine wastes.
  - Use suitable measures to ensure that pollutants are removed from runoff that was in contact with ore stockpiles or waste facilities and are not discharged or released into surface waters or groundwater.
- Properly characterize ore and waste rock to identify materials that have the potential to release acidity or other contaminants when exposed by mining.
- Use suitable measures to minimize development and prevent release of acidity or other contaminants.
  - Segregate and isolate potentially problematic materials from air and water.
  - Install impermeable caps, liners, and surface water diversions.
  - Blend acid-consuming materials, such as limestone, with the waste.
  - Require water treatment as needed.
- Limit slope steepness and length to interrupt surface runoff and reduce soil erosion.
- Install suitable support structures, such as retaining walls, in conjunction with a drainage system to support facility berms while draining excess water.
- Construct waste facilities in successive lifts where practicable to promote long-term stability and post-reclamation land productivity.
- Use suitable measures to stabilize stockpiles not scheduled for immediate processing to avoid or minimize wind and water erosion, oxidation of reactive materials, and runoff of toxic waters.
- Monitor containment dams and water and sediment control features to ensure contaminants are not reaching streams or other sensitive resources.

Reserve Pits

- Locate reserve pits in stable areas on the drill pad to the extent practicable.
- Locate pits away from natural watercourses, riparian areas, wetlands, floodplains, and areas of shallow groundwater wherever practicable.
  - Use suitable measures to ensure full containment of drilling fluids where the reserve pit must be placed in a sensitive location or in porous material.
- Design the reserve pit to contain all anticipated drilling muds, cuttings, fracture fluids, and precipitation while maintaining a suitable amount of freeboard to avoid or minimize overtopping.
- Use suitable measures to avoid or minimize seepage from the reserve pit contaminating groundwater.
- Remove any visible or measurable layer of oil from the surface of the reserve pit after cessation of drilling and completion of operations, and continue to keep the pit free of oil.
- Use suitable measures to avoid or minimize surface waters and groundwater from entering open pits.

Tailings, Settling, Process Water, and Slime Ponds

- Use the minimum amount of water necessary for efficient materials processing to reduce the volume of water requiring treatment, maximize the capacity of settling ponds, and avoid contaminating nonprocess water.
  - ❑ Recycle treatment water or used closed loop systems where practicable.
- Use suitable measures to treat, store, and dispose of wastewater from mine inflows and leaching and milling operations in a manner that avoids or minimizes adverse effects to soil, water quality, and riparian resources.
- Use suitable measures to ensure that pollutant materials removed from the process water and wastewater streams are retained in storage areas and are not discharged or released into surface waters or groundwater.
  - ❑ Design, construct, operate, and maintain water control devices, such as diversion structures and berms, and all solids retention structures, such as berms, dikes, pond structures, and dams, to function effectively through the life of the project with reduced risk of failure.
  - ❑ Locate storage ponds and storage areas in places where they will not be washed out by reasonably predictable flooding or return of a relocated stream to its original streambed.
  - ❑ Place materials removed from settling ponds in locations where liquids from the materials cannot flow overland into surface waters.
  - ❑ Provide for contingencies to avoid or minimize failure and release of untreated wastes and wastewater into waters of the United States or waters of the State.
- Design tailings facilities, dams, and berms to acceptable factors of safety using standard geotechnical engineering practices and considering foundation conditions and materials; construction materials and practices; the seismicity of the area; and the human and environmental resources at risk.
- Design ponds to contain all sediment-laden process water as well as surface runoff, seepage, and expected precipitation.
  - ❑ Use suitable measures to ensure that water is kept below the crest of the dam or berm.
  - ❑ Size the spillway to release overflows in a volume and velocity that does not erode the spillway, the area beyond the outlet or the downstream channel.
  - ❑ Use suitable measures to ensure water meets applicable Federal, State, and local water quality standards before discharge to waters of the United States or waters of the State.
- Divert surface water around the impoundment area before construction and, where appropriate, construct a drain field below dams and berms to reduce the water levels to maintain structural integrity.
- Install monitoring devices to measure water levels and mass movement within tailings or water retaining structures where human and environmental resources are at risk.
- Use suitable measures to minimize groundwater seepage into impoundments and avoid or minimize leaching of contaminated waters into the groundwater.
- Construct watertight impoundments for containment of mill process water, cyanide solutions, sulfide tailings, or phosphate slimes.
- Use closed-system ponds when water contains potentially hazardous materials such as cyanide or other beneficiation chemicals.
  - ❑ Ensure that solutions containing chemicals used in beneficiation, such as floatation reagents or cyanide, are properly treated or removed from process ponds and disposed of in accordance with applicable State and Federal requirements.

- Install and seasonally monitor groundwater quality monitoring wells if a risk of groundwater pollution exists (see BMP WatUses-2 [Water Wells for Production and Monitoring]).
- Establish a suitable inspection schedule to ensure that water diversion structures, conveyances, and storage facilities are performing as designed and appropriately maintained.

Min-7. Produced Water

Manual or Handbook Reference FSM 2820.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by appropriately managing water produced during the extraction of minerals, geothermal energy, oil, and gas.

Explanation Produced water is often a byproduct of oil and gas, geothermal energy, and mineral exploration and production due to the dewatering of underground aquifers. Disposal of produced water is a critical environmental impact to consider because of the large quantities produced and the potential low quality of the water. Potential impacts of produced water disposal include groundwater contamination, increased turbidity, addition of nutrients (primarily nitrogen from blasting residuals), sedimentation, erosion, altered hydrology, loss of aquatic habitat, reduced water quality, and loss of soil productivity. The BLM, States, or the U.S. Environmental Protection Agency (EPA) regulate disposal of produced water. Where water treatment and disposal is allowed on NFS lands, the Forest Service regulates all surface-disturbing activities and determines the conditions that are necessary to protect surface resources including soil and water.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Prepare a water management plan that is consistent with land management plan desired conditions, goals, and objectives for water quality.
- Contain and limit the amount of produced water by recycling water through the mineral beneficiation process.
- Use produced water for a beneficial use, such as for mineral beneficiation or agriculture, where practicable.
- Discharge or otherwise dispose of produced water in compliance with the CWA and Safe Drinking Water Act, with appropriate approvals from the State and EPA.
- Re-inject produced water of suitable quality into acceptable underground reservoirs when authorized and appropriate.
- Avoid, minimize, or mitigate surface discharge effects including headcuts, stream crossing washouts, impoundments, channel stability, and flooding.
- Use applicable practices of BMP AqEco-3 (Ponds and Wetlands) when constructing ponds or impoundments to store produced water on the surface.

Min-8. Minerals Site Reclamation

Manual or Handbook Reference FSM 2840 and FSM 2522.14.

Objective Reclaim minerals exploration and production sites and surrounding disturbed areas to as near to the predisturbed condition as is reasonably practicable after completion of exploration; production; or operations to avoid, minimize, or mitigate long-term adverse effects to soil, water quality, and riparian resources.

Explanation All lands disturbed by minerals exploration and production are required to be reclaimed to a condition consistent with the land management plan and applicable State soil and water quality requirements after all mining activities are completed. This practice will help ensure a systematic approach to reclaiming mineral, geothermal energy, and oil and gas operations. Although reclamation is usually thought of as the final step in managing mineral operations, reclamation measures must be considered during project planning; included in the approved plan, permit, or other authorization; and implemented during operations, as well as closure, to reduce potential resource impacts and facilitate the final reclamation effort.

Reclamation of abandoned mined lands sites poses additional problems to those associated with active sites. Typically these historical mineral operations were developed with little if any planning or operational controls to reduce environmental impacts. As a result, data about the environmental baseline—as well as the project facilities, equipment, and materials that are left onsite—may be minimal or absent. This information must be developed during analysis of the site so that restoration efforts are cost effective and achieve the desired results.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Develop and implement a reclamation plan to rehabilitate and restore, to the extent practicable, the natural ecological components, structures, and processes consistent with land management plan desired conditions, goals, and objectives at minerals sites.
- Reclaim facilities, activities, and associated surface disturbance as soon as practicable after completion of their intended use.
- Establish the optimal timing and scheduling of reclamation operations.
    - Reclaim and stabilize facilities, disturbed areas, surface water diversion structures, and transport and storage areas before the end of seasonal shutdown so that they will function as designed to prevent adverse impacts to surface water from erosion and sedimentation.
- Sample and test the site to identify hazardous materials and associated areas that may be contaminated by petroleum products, reactive materials, or other chemicals.
- Use suitable measures to isolate, neutralize, remove, or treat hazardous or contaminated materials, including chemicals, reactive materials, acidic wastes, fuels, pit fluids, sediment, and human waste, consistent with applicable Federal, State, and local regulations to achieve applicable standards.
    - Remove or stabilize materials in settling ponds in a manner suitable for the volume, type, toxicity, and hazards of the materials.

- Require removal or encapsulation of waste material as necessary to avoid or minimize contaminating nearby waterbodies before operator abandons site or reclamation is accepted as final.

- Remove facilities, materials, and equipment (including septic system) from NFS lands.
- Use suitable measures to control or minimize erosion and sedimentation and ensure the stability of project components, including water drainage, diversion, conveyance, and storage facilities, as well as surface erosion and landslide control measures. (see BMP Veg-1 [Vegetation Management Planning], BMP Veg-2 [Erosion Prevention and Control], BMP Veg-3 [Aquatic Management Zones], BMP WatUses-4 [Water Diversions and Conveyances], BMP WatUses-5 [Dams and Impoundments], and BMP WatUses-6 [Dam Removal]).
- Use suitable measures to divert, convey, and store surface water and groundwater away from mine (open pits or adits) and mine waste (tailings, waste rock, ore, and spent ore) facilities to the extent practicable to ensure stability and prevent formation of contaminated leachate or drainage.
  - Intercept and collect groundwater flows as needed to minimize potential for groundwater contamination and to maintain stability of reclaimed areas.
- Install and seasonally monitor groundwater wells in areas where a risk of groundwater pollution exists (see BMP WatUses-2 [Water Wells for Production and Monitoring]).
- Properly abandon, plug, and cap all drill holes, cores, and wells per applicable State or Federal requirements.
- Stabilize or restore stream channels, wetlands, floodplains, and riparian areas to achieve desired conditions for aquatic ecosystem composition, structure, function, and processes and to re-establish or rehabilitate aquatic habitats to the extent practicable (see BMP AqEco-3 [Ponds and Wetlands] and BMP AqEco-4 [(Stream Channels and Shorelines]).
- Construct passive or active water treatment facilities as needed.
- Use suitable measures to control aquatic or wetland invasive species.
- Back-fill and recontour disturbed areas, including exploratory trenches, pits, adits, or holes to the original contour, where practicable, or to an acceptable post-mining contour that blends with the surrounding topography to re-establish surface and subsurface hydrologic pathways to the extent practicable.
  - Stabilize benches around an open pit when backfilling is not practical.
- Confirm physical stability of project components including design slopes and factors of safety.
- Reconstruct, maintain, or decommission roads, trails, and staging areas consistent with land management plan desired conditions, goals, and objectives for the area (see Road Management BMPs).
- Establish effective ground cover on disturbed sites to avoid or minimize accelerated erosion and soil loss.
  - Use suitable measures to prepare or treat subsoil and overburden to improve infiltration capacity on the site.
  - Spread topsoil or growth medium and woody material on the disturbed areas.
  - Test and use suitable measures to ameliorate topsoil or growth medium as necessary to achieve revegetation and ground cover objectives.
  - Use suitable measures to prepare the seedbed improve infiltration and roughen surface for seed catch.

- Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

- Perform mitigation required by the Operating Plan to protect water quality and quantity.
- Consider long-term management of the site and nearby areas to promote reclamation success.
  - Use suitable measures to limit human, vehicle, and livestock access to site as needed to protect reclaimed areas and allow for recovery of vegetation.
  - Monitor reclaimed areas for a period sufficient to demonstrate that measures to protect surface water and groundwater are functional and effective over the long term.
  - Implement interim operation, monitoring, and maintenance as required to protect reclaimed areas using suitable measures like fencing, road closure, or invasive species control until long-term stability, erosion control, and revegetation have been successfully established.
- Accept reclamation as complete when all reclamation measures are determined to be functional and effective.
- Implement long-term operation, monitoring, and maintenance activities as necessary for facilities, including roads, diversion ditches, dams, water treatment plants, fencing, gates, and signs, that must perform as designed for an indefinite period to prevent adverse impacts to water resources.

Geothermal Energy, Oil, and Gas Activities

- Reclaim well sites in a timely manner following well completion or plugging to avoid or minimize adverse effects to soil, water quality, and riparian resources.
- Permanently seal abandoned wells using appropriate protective measures in compliance with local and State requirements.
- Reclaim reserve pits to a condition that blends with the rest of the reclaimed pad area and restore the pit area to a safe and stable condition.

Resources for Minerals Management Activities

Aggregate Mining

British Columbia Ministry of Energy and Mines. 2002. Aggregate operators best management practices handbook for British Columbia, Volume 1—Introduction and planning and Volume 2—Best management practices. Victoria, BC. Available at http://142.32.76.167/mining/Aggregate/BMP/Pages/default.aspx.

Ecology and Environment, Inc. 2006. User's manual best management practices for gravel pits and the protection of surface water quality of Alaska. Anchorage, AK: Alaska Department of Environmental Conservation, Division of Water. 43 p. Available at http://www.dec.State.ak.us/water/wnpspc/pdfs/gravelpitbmp_guidance_final_063006.pdf.

Highland Engineering, Inc. 2009. Water quality best management practices for the aggregate mining industry. Duluth, GA: Georgia Construction Aggregate Association. 80 p. Available at http://gcaa.org/gcaaweb/bmpmanual.pdf.

Abandoned Mine Lands

Colorado Department of Natural Resources. Best practices in abandoned mine land reclamation: the remediation of past mining activities. Denver, CO: Colorado Department of Natural Resources, Division of Minerals & Geology. 42 p. Available at http://mining.state.co.us/pdfFiles/bmp.pdf.

Ferris, F., and others. 1996. Handbook of western reclamation techniques. Denver, CO: U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. 500 p. Available at http://www.techtransfer.osmre.gov/NTTMainSite/Library/hbmanual/westrecl.shtm.

Hutchison, I.; Ellison, R., eds. 1992. Mine Waste Management. ISBN 9780873717465. CA: California Mining Association. 672 p.

International Network for Acid Prevention Web site, particularly the Completed Projects page. http://www.inap.com.au/.

O'Kane Consultants, Inc. 2003. Evaluation of long term performance of dry cover systems. OKC Report No. 684-02. Salt Lake City, UT: International Network for Acid Prevention. 190 p. Available at http://www.inap.com.au/completed_research_projects.htm.

Passive In-Situ Remediation of Acid Mine and Industrial Drainage (Piramid) Consortium. 2003. Engineering guidelines for the passive remediation of acidic and metalliferous mine drainage and similar wastewaters. United Kingdom: Piramid Consortium. Available at http://www.eugris.info/DisplayResource.asp?ResourceID=4269.

Skousen, J.; Rose, A.; Geidel, G.; Foreman, J.; Evans, R.; Hellier, W. 1998. A handbook of technologies for the avoidance and remediation of acid mine drainage. Morgantown, WV: The National Mineland Reclamation Center, Acid Drainage Technology Initiative. Available at http://aciddrainage.com/publications.cfm.

U.S. Department of the Interior, Bureau of Land Management. 2001. Draft solid minerals reclamation handbook. 136 p. Available at http://www.fs.fed.us/geology/documents/blm.pdf.

U.S. Environmental Protection Agency (EPA). 2000. Abandoned mine site characterization and cleanup handbook. EPA 910-B-00-001. Denver, CO: EPA Region 8, San Francisco; CA: EPA Region 9; and Seattle, WA: EPA Region 10. 120 p. Available at http://www.epa.gov/superfund/policy/remedy/pdfs/amscch.pdf.

Bonding

Marks, M.B.; Buchta, T.; Newman, C.; Lentz, R.; and others. 2004. Training guide for reclamation bond estimation and administration for mineral plans of operation. Washington, DC: U.S. Department of Agriculture (USDA), Forest Service, Minerals and Geology. 133 p. Available at http://www.fs.fed.us/geology/mgm_minerals.html.

General

Idaho Department of Lands. 1992. Best management practices for mining in Idaho. Boise, ID: Idaho Department of Lands. 150 p. Available at http://www.idl.idaho.gov/Bureau/Minerals/bmp_manual1992/bmp_index.htm.

Hard Rock Mining

EPA, Region 10. 1999. EPA and hardrock mining—A sourcebook for industry in the Northwest and Alaska. EPA-910-R-99-016, draft. Seattle, WA.

USDA Natural Resources Conservation Service. National conservation practice standards—457 mine shaft and adit closing. Available at http://www.nrcs.usda.gov/technical /standards/nhcp.html.

Instream/Riparian (Placer) Mining

Greystone. 1998. In-stream aggregate extraction and reclamation guidance document. Denver, CO: Colorado Department of Natural Resources, Division of Minerals and Geology. 99 p. Available at http://mining.State.co.us/Policies.htm.

McCulloch, R.B.; Ihie, B.; Ciliberti, V.; Williams. M. M. 1993. Montana Placer Mining BMPs: Guidelines for planning, erosion control, and reclamation. Special Publication 106. Butte, MT: Montana Bureau of Mines and Geology. 32 p. Available at http://www.mbmg.mtech.edu/gmr/gmr-mines_exploration.asp or http://www.mbmg.mtech.edu/mbmgcat/public/ListCitation.asp?pub_id=11696&.

Yukon Placer Secretariat. 2009. Guidebook of mitigation measures for placer mining in the Yukon. Whitehorse, Yukon: Yukon Placer Secretariat. 130 p. Available at http://www.yukonplacersecretariat.ca/infocentre.html.

Oil and Gas

U.S. Department of the Interior, Bureau of Land Management; USDA Forest Service. 2007. Gold book—Surface operating standards and guidelines for oil and gas exploration and development. BLM/WO/ST-06/021+3071/REV 07. Denver, CO: U.S. Department of the Interior, Bureau of Land Management. 84 p. Available at http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices/gold_book.html.

University of Colorado Law School, Natural Resource Law Center. 2009. Intermountain oil and gas BMP project. Available at http://www.oilandgasbmps.org/.

Rangeland Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from rangeland management activities. Rangeland use includes grazing by cattle, sheep, goats, horses, and saddle stock used to manage the range and recreational stock. A primary purpose of the rangeland management program is to provide forage for commercial livestock operations. Grazing can also be a means of managing vegetation to meet other resource management objectives, such as fuels management, invasive species management, wildlife habitat improvement, and reduction of competing vegetation in plantations.

Three National Core BMPs are for Rangeland Management Activities. These BMPs are to be used when managing livestock grazing on National Forest System (NFS) lands. Each BMP is based on administrative directives that guide and direct the Forest Service planning and permitting of livestock grazing activities on NFS land. BMP Range-1 (Rangeland Management Planning) is a planning BMP for management of grazing allotments. BMP Range-2 (Rangeland Permit Administration) provides practices to be used when administering rangeland permits, including controlling overall livestock numbers, distribution, and season of use. BMP Range-3 (Rangeland Improvements) provides guidance for construction and maintenance of structural and nonstructural improvements and improvement of deteriorated rangeland soil and water resources.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Rangeland Management BMPs	
Range-1	Rangeland Management Planning
Range-2	Rangeland Permit Administration
Range-3	Rangeland Improvements

Range-1. Rangeland Management Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2200 and Forest Service Handbook (FSH) 2209.13, chapter 90.

Objective Use the project-level National Environmental Policy Act (NEPA) planning process to develop measures to include in the Allotment Management Plan (AMP) to avoid, minimize, or mitigate adverse impacts to soil, water quality, and riparian resources from rangeland management activities.

Explanation Analysis of existing rangeland conditions and other resource values is conducted for each allotment as part of the project-level NEPA analysis and decision process for authorizing livestock grazing on NFS lands. The AMP is derived from the NEPA document and decision and is the primary document that guides implementation of land management plan direction for rangeland resources at the allotment (project) level. The AMP is included as part of the grazing permit and provides special management provisions, instructions, and terms and conditions for that permit.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when completing allotment management planning and analysis.
- Validate land management plan grazing suitability decisions for the allotment.
- Establish desired conditions for the allotment consistent with land management plan goals and objectives for water quality and AMZs.
  - Consider linkages between rangelands and soils, water quality, and riparian and aquatic systems when determining rangeland desired conditions.
  - Consider the ecological potential of riparian and aquatic systems when determining AMZ desired conditions.
- Evaluate current rangeland condition and trends using accepted protocols.
  - Review past management within the allotment.
- Determine management objectives and needs for livestock grazing and water resources affected by livestock grazing from management direction in the land management plan, biological opinions, or other binding direction and comparison of desired conditions with existing conditions.
- Identify potential management strategies and rangeland and riparian improvement needs to maintain or move resources in the allotment toward achieving desired conditions.
  - Establish management requirements such as the season of use, number, kind, class of livestock, and the grazing systems.
- Establish annual endpoint indicators of use (e.g., forage utilization, stubble height, streambank alteration, woody browse use) related to the desired conditions and triggers (thresholds) for management actions, such as modifying intensity, frequency, duration, and timing or excluding livestock use.
  - Set the indicator thresholds at levels suitable to maintain or achieve desired conditions for uplands, riparian areas, and aquatic ecosystems.
- Develop a monitoring strategy and plan for adaptive management of the allotment.
  - Use accepted protocols to evaluate compliance with annual indicators of use and other land management plan standards.
  - Use accepted protocols to evaluate ecological status and trend, including water quality, aquatic habitats, and beneficial uses.
- Document the following items from the project-level NEPA decision and analysis in the AMP, grazing permit, and Annual Operating Instructions (AOI):
  - Management objectives for livestock grazing and all resources affected by livestock grazing.
  - Management requirements for livestock grazing in the allotment.
  - Monitoring requirements to implement adaptive management in the allotment.
  - Schedules for rehabilitating rangelands that do not meet land management plan objectives, initiating range improvements, and maintaining existing improvements (see BMP Range-3 [Rangeland Improvements]).

Range-2. Rangeland Permit Administration

Manual or Handbook Reference FSH 2209.13.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when managing rangeland vegetation and livestock grazing through administration and monitoring of grazing permits and AOI.

Explanation Improper grazing can adversely affect the watershed condition in several ways. Loss of effective ground cover in the uplands leads to increases in overland flow and peak runoff. Soil compaction, loss of ground cover, and reduced plant vigor in riparian areas decreases the ability of the riparian area to filter pollutants and function as a floodplain. Streambank trampling increases stream channel width/depth ratio, resulting in a change in stream type and a lowering of the water table. Wider and shallower streams have higher stream temperatures and lower dissolved oxygen content and are often unable to move the sediment load effectively, resulting in increased flooding and bank stress. Introducing sediment, nutrients, and pathogens into waterbodies from grazing can lower water quality. Managing livestock numbers, distribution, timing, and season of use can reduce the potential for these impacts.

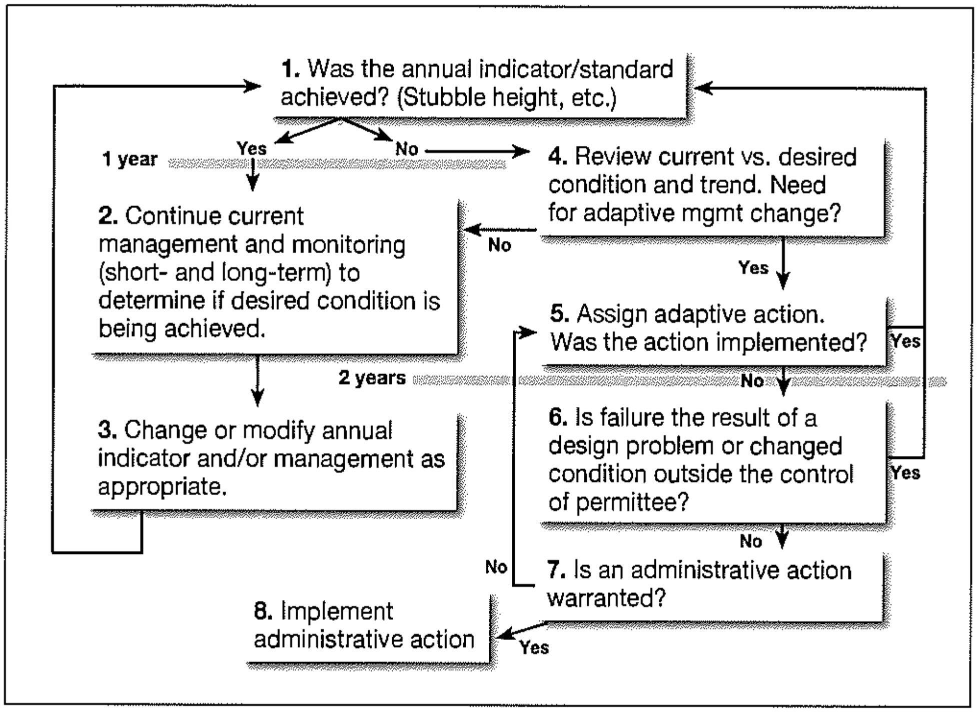
A grazing permit is used to authorize livestock grazing on NFS lands. The permit delineates the area to be grazed and defines the number, kind, and class of livestock to be grazed and the season of use. The special terms and conditions in the permit contain required management practices from the project-level NEPA decision to avoid, minimize, or mitigate effects to water quality and other resource values. The permit and AMP also include monitoring requirements to evaluate compliance with standards and determine long-term trends in range condition.

AOI issued to the grazing permittee specify those annual actions needed to implement the management direction set forth in the project-level NEPA-based decision. The AOI identify the obligations of the permittee and the Forest Service and clearly articulate annual grazing management requirements, standards, and monitoring necessary to document compliance. The permittee carries out the terms and conditions of the permit under the immediate direction and supervision of the district ranger.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Conduct implementation and effectiveness monitoring as specified in the AMP.
- Monitor water quality, habitat, or other designated beneficial uses of water as necessary (e.g., 303(d) listed streams, required terms of Biological Opinions).
- Use monitoring results as an adaptive management feedback loop to revise, if necessary, annual grazing requirements in the AOI to account for current allotment conditions and trends (figure 2).
- Use results of annual compliance monitoring and periodic trend monitoring, as well as forage utilization by wildlife and recreational livestock, to determine allowable annual amount of livestock use to meet rangeland and AMZ desired conditions.
- Adjust livestock numbers, season of use, and distribution when monitoring and periodic assessments indicate consistent noncompliance with permit provisions.
    - Use suitable range management tools to alter livestock distribution.

Figure 2. Adaptive Management Process for management of range allotments.



- Consider resting (placing an area in nonuse status for a period of time) a pasture or an allotment to allow for natural recovery of resource conditions.

- Document adaptive management actions such as allowable use, the planned sequence of grazing on the allotment, and any other operational changes in the AOI.
  - Modify the AMP and terms and conditions in the grazing permit for adaptive management actions that become consistent over a period of years or grazing rotations.
- Modify, cancel, or suspend the permit in whole or in part, as needed, to ensure proper use of the rangeland resource and protection of water quality.
  - Use permit authorities to change operations to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when special circumstances (e.g., drought) occur.

Range-3. Rangeland Improvements

Manual or Handbook Reference FSM 2240.

Objective Implement range improvements to maintain or improve soil, water quality, and riparian resources.

Explanation Rangeland improvements targeted at soil, water quality, and riparian resources are designed to protect or improve conditions of sensitive areas, streams, riparian areas, and wetlands and move these resources toward desired conditions. Improvements should emphasize protecting the beneficial uses in these areas. Improvements may supplement changes in annual use levels, seasonal use, distribution, and number, or other administrative actions.

Development and maintenance of rangeland improvements can be the responsibility of either the permittee or the Forest Service. The district ranger will ensure that the permittee is involved as a cooperator in rangeland improvements. The permittee may construct or maintain improvements under Forest Service direction, or Forest Service crews or contractors may construct or maintain improvements.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify and evaluate range improvement needs for soil, water quality, and riparian resources during watershed analysis, watershed condition assessment, project-level rangeland NEPA, or other assessment efforts.
- Include and schedule improvement actions and maintenance in the AMP and grazing permit.
- Design, implement, and maintain structural and nonstructural range improvements to achieve or sustain desired conditions for the rangeland, soils, water quality, and riparian resources in the allotment as determined in the project-level NEPA decision.
  - Use rangeland vegetation species and establishment techniques suitable to the project site and objectives and consistent with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
  - Use applicable Chemical Use Activities BMPs when using chemicals to treat rangeland vegetation and control invasive species.
  - Use applicable practices of BMP Veg-8 (Mechanical Site Treatment) when implementing mechanical treatments of rangeland vegetation.
  - Use applicable practices of BMP Fire-2 (Use of Prescribed Fire) when using prescribed fire to improve rangeland vegetation and conditions.
  - Use applicable practices of BMP AqEco-3 (Ponds and Wetlands) and BMP AqEco-4 (Stream Channels and Shorelines) for improvement activities that involve waterbodies.
  - Use applicable practices of BMP WatUses-3 (Administrative Water Developments) when developing water sources for livestock watering.

Resources for Rangeland Management Activities

Best Management Practices

Harmon, W., ed. 1999. Best management practices for grazing. Helena, MT: Montana Department of Natural Resources and Conservation. 28 p.

Meitl, J.; Maguire, T., eds. 2003. Compendium of best management practices to control polluted runoff: A source book. Boise, ID: Idaho Department of Environmental Quality. Available at http://www.deq.State.id.us/water/data_reports/surface_water/nps/reports.cfm#bmps.

U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). National conservation practice standards—383 fence. Available at http://www.nrcs.usda.gov/technical/standards/nhcp.html.

U.S. Environmental Protection Agency. 2003. National management measures for the control of nonpoint source pollution from agriculture. EPA 841-B-03-004. Washington, DC. Available at http://water.epa.gov/polwaste/nps/agriculture/agmm_index.cfm.

Wyoming Department of Environmental Quality (WDEQ). 1997. Best management practices for grazing. Cheyenne, WY: Wyoming Department of Environmental Quality, Water Quality Division. 17 p. Available at http://deq.State.wy.us/wqd/watershed/Downloads/NPS%20 Program/92602.pdf.

Ecological Site Description

USDA NRCS. Ecological site description (ESD) system for rangeland and forestland. Database. Available at http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx

Proper Functioning Condition

Pritchard, D.; and others. 1998. Guide to assessing proper functioning condition and the supporting science for lotic areas. TR1737-15 Riparian Area Management. Denver, CO: U.S. Department of the Interior, Bureau of Land Management; USDA Forest Service, USDA NRCS. 126 p. Available at http://www.blm.gov/nstc/library/techref.htm.

Pritchard, D.; and others. 1999 (Rev. 2003). Guide to assessing proper functioning condition and the supporting science for lentic areas. TR1737-16 Riparian Area Management. Denver, CO: U.S. Department of the Interior, Bureau of Land Management; USDA Forest Service, USDA NRCS. 110 p. Available at http://www.blm.gov/nstc/library/techref.htm.

Rangeland Health Assessment

Pellant, M.; Shaver, P.; Pyke, D.A.; Herrick, J.E. 2005. Interpreting indicators of rangeland health, version 4. Technical Guide 1734-6. Denver, CO: U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center. Available at http://www.blm.gov/nstc/library/techref.htm.

Riparian Area Grazing Management

Clary, W.P.; Webster, B.F. 1989. Managing grazing of riparian areas in the Intermountain Region. Gen. Tech. Rep. INT-263. Ogden, UT: USDA Forest Service, Intermountain Research Station. 11 p. Available at http://www.fs.fed.us/rm/pubs_int/int_gtr263.pdf.

Wyman, S.; Bailey, D.; Borman, M.; Cote, S.; and others. 2006. Riparian area management: Grazing management processes and strategies for riparian-wetland areas. Technical Reference 1737-20. Denver, CO: U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center. 105 p. Available at http://www.blm.gov/nstc/library/techref.htm.

Riparian Area Monitoring

Burton, T.A.; Smith, S.J.; Cowley, E.R. 2011. Riparian area management: Multiple indicator monitoring (MIM) of stream channels and aquatic vegetation. Technical Reference 1737-23. Denver, CO: U.S. Department of the Interior, Bureau of Land Management. 155 p. Available at http://www.blm.gov/nstc/library/techref.htm.

Stubble Height

University of Idaho, Stubble Height Review Team. 2004. Stubble height study report Contribution No. 986. Moscow, ID: University of Idaho, Forest, Wildlife and Range Experiment Station. Available at http://www.cnrhome.uidaho.edu/documents/Stubble_Height_Report.pdf?pid=74895&doc=1.

Recreation Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from recreation activities. An objective of the Forest Service recreation program is to provide nonurbanized outdoor recreation opportunities in natural appearing forest and rangeland settings. Recreation activities on National Forest System (NFS) lands take place at developed and undeveloped sites or are dispersed across broad areas.

Twelve National Core BMPs are in the Recreation Management Activities category. These BMPs are to be used when managing recreation use and facilities on NFS lands. BMP Rec-1 (Recreation Planning) is a planning BMP for recreation activities at the land management plan scale and project scale. BMP Rec-2 (Developed Recreation Sites) provides practices for sites that are designed and constructed to provide facilities for users. BMP Rec-3 (Dispersed Use Recreation) covers dispersed recreation, including user-created sites and frequently used areas. BMP Rec-4 (Motorized and Nonmotorized Trails) provides practices for construction, operation, and maintenance of the designated trail system. BMP Rec-5 (Motorized Vehicle Use Areas) covers areas designated for cross-country motor vehicle use. BMP Rec-6 (Pack and Riding Stock Use Areas) has practices for trailheads, corrals, and other areas where pack and riding stock use is concentrated. BMP Rec-7 (Over-Snow Vehicle Use) has direction for snowmobile trails and other over-snow vehicle uses. BMP Rec-8 (Watercraft Launches) is for boat launches on lakes and rivers. BMP Rec-9 (Recreation Special Use Authorizations) provides direction for recreation residences, outfitters and guides, and other recreation activities operated under special use authorizations. BMP Rec-10 (Ski Runs and Lifts), BMP Rec-11 (Ski Area Snowmaking), and BMP Rec-12 (Ski Area Facilities) provide practices for ski areas.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Recreation Activities BMPs	
Rec-1	Recreation Planning
Rec-2	Developed Recreation Sites
Rec-3	Dispersed Use Recreation
Rec-4	Motorized and Nonmotorized Trails
Rec-5	Motorized Vehicle Use Areas
Rec-6	Pack and Riding Stock Use Areas
Rec-7	Over-Snow Vehicle Use
Rec-8	Watercraft Launches
Rec-9	Recreation Special Use Authorizations
Rec-10	Ski Runs and Lifts
Rec-11	Ski Area Snowmaking
Rec-12	Ski Area Facilities

Rec-1. Recreation Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2310; FSM 2332; FSM 2333; FSM 2341; and Forest Service Handbook (FSH) 2309.18, chapter 10.

Objective Use the applicable recreation planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during recreation activities.

Explanation Recreation activities occur in a variety of settings and intensities on NFS lands, including at developed or undeveloped recreation sites or dispersed across broad areas. The objective of recreation planning is to provide for the current and future outdoor recreation demands while integrating recreation use with other resource concerns. The Recreation Opportunity Spectrum (ROS) system provides a framework for stratifying and defining classes of outdoor recreation opportunities along a continuum that combines physical, biological, social, and management conditions for providing a variety of recreational experiences across an array of settings. ROS is management tool that integrates social considerations and biophysical components of a landscape to achieve multiple social and natural resource objectives. ROS classes, and standards and guidelines, are established in the land management plan. ROS class primarily guides management of recreation use.

Recreation facilities on NFS lands are constructed and maintained by the Forest Service or others under a Forest Service authorization. These facilities include developed recreation sites, organization camps, recreation residence tracts, motorized and nonmotorized trails and facilities, dispersed recreation sites, and winter sports centers such as alpine ski areas. Some small facilities are constructed and managed by Forest Service personnel using agency design criteria and management guidelines as incorporated into project plans. Facilities developed by others on NFS lands are administered through special use authorizations issued by the Forest Service to public or private agencies, groups, or individuals. Special use authorizations must include terms and conditions to protect the environment and otherwise comply with the requirements of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1752).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Land Management Plans

- Consider the beneficial and adverse effects of recreation use on water quality and watershed condition when developing desired conditions, ROS classes, and management direction for the plan area.
  - Identify areas where the adverse effects of recreational use to water quality and watershed condition outweigh the benefits.
- Include design criteria, standards, and guidelines for recreational use to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Project or Activity Planning

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning recreation projects.
- Select site locations for recreation facilities that avoid or minimize the potential for adverse effects to water quality and riparian resources.
- Design the capacity and layout of the recreation site to be consistent with land management plan desired conditions, goals, and objectives for soil, water quality, and riparian resources.

- Consider capacity and patterns of use at a site when determining measures to avoid, minimize, or mitigate adverse effects from recreational use to soil, water quality, and riparian resources.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to incorporate suitable erosion and stormwater controls in the project design.
- Use applicable practices of BMPs for access roads and water, sanitation, and solid waste systems at recreation sites (see Roads Management Activities BMPs and Facilities and Nonrecreation Special Uses Management Activities BMPs) as needed.
- Use applicable practices of BMP Road-10 (Equipment Refueling and Servicing) for recreation sites where vehicles or other equipment will be stored and maintained.
- Use applicable practices of BMP Fac-6 (Hazardous Materials) for management of hazardous materials at recreation sites.
- Determine instream flow needs to minimize damage to scenic and aesthetic values, fish and wildlife habitat, and to otherwise protect the environment where the operation of the recreation site would modify existing streamflow regimes (see BMP WatUses-1 [Water Uses Planning]).

Rec-2. Developed Recreation Sites

Manual or Handbook Reference FSM 2332, FSM 2333, and FSM 2334.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at developed recreation sites by maintaining desired levels of ground cover, limiting soil compaction, and minimizing pollutants entering waterbodies.

Explanation Developed recreation sites provide amenities for user comfort and can be located in motorized or nonmotorized settings. Oftentimes these areas concentrate high volumes of use into relatively small areas and may be located on or near waterbodies, thereby increasing the potential for water quality degradation. Potential pollutants generated by use at developed recreation sites include, but are not limited to, human and animal waste; solid wastes (trash); petroleum products; and other hazardous substances. In addition, continuous or recurring use at one site can cause excessive soil compaction; damage to vegetation, wetlands, and riparian areas; and erosion and sediment transport from the site.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to construct and maintain appropriate erosion control and stormwater management measures to avoid or minimize adverse effects to water quality from pollutant runoff at the site.
- Use applicable practices of Roads Management Activities BMPs for construction and maintenance of access roads.
- Use applicable practices of BMP Roads-9 (Parking and Staging Areas) for trailheads and other parking areas at develop recreation sites.
- Use applicable practices of BMP Fac-3 (Potable Water Supply Systems), BMP Fac-4 (Sanitation Systems), and BMP Fac-5 (Solid Waste Management) for water, sanitation, and solid waste systems at developed recreation sites.

- Evaluate and adjust design capacity of the site when recreation use is causing adverse effects to water quality or riparian resources.
- Provide hardened campsites located sufficiently far from surface waterbodies to provide an adequate vegetative filter strip to avoid or minimize sediment delivery (see BMP Plan-3 [AMZ Planning]).
- Consider potential impacts to soils, water quality, and riparian resources when establishing recreation site use periods.
- Use suitable measures to avoid or minimize overuse on sensitive areas.
- Use suitable public relations, information, and enforcement tools to encourage the public to conduct their activities in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Provide information on the location of the nearest RV (recreational vehicle) wastewater disposal station.
- Periodically evaluate the condition of soil, water quality, and riparian resources at and near developed sites to identify signs of insufficient ground cover, detrimental soil compaction, excessive runoff, sedimentation, or chemical or pollutant release by recreationists.
  - Relocate trails, parking areas, campsites, play areas, or water distribution points that are causing offsite resource damage.
  - Redesign and reconstruct, or close and rehabilitate, areas of recreation sites that exhibit signs of overuse.
  - Use suitable measures to restrict access, when necessary, to nearby wetlands and riparian areas that show signs of excessive damage from recreation use to allow for vegetative recovery.
- Rehabilitate unwanted user-created trails and sites within the developed recreation site and employ suitable measures to discourage their creation and use (see BMP Fac-10 [Facility Site Reclamation]).
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim the developed recreation site after the need for it ends.

Rec-3. Dispersed Use Recreation

Manual or Handbook Reference FSM 2330.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by managing dispersed activities and undeveloped sites to maintain ground cover, maintain soil quality, control runoff, and provide needed sanitary facilities to minimize the discharge of nonpoint source pollutants and maintain streambank and riparian area integrity.

Explanation Dispersed recreation use takes many forms, both motorized and nonmotorized, across a range of forest and grassland settings. Many dispersed uses and user-created undeveloped sites are located adjacent to or provide easy access to lakes and rivers and lack the design and amenities offered at developed sites to mitigate effects of use. As a result, the impacts of dispersed recreation use on soils, water quality, and riparian resources can be greater than impacts at developed sites. Nonpoint source pollution from dispersed recreation use includes human and animal wastes, petroleum products, other hazardous substances, streambank disturbance, stream channel alteration, and sediment eroded from the site.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct dispersed recreation activities in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Designate locations and crossings for allowable motorized vehicle use within the AMZ as part of travel management (see BMP Plan-3 [AMZ Planning] and BMP Road-1 [Travel Management and Analysis]).
    - Use suitable measures to limit crossings and restrict motorized use within the AMZ to the extent practicable.
- Manage use to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - Develop and designate campsites in appropriate locations.
    - Limit group size and periods of use (numbers of consecutive days, time of day, etc.).
- Consider providing primitive sanitation facilities in areas where perpetual concentrated dispersed recreation use is causing adverse effects to soil, water quality, or riparian resources (see BMP Fac-4 [Sanitation Systems]).
- Close and rehabilitate dispersed or undeveloped sites that are causing unacceptable adverse effects on soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).
    - Manage site to mitigate adverse effects of use when closure is not practicable.

Rec-4. Motorized and Nonmotorized Trails

Manual or Handbook Reference FSM 2353, FSH 2309.18, FSM 7715.5, FSM 7723, and EM (Engineering Management) 7720-104.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling soil erosion, erosion of trail surface materials, and water quality problems originating from construction, maintenance, and use of motorized and nonmotorized trails.

Explanation The Forest Service manages about 133,000 miles of trails that are part of the designated transportation system. Only portions of these trails are open to motorized vehicle use. Almost all NFS trails serve nonmotorized users, including hikers, bicyclists, and equestrians, alone or in some combination with motorized uses.

Trail construction, maintenance, and use by motorized vehicles and human or stock traffic can adversely affect water quality by increased sediment delivery and contamination from vehicle fluids and human and animal wastes to nearby waterbodies. Compaction of the trail surface limits water infiltration, which can lead to concentrated runoff on the trail surface. Concentrated runoff on trails lacking adequate drainage causes erosion of the trail surface and can transport sediment and other pollutants directly into waterbodies if not filtered. Heavy tread, foot, or hoof traffic can loosen some trail surface materials, making them more susceptible to erosion.

Trails open to motorized use are designated during the travel management process and depicted on the Motor Vehicle Use Map (MVUM). Motorized use is designated by allowed vehicle class and, if appropriate, time of year, with the objective of minimizing damage to soil and water resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable Road Management Activities BMPs for construction, operation, and maintenance of motorized trails.
- Locate or relocate trails to conform to the terrain, provide suitable drainage, provide adequate pollutant filtering between the trail and nearby waterbodies, and reduce potential adverse effects to soil, water quality, or riparian resources.
    - Avoid sensitive areas, such as riparian areas, wetlands, stream crossings, inner gorges, and unstable areas to the extent practicable.
    - Use suitable measures to mitigate trail impacts to the extent practicable where sensitive areas are unavoidable.
    - Use suitable measures to hydrologically disconnect trails from waterbodies to the extent practicable.
- Design, construct, and maintain trail width, grades, curves, and switchbacks suitable to the terrain and designated use.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for control of erosion and stormwater when constructing trails.
- Install and maintain suitable drainage measures to collect and disperse runoff and avoid or minimize erosion of trail surface and adjacent areas.
- Use and maintain surfacing materials suitable to the trail site and use to withstand traffic and minimize runoff and erosion.
    - Pay particular attention to areas where high wheel slip (curves, acceleration, and braking) during motorized use generates loose soil material.
- Design stream crossings to use the most cost-efficient structure consistent with resource protection, facility needs, and types of use and safety obligations (see BMP Road-2 [Road Location and Design] and BMP Road-7 [Stream Crossings]).
- Designate season of use to avoid periods when trail surfaces are particularly prone to unacceptable erosion, rutting, or compaction.
- Designate class of vehicle and type of nonmotorized uses (e.g., hiking, bicycling, and equestrian uses) suitable for the trail width, location, waterbody crossings, and trail surfaces to avoid or minimize adverse effects to soil, water quality, or riparian resources.
- Monitor trail condition at regular intervals to identify drainage and trail surface maintenance needs to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Manage designated trails to mitigate adverse effects to soil, water quality, and riparian resources from over-use when closure and rehabilitation is not practicable or desired.
    - Change designated vehicle class and season-of-use period as necessary.
- Close and rehabilitate unauthorized trails that are causing adverse effects on soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).

Equestrian Trails

- Plan trails so that equestrian users will go slower in sensitive areas to protect trail tread.
- Use a trail design that constricts equestrian users to a designated tread, where practicable, to minimize the tendency of stock to create braided or multiple trail treads.
- Provide reasonable access to stock water at suitable intervals along designated equestrian trails where practicable.

Rec-5. Motorized Vehicle Use Areas

Manual or Handbook Reference FSM 2353.28, FSH 2309.18 23.22, and FSM 7716.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at motorized vehicle use areas by managing activities to maintain ground cover, maintain soil quality, and control runoff to minimize discharge of nonpoint source pollutants and maintain streambank and riparian area integrity.

Explanation Forest Service policy recognizes that motor vehicles are a legitimate and appropriate way for people to use the national forests and grasslands—in the right places and with proper management. Unrestricted cross-country travel by motor vehicles increases soil erosion and adversely affects water quality. The first vehicle driving across a particular piece of ground may not harm the land. After many more vehicles have crossed the same path, however, the result may be a user-created route and lasting impacts to soil, water quality, and riparian resources. The proliferation of user-created roads and trails is a major challenge on many national forests and grasslands. User-created routes, in general, are not located, designed, or maintained to avoid, minimize, or mitigate adverse effects to soil, water quality, or riparian resources. The Travel Management Rule adopted in 2005 restricts motor vehicle use to designated roads, trails, and areas on NFS lands to better manage motor vehicle use and protect NFS resources.

Limited areas on NFS lands open to cross-country motorized use may be designated during the travel management process and, if designated, are depicted on the MVUM. These areas should have natural resource characteristics that are suitable for motor vehicle use, or should be so altered by past actions that motor vehicle use might be appropriate. Motorized use is designated by allowed vehicle class and, if appropriate, by time of year, with the objective of minimizing damage to soil and watershed resources. Limited cross-country use of motorized vehicles within a specified distance from designated routes may be allowed for purposes of dispersed camping and big game retrieval. After motor vehicle use areas are established on a national forest or grassland, motor vehicle use outside of these designated areas is prohibited.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct motorized vehicle use activities within designated areas in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Locate and maintain designated motor vehicle use areas to avoid or minimize adverse effects on soil, water quality, and riparian resources.

- Consider suitability of slopes, access points, vegetation cover and similar features, and soil characteristics such as erodibility and texture, for motor vehicle use.
- Favor areas that are naturally barren or have been significantly altered by past motorized vehicle use or land use (e.g., gravel pits, reservoir bathtub rings, or lake bottoms).
- Avoid areas of sensitive soils and floodplains.
- Manage hillclimb areas to minimize length and steepness.
- Avoid concentration of motor vehicle use in bowl-shaped areas above draws that are susceptible to erosion.

- Designate season-of-use periods to avoid periods when soils are particularly prone to unacceptable erosion, rutting, or compaction.
- Designate class of vehicle suitable for the soil and terrain of the designated motor vehicle use area to avoid or minimize adverse effects to soil, water quality, or riparian resources.
- Clearly delineate and mark designated motor vehicle use areas in the field where practicable.
- Monitor designated motor vehicle use areas at regular intervals to identify drainage and soil cover maintenance needs to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Manage designated motor vehicle use areas, particularly hillclimb areas, to mitigate adverse effects to soil, water quality, and riparian resources from over-use when closure and rehabilitation is not practicable or desired.
    - Change designated vehicle class and season-of-use period as necessary.
    - Schedule use periods of hillclimbs to allow for rehabilitation.
    - Rotate hillclimb areas to extend the lifespan of a hillclimb.
- Close and rehabilitate designated motor vehicle use areas that are causing unacceptable adverse effects to soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).
- Place suitable restrictions on motor vehicle use off designated routes for dispersed camping and big game retrieval to avoid, minimize, or mitigate adverse effects on soil, water quality, and riparian resources.
    - Avoid riparian, wetland, or other identified sensitive resource areas where practicable.
    - Designate stream-crossing sites to the extent practicable.

Rec-6. Pack and Riding Stock Use Areas

Manual or Handbook Reference FSH 2309.18 22.43 and 23.12.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at pack and riding stock use areas by managing activities to maintain ground cover, maintain soil quality, control runoff, and provide needed sanitary facilities to minimize discharge of nonpoint source pollutants and maintain streambank and riparian area integrity.

Explanation Pack and riding stock can affect soil, water quality, and riparian resources while on trails and at campsites, watering areas, and loading areas. The level of use at a site can range from single-day use by one or more riders at a remote site to large developed campsites and trails used repeatedly by outfitter and guide operations, commercial stock operators, and other recreational users. Use may take place in the general forest area or in designated wilderness areas. Access areas, in general, are used for loading and unloading, parking, and turning around vehicles and stock trailers. Potential impacts include loss of ground cover, soil compaction, rutting, or puddling, and increased erosion, streambank trampling, spread of weeds, and water contamination from animal waste.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct activities on trails and at stock use areas in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Provide information on proper stock tethering, watering, and manure handling and disposal techniques.
- Use applicable practices of BMP Rec-2 (Developed Recreation Sites) when designing, constructing, and maintaining developed areas for pack and riding stock use.
- Install simple temporary holding facilities in both wilderness and nonwilderness areas.
  - Evaluate soils and vegetation for vulnerability of damage or disruption from stock use when choosing holding facility sites.
  - Locate corrals and tethering areas at a suitable distance from waterbodies to avoid or minimize adverse effects to soil, water quality, and riparian resources.
- Designate specific watering locations on streams, ponds, and lakes to avoid or minimize general use along streambanks or shorelines.
- Provide designated watering areas at developed stock use areas where practicable.
  - Surface the areas around water hydrants, troughs, and stock tanks using suitable materials to mitigate trampling effects.
  - Locate designated watering areas at a suitable distance from waterbodies to avoid or minimize adverse effects to soil, water quality, and riparian resources.
- Provide manure disposal bins at developed pack and riding stock use areas.
  - Locate manure receptacles on level ground at a suitable distance to provide adequate pollutant filtering between the accumulated manure and nearby waterbodies.
  - Provide positive drainage to prevent puddles from forming within and around the manure receptacle.
  - Provide tools (e.g., wheelbarrows, rakes, and bags) to facilitate manure cleanup.
  - Periodically remove or treat accumulated animal waste to avoid or minimize contaminating waterbodies.
- Monitor pack and riding stock use areas at regular intervals to identify drainage and ground surface maintenance needs to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Manage pack and riding stock use areas to mitigate adverse effects to soil, water quality, and riparian resources from over-use when closure and rehabilitation is not practicable or desired.
- Close and rehabilitate pack and riding stock use areas that are causing adverse effects on soil, water quality, and riparian resources (see BMP Fac-10 [Facility Site Reclamation]).

Rec-7. Over-Snow Vehicle Use

Manual or Handbook Reference FSM 7718.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from over-snow vehicle use.

Explanation An over-snow vehicle is a motor vehicle that is designed for use over snow and that runs on a track or tracks and a ski or skis, while in use over snow. Over-snow vehicles include snowmobiles, snow cats, and snow grooming machines. Snowmobiles and snow cats are used for access and for recreational activities. Snow grooming machines are used to prepare snow on trails for downhill or cross-country skiing or snowmobile use.

An over-snow vehicle traveling over snow results in different impacts to soil and water resources than do motor vehicles traveling over the ground. Unlike other motor vehicles traveling cross-country, over-snow vehicles generally do not create a permanent trail or have direct impact on soil and ground vegetation when snow depths are sufficient to protect the ground surface. Emissions from over-snow vehicles, particularly two-stroke engines on snowmobiles, release pollutants like ammonium, sulfate, benzene, polycyclic aromatic hydrocarbons, and other toxic compounds that are stored in the snowpack. During spring snowmelt runoff, these accumulated pollutants are released and may be delivered to surrounding waterbodies. In addition, over-snow vehicles that fall through thin ice can pollute waterbodies.

Use of NFS lands and trails by over-snow vehicles may be allowed, restricted, or prohibited at the discretion of the local line officer.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct cross-country over-snow vehicle use on trails in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - ❑ Provide information on the hazards of running over-snow vehicles on thin ice.
    - ❑ Provide information on effects on over-snow vehicle emissions on air quality and water quality.
- Use applicable practices of BMP Rec-4 (Motorized and Nonmotorized Trails) when locating, designing, constructing, and maintaining trails for over-snow vehicle use.
- Allow over-snow vehicle use cross-country or on trails when snow depths are sufficient to protect the underlying vegetative cover and soil or trail surface.
    - ❑ Specify the minimum snow depth for each type or class of over-snow vehicle to protect underlying resources as part of any restrictions or prohibitions on over-snow use.
    - ❑ Specify season of use to be at times when the snowpack is expected to be of suitable depth.
    - ❑ Specify over-snow vehicle class suitable for the expected snowpack and terrain or trail conditions.
- Use and enforce closure orders to mitigate effects when adverse effects to soil, water quality, or riparian resources are occurring.

- Use applicable practices of BMP Rec-2 (Developed Recreation Sites) when constructing and operating over-snow vehicle trailheads, parking, and staging areas.
  - Use suitable measures to trap and treat pollutants from over-snow vehicle emissions in snowmelt runoff or locate the staging area at a sufficient distance from nearby waterbodies to provide adequate pollutant filtering.

Rec-8. Watercraft Launches

Manual or Handbook Reference FSM 2334.24 and FSM 2335.1.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from facilities at locations used to launch and retrieve watercraft.

Explanation Facilities related to the use and enjoyment of watercraft (nonpowered boats, powerboats, personal watercraft, etc.) can affect water quality. These facilities include boat ramps, roads, and parking facilities, sanitation facilities, marinas, and other infrastructure. The immediate proximity and connection of the facility to the water's edge provides a direct pathway for pollutants to enter the waterbody.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use suitable public relations and information tools and enforcement measures to encourage the public to conduct boating and related activities in a manner that will avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Provide information on measures for preventing the spread of aquatic invasive species, proper fish cleaning and disposal of fish waste, proper disposal of solid waste while boating, and preventing wake damage to shorelines.
- Locate and design watercraft launch sites to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Avoid excessive impacts to aquatic or riparian vegetation and fish spawning or rearing habitat.
  - Minimize the effect of boat wakes on adjacent shoreline and reduce the potential for sediment accumulation on the ramp.
  - Minimize the required amount of cut and fill below the waterline in the submerged or submersible zone.
- Establish suitable ramp elevation and slope to minimize ramp size while providing a ramp that is usable throughout the normal range of water elevations.
  - Use average high- and low-water elevations for each month of the intended use period over a suitable period of record to determine design high-water and design low-water elevations.
  - Extend ramp toe to a sufficient depth below the design low-water elevation to provide adequate water depth to float the average boat from its trailer while providing a hard surface for the trailer to travel on during launch and retrieval.
  - Minimize the distance of the top of the ramp above the design high-water elevation consistent with local topography.
  - Design the launch ramp slope to minimize erosion from water and vehicle tire disturbance.

- Design ramp width to provide adequate space for boaters of varying ability to maneuver the boat trailers down the ramp.
- Use surfacing material suitable for the ramp location and character of use to provide sufficient traction to discourage wheel spin and damage to the ramp or surrounding soil and water resources.
- Use suitable measures along both sides and across the lower end of the launch ramp to protect the structure from externally generated forces such as current, waves, and boat wakes.
- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) and BMP Fac-2 (Facility Construction and Stormwater Control) when constructing, reconstructing, or maintaining watercraft launch facilities.
- Use applicable practices of BMP Rec-2 (Developed Recreation Sites) when constructing and operating parking and staging areas at watercraft launch facilities.
- Use applicable practices of BMP Road-10 (Equipment Refueling and Servicing) at fuel dispensing facilities.
- Manage boating activities where necessary to decrease turbidity and physical destruction of shallow water habitats.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim watercraft launch sites when discontinuing their use.

Rec-9. Recreation Special Use Authorizations

Manual or Handbook Reference FSM 2343, FSM 2721, and FSH 2709.11.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from physical, chemical, and biological pollutants resulting from activities under recreation special use authorizations.

Explanation This BMP covers all recreation special use activities with the exceptions of ski areas. BMP Rec-10 (Ski Runs and Lifts), BMP Rec-11 (Ski Area Snowmaking), and BMP Rec-12 (Ski Area Facilities) provide direction specific to ski areas.

The Forest Service role in defining and requiring the implementation of BMPs occurs during the development of the recreation special use authorization and administration of the use. Discussions between the Forest Service and the permit holder concerning soil, water quality, and riparian resource impacts and appropriate BMP use should occur at the time of permit development and renewal. The special use authorization details the conditions that must be met, including management requirements and mitigation measures to protect water quality. The permit holder will be required to conform to all applicable Federal, State, and local regulations governing water resource protection and sanitation. State water quality law may require that the permit holder obtain a pollution discharge permit, water quality certification, or other authorization from a State, regional, or local government entity.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to provide erosion and stormwater controls when constructing facilities.

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working around waterbodies.

- Use applicable practices of Road Management Activities BMPs for access for authorized activities.
- Use applicable practices of Chemical Use Management Activities BMPs for use of chemicals in authorized activities.
- Use applicable practices of BMP Fac-3 (Potable Water Supply Systems), BMP Fac-4 (Sanitation Systems), BMP Fac-5 (Solid Waste Management), and BMP Fac-6 (Hazardous Materials) for public water supplies, sanitation systems, solid waste management, and hazardous materials for authorized activities.
- Administer the permit to appropriate standards to avoid, minimize, or mitigate adverse effects of permitted activities to soil, water quality, and riparian resources.

Rec-10. Ski Runs and Lifts

Manual or Handbook Reference FSM 2342.1 and FSH 2709.11 41.6.

Objective Objective: Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during the construction, operation, and maintenance of ski runs and lifts.

Explanation A ski area and its operation are complex and can result in a variety of adverse effects to soil, water quality, and riparian resources. These adverse effects can be particularly true for ski runs and lifts. Because good ski runs tend to be steep, extra precautions are needed to avoid or minimize accelerated erosion and resulting sedimentation. Ski run clearing, slope grading, and developing access routes, ski lift and towline facilities, and similar actions can expose and compact soils, resulting in accelerated runoff and erosion. Increased runoff can alter water yield and runoff regimes, augment peakflows, and increase instream sediment from channel erosion. Appropriate soil and water protection measures should be included in the ski area's operation and maintenance plan.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate ski runs and lifts on stable geology and soils to minimize risk of slope failures.
- Avoid wetlands and riparian areas when locating ski runs and lifts wherever practicable.
- Incorporate suitable measures in the design and construction of ski runs, including consideration of runoff of additional water from snowmaking, to avoid or minimize undesirable increases in runoff.
- Use applicable practices of Mechanical Vegetation Management Activities BMPs when clearing vegetation for ski runs and lift lines.
    - Use yarding equipment suitable to the steepness of the terrain to avoid or minimize adverse effects to soil and water quality (see BMP Veg-1 [Vegetation Management Planning]).
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to provide erosion and stormwater controls when constructing ski runs and lifts.
    - Clear and construct ski runs and lift lines in sections to limit the area of exposed disturbed soil at any one time.
    - Stabilize a completed section before beginning work on the next section.

- Avoid diverting streams and minimize disrupting swales, ephemeral channels, and wetlands.
- Minimize grading or recontouring of hill slopes to maintain intact soil horizons and infiltrative properties.
- Cut stumps flush with soil surface or grind in place instead of grubbing when clearing trees from ski runs wherever practicable.
- Use applicable practices of BMP Road-7 (Stream Crossings) to design and construct stream crossings to minimize riparian and channel disturbance and pass anticipated flood flows and associated debris, while allowing desired aquatic organism passage.
    - Maintain normal stream patterns, geometry, and habitat features to the extent practicable.
- Use low-pressure construction and maintenance equipment whenever practicable to reduce surface impact on steep slopes.
- Stockpile biologically active topsoil removed during excavation for use in reclamation.
    - Store stockpiled topsoil separately from other vegetative slash, soil, or rock and protect from wind and water erosion, unnecessary compaction, and contaminants.
- Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Maintain desired ground cover with irrigation, fertilization, or other treatments as necessary.
- Use suitable measures to direct overland flow on slopes into areas with intact soil horizons to encourage infiltration and disconnect overland flow from waterbodies.
- Treat disturbed soil to promote onsite water capture and infiltration.
- Prohibit traffic on disturbed areas during periods of excessive soil moisture, precipitation, or runoff.
- Monitor revegetation response (height, root growth, ground coverage, etc.) in terms of its capacity to avoid or minimize erosion during runoff.
    - Perform additional revegetation or erosion control as needed to protect water quality and soil integrity.

Rec-11. Ski Area Snowmaking

Manual or Handbook Reference FSM 2343.1 and FSH 2709.11 41.6.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources at all stages of the snowmaking process, including diversions, conveyance, storage, application, and return of applied waters.

Explanation All phases of snowmaking at a ski area can affect the watershed and water quality. Construction of diversion, conveyance, storage, and delivery structures can create ground disturbance leading to erosion and sedimentation. Water withdrawal from rivers and streams can create or exacerbate stream dewatering and adversely affect overwintering habitat for fish and other aquatic-dependent species. Transfer of water from one basin to another for snowmaking can lead to an annual water supply outside the natural range of variation in the receiving watershed. This additional water in spring runoff can cause changes in stream channel morphology including streambank erosion and headward extension of the channel.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Manage snowmaking and snow farming to avoid or minimize slope failures and gully erosion on the hillslopes and excessive bank erosion and sediment in receiving streams.
  - ❑ Limit snowmaking on graded terrain to the extent practicable to minimize surface runoff and subsequent erosion from reduced infiltration capacity.
- Use applicable practices of BMP WatUses-1 (Water Uses Planning) when authorizing snowmaking.
- Use applicable practices of BMP AqEco-3 (Ponds and Wetlands), BMP WatUses-4 (Water Diversions and Conveyances), and BMP WatUses-5 (Dams and Impoundments) when obtaining water and developing water storage facilities for snowmaking.
- Transport water to the slopes in the least disruptive manner.
  - ❑ Use applicable practices of BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Ways) when constructing, maintaining, and operating pipelines.
- Design snowmaking systems to return runoff water to the source from which it was removed.
  - ❑ Avoid interbasin transfer of waters, where practicable, to maintain original duration, magnitude, and patterns of runoff in affected watersheds.
- Avoid contaminating return water with chemicals or other pollutants.
- Monitor all aspects of the process and correct problems as they occur to avoid or minimize long-term effects.
  - ❑ Regularly inspect snowmaking lines and equipment to prevent accidental discharges and erosion due to equipment failure.

Rec-12. Ski Area Facilities

Manual or Handbook Reference FSM 2343.1 and FSH 2709.11 41.6.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources originating from design, construction, operation, and maintenance of ski area facilities.

Explanation Ski area facilities include buildings, sanitary facilities, parking lots, and other infrastructure. These facilities can be located at the base of the ski area, mid-slope, or at the top of the ski hill. During construction and operation of facility sites, land may be cleared of existing vegetation and ground cover, exposing mineral soil that may be more easily eroded by water, wind, and gravity. Changes in land use and impervious surfaces can alter temporarily or permanently stormwater runoff that, if left uncontrolled, can affect morphology, stability, and quality of nearby streams and other waterbodies. Receiving waters can be contaminated by oil, grease, anti-freeze, sewage, trash, sediment, and salt. Construction and operation of these facilities should include measures that will avoid, minimize, or mitigate effects to water quality.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate ski area facilities on stable geology and soils to minimize risk of slope failures.
- Avoid wetlands and riparian areas to the extent practicable when locating ski area facilities.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to provide erosion and stormwater controls when constructing and operating ski area facilities.
- Use applicable practices of BMP Road-2 (Road Location and Design), BMP Road-3 (Road Construction and Reconstruction), BMP Road-4 (Road Operations and Maintenance), BMP Road-8 (Snow Storage and Removal), and BMP Road-9 (Parking Sites and Staging Areas) for designing, constructing, maintaining, and operating roads and parking areas at ski area facilities.
- Use applicable practices of BMP Fac-9 (Pipelines, Transmission Facilities, and Rights-of-Way) for managing power and utility lines at the ski area facilities.
- Use applicable practices of BMP Fac-6 (Hazardous Materials), BMP Fac-7 (Vehicle and Equipment Wash Water), and BMP Road-10 (Equipment Refueling and Servicing) for activities related to storage and maintenance of ski area vehicles and equipment.
- Use applicable practices of BMP Fac-3 (Potable Water Supply Systems) for drinking water, BMP Fac-4 (Sanitation Systems) for managing human waste, and BMP Fac-5 (Solid Waste Management) for managing solid waste at ski area facilities.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) when discontinuing use at ski area facilities.

Resources for Recreation Management Activities

Marinas and Recreational Boating

Oregon State Marina Board. 2002. Best management practices for environmental and habitat protection in design and construction of recreational boating facilities. Oregon State Marina Board. 9 p. Available at http://www.boatoregon.com/OSMB/library/docs/BoatingFacBMP2002-1.pdf.

U.S. Environmental Protection Agency (EPA), Office of Water. 2005. National management measures to control nonpoint source pollution from marinas and recreational boating. EPA-841-B-05-003. Washington, DC: U.S. Environmental Protection Agency, Office of Water. Available at http://www.epa.gov/owow/NPS/mmsp/index.html.

Off-Highway Vehicles

McCullah, J.; Sloan, R.; Dettman, K.; Jacobson, N.; and others. 2007. OHV BMP manual for erosion and sediment control. Sacramento, CA: State of California, Department of Parks and Recreation, Off-Highway Motor Vehicle Recreation Division. 317 p. Available at http://www.watchyourdirt.com/erosion-control-files/.

Shooting Ranges

EPA. 2005. Best management practices for lead at outdoor shooting ranges. EPA 902-B-01-001. New York, NY. Available at http://www.epa.gov/region02/waste/leadshot/epa_bmp.pdf.

Site Restoration

Therrell, L.; Cole, D.; Claassen, V.; Ryan, C.; Davies, M.A. 2006. Wilderness and backcountry site restoration guide. 0623-2815-MTDC. Missoula, MT: U.S. Department of Agriculture (USDA), Forest Service, Technology and Development Program. 394 p. Available at http://www.treesearch.fs.fed.us/pubs/26795.

Ski Areas

USDA Forest Service. 2000. Ski area BMPs—(Best management practices) guidelines for planning, erosion control, and reclamation. Salt Lake City, UT: U.S. Department of Agriculture, Forest Service, Wasatch-Cache National Forest, in cooperation with Sun Valley Corporation and Snowbasin Ski Area. 28 p.

Trails Davies, M.A.; Outka-Perkins, L. 2006. Building mountain bike trails: Sustainable singletrack. 0623-2314-MTDC (DVD). Missoula, MT: USDA Forest Service, Technology and Development Program. Available at http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm06232341/index.htm.

Hesselbarth, W.; Vachowski, B.; Davies, M.A. 2007. Trail construction and maintenance notebook. 0723-2806-MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Technology and Development Program. 178 p. Available at http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm07232806/ .

State of New Hampshire, Department of Resources and Economic Development. 2004. Best management practices for erosion control during trail maintenance and construction. Concord, NH: State of New Hampshire, Department of Resources and Economic Development, Division of Parks and Recreation, Bureau of Trails. 27 p. Available at http://atfiles.org/files/pdf/BMPmanual2004.pdf.

Steinholz, R.T.; Vachowski, B. 2007. Wetland trail design and construction. 0723-2804-MTDC. Missoula, MT: USDA Forest Service, Technology and Development Program. 90 p. Available at http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm07232804/index.htm

Road Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and instream riparian resources that may result from road management activities. Road management activities include travel route planning, design, construction, operation, maintenance, reconstruction, storage, and decommissioning. Other transportation-system-related activities include stream and waterbody crossings, snow removal, parking areas, and equipment refueling and servicing areas.

Eleven National Core BMPs are in the Road Management Activities Category. These BMPs are to be used when managing roads on National Forest System (NFS) lands. BMP Road-1 (Travel Management Planning and Analysis) is a planning BMP for transportation systems. BMP Road-2 (Road Location and Design), BMP Road-3 (Road Construction and Reconstruction), and BMP Road-4 (Road Operations and Maintenance) provide project-level direction for road construction and operations. BMP Road-5 (Temporary Roads) provides direction for construction and use of temporary roads. BMP Road-6 (Road Storage and Decommissioning) provides direction for roads that will not be needed for 1 year or more, or that are no longer needed. BMP Road-7 (Stream Crossings) provides practices for fords, bridges, culverts, and other crossings of flowing or standing water. BMP Road-8 (Snow Removal and Storage) provides direction for snowplowing. BMP Road-9 (Parking Areas and Staging Areas) provides direction for constructing and operating permanent and temporary parking areas. BMP Road-10 (Equipment Refueling and Servicing) provides practices for vehicle refueling and servicing areas. BMP Road-11 (Road Storm-Damage Surveys) provides direction for monitoring of roads after major storms. Each BMP draws on administrative directives that guide agency management of roads on NFS land (Forest Service Manual [FSM] 7710).

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Road BMPs	
Road-1	Travel Management Planning and Analysis
Road-2	Road Location and Design
Road-3	Road Construction and Reconstruction
Road-4	Road Operations and Maintenance
Road-5	Temporary Roads
Road-6	Road Storage and Decommissioning
Road-7	Stream Crossings
Road-8	Snow Removal and Storage
Road-9	Parking and Staging Areas
Road-10	Equipment Refueling and Servicing
Road-11	Road Storm-Damage Surveys

Road-1. Travel Management Planning and Analysis

Manual or Handbook Reference Forest Service Manual (FSM) 7710; Forest Service Handbook (FSH) 7709.55; and FSH 7709.59, chapter 10.

Objective Use the travel management planning and analysis processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during road management activities.

Explanation Road management related planning includes travel analyses as well as consideration of road management objectives and maintenance levels to address access needs and adjustments for projects. Planning occurs at scales that range from forestwide assessments and plans, to watershed scale or project-level analyses, to individual road activities. Effects to soil, water quality, and riparian resources are evaluated during planning and balanced with the social, economic, and land management needs of the area. Appropriate protection and mitigation measures are considered when soil, water quality, and riparian resources may be adversely impacted.

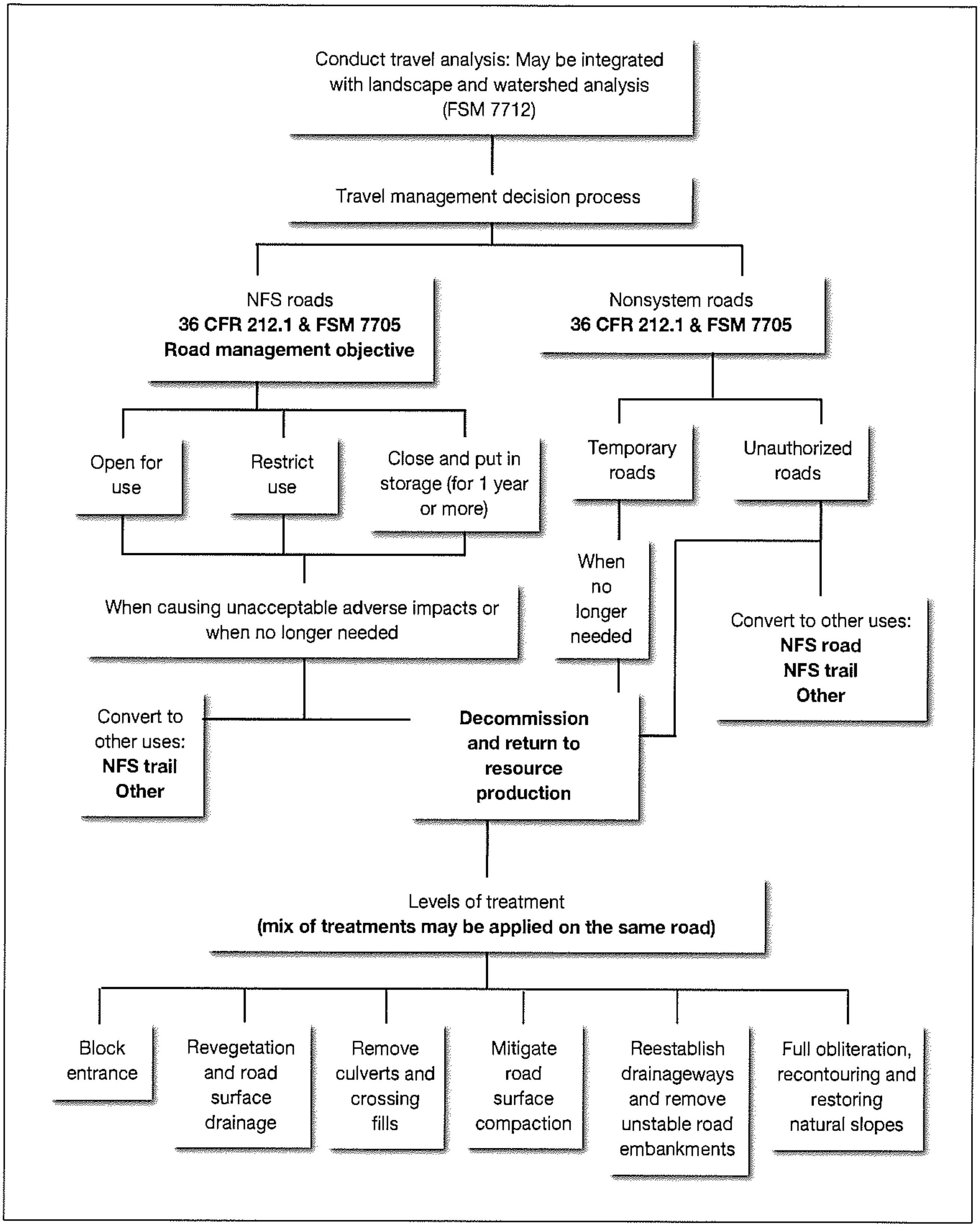
Travel analysis is conducted at a scope and scale determined by the line officer and used to inform future project decisions on the benefits and risks of, as well as the ongoing need for, the transportation system. Project-level travel analyses are conducted to inform decisions and facilitate vegetation, fire and fuels, rangeland, recreation, minerals, or other management actions. Such analyses contain detail on the condition of individual roads. Options for road management are shown in figure 3.

Road Management Objectives (RMOs) are developed and documented for each system road and include the intent and purpose in providing access to implement the land management plan. In addition to considering route needs at the site scale, RMOs also document the purpose of the road (access needs) along with operational maintenance levels and objectives.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when conducting travel management planning and analysis.
- Use interdisciplinary coordination for travel planning and project-level transportation analysis, including engineers, hydrologists, soil scientists, and other resource specialists as needed, to balance protection of soil, water quality, and riparian resources with transportation and access needs.
- Design the transportation system to meet long-term land management plan desired conditions, goals, and objectives for access rather than to access individual sites.
- Limit roads to the minimum practicable number, width, and total length consistent with the purpose of specific operations, local topography, geology, and climate to achieve land management plan desired conditions, goals, and objectives for access and water quality management.
    - Use existing roads when practicable.
    - Use system roads where access is needed for long-term management of an area or where control is needed in the location, design, or construction of the road to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Figure 3. Road Options



- Use temporary roads for short-term access needs if the road can be constructed, operated, and obliterated without specific control of techniques to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources (See BMP Road-5 [Temporary Roads]).
- Decommission temporary roads and return to resource production when the access is no longer needed (See BMP Road-6 [Road Storage and Decommissioning]).
- Consider placing roads in storage (Maintenance Level 1) when the time between intermittent uses exceeds 1 year and the costs of annual maintenance (both economic and potential disturbance) or potential failures due to lack of maintenance exceed the benefits of keeping the road open in the interim (See BMP Road-6 [Road Storage and Decommissioning]).
- Consider decommissioning unneeded existing roads within a planning area when planning new system roads to reduce cumulative impacts to soil, water quality, and riparian resources (See BMP Road-6 [Road Storage and Decommissioning]).

- Plan road networks to have the minimum number of waterbody crossings as is practicable and necessary to achieve transportation system desired conditions, goals, and objectives.
- Develop or update RMOs for each system road to include design criteria, operation criteria, and maintenance criteria to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Use applicable practices of BMP Road-2 (Road Location and Design) to establish design elements and standards.
  - Use applicable practices of BMP Road-4 (Road Operations and Maintenance) to establish criteria on how the road is to be operated and maintained.
  - Revise RMOs as needed to meet changing conditions.
- Identify and evaluate road segments causing, or with the potential to cause, adverse effects to soil, water quality, and riparian resources.
  - Identify and prioritize suitable mitigation measures to avoid, minimize, or mitigate adverse effects (see BMPs Road-2 (Road Location and Design), Road-3 (Road Construction and Reconstruction), Road-4 (Road Operations and Maintenance), Road-6 (Road Storage and Decommissioning), and Road-7 (Stream Crossings) for potential mitigation measures).

Road-2. Road Location and Design

Manual or Handbook Reference FSM 7720 and FSH 7709.56.

Objective Locate and design roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Explanation Roads are located according to standards and specifications to meet their use objectives while protecting other resources. Well-defined project objectives are needed to locate and design roads that will best address environmental and resources issues as well as road use, safety, and traffic requirements.

New roads can be designed to avoid or minimize adverse effects to soil, water quality, and riparian resources, while existing roads may need to be redesigned or relocated to mitigate such effects. Management needs have changed considerably since most NFS roads were constructed. Influences of roads on aquatic and riparian systems are currently better understood. Designs for improvements to existing roads often revise the original design to change location, drainage, crossing type or size, or surfacing. Improvements to the road system are made on a priority basis that considers road and resource condition, values at risk, available funding, and cost.

In addition, some situations may require adherence to special conditions associated with Clean Water Act (CWA) 401 certification, CWA 402 permits, and CWA 404 permits. State and local entities may also provide guidance and regulations such as a Forest Practices Act or a Stream Alteration Act. Land management plans often contain direction on location of roads relative to streams, wetlands, and unstable landforms.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Location

- Locate roads to fit the terrain, follow natural contours, and limit the need for excavation.
    - ❑ Avoid locations that require extended steep grades, sharp curves, or switchbacks.
- Locate roads on stable geology with well-drained soils and rock formations that dip into the slope.
    - ❑ Avoid hydric soils, inner gorges, overly steep slopes, and unstable landforms to the extent practicable.
- Locate roads as far from waterbodies as is practicable to achieve access objectives, with a minimum number of crossings and connections between the road and the waterbody.
    - ❑ Avoid sensitive areas such as riparian areas, wetlands, meadows, bogs, and fens, to the extent practicable.
    - ❑ Provide an AMZ of suitable width between the road and a waterbody to maintain desired conditions, goals, and objectives for structure, function, and processes of the AMZ and associated waterbody when a road must parallel a waterbody (See BMP Plan-3 [AMZ Planning]).
- Relocate existing routes or segments that are causing, or have the potential to cause, adverse effects to soil, water quality, and riparian resources, to the extent practicable.
    - ❑ Obliterate the existing road or segment after the relocated section is completed (see BMP Road-6 [Road Storage and Decommissioning]).

Predesign

- Consider design criteria relative to soil, water quality, and riparian resources from the decision document and associated National Environmental Policy Act (NEPA) analysis document.
- Consider the road RMOs and likely future maintenance schedule in the initial design.
- Conduct suitable site investigations, data collection, and evaluations commensurate with the anticipated design and sensitivity of the area to soil, water quality, and riparian resource impacts.
    - ❑ Consider subsurface conditions and conduct suitable investigations and stability analyses for road and bridge locations where slope instability can occur due to road construction.
    - ❑ Conduct a suitable soils and geotechnical evaluation to identify susceptibility to erosion and stable angles of repose.

Design

- Design the road to fit the ground and terrain with the least practicable impacts to soil, water quality, and riparian resources considering the purpose and life of the road, safety, and cost.
  - Use road standards that minimize impacts for grade and alignment (e.g., width, turning radius, and maximum slope).
  - Use low impact development treatments that reduce long-term maintenance needs wherever practicable.
- Design the road to maintain stable road prism, cut, and fill slopes.
  - Design cut and fill slope ratios to reduce soil loss from mass failures.
  - Use structural or nonstructural measures as necessary to stabilize cut and fill slopes.
- Design the road surface drainage system to intercept, collect, and remove water from the road surface and surrounding slopes in a manner that minimizes concentrated flow in ditches, culverts, and over fill slopes and road surfaces.
  - Use structural or nonstructural measures suitable to the road materials, road gradient, and expected traffic levels.
  - Use an interval between drainage features that is suitable for the road gradient, surface material, and climate.
  - Use suitable measures to avoid or minimize erosion of ditches.
- Design the road subsurface drainage system to intercept, collect, and remove groundwater that may flow into the base course and subgrade, lower high-water tables, and drain water pockets.
  - Use suitable subsurface dispersion or collection measures to capture and disperse locally shallow groundwater flows intercepted by road cuts.
  - Use suitable measures to release groundwater into suitable areas without causing erosion or siltation.
- Design the road for minimal disruption of natural drainage patterns and to minimize the hydrologic connection of the road segment or network with nearby waterbodies.
  - Use suitable structural or nonstructural measures to avoid or minimize gully formation and erosion of fill slopes at outfalls of road surface drainage structures.
  - Use suitable measures to avoid, to the extent practicable, or minimize direct discharges from road drainage structures to nearby waterbodies.
  - Provide sufficient buffer distance at the outfalls of road surface drainage structures for water to infiltrate before reaching the waterbody.
  - Use applicable practices of BMP Road-7 (Stream Crossings) to limit the number and length of water crossing connected areas to the extent practicable.
- Design road surface treatment to support wheel loads, stabilize the roadbed, reduce dust, and control erosion consistent with anticipated traffic and use.
  - Consider whether road closures or roadway surface drainage and erosion protection can adequately mitigate adverse effects to soil, water quality, and riparian resources.
- Design roads within the AMZ (when no practicable alternative exists outside of the AMZ to achieve access objectives) to maintain desired conditions, goals, and objectives for AMZ structure, function, and processes (See BMP Plan-3 [AMZ Planning]).

- Use suitable measures to minimize or mitigate effects to waterbodies and other sensitive areas when adverse impacts cannot be practicably avoided.

- Design waterbody crossings to avoid or minimize adverse effects to soil, water quality, and riparian resources to the extent practicable consistent with road use, legal requirements, and cost considerations (See BMP Road-7 [Stream Crossings]).
- Design a post-construction site vegetation plan, including short- and long-term objectives, using suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Road-3. Road Construction and Reconstruction

Manual or Handbook Reference FSM 7720, FSH 7709.56, and FSH 7709.57.

Objective Avoid or minimize adverse effects to soil, water quality, and riparian resources from erosion, sediment, and other pollutant delivery during road construction or reconstruction.

Explanation During road construction and reconstruction activities, vegetation and ground cover is removed exposing soil to erosion. Temporary and long-term erosion control and stormwater management measures are necessary to reduce erosion and maintain overall slope stability. These erosion control measures may include vegetative and structural practices to ensure long-term stability of the area.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when constructing or reconstructing system roads.
- Use suitable construction techniques to create stable fills.
  - Use full bench construction techniques or retaining walls where stable fill construction is not possible.
  - Avoid incorporating woody debris in the fill portion of the road prism.
  - Leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill.
  - Avoid use of road fills for water impoundment dams unless specifically designed for that purpose.
- Identify and locate waste areas before the start of operations.
  - Deposit and stabilize excess and unsuitable materials only in designated sites.
  - Do not place such materials on slopes with a risk of excessive erosion, sediment delivery to waterbodies, mass failure, or within the AMZ.
  - Provide adequate surface drainage and erosion protection at disposal sites.
- Do not permit sidecasting within the AMZ.
  - Avoid or minimize excavated materials from entering waterbodies or AMZs.
- Develop and follow blasting plans when necessary.
  - Use restrictive blasting techniques in sensitive areas and in sites that have high landslide potential.

- Avoid blasting when soils are saturated.
- Remove slash and cull logs to designated sites outside the AMZ for storage or disposal.
  - Consider using cull logs in aquatic ecosystem projects to achieve aquatic resource management objectives as opportunities arise.
- Use suitable measures in compliance with local direction to prevent and control invasive species.
- Construct pioneer roads using suitable measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Confine construction of pioneer roads to the planned roadway limits unless otherwise specified.
  - Locate and construct pioneering roads to avoid or minimize undercutting of the designated final cut slope.
  - Avoid deposition of materials outside the designated roadway limits.
  - Use suitable crossing structures, or temporarily dewater live streams, where pioneer roads intersect streams.
  - Use suitable erosion and stormwater control measures as needed (see BMP Fac-2 [Facility Construction and Stormwater Control]).
- Reconstruct existing roads to the degree necessary to provide adequate drainage and safety.
  - Avoid disturbing stable road surfaces.
  - Use suitable measures to avoid, to the extent practicable, or minimize direct discharges from road drainage structures to nearby waterbodies.

Road-4. Road Operations and Maintenance

Manual or Handbook Reference FSM 7732 and FSH 7709.59, chapter 60.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling road use and operations and providing adequate and appropriate maintenance to minimize sediment production and other pollutants during the useful life of the road.

Explanation Control of road use and operations and appropriate maintenance can protect road investment and soil, water quality, and riparian resources. Periodic inventory and assessment that determine road condition are used to determine operational controls and maintenance needs.

Operational objectives and activities are documented in the RMOs. In travel management decisions, roads open to motorized vehicle use are designated by allowed vehicle class and, if appropriate, by time of year. Road operations include administering permits, contracts, and agreements, controlling allowed use, maintaining roads in closed status, and revising maintenance levels and seasonal closures as needed. Road closures and restrictions are necessary because many forest roads are designed for dry season use. Many local roads are not surfaced; while others have some surfacing but little to no base. Such roads can be damaged by use during wet periods or by loads heavier than the road was designed to convey.

Properly maintained road surfaces and drainage systems can reduce adverse effects to water resources by encouraging natural hydrologic function. Roads and drainage systems normally deteriorate because of traffic, weather, and age. In addition, roads occasionally become saturated by groundwater springs and seeps after a wildfire or unusually wet periods. Many such conditions can be corrected by timely maintenance. While routine maintenance is needed to ensure the road performs as designed, however, it can also be a source of soil disturbance, concentrated flow, sediment production, and slope instability if done improperly. Lower impact maintenance techniques may be desired to minimize disturbance of stable sites.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Operations

- Designate season of use to avoid or restrict road use during periods when use would likely damage the roadway surface or road drainage features.
- Designate class of vehicle and type of uses suitable for the road width, location, waterbody crossings, and road surfaces to avoid or minimize adverse effects to soil, water quality, or riparian resources to the extent practicable.
- Use suitable measures to communicate and enforce road use restrictions.
- Use suitable measures to avoid or minimize adverse effects to soil, water quality, or riparian resources when proposed operations involve use of roads by traffic and during periods for which the road was not designed.
    - ❑ Strengthen the road surface in areas where surfaces are vulnerable to movement such as corners and steep sections.
    - ❑ Upgrade drainage structures to avoid, to the extent practicable, or minimize direct discharges into nearby waterbodies.
    - ❑ Restrict use to low-ground-pressure vehicles or frozen ground conditions.
    - ❑ Strengthen the road base if roads are tending to rut.
    - ❑ Adjust maintenance to handle the traffic while minimizing excessive erosion and damage to the road surface.
- Ensure that drainage features are fully functional on completion of seasonal operations.
    - ❑ Shape road surfaces to drain as designed.
    - ❑ Construct or reconstruct drainage control structures as needed.
    - ❑ Ensure that ditches and culverts are clean and functioning.
    - ❑ Remove berms unless specifically designed for erosion control purposes.
- Consider potential for water quality effects from road damage when granting permits for oversize or overweight loads.
- Use suitable road surface stabilization practices and dust abatement supplements on roads with high or heavy traffic use (See FSH 7709.56 and FSH 7709.59).
- Use applicable practices of Chemical Use Management Activities BMPs when chemicals are used in road operations.

Inspection

- Periodically inspect system travel routes to evaluate condition and assist in setting maintenance and improvement priorities.

- Give inspection priority to roads at high risk of failure to reduce risk of diversions and cascading failures.

- Inspect drainage structures and road surfaces after major storm events and perform any necessary maintenance (see BMP Road-11 [Road Storm-Damage Surveys]).
  - Repair and temporarily stabilize road failures actively producing and transporting sediment as soon as practicable and safe to do so.
- Inspect roads frequently during all operations.
  - Restrict use if road damage such as unacceptable surface displacement or rutting is occurring.

Maintenance Planning

- Develop and implement annual maintenance plans that prioritize road maintenance work for the forest or district.
  - Increase priority for road maintenance work on road sections where road damage is causing, or potentially would cause, adverse effects to soil, water quality, and riparian resources.
  - Consider the risk and consequence of future failure at the site when prioritizing repair of road failures.
- Develop and implement annual road maintenance plans for projects where contractors or permittees are responsible for maintenance activities.
  - Define responsibilities and maintenance timing in the plan.

Maintenance Activities

- Maintain the road surface drainage system to intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces.
  - Clean ditches and catch basins only as needed to keep them functioning.
  - Do not undercut the toe of the cut slope when cleaning ditches or catch basins.
  - Use suitable measures to avoid, to the extent practicable, or minimize direct discharges from road drainage structures to nearby waterbodies.
- Identify diversion potential on roads and prioritize for treatment.
  - Minimize diversion potential through installation and maintenance of dips, drains, or other suitable measures.
- Maintain road surface treatments to stabilize the roadbed, reduce dust, and control erosion consistent with anticipated traffic and use.
- Grade road surfaces only as necessary to meet the smoothness requirements of the assigned operational maintenance level and to provide adequate surface drainage.
  - Do not undercut the toe of the cut slope when grading roads.
  - Do not permit sidecasting of maintenance-generated debris within the AMZ to avoid or minimize excavated materials entering waterbodies or riparian areas.
  - Avoid overwidening of roads due to repeated grading over time, especially where sidecast material would encroach on waterbodies.
  - Use potential sidecast or other waste materials on the road surface where practicable.
  - Dispose of unusable waste materials in designated disposal sites.

- Remove vegetation from swales, ditches, and shoulders, and cut and fill slopes only when it impedes adequate drainage, vehicle passage, or obstructs necessary sight distance to avoid or minimize unnecessary or excessive vegetation disturbance.
- Maintain permanent stream crossings and associated fills and approaches to reduce the likelihood that water would be diverted onto the road or erode the fill if the structure becomes obstructed.
- Identify waterbody-crossing structures that lack sufficient capacity to pass expected flows, bedload, or debris, or that do not allow for desired aquatic organism passage, and prioritize for treatment.
    - Use applicable practices of BMP Road-7 (Stream Crossings) to improve crossings.
- Use applicable practices of BMP Road-6 (Road Storage and Decommissioning) for maintenance and management of Maintenance Level 1 roads.
- Ensure the necessary specifications concerning prehaul maintenance, maintenance during haul, and posthaul maintenance (putting the road back in storage) are in place when maintenance level 1 roads are opened for use on commercial resource management projects or other permitted activities.
    - Require the commercial operator or responsible party to leave roads in a satisfactory condition when project is completed.

Road-5. Temporary Roads

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of temporary roads.

Explanation Temporary roads may be used in situations where access needs are short-term and the roads can be constructed without requiring advanced engineering design or construction practices to avoid, minimize, or mitigate adverse effects to resources. Practices related to road location and stormwater and erosion control should be applied to temporary roads. Temporary roads are to be decommissioned and the area returned to resource production after the access is no longer needed.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Road-2 (Road Location and Design) to locate temporary roads.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when constructing temporary roads.
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Schedule construction activities to avoid direct soil and water-disturbance during periods of the year when heavy precipitation and runoff are likely to occur.
- Routinely inspect temporary roads to verify that erosion and stormwater controls are implemented, functioning, and appropriately maintained.

- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning.
- Use suitable measures in compliance with local direction to prevent and control invasive species.
- Use temporary crossings suitable for the expected uses and timing of use (See BMP Road-7 [Stream Crossings]).
- Use applicable practices of BMP Road-6 (Road Storage and Decommissioning) to obliterate the temporary road and return the area to resource production after the access is no longer needed.

Road-6. Road Storage and Decommissioning

Manual or Handbook Reference FSH 7709.59, chapter 60 and FSM 7734.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by storing closed roads not needed for at least 1 year (Intermittent Stored Service) and decommissioning unneeded roads in a hydrologically stable manner to eliminate hydrologic connectivity, restore natural flow patterns, and minimize soil erosion.

Explanation Roads not needed for access for long periods (greater than 1 year) may be put into storage (Intermittent Stored Service—Maintenance Level 1) to reduce maintenance costs. Level 1 roads receive basic custodial maintenance focusing on maintaining drainage facilities and runoff patterns to avoid or minimize damage to adjacent resources and to perpetuate the road for future use. The integrity of the roadway is retained to the extent practicable and measures are implemented to reduce sediment delivery from the road surface and fills and reduce the risk of crossing failure and stream diversion.

Roads no longer needed are identified during transportation planning activities at the forest, watershed, or project level. The former road may be decommissioned or converted to a trail as appropriate. Decommissioned roads are stabilized and restored to a more natural state to protect and enhance NFS lands. Temporary roads constructed for a specific short-term purpose (e.g., ski area development, minerals exploration, or timber harvesting) are decommissioned at the completion of their intended use.

Road decommissioning includes a variety of treatments to block the road, revegetate the road surface, restore surface drainage, remove crossing structures and fills, mitigate road surface compaction, re-establish drainageways, remove unstable road embankments, and recontour the surface to restore natural slopes. One or more treatments are applied to decommission the road depending on resource objectives and cost.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Activities

- Implement suitable measures to close and physically block the road entrance so that unauthorized motorized vehicles cannot access the road.
  - Remove the road from the Motor Vehicle Use Map (MVUM) to include the change in the annual forestwide order associated with the MVUM.
- Establish effective ground cover on disturbed sites to avoid or minimize accelerated erosion and soil loss.

- Use suitable species and establishment techniques to stabilize and revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Road Storage

- Evaluate all stream and waterbody crossings for potential for failure or diversion of flow if left without treatment.
    - Use suitable measures to reduce the risk of flow diversion onto the road surface.
    - Consider leaving existing crossings in low-risk situations where the culvert is not undersized, does not present an undesired passage barrier to aquatic organisms, and is relatively stable.
    - Remove culverts, fill material, and other structures that present an unacceptable risk of failure or diversion.
    - Reshape the channel and streambanks at the crossing-site to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site.
    - Use suitable measures to avoid or minimize scour and downcutting.
- Use suitable measures to ensure that the road surface drainage system will intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces without frequent maintenance.
- Use suitable measures to stabilize unstable road segments, seeps, slumps, or cut or fill slopes where evidence of potential failure exists.

Road Conversion to Trail

- Reclaim unneeded road width, cut, and fill slopes when converting a road for future use as a trail.
- Use suitable measures to stabilize reclaimed sections to avoid or minimize undesired access and to restore desired ecologic structures or functions.
- Use suitable measures to ensure that surface drainage will intercept, collect, and remove water from the trail surface and surrounding slopes in a manner that minimizes concentrated flow and erosion on the trail surfaces without frequent maintenance.
- Use applicable practices of BMP Road-7 (Stream Crossings) to provide waterbody crossings suitable to the expected trail uses.

Road Decommissioning

- Use existing roads identified for decommissioning as skid roads in timber sales or land stewardship projects before closing the road, where practicable, as the opportunity arises.
- Evaluate risks to soil, water quality, and riparian resources and use the most practicable, cost-effective treatments to achieve long-term desired conditions and water quality management goals and objectives.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when obliterating system roads.
- Implement suitable measures to re-establish stable slope contours and surface and subsurface hydrologic pathways where necessary to the extent practicable to avoid or minimize adverse effects to soil, water quality, and riparian resources.
    - Remove drainage structures.

- ❑ Recontour and stabilize cut slopes and fill material.
- ❑ Reshape the channel and streambanks at crossing sites to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site.
- ❑ Restore or replace streambed materials to a particle size distribution suitable for the site.
- ❑ Restore floodplain function.

- Implement suitable measures to promote infiltration of runoff and intercepted flow and desired vegetation growth on the road prism and other compacted areas.
- Use suitable measures in compliance with local direction to prevent and control invasive species.

Road-7. Stream Crossings

Manual or Handbook Reference Manual or Handbook Reference: FSM 7722 and FSH 7709.56b.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing, reconstructing, or maintaining temporary and permanent waterbody crossings.

Explanation Forest and grassland management activities often occur in areas that require surface waters to be crossed. Depending on the activity type and duration, crossings may be needed permanently or temporarily. Permanent crossings, in general, are more durable and are designed by an engineer to meet applicable standards while also protecting water quality and riparian resources.

Examples of crossings include culverts, bridges, arched pipes, low-water crossings, vented fords, and permeable fills. Crossing materials and construction will vary based on the type of access required, duration of need, and volume of use expected. Crossings should be designed and installed to provide for flow of water, bedload, and large woody debris, desired aquatic organism passage, and to minimize disturbance to the surface and shallow groundwater resources.

Construction, reconstruction, and maintenance of a crossing usually requires heavy equipment to be in and near streams, lakes, and other aquatic habitats to install or remove culverts, fords, and bridges, and their associated fills, abutments, piles, and cribbing. Such disturbance near the waterbody can increase the potential for accelerated erosion and sedimentation by altering flow paths and destabilizing streambanks or shorelines, removing vegetation and ground cover, and exposing or compacting the soil. Use of heavy equipment has a potential for contaminating the surface water from vehicle fluids or introducing aquatic nuisance species.

Some crossings may require adherence to special conditions associated with CWA 401 certification or CWA 404 permits. State and local entities may also provide guidance and regulations such as a Forest Practices Act or a Stream Alteration Act.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

All Crossings

- Plan and locate surface water crossings to limit the number and extent to those that are necessary to provide the level of access needed to meet resource management objectives as described in the RMOs.

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.
- Use crossing structures suitable for the site conditions and the RMOs.
- Design and locate crossings to minimize disturbance to the waterbody.
- Use suitable measures to locate, construct, and decommission or stabilize bypass roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Use suitable surface drainage and roadway stabilization measures to disconnect the road from the waterbody to avoid or minimize water and sediment from being channeled into surface waters and to dissipate concentrated flows.
- Use suitable measures to avoid, minimize, or mitigate damage to the waterbody and banks when transporting materials across the waterbody or AMZ during construction activities.

Stream Crossings

- Locate stream crossings where the channel is narrow, straight, and uniform, and has stable soils and relatively flat terrain to the extent practicable.
  - Select a site where erosion potential is low.
  - Orient the stream crossing perpendicular to the channel to the extent practicable.
  - Keep approaches to stream crossings to as gentle a slope as practicable.
  - Consider natural channel adjustments and possible channel location changes over the design life of the structure.
- Design the crossing to pass a normal range of flows for the site.
  - Design the crossing structure to have sufficient capacity to convey the design flow without appreciably altering streamflow characteristics.
  - Install stream crossings to sustain bankfull dimensions of width, depth, and slope and maintain streambed and bank resiliency and continuity through the structure.
- Bridge, culvert, or otherwise design road fill to prevent restriction of flood flows.
  - Use site conditions and local requirements to determine design flood flows.
  - Use suitable measures to protect fill from erosion and to avoid or minimize failure of the crossing at flood flows.
  - Use suitable measures to provide floodplain connectivity to the extent practicable.
- Use suitable measures to avoid or minimize scour and erosion of the channel, crossing structure, and foundation to maintain the stability of the channel and banks.
- Design and construct the stream crossing to maintain the desired migration or other movement of fish and other aquatic life inhabiting the waterbody.
  - Consider the use of bottomless arch culverts where appropriate to allow for natural channel migration and desired aquatic organism passage.
  - Install or maintain fish migration barriers only where needed to protect endangered, threatened, sensitive, or unique native aquatic populations, and only where natural barriers do not exist.
  - Use stream simulation techniques where practicable to aid in crossing design.

- Bridges
    - ❑ Use an adequately long bridge span to avoid constricting the natural active flow channel and minimize constriction of any overflow channel.
    - ❑ Place foundations onto nonscour-susceptible material (e.g., bedrock or coarse rock material) or below the expected maximum depth of scour.
    - ❑ Set bridge abutments or footings into firm natural ground (e.g., not fill material or loose soil) when placed on natural slopes.
    - ❑ Use suitable measures as needed in steep, deep drainages to retain approach fills or use a relatively long bridge span.
    - ❑ Avoid placing abutments in the active stream channel to the extent practicable.
    - ❑ Place in-channel abutments in a direction parallel to the streamflow where necessary.
    - ❑ Use suitable measures to avoid or minimize, to the extent practicable, damage to the bridge and associated road from expected flood flows, floating debris, and bedload.
    - ❑ Inspect the bridge at regular intervals and perform maintenance as needed to maintain the function of the structure.
- Culverts
    - ❑ Align the culvert with the natural stream channel.
    - ❑ Cover culvert with sufficient fill to avoid or minimize damage by traffic.
    - ❑ Construct at or near natural elevation of the streambed to avoid or minimize potential flooding upstream of the crossing and erosion below the outlet.
    - ❑ Install culverts long enough to extend beyond the toe of the fill slopes to minimize erosion.
    - ❑ Use suitable measures to avoid or minimize water from seeping around the culvert.
    - ❑ Use suitable measures to avoid or minimize culvert plugging from transported bedload and debris.
    - ❑ Regularly inspect culverts and clean as necessary.
- Low-Water Crossings
    - ❑ Consider low-water crossings on roads with low traffic volume and slow speeds, and where water depth is safe for vehicle travel.
    - ❑ Consider low-water crossings to cross ephemeral streams, streams with relatively low baseflow and shallow water depth or streams with highly variable flows or in areas prone to landslides or debris flows.
    - ❑ Locate low-water crossings where streambanks are low with gentle slopes and channels are not deeply incised.
    - ❑ Select and design low-water crossing structures to maintain the function and bedload movement of the natural stream channel.
    - ❑ Locate unimproved fords in stable reaches with a firm rock or gravel base that has sufficient load-bearing strength for the expected vehicle traffic.
    - ❑ Construct the low-water crossing to conform to the site, channel shape, and original streambed elevation and to minimize flow restriction, site disturbance, and channel blockage to the extent practicable.
    - ❑ Use suitable measures to stabilize or harden the streambed and approaches, including the entire bankfull width and sufficient freeboard, where necessary to support the design vehicle traffic.

- Use vented fords with high vent area ratio to maintain stream function and aquatic organism passage.
- Construct the roadway-driving surface with material suitable to resist expected shear stress or lateral forces of water flow at the site.
- Consider using temporary crossings on roads that provide short-term or intermittent access to avoid, minimize, or mitigate erosion, damage to streambed or channel, and flooding.
- Design and install temporary crossings suitable for the expected users, loads, and timing of use.
- Design and install temporary crossing structures to pass a design storm determined based on local site conditions and requirements.
- Install and remove temporary crossing structures in a timely manner as needed to provide access during use periods and minimize risk of washout.
- Use suitable measures to stabilize temporary crossings that must remain in place during high runoff seasons.
- Monitor temporary crossings regularly while installed to evaluate condition.
- Remove temporary crossings and restore the waterbody profile and substrate when the need for the crossing no longer exists.

Standing Water and Wetland Crossings

- Disturb the least amount of area as practicable when crossing a standing waterbody.
- Provide for sufficient cross drainage to minimize changes to, and avoid restricting, natural surface and subsurface water flow of the wetland under the road to the extent practicable.
  - Locate and design roads or road drainage to avoid dewatering or polluting wetlands.
  - Avoid or minimize actions that would significantly alter the natural drainage for flow patterns on lands immediately adjacent to wetlands.
- Use suitable measures to increase soil-bearing capacity and reduce rutting from expected vehicle traffic.
- Construct fill roads only when necessary.
  - Construct fill roads parallel to water flow and to be as low to natural ground level as practicable.
  - Construct roads with sufficient surface drainage for surface water flows.

Road-8. Snow Removal and Storage

Manual or Handbook Reference FS-7700-41 and FSH 7709.59, chapter 24.11.

Objective Avoid or minimize erosion, sedimentation, and chemical pollution that may result from snow removal and storage activities.

Explanation Snow removal from roads and parking areas may adversely affect water quality and riparian resources in several ways. Plowing may physically displace native or engineered surfaces on roads, damage drainage structures, or alter drainage patterns. Plowing may also remove protective soil cover (e.g., vegetation or mulch). These changes can result in concentrated flow, increased erosion, and greater risk of sediment delivery to waterbodies.

Snow piled in large mounds or berms, or in sensitive areas, may contribute to increased run-off, hill slope erosion, mass slope instability, and in-channel erosion from snowmelt. Snow stored in riparian areas and floodplains may compact soils, break or stunt vegetation, or channel runoff in undesirable patterns, thereby weakening the buffering capacity of these areas. Additionally, both snow removal and storage may result in additions of salts or fine aggregates used for de-icing or traction control and other vehicle pollutants directly to surface water and indirectly to both surface water and groundwater during runoff.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Develop a snow removal plan for roads plowed for recreation, administrative, or other access to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Use existing standard contract language (C5.316# or similar) for snow removal during winter logging operations to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
- Limit use of approved deicing and traction control materials to areas where safety is critical (e.g., intersections, steep segments, and corners).
    - Use site-specific characteristics such as road width and design, traffic concentration, and proximity to surface waters to determine suitable amount of de-icing material to apply.
    - Use effective plowing techniques to optimize chemical de-icer use.
    - Consider use of alternative materials to chemical de-icers, such as sand or gravel, in sensitive areas.
    - Use properly calibrated controllers to ensure material application rates are accurately regulated.
    - Limit spray distribution of chemical de-icers when near surface waters.
    - Design paved roads and parking lots to facilitate sand removal (e.g., curbs or paved ditches).
- Use suitable measures when storing de-icing materials to avoid or minimize mobility of the materials.
    - Store de-icing materials on a flat, upland, impervious area of adequate size to accommodate material stockpiles and equipment movement.
    - Stockpile de-icing materials under cover and provide runoff collection, containment, and treatment, as necessary, to avoid or minimize offsite movement.
- Move snow in a manner that will avoid or minimize disturbance of or damage to road surfaces and drainage structures.
    - Mark drainage structures to avoid damage during plowing.
    - Conduct frequent inspections to ensure road drainage is not adversely affecting soil or water resources.
- Control areas where snow removal equipment can operate to avoid or minimize damage to riparian areas, floodplains, and stream channels.
- Install snow berms where such placement will preclude concentration of snowmelt runoff and will serve to dissipate melt water.
    - Provide frequent drainage through snow berms to avoid concentration of snowmelt runoff on fillslopes and other erosive areas, to dissipate melt water, and to avoid or minimize sediment delivery to waterbodies.

- Store snow in clearly delineated pre-approved areas where snowmelt runoff will not cause erosion or deliver snow, road de-icers, or traction-enhancing materials directly into surface waters.
  - Store or dispose of snow adjacent to or on pervious surfaces in upland areas away from waterbodies to the extent practicable.
  - Do not store or dispose of snow in riparian areas, wetlands, or streams unless no other practicable alternative exists.
- Manage discharge of meltwater to avoid or minimize runoff of pollutants into surface waterbodies or groundwater.
  - Use suitable measures to filter and treat meltwater before reaching surface water or groundwater.
  - Use suitable measures to disperse meltwater to avoid creating concentrated overland flow.
  - Collect and properly dispose of onsite litter, debris, and sediment from meltwater settling areas.
- Discontinue road use and snow removal when use would likely damage the roadway surface or road drainage features.
  - Modify snow removal procedures as necessary to meet water quality concerns.
- Replace lost road surface materials with similar quality material and repair structures damaged in snow removal operations as soon as practicable.

Road-9. Parking and Staging Areas

Manual or Handbook Reference FSM 7710, FSM 7720, and FSM 7730.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing and maintaining parking and staging areas.

Explanation Parking and staging areas on NFS lands may be permanent or temporary and are associated with a variety of uses including administrative buildings, developed recreation sites, trailheads, and forest management projects. These parking facilities sometimes constitute large areas with little or no infiltration capacity. Runoff from these areas can create rills or gullies and carry sediment, nutrients, and other pollutants to nearby surface waters.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Design and locate parking and staging areas of appropriate size and configuration to accommodate expected vehicles and avoid or minimize adverse effects to adjacent soil, water quality, and riparian resources.
  - Consider the number and type of vehicles to determine parking or staging area size.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) for stormwater management and erosion control when designing, constructing, reconstructing, or maintaining parking or staging areas.
- Use suitable measures to harden and avoid or minimize damage to parking area surfaces that experience heavy use or are used during wet periods.

- Use and maintain suitable measures to collect and contain oil and grease in larger parking lots with high use and where drainage discharges directly to streams.
- Connect drainage system to existing stormwater conveyance systems where available and practicable.
- Conduct maintenance activities commensurate with parking or staging area surfacing and drainage requirements as well as precipitation timing, intensity, and duration.
- Limit the size and extent of temporary parking or staging areas.
  - Take advantage of existing openings, sites away from waterbodies, and areas that are apt to be more easily restored to the extent practicable.
  - Use temporary stormwater and erosion control measures as needed.
  - Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to rehabilitate temporary parking or staging areas as soon as practicable following use.

Road-10. Equipment Refueling and Servicing

Manual or Handbook Reference FSM 2160 and FSH 7109.19, chapter 40.

Objective Avoid or minimize adverse effects to soil, water quality, and riparian resources from fuels, lubricants, cleaners, and other harmful materials discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources during equipment refueling and servicing activities.

Explanation Many activities require the use and maintenance of petroleum-powered equipment in the field. For example, mechanical vegetation management activities may employ equipment that uses or contains gasoline, diesel, oil, grease, hydraulic fluids, antifreeze, coolants, cleaning agents, and pesticides. These petroleum and chemical products may pose a risk to contaminating soils, surface water, and groundwaters during refueling and servicing the equipment. BMP Fac-6 (Hazardous Materials) provides additional guidance for handling hazardous materials.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Plan for suitable equipment refueling and servicing sites during project design.
  - Allow temporary refueling and servicing only at approved locations, located well away from the AMZ, groundwater recharge areas, and waterbodies.
- Develop or use existing fuel and chemical management plans (e.g., Spill Prevention Control and Countermeasures [SPCC], spill response plan, and emergency response plan) when developing the management prescription for refueling and servicing sites.
- Locate, design, construct, and maintain petroleum and chemical delivery and storage facilities consistent with applicable local, State, and Federal regulations.
- Use suitable measures around vehicle service, storage and refueling areas, chemical storage and use areas, and waste dumps to fully contain spills and avoid or minimize soil contamination and seepage to groundwater.
- Provide training for all agency personnel handling fuels and chemicals in their proper use, handling, storage, and disposal.

- Ensure that contractors and permit holders provide documentation of proper training in handling hazardous materials.

- Use suitable measures to avoid spilling fuels, lubricants, cleaners, and other chemicals during handling and transporting.
- Prohibit excess chemicals or wastes from being stored or accumulated in the project area.
- Remove service residues, used oil, and other hazardous or undesirable materials from NFS land and properly dispose them as needed during and after completion of the project.
- Clean up and dispose of spilled materials according to specified requirements in the appropriate guiding document.
- Report spills and initiate suitable cleanup action in accordance with applicable State and Federal laws, rules, and regulations.
    - Remove contaminated soil and other material from NFS lands and dispose of this material in a manner consistent with controlling regulations.
- Prepare and implement a certified SPCC Plan for each facility, including mobile and portable facilities, as required by Federal regulations.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim equipment refueling and services site when the need for them ends.

Road-11. Road Storm-Damage Surveys

Manual or Handbook Reference FSM 7730 and FSM 2350.

Objective Monitor road conditions following storm events to detect road failures; assess damage or potential damage to waterbodies, riparian resources, and watershed functions; determine the causes of the failures; and identify potential remedial actions at the damaged sites and preventative actions at similar sites.

Explanation Large storms stress road systems in multiple ways: large volumes of water are transported on road surfaces and through its drainage systems; significant volumes of water and debris are transported through stream crossings; and elevated pore pressures on unstable hillslopes, road cutslopes, and fillslopes sometimes generate mass failures. All road drainage systems, stream crossings with culverts, and unstable slopes have the potential to fail during periods of high runoff. The probabilities of failure differ greatly, and the potential consequences to water quality and designated uses vary dramatically from no impacts to severe and long-term impacts to aquatic systems.

Surveying roads during or soon after storms is critical to timely detection of these problems. Observation of problems caused by storm runoff is of great value in understanding both the causes of failure and in adapting designs and prescriptions that reduce both the probability and consequences of future road failures. Over time, this kind of monitoring illustrates how and where roads can fail and points readily to practice modifications that can reduce adverse effects to water quality and watershed function.

The Emergency Relief for Federally Owned Roads (ERFO) Program is intended to help assess and fund the unusually heavy expenses associated with repairing and reconstructing Federal roads and bridges seriously damaged by a natural disaster over a wide area or catastrophic failure. To qualify for this type of funding, applications for repair must be submitted to the Federal Highways Administration through the ERFO program (FSM 7700).

Practices

ERFO-Related Damage Surveys

- Complete a Damage Survey Report (DSR) at damaged sites potentially eligible for ERFO funds.
- Complete the Forest Service-developed supplemental form DSR+ in the field to more thoroughly describe, in categorical terms, the cause(s) and consequences of the damage.
  - The DSR+ form and instructions may be found at http://www.stream.fs.fed.us/bmp/damagesurveys.
- Record the following information from damage sites that have been documented on the DSR and DSR+ forms in appropriate corporate database(s), including geographic information systems:
  - The geographic locations (points or road segments) where damage occurred.
  - The date of occurrence (year and month, if available).
  - The type of failure and its cause.

Special Storm Damage Surveys

- Determine the need to do more comprehensive surveys and analysis of road damage after particularly large storm events.
  - Survey all roads in the area, typically an entire watershed, ranger district, or national forest or grassland, affected by the storm or those roads that may be particularly susceptible to failure.

All Damage Surveys

- Analyze results from EFRO surveys, routine damage reconnaissance, and special surveys for patterns of damage and causes.
- Use these patterns of road damage to formulate recommendations of practice changes to reduce the incidence of future damage. Consider practice changes such as—
  - Locating or relocating roads to more stable terrain (see BMP Road-2 [Road Location and Design]);
  - Disconnecting road surface drainage from crossings and channels (see BMP Road-3 [Road Construction and Reconstruction]);
  - Using special protections in locations on unstable landforms or areas with high erosion potential (see BMP Road-3 [Road Construction and Reconstruction]);
  - Increasing the capacity of stream-crossing structures to pass water, debris, and sediment to reduce the probabilities of failure (see BMP Road-7 [Stream Crossings]);
  - Building or rebuilding stream crossings to eliminate or reduce diversion potential (see BMP Road-7 [Stream Crossings]);
  - Building or rebuilding stream crossings to improve aquatic species passage (see BMP Road-7 [Stream Crossings]); or
  - Decommissioning or storing roads in a hydrologically benign condition (see BMP Road-6 [Road Storage and Decommissioning]).
- Enter and store the results of data analysis in corporate data management systems to facilitate sharing among units that have similar terrain and road practices.

Resources for Road Management Activities

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State Forestry BMP Documents

See Appendix B.

Mechanical Vegetation Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from mechanical treatments to manage vegetation. Mechanical treatments are used to manage vegetation for a variety of purposes including timber harvest, site preparation, vegetation type conversion, fire or fuels treatment, forest health and rangeland improvement, and wildlife habitat improvement. Authorizing documents for mechanical treatments are timber sale contracts, stewardship contracts, or project plans.

Eight National Core BMPs are in the Mechanical Vegetation Management Activities category. These BMPs are to be used in all mechanical vegetation management projects on National Forest System (NFS) lands. BMP Veg-1 (Vegetation Management Planning) is a planning BMP for vegetation management projects. BMP Veg-2 (Erosion Prevention and Control) provides direction for erosion control measures for mechanical vegetation treatment projects. BMP Veg-3 (Aquatic Management Zones) provides direction for mechanical vegetation treatments in the areas adjacent to waterbodies. BMP Veg-4 (Ground-Based Skidding and Yarding Operations) and BMP Veg-5 (Cable and Aerial Yarding Operations) provide direction for yarding activities in timber management projects. BMP Veg-6 (Landings) provides direction for construction and use of landings. BMP Veg-7 (Winter Logging) provides additional direction for skidding and yarding operations in winter. BMP Veg-8 (Mechanical Site Treatment) provides practices for other mechanical vegetation treatments for site preparation, fuel treatment, and habitat improvements.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Mechanical Vegetation Management BMPs	
Veg-1	Vegetation Management Planning
Veg-2	Erosion Prevention and Control
Veg-3	Aquatic Management Zones
Veg-4	Ground-Based Skidding and Yarding Operations
Veg-5	Cable and Aerial Yarding Operations
Veg-6	Landings
Veg-7	Winter Logging
Veg-8	Mechanical Site Treatment

Veg-1. Vegetation Management Planning

Manual or Handbook Reference Forest Service Manual (FSM) 1921.12.

Objective Use the applicable vegetation management planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during mechanical vegetation treatment activities.

Explanation Vegetation on NFS lands is managed for a variety of purposes to achieve land management plan desired conditions, goals, and objectives for many resources. Planning for vegetation management generally follows a sequence of steps. The gathering and assessment of data involves evaluating the current condition of the vegetation compared to land management plan desired conditions, goals, and objectives. Potential vegetation treatment options to move the site towards desired conditions are developed and compared. Detailed treatment prescriptions are prepared to implement the preferred treatment option. The project is subjected to the National Environmental Policy Act (NEPA) analysis process where alternatives are developed and effects are analyzed. A decision is made and implemented. During the development of vegetation treatment prescriptions and alternatives, site specific measures consistent with BMP guidance to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resource are identified and included in the project as design criteria or mitigation measures. These BMP prescriptions are incorporated into the timber sale contract, stewardship contract, or project plan.

Vegetation management for scheduled timber harvest on NFS lands has additional specific requirements from the National Forest Management Act that are incorporated into the project in the planning process. Scheduled timber harvest can occur only where watershed conditions will be maintained, lands can be adequately restocked within 5 years after final regeneration harvest, and water quality will be protected.

Practices

Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone (AMZ) Planning) when planning vegetation management projects.
  - ❑ Evaluate opportunities to use proposed mechanical vegetation treatment projects to achieve AMZ desired conditions, goals, and objectives in the project area.
- Evaluate and field verify site conditions in the project area to design mechanical vegetation treatment prescriptions that avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - ❑ Validate land management plan timber suitability decisions for the project area.
  - ❑ Design mechanical vegetation treatment prescriptions to limit site disturbance, soil exposure, and displacement to acceptable levels as determined from the land management plan desired conditions, standards, and guidelines or other local direction or requirements.
  - ❑ Evaluate direct, indirect, and cumulative effects of vegetation alteration on streamflow regimes and consequent channel responses at suitable watershed scales.
  - ❑ Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for ground-based, cable, and aerial yarding systems (see BMP Veg-4 [Ground-Based Skidding and Yarding Operations] and BMP Veg-5 [Cable and Aerial Yarding Operations]).
  - ❑ Use the most economically practicable yarding system that will minimize road densities.
  - ❑ Consider site preparation and fuel treatment needs and options.
  - ❑ Use applicable practices of BMP Veg-8 (Mechanical Site Treatment) to determine areas suitable for mechanical treatments for site preparation, fuels treatment, habitat improvements, or other vegetation management purposes.
  - ❑ Evaluate the capabilities of the machinery likely to operate in the landscape under consideration.
  - ❑ Use preplanning to schedule entry or timing of mechanical and other vegetation treatments (e.g., prescribed fire or chemical treatments) when needed for large projects.

- Evaluate and field verify site conditions in the project area to design a transportation plan associated with the mechanical vegetation treatments to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - Use the logging system that best fits the topography, soil types, and season, while minimizing soil disturbance and road densities and that economically achieves silvicultural objectives.
    - Use applicable practices of BMP Road-2 (Road Location and Design), BMP Veg-4 (Ground-Based Skidding and Yarding Operations), BMP Veg-5 (Cable and Aerial Yarding Operations), and BMP Veg-6 (Landings) to determine proposed location and size of roads, landings, skid trails, and cable corridors.
    - Use applicable practices of BMP Road-1 (Travel Management Planning and Analysis) and BMP Road-5 (Temporary Roads) to determine the need for specified roads and temporary roads.
    - Evaluate the condition of system roads, including roads in storage, and unauthorized roads in the project area to determine their suitability for use in the project and any reconstruction or prehaul maintenance needs.
    - Evaluate the Road Management Objective of system roads to determine where log hauling should be prohibited or restricted.
- Identify sources of rock for roadwork, riprapping, and borrow materials (see BMP Min-6 [Mineral Materials Resource Sites]).
- Identify water sources available for purchasers' use (see BMP WatUses-3 [Administrative Water Developments]).
- Ensure the timber sale contract, stewardship contract, or other implementing document includes BMPs from the decision document to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - Use appropriate standard B and C provisions and regional or local provisions to address measures and responsibilities consistent with the BMPs in the decision document in the timber sale or stewardship contract.
    - Delineate all protected or excluded areas, including AMZs and waterbodies, on the sale area map or project map.
    - Delineate approved water locations, staging areas, and borrow areas on the sale area map or project map.
    - Ensure that the final unit location, layout, acreage, and logging system or mechanical treatment and Knutson-Vandenberg Act plans are consistent with the decision document.
- Use contract modification procedures to the extent practicable to modify unit design, treatment methods, or other project activities where necessary to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources based on new information or changed conditions discovered during project implementation.

Veg-2. Erosion Prevention and Control

Manual or Handbook Reference Forest Service Handbook (FSH) 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.

Explanation Prevention and control of erosion on areas undergoing mechanical vegetation treatments is critical to maintaining water quality. The process of erosion control has three basic phases: planning, implementation, and monitoring. During planning, areas subject to excessive erosion, detrimental soil damage and mass failure can be identified and avoided. Also during planning, treatments can be designed and units laid out to minimize or mitigate damage to soils, streambanks, shorelines, wetlands, riparian areas, and water quality. Planning for erosion control is addressed in BMP Plan-2 (Project Planning and Analysis) and BMP Veg-1 (Vegetation Management Planning). Suitable erosion control measures are implemented while the mechanical vegetation treatment is ongoing and following project completion. Inspection and maintenance of implemented measures will ensure their function and effectiveness over their expected design period.

The potential for accelerated erosion or other soil damage during or following mechanical treatments depends on climate, soil type, site conditions, and type of equipment and techniques used at the site. Erosion control measures are grouped into two general categories: structural measures to control and treat runoff and increase infiltration and nonstructural measures to increase ground cover. Many erosion control handbooks, technical guides, and commercial products are available. Both structural and nonstructural measures require onsite expertise to ensure proper design and implementation to conform to local site characteristics.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Establish designated areas for equipment staging and parking to minimize the area of ground disturbance (see BMP Road-9 [Parking Sites and Staging Areas]).
- Use provisions in the timber sale contract or land stewardship contract to implement and enforce erosion control on the project area.
    - Work with the contractor to locate landings, skid trails, and slash piles in suitable sites to avoid, minimize, or mitigate potential for erosion and sediment delivery to nearby waterbodies.
- Develop an erosion control and sediment plan that covers all disturbed areas including skid trails and roads, landings, cable corridors, temporary road fills, water source sites, borrow sites, or other areas disturbed during mechanical vegetation treatments.
- Refer to State or local forestry or silviculture BMP manuals, guidebooks, and trade publications for effective structural and nonstructural measures to—
    - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion before the next growing season.
    - Maintain the natural drainage pattern of the area wherever practicable.
    - Control, collect, detain, treat, and disperse stormwater runoff from disturbed areas.
    - Divert surface runoff around bare areas with appropriate energy dissipation and sediment filters.
    - Stabilize steep excavated slopes.

- Use suitable species and establishment techniques to cover or revegetate disturbed areas in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Use suitable measures in compliance with local direction to prevent and control invasive species.
- Install sediment and stormwater controls before initiating surface-disturbing activities to the extent practicable.
- Operate equipment when soil compaction, displacement, erosion, and sediment runoff would be minimized.
    - Avoid ground equipment operations on unstable, wet, or easily compacted soils and on steep slopes unless operation can be conducted without causing excessive rutting, soil puddling, or runoff of sediments directly into waterbodies.
    - Evaluate site conditions frequently to assess changing conditions.
    - Adjust equipment operations as necessary to protect the site while maintaining efficient project operations.
- Install suitable stormwater and erosion control measures to stabilize disturbed areas and waterways on incomplete projects before seasonal shutdown of operations or when severe storm or cumulative precipitation events that could result in sediment mobilization to waterbodies are expected.
- Routinely inspect disturbed areas to verify that erosion and stormwater controls are implemented and functioning as designed and are suitably maintained.
- Maintain erosion and stormwater controls as necessary to ensure proper and effective functioning.
    - Prepare for unexpected failures of erosion control measures.
- Implement mechanical treatments on the contour of sloping ground to avoid or minimize water concentration and subsequent accelerated erosion.

Veg-3. Aquatic Management Zones

Manual or Handbook Reference FSM 2526, FSM 2527.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting mechanical vegetation treatment activities in the AMZ.

Explanation Designation of an AMZ around and adjacent to waterbodies is a typical BMP to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. Mechanical vegetation treatments are a tool that can be used within the AMZ to achieve a variety of resource-desired conditions and objectives when implemented with suitable measures to maintain riparian and aquatic ecosystem structure, function, and processes. Depending on site conditions and resource-desired conditions and objectives, mechanical vegetation treatments in the AMZ could range from no activity or equipment exclusion to purposely using mechanical equipment to create desired disturbances or conditions. When treatments are to be used in the AMZ, a variety of measures can be employed to avoid, minimize, or mitigate soil disturbance, damage to the waterbody, loss of large woody debris recruitment, and shading, and impacts to floodplain function.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-3 (AMZ Planning) to determine the need for and width of the AMZ considering the proposed mechanical vegetation treatments.
  - Modify AMZ width as needed to provide assurance of leave-tree wind firmness where high windthrow risk is identified.
- Clearly delineate AMZ locations and boundaries in the project area using suitable markings and structures.
  - Maintain or reestablish these boundaries as necessary during project implementation or operation.
  - Specify AMZ layout, maintenance, and operating requirements in contracts, design plans, and other necessary project documentation.
- Use mechanical vegetation treatments in the AMZ only when suitable to achieve long-term AMZ-desired conditions and management objectives (see BMP Plan-3 [AMZ Planning]).
- Modify mechanical vegetation treatment prescriptions and operations in the AMZs as needed to maintain ecosystem structure, function, and processes.
  - Design silvicultural or other vegetation management prescriptions to maintain or improve the riparian ecosystem and adjacent waterbody.
  - Use yarding systems or mechanical treatments that avoid or minimize disturbance to the ground and vegetation consistent with project objectives.
  - Conduct equipment operations in a manner that maintains or provides sufficient ground cover to meet land management plan desired conditions, goals, and objectives to minimize erosion and trap sediment.
  - Use suitable measures to avoid or minimize soil disturbance from equipment operations to stay within acceptable disturbance levels when conducting mechanical vegetation treatment operations.
  - Prescribe mechanical site preparation techniques and fuels and residual vegetation treatments that avoid or minimize excessive erosion, sediment delivery to nearby waterbodies, or damage to desired riparian vegetation.
  - Conduct operations in a manner that avoids or minimizes introduction of excess slash or other vegetative debris into the AMZ and waterbodies; damage to streambanks, shorelines, and edges of wetlands; and adverse effects to floodplain functioning.
  - Retain trees as necessary for canopy cover and shading, bank stabilization, and as a source of large woody debris within the AMZ.
  - Avoid felling trees into streams or waterbodies, except as planned to create habitat features.
- Locate transportation facilities for mechanical vegetation treatments, including roads, landings, and main skid trails, outside of the AMZ to the extent practicable.
  - Minimize the number of stream crossings to the extent practicable.
  - Evaluate options for routes that must cross waterbodies and choose the one (e.g., specified road vs. temporary road vs. skid road or trail) that avoids or minimizes adverse effects to soil, water quality, and riparian resources to the greatest extent practicable.
  - Do not use drainage bottoms as turn-around areas for equipment during mechanical vegetation treatments.
- Use suitable measures to disperse concentrated flows of water from road surface drainage features to avoid or minimize surface erosion, gully formation, and mass failure in the AMZ and sediment transport to the waterbody.

- Monitor the AMZ during mechanical operations to evaluate compliance with prescription and mitigation requirements in the authorizing document.
  - Adjust operations in the AMZ to avoid, minimize, or mitigate detrimental soil impacts where they are occurring.
  - Use suitable mitigation or restoration measures on areas in the AMZ that show signs of unacceptable erosion or those with high potential for erosion due to mechanical operations in the AMZ.
  - Remove unauthorized debris from waterbodies using techniques that will limit disturbance to bed and banks, riparian areas, aquatic-dependent species, and the waterbody unless significant damage would occur during its removal or leaving it in meets desired conditions for the waterbody.

Veg-4. Ground-Based Skidding and Yarding Operations

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during ground-based skidding and yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Explanation Ground-based yarding systems include an array of equipment from horses, rubber-tired skidders, and bulldozers, to feller or bunchers, forwarders, and harvesters. Each method can compact soil and cause soil disturbance, though the amount of impact depends on the specific type of equipment used, the operator, unit design, and site conditions. Ground-based yarding systems can be designed and implemented to avoid, minimize, or mitigate potential adverse effects to soils, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use ground-based yarding systems only where physical site characteristics are suitable to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
  - Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for ground-based yarding systems.
- Use existing roads and skid trail networks to the extent practicable.
  - Create new roads and skid trail where re-use of existing ones would exacerbate soil, water quality, and riparian resource impacts.
- Design and locate skid trails and skidding operations to minimize soil disturbance to the extent practicable.
  - Designate skid trails to the extent practicable to limit site disturbance.
  - Locate skid trails outside of the AMZ to the extent practicable.
  - Locate skid trails to avoid concentrating runoff and provide breaks in grade.
  - Limit the grade of constructed skid trails on geologically unstable, saturated, highly erodible, or easily compacted soils.
  - Avoid long runs on steep slopes.

- Use suitable measures during felling and skidding operations to avoid or minimize disturbance to soils and waterbodies to the extent practicable.
  - Perform skidding or yarding operations when soil conditions are such that soil compaction, displacement, and erosion would be minimized.
  - Suspend skidding or yarding operations when soil moisture levels could result in unacceptable soil damage.
  - Avoid skidding logs in or adjacent to a stream channel or other waterbody to the extent practicable.
  - Skid across streams only at designated locations.
  - Use suitable measures at skid trail crossings to avoid or minimize damage to the stream channel and streambanks.
  - Directionally fell trees to facilitate efficient removal along predetermined yarding patterns with the least number of passes and least amount of disturbed area (e.g., felling-to-the-lead).
  - Directionally fell trees away from streambanks, shorelines, and other waterbody edges.
  - Remove logs from wet meadows or AMZs using suitable techniques to minimize equipment operations in the sensitive area and minimize dragging the logs on the ground.
  - Winch or skid logs upslope, away from waterbodies.
  - Use low ground pressure equipment when practicable, particularly on equipment traveling over large portions of units with sensitive soils or site conditions.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion to the extent practicable.
- Use suitable measures to stabilize and restore skid trails after use.
  - Reshape the surface to promote dispersed drainage.
  - Install suitable drainage features.
  - Mitigate soil compaction to improve infiltration and revegetation conditions.
  - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion before the next growing season.
  - Use suitable measures to promote rapid revegetation.
  - Use suitable measures in compliance with local direction to prevent and control invasive species.

Veg-5. Cable and Aerial Yarding Operations

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during cable and aerial yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Explanation Cable and aerial yarding systems partially or fully suspend logs off the ground when yarding logs to the landing. They include skyline cable, helicopter, and balloon systems that typically are used in steep, erodible, and unstable areas where ground-based systems should not operate. Soil disturbance and erosion risks from these systems are primarily confined to cable corridors and landings.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use cable or aerial yarding systems on steep slopes where ground-based equipment cannot operate without causing unacceptable ground disturbance.
  - Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for cable or aerial yarding systems.
  - Consider slope shape, potential barriers, lift and deflection requirements, and availability of suitable landing locations when selecting cable-yarding systems.
- Identify areas requiring cable or aerial yarding during project planning and in the contract.
- Identify necessary equipment capabilities in the contract.
- Locate cable corridors to efficiently yard materials with the least soil damage.
  - Use suitable measures to minimize soil disturbance when yarding over breaks in slope.
- Fully suspend logs to the extent practicable when yarding over AMZs and streams.
- Postpone yarding operations when soil moisture levels are high if the specific type of yarding system results in unacceptable soil disturbance and erosion within cable corridors.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion in cable corridors to the extent practicable.

Veg-6. Landings

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of log landings.

Explanation Log landings, in general, are the site of intense activity, serving as the endpoint of yarding operations, the setup location of large equipment (such as skyline yarders), loading areas for log trucks, and fueling and maintenance locations for heavy equipment. To accommodate all this activity, landings tend to be large, and their soils generally become compacted, rutted, and disturbed much more than the rest of the project area. Thus, landings have a high probability of being a source of concentrated overland flow containing sediment and other pollutants.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Minimize the size and number of landings as practicable to accommodate safe, economical, and efficient operations.
- Locate landings to limit the potential for pollutant delivery to waterbodies.
  - Locate landings outside the AMZ and as far from waterbodies as reasonably practicable based on travel routes and environmental considerations.
  - Avoid locating landings near any type of likely flow or sediment transport conduit during storms, such as ephemeral channels and swales, where practicable.
  - Locate landings to minimize the number of required skid roads.

- Avoid locating landings on steep slopes or highly erodible soils.
- Avoid placing landings where skidding across drainage bottoms is required.

- Design roads and trail approaches to minimize overland flow entering the landing.
- Re-use existing landings where their location is compatible with management objectives and water quality protection.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion as needed during construction and use of log landings.
  - Install and maintain suitable temporary erosion control and stabilization measures when the landing will be reused within the same year.
- Use applicable practices of BMP Fac-6 (Hazardous Materials) and BMP Road-10 (Equipment Refueling and Servicing) when managing fuels, chemicals, or other hazardous materials on the landing.
- Use suitable measures as needed to restore and stabilize landings after use.
  - Remove all logging machinery refuse (e.g., tires, chains, chokers, cable, and miscellaneous discarded parts) and contaminated soil to a proper disposal site.
  - Reshape the surface to promote dispersed drainage.
  - Install suitable drainage features.
  - Mitigate soil compaction to improve infiltration and revegetation conditions.
  - Apply soil protective cover on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion before the next growing season.
  - Use suitable measures to promote rapid revegetation.
  - Use suitable species and establishment techniques to cover or revegetate disturbed areas in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Veg-7. Winter Logging

Manual or Handbook Reference FSH 2409.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from winter logging activities.

Explanation Winter logging on frozen or snow-covered ground is a common BMP in the colder regions of the country to avoid or minimize soil, watershed, riparian, and wetland impacts. Winter logging is not without risks of watershed effects. Unknowingly operating in wetland or riparian areas when the snow cover is inadequate can cause damage to soil and vegetation. Skidding or hauling on roads when the roadbed or the soil is not sufficiently frozen can cause soil compaction and rutting. Inadequate installation and maintenance of erosion controls before snowmelt and spring runoff can cause accelerated erosion and damage to roads.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Consider using snow-roads and winter harvesting in areas with high-water tables, sensitive riparian conditions, or other potentially significant soil erosion and compaction hazards.
    - Use snow roads for single-entry harvests or temporary roads.
- Mark existing culvert locations before plowing, hauling, or yarding operations begin to avoid or minimize damage from plowing or logging machinery.
- Ensure all culverts and ditches are open and functional during and after logging operations.
- Plow any snow cover off roadways to facilitate deep-freezing of the road grade before hauling.
    - Manage hauling to avoid or minimize unacceptable damage to the road surface.
- Use suitable measures to cross streams (see BMP Road-7 [Stream Crossings]).
    - Restore crossings to near preroad conditions to avoid or minimize ice dams when use of the snow-road is no longer needed.
- Conduct winter logging operations when the ground is frozen or snow cover and depth is adequate to avoid or minimize unacceptable rutting or displacement of soil.
- Suspend winter operations if ground and snow conditions change such that unacceptable soil disturbance, compaction, displacement, or erosion becomes likely.
- Compact the snow on skid trail locations when adequate snow depths exist before felling or skidding trees.
- Avoid locating skid trails on steep areas where frozen skid trails may be subject to soil erosion the next spring.
- Mark AMZ boundaries and stream courses before the first snow in a manner that will be clearly visible in heavy snows.
- Avoid leaving slash in streams or AMZs to the extent practicable.
- Install and maintain suitable erosion control on skid trails before spring runoff (see BMP Veg-2 [Erosion Prevention and Control]).
    - Install erosion control measures during the dry season if needed.

Veg-8. Mechanical Site Treatment

Manual or Handbook Reference None known.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling the introduction of sediment, nutrients, chemical, or other pollutants to waterbodies during mechanical site treatment.

Explanation Mechanical treatments are used to remove or reduce the amount of live and dead vegetation on a site to meet management objectives, such as site preparation for reforestation, fuel treatments to reduce fire hazards, wildlife habitat improvement, recreation access, utility corridor maintenance, and other activities that require removing vegetation from specified areas on a periodic and repeated basis. Mechanical treatments include cutting and piling; chipping or mulching; roller chopping or masticating using heavy equipment; and pushing over vegetation. Disturbance from mechanical site treatments can expose and compact soils, resulting in accelerated runoff and erosion.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Evaluate multiple site factors, including soil conditions, slope, topography, and weather, to prescribe the most suitable mechanical treatment and equipment to avoid or minimize unacceptable impacts to soil while achieving treatment objectives.
  - Consider the condition of the material and the site resulting from the treatment in comparison to desired conditions, goals, and objectives for the site when analyzing treatment options (e.g., a mastication treatment will result in a very different condition than a grapple pile and burn treatment).
  - Use land management plan direction, or other local guidance, to establish residual ground cover requirements and soil disturbance limits suitable to the site to minimize erosion.
  - Consider offsite use options for the biomass material to reduce onsite treatment and disposal.
- Use applicable practices of BMP Veg-3 (Aquatic Management Zones) when conducting mechanical treatments in the AMZ.
- Use applicable practices of BMP Veg-2 (Erosion Prevention and Control) to minimize and control erosion.
  - Conduct mechanical activities when soil conditions are such that unacceptable soil disturbance, compaction, displacement, and erosion would be avoided or minimized.
  - Consider using low ground-pressure equipment, booms, or similar equipment to minimize soil disturbance.
- Operate mechanical equipment so that furrows and soil indentations are aligned on the contour.
- Scarify the soil only to the extent necessary to meet reforestation objectives.
  - Use site-preparation equipment that produces irregular surfaces.
  - Avoid or minimize damage to surface soil horizons to the extent practicable.
- Conduct machine piling of slash in such a manner to leave topsoil in place and to avoid displacing soil into piles.
- Re-establish vegetation as quickly as possible.
  - Evaluate the need for active and natural revegetation of exposed and disturbed sites.
  - Use suitable species and establishment techniques to revegetate the site in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.

Resources for Mechanical Vegetation Management Activities

BMP Effectiveness

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Selected State Forestry BMP Documents See Appendix B.

Water Uses Management Activities

The purpose of this set of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from development and operation of infrastructure to collect, impound, store, transmit, and distribute water for uses on and off National Forest System (NFS) lands. Water use infrastructure includes wells for public or private water supply or groundwater monitoring; water source developments for Forest Service uses; water diversions and conveyances for uses off of NFS lands; and dams and impoundments for water supply storage, flood control, power generation, recreation, and wildlife habitat.

States govern the allocation of water for beneficial use. State laws and programs for water allocation vary widely across the country, from riparian rights systems to administrative permits to court-adjudicated water rights systems. The Forest Service responsibility when authorizing water use infrastructure projects is to avoid or minimize damage to NFS resources in compliance with environmental laws and land management plan direction.

Six National Core BMPs are in the Water Uses Management Activities category. These BMPs are to be used in all water use projects on NFS lands to the extent allowed by State laws and regulations pertaining to water allocation. Each BMP was formulated to reflect administrative directives that guide the Forest Service's development and administration of water uses on NFS lands. BMP WatUses-1 (Water Uses Planning) is a planning BMP for water uses projects. BMP WatUses-2 (Water Wells for Production and Monitoring) provides practices for drilling, operating, and abandoning water production and monitoring wells. BMP WatUses-3 (Administrative Water Developments) provides direction for development of water sources to be used for NFS land management purposes such as stock watering, potable water at campgrounds, or fire protection. BMP WatUses-4 (Water Diversions and Conveyances) provides direction for diversion and conveyance of surface water for third-party uses on or off NFS lands. BMP WatUses-5 (Dams and Impoundments) provides direction for construction and operation of dams and impoundments for flood control, hydroelectric power generation, water supplies, and recreation on NFS lands. BMP WatUses-6 (Dam Removal) provides direction for removal of dams and impoundments to restore streams and rivers.

States will be used in the rest of this resource category to signify both States and those tribes that have received approval from the U.S. Environmental Protection Agency (EPA) for treatment as a State under the Clean Water Act (CWA).

Water Uses BMPs	
WatUses-1	Water Uses Planning
WatUses-2	Water Wells for Production and Monitoring
WatUses-3	Administrative Water Developments
WatUses-4	Water Diversions and Conveyances
WatUses-5	Dams and Impoundments
WatUses-6	Dam Removal

WatUses-1. Water Uses Planning

Manual or Handbook Reference Forest Service Manual (FSM) 2540.

Objective Use the applicable authorization and administrative planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during construction, operation, maintenance, and restoration of water use infrastructure.

Explanation Development and operation of infrastructure for water uses involve ground disturbance for construction of the facility and changes to water levels and flow regimes in source and receiving waterbodies and aquifers during operations. During planning, site conditions are evaluated and water levels and flow needs of the aquatic ecosystem are assessed to determine site-specific measures to avoid, minimize, or mitigate adverse effects to soil, water quality, groundwater, and riparian resources.

Infrastructure for water uses may be developed on NFS lands by the Forest Service for a variety of administrative and resource management purposes. As new sites are created and existing sites are expanded or rehabilitated, potential effects of the proposed development and operation on soil, water quality, groundwater, and riparian resources are considered in the project National Environmental Policy Act (NEPA) analysis and decision. Site-specific BMP prescriptions are included in the project plan, contract, or other authorizing document as appropriate.

Infrastructure developed by others on NFS lands are administered through authorizations issued by the Forest Service to a public or private agency, group, or individual. Authorization documents include terms and conditions to protect the environment and comply with the requirements of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1752) and other laws. Control of nonpoint sources of water pollution using appropriate BMPs is included in these environmental protection requirements.

Facilities on lands withdrawn under authority of the Federal Energy Regulatory Commission (FERC) are exempt from Forest Service administrative control through the NFS permit system. When a FERC permit is issued or renewed, however, the Forest Service may provide FERC with recommended requirements and mitigation measures under which the permittee should operate to protect NFS resources. Such recommendations may include any BMPs necessary to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone (AMZ) Planning) when planning water use projects.
- Encourage reuse of water, to the extent practicable, to minimize withdrawals from surface water or groundwater sources.
- Determine the water quality, water quantity, flow regimes, and water levels necessary to maintain land management plan desired conditions, goals, and objectives, including applicable water quality standards for waterbodies and aquatic and groundwater-dependent ecosystems that are affected by the proposed project.
  - Specify a range of flows and levels to support desired uses and values.
- Obtain surface water (e.g., instream flow rights) and groundwater under appropriate Federal and State legal and regulatory authorities to avoid, minimize, or mitigate adverse effects to stream

processes, aquatic and riparian habitats and communities, groundwater-dependent ecosystems, and recreation and aesthetic values.

   - Prioritize protection of imperiled native species.

- Evaluate water levels, flows, and water quality of the affected waterbody or aquifer to ensure that the source can provide an adequate supply and quality of water for the intended purpose(s) and avoid or minimize damage to NFS resources.
   - Consider how the collection, diversion, storage, transmission, and use of the water would directly, indirectly, and cumulatively affect streamflow, water level, channel morphology and stability, groundwater, and aquatic and riparian habitats in source and receiving waterbodies at a watershed scale(s) suitable for the project area and impacts.
   - Consider the potential impacts of current and expected environmental conditions such as climate change on precipitation type, magnitude, frequency, and duration and related effects on runoff patterns and water yield.
- Develop a strategic plan for the development of a suitable number of durable long-term water sources for Forest Service administrative and resource management uses to achieve land management plan desired conditions, goals, and objectives.
   - Obtain necessary water rights, allocations, or permits and water quality permits and certifications from applicable Federal, State, and local agencies for Forest Service administrative or resource management water uses.
- Include permit conditions at the point of diversion, withdrawal, or storage to minimize damage to water-dependent resources and values consistent with land management plan desired conditions, goals, and objectives in authorizations for new or existing water use facilities.
   - Consider the water needs for physical stream processes, water quality, aquatic biota and their habitat, riparian habitat and communities, aesthetic and recreational values, and special designations such as Federal and State wild or scenic rivers.

WatUses-2. Water Wells for Production and Monitoring

Manual or Handbook Reference Forest Service Handbook (FSH) 7409.11, chapter 41.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, groundwater, and riparian resources from excessive withdrawals and contamination transmitted from or by water-well and monitoring-well developments.

Explanation Construction and operation of production wells, monitoring wells, and associated facilities have the potential to alter water levels and flow paths; contaminate surface water and groundwater; expose soil to accelerated erosion; and threaten the viability of aquatic and terrestrial species dependent on local surface water and groundwater. Properly designed wells and aboveground well-casing collars minimize the risk of aquifer contamination from the well-casing, animal and human activities, and accidental or intentional placement of materials into wells. Well uses should be within sustainable levels to avoid onsite and offsite effects to groundwater levels, streamflows, and riparian-dependent resources. States regulate water well drilling, and requirements vary.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate water production wells on high or well-drained ground at a sufficient distance away from potential contamination sources to avoid or minimize contamination.
- Locate monitoring wells according to a monitoring plan to minimize the number of wells needed to achieve monitoring objectives.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to control stormwater and erosion during construction of drill pads and associated facilities for well operation.
- Construct and complete wells consistent with applicable Federal and State regulations.
  - Use licensed well drilling contractors.
  - Use suitable measures to avoid or minimize well contamination, inter-aquifer exchange of water, floodwaters from contaminating the aquifer, and infiltration of surface water.
- Operate wells in such a manner as to avoid excessive withdrawals, maintain suitable groundwater levels, and minimize effects to groundwater-dependent ecosystems.
- Permanently seal abandoned wells consistent with applicable Federal, State, and local regulations and requirements.
  - Use licensed well drilling contractors.
  - Use suitable measures to avoid or minimize contaminating the aquifer or surface waters and interaquifer exchange and mixing of water.
  - Use suitable measures to preserve hydrogeologic conditions of the ground and aquifers.

WatUses-3. Administrative Water Developments

Manual or Handbook Reference FSM 2540.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when developing and operating water sources for Forest Service administrative and resource management purposes.

Explanation Water source developments are needed to supply water for a variety of Forest Service administrative and resource management purposes, including road construction and maintenance, dust control, fire control, recreation facilities, and livestock and wildlife watering. Water sources may be developed and used permanently or temporarily based on the needs of the management activity. Permanent water source development should be aimed toward the construction of a limited number of durable, long-term water sources. Piped and impounded diversions such as wells, spring developments, hydrants, supply lines, drains, ponds, cisterns, tanks, and dams are examples of permanent structures. Temporary water sources may be needed to support one-time or emergency projects such as watershed restoration and fire suppression.

Water source developments include the access road, turnaround, and drafting area. Soil, water quality, and riparian resources may be impacted by permanent or temporary water source construction and use. Potential impacts include erosion and sediment delivery to waterbodies; streambank and streambed alterations; contamination from equipment leaks or spills; changes in water temperatures; reduction in streamflows; loss of riparian vegetation; direct injury to aquatic species from pumping equipment; and transportation of eggs, larvae, and adults out of the aquatic system. Proper location and design of water sources or upgrading existing water source facilities can avoid, minimize, or mitigate adverse these impacts.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Design, construct, maintain, and monitor permanent waters sources in compliance with Federal, State, and local requirements.

Drafting From Streams or Standing Waterbodies

- Locate water source developments, including access roads, in such a manner as to avoid or minimize disturbance to the riparian area and streambanks and erosion and sedimentation to the extent practicable.
  - ❑ Draft from existing roads and bridges to the extent practicable to avoid creating new access roads.
  - ❑ Use existing hardened facilities, such as boat launches and campground access roads, for emergency or other short-term uses rather than native surface areas prone to erosion.
  - ❑ Locate facilities to minimize potential damage from streamflows.
  - ❑ Locate permanent storage tanks, dry hydrants, and standpipes outside of the AMZ to the extent practicable.
  - ❑ Locate off-channel ponds in areas where they will not be inundated with sediment at high flows.
  - ❑ Locate ponds or storage tanks as close to the major water use as practicable when water must be conveyed for use at a distance from the source.
- Design source developments, including access roads, in such a manner as to avoid or minimize disturbance to the riparian area and streambanks and to avoid or minimize erosion, sediment, and other pollutants to the extent practicable.
  - ❑ Design permanent facilities to maintain long-term stream function and processes.
  - ❑ Limit the size of the facility development footprint (area of bare soil with reduced infiltration capacity) to the minimum necessary for efficient operations to the extent practicable.
  - ❑ Design facility to minimize hydrologic connectivity with the waterbody to the extent practicable by providing a suitable vegetated filter strip, and designing access road slope and length, or using other suitable measures, to direct flow away from the waterbody (see BMP Road-2 [Road Location and Design]).
  - ❑ Modify vehicle access and turnaround areas to reduce the size of the facility within the most sensitive areas of the AMZ.
  - ❑ Install hardened facilities where an adequate streamflow exists throughout the drafting season.
- Construct water source developments, including access roads, in such a manner as to avoid or minimize disturbance to the riparian area and streambanks and erosion, sediment, and other pollutants to the extent practicable.
  - ❑ Use applicable practices of BMP Road-3 (Road Construction and Maintenance) when constructing access roads to control stormwater runoff and erosion.
  - ❑ Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies.
  - ❑ Use applicable practices of BMP AqEco-3 (Ponds and Wetlands) when constructing off-channel ponds.

- Use suitable measures to minimize streambank alteration and excavation activity within the streambed to the extent practicable while providing an adequate area for water drafting.

- Conduct operations at water source developments in such a manner as to avoid, minimize, or mitigate adverse effects to aquatic species and habitats from water drafting.
  - Obtain and maintain water rights for administrative use and resource needs.
  - Avoid or minimize effects to the waterbody or aquifer by withdrawing only the minimum amount of water sufficient to achieve administrative or resource management needs.
  - Establish limits or guidelines for water withdrawals from a lake, pond, or reservoir source based on evaluation of storage capacity and recharge and potential impacts to habitat from drafting and drawdown.
  - Establish limits or guidelines for absolute pumping rates and pumping rate in relation to streamflow.
  - Limit drafting operations to daylight hours to avoid attracting fish to the drafting pool.
  - Use suitable screening devices to avoid or minimize transport of aquatic organisms out of the source waterbody.
  - Use suitable measures to avoid or minimize contamination from spills or leaks.
  - Use applicable practices of BMP Fac-6 (Hazardous Materials) to manage contamination from spills or leaks.
- Maintain sources and facilities such that diversion, drainage, and erosion control features are functional.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim water use sites when no longer needed.
  - Repair or restore temporary sources to their pre-use condition to the extent practicable before project completion.
  - Apply suitable seasonal protection measures to temporary sources if use extends past a single season.

Spring Developments

- Locate the water trough, tank, or pond at a suitable distance from the spring to avoid or minimize adverse effects to the spring and wetland vegetation from livestock trampling or vehicle access.
- Locate the spring box to allow water to flow by gravity from the spring to the spring box to eliminate disturbance from pumps and auxiliary equipment.
- Design the collection system to avoid, minimize, or mitigate adverse effects to the spring development and downstream waters from excessive water withdrawal, freezing, flooding, sedimentation, contamination, vehicular traffic, and livestock as needed.
  - Collect no more water than is sufficient to meet the intended purpose of the spring development.
  - Ensure that enough water remains in the spring to support the source groundwater-dependent ecosystem and downstream aquatic ecosystems.
  - Avoid or minimize sediment or bacteria from entering the water supply system.
  - Trap and remove sediment that does enter the system.
  - Intercept the spring flow below the ground surface upslope of where the water surfaces.

- Size the spring box sufficient to store expected volume of sediment generated between maintenance intervals and enough water for efficient operation of the system, and to provide access for maintenance and cleaning.
- Avoid or minimize backing up of spring flow by providing overflow relief sized to carry the maximum flow expected from the spring during periods of wet weather.
- Use suitable measures to avoid or minimize erosion at the overflow outlet.
- Maintain fish and wildlife access to water released below the spring development to the extent practicable.

- Construct the spring development in such a manner to avoid or minimize erosion, damage to vegetation, and contamination.
  - Use applicable practices from BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in springs.
  - Divert all surface water away from the spring to the extent practicable to avoid or minimize flooding near the spring development.
  - Use suitable species and establishment techniques for wet conditions to cover or revegetate disturbed areas near springs in compliance with local direction and requirements per FSM 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- Operate and maintain the spring development and associated water storage in such a manner as to provide water of sufficient quantity and quality for the intended uses and avoid or minimize failure of infrastructure causing concentrated runoff and erosion.
  - Disinfect the spring water as needed to maintain water quality sufficient for intended uses in such a manner as to avoid or minimize adverse effects to the spring source.
  - Use suitable measures to manage uses such as livestock grazing and vehicle traffic around the spring development to avoid or minimize erosion and sedimentation affecting the spring.
  - Avoid heavy vehicle traffic over the uphill water-bearing layer to avoid or minimize compaction that may reduce water flow.
  - Use suitable measures to avoid or minimize overflow of water trough, tank, or pond.
  - Periodically monitor the spring development and promptly take corrective action for sediment buildup in the spring box, clogging of outlet and overflow pipes, diversion of surface water from the collection area and spring box, erosion from overflow pipes, and damage from animals.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim spring development sites when no longer needed.

WatUses-4. Water Diversions and Conveyances

Manual or Handbook Reference FSM 2729 and FSM 7510.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from construction, operation, and maintenance of water diversion and conveyance structures.

Explanation Water may be diverted from waterbodies on NFS lands by third parties and delivered to sites on or off of NFS lands for a variety of purposes, including agriculture, mining, domestic water supply, hydroelectric power generation, or other uses. Water delivery systems consist of a diversion structure and some type of conduit. Conduits can be ditches, open canals, flumes, tunnels, pipelines, or even natural channels. Structures to regulate flow, dispose of excess water, or trap sediment and debris may also be part of the water delivery system.

The construction, operation, and maintenance of water diversions and conveyances can have adverse direct and indirect effects on soil, water quality, and riparian resources. The construction or presence of access routes, head gates, storage tanks, reservoirs, and other facilities can alter water quality, water yield, runoff regimes, natural channel geomorphic processes, and fish and wildlife habitats. Altered flow regimes can result in elevated water temperatures, proliferating algal blooms, and invasive aquatic flora and fauna. Water yield and runoff changes can change sediment dynamics and affect channel shape and substrate composition. Regular maintenance of diversions and conveyances can result in contamination from pesticide applications, vegetation damage, and continued soil disturbance leading to increased erosion; however, lack of regular maintenance can increase the potential for even greater effects from failures of ditches and diversions.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Locate water conveyance structures in stable areas where they are not susceptible to damage from side drainage flooding.
- Design diversion and conveyance structures to efficiently capture and carry design flows in such a manner as to avoid or minimize erosion of streambanks, ditches, and adjacent areas.
    - ❑ Design intake and outflow structures to minimize streambank and streambed damage and minimize disruption of desired aquatic organism movement.
    - ❑ Design water conveyance structure to have sufficient capacity to carry the design volume of water with appropriate freeboard to avoid or minimize damage or overtopping.
    - ❑ Consider velocity of the water, horizontal and vertical alignment of the ditch or canal, amount of stormwater that may be intercepted, and change in water surface elevation at any control structures when determining appropriate freeboard needed.
    - ❑ Use suitable measures in the design to control velocity and slope to avoid or minimize erosion of the ditch.
    - ❑ Use suitable measures in the design to minimize water loss to evaporation and leakage.
    - ❑ Mitigate water imports and water disposal (including reservoir releases) so that the extent of stable banks, channel pattern, profile and dimensions are maintained in each receiving stream reach to meet applicable instream water quality standards.
- Construct diversion and conveyance structures to perform as intended in the most efficient manner and in such a way as to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
    - ❑ Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when constructing diversion structures in waterbodies.
    - ❑ Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to control stormwater and erosion when constructing diversion or conveyance structures.
    - ❑ Use suitable measures to stabilize the banks of the diversion channel or conveyance structure to avoid or minimize resulting erosion and instream sedimentation.

- Construct or install structures such as inlets, outlets, turnouts, checks, and crossings in such a manner as to maintain the capacity or freeboard of the ditch and the effectiveness of any lining or other channel stabilization measure.
- Use suitable measures at outlets to avoid or minimize erosion downstream of the structure when design flows are released.
- Use suitable measures on inlet structures to avoid or minimize debris entering the water conveyance structure.

- Operate diversion structures in such a manner as to leave desired or required flows and water levels in the source waterbody as determined in project planning (see BMP WatUses-1 [Water Uses Planning]).
- Operate and maintain diversion and conveyance structures in such a manner as to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from failures.
  - Limit operation of the diversion and conveyances to the established period of use.
  - Regularly inspect diversion and conveyance structures at suitable intervals to identify maintenance needs and situations that could lead to future overtopping or failures.
  - Do not flush or otherwise move sediment from behind diversion structures downstream.
  - Deposit and stabilize sediment removed from behind a diversion structure in a suitable designated upland site.
  - Maintain suitable vegetative cover near canal and ditch banks to stabilize bare soils and minimize erosion.
  - Harden or reroute breach-prone segments of ditches to minimize potential for failure and erosion of fill slopes.
  - Maintain and operate water conveyance structures to carry their design volumes of water with appropriate freeboard.
  - Keep water conveyance structures clear of vegetation, debris and other obstructions to minimize potential for failures.
  - Use applicable Chemical Use Activities BMPs when using chemicals to treat vegetation as a part of water conveyance structure maintenance.
- Use applicable measures of BMP AqEco-4 (Stream Channels and Shorelines) and BMP Fac-10 (Facility Site Reclamation) to restore the stream channel and surrounding areas after the diversion or conveyance structure is no longer needed.

WatUses-5. Dams and Impoundments

Manual or Handbook Reference FSM 7500, FSH 7509.11, FSM 2770, and FSH 2709.15.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from construction, operation, and maintenance of dams and impoundments.

Explanation The physical presence and operation of dams can result in changes in water quality, water quantity, sediment routing, channel morphology, stability, and habitat. Water quality can be impacted by changes in erosion, sedimentation, temperature, dissolved gases, and water chemistry. Resulting biologic and habitat impacts that may result include loss of habitat for existing or desirable fish, amphibian, and invertebrate species; shift from cold water to warm water species (or conversely, shift from warm-water to cold-water species); blockage of fish passage; or loss of spawning or other necessary habitat.

The operation of dams can result in diverse impacts on water quality. The area and depth of the impoundment, as well as the timing and volume of releases, determines the extent and complexity of the upstream and downstream impacts. For example, impacts of low-head dams with small impounded areas will involve sedimentation and fish passage; larger storage dams may have those issues as well as temperature, flow regulation, and water quality considerations. Impacts from dams are different above (upstream) and below (downstream) the dam. Upstream impacts occur primarily in the impoundment or reservoir created by the presence and operation of the dam. Downstream impacts result from changes in sediment load, water quantity, chemistry and the timing and magnitude of water releases.

Federal laws provide the Forest Service the authority to require or recommend BMPs to avoid, minimize, or mitigate adverse effects to soil, water quality, riparian and other resources from new or existing hydroelectric projects and associated infrastructure on or adjacent to NFS lands. The specific regulations and procedures that apply vary depending on project-specific circumstances (see FSM 2770 and FSH 2709.15).

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Select a design and location such that the benefits of the dam are maximized and the disturbances to the environment or hazards to downstream inhabitants are minimized.
    - ❑ Implement applicable practices of BMP AqEco-3 (Ponds and Wetlands) to locate and design dams and impoundments.
    - ❑ Complete a geotechnical review of the dam site using established protocols for stability issues.
- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when working in or near waterbodies to construct dams and impoundments.
- Use applicable practices of BMP Fac-2 (Facility Construction and Stormwater Control) to control stormwater and erosion when constructing dams and impoundments.
- Operate and maintain dams and impoundments in such a manner as to avoid, minimize, or mitigate adverse impacts to soil, water quality, and riparian resources.
    - ❑ Work with dam operators, and Federal and State regulatory agencies, to ensure that water chemistry; temperature; dissolved oxygen; nutrient levels; and hydrologic conditions, including the timing, duration and magnitude of flows, meet land management plan desired conditions, goals, and objectives (see BMP WatUses-1 [Water Uses Planning]).
- Decommission dams and impoundments that are no longer needed for mission purposes (see BMP WatUses-6 [Dam Removal]).

WatUses-6. Dam Removal

Manual or Handbook Reference FSM 7500 and FSH 7509.11.

Objective Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during and after removal of dams.

Explanation Many existing dams no longer serve their originally intended purposes or are in varying stages of disrepair and in need of significant repair and maintenance to meet modern dam safety standards. Removal of outdated dams, where the negative impacts outweigh their benefits, is a critical mechanism in achieving restoration of natural river ecology, re-establishing river continuity, and maintaining public safety.

The most important positive outcomes of dam removal are the reconnection of river reaches so that they can operate as an integrated system and the increased accessibility to upstream habitat and spawning areas for migratory and anadromous fish. Dam removal can cause short-term impacts to the river environment from released water and sediment and exposure of previously inundated land to achieve long-term desired conditions. Careful planning can limit the effects of released sediment and toxic pollutants on aquatic life, prevent extensive erosion in the restored stream channel, and limit the potential intrusion of exotic plant species in the former impoundment.

Restoring a river by removing a dam often implies that the physical and biological components will return to the same level that existed before the dam was built. Dam removal can restore some, but not all, of the characteristics of the predam river, however. The removal of a dam has the effect of reversing some undesirable changes subject to the limits imposed by many other human influences in the watershed. Productive, useful ecosystems can result from dam removal, but predictions of outcomes are sometimes difficult because of the many interrelated changes in physical and biological systems caused by placement of the dam and other physical stresses on the river. Dam removal often results in the replacement of one aquatic community with another that is partly natural and partly artificial. Reservoirs create wetland areas in some cases; the removal of a dam and draining of a reservoir may create some wetlands downstream but at the expense of some wetlands upstream. The ultimate goal for a dam removal project is to restore the channel and its biological function to the best long-term sustainable state possible to achieve desired conditions within the context of other community issues and location within the watershed.

Practices Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

Planning

- Use applicable practices of BMP AqEco-1 (Aquatic Ecosystem Improvement and Restoration Planning) when planning dam decommissioning or removal projects.
- Evaluate system hydrology and hydraulics to assess how dam removal would affect aquatic species passage, potential flood impacts at various flows, and potential impacts to surrounding infrastructure.
- Develop a sediment management plan (e.g., natural erosion, dredging, stabilization in place, relocation on or off site, or a combination of methods) that best suits sediment quality, quantity, and physical characteristics, as well as the sensitivity of downstream reaches and the river's ability to transport sediment.

- Quantitatively determine sediment volume and physical parameters, including grain size distribution, density, shear strength, cohesion, stratification, natural armoring potential, organic content, and moisture content.
- Evaluate potential for contaminants trapped behind the dam by considering current and past upstream land uses, such as industrial activity and road density, and by adequately sampling and analyzing sediments to determine the contamination level, if any, and graduation and distribution.
- Estimate sediment transport to address fate of released sediment and potential contaminants.
- Evaluate potential disposal sites for long-term viability and stability of relocated sediments.

- Identify the various aquatic and aquatic-dependent species that live in the river or on the floodplain and their life histories to determine protection strategies, including timing of dam removal, sediment management, species relocation, and monitoring during construction.
- Evaluate floodplain and instream infrastructure to determine whether bridges, culverts, utility pipes, or other infrastructure might be affected, particularly by the drop of water level in the impoundment.
- Develop a channel and vegetation restoration plan (see BMP AqEco-4 [Stream Channels and Shorelines] and BMP Fac-10 [Facility Site Reclamation]).
    - Evaluate the need for active and natural channel and bank reconstruction.
    - Evaluate the need for active and natural revegetation of exposed and disturbed sites.
- Determine necessary Federal, State, and local permits needed for dam removal.

Construction

- Use applicable practices of BMP AqEco-2 (Operations in Aquatic Ecosystems) when removing dams.
- Remove or otherwise mitigate the sediment stored behind the impoundment before dismantling the structure.
- Drain the impoundment before removing structures to avoid downstream flooding and channel erosion.
    - Drain the impoundment slowly to minimize release of sediment downstream, allow bed of impoundment and stream to drain and stabilize, and avoid a sudden release of water that could unnecessarily damage downstream infrastructure or habitat.
    - Consider drawing down the impoundment during a time when exposed sediments would have an opportunity to stabilize and revegetate before structural removal of the dam.
- Demolish the structure in an efficient manner that avoids or minimizes adverse environmental effects to the extent practicable.
    - Remove entire vertical extent of the dam structure and as much of the lateral extent as practicable so as to not impinge on streamflow.
    - Consider phasing a project to minimize short-term impacts on the environment, beginning with out-of-channel work early in the phasing to accelerate and facilitate the removal process.
- Stabilize or relocate affected floodplain and instream infrastructure as needed to avoid, minimize, or mitigate adverse effects.

Restoration

- Use applicable practices of BMP AqEco-4 (Stream Channels and Shorelines) to restore streams when dams are removed.
- Use applicable practices of BMP Fac-10 (Facility Site Reclamation) to reclaim dam and associated infrastructure sites, such as temporary access roads, landings, and work areas, when dams are decommissioned.
- Simulate natural portions of surrounding stream or other nearby habitat to restore habitat more effectively.

Resources for Water Uses Management Activities

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Glossary

adverse effects to soil, water quality, and riparian resources: Direct, indirect, and cumulative impacts to soil quality, surface water, and groundwater resources and riparian structure, function, and processes that prevent achievement of land management plan desired conditions, goals, and objectives for water resources; attainment of applicable Federal, State, or local water quality standards; or other water quality related requirements.

aquatic ecosystem: The stream channel, lake, or estuary bed, water, and biotic communities and the habitat features that occur therein (Forest Service Manual [FSM] 2526.05).

Aquatic Management Zone (AMZ): An administratively designated zone adjacent to stream channels and other waterbodies. The AMZ is delineated for applying special management controls aimed at maintaining and improving water quality or other water- and riparian-dependent values, including groundwater-dependent ecosystems. The width of the AMZ is determined based on site-specific factors and local requirements. AMZ delineation may encompass the floodplain and riparian areas when present. AMZ designation can have synergistic benefits to other resources, such as maintaining and improving aquatic and riparian area-dependent resources, visual and aesthetic quality, wildlife habitat, and recreation opportunities. A variety of names for the AMZ concept are used in the States and Forest Service regions: Water Influence Zone (WIZ), Rocky Mountain Region 2 (R2); Stream Environment Zones, Pacific Southwest Region (R5); Riparian Conservation Areas, R5; Riparian Reserves, R5 and Pacific Northwest Region (R6); Riparian Habitat Conservation Areas, R5 and R6; Streamside Management Unit (SMU), R6; Riparian Corridor, Southern Region (R8); Riparian Management Corridor (RMC), Eastern Region (R9); and Riparian Management Area, Alaska Region (R10). For purposes of the National Core BMPs, these areas will be referred to as AMZs.

bankfull or bankfull discharge: The bankfull stage corresponds to the discharge at which channel maintenance is the most effective; that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work results in the average morphologic characteristics of channels. Bankfull discharge is associated with a momentary maximum flow that, on the average, has a recurrence interval of 1.5 years as determined using a flood frequency analysis. (Dunne and Leopold 1978). In stable rivers, bankfull is reached when the water cannot be contained within its banks and flooding begins. In entrenched streams, bankfull width is restricted, and more difficult to determine, but the top of depositional features is typically bankfull. On aggrading streams, the bankfull discharge is no longer contained within the banks during a bankfull event, often causing excessive flooding. A stream's bankfull discharge may increase or decrease with hydrologic modifications, changes in impervious land surfaces, or vegetative cover types that alter the rates of water movement through the watershed (Rosgen 1996).

beneficial use (designated use): Use specified in water quality standards for each waterbody or segment whether or not it is being attained. Types of uses include public water supplies; protection and propagation of fish, shellfish, and wildlife; recreation; agriculture; industry; navigation; marinas; groundwater recharge; aquifer protection; and hydroelectric power (EPA 2007).

Best Management Practices (BMPs) for water quality: Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (36 CFR 219.19).

buffer zone: (See Aquatic Management Zone.) (1) A protective, neutral area between distinct environments. (2) An area that acts to minimize the impact of pollutants on the environment or public welfare.

Burned Area Emergency Response (BAER) Program: A program initiated after a wildfire to determine the need for and to prescribe and implement emergency treatments to minimize threats to life or property or to stabilize and avoid or minimize unacceptable degradation to natural and cultural resources resulting from the effects of the wildfire. Such treatments are identified in an approved BAER report and funded under the BAER funding authority (FSM 2523).

chain of custody: A legal term that refers to the ability to guarantee the identity and integrity of the sample (or data) from collection through reporting of the test results. It is a process used to maintain and document the chronological history of the sample (or data). Chain of custody documents should include the name or initials of the person collecting the sample (or data), each person or entity subsequently having custody of it, dates the items were collected or transferred, the collection location, a brief description of the item, and a sample identification number.

Clean Water Act (CWA) 401 Certification: Certification by a State that a permit or license issued by the Federal Government meets applicable State water quality and pollution control requirements. Under section 401(a) (1) of the CWA, Federal agencies may not issue permits for activities that "may result in any discharge into navigable waters" until the State or tribe where the discharge would originate has granted or waived section 401 certification.

CWA 402 Permit: (See National Pollutant Discharge Elimination System.) Permit issued by a State or the U.S. Environmental Protection Agency that authorizes point source discharges to waters of the United States, including certain stormwater discharges from development, industrial, or construction activities (33 U.S.C. § 1342) (see Stormwater Permit). These permits often regulate the amount, timing, and composition of discharges.

CWA 404 Permit: Permit issued by the U.S. Army Corps of Engineers to regulate the discharge of dredge and fill materials to waters of the United States, including wetlands (33 U.S.C. § 1344).

cumulative watershed effects (CWE): Cumulative watershed effects (CWE) are a change in watershed condition or water quality caused by the accumulation and interaction of multiple individual impacts of land and resource management activities within a watershed over time and space. CWE may occur at locations far distances away from the sites of actual disturbance and later in time after the disturbance has occurred.

effectiveness monitoring: Monitoring to evaluate whether the specified BMPs had the desired effect (MacDonald et al. 1991).

ephemeral stream: A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all times above the zone of saturation (Briggs 1996).

fen: Ancient wetland ecosystem dependent on nutrient-rich local or regional groundwater flow systems maintaining perennial soil saturation and supporting continuous organic soil (i.e., peat) accumulation (Bedford and Godwin 2003, Chimner et al. 2010, Clymo 1983, Cooper and Andrus 1994, Gorham 1953). Groundwater controls fen type, distribution, plant community composition, pH, water chemistry, and microtopography.

floodplain: The lowland and relatively flat areas adjoining inland streams and standing bodies of water and coastal waters, including debris cones and flood-prone areas of offshore islands, including at a minimum, that area subject to a 1-percent chance of flooding in any given year (FSM 2527.05).

ground cover: Material on the soil surface that impedes raindrop impact and overland flow of water. Ground cover consists of all living and dead herbaceous and woody materials in contact with the ground and all rocks greater than 0.75 inches in diameter.

groundwater-dependent ecosystem: Community of plants, animals, and other organisms whose extent and life processes depend on groundwater. Examples include many wetlands, groundwater-fed lakes and streams, cave and karst systems, aquifer systems, springs, and seeps (USDA Forest Service 2007).

implementation monitoring: Monitoring to evaluate whether BMPs were carried out as planned and specified in the environmental assessment, environmental impact statement, other planning document, permit, or contract (MacDonald et al. 1991).

inner gorge: A geomorphic feature that consists of the area of channel side slope situated immediately adjacent to the stream channel and below the first break in slope above the stream channel. Debris sliding and avalanching are the dominant mass wasting processes associated with the inner gorge (USDA Forest Service 2000).

intermittent stream: A stream or reach of stream channel that flows, in its natural condition, only during certain times of the year or in several years. Characterized by interspersed, permanent surface water areas containing aquatic flora and fauna adapted to the relatively harsh environmental conditions found in these types of environments (Briggs 1996).

lake: An inland body of standing water, perennial or intermittent, that occupies a depression in the Earth's surface and is too deep to permit vegetation to take root completely across the expanse of water.

land management plan: An individual planning document adopted under the National Forest Management Act and 36 CFR 219 that provides direction for management of a Forest Service administrative unit.

low impact development: A comprehensive stormwater management and site design technique to create a hydrologically functional site that mimics predevelopment conditions by using design techniques that infiltrate, filter, evaporate, and store runoff close to its source.

meadow: Low-level grassland near a stream, lake, or other waterbody.

municipal supply watershed: A watershed that serves a public water system as defined in the Safe Drinking Water Act of 1974, as amended (42 U.S.C. §§ 300f, et seq.), or as defined in State safe drinking water statutes or regulations (FSM 2542.05).

National Core Best Management Practices (BMPs): The nationally standardized set of general, nonprescriptive BMPs for the broad range of activities that occur on National Forest System lands as specified in the National Core BMP Technical Guide (FS-990a). The National Core BMPs require development of site-specific BMP prescriptions based on site conditions and local and regional requirements to achieve compliance with established State, tribal, and national water quality goals. (FSM 2532.05).

National Core BMPs Monitoring Protocols: The nationally standardized set of procedures for monitoring the implementation and effectiveness of the National Core BMPs as specified in the National Core BMP Monitoring Technical Guide (FS-990b) (FSM 2532.05).

National Pollutant Discharge Elimination System (NPDES): (See CWA 402 Permit.) The system for regulating the point source discharge of pollutants to waters of the United States through the issuance of permits by State water quality regulatory authorities or EPA. Section 402 of the CWA established this system.

navigable waters: Waters of the United States, including the territorial seas (CWA section 502[7]).

nonpoint source pollution: Any source of water pollution that does not meet the legal definition of "point source" in Section 502(14) of the Clean Water Act. Nonpoint sources of water pollution generally originate at indefinable or diffuse sources, and do not discharge at specific locations (FSM 2532.05).

perennial stream: A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in areas adjacent to the stream (Briggs 1996).

pesticide: A general term applied to a variety of chemical pest controls, including insecticides for insects, herbicides for plants, fungicides for fungi, and rodenticides for rodents.

point source: Any discernible, confined, and discrete conveyance, such as pipes, ditches, or channels, from which pollutants are or may be discharged (CWA section 502(14); 40 CFR 122.2).

pollutant: Dredged spoil; solid waste; incinerator residue; filter backwash; sewage; garbage; sewage sludge; munitions; chemical wastes; biological materials; radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended [42 U.S.C. 2001 *et seq.*]); heat, wrecked, or discarded equipment; rock, sand, and cellar dirt; and industrial, municipal, and agricultural waste discharged into water (CWA section 502[6], 40 CFR 122.2).

pollution: The manmade or man-induced alteration of the chemical, physical, biological, or radiological integrity of water (CWA section 502[19]; 40 CFR 130.2 [c]).

pond: An inland body of standing water, perennial or intermittent, that occupies a depression in the Earth's surface and is shallow enough to permit vegetation to take root completely across the expanse of water. A pond may be natural or manmade.

practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR 230.3). Resource objectives should also be considered when determining practicable alternatives to meet a project's overall purposes.

practice: The recommended means for achieving the Best Management Practice (BMP) objective. Not all recommended practices will be applicable in all settings; other practices may not be listed in the BMP that would work as well, or better, to meet the BMP objective in a given situation. State or local rules or regulations may require some recommended practices in some locations. The practices are written in general, nonprescriptive terms. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are used to develop site-specific BMP prescriptions to apply the recommended practices on the ground.

reclamation: Returning disturbed land to as near to its predisturbed condition as is reasonably practical.

reference condition: The set of selected measurements and conditions used as representative of the natural potential condition of a stream or waterbody. The selected measurements and conditions describe a minimally impaired watershed or reach characteristic of a stream type in an ecoregion. Minimally impaired sites are those with the least anthropogenic influences and represent the best range of conditions that can be achieved by similar streams within an ecoregion. Reference conditions can be established using a combination of methods: a single site or multiple reference sites; historical data; simulation models; and expert opinion or professional judgment (EPA 1996).

rehabilitation: A putting back into good condition, re-establishing on a firm, sound basis.

restoration: A putting or bringing back into a former, normal, or unimpaired state or condition.

riparian area: A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem that is identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

site-specific BMP prescriptions: Site-specific techniques implemented on the ground to control nonpoint source pollution. Site-specific BMP prescriptions are determined during the project planning process and described in decision documents to apply the National Core BMPs to the ground based on local site conditions. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are used to develop site-specific BMP prescriptions.

stormwater permit: A form of CWA 402 permit regulating stormwater discharges from industrial activities, including construction activities disturbing areas of 1 acre or larger (40 CFR 122.26).

stream simulation: A method of designing crossing structures (usually culverts) with the aim of creating within the structure a channel as similar as possible to the natural channel in both structure and function (USDA Forest Service 2008b).

swale: A landform feature lower in elevation than adjacent hillslopes, usually present in headwater areas of limited areal extent, generally without display of a defined watercourse or channel, which may or may not flow water in response to snowmelt or rainfall. Swales exhibit little evidence of surface runoff and may be underlain by porous soils and bedrock that readily accept infiltrating water. These areas are where soil moisture concentrates but often do not exhibit pedalogic or botanical evidence of saturated conditions (Dunne and Leopold 1978).

underground injection system: Any manmade design, structure, or activity that places fluids, mainly stormwater, but also septic effluent, treated drinking water, and other fluids, below the ground.

unstable soils: Those soils that have properties that make them susceptible to dislodgement and downslope transport of soil and rock material under direct gravitational stress. The process includes slow displacement such as creep and rapid movements, such as landslides.

waterbody: Features such as rivers, streams, reservoirs, lakes, ponds, wet meadows, fens, bogs, marshes, and wetlands. A waterbody may be perennial, intermittent, or ephemeral.

water quality: The chemical, physical, and biological integrity of surface water and groundwater.

water right: A property right granted by a State for the use of a portion of the public's surface water resource obtained under applicable legal procedures.

Waters of the United States: (1) All waters that are currently used, were used in the past, or may be susceptible to be used in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; (2) all interstate waters, including interstate wetlands; (3) all other waters, such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds that the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including any such waters (a) that are or could be used by interstate or foreign travelers for recreational or other purposes, (b) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce, or (c) that are used or could be used for industrial purposes by industries in interstate commerce; and (4) all impoundments of waters otherwise defined as waters of the United States under this definition, including (a) tributaries of waters identified in paragraphs 1 through 4 of this definition, (b) the territorial sea, and (c) wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (7) of this definition (40 CFR 122.2).

wetlands: Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that, under normal circumstances, do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 122.2).

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Appendix A. Forest Service Regional Best Management Practices Guidance Documents

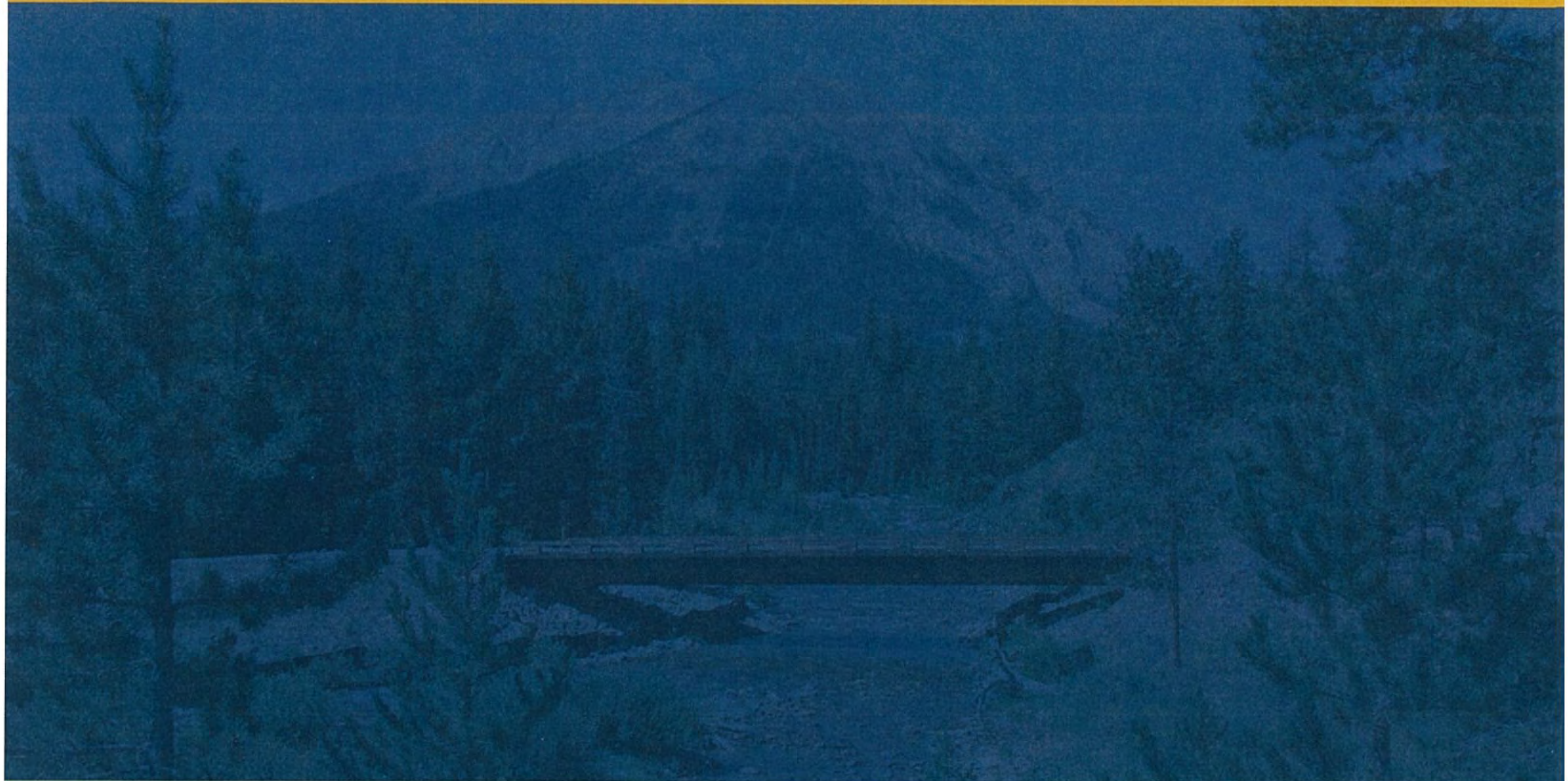
Forest Service Region	Best Management Practices Document	Available at:
Northern Region (Region 1)	FSH 2509.22, Soil and Water Conservation Practices (1988)	http://www.fs.fed.us/publications/
Rocky Mountain Region (Region 2)	FSH 2509.25, Watershed Conservation Practices Handbook (2006)	http://www.fs.fed.us/publications/
Southwest Region (Region 3)	FSH 2509.22, Soil and Water Conservation Practices	http://www.fs.fed.us/publications/
Intermountain Region (Region 4)	FSH 2509.22, Soil and Water Conservation Practices (1988)	http://www.fs.fed.us/publications/
Pacific Southwest Region (Region 5)	Water Quality Management for National Forest System Lands in California (2000)	http://www.fs.fed.us/r5/publications/water_resources/waterquality/index.html
Pacific Northwest Region (Region 6)	General Water Quality Best Management Practices (1988)	—
Southern Region (Region 8)	Soil and Water Conservation Practices Guide (2002)	http://fsweb.r8.fs.fed.us/nr/bio_phy_res/water/Literature.shtml
Eastern Region (Region 9)	—	—
Alaska Region (Region 10)	FSH 2509.22 Soil and Water Conservation Practices (2006)	http://www.fs.fed.us/publications/

Appendix B. Selected State Forestry Best Management Practices Documents[a]

State	Best Management Practices Document	Available at:
Alabama	Alabama's Best Management Practices for Forestry	http://www.forestry.state.al.us/publications/BMPs/2007_BMP_Manual.pdf
Alaska	Implementing Best Management Practices for Timber Harvest Operations from the Alaska Forest Resources and Practices Regulations	http://forestry.alaska.gov/forestpractices.htm#acts
Arkansas	Best Management Practices for Water Quality Protection	http://forestry.arkansas.gov/Services/ManageYourForests/Documents/bmpbookrevise.pdf
Colorado	Forestry Best Management Practices to Protect Water Quality in Colorado	http://www.csfs.colostate.edu/pdfs/ForestryBMP-CO-2010.pdf
Florida	Silviculture Best Management Practices	http://www.fl-dof.com/forest_management/index.html
Georgia	Georgia's Best Management Practices for Forestry	http://www.gfc.state.ga.us/ForestManagement/bmp.cfm
Idaho	Compendium of Best Management Practices to Control Polluted Runoff: A Source Book	http://www.deq.State.id.us/water/data_reports/surface_water/nps/reports.cfm#bmps
Illinois	Forestry Best Management Practices	http://coas.siu.edu/docs/BMPbooklet2.pdf
Indiana	Indiana Forestry BMPs—protecting the woods while harvesting	http://www.in.gov/dnr/forestry/files/BMP.pdf Additional BMPs at http://www.in.gov/dnr/forestry
Kentucky	Kentucky Forest Practice Guidelines for Water Quality Protection	http://www.ca.uky.edu/forestryextension/publications_BMPs.pdf
Louisiana	Recommended Forestry Best Management Practices for Louisiana	http://www.ldaf.state.la.us/portal/offices/Forestry/ForestManagement/BestManagementPractices/tabid/232/Default.asp
Maine	Best Management Practices for Forestry: Protecting Maine's Water Quality	http://www.maine.gov/doc/mfs/pubs/bmp_manual.htm
Michigan	Sustainable Soil and Water Quality Practices on Forest Land	http://michigan.gov/documents/dnr/IC4011_SustainableSoilandWaterQualityPracticesonForestLand_268417_7.pdf
Minnesota	Sustaining Minnesota Forest Resources: Voluntary Site-level Forest Management Guidelines for Landowners, Loggers and Resource Managers	http://www.frc.state.mn.us/resources_documents_management.html
Mississippi	Mississippi's BMPs—Best Management Practices for Forestry in Mississippi	http://www.mfc.ms.gov/water-quality.php
Missouri	Missouri Watershed Protection Practice—2006 Management Guidelines for Managing Forested Watersheds to Protect Streams	http://mdc.gov/landwater-care/stream-and-watershed-management
Montana	Water Quality BMPs for Montana Forests	http://www.dnrc.mt.gov/forestry/Assistance/Practices/Documents/2001WaterQualityBMPGuide.pdf
Nevada	Best Management Practices Handbook	http://www.cicacenter.org/pdf/NVBMPHandbook.pdf
New Hampshire	Best Management Practices for Forestry: Protecting New Hampshire's Water Quality	http://extension.unh.edu/resources/248/Best_Management_Practices_for_Forestry_Protecting_NH's_Water_Quality
New Mexico	New Mexico Forest Practices Guidelines	http://www.emnrd.state.nm.us/FD/Publications/documents/NM_ForestPracticesGuidelines2008.pdf
New York	New York State Forestry Best Management Practices for Water Quality, BMP Field Guide, 2011 Edition.	http://www.nysbmpguidelines.com

State	Best Management Practices Document	Available at:
North Carolina	North Carolina Forestry Best Management Practices Manual to Protect Water Quality	http://www.ncforestservice.gov/water_quality/bmp_manual.htm
North Dakota	North Dakota Forestry Best Management Practices	http://www.ndsu.edu/fileadmin/ndfs/docs/r_forestry/BMP_2010_FINAL_DOC_11_12_10.pdf
Ohio	BMPs for Erosion Control for Logging Practices in Ohio	http://ohioline.osu.edu/b916/index.html
Oregon	Forest Practices Act Rulebook	http://oregon.gov/ODF/privateforests/fpaguidance.shtml
Pennsylvania	Best Management Practices for Pennsylvania's Forests—promoting forest stewardship through education, cooperation, and voluntary action	http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr_005564.pdf
South Carolina	South Carolina's BMPs for Forestry	http://www.state.sc.us/forest/bmpmanual.pdf
South Dakota	Forestry Best Management Practices for South Dakota	http://sdda.sd.gov/Forestry/publications.PDF/Forestry-BMP.pdf
Tennessee	Guide to Forestry Best Management Practices in Tennessee	http://www.tn.gov/agriculture/publications/forestry/BMPs.pdf
Texas	Texas Forestry Best Management Practices	http://texasforestservice.tamu.edu/main/article.aspx?id=75&terms=bmps
Utah	Utah's Forest Water Quality Guidelines—A Technical Manual for Landowners, Loggers and Resource Managers	http://forestry.usu.edu/htm/rural-forests/forest-management/best-management-practices-bmps-and-water-quality
Vermont	Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont	http://www.vtfpr.org/watershed/ampprog.cfm
Virginia	Virginia's Forestry Best Management Practices for Water Quality Technical Manual	http://www.dof.virginia.gov/wq/index-BMP-Guide
Washington	Title 222 WAC – Forest Practices Rules	http://www.dnr.wa.gov/BusinessPermits/Topics/ForestPracticeRules/Pages/fs_rules.aspx
West Virginia	West Virginia Silvicultural Best Management Practices for Controlling Soil Erosion and Sedimentation from Logging Operations.	http://www.wv.forestry.com/BMP%20Book%Complete.pdf
Wisconsin	Wisconsin's forestry best management practices for water quality: Field manual for loggers, landowners and land managers	http://dnr.wi.gov/forestry/Usesof/bmp/bmpfieldmanual.htm
Wyoming	Wyoming Forestry Best Management Practices—Forestry BMPs, Water Quality Protection Guidelines	http://slf-web.state.wy.us/oldsite/forestry/bmp2.aspx

[a] *Forestry BMP documents for States that contain NFS lands.*



Log Cabin and Our House Diversion Dams
Sediment Management Plan

Attachment B

Channel Morphology Field Data Sheet

Yuba River Development Project

FERC Project No. 2246

June 2018

Example of form used for Cross Section Data, Channel Morphology Monitoring.

Stream/Reach: ____________________ Cross Section:

Site: ____________________ __________

Date: ____________________

Crew Members: ____________________

Critical points: behind HP, HP, Fprone left , BF left, WS left, TW, WS right, BF right, Fprone right, TP, beyond TP.
HP and zero on left bank as looking d/s

Station	BS	HI	FS	Elev	Notes

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Log Cabin and Our House Diversion Dams
Sediment Management Plan

Attachment C

Geomorphology Photo point
Data Sheet

Yuba River Development Project
FERC Project No. 2246

June 2018

PHOTO POINT PROCEDURES

Images taken at the photo points will be landscape photographs that will be taken each monitoring period from the same locations. The views in the photographs will be the same so that differences between monitoring periods can be compared.

Photo point locations will be established to document channel and riparian vegetation conditions within each monitoring location. The location(s) will be established at a location from which multiple view photographs could be taken, if possible. If necessary to document the riparian vegetation, more than one photo point location will be established. Within each view, an identifiable object, such as a large rock, will be included, if possible, to assist with scale and orientation during the monitoring periods. The photo point markers will be located in places that will likely not be eroded easily by high floods or disturbed by other activities, such as vandalism. Markers will be as inconspicuous as possible to minimize the potential for vandalism.

Photo point locations will be established from which channel conditions, including bank erosion, stream bank and bar vegetation, and vegetation within floodplains are clearly visible. If a location is established within the stream channel, a GPS point and distance(s) from the stream banks or other permanent marker will be used to document its position.

This attachment describes the procedure for documenting the photo point locations and for retaking the photographs each monitoring period. A field datasheet is provided. One datasheet will be filled out for each photo point location. For those locations where more than one view is taken from the same photo point location, all the views can be recorded on the same datasheet.

DOCUMENTING PHOTO POINT LOCATIONS

Photo point locations will be selected in consultation with the USDA-FS, State Water Board, and CDFG. A site marker, such as a stake, will be placed at the location. During the first monitoring period, the photo point locations will be established, using the following procedure:

- The photographer will stand immediately over the site marker, if possible. If this is not possible, the location of the photographer relative to the marker will be recorded on the datasheet (distance and angle from the marker).

- The time of the photograph, camera type, focus distance, height of the camera above the ground, compass bearing and vertical angle of the view will be recorded on the datasheet.

- At least one reference point will be established for each photo point location. The reference point will be within 200 feet of the photo point location. A reference point could be a large tree outside of the flood zone or a large rock. The distance, compass bearing, and vertical angle will be measured and recorded from the reference point to the photo point location. A marker will be placed on the reference point. The reference point will be described on the datasheet and a site sketch will be drawn showing major landmarks and the locations of the photo points and reference points. The information from the initial sketch with the reference point locations identified will be transferred to GIS for display over a high resolution aerial image and stored electronically.

- Additional photographs will be taken of the reference point and the photo point locations. The locations of each will be marked and labeled on the photographs for future use in the field. All information on the location of the photo points and reference points will be stored electronically.

- The locations of the photo and reference points will be recorded with GPS. These locations will be overlain on aerial photographs of each monitoring location to document the approximate locations of the points. The maps will be completed at a scale with sufficient detail to identify obvious landmarks and trees. These maps will be electronically stored for future use.

- Each photo point will be given an identification number, which will be used through the duration of the monitoring.

Repeat Photography

The procedures for the photo points that will be followed during the subsequent monitoring periods are described below.

- For each photo point monitoring period, the field crew will take copies of the original photo point documentation on the locations of the photo and reference point markers, copies of the photographs, and maps. The type(s) of cameras used to take the photo points will be noted on the datasheet.

- The photographer will stand at the same place and height as that which the first photographs were taken. The camera will be aligned with the view at the same compass bearing as recorded during the initial photographs. The view will be compared with the previous photographs to ensure that it is as close as possible to the original.

- The time of the photograph, camera type, focus distance, height of the camera above the ground, compass bearing and vertical angle of the view will be recorded for this monitoring period.

- If the photo point marker cannot be located, an attempt will be made to locate a new photo point as close as possible to the original location using the reference point documentation, maps, and previous photographs. The USDA-FS, State Water Board, and CDFG will be notified and consulted if a new location is established.

- The new photographs will be catalogued with the previous photographs and stored electronically. The photographs will be compared with the previous photographs in the Geomorphology and Riparian Monitoring Report.

LITERATURE CITED

Powell, D.C. 2006. Recording the changes: field guide to establishing and maintaining permanent camera point systems. United States Department of Agriculture – Forest Service. Pacific Northwest Region. FS-14-SO-09-06. August. 21 pp.

PHOTO POINT DATASHEET

Site Name: ______________________ Photo Point Identification Number:______________

Date:________ Time:_______________ Weather Conditions:_________________________

GPS Coordinates:_________________ Photographer:_______________________________

Camera Type:____

Subject of Photograph and Purpose of Photographs:

Photo 1	**Photo 2**	**Photo 3**
Camera Height (ft):	Camera Height (ft):	Camera Height (ft):
Camera Angle:	Camera Angle:	Camera Angle:
Azimuth:	Azimuth:	Azimuth:
Focus Distance:	Focus Distance:	Focus Distance:
Photo No.:	Photo No.:	Photo No.:
Camera No.:	Camera No.:	Camera No.:
Photo 4	**Photo 5**	**Photo 6**
Camera Height (ft):	Camera Height (ft):	Camera Height (ft):
Camera Angle:	Camera Angle:	Camera Angle:
Azimuth: o	Azimuth:	Azimuth:
Focus Distance:	Focus Distance:	Focus Distance:
Photo No.:	Photo No.:	Photo No.:
Camera No.:	Camera No.:	Camera No.:

Reference Point 1	**Sketch of Photo and Reference Point Locations:**
Description:	
Marking:	
Azimuth: Angle:	
Distance to photo point marker (ft):	
Reference Point 2	
Description:	
Marking:	
Azimuth: Angle:	
Distance to photo point marker (ft):	
Reference Point 3	
Description:	
Marking:	
Azimuth: Angle:	
Distance to photo point marker (ft):	

EQUIPMENT CHECKLIST

1. Datasheets
2. Photo point location markers
3. Sledge hammer
4. Markers for reference points
5. Tape measure (at least 100 feet)
6. Compass
7. Clinometer
8. Field Map
9. GPS unit

Log Cabin and Our House Diversion Dams Sediment Management Plan

Attachment D

Suspect Invasive Species Report

Yuba River Development Project

FERC Project No. 2246

June 2018

CALIFORNIA DEPARTMENT OF
FISH AND GAME

Suspect Invasive Species Sighting Report

You may not be able to provide all of the information requested below, but please fill in as much as you can.

General type of organism (plant, shellfish, snake, etc) and its name if known

Date of Sighting

Description of organism (size, color, shape and other distinguishing characteristics)

The county in California where the sighting took place

Directions to the location of the sighting

If any photographs were taken, please include them when you submit this form.

Landowner or Land Manager (if known)

First and Last name of person who sighted the suspect invasive species

Best phone number to reach this person (include area code): ______________________

Best time to reach this person:

Day: 8am-noon ☐ Noon-5pm ☐ **Eve:** 5pm – 9pm ☐

E-Mail address: ______________________

Mailing Address: ______________________

When completed, please mail this form and any pictures and/or samples to:

Invasive Species Program
Habitat Conservation Branch
Department of Fish and Game
1416 Ninth Street, 12th Floor
Sacramento, CA 95814

Log Cabin and Our House Diversion Dams
Sediment Management Plan

Attachment E

Field Soil Moisture Test

Yuba River Development Project
FERC Project No. 2246

June 2018

Use this protocol by digging a small pit and sample 4 to 6 inches below the mineral soil surface (below the surface litter). Collect enough soil to form a 1 to 2 inch ball by molding with hand pressure. Pick out excessive rock fragments & squeeze with 6 directional squeezes. If a ball is formed that holds together under repeated tosses (1 to 2 feet into the air) then the soil is too wet for equipment operation.

Table 1. Protocol for determining operability on soils based on soil moisture[1]

Soil Moisture % Increases Downward	**Coarse Soils** Loamy sands, fine sandy loam, very fine sands, coarse sands	**Light Soils** Fine sandy loams, sandy loams, very fine sandy loam	**Med. Soils (<35% clay)** Sandy clay loam, loam, silt loam, sandy clay loam, clay loam	**Heavy Soils (>35% clay)** Clay loam, sandy clay, silty clay loam, clay
Dry soils	Dry, loose, single grained flows thru fingers	Dry, loose, flows thru fingers	Powdery, dry, sometimes slightly crusted but breaks down into powdery conditions	Hard, baked, cracked sometimes has loose crumbs on surface
Slightly Moist soil	Still appears dry, will not form a ball with pressure	Still appears to be dry; will not form a ball	Somewhat crumbly, but will hold together from pressure	Somewhat pliable; will form ball under pressure. At plastic limit.
Moist soil	Still appears dry, will not form a ball with pressure	Tends to ball under pressure but seldom will hold together	Forms a ball and is very pliable, sticks readily if high in clay.	Easily ribbons out between fingers, has a slick feeling. At plastic limit.
Very moist soil	Tends to stick together slightly, sometimes forms a very weak ball	Forms a weak ball breaks easily, will not stick. Plastic limit or nonplastic.	Forms a ball and is very pliable, sticks readily if high in clay. Exceeds plastic limit.	Easily ribbons out between fingers, has a slick feeling. Exceeds plastic limit.
Wet soils	Upon squeezing, free water may appear. Wet outline is left on hand. Nonplastic.	Upon squeezing free water may appear. Wet outline left on hand.	Can squeeze out free water. Wet outline left on hand.	Puddles and free water forms on surface. Wet outline left on hand.

(yellow)	Not operable for mechanical equipment
(light yellow)	Not operable for heavy equipment, operable for low ground pressure equipment, such as ATVs
(white)	Operable for all mechanical equipment

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ATTACHMENT 2

Support from the Forest Service, CDFW, and USFWS for Attached Updated
Our House and Log Cabin Diversion Dams Sediment Management Plan

USDA United States Department of Agriculture | Forest Service | Tahoe National Forest Supervisor's Office

631 Coyote Street
Nevada City, CA 95959
530-478-6100
TDD: 1-800-735-2929
Fax: 530-478-6109

File Code: 2770
Date: July 24, 2018

Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901

Subject: FOREST SERVICE APPROVAL OF YUBA COUNTY WATER AGENCY'S REQUEST TO REVISE THE LOG CABIN AND OUR HOUSE DIVERSION DAMS SEDIMENT MANAGEMENT PLAN FOR THE YUBA RIVER DEVELOPMENT PROJECT, EXISTING LICENSE, FERC NO. 2246

~~Dear Mr. Aikens:~~ Curt,

This letter provides USDA Forest Service, Tahoe National Forest (hereafter, "Forest Service") approval of the revised **existing license** *Log Cabin and Our House Diversion Dams Sediment Management Plan* (hereafter, "Plan") for Yuba County Water Agency's (YCWA) Yuba River Development Project, existing/current license (YRDP, FERC no. 2246). We have reviewed the most recent version of the Plan (June 2018) and agree with the proposed revisions.

In late 2013 and early 2014, the Forest Service along with other federal and state agencies and stakeholders, worked with YCWA to develop a sediment management plan for the Log Cabin and Our House Diversion Dams which are within the YRDP. YCWA filed a final Plan with FERC in May 2014. The Forest Service provided a letter to YCWA approving this Plan in September 2014. YCWA pursued additional necessary permits, FERC approved the Plan in March of 2016, and YCWA then began implementing the Plan.

During implementation in 2016 and 2017, it was determined that modifications of some aspects of the Plan were needed to fully address sediment issues at Log Cabin and Our House Diversion Dam. Over the past several months, the Forest Service, along with other federal and state agencies and stakeholders, have been consulting with YCWA on modifying the Plan. The significant changes from the FERC-approved 2016 version of the Plan include: (1) the addition of methods to manage blockage of dam outlets, (2) the addition of key relevant Forest Service Best Management Practices (BMP's) for Water Quality, and (3) updates of BMP's required by other federal and state agencies.

The Forest Service understands that YCWA will provide the revised Plan to FERC for review and approval along with a copy of this Forest Service letter and similar supporting documentation from other resource agencies and stakeholders. We appreciate the collaborative approach you have taken to work on revisions of these Plans. If you have any questions regarding this letter, you may contact Amy Lind (Tahoe and Plumas National Forests, Hydroelectric Coordinator) at alind@fs.fed.us or (530)-478-6298.

Sincerely,

ELI ILANO
Forest Supervisor

cc: Alonzo Henderson, Dawn Alvarez, Amy Lind, Jim Lynch (HDR)

Palmer, Jacare

From:	Lose, Sarah@Wildlife <Sarah.Lose@wildlife.ca.gov>
Sent:	Monday, July 23, 2018 9:19 AM
To:	Lynch, Jim; Lind, Amy -FS; Murphy, Stephanie (stephanie.murphy@stantec.com); Kennedy, Amy@Wildlife; Lawson, Beth@Wildlife; Choy, Philip@Waterboards; Tadlock, Stephanie@Waterboards; Grothe, Douglas E CIV USARMY CESPK (US); traci@foothillswaternetwork.org; blancapaloma@msn.com
Cc:	Kent, Robin; Palmer, Jacare; Fillmore, Kassandra; Geoff Rabone (grabone@ycwa.com)
Subject:	Re: Yuba Relicensing: Filing Log Cabin and Our House Sediment Plans & Request for E-Mails of Support

Jim,

The CDFW supports inclusion of the Log Cabin and Our House Diversion Dams Sediment Management Plan (dated June 2018) under the existing license but notes that YCWA has a current RMA (1600-2014-0163-R2) that references a different sediment management plan dated July 2014.

YCWA's current RMA will expire on December 31, 2019. CDFW did receive on June 22, 2018, an application for amendment to the current RMA, but YCWA did not submit the updated Log Cabin and Our House Diversion Dams Sediment Management Plan (dated June 2018) as a part of their amendment application.

CDFW suggest that YCWA submit the updated plan for inclusion in their amended RMA in order for their LSAA permit to be consistent with this Plan.

Sarah Lose
Senior Environmental Scientist (Specialist)
California Department of Fish and Wildlife
916-747-5226

From: Lynch, Jim <Jim.Lynch@hdrinc.com>
Sent: Thursday, July 19, 2018 1:30 PM
To: Lind, Amy -FS; Murphy, Stephanie (stephanie.murphy@stantec.com); Kennedy, Amy@Wildlife; Lawson, Beth@Wildlife; Choy, Philip@Waterboards; Tadlock, Stephanie@Waterboards; Grothe, Douglas E CIV USARMY CESPK (US); traci@foothillswaternetwork.org; blancapaloma@msn.com
Cc: Kent, Robin; Palmer, Jacare; Fillmore, Kassandra; Geoff Rabone (grabone@ycwa.com); Lose, Sarah@Wildlife
Subject: RE: Yuba Relicensing: Filing Log Cabin and Our House Sediment Plans & Request for E-Mails of Support

Thanks, Amy.

Anyone else?

James Lynch
D 916.679.8740 **M** 916.802.6247

hdrinc.com/follow-us

From: Lind, Amy -FS [mailto:alind@fs.fed.us]
Sent: Thursday, July 19, 2018 1:28 PM
To: Lynch, Jim <Jim.Lynch@hdrinc.com>; Murphy, Stephanie (stephanie.murphy@stantec.com) <stephanie.murphy@stantec.com>; Kennedy, Amy@Wildlife (Amy.Kennedy@wildlife.ca.gov) <Amy.Kennedy@wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>; Philip.Choy@Waterboards.ca.gov; Stephanie.Tadlock@waterboards.ca.gov; Grothe, Douglas E CIV USARMY CESPK (US) <Doug.Grothe@usace.army.mil>; traci@foothillswaternetwork.org; blancapaloma@msn.com
Cc: Kent, Robin <Robin.Kent@hdrinc.com>; Palmer, Jacare <Jacare.Palmer@hdrinc.com>; Fillmore, Kassandra <Kassandra.Fillmore@hdrinc.com>; Geoff Rabone (grabone@ycwa.com) <grabone@ycwa.com>; Lose, Sarah@Wildlife <Sarah.Lose@wildlife.ca.gov>
Subject: RE: Yuba Relicensing: Filing Log Cabin and Our House Sediment Plans & Request for E-Mails of Support

YCWA: The Forest Service supports the revised Log Cabin and Our House Diversion Dams Sediment Management Plan (dated June 2018) for the **new license,** and YCWA's letter to FERC requesting this new version of the Plan be used for FERC's NEPA analysis of the amended Final License Application.

The Forest Service is planning to include this revised version of the Log Cabin and Our House Diversion Dams Sediment Management Plan in our Final 4(e) Conditions.

Thank you for working with us, and other relicensing participants, to revise this Plan.

Please note that for revisions to the **existing/current license** Plan, I am drafting a letter of approval and hope to have that to you by early next week.

Best Regards,
Amy Lind

Amy Lind
Hydroelectric Coordinator
Forest Service
Tahoe and Plumas National Forests
p: 530-478-6298
alind@fs.fed.us
631 Coyote St.
Nevada City, CA 95959
www.fs.fed.us
Caring for the land and serving people

From: Lynch, Jim [mailto:Jim.Lynch@hdrinc.com]
Sent: Thursday, July 19, 2018 12:33 PM
To: Lind, Amy -FS <alind@fs.fed.us>; Murphy, Stephanie (stephanie.murphy@stantec.com) <stephanie.murphy@stantec.com>; Kennedy, Amy@Wildlife (Amy.Kennedy@wildlife.ca.gov) <Amy.Kennedy@wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>;

Philip.Choy@Waterboards.ca.gov; Stephanie.Tadlock@waterboards.ca.gov; Grothe, Douglas E CIV USARMY CESPK (US) <Doug.Grothe@usace.army.mil>; traci@foothillswaternetwork.org; blancapaloma@msn.com
Cc: Kent, Robin <Robin.Kent@hdrinc.com>; Palmer, Jacare <Jacare.Palmer@hdrinc.com>; Fillmore, Kassandra <Kassandra.Fillmore@hdrinc.com>
Subject: Yuba Relicensing: Filing Log Cabin and Our House Sediment Plans & Request for E-Mails of Support

Just following up on YCWA's filing of the:

1. *Log Cabin and Our House Diversion Dams Sediment Management Plan* under the existing license
2. *Log Cabin and Our House Diversion Dams Sediment Management Plan* for the new license

Attached are the clean versions of both plans, which I believe we agreed to, and draft letters that YCWA would use to file the plans with FERC.

I'd like to attach to our filing letter any emails supporting the plans, as we have discussed. If you could, please send the support emails to me by COB this Friday.

Thanks, and contact me if you have any questions or anticipate a delay in getting to us the support emails.

James Lynch
Senior Vice President, Hydropower Services

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916.679.8740 **M** 916.802.6247
James.Lynch@hdrinc.com

hdrinc.com/follow-us

From: Lynch, Jim
To: Fillmore, Kassandra; Palmer, Jacare
Subject: FW: YRDP: Filing of Revised Sediment Plan Under Existing License
Date: Tuesday, August 7, 2018 4:57:54 PM

James Lynch
D 916.679.8740 M 916.802.6247

hdrinc.com/follow-us

From: Welsh, Daniel [mailto:daniel_welsh@fws.gov]
Sent: Tuesday, August 7, 2018 4:43 PM
To: Lynch, Jim <Jim.Lynch@hdrinc.com>
Cc: Alison Willy <alison_willy@fws.gov>; Millsap, Stephanie <stephanie_millsap@fws.gov>
Subject: YRDP: Filing of Revised Sediment Plan Under Existing License

Jim,

The U.S. Fish and Wildlife Service (USFWS) supports Yuba County Water Agency's (YCWA) June 2018 proposed update to the Our House and Log Cabin Diversion Dams Sediment Management Plan (Plan). This Plan would replace the similar plan, filed May 2014, in the existing license.

USFWS, YCWA, and other agencies have noted improvements that could be made to the Plan based on lessons learned during plan implementation. YCWA, FWS, and other agencies collaboratively worked together to revise and update the Log Cabin and Our House Diversion Dams Sediment Management Plan.

If you have any questions about our support for the updated Plan please contact me or Stephanie Millsap.

Sincerely,

Dan Welsh, Deputy Field Supervisor
U.S. Fish and Wildlife Service
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, CA 95814
(916) 930-5639 (office)
(916) 468-8470 (cell)
Daniel_Welsh@fws.gov

Cultural Resources Investigation for the

Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan

for the
Yuba River Development Project
(FERC Project No. 2246)
Nevada, Yuba, and Sierra Counties, California

[redacted]

Appendix B

Resumes of Key Personnel

Danielle Risse

Senior Archaeologist

Danielle has 20 years of archaeological experience throughout California, Nevada, Oregon, Washington and Virginia. Her broad experience ranges from working with the remains of slave quarters on the Virginia Coastal Plain, to 19th and 20th century mining sites located in desolate mountain ranges throughout Nevada. She has recorded a prehistoric hunting landscape with over 500 petroglyph panels and excavated a portion of a Chinatown in Nevada's capital city. Ms. Risse has participated in well over 300 cultural resources investigations. Her primary responsibilities include project planning and execution, field and budget management, analysis and interpretation of data, and subsequent analytical reporting of results. Danielle has served as project manager and field director for historic and prehistoric field projects, including conducting site reconnaissance and recordation, site excavation and resource evaluation and mitigation. She has completed numerous historic contexts, analyzed historic and prehistoric artifact assemblages, including an extensive assemblage of Chinese material remains, and written numerous cultural resources management reports. Since joining HDR in July 2010, Danielle has been immersed in multiple hydropower and electrical transmission projects. Her efforts at HDR have included drafting cultural resources inventory and evaluation reports and management plans, conducting field work, project management and performing day to day tribal and agency consultation efforts. Danielle meets the Secretary of Interior's Professional Qualifications Standards for archaeology and is an expert on compliance requirements for Section 106 of the National Historic Preservation Act.

EDUCATION
Master of Arts, Anthropology, College of William and Mary

Bachelor of Arts, Anthropology, University of California Davis

INDUSTRY TENURE
20 years

HDR TENURE
9 years

OFFICE LOCATION
Sacramento, CA

RELEVANT EXPERIENCE

Yuba River Development Project, Yuba County Water Agency, *Nevada, Yuba, and Sierra Counties, CA*
Danielle serves as the lead cultural resources specialist on a number of separate efforts related to the Yuba River Development Project, which is a hydroelectric project licensed by FERC. Danielle's efforts include project management, field survey, resource documentation and evaluation, reporting, and day to day consultation with tribes and agencies.

BNSF Tower Review Project, BNSF Railway, *near Fresno, Greenville, and Stockton, California*
Danielle performed cultural resources records search reviews of existing data for Positive Train Control towers and other tower types.

Phase I Archaeological Investigation for the Oregon Trunk 53_142.14.PTC Tower, BNSF Railway, *Deschutes County, Oregon*
Danielle conducted Phase 1 field inventory of proposed tower location and drafted inventory report.

Weston Substation Expansion Project, PacifiCorp, *Umatilla County, Oregon*
Danielle served as the cultural lead and conducted a due diligence site visit and drafted a due diligence memo regarding cultural resources sensitivities.

Montague Wind Energy Project, Avangrid Renewables LLC, *Gilliam County, Oregon*
Danielle served as a field crew member for cultural survey of proposed wind facility sites.

Spring Street Sewage Treatment Plant Upgrade Project, City of Klamath Falls, *Klamath County, Oregon*
Danielle served as the cultural resources lead and conducted a records search, archival research, field survey, and assisted with report writing and finalization.

Proposed Pacific Marine Energy Center South Energy Test Site FERC Relicensing, Oregon State University, *Lincoln County, Oregon*
Danielle served as the cultural lead and conducted a records search, archival research, field survey and shovel probing, and helped draft the cultural resources inventory report. Danielle also assisted client with tribal and agency consultation.

Gartina Falls Hydroelectric Project Licensing (FERC No. 14066-000), *Chichagof Island, Southeast Alaska*
Danielle worked on field survey team and conducted archival research.

Yuba-Bear Hydroelectric, Drum-Spaulding Hydroelectric and Rollins Transmission Line Project Joint Relicensing, Pacific Gas & Electric (PG&E) and Nevada Irrigation District, *Placer, Sierra, Sutter, and Yuba Counties, CA*
Danielle served as a cultural resources specialist, providing support services for the preparation of relicensing documents, conducting tribal and agency consultation, site testing, inventory and lab management.

American River Common Features, Natomas Basin Reach I Contract 1, Engineering Services and Cultural Resource Monitoring during Construction, *Sacramento County, California*
Danielle served as a cultural resources monitor during project construction. This included monitoring daily construction activities, coordinating with construction personnel and Native American monitors from four separate tribal groups, keeping detailed daily notes of project activities and personnel.

Sam's Valley Transmission Line Reinforcement Project, *Medford, Oregon.*
Danielle served as the lead cultural resources specialist for the project, which included supervising a 23 mile long transmission line survey and excavation of 159 shovel probes testing for subsurface depth of cultural deposits. Danielle prepared the inventory and evaluation report for the project, which included site documentation and National Register of Historic Places evaluations. Danielle also completed extensive consultation with local tribes, the BLM, and the State Historic Preservation Officer throughout the project to ensure positive cooperation between the project proponent and consulting parties.

Don Pedro Hydroelectric Project FERC Relicensing, Turlock and Modesto Irrigation Districts, *Tuolumne County, CA*
Danielle served as the cultural resources manager responsible for preparation of cultural resources-related study plans, implementation of cultural resources studies conducted for the relicensing, drafting the project inventory/evaluation reports for compliance with Section 106, developing the Historic Properties Management Plan and completing day-to-day tribal and agency consultation efforts.

Cultural Resources Inventory of Line 2 and Line 4 Transmission Lines for Pacific Power, *Shasta and Siskiyou Counties, CA*
Danielle served as the project manager and field director responsible for field documentation of resources, resource evaluations, and reporting efforts. Project included survey of a patch work for Forest Service lands along the transmission lines that spanned roughly 50 miles.

La Grange Hydroelectric Project FERC Licensing, Turlock and Modesto Irrigation Districts, *Tuolumne and Stanislaus County, CA*
Danielle served as the cultural resources manager responsible for preparation of cultural resources-related study plans, implementation of cultural resources studies conducted for the licensing, drafting the project inventory/evaluation reports for compliance with Section 106, developing the Historic Properties Management Plan and completing day-to-day tribal and agency consultation efforts.

SunEdison's Bevan's Point Solar Project, *Malin, Oregon.*
Danielle completed a feasibility study for project planning purposes entailing a review of previous cultural resources and investigations and site visit to the project location.

Tahoe to Pyramid Lake Bike Path- Cultural Resources Survey, *Nevada County, California*
Danielle served as project manager and conducted the cultural resources survey and site form write-up.

Goldfield Mining District- Cultural Context, *Esmeralda County, Nevada*
Danielle served as project manager and conducted archival research.

Minoletti/Goicoechea Ranch House in Newark Valley, *White Pine County, Nevada*
Danielle served as project manager and contribution to the design of an interpretive sign.

Lower Truckee River Canyon- Cultural Resources Survey, *Washoe County, Nevada*
Danielle served as project manager and conducted the cultural resources survey, site recordation and evaluation, and report writing.

Historic Preservation Treatment Plan for Site 26Wp4771 (CrNV-46-7566), *White Pine County, Nevada*
Danielle drafted this plan.

Eureka County Water Pipeline and Spring Box Replacement Project, *Eureka County, Nevada*
Danielle served as project manager and conducted the cultural resources survey, site evaluation, and report write-up.

Couer Rochester Mineral Exploration Program, *Pershing County, Nevada*
Danielle served as project manager and conducted the cultural resources survey, site recordation and write-up, and report write-up.

Historic Preservation Treatment Plan for Site 26Wp6372 (CrNV-04-8262), *Bald Mountain Mining District, White Pine County, Nevada*
Danielle drafted this plan.

Bishop Creek Dam Access Road Survey and Final Mitigation Plan, *Elko County, Nevada*
Danielle served as project manager and performed site form write-up, site evaluations, and report writing.

Data Recovery at 26Or199, Carson City China Town, *Carson City, Nevada*
Danielle served as field supervisor for the mitigation of an early to late urban Chinese occupation, and conducted artifact analysis and report write-up.

Truckee Canyon Water System Expansion- Cultural Resources Inventory, *Mustang, Washoe County, Nevada*
Danielle served as project manager and field supervisor, and performed site recordation and evaluation, and report writing.

Marigold Mine - Re-evaluation of 51 Sites, *Humboldt County, Nevada*
Danielle conducted project management, site form write-up, site evaluations, and report writing.

Converse Mine - Cultural Resources Inventory, *Humboldt County, Nevada*
Danielle conducted project management, site form write-up, site evaluations, and report writing.

Prehistoric Bella Vista Site Complex South Truckee Meadows, Data Recovery Project at Sites 26Wa2054, 26Wa6651, and 26Wa7478, *Washoe County, Nevada*
Danielle completed report write-up and artifact and statistical analysis.

Cultural Resources Survey of 1600 acres, - including the recordation of over 500 petroyglyph panels, *Storey County, Nevada*
Danielle served as project manager and field supervisor.

Manhattan Mining District - Cultural Context, *Nye County, Nevada*
Danielle conducted archival research and historic context write-up.

SELECTED REPORTS

Kautz, Robert R. and Danielle Risse. Carson City's "China Town," The Archaeology of Urban Nevada. Kautz Environmental Consultants, Reno, Nevada.

Risse, Danielle, Dwight D. Simons, Leesa Gratreak, Kamil Rochon, and Monica Ruth. 2019. *Cultural Resources Study Report; A Cultural Resources Inventory for the Camp Far West Hydroelectric Project, Nevada, Placer, and Yuba Counties, California (FERC No. 2997).* Prepared by HDR, Inc. Prepared for South Sutter Water District.

Risse et al. 2013. Cultural Resources Inventory for the Diversion Tunnel Maintenance: Inlet Works Vent Pipe Slip Lining Don Pedro Hydroelectric Project (FERC No. 2299), Tuolumne County, California. Prepared by HDR. November 2013.

Risse et al. 2014. Cultural Resources Inventory and Research Design for Shoreline Stabilization at the Don Pedro Hydroelectric Project (FERC No. 2299), in Tuolumne County, California. Prepared by HDR. October 2014.

Risse et al. 2015a. Historic Properties Study; A Cultural Resources Inventory of the Don Pedro Project, Conducted for FERC Relicensing (FERC No. 2299), Tuolumne County, California. Prepared by HDR Engineering, Inc., Sacramento, CA, and Far Western Anthropological Research Group, Inc., Davis, CA. May 2015.

Risse et al. 2015. Addendum to the Historic Properties Study; A Cultural Resources Inventory of the Don Pedro Project, Conducted for FERC Relicensing (FERC No. 2299), Tuolumne County, California. Prepared by HDR Engineering, Inc., Sacramento, CA, and Far Western Anthropological Research Group, Inc., Davis, CA. May 2015.

Risse et al. 2017. Cultural Resources Study Report for the La Grange Hydroelectric Project FERC Licensing. Prepared by HDR, Inc. Filed with FERC as Privileged Information. February 2017.

Risse, Danielle, Dwight Simons, and Robert R. Kautz. A Literature Review of Cultural Resource Investigations, Alpine Meadows, Placer County, California. Kautz Environmental Consultants, Reno, Nevada.

Risse, Danielle and Robert R. Kautz. A Testing Plan for Sites CrNV-01-1820 and CrNV-11-13855, Big Ledge Mine, Elko County, Nevada. Kautz Environmental Consultants, Reno, Nevada.

Risse, Danielle and Robert R. Kautz. An Historic Preservation Treatment Plan for Site 26Ek3852/CrNV-01-1819, Big Ledge Mine, Elko County, Nevada. Kautz Environmental Consultants, Reno, Nevada.

Simons, Dwight, Robert R. Kautz, Danielle Risse, and Barbara Malinky. A Cultural Context for the Manhattan Mining District, Nye County, Nevada. Kautz Environmental Consultants, Reno, Nevada.

Risse, Danielle and Dwight Simons. A Re-Evaluation of 51 Sites for Marigold Mine, Humboldt County, Nevada. Kautz Environmental Consultants, Inc., Reno, Nevada.

Risse, Danielle and Dwight Simons. A Cultural Resources Inventory of the Solar Development Project Near Luning, Mineral County, Nevada. Kautz Environmental Consultants, Inc., Reno, Nevada.

Kimball, Monique and Danielle Risse. The Minoletti/Goicoechea Ranch House, The Story of an Early Nevada Ranch, Newark Valley, White Pine County, Nevada. Kautz Environmental Consultants, Inc., Reno, Nevada.

Risse, Danielle. Mountain View Cemetery Cultural Resources Inventory, Washoe County, Nevada. Kautz Environmental Consultants, Inc., Reno, Nevada.

Simons, Dwight, Robert Kautz, and Danielle Risse. A Gilded Mirage: A Cultural Context for the Goldfield Mining District, Esmeralda County, Nevada. Kautz Environmental Consultants, Inc., Reno, Nevada.

Risse, Danielle. A Cultural Resources Inventory of 811 Acres for the Elko Water Reclamation Facility, Elko County, Nevada. Kautz Environmental Consultants, Inc., Reno, Nevada.

Risse, Danielle. A Cultural Resources Survey for the Eureka County Water Pipeline and Spring Box Replacement Project, Eureka County, Nevada.

Monica Ruth

Cultural Resources Specialist

EDUCATION
Bachelor of Arts, Anthropology, California State University, Sacramento, 2006

PROFESSIONAL MEMBERSHIPS
Society for California Archaeology

INDUSTRY TENURE
7+ years

HDR TENURE
13 years

PAPERS AND PRESENTATIONS
"Building trust and healthy relationships with Native American tribes: FERC relicensings and fulfilling federal trust and consultation responsibilities." Paper presented at 2019 Annual Meeting of the Society for California Archaeology, Sacramento, California

Ms. Ruth has over 7 years of experience as a Cultural Resources Specialist in California, Oregon, and Washington working on hydroelectric, electrical transmission lines licensing and compliance projects. Ms. Ruth has experience in tribal consultation, laboratory analysis, archival research, field preparation including drafting Bureau of Land Management land use permits, research design development, and proposal and budget development. She has been a contributing author for technical reports and cultural resources studies. She performs tribal consultation efforts consistent with Section 106 of the National Historic Preservation Act requirements and PRC 21080.3.1 of the California Environmental Quality Act, assists in preparation and production of various cultural resources management documents for submission to federal agencies and tribes, and provides logistical support for field and office based cultural resources management efforts. Ms. Ruth also drafts and coordinates environmental permitting documents, including applications for the Clean Water Act (CWA) Section 401 Water Quality Certification, the United States Army Corps of Engineers (USACE) CWA 404 Nationwide Permit, and the California Department of Fish and Wildlife (CDFW) Streambed and Lake Alteration Agreement.

RELEVANT EXPERIENCE

Devil Canyon Hydroelectric Relicensing, Department of Water Resources, *San Bernardino County, California*
Monica assisted with field logistics for cultural resources inventory and the production of technical reports and management plan on an archaeological field inventory.

South State Water Project Hydroelectric Relicensing, Department of Water Resources and Los Angeles Department of Water and Power, *Los Angeles County, California*
Monica assisted with field logistics cultural resources inventory and the production of technical reports and management plan on an archaeological field inventory.

Don Pedro Hydroelectric Project FERC Relicensing, Turlock and Modesto Irrigation Districts, *Tuolumne County, California*
Monica assisted with archival and records research and in producing the project inventory and evaluation reports for compliance with Section 106, developing the Historic Properties Management Plan, and completing day-to-day tribal and agency consultation efforts.

La Grange Hydroelectric Project FERC Licensing, Turlock and Modesto Irrigation Districts, *Tuolumne and Stanislaus County, California*
Monica assisted with archival and records research and in producing the project inventory and evaluation reports for compliance with Section 106, developing the Historic Properties Management Plan, and completing day-to-day tribal and agency consultation efforts.

Tuolumne River Levee Repair Project, Turlock Irrigation District, *Stanislaus County, California*
Monica assisted with archival and records research in producing the project inventory report for compliance with Section 106 and CEQA including tribal and agency consultation efforts.

Beardsley-Donnells Hydroelectric License Implementation, Tri-Dam Project of the South San Joaquin and Oakdale Irrigation Districts, *Tuolumne County, California*
Monica serves as a cultural resources specialist during license implementation and conducts tribal and agency consultation in compliance with Section 106 of the NHPA in order to implement the historic properties management plan. Monica has also served as a field technician performing site testing and excavation, and assisted with associated reporting and treatment plan preparation.

Tulloch Hydroelectric License Implementation, Tri-Dam Project of the South San Joaquin and Oakdale Irrigation Districts, *Tuolumne County, California*
Monica serves as a cultural resources specialist during license implementation and conducts tribal and agency consultation in compliance with Section 106 of the NHPA in order to implement the historic properties management plan.

Riverbank Feasibility Studies, City of Santa Cruz, *Santa Cruz County, California*
Monica performed archival and records research to assist with feasibility studies for the City of Santa Cruz.

Camp Far West Hydroelectric Relicensing, South State Water District, *Nevada, Placer and Yuba Counties, California*
Monica assisted with archival and records research in producing the project inventory report for compliance with Section 106 and CEQA including tribal and agency consultation efforts.

Camp Far West Transmission Line Relicensing, Pacific Gas and Electric Company, *Placer and Yuba Counties, California*
Monica performed archival and record searches, field survey of the transmission line, consultation and coordination with tribes and agencies, and drafting the historic property management plan.

Camp Far West Auxiliary Spillway Expansion Project, South State Water District, *Yuba County, California*
Monica assisted with archival and records research in producing the project inventory report for compliance with Section 106 and CEQA including tribal and agency consultation efforts. Monica also assisted in preparation of cultural and tribal resources sections of CEQA Mitigated Negative Declaration document.

Yuba River Development Project, Yuba Water Agency, *Nevada, Yuba, and Sierra Counties, California*
Monica serves as a cultural resources specialist on a number of separate efforts related to the Yuba River Development Project, which is a hydroelectric project licensed by FERC. Efforts include field survey, archival and records research, resource documentation and evaluation, reporting and management plan preparation, and day to day consultation with tribes and agencies.

Cultural Resources Inventory of Line 2 and Line 4 Transmission Lines for Pacific Power, *Shasta and Siskiyou Counties, California*
Monica served as a field technician responsible for field documentation of resources and reporting efforts. Project included survey Forest Service lands along the transmission lines damaged by the Delta Fire.

Proposed Pacific Marine Energy Center South Energy Test Site FERC Relicensing, Oregon State University, *Lincoln County, Oregon*
Monica served as a cultural resources specialist, completing such tasks as report preparation and assisting with tribal and agency consultation.

Klamath Falls Spring Street Sewage Treatment Plant Project, City of Klamath Falls, *Klamath County, Oregon*
Monica served as a field technician and cultural resources specialist for survey of sewage treatment plant and performed archival and records research, resource documentation, report preparation, and tribal/agency consultation efforts.

Sam's Valley Transmission Line Reinforcement Project, *Medford, Oregon.*
Monica assisted with field logistics and inventory report preparations, including agency and tribal consultation efforts.

Pacific Coast Fertilizer Project, Pacific Coast Fertilizer LP, *Cowlitz County, Washington*
Monica served as a field technician for survey of private lands and assisted with resource documentation, report preparation, and tribal/agency consultation efforts.

EDUCATION

MS, Historic Preservation, University of Oregon, 2012

BA, Architectural History; Minors in Business Administration and Historic Preservation, University of Oregon, 2010

Certification, GIS, Clackamas Community College, 2016

PROFESSIONAL MEMBERSHIPS

Friends of the Historic Columbia River Highway Board of Directors (2013-2016), Committee Member (2013-2019), Volunteer (2013-present)

Restore Oregon, Member and Volunteer, Portland (2011-present)

Architectural Heritage Center, Education Committee, Member, Docent, and Tour Guide, Portland (2011-present)

Oregon City Parks Foundation, Volunteer and Grant Committee, Oregon City (2016-Present)

DoCoMoMo Oregon, Volunteer and Docent, Portland (2015-Present)

INDUSTRY TENURE

8.5 years

HDR TENURE

3.5 years

OFFICE LOCATION

Portland, OR

TRAINING

Oregon Department of Transportation, Cultural Resources Consultant Qualification Training for Architectural History, Salem (OR)

ACHP/CEQ Guidance for Integrating NEPA and Section 106, NWAEP, Portland (OR)

Caltrans Environmental Compliance: Introduction to Cultural Resources Compliance, Sacramento (CA)

Leesa Gratreak

Architectural Historian

Leesa Gratreak is an architectural historian with over 8 years of professional experience conducting historic surveys and providing cultural resource management services, as well as 4 years of experience volunteering with the University of Oregon conducting historic resource surveys, condition assessments and intensive level research. Her experience includes large-scale reconnaissance and intensive level survey, Section 106, Section 4(f), FERC Relicensing, NEPA, and CEQA compliance, historic research and context development, GIS mapping and analysis, MPD development, HABS/HAER documentation, National Register nominations, and preservation and restoration planning strategies for private and public entities. Leesa has worked extensively throughout the West.

RELEVANT EXPERIENCE

Kirtland Air Force Base (AFB), Draft Environmental Assessment Reports for Upcoming Work at Kirtland AFB, (2019), *Albuquerque, NM*
Role: Architectural history lead, report author. HDR is providing as-needed NEPA technical support for projects involving Kirtland AFB. Work includes drafting cultural resources portion of EAs/EISs and SHPO and Tribal consultation.

Caltrain, Condition Assessment of Historic Train Stations, (2018), *CA*
Role: Architectural history and historic preservation lead. Lead report author and field lead. HDR conducted in-depth condition assessment of building envelope, materials, construction, as well as interior features and significant features in the setting for six NRHP listed train stations in San Mateo and Santa Clara County, CA. Included detailed recommendations for prioritizing repairs and maintaining historic character-defining features.

Montana-Dakota Utilities Company, Architectural Resources Inventory for the MDU ARS Miles City 115 kV Transmission Line and Substation, (2018-current), *MT*
Role: Architectural history lead and primary report author. HDR is providing technical assistance with Section 106 Compliance and historical documentation for the MDU ARS Miles City 115 kV Transmission Line and Substation Project in Custer County, MT in order to permit new construction.

Pyramid Lake Paiute Tribe, Cultural Resources Inventory and National Register of Historic Places Evaluation for the Prosser Creek Hydroelectric Project Licensing, (2018), *CA*
Role: Architectural history lead and primary report author. HDR provided technical assistance with Section 106 Compliance and historical documentation for the Prosser Creek Hydroelectric Project in Nevada County, CA in order to issue a new FERC license.

California Department of Water Resources (DWR), FERC Relicense of the Devil Canyon Project, (2017-current), *CA*
Role: Architectural history lead, field lead, lead report writer. HDR is

Handling Cultural Resource issues in Clean Water Act Section 404 Permitting, NWAEP, Portland (OR)

Oregon Connecting to Collections, Collections Care Workshop, Oregon, Oregon Heritage Conference, Portland (OR)

providing technical assistance with Section 106 Compliance and historical documentation for the Devil Canyon Hydroelectric Project near San Bernardino, CA in order to relicense the hydropower facility.

California Department of Water Resources (DWR), FERC Relicense of the South SWP Project, (2017-current), *CA*
Role: Architectural history lead, field lead, lead report writer. HDR is providing technical assistance with Section 106 Compliance and historical documentation for the South SWP Hydroelectric Project near in order to relicense the hydropower facilities.

U.S. Marine Corps Forces Reserve (MARFORRES), Heritage Asset and Historic Resources Inventory, (2017-current), *USA*
Role: Architectural historian, project deliverables lead, research lead. HDR is providing technical assistance to MARFORRES in order to inventory, research and create a database for all known heritage assets and historic resources located at all 160 MARFORRES locations in the U.S. Ms. Gratreak has U.S. Government Common Access Car clearance until 2021.

Pacific Gas and Electric (PG&E), Camp Far West Transmission Line FERC Relicense Cultural Resource Study, (2017-current), *CA*
Role: Architectural history lead, field lead, lead report writer. HDR is providing technical assistance with Section 106 Compliance and historical documentation for the Camp Far West Transmission Line Project, located near Wheatland, CA.

Idaho Department of Transportation (ITD), State Highway 41, Mullen to East Prairie, (2017-2018), *ID*
Role: Architectural history lead, field lead, lead report writer. HDR provided technical assistance with Section 106 and 4(f) compliance for the SH-41 upgrade and expansion project. Includes determinations of eligibility, intensive level survey, findings of effect, consultation, and mitigation recommendations.

Oregon Department of Environmental Quality (DEQ), City of Klamath Falls Sewage Treatment Plant Upgrade Project, (2018-2019), *Klamath Falls, OR*
Role: Architectural history lead, report author, lead researcher. HDR conducted a cultural resource survey for the City of Klamath Falls Sewage Treatment Plant Upgrade Project in order to complete Section 106 compliance. Included historic context development and Section 106 documentation.

Prevailing Winds, sPower (2018-2019), *Yankton, SD*
Role: Architectural Historian, field staff, and report author. HDR conducted a cultural resource survey for sPower's Prevailing Winds wind farm project in Bon Homme, Charles Mix, Hutchinson, and Yankton counties in order to complete Section 106 compliance. The 50,364-acre project includes 61 turbines 590 feet tall with a 27-mile transmission line. HDR surveyed and evaluated more than 200 architectural resources for NRHP eligibility.

Oregon Department of Transportation (ODOT), I-205 Abernathy Project, (2017-2018), *Clackamas County, OR*
Role: Architectural history lead, field lead, lead report writer. HDR provided technical assistance with Section 106 and 4(f) compliance for the I-205

upgrade and expansion Project. Includes determinations of eligibility, findings of effect, and mitigation recommendations.

ODOT, I-84: N Huntington Interchange Bridge Project, (2018-2019), *Baker County, OR*

Role: Architectural history lead, lead report writer. HDR provided technical assistance with Section 106 and 4(f) compliance for the I-84 N Huntington Interchange Bridge upgrade project. Included determinations of eligibility and findings of effect.

Federal Transit Administration (FTA) and Northern Indiana Commuter Transportation District (NICTD), Railway Expansion Double-Track NWI Project, (2017-2018), *IN*

Role: Field technician, architectural historian, research technician, report author. HDR provided technical assistance with Section 106 compliance for the double-track expansion of the South Shore Commuter Rail Line including NRHP eligibility recommendations.

Minnesota Power Company, Cultural Resources Investigation and Section 106 Consultation, Great Northern Transmission Line Project, (2016-Current), *MN*

Role: Field lead, architectural history lead, lead report author, GIS technician. HDR is providing technical assistance, including large-scale reconnaissance level survey and recommending areas of potential effect and appropriate documentation levels for Section 106 compliance, making determinations of National Register eligibility to historic buildings and sites, and using the Secretary of the Interior's Standards to determine impacts to historic buildings by proposed construction and development activity. The Great Northern Transmission Line Project spans over 220 miles through Roseau, Lake of the Woods, Koochiching, and Itasca Counties in Minnesota.

USACE Honolulu District, Waiahole Reservoir System-Reservoirs No. 155 and 225 HAER Documentation and Section 106 Consultation, (2017-2018), *O'ahu, HI*

Role: Architectural historian, researcher. HDR provided technical assistance with Section 106 Compliance and Historic American Engineering Record (HAER) documentation to facilitate safety upgrades to the Waiahole Ditch Irrigation System, O'ahu, Hawai'i.

Metrolink and San Bernardino County Transportation Authority (SBCTA), Section 106 and NEPA Support for Metro Project, (2017-current), *San Bernardino, CA*

Role: Architectural history lead, report author, field lead, GIS technician. HDR is currently providing technical assistance to support the Metrolink rail project in San Bernardino, CA. The project entails Section 106 and NEPA documentation, National Register eligibility determinations, and Federal Communications Commission documentation for both track placement and communication towers. Also includes design review for the Redlands Depot, a historic train station.

Caltrans Cultural Resources Evaluation and Documentation for the Widening of Interstate 5 (I-5) between State Route 73 (SR-73) and El Toro Road, (2018), *Orange County, CA*

Role: Architectural historian, report author. HDR provided technical support to Caltrans in order to complete Section 106 and CEQA compliance for the I-

5 Widening Project: SR-73 to El Toro Road. This included National Register Eligibility Evaluations, research, and evaluation of effects.

Phase 1 Background Investigations for BNSF Communication Base Stations in Deschutes and Klamath Counties, (2017), *Oregon*
Role: Architectural Historian, lead researcher, report author. HDR provided technical support for BNSF in order to implement new base station towers in Deschutes and Klamath Counties in Oregon. The investigation was completed to assist BNSF in meeting its regulatory obligations pursuant to the Nationwide Programmatic Agreement for the Review of Effects on Historic Properties for Certain Undertakings Approved by the Federal Communications Commission (2004).

USACE – Mobile District, TO 06, Technical Support for Section 106 Compliance and Update Integrated Cultural Resources Management Plan for DLA Installation Support, Defense Supply Center, (2016-current), *Richmond, VA*
Role: Architectural historian, research technician. HDR is providing technical assistance with Section 106 Compliance and Archaeological Testing for DLA Installation Support at Richmond at the Defense Supply Center Richmond (DSCR), Virginia.

South Sutter Water District (SSWD), FERC Relicense and Spillway Permitting, Camp Far West Hydroelectric Project, (2016-2018), *CA*
Role: Field lead, architectural history lead, lead report author. HDR provided technical assistance with Section 106 Compliance and historical documentation for the Camp Far West Hydroelectric Project, located near Wheatland, CA.

JBSA Fort Sam Houston, Draft Environmental Assessment Reports for Upcoming Work at JSBA Fort Sam Houston, (2017-Current), *San Antonio, TX* Role: Architectural history lead, report author. HDR is providing as-needed NEPA technical support for projects involving JSBA-Fort Sam Houston and JBSA-Ranolph. Work includes drafting cultural resources portion of EAs/EISs and SHPO and Tribal consultation.

Turlock and Modesto Irrigation Districts, FERC Relicense of La Grange Dam and Powerhouse, (2016-2017), *CA*
Role: Architectural history lead, field lead, lead report writer. HDR provided technical assistance with Section 106 Compliance and historical documentation for the La Grange Hydroelectric Project near La Grange, CA.

Pacific Gas and Electric (PG&E), National Register of Historic Places Evaluation of the French Meadows 60 kV Transmission Line, FERC Project No. 2479, (2016-2017), *Placer County, CA*
Role: Architectural historian, report author. HDR provided technical assistance including a National Register evaluation to support the HPMP developed for the French Meadows Transmission Line FERC relicense. Placer County, CA.

Colorado Department of Transportation (CDOT), I-70 Transportation Project, (2017), *CO*
Role: Architectural historian, report author. HDR provided assistance to the Colorado DOT in the form of Section 106 consultation for the I-70 transportation project, including providing site records and narrative architectural descriptions.

USACE Seattle District, Levee Documentation and National Register Evaluation, (2016-2017), *WA*
Role: Architectural historian, research technician, report author. HDR provided technical assistance with Section 106 Compliance and National Register eligibility evaluations for six levees in Washington State.

City of Vancouver, NEPA Reevaluation and Cultural Resources FONSI for Washington NE 18th Street Project, (2016), *WA*
Role: Architectural historian, field lead, report author. HDR provided technical assistance and a NEPA Reevaluation for the NE 18th Street transportation improvement project, prepared Finding of No Significant Impact memo, Vancouver, WA.

Alaska Department of Transportation & Public Affairs (ADOT&PF), Cultural Resources Survey for the South Tongass Highway Pavement Rehabilitation Project, (2016), *Ketchikan Gateway Borough, AK*
Role: Architectural historian, report author, research technician. HDR provided technical assistance with Section 106 Compliance and National Register eligibility evaluations for the South Tongass Highway Pavement Rehabilitation Project. Ketchikan Gateway Borough, AK.

Portsmouth Naval Shipyard, Section 106 Consultation Technical Assistance, (2016), *Kittery, ME*
Role: Architectural historian, report author, research technician, GIS support. HDR provided technical assistance in Section 106 Consultation, including drafting consultation letters for interested parties. Kittery, ME.

Yuba County Water Agency (YCWA), Old Colgate Diversion Dam and New Colgate Powerhouse and Penstock HAER Documentation and Section 106 Consultation, (2017-2017), *Yuba County, CA*
Role: Architectural historian, report author, research technician. HDR provided technical assistance with Section 106 Compliance and Historic American Engineering Record (HAER) documentation as part of FERC relicensing for the Old Colgate Diversion Dam near Dobbins, CA.

Idaho Department of Transportation (ITD), Section 106 and 4(f) Analysis for Railroad Avenue Road Improvement Project, (2016), *St. Maries, ID*
Role: Architectural historian, field lead. HDR provided technical assistance with Section 106 and 4(f) documentation for the St. Maries, Idaho Railroad Avenue road improvements.

NON-HDR EXPERIENCE

Section 106, 4(f), NEPA, CEQA, FEMA, Design Review

Amtrak, Condition and Integrity Assessment of Amtrak Stations across the United States for Section 106 Mitigation. Analyzed existing condition, integrity and significance of over 10 Historic Amtrak Stations across the United States for Section 106 documentary purposes. Developed final reports and photo logs.

Amtrak, Design Review and Section 106 Support for King Street Station Rehabilitation, Seattle WA. Lead design reviewer for rehabilitation alterations to King Street Station. Included identifying character-defining features and alteration placement properties.

Oregon Department of Transportation (ODOT), Outer Powell Transportation Safety Project, Section 106/4(f), Portland, OR. Field Lead and Field Safety Supervisor; GIS Lead. Developed survey plan. Conducted Intensive Level Survey involving 25 residential properties. Researched, evaluated, and documented resources to create determinations of National Register eligibility and aid in Section 106 Findings of Effect. Also determined area of potential effect for historic resources.

ODOT, Historic Resources Report for 20s-30s Bikeway Project, Section 106/4(f), Portland, OR. Field Safety Supervisor and Field Lead; GIS Lead. Developed survey plan. Conducted Reconnaissance Level Survey of over 20 properties and Intensive Level Survey and Findings of Effect for two. Compiled report on potential bikeways project. Determined National Register eligibility and Section 106 Findings of Effect. Also determined area of potential effect for historic resources.

Idaho Power Company and Rocky Mountain Power Company, Boardman-Hemmingway Transmission Line Project, Section 106/NEPA, State Regulations, Oregon/Idaho. Field Safety Supervisor and Field Lead; GIS Lead. Aided in development of survey plan. Aided in survey, documentation, evaluation, and research of an area of 3,000 square miles; also co-authoring report deliverables and other agency documents. Extensive Reconnaissance and Intensive Level Survey. Included recommending areas of potential effect and appropriate documentation levels for Section 106 compliance, making determinations of National Register eligibility to historic buildings and sites, using the Secretary of the Interior's Standards to determine impacts to historic buildings by proposed construction and development activity, and interpreting 36 CFR 800 for agency representatives.

Idaho Power Company and Rocky Mountain Power Company, Gateway West Transmission Line Project, Section 106/NEPA, Idaho/Wyoming. Field Safety Supervisor and Field Lead; GIS Lead. Aided in development of survey plan, as well as survey, documentation, evaluation, and research of over 300 historic structures in Idaho and Wyoming; also co-authored report deliverables and other agency documents. Extensive Reconnaissance and Intensive Level Survey. Worked with BLM Manual 6280 to develop an Oregon Trail specific Trails Report to analyze unique visual effects to the Oregon National Historic Trail on public lands. Included recommending areas of potential effect and appropriate documentation levels for Section 106 compliance, making determinations of National Register eligibility to historic buildings and sites, and using the Secretary of the Interior's Standards to determine impacts to historic buildings by proposed construction and development activity.

Portland General Electric, Cascade Crossing Transmission Line Project, Section 106/NEPA, OR. Aided in survey, documentation, evaluation, and research of over 2,000 historic structures in Oregon; also co-authored report deliverables. Included making determinations of effect and eligibility evaluations for properties across Oregon through Reconnaissance Level Survey and determining areas of potential effect. Entered sites into Oregon Historic Sites Database. Included survey of the Boardman Bombing Range.

srmERNST, California Environmental Quality Act (CEQA) Evaluation/Section 106 and Design Compliance Review Specialist,

Historic Property Standards and Compliance Review, Oakland, CA. The Standards Compliance Review examined the project-specific impacts of a proposed project in relation to the Broadway Valdez District Specific Plan (BVDSP) Environmental Impact Report (EIR) for Oakland, CA. Included a review of the proposed project's consistency with the applicable goals, policies, and design guidelines pertaining to historic resources. Also identified applicable mitigation measures due to effects and restoration recommendations.

CEQA/Section 106 Historic Evaluation and Design Compliance Review, Black Pine Circle School, Berkeley, CA. Drafted formal Historic Resources Evaluation per CEQA and Section 106 requirements, including historic context and detailed architectural description for a historic school building in Berkeley, CA. Also conducted Secretary of the Interior's Standards compliance analysis of proposed building rehabilitation and alteration.

California Highway Patrol, Architectural Description, Historic Context and California Register of Historical Places Evaluation of the Truckee Ranger Station for CEQA and Section 106 compliance, Truckee, CA. Developed architectural description, historic context, and eligibility recommendations for the Contemporary Style Truckee Ranger Station in Truckee, CA. Intensive Level Survey conducted.

California Department of Transportation (Caltrans), US 101/Hearn Avenue Interchange, Section 106/CEQA, Santa Rosa, CA. Per Section 106 and CEQA compliance requirements, prepared detailed architectural descriptions, historic contexts, DPR forms, and eligibility evaluations for three building complexes located near a planned construction area. Intensive Level Survey conducted. Also drafted mapping deliverables.

FEMA, Architectural Descriptions and Integrity Analysis, Section 106 Compliance, Sonoma County, CA. Drafted architectural descriptions and integrity analysis of alterations for FEMA work to be done along the Russian River in Sonoma County as part of the Sonoma County Flood Elevation Program. Also developed summary of potential project effects to historic resources and co-authored report to FEMA.

US Department of the Interior, Section 106, Historic Resources Evaluation Report for King Salmon, Alaska Fish and Wildlife Field Office, AK. Aided in report writing and historic resource eligibility evaluations for Historic Resources Evaluation Report: Alaska Peninsula/Becharof National Wildlife Refuge Headquarters – King Salmon Fish and Wildlife Field Office. Included extensive historical research at the National Archives and other repositories to fulfill Section 106 requirements.

Bonneville Power Administration, Cultural Resources Inventory for Kalispell to Kerr Transmission Line Project, Section 106, Northwestern Montana. Field Lead and Field Safety Supervisor; GIS Technician. Conducted Reconnaissance Level and Intensive Level Survey of transmission line, substations, and historic resources to help determine area of potential effects, and research including local repositories. Assisted with historic context for final report as well as final mapping deliverables to fulfill Section 106 requirements.

Federal Aviation Administration (FAA) and City of Gooding, Idaho, Class III Cultural Resource Inventory of Gooding Municipal Airport, ID.

Field Lead and Site Safety Supervisor; GIS Lead**.** Developed survey plan. Analyzed existing condition, integrity and significance of the Gooding Municipal Airport through Intensive Level Survey. Provided recommendations on eligibility and effects, including area of potential effect. Co-Authored final report and authored mapping deliverables.

Shell Puget Sound Refinery, Poplar Plantation Property Wetland Mitigation, Anacortes, WA. Aided in research and historic context for the Poplar Plantation Property. Analyzed historic maps and primary research documents.

Historic District Survey/Nominations and Historic Building Recordation/HAER Recordation

Portland Water Bureau, Historic American Engineering Record (HAER) Recordation, Washington Park Reservoirs, Portland, OR. Field Safety Supervisor and Field Lead; GIS Lead and CAD technician. Prepared a HAER Level II report for the historic Washington Park Reservoirs to aid the city in complying with safety and security standards. Intensive level research and documentation. Completed measured drawings and worked with CAD lead on translating drawings to CAD, and editing CAD drawings. Completing all mapping deliverables and lead survey technician.

County of Maui Planning Department, Lahaina Reconnaissance Level Survey Report for Lahaina National Historic Landmark District, Lahaina, HI. Field Safety Supervisor and Field Lead; GIS Lead. Researched and prepared historic context and survey report to assist in establishing updated boundaries for previously established National Historic Landmark District. The survey encompassed approximately 300 buildings and 56 sites associated with the district's historic period. Conducted public outreach and worked directly with the County on coordinating research and survey needs.

ODOT, Historic Context and MPD Outline for US Highway 101 through Oregon State, OR. Field Safety Supervisor and Field Lead; GIS Lead. Prepared a historic context of US Highway 101 through Oregon, including its entire development, alterations, and descriptions of associated resources. Project included field survey of the highway (+300 miles) and extensive repository research. Also included summary of property themes and types, along with registration requirements for a potential Multiple Property Document (MPD) for resources associated with US Highway 101 through Oregon.

City of West Linn, Intensive Level Survey, West Linn, OR. Field Lead and Site Safety Supervisor; GIS Lead**.** Conducted research, developed survey, drafter site and floor plans for the existing building. Performed intensive documentary and contextual analysis. In addition, Leesa designed a 2'X3' interpretive panel for Field's Bridge Park, a work product requested by the City of West Linn and currently installed within the park.

Oak Hills National Register Nomination, Beaverton, OR. Field Technician and Lead Author Conducted field research including Intensive Level Surveys for Oak Hills Historic District nomination and compiled research and documentation for nomination. Listed the first Mid-Century Historic District in Oregon, which required extensive research to prove significance under Criterion Consideration G.

Survey of potential Historic District, Willamette Heights, Springfield, OR. Field Technician; Project Lead. Developed survey plan, conducted research, and evaluated the Willamette Heights neighborhood of Springfield, Oregon for inclusion in the National Register. Survey included over 100 resources and recommendations for ILS, potential boundary expansion of a nearby district, and the creation of a new district for the City of Springfield.

State Historic Preservation Office (SHPO), Reconnaissance Level Survey, Jacksonville, OR. Created survey plan, completed resurvey of over 600 properties in the Jacksonville National Historic District, and prepared a final report with recommendations, potential boundary changes, and potential period of significance alterations.

Environmental Protection Agency (EPA), Argonaut Dam HAER, Amador County, CA. GIS Lead Prepared Historic American Engineering Record documentation of former mine tailing dam in California. Conducted extensive historic research and analyzed as-built plans. Authored mapping deliverables.

Hawai'i State Historic Preservation Division, Selective Reconnaissance Level Survey, Wahiawa, HI. Field Lead and Field Safety Supervisor. Conducted research, aided in developing survey plan, and led field team during survey of over 3,000 historic resources in Wahiawa, HI. Work included drafting fieldwork safety plan, working directly with the local community at two public meetings, and being responsible for Hawaii State Historic Preservation Division (SHPD) report deliverables.

Los Angeles Department of Water and Power (LADWP), HAER for North Haiwee Dam No. 1/The First Los Angeles Aqueduct, Inyo County, CA. GIS Lead**.** Prepared HAER documentation, including descriptions of dam, associated features, and site, condition assessment, and historic context. Conducted extensive research. Authored mapping deliverables

San Francisco Public Utilities Commission (SFPUC), Bay Division Crossing of Hetch Hetchy Aqueduct System HAER Report, CA. Prepared technical HAER II Report for partial decommissioning of Historic Hetch Hetchy Aqueduct that provides municipal water for the City and County of San Francisco. Conducted extensive research, authored architectural and engineering descriptions

Channel 35 Studio Relocation Project, City of Los Angeles, CA. Analyzed existing condition, integrity and significance of three historic buildings within the El Pueblo de Los Angeles/Los Angeles Plaza Historic District for documentation within California Office of Historic Preservation filing system. Prepared Cultural Resources Assessment Report.

Willamette Falls Legacy Project, Historical and Cultural Interpretation Component, Oregon City, OR. Conducted extensive research at Oregon Historical Society and Oregon State Library to assist in developing design plan and interpretive materials related to proposed river walk at historic Oregon City mill site.

SHPO, (Survey and Documentation Staff) Salem, OR. Completed a ten-city survey in the State of Oregon, with a total of over 2,000 properties. Also completed additional National Register work including narrative description, Intensive Level Research, and drafted floor plans. Involved in nominations for the Winn Barn in Weston, Oregon (listed) and the C.J. Livingston House in Portland, Oregon (listed). Gained Oregon Historical Sites Database mastery and aided in developing state survey guidelines.

Condition Assessment of the Southern Pacific Passenger Depot, Eugene, OR. Complete physical description of building, including a focus on masonry components, construction techniques and recommendations for preservation and maintenance.

Survey of Tudor Style Buildings, Eugene, OR. Surveyed and documented over 300 Tudor Style buildings. Conducted intensive research with deeds, city directories, Sanborn Maps, and other primary sources.

Survey of Historic Structures, Clackamas County, OR. Surveyed, documented, and analyzed structural changes to over 400 historic properties, along with intensive research with deeds, SHPO cultural resource inventories, Sanborn Maps, and other primary sources.

Survey of Historic Structures, Junction City, OR. Surveyed, documented, and analyzed structural changes to historic properties, along with intensive research with Sanborn Maps, city directories, and other primary sources.

National Register Nomination, University Street, Eugene, OR. Intensive level survey of a residential property in Eugene, utilizing Sanborn Maps, city directories, deeds, oral and written histories, and other primary sources. Completed site plan, floor plans, and informational interviews with City residents.

FERC Relicensing

Minnesota Power, Thomson Forebay Remediation Project Environmental Analysis Report, Thomson, MN Developed cultural resource sections of an Environmental Analysis Report to comply with FERC regulations for emergency repairs to and relicensing of the Thomson Forebay Remediation Project. Developed photographic appendix demonstrating existing site conditions, and analyzed potential effects of relicensing alternatives to the historic hydroelectric project.

Due Diligence Research/Geographic Informational Systems (GIS) Applications/Environmental Cleanup Research

Confidential Client, Alaska, (GIS Mapping Lead). Preparing all field maps, result maps and managing the Project Geodatabase. Includes data manipulation and analysis.

Vulnerability Analysis for Major Oil Company's Portland Facility, Portland, OR. Lead Research Technician and GIS Lead Developed a vulnerability analysis based on potential ecological, economic, and social resources that could potentially be impacted by a release of oil from the facility. The report included research on endangered and threated species, critical fish and wildlife habitats, historic and social resources of concern, and a multi-page GIS mapbook showing results and planning measures.

FedEx, Due Diligence and City Development Code Technician, Distribution Facility Expansion, North Salt Lake, UT. Lead Research Technician Due diligence research related to manufacturing distribution center design, environmental compliance, and additional City code requirements including: zoned uses, transportation, variances and party wall design, parking, all aspects of circulation, fire and other codes, flood and wetland planning, and other aspects of planning.

City of South Salt Lake City, Waste Transfer Station Due Diligence and City Development Code Technician, Sandy City, UT. Lead Research Technician Due diligence research related to waste transfer station design, environmental compliance, and additional City code requirements including: zoned uses, transportation, variances and party wall design, parking, and all aspects of circulation.

Portland General Electric, Environmental Cleanup Research/Due Diligence, Portland Harbor Superfund Project, Portland, OR. Superfund due diligence includes research related to the entire downtown Portland Willamette Riverfront, research on specific entities and research on specific contaminants and contamination occurrences. Deed and plat research, as well as intensive research with primary historical documents.

PREVIOUS EMPLOYMENT

AECOM, Portland, OR, May 2012 – March 2016
Architectural Historian, GIS Lead

Private Consultant, Sep 2011 – May 2012
Surveyed the Jacksonville Historic District, over 600 properties; provided restoration and historic district re-boundary recommendations to Jacksonville County Planning.

Oregon State Historic Preservation Office, June – Sep 2011
Survey and Inventory Lead

PUBLICATIONS & PRESENTATIONS

Presentation, Guest Lecturer for University of Oregon Historic Preservation Program. National Register Nomination AAAP 531, Spring Term 2019. Lecture developed to teach students about surveying for historic districts and large scale reconnaissance and intensive level survey. Included extensive tour of Eastmoreland, Oregon to explain Ms. Gratreak's experience surveying for that potential district.

Presentation at the Society for California Archaeology Annual Conference Regarding Architectural Resources Survey During FERC Licensing. *How do We Survey That?! Unique Architectural Resources and FERC Licensing*; Society for California Archaeology, March 2019. The presentation included an overview of the survey process including: safety; research and confidentiality; determining resource boundaries and significance; and highlighted many example of my previous work in California and the West.

Presentation at the ODOT Geo-Environmental Conference on Cultural Landscapes: *U.S. 101 Oregon Coast Highway Applying Historic Context to the Cultural Landscape*; ODOT, April 2015. The presentation included Historic Context and MPD outline for US 101 and how the resources relate to the larger conversation of cultural landscapes. Defined what they are, described components, and gave examples of significant cultural landscapes along US 101 in Oregon.

Presentation on the Oak Hills, Oregon National Register Historic District; Presented at the Society of Architectural Historians Pacific Northwest (Marion Dean Ross) Chapter's Annual Conference, Salem, OR, 2013.

Oak Hills National Register Nomination; URS/AECOM, Beaverton, Oregon, May 2013. As Historian and Field Technician, conducted field research including intensive level surveys, demographic and architectural statistics, and plan-type typology; compiled and documented research for the Oak Hills Historic District nomination.

Masonry Conservation Handbook; University of Oregon, May 2012 (http://www.cottagegrove.org/commdev/documents/Masonry%20Conservation%20Handbook%202013.pdf). Co-authored a masonry conservation handbook for the City of Cottage Grove, Oregon. Lead author on the chapter on brick which included information on cleaning, repair, security, maintenance, documentation, and historical research.

Owen Ford

Archaeologist

Mr. Ford has 26 years of experience in archaeological investigations, including extensive experience and technical knowledge in Cultural Resource Management (CRM). This includes all phases of field investigations from construction monitoring to data recovery, artifact analysis and curation, background research, and report writing from multiple regions in the United States and in Central America. Mr. Ford has provided extensive consulting and task management support for HDR Inc., Aspen Environmental, SWCA Inc., Anthony & Brown Consulting, The Center for Archaeological Research at the University of Texas at San Antonio (UTSA), TRC Inc., and Epsilon Systems Solutions, Inc.

Mr. Ford has extensive experience working with and running field crews on federally managed properties including: National Forest Service, Bureau of Land Management, U.S. Forest Service, and bases for United States Navy, Air Force, and Army. He has experience running crews under Section 106, Section 110 and NEPA guidelines. During his 25 years of experience he has conducted prehistoric and historic investigations in Alaska, California, Nevada, Oregon, New Mexico, Oklahoma, Lousiana, and Texas.

EDUCATION

M.A., Cultural Resources Management – *in progress*, Adams State University

B.A., Anthropology – 1993, Texas State University

INDUSTRY TENURE

25 years

SELECT PROJECT EXPERIENCE

Camp Far West Reservoir Hydro Project, Nevada County, California (2016). Directed survey crews for artifact identification and recordation of historic and prehistoric site remains. *Client: Nevada Irrigation District*

Sterling Highway Milepost 45-60 Project, Kenai Peninsula, Alaska (2016). Assisted in development of monitoring and curation plan, background research for additional pedestrian survey and subsurface testing. *Client: Alaska Department of Transportation and Public Facilities*

DOT&PF Maintenance and Operations, Denali District Materials Site Project, Alaska (2016). Participated in pedestrian survey and subsurface testing of DOT&PF materials site, site boundary delineation for the Ringling site (GUL-00077). *Client: Alaska Department of Transportation and Public Facilities*

Iliamna River Bridge Historic American Engineering Record Documentation and Consultation, Alaska (2016). Assisted in development of memorandum of agreement, background research. *Client: Alaska Department of Transportation and Public Facilities*

Sam's Valley Transmission Line Project, Jackson County, Oregon (2016). Pedestrian survey and testing for historic and prehistoric remains along proposed transmission lines and substation locations. *Client: Pacific Power*

Don Pedro Reservoir Repatriation Project, Tuolumne County, California (2016). Reinternment of native remains previously excavated in 1970. *Client: Toulumne Irrigation District*

Cultural Monitoring for PG&E Woodleaf-Kanaka Transmission Line, Butte County, California (2016). Monitored crews and established boundaries for protection of previously and newly identified cultural remains. *Client: Pacific Gas and Electric*

Don Pedro Shoreline Stabilization Construction Monitoring, Tuolumne County, California (2015). Consulted construction crews on impact avoidance to cultural materials and monitored during construction for compliance. *Client: Toulumne Irrigation District*

Cultural Resources Survey at Beale AFB, Yuba County, California (2015). Directed crews for survey and artifact analysis of historic and prehistoric site remains. *Client: United States Air Force*

Site Evaluations for Nevada Irrigation District at Jackson Meadows Reservoir, Nevada County, California (2014). Assisted in directing crews on excavation of prehistoric sites. *Client: Nevada Irrigation District*

G2/B-29 Road Bio Survey, Naval Air Weapons Station, China Lake, Kern County, California (2014). Directed crews for survey and artifact analysis of historic and prehistoric site remains. *Client: United States Navy*

Woodleaf Cultural Monitoring for Hazardous Tree Removal for PG&E Transmission Lines, Butte County, California (2014). Monitored crews for impact analysis of cultural remains. *Client: PG&E*

Tri-Dam Project Beardsley-Donnells Hydroelectric Project (FERC No. 2005) License Implementation-Site Recordation, Tuolumne County, California (2014). Directed field crews on prehistoric site excavation and recordation *Client: Tri-Dam Project*

Yuba River Development Project (FERC No. 2246) Relicensing, Yuba County, California (2014). Assisted in directing field crews on survey and recordation of historic remains. *Client: Yuba County Water Agency*

Bullpup East Expansion Cultural Resources Survey, Naval Air Weapons Station, China Lake, Inyo County, California (2014). Directed field crews on prehistoric and historic site recordation. *Client: United States Navy*

Cultural Resources Survey for the Water Treatment Plant at Rancho Murieta, Sacramento County, California (2014). Directed field crews on survey for prehistoric and historic remains. *Client: Rancho Murieta CSD*

JCIF Petroglyph Recordation at CA-INY-130 & CA-INY-6534, Naval Air Weapons Station, China Lake, Inyo County, California (2013). Directed field crews on petroglyph recordation procedures. *Client: United States Navy*

SCE Utility Pole Replacement Survey in the White Mountains, Inyo County, California (2013). Directed field crews on prehistoric and historic site recordation. Duties included technical write up. *Client: Southern California Edison*

Survey for Ewiiaapaayp Tribal Reservation at San Diego County, California (2013). Directed field crews for survey and artifact analysis of historic and prehistoric site remains. *Client: Paiky*

Survey for La Posta Tribal Reservation at San Diego County, California (2013). Directed field crews for survey and artifact analysis of historic and prehistoric site remains. *Client: Paiky*

Survey for GPO's Investigations at Dixie Valley, Nevada for Fallon Naval Air Station, Churchill County, Nevada (2013). Directed field crews for survey and artifact analysis of historic and prehistoric site remains. Duties included technical write up. *Client: United States Navy*

Mammoth Lakes Cultural Resource Survey, Bodie Hills, Mono County, California (2012). Directed field crews on prehistoric and historic site recordation. Other duties included laboratory analysis and technical write up. *Client: United States Forest Service*

Bodie Hills FY12 Cultural Resource Survey, Bodie Hills, Mono County, California (2012). Directed field crews on prehistoric and historic site recordation. Other duties included laboratory analysis and

CULTURAL RESOURCES INVESTIGATION FOR THE

MODIFICATION TO THE LOG CABIN AND OUR HOUSE DIVERSION DAMS SEDIMENT MANAGEMENT PLAN

FOR THE
YUBA RIVER DEVELOPMENT PROJECT
(FERC PROJECT NO. 2246)
NEVADA, YUBA, AND SIERRA COUNTIES, CALIFORNIA

[redacted]

Appendix C

Consultation with Tribes and Agencies

Date	Tribe/Agency	Action	Project/Phase
9/18/2017	Kathleen Forest (SHPO); Danielle Risse (HDR); Monica Ruth (HDR)	Danielle and Monica called Kathleen to discuss a plan for consultation regarding a construction modification for the Our House Diversion Dam sediment management plan, in order to place a dewatering pipe on the unpaved portion of CA-YUB-1733H, a historic road within the project APE. Kathleen informed Danielle and Monica that formal consultation will be necessary and needs to be provided in hard copy. YCWA provided a letter and attachments via email and hard copy to request concurrence from SHPO on the construction modification. Kathleen let Danielle and Monica know that an initial email with project information would be helpful prior to a phone call so that Kathleen can make sure the right people are on the call and can be of greater assistance. Monica replied thanking Kathleen for her assistance.	Sediment Management
9/18/2017	Carrie Smith (Tahoe National Forest); Monica Ruth (HDR)	Monica Ruth forwarded the email addressed to Kathleen Forest (SHPO) regarding the construction modification at the Our House Diversion Dam to Carrie Smith and followed up with a phone call and left a voice message. Monica asked Carrie if she had any concerns with the proposed plan of action.	Sediment Management
9/19/2017	Curt Aikens (YCWA); Anmarie Medin (SHPO)	Curt emailed Anmarie stating that he just got off the phone with Kathleen Forest (SHPO) and she said that she just provided Anmarie with the request submitted by HDR for approval to set a 24 in pipe on a historic road protected by plywood. He stresses that this is a critically important $5 million project that has a very tight time frame. He would appreciate an update on where they stand by the end of the day if at all possible. Anmarie replies that she has a few questions about the letter HDR sent. 1) what type of material will be used for the pipe? 2) How will the sections of pipe be fastened together to ensure continuous flow? 3) What is the potential for erosion at joints? 4) How will the pipe segments be placed? Curt responds that 1) the pipe is made of high quality poly-ethylene plastic, the pipe walls are 1 in thick and diameter is 24 in. 2) the pipe comes in 25 foot sections and they are heat fused together and the joints are designed to be as strong or stronger than the pipe. 3) The potential for erosion or leakage at the joints is very low. 4) the pipe is heat fused together away for the historic road. Then the plan is to place plywood on the historic road and drag the fused pipe in place with a street tracked excavator. Anmarie sent Curt a digital copy of the OHP's concurrence letter.	Sediment Management
9/25/2017	Carrie Smith (Tahoe National Forest); Monica Ruth (HDR)	Monica called Carrie to follow up on emails and voice mail sent the week prior regarding sediment management and the construction plan change. Carrie said she is ok with the change.	Sediment Management
9/26/2017	Carrie Smith (Tahoe National Forest); Monica Ruth (HDR); Danielle Risse (HDR)	In response to emails from 9/18/2017. Carrie states that YCWA should evaluate the historic resource. Danielle agrees and thanks Carrie for her assistance.	Sediment Management
10/13/2017	Danielle Risse (HDR); Bill Slater (USFS)	Danielle explained to Bill that HDR was contacted by the construction inspector to inform them that a bone that looked like a femur fell out of one of the haul trucks at the top of the Our House Dam Road around 8AM 10/13. The men stopped work and called the coroner, who arrived at 8:30AM. The coroner told the construction inspector, John Avilla, that he believed it was from a bear and that they could continue their work. Danielle gave Bill the coroners name and contact information. Danielle also explained that she has asked for photos of the bone and told the construction crew to stop work within 100 feet of the area where the bone may have come from, as per the inadvertent discovery plan. Danielle then called Bill to speak on this topic. Bill replied that YCWA may continue work.	Sediment Management
10/13/2017	Danielle Risse (HDR); Alex Perrone (CSU Chico, Human ID Lab)	Danielle sent photos of the bone recovered during sediment removal to the Human ID Lab in CSU Chico asking for a determination on the bone (human vs. nonhuman). Alex replied that the bone appears to be non-human.	Sediment Management
10/15/2017	Danielle Risse (HDR); Alex Perrone (CSU Chico, Human ID Lab)	Danielle sent more photos of possible human remains to the Human ID Lab, asking for determination. Alex replied that the bones are also non-human. Danielle thanks Alex.	Sediment Management
10/16/2017	Danielle Risse (HDR); Jim Lynch (HDR); Mike Kline (YCWA); Bill Slater (USFS); Carrie Smith (Tahoe National Forest)	Danielle forwarded the email from the Human ID Lab for CSU Chico from 10/16/2017 and states that work may proceed in the discovery location. Nothing further needs to be done with the bone. Bill responded that he is monitoring the discussion, that the discovery context is not an archaeological site, and that work is proceeding.	Sediment Management
10/19/2017	Danielle Risse (HDR); Alex Perrone (CSU Chico, Human ID Lab)	Danielle sends photos of another bone found during sediment removal work and ask for a determination of non-human/human. Alex replies indicating that these photographs are also non-human (the bone is a metapodial, likely belonging to a deer).	Sediment Management
11/14/2017	Danielle Risse (HDR); Anmarie Medin (SHPO); Carrie Smith (TNF); Kurt Powers (FERC)	Following notification of HDR's environmental monitor that the construction crew was removing the temporary bypass pipe from the historic road without an archaeological monitor present, Danielle called and notified the following agencies per monitoring protocols: SHPO, TNF, and FERC. Danielle called and left messages stating that some pipe removal had occurred without the archaeological monitor present. She also let them know that the work had stopped and an archaeological monitor would assess the condition of the road following this unmonitored work to see if any impacts to the historic road had been incurred. The cultural monitor would remain present for all continued removal of the pipe on the road.	Sediment Management
11/15/2017	Mike Kline (YCWA); Carrie Smith (TNF); Anmarie Medin (SHPO); Kurt Powers (FERC); Danielle Risse (HDR)	Mike sent an email following up on phone calls made by Danielle regarding the Our House Diversion Dam Sediment Removal Project. Attached to the email if the last SHPO concurrence letter received in regard to this project. As Risse reported, the construction contractor began removing the temporary bypass pipe that was placed on an archaeological site comprising an historic road (CA-YUB-1733H). The site is currently unevaluated regarding it NRHP of eligibility. The construction contractor began this work yesterday without the archaeological monitor present. However, YCWA was able to stop them before any damage to the road occurred and an archaeological monitor on site today reported there was no damage to the road. The archaeological monitor will remain on site until the pipe is fully removed by the construction monitor. HDR will be including a reference to this incident in their cultural resources monitoring report that will be prepared and submitted to tribes and agencies following the completion of the archaeological monitoring.	Sediment Management
11/16/2017	Mike Kline (YCWA); Carrie Smith (TNF); Anmarie Medin (SHPO); Kurt Powers (FERC)	In response to Mike's email from 11/15/2017, Anmarie thanks Mike for this follow-up email and quick action. SHPO understands the difficulties of getting everyone on the same page when work starts. They look forward to receiving HDR's final monitoring report.	Sediment Management
1/30/2018	HDR; Cultural Participants	HDR submitted "Letter Report for Archaeological Monitoring for the Log Cabin and Our House Diversion Dams Sediment Management Plan Implementation on YCWA's Yuba River Development Project" to participating tribes and agencies.	Sediment Management
2/15/2018	Danielle Risse (HDR); Marybeth Gaye (FERC)	Gaye called Risse stating that the privileged materials of the Our House Cultural Resources Monitoring Report were not showing up in FERC's privileged files. She asked that Risse re-file them as a supplement to the original filing.	Sediment Management
2/20/2018	HDR; FERC filing	HDR re-filed the Our House Cultural Resources Monitoring Report with FERC.	Sediment Management

Date	Tribe/Agency	Action	Project/Phase
2/20/2018	Danielle Risse (HDR); Cherilyn Neider (UAIC)	Neider is writing in response to Curt Aiken's (YCWA) letter report for the Archaeological Monitoring for the Log Cabin and Our House Diversion Dams Sediment Management Plan Implementation (FERC No. 2246-079). In his report, Aiken's notes under the section titled "Incidental Discovery" that bones identified as deer and bear were found during sediment removal from the Our House Diversion Sam impoundment. UAIC would like to request a site visit to this area, as well as a copy of the identification report completed by the Human Identification lab. Neider would like to know what dates in March would be best for Risse to visit this area.	Sediment Management
3/7/2018	Danielle Risse (HDR); Cherilyn Neider (UAIC)	In response to email from 2/20/2018. Risse thanks Neider for her email. Risse provided Neider with copies of the emails she received from the Human Identification Lab; they did not provide any reports. Copies of the photos of the bones that were found are also provided. Each bone appeared to be non-human, but she felt it would be best to confirm this identification with the Human Identification lab. She is available for a site visit any day of the weeks of 3/12 and 3/19. The sediment removal area where the bones were recovered is now under water. Risse forwarded the email Matthew Moore (UAIC).	Sediment Management
3/12/2018	Danielle Risse (HDR); Cherilyn Neider (UAIC)	Neider called Risse for more information on the non-human bones found during the Sediment Removal at the Our House Diversion Dam. Risse stated that all three discoveries appeared to have been part of debris that has washed into the river from someplace up above the project location. Neider dais that she would relay this to the others at UAIC and would then get back to Risse on whether or not UAIC still wanted a site visit.	Sediment Management
3/20/2018	Danielle Risse (HDR); Cherilyn Neider (UAIC)	Neider would like to work with Risse to schedule a site visit to the sediment removal area where the bear bone was found. She understands that the bones were not found in situ, but UAIC would still like to survey the banks along the stretch where the bones had been removed along with the sediment. Neider gives some dates for the site visit and asks if Risse is available. Risse is available for all of the dates that Neider provided and is happy to meet with UAIC for a site visit.	Sediment Management
3/22/2018	Danielle Risse (HDR); Cherilyn Neider (UAIC)	In response to email from 3/20/2018. Neider says that Tuesday, April 25 at 10 AM will work then. What is the best meeting location? Risse asks to meet at the intersection of Ridge Road and Our House Road. There is a pull out right where you turn onto Our House Dam Road off of Ridge Road. Risse gives her cell number in case Neider needs it. Neider thanks Risse. If any questions come up between now and then, UAIC will be sure to reach out.	Sediment Management
3/22/2018	Danielle Risse (HDR); Carrie Smith (Tahoe National Forest)	DHR found animal bones during the sediment removal work behind Out House Diversion Dam on the Middle Yuba River. UAIC would like to go out for a site visit. Since this area is on Tahoe National Forest Lands, Risse would like to make sure that Smith is aware of this visit and to confirm the they don't need any sort of Special Use Permit for meeting with the tribe and looking around the edge of the Our House Diversion Dam impoundment. Smith confirmed that Risse does not need Special Use Permit.	Sediment Management
3/30/2018	Gene Whitehouse, UAIC	Gene Whitehouse provided a letter to YCWA following receipt of the Our House Dam Road Evaluation Report, indicating continued interest in the project.	Sediment Management
4/23/2018	Danielle Risse (HDR); Cherilyn Neider (UAIC)	Risse checked in with Smith to confirm the field visit on Wed April 25. Neider states that Matthew Moore (UAIC) is planning to meet Risse at the location provided below. Risse confirms that she will have her cell phone and should have signal at the meeting place. Neider thanks Risse.	Sediment Management
4/24/2018	Danielle Risse (HDR); Cherilyn Neider (UAIC)	Neider called Risse to cancel fieldwork for 4/25.	Sediment Management
6/13/2018	Carrie Smith (Tahoe National Forest); Danielle Risse (HDR)	Smith asks if Risse can send the GIS information for Log Cabins and Our House dams work from 2014.	Relicensing; Sediment Management
6/15/2018	Carrie Smith (Tahoe National Forest); Danielle Risse (HDR)	In response to email from 6/13/2018. Risse will have no problem getting Smith what she asked for. Did she want the HIS shapefiles for the cultural resources around Log Cabin and Our House Dams or did she want the APE or survey coverage shapefiles as well. Smith confirms that she needs the survey/APE/sites shapefiles	Relicensing; Sediment Management
6/19/2018	Carrie Smith (Tahoe National Forest); Danielle Risse (HDR)	In response to email from 6/15/2018. Risse states that it will be no problem. It will take a few days to prep and then we can email the shapefiles over to Smith. Risse sent the shapefiles for the following: APE, Resource Boundaries, and Survey Coverage for the Sediment Management work; and the APE, Resource Boundaries, and Survey Coverage for the FERC Relicensing work.	Relicensing; Sediment Management
7/18/2018	Monica Ruth (HDR); Carrie Smith (TNF)	Ruth informed Smith that YCWA has requested HDR to do a survey of some potential spoils areas for their sediment management implementation for the Log Cabin and Our House diversion dams. Ruth attached a map showing the potential spoils areas along with a 1/4-mile buffer. Ruth wanted to check in with the Tahoe National Forest to see if there are any reports and/or sites in those areas or within 1/4 mile of them. Would it be easiest to make an appointment to collect copies of the reports and/or resources? Ruth also mentions that Danielle Risse (HDR) had remembered that Smith was interested in Celestial Valley stuff so they wanted to be sure to check in and see if there is anything major HDR should keep an eye out for. Smith replies and states that she is turning the request over to Aoife Kilmartin (TNF), the archaeologist working at the Yuba River and at this point in time can provide Ruth the information.	Sediment Management
7/19/2018	Monica Ruth (YCWA); Aoife Kilmartin (TNF)	In response to email from 7/18/2016. Kilmartin did a records search and it does not appear that they have any reports or recorded sites in the project area or buffer.	Sediment Management
8/27/2018	Monica Ruth (HDR); NAHC	Ruth requested a local government tribal consultation list and a search of the Sacred Lands files from the Native American Heritage Commission in support of the Log Cabin and Our House Diversion Dams Sediment Management Plan.	Sediment Management
8/29/2018	Monica Ruth (HDR); NAHC	The NAHC responded with a tribal consultation list for the Log Cabin and Our House Diversion Dams Sediment Management Plan. The search of the Sacred Lands files yielded no results.	Sediment Management

Date	Tribe/Agency	Action	Project/Phase
10/3/2018	Danielle Risse (HDR); Kurt Powers (FERC)	Risse let Powers know that during this year's implementation of the sediment management plan, a potentially historic artifact was uncovered. This discovery was made within the last couple of days. The age and function of this item is unknown and could be related to the Log Cabin Diversion Dam and/or historic mining that occurred in drainages throughout the area. Risse recommends documentation of the artifact as an isolated find, complete a brief letter report documenting its discovery and evaluating its eligibility to the NRHP and then sending these materials to tribes and Tahoe National Forest for review and then to SHPO for review and concurrence on the eligibility determination. Risse asks Powers how he would like YCWA to proceed regarding the potentially historic artifact discovered during this year's sediment management work. Powers thanks Risse for notifying the Commission about the find. He will get back to Risse after reviewing the materials that Risse sent him. He asks if Risse has notified the SHPO of the unanticipated discovery as well and if the project has a Historic or Cultural Resources Management Plan in place. Risse thanks Powers. She has not notified SHPO of the find as she did not think an isolated artifact was enough to bug them about, but they can if Powers would like them to. There is no Cultural Resources Management Plan in place. There is a draft HPMP that was prepared for the ongoing relicensing process for the Yuba River Development Project (YRDP), but no license has been issued by FERC yet and no programmatic agreement has been executed implementing the HPMP. They have been following the traditional section 106 process for this Powers will talk with his manager and FPO to see if Risse needs to notify the SHPO. Risse thanks Powers.	Sediment Management
10/5/2018	Danielle Risse (HDR); Kurt Powers (FERC)	In continuation of email from 10/03/2018. Powers spoke with other and though it is a relatively small find/artifact FERC would like YCWA to notify the SHPO, Tahoe National Forest, and any relevant Native American tribes. Powers would like to be copied on any email/letter/etc. The overall plan Risse addressed for the discovery otherwise sounds good. Risse thanks Powers. She will proceed accordingly.	Sediment Management
10/14/2018	Danielle Risse (HDR); Cultural Participants	Risse sent cultural participants a Notice of Artifact Discovery for the Yuba River Development Project (FERC No. 2246) Log Cabin Diversion Dam Sediment Management Project. The notice states that YCWA will document the artifact as an isolated find and complete a brief letter report documenting its discovery and evaluating its eligibility to the HRNP.	Sediment Management
10/16/2018	Monica Ruth (HDR); Regina Cuellar (Shingle Springs Band of Miwok Indians)	Ruth forwarded Cuellar the email sent to cultural participants from 10/14/2018.	Sediment Management
10/16/2018	YCWA; FERC	YCWA eFiled the Notice of Artifact Discovery for the Yuba River Development Project (FERC No. 2246) Log Cabin Diversion Dam Sediment Management Project.	Sediment Management
12/10/2018	Monica Ruth (HDR); Kurt Powers (FERC)	Ruth called Powers regarding the artifact discovery from the Sediment Management Plan Implementation to follow up on his request to file anything sent out. He said filing all correspondence at the end of consultation is good, HDR doesn't need to file each time they send something out. Powers said if there is a specific request prior to the conclusion to have FERC provide more information or get involved, to go ahead and file that.	Sediment Management
12/13/2018	Gene Whitehouse (UAIC); YCWA	YCWA submitted a notice of opportunity to consult for the Log Cabin and Our House Diversion Dams Sediment Management Plan Improvements under CEQA and Section 106 of the NHPA. YCWA provided a list of improvements to the Plan.	Sediment Management
12/13/2018	Cultural Participants	YCWA submitted a notice of opportunity to consult for the Log Cabin and Our House Diversion Dams Sediment Management Plan Improvements under CEQA and Section 106 of the NHPA. YCWA provided a list of improvements to the Plan.	Sediment Management
12/27/2018	Gene Whitehouse (UAIC); Curt Aikens (YWA)	Whitehouse thanks Aikens for requesting information regarding the Log Cabin and Our House Diversion Dams Sediments Management Plan Improvements. The UAIC would like to consult on this project. The UAIC would like to receive copies of any archaeological reports that are completed for the project, environmental documents for the proposed project so that they have the opportunity to comment on appropriate identification, assessment and mitigation related to cultural resources. The UAIC also requests and recommend that UAIC tribal representatives observe and participate in all cultural resource surveys.	Sediment Management
12/27/2018	Crystal Rios (Greenville Rancheria); Curt Aikens (YWA)	The Greenville Rancheria has reviewed the letter dated 12/12/2018. The Rancheria has no comments or objections with the sediment management plan improvements under CEQA and Section 106.	Sediment Management
1/3/2019	Kimberly Bose (FERC); Curt Aikens (YWA)	YWA e-filed the request for designation as FERC's non-federal representative from informal consultation under Section 106 of the National Historic Preservation Act and under Section 7 of the Endangered Species Act for the Log Cabin and Our House Diversion Dams Sediment Management Plans Improvements	Sediment Management
1/4/2019	Danielle Risse (HDR); Curt Aikens (YWA); Cherilyn Neider (UAIC)	In response to the letter notifying the UAIC of an opportunity to consult on the Log Cabin and Our House Diversion Dams Sediment Management Plan. Neider requests: consultation for this project; all existing cultural resource assessments; requests for and results of records searches; and the GIS shapefiles for the proposed project's APE. Risse thanked Neider for her response. As requested, they will continue to consult with the UAIC on this project. She will submit the cultural assessment materials to the UAIC for this project when they are completed. A summary of the records search will also be included. However, per the signed agreement with the California Historic Resources Information System, HDR cannot provide other entities copies of the original materials received from the information system. Risse will forward the shapefiles for the APE shortly. Risse sent the APE shapefiles.	Sediment Management
1/10/2019	Danielle Risse (HDR); Curt Aikens (YWA); Cherilyn Neider (UAIC)	Neider thanks Risse for providing the shapefiles. They look forward to receiving the summary of the records search.	Sediment Management
1/11/2019	Danielle Risse (HDR); Melodi McAdams (UAIC); Matt Moore (UAIC)	Risse states that YWA (formerly YWCA) received a letter from the UAIC regarding the Sediment Management Project. The letter includes a request for a site visit/meeting. Risse will be visiting the proposed Celestial Valley spoils pile location for the project on January 21st at 9AM. As the location is on private lands, they re trying to consolidate the visits to the location as much as possible to prevent too many disturbances to the private land owner.	Sediment Management
1/14/2019	Julianne Polanco (SHPO); Curt Aikens (YWA)	Aikens submitted the National Register of Historic Places Evaluation of Archaeological Isolate P-58-3095/HDR-YCWA-ISO-718 letter report requesting concurrence on the NRHP evaluations to Polanco. Copies of this letter was sent to cultural participants.	Sediment Management
1/15/2019	Danielle Risse (HDR); Jamie Moore, Carrie Smith, Daniel Elliot (USFS)	Risse does not believe that a permit is needed for a built environment only field visit, but she asks Moore, Smith, and Elliot is this is incorrect. No archaeological work will be conducted , thus Risse assumes no ARPA or other permitting is needed, but would like confirmation.	Sediment Management

Date	Tribe/Agency	Action	Project/Phase
1/16/2019	Geoff Rabone (YWA); John Aedo (FERC)	Rabone called Aedo. Aedo wanted Rabone to clarify the relationship between a couple of requests her received related to the Our House and Log Cabin Sediment Management Plan. The letter to FERC dated January 3, 2019 was a request for designation of YCWA as the Non-federal representative for cultural consultation related to the Sediment Management Plan. A previous letter to FERC in August of 2018 had requested approval of an Amendment to the plan triggered additional cultural and environmental consultation, since YWA had changed the proposed project. When YWA contacted interested tribes for the additional consultation, YWA realized that they needed separate non-federal representative recognition for the plan, and that the recognition for FERC relicensing and other undertakings didn't cover the plan. Aedo stated that he was fine with this. He asked if YWA had already completed the additional cultural consultation. Rabone replied that he didn't think they had, as they were trying to schedule site visits with responding tribes. Aedo said that he would send out a letter recognizing YWA as the non-federal representative for cultural consultation for the sediment management plan. Aedo would like to wait on approving the amendment to the plan to add Celestial Valley until after YWA sends him documentation that the consultation is complete. Then, he can finalize the amended the plan.	Sediment Management
1/16/2019	FERC; US Fish and Wildlife Service; California OHP; YWA	FERC issued a letter to the US Fish and Wildlife Service and the California Office of Historic Preservation designating YWA as the non-federal representative for consultation under the Endangered Species Act and the National Historic Preservation Act for the Yuba River Project No. 2426. Sediment Management Plan	Sediment Management
1/30/2019	Curt Aikens (YWA); Julianne Polanco (SHPO)	SHPO sent YWA a letter with concurrence on the NRHP evaluation of archaeological isolate P-58-3095/ HDR-YCWA-ISO-718.	Sediment Management
1/31/20196/11	Danielle Risse (HDR); Brendon Greenaway (SHPO)	Greenaway sent Risse a copy of the letter sent to Curt Aikens (YWA) from SHPO on 1/30/2019.	Sediment Management
2/4/2019	Danielle Risse (HDR); Melodi McAdams (UAIC); Matt Moore (UAIC)	In continuation of email from 1/11/2019. McAdams thanked Risse for the invitation for a site visit. McAdams stated that one of the concerns that UAIC sees that is often not address with this type of work is that cultural items are often mixed in with river sediments. She is hoping to see a mechanism for checking river sediments for cultural items and addressing whatever is found.	Sediment Management
2/8/2019	Danielle Risse (HDR); Melodi McAdams (UAIC); Matt Moore (UAIC)	In continuation of email from 2/4/2019. Risse is aware of the potential for cultural materials to be intermixed with the sediments that are washing down the drainages associated with the sediment management plan. The Plan and associated environment permits that have to be acquired prior to implementation of the sediment management activities require an environmental monitor to be on site during all sediment removal work, the preparation and implementation of a monitoring plan, and construction crew training - all of which includes consideration of procedures to follow should either cultural materials or potential human remains be identified during sediment removal work. McAdams thanked Risse for the clarification. She asked if Risse can send the management plan that is currently being used so that UAIC can review the language.	Sediment Management
2/13/2019	Danielle Risse (HDR); Melodi McAdams (UAIC); Matt Moore (UAIC)	Risse sent the current sediment management plan approved by FERC and the current environmental monitoring plan.	Sediment Management
3/11/2019	YWA; FERC	YWA e-filed the National Register of Historic Places Evaluation of Archaeological Isolate P-58-3095/HDR-YCWA-ISO-718, discovered during Log Cabin Sediment Management with FERC. Copies of the transmittal letter was distributed to tribes and agencies	Sediment Management
3/14/2019	Monica Ruth (HDR); NCIC	Ruth submitted a letter report ackage for National Register of Historic Places Evaluation of Archaeological Isolate P-58--3095/HDR-YCWA-ISO-718, discovered during Log Cabin Sediment Management.	Sediment Management
3/18/2019	Monica Ruth (HDR); NAHC	Ruth requested a local government tribal consultation list and a search of the Sacred Lands files from the Native American Heritage Commission in support of the updated Log Cabin and Our House Diversion Dams Sediment Management Plan.	Sediment Management
3/19/2019	Danielle Risse (HDR); Aoife Kilmartin (Tahoe National Forest); Carrie Smith (Tahoe National Forest)	Risse contacted Smith and Aoife regarding YCWA's proposed updates to their Log Cabin and Our House Diversion Dams Sediment Management Plan. YCWA is proposing to make various updated to the Plan (desribed fully in email). As the new Plan must obtain approval from FERC prior to implementation. Accordinghly , Risse contacted Smith and Kilmartin to ask for the following: 1) Can you let us know if you have any cultural resources records (i.e., site records or reports) for the Grizzly Gulch disposal site and the off-site mitigation location – either within these areas or within 0.25 mile of these areas (we already contacted you a couple months ago about the Celestial Valley disposal site)? See the attached maps of each of these areas. If you do have records for these areas, please let us know how we can get them (e.g., can they be mailed or would you like us to pick them up)? 2) Almost the entirely of the off-site mitigation location is on TNF lands (1.2 acres of 1.8 acres total). Accordingly, I believe we will need an ARPA permit or special use permit before we can conduct a cultural survey of this area. We'd like to get this area surveyed in a couple of weeks. Can you let us know if we need a permit from TNF to survey these lands and if so, what permit form you would like us to fill out?	Sediment Management
3/19/2019	Kamil Rochon (HDR); NCIC	Rochon submitted a record search request for YCWA's Log Cabin Sediment Management Project.	Sediment Management
3/22/2019	Native American Heritage Commission	The NAHC responded with a tribal consultation list for the Log Cabin and Our House Diversion Dams Sediment Management Plan. The search of the Sacred Lands files yielded no results.	Sediment Management
3/22/2019	Danielle Risse (HDR); Carrie Smith (Tahoe National Forest)	Smith states that they havbe recorded a site recently to the southwestof the Celestial Valley project area. Smith states that there is no need for a permit for survey of an acre.	Sediment Management
3/22/2019	Danielle Risse (HDR); Carrie Smith (Tahoe National Forest)	In reponse to email from 3/19/2019. Smite states that there is one site to the west of the Grizzly Gulch area. Smith send Risse Monitoring Reports for the site located to the west of the Grizzly Gulch area (05175300202). Risse thanks Smith. She will see the report when it's done and Risse will let Smith know if anything exciting is found.	Sediment Management
3/26/2019	Monica Ruth (HDR); Cultural Participants	Ruth extends an invitation to cultural partcipants to survey the Celestial Valley project area for the YCWA sediment management plan modification work. Work with begin at Celestial Valley at 9 AM on Monday, April 1st.	Sediment Management

Date	Tribe/Agency	Action	Project/Phase
3/27/2019	Monica Ruth (HDR); Cultural Participants	In continuation of email from 3/26/2019. Ruth forwarded the invitation to Cuellar. Ruth forwarded the email to Creig Marcus (Enterprise Rancheria) and left a message for him and Glenda Nelson (Enterprise Rancheria) inviting them to the field survey. Ruth spoke with Wallace Clark(KonKow Valley Band of Maidu Indians). He will not be able to make it but asked that Ruth foward the invitation to Jessica Lopez (KonKow Valley Band of Maidu Indians). Ruth spoke with Kyle Self (Greenville Rancheria). He will not be joining the field survey. Ruth soke with Ben Clark (Mooretown Rancheria of Maidu Indians). He says their tribal monitoring program is not yet established and they will not be joining us. Ruth spoke to Grayson Coney (Tsi Akim Maidu). He states that there are deep milling stations in the area, the first 3/4 mile of Celestial Valley Road has cultural resources especially isolates. He is not lanning to join. Ruth spoke with Darrel Cruz (Washoe Tribe of Nevada and California). He will not be joining and defers to more local tribes. Ruth spoke and left messages with the the following: Patty Allen (Greenville Rancheria), Shelly Covert (Nevada City Rancheria), Jason Ryberg (Tsi Akim Maidu), Melodi McAdams (UAIC), Denis Ramirez (Mechoopda). Ruth called the number for Cathy Bihpo (Strawberry Valley Rancheria) and the phone number is temporarily out of service and so Ruth could not leave a message.	Sediment Management
3/28/2019	Monica Ruth (HDR); Cultural Participants	In continuation of emails and phone calls from 3/27/2019. Melodi McAdams (UAIC) thanked Ruth for the invitation, unfortunatel they will not be sending a representative to the site visit. Ruth thanks McAdams for letting her know.	Sediment Management
4/4/2019	Danielle Risse (HDR); Tim Warner (USACE)	Risse let Warner know that the HDR field personnel checking in with the park office as directed in the 1/17/2019 email. The park office directed HDR to send Warner an email directly as they will be in and out of the office.	Sediment Management
8/26/2019	Julianne Polanco (SHPO); Curt Aikens (YCWA)	SHPO filed with FERC a response letter to YCWA's request for review of the APE revisions for the Log Cabin and Our House Diversion Dams Sediment Management Plan. The SHPO does not object to the proposed APE revision.	Sediment Management
11/1/2019	Curt Aikens (YCWA); Participating Tribes and Agencies	YCWA sent the *Cultural Resources Investigation for the Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan for the Yuba River Development Project* to participating tribes and agencies for a 30-day review.	Sediment Management
11/7/2019	Danielle Risse (HDR); Carrie Smith (TNF)	Smith stated that the text of the sediment management report needs to state how much of the land in private vs. FS land and the total acres in the APE. Appendix E also needs to the private vs. FS land in the legend. Risse thanked Smith for the comments. Smith added that she will need the GIS shapefile for the APE total and the survey coverage. Risse asked if Smith would like the shapefile now or if it would be okay to send with the report after it's revision.	Sediment Management
11/7/2019	Danielle Risse (HDR); Carrie Smith (TNF)	Smith called and left a message with Risse asking if HDR-CV-01, -02, -03, -04, and -05 are on FS land. If they are, they will need to be assigned a FS number. If not, then the FS will have no comments at this time. Risse responded that the following sites were documented or continue on to TNF land. HDR-CV-01: Celestial Valley Road, a small recorded sectiontravels through TNF lands. HDR-CV-04: Large mining site, the portion recorded was on private land but the site continues onto TNF lands to the east and west. HDR-CV-05: Camptonville Road, the portion recorded was on private land but the site continues onto TNF lands to the east and west.	Sediment Management
11/20/2019	Kamil Rochon (HDR); Kyle Piercy (Northeastern Information Center)	Kyle Piercy with the Northeastern Information Center provided primary number and trinomial assignments to Kamil Rochon and informed her that the Northeast Center of the California Historical Resources Information System has processed the resource records for the sites submitted to the Info Center. Because the isolate (HDR-CV-ISO-1) fell within the boundaries of site HDR-CV-04, they processed it as an update of that site record as their policy is not to have two resources occupy the same space. Kamil thanked Kyle. HDR has combined the "isolate" information into the site.	Sediment Management
12/10/2019	Gene Whitehouse (UAIC); Curt Aikens (YWA)	Chairman Gene Whitehouse submitted a letter to Curt Aikens in response to the Cultural Resources Investigation for the Modificiation to the Log Cabin and Our House Diversion Dams Sediment Management Plan thanking him for requesting consultation on the project. Based on information provided by YWA, UAIC's records indicate that this project is not likely to affect resources that may be of importantce to the UAIC. UAIC would like YWA to continue to provide information on the project so they have the opportunity to comment on potential impactes related to cultural resources.	Sediment Management

From:	Ruth, Monica
To:	nahc@nahc.ca.gov
Subject:	Yuba Water Agency - request for tribal contacts and search of Sacred Lands File
Date:	Monday, August 27, 2018 5:52:00 PM
Attachments:	ATTACHMENT_APE_Tribal_Contacts.pdf Local-Government-Tribal-Consultation-List-Request-Form-Update.pdf

Hello,

The Yuba Water Agency proposed to the Federal Energy Regulatory Commission (FERC) to conduct dredging operations to alleviate sediment build-up at Log Cabin and Our House Diversion Dams, both Yuba River Development Project (Project) facilities. Yuba Water Agency drafted the *Log Cabin and Our House Diversion Dams Sediment Management* Plan (Plan) to address sedimentation management at both Log Cabin Diversion Dam and at Our House Diversion Dam and filed it with FERC in 2014.

HDR provided consultation support to Yuba Water Agency for the initial Plan. The Plan is now being updated to improve sediment management at the dams. These updates include adding a new spoils area where sediment can be stockpiled. At this time, on behalf of Yuba Water Agency, we are requesting a tribal consultation list and search of the Sacred Lands file in support of CEQA and Section 106 of the National Historic Preservation Act for the Plan updates. Attached please find a local government tribal consultation list request form and map showing the area of potential effects for this work.

Please let me know if you have any questions.

Thank you,
Monica

Monica Ruth, B.A. Anthropology
Cultural Resources Specialist

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento CA, 95833
Direct: 916-679-8818
Monica.Ruth@hdrinc.com
hdrinc.com/follow-us

Local Government Tribal Consultation List Request

Native American Heritage Commission
1550 Harbor Blvd, Suite 100
West Sacramento, CA 95691
916-373-3710
916-373-5471 – Fax
nahc@nahc.ca.gov

Type of List Requested

- [x] **CEQA Tribal Consultation List (AB 52)** – ***Per Public Resources Code § 21080.3.1, subs. (b), (d), (e) and 21080.3.2***

- [ ] **General Plan (SB 18)** - ***Per Government Code § 65352.3.***

Local Action Type:

- [ ] **General Plan**
- [ ] **General Plan Element**
- [ ] **General Plan Amendment**
- [ ] **Specific Plan**
- [ ] **Specific Plan Amendment**
- [ ] **Pre-planning Outreach Activity**

Required Information

Project Title: LOG CABIN AND OUR HOUSE DIVERSION DAMS SEDIMENT MANAGEMENT PLAN

Local Government/Lead Agency: Yuba Water Agency

Contact Person: Monica Ruth

Street Address: 2379 Gateway Oaks Drive, Suite 200

City: Sacramento **Zip:** 95833

Phone: 916-679-8818 **Fax:** 916-679-8701

Email: monica.ruth@hdrinc.com

Specific Area Subject to Proposed Action

County: ______ **City/Community:** ______

Project Description:

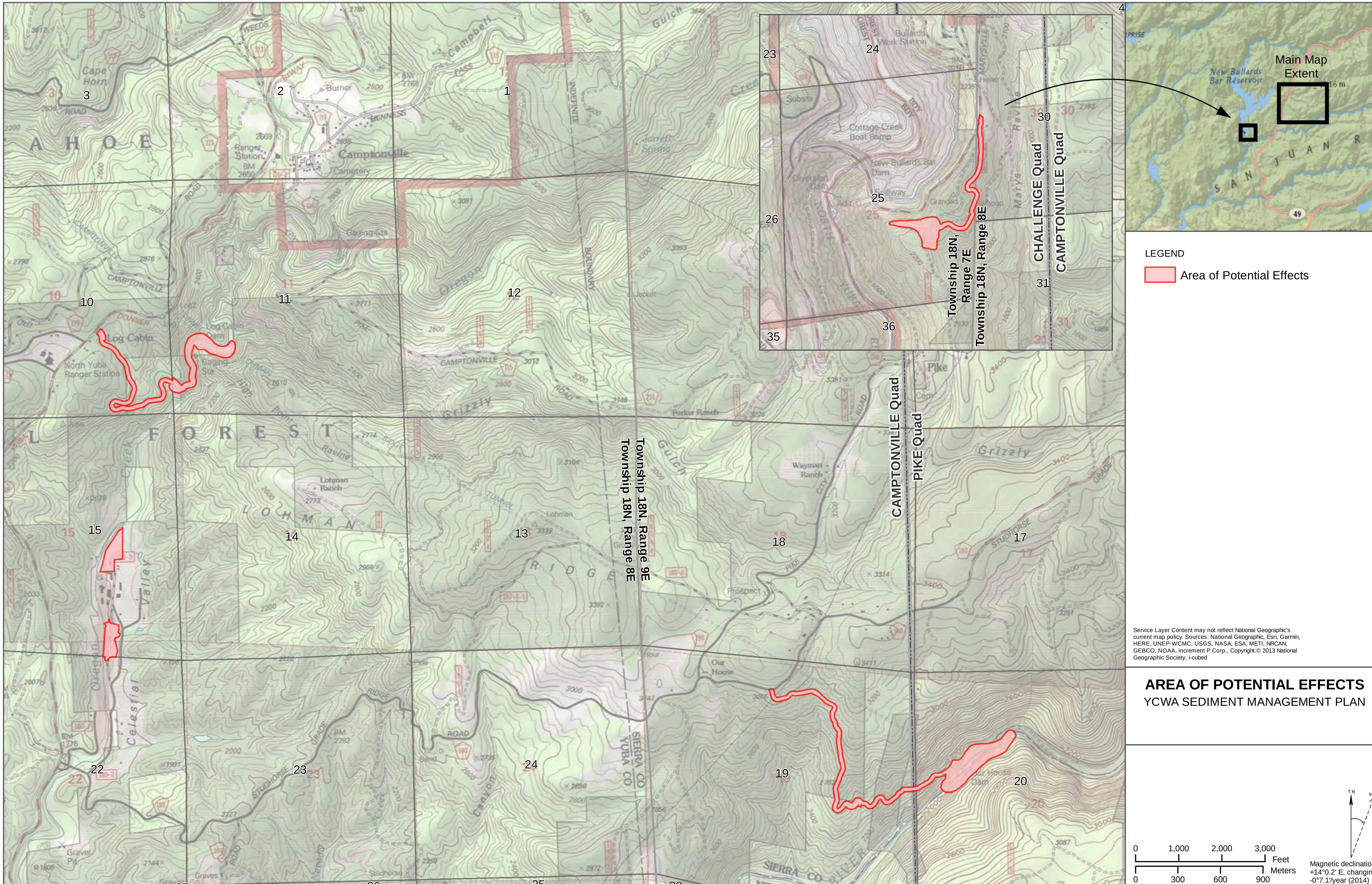
The Yuba Water Agency proposed to FERC to conduct dredging operations to alleviate sediment build-up at Log Cabin and Our House Diversion Dams, which are Yuba River Development Project facilities. Yuba Water Agency drafted the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan) to address sedimentation management at both diversion dams and filed it with FERC in 2014. The Plan is now being updated to improve sediment management at the dams.

Additional Request

- [x] **Sacred Lands File Search** - ***Required Information:***

USGS Quadrangle Name(s): Camptonville, Pike, Challenge

Township: 18N **Range:** 7E, 8E, 9E **Section(s):** (see attached map)



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NATIVE AMERICAN HERITAGE COMMISSION
Environmental and Cultural Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710

August 29, 2018

Geoff Rabone
Yuba County Water Agency

Sent by E-mail: grabone@ycwa.com
Cc: monica.ruth@hdrinc.com

RE: Proposed Log Cabin and Our House Diversion Dams Sediment Management Plan Project, Community of Camptonville; Camptonville, Pike, and Challenge USGS Quadrangles, Yuba County, California

Dear Mr. Rabone:

Attached is a consultation list of tribes with traditional lands or cultural places located within the boundaries of the above referenced counties. Please note that the intent of the reference codes below is to avoid or mitigate impacts to tribal cultural resources, as defined, for California Environmental Quality Act (CEQA) projects under AB-52.

As of July 1, 2015, Public Resources Code Sections 21080.3.1 and 21080.3.2 **require public agencies** to consult with California Native American tribes identified by the Native American Heritage Commission (NAHC) for the purpose mitigating impacts to tribal cultural resources:

> **Within 14 days** of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, which shall be accomplished by means of at least one written notification that includes a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation pursuant to this section. (Public Resources Code Section 21080.3.1(d))

The law does not preclude agencies from initiating consultation with the tribes that are culturally and traditionally affiliated with their jurisdictions. The NAHC believes that in fact that this is the best practice to ensure that tribes are consulted commensurate with the intent of the law.

In accordance with Public Resources Code Section 21080.3.1(d), formal notification must include a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation. The NAHC believes that agencies should also include with their notification letters information regarding any cultural resources assessment that has been completed on the APE, such as:

1. The results of any record search that may have been conducted at an Information Center of the California Historical Resources Information System (CHRIS), including, but not limited to:

   - A listing of any and all known cultural resources have already been recorded on or adjacent to the APE;
   - Copies of any and all cultural resource records and study reports that may have been provided by the Information Center as part of the records search response;
   - If the probability is low, moderate, or high that cultural resources are located in the APE.
   - Whether the records search indicates a low, moderate or high probability that unrecorded cultural resources are located in the potential APE; and
   - If a survey is recommended by the Information Center to determine whether previously unrecorded cultural resources are present.

2. The results of any archaeological inventory survey that was conducted, including:

   - Any report that may contain site forms, site significance, and suggested mitigation measurers.

     All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure in accordance with Government Code Section 6254.10.

3. The results of any Sacred Lands File (SFL) check conducted through Native American Heritage Commission. <u>A search of the SFL was completed for the project with negative results however the area is sensitive for potential tribal cultural resources.</u>

4. Any ethnographic studies conducted for any area including all or part of the potential APE; and

5. Any geotechnical reports regarding all or part of the potential APE.

Lead agencies should be aware that records maintained by the NAHC and CHRIS is not exhaustive, and a negative response to these searches does not preclude the existence of a cultural place. A tribe may be the only source of information regarding the existence of a tribal cultural resource.

This information will aid tribes in determining whether to request formal consultation. In the case that they do, having the information beforehand well help to facilitate the consultation process.

If you receive notification of change of addresses and phone numbers from tribes, please notify me. With your assistance we are able to assure that our consultation list contains current information.

If you have any questions, please contact me at my email address: gayle.totton@nahc.ca.gov.

Sincerely,

Gayle Totton

Gayle Totton, M.A., PhD.
Associate Governmental Program Analyst

From:	Ruth, Monica
To:	"nahc@nahc.ca.gov"
Subject:	Yuba Water Agency - request for tribal contacts and search of Sacred Lands File
Date:	Monday, March 18, 2019 4:20:19 PM
Attachments:	EMBEDDED_Sediment_Cultural_APE_Vicinity_8x11.jpg Local-Government-Tribal-Consultation-List-Request-Form-Update.pdf

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Hello,

The Yuba Water Agency (YWA), owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) - is seeking to notify and consult with potentially affected Native American tribes regarding proposed improvements to the Log Cabin and Our House Diversion Dams Sediment Management Plan (Plan) in Yuba, Sierra, and Nevada counties.

Tribes were recently provided a notice of opportunity consult in December 12, 2018. The Plan is now being updated to improve sediment management at the dams, which includes the addition of a new spoils area where sediment can be stockpiled and another location for off-site re-vegetation mitigation. At this time, on behalf of Yuba Water Agency, we are requesting a tribal consultation list and search of the Sacred Lands file in support of CEQA and Section 106 of the National Historic Preservation Act for the Plan updates. Attached please find a local government tribal consultation list request form and map showing the area of potential effects for this work.

Please let me know if you have any questions.

Thank you,

Monica

Monica Ruth, B.A. Anthropology
Cultural Resources Specialist

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento CA, 95833
Direct: 916-679-8818
Monica.Ruth@hdrinc.com
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Local Government Tribal Consultation List Request

Native American Heritage Commission
1550 Harbor Blvd, Suite 100
West Sacramento, CA 95691
916-373-3710
916-373-5471 – Fax
nahc@nahc.ca.gov

Type of List Requested

☒ **CEQA Tribal Consultation List (AB 52)** – *Per Public Resources Code § 21080.3.1, subs. (b), (d), (e) and 21080.3.2*

☐ **General Plan (SB 18)** - *Per Government Code § 65352.3.*

Local Action Type:

___ **General Plan** ___ **General Plan Element** ___ **General Plan Amendment**

___ **Specific Plan** ___ **Specific Plan Amendment** ___ **Pre-planning Outreach Activity**

Required Information

Project Title: Log Cabin and Our House Diversion Dams Sediment Management Plan

Local Government/Lead Agency: Yuba Water Agency

Contact Person: Geoff Rabone

Street Address: 1220 F Street

City: Marysville **Zip:** 95901

Phone: 530-741-5005 **Fax:** ___

Email: grabone@yubawater.org

Specific Area Subject to Proposed Action

County: Sierra , Yuba, and Nevada **City/Community:** ___

Project Description:

The Yuba Water Agency (YWA), owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) - is seeking to notify and consult with potentially affected Native American tribes regarding proposed improvements to the Log Cabin and Our House Diversion Dams Sediment Management Plan (Plan) in Yuba, Sierra, and Nevada counties.

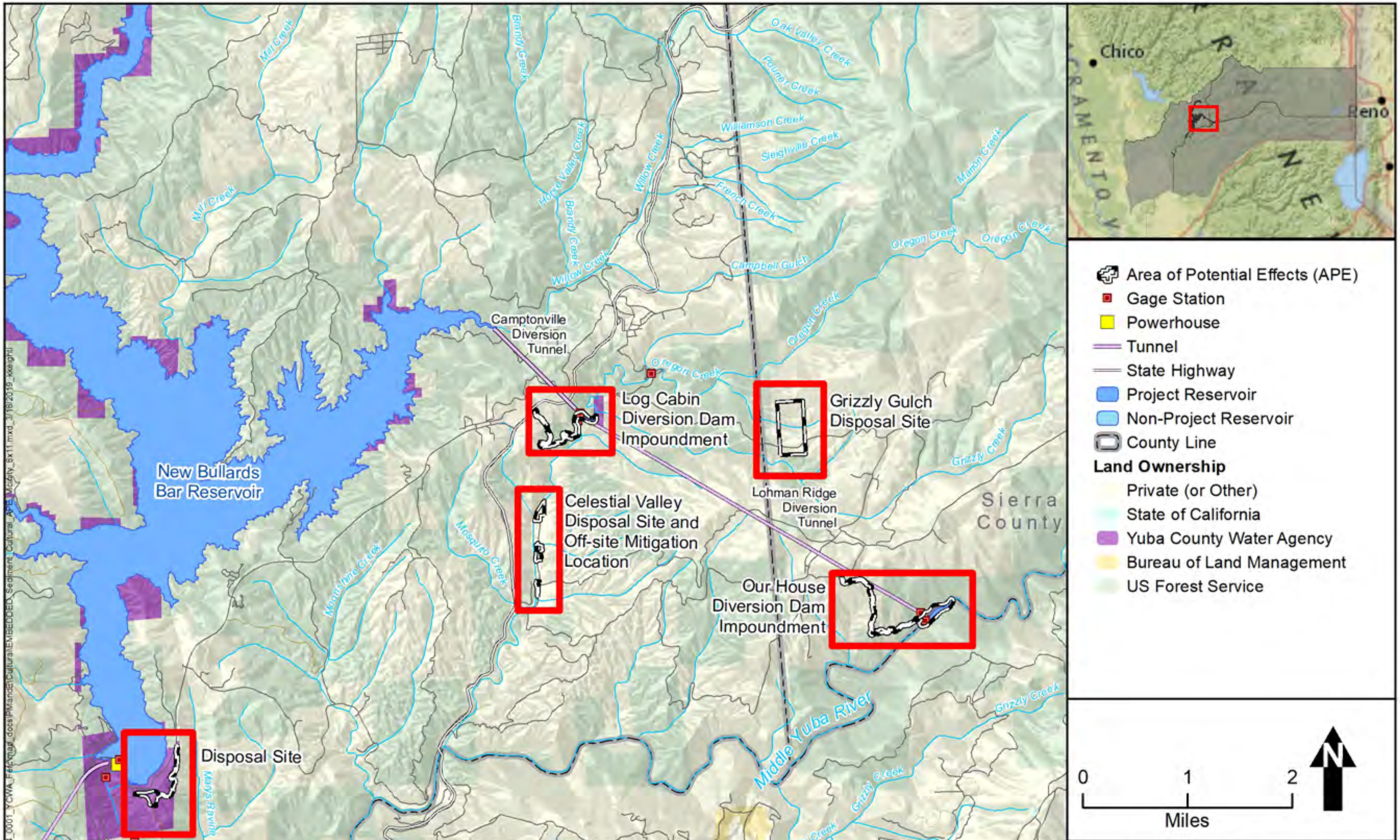
The Plan is now being updated to improve sediment management at the dams, which includes the addition of a new spoils area where sediment can be stockpiled and another location for off-site re-vegetation mitigation.

Additional Request

☒ **Sacred Lands File Search** - ***Required Information:***

USGS Quadrangle Name(s): Camptonville, CA; Challenge, CA; Pike, CA

Township: see attached map **Range:** ___ **Section(s):** ___



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NATIVE AMERICAN HERITAGE COMMISSION
Cultural and Environmental Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691 Phone: (916) 373-3710
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov

March 22, 2019

Geoff Rabone
Yuba Water Agency

VIA Email to: grabone@yubawater.org

RE: Native American Tribal Consultation, Pursuant to the Assembly Bill 52 (AB 52), Amendments to the California Environmental Quality Act (CEQA) (Chapter 532, Statutes of 2014), Public Resources Code Sections 5097.94 (m), 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2 and 21084.3, **Log Cabin and Our House Diversion Dams Sediment Management Plan Project**, near the Communities of Camptonville, Pike, and North San Juan; Camptonville, Challenge, and Pike USGS Quadrangles, Sierra, Nevada, and Yuba Counties

Dear Mr. Rabone:

Pursuant to Public Resources Code section 21080.3.1 (c), attached is a consultation list of tribes that are traditionally and culturally affiliated with the geographic area of the above-listed project. Please note that the intent of the AB 52 amendments to CEQA is to avoid and/or mitigate impacts to tribal cultural resources, (Pub. Resources Code §21084.3 (a)) ("Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource.")

Public Resources Code sections 21080.3.1 and 21084.3(c) require CEQA lead agencies to consult with California Native American tribes that have requested notice from such agencies of proposed projects in the geographic area that are traditionally and culturally affiliated with the tribes on projects for which a Notice of Preparation or Notice of Negative Declaration or Mitigated Negative Declaration has been filed on or after July 1, 2015. Specifically, Public Resources Code section 21080.3.1 (d) provides:

> Within 14 days of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, which shall be accomplished by means of at least one written notification that includes a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation pursuant to this section.

The AB 52 amendments to CEQA law does not preclude initiating consultation with the tribes that are culturally and traditionally affiliated within your jurisdiction prior to receiving requests for notification of projects in the tribe's areas of traditional and cultural affiliation. The Native American Heritage Commission (NAHC) recommends, but does not require, early consultation as a best practice to ensure that lead agencies receive sufficient information about cultural resources in a project area to avoid damaging effects to tribal cultural resources.

The NAHC also recommends, but does not require that agencies should also include with their notification letters, information regarding any cultural resources assessment that has been completed on the area of potential effect (APE), such as:

1. The results of any record search that may have been conducted at an Information Center of the California Historical Resources Information System (CHRIS), including, but not limited to:

   - A listing of any and all known cultural resources that have already been recorded on or adjacent to the APE, such as known archaeological sites;

   - Copies of any and all cultural resource records and study reports that may have been provided by the Information Center as part of the records search response;

   - Whether the records search indicates a low, moderate, or high probability that unrecorded cultural resources are located in the APE; and

   - If a survey is recommended by the Information Center to determine whether previously unrecorded cultural resources are present.

2. The results of any archaeological inventory survey that was conducted, including:

   - Any report that may contain site forms, site significance, and suggested mitigation measures.

   All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for public disclosure in accordance with Government Code section 6254.10.

3. The result of any Sacred Lands File (SLF) check conducted through the Native American Heritage Commission was <u>negative however the area is sensitive for cultural resources</u>.

4. Any ethnographic studies conducted for any area including all or part of the APE; and

5. Any geotechnical reports regarding all or part of the APE.

Lead agencies should be aware that records maintained by the NAHC and CHRIS are not exhaustive and a negative response to these searches does not preclude the existence of a tribal cultural resource. A tribe may be the only source of information regarding the existence of a tribal cultural resource.

This information will aid tribes in determining whether to request formal consultation. In the event that they do, having the information beforehand will help to facilitate the consultation process.

If you receive notification of change of addresses and phone numbers from tribes, please notify the NAHC. With your assistance, we can assure that our consultation list remains current.

If you have any questions, please contact me at my email address: gayle.totton@nahc.ca.gov.

Sincerely,

Gayle Totton

Gayle Totton, B.S., M.A., Ph. D
Associate Governmental Program Analyst

Attachment

530.741.5000
info@yubawater.org
yubawater.org

YUBA WATER AGENCY

December 12, 2018

Via U.S. Mail

To: Distribution List

Subject: **Notice of Opportunity to Consult for the Log Cabin and Our House Diversion Dams Sediment Management Plan Improvements for Yuba County Water Agency's Yuba River Development Project in Yuba, Sierra, and Nevada Counties, California (FERC No. 2246-079).**

[redacted]

Dear Tribal Representative,

[redacted]

The Yuba County Water Agency (YCWA), owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) - is notifying and seeking to consult with potentially affected Native American tribes regarding proposed improvements to the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan). In a letter dated November 5, 2013, FERC directed YCWA to develop a Plan for the permanent, long-term solution for sediment control at Log Cabin Diversion Dam, and to file the Plan with FERC for approval. YCWA drafted the Plan to address sedimentation management at both Log Cabin Diversion Dam and at Our House Diversion Dam and filed the plan with FERC on May 5, 2014. FERC approved the mechanical sediment removal and emergency sediment removal portions of the plan on September 23, 2014, and the sediment passage portions of the Plan on March 4, 2016. YCWA implemented the mechanical sediment removal portions of the Plan in October 2014 upon FERC's approval, after obtaining all necessary permits and approvals.

Plan Improvements

Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. These improvements include:

- **Difference in period, length, and flows for sediment passage at both Log Cabin and Our House Dams:** change from November 1 through March 15 to October 1 through March 21; instead of being open for 96 hours, the valves will be left open for nine days and closed over a period of two days; the Our House flow was changed from 600 cubic feet per second (cfs) to 1,500 cfs to trigger passage; valves may also now be opened more than once under the proper conditions. This change was made to improve the sediment passage through the dam. Widening the period would allow for higher chances of the correct triggers, and longer terms would increase the amount of sediment that goes through the valve.

- **Blockage of outage dredging:** If after October 1, YCWA determines that any one of the Our House Diversion Dam's or the Log Cabin Diversion Dam's fish release valves or low level outlet valves has been partially or fully blocked by sediment, then YCWA may take remedial actions at that valve by the following April 1 or 10 (as described below), consistent with existing permits, to return that valve to proper functioning condition. All of this is new to the Plan, but within the existing footprint of the sediment removal work. No additional ground disturbance will result from this work. The equipment will be staged and used at the area right of the dam, which is where the dredge would be set up (similar to the pumps for the dewatering of the pool at the base of the dam). The air/water nozzles will be positioned from the side of the dam, as well. They do not dewater the area. The suction dredge would pump water over the dam directly as it pulls away material and water from the valves. All equipment would be brought down the existing roads by truck, no larger than flatbeds that ca[redacted]could include:
    - Using air and/or water nozzles to blow sediment out of the valves; and/or
    - [redacted]0 yds^3 of accumulated sediment upstream of the valve. The sediment would be pumped around the dam and discharged directly to the river downstream of the dam. During these activities, YCWA would reduce flows over the spillway to ensure the safety of the divers working in the diversion pool and to maintain minimum flow requirements. Once sediment has been cleared from the outlet, YCWA would open the low level outlet to flush the outlet and distribute the deposited material further downstream. The low level outlet would then be closed gradually over the course of four days, with the goal of avoiding any additional sediment buildup that could clog the outlets. YCWA may close the valve completely at any time during the four days if YCWA anticipates the outlet is at risk of being reclogged.

  All activities related to above suction-dredging (dredging and opening of the low level outlet as described above) shall be completed by April 1, unless high flows preclude safe access, in which case suction dredging may continue until no later than April 10.

- **Increase of amount of sediment removed at one time from impoundments:** from 20,000 to 40,000 cubic yards at Log Cabin and from 40,000 to 100,000 cubic yards at Our House. This change was precipitated in part by the 2017 storms, which swept large amounts of sediment into both impoundments, but also by experience, which demonstrated that more sediment than previously expected can be removed from an impoundment during a single removal event.

- **The Best Management Practices (BMPs)** have been more clearly formalized in the Plan, following the Forest Service handbook BMPs.

- **Disposal of Sediment:** In the original version of the Plan, there was a footnote saying the Celestial Valley spoils pile sites were not planned for use at the time and would be permitted later, if they were to be used. That footnote has been removed, the Celestial Valley spoils piles will be used for disposal sites, and permitting does apply. See Attachment 1 for a map of the spoils piles location.

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info@yubawater.org
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YUBA WATER AGENCY

Consultation

As the Plan must obtain approval from FERC prior to implementation, it is defined as a federal undertaking and therefore must comply with Section 106 of the National Historic Preservation Act (NHPA) (Section 106) of 1966, as amended, at 36 C.F.R. Part 800. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties (i.e., cultural resources listed in or eligible for listing in the National Register of Historic Places [NRHP]). As the Plan also requires approvals by state agencies, it must also comply with the California Environmental Quality Act (CEQA). CEQA requires state agencies to determine and consider whether a project may have a significant effect on cultural resources that are historical resources, unique archaeological sites, or tribal cultural resources.

In 2014, a cul[redacted]ducted by HDR Engineering, Inc. (HDR), on behalf of YCWA, to identify any cultural resources within the area that could be impacted by implementation of the Plan (i.e., the area of potential effects or APE). YCWA completed formal NRHP and CEQA evaluati[redacted]ffected by Plan implementation activities in consultation with appropriate tribes, federal agencies, and the State Historic Preservation Officer (SHPO). YCWA concluded that the implementation of the Plan would result in no adverse effect to historic properties pursuant to the regulations at 36 C.F.R. Part 800.5(d)(1) for Section 106 compliance and would result in a less-than-significant impact to historical resources under the provisions of CEQA, and there was no objection by the SHPO (letter dated August 20, 2014, OHP Ref #FERC_2013_1002_001).

At this time, YCWA is seeking to consult with California Native American tribes that are traditionally and culturally affiliated with the APE for the proposed Plan improvements, in compliance with CEQA, California Public Resources Code (PRC) Section 21080.3.1. Additionally, to assist with historic property identification efforts in support of Section 106, YCWA is seeking information that may be pertinent to understanding the cultural/tribal resources that should be taken into consideration for the proposed Plan improvements.

In support of these consultation efforts, YCWA has requested the assistance of the Native American Heritage Commission (NAHC), in compliance with PRC 21080.3.1(c) and Section 106, to provide a list of California Native American tribes that are traditionally and culturally affiliated with the APE. The NAHC has provided a list of California Native American tribes in support of these efforts, which is included here as part of the distribution list.

YCWA would like to notify you of the opportunity to consult with YCWA regarding the potential for the Plan improvements to impact tribal cultural resources, as defined in PRC Section 21074, or historic properties, as defined in Section 106 regulations. The purposes of tribal consultation under PRC Section 21080.3.1, as part of the CEQA review process and Section 106, are to determine whether tribal cultural resources or historic properties are present within the APE, and if so, whether the Plan improvements will significantly impact those resources. If tribal cultural resources or historic properties may be significantly impacted, then consultation will also help to determine the most appropriate way to avoid or mitigate those impacts.

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YUBA WATER AGENCY

In partial fulfillment of Section 106 requirements, as well as in accordance with Section 21080.3.1(d) of the PRC, YCWA is requesting a written response to either request or decline consultation for the Plan improvements. If you have any comments, concerns or information relevant to the APE, please send them to the address below. In accordance with Section 21080.3.1(d) of the PRC you have 30 days from the receipt of this letter to either request or decline consultation in writing. Please send your written response to:

Danielle Risse, Senior Cultural Resources Specialist
HDR Engineering, Inc.
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
[redacted] Danielle.Risse@hdrinc.com [redacted]
916-679-8796

If we do not r[redacted]n our files and we will continue to move forward with the Plan improvements.

Thank you and we look forward to your response.

Sincerely,

Mike Klein
for

Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

Attachment (1): Map of Spoils Pile Area

Cc: Distribution List
Carrie Smith, Tahoe National Forest

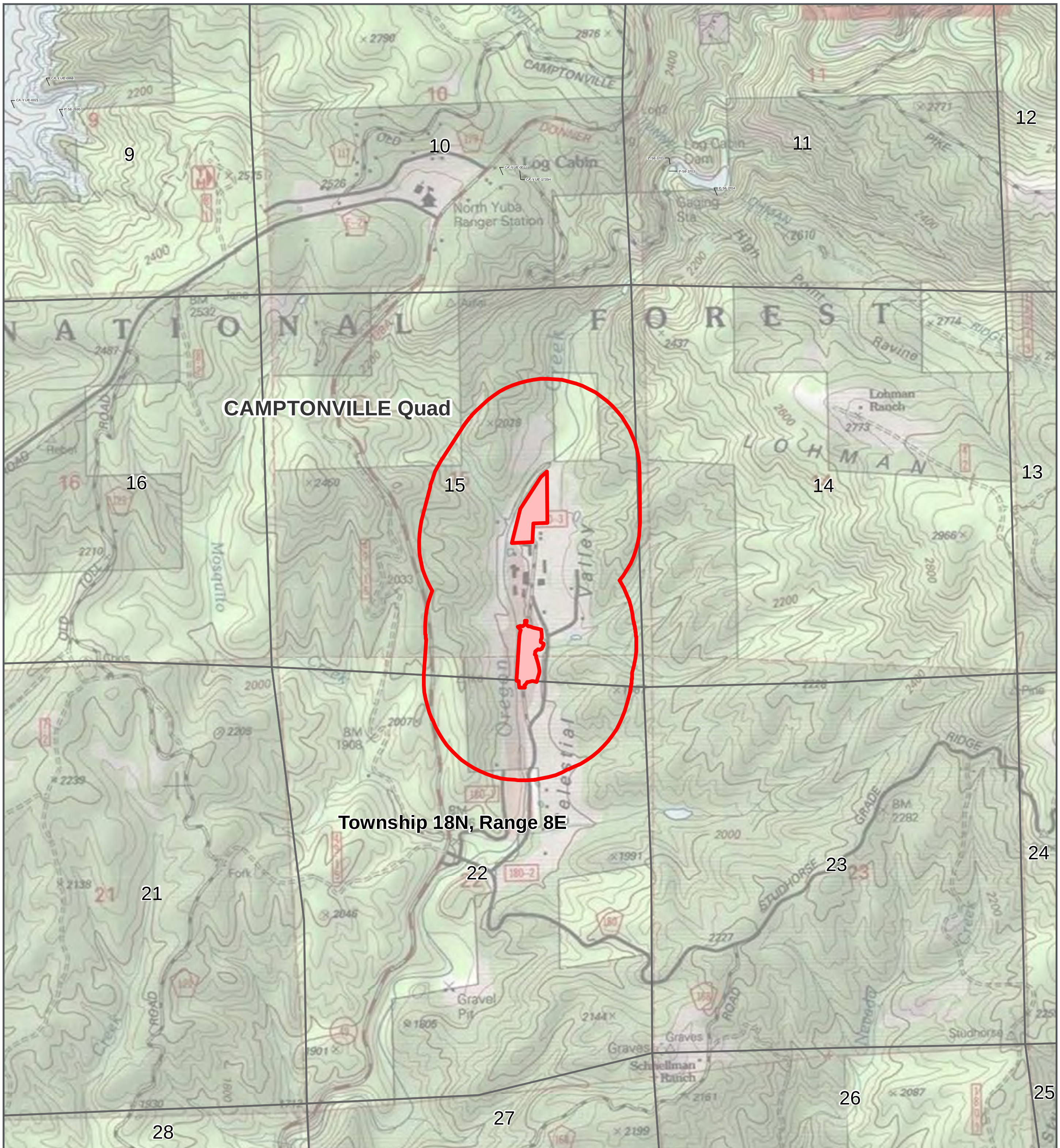
<u>References Cited</u>

Ramsey Ford, Dawn. 2014. *Cultural Resources Investigation for the Log Cabin and Our House Diversion Dams Sediment Management Plan for the Yuba River Development Project (FERC Project No. 2246), Nevada, Yuba, and Sierra Counties, California*. Prepared for YCWA. Prepared by HDR, Inc., Sacramento, CA.

Attachment 1:

MAP OF CELESTIAL VALLEY SPOILS PILE AREA

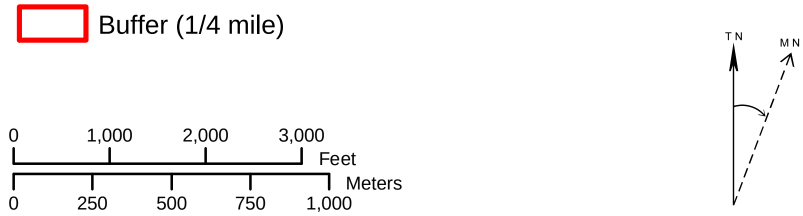
Yuba River Development Project, FERC Project No. 2246



LEGEND

Project Area

Buffer (1/4 mile)



Magnetic declination:
+14°0.2' E, changing
-0°7.1'/year (2014)

Service Layer Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., Copyright:© 2013 National Geographic Society, i-cubed
Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.
Projection is NAD 1983 UTM Zone 10 North

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info@yubawater.org
yubawater.org

YUBA WATER AGENCY

December 12, 2018

Via Certified Mail

Gene Whitehouse, Chairman
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

Subject: **Notice of Opportunity to Consult for the Log Cabin and Our House Diversion Dams [redacted] County Water Agency's Yuba River Development Project in Yuba, Sierra, and Nevada Counties, California (FERC No. 2246-079).**
[redacted]

Dear Chairman Whitehouse:

The Yuba County Water Agency (YCWA), owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) - is notifying and seeking to consult with potentially affected Native American tribes regarding proposed improvements to the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan). In a letter dated November 5, 2013, FERC directed YCWA to develop a Plan for the permanent, long-term solution for sediment control at Log Cabin Diversion Dam, and to file the Plan with FERC for approval. YCWA drafted the Plan to address sedimentation management at both Log Cabin Diversion Dam and at Our House Diversion Dam and filed the plan with FERC on May 5, 2014. FERC approved the mechanical sediment removal and emergency sediment removal portions of the plan on September 23, 2014, and the sediment passage portions of the Plan on March 4, 2016. YCWA implemented the mechanical sediment removal portions of the Plan in October 2014 upon FERC's approval, after obtaining all necessary permits and approvals.

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YUBA WATER AGENCY

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YUBA WATER AGENCY

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YUBA WATER AGENCY

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Danielle Risse, Senior Cultural Resources Specialist
HDR Engineering, Inc.
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
[redacted] Danielle.Risse@hdrinc.com [redacted]
916-679-8796

If we do not [redacted] in our files and we will continue to move forward with the Plan improvements.

Thank you and we look forward to your response.

Sincerely,

Mike Kline
for

Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

Attachment (1): Map of Spoils Pile Area

cc: Matthew Moore, UAIC Tribal Historic Preservation Officer
Marcos Guerrero, UAIC Cultural Resources Manager
Geoff Rabone, YCWA Project Manager

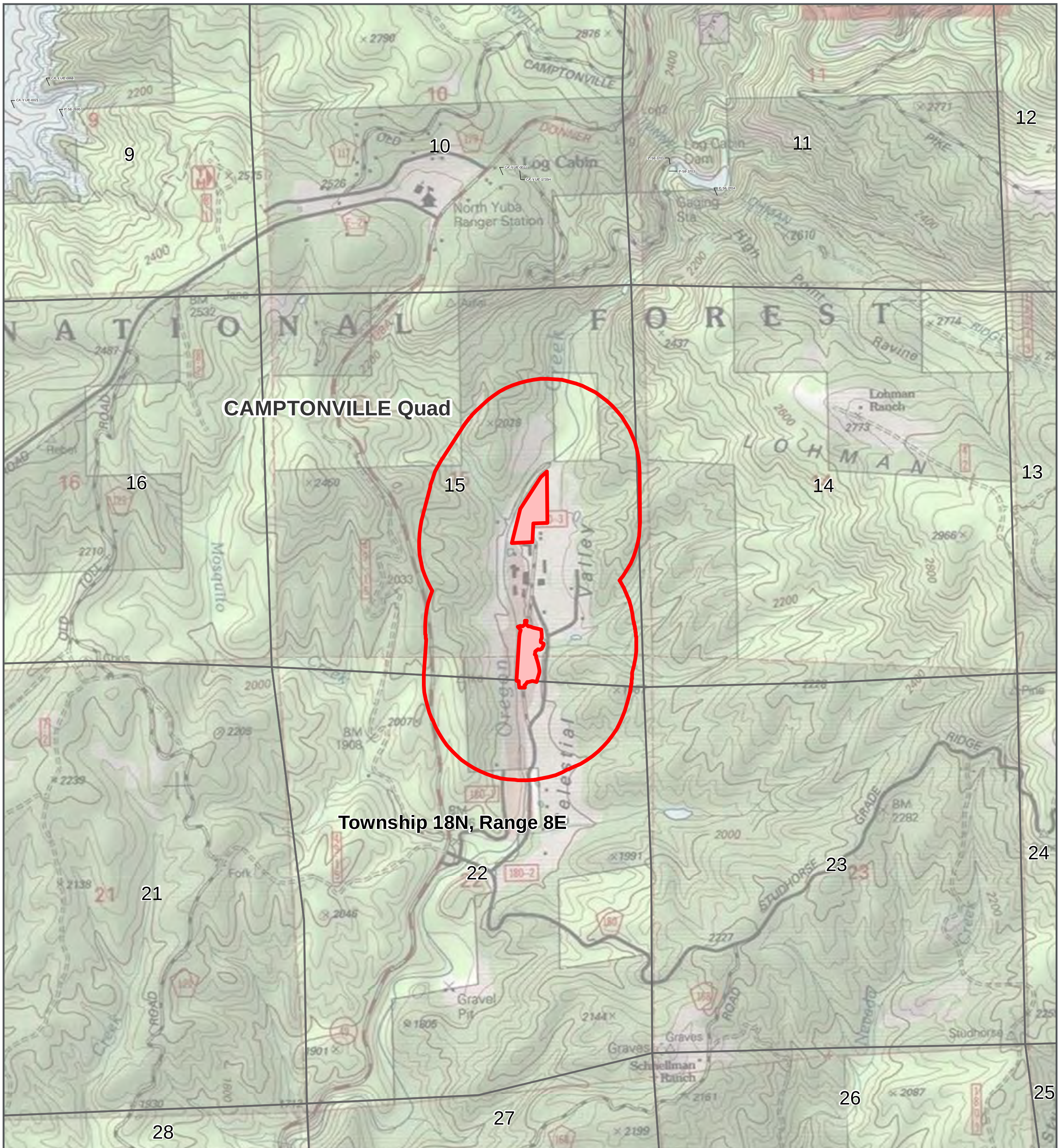
<u>References Cited</u>

Ramsey Ford, Dawn. 2014. *Cultural Resources Investigation for the Log Cabin and Our House Diversion Dams Sediment Management Plan for the Yuba River Development Project (FERC Project No. 2246), Nevada, Yuba, and Sierra Counties, California*. Prepared for YCWA. Prepared by HDR, Inc., Sacramento, CA.

Attachment 1:

MAP OF CELESTIAL VALLEY SPOILS PILE AREA

Yuba River Development Project, FERC Project No. 2246



LEGEND

Project Area

Buffer (1/4 mile)

0 1,000 2,000 3,000 Feet

0 250 500 750 1,000 Meters

TN MN

Magnetic declination:
+14°0.2' E, changing
-0°7.1'/year (2014)

Service Layer Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., Copyright:© 2013 National Geographic Society, i-cubed
Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.
Projection is NAD 1983 UTM Zone 10 North

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Greenville Rancheria

P.O. Box 279 / 410 Main Street • Greenville, CA 95947 • 530.284-7990 • Fax 530.284-7299

December 27, 2018

Curt Aikens General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

Project: Improvement for Yuba County Water Agency

Dear: Curt Aikens

The Greenville Rancheria has reviewed your letter dated December 12th 2018, for your Yuba County Water Agency Improvement Project. We have no comments or objections with your project. If at any time during your project things change, please advise us via mail for our review.

Sincerely, Crystal Rios

Crystal Rios
Tribal Vice Chairwoman
Greenville Rancheria

MIWOK United Auburn Indian Community
MAIDU of the Auburn Rancheria

Gene Whitehouse, Chairman | John L. Williams, Vice Chairman | Calvin Moman, Secretary | Jason Camp, Treasurer | Gabe Cayton, Council Member

Received
JAN 7 2019
Yuba Water Agency

December 27, 2018

Curt Aikens
Yuba County Water Agency
1220 F Street
Marysville, CA 95901

Subject: Log Cabin and Our House Diversion Dams Sediment Management Plan Improvements for Yuba County Water Agency's Yuba River Development Project (FERC No. 2246-079)

Dear Curt Aikens,

Thank you for requesting information regarding the above referenced project. The United Auburn Indian Community (UAIC) of the Auburn Rancheria is comprised of Miwok and Southern Maidu (Nisenan) people whose tribal lands are within Placer County and whose service area includes El Dorado, Nevada, Placer, Sacramento, Sutter, and Yuba counties. The UAIC is concerned about development within its aboriginal territory that has potential to impact the lifeways, cultural sites, and landscapes that may be of sacred or ceremonial significance. We appreciate the opportunity to comment on this and other projects. The UAIC would like to consult on this project.

In order to ascertain whether the project could affect cultural resources that may be of importance to the UAIC, we would like to receive copies of any archaeological reports that are completed for the project. We also request copies of environmental documents for the proposed project so that we have the opportunity to comment on appropriate identification, assessment and mitigation related to cultural resources. Finally, we request and recommend that UAIC tribal representatives observe and participate in all cultural resource surveys. To assist in locating and identifying cultural resources, UAIC's Preservation Department offers a mapping, records and literature search services program. This program has been shown to assist project proponents in complying with applicable environmental protection laws and choosing the appropriate mitigation measures or form of environmental documentation during the planning process. If you are interested in the program, please let us know.

The UAIC's Preservation Committee would like to set up a meeting or site visit, and begin consulting on the proposed project. Based on the Preservation Committee's identification of cultural resources in and around your project area, the UAIC recommends that a tribal monitor be present during any ground disturbing activities.

Thank you again for taking these matters into consideration, and for involving the UAIC in the planning process. We look forward to reviewing the additional documents requested. Please contact Melodi McAdams, Cultural Resources Supervisor, at (530) 328-1109 or email at mmcadams@auburnrancheria.com if you have any questions.

Sincerely,

Gene Whitehouse,
Chairman

CC: Matthew Moore, Tribal Historic Preservation Officer
Danielle Risse, HDR Engineering

530.741.5000
info@yubawater.org
yubawater.org

YUBA WATER AGENCY

January 3, 2019

<u>Via Electronic Submittal (eFile)</u>

Kimberly D. Bose, Secretary
FEDERAL ENERGY REGULATORY COMMISSION
888 – 1st Street, N.E.
Washington, D.C. 20426-0001

Subject: **Yuba River Development Project**
FERC Project No. 2246-079
[redacted] Representative for Informal Consultation under Section 106 of the National Historic Preservation Act and under Section 7 of the Endangered Species Act for the Log Cabin and Our House Diversion [redacted]

Dear Secretary Bose:

Yuba County Water Agency (YCWA) is the owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) as FERC Project No. 2246. In accordance with 36 Code of Federal Regulations (CFR) §800.2(c)(4) and 50 CFR §402.8, YCWA is requesting designation as FERC's non-federal representative for purposes of Section 106 of the National Historic Preservation Act consultation and for purposes of Section 7 of the Endangered Species Act consultation for proposed modifications to the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (the Plan). The Log Cabin and Our House Diversion Dams are facilities of the YRDP.

In a letter dated November 5, 2013, FERC directed YCWA to develop a plan for the permanent, long-term solution for sediment control at Log Cabin Diversion Dam, and to file the plan with FERC for approval. YCWA drafted the Plan to address sedimentation management at both Log Cabin Diversion Dam and at Our House Diversion Dam and filed the plan with FERC on May 5, 2014. FERC approved the mechanical sediment removal and emergency sediment removal portions of the Plan on September 23, 2014, and the sediment passage portions of the Plan on March 4, 2016. YCWA implemented the mechanical sediment removal portions of the Plan in October 2014 upon FERC's approval, after obtaining all necessary permits and approvals. Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. These improvements include:

- **Difference in period, length, and flows for sediment passage at both Log Cabin and Our House Dams:** change from November 1 through March 15 to October 1 through March 21; instead of being open for 96 hours, the valves will be left open for nine days and closed over a period of two days; the Our House flow was changed from 600 cubic feet per second (cfs) to 1,500 cfs to trigger passage; valves may also now be opened more than once under the proper conditions. This change was made to improve the sediment passage through the dam. Widening the period would allow for higher chances of the correct triggers, and longer terms would increase the amount of sediment that goes through the valve.

- **Blockage of outage dredging:** If after October 1, YCWA determines that any one of the Our House Diversion Dam's or the Log Cabin Diversion Dam's fish release valves or low level outlet valves has been partially or fully blocked by sediment, then YCWA may take remedial actions at that valve by the following April 1 or 10 (as described below), consistent with existing permits, to return that valve to proper functioning condition. All of this is new to the Plan, but within the existing footprint of the sediment removal work. No additional ground disturbance will result from this work. The equipment will be staged and used at the area right of the dam, which is where the dredge would be set up (similar to the pumps for the dewatering of the pool at the base of the dam). The air/water nozzles [redacted] do not dewater the area. The suction dredge would pump water over the dam directly as it pulls away material and water from the valves. All equipment would be brought down the existing roads by truck, no larger than flatbeds that ca [redacted] could include:
    - Using air and/or water nozzles to blow sediment out of the valves; and/or
    - Employing a suction dredge to remove, at each dam, up to 250 yds^3 of accumulated sediment upstream of the valve. The sediment would be pumped around the dam and discharged directly to the river downstream of the dam. During these activities, YCWA would reduce flows over the spillway to ensure the safety of the divers working in the diversion pool and to maintain minimum flow requirements. Once sediment has been cleared from the outlet, YCWA would open the low level outlet to flush the outlet and distribute the deposited material further downstream. The low level outlet would then be closed gradually over the course of four days, with the goal of avoiding any additional sediment buildup that could clog the outlets. YCWA may close the valve completely at any time during the four days if YCWA anticipates the outlet is at risk of being reclogged.

All activities related to above suction-dredging (dredging and opening of the low level outlet as described above) shall be completed by April 1, unless high flows preclude safe access, in which case suction dredging may continue until no later than April 10.

- **Increase of amount of sediment removed at one time from impoundments:** from 20,000 to 40,000 cubic yards at Log Cabin and from 40,000 to 100,000 cubic yards at Our House. This change was precipitated in part by the 2017 storms, which swept large amounts of sediment into both impoundments, but also by experience, which demonstrated that more sediment than previously expected can be removed from an impoundment during a single removal event.

- **The Best Management Practices (BMPs)** have been more clearly formalized in the Plan, following the Forest Service handbook BMPs.

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yubawater.org

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- **Disposal of Sediment:** In the original version of the Plan, there was a footnote saying the Celestial Valley spoils pile sites were not planned for use at the time and would be permitted later, if they were to be used. That footnote has been removed, the Celestial Valley spoils piles will be used for disposal sites and potential revegetation, and permitting does apply.

As the Plan improvements will require FERC approval and may have the potential to affect historic properties[1], the proposed Plan improvements are a federal undertaking subject to the requirements of Section 106 and its implementing regulations found at 36 CFR 800. Section 106 requires federal agencies to take into account the effects of their projects on historic properties and to consult with Native American tribes, agencies, and other interested parties, as appropriate. Similarly, the effects of the proposed Plan improvements on species listed under the Endangered Species Act must also be taken into account and consultation [redacted]

Under 36 CFR §800.2(c)(4), FERC may authorize an applicant for a federal license or approvals to initiate Section 106 co[redacted]O) and others and under 50 CFR §402.8, FERC may similarly authorize an applicant to initiate Section 7 consultation with the United States Fish and Wildlife Service (USFWS). By this letter, YCWA is requesting designation as the non-federal representative for Section 106 consultation with the SHPO, federal agencies, tribes, and other interested parties and Section 7 consultation with the USFWS on behalf of FERC with regard to the proposed Plan improvements. If you have any questions regarding this matter, please contact me at the address below.

Sincerely,

Nicholas (Willie) Whittlesey Jr. for:

Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

cc: Kurt Powers – FERC, D.C.

[1] The Celestial Valley spoils pile locations have not been previous inventoried for cultural resources. Historic properties are cultural resources that are eligible for or listed in the National Register of Historic Places (NRHP). Nor has the site been surveyed or assessed for potential species listed under the Endangered Species Act.

FEDERAL ENERGY REGULATORY COMMISSION
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 2246-066-California
Yuba River Project
Yuba County Water Agency

January 16, 2019

Ms. Jennifer Norris
Field Supervisor
U.S. Fish and Wildlife Service
2800 Cottage Way
Room W-2605
Sacramento, CA 95825

Ms. Julianne Polanco
State Historic Preservation Officer
California Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Subject: Designation of non-federal representative for consultation under the Endangered Species Act and the National Historic Preservation Act

To the parties addressed:

By letter dated January 3, 2019, Yuba County Water Agency, licensee for the Yuba River Project No. 2426, requested designation as our non-federal representative for the purpose of informal consultation with the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Services (NMFS), pursuant to section 7 of the Endangered Species Act (ESA).[1] The licensee also requested designation as our non-federal representative for the purpose of consultation with the California State Historic Preservation Officer (California SHPO), appropriate Indian Tribes, and other consultation parties, pursuant to section 106 of the National Historic Preservation Act (NHPA).

The licensee proposes to revise its Sediment Management Plan for the Log Cabin and Our House Diversion Dams. Among the contemplated activities of the revised plan, it would: increase the amount of sediment removed from behind the diversion dams; revise best management practices; and revise the location for disposal of sediment.

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[1] The licensee's designation request can be accessed by following this link: https://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20190103-5165

Implementation of these activities has the potential to affect historic properties and federally-listed species. The project is located on the Yuba River and Oregon Creek in Yuba, Nevada, and Sierra counties, California.

By this letter, we designate the licensee as our non-federal representative for the purpose of conducting informal consultation with the FWS and NMFS, pursuant to the regulations at 50 C.F.R.§402.08 implementing section 7 of the ESA. The role of the non-federal representative may include conducting studies, developing and supplying information, attending meetings, ensuring that pertinent endangered species information is maintained in a project file, participating in informal consultation with your agency, developing a draft biological assessment if necessary, and keeping the Federal Energy Regulatory Commission (Commission) apprised of its actions. However, the Commission remains ultimately responsible for all findings and determinations regarding the effects of the project on any federally-listed species or critical habitat.

By this letter, we also designate the licensee as our non-federal representative for the purpose of conducting consultation with the California SHPO, appropriate Indian tribes, and other consultation parties pursuant to the regulations at 36 C.F.R. §800.2(c)(4) implementing section 106 of the NHPA. As our non-federal representative, the licensee can perform tasks in support of our compliance with section 106. Such tasks may include, for example: performing cultural resource surveys and studies, determining areas of potential effect, identifying eligible properties, determining any adverse effects to those properties, proposing mitigation to address adverse effects if needed, and developing a draft Memorandum of Agreement in order to memorialize any proposed mitigation. However, the Commission remains ultimately responsible for all findings and determinations made pursuant to section 106.

We appreciate your assistance with section 7 and section 106 consultations regarding the Sediment Management Plan at the Yuba River Project. If you have any questions concerning this matter, please contact me at (415) 369-3335 or by email at john.aedo@ferc.gov.

Sincerely,

John Aedo
Fishery Biologist
Division of Hydropower
Administration and Compliance

cc: Mr. Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

530.741.5000
info@yubawater.org
yubawater.org

July 23, 2019

Via Certified U.S. Mail

To: Distribution List

Subject: Update to the Log Cabin and Our House Diversion Dams Sediment Management Plan Improvements for Yuba County Water Agency's Yuba River Development Project in Yuba, Sierra, and Nevada Counties, California (FERC No. 2246-079).

Dear Tribal Representative,

The Yuba County Water Agency (YCWA), owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) - is continuing consultation with potentially affected Native American tribes regarding proposed improvements to the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan). As the Plan must obtain approval from FERC prior to implementation, it is defined as a federal undertaking and therefore must comply with Section 106 of the National Historic Preservation Act (NHPA) (Section 106) of 1966, as amended, at 36 Code of Federal Regulations (C.F.R.) Part 800. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties (i.e., cultural resources listed in or eligible for listing in the National Register of Historic Places [NRHP]) within the Area of Potential Effects (APE). As the Plan also requires approvals by state agencies, it must also comply with the California Environmental Quality Act (CEQA). CEQA requires state agencies to determine and consider whether a project may have a significant effect on cultural resources that are historical resources, unique archaeological sites, or tribal cultural resources. The purposes of tribal consultation under CEQA at Public Resources Code (PRC) Section 21080.3.1 and Section 106 are to determine whether tribal cultural resources or historic properties are present within the APE, and if so, whether the Plan improvements will significantly impact those resources. If tribal cultural resources or historic properties may be significantly impacted, then consultation will also help to determine the most appropriate way to avoid or mitigate those impacts.

In compliance with PRC 21080.3.1 and Section 106, a letter dated December 12, 2018 was distributed to Native American tribes to provide notice of the opportunity to consult with YCWA regarding the potential for the Plan improvements to impact tribal cultural resources, as defined in PRC Section 21074, or historic properties, as defined in Section 106 regulations (see Attachment 1).

At this time, YCWA is notifying you of the following additional improvements to the Plan:

- **Disposal of Sediment:** In addition to the Celestial Valley spoils piles that will be used for sediment disposal, an area of 80 acres located at Grizzly Gulch in Sierra County is proposed for an additional disposal location. See Attachment 2 for a map of this location.

- **Off-site Mitigation Re-vegetation:** As part of the Plan implementation improvements, all riparian vegetation being removed during Plan implementation with a diameter at breast height over 4 inches must be restored at an off-site mitigation location. An area of 0.89 acres located in Celestial Valley will be used for this effort. Some of this area will need to be cleared to provide access for planting willows and cottonwood. See Attachment 3 for a map of this location.

At this time, YCWA is seeking to consult with California Native American tribes that are traditionally and culturally affiliated with the APE for the proposed Plan improvements, in compliance with PRC Section 21080.3.1. Additionally, to assist with historic property identification efforts in support of Section 106, YCWA is seeking information that may be pertinent to understanding the cultural/tribal resources that should be taken into consideration for the proposed Plan improvements. [1]

In partial fulfillment of Section 106 requirements, as well as in accordance with Section 21080.3.1(d) of the PRC, YCWA is requesting a written response to either request or decline consultation for the Plan improvements. If you have any comments, concerns or information relevant to the APE, please send them to the address below. In accordance with Section 21080.3.1(d) of the PRC you have 30 days from the receipt of this letter to either request or decline consultation in writing. Please send your written response to:

Danielle Risse, Senior Cultural Resources Specialist
HDR Engineering, Inc.
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
Danielle.Risse@hdrinc.com
916-679-8796

Thank you and we look forward to your response.

Sincerely,

Willie Whittlesey for:

Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

[1] In support of these consultation efforts, YCWA has requested the assistance of the Native American Heritage Commission (NAHC), in compliance with PRC 21080.3.1(c) and Section 106, to provide a list of California Native American tribes that are traditionally and culturally affiliated with the APE. The NAHC has provided a list of California Native American tribes in support of these efforts, which is included here in the distribution list.

Attachments: 1) Letter dated December 12, 2018 Providing Notice of Opportunity to Consult

2) Map of Grizzly Gulch Sediment Disposal Site

3) Map of Off-site Mitigation Site

Cc: Distribution List
Carrie Smith, Tahoe National Forest

Attachment 1

Letter Dated December 12, 2018 Providing Notice of Opportunity to Consult

530.741.5000
info@yubawater.org
yubawater.org

YUBA WATER AGENCY

December 12, 2018

Via U.S. Mail

To: Distribution List

Subject: **Notice of Opportunity to Consult for the Log Cabin and Our House Diversion Dams Sediment Management Plan Improvements for Yuba County Water Agency's Yuba River Development Project in Yuba, Sierra, and Nevada Counties, California (FERC No. 2246-079).**

[redacted]

Dear Tribal Representative,

[redacted]

The Yuba County Water Agency (YCWA), owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC) - is notifying and seeking to consult with potentially affected Native American tribes regarding proposed improvements to the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan). In a letter dated November 5, 2013, FERC directed YCWA to develop a Plan for the permanent, long-term solution for sediment control at Log Cabin Diversion Dam, and to file the Plan with FERC for approval. YCWA drafted the Plan to address sedimentation management at both Log Cabin Diversion Dam and at Our House Diversion Dam and filed the plan with FERC on May 5, 2014. FERC approved the mechanical sediment removal and emergency sediment removal portions of the plan on September 23, 2014, and the sediment passage portions of the Plan on March 4, 2016. YCWA implemented the mechanical sediment removal portions of the Plan in October 2014 upon FERC's approval, after obtaining all necessary permits and approvals.

Plan Improvements

Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. These improvements include:

- **Difference in period, length, and flows for sediment passage at both Log Cabin and Our House Dams:** change from November 1 through March 15 to October 1 through March 21; instead of being open for 96 hours, the valves will be left open for nine days and closed over a period of two days; the Our House flow was changed from 600 cubic feet per second (cfs) to 1,500 cfs to trigger passage; valves may also now be opened more than once under the proper conditions. This change was made to improve the sediment passage through the dam. Widening the period would allow for higher chances of the correct triggers, and longer terms would increase the amount of sediment that goes through the valve.

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- **Blockage of outage dredging:** If after October 1, YCWA determines that any one of the Our House Diversion Dam's or the Log Cabin Diversion Dam's fish release valves or low level outlet valves has been partially or fully blocked by sediment, then YCWA may take remedial actions at that valve by the following April 1 or 10 (as described below), consistent with existing permits, to return that valve to proper functioning condition. All of this is new to the Plan, but within the existing footprint of the sediment removal work. No additional ground disturbance will result from this work. The equipment will be staged and used at the area right of the dam, which is where the dredge would be set up (similar to the pumps for the dewatering of the pool at the base of the dam). The air/water nozzles will be positioned from the side of the dam, as well. They do not dewater the area. The suction dredge would pump water over the dam directly as it pulls away material and water from the valves. All equipment would be brought down the existing roads by truck, no larger than flatbeds that ca[redacted]could include:
    - Using air and/or water nozzles to blow sediment out of the valves; and/or
    - [redacted]0 yds^3 of accumulated sediment upstream of the valve. The sediment would be pumped around the dam and discharged directly to the river downstream of the dam. During these activities, YCWA would reduce flows over the spillway to ensure the safety of the divers working in the diversion pool and to maintain minimum flow requirements. Once sediment has been cleared from the outlet, YCWA would open the low level outlet to flush the outlet and distribute the deposited material further downstream. The low level outlet would then be closed gradually over the course of four days, with the goal of avoiding any additional sediment buildup that could clog the outlets. YCWA may close the valve completely at any time during the four days if YCWA anticipates the outlet is at risk of being reclogged.

  All activities related to above suction-dredging (dredging and opening of the low level outlet as described above) shall be completed by April 1, unless high flows preclude safe access, in which case suction dredging may continue until no later than April 10.

- **Increase of amount of sediment removed at one time from impoundments:** from 20,000 to 40,000 cubic yards at Log Cabin and from 40,000 to 100,000 cubic yards at Our House. This change was precipitated in part by the 2017 storms, which swept large amounts of sediment into both impoundments, but also by experience, which demonstrated that more sediment than previously expected can be removed from an impoundment during a single removal event.

- **The Best Management Practices (BMPs)** have been more clearly formalized in the Plan, following the Forest Service handbook BMPs.

- **Disposal of Sediment:** In the original version of the Plan, there was a footnote saying the Celestial Valley spoils pile sites were not planned for use at the time and would be permitted later, if they were to be used. That footnote has been removed, the Celestial Valley spoils piles will be used for disposal sites, and permitting does apply. See Attachment 1 for a map of the spoils piles location.

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Consultation

As the Plan must obtain approval from FERC prior to implementation, it is defined as a federal undertaking and therefore must comply with Section 106 of the National Historic Preservation Act (NHPA) (Section 106) of 1966, as amended, at 36 C.F.R. Part 800. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties (i.e., cultural resources listed in or eligible for listing in the National Register of Historic Places [NRHP]). As the Plan also requires approvals by state agencies, it must also comply with the California Environmental Quality Act (CEQA). CEQA requires state agencies to determine and consider whether a project may have a significant effect on cultural resources that are historical resources, unique archaeological sites, or tribal cultural resources.

In 2014, a cul[redacted]ducted by HDR Engineering, Inc. (HDR), on behalf of YCWA, to identify any cultural resources within the area that could be impacted by implementation of the Plan (i.e., the area of potential effects or APE). YCWA completed formal NRHP and CEQA evaluati[redacted]ffected by Plan implementation activities in consultation with appropriate tribes, federal agencies, and the State Historic Preservation Officer (SHPO). YCWA concluded that the implementation of the Plan would result in no adverse effect to historic properties pursuant to the regulations at 36 C.F.R. Part 800.5(d)(1) for Section 106 compliance and would result in a less-than-significant impact to historical resources under the provisions of CEQA, and there was no objection by the SHPO (letter dated August 20, 2014, OHP Ref #FERC_2013_1002_001).

At this time, YCWA is seeking to consult with California Native American tribes that are traditionally and culturally affiliated with the APE for the proposed Plan improvements, in compliance with CEQA, California Public Resources Code (PRC) Section 21080.3.1. Additionally, to assist with historic property identification efforts in support of Section 106, YCWA is seeking information that may be pertinent to understanding the cultural/tribal resources that should be taken into consideration for the proposed Plan improvements.

In support of these consultation efforts, YCWA has requested the assistance of the Native American Heritage Commission (NAHC), in compliance with PRC 21080.3.1(c) and Section 106, to provide a list of California Native American tribes that are traditionally and culturally affiliated with the APE. The NAHC has provided a list of California Native American tribes in support of these efforts, which is included here as part of the distribution list.

YCWA would like to notify you of the opportunity to consult with YCWA regarding the potential for the Plan improvements to impact tribal cultural resources, as defined in PRC Section 21074, or historic properties, as defined in Section 106 regulations. The purposes of tribal consultation under PRC Section 21080.3.1, as part of the CEQA review process and Section 106, are to determine whether tribal cultural resources or historic properties are present within the APE, and if so, whether the Plan improvements will significantly impact those resources. If tribal cultural resources or historic properties may be significantly impacted, then consultation will also help to determine the most appropriate way to avoid or mitigate those impacts.

530.741.5000
info@yubawater.org
yubawater.org

YUBA WATER AGENCY

In partial fulfillment of Section 106 requirements, as well as in accordance with Section 21080.3.1(d) of the PRC, YCWA is requesting a written response to either request or decline consultation for the Plan improvements. If you have any comments, concerns or information relevant to the APE, please send them to the address below. In accordance with Section 21080.3.1(d) of the PRC you have 30 days from the receipt of this letter to either request or decline consultation in writing. Please send your written response to:

Danielle Risse, Senior Cultural Resources Specialist
HDR Engineering, Inc.
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
[redacted] Danielle.Risse@hdrinc.com
916-679-8796

If we do not re[redacted]in our files and we will continue to move forward with the Plan improvements.

Thank you and we look forward to your response.

Sincerely,

Mike Klin
for

Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

Attachment (1): Map of Spoils Pile Area

Cc: Distribution List
Carrie Smith, Tahoe National Forest

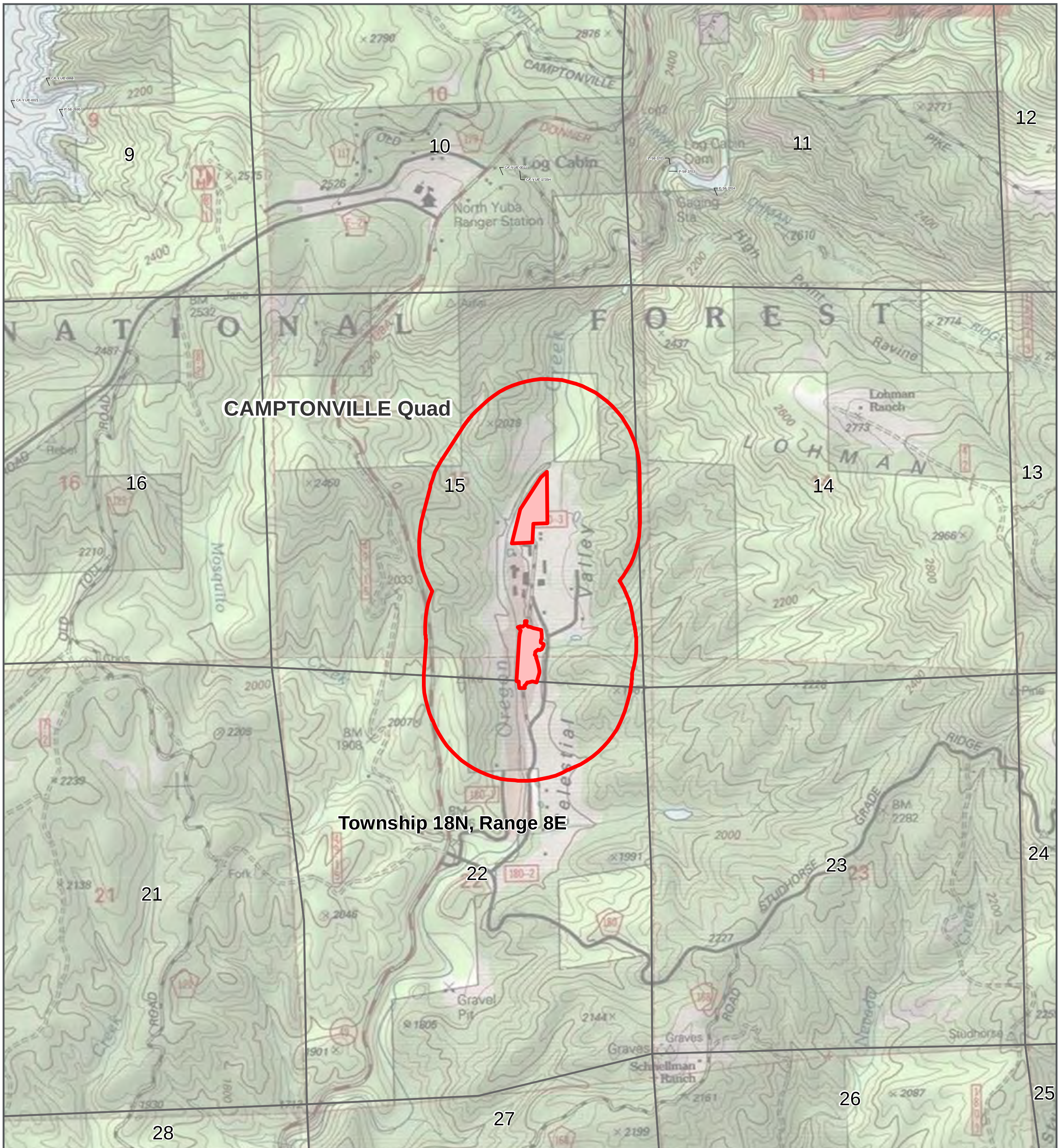
<u>References Cited</u>

Ramsey Ford, Dawn. 2014. *Cultural Resources Investigation for the Log Cabin and Our House Diversion Dams Sediment Management Plan for the Yuba River Development Project (FERC Project No. 2246), Nevada, Yuba, and Sierra Counties, California*. Prepared for YCWA. Prepared by HDR, Inc., Sacramento, CA.

Attachment 1:

MAP OF CELESTIAL VALLEY
SPOILS PILE AREA

Yuba River Development Project, FERC Project No. 2246



LEGEND

Project Area

Buffer (1/4 mile)

0 1,000 2,000 3,000 Feet

0 250 500 750 1,000 Meters

TN MN

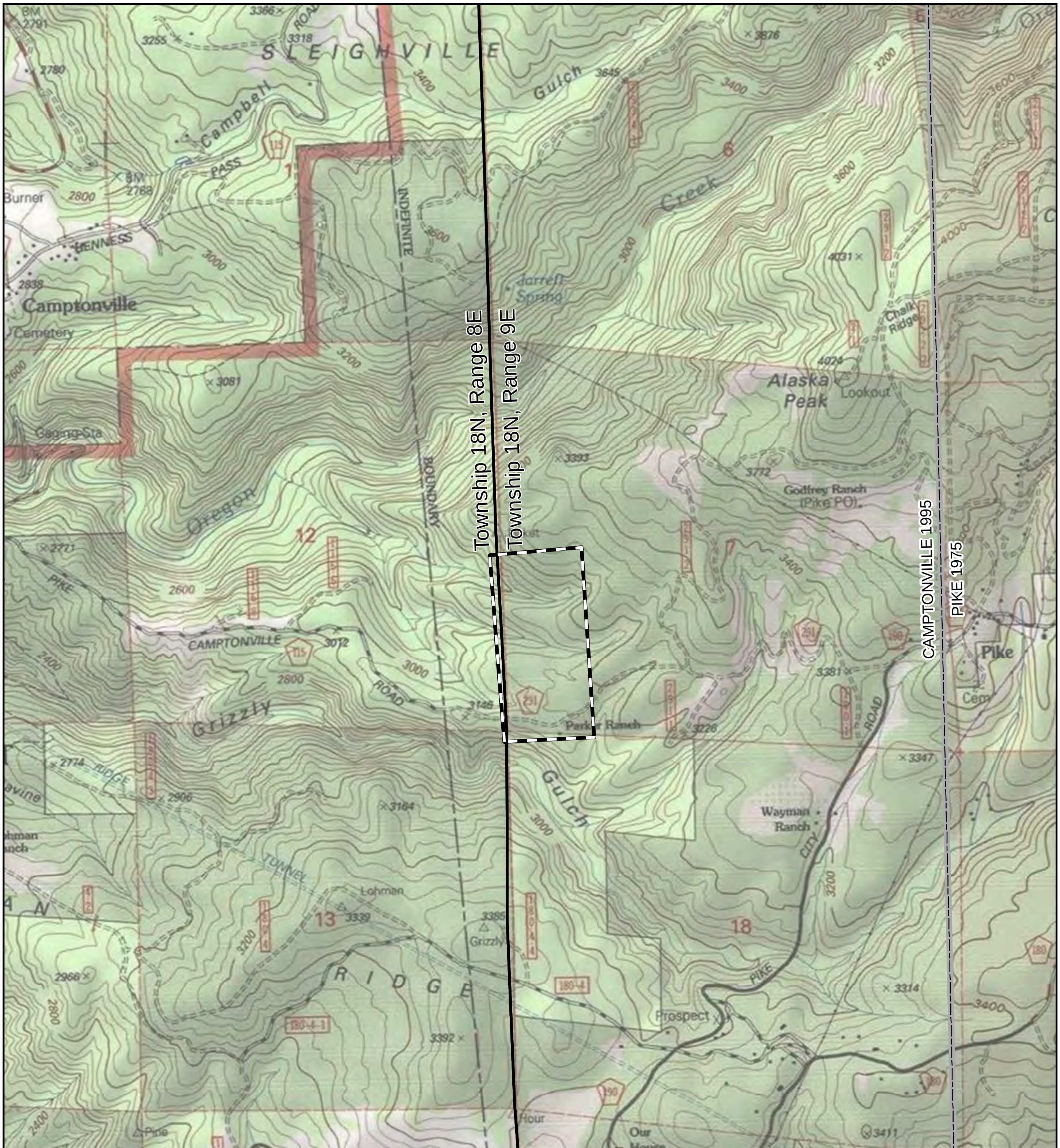
Magnetic declination:
+14°0.2' E, changing
-0°7.1'/year (2014)

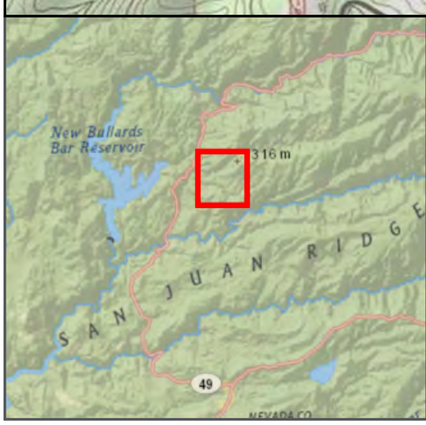
Service Layer Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., Copyright:© 2013 National Geographic Society, i-cubed
Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.
Projection is NAD 1983 UTM Zone 10 North

PATH: G:\PROJECTS\YCWA\OC_MYR_SEDMONITORING\7.2_WORKING\MAP_DOCS\CULTURAL\ATTACHMENT_CELESTIAL_VALLEY_IC_MAP.MXD - USER: KKEIGHTL - DATE: 7/18/2018

Attachment 2

Map of Grizzly Gulch Sediment Disposal Site





Area of Potential Effects

Township & Range

USGS Quad Boundary

GRIZZLY GULCH DISPOSAL SITE

Log Cabin and Our House Diversion Dams Sediment Management Plan

0 1,200 2,400 3,600 Feet

0 300 600 900 1,200 Meters

TN MN

Magnetic declination: +14°0.2' E, changing -0°7.1'/year (2019)

Service Layer Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., Copyright:© 2013 National Geographic Society, i-cubed
Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.
Projection is NAD 1983 UTM Zone 10 North

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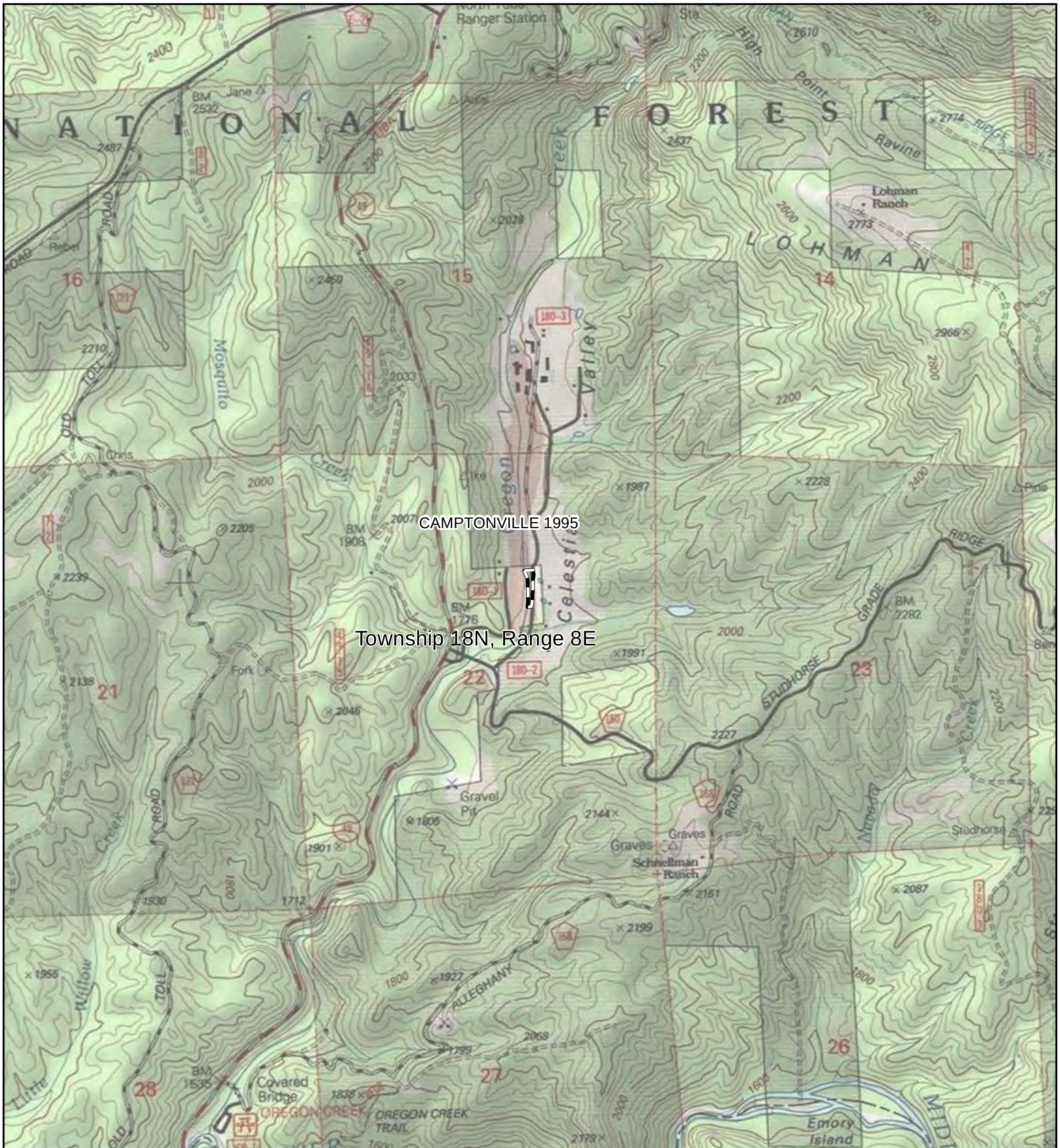
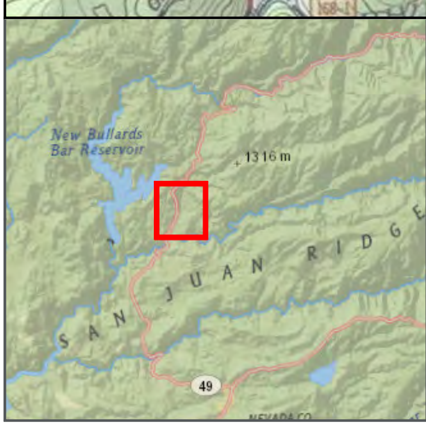
Attachment 3

Map of Off-site Mitigation Site





Area of Potential Effects

Township & Range

USGS Quad Boundary

OFF-SITE MITIGATION LOCATION

OUR HOUSE DIVERSION DAM
SEDIMENT MANAGEMENT PLAN
YUBA WATER AGENCY

0 1,200 2,400 3,600 Feet

0 300 600 900 1,200 Meters

TN MN

Magnetic declination:
+14°0.2' E, changing
-0°7.1'/year (2019)

Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.
Projection is NAD 1983 UTM Zone 10 North

PATH: G:\PROJECTS\YCWA\274_0001_YCWA_FERC\MAP_DOCS\PMANDE\CULTURAL\ATTACHMENT_OFF-SITE_MITIGATION_APE.MXD - USER: KKEIGHTL - DATE: 7/22/2019

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info@yubawater.org
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RECEIVED
JUL 23 2019
OHP

YUBA WATER AGENCY

July 23, 2019

OHP Reference: FERC_2013_1002_001

Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Re: Log Cabin and Our House Diversion Dams Sediment Management Plan on Yuba County Water Agency's Yuba River Development Project in Yuba, Sierra, and Nevada Counties, California (FERC No. 2246-079). Section 106 consultation for Plan Modifications.

Dear Ms. Polanco,

The Yuba County Water Agency (YCWA) is continuing consultation with the State Historic Preservation Officer (SHPO) under the authority of the Federal Energy Regulatory Commission (FERC), regarding the undertaking referenced above, per 36 Code of Federal Regulations (C.F.R.) Part 800. In accordance with §800.2(c)(4), FERC has designated YCWA as its non-federal representative for consultation in accordance with regulations for Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, during implementation of the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan). In a letter dated November 4, 2013, the SHPO did not object to the area of potential effect (APE) for the Plan. Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. At this time, YCWA requests SHPO's concurrence on the following revisions to the APE to address proposed Plan improvements. In particular, the APE is being expanded to include new spoils locations and an area to be used for re-vegetation as part of an off-site mitigation for vegetation disturbance during sediment management activities.

In a letter dated November 5, 2013, FERC directed YCWA to develop a plan for the permanent, long-term solution to sediment control at Log Cabin Diversion Dam, and to file the plan with FERC for approval. YCWA drafted the Plan to address sedimentation management at both Log Cabin Diversion Dam and at Our House Diversion Dam and filed the plan with FERC on May 5, 2014. FERC approved the mechanical sediment removal and emergency sediment removal portions of the Plan on September 23, 2014, and the sediment passage portions of the Plan on March 4, 2016. YCWA implemented the mechanical sediment removal portions of the Plan in October 2014 upon FERC's approval, after obtaining all necessary permits and approvals. Since its implementation, YCWA and agencies have noted improvements that could be made to the Plan based on lessons learned during Plan implementation. These improvements include:

- **Difference in period, length, and flows for sediment passage at both Log Cabin and Our House Dams:** change from November 1 through March 15 to October 1 through March 21; instead of being open for 96 hours, the valves will be left open for nine days and closed over a period of two days; the Our House flow was changed from 600 cubic feet per second (cfs) to 1,500 cfs to trigger passage; valves may also now be opened more than once under the proper conditions. This change was made to improve the sediment passage through the dam. Widening the period would allow for higher chances of the correct triggers, and longer terms would increase the amount of sediment that goes through the valve.

- **Blockage of outage dredging:** If after October 1, YCWA determines that any one of the Our House Diversion Dam's or the Log Cabin Diversion Dam's fish release valves or low level outlet valves has been partially or fully blocked by sediment, then YCWA may take remedial actions at that valve by the following April 1 or 10 (as described below), consistent with existing permits, to return that valve to proper functioning condition. All of this is new to the Plan, but within the existing footprint of the sediment removal work. No additional ground disturbance will result from this work. The equipment will be staged and used at the area right of the dam, which is where the dredge would be set up (similar to the pumps for the dewatering of the pool at the base of the dam). The air/water nozzles will be positioned from the side of the dam, as well. They do not dewater the area. The suction dredge would pump water over the dam directly as it pulls away material and water from the valves. All equipment would be brought down the existing roads by truck, no larger than flatbeds that carry the pumps down for sediment removal work. This work could include:

  - Using air and/or water nozzles to blow sediment out of the valves; and/or

  - Employing a suction dredge to remove, at each dam, up to 250 yds^3 of accumulated sediment upstream of the valve. The sediment would be pumped around the dam and discharged directly to the river downstream of the dam. During these activities, YCWA would reduce flows over the spillway to ensure the safety of the divers working in the diversion pool and to maintain minimum flow requirements. Once sediment has been cleared from the outlet, YCWA would open the low level outlet to flush the outlet and distribute the deposited material further downstream. The low level outlet would then be closed gradually over the course of four days, with the goal of avoiding any additional sediment buildup that could clog the outlets. YCWA may close the valve completely at any time during the four days if YCWA anticipates the outlet is at risk of being reclogged.

  All activities related to above suction-dredging (dredging and opening of the low level outlet as described above) shall be completed by April 1, unless high flows preclude safe access, in which case suction dredging may continue until no later than April 10.

- **Increase of amount of sediment removed at one time from impoundments:** from 20,000 to 40,000 cubic yards at Log Cabin and from 40,000 to 100,000 cubic yards at Our House. This change was precipitated in part by the 2017 storms, which swept large amounts of sediment into both impoundments, but also by experience, which demonstrated that more sediment than previously expected can be removed from an impoundment during a single removal event.

- **The Best Management Practices (BMPs)** have been more clearly formalized in the Plan, following the Forest Service handbook BMPs.

- **Disposal of Sediment:** In the original version of the Plan, there was a footnote saying the Celestial Valley spoils pile sites were not planned for use at the time and would be permitted later, if they were to be used. That footnote has been removed. The Celestial Valley spoils piles will be used for disposal sites and potential revegetation, and permitting does apply. Additionally, YCWA is proposing to use an 80-acre area in Grizzly Gulch, Sierra County, for sediment disposal. See Attachment 1 for the spoils piles location additions to the APE.

- **Off-site Mitigation Re-vegetation:** As part of the Plan implementation improvements, all riparian vegetation being removed during Plan implementation with a diameter at breast height over 4 inches must be restored at an off-site mitigation location. An area of 0.89 acres located in Celestial Valley will be used for this effort. Some of this area will need to be cleared to provide access for planting willows and cottonwood. See Attachment 1 for the off-site mitigation location addition to the APE.

<u>Area of Potential Effects</u>

The revised APE includes: one additional site to be used for off-site mitigation re-vegetation comprised of 0.89 acres of lands located on both Tahoe National Forest (TNF) and privately owned lands along Oregon Creek in Celestial Valley; two spoil disposal sites on privately owned lands along Oregon Creek totaling an additional 12 acres; and approximately 80 acres on privately owned lands in Grizzly Gulch to be used for sediment disposal (see Attachment 1). The revised APE totals approximately 171 acres and includes all lands previously identified for the footprint of potential disturbance areas associated with the planned mechanical sediment removal and covers a total of seven discontiguous areas that incorporate the Log Cabin and Our House diversion dams and their existing impoundments, access roads, staging areas, potential catchment areas, laydown areas, sediment disposal sites, and the off-site mitigation site. The APE falls within portions of Sierra, Nevada, and Yuba counties, and is to the south and east of New Bullards Bar Reservoir. The APE is predominantly mountainous with ponderosa pine mixed coniferous forest. The APE is depicted on the Challenge, CA (1995), the Camptonville, CA (1995), and the Pike, CA (1975) Unites States Geological Survey (USGS) 7.5-minute quadrangle maps and has the following legal description: Section 25 of Township 18 North, Range 7 East; Sections 10, 11, 12, 13, 15, 22, and 30 of Township 18 North, Range 8 East; Sections 7, 18, 19 and 20 of Township 18 North, Range 9 East.

At this time, YCWA requests your concurrence on the following:

- In accordance with §800.4(a)(1), YCWA requests your concurrence on the appropriateness of the revised APE for the undertaking.

Pursuant to §800.4, we look forward to your response within 30 days of your receipt of this submittal.

Please do not hesitate to contact me should you have any questions or comments regarding this request. For cultural resources-related questions, please contact Ms. Danielle Risse, Senior Cultural Resources Specialist at HDR, Inc., at 916-679-8796 or Danielle.Risse@hdrinc.com.

Respectfully submitted,

Willie Whittlesey for:

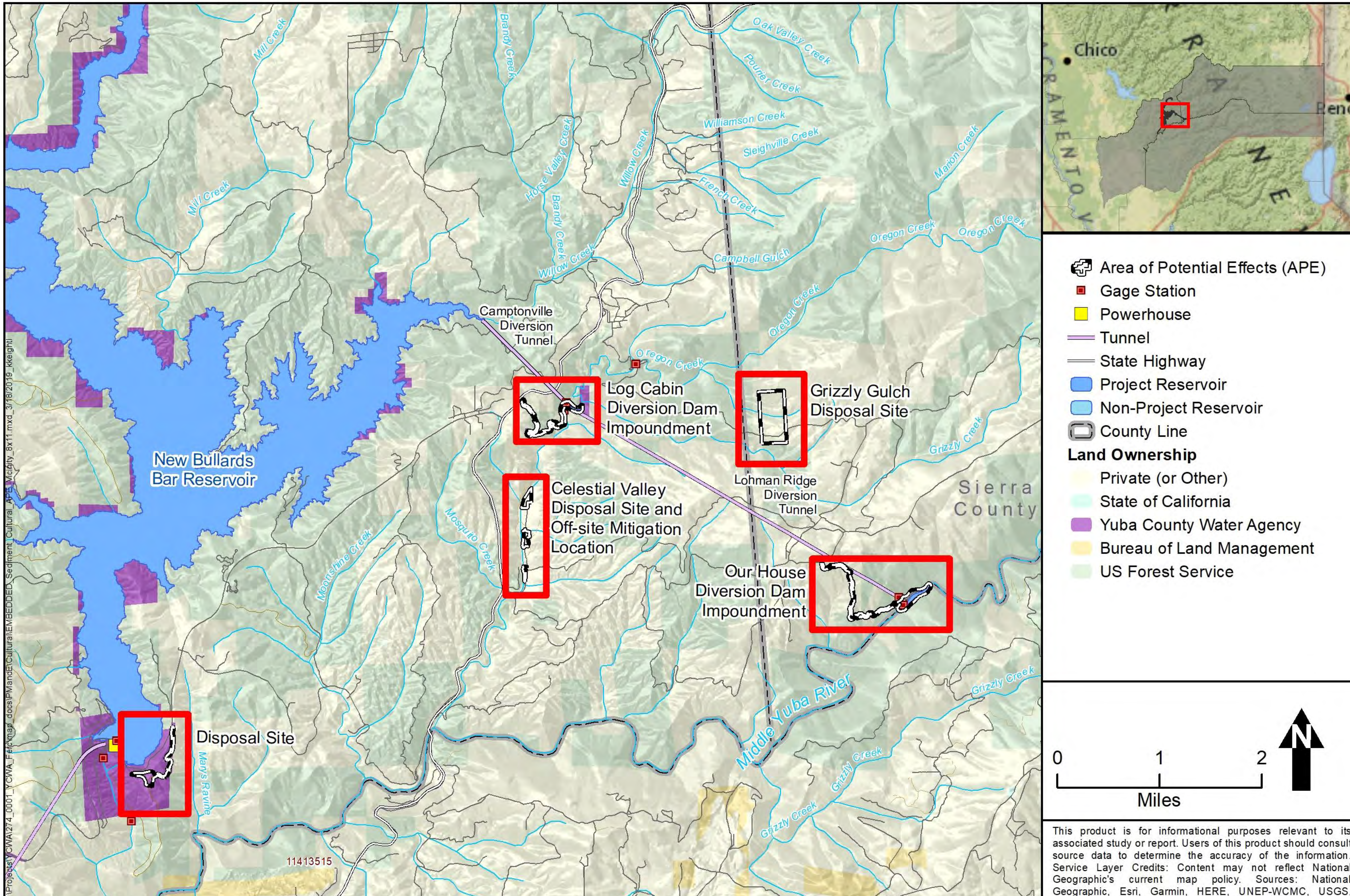
Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

Attachment: 1) Maps of Area of Potential Effects

cc: Distribution List

Attachment 1

Maps of Area of Potential Effects



Chico
Reno
New Bullards Bar Reservoir
Camptonville Diversion Tunnel
Log Cabin Diversion Dam Impoundment
Grizzly Gulch Disposal Site
Lohman Ridge Diversion Tunnel
Celestial Valley Disposal Site and Off-site Mitigation Location
Our House Diversion Dam Impoundment
Disposal Site
Sierra County
Middle Yuba River
Mill Creek
Brandy Creek
Oak Valley Creek
Pauley Creek
Williamson Creek
Sleighville Creek
Horse Valley Creek
Willow Creek
French Creek
Marion Creek
Oregon Creek
Campbell Gulch
Grizzly Creek
Mosquito Creek
Moonshine Creek
Mays Ravine
11413515
Area of Potential Effects (APE)
Gage Station
Powerhouse
Tunnel
State Highway
Project Reservoir
Non-Project Reservoir
County Line
Land Ownership
Private (or Other)
State of California
Yuba County Water Agency
Bureau of Land Management
US Forest Service
0
1
2
Miles
N
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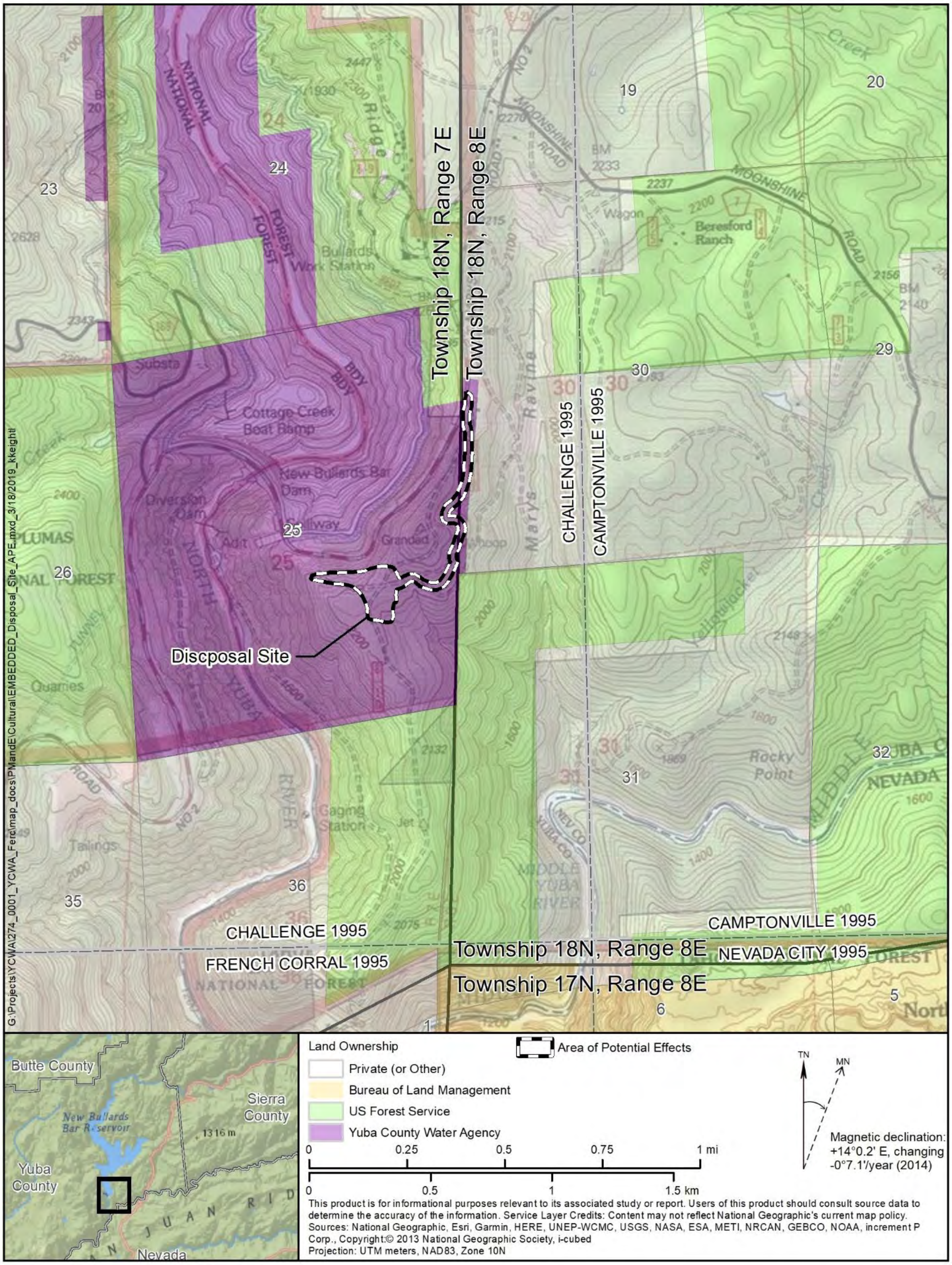
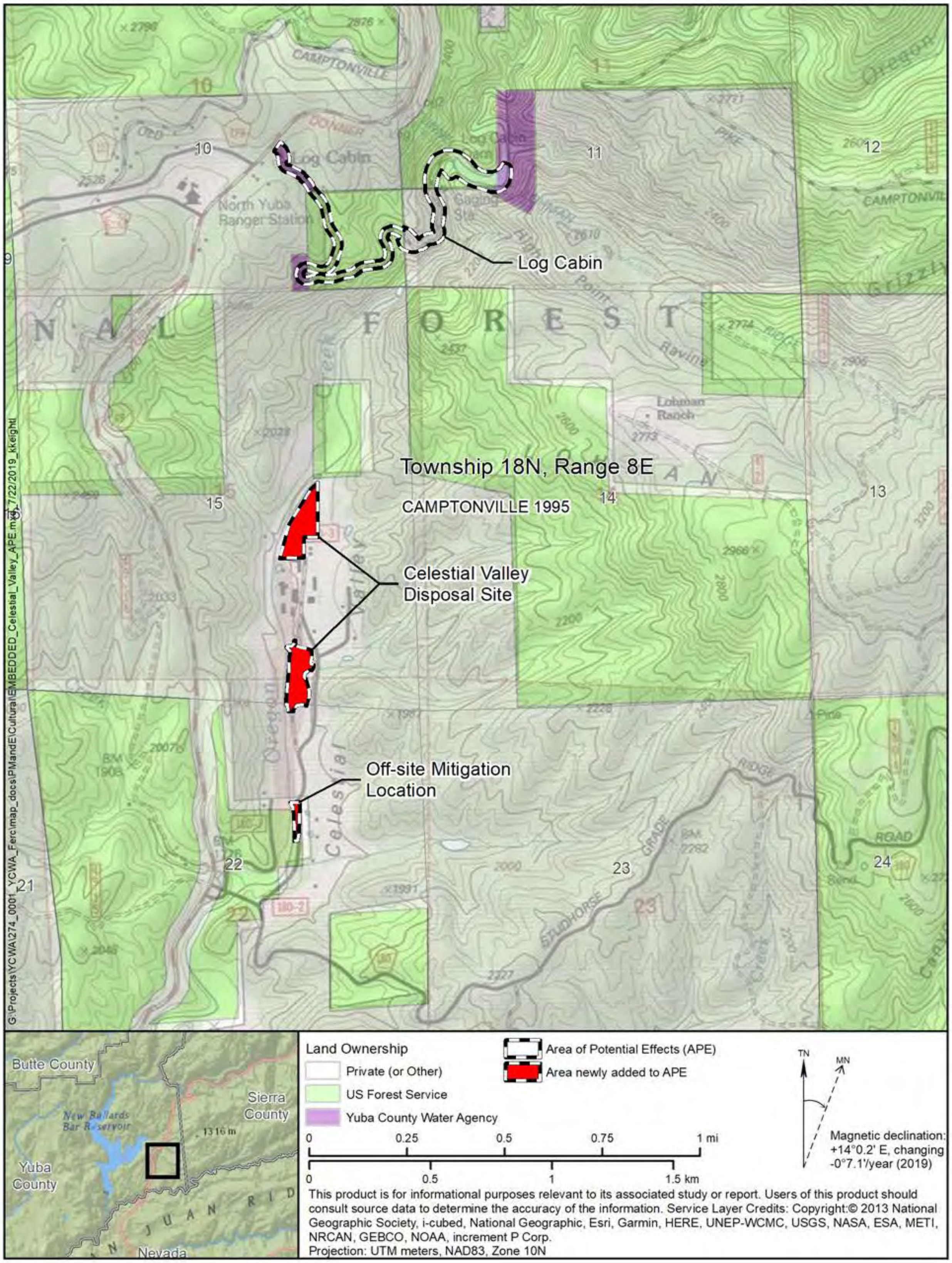
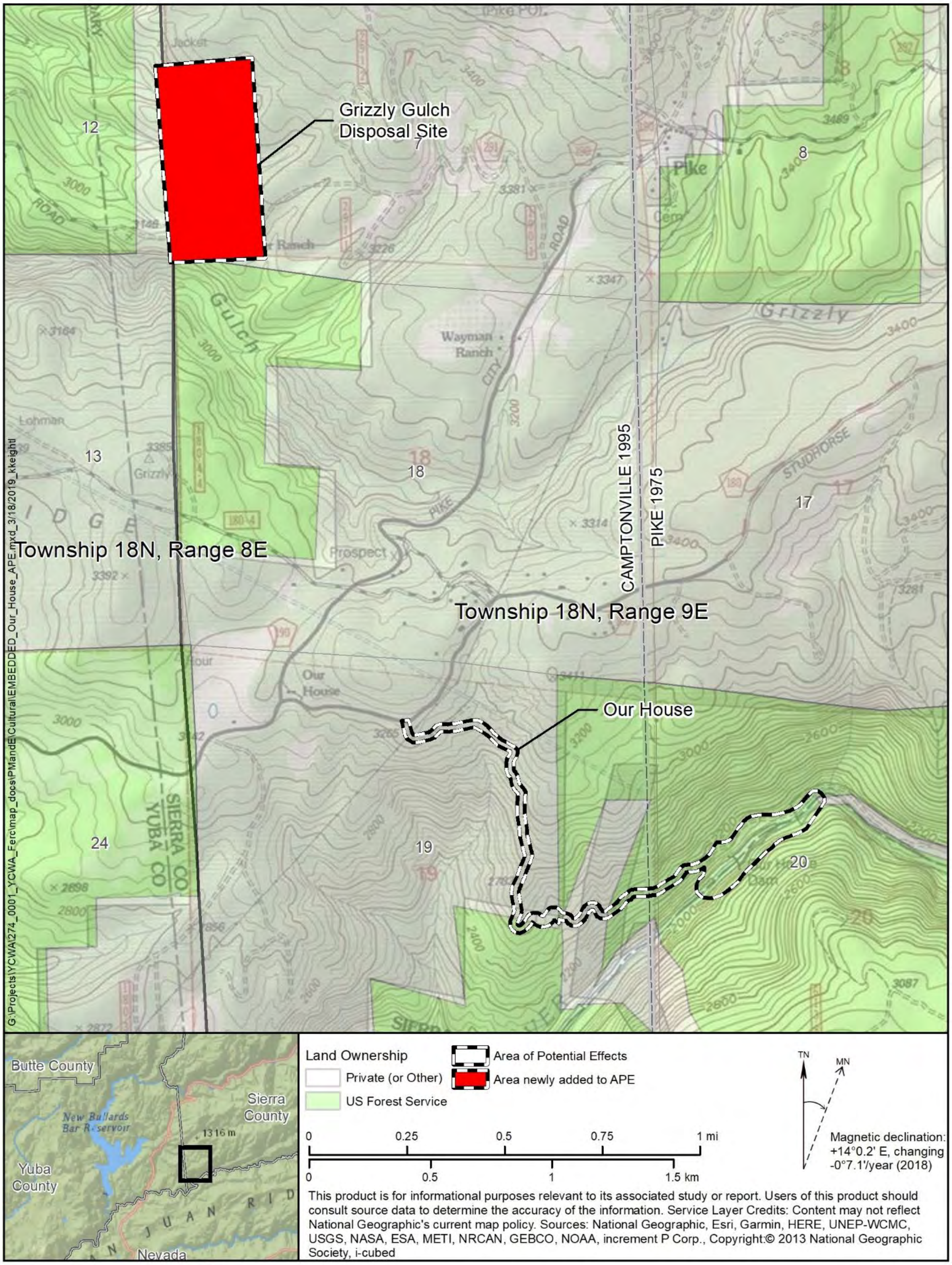

Township 18N, Range 7E
Township 18N, Range 8E
Township 18N, Range 8E
Township 17N, Range 8E
CHALLENGE 1995
CAMPTONVILLE 1995
CHALLENGE 1995
FRENCH CORRAL 1995
CAMPTONVILLE 1995
NEVADA CITY 1995
Discposal Site
19
20
23
24
25
26
29
30
31
32
35
36
6
5
New Bullards Bar Dam
Cottage Creek Boat Ramp
Diversion Dam
Bullards Work Station
Beresford Ranch
MOONSHINE ROAD
NORTH YUBA
MIDDLE YUBA RIVER
Rocky Point
Gaging Station
Tailings
Quarries
PLUMAS NATIONAL FOREST
Land Ownership
Area of Potential Effects
Private (or Other)
Bureau of Land Management
US Forest Service
Yuba County Water Agency
0
0.25
0.5
0.75
1 mi
0
0.5
1
1.5 km
TN
MN
Magnetic declination:
+14°0.2' E, changing
-0°7.1'/year (2014)
Butte County
Sierra County
Yuba County
New Bullards Bar Reservoir
Nevada
This product is for informational purposes relevant to its associated study or report. Users of this product should consult source data to determine the accuracy of the information. Service Layer Credits: Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., Copyright:© 2013 National Geographic Society, i-cubed
Projection: UTM meters, NAD83, Zone 10N
G:\Projects\YCWA\274_0001_YCWA_Ferc\map_docs\PMandE\Cultural\EMBEDDED_Disposal_Site_APE.mxd_3/18/2019_kkeight


Log Cabin
Township 18N, Range 8E
CAMPTONVILLE 1995
Celestial Valley Disposal Site
Off-site Mitigation Location
Land Ownership
Private (or Other)
US Forest Service
Yuba County Water Agency
Area of Potential Effects (APE)
Area newly added to APE
TN
MN
Magnetic declination: +14°0.2' E, changing -0°7.1'/year (2019)
0 0.25 0.5 0.75 1 mi
0 0.5 1 1.5 km
Butte County
Sierra County
Yuba County
Nevada
New Bullards Bar Reservoir
This product is for informational purposes relevant to its associated study or report. Users of this product should consult source data to determine the accuracy of the information. Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed, National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.
Projection: UTM meters, NAD83, Zone 10N
G:\Projects\YCWA\274_0001_YCWA_Ferc\map_docs\PMandE\Cultural\EMBEDDED_Celestial_Valley_APE.mxd, 7/22/2019, kknight


Grizzly Gulch Disposal Site
Our House
Township 18N, Range 8E
Township 18N, Range 9E
CAMPTONVILLE 1995
PIKE 1975
12
7
8
13
18
17
24
19
20
Pike
Grizzly
Gulch
Wayman Ranch
Prospect
STUDHORSE
SIERRA CO
YUBA CO
G:\Projects\YCWA\274_0001_YCWA_Ferc\map_docs\PMandE\Cultural\EMBEDDED_Our_House_APE.mxd_3/18/2019_kkeightl
Butte County
Sierra County
New Bullards Bar Reservoir
Yuba County
Nevada
1316 m
Land Ownership
Private (or Other)
US Forest Service
Area of Potential Effects
Area newly added to APE
0
0.25
0.5
0.75
1 mi
0
0.5
1
1.5 km
TN
MN
Magnetic declination: +14°0.2' E, changing -0°7.1'/year (2018)
This product is for informational purposes relevant to its associated study or report. Users of this product should consult source data to determine the accuracy of the information. Service Layer Credits: Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., Copyright:© 2013 National Geographic Society, i-cubed

State of California • Natural Resources Agency
Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION
Lisa Ann L. Mangat, *Director*

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

August 26, 2019

Reply in Reference To: FERC_2013_1002_001

Mr. Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

RE: Yuba River Development Project (FERC Project No. 2246-079) Sediment Management Plan

Dear Mr. Aikens,

The State Historic Preservation Officer (SHPO) received your consultation letter seeking comments on a revision to the Area of Potential Effects (APE) for the *Log Cabin and Our House Diversion Dams Sediment Management Plan*, which is part of the Yuba River Development Project in Yuba, Sierra, and Nevada Counties. The Yuba County Water Agency (YCWA), under the authority of the Federal Energy Regulatory Commission (FERC), proposes to expand the APE to include a 0.89-acre area to be used for off-site re-vegetation; two spoil disposal sites totaling 12-acres; and approximately 80-acres to be used for sediment disposal. The expanded APE would total approximately 171-acres and will include all areas associated with planned mechanical sediment removal. YCWA attached a map depicting the expanded APE with its submittal.

Following staff review of the submittal, pursuant to 36 CFR § 800.4(a)(1), the SHPO does not object to the proposed APE revision. If you have any questions or concerns, please contact Brendon Greenaway at (916) 445-7036 or Brendon.Greenaway@parks.ca.gov.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

530.741.5000
info@yubawater.org
yubawater.org

YUBA WATER AGENCY

November 1, 2019

Via Certified U.S. Mail

To: Distribution List and Tahoe National Forest

Subject: Cultural Resources Investigation for the Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan for Yuba County Water Agency's Yuba River Development Project in Yuba, Sierra, and Nevada Counties, California (FERC No. 2246-079). [PRIVILEGED INFORMATION ENCLOSED]

Dear Tribal/Agency Representative,

The Yuba County Water Agency (YCWA), owner and operator of the Yuba River Development Project (YRDP) - a hydroelectric system licensed by the Federal Energy Regulatory Commission (FERC), is continuing consultation with potentially affected Native American tribes and the Tahoe National Forest (TNF) regarding modifications to the *Log Cabin and Our House Diversion Dams Sediment Management Plan* (Plan) and is providing the following report on compact disc for your review and comment:

- *Cultural Resources Investigation for the Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan for the Yuba River Development Project (FERC Project No. 2246); Nevada, Yuba, And Sierra Counties, California.* **[PRIVILEGED INFORMATION ENCLOSED]**

The enclosed report documents the results of a cultural resources inventory conducted by HDR Engineering, Inc. (HDR), for YCWA, to identify any historic properties, historical resources, unique archaeological resources, or tribal cultural resources (TCRs) within the newly added areas of the Area of Potential Effects (APE) in partial fulfillment of requirements found in Section 106 of the National Historic Preservation Act (NHPA) (Section 106) of 1966, as amended, at 36 Code of Federal Regulations (C.F.R.) Part 800, and the California Environmental Quality Act (CEQA), of 1970, as amended.[1] A cultural resources investigation was conducted by HDR for YCWA in 2014 to identify any cultural resources within the APE for Plan implementation. Both the Plan and the APE have since been updated, and thus identification efforts for historic properties, historical resources, unique archaeological resources, and TCRs were updated and documented in the enclosed report.

[1] As the Plan must obtain approval from FERC prior to implementation, it is defined as a federal undertaking and therefore must comply with Section 106. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties (i.e., cultural resources listed in or eligible for listing in the National Register of Historic Places [NRHP]) within the APE. As the Plan also requires approvals by state agencies, it must also comply with the CEQA. CEQA requires state agencies to identify the significant environmental impacts of their projects, including impacts to historical resources, unique archaeological sites, and TCRs listed or determined to be eligible by the State Historical Resources Commission for listing, in the California Register of Historical Resources (CRHR) (Public Resources Code [PRC] SS5024.1, Title 14 CCR, Section 4850 et seq.) or local registers of historical resources (PRC 5020.1[k]), or which are any object, building, structure, site, area, place, record, or manuscript determined by a lead agency to be historically significant or significant within any part of California history.

The present investigation identified six cultural resources within the newly added areas of the APE: four historic archaeological sites, one resource with both archaeological and built environment components, and one modern isolated find (HDR-CV-ISO-1). All six of these cultural resources have been evaluated as ineligible for inclusion on the NRHP and the CRHR. Additionally, none of these resources appear to be unique archaeological resources or TCRs. As no historic properties, historical resources, unique archaeological resources, or TCRs have been identified within the newly added areas of the APE, the Project will not adversely affect (Section 106) or significantly impact (CEQA) any of these resources types. Consequently, no further cultural resources management consideration prior to the implementation of the updated Plan is recommended.

At this time, YCWA is consulting with California Native American tribes that are traditionally and culturally affiliated with the APE and the TNF, in partial compliance with Section 106 and CEQA, to provide you the enclosed report for a 30-day review period. Following this review period and consideration of any comments received, this report will be provided to the State Historic Preservation Officer for review and concurrence. In partial fulfillment of Section 106 requirements, as well as in accordance with Section 21080.3.1(d) of the Public Resources Code, YCWA is requesting any comments or concerns on the enclosed report, and/or information relevant to the updated Plan be received within 30 days from the date of this letter. Written comments may be provided to:

Danielle Risse, Senior Cultural Resources Specialist
HDR Engineering, Inc.
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
Danielle.Risse@hdrinc.com
916-679-8796

Thank you and we look forward to your response.

Sincerely,

for Geoffrey L. Rabone

Curt Aikens
General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-6278

Enclosure (on disc): 1) *Cultural Resources Investigation for the Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan for the Yuba River Development Project (FERC Project No. 2246); Nevada, Yuba, And Sierra Counties, California* **[PRIVILEGED INFORMATION ENCLOSED]**

Cc: Distribution List
Carrie Smith (Tahoe National Forest)

MIWOK United Auburn Indian Community
MAIDU of the Auburn Rancheria

Gene Whitehouse, Chairman | John L. Williams, Vice Chairman | Calvin Moman, Secretary | Jason Camp, Treasurer | Gabe Cayton, Council Member

December 10, 2019

Curt Aikens
Yuba County Water Agency
1220 F Street
Marysville, CA 95901

Subject: Cultural Resources Investigation for the Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan for the Yuba River Development Project (FERC No. 224)

Dear Curt Aikens,

Thank you for requesting consultation regarding the above referenced project. The United Auburn Indian Community (UAIC) of the Auburn Rancheria is comprised of Miwok and Southern Maidu (Nisenan) people whose tribal lands are within Placer County and whose areas of interest based on past lifeways extend into El Dorado, Nevada, Placer, Sacramento, Sutter, and Yuba counties. The UAIC is concerned about development within its traditional territory that has potential to impact the lifeways, cultural sites, and landscapes that may be of historic, ceremonial, or tribal significance. We appreciate the opportunity to comment on this and other projects in UAIC's geographic area of cultural affiliation.

Based on the information provided by your agency, our records indicate that this project is not likely to affect resources that may be of importance to the UAIC. Please continue to send us information on the proposed project's environmental documents so that we have the opportunity to comment on potential impacts related to cultural resources. The information gathered will provide us with a better understanding of the resources on site and is invaluable for consultation purposes. Finally, please contact us if you find any Native American cultural resources in the project area. Any Native American cultural resources requiring evaluation must include Tribal values provided by Native American tribes that are geographically and culturally affiliated with the area in evaluating the significance of these resources.

Thank you again for taking these matters into consideration, and for involving the UAIC in the planning process. Please contact Anna M. Starkey, Cultural Regulatory Specialist, at (916) 251-1565 or email at astarkey@auburnrancheria.com if you have any questions.

Sincerely,

Gene Whitehouse,
Chairman

CC: Matthew Moore, Tribal Historic Preservation Officer
Danielle Risse, HDR Engineers, Inc.

Cultural Resources Investigation for the

Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan

for the
Yuba River Development Project
(FERC Project No. 2246)
Nevada, Yuba, and Sierra Counties, California

[redacted]

Appendix D

Comments and Response to Comments Table

Table D-1: Comments and responses to comments on the Cultural Resources Investigation.

Tribe/ Agency[1]	Comment No.	Page/ Section No.	Comment[2]	YCWA Response
TNF	1.	General	Add if sites are located on private property or Forest Service (FS) lands. If a site is on TNF Forest Service lands, TNF will need to assign a FS site number.	YCWA has updated the report to include land owner status. After communications with TNF via email on November 7, 2019, it was made clear that none of the sites require FS site number assignments as TNF does not assign numbers to county roads or sites on privately owned lands.
TNF	2.	General	List how much of the APE is on privately owned land and how much is on Forest Service land, with total acres listed as well.	YCWA has updated the report to include this information.
TNF	3.	Appendix E	Land ownership needs to be shown in the map legend.	YCWA has updated the map legend to include this information.
TNF	4.	-	TNF will need GIS [Geographic Information System] shapefile for the APE as well as which acres were/were not surveyed.	YCWA has provided GIS shapefiles to TNF with this information.
NEIC	5.	General	Because HDR-CV-ISO-1 fell within the boundaries of HDR-CV-04, we processed it as an update of that site record as our policy is not to have two resources occupy the same space.	In regards to HDR-CV-ISO-01 and HDR-CV-04, since they will be given the same primary number, HDR-CV-ISO-01 will be combined into HDR-CV-04, and HDR-CV-ISO-01 will be discarded. This change is reflected in the updated record for HDR-CV-04 and the report.

[1] NEIC: Northeastern information Center; TNF: Tahoe National Forest
[2] Comments provided by TNF and NEIC were provided via email and are documented in the consultation log included in Appendix C.

Cultural Resources Investigation for the

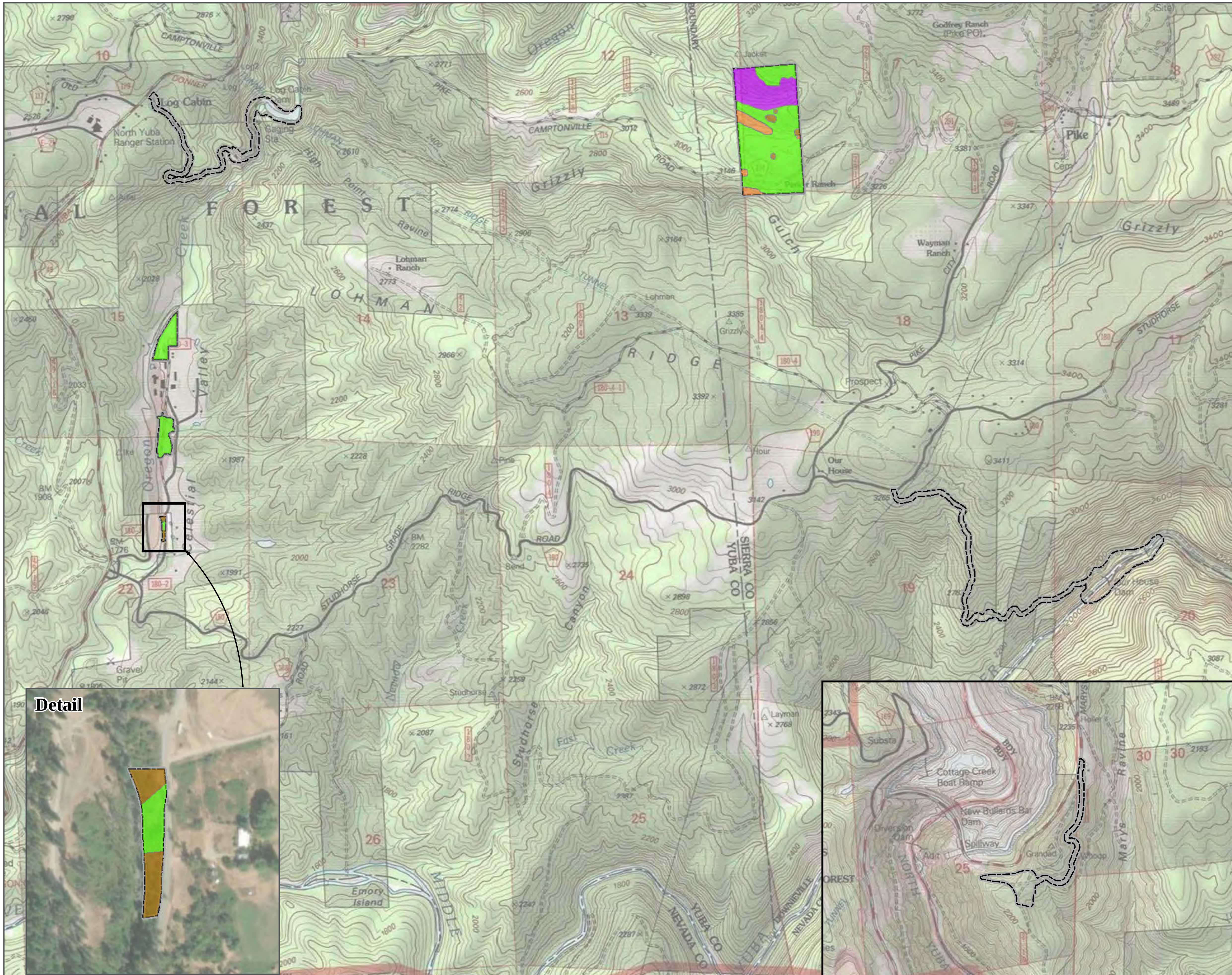
Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan

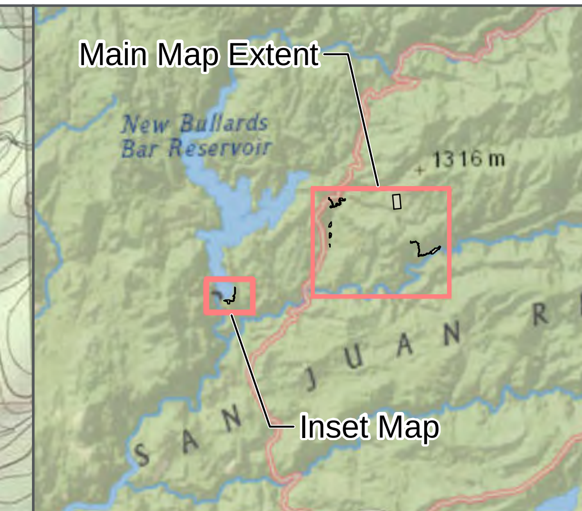
for the
Yuba River Development Project
(FERC Project No. 2246)
Nevada, Yuba, and Sierra Counties, California

[redacted]

Appendix E

Survey Coverage Maps





LEGEND

APE

Survey coverage for new areas

- Not Surveyed - too steep
- Not Surveyed - too steep/vegetated
- Not Surveyed - too vegetated
- Surveyed

SURVEY STATUS

SEDIMENT DISPOSAL
YUBA WATER AGENCY

0 1,000 2,000 3,000 Feet
0 300 600 900 Meters

TN MN

Magnetic declination: +14°0.2' E, changing -0°7.1'/year (2019)

PATH: \\SAC-SRV01\GIS\PROJECTS\YCWA\274_0001_YCWA_FERC\MAP_DOCS\PMANDE\CULTURAL\ATTACHMENT_SEDIMENT_DISPOSAL_SITE_CV_SURVEY_STATUS_24K.MXD - USER: BSCHRETZMA - DATE: 10/17/2019

Cultural Resources Investigation for the

Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan

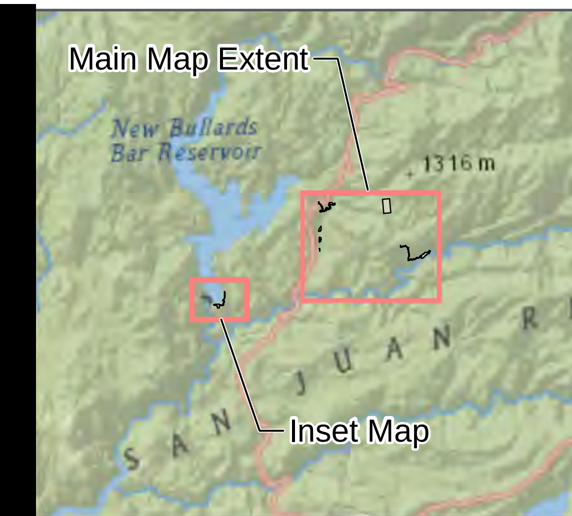
for the
Yuba River Development Project
(FERC Project No. 2246)
Nevada, Yuba, and Sierra Counties, California

[redacted]

Appendix F

Resource Location Maps

[redacted]



LEGEND

APE

Resource in new area

Projection is NAD 1983 UTM Zone 10 North

CULTURAL RESOURCES

SEDIMENT DISPOSAL
YUBA WATER AGENCY

0 1,000 2,000 3,000 Feet

0 300 600 900 Meters

TN MN

Magnetic declination:
+14°0.2' E, changing
-0°7.1'/year (2019)

Cultural Resources Investigation for the

Modification to the Log Cabin and Our House Diversion Dams Sediment Management Plan

for the
Yuba River Development Project
(FERC Project No. 2246)
Nevada, Yuba, and Sierra Counties, California

[redacted]

Appendix G

Resource Records

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Attachment G

Air Quality/Greenhouse Gas Emissions Modeling Output

Log Cabin and Our House Diversion Dams Sediment Management Plan

Feather River AQMD Air District, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	1.00	User Defined Unit	80.00	0.00	1

1.2 Other Project Characteristics

Urbanization Rural **Wind Speed (m/s)** 3.4 **Precipitation Freq (Days)** 67

Climate Zone 3 **Operational Year** 2021

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 641.35 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - There are no choices for sediment landfill so I chose recreational. 80 acres is the size of disposal site #3.

Construction Phase - Schedule is 60 days per season working 6 day weeks as Described in Sediment Management Plan

Off-road Equipment - Plan Table 3.3-4 says water truck may run 10 hr/day. I assumed 2 hr/day for watering these small areas.

Off-road Equipment - Suction pump projected to run 10 hrs 1 day per year. Average over 60 days is 0.17 hr per day.

Trips and VMT - Some of the workers will arrive in 4-door company trucks, so 20 trips per day is adequate.

On-road Fugitive Dust - Tracking the varioius routes on Google Maps indicates that 2-5% of the trip is unpaved, including off-road trucks.

Grading - Assuming average silt depth at both extraction and landfilling sites is 2 yards, 140,000 cu yd is 14 acres.

Construction Off-road Equipment Mitigation - Set Clean Paved Road control efficiency to 53% in accordance with BAAQMD CEQA guidance.

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	53
tblConstDustMitigation	WaterUnpavedRoadMoistureContent	0	0.5
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	155.00	60.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblGrading	AcresOfGrading	75.00	14.00
tblGrading	AcresOfGrading	0.00	14.00
tblGrading	MaterialExported	0.00	140,000.00
tblGrading	MaterialImported	0.00	140,000.00
tblLandUse	LotAcreage	0.00	80.00
tblLandUse	Population	0.00	1.00
tblOffRoadEquipment	HorsePower	212.00	305.00
tblOffRoadEquipment	HorsePower	158.00	196.00

tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	402.00	115.00
tblOffRoadEquipment	HorsePower	84.00	172.00
tblOffRoadEquipment	HorsePower	203.00	247.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	0.00
tblOffRoadEquipment	UsageHours	8.00	10.00
tblOffRoadEquipment	UsageHours	8.00	10.00
tblOnRoadDust	AverageVehicleWeight	2.40	16.00
tblOnRoadDust	HaulingPercentPave	100.00	95.00
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripLength	20.00	344.00
tblTripsAndVMT	HaulingTripNumber	17,500.00	0.00
tblTripsAndVMT	HaulingTripNumber	17,500.00	600.00
tblTripsAndVMT	WorkerTripLength	16.80	47.00
tblTripsAndVMT	WorkerTripLength	16.80	35.00
tblTripsAndVMT	WorkerTripNumber	38.00	16.00
tblTripsAndVMT	WorkerTripNumber	10.00	4.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2020	13.1140	144.0671	96.8349	0.3359	271.4708	5.2700	276.7408	29.7051	5.0782	34.7832	0.0000	33,273.3660	33,273.3660	4.2666	0.0000	33,380.0317
Maximum	**13.1140**	**144.0671**	**96.8349**	**0.3359**	**271.4708**	**5.2700**	**276.7408**	**29.7051**	**5.0782**	**34.7832**	**0.0000**	**33,273.3660**	**33,273.3660**	**4.2666**	**0.0000**	**33,380.0317**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2020	4.3327	50.7081	115.2486	0.3359	39.6190	0.7781	40.3971	5.2789	0.7449	6.0238	0.0000	33,273.3660	33,273.3660	4.2666	0.0000	33,380.0317
Maximum	**4.3327**	**50.7081**	**115.2486**	**0.3359**	**39.6190**	**0.7781**	**40.3971**	**5.2789**	**0.7449**	**6.0238**	**0.0000**	**33,273.3660**	**33,273.3660**	**4.2666**	**0.0000**	**33,380.0317**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**66.96**	**64.80**	**-19.02**	**0.00**	**85.41**	**85.23**	**85.40**	**82.23**	**85.33**	**82.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**1.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**	**0.0000**	**2.3000e-004**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**1.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**	**0.0000**	**2.3000e-004**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	9/15/2020	11/23/2020	6	60	Sediment Removal
2	Grading	Grading	9/15/2020	11/23/2020	6	60	Sediment Disposal

Acres of Grading (Site Preparation Phase): 14

Acres of Grading (Grading Phase): 14

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Excavators	3	10.00	196	0.38
Site Preparation	Off-Highway Trucks	1	2.00	300	0.38
Site Preparation	Off-Highway Trucks	4	10.00	300	0.38
Site Preparation	Pumps	1	10.00	172	0.74
Site Preparation	Pumps	4	24.00	84	0.74
Site Preparation	Rubber Tired Dozers	0	10.00	247	0.40
Site Preparation	Rubber Tired Loaders	1	10.00	247	0.36
Site Preparation	Sweepers/Scrubbers	1	1.00	64	0.46
Site Preparation	Tractors/Loaders/Backhoes	0	10.00	97	0.37
Grading	Crawler Tractors	2	10.00	305	0.43
Grading	Excavators	0	8.00	158	0.38

Grading	Graders	0	8.00	187	0.41
Grading	Off-Highway Trucks	1	2.00	300	0.38
Grading	Off-Highway Trucks	1	10.00	115	0.38
Grading	Rubber Tired Dozers	0	8.00	247	0.40
Grading	Scrapers	0	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	0	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	15	16.00	0.00	0.00	47.00	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	4.00	0.00	600.00	35.00	6.60	344.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Water Unpaved Roads

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.7122	0.0000	0.7122	0.0971	0.0000	0.0971			0.0000			0.0000
Off-Road	9.9522	90.8899	76.6654	0.1814		4.2487	4.2487		4.1326	4.1326		17,356.2936	17,356.2936	3.1971		17,436.2199
Total	**9.9522**	**90.8899**	**76.6654**	**0.1814**	**0.7122**	**4.2487**	**4.9609**	**0.0971**	**4.1326**	**4.2297**		**17,356.2936**	**17,356.2936**	**3.1971**		**17,436.2199**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2403	0.2294	1.7815	4.8500e-003	0.5715	3.2400e-003	0.5747	0.1515	2.9900e-003	0.1545		483.3029	483.3029	0.0152		483.6830
Total	**0.2403**	**0.2294**	**1.7815**	**4.8500e-003**	**0.5715**	**3.2400e-003**	**0.5747**	**0.1515**	**2.9900e-003**	**0.1545**		**483.3029**	**483.3029**	**0.0152**		**483.6830**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Fugitive Dust					0.1186	0.0000	0.1186	0.0162	0.0000	0.0162			0.0000			0.0000
Off-Road	2.6599	18.0199	94.0336	0.1814		0.5641	0.5641		0.5380	0.5380	0.0000	17,356.2936	17,356.2936	3.1971		17,436.2199
Total	**2.6599**	**18.0199**	**94.0336**	**0.1814**	**0.1186**	**0.5641**	**0.6827**	**0.0162**	**0.5380**	**0.5542**	**0.0000**	**17,356.2936**	**17,356.2936**	**3.1971**		**17,436.2199**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2403	0.2294	1.7815	4.8500e-003	0.3080	3.2400e-003	0.3112	0.0868	2.9900e-003	0.0898		483.3029	483.3029	0.0152		483.6830
Total	**0.2403**	**0.2294**	**1.7815**	**4.8500e-003**	**0.3080**	**3.2400e-003**	**0.3112**	**0.0868**	**2.9900e-003**	**0.0898**		**483.3029**	**483.3029**	**0.0152**		**483.6830**

3.3 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.7122	0.0000	0.7122	0.0971	0.0000	0.0971			0.0000			0.0000
Off-Road	1.8662	22.1232	12.7823	0.0308		0.8576	0.8576		0.7890	0.7890		2,986.6951	2,986.6951	0.9660		3,010.8441
Total	**1.8662**	**22.1232**	**12.7823**	**0.0308**	**0.7122**	**0.8576**	**1.5697**	**0.0971**	**0.7890**	**0.8860**		**2,986.6951**	**2,986.6951**	**0.9660**		**3,010.8441**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0095	30.7813	5.2658	0.1179	268.8203	0.1599	268.9802	29.1966	0.1530	29.3496		12,356.8724	12,356.8724	0.0855		12,359.0109
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0458	0.0433	0.3399	9.1000e-004	0.6547	6.1000e-004	0.6553	0.1628	5.6000e-004	0.1634		90.2020	90.2020	2.8700e-003		90.2738
Total	**1.0553**	**30.8246**	**5.6057**	**0.1188**	**269.4750**	**0.1605**	**269.6355**	**29.3594**	**0.1536**	**29.5129**		**12,447.0743**	**12,447.0743**	**0.0884**		**12,449.2847**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.1186	0.0000	0.1186	0.0162	0.0000	0.0162			0.0000			0.0000
Off-Road	0.3771	1.6342	13.8278	0.0308		0.0503	0.0503		0.0503	0.0503	0.0000	2,986.6951	2,986.6951	0.9660		3,010.8441
Total	**0.3771**	**1.6342**	**13.8278**	**0.0308**	**0.1186**	**0.0503**	**0.1689**	**0.0162**	**0.0503**	**0.0665**	**0.0000**	**2,986.6951**	**2,986.6951**	**0.9660**		**3,010.8441**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0095	30.7813	5.2658	0.1179	38.7588	0.1599	38.9187	5.0803	0.1530	5.2333		12,356.8724	12,356.8724	0.0855		12,359.0109
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0458	0.0433	0.3399	9.1000e-004	0.3151	6.1000e-004	0.3157	0.0794	5.6000e-004	0.0800		90.2020	90.2020	2.8700e-003		90.2738
Total	**1.0553**	**30.8246**	**5.6057**	**0.1188**	**39.0738**	**0.1605**	**39.2344**	**5.1597**	**0.1536**	**5.3133**		**12,447.0743**	**12,447.0743**	**0.0884**		**12,449.2847**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.548006	0.027951	0.168590	0.116668	0.030134	0.006169	0.020582	0.073209	0.001179	0.001068	0.004478	0.001079	0.000886

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Unmitigated	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Total	**1.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**		**2.3000e-004**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000		2.2000e-004	2.2000e-004	0.0000		2.3000e-004
Total	**1.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**2.2000e-004**	**2.2000e-004**	**0.0000**		**2.3000e-004**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Log Cabin and Our House Diversion Dams Sediment Management Plan

Feather River AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	1.00	User Defined Unit	80.00	0.00	1

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	3.4	**Precipitation Freq (Days)**	67
Climate Zone	3			**Operational Year**	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - There are no choices for sediment landfill so I chose recreational. 80 acres is the size of disposal site #3.

Construction Phase - Schedule is 60 days per season working 6 day weeks as Described in Sediment Management Plan

Off-road Equipment - Plan Table 3.3-4 says water truck may run 10 hr/day. I assumed 2 hr/day for watering these small areas.

Off-road Equipment - Suction pump projected to run 10 hrs 1 day per year. Average over 60 days is 0.17 hr per day.

Trips and VMT - Some of the workers will arrive in 4-door company trucks, so 20 trips per day is adequate.

On-road Fugitive Dust - Tracking the varioius routes on Google Maps indicates that 2-5% of the trip is unpaved, including off-road trucks.

Grading - Assuming average silt depth at both extraction and landfilling sites is 2 yards, 140,000 cu yd is 14 acres.

Construction Off-road Equipment Mitigation - Set Clean Paved Road control efficiency to 53% in accordance with BAAQMD CEQA guidance.

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	53
tblConstDustMitigation	WaterUnpavedRoadMoistureContent	0	0.5
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	155.00	60.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblGrading	AcresOfGrading	75.00	14.00
tblGrading	AcresOfGrading	0.00	14.00
tblGrading	MaterialExported	0.00	140,000.00
tblGrading	MaterialImported	0.00	140,000.00
tblLandUse	LotAcreage	0.00	80.00
tblLandUse	Population	0.00	1.00
tblOffRoadEquipment	HorsePower	212.00	305.00

tblOffRoadEquipment	HorsePower	158.00	196.00
tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	402.00	300.00
tblOffRoadEquipment	HorsePower	402.00	115.00
tblOffRoadEquipment	HorsePower	84.00	172.00
tblOffRoadEquipment	HorsePower	203.00	247.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	0.00
tblOffRoadEquipment	UsageHours	8.00	10.00
tblOffRoadEquipment	UsageHours	8.00	10.00
tblOnRoadDust	AverageVehicleWeight	2.40	16.00
tblOnRoadDust	HaulingPercentPave	100.00	95.00
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripLength	20.00	344.00
tblTripsAndVMT	HaulingTripNumber	17,500.00	0.00
tblTripsAndVMT	HaulingTripNumber	17,500.00	600.00
tblTripsAndVMT	WorkerTripLength	16.80	47.00
tblTripsAndVMT	WorkerTripLength	16.80	35.00
tblTripsAndVMT	WorkerTripNumber	38.00	16.00
tblTripsAndVMT	WorkerTripNumber	10.00	4.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.3688	4.1049	2.6601	9.5900e-003	6.7280	0.1489	6.8769	0.7466	0.1432	0.8898	0.0000	863.7042	863.7042	0.1142	0.0000	866.5588
Maximum	**0.3688**	**4.1049**	**2.6601**	**9.5900e-003**	**6.7280**	**0.1489**	**6.8769**	**0.7466**	**0.1432**	**0.8898**	**0.0000**	**863.7042**	**863.7042**	**0.1142**	**0.0000**	**866.5588**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.1240	1.4827	3.1524	9.5900e-003	1.0075	0.0227	1.0301	0.1388	0.0217	0.1605	0.0000	863.7036	863.7036	0.1142	0.0000	866.5582
Maximum	**0.1240**	**1.4827**	**3.1524**	**9.5900e-003**	**1.0075**	**0.0227**	**1.0301**	**0.1388**	**0.0217**	**0.1605**	**0.0000**	**863.7036**	**863.7036**	**0.1142**	**0.0000**	**866.5582**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**

Percent Reduction	**66.38**	**63.88**	**-18.51**	**0.00**	**85.03**	**84.77**	**85.02**	**81.41**	**84.86**	**81.96**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	9-14-2020	9-30-2020	1.0104	0.3551
		Highest	1.0104	0.3551

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	9/15/2020	11/23/2020	6	60	Sediment Removal
2	Grading	Grading	9/15/2020	11/23/2020	6	60	Sediment Disposal

Acres of Grading (Site Preparation Phase): 14

Acres of Grading (Grading Phase): 14

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Excavators	3	10.00	196	0.38
Site Preparation	Off-Highway Trucks	1	2.00	300	0.38
Site Preparation	Off-Highway Trucks	4	10.00	300	0.38
Site Preparation	Pumps	1	0.17	172	0.74
Site Preparation	Pumps	4	24.00	84	0.74
Site Preparation	Rubber Tired Dozers	0	10.00	247	0.40
Site Preparation	Rubber Tired Loaders	1	10.00	247	0.36
Site Preparation	Sweepers/Scrubbers	1	1.00	64	0.46
Site Preparation	Tractors/Loaders/Backhoes	0	10.00	97	0.37
Grading	Crawler Tractors	2	10.00	305	0.43
Grading	Excavators	0	8.00	158	0.38
Grading	Graders	0	8.00	187	0.41
Grading	Off-Highway Trucks	1	2.00	300	0.38
Grading	Off-Highway Trucks	1	0.83	115	0.38
Grading	Rubber Tired Dozers	0	8.00	247	0.40
Grading	Scrapers	0	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	0	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	15	16.00	0.00	0.00	47.00	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	4.00	0.00	600.00	35.00	6.60	344.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Water Unpaved Roads

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0214	0.0000	0.0214	2.9100e-003	0.0000	2.9100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2750	2.5266	2.0539	4.9400e-003		0.1183	0.1183		0.1148	0.1148	0.0000	429.6989	429.6989	0.0851	0.0000	431.8272
Total	**0.2750**	**2.5266**	**2.0539**	**4.9400e-003**	**0.0214**	**0.1183**	**0.1396**	**2.9100e-003**	**0.1148**	**0.1177**	**0.0000**	**429.6989**	**429.6989**	**0.0851**	**0.0000**	**431.8272**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.4200e-003	6.1300e-003	0.0550	1.5000e-004	0.0165	1.0000e-004	0.0166	4.3800e-003	9.0000e-005	4.4700e-003	0.0000	13.5677	13.5677	4.3000e-004	0.0000	13.5784
Total	**6.4200e-003**	**6.1300e-003**	**0.0550**	**1.5000e-004**	**0.0165**	**1.0000e-004**	**0.0166**	**4.3800e-003**	**9.0000e-005**	**4.4700e-003**	**0.0000**	**13.5677**	**13.5677**	**4.3000e-004**	**0.0000**	**13.5784**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.5600e-003	0.0000	3.5600e-003	4.8000e-004	0.0000	4.8000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0748	0.5191	2.5148	4.9400e-003		0.0163	0.0163		0.0155	0.0155	0.0000	429.6984	429.6984	0.0851	0.0000	431.8267
Total	**0.0748**	**0.5191**	**2.5148**	**4.9400e-003**	**3.5600e-003**	**0.0163**	**0.0198**	**4.8000e-004**	**0.0155**	**0.0160**	**0.0000**	**429.6984**	**429.6984**	**0.0851**	**0.0000**	**431.8267**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.4200e-003	6.1300e-003	0.0550	1.5000e-004	8.9200e-003	1.0000e-004	9.0200e-003	2.5300e-003	9.0000e-005	2.6200e-003	0.0000	13.5677	13.5677	4.3000e-004	0.0000	13.5784
Total	**6.4200e-003**	**6.1300e-003**	**0.0550**	**1.5000e-004**	**8.9200e-003**	**1.0000e-004**	**9.0200e-003**	**2.5300e-003**	**9.0000e-005**	**2.6200e-003**	**0.0000**	**13.5677**	**13.5677**	**4.3000e-004**	**0.0000**	**13.5784**

3.3 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0214	0.0000	0.0214	2.9100e-003	0.0000	2.9100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0560	0.6637	0.3835	9.3000e-004		0.0257	0.0257		0.0237	0.0237	0.0000	81.2845	81.2845	0.0263	0.0000	81.9418
Total	**0.0560**	**0.6637**	**0.3835**	**9.3000e-004**	**0.0214**	**0.0257**	**0.0471**	**2.9100e-003**	**0.0237**	**0.0266**	**0.0000**	**81.2845**	**81.2845**	**0.0263**	**0.0000**	**81.9418**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0302	0.9073	0.1573	3.5400e-003	6.6501	4.7900e-003	6.6549	0.7318	4.5900e-003	0.7363	0.0000	336.6209	336.6209	2.2600e-003	0.0000	336.6773
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2300e-003	1.1600e-003	0.0104	3.0000e-005	0.0188	2.0000e-005	0.0188	4.6700e-003	2.0000e-005	4.6800e-003	0.0000	2.5321	2.5321	8.0000e-005	0.0000	2.5341
Total	**0.0315**	**0.9085**	**0.1678**	**3.5700e-003**	**6.6688**	**4.8100e-003**	**6.6737**	**0.7364**	**4.6100e-003**	**0.7410**	**0.0000**	**339.1530**	**339.1530**	**2.3400e-003**	**0.0000**	**339.2114**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.5600e-003	0.0000	3.5600e-003	4.8000e-004	0.0000	4.8000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0113	0.0490	0.4148	9.3000e-004		1.5100e-003	1.5100e-003		1.5100e-003	1.5100e-003	0.0000	81.2844	81.2844	0.0263	0.0000	81.9417
Total	**0.0113**	**0.0490**	**0.4148**	**9.3000e-004**	**3.5600e-003**	**1.5100e-003**	**5.0700e-003**	**4.8000e-004**	**1.5100e-003**	**1.9900e-003**	**0.0000**	**81.2844**	**81.2844**	**0.0263**	**0.0000**	**81.9417**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0302	0.9073	0.1573	3.5400e-003	0.9824	4.7900e-003	0.9872	0.1330	4.5900e-003	0.1376	0.0000	336.6209	336.6209	2.2600e-003	0.0000	336.6773
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2300e-003	1.1600e-003	0.0104	3.0000e-005	9.0400e-003	2.0000e-005	9.0600e-003	2.2800e-003	2.0000e-005	2.3000e-003	0.0000	2.5321	2.5321	8.0000e-005	0.0000	2.5341
Total	**0.0315**	**0.9085**	**0.1678**	**3.5700e-003**	**0.9914**	**4.8100e-003**	**0.9963**	**0.1353**	**4.6100e-003**	**0.1399**	**0.0000**	**339.1530**	**339.1530**	**2.3400e-003**	**0.0000**	**339.2114**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.548006	0.027951	0.168590	0.116668	0.030134	0.006169	0.020582	0.073209	0.001179	0.001068	0.004478	0.001079	0.000886

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Unmitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

The document is here: Draft IS-MND_Sed Plan_08052019.docx
The back-up documents go here: Admin Record - Reference Hard Copies

Table 3.3-2. Feather River AQMD Thresholds of Significance.

	NOx[1] (lb/day)	ROG[1] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)	GHG (lb/day)
Construction or Operat	25	25	80	Not Established	Not Established

Construction NOx and ROG may be averaged over the life of the project but may not exceed 4.5 tons per year each.

The No significant impact thresholds in the other air district are comperable.

Mitigated Construction in 2020 Calendar Year First Draft of Text

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day
At Dam	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	2.31	10.14	108.48	0.205	0.307	0.307	19,678	3.95	19,777
	Commute	0.24	0.23	1.78	0.005	0.311	0.090	483	0.02	484
At Disposa	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	0.38	1.63	13.83	0.031	0.050	0.050	2,987	0.97	3,011
	Hauling	1.01	30.78	5.27	0.118	47.943	6.136	12,357	0.09	12,359
	Commute	0.05	0.04	0.34	0.001	0.316	0.080	90	0.00	90
	Total	3.98	42.83	129.70	0.36	49.16	6.70	35,595	5.02	35,720

Mitigated Construction in 2020 Calendar Year First Draft of Text

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	Tonne	Tonne	Tonne
At Dam	Fugitive Dust					0.0036	0.0005			
	Off-Road Eqpt	0.061	0.267	2.816	0.005	0.0081	0.0081	467	0.097	469
	Commute	0.006	0.006	0.055	0.000	0.0090	0.0026	14	0.0004	14
At Disposal	Fugitive Dust					0.0036	0.0005			
	Off-Road Eqpt	0.011	0.049	0.415	0.001	0.0015	0.0015	81	0.026	82
	Hauling	0.030	0.907	0.157	0.004	1.2082	0.1597	337	0.002	337
	Commute	0.001	0.001	0.010	0.000	0.0091	0.0023	3	0.0001	3
	Total	0.110	1.231	3.453	0.010	1.2430	0.1752	901	0.126	904

Re-Running the model on 9/19/19 with one fewer excavators and one fewer wheeled loader and 6 days per week but still 60 working days (Winter11.xls file) (Annual11.xls file)

I removed one excavator and one wheeled loader, BUT took the Tier 4F off an excavator and the remaining wheeled loader (10% of off-road HP)

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day
At Dam	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	2.66	18.02	94.03	0.181	0.683	0.554	17,356	3	17,436
	Commute	0.24	0.23	1.78	0.005	0.311	0.090	483	0	484
At Disposa	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	0.38	1.63	13.83	0.031	0.169	0.067	2,987	1	3,011
	Hauling	1.01	30.78	5.27	0.118	38.919	5.233	12,357	0	12,359
	Commute	0.05	0.04	0.34	0.001	0.316	0.080	90	0	90
	Total	4.33	50.71	115.25	0.34	40.63	6.06	33273	4.27	33380

I removed one excavator and one wheeled loader, BUT took the Tier 4F off an excavator and the remaining wheeled loader.

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
At Dam	Fugitive Dust					0.0036	0.0005			
	Off-Road Eqpt	0.07480	0.51910	2.51480	0.005	0.0163	0.0155	430	0.085	432
	Commute	0.00642	0.00613	0.05500	0.000	0.0090	0.0026	14	0.000	14
At Disposal	Fugitive Dust					0.0036	0.0005			
	Off-Road Eqpt	0.01130	0.04900	0.41480	0.001	0.0015	0.0015	81	0.026	82
	Hauling	0.03020	0.90730	0.15730	0.004	0.9872	0.1376	337	0.002	337
	Commute	0.00123	0.00116	0.01040	0.000	0.0091	0.0023	3	0.000	3
	Total	0.124	1.483	3.152	0.010	1.030	0.160	864	0.114	867

Ratios of new numbers to first draft numbers

Fugitive Dust					1.00	1.00				
Off-Road Eqpt	1.15	1.78	0.87	0.88	2.22	1.80	0.88	0.81	0.88	Reduced equipment counts
Commute	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	OK
Fugitive Dust					1.00	1.00				
Off-Road Eqpt	1.00	1.00	1.00	1.00	3.36	1.32	1.00	1.00	1.00	Don't know why the PM went up.
Hauling	1.00	1.00	1.00	1.00	0.81	0.85	1.00	1.00	1.00	OK
Commute	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

I squeeked below 900 tons!

				1.00	1.00				
1.23	1.94	0.89	0.92	2.02	1.92	0.92	0.88	0.92	less equipment
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
				1.00	1.00				
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Interesting that off road PM did not go up in annual numbers
1.00	1.00	1.00	1.00	0.82	0.86	1.00	1.00	1.00	
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

I had to stretch the work period to get 60 work days so that hauling trips per day did not increase. Daily on-road hauling is my problem
Removing one excavator and one front-end loadder dropped my off-road emissions by about 8%, but that does not matter much.
Removing two big devices lowered daily NOx from 11.8 to 10.5 lb/day, which is about 25% of the daily NOx.
This assumed that no Tier 4 final equipment are available for 10% of the off-road equipment.
Taking the Tier4F off of one excavator and one wheeled loader (10% of my equipment HP) took off-road NOx back up to 19.65 lb/day.

Unmitigated Construction in 2020 Calendar Year

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day
At Dam	Fugitive Dust					0.712	0.097			
	Off-Road Eqpt	9.95	90.89	76.67	0.181	4.961	4.230	17,356	3.2	17,436
	Commute	0.24	0.23	1.78	0.005	0.575	0.155	483	0.0	484
At Disposa	Fugitive Dust					0.712	0.097			
	Off-Road Eqpt	1.87	22.12	12.78	0.031	1.570	0.886	2,987	1.0	3,011
	Hauling	1.01	30.78	5.27	0.118	268.980	29.350	12,357	0.1	12,359
	Commute	0.05	0.04	0.34	0.001	0.655	0.163	90	0.0	90
	Total	13.11	144.07	96.83	0.34	278.17	34.98	33,273	4.3	33,380

Interesting that CO is lower in the unmitigated scenario. Tier 4F off-road equipment is key.

Unmitigated Construction in 2020 Calendar Year

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	Tonne	Tonne	Tonne
At Dam	Fugitive Dust					0.0214	0.0029			
	Off-Road Eqpt	0.27500	2.52660	2.05390	0.005	0.118	0.115	430	0.085	432
	Commute	0.00642	0.00613	0.05500	0.000	0.017	0.004	14	0.000	14
At Disposal	Fugitive Dust					0.0214	0.0029			
	Off-Road Eqpt	0.05600	0.66370	0.38350	0.001	0.026	0.024	81	0.026	82
	Hauling	0.03020	0.90730	0.15730	0.004	6.655	0.736	337	0.002	337
	Commute	0.00123	0.00116	0.01040	0.000	0.019	0.005	3	0.000	3
	Total	0.369	4.105	2.660	0.010	6.877	0.890	864	0.114	867

Mitigated Construction in 2022 Calendar Year 2022 came close to hitting 25 lb/day NOx until I took the Tier 4F of two off-road devices

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day
At Dam	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	2.49	14.84	93.83	0.181	0.466	0.448	17359	3.1	17437
	Commute	0.20	0.18	1.43	0.005	0.311	0.090	449	0.0	449
At Disposa	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	0.38	1.63	13.83	0.031	0.050	0.050	2982	1.0	3006
	Hauling	0.88	23.98	4.73	0.115	38.875	5.192	12046	0.1	12048
	Commute	0.04	0.03	0.27	0.001	0.316	0.080	84	0.0	84
	Total	3.98	40.67	114.10	0.33	40.26	5.89	32,920	4.2	33,025

Mitigated 2026 construction 2027 startup year.

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day
At Dam	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	2.36	12.36	93.72	0.182	0.387	0.375	17364	3.0	17440
	Commute	0.16	0.12	1.02	0.004	0.311	0.089	383	0.0	383
At Disposa	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	0.38	1.63	13.83	0.031	0.050	0.050	2980	1.0	3004

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
	Hauling	0.61	13.46	3.95	0.110	38.804	5.124	11537	0.1	11538
	Commute	0.03	0.02	0.19	0.001	0.316	0.080	71	0.0	72
	Total	3.54	27.59	112.71	0.33	40.10	5.75	32,336	4.1	32,437

Projecting to forward years using all the same assumptions (80% of off-road equipment specified as Tier 4F and the other on-road following fleet turnover required by current regulations

Mitigated 2029 construction 2030 startup year. Last year under this EA

		ROG	NOx	CO	SO2	PM10	PM2.5	CO2	CH4	CO2e
		lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day
At Dam	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	2.36	12.36	93.72	0.182	0.387	0.375	17364	3.0	17440
	Commute	0.13	0.09	0.83	0.003	0.310	0.089	348	0.0	348
At Disposa	Fugitive Dust					0.119	0.016			
	Off-Road Eqpt	0.38	1.63	13.83	0.031	0.050	0.050	2980	1.0	3004
	Hauling	0.60	12.36	3.86	0.109	38.801	5.121	11424	0.1	11426
	Commute	0.03	0.02	0.16	0.001	0.316	0.080	65	0.0	65
	Total	3.49	26.46	112.40	0.33	40.10	5.75	32,182	4.1	32,283

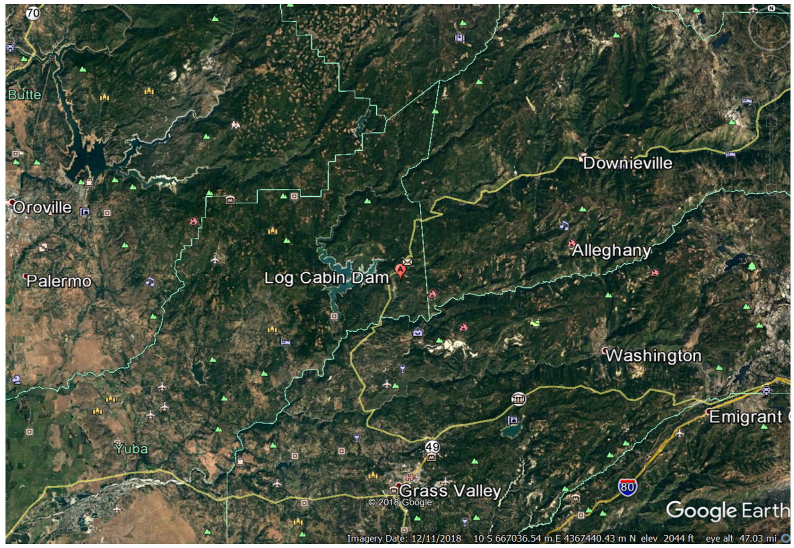
On-road trucks and cars continue to go down slowly, but off-road equipment bottoms out so we never hit 25 lb/day NOx.

Table 3.3-1. Ambient air quality attainment status setting.

	Log Cabin Diversion Dam	Our House Diversion Dam	Disposal Site 1	Disposal Site 2	Disposal Site 3
County Where Located	Yuba	Sierra/Nevada	Yuba	Yuba	Sierra
Federal 8-hr Ozone	A	A/NA	A	A	A
Federal PM10	U	U	U	U	U
Federal PM2.5	A	A	A	A	A
Federal CO	A	A	A	A	A
State Ozone	NA	U/NA	NA	NA	U
State PM10	NA	NA	NA	NA	NA
State PM2.5	A	U/U	A	A	U
State CO	U	U	U	U	U

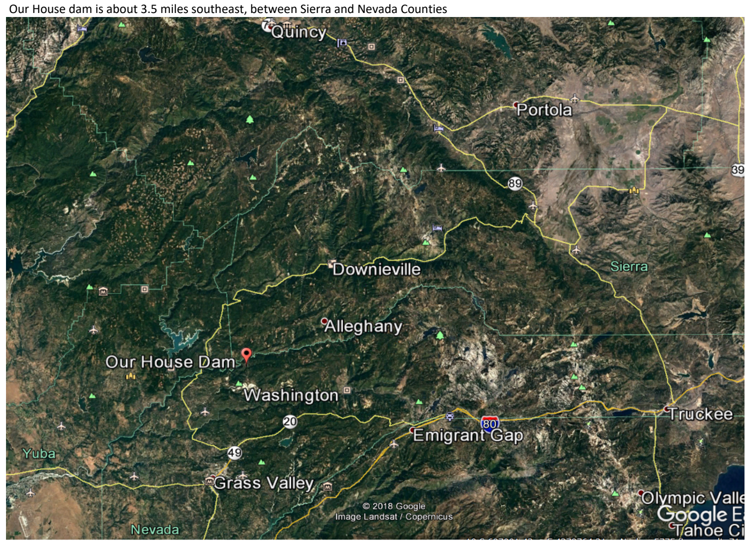
Source: Area Designations Maps / State and National, http://www.arb.ca.gov/desig/adm/adm.htm 8/6/19

Log Cabin Dam in Eastern Yuba County, just east of New Bullards Bar Reservoir, 45 miles SC of Chico, 27 miles ESE of Oroville



County Where Located	Yuba
Federal 8-hr Ozone	A
Federal PM10	U
Federal PM2.5	A
Federal CO	A
State Ozone	NA
State PM10	NA
State PM2.5	A
State CO	U

Our House dam is about 3.5 miles southeast, between Sierra and Nevada Counties



County Where Located	Between Sierra and Nevada counties
Federal 8-hr Ozone	A/NA
Federal PM10	U
Federal PM2.5	A
Federal CO	A
State Ozone	NA/U
State PM10	NA
State PM2.5	U/U
State CO	U

Disposal Site 1

County Where Located	Yuba
Federal 8-hr Ozone	A
Federal PM10	U
Federal PM2.5	A
Federal CO	A
State Ozone	NA
State PM10	NA
State PM2.5	A
State CO	U

Disposal Site one just below the reservoir in Yuba County

ProjectNar	LocationS	EMFAC_ID	WindSpee	Precipitatic	ClimateZoı	Urbanizatic	Operationa	UtilityComp	CO2Intens
Log Cabin	AD	FRAQMD	3.4	67	3	Rural	2023	Pacific Ga	641.35

CH4Intens	N2OIntens	TotalPopul	TotalLotAc	UsingHistc	ConstructionPhaseStartDate
0.029	0.006	1	80	0	2022/09/14

PollutantS	PollutantFu	PollutantName
1	Reactive C	ROG
1	Nitrogen C	NOX
1	Carbon Mc	CO
1	Sulfur Diox	SO2
1	Particulate	PM10
1	Particulate	PM2_5
1	Fugitive PI	PM10_FUG
1	Fugitive PI	PM25_FUG
1	Biogenic C	CO2_BIO
1	Non-Bioge	CO2_NBIO
1	Carbon Dic	CO2
1	Methane ((	CH4
1	Nitrous Ox	N2O
1	CO2 Equiv	CO2E

LandUseTy	LandUseS	LandUseU	LandUseS	LotAcreage	LandUseS	Population	BuildingSp	GreenSpac	RecSwimm
Recreation	User Defin	1	User Defin	80	0	1	0	0	0

ıingAreaAllowEdit

tblConstructionPhase

PhaseNum	PhaseNam	PhaseType	PhaseStar	PhaseEnd	NumDaysW	NumDays	PhaseDescription
1	Site Prepa	Site Prepa	2022/09/14	2022/11/22	6	60	Sediment Removal
2	Grading	Grading	2022/09/14	2022/11/22	6	60	Sediment Disposal

PhaseNam	OffRoadEc	OffRoadEc	UsageHou	HorsePow	LoadFactor
Site Prepa	Excavators	3	10	196	0.38
Site Prepa	Off-Highwa	1	2	300	0.38
Site Prepa	Off-Highwa	4	10	300	0.38
Site Prepa	Pumps	1	10	172	0.74
Site Prepa	Pumps	4	24	84	0.74
Site Prepa	Rubber Tir	0	10	247	0.4
Site Prepa	Rubber Tir	1	10	247	0.36
Site Prepa	Sweepers/	1	1	64	0.46
Site Prepa	Tractors/Lo	0	10	97	0.37
Grading	Crawler Tr	2	10	305	0.43
Grading	Excavators	0	8	158	0.38
Grading	Graders	0	8	187	0.41
Grading	Off-Highwa	1	2	300	0.38
Grading	Off-Highwa	1	10	115	0.38
Grading	Rubber Tir	0	8	247	0.4
Grading	Scrapers	0	8	367	0.48
Grading	Tractors/Lo	0	8	97	0.37

PhaseNam	WorkerTrip	VendorTrip	HaulingTrip	WorkerTrip	VendorTrip	HaulingTrip	WorkerVeh	VendorVeh	HaulingVeh
Site Prepa	16	0	0	47	6.6	20	LD_Mix	HDT_Mix	HHDT
Grading	4	0	600	35	6.6	344	LD_Mix	HDT_Mix	HHDT

ıicleClass

PhaseNam	WorkerPer	VendorPer	HaulingPe	RoadSiltLo	MaterialSil	MaterialMo	AverageVe	MeanVehicleSpeed
Site Prepa	100	100	100	0.1	8.5	0.5	2.4	40
Grading	100	100	95	0.1	8.5	0.5	16	40

PhaseNam	Demolition	DemolitionUnitAmount

PhaseNam	MaterialIm	MaterialEx	GradingSiz	ImportExp	MeanVehic	AcresOfGr	MaterialMo	MaterialMo	MaterialSilt
Site Prepa	0	140000	Cubic Yarc	0	7.1	14	7.9	12	6.9
Grading	140000	0	Cubic Yarc	0	7.1	14	7.9	12	6.9

tContent

tblArchitecturalCoating

PhaseNam	Architectur	Architectur	EF_Reside	ConstArea	EF_Reside	ConstArea	EF_Nonres	ConstArea	EF_Nonres

ConstArea	EF_Parkin	ConstArea_Parking

ParkingLotAcreage

VehicleTrip	VehicleTrip	WD_TR	ST_TR	SU_TR	HW_TL	HS_TL	HO_TL	CC_TL	CW_TL
User Defin	User Defin	0	0	0	0	0	0	6.6	14.7

CNW_TL	PR_TP	DV_TP	PB_TP	HW_TTP	HS_TTP	HO_TTP	CC_TTP	CW_TTP	CNW_TTP
6.6	0	0	0	0	0	0	0	0	0

Season	EmissionT	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD
A	CH4_IDLE	0	0	0	0	0.003629	0.00294	0.016211	1.002463
A	CH4_RUN	0.0037	0.008894	0.008421	0.014778	0.021128	0.008798	0.003732	0.004011
A	CH4_STRI	0.005303	0.014293	0.013847	0.024925	0.014605	0.006427	0.064967	0.08028
A	CO_IDLEX	0	0	0	0	0.119802	0.112373	0.238446	2.174762
A	CO_RUNE	0.534594	1.047014	0.966859	1.491978	1.439667	0.758325	0.324942	0.530766
A	CO_STRE	1.166996	2.869086	2.570584	4.232051	1.986315	0.92775	4.860481	1.320548
A	CO2_NBIC	0	0	0	0	9.903668	15.02085	188.6232	6402.486
A	CO2_NBIC	229.9485	280.0527	326.7545	458.6258	665.6106	712.1856	1193.825	1527.012
A	CO2_NBIC	55.36022	68.18287	79.39082	109.32	20.60704	19.92423	36.13398	3.817657
A	NOX_IDLE	0	0	0	0	0.12624	0.129241	0.583039	18.70883
A	NOX_RUN	0.048135	0.110454	0.121643	0.2229	3.133191	1.721075	1.294147	1.845182
A	NOX_STR	0.07642	0.171894	0.230631	0.437057	0.704186	0.452745	14.8316	20.40791
A	PM10_IDL	0	0	0	0	0.001378	0.001424	0.000266	0.007254
A	PM10_PM	0.03675	0.03675	0.03675	0.03675	0.07644	0.08918	0.13034	0.060992
A	PM10_PM	0.008	0.008	0.008	0.008	0.010722	0.010949	0.012	0.035533
A	PM10_RU	0.001532	0.002045	0.001767	0.001848	0.032193	0.02258	0.003747	0.00644
A	PM10_STI	0.002256	0.003093	0.002765	0.002712	0.000733	0.000293	0.00075	0.000032
A	PM25_IDL	0	0	0	0	0.001318	0.001362	0.000254	0.006941
A	PM25_PM	0.01575	0.01575	0.01575	0.01575	0.03276	0.03822	0.05586	0.026139
A	PM25_PM	0.002	0.002	0.002	0.002	0.002681	0.002737	0.003	0.008883
A	PM25_RU	0.001411	0.001885	0.001625	0.001706	0.030765	0.021586	0.003582	0.006162
A	PM25_STI	0.002075	0.002845	0.002542	0.002494	0.000674	0.00027	0.000689	0.000029
A	ROG_DIUI	0.037416	0.117908	0.097716	0.124314	0.00286	0.001	0.001259	0.000065
A	ROG_HTS	0.091444	0.231563	0.190654	0.258834	0.087988	0.030621	0.040169	0.002296
A	ROG_IDLE	0	0	0	0	0.013866	0.012712	0.017364	0.58694
A	ROG_RES	0.02625	0.075295	0.066344	0.091871	0.00113	0.000455	0.000486	0.000032
A	ROG_RUN	0.009281	0.02219	0.020889	0.037076	0.195284	0.135543	0.048001	0.081155
A	ROG_RUN	0.031445	0.136766	0.109304	0.160345	0.309489	0.06892	0.016994	0.000187
A	ROG_STR	0.071526	0.192759	0.186752	0.336164	0.196969	0.08667	0.282801	0.029443
A	SO2_IDLE	0	0	0	0	0.000097	0.000146	0.001807	0.061083
A	SO2_RUN	0.002303	0.002813	0.003277	0.004599	0.006483	0.006907	0.011416	0.014571
A	SO2_STRI	0.000573	0.000732	0.000839	0.001169	0.000243	0.000216	0.000446	0.00006
A	TOG_DIUI	0.037416	0.117908	0.097716	0.124314	0.00286	0.001	0.001259	0.000065
A	TOG_HTS	0.091444	0.231563	0.190654	0.258834	0.087988	0.030621	0.040169	0.002296
A	TOG_IDLE	0	0	0	0	0.018462	0.01658	0.023737	0.668186
A	TOG_RES	0.02625	0.075295	0.066344	0.091871	0.00113	0.000455	0.000486	0.000032
A	TOG_RUN	0.013496	0.03231	0.03046	0.0539	0.233133	0.15655	0.055993	0.092606
A	TOG_RUN	0.031445	0.136766	0.109304	0.160345	0.309489	0.06892	0.016994	0.000187
A	TOG_STR	0.07831	0.211043	0.204468	0.368045	0.215657	0.094892	0.309632	0.032236
S	CH4_IDLE	0	0	0	0	0.003629	0.00294	0.015068	0.944789
S	CH4_RUN	0.004328	0.010318	0.00979	0.017235	0.021698	0.008901	0.003796	0.004022
S	CH4_STRI	0.004276	0.011481	0.011153	0.020091	0.013667	0.006045	0.060899	0.075027
S	CO_IDLEX	0	0	0	0	0.119802	0.112373	0.165801	1.580534
S	CO_RUNE	0.683916	1.307905	1.219432	1.881135	1.463931	0.762785	0.328467	0.532905
S	CO_STRE	0.941226	2.293348	2.066816	3.411233	1.818495	0.854508	4.461598	1.210358
S	CO2_NBIC	0	0	0	0	9.903668	15.02085	199.9105	6782.729
S	CO2_NBIC	255.6474	310.4	362.278	507.026	665.6106	712.1856	1193.825	1527.012
S	CO2_NBIC	55.36022	68.18287	79.39082	109.32	20.60704	19.92423	36.13398	3.817657
S	NOX_IDLE	0	0	0	0	0.12624	0.129241	0.601805	19.31026
S	NOX_RUN	0.043546	0.098446	0.109054	0.200046	2.930127	1.61234	1.208681	1.731665
S	NOX_STR	0.070518	0.158285	0.212713	0.403386	0.657767	0.425474	14.78672	20.40169

S	PM10_IDL	0	0	0	0	0.001378	0.001424	0.000224	0.006136
S	PM10_PM	0.03675	0.03675	0.03675	0.03675	0.07644	0.08918	0.13034	0.060992
S	PM10_PM	0.008	0.008	0.008	0.008	0.010722	0.010949	0.012	0.035533
S	PM10_RU	0.001532	0.002045	0.001767	0.001848	0.032193	0.02258	0.003747	0.00644
S	PM10_STI	0.002256	0.003093	0.002765	0.002712	0.000733	0.000293	0.00075	0.000032
S	PM25_IDL	0	0	0	0	0.001318	0.001362	0.000214	0.005871
S	PM25_PM	0.01575	0.01575	0.01575	0.01575	0.03276	0.03822	0.05586	0.026139
S	PM25_PM	0.002	0.002	0.002	0.002	0.002681	0.002737	0.003	0.008883
S	PM25_RU	0.001411	0.001885	0.001625	0.001706	0.030765	0.021586	0.003582	0.006162
S	PM25_STI	0.002075	0.002845	0.002542	0.002494	0.000674	0.00027	0.000689	0.000029
S	ROG_DIUI	0.093734	0.298577	0.245342	0.307851	0.007074	0.002429	0.003219	0.000164
S	ROG_HTS	0.110835	0.296765	0.241279	0.311455	0.108519	0.036156	0.051386	0.002676
S	ROG_IDLE	0	0	0	0	0.013866	0.012712	0.016196	0.553172
S	ROG_RES	0.068147	0.198735	0.171728	0.230562	0.003033	0.001151	0.001386	0.000086
S	ROG_RUN	0.01084	0.025723	0.024284	0.043205	0.196695	0.135799	0.048161	0.081181
S	ROG_RUN	0.030727	0.133615	0.10673	0.156952	0.308339	0.068639	0.017141	0.000191
S	ROG_STR	0.057669	0.15484	0.150416	0.270961	0.184316	0.081525	0.265096	0.027516
S	SO2_IDLE	0	0	0	0	0.000097	0.000146	0.001914	0.06471
S	SO2_RUN	0.002562	0.00312	0.003636	0.005089	0.006484	0.006908	0.011416	0.014571
S	SO2_STRI	0.000569	0.000722	0.00083	0.001154	0.00024	0.000215	0.000439	0.000058
S	TOG_DIUI	0.093734	0.298577	0.245342	0.307851	0.007074	0.002429	0.003219	0.000164
S	TOG_HTS	0.110835	0.296765	0.241279	0.311455	0.108519	0.036156	0.051386	0.002676
S	TOG_IDLE	0	0	0	0	0.018462	0.01658	0.022126	0.629744
S	TOG_RES	0.068147	0.198735	0.171728	0.230562	0.003033	0.001151	0.001386	0.000086
S	TOG_RUN	0.01577	0.037461	0.035412	0.062823	0.235192	0.156925	0.056226	0.092644
S	TOG_RUN	0.030727	0.133615	0.10673	0.156952	0.308339	0.068639	0.017141	0.000191
S	TOG_STR	0.06314	0.169527	0.164685	0.296659	0.201802	0.08926	0.290246	0.030127
W	CH4_IDLE	0	0	0	0	0.003629	0.00294	0.017371	1.082108
W	CH4_RUN	0.003493	0.008501	0.008004	0.014095	0.020528	0.008685	0.003659	0.004
W	CH4_STRI	0.006405	0.017403	0.016803	0.030243	0.015737	0.006887	0.070232	0.087547
W	CO_IDLEX	0	0	0	0	0.119802	0.112373	0.314974	2.995362
W	CO_RUNE	0.504294	0.99916	0.917789	1.421161	1.414412	0.753628	0.321049	0.528433
W	CO_STRE	1.464224	3.626112	3.23809	5.333741	2.210714	1.025133	5.43312	1.480759
W	CO2_NBIC	0	0	0	0	9.903668	15.02085	173.2543	5877.389
W	CO2_NBIC	222.7847	271.5713	316.8175	445.0686	665.6106	712.1856	1193.825	1527.012
W	CO2_NBIC	55.36022	68.18287	79.39082	109.32	20.60704	19.92423	36.13398	3.817657
W	NOX_IDLE	0	0	0	0	0.12624	0.129241	0.557141	17.8783
W	NOX_RUN	0.053866	0.124147	0.136622	0.250207	3.202448	1.756817	1.320513	1.881431
W	NOX_STR	0.086291	0.193931	0.260371	0.493558	0.76449	0.489168	14.89147	20.41623
W	PM10_IDL	0	0	0	0	0.001378	0.001424	0.000323	0.008798
W	PM10_PM	0.03675	0.03675	0.03675	0.03675	0.07644	0.08918	0.13034	0.060992
W	PM10_PM	0.008	0.008	0.008	0.008	0.010722	0.010949	0.012	0.035533
W	PM10_RU	0.001532	0.002045	0.001767	0.001848	0.032193	0.02258	0.003747	0.00644
W	PM10_STI	0.002256	0.003093	0.002765	0.002712	0.000733	0.000293	0.00075	0.000032
W	PM25_IDL	0	0	0	0	0.001318	0.001362	0.000309	0.008418
W	PM25_PM	0.01575	0.01575	0.01575	0.01575	0.03276	0.03822	0.05586	0.026139
W	PM25_PM	0.002	0.002	0.002	0.002	0.002681	0.002737	0.003	0.008883
W	PM25_RU	0.001411	0.001885	0.001625	0.001706	0.030765	0.021586	0.003582	0.006162
W	PM25_STI	0.002075	0.002845	0.002542	0.002494	0.000674	0.00027	0.000689	0.000029
W	ROG_DIUI	0.007884	0.023173	0.020135	0.02776	0.000601	0.000243	0.000231	0.000015
W	ROG_HTS	0.090432	0.231936	0.189758	0.256488	0.091956	0.031055	0.040088	0.002327
W	ROG_IDLE	0	0	0	0	0.013866	0.012712	0.018641	0.633572

W	ROG_RES	0.006567	0.018595	0.016627	0.023671	0.000339	0.000146	0.00013	0.000009
W	ROG_RUN	0.008771	0.02122	0.01986	0.035407	0.193798	0.135265	0.047822	0.081127
W	ROG_RUN	0.036699	0.164879	0.131623	0.191486	0.34049	0.07611	0.018976	0.000205
W	ROG_STR	0.086381	0.234708	0.226612	0.407886	0.212237	0.092884	0.305723	0.032108
W	SO2_IDLE	0	0	0	0	0.000097	0.000146	0.001661	0.056073
W	SO2_RUN	0.002231	0.002727	0.003177	0.004463	0.006483	0.006907	0.011416	0.014571
W	SO2_STRI	0.000578	0.000745	0.000851	0.001188	0.000247	0.000218	0.000456	0.000062
W	TOG_DIUI	0.007884	0.023173	0.020135	0.02776	0.000601	0.000243	0.000231	0.000015
W	TOG_HTS	0.090432	0.231936	0.189758	0.256488	0.091956	0.031055	0.040088	0.002327
W	TOG_IDLE	0	0	0	0	0.018462	0.01658	0.025474	0.721273
W	TOG_RES	0.006567	0.018595	0.016627	0.023671	0.000339	0.000146	0.00013	0.000009
W	TOG_RUN	0.012752	0.030894	0.028958	0.051457	0.230964	0.156144	0.055731	0.092564
W	TOG_RUN	0.036699	0.164879	0.131623	0.191486	0.34049	0.07611	0.018976	0.000205
W	TOG_STR	0.094574	0.256971	0.248108	0.446567	0.232373	0.101697	0.334728	0.035154

OBUS	UBUS	MCY	SBUS	MH
0.012218	0	0	0.825087	0
0.009018	0.058742	0.402867	0.015387	0.045642
0.03073	0.06634	0.168538	0.100522	0.029129
0.253451	0	0	4.641934	0
0.619565	3.181026	20.26568	0.941776	3.256408
6.179397	9.633886	10.16078	6.764104	6.870943
129.6488	0	0	1309.081	0
1342.933	2053.496	160.3845	1171.509	1229.487
66.83928	111.8794	48.17151	30.12947	58.42999
0.286949	0	0	11.99379	0
1.06247	3.923963	1.17169	4.852099	1.921993
2.956545	14.32604	0.319782	16.33179	0.988017
0.000027	0	0	0.011559	0
0.13034	0.592997	0.01176	0.7448	0.13034
0.012	0.012	0.004	0.011251	0.012941
0.002979	0.066263	0.001812	0.026137	0.041659
0.000881	0.001266	0.003895	0.00045	0.001288
0.000025	0	0	0.011059	0
0.05586	0.254142	0.00504	0.3192	0.05586
0.003	0.003	0.001	0.002813	0.003235
0.00283	0.063365	0.001699	0.024999	0.039789
0.00081	0.001164	0.003682	0.000414	0.001185
0.00173	0.00494	1.505254	0.002542	1.564149
0.0205	0.066755	1.018187	0.023539	0.103756
0.034715	0	0	0.546711	0
0.000558	0.00179	0.746441	0.000907	0.392749
0.055428	0.272285	2.231716	0.127066	0.145848
0.045008	0.016768	0.918837	0.009087	0.032353
0.376595	0.894674	2.302004	0.326922	0.392837
0.001249	0	0	0.01264	0
0.013056	0.019887	0.001999	0.011243	0.012218
0.000777	0.001298	0.000716	0.000418	0.000704
0.00173	0.00494	1.505254	0.002542	1.564149
0.0205	0.066755	1.018187	0.023539	0.103756
0.048032	0	0	0.77808	0
0.000558	0.00179	0.746441	0.000907	0.392749
0.06888	0.351321	2.713698	0.153162	0.2009
0.045008	0.016768	0.918837	0.009087	0.032353
0.412325	0.979556	2.503409	0.357939	0.430107
0.012194	0	0	0.824406	0
0.009262	0.060538	0.392188	0.015795	0.048133
0.028535	0.057929	0.139453	0.078785	0.026841
0.244722	0	0	4.491981	0
0.633288	3.234929	20.37823	0.965839	3.403297
5.548633	7.609296	9.136516	4.362735	6.106895
136.3776	0	0	1378.027	0
1342.933	2053.496	160.3845	1171.509	1229.487
66.83928	111.8794	48.17151	30.12947	58.42999
0.296106	0	0	12.37826	0
0.984244	3.64248	0.978486	4.521574	1.746968
2.886789	14.24012	0.292138	16.28837	0.92154

0.000022	0	0	0.009745	0
0.13034	0.592997	0.01176	0.7448	0.13034
0.012	0.012	0.004	0.011251	0.012941
0.002979	0.066263	0.001812	0.026137	0.041659
0.000881	0.001266	0.003895	0.00045	0.001288
0.000021	0	0	0.009323	0
0.05586	0.254142	0.00504	0.3192	0.05586
0.003	0.003	0.001	0.002813	0.003235
0.00283	0.063365	0.001699	0.024999	0.039789
0.00081	0.001164	0.003682	0.000414	0.001185
0.00418	0.012064	4.063182	0.00588	3.852
0.023996	0.085877	1.63343	0.024728	0.126951
0.034244	0	0	0.543178	0
0.001534	0.005271	2.442823	0.002433	1.148133
0.056033	0.276729	2.154175	0.128076	0.152013
0.044797	0.016129	0.899548	0.008051	0.032106
0.349686	0.781237	1.904579	0.256231	0.361975
0.001313	0	0	0.013298	0
0.013056	0.019888	0.001998	0.011243	0.01222
0.000766	0.001262	0.000687	0.000378	0.000691
0.00418	0.012064	4.063182	0.00588	3.852
0.023996	0.085877	1.63343	0.024728	0.126951
0.047496	0	0	0.774057	0
0.001534	0.005271	2.442823	0.002433	1.148133
0.069763	0.357807	2.623022	0.154636	0.209895
0.044797	0.016129	0.899548	0.008051	0.032106
0.382862	0.855356	2.071304	0.28054	0.396318
0.012251	0	0	0.826027	0
0.008741	0.056816	0.425947	0.014981	0.043041
0.033211	0.076254	0.210908	0.120727	0.031903
0.265505	0	0	4.849012	0
0.604543	3.125826	22.44476	0.918425	3.100766
6.963895	12.18337	12.21665	9.307056	7.882469
120.3565	0	0	1213.87	0
1342.933	2053.496	160.3845	1171.509	1229.487
66.83928	111.8794	48.17151	30.12947	58.42999
0.274303	0	0	11.46285	0
1.092412	4.021202	1.291535	4.955641	2.003919
3.047871	14.42606	0.352473	16.37553	1.074087
0.000032	0	0	0.014066	0
0.13034	0.592997	0.01176	0.7448	0.13034
0.012	0.012	0.004	0.011251	0.012941
0.002979	0.066263	0.001812	0.026137	0.041659
0.000881	0.001266	0.003895	0.00045	0.001288
0.000031	0	0	0.013457	0
0.05586	0.254142	0.00504	0.3192	0.05586
0.003	0.003	0.001	0.002813	0.003235
0.00283	0.063365	0.001699	0.024999	0.039789
0.00081	0.001164	0.003682	0.000414	0.001185
0.000443	0.001015	0.193161	0.000765	0.304574
0.020177	0.070802	1.024624	0.023441	0.114357
0.035365	0	0	0.551591	0

0.000218	0.000629	0.12941	0.000373	0.140893
0.054743	0.267518	2.386865	0.126062	0.13941
0.048999	0.02041	1.065568	0.011293	0.03453
0.406993	1.028377	2.881076	0.392635	0.43025
0.00116	0	0	0.011731	0
0.013056	0.019886	0.002038	0.011242	0.012215
0.00079	0.001342	0.000767	0.00046	0.000721
0.000443	0.001015	0.193161	0.000765	0.304574
0.020177	0.070802	1.024624	0.023441	0.114357
0.048772	0	0	0.783635	0
0.000218	0.000629	0.12941	0.000373	0.140893
0.06788	0.344365	2.896994	0.151698	0.191505
0.048999	0.02041	1.065568	0.011293	0.03453
0.445607	1.125944	3.132943	0.429886	0.47107

RoadPerce	RoadSiltLo	MaterialSil	MaterialMo	MobileAve	MeanVehic	CARB_PM_VMT
100	0.1	4.3	0.5	2.4	40	0

Woodstove	NumberCo	NumberCa	NumberNo	NumberPe	Woodstove	WoodstoveWoodMass

FireplacesI	NumberWo	NumberGa	NumberPro	NumberNo	FireplaceH	FireplaceD	FireplaceWoodMass

ROG_EF	ROG_EF_	ROG_EF_PesticidesFertilizers
2.14E-05	3.54E-07	5.15E-08

Area_EF_I	Area_Resi	Area_EF_I	Area_Resi	Area_EF_I	Area_Nonr	Area_EF_I	Area_Nonr	Reapplicat	Area_EF_I
250	0	250	0	250	0	250	0	10	250

Area_Parking
0

NumberSn	NumberSummerDays
0	180

EnergyUse	T24E	NT24E	LightingEle	T24NG	NT24NG
User Defin	0	0	0	0	0

WaterLanc	WaterLanc	IndoorWat	OutdoorWa	ElectricityI	ElectricityI	ElectricityI	ElectricityI	SepticTank	AerobicPer
User Defin	User Defin	0	0	2117	111	1272	1911	10.33	87.46

Anaerobic	AnaDigest	AnaDigestCogenCombDigestGasPercent
2.21	100	0

SolidWaste	SolidWaste	SolidWaste	LandfillNo(	LandfillCap	LandfillCaptureGasEnergyRecovery
User Defin	User Defin	0	6	94	0

Vegetation	Vegetation	AcresBegi	AcresEnd	CO2peracre

BroadSpec	NumberOf	CO2perTree

ConstMitig	FuelType	Tier	NumberOfl	TotalNumb	DPF	OxidationCatalyst
Crawler Tr	Diesel	Tier 4 Fina	2	2	No Change	0
Excavators	Diesel	Tier 4 Fina	2	3	No Change	0
Graders	Diesel	No Change	0	0	No Change	0
Off-Highwa	Diesel	Tier 4 Fina	7	7	No Change	0
Pumps	Diesel	Tier 4 Fina	5	5	No Change	0
Rubber Tir	Diesel	No Change	0	0	No Change	0
Rubber Tir	Diesel	No Change	0	1	No Change	0
Scrapers	Diesel	No Change	0	0	No Change	0
Sweepers/	Diesel	Tier 4 Fina	1	1	No Change	0
Tractors/Lo	Diesel	No Change	0	0	No Change	0

SoilStabiliz	SoilStabiliz	SoilStabiliz	ReplaceGr	ReplaceGr	ReplaceGr	WaterExpc	WaterExpc	WaterExpc	WaterExpc
1	80	80	1	63	63	1	2	55	55

WaterUnpa	WaterUnpa	WaterUnpa	WaterUnpa	CleanPavedRoadPercentReduction
1	1	0.5	15	53

ProjectSet	IncreaseDe	IncreaseDe	IncreaseDe	IncreaseDi	ImproveWa	ImproveWa	ImproveDe	ImproveDe	IncreaseTr

IncreaseTr	IntegrateB	IntegrateB	ImprovePe	ImprovePe	ProvideTra	ProvideTra	ProvideTra	Implement	LimitParkir

LimitParkir	UnbundleF	UnbundleF	OnStreetM	OnStreetM	ProvideBR	ProvideBR	ExpandTra	ExpandTra	IncreaseTr

IncreaseTr	IncreaseTransitFrequencyHeadwaysPercentReduction

Implement	Implement	Implement	TransitSub	TransitSub	TransitSub	Implement	Implement	Workplace	Workplace
0			0			0		0	

Workplace	Encourage	Encourage	Encourage	Encourage	MarketCor	MarketCor	Employee\	Employee\	Employee\
	0				0		0		2

ProvideRic	ProvideRic	Implement	ImplementSchoolBusProgramPercentFamilyUsing
0		0	

Landscape	Landscape	Landscape	Landscape	Landscape	Landscape	UseLowVC	UseLowVC	UseLowVC	UseLowVC
0		0		0		0	250	0	250

UseLowVC	UseLowVC	UseLowVC	UseLowVC	HearthOnly	NoHearthC	UseLowVC	UseLowVC	UseLowVOCPaintParl
0	250	0	250	0	0	0	0	250

kingValue

ExceedTitl	ExceedTitl	InstallHigh	InstallHigh	OnSiteRer	KwhGener	KwhGener	PercentOfI	PercentOfElectricityUs

seGenerated

ApplianceT	ApplianceL	PercentImprovement
ClothWasher		30
DishWasher		15
Fan		50
Refrigerator		15

tblWaterMitigation

ApplyWate	ApplyWate	ApplyWate	UseReclai	PercentOu	PercentInd	UseGreyW	PercentOu	PercentInd	InstallLowF
0			0			0			0

PercentRe	InstallLowF	PercentRe	InstallLowF	PercentRe	InstallLowF	PercentRe	TurfReduc	TurfReduc	TurfReduc
32	0	18	0	20	0	20	0		

UseWaterE	UseWaterE	WaterEffici	MAWA	ETWU
0	6.1	0		

InstituteRe	InstituteRecyclingAndCompostingServicesWastePercentReduction

tblOperationalOffRoadEquipment

OperOffRc	OperOffRc	OperHours	OperDaysl	OperHorse	OperLoadI	OperFuelType

FleetMixLa	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS
User Defin	0.565791	0.027231	0.167762	0.105611	0.024654	0.005362	0.020779	0.074615	0.001178

UBUS	MCY	SBUS	MH
0.000997	0.004228	0.001044	0.00075

tblStationaryGeneratorsPumpsUse

Generators	NumberOf	Generators	HorsePow	Load_Fact	HoursPerD	HoursPerY	GeneratorsPumpsEquipmentDes

cription

BoilerEquip	NumberOf	BoilerFuelT	BoilerRatin	DailyHeatI	AnnualHea	BoilerEquipmentDescription

tblStationaryUserDefined

UserDefine	UserDefine	TOG_lb_da	TOG_tpy	ROG_lb_d	ROG_tpy	CO_lb_day	CO_tpy	NOX_lb_da	NOX_tpy

SO2_lb_da	SO2_tpy	PM10_lb_(	PM10_tpy	PM2_5_lb_	PM2_5_tpy	CO2_lb_da	CO2_tpy	CH4_lb_da	CH4_tpy

Generators	TOG_EF	TOG_EF_U	ROG_EF	ROG_EF_	CO_EF	CO_EF_U	NOX_EF	NOX_EF_U	SO2_EF

SO2_EF_U	PM10_EF	PM10_EF_	PM2_5_EF	PM2_5_EF	CO2_EF	CO2_EF_U	CH4_EF	CH4_EF_UOM

BoilerEqui	TOG_EF	TOG_EF_	ROG_EF	ROG_EF_	CO_EF	CO_EF_U	NOX_EF	NOX_EF_	SO2_EF

SO2_EF_U	PM10_EF	PM10_EF_	PM2_5_EF	PM2_5_EF	CO2_EF	CO2_EF_U	CH4_EF	CH4_EF_UOM

SubModul	PhaseNam	Season	Remarks
1			
3			There are no choices for sediment landfill so I chose recreational. 80 acres is
4			Schedule is 60 days per season working 6 day weeks as Described in Sedime
5	Grading		Plan Table 3.3-4 says water truck may run 10 hr/day. I assumed 2 hr/day for v
5	Site Preparation		Suction pump projected to run 10 hrs 1 day per year. Average over 60 days is
6			Some of the workers will arrive in 4-door company trucks, so 20 trips per day i
7			Tracking the varioius routes on Google Maps indicates that 2-5% of the trip is
9			Assuming average silt depth at both extraction and landfilling sites is 2 yards,
25			Set Clean Paved Road control efficiency to 53% in accordance with BAAQMD

the size of disposal site #3.I put in a population of 1 because I am trying to avoid CalEEMod DBNull errors.
ent Management Plan
watering these small areas.For hydroseeding truck, 10 hours per maximum day times 5 days per year works out
0.17 hr per day. Plan Table 3.3-4 says water truck may run 10 hr/day. I assumed 2 hr/day for watering these sr
s adequate.Commute assumed origin is Yuba City. Sediment hauling distance is 6-11 miles, 11 assumed. Adju
unpaved, including off-road trucks.A 15 yard dump truck might weigh about 27 tons loaded, so averaging the loa
140,000 cu yd is 14 acres.
CEQA guidance.15 mph on unpaved roads is per FRAQMD Dust Control guidance

to an average of 0.83 hr/day annual average.
nall areas.
isted trips to be 1 long trip per truck per day.
aded and unloaded trips is approximately 16 tons.