ELDORADO NATIONAL FOREST
AMADOR RANGER DISTRICT
BIOLOGICAL ASSESSMENT / EVALUATION FOR BOTANICAL SPECIES:

Foster Meadow Restoration Project
2017

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I. INTRODUCTION

Purpose: Forest Service Manual 2672.42 specifies that a biological evaluation (BE) and a biological assessment (BA) be prepared to determine if a project may affect any USDA Forest Service (FS) sensitive species and US Fish and Wildlife Service (USFWS) threatened, endangered, or proposed species and their designated or proposed critical habitat. This BE/BA is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)). The purpose of this BE/BA is to review the Foster Meadow Restoration Project in sufficient detail to determine to what extent the proposed action may affect any threatened, endangered, proposed, and sensitive (TES) plant species for the project area.

The Amador Ranger District of the Eldorado National Forest proposes a Meadow Restoration Project at Foster meadow.

Location:. Foster meadow, the project area is located approximately 40 miles east of Jackson, Ca., one mile north of State Highway 88, in the vicinity of the Peddler Hill maintenance station.

Species:

Listed

A species list was obtained from the USFWS to identify threatened, endangered, or proposed listed species that could occur, or be affected by projects on the Eldorado National Forest from the USDI Fish and Wildlife Service pursuant to Section 7 (c) of the Endangered Species Act (current as of August 2, 2017).

Currently the only TEP plant species expected to occur on the Eldorado NF is *Packera layneae*. Potential habitat for *Packera layneae* is not found within the proposed project area.

Sensitive

There are no known occurrences of within the project area. Potential habitat for the following species is known to occur in the project area:

1. *Botrychium ascendens*
2. *Botrychium crenulatum*
3. *Botrychium lunaria*
4. *Botrychium minganense*
5. *Botrychium montanum*
6. *Botrychium pedunculosum*
7. *Bruchia bolanderi*
8. *Helodium blandowii*
9. *Meesia uliginosa*
10. *Ophioglossum pusillum*

Table 1 lists all Sensitive plant taxa from the ENF. No other Threatened, Endangered, Proposed, or Sensitive (TEPS) plant taxa have known occurrences or potential habitat on the ENF. Taxa that do not have potential habitat in the project area are not further analyzed in this document. Botanical surveys conducted for the proposed project focused on species with potential habitat. Botanists searched for these habitats (e.g., meadow) as well as for the Sensitive taxa.

Table 1. Habitat potential of the Proposed Foster Meadow Restoration Project for TEPS plant taxa known or suspected to occur on the Eldorado National Forest.

Species	Status[1]	On ENF[2]	Known in Project Area	Suitable Habitat in Project Area	Rationale For Determination Of No Suitable Habitat/No Effect
Three-bracted onion (Allium tribracteatum)	S	P	No	No	Grows on open ridges with gravelly lahar soils (lava cap communities) in chaparral and lower & upper montane coniferous forests from ~ 3,300 to 10,000 feet in elevation.

El Dorado manzanita (Arctostaphylos nissenana)	S	K	No	No	Grows on highly acidic slate and shale soils and is often associated with closed-cone conifer forest from about 1,400 to 3,600 feet.
Big-scale balsamroot (Balsamorhiza macrolepis var. macrolepis)	S	P	No	No	Grows in chaparral, vernally moist meadows & grasslands, grasslands within oak woodland, and ponderosa pine forest below 4,600 feet.
Upswept moonwort (Botrychium ascendens)	S	P	No	Yes	Grows in lower montane coniferous forest, meadows, and seeps from 4,900 to over 7,500 feet in elevation.
Scalloped moonwort (Botrychium crenulatum)	S	K	No	Yes	Grows in fens, lower montane coniferous forest, meadows, seeps, and freshwater marshes from 4,900 feet to 10,500 feet in elevation.
Common moonwort (Botrychium lunaria)	S	P	No	Yes	Grows in meadows, seeps, subalpine and upper montane coniferous forest from 7,450 feet to over 11,000 feet in elevation.
Mingan moonwort (Botrychium minganense)	S	K	No	Yes	Grows in fens, lower and upper montane coniferous forest, meadows, and seeps from 4,900 to 6,750 feet.
Mountain moonwort (Botrychium montanum)	S	K	No	Yes	Grows in lower and upper montane coniferous forest, meadows, and seeps from 4,900 feet to 7,000 feet in elevation.
Paradox moonwort (Botrychium paradoxum)	S	K	No	Yes	Grows in lower and upper montane coniferous forest, meadows, and seeps from 4,900 feet to 7,000 feet in elevation.
Stalked moonwort (Botrychium pendunculosum)	S	P	No	Yes	Grows in lower and upper montane coniferous forest, meadows, and seeps from 4,900 feet to 7,000 feet in elevation.
Bolander's bruchia (Bruchia bolanderi)	S	K	No	Yes	Grows in meadows and fens in montane and subalpine communities from about 5,500 to 9,000 feet. Grows in ephemeral habitats such as erosional ditches or small streamlets through wet meadows.
Pleasant Valley mariposa lily (Calochortus clavatus var. avius)	S	K	No	No	Grows in openings in mixed conifer & ponderosa pine forest, usually on ridgetops and south-facing slopes from 2,500 to 5,600 feet.
Mountain lady's slipper (Cypripedium montanum)	S	P (K on inholding)	No	No	Grows in moist areas and upland sites with northerly aspects, loamy soils and shade, from 3,500 to 5,700 feet (generally <5,000 ft).
Branched Collybia (Dendrocollybia racemosa)	S	K	No	No	Grows on remains of decayed mushrooms or occasionally in duff/leaf litter, in mid-mature to old-growth stands of mixed hardwood-conifer forests. Evidence of timber harvest at some extant occurrences.
Tahoe draba (Draba asterophora var. asterophora)	S	H	No	No	Restricted to rocky ledges and talus slopes in subalpine and alpine habitats above 8,200 feet.
Cup Lake draba (Draba asterophora var. macrocarpa)	S	K	No	No	Restricted to sandy slopes, rocky ledges, and talus slopes in subalpine and alpine habitats above 8,200 ft.

Tripod buckwheat (Eriogonum tripodum)	S	K	No	No	Grows on serpentine soils in foothill and cismontane woodlands below 5,300 feet.
Blandow's bog-moss (Helodium blandowii)	S	P	No	Yes	Grows in wet meadows, fens, & seeps in subalpine coniferous forest and alpine lakes from 6,100 to 9,000 feet.
Parry's horkelia (Horkelia parryi)	S	K	No	No	Grows on stony, disturbed, slightly acidic soils in open chaparral and cismontane woodland below 3,400 feet.
Hutchison's lewisia (Lewisia kelloggii ssp. hutchisonii)	S	K	No	No	Grows in openings in upper montane coniferous forest, often on slate soils and on soils that are sandy granitic to erosive volcanic from 4,800 to 7,000 feet.
Kellogg's lewisia (Lewisia kelloggii ssp. kelloggii)	S	K	No	No	Grows on granitic and volcanic balds from about 5,000 to 8,000 feet.
Long-petaled lewisia (Lewisia longipetala)	S	K	No	No	Restricted to subalpine & alpine slopes or basins with deep snow accumulations, above 8,200 feet.
Saw-toothed lewisia (Lewisia serrata)	S	K	No	No	Restricted to steep, nearly vertical cliffs in inner gorges of perennial streams and rarely near seeps and intermittent streams. Grows between 2,800 and 4,800 feet in the American River watershed.
Broad-nerved hump-moss (Meesia uliginosa)	S	P	No	Yes	Grows in permanently wet, primarily spring-fed meadows and fens in montane to subalpine coniferous forest from 4,200 to 9,200 feet.
Elongate Copper Moss (Mielichhoferia elongata)	S	P	No	No	Grows on metamorphic, sedimentary, limestone, and serpentine rock outcrops that often contain copper or other heavy metals and that are seasonally moist or less commonly on moist soil. ponderosa pine. Grows from sea level to 3550 feet.
Yellow bur navarretia (Navarretia prolifera ssp. lutea)	S	K	No	No	Grows in openings in or adjacent to mixed conifer forest or cismontane woodland on rocky ridgelines, saddles, or eroding ephemeral drainages from 2,300 to 5,000 feet.
Adder's tongue (Ophioglossum pusillum)	S	P	No	Yes	Grows in moist habitat including wet meadows and roadside ditches.
Layne's ragwort (Packera layneae)	T, S	K	No	No	Grows on rocky, gabbroic or serpentinitic soils in chaparral and cismontane woodland below 3,000 feet.
Veined water lichen (Peltigera gowardii)	K	K	No	No	Grows on rocks in cold, unpolluted spring-fed streams without marked seasonal fluctuation. Submerged most of year. Peak flows must not scour the rocks & gravels where this species attaches.
Stebbins' phacelia (Phacelia stebbinsii)	S	K	No	No	Grows on dry, open, rocky sites (bedrock outcrops, rubble or talus) on ledges or moderate to steep slopes and on damp, mossy inner gorges from 2,000 to 6,800 feet.

Olive phaeocollybia (Phaeocollybia olivacea)	S	P (K on inholding)	No	No	Conifer and hardwood forests where it grows in the humus layer. Logging disturbance, when present, is not intense (e.g. clear-cut or patch-cut).
Whitebark pine (Pinus albicaulis)	C, S	K	No	No	Whitebark pine typically occurs on cold and windy high elevation sites in western north America (7,000-12,000 feet).
Sierra blue grass (Poa sierrae)	S	K	No	No	Grows in lower montane coniferous forest on steep, shady, moist slopes from 1,200 feet to 3,800 feet.

[1] S = Forest Service Sensitive; T =Federally Listed as Threatened; C= Candidate Species

[2] H = historic record; K = known to occur on ENF; P = suspected to occur on ENF

Field reconnaissance: The project area was surveyed for Sensitive plants and invasive plants in 2009 and 2016. Surveys were intuitive targeting potential habitat in the project area. In 2009 *Botrychium simplex* was found growing in a fen within the meadow. Additional surveys in 2016 extended the known occurrence of *Botrychium simplex* and also found an additional population within the meadow.

No formal or informal consultation with the USFWS has been conducted since TEP species or potential habitat does not exist in or near the project area.

III. CURRENT MANAGEMENT DIRECTION

Endangered Species Act

The purpose of the Endangered Species Act (ESA) is to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved and to provide for the conservation of such endangered species and threatened species. The ESA directs federal agencies to ensure that actions authorized, funded, or carried out by these agencies are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of their critical habitats (ESA Section 7(a)(2)).

Executive Orders

Executive Order 13112 of February 3, 1999 documents Presidential direction to affected federal agencies to "…identify actions subject to the availability of appropriations... encourage planning and action at local, State, and regional ecosystem-based levels... and prepare and issue Invasive Species Management Plans.... to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive (plant) species cause."

Forest Service Manual

Forest Service Manual direction (FSM 2672.1 and FSM 2672.43) requires that activities be reviewed for potential effects on rare species and outlines policy, objectives and procedures.

The Forest Service Manual (FSM 2670) (USDA Forest Service 2005) also directs national forests to assist states in achieving conservation goals for endemic species; complete biological evaluations of programs and activities; avoid and minimize impacts to species with viability concerns; analyze the significance of adverse effects on populations or habitat; and coordinate with states and USFWS. The Forest Service Manual (2670.15) further defines sensitive species as those plant species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trend in numbers, density or habitat capability that would reduce a species distribution.

FSM 2670.32 states to "avoid or minimize impacts to species whose viability has been identified as a concern." "A [viable] population…has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range within the planning area" (FSM 2670.5). If impacts cannot be avoided then the Forest must analyze the significance of the potential adverse effects on the population or its habitat within the area of concern and on the species as a whole. Impacts may be allowed but the decision must not result in a trend toward federal listing.

FSM 2670.22 directs national forests to “maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.” To comply with this direction, Forests are encouraged to track and evaluate effects to additional species that may be of concern even though they are not currently listed as sensitive. Such plant species are referred to as Special Interest or watch list species.
Forest Service Manual 2900 (USDA Forest Service 2011) contains national direction for noxious weed management. Specific policies included in FSM 2900 include:

- Determine the risk of introducing, establishing, or spreading invasive species associated with any proposed action, as an integral component of project planning and analysis, and where necessary provide for alternatives or mitigation measures to reduce or eliminate that risk prior to project approval.

- Ensure that all Forest Service management activities are designed to minimize or eliminate the possibility of establishment or spread of invasive species on the National Forest System, or to adjacent areas. Integrate visitor use strategies with invasive species management activities on aquatic and terrestrial areas of the National Forest System. At no time are invasive species to be promoted or used in site restoration or re-vegetation work, watershed rehabilitation projects, planted for bio-fuels production, or other management activities on national forests and grasslands.

- Use contract and permit clauses to require that the activities of contractors and permittees are conducted to prevent and control the introduction, establishment, and spread of aquatic and terrestrial invasive species. For example, where determined to be appropriate, use agreement clauses to require contractors or permittees to meet Forest Service-approved vehicle and equipment cleaning requirements/standards prior to using the vehicle or equipment in the National Forest System.

Land and Resource Management Plan (LRMP)

TES plants

In the Eldorado National Forest LRMP (USDA FS 1989), under Management Practice 49, the General Direction is to "provide for protection and habitat needs of sensitive plants so that Forest activities would not jeopardize the continued existence of such species". It is reiterated several times in the LRMP that “sensitive plants will be managed to insure that species do not become threatened or endangered because of Forest Service actions”. Under the Issue Resolution for Fish and Wildlife on page 2-15, the LRMP states that “sensitive plants are protected as if they are threatened and endangered species”.

Special Interest Areas

Management Emphasis:
“Manage the areas principally for their recreation use substantially in their natural condition. Preserve the integrity of the special interest features for which the areas were established.”

Sierra Nevada Forest Plan Amendment (SNFPA)

The Record of Decision (ROD) for the 2004 Sierra Nevada Forest Plan Amendment identified the following direction applicable to motorized travel management and TES plants:

- Bog and Fen Habitat (SNFPA ROD page 65, S&G #118): Prohibit or mitigate ground-disturbing activities that adversely affect hydrologic processes that maintain water flow, water quality, or water temperature critical to sustaining bog and fen ecosystems and plant species that depend on these ecosystems. During project analysis, survey, map, and develop measures to protect bogs and fens from such activities as trampling by livestock, pack stock, humans, and wheeled vehicles.

- Sensitive Plant Surveys (Corrected Errata, April 19, 2005): Conduct field surveys for TEPS plant species early enough in project planning process that the project can be designed to conserve or enhance TEPS plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook (FSH 2609.25.11). If additional field surveys are to be conducted as part of project implementation, survey results must be documented in the project file. (Management Standard & Guideline 125). The standards and guidelines provide direction for conducting field surveys, minimizing or eliminating direct and indirect impacts from management activities, and adherence to the Regional Native Plant Policy (USDA Forest Service 2004).

Desired Condition

The main goal of the ENF Forest Sensitive Plant Program is to maintain viable populations of sensitive plant species. Conversely, the goal of the ENF Weeds Program is to eradicate or control the spread of noxious and other non-native invasive plants on these federal lands, and thus prevent or minimize impacts to other resources.

The current condition of Sensitive plant species on the Eldorado National Forest reflects the effects of past and present management activities. Presently there is not enough evidence to suggest whether Sensitive plant populations and/or ranges are increasing, decreasing, or stable. Monitoring of occurrences, which detects decreases or increases from year to year, may merely reflect normal variation in individual numbers as a response to annual climatic changes. There is also considerable uncertainty regarding future changes in local climatic patterns. Given the lack of data needed to take a proactive management approach to these Sensitive plant species, the best available interim management approach is to minimize impacts to known occurrences of Sensitive plant species while allowing expansion into suitable unoccupied habitat. This strategy would also maximize the diversity of habitat and microsite conditions (slope, aspect, elevation, etc) for Sensitive plants on the Eldorado National Forest which may be important in face of future climate change. While much is unknown about the potential long-term effects of a warming and/or drying climate on Sensitve plant species, in the near term, maintaining habitat diversity across the species range may be the best means to manage for species which could require unique microsites to persist under future climatic conditions.

IV. PROJECT DESCRIPTION

The Amador Ranger District, El Dorado National Forest and project stakeholders are seeking to restore the natural hydrologic functions of the Foster Meadow system to provide improved water quality, timing of flows and enhanced aquatic and terrestrial habitats onsite and downstream. Attendant with that objective is to remove barriers to aquatic organism passage in this reach of the Middle Fork Cosumnes River. The Foster Meadow Restoration Project proposes to meet these objectives by filling gullies within the meadow using local fill taken from meadow margins and terraces, and installing an aquatic organism passage structure at Foster Meadow road (9N14) crossing. This will require excavation and placement of approximately 22,533 cubic yards in seven (7) total plugs to eliminate the existing gullies as a conduit for flow. The design of the proposed action applies the principles of fluvial geomorphology and the science of landscapes formed by flowing water, to understand the processes that have governed the development of the meadow through the Holocene period (last 10,000 years). This method also helps determine the possible mechanisms that have led to channel degradation and loss of floodplain connection/ecosystem function. This approach combines quantitative data with qualitative observations and historical overviews of land uses, both onsite and watershed-wide.

Table 2 summarizes the action items proposed to restore the hydrologic functions of Foster Meadow utilizing a modified pond-and-plug restoration technique. The design for Foster Meadow is a near-complete gully fill ("plugs"), with the majority of fill material generated from terrace grading and a smaller amount coming from four small borrow ponds along the margins of the meadow. The purpose of the fill material is to raise/restore the base elevation of surface water flow in the meadow. Generally, surface flows will be re-directed to remnant channel(s) elsewhere in the meadow. Surface flows would only cross the "plugs" during floods. Specific features of the project design are discussed in greater detail in the Meadow Component section, below.

Table 2. Action items of the Foster Meadow Restoration Project

Item Number	Action
1	Fill and stabilize the gullied channel of the Middle Fork Cosumnes River in Foster Meadow through (Figures 2 through 4): • Excavation of approximately 22,500 yd^3 of material from 4 small borrow pits along the margins of the meadow and 4 terrace cuts areas in the meadow. This material will be used to construct the plugs. • Construction of 7 plugs in the meadow to achieve the partial or complete filling or approximately 4,400 feet of channels. The plugs will total approximately 3.1 acres in size. • Construction of 9 in-channel rock riffles in the meadow just down-gradient of the plugs and ponds. It is expected that rock for the riffles will be imported from the Tragedy Pit. Motorized equipment in the meadow would be used in order to accomplish this action item. Approximately 20.72 acres are wet meadow floodplain, 2.20 acres are intermittent and perennial channels, and 4.51 acres are upland.

Item Number	Action
2	Improve aquatic organism passage at Forest Highway 54 crossing by: • Placing rock/soil/vegetation in the channel and floodplain to raise the elevation and eliminate current 'waterfall' at the main culvert. Rock will be imported from Tragedy Pit for this component. • Replacing the existing culvert and adding at least three culverts at floodplain elevation. Motorized equipment would be used in order to accomplish this action item.
3	Plant riparian vegetation throughout portions of the meadow in those areas that are currently deficient in riparian vegetation. Sod and willow transplants would be excavated and placed using heavy equipment. Native seeding, planting of container stock, and willow plantings would be done by hand.

The 27-acre Foster Meadow Project area can be delineated into several reaches of work separated by reaches that are still functional. The functional reaches are at risk from headcuts moving upstream from the degraded reaches. Figure 1 (Vicinity and Project Area Map) shows the relative location of the treatment reaches under the proposed action. At the upstream end of the project, the culvert at the Forest Highway (FH) 54/Foster Meadow Road (9N14) crossing is a fish barrier and a risk for failure. Downstream of the road crossing there are three (3) distinct meadow sections: Pocket 1, Pocket 2, and Main Meadow.

Meadow Restoration Component

Ultimately, the design concept for degraded meadows in the Foster Meadow project areas is to implement near-complete gully fill. The fill material would be excavated from four (4) small borrow ponds along the margins of the meadow and grading four (4) areas of in-meadow terrace down to the design floodplain elevation. This design significantly reduces risk associated with frequent overland flow over plugs and into ponds. Given meadow slopes of 1% -3% and a gully near the center of the meadow, the more traditional pond and plug technique would have some risk.

The principal function of the borrow ponds is to provide native fill material for plug construction. Since the ponds will fill with groundwater and maintain ponded water year-round, habitat features and diversity are incorporated into their construction. These include varying water depths, islands, peninsulas, basking logs, etc., which are determined as fill needs are met. Topsoil is removed and stockpiled adjacent to the plug fill zone to top dress the completed plug. Meadow vegetation such as sod mats and willow wads would be salvaged by excavating and stockpiling the material to use for revegetation of the completed project.

All plugs and borrow ponds are sited and configured to accommodate surface and subsurface through flow as well as adjacent hillslope-generated surface and groundwater inflows. Plugs are constructed with wheel loader(s) to provide wheel compaction of the fill. The compaction levels are intended to match the porosity/transmissivity of the native meadow soils. This allows moisture to move freely within the plug soil profile and support erosion resistant meadow vegetation for long term durability as well as preventing preferential pathways for subsurface flows either in the plug or the native material.

Design features specific to the Pocket Meadows #1 and #2 are as follows (Figure 2). All gully fill for Pocket Meadow #1 will be generated from the one borrow pond excavated into the timbered terrace to the south. Approximately 7 trees (red fir/lodgepole) will be incorporated into the plug fill surfaces and the remnant channel for velocity reduction. This borrow pond will provide an off-channel, in-forest, perennial surface water habitat feature. The majority of the earth fill for the gully in Pocket Meadow #2 will be generated from cutting terrace features down to floodplain elevation. This will provide more meadow area and floodplain extent, but not open water habitat. One borrow pond will be excavated into the forested terrace to the north. This will be an off-channel, in-forest, perennial surface water habitat feature. Approximately 4 red fir trees would be removed and used for habitat in the pond.

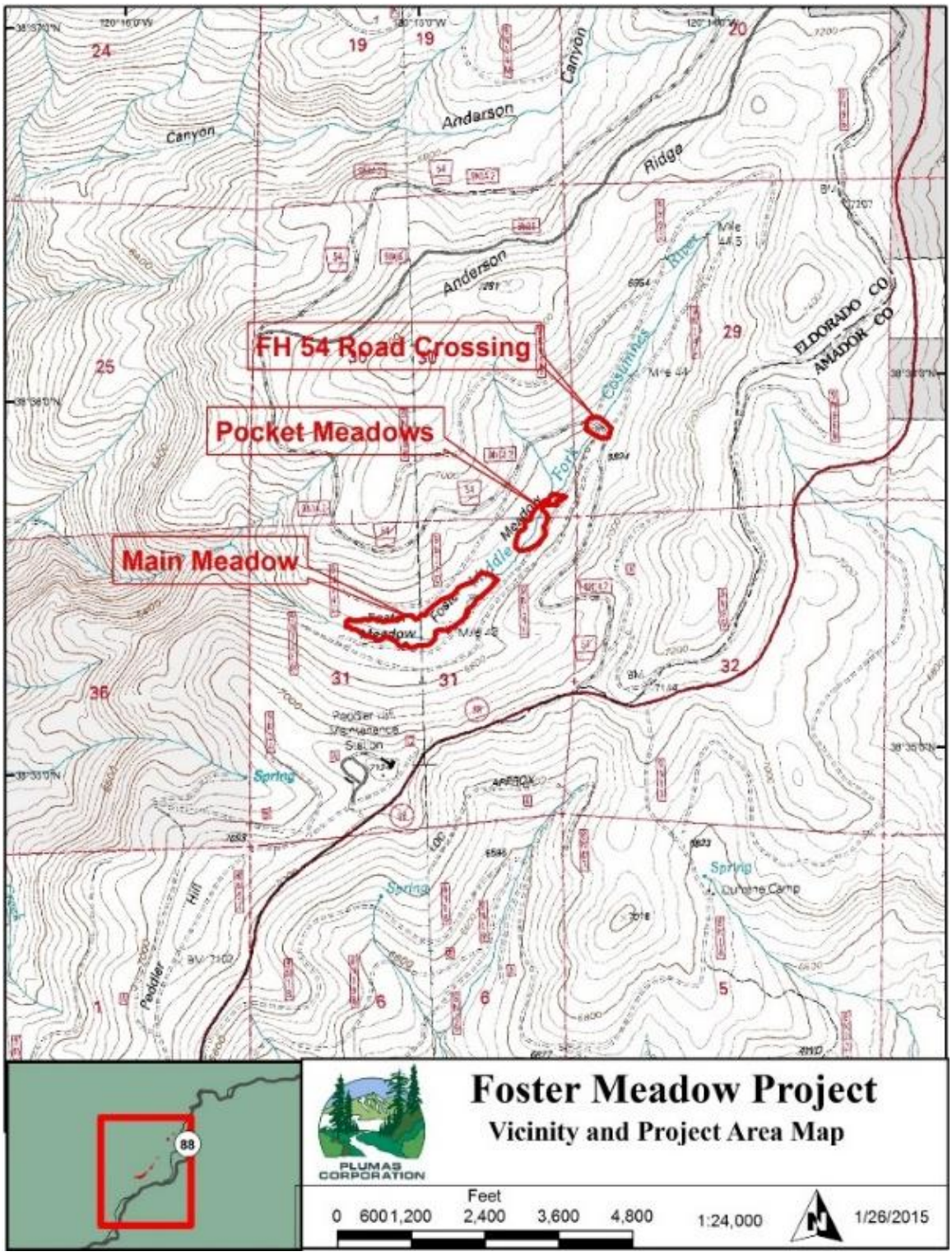

Figure 1. Foster Meadow Restoration Project Treatment Reaches.

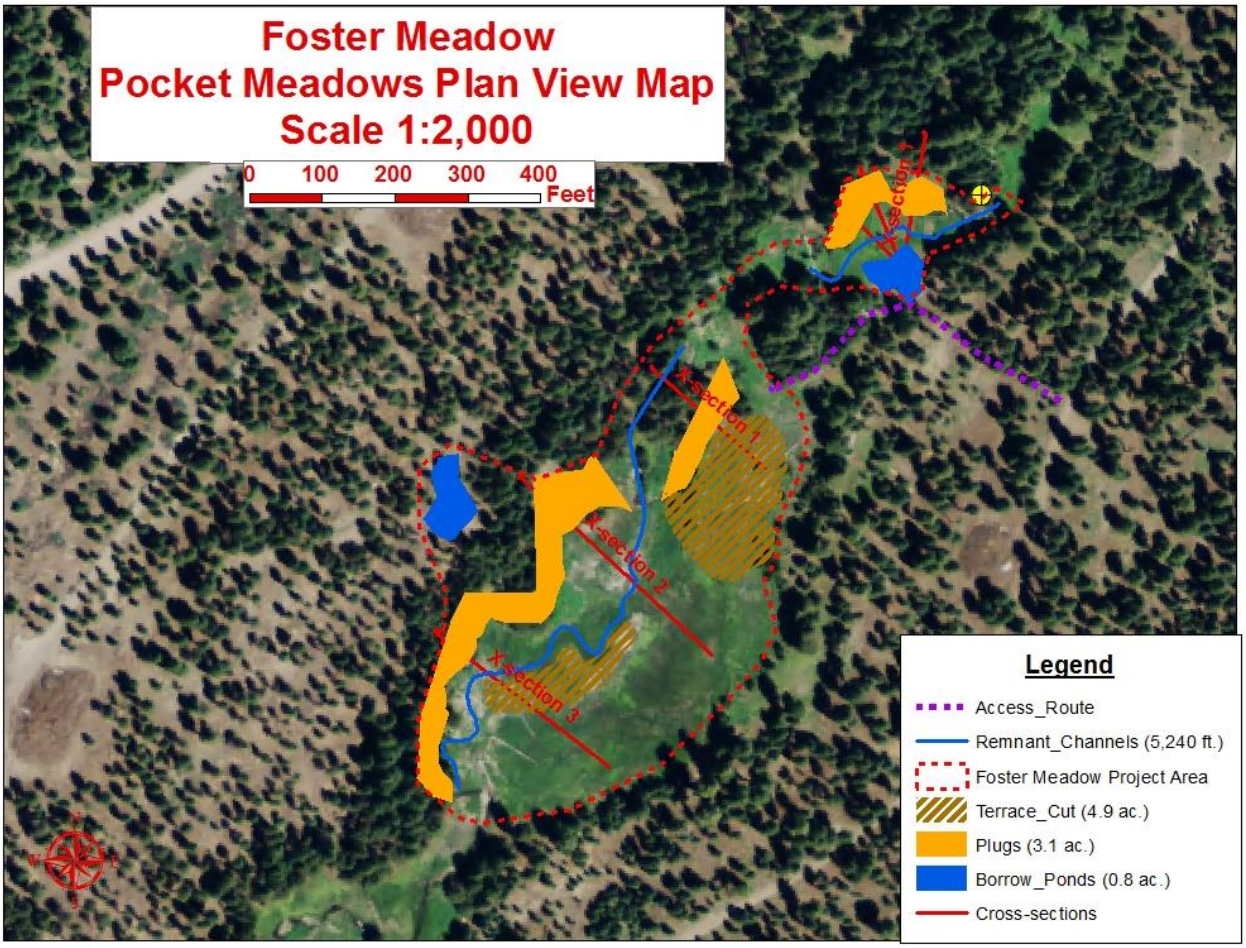

Figure 2. Foster Pocket Meadows Restoration Design Schematic.

Design features specific to the Main Meadow include having the bulk of the gully fill being generated from terrace cut (Figure 3). This will reduce shear stresses on the remnant channel and reverse the xeric trend on approximately 5 acres of wet meadow that are currently transitioning to upland vegetation. The lower end of the project will require using 9 rock riffles to raise the base level of the channel, in lieu of gully fill, in its existing alignment. The installation of riffles in the existing channel will raise the base level at the downstream end of the project, allowing a seamless transition of the new

meadow gradient to the existing channel at the downstream end of the project. All access for equipment and materials will be on existing open or closed roads and recent timber harvest skid trails and landings.

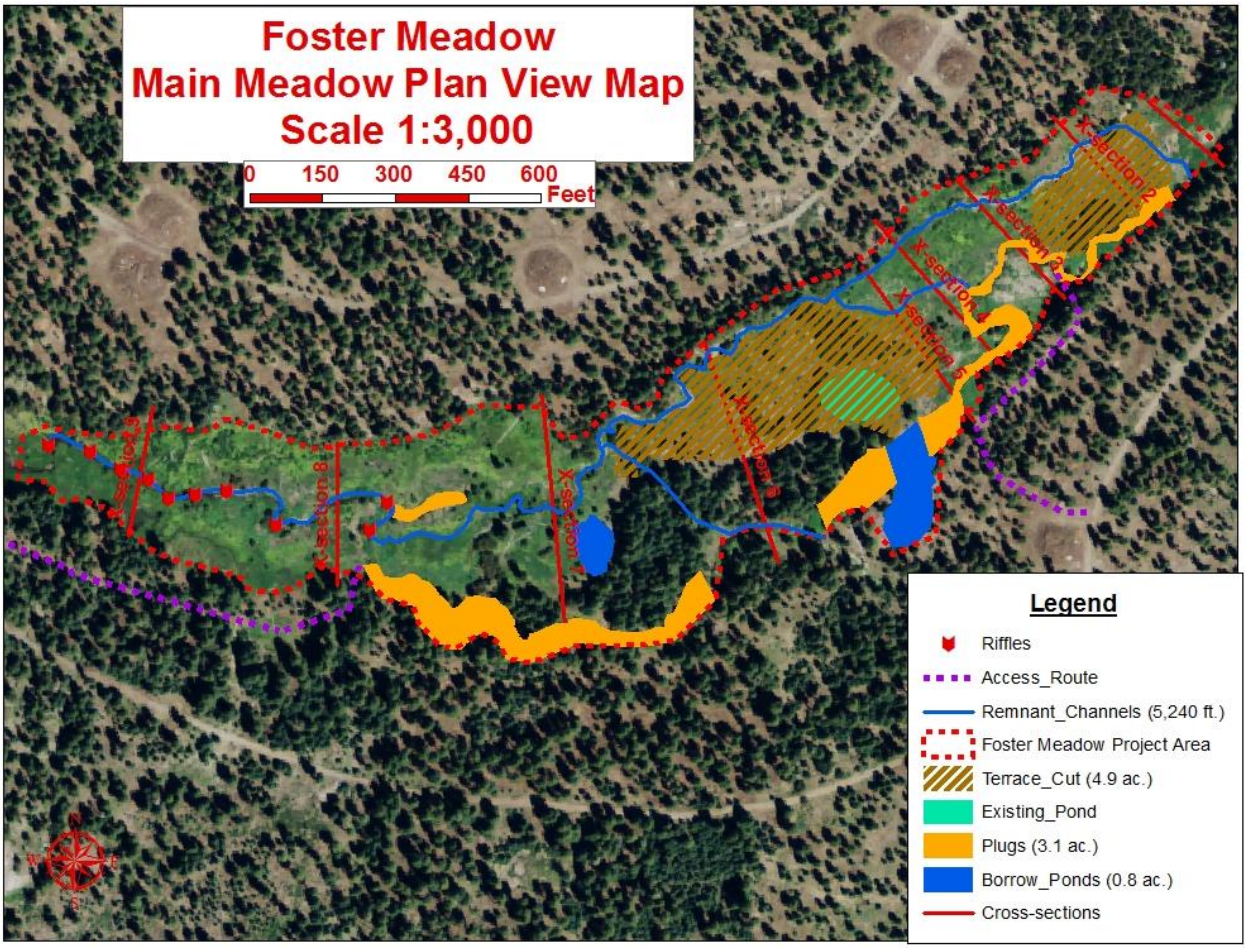

Figure 3. Foster Meadow Main Meadow Restoration Design Schematic.

Aquatic Passage Component

The second phase of the project will be construction of the AOP. The AOP will reduce the backwater effect of high flow from a single culvert with additional culverts set at floodplain elevation. The floodplain culverts would be installed in the road crossing with invert elevations approximately 1 foot above the invert elevation of the channel culvert. Ideally, no less than 3 additional culverts should be installed. These floodplain culverts would be 'squash' type, and set at as close an interval practicable across the floodplain. The AOP also includes the construction of a valley grade structure (VGS). The VGS will provide a durable, aquatic organism-passable channel/floodplain transition reach (125 feet long) between the road crossing elevation and downstream channel elevation, which would eliminate the current "waterfall" at the culvert outlet. Because the project is a forest highway road crossing, the AOP and VGS will be engineered. The VGS will require approximately 500 yds^3 of 2.0-foot minus rock and soil, sourced from the USFS Tragedy Pit (approximately 8 miles from the Project site). A water truck will be required on-site for dust suppression during rock transport. One

excavator (36” bucket) and four rock trucks will be required to load and transport rock to the Project site, and placement of rock at the VGS will require the use of a second excavator.

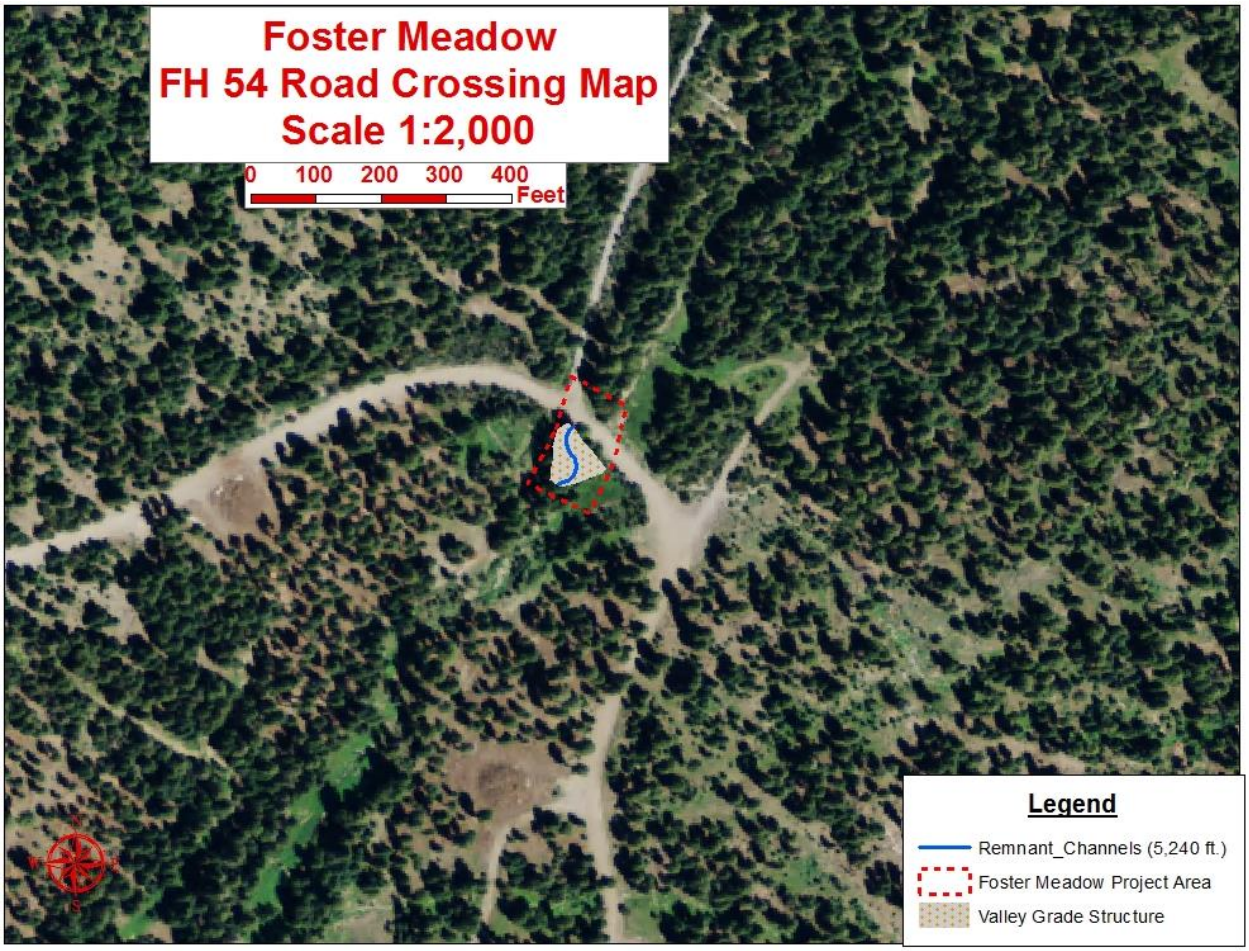

Figure 4. Foster Meadow FH 54/Foster Meadow road (9N14) crossing aquatic passage structure.

Revegetation

Upon completion, all plug surfaces are ripped to a depth of 12” to facilitate rainfall infiltration, dressed with the recovered topsoil, and seeded with native seed. Sod mats, willow wads, and other meadow vegetation from fill and borrow sites will be transplanted to plug edges, terraces and key locations on the remnant channel. Willow stakes will be planted next to stream channels and disturbed areas following construction in the fall to reduce immediate post-project vulnerability to erosion. In the spring following project construction, disturbed areas in the meadow and on graded terraces will be seeded using native seeds collected from Foster Meadow. In key locations during spring seeding, there will also be supplementary willow staking and hand-planting of container stock from locally-sourced material. Container stock will consist of rhizomatous species that can quickly colonize the terrace cuts and plugs. ENF staff will monitor survival of willow cuttings and percent cover of seeded areas for three years following construction. Successful revegetation will be achieved with 70% survival of willow cuttings and 50% cover of seeded areas. Any areas that do not meet the survival or cover area would be replanted.

Project Monitoring

The Foster Meadow Restoration Project is expected to benefit multiple resources by restoring the hydrological and ecological functions of the meadow floodplain system. The purpose of project monitoring is to measure project effectiveness on water quality, timing of flows, and enhancement of wildlife and aquatic habitats. Monitoring parameters and methods that would be utilized are outlined in Table 3.

Table 3. Project Effectiveness Monitoring of the Proposed Action

Monitoring Parameter	Method	Responsible Party
Water Temperature	Water temperature data loggers installed above and below project area May-Sept*	Plumas Corporation**
Aquatic Habitat	California Rapid Assessment Method (CRAM) and Forest Service Stream Condition Inventory (SCI) conducted once pre- and post-project	Plumas Corporation (CRAM); USFS-ENF (SCI)
Groundwater	4 groundwater wells (approximately 6 to 12 ft in depth) made of 3/4" galvanized perforated pipe, measured monthly*	Plumas Corporation**
Stream Flow	Staff gage and pressure transducer installed at the bottom of project area; monthly* manual calibration flow measurements; quarterly* collection of oxygen isotope samples and measurement of electrical conductivity (EC) from inflows, springs, and wells	Plumas Corporation**
Sediment Supply	Channel cross-section surveys; CRAM and SCI	Plumas Corporation (CRAM); USFS-ENF (SCI)
Meadow Vegetation	All revegetation areas would be monitored for three years following project completion. Monitoring will quantify willow survival and percent cover of native meadow vegetation.	USFS-ENF

**As access permits*
***Plumas Corporation has secured funding for monitoring through 2019, and is working with the Cosumnes Coalition so that this group can continue monitoring outside of the existing funding window.*

Design Criteria

The following mitigation measures and coordinating requirements are incorporated into the Proposed Action:

Air Quality - Soil-disturbing activities that generate fugitive dust PM10 emissions that are visible beyond the project property lines would be controlled through the implementation of the following measures as needed:

- Construction fill and cut areas would be watered as necessary to prevent visible emissions from extending more than 100 feet beyond the active work areas unless the area is inaccessible to watering vehicles due to slope conditions or other safety factors.
- Disturbed surface areas would be watered in sufficient quantity and frequency to suppress dust and maintain a stabilized surface.
- At least 80 percent of all inactive disturbed surface areas would be watered on a daily basis when there is evidence of wind driven fugitive dust, excluding any areas which are inaccessible due to excessive slope or other safety conditions.
- All unpaved roads used for any vehicular traffic would be watered at least once per every two hours of active operations.
- A water truck will be available on site. Water will be drafted from Lower Bear River Reservoir, approximately one-quarter mile from the project area. See the aquatic resources design criteria for aquatic resource protection measures to be implemented during drafting activities.

Range – There are no active range allotments in the project area.

Heritage – Management measures, other than avoidance, are not required to protect heritage resources from project activities (Foster Meadow Restoration Design Cultural Resource Report, R2016-05-03-10015, 9/09/2016). Known historic properties will be flagged for avoidance prior to project implementation. This does not fully eliminate the chance of discovering unrecorded sites or subsurface remains within the project boundary. If project ground disturbance should expose a cultural deposit, disturbance activities will be suspended until a qualified archaeologist can examine the area, evaluate the material, and adequate protection measures are incorporated. In the event that human remains are uncovered during project activity, project managers must stop work and contact El Dorado National Forest. If the remains are determined to be of Native American origin, both the Native American Heritage Commission and any identified descendants shall be notified (Health and Safety Code 7050.5, Public Resources Code Section 5097.94 and 5097.98).

Terrestrial Wildlife – Should project activities take place during the nesting/reproductive periods for these species (February 15-September 15), surveys of the project adjacent CA spotted owl, and northern goshawk Protected Activity Centers (PACs) would be conducted in an attempt to determine nesting status and species presence. Based on the survey results efforts will be made to minimize potential disturbance impacts based on recommendations of the project biologist.

Aquatic – There are no LOPs proposed for aquatic and riparian species. The proposed activities meet the standards and guidelines for aquatic and riparian dependent species. Additional design criteria for botanical species, hydrology, and soils provide additional protection measures for aquatic resources.

- The project activities will conform to the conservation measures and terms and conditions requirements in the Biological Opinion (USFWS 12/19/2014), and subsequent letter which appends this and other projects to that document (USFWS 02/08/2018).
- Visual Encounter surveys will be conducted for Sierra Nevada yellow-legged frogs by a qualified forest service biologist within 24 hours of construction at the Foster Meadow Road 9N14 stream crossing and within the entire Foster Meadow project area.
- If the Sierra Nevada yellow-legged frog are found within the project area during project implementation, their safety shall be assessed by qualified personnel and dealt with according to the Terms and Conditions described in the 2014 Programmatic Biological Opinion issued by the US Fish and Wildlife Service.
- Existing waterholes and other aquatic sites including ponds, lakes and streams used for water drafting would be surveyed for Aquatic TES species and flow levels taken prior to use. In the event TES species are found to occur at drafting sites; sites will not be used and future surveys would be conducted by an aquatic specialist to determine presence of potential populations. Dufrene Pond, a nearby manmade pond designated for drafting, contains a small breeding population of SNYLF and will **not** be used for drafting water for dust abatement or other construction needs.
- The use of low velocity water pumps and screening devices for pumps (per S&G 110) will be utilized during drafting for project treatments to prevent mortality of eggs, tadpoles, juveniles, and adult SNYLF. A drafting box measuring 2 feet on all sides covered in a maximum of 0.25 inch screening is required.

Hydrology – Construction activities in Foster Meadow would occur during the time of year when the flow of the Middle Fork Cosumnes River is at its lowest. This typically occurs between August 1 and October 30. Required permits would be obtained including, at the least, the 404 permit from the U.S. Army Corps of Engineers and the 401 Permit from the Central Regional Valley Water Board. Additionally, construction would be supervised on-site by at least one person who has worked on at least one previous pond and plug project. Watershed mitigation measures also would include the use of Best Management Practices (BMPs) to protect water quality. The following management requirements from the U.S. Forest Service Region 5 *Water Quality Management Handbook* (USDA 2011) would be applied to prevent impacts to on-site and downstream water quality during implementation:

- **BMP 1.18 Meadow Protection –** The objective of this BMP is to avoid damage to ground cover, soil, and the hydrologic function of meadows.
- **BMP 2.5 Water Source Development and Utilization -** The objective of this BMP applies to dust abatement and other management activities requiring the use of water while protecting and maintaining water quality. Water may be needed to assist in construction of structures. Approved drafting sites designated by the district hydrologist would be utilized.
- **BMP 2.8 Stream Crossings** – This BMP minimizes water, aquatic and riparian resource disturbances and related sediment production when constructing, reconstructing, or maintaining temporary and permanent water crossings.
- **BMP 2.11 Equipment Refueling and Servicing -** This BMP prevents pollutants such as fuels, lubricants, bitumens and other harmful materials from being discharged into or near rivers, streams and impoundments, or into natural or man-made channels. Servicing and refueling activities would be located a minimum of 100 feet away from the meadow edge. Site specific locations for equipment fueling would be identified prior to or during project implementation. A non-porous mat or equivalent would be used for the refueling at the staging area.
- **BMP 2.13 Erosion Control Plan -** The requirements of this BMP are met through: 1) the Design Features for hydrology and soil resources that are in the proposed action, 2) the erosion control measures and monitoring that will be contained in the 404 permit (U.S. Army Corps of Engineers) and 401 Permit (State Water Quality Control Board, and 3) other applicable BMP's in the 2011 WQMH as listed in this section.
- **BMP 5.3 Tractor Operation Limitation in Wetlands & Meadows –** The objective of this BMP is to limit turbidity and sediment production resulting from compaction, rutting, run-off concentration, and subsequent

erosion by excluding the use of mechanical equipment in wetlands and meadows except for the purpose of restoring wetland meadow and meadow function.

- **BMP 7.1 Watershed Restoration -** The objective of this BMP is to repair degraded watershed conditions and improve water quality and soil stability. Restoration measures described herein reflect state-of-the-art techniques and have been chosen to custom fit the unique hydrologic, physical, biological and climatic characteristics of Foster Meadow. The proposed design for restoration of Foster Meadow restores the meadow condition and hydrologic function to the watershed as described in this document.
- **BMP 7.4 Forest and Hazardous Substance Spill Prevention Control and Countermeasure (SPCC) Plan -** The objective of this BMP is to prevent contamination of waters from accidental spills. BMP 7.4 would be implemented when a total oil product at a site exceeds 1,320 gallons or any single container exceeds 660 gallons. The forest has a SPCC spill plan designed to guide the emergency response to spills during construction.
- **BMP 7.6 Water Quality Monitoring -** The objective of this BMP is to collect representative water data to determine base line conditions for comparison to established water quality standards, which are related to beneficial uses for that particular watershed. This BMP is implemented through establishment of Stream Condition Inventory (SCI) site prior to project implementation to establish a pre-project condition, and through the requirements of the 401 Water Quality Certification that will be obtained for the project..
  BMP 7.8 Cumulative Off-site Watershed Effect - This BMP serves to protect the identified beneficial uses of water from the combined effects of multiple management activities. Beneficial uses and effects have been documented in the Hydrology Report. Impacts of past and present activities including impacts of the proposed future management activities were considered in the evaluation of the analysis area, and summarized in the attached hydrology report.

Botany - Management of botanical resources, special habitats, and noxious weeds would follow the standards and guidelines in the Sierra Nevada Forest Amendment Record of Decision (SNFPA ROD 2004). Specific design criteria and protection measures for the Foster Meadow project include:

- Any new occurrences of sensitive plants identified within the project area would be flagged and avoided when necessary.
- A watchlist species, *Botrychium simplex*, occurs within Foster meadow. All known occurrences will be flagged for avoidance during project implementation. Should any new threatened, endangered, sensitive (TES) or watchlist species be located during the proposed project, available steps will be taken to evaluate and mitigate effects.
- Fens within Foster Meadow would be flagged prior to project implementation for avoidance. Crews conducting repair work at Foster Meadow would be informed of the location of the fen.
- All off-road equipment would be cleaned to insure it is free of soil, seeds, vegetative matter or other debris that could contain seeds before entering the project area.
- Infestations of invasive plants that are discovered during project implementation would be documented and locations mapped. New sites would be reported to the Forest botanist. Rock for riffle construction would be weed free.
- Onsite sand, gravel, rock, or organic matter would be used where possible.
- Any seed used for restoration or erosion control would be from a locally collected source (ENF, Seed, Mulch and Fertilizer Prescription, 2000).

Soil Resources - Standard mitigation measures have been developed under consultation with soil scientists and engineers as an integral component of meadow floodplain restoration. These mitigation measures have been monitored and refined based on previous projects of this type.

- Construction would occur during the low flow period, and coincides with the most favorable moisture conditions to the depth of borrow site excavation. The subsurface soil material excavated is used to plug the adjacent channel incision. This material requires enough moisture to allow for compaction to background condition of the adjacent native soil. The purpose of compaction is to preclude subsidence of the plug material during saturated conditions. Subsidence can lead to the initiation of erosion on the plugs. Utilization of onsite fill material allows the best match of soil types at the least cost. Material too wet to efficiently transport and work would be avoided. The subsurface (compacted) portions of the plug are constructed using the 'layer lift' method, which entails spreading the material in a thin veneer over the general area of the plug with each delivered bucket load of material. This repeated action, with occasional re-cutting of the working surface allows for efficient wheel compaction without supplemental equipment.

- Topsoil, and any organic material, in the area of excavation would be removed to a depth of approximately one foot and stockpiled adjacent to the plugs. When the plugs have been constructed to the design elevation, the plug surface would be cross-ripped to a depth of 12" to restore a deep infiltration capacity. Stockpiled topsoil with associated organics and native seed bank would be spread across the plug with a low ground-pressure track loader. The final pass with equipment is to dress and roughen the topsoil surface for microclimate roughness and to fully incorporate the topsoil with the surface of the subsoil.
- Equipment travel into the project area would be restricted to existing open or closed roads and recent timber harvest skid trails and landings. During construction, routes from the borrow sites to plug areas with compaction resulting from construction would be scarified perpendicular to expected surface water flow and dressed with scattered organic material.
- Staging areas and temporary haul routes used during the project would be minimized to minimize soil compaction and disturbance to the greatest extent possible. After construction, they would be sub-soiled, perpendicular to surface flow directions, to the full depth of compaction to restore soil porosity. Areas with residual meadow sod would only be lightly scarified to preserve sod integrity. The emphasis is on the least soil disruption while loosening the soil. Extensive mixing or plowing can have a negative effect on soil microorganisms. This technique has been successful in loosening the soil, restoring soil porosity, providing a high infiltration capacity, and thereby reducing cumulative watershed effects.
- The project will require re-vegetation. Access routes are expected to have residual sod, and thus not require seeding, but may receive mulching and possibly seed, depending on the condition of the sod. Revegetation will consist of the following measures:
    - All desirable plant material that would be excavated or buried in plugs, such as sod mats and willow wads, will be removed and transplanted to plugs, terraces and at key locations in the remnant channel. Locations of transplants are prioritized according to need for maximum soil protection in bare areas and areas of potentially high stress.
    - During the spring and summer following project completion, locally collected seeds would be dispersed into terrace cuts, plugs, and other heavily disturbed areas.
    - Container stock from locally-sourced material would be hand planted in the spring and summer in key locations. Container stock will consist of rhizomatous species that can quickly colonize the terrace cuts and plugs.
    - All revegetation areas would be monitored for three years following project completion. Successful revegetation would consist of 70% survival of willow cuttings and transplanted seedlings. Seeded areas would have at least 50% cover of native vegetation. Any areas that do not meet the survival or cover criteria would be reseeded or replanted.
- Erosion control would be accomplished using locally collected materials (wood chips, duff, pine needles, etc.). Straw would not be used.
- Meadow restoration projects include rest from grazing in disturbed areas for up to three years after construction in order to allow the newly planted vegetation to become established. Currently, the project area is not grazed and the allotment will not be re-opened, so this mitigation requires no further action.

Fire/Fuels Management - While the project area is located in a meadow and outside of state identified very fire hazard severity zones, portions of the meadow are expected to be dry, with a risk for wildfire associated with the use of any internal combustion engine. A trash pump and/or water truck will be on site to assist with vegetation transplants and dust control, as well as to reduce the risk of wildfire. In addition, equipment would be re-fueled and serviced at the designated staging area, which is outside of the riparian area and meadow. No fuel would be stored on-site. In the event of an accidental spill, hazmat materials for quick on-site clean-up would be kept at the project sites during all construction activities, and in each piece of equipment.

V. EXISTING SPECIES AND HABITAT CONDITION

Foster Meadow consists of a 32 acre upper alpine meadow near the headwaters for the Middle Fork of the Cosumnes River which passes through and along the edge of the meadow within the project area. The channel is deeply incised but supports typical riparian vegetation consisting of Salix sp, *Lupinus polyphyllus, Heracleum lanatum, Senecio triangularis* and *Delphinium glaucum*. As a result of the down cut channel there are large patches of xeric vegetation with little to sparse cover of meadow vegetation. These areas are typically dominated by *Veratrum californica, Mertensia ciliata, Ligusticum grayi* and *Oreostemma alpigenum*. The meadow also includes a number of seeps where more typical wet meadow vegetation has managed to persist dominated by robust carex sp, *Eleocharis* sp, *Deschampsia cespitosa, Bistorta*

bistortoides, and grasses and forbs. Lodgepole pine encroachment has been a problem in the lower portions of the meadow which have been repeatedly addressed by past projects to cut and pile young lodgepoles throughout the meadow. There are two fens within the meadow. *Botrychium simplex* (a special interest species; Appendix A) is found within the meadow growing in one of the fens and also along the channel in the lower portion of the meadow.

Listed Species

Layne's ragwort (*Packera layneae*)

Layne's butterweed is a perennial herb in the sunflower family (CNPS, 2001; USFWS, 2002) found in foothill woodland and chaparral habitats along the west slope of the Sierra Nevada in El Dorado and Tuolumne Counties at elevations between 60 and 3,000 feet. About 36 occurrences of this plant are documented on the Eldorado National Forest. Of the 32 documented occurrences in El Dorado County, two are located wholly on the ENF, one is located partially on the ENF, and one is located on a state-owned ecological preserve, and the remainder are found on private lands primarily in the Cameron Park area. *There is no potential habitat for this listed species within the proposed analysis area.*

Sensitive species

Moonworts (*Botrychium* spp.)

Botrychium species are widely distributed in North America and elsewhere. In California they occur infrequently in a variety of moist habitats throughout the Sierra Nevada and other portions of the state. Most moonwort species show a marked affinity for neutral substrates with high mineral content, especially soils developed on limestone bedrock or otherwise containing high calcium content. High elevation habitats suitably moist and cool are abundant throughout the Sierra Nevada and northern California mountains, but these mountains are mostly composed of granites, volcanics, and crustal basalts not rich in soluble calcium. However, leaf litter from incense cedar may favorably modify soils for some moonworts.

Documentation of population numbers and distribution patterns are incomplete largely because members of this genus are difficult to distinguish, and very uncommon and sporadic in distribution (Wagner and Wagner, 1993). These species appear sensitive to activities such as grazing, trampling, logging, and recreational activities such as OHV use.

Seven species of moonworts are listed as Sensitive species. They were listed as a group because 1) most species in this genus are rare in California; 2) individual species are very difficult to distinguish from each other; and 3) all have similar habitat preferences (wet or moist soils such as in meadows and fens or along the edges of lakes and streams). From the CNPS online inventory (CNPS, 2007):

1. Upswept moonwort (*Botrychium ascendens*): lower montane coniferous forest, meadows, seeps, 4,900 to over 7,500 feet
2. Scalloped moonwort (*Botrychium crenulatum*): Fens, lower montane coniferous forest, meadows, seeps, freshwater marshes, 4,900 to over 10,500 feet
3. Common moonwort (*Botrychium lunaria*): Meadows, seeps, subalpine and upper montane coniferous forest, 7,450 to over 11,000 feet
4. Mingan moonwort (*Botrychium minganense*): Fens, lower and upper montane coniferous forest, 4,900 to 6,750 feet.
5. Mountain moonwort (*Botrychium montanum*): Lower and upper montane coniferous forest, meadows, seeps, 4,900 to 7,000 feet.
6. Paradox moonwort (*Botrychium paradoxum*): Lower and upper montane coniferous forest and meadows.
7. Stalked moonwort (*Botrychium pendunculosum*): Lower and upper montane coniferous forest and meadow.

Threats to moonworts are defined as actions that alter existing site characteristics, including actions that would change the microclimate, canopy coverage, hydrology, or mycorrhizal association on a site from the regime that has supported a given population. Potential actions that could alter site condition include timber harvest, firewood cutting, fire suppression, road widening and maintenance activities, livestock grazing, invasive plant establishment, herbicide use, and recreational activity (camping and off-road vehicle driving).

Bruchia bolanderi (Bolander's candle moss)

Bolander's candle moss is found only from California and Oregon (Christy and Wagner 1996) and extends east to Nevada and Utah (Shevock pers. comm.). There are 28 known occurrences in California in El Dorado, Fresno, Tehama, Madera, Mariposa, Modoc, Nevada, Tulare, Tuolumne, Tehama and Plumas counties (CNDDB 2015), and two additional occurrences on the Eldorado National Forest that are not listed in the CNDDB records. The California Native Plant

Society (CNPS) considers this moss fairly endangered in California and rare outside of California (CNPS 2001). *Bruchia bolanderi* grows on moist soil in lower and upper montane coniferous forest, often along exposed edges of fens, seeps, streams through meadows or in exposed and disturbed soils or under grasses; sometimes partially shaded by coniferous forests. It grows from about 4,000 to above 9,000 feet. The abundant production of spores provides ample dispersal opportunities. The species is opportunistic, taking advantage of disturbed sites and minimal competition from other vegetation (Christy and Wagner 1996). However, sporophytes are infrequently encountered in many California populations. The species is difficult to identify without a sporophyte. Trend is not determined. No population monitoring has occurred.

There are two occurrences known from the Eldorado National Forest. One is in the vicinity of Schneider Cow Camp and another in Desolation Wilderness along the Twin Lakes Trail. The species is opportunistic, taking advantage of disturbed sites and minimal competition from other vegetation. The ephemeral nature of this species and its occurrence in disturbed sites allow some flexibility in management. Potential threats include direct impacts from management activities that directly damage the plants, including cattle grazing and trampling. How this moss responds to being burned is unknown.

Blandow's bogmoss (*Helodium blandowii)*

Blandow's bogmoss is known from Europe, Asia, and across northern United States from New Jersey and Ohio west to California and Nevada, and northwards to Canada (Flowers 2001). In California, it is known from Kings Canyon National Park in Fresno County, from the Inyo National Forest and from the Klamath National Forest. It is also known from the Mt Rose area, along Ophir Creek on the Humboldt-Toiyabe NF, just outside of the Lake Tahoe Basin. On the Toiyabe National Forest, it is known from Mono County north of Bridgeport.

Blandow's bog moss grows on wet meadows, fens and seeps in subalpine coniferous forest and alpine lakes. The two most critical factors affecting the abundance and distribution of fen species such as Blandow's bog moss are hydrology and the nutrient concentration of incoming water. Changes in hydrology may occur either intentional or inadvertent through road or trail construction or cattle trails. Direct trampling by livestock has also been identified as a threat.

Broad-nerved hump-moss (*Meesia uliginosa*)

Meesia uliginosa also has a worldwide distribution. There are 46 known occurrences in California and the majority of the California occurrences are in the Sierra Nevada (CNDDB, 2015). Its distribution is sporadic throughout the Sierra Nevada and fewer occurrences are known than for *M. triquetra*. It is known to occur from Siskiyou County south to Tulare County with one collection from the San Jacinto Mountains in Riverside County. Populations of *M. uliginosa* are reported to be small and infrequently encountered. There are no known occurrences of *M. uliginosa* on the Eldorado NF but potential habitat does exist (ENF, 2015a; CNPS, 2015).

M. uliginosa grow in bogs and fens in cold, permanently saturated, spring-fed meadows and fens at elevations between 4,200 to 9,200 feet. It often grows in association with *Sphagnum* moss, *Drosera* (sundew), and *Vaccinium* (huckleberry). This moss occurs in fens, peaty soil banks, seeps, meadows, and rock fissures (Harpel, 2003) These meadows are generally in the upper levels of mixed conifer to subalpine forests.

The two most critical factors affecting the abundance and distribution of fen species such as *M. uliginosa* are hydrology and the nutrient concentration of incoming water. Changes in hydrology may occur through ditching related to road or trail construction or cattle trails. Direct trampling by livestock has also been identified as a threat.

Adder tongue (*Ophioglossum pusillum*)

CNPS inventory notes only four occurrences in California in El Dorado, Lake, Mendocino, and Siskiyou counties (2015). On the Eldorado the one known occurrences was recorded on SPI lands near Loon Lake (ENF, 2015a). *Ophioglossum pusillum* is known to occur in wet seeps and springs, meadows, and edges of pounds (3,700-6,200 feet) (Jepson, 2015). Like Botrychium species this cryptic fern is likely to be easily overlooked in wet meadows and other potential habitat. These species could be impacted by grazing, trampling, logging, and recreational activities such as OHV use.

Special Interest Plants and plant Communities

Refer to Appendix A, Botany report for Special Interest Species.

Noxious Weeds

See Appendix B for the Noxious Weed Risk Assessment and Appendix C for Noxious Weeds of Concern for the ENF. Implementation of included design criteria should minimize the likelihood of project activities enhancing or spreading invasive species into the proposed project area.

VI. EFFECTS

Analysis area defined: This analysis addresses activities and actions associated within the Foster Meadow Restoration Project on Eldorado National Forest. The cumulative effects for botany are bound in time by the first botany records on the Eldorado National forest (early 1980's) and covers all proposed activities that are likely to occur in the project area during the next 5 years. The spatial extent of the analysis includes all known and potential occurrences found within the area of the proposed project.

Direct and indirect effects for known sensitive plants

There are no TES species known from the project area so direct and indirect effects are not expected. Survey coverage of the meadow was complete, but it is always possible for a Sensitive plant population to be overlooked during past surveys. If this were the case undetected individuals could be crushed, uprooted, or destroyed during the construction of plug and ponds and creation of large terrace cuts within the meadow. Additionally any undetected Sensitive species occurring in the meadow could be impacted following project implementation by altered microsite and hydrologic condition. But, given the limited area included in the proposed action there is a low likelihood that Sensitive plant populations have gone undetected within the meadow. If any new Sensitive species are discovered prior to project implementation these populations would be protected from project activities.

Soil disturbances can provide opportunities for the introduction and proliferation of invasive species. These species have the potential to quickly outcompete native plants including Sensitive plants for sunlight, water, and nutrients. These species can also form dense monocultures which can alter habitat for Sensitive plant species. Seeds of these species can be carried into Sensitive plant areas on equipment, vehicles, and on workers boots and clothing. The magnitude of this impact is difficult to predict since it is contingent on the introduction of a noxious weed species into an area, an event which may or may not occur.

Cumulative Effects

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects and is consistent with National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008).

Forest Service Activities: Adverse impacts to sensitive plants from recent (1989-2011) activities have largely been minimized by the use of mitigation measures, mainly the use of avoidance. Ongoing and future management activities in the Foster Meadow project area would likely include prescribed burning, hazard tree removal and implementation of ongoing FS projects in the area. It is anticipated that future impacts to sensitive plants would continue to be minimized through the use of avoidance for the above foreseeable actions. Avoidance or other means of mitigating impacts to sensitive plant occurrences is consistent with direction contained in in the ENF LMRP, which includes under Standard And Guideline 49 (p. 4-91), "provide for the protection and habitat needs of sensitive plants so that Forest activities would not jeopardize the continued existence of such species."

Climate change: Anthropogenic caused increases in temperatures and changes in precipitation are likely to impact both ecosystem structure and ecosystem processes (IPCC, 2007). Climate controls many ecosystem processes including species distribution and abundance, regeneration, vegetation productivity and growth, and disturbance all of which could affect FS sensitive species on the Eldorado National Forest. While there is some uncertainty regarding the scale, rate, and direction of future climatic conditions in the western United States and the Sierra Nevada (North et al., 2009) some general observation regarding past changes and expected future changes are generally agreed upon.

Climate change effects on precipitation and mean temperature have been difficult to predict with considerable variation between different models. According to Dettinger (2005), the most common prediction among the most recent models for California is temperature warming by about 9 degrees F by 2100, with precipitation remaining similar or slightly reduced

compared to today. Most models agree that summers would be drier than they are currently, regardless of levels of annual precipitation. Current estimates of predicted climate change on vegetation patterns forecast that forest types and other vegetation dominated by woody plants in California would migrate to higher elevations as warmer temperatures make those areas suitable for colonization and survival (Lenihan et al. 2003). However, rare and uncommon species are expected to experience a number of barriers when adjusting to a rapidly changing climate because of the combination of a small number of occurrences, narrow elevational ranges, and requirements for specific soils types.

VII. OTHER MANAGEMENT ISSUES AND RECOMMENDATIONS:
None.

VIII. MITIGATIONS AND MONITORING
Sensitive plants
Any new occurrences of sensitive plants identified within the project area would be flagged and avoided when necessary.

IX. DETERMINATION

For Listed Species
The proposed Foster Meadow Restoration Project will not affect *Packera layneae* or its habitat. Formal consultation with the U.S. Fish and Wildlife Service pursuant to Section 7 of the Endangered Species Act is not required.

For Candidate species
The proposed Foster Meadow Restoration Project would not affect *Pinus albicaulis*.

For Sensitive Species
There is no potential habitat for *Allium tribracteatum, Arctostaphylos nissenana, Balsamorhiza macrolepis var. macrolepis, Calochortus clavatus var. avius, Cypripedium montanum, Dendrocollybia racemose, Draba asterophora var. asterophora, Draba asterophora var. macrocarpa, Eriogonum tripodum, Horkelia parryi, Lewisia kelloggii ssp. hutchisonii, Lewisia kelloggii ssp. kelloggii, Lewisia longipetala, Lewisia serrata, Navarretia prolifera ssp. lutea, Mimulus pulchellus, Mielichhoferia elongate, Peltigera gowardii,* in the project area. Therefore the proposed action would not affect these species.

Some suitable habitat for *Botrychium ascendens, Botrychium crenulatum, Botrychium lunaria, Botrychium minganense, Botrychium montanum, Botrychium pendunculosum, Bruchia bolanderi, Helodium blandowii, Meesia uliginosa, Ophioglossum pusillum* occurs in the Foster Meadow Restoration Project area, but no occurrences were not found during past or recent surveys. Because past surveys cannot positively state the absence of a sensitive plant species it is possible that the proposed project could affect undetected individuals in the project area. Therefore, the proposed project may affect undiscovered individuals but is not likely to result in a trend toward Federal listing or loss of viability for the 10 species listed above.

X. REFERENCES

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APPENDIX A: BOTANY REPORT FOR SPECIAL INTEREST PLANTS

I. INTRODUCTION

Purpose: The purpose of the Botany Report is to describe effects on Special Interest (or watch list) plant species, special interest plant communities, and other botanical resources.

Special Interest Plant Species and communities:
The Foster Meadow project occurs in an upper alpine meadow that also includes two fens and *Botrychium simplex.*

II. CURRENT MANAGEMENT DIRECTION

Special Interest species: A number of plant species do not meet all of the criteria to be included on the Regional Forester's Sensitive Plant List, but are of sufficient concern that we need to consider them in the planning process. These include species that are locally rare – as opposed to declining throughout their range – are of public concern, occur as disjunct populations, are newly described taxa, or lack sufficient information on population size, threats, trend or distribution.

Such species make an important contribution to forest biodiversity and are addressed as appropriate through the NEPA process. To better identify these species, forests have been encouraged to develop watch lists for these special interest species. These watch lists are dynamic and updated as the need arises to reflect changing conditions and new information.

Bog and Fen Habitat (SNFPA ROD page 65, S&G #118): Prohibit or mitigate ground-disturbing activities that adversely affect hydrologic processes that maintain water flow, water quality, or water temperature critical to sustaining bog and fen ecosystems and plant species that depend on these ecosystems. During project analysis, survey, map, and develop measures to protect bogs and fens from such activities as trampling by livestock, pack stock, humans, and wheeled vehicles.

Table 1. Watch list species with potential habitat in the Foster Meadow Restoration Project Area (updated 2016)

Species	Common Name	CNPS Ranking	Habitat	Potential Habitat in project Area	Lower Elevation (ft)	Upper Elevation (ft)
Allium sanbornii var. congdonii	Congdon's onion	4. No 3	Serpentine outcrops	No	Up to 4,000	
Allium sanbornii var. sanbornii	Sanborn's onion	4.2	Serpentine outcrops	No	Up to 5,020	
Astragalus austiniae	Austin's milkvetch	1B.3	Alpine boulder & rock field in subalpine coniferous forest.	No	7,600	8,825
Astragalus whitneyi var. lenophyllus	Whitney's milk-vetch	4.3	Alpine boulder & rock field in subalpine coniferous forest.	No	Above 4,900	
Bolandra californica	Sierra bolandra	4.3	Rock crevices and wet cliffs along streams.	No	3,100	4,200
Botrychium simplex	Yosemite moonwort	--	Moist and wet meadow, seeps, fens and streamside habitats about 6,000 feet in elevation.	Yes	Above 5,000	

Species	Common Name	CNPS Ranking	Habitat	Potential Habitat in project Area	Lower Elevation (ft)	Upper Elevation (ft)
Calystegia vanzuukiae	Van Zuuk's morning glory	1B.3	Serpentine outcrops	No	1,640	3,900
Carex cyrtostachya	arching sedge	1B.2	Narrow endemic from the western slope of the northern Sierra Nevada of California	No	2,000	4,460
Carex davyi	Davy's sedge	1B.3	Upper montane coniferous forest to Subalpine coniferous forest; Dry often sparse meadows or rocky areas.	No	Above 4,500	
Climacium dendroides	Tree Climacium moss	2B.1	Occurs in occasionally flooded mineral soil, especially on lake and river margins	No	Above ~3,500 (limited information available)	
Ceanothus fresnensis	Fresno ceanothus	4.3	Cismontane woodland (openings), lower montane coniferous forest	No	3,650	6,900
Chaenactis douglasii var. alpina	alpine dusty maindens	2B.3	Alpine boulder and rock field (granitic), Rocky or gravelly ridges, talus, fell-fields, crevices	No	Above 9,800	
Chlorogalum grandiflorum	red hills soapwort	1B.2	Serpentine outcrops, open shrubby or wooded hills; Chaparral, Foothill Woodland, Yellow Pine Forest	No	Up to 3,150	
Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	4.2	Foothill woodland, chaparral, cismontane woodland, lower montane coniferous forest. Often found growing in road cuts	No	Up to 3,000	
Clarkia virgata	Sierra clarkia	4.3	Foothill woodland, cismontane woodland, lower montane coniferous forest, yellow pine forest	No	2,460 to 5,675	

Species	Common Name	CNPS Ranking	Habitat	Potential Habitat in project Area	Lower Elevation (ft)	Upper Elevation (ft)
Claytonia megarhiza	fell-fields claytonia	2B.3	Subalpine, alpine gravel, talus, crevices, growing In crevices between rocks in rocky or gravelly soils.	No	Above 8,500	
Corallorhiza trifida	northern coralroot; Early coralroot	2B.1	Wet, open to shaded, generally coniferous forest. In California, under firs, in partial shade	No	4,500	5,600
Drosera anglica	English sundew	2B.3	Fens, meadows and seeps often with Sphagnum	Yes	4,250	6,500
Drosera rotundifolia	round leaf sundew	--	Fens, meadows and seeps often with Sphagnum	Yes	Up to 8,900	
Dryopteris filix-mas	male fern	2B.3	Upper montane coniferous forest (granitic, rocky); Granitic cliffs	No	Above 7,800	
Mimulus laciniatus	Cutleaf monkey flower	4.3	Growing on decomposed granite in moist sandy places.	No	Above 3,100	
Myrica hartwegii	Sierra sweet bay	4.3	streambanks and other moist places in foothill and low montane forest	No	Up to 6,000	
Orthotrichum holzingeri	Holzinger's orthotrichum moss	1B.3	Usually on rock in and along streams, rarely on tree limbs.	No	2,345	6,000
Perideridia bacigalupii	Mother Lode Yampah	4.2	Sites in which it occurs include open rocky areas, chaparral openings, slopes, and road cuts. Usually on serpentine	No	Up to 3,500	

Species	Common Name	CNPS Ranking	Habitat	Potential Habitat in project Area	Lower Elevation (ft)	Upper Elevation (ft)
Piperia colemanii	Coleman's Rein Orchid	4.3	Open conifer forest, scrub; often in sandy soils.	No	3,900	7,545
Piperia leptopetala	petaled rein orchid	4.3	Generally dry sites, scrub, woodland; Chaparral, Foothill Woodland, Yellow Pine Forest, Red Fir Forest.	No	1,100	7,300
Pseudostellaria sierrae	Sierra Starwort	4.2	Meadows, dry understory of mixed oak or conifer forest	Yes	4,000	7,200
Rhynchospora alba	white beaked-rush	2B.2	Wet meadows, fens, seeps, and marshes	Yes	Up to 6,700	
Rhynchospora capitellata	brownish beakrush	2B.2	Wet meadows, fens, seeps, and marshes	Yes	Up to 6,560	
Sambucus nigra L. ssp. caerulea	Blue Elderberry	--	Riparian areas; of concern below 3,000' as host plant for Threatened Valley Elderberry Longhorn Beetle	No	Up to 3,200	

Species	Common Name	CNPS Ranking	Habitat	Potential Habitat in project Area	Lower Elevation (ft)	Upper Elevation (ft)
Sparganium natans	Small bur reed	4.3	Wetland-riparian, lake margins.	Yes	2,800	8,560
Taxus brevifolia	Pacific yew	--	Mixed Evergreen Forest, Douglas-Fir Forest, Yellow Pine Forest, Red Fir Forest	No	Up to 4,600	
Torreya californica	California nutmeg	--	Mixed Evergreen Forest, Douglas-Fir Forest, Yellow Pine Forest	No	Up to 3,000	
Viburnum ellipticum	oval-leaved viburnum	2B.3	Chaparral, Cismontane woodland, Lower montane coniferous forest. Chaparral, yellow-pine forest, generally n-facing slopes	No	Up to 4,500	
Wyethia reticulata	El Dorado County mule ears	1B.2	Stony red clay and gabbroic soils; often in openings in gabbro chaparral	No	Up to 2,060	

III. EXISTING ENVIRONMENT

Foster Meadow consists of a 32 acre upper alpine meadow near the headwaters for the Middle Fork of the Cosumnes River which passes through and along the edge of the meadow within the project area. The channel is deeply incised but supports typical riparian vegetation consisting of some Salix sp, *Lupinus polyphyllus*, *Heracleum lanatum*, *Senecio triangularis* and *Delphinium glaucum*. As a result of the down cut channel there are large patches of xeric vegetation with little to sparse cover of meadow vegetation. These areas are typically dominated by *Veratrum californica*, *Mertensia ciliata*, *Ligusticum grayi* and *Oreostemma alpigenum*. The meadow also includes a number of seeps where more typical wet meadow vegetation has managed to persist dominated by robust carex sp, *Eleocharis* sp, *Deschampsia cespitosa*, *Bistorta bistortoides*, and grasses and forbs. Lodgepole encroachment has been a problem in the lower portions of the meadow which have been repeatedly addressed by past projects to cut and pile young lodgepoles throughout the meadow. There are two fens within the meadow. *Botrychium simplex* is found within the meadow growing in one of the fens and also along the channel in the lower portion of the meadow.

IV. DESIGN CRITERIA

- If new watch plant occurrences are discovered during project implementation the project botanist would be notified to develop necessary protection measures.
- Fens within Foster Meadow would be flagged prior to project implementation for avoidance. Crews conducting repair work at Foster Meadow would be informed of the location of the fen.

V. EFFECTS

Alternative 1:

Watchlist species: There are two occurrences of *Botrychium simplex* within the proposed project area. Both sites will be flagged for avoidance during project implementation and therefore should not be directly impacted by project activities. One occurrence is adjacent to the proposed terrace cut in the pocket meadow but the proposed terrace cut is not expected

to impact hydrologic condition of the fen and surrounding habitat occupied by *Botrychium simplex*. The fen does show some evidence of past erosion/down cutting but currently appears to have stabilized. Checkdams were installed in a small unnamed tributary near the fen where Botrychium simplex also occurs (within the pocket meadow). The expected increase in the water table within the meadow is expected to improve the habitat where the Botrychium simplex occurs as well as reduce the risk of future degradation of the fen from further erosion and dewatering. The second *Botrychium simplex* occurs along the banks of the Middle Fork of the Cosumnes at the lower in of the meadow near the proposed riffles. There was only one plant found in 2016 in the degraded channel. The plant will be avoided during the construction of the 9 riffles but the resulting increase in the base level of the channel may inundate the occurrence.

If any new special interest plant species are discovered in the project area, necessary actions would be considered to limit impacts from project activities. Therefore, the proposed project is not expected to cause cumulative effects for special interest plant species within the proposed project area.

VI. MITIGATION

None required.

APPENDIX B: NOXIOUS WEED RISK ASSESSMENT

Five factors of weed spread were analyzed for the proposed Foster Meadow Restoration Project. Determinations of risk (High, Moderate, and Low) are summarized below along with the total risk of weed spread for the proposed project if suggested mitigation measures are implemented.

If the proposed project includes all listed mitigation measures to reduce or eliminate the risks of introducing or spreading noxious weeds in the project area then it is my determination that the risk of spreading noxious weeds in the project area is ***Low.***

Introduction: This assessment is in compliance with the Eldorado National Forest Land and Resource Management Plan (USFS ENF LRMP 1988), the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and Record of Decision (ROD), Executive Order on Invasive Species (Executive Order 13112), and the direction in the Forest Service Manual section 2900, Noxious Weed Management (2012), which includes a policy statement calling for a risk assessment for noxious weeds to be completed for every project. The overriding principle stated in these documents is that the costs associated with preventing an infestation are much less than the costs of eliminating a population once it has expanded, and of dealing with the effects of a degraded plant community.

Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, or being nonnative or new to or not common to the United States or parts thereof (FSM 2900). In order to control noxious weeds the US Forest Service has adopted an integrated weed management approach to reduce the spread of noxious weeds on to, and from National Forest System lands. The main objective of this integrated approach to weed management is to prevent the introduction and establishment of noxious weed infestations, and control (contain and suppress) existing noxious weed infestations on National Forest System lands (FSM 2900). In addition when any ground disturbing action or activity is proposed, the federal agency is required to determine the risk of introducing or spreading noxious weeds associated with the proposed action (FSM 2900).

1. Noxious Weeds Present In or Near Project Area (Low)
Overall, the Foster Meadow Restoration area is relatively free of priority invasive species. There are no high priority invasive plant infestations within the meadow or surrounding area. However, some low priority weeds are found in low levels surrounding the project area including, mullein (*Verbascum thapsus*), bull thistle (*Cirsium vulgare*) and cheat grass (*Bromus tectorum),* but due to their low levels it is not expected that project work will overly impact these species and spread them much further throughout the project area.

2. Habitat Vulnerability (Low)
The proposed Foster Meadow Restoration Project occurs in a high alpine meadow that is in relatively stable condition. In general a robust cover of native meadow vegetation found throughout the area will limit the susceptibility of the meadow to invasion by non-native species. While much of the meadow vegetation is stable and robust, there are areas within the meadow that exhibit sparse cover of native vegetation cover due to meadow dewatering and will have a slightly elevated risk for invasion. That said, the overall meadow vegetation is robust and should limit the establishment of many invasive species of concern for the Eldorado NF.

3. Non-project Weed Vectors (Moderate)
Weed vectors currently in the project area and vicinity include: off-highway vehicles (OHVs) such as motorcycles and four-wheel drive vehicles; road maintenance equipment; recreationists; private cars and trucks; Forest Service vehicles and workers; logging equipment on private land and FS; and wildlife. Natural dispersal from wind may also spread the seeds of some invasive species into the proposed project area. Wildlife may also disperse certain noxious weeds that can become attached to fur, or when viable seeds pass through digestive systems. Vehicles traveling routes and roads may pick up seeds from existing infestations and spread them to other locations on the forest. For some species, seeds can become affixed to clothing and gear (e.g. non-native annual grasses). Other species do not have dispersal mechanisms for attaching and would most like travel in mud on vehicle and tire tread (e.g. yellow starthistle, scotch broom, and spotted knapweed).

4. Habitat Alteration Expected as Result of Projects (Moderate)
The proposed project would result in relatively major habitat alteration during and immediately following the construction of the proposed plug and ponds. Heavy equipment operating within the meadow will crush and uproot meadow

vegetation, and significant amounts of soil will be moved when creating terrace cuts, digging ponds on the meadow perimeter and filling the existing channel creating large areas with limited native vegetation cover and bareground immediately following project construction. Steps will be taken to reduce long-term habitat alteration and revegetate the meadow following project completion (setting aside topsoil, salvaging and replanting root wads and sod mats, planting locally collected seeds and container stock), but in the short-term the project will result in large portions of the meadow with reduced cover of native vegetation. This is important because seeds of potential and known invasive plants all require sunlight and contact with mineral soil for germination and growth (Zouhar, 2008) and could easily become established if introduced into the project area during implementation.

Long-term habitat alterations associated with the proposed Foster Meadow Restoration project are expected to reduce the vulnerability of the meadow to future invasion. To the extent that the proposed action raises the water table in the meadow native species are expected to respond favorably- potentially establishing in areas with limited native vegetation cover due to the down cut channel currently draining the meadow.

5. Increased Vectors as a Result of Project Implementation (Moderate)
The proposed project would *temporarily* increase potential weed vectors due to the increase in project related vehicle use. Potential introduction of invasive may occur when equipment is first brought into the project area.

Another potential vector for invasive species related to project activities is the importation of materials for the construction of riffles in the lower reaches of the meadow.

Management requirements have been incorporated into the project to reduce or eliminate the likelihood of most vector opportunities related to the proposed project (see section 6).

6. Mitigation Measures
The following mitigation measures should be included in the Foster Meadow Restoration project. These mitigation measures have been designed to limit the potential introduction of new noxious weeds into the project area and limit the potential spread of existing priority invasive plant infestations.

- All off-road equipment would be cleaned to insure it is free of soil, seeds, vegetative matter or other debris that could contain seeds before entering the project area.

- Infestations of invasive plants that are discovered during and after project implementation would be documented and mapped. New sites would be reported to the Forest botanist and treated using methods analyzed in the Forest's invasive Plant Management Plan (Invasive Plant EA 2011).

- Rock for riffle construction would be weed free. Onsite sand, gravel, rock, or organic matter would be used where possible.

- Any seed used for restoration or erosion control would be from a locally collected source (ENF, Seed, Mulch and Fertilizer Prescription, 2000).

7. Anticipated weed response to proposed action (Low Risk)
The proposed Foster Meadow Restoration project would: 1) occur in relatively intact upper alpine meadow with a moderate risk for invasion and 2) occur in a portion of the Eldorado with few high priority noxious weed infestations; but does involves activities that could introduce or spread existing noxious weeds and will create substantial soil disturbance within the meadow. Because of the above factors, the anticipated weed response to the proposed action is High/Moderate if recommended mitigations are not included. By including all of the mitigations listed in section 6, it is anticipated that the risk of spreading and/or introducing noxious weeds would be reduced to a low level of risk.

This weed risk assessment is restricted to the project description in this Biological Evaluation. If activities are proposed that extend beyond the activities described in this document, then a new assessment would be required

APPENDIX C: NOXIOUS/INVASIVE WEEDS OF CONCERN

Invasive Plant List for the Eldorado National Forest 2/23/2016

Group 1 (Eradicate): Highly invasive species known to occur on the Eldorado National Forest. Species are uncommon and are a priority for inventory, control, and eradication.

Acroptilon repens Russian knapweed
Aegilops triuncialis barbed goatgrass
Ailanthus altissima Chinese tree of heaven
Arundo donax Arundo
Centaurea calcitrapa purple starthistle
Centaurea diffusa diffuse (white) knapweed
Centaurea stoebe spotted knapweed
Cirsium arvense Canada thistle
Euphorbia oblongata oblong spurge
Isatis tinctoria dyer's woad
Lepidium latifolium tall whitetop
Lythrum salicaria purple loosestrife
Sorghum halepense Johnson grass

Group 2 (Control): Established or widespread species known to occur on the Eldorado National Forest. Inventory all infestations. Annually treat a portion of known infestations, focusing first on eradicating/containing isolated outlying infestations and, over time, reducing the footprint of larger, less isolated infestations.

Carduus pycnocephalus Italian thistle
Centaurea melitensis tocalote
Centaurea solstitialis yellow starthistle
Chondrilla juncea rush skeleton weed
Cytisus scoparius Scotch broom
Elymus caput-medusae medusahead
Foeniculum vulgare Fennel
Genista monspessulana French broom
Spartium junceum Spanish broom

Group 3 (Control): Established or widespread species known to occur on the Eldorado National Forest. Inventory and treat isolated leading edge infestations or where concurrent with higher priority infestations.

Brassica nigra black mustard
Bromus tectorum cheat grass
Chenopodium botrys Jerusalem-oak goosefoot
Cirsium vulgare bull thistle
Hedera helix English Ivy
Hypericum perforatum Klamath weed
Lathyrus latifolius perennial sweet pea
Leucanthemum vulgare Oxeye daisy
Melilotus alba white sweet clover
Melilotus officinalis yellow sweet clover
Rubus armeniacus Himalayan blackberry
Rubus laciniatus cut leaf blackberry
Salsola tragus Russian thistle/tumbleweed
Silybum marianum milk thistle
Torilis arvensis hedge parsley
Tribulus terrestris puncture vine
Vinca major periwinkle

Group 4 (Manage through education and prevention): Species are well established across forest or have minor economic or ecological impacts. Forest will use appropriate prevention and education measures to limit further spread.

Bromus diandrus ripgut brome
Bromus madritensis var. rubens red brome
Conium maculatum poison hemlock
Cynodon dactylon Bermuda grass
Cynosurus echinatus spiny dogtail
Dactylis glomerata Orchard grass
Festuca arundinacea tall fescue
Hirschfeldia incana mustard
Lychnis coronaria rose campion/ mullein pink
Sisymbrium altissimum Jim Hill mustard
Verbascum thapsus mullein

Potential invasives: Species not yet found on the Eldorado National Forest. If found, infestations should be inventoried and targeted for eradication or control.

Aegilops cylindrica Jointed goatgrass
Cardaria chalepensis small whitetop
Cardaria draba hoarycress
Cardaria pubescens whitetop
Carduus nutans musk thistle
Carthamus lanatus Woolly distaff thistle
Centaurea pratensis meadow knapweed
Centaurea sulphurea Sicilian starthistle
Cortaderia selloana pampas grass
Dittrichia graveolens stinkwort
Euphorbia esula leafy spurge
Linaria genistifolia ssp. *dalmatica* dalmatian toadflax
Linaria vulgaris yellow toadflax
Nicotiana glauca Tree tobacco
Onopordum acanthium Scotch thistle
Phragmites australis common reed
Polygonum cuspidatum Japanese knotweed
Polygonum sachalinensis Sakhalin knotweed
Potentilla recta Sulfur cinquefoil
Sesbania punicea Scarlet wisteria
Tamarix chinensis Salt Cedar
Tanacetum vulgare tansy
Ulex europaeus Gorse