

Draft Appendix E

Restoration Projects Statewide Order: Description and Eligibility

Categories of Eligible Project Types, Geographic Scope,
Programmatic Sideboards, General Protection Measures,
Other Requirements, and Design Guidelines

Contents

	<u>Page</u>
E Restoration Projects Statewide Order Description and Eligibility	E-1
E.1 Introduction	E-1
E.2 Categories of Eligible Project Types	E-4
E.3 Geographic Scope	E-5
E.3.1 Region 1—North Coast	E-5
E.3.2 Region 2—San Francisco.....	E-5
E.3.3 Region 3—Central Coast.....	E-5
E.3.4 Region 4—Los Angeles.....	E-6
E.3.5 Region 5—Central Valley	E-6
E.3.6 Region 6—Lahontan.....	E-6
E.3.7 Region 7—Colorado River.....	E-6
E.3.8 Region 8—Santa Ana.....	E-9
E.3.9 Region 9—San Diego.....	E-9
E.4 Categories of Restoration Projects in the General Order.....	E-9
E.4.1 Improvements to Stream Crossings and Fish Passage.....	E-9
E.4.2 Removal of Small Dams, Tide Gates, Flood Gates, and Legacy Structures	E-11
E.4.3 Bioengineered Bank Stabilization.....	E-13
E.4.4 Restoration and Enhancement of Off-Channel and Side- Channel Habitat.....	E-14
E.4.5 Water Conservation.....	E-15
E.4.6 Floodplain Restoration.....	E-16
E.4.7 Removal of Pilings and Other In-Water Structures.....	E-17
E.4.8 Removal of Nonnative Terrestrial and Aquatic Invasive Species and Revegetation with Native Plants	E-17
E.4.9 Establishment, Restoration, and Enhancement of Tidal, Subtidal, and Freshwater Wetlands.....	E-18
E.4.10 Establishment, Restoration, and Enhancement of Stream and Riparian Habitat and Upslope Watershed Sites	E-20
E.5 Programmatic Sideboards, General Protection Measures, and Other Requirements	E-23
E.5.1 Programmatic Sideboards	E-23
E.5.2 General Protection Measures.....	E-24
E.5.3 Pre-Application Consultation	E-39
E.5.4 Projects Requiring Oversight by Other Agencies	E-39
E.5.5 Activities Prohibited under the General Order	E-40
E.6 Design Guidelines.....	E-41
E.7 References	E-58

Figures

Figure E-1	Restoration Projects Statewide Order Process Flow Chart.....	E-2
Figure E-2	Restoration Projects Statewide Order CEQA Process Flow Chart.....	E-3
Figure E-3	Restoration Projects Statewide Order Geographic Scope	E-7

E Restoration Projects Statewide Order Description and Eligibility

E.1 Introduction

The State Water Resources Control Board (State Water Board) has developed a Clean Water Act Section 401 General Water Quality Certification and Waste Discharge Requirements for Restoration Projects Statewide Order (Order) to improve the efficiency of regulatory reviews for projects throughout the state that would restore aquatic and riparian resource functions and/or services. The Order establishes an authorization process for environmentally beneficial restoration projects.

The purpose of the Order is to expedite consultation, authorization, and permitting of restoration projects intended to help the State of California achieve its habitat restoration, species recovery, and water quality improvement goals.

It is anticipated that the Order will authorize projects that originate from a variety of mandates and programs, including projects that are part of larger programs and/or initiatives that guide restoration throughout the State (e.g., Propositions 1 and 68 funds administered by state, regional, and local conservancies and state agencies, California Department of Fish & Wildlife [CDFW] Fisheries Restoration Grant Program [FRGP], State Water Board Comprehensive Response to Climate Change (Resolution), State Water Board Non-point Source (Section 319h) grant program for restoration activities, California EcoRestore, Bay-Delta Water Quality Control Plan (Basin Plan), Central Valley Flood Protection Plan – Conservation Strategy, San Joaquin River Restoration Program, San Francisco Bay Restoration Authority (Measure AA), and others).

The State Water Board has previously adopted a programmatic authorization for restoration projects less than 5 acres and a cumulative total of 500 linear feet of stream bank or coastline, and that qualify under the California Environmental Quality Act (CEQA) categorical exemption under California Code of Regulations title 14, section 15333, “Small Habitat Restoration Projects” (SHRP; General Order Number SB12006GN). This Order intends to provide authorization for restoration projects that meet the eligibility criteria in this Order, but do not qualify for authorization under the SHRP. Order and CEQA process flow charts (see Figures E-1 and E-2) provide general step-by-step guides to assist a project proponent through the project eligibility and notification process.

Figure E-1 Restoration Projects Statewide Order Process Flow Chart

Source: ESA 2020

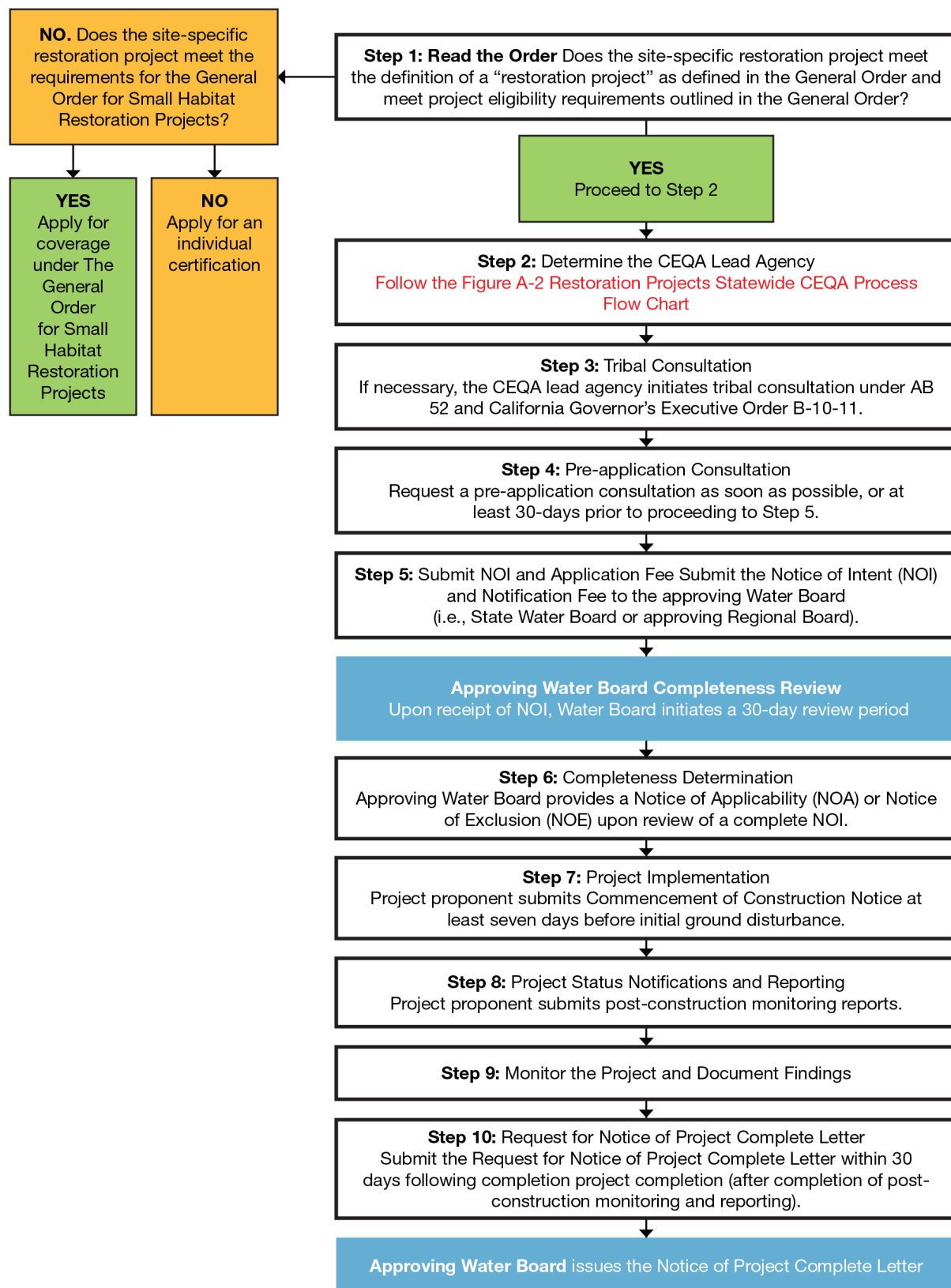
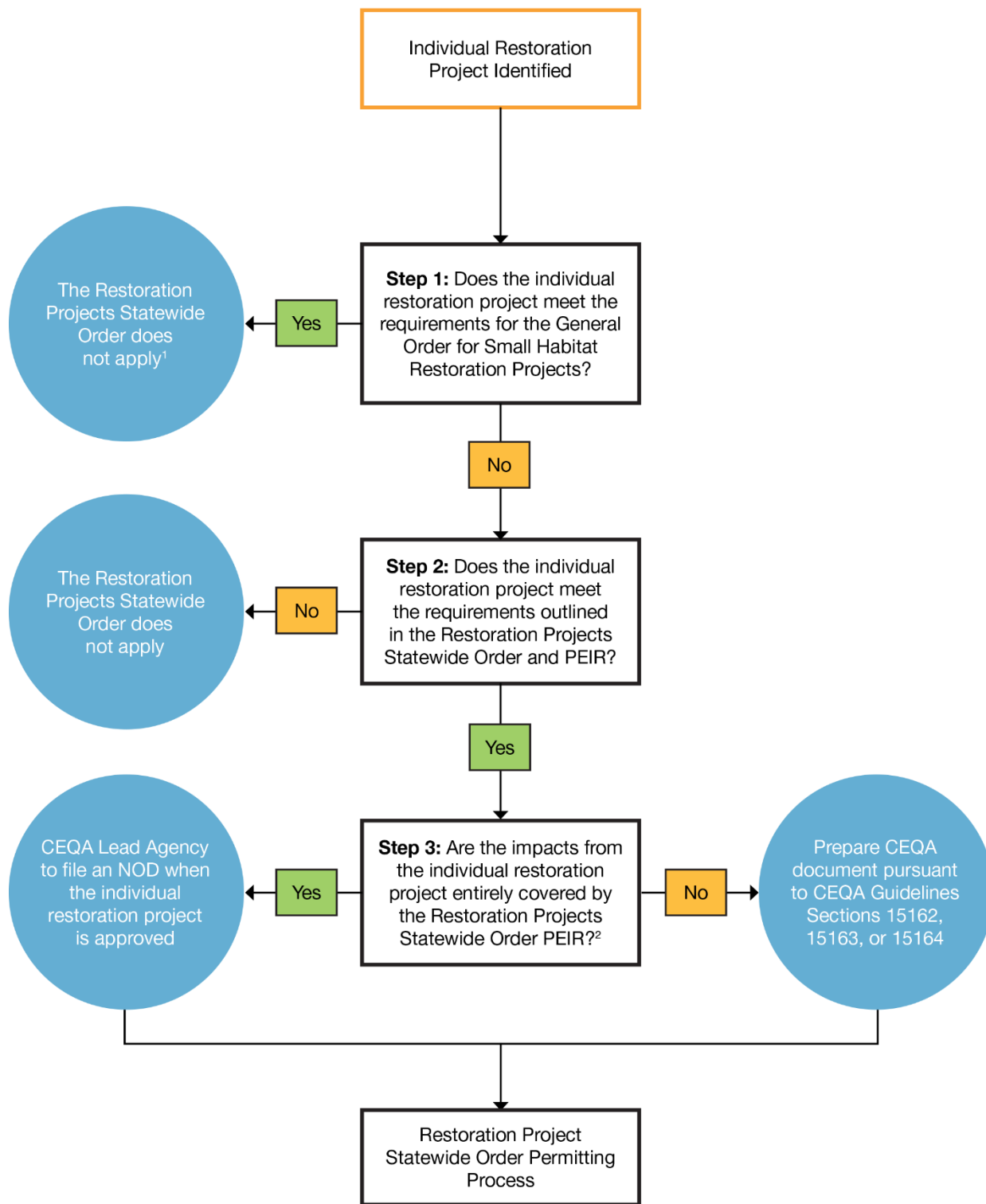


Figure E-2 Restoration Projects Statewide Order CEQA Process Flow Chart

Source: ESA 2020



1 Obtain coverage under the General Order for Small Habitat Restoration Projects

2 Contact the State Water Board if they will be the lead agency for the site-specific restoration project

As described in the Order, all authorized projects must meet the definition of a restoration project as defined below and comply with all applicable water quality control plans and state policy for water quality control. A "restoration project" is defined as one that would result in a net increase in aquatic or riparian resource area, functions and/or services through implementation of the eligible project types, relevant protection measures, and design guidelines.

E.2 Categories of Eligible Project Types

The categories of restoration project types eligible for enrollment under the Order are listed below. These eligible project types are described in detail in Section E.4, *Categories of Restoration Projects in the Order*. An individual permitted project may incorporate one or more of these project types. Projects may conduct restoration activities such as establishment, reestablishment, rehabilitation, and/or enhancement for any of these project types:

- ◆ **Improvements to Stream Crossings and Fish Passage**—for upstream and downstream movement by fish and other species, and to improve functions of streams.
- ◆ **Removal of Small Dams, Tide Gates, Flood Gates, and Legacy Structures**—to improve fish and wildlife migration, tidal and freshwater circulation and flow, and water quality.
- ◆ **Bioengineered Bank Stabilization**—to reduce input of fine sediment, enhance aquatic and riparian habitat, and improve water quality.
- ◆ **Restoration and Enhancement of Off-Channel and Side-Channel Habitat**—to improve aquatic and riparian habitat for fish and wildlife; to restore the hydrologic, hydraulic, and biogeochemical functions and processes of streams; or both.
- ◆ **Water Conservation Projects**—to reduce low-flow stream diversions, through installation of features such as off-stream storage tanks and ponds and necessary off-channel infrastructure.
- ◆ **Floodplain Restoration**—to improve ecosystem function by creating hydrologic connections between streams and floodplains, through such measures as breaching and removal of levees, breaching and removal of berm and dike setbacks, and hydraulic reconnection and revegetation.
- ◆ **Removal of Pilings and Other In-Water Structures**—to improve water quality and aquatic habitat for fish and wildlife.
- ◆ **Removal of Nonnative Invasive Species and Revegetation with Native Plants**—to improve watershed functions, such as aquatic and riparian habitat for fish and wildlife.
- ◆ **Establishment, Restoration, and Enhancement of Tidal, Subtidal, and Freshwater Wetlands**—to create or improve wetland ecological functions.

- ◆ **Establishment, Restoration, and Enhancement of Stream and Riparian Habitat and Upslope Watershed Sites**—to create or restore the functions of streams and riparian areas, including upslope watershed sites that could contribute sediment to streams or disrupt floodplain and riparian functions.

E.3 Geographic Scope

The Order considers a variety of types of aquatic, riparian, and floodplain restoration projects that take place throughout California. The State Water Board protects water quality by setting statewide policy for water quality control and water quality control plans and coordinating and supporting the nine Regional Water Quality Control Boards. The Regional Boards conduct rulemaking and regulatory activities through issuance and implementation of regional water quality control plans (basin plans). Because the Order is administered and used, in part, by the Regional Boards, the study area (geographic scope) is defined as the nine water quality control regions (see Figure E-3).

E.3.1 Region 1—North Coast

The North Coast Regional Board's jurisdiction encompasses watersheds draining to the Pacific Ocean from California's northern border to the southerly boundaries of the Estero de San Antonio and Stemple Creek watersheds. This region includes all of Del Norte, Humboldt, Trinity, and Mendocino Counties, and portions of Siskiyou, Modoc, Glenn, Lake, Sonoma, and Marin Counties. Major bodies of water in this region include the Smith, Klamath, Trinity, Eel, Mattole, and Russian Rivers, and Humboldt Bay.

E.3.2 Region 2—San Francisco

The San Francisco Bay Regional Board's jurisdiction encompasses watersheds draining to the Pacific Ocean from Tomales Bay in the north to Pescadero Creek in the south, excluding watersheds that drain to either the Sacramento River or the San Joaquin River. This region includes all of San Francisco County and portions of Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and Santa Cruz Counties. The dominant feature of this region is the San Francisco Bay estuary, which conveys the waters of the Sacramento and San Joaquin Rivers into the Pacific Ocean. Other major tributaries to the San Francisco Bay estuary include the following watersheds: Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara Basin, Solano, and Sonoma. This region also includes coastal portions of Marin and San Mateo Counties.

E.3.3 Region 3—Central Coast

The Central Coast Regional Board's jurisdiction encompasses watersheds draining to the Pacific Ocean from Pescadero Creek south to the southeasterly boundary of the Rincon Creek watershed. This region includes all of Santa Cruz and Monterey Counties and portions of San Mateo, Santa Clara, San Benito, San Luis Obispo, Santa Barbara, Kern, and Ventura Counties. Major bodies of water in this region include the Pajaro and Salinas Rivers, and Morro and Monterey Bays.

E.3.4 Region 4—Los Angeles

The Los Angeles Regional Board’s jurisdiction encompasses watersheds draining to the Pacific Ocean from the Ventura River watershed south to the San Gabriel River watershed. This region includes portions of Ventura County, Los Angeles County, and Orange, Kern, and Santa Barbara Counties. Major bodies of water in this region include the Santa Clara, Los Angeles, and San Gabriel Rivers; Santa Monica Bay; and the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente).

E.3.5 Region 5—Central Valley

The Central Valley Regional Board’s jurisdiction encompasses all watersheds that drain to the Sacramento and San Joaquin Rivers. This region includes Tehama, Butte, Plumas, Colusa, Sutter, Yuba, Sacramento, San Joaquin, Stanislaus, Merced, Fresno, Kings, Tulare, Madera, Mariposa, Tuolumne, Calaveras, and Amador Counties. It also includes portions of Modoc, Lassen, Sierra, Nevada, Placer, El Dorado, and Alpine Counties to the east, and portions of San Benito, Santa Clara, Alameda, Contra Costa, Solano, Napa, Lake, Glenn, and Siskiyou Counties to the west. Major rivers in this region include the Sacramento, Pit, Feather, Yuba, Bear, American, San Joaquin, Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. Major reservoirs and lakes in this region include Shasta, Oroville, Folsom, Clear, Pardee, New Hogan, Millerton, McClure, Don Pedro, and New Melones Lakes.

E.3.6 Region 6—Lahontan

The Lahontan Regional Board’s jurisdiction encompasses all watersheds within the boundaries of California that drain to the Great Basin. Jurisdiction extends from California’s northern border to the northern Mojave Desert and includes all of California’s eastern border east of the Sierra Nevada crest. This region includes Inyo and Mono Counties and portions of Los Angeles, Kern, San Bernardino, Alpine, El Dorado, Placer, Nevada, Sierra, Plumas, Lassen, and Modoc Counties. Major bodies of water in this region include Lake Tahoe; Eagle, Honey, Owens, and Mono Lakes; and the Susan, Truckee, Carson, Walker, Owens, and Mojave Rivers.

E.3.7 Region 7—Colorado River

The Colorado River Regional Board’s jurisdiction encompasses all watersheds within the boundaries of California that drain to the Colorado River. This region includes Imperial County and portions of San Bernardino, Riverside, and San Diego Counties. Major bodies of water in this region include the Salton Sea, the Southern Mojave and Lower Colorado Rivers, the Imperial Reservoir, and Havasu and Mohave Lakes.

Figure E-3 Restoration Projects Statewide Order Geographic Scope

Source: ESRI 2018; State Water Board 2019; ESA 2019



E.3.8 Region 8—Santa Ana

The Santa Ana Regional Board's jurisdiction encompasses the Santa Ana River watershed, which drains to the Pacific Ocean. This region includes portions of Los Angeles, San Bernardino, Riverside, and Orange Counties. Major bodies of water in this region include Anaheim and Newport Bays, the Santa Ana and Jacinto Rivers, and Lake Elsinore.

E.3.9 Region 9—San Diego

The San Diego Regional Board's jurisdiction encompasses all watersheds that drain to the Pacific Ocean from the southern border of the Santa Ana Regional Board's jurisdictional limits to the southern border of California. This region includes portions of San Diego, Riverside, and Orange Counties. Major water bodies in this region include the San Juan, Santa Margarita, San Luis Rey, Carlsbad, San Dieguito, Peñasquitos, San Diego, Pueblo San Diego, Sweet Water, Otay, and Tijuana Rivers and San Diego and Oceanside Harbor bays.

E.4 Categories of Restoration Projects in the General Order

The Order addresses restoration practices that require Section 401 water quality certification and/or waste discharge requirements. Sections E.4.1 through E.4.10 below present detailed descriptions of the categories of restoration project types eligible for enrollment under the Order. Each project category discussion briefly summarizes the project purpose, describes different activities and/or subproject types, and summarizes typical construction activities associated with projects falling into that category.

During the Order enrollment process, the approving Water Boards will determine whether an individual restoration project is eligible for inclusion in the Order. Where restoration activities may involve a FERC-licensed facility, the restoration project may be covered by this General Order only upon receipt of written approval by the Deputy Director for the Division of Water Rights or their designee. All projects authorized under the Order must also incorporate applicable general protection measures into their project design to ensure avoidance and minimization of impacts on aquatic resources. A description of programmatic sideboards, general protection measures, design guidelines, and other requirements can be found in Sections E.5 and E.6.

E.4.1 Improvements to Stream Crossings and Fish Passage

Improvements to stream crossings and fish passage, including fish screens, provide a number of ecological benefits. For example, they provide safe passage for migratory and nonmigratory species, beneficial transport of sediment and debris, and improved hydrology and hydraulics. Stream crossing and fish passage improvements must be consistent with National Marine Fisheries Service (NMFS) and CDFW fish passage criteria.

Stream Crossings, Culverts, and Bridges

Stream crossing, culvert, and bridge projects generally involve removing, replacing, modifying, retrofitting, installing, or resetting existing culverts, fords, bridges, and other stream crossings and water control structures of any size. This includes projects that are developed to upgrade undersized, deteriorated, or misaligned culverts.

Projects to replace culverts or bridges are ineligible for coverage under the Order if they do not meet the definition of a restoration project (as provided in section V.) and the terms and conditions of the Order. Bridges and culverts should be designed to match gradients and adequately convey flow and materials (e.g., the 100-year flood) in addition to allowing fish passage. Any new or replacement crossing, culvert, or bridge that intersects potential habitat for listed salmonid species, also must meet CDFW and/or NMFS fish passage criteria, as applicable. If a bridge or culvert is designed to convey less than the 100-year design flow, the project should demonstrate that a smaller structure will not result in excessive flooding, erosion/sedimentation, headcutting, or habitat impacts.

Constructing or installing a stream crossing, culvert, or bridge may include site excavation, formation and pouring of a concrete foundation and walls/abutments, and installation of the crossing structure, as well as placement of bioengineered and/or rock slope protection (RSP) to protect abutments, piers and walls. Where RSP is deemed necessary, use natural stream material to fill and cover exposed rock and/or use bioengineered techniques, listed below, where appropriate.

Fish Screens

Projects in this category involve installing, operating, and maintaining fish screens on existing water intakes. See the additional discussion in Section E.5.3, *Pre-Application Consultation*.

Constructing or installing a fish screen usually includes site excavation, formation and pouring of a concrete foundation and walls, and installation of the fish screen structure. Typically, if the fish screen is placed in or near flood-prone areas, rock or other armoring is installed to protect the screen. Fish screen types include self-cleaning screens (including flat plate, rotary drum screens, cone screens, and other designs with a variety of cleaning mechanisms) and non-self-cleaning screens (including tubular, box, and other designs). All fish screens must be consistent with NMFS fish screening criteria.

Fishways

This project type involves removing, relocating, constructing, repairing, or maintaining fishways. This project type may include riffle-pool complexes (e.g., rock/boulder ramps) or installation of fishways that bypass barriers. Engineered fish ladder structures should be avoided unless there are no other viable alternatives. See the additional discussion in Section E.5.3, *Pre-Application Consultation*.

Constructing and/or installing fishways usually includes site excavation, formation and pouring of a concrete foundation and walls, pile driving, excavation and installation of an entry and exit channel, and installation of the fishway structure. Heavy equipment is typically used for excavation and preparation of the ladder site.

Headcut Stabilization

Stabilizing headcuts¹ is often required to stabilize the bed of a stream and promote structural sustainability over time. This improvement is also used to stop stream incision, increase connection to the adjacent floodplain, and enhance floodplain inundation.

Construction of these project types typically includes site excavation, and may include installation of a control structure (e.g., boulders, earthen fill). Heavy equipment is typically used for excavation.

E.4.2 Removal of Small Dams, Tide Gates, Flood Gates, and Legacy Structures

These projects are designed to reconnect stream corridors, floodplains, and estuaries; establish wetlands; improve passage by aquatic organisms; and restore more natural channel and flow conditions. They also help to restore fisheries access to historic habitat for spawning and rearing and improve the long-term quality of aquatic habitat and stream geomorphology. All projects must be designed with seasonal construction considerations to minimize potential adverse effects on water quality and/or aquatic species.

This project type involves removing small dams, tide gates, flood gates, and legacy structures to improve fish and wildlife migration, tidal and freshwater circulation and flow, and water quality. This project type may also include separation of streams from artificial impoundments (e.g., ponds or lakes) by realigning and/or rerouting channels around these artificial water bodies and/or through the use of vertical concrete or sheet-pile walls.

Removal of Small Dams

Small dams are removed to restore fisheries access to historic habitat for spawning and rearing and to improve long-term habitat quality and natural stream geomorphology. Types of eligible small dams include permanent, flashboard, debris basin, earthen, and seasonal dams that have the characteristics listed below.

Consistent with the NMFS programmatic restoration *Biological Opinion to Facilitate Implementation of Restoration Projects in the Central Valley* (NMFS 2018), small dams included in the Order are those defined by the California Division of Dam Safety as dams of non-jurisdictional size. Those dams are smaller in height or impounding capacity than dams as defined by California Water Code Section 2002 (Division 3, Part 1, Chapter 1, 6002), where “dam” means:

Any artificial barrier, together with appurtenant works, which does or may impound or divert water, and which either (a) is or will be 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the department, or from

¹ Headcut, in stream geomorphology, is an erosional feature of some intermittent and perennial streams with an abrupt vertical drop, also known as a knickpoint, in the stream bed.

the lowest elevation of the outside limit of the barrier, as determined by the department, if it is not across a stream channel or watercourse, to the maximum possible water storage elevation or (b) has or will have an impounding capacity of 50 acre-feet or more.

Facilities under the jurisdiction of the Federal Energy Regulatory Commission (FERC) may be covered by this general order upon receipt of written approval by the Deputy Director for the Division of Water Rights. See additional discussion in Section E.5.3, *Pre-Application Consultation*.

Implementing small dam removal projects may require the use of heavy equipment (e.g., self-propelled logging yarders, mechanical excavators, backhoes). Some small dams can be removed using hand tools such as jackhammers. Any use of explosives for removal of a small dam must be justified by individual restoration project conditions including equipment access difficulties. The use of explosives must occur in dry or dewatered conditions and potential harm to special-status species from the explosives blast and pressure waves must be analyzed. Using explosives is an eligible activity; however, this approach would also require additional review and approval by appropriate regulatory agencies.

Projects meeting any of the following conditions are ineligible for authorization under the Order:

- ◆ Projects involving dams licensed under FERC that have not received authorization from the Director of the Division of Water Rights;
- ◆ Sediments stored behind the dam have a reasonable potential to contain environmental contaminants (dioxins, chlorinated pesticides, polychlorinated biphenyls [i.e., PCBs], or mercury) beyond the freshwater probable effect levels summarized in the National Oceanic and Atmospheric Administration Screening Quick Reference Table guidelines (NOAA 2008). OR
- ◆ Projects that have been determined, through pre-application consultation (see Section E.5.3), to require more detailed analysis based on the risk of significant loss or degradation of downstream spawning or rearing areas by sediment deposition.

Sites are considered to have a reasonable potential to contain contaminants of concern if they are downstream of historical contamination sources such as lumber or paper mills, industrial sites, mining sites, or intensive agricultural production going back several decades (i.e., since chlorinated pesticides were legal to purchase and use). Therefore, preliminary sediment sampling is advisable in these areas to determine whether a project is eligible for authorization under the Order.

Conversely, small dams that do not have historical contamination sources in the upstream watershed are considered to have low potential to contain contaminants; therefore, they could be considered low risk with reduced sediment sampling and evaluation.

This Order will only include dam removal that will restore natural contours upstream, naturally or with excavation, to minimize negative effects on downstream habitat. Dam removal projects will (1) have a volume of sediment available for release that is small relative to the size of the stream channel, and that when released by storm flows, will have minimal effects on downstream habitat as verified by a qualified and appropriate scientist and engineer, and reviewed by either CDFW or NMFS scientists and engineers, or (2) be designed to remove sediment trapped by the dam down to the elevation of the target thalweg including design channel and floodplain dimensions.

Removal of Tide Gates and Flood Gates

Removal of or upgrades to existing tide and flood gates involve modifying gate components and mechanisms in tidal stream systems where full tidal exchange is incompatible with the current land use (e.g., where high-tide backwater effects are of concern). Tide/flood gate replacement or retrofitting may include such activities as installation of temporary cofferdams and dewatering pumps, and excavation of existing channels, adjacent floodplains, flood channels, and wetlands, and may include structural elements such as streambank restoration and hydraulic roughness.

The placement of new gates where they did not previously exist is not eligible for authorization under the Order. The replacement of tide gates is eligible only if project proponents can demonstrate that such a replacement would increase or enhance ecological processes. Tide and flood gates may be plugged by removing the culvert and backfilling the berm or levee to prevent fish from accessing unsuitable habitat.

Excavators, cranes, boats, barges, pumps, dump trucks, and similar equipment are typically used to implement the projects in this category.

Removal of Legacy Structures

This activity includes the removal of nonfunctioning in-channel and floodplain legacy habitat structures (e.g., grade control structures and defunct boulder weirs) to improve water quality and channel geomorphology.

Removal of legacy structures may require the use of excavators, cranes, dump trucks, vibratory pile drivers, and similar equipment.

E.4.3 Bioengineered Bank Stabilization

Bioengineered bank stabilization projects improve riparian and stream habitat by increasing stream shade to lower stream temperatures, production of invertebrates, future recruitment of large woody material, and bank stability. Riparian habitat restoration projects increase the number of plants and plant groupings, and include natural regeneration, exclusion fencing for livestock, bioengineering, and revegetation.

To improve aquatic and riparian habitats and reduce soil erosion and sedimentation of streams and wetlands, bioengineered bank stabilization integrates living woody and herbaceous materials with earthwork and recontouring of streambanks. Both organic and inorganic materials are put into place to stabilize and improve the structure of the soil where site constraints limit opportunities for natural channel meander. Bank stabilization structures that use bioengineering techniques minimize many of the

impacts on aquatic resources commonly caused by traditional or conventional engineered bank structures. Examples of bioengineering project types include revetment² consisting of trees, native plant materials, or willow walls, and willow siltation baffles, brush mattresses, brush check dams, and brush bundles. Bioengineered project types may also include the placement of buried riprap³ with soil and vegetation plantings on top.

Bioengineered bank stabilization techniques use a minimal amount of hard materials (e.g., rock) and are not intended to include traditional hard engineering techniques, which would not be permitted under the Order. Part XI, *Riparian Habitat Restoration*, of the CDFW *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 2010: Vol. II) identifies examples of techniques that would be permitted under the Order.

Bioengineered bank stabilization structures are suitable for many low-order, low-gradient stream segments where the channel is not aggrading⁴ or degrading⁵ rapidly, and where sufficient space is available to reshape the eroding bank to an appropriate slope. The Order would not cover projects that merely protect property from bank erosion; however, many restoration project types, including multi-benefit projects that include bioengineered bank stabilization would be eligible for coverage under the Order.

The use of boulders should be limited in scope and quantity to the minimum necessary to stabilize the slope and protect it from expected streamflows during storms. Boulder structures should be part of a larger restoration design with the primary purpose of improving habitat, and should include a riparian revegetation element. Bridge abutments and other structural improvements installed as part of the restoration design of fish passage projects may require additional stabilization with boulder and rock banks.

Guidelines for streambank stabilization techniques are described in Part VII, *Project Implementation*, of the CDFW *Riparian Habitat Restoration Manual* (Flosi et al. 2010: Vol. I or subsequent updates).

Projects in this category may require the use of heavy equipment (e.g., self-propelled logging yarders, excavators, backhoes, and/or dump trucks).

E.4.4 Restoration and Enhancement of Off-Channel and Side-Channel Habitat

Restoring and enhancing off-channel and side-channel habitat features helps to improve aquatic and riparian habitat for fish and wildlife. Restoration project types in this category have the following benefits:

- ◆ Increase habitat diversity and complexity
- ◆ Improve heterogeneity (e.g., nonuniform character) of flows
- ◆ Provide long-term nutrient storage and substrate for aquatic macroinvertebrates
- ◆ Moderate flow disturbances

² Revetments are sloping structures placed on banks or cliffs in such a way as to absorb the energy of incoming water.

³ Riprap is placed rock or other material used to armor shorelines and streambeds against scour and water, wave erosion.

⁴ A stream becoming increasingly shallow as a result of sediment deposition.

⁵ A stream actively deepening its channel and capable of transporting more sediment load than is presently provided.

- ◆ Increase retention of leaf litter
- ◆ Provide refuge for fish during high flows

Projects proposed for side-channel or off-channel habitat also typically improve hydrologic connections between main channels and their floodplains.

This project category typically involves reconnecting and creating side-channel, alcove, oxbow, pond, off-channel, floodplain, and other habitats, and potentially removing off-channel fill and plugs. New side channels and alcoves may be constructed in geomorphic settings that accommodate such features. This activity category typically applies to areas where side channels, alcoves, and other backwater habitats have been filled or blocked from the main channel, disconnecting them from most if not all flow events.

Work may involve removing or breaching levees, berms, and dikes; excavating channels; constructing wooden or rock tailwater⁶ control structures; and constructing large wood habitat features.

The use of logs or boulders as stationary water-level control structures is an eligible project element under the Order. With the exception of offstream storage projects to reduce low-flow stream diversions, projects involving the permanent installation of a flashboard dam, head gate, or other mechanical structure are not eligible for authorization under the Order.

Excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

E.4.5 Water Conservation

Creation, operation, and maintenance of water conservation projects including offstream storage tanks and ponds and associated off-channel infrastructure reduce low-flow stream diversions and enhance streamflows, particularly base flows for fish and wildlife habitat during the dry season. These projects typically require placing infrastructure (e.g., pumps, piping, screens, and headgates) in or adjacent to the stream to provide alternative water intake facilities. Exclusion fencing may be constructed to manage grazing in aquatic and riparian habitat as described in Section E.4.10, *Establishment, Restoration, and Enhancement of Stream and Riparian Habitat and Upslope Watershed Sites*.

Other projects in this category include piping ditches to create a more efficient use of water where the water saved will be dedicated to fish and wildlife under the terms of California Water Code Section 1707 or forbearance agreements. These projects are designed to improve streamflow and riparian habitat for fish and wildlife. Excavators and other heavy equipment may be used to implement the projects.

⁶ Water body located downstream of a dam or other dam or other barrier.

E.4.6 Floodplain Restoration

Project types in this category improve the diversity and complexity of aquatic, meadow, and riparian habitat, as well as ecosystem function, because they have the following effects:

- ◆ Provide opportunities for sediment to deposit on the floodplain seasonally, which enhances meadow vegetation, use by birds and mammals, and fish rearing and spawning; and also provide refuge from predators and physical stressors
- ◆ Create intermittent hydrologic connections between streams and floodplains
- ◆ Increase floodway capacity and the frequency and duration of floodway inundation
- ◆ Improve ecosystem functions for aquatic and terrestrial species and also improve water quality
- ◆ Reconnect stream channels to floodplains, thus improving the fluvial dynamics of the watershed system, for example, by allowing normal patterns of sediment deposition and transport, as well as, channel migration
- ◆ Reduce or eliminate areas that strand native fish or provide habitat for nonnative predatory fish, or both
- ◆ Provide high-flow and thermal refuges for native fish and other aquatic species

Floodplains should mimic natural flooding patterns and remain flooded/inundated long enough to activate food webs. Floodplain restoration can involve rock placement, specifically as engineered stream material, riffle ramps, weirs, and other strategies to aggrade the channel and enable connectivity to floodplains.

Floodplain restoration projects may be implemented through various strategies. Some involve setback, breaching, and removal of levees, berms, and dikes, and excavation and/or fill for hydraulic reconnection (including restoration to stage zero⁷) and revegetation.

Levee setback projects involve constructing new levees to facilitate removal or breaching of existing levees and creation of aquatic or riparian habitat. These project types may also include filling and/or reshaping of on- and off-channel gravel pits. Levees may be adjusted or a low levee bench may be created to allow for tidal inundation or channel margin habitat.

Floodplain projects may also reconnect historical stream and river channels and freshwater deltas with floodplains, and reconnecting historical estuaries to tidal influence, through levee removal, setback, and breaching or construction of floodplain surfaces that connect at base flow. Floodplain restoration projects may be planned where floodplains and estuaries have been disconnected from adjacent streams and rivers.

⁷ Streams that are fully connected with their floodplains; typically, multi-thread.

Meadow and floodplain restoration may involve reconnecting down-cut channels to their floodplains to restore hydrologic processes and meadow health; filling incised, entrenched channels; creating new stream channels; regrading floodplains; or realigning channels or installing stabilization structures. Incised channels should only be filled if the watershed conditions that triggered incision have been considered and would not result in continued incision (project failure) and/or can be mitigated by the project. These restoration actions may rely on watershed processes to complete work over time to restore a channel network and floodplain that supports wetlands or grasslands.

Proposals for projects to create off-channel or side-channel habitats, floodplain restoration project proposals will include information regarding considerations for water supply (channel flow, overland flow, and groundwater), water quality, and reliability; risks of channel changes; and channel and hydraulic grade.

Excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement these projects.

E.4.7 Removal of Pilings and Other In-Water Structures

Untreated and chemically treated wood pilings, piers, vessels, boat docks, and derelict fishing gear, and similar structures built using plastic, concrete, and other materials, may be removed to improve water quality and habitat for fish and wildlife. These projects are designed to remove contaminant sources and hazards from stream, river, and estuary habitats.

Boats, barges, excavators, dump trucks, front-end loaders, and similar equipment may be used to implement these projects.

E.4.8 Removal of Nonnative Terrestrial and Aquatic Invasive Species and Revegetation with Native Plants

Removing nonnative terrestrial and aquatic invasive species and/or revegetating with native plants improves aquatic, riparian, and wetland habitat for fish and wildlife in a variety of ways. These projects are designed to improve or provide the following benefits:

- ◆ Composition, structure, and abundance of native biological communities important for bank stability
- ◆ Stream shading, riparian canopy, and understory establishment and diversity
- ◆ Input of large wood and other organic material into streams
- ◆ Nesting and roosting habitat
- ◆ Reduction of soil erosion
- ◆ Water quality improvement
- ◆ Greater dune stability and habitat complexity
- ◆ Improved soil health

- ◆ Other ecological benefits, all of which are important elements of species habitat and water quality

Removal of Nonnative Terrestrial and Aquatic Invasive Species

Manual, mechanical, biological, and chemical methods can be used independently or in combination to remove invasive nonnative species from aquatic and riparian areas. Sites with a variety of invasive species may receive several different types of treatments. If chemical methods are used, the treatment will need to comply with labeling, application by qualified individuals (when required), as well as any required buffers from aquatic areas and/or additional authorizations, such as National Pollution Discharge Elimination System (NPDES) permit, as applicable.

This project type also includes removal and/or management of nonnative predatory fish and other nonnative fish and wildlife, as long as the activity is associated with a restoration project.

Revegetation with Native Plants

Revegetation with native plants should mimic the area's naturally occurring riparian and aquatic habitats and use seed or plant stock from the local watershed. Activities may include:

- ◆ Planting and seeding native trees, shrubs, and herbaceous plants
- ◆ Placing sedges, rushes, grasses, succulents, forbs, and other native vegetation
- ◆ Gathering and installing willow cuttings, stakes, mats, and fences
- ◆ Temporary irrigation
- ◆ Coordination with upstream operators to control dam releases or instream flow levels to provide water during plant establishment

E.4.9 Establishment, Restoration, and Enhancement of Tidal, Subtidal, and Freshwater Wetlands

Establishing, restoring, and enhancing tidal, subtidal, and freshwater wetlands results in more wetland area, increased primary and secondary ecological productivity, and more diversity of habitat.

This project type generally involves grading (e.g., creating depressions, berms, and drainage features) or breaching (e.g., excavating breaks in levees, dikes, and/or berms), or both, to create topography and hydrology that:

- ◆ Supports native wetland plants (planted or recruited naturally)
- ◆ Provides habitat elements for target species
- ◆ Provides other targeted wetland functions
- ◆ Allows fish and other aquatic species to use channel networks and marsh plains with hydrologic variability (seasonally or tidally)
- ◆ Provides hydrologic connectivity to local, low-lying subwatershed areas

These projects also establish, maintain, restore, or enhance off-channel and vernal pools to support habitat for amphibians or vernal pools, which support plants and animals.

Project types in this category also create ecotones (transitional zones between two habitat or community types [aquatic/upland interface]) and/or “living shorelines” that could use fill and excavation with native vegetation (submerged and/or emergent), alone or in combination with offshore sills (e.g., artificial reefs), to stabilize the shoreline.

Creation of ecotones could require extensive beneficial fill and have the potential to affect adjacent existing wetlands; however, these projects are necessary to allow tidal wetlands to respond to sea level rise, and they provide refuge for native wildlife and buffer wetlands from adjacent municipal and industrial land uses.

Living shorelines provide a natural alternative to “hard” shoreline stabilization methods like stone sills or bulkheads; they provide numerous ecological benefits, including water quality improvements, habitat for fish and invertebrates, and buffering of the shoreline from waves and storms.

Living shoreline projects use a suite of habitat restoration techniques to reinforce the shoreline, minimize coastal erosion, and maintain coastal processes while protecting, restoring, enhancing, and creating natural habitat for fish and aquatic plants and wildlife. The term “living shorelines” was coined because the approach provides living space for estuarine and coastal organisms. Strategic placement of native vegetation and natural materials or shells for native shellfish settlement enhances habitat values by creating new living space. The techniques also increase the connectivity of wetlands and deeper intertidal and subtidal lands while providing a measure of shoreline protection.

Living shoreline design strategies can use rock armoring, rock sill, groin, or breakwater installations only if the use of such design strategies is integral to the restoration basis of design.

Project types in this category include excavation, removal, and/or placement of fill materials to restore or approximate pre-disturbance site conditions; contouring wetlands to establish more natural topography, hydrology, and/or hydraulics; and setting back, modifying, or breaching existing dikes, berms, and levees.

This project category may also include:

- ◆ Constructing transitional tidal marsh habitat (i.e., “horizontal levees,” setback berms, or ecotones)
- ◆ Backfilling artificial channels
- ◆ Removing existing drainage structures, such as drain tiles
- ◆ Filling, blocking, or reshaping drainage ditches to restore wetland hydrology
- ◆ Establishing tidal/fluvial channels and wetlands in tidal waters where those wetlands previously existed, or have migrated or will migrate as a result of sea level rise
- ◆ Installing structures or fill necessary to establish wetland or stream hydrology
- ◆ Constructing nesting/planting islands

- ◆ Constructing open water areas
- ◆ Constructing noncommercial, native oyster habitat (e.g., reefs) over an unvegetated bottom in tidal waters
- ◆ Conducting noncommercial, native shellfish seeding
- ◆ Establishing submerged aquatic vegetation (e.g., eelgrass beds) in areas where those plant communities previously existed

Activities needed to establish vegetation including plowing or disking for preparation of seed beds and planting appropriate wetland species may also be included.

Project activities that plan for climate change, including sea level rise, should be considered in tidally influenced locations. California's Climate Adaptation Strategy recommends using ecotones and living shorelines as a potential adaptation method to reduce the need for engineered "hard" shoreline protection devices and to provide valuable, functional coastal habitat (CNRA 2018). The California State Coastal Conservancy's Climate Change Policy also supports the use of living shorelines for their ability to improve the resiliency of estuarine habitat to future sea level rise and other related effects of climate change (SCC 2011).

Ecotone habitat levees, where appropriate for an individual project location, should be used when new exterior levees are required to protect adjacent landowners from the return of tidal inundation. The project side of the levee should be constructed with areas of longer gentle slopes to accommodate upland refugia for sensitive salt marsh and brackish marsh species during higher tides associated with phenomena such as storm surges and king tide events. Interior berms' connection to adjacent uplands must consider access by predators during high tides. In addition, sidecast material should be used during the excavation of new channels to recontour pond bottoms to achieve the desired hydrology. This would include creating islands disconnected from uplands to provide future upland refugia and nesting areas in larger marshes.

Excavators, graders, bulldozers, dump trucks, front-end loaders, boats, barges, and similar equipment may be used to implement these projects.

E.4.10 Establishment, Restoration, and Enhancement of Stream and Riparian Habitat and Upslope Watershed Sites

Stream and Riparian Habitats

Establishing, restoring, and enhancing stream and riparian habitats provides the following benefits:

- ◆ Habitat complexity, diversity, and cover for fish and other aquatic species
- ◆ Increased spawning and rearing habitat
- ◆ Improved migration corridors
- ◆ Improved pool habitat and pool-to-riffle ratios
- ◆ Restoration of sinuosity
- ◆ Improved water quality
- ◆ Reconnection of the channel to the floodplain and associated functions

These projects may typically include the following activities:

- ◆ Placing large woody material and boulders
- ◆ Constructing engineered logjams
- ◆ Constructing porous boulder structures and vanes
- ◆ Installing small wood structures or beaver dam analogues
- ◆ Enhancing vegetation
- ◆ Conducting bank stabilization and erosion control work
- ◆ Stabilizing headcuts
- ◆ Augmenting and placing gravel
- ◆ Removing and replacing concrete-lined channels with natural materials

Project activities may also include excavating, sorting, placing, and contouring existing on-site materials (e.g., historic mine tailings) on perched floodplains and in channels to reconnect those habitats and improve spawning and rearing conditions.

Project types in this category typically occur in areas where channel structure is lacking because of past stream cleaning (removal of large woody material), riparian timber harvest, historic grazing and meadow dewatering practices, hydromodification, or urbanization, and in areas where natural gravel supplies are low as a result of human-caused disruptions. These projects occur in stream channels and adjacent floodplains to increase channel stability, rearing habitat, pool formation, deposition of spawning gravel, channel complexity, hiding cover, low-velocity areas, and floodplain function. Helicopters, excavators, dump trucks, front-end loaders, full-suspension yarders, and similar equipment may be used to implement these projects.

Engineered logjams are large wood structures that include an anchoring system, such as rebar pinning, ballast rock, or vertical posts. These structures are designed to redirect flows and change scour and deposition patterns. To the extent practical, they are patterned after stable natural logjams and can be anchored in place using rebar, rock, or piles (driven into a dewatered area or the streambank, but not in water). Engineered logjams create a hydraulic shadow (low-velocity zone downstream) that allows sediment to settle. Scour holes develop adjacent to the engineered logjam. While providing valuable fish and wildlife habitat, they also redirect flow and can stabilize a streambank or downstream gravel bar.

Large woody material may be installed using either anchored or unanchored logs, or both, depending on site conditions and wood availability. Wood loading methods may include but are not limited to direct felling, whole-tree tipping and placement, use of helicopters, use of excavators, and grip hoisting.

Establishment, restoration, and enhancement of stream habitats may also include the following activities:

- ◆ Removing revetment and other streambank armoring materials
- ◆ Installing grade control structures using native/natural materials to improve general habitat and water quality, thus allowing establishment of native vegetation for birds, fish, and other species

- ◆ Improving stream morphology and channel dynamics; restoring sediment input and retention balance; and improving water quality
- ◆ Placing boulder structures (e.g., roughened channels, boulder ramps/riffle ramps, boulder weirs, vortex boulder weirs, boulder clusters, and single and opposing boulder wing deflectors)
- ◆ Placing imported spawning gravel

In addition, infrastructure located along streams and in riparian areas may be removed or relocated. The primary purpose of infrastructure removal is to eliminate or reduce impacts on riparian areas and vegetation, improve bank stability, reduce erosion, reduce sedimentation into adjacent streams, and provide for native revegetation or natural native plant recruitment. Among the types of infrastructure that could be removed or relocated are boat docks, boat haul-out locations, campgrounds and campsites, day-use sites, roads/trails, and off-highway/off-road vehicle routes that affect aquatic resources or riparian habitat. See Section E.4.7, *Removal of Pilings and Other In-Water Structures*, for further detail on removal of in-water structures.

Upslope Watershed Sites

Sites in upslope watershed areas may be restored to reduce the delivery of sediment to streams, promote natural hydrologic processes, and restore habitats for birds, amphibians, fish, and other species. This project type also includes road- and trail-related restoration including decommissioning, upgrading, and storm-proofing of roads and trails. The following are some of the specific techniques that may be used:

- ◆ Removing, installing, or upgrading culverts
- ◆ Constructing water bars⁸ and dips
- ◆ Deep-ripping decommissioned roadbeds
- ◆ Reshaping road prisms to improve watershed functions
- ◆ Vegetating fill, cut slopes, and roadbeds
- ◆ Removing and stabilizing sidecast materials
- ◆ Grading or resurfacing roads and trails that have been improved for aquatic restoration, using gravel, bark chips, or other permeable materials
- ◆ Shaping the contours of the road or trail base
- ◆ Removing road fill to native soils
- ◆ Installing new culverts under trails or roads to reduce ditch length
- ◆ Stabilizing the soil and tilling compacted soils to establish native vegetation

These actions target priority roads and trails that contribute sediment to streams or disrupt floodplain and riparian functions.

This project type may also include installing exclusion fencing to manage or prevent grazing access to stream and riparian areas to facilitate the establishment of native riparian and stream habitat and the improvement of water quality. This project type includes controlled access to walkways that livestock use to cross streams and adjacent

⁸ A water bar or interceptor dike is a road construction feature that is used to prevent erosion on sloping roads, cleared paths through woodland (for utility companies such as electricity pylons), or other accessways by reducing flow length.

riparian areas. At stream crossings, gravel may be placed above the ordinary high-water mark within the fenced corridor to reduce trail erosion and delivery of sediment to the stream. Upland watering facilities (that do not involve water rights concerns) may be installed to reduce livestock use in riparian areas and stream channels. Planting native plants such as trees, shrubs, forbs, and graminoids may be necessary to manage invasive species and establish a healthy riparian corridor. Such projects reduce impacts of livestock on riparian soils and vegetation, streambanks, channel substrates, and water quality.

Equipment such as excavators, bulldozers, dump trucks, and front-end loaders may be used to implement these projects, which promote water quality and habitat improvement.

E.5 Programmatic Sideboards, General Protection Measures, and Other Requirements

In order to qualify for coverage under the Order, projects must meet the appropriate programmatic sideboards, general protection measures, and other conditions described in Sections E.5.1 through E.5.4. Section E.5.5 identifies activities that are prohibited under the Order.

Depending upon a project's construction details, not all general protection measures may be appropriate or necessary for a project to avoid and minimize impacts. Alternative measures may be proposed in the Notice of Intent for approving Water Board consideration to accommodate site-specific constraints or technological advances.

E.5.1 Programmatic Sideboards

Individual habitat restoration projects authorized through the Order should be designed, planned, and implemented in a manner consistent with the techniques and minimization measures presented in the following guidance documents, as appropriate to project type:

- ◆ CDFW's *California Salmonid Stream Habitat Restoration Manual*, Fourth Edition, Volume II (Flosi et al. 2010), which consists of the following four chapters:
 - Part IX, *Fish Passage Evaluation at Stream Crossings*
 - Part X, *Upslope Assessment and Restoration Practices*
 - Part XI, *Riparian Habitat Restoration*
 - Part XII, *Fish Passage Design and Implementation*
- ◆ CDFW Fisheries Restoration Grant Program guidance documents (see: <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=183423>)
- ◆ *NMFS Guidelines for Salmonid Passage at Stream Crossings* (NMFS 2001)

- ◆ *NMFS Fish Screening Criteria for Anadromous Salmonids* (NMFS 1997)
- ◆ *NMFS Science based and tools for evaluating stream engineering, management, and restoration proposals* (Skidmore et al. 2011)
- ◆ *Stream Habitat Restoration Guidelines* (Cramer 2011)
- ◆ Any relevant future updates, guidance, and/or agency requirements, where appropriate

Actions not guided by the above manuals but may be eligible for permitting under the Order include newer, innovative approaches to restoration design that are not yet in the manual but have demonstrated success. Examples include fishway operation and maintenance, and permanent removal of summer dams and other types of small dams.

The Order requires that all projects implement appropriate general protection measures, which are identified in the application materials, to reduce the potential for ancillary effects on aquatic resources, including effects on water quality, sensitive habitats, special-status species, and other riparian and aquatic species. These required measures are described below in Section E.5.2, *General Protection Measures*.

General administration of the Order will be conducted by the State Water Board. The State Water Board and Regional Boards will be responsible for enrolling individual restoration projects under the Order, as applicable, within their respective jurisdictional boundaries as outlined under Section E.3, Geographic Scope, above. The approving Water Board will have the authority to issue a Notice of Applicability (NOA).

E.5.2 General Protection Measures

All projects permitted under the Order must incorporate applicable general protection measures, identified below, to ensure avoidance and minimization of impacts to aquatic/riparian resources from construction activities.

General protection measures are fundamental to enrollment under the Order and applicable measures must be incorporated into project design. The purpose of the Order's protection measures is to incorporate best management practices (often referred to as BMPs) into projects submitted for review and approval through the Order, and to avoid and/or minimize potential short-term, long-term and cumulative adverse effects. These standards and practices represent sound and proven methods to reduce the potential adverse effects of an action. However, modified measures may be proposed by the project proponent or recommended by the authorizing Water Board, based upon site-specific conditions or technological constraints or advances. Each general protection measure described herein may be used in combination with other measures, as applicable to each restoration project.

Specific measures may be modified, added, or removed on an individual basis by the project proponent with authorization from the approving Water Board or on a programmatic (or statewide) basis with the State Water Board's approval. Further, it is important to note that additional protection measures pertaining to resources outside of Water Board's jurisdiction may be recommended and/or required by other agencies to

address potential resource impacts on a project-by-project basis. This may include measures addressing impacts to special-status wildlife, fish, and plant species, air quality, noise, cultural resources and others. These measures would typically be expected to be incorporated into projects as environmental commitments or as mitigation measures developed and committed to as part of the CEQA review process. (See the *Program Environmental Impact Report (PEIR) for Restoration Projects Statewide Order* for mitigation measures identified as part of the CEQA review process for this Order.) Additional conditions may also be required by other agencies during their permitting processes.

General Protection Measures

- ◆ **GPM-1: Receipt and Copies of All Permits and Authorizations:** Work shall not begin until all necessary permits and authorizations have been received (e.g., USACE, USFWS, NMFS, State and Regional Boards, CDFW). The project proponent will ensure that a readily available copy of the applicable agency permits and authorizations (e.g., USFWS Biological Opinion, NMFS Biological Opinion, Section 404 permit, etc.) is maintained by the construction foreman/manager on the project site for the duration of project activities.
- ◆ **GPM-2: Construction Work Windows.** Construction work windows may be required in order to avoid impacts to aquatic resources and associated beneficial uses during the wet season. Project proponents must also follow the applicable Regional Board's construction work windows, unless otherwise approved.
- ◆ **GPM-3: Construction Hours.** Construction activities shall be limited to daylight hours, to the extent feasible. If nighttime construction is necessary, all project lighting (e.g., staging areas, equipment storage sites, roadway, and construction footprint) will be selectively placed and directed onto the roadway or construction site and away from aquatic habitats. Light glare shields will be used to reduce the extent of illumination into aquatic habitats. If the work area is near surface waters, the lighting will be shielded so that it does not shine directly into the water.
- ◆ **GPM-4: Environmental Awareness Training.** For projects occurring in aquatic resources (e.g., wetlands, riparian areas, etc.), prior to engaging existing or new personnel in construction activities, new construction personnel will participate in environmental awareness training conducted by an agency-approved biologist or resource specialist.⁹ Construction personnel will be informed regarding the identification, potential presence, legal protections, avoidance and minimization measures, and applicable general protection measures for all aquatic resources with the potential to occur within or immediately adjacent to the project site. Construction personnel will be informed of the procedures to follow should aquatic resources be disturbed during construction activities. For projects where the agency-approved biologist or resource specialist is not regularly on the project site, training may be provided

⁹ Agency-approved monitor refers to monitors who demonstrate qualifications and can be approved by CDFW, NMFS, and/or USFWS and accepted by authorizing Water Board.

via online/web-based meeting with an interactive portion (e.g., web-based or in-person discussion) to be included during remote training sessions. For projects that may continue over an extended duration and require excessive training events, a training video developed under the supervision of the FWS-approved biologist or resource specialist may be used to train new personnel, as long as an FWS-approved biologist or resource specialist is available via phone to answer questions about the training or that may arise during construction

- ♦ **GPM-5: Environmental Monitoring.** As required in the NOA or other agency permit, a biologist or resource specialist will ensure that all applicable protective measures are implemented during project construction. The agency-approved biologist or resource specialist will have authority to stop any work if they determine that any permit requirement is not fully implemented. The agency-approved biologist or resource specialist will prepare and maintain a monitoring log of construction site conditions and observations, which will be kept on file.
- ♦ **GPM-6: Work Area and Speed Limits** Construction work and materials staging will be restricted to designated work areas, routes, staging areas, temporary interior roads, or the limits of existing roadways. Prior to initiating construction or grading activities, brightly colored fencing or flagging or other practical means shall be erected to demarcate the limits of the project activities, including the boundaries of designated staging areas; ingress and egress corridors; stockpile areas for spoils disposal, soil, and materials; and equipment exclusion zones. Flagging or fencing shall be maintained in good repair for the duration of project activities. Vehicles will obey posted speed limits on public roadways and will limit speeds to 20 miles per hour (mph) within the project area on unpaved surfaces and unpaved roads (to reduce dust and soil erosion) or in areas where special-status species have the potential to occur. Speeds greater than 20 mph may be permitted in the project area where special-status species are not expected to occur (e.g., within areas from which special-status species have been excluded) and where there is no risk of generating excessive dust (e.g., surfaces are paved, saturated, or have been treated with other measures to prevent dust).
- ♦ **GPM-7: Environmentally Sensitive Areas:** Monitoring, flagging, or fencing will be used to minimize disturbance to environmentally sensitive areas (e.g., waters and wetlands).

If fencing is used:

- Fencing used must be approved by CDFW and/or USFWS for compatibility with species under their jurisdiction, as applicable, that may occur on site.
- The agency-approved biologist or resource specialist will determine the location of fencing prior to the start of construction (e.g., between active work area(s) and sensitive resources).
- Fencing will remain in place throughout the duration of the construction activities, and will be inspected and maintained regularly by the agency-approved biologist or resource specialist until completion of the project.

- Repairs to the fencing will be made within 24 hours of discovery.
- Fencing will be removed when all construction equipment is removed from the site, the area is cleared of debris and trash, and the area is returned to natural conditions.
- ♦ **GPM-8: Prevent Spread of Invasive Species.** The spread or introduction of invasive exotic plant species by arriving vehicles, equipment, imported gravel, and other materials, will be avoided to the maximum extent possible. When practicable, invasive exotic plants in the project areas shall be removed and properly disposed of in a manner that will not promote their spread. Equipment shall be cleaned of any sediment or vegetation at designated wash stations before entering or leaving the project area to avoid spreading pathogens or exotic/invasive species. Isolated infestations of noxious weeds identified in the project area will be treated with approved eradication methods at an appropriate time to prevent further formation of seed and destroy viable plant parts and seed. Wash sites must be in confined areas that limit run-off to any surrounding habitat and on a flat grade. Upland areas will use rice straw or invasive species-free local slash/mulch for erosion control, while the remainder of the project area will use certified, weed-free erosion control materials. Mulch must be certified weed-free. The project proponent will follow the guidelines in the CDFW's California Aquatic Invasive Species Management Plan (CDFW 2008) and Aquatic Invasive Species Disinfection/Decontamination Protocols (CDFW 2016), where relevant. Construction supervisors and managers will be educated on weed identification and the importance of controlling and preventing the spread of noxious weeds.
- ♦ **GPM-9: Practices to Prevent Pathogen Contamination.** The project proponent will review and implement restoration design considerations and best management practices as published by the Working Group for *Phytophthoras* in Native Habitats (www.calphytos.org), when there is a risk of introduction and spread of plant pathogens in site plantings. (See also: <http://www.suddenoakdeath.org/welcome-to-calphytos-org-phytophthoras-in-native-habitats/resources/#restoration>.)
- ♦ **GPM-10: Equipment Maintenance and Materials Storage.** Vehicle traffic will be confined to existing roads and the proposed access route(s). All machinery must be in good working condition, showing no signs of fuel or oil leaks. Oil, grease, or other fluids shall be washed off at designated wash stations prior to equipment entering the construction site. Inspection and evaluation for the potential for fluid leakage will be performed daily during construction. Where possible, and where it would not result in greater impact to aquatic resources, no equipment refueling, or fuel storage will take place within 100 feet of a body of water. All fuel and chemical storage, servicing, and refueling shall be done in an upland staging area or other suitable location (e.g., barges) with secondary containment to prevent spills from traveling to surface water or drains. Project proponents will establish staging areas for equipment storage and maintenance, construction materials, fuels, lubricants, solvents, and other possible contaminants in coordination with resource agencies. Staging areas will have a

stabilized entrance and exit and will be located in upland areas to the extent possible and at least 100 feet from bodies of water unless site-specific circumstances do not provide such a setback or would result in further damage to sensitive resources, in which case the maximum setback possible will be used. Fluids will be stored in appropriate containers with covers and properly recycled or disposed of offsite. Machinery stored on site shall have pans or absorbent mats placed underneath potential leak areas.

- ◆ **GPM-11: Material Disposal.** All refuse, debris, unused materials, and supplies that cannot reasonably be secured shall be removed daily from the project work area and deposited at an appropriate disposal or storage site. All construction debris shall be removed from the project work area immediately upon project completion. The Water Quality and Hazardous Materials measures (see below), will be implemented as applicable to ensure proper handling and disposal of hazardous materials.
- ◆ **GPM-12: Fugitive Dust Reduction.** To reduce dust, construction vehicles will be speed restricted as described in GPM-6, *Work Area and Speed Limits* when traveling on non-paved surfaces. Stockpiled materials susceptible to wind-blown dispersal will be covered with plastic sheeting or other suitable material to prevent movement of the material. During construction, water (e.g., trucks and portable pumps with hoses) or other approved methods will be used to control fugitive dust, as necessary. Dust suppression activities must not result in a discharge to waters of the state unless such discharges are approved by the State or Regional Board.
- ◆ **GPM-13: Trash Removed Daily.** During project activities all trash will be properly contained within sealed containers, removed from the work site, and disposed of daily.
- ◆ **GPM-14: Project Cleanup after Completion.** Work pads, temporary falsework, and other construction items will be removed from the 100-year floodplain by the end of the construction window. Removal of materials must not result in discharge to waterbodies.
- ◆ **GPM-15: Revegetate Disturbed Areas.** All temporarily disturbed areas will be de-compacted and seeded/planted with an assemblage of native riparian, wetland, and/or upland plant species suitable for the area. The project proponent shall develop a revegetation plan, including (as applicable) a schedule; plans for grading of disturbed areas to pre-project contours; planting palette with plant species native to the project area; invasive species management; performance standards; and maintenance requirements (e.g., watering, weeding, and replanting). Plants for revegetation will come primarily from active seeding and planting; natural recruitment may also be proposed if site conditions allow for natural recruitment to reestablish vegetation and avoid potential negative risks associated with erosion and impacts to water quality. Plants imported to the restoration areas will come from local stock, and to the extent possible, local nurseries. Only native plants (genera) will be used for restoration efforts. Certified weed-free native mixes and mulch will be used for restoration planting or

seeding. Revegetation activities within and adjacent to waters of the state shall commence as soon as is practicable after construction activities at a site are complete.

Water Quality and Hazardous Materials

Staging and Stockpiling of Materials

- ◆ **WQHM-1: Staging Areas and Stockpiling of Materials and Equipment.**

Staging, storage, and stockpile areas must be outside of waters of the state. To the extent feasible, staging will occur on access roads or other previously disturbed upland areas, such as developed areas, paved areas, parking lots, areas with bare ground or gravel, and areas clear of vegetation, to avoid aquatic habitats and limit disturbance to surrounding habitats. Similarly, all maintenance equipment and materials (e.g., road rock and project spoil) will be restricted to the existing service roads, paved roads, or other determined designated staging areas. See GPM-10 for more details regarding protection measures for materials storage.

Staging areas will be established for equipment storage and maintenance, construction materials, fuels, lubricants, solvents, and other possible contaminants in coordination with resource agencies. Staging areas will have a stabilized entrance and exit and will be located at least 100 feet from bodies of water unless site-specific circumstances do not provide such a setback, in such cases the maximum setback possible will be used. If an off-road site is chosen and if special-status species are potentially present, the Biological Monitor will survey the selected site to verify that no aquatic resources would be disturbed by staging activities.

Stockpiling of materials, portable equipment, vehicles and supplies (e.g., chemicals), will be restricted to the designated construction staging areas. If rain is predicted in the forecast during the dry season, and stockpiled soils will remain exposed and unworked for more than 7 days, then erosion and sediment control measures must be used. If there is a high-wind scenario, then soils will be covered at all times. During the wet season, no stockpiled soils will remain exposed, unless properly installed and maintained erosion and sediment controls are in place on and around the stockpile. Temporary stockpiling of material onsite will be minimized. Stockpiled material shall be placed in upland areas far enough away from aquatic habitats that these materials cannot discharge to a water of the state.

Erosion and Sedimentation Control Measures

- ◆ **WQHM-2: Storm Water Pollution Prevention Plan.** For project construction sites greater than one acre, the project proponent shall prepare and implement a site-specific storm water pollution prevention plan (SWPPP), consistent with State and Regional Board requirements for a General Permit for Storm Water Discharges Associated with Construction Activity. Preconstruction and post-construction best management practices (BMPs) identified in the SWPPP would be implemented for all phases of the project to limit the discharge of pollutants in

stormwater runoff. The BMPs would address all land- and water-based construction activities; excavation, grading, placement/removal of in-channel material; hazardous materials and waste containment and disposal procedures; and spill prevention, response, and cleanup procedures (see also WQHM-4 below). The plan also would describe BMP inspection, monitoring, and maintenance procedures, and include a Rain Event Action Plan, where applicable.

- ◆ **WQHM-3: Erosion Control Plans.** For project construction sites less than one acre, the project proponent shall develop and implement an erosion control plan, which will include appropriate BMPs to reduce the potential release of water quality pollutants to receiving waters. BMPs may include the following measures:
 - Install erosion control measures, such as straw bales, silt fences, fiber rolls, or equally effective measures, at repair areas adjacent to stream channels, drainage canals, and wetlands, as needed. Erosion control measures shall be monitored during and after each storm event for effectiveness. Modifications, repairs, and improvements to erosion control measures shall be made as needed to protect water quality.
 - No erosion control products will be used that include synthetic or plastic monofilament or cross-joints in the netting that are bound/stitched (such as straw wattles, fiber rolls, or erosion control blankets), and which could trap snakes, amphibians, and other wildlife.

Other Water Quality Measures

- ◆ **WQHM-4: Hazardous Materials Management and Spill Response Plan.** As part of the SWPPP or Erosion Control Plan (see WQHM-2 and WQHM-3), project proponent will prepare and implement a hazardous materials management and spill response plan. Project proponent will ensure that any hazardous materials are stored at the staging area(s) with an impermeable membrane between the ground and hazardous material and that the staging area is designed to prevent the discharge of pollutants to groundwater and runoff water. Project proponent will stop work, follow the spill response plan, and arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills. (See WQHM-6. *Accidental Discharge of Hazardous Materials* for accidental discharges of a reportable quantity of a hazardous material, sewage, or an unknown material.) Project proponent will notify regulatory agencies within 24 hours of any leaks or spills. Project proponent will properly contain and dispose of any unused or leftover hazardous products off-site. Project proponent will use and store hazardous materials, such as vehicle fuels and lubricants, in designated staging areas located away from stream channels and wetlands, according to local, state, and federal regulations, as applicable. Also see GPM-10: *Equipment Maintenance and Materials Storage* for more detail on spill prevention.
- ◆ **WQHM-5: In-Water Concrete Use.** A dewatering plan must be submitted and approved by State and/or Regional Boards for in-water concrete use. Where

possible, poured concrete should be excluded from contact with surface or groundwater during initial curing, ideally for 30 days after it is poured. During that time, runoff from the concrete shall not be allowed to enter surface or groundwater. If this is not feasible due to expected flows and site conditions, commercial sealants that are non-toxic to aquatic life may be applied before it comes into contact with flowing water. Only sealants that have been tested and found non-toxic to freshwater aquatic life, including benthic macro-invertebrates, may be used on concrete surfaces that could come into contact with flowing water. Concrete is considered to be cured when water poured over the surface of concrete consistently has a pH of less than 8.5. (Note: Demonstration of non-toxicity to aquatic life may be evaluated by measuring survival of test organisms in a 96-hour bioassay. The bioassay should be performed according to the most up-to-date protocols in 40 C.F.R. part 136, currently *Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms*, 5th Edition (EPA-821-R-02-012), including sample collections, handling, and preservation per U.S. EPA protocols).

- ♦ **WQHM-6. Accidental Discharge of Hazardous Materials.** Following an accidental discharge of a reportable quantity of a hazardous material, sewage, or an unknown material, the following applies (Wat. Code, § 13271):

As soon as (A) discharger has knowledge of the discharge or noncompliance, (B) notification is possible, and (C) notification can be provided without substantially impeding cleanup or other emergency measures then:

- first call – 911 (to notify local response agency)
- then call – Office of Emergency Services (OES) State Warning Center at: (800) 852-7550 or (916) 845-8911
- Lastly, follow the required OES procedures as set forth in: http://www.caloes.ca.gov/FireRescueSite/Documents/CalOESSpill_Booklet_Feb2014_FINAL_BW_Acc.pdf

Following notification to OES, the discharger shall notify the State or Regional Board (and other agencies requiring notification in their respective permits), as soon as practicable (ideally within 24 hours). Notification may be via telephone, e-mail, delivered written notice, or other verifiable means.

General In-Water Measures

- ♦ **IWW-1: Appropriate In-Water Materials.** Selection and use of gravels, cobble, boulders, and instream woody materials in streams will be performed to avoid and/or minimize adverse impacts to aquatic resources, special-status aquatic species, and their habitats. On-site gravels will be screened and sorted; gravels imported from a commercial source will be clean-washed and of appropriate size. As necessary to protect aquatic species, placement will be overseen by an agency-approved Monitor; implementation timing will be determined based on the least amount of overlap, or impact on, all aquatic natural resources that may be affected and the timing of their use of the receiving area. Imported gravel from

outside the project watershed shall not be from a source known to contain historic hydraulic gold mine tailings, dredger tailings, or mercury mine waste or tailings. Materials that may foul or degrade spawning gravels, such as sand or soil eroding from sand bag or earthen dams shall be managed to avoid release and exposure in salmonid streams.

- ♦ **IWW-2: In-Water Vehicle Selection and Work Access.** If work requires that equipment enter wetlands or below the bank of a waters of the state, equipment with low ground-pressure should be selected where feasible to minimize soil compaction. Low ground-pressure heavy equipment mats should be used if needed to lessen soil compaction. Hydraulic fluids in mechanical equipment working in the waters of the state, shall not contain organophosphate esters. Vegetable based hydraulic fluids are preferred, where feasible. The amount of time this equipment is stationed, working, or traveling in the waters of the state shall be minimized. All equipment will be removed from the aquatic feature during non-work hours where appropriate or returned to the agency-approved staging area in the aquatic feature.
- ♦ **IWW-3: In-Water Placement of Materials, Structures, and Operation of Equipment.** Material used for bank stabilization shall minimize discharge sediment or other forms of waste to waters of the state. Where feasible, construction will occur from the top of the stream bank, or on a ground protection mat underlain with filter fabric. All materials placed in streams, rivers or other waters shall be nontoxic. Any combination of wood, plastic, cured concrete, steel pilings, or other materials used for in-channel structures shall not contain coatings or treatments, or consist of substances toxic to aquatic organisms (e.g., zinc, arsenic, creosote, copper, other metals, pesticides, or petroleum-based products) that may leach into the surrounding environment in amounts harmful to aquatic organisms. Except for the following conditions, equipment must not be operated in standing or flowing waters without site-specific approval from State or Regional Board staff:
 - All construction activities must be effectively isolated from water flows to minimize the potential for runoff. This may be accomplished by working in the dry season or dewatering the work area in the wet season.
 - When work in standing or flowing water is required, structures for isolating the in-water work area and/or diverting the water flow must not be removed until all disturbed areas are cleaned and stabilized. The diverted water flow must not be contaminated by construction activities.
 - All open flow temporary diversion channels must be lined with filter fabric or other appropriate liner material to prevent erosion. Structures used to isolate the in-water work area and/or divert the water flow (e.g., coffer dam or geotextile silt curtain) must not be removed until all disturbed areas are stabilized.
- ♦ **IWW-4: In-Water Staging Areas and Use of Barges.** Where appropriate and practical, barges shall be used to stage equipment and construct the project,

while reducing noise, traffic disturbances and effects to terrestrial vegetation. When barge use is not practical, construction equipment and project materials may be staged in designated agency-approved staging areas. Existing staging sites, maintenance toe roads, and crown roads shall be used to the maximum extent possible for project staging and access to avoid affecting previously undisturbed areas. For projects that involve in-water work for which boats and/or temporary floating work platforms are necessary, buoys will be installed so that moored vessels will not beach on the shoreline and anchor lines will not drag. Moored vessels and buoys will not be within 25 feet of vegetated shallow waters.

Dewatering Activities and Aquatic Species Relocation

- ♦ **IWW-5: Cofferdam Construction.** Cofferdams may be installed both upstream and downstream, and along portions of the cross section of a channel or other waterway if necessary to isolate the extent of the work areas. When feasible, construction of cofferdams will begin in the upstream area and continue in a downstream direction, allowing water to drain and allowing fish and aquatic wildlife species to leave (under their own volition), from the area being isolated by the cofferdam, prior to closure. The flow will then be diverted only when construction of the upstream dam is completed and the work area has been naturally drained of flow, at this point, the downstream dam, if necessary, would be completed and then flow would be diverted around the work area. Cofferdams and stream diversion systems shall remain in place and fully functional throughout the construction period. In order to minimize adverse effects to aquatic species, stream diversions shall be limited to the shortest duration necessary to complete in-water work. In-water cofferdams will only be built from materials such as sandbags, clean gravel, rubber bladders, vinyl, steel, or earthen fill, in a manner that minimizes siltation and/or turbidity. Where possible, cofferdams should be pushed into place. If pile driving (sheet piles) is required, vibratory hammers should be used and impact hammer should be avoided. If necessary, the footing of the cofferdam will be keyed into the channel bed at an appropriate depth to capture the majority of subsurface flow needed to dewater the streambed. When cofferdams with bypass pipes are installed, debris racks will be placed at the bypass pipe inlet in a manner that minimizes the potential for fish impingement and/or entrapment. As needed and where feasible, bypass pipes will be monitored for accumulation of debris. All accumulated debris shall be removed. When appropriate, cofferdams will be removed so surface elevations of water impounded above the cofferdam will not be reduced at a rate greater than one inch per hour. Cofferdams in tidal waters should be removed during the lowest possible tide and in slack water to the extent feasible to minimize disturbance and turbidity. This will minimize the probability of fish and other aquatic species stranding as the area upstream becomes dewatered. All dewatering/diversion facilities shall be installed such that natural flow is maintained upstream and downstream of project areas.

An area may need to be dewatered for long enough to allow special-status species to leave on their own before final clearance surveys and construction can begin.

- ◆ **IWW-6: Dewatering/Diversion.** The area to be dewatered will encompass the minimum area necessary to perform construction activities. The project proponent will provide a dewatering plan with a description of the proposed dewatering structures, and appropriate types of BMPs for the installation, operation, maintenance, and removal of those structures. The period of dewatering/diversion will extend only for the minimum amount of time needed to perform the restoration activity and to allow special-status species time to leave on their own before final clearance surveys and construction can begin. Where feasible and appropriate, dewatering/diversion will occur via gravity-driven systems, and where water is pumped from within the construction area, it should be pumped to upland areas (where feasible) and to a location where it can infiltrate without return flows to the watercourse. Dewatering/diversion will be designed to avoid direct and preventable indirect mortality of fish and other aquatic species. If special-status fish species may be present in the area to be dewatered, a fish capture and relocation plan will be developed and implemented for review and approval by appropriate agencies (e.g., CDFW, NMFS, USFWS, as applicable). Stream flows will be allowed to gravity flow around or through the work site using temporary bypass pipes or culverts. Bypass pipes will be sized to accommodate, at a minimum, twice the expected construction-period flow, to not increase stream velocity, and will be placed at stream grade. Conveyance pipe outlet energy dissipaters will be installed to prevent scour and turbidity at the discharge location. When use of gravity-fed dewatering is not feasible and pumping is necessary to dewater a work site, a temporary siltation basin and/or use of silt bags may be required to prevent sediment from re-entering the wetted channel. Silt fences or mechanisms to avoid sediment input to the flowing channel will be installed adjacent to flowing water. Water pumped or removed from dewatered areas shall be conducted in a manner that does not contribute turbidity to nearby receiving waters. Where possible, pumps shall be refueled in an area well away from the stream channel. Fuel absorbent mats shall be placed under the pumps while refueling. Equipment working in the stream channel or within 25 feet of a wetted channel shall have a double (i.e., primary and secondary) containment system for diesel and oil fluids.
- ◆ All work shall comply with the CDFW Fish Screening Criteria (CDFW 2001) and NMFS Fish Screening Criteria for Anadromous Salmonids (NMFS 1997). Pump intakes shall be covered with mesh per the requirements of current fish screening criteria to prevent potential entrainment of fish or other aquatic species that could not be removed from the area to be dewatered. The pump intake shall be checked periodically for impingement of fish or other aquatic species. Diverted flows must be of sufficient quality and quantity, and of appropriate temperature, to support existing fish and other aquatic life both above and below the diversion. Pre-project flows must be restored to the affected surface water body upon completion of work at that location. Where diversions are planned, contingency plans shall be developed that include oversight for breakdowns, fueling, maintenance, leaks, etc.

- ♦ **IWW-7: Fish and Aquatic Species Exclusion While Installing Diversion Structures.** Fish and other aquatic species shall be excluded from occupying the area to be dewatered by blocking the stream channel above and below the area to be dewatered with fine-meshed block nets or screens while coffer dams and other diversion structures are being installed. Block net mesh shall be sized to ensure aquatic species upstream or downstream do not enter the areas proposed for dewatering. Mesh will be no greater than 1/8-inch diameter. The bottom of the net must be completely secured to the channel bed. Block nets or screens must be checked at least twice daily at the beginning and end of the workday and cleaned of debris to permit free flow of water. Block nets or screens shall be placed and maintained throughout the dewatering period at the upper and lower extent of the areas where aquatic species will be removed. Net placement is temporary and will be removed once dewatering has been accomplished or construction work is complete for the day.
- ♦ **IWW-8: Removal of Diversion and Barriers to Flow.** Upon completion of construction activities, any diversions or barriers to flow will be removed in a manner that will allow flow to resume with the least disturbance to the substrate. Alteration of creek beds will be minimized to the maximum extent possible; any imported material that is not part of the project design will be removed from stream beds upon completion of the project.

In-water Pile Driving and Pile Replacement

- ♦ **IWW-9: In-Water Pile Driving Plan for Sound Exposure.** Project proponents shall develop a plan for pile-driving activities to minimize impacts to special-status species and submit it to relevant agencies for approval prior to the start of in-water pile driving activities. Measures will be implemented to minimize underwater sound pressure to levels below fish thresholds for peak pressure and accumulated sound exposure levels. Thresholds levels for special-status fish under NMFS jurisdiction are established in the Fisheries Acoustic Work Group's Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities (FAWG 2008) and may be used as a guideline for special-status fish. The plan will describe the least impactful method to aquatic organisms, and will identify the number, type, and size of piles, estimated sound levels caused by the driving, how many piles will be driven each day, qualifications of monitors, any other relevant details on the nature of the pile driving activity, and the actions that will be taken to ensure a project stays within the required sound exposure thresholds.
- ♦ **IWW-10: In-Water Pile Driving Methods.** Pile driving shall occur during approved work windows with reduced currents and only during daylight hours. Pile driving shall be conducted with vibratory or low/nonimpact methods (i.e., hydraulic) that result in sound pressures below threshold levels to the extent feasible. Applied energy and frequency will be gradually increased until necessary full force and frequency are achieved. If it is determined that impact hammers are required and/or underwater sound monitoring demonstrates that thresholds are being exceeded, the contractor shall implement sound dampening

or attenuation devices to reduce levels to the extent feasible; these may include the following:

- A cushioning block used between the hammer and pile.
- Use of a confined or unconfined air bubble curtain.
- If feasible, pile driving could be done in the dry area (dewatered) behind the cofferdam.

Pile driving will follow the criteria outlined in the most recent version of the California Department of Transportation's *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish* (Caltrans 2015).

- ♦ **IWW-11: Sediment Containment during In-Water Pile Driving.** A continuous length of silt curtain, fully surrounding the pile driving area and installed in close proximity to piers, must be used as necessary and as practicable to protect aquatic resources and to provide sediment containment while construction activities are occurring if working in a wetted channel. The silt curtain shall prevent the release of a turbidity plume and trap sediment that may become suspended as a result of the pile driving. The bottom of the silt curtains must be weighted with ballast weights or rods affixed to the base of the fabric to resist the natural buoyancy of the silt curtain fabric and lessen its tendency to move in response to currents. Where feasible and applicable, the floating silt curtains must be anchored and deployed from the surface of the water to just above the substrate. The silt curtain must be monitored for damage, dislocation or gaps and must be immediately repaired where it is no longer continuous or where it has loosened. The silt curtain must restrict the surface visible turbidity plume to the area of pile construction and must control and contain the migration of re-suspended sediments at the water surface and at depth.
- ♦ **IWW-12: Pile-driving Monitoring.** An agency-approved biologist shall be on site during pile-driving activities to minimize effects to special-status species that could be present. If any stranding, injury, or mortality to special-status species is observed, federal and state wildlife agencies shall be notified in writing (e.g., via email) within 24 hours and in-water pile driving shall cease until the applicable federal and/or state agencies provide guidance on how to proceed.

Dredging Operations and Dredge Materials Reuse

- ♦ **IWW-13: Dredging Operations and Dredging Materials Reuse Plan.** Project proponent will develop and implement a dredging operations and dredging materials management plan to minimize the effects that could occur during dredging operations and material reuse and disposal. The plan shall describe a sampling program for conducting physical and chemical analyses of sediments before disturbance. It shall also describe BMPs to be implemented during dredging operations (e.g., using less intrusive dredging procedures, properly containing dredging spoils and water, using silt curtains, methods to minimize turbidity, and timing dredging activity to coincide with low flows). The plan also

shall describe methods to evaluate the suitability of dredged material for reuse and disposal.

Vegetation/Habitat Disturbance and Revegetation, and Herbicide Use

Vegetation/Habitat Disturbance and Revegetation

- ♦ **VHDR-1: Avoidance of Vegetation Disturbance.** The project proponent will minimize, to the greatest extent feasible, the amount of soil, terrestrial vegetation, emergent native vegetation, and submerged vegetation (e.g., eelgrass and kelp in marine areas, or submerged aquatic vegetation in brackish and freshwater areas) disturbed during project construction and completion and using methods creating the least disturbance to vegetation. Disturbance to existing grades and native vegetation, the number of access routes, the size of staging areas, and the total area disturbed by the project shall be limited to the extent of all temporary and permanent impacts as defined by the final project design. All roads, staging areas, and other facilities shall be placed to avoid and limit disturbance to waters of the state and other aquatic habitats (e.g., streambank or stream channel, riparian habitat) as much as possible. When possible, existing ingress or egress points shall be used and/or work shall be performed from the top of the creek banks or from barges on the waterside of the stream or levee bank, or dry gravel beds. Existing native vegetation shall be retained as practicable, emphasizing the retention of shade-producing and bank stabilizing trees and brush with greater than 6-inch diameter branches or trunks. Where possible, vegetation disturbance and soil compaction shall be minimized by using low ground-pressure equipment with a greater reach or that exerts less pressure per square inch on the ground than other equipment.
- ♦ **VHDR-2: Native and Invasive Vegetation Removal Materials and Methods:** If riparian vegetation is to be removed with chainsaws or other power equipment, machines that operate with vegetable-based bar oil will be used, as practicable. All invasive plant species (e.g., those rated as invasive by the California Invasive Plant Council or local problem species) shall, if feasible, be removed from the project site, using locally and routinely accepted agriculture practices. Invasive plant material shall be destroyed using approved protocols and disposed of at an appropriate upland disposal or compost area. Invasive plant materials stockpiled at sites known to experience flash flooding outside the flood season shall be removed within 15 days of the initial creation of the stockpile in order to contain the potential spread of invasive plant material. Stockpiling of invasive plant materials is prohibited during the flood season.
- ♦ **VHDR-3: Revegetation Materials and Methods.** Upon completion of work, site contours will be returned to preconstruction conditions or designed to provide increased biological and hydrological functions. Where disturbed, topsoil shall be conserved for reuse during restoration to the extent practicable. Native plant species comprising a diverse community structure (plantings of both woody and herbaceous species, if both are present) that follow an agency-approved plant palette shall be used for revegetation of disturbed and compacted areas, as appropriate. Any area barren of vegetation as a result of project implementation

shall be restored to a natural state by mulching, seeding, planting, or other means with native trees, shrubs, willow stakes, erosion control native seed mixes, or herbaceous plant species following completion of project construction. Irrigation may also be required in order to ensure survival of containerized shrubs or trees or other vegetation depending on rainfall. Soils that have been compacted by heavy equipment shall be decompacted, as necessary, to allow for revegetation at project completion as heavy equipment exits the construction area.

- ♦ **VHDR-4: Revegetation Erosion Control Materials and Methods.** If erosion control fabrics are used in revegetated areas, they shall be slit in appropriate locations as necessary to allow for plant root growth. Only non-monofilament, wildlife-safe fabrics shall be used. All plastic exclusion netting placed around plantings will be removed after 2 years or sooner if practicable.
- ♦ **VHDR-5: Revegetation Monitoring and Reporting.** All revegetated areas will be maintained and monitored for a minimum of 2 years after replanting is complete and until success criteria are met, to ensure the revegetation effort is successful. The standard for success is 60% absolute cover compared to an intact, local reference site. If an appropriate reference site cannot be identified, success criteria will be developed for review and approval by the authorizing Water Board on a project-by-project basis based on the specific habitat impacted and known recovery times for that habitat and geography. The project proponent will prepare a summary report of the monitoring results and recommendations at the conclusion of each monitoring year.

Herbicide Use

- ♦ **VHDR-6: General Herbicide Use.** Chemical control of invasive plants and animals shall only be used when other methods are determined to be ineffective or infeasible and all projects must be in compliance with Regional Board Basin Plan requirements. Chemical use will be evaluated on a project-by-project basis with consideration of (and preference given towards) integrated pest management (IPM) strategies wherever possible. See University of California Statewide IPM Program for guidance documents (<http://ipm.ucanr.edu/index.html>). Broadcast spraying, including the use of aerial drones, may be used if it provides greater application accuracy and access.

Chemical use is restricted in accordance with approved application methods and best management practices designed to prevent exposure to non-target areas and organisms. Any chemical considered for control of invasive species must be approved for use in California, adhere to all regulations per the California Environmental Protection Agency (CEPA 2011 or most recent version), and be applied by a licensed applicator under all necessary state and local permits. Use herbicides only in a context where all treatments are considered, and various methods are used individually or in concert to maximize the benefits while reducing undesirable effects and applying the lowest legal effective application rate, unless site-specific analysis determines a lower rate is needed to reduce non-target impacts. Treat only the minimum area necessary for effective control.

Within 25 feet of any water of the state, only formulations approved by EPA and State Water Board for aquatic use will be utilized. Soil-activated herbicides can be applied as long as directions on the label are followed. Aquatic pesticides shall be applied in compliance with NPDES order(s), where applicable (see also: https://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/).

- ◆ **VHDR-7: Herbicide Application Planning.** Written chemical application recommendations should be provided by each project proponent from a certified Pest Control Advisor (PCA) (CEPA 2011). The PCA can ensure that legal, appropriate, and effective chemicals are used with appropriate methodologies. Field scouting must be done before application, and the licensed Applicator (CEPA 2011) must be on-site to lead all applications, and shall adhere to standard protection measures for application. Prior to field scouting or application, the PCA or licensed applicator, shall receive Environmental Awareness Training (see GPM-4) for the project so that they are aware of special status species and habitats present at the project site.
- ◆ **VHDR-8 Herbicide Application Reporting.** The licensed applicator shall keep a record of all plants/areas treated, amounts and types of herbicide used, and dates of application, and pesticide application reports must be completed within 24 hours of application and submitted to applicable agencies for review. Wind and other weather data will be monitored and reported for all application reports.

E.5.3 Pre-Application Consultation

The project proponent shall contact the approving Water Board to submit available project information and request a pre-application consultation meeting prior to submittal of the NOI. The approving Water Board may waive the pre-application meeting requirement on a case-by-case basis.

Restoration projects can be complex and often benefit from pre-application consultation with the approving Water Board during the early stages of planning and design. During the pre-application consultation meeting, the approving Water Board will review project materials and provide project-specific guidance for navigating the approval process. A site visit may also be conducted at the discretion and request of the approving Water Board. Whether or not a waiver is granted, and/or the extent of the pre-application consultation, will depend on project complexity and development of design and planning.

E.5.4 Projects Requiring Oversight by Other Agencies

The following project types may require additional design review and oversight by other regulatory agency staff and agency engineers, including, but not limited to:

- ◆ NMFS—for projects where anadromous and/or marine fish considered federal special-status species¹⁰ are present

¹⁰ Special-status species are species that are legally protected or otherwise considered sensitive by federal or state resource agencies (federal Endangered Species Act [FESA], California Endangered Species Act [CESA], or Species of Special Concern) or by local resource agencies.

- ◆ USFWS—for projects where freshwater fish and wildlife considered federal special-status species¹⁰ are present
- ◆ CDFW—for projects where fish and wildlife considered state special-status species¹⁰ are present

The aforementioned regulatory agencies may impose specific requirements, including but not limited to the following, for certain project types:

- ◆ For stream crossing projects, allow passage of the life stages and special-status salmonid species historically passing there.
- ◆ For retrofit culverts, meet the fish passage criteria for the passage needs of the special-status species and life stages that historically passed through the site before the existence of the road crossing according to NMFS Crossing Guidelines and CDFW stream crossing criteria (see Part XII, *Fish Passage Design and Implementation*, of the CDFW *California Salmonid Stream Habitat Restoration Manual* [Flosi et al. 2010:Vol. II]).
- ◆ Designs for fish ladders and culvert replacement or modification projects planned in fish-bearing waterways, reviewed and authorized by a NMFS (or CDFW) fish passage specialist before the start of work.
- ◆ Designs for fishways and culvert replacement or modification designs, designed and stamped by a State of California–registered Engineer.
- ◆ Designs for fishways, consistent with the fishway design guidelines presented in NMFS’s *Anadromous Salmonid Passage Facility Design* (NMFS 2011).
- ◆ New fishways, constructed to provide passage conditions suitable for year-round, bidirectional movement by adult and juvenile salmonids.
- ◆ New fishways, have a maximum vertical jump of six inches, unless NMFS guidelines are changed.
- ◆ Flow patterns in new fishways, be stable, with no water surges.
- ◆ Energy dissipation in new fishways, be complete in a step-and-pool fishway, with no carryover from pool to pool.
- ◆ Sediment composition and quantity, and effects of sediment transport, evaluated by a qualified geomorphologist for all summer dam removal projects.

E.5.5 Activities Prohibited under the General Order

The following activities are not within the scope of the Order and will require separate permitting approvals with the State Water Board and/or Regional Boards:

- ◆ Use of gabion baskets.
- ◆ Use of cylindrical riprap (e.g., Aqualogs).

- ◆ Use of undersized riprap (e.g., will not remain in place during a 100-year flow event).
- ◆ Construction of permanent dams (does not apply to beaver dam analogs) or concrete-lined channels of any sort.
- ◆ Use of chemically treated timbers used for grade or channel stabilization structures, bulkheads, or other structures within or immediately adjacent to waters of the state, or where runoff from the treated material could enter waters of the state.
- ◆ Activities that result in long-term, substantial disruption of the movement of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the project areas.
- ◆ Elimination of a riffle, pool, or riffle/pool complex that is not replaced/enhanced elsewhere by the project. (Note: In some instances, a restoration project may affect or modify riffle/pool complex. For example, a culvert removal may affect an existing pool. These types of projects would be allowed under the Order.)
- ◆ Water diversions, except diversions associated with water conservation projects as described in Section E.4.5, *Water Conservation*, and those necessary to temporarily dewater the construction site of a restoration project.
- ◆ With the exception of storage projects to reduce low flow stream diversions (see Section E.4.5), off-channel/side-channel habitat projects that require the installation of a flashboard dam, head gate, or other mechanical structures, except storage projects to reduce low flow stream diversions (see Section E.4.5).
- ◆ Creation or potential creation of a barrier to anadromous fish passage as determined by the NMFS fish passage guidelines or equivalent CDFW guidelines, as applicable (including any associated maintenance activities, or lack thereof).
- ◆ Use of excess riprap bank protection, other than the minimum amount needed to achieve project goals, as determined by the State Water Board or appropriate Regional Board, as applicable.
- ◆ Installation of infiltration galleries (subsurface structure, typically including perforated conduits in gravel, to expedite transfer of water to or from a soil).
- ◆ Managed surrogate floodplain and managed returned flows that do not allow for volitional movement (ingress and egress) of fish to the main channel (up and/or downstream).

E.6 Design Guidelines

Project type-specific design guidelines have been developed with assistance from multiple regulatory agencies (e.g., CDFW, NMFS, USFWS) to help project proponents during the design development of their individual projects, in a manner that is appropriate and sustainable, minimizes adverse effects on aquatic habitats, and

maximizes the ecological benefits of the restoration. For example, these guidelines include designing restored streams in ways that provide fish passage and withstand probable flooding events. The project proponent may modify design approaches that do not conform with the specific guidelines, based on site-specific conditions or technological constraints or advances, or regionally accepted guidance documents. The guidance included in this section is not meant to encompass all possible project designs that may be approved for enrollment under the Order.

General

The design of restoration projects should be based on a process-based approach that considers the multiple interactions of physical, chemical, and biological processes over a wide variety of spatial and temporal scales in order to identify the root causes of the problems, and to confirm the proposed solution (project) will be effective and appropriate given the physical setting (see Kondolf et al., 2001; Simon et al., 2007; Smith and Prestegard, 2005; Wohl et al., 2005, Wohl et al., 2015).

Improvements to Stream Crossings and Fish Passage

Stream Crossing, Culvert, and Bridge Projects

Design guidelines for this category typically includes:

- ◆ All stream crossing projects permitted under the Order should consider storm-proofing measures presented in Weaver et al. (2014). Culverts should also conform to design guidelines for conveyance of the 100-year peak flow and associated sediment and wood loads, as specified in Cafferata et al. (2017).
- ◆ Projects located in channels that provide potential spawning and/or rearing habitat for anadromous salmonids should follow NMFS guidelines for salmonid passage at stream crossings.
- ◆ Bridges and culverts should be designed to adequately convey flow and materials (e.g., 100-year flood), in addition to allowing for fish passage. If a bridge/culvert is designed to convey less than the 100-year design flow, then the project should demonstrate how the smaller culvert avoids excessive erosion/sedimentation, headcutting, or habitat impacts.
- ◆ Culverts should be designed to match channel gradients.
- ◆ All road and stream crossing structures should comply with current NMFS and CDFW fish passage guidelines and utilize stream simulations following NMFS Stream Simulation Design to inform the project design.
- ◆ Structures should be designed to provide passage for all life stages of native fish species.
- ◆ Bridges (including concrete box culverts, which are constructed as bridges in accordance with current NMFS and CDFW guidelines) should be designed with vertical abutments. Treated wood should not be used for bridge construction or replacement.

- ◆ Placement of rock slope protection (RSP) within the bankfull width of the stream should be avoided except for the minimum necessary for protection of bridge abutments and pilings, culverts and other stream crossing infrastructure. The amount and placement of any RSP should not constrict the bankfull flow. The toe of RSP used for streambank stabilization should be placed sufficiently below the streambed scour depth to ensure stability. Where RSP is deemed necessary, use natural stream material to fill and cover exposed rock and/or use bioengineered techniques, listed below, where appropriate.
- ◆ Drivable wet crossings should be appropriately armored on the downstream side to reduce potential for scouring.

Fish Screens

This category includes the installation, operation, and maintenance of fish screens on water intakes. See additional discussion in the Section E.5.3, *Pre-Application Consultation*.

Fishways

Design guidelines for this type includes:

- ◆ Fishway projects should conduct watershed and reach scale analysis of the hydrograph, sediment and large woody debris supply and transport, and of streambed and bank dynamics (e.g., is the channel actively incising or aggrading) to confirm that the proposed design is appropriate and expected to function as designed over the lifetime of the project (20-to-30 years).
- ◆ Design fishways should be based on target species, level of maintenance, and monitoring requirements to ensure reliable fish passage.
- ◆ Where appropriate, design fishways considering passage for other aquatic wildlife species (e.g., amphibians), in addition to that of salmonids, sturgeon and other native fish species. Fishways primarily designed for salmonids can be impediments to passage of other aquatic species, if they do not have adequate surfaces for attachment, velocities are too high, or there are inadequate places for resting. For example, providing for rounded corners, resting areas or providing a natural stream channel (stream simulation) or wetted ramp for passage over the impediment have been effective in facilitating passage of other aquatic wildlife.
- ◆ See additional discussion below, Section E.5.3, *Pre-Application Consultation*.

Headcut Stabilization

Design guidelines for headcut stabilization includes:

- ◆ Where appropriate based on evaluation and review with agencies (i.e., low risk to property and infrastructure), project designs should consider avoiding headcut stabilization and allow the stream to naturally adjust to a new grade. Where headcut stabilization is necessary, provide fish passage through constructed

riffles for pool/riffle streams or a series of log or rock structures for step/pool channels as described below.

- Headcuts should be designed with sufficient amounts of appropriately sized and installed material to prevent continued up-stream migration of the headcut. Materials could include both rock and organic materials.
- Materials should not contain gabion baskets, sheet pile, concrete, articulated concrete block, and cable anchors.
- Stabilization efforts should focus on the plunge pool, the headcut, as well as a short distance of stream above the headcut.
- Designs should minimize lateral migration of channel around headcut (“flanking”) by placing rocks and organic material at a lower elevation in the thalweg to direct flows to the natural low point of the channel.
- ◆ If large wood and boulder placement will be used for headcut stabilization, refer to conditions for large wood as described under Stream and Riparian Habitat Establishment below.
- ◆ Construct structures in a ‘V’ or ‘U’ shape, oriented with the apex upstream, and lower in the center or along the thalweg, to direct flows to the middle of channel.
- ◆ Key structures into the streambed to minimize structure undermining due to scour, if practicable, at least 2.5x their exposure height. The structures should also be keyed into both banks—if feasible greater than 8 feet.
- ◆ If several structures will be used in series, consider spacing them at the appropriate distances to promote fish passage of all life stages of native fish. Consider incorporating current NMFS and/or CDFW fish passage criteria (e.g., jump height, pool depth, etc.) in the design of step structures. Spacing should be no closer than the net drop in water surface elevation (in feet) divided by the channel gradient (in percent expressed as a decimal)) (e.g., a one-foot high step structure in a stream with a two-percent gradient should have a minimum spacing of 50 feet [$1/0.02$]).
- ◆ Designs should consider including gradated (cobble to fine) material in the rock structure material mix to help seal the structure/channel bed, thereby preventing subsurface flow and ensuring fish passage immediately following construction if natural flows are sufficient.

Small Dam, Tide Gate, Flood Gate, and Legacy Structure Removal

Small Dam Removal

See additional discussion below under Section E.5.3, *Pre-Application Consultation*.

Tide Gate Removal

Design guidelines for tide gate removal includes:

- ◆ If a culvert or bridge will be constructed at the location of a removed tide gate, consider designing the structure to allow for full tidal exchange, if feasible.

Removal of Legacy Structures

Design guidelines for legacy structure removal includes:

- ◆ If the structure being removed contains material (i.e., large wood, boulders, concrete, etc.) not typically found within the stream or floodplain at that site, consider disposing of removed material at an approved landfill or disposal site.
- ◆ If the structure being removed contains material (i.e., large wood, boulders, etc.) that is typically found within the stream or floodplain at that site, the material could be reused to implement habitat improvements described under other restoration project types in the Order.
- ◆ If the structure being removed is keyed into the bank, consider filling in “key” holes with native materials to restore contours of stream bank and floodplain. Fill material should be adequately compacted to prevent washing out of the soil during over-bank flooding. Material from the stream channel should not be mined to fill in “key” holes.
- ◆ When removal of buried log structures may result in significant disruption to riparian vegetation or the floodplain, consider using a chainsaw to extract the portion of log within the channel and leaving the buried sections within the streambank.
- ◆ If the legacy structures (log, rock or gabion weirs) were placed to provide grade control, evaluation of the site for potential headcutting and incision due to structure removal should be conducted. If headcutting and channel incision are likely to occur due to structure removal and are not desired to achieve proper functioning habitat conditions, additional measures should be taken to minimize these impacts, to the extent practicable.

Bioengineered Bank Stabilization

Guidelines for stream bank stabilization techniques are described in Part VII of the CDFW Manual, *Project Implementation*. Design guidelines for this project type includes:

- ◆ Restore damaged streambanks to a natural slope and profile suitable for establishment of riparian vegetation.
- ◆ When necessary, consider the use of soil layers or lifts that are strengthened with biodegradable fabrics that are penetrable by plant roots.
- ◆ Include large wood to the extent it would naturally occur. If possible, wood should have untrimmed root wads to provide functional refugia habitat for fish. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.

- ◆ Use a diverse assemblage of vegetation species that is appropriate for the project area, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains, stream channels, etc., if the soil is not contaminated with pathogens
- ◆ Install fencing and signage, as necessary to prevent access to revegetated sites by livestock or unauthorized persons. Coordination with local public agencies, such as police and social work groups, should be considered for site protection.
- ◆ Limit the extent and quantity of rock or boulders to the minimum necessary to prevent scour from expected moderate to high stream flows and velocities. Bridge abutments and other infrastructure improvements to the restoration design of fish passage projects may require additional boulder and rock bank stabilization.

Off-Channel/Side-Channel Habitat Restoration and Enhancement

Design guidelines for this project type includes:

- ◆ Off- and side-channel habitat restoration site selection and design should be based, in part, on the review of evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.
- ◆ Excavated material removed from off- or side-channels should be hauled to an upland site or spread across the adjacent floodplain, as long as the soil is considered suitable for application (e.g., free of contaminants and/or pathogens), in a manner that does not restrict floodplain capacity or otherwise degrade floodplain function and is in compliance with regulations.
- ◆ Where special-status species that require access to stream habitat are present, a project should not create habitats that could attract fish and then become isolated from the stream without providing special status fish an opportunity to return to the stream. Instead, off-channel features should be designed so that they slope towards and drain to the primary stream habitat as streamflow subsides. Isolated pools or ponds that do not incorporate return channels to the stream should be located at an appropriate distance away from the edge of the active channel to avoid temporary connectivity and subsequent fish stranding following flood events. Projects should not result in stranding of fish in isolated water bodies.

Water Conservation Projects

Design guidelines for this project type includes:

- ◆ Design tanks so that water diverters have sufficient storage capacity to cover any domestic, irrigation, or livestock needs during the no-pump time periods, (e.g., dry season). No-pump time period should be based upon the season, local conditions, forbearance agreement and existing studies if available.
- ◆ Screen all pump intakes in accordance with current NMFS and CDFW fish screen criteria.

- ◆ Register water conservation projects that include water storage tanks and a forbearance agreement for the purpose of storing winter and early spring water for summer and fall use, pursuant to California Water Code § 1228.3 and with the State Water Board, as applicable.

Floodplain Restoration

Design guidelines for floodplain restoration projects include:

- ◆ As applicable, fish passage and or screening needs should be addressed with the installation of new structures.
- ◆ Channel reconstruction, reset, or relocation:
 - Design actions to restore floodplain characteristics—elevation, width, sinuosity, gradient, length, and roughness—in a manner that closely mimics or resets, to the extent possible, those that would naturally occur at that stream and valley type.
 - Where appropriate, remove non-native fill material from the channel and floodplain to an upland site or appropriate offsite disposal location, potentially including a landfill (for human debris).
 - Where appropriate, construct geomorphically appropriate stream channels and floodplains (e.g., enable natural transport processes including the creation of depositional and scour features) within a watershed and reach context.
 - When necessary, decompact soils once overburden material is removed. Overburden or fill comprised of pathogen free (where feasible) and native materials, which originated from the project area, may be used within the floodplain where appropriate to support the project goals and objectives.
 - Structural elements should fit within the geomorphic context of the stream system. For example, construct riffles preferentially in pool-riffle stream types, and roughened channels and boulder step structures in step-pool and cascade stream types.
 - To the extent feasible, select weed-free locally occurring material (large wood, rock, sand, gravel) that mimic natural stream system materials.
 - To the extent feasible, salvage and utilize existing native materials such as sod, willows, and topsoil.
- ◆ Setback or removal of existing berms, dikes and levees:
 - Design actions to restore floodplain characteristics—elevation, width, gradient, length and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur in that area.
 - Remove drain pipes, fences, concrete and other structural improvements to the extent possible.

- Remove non-native fill material from the floodplain and, if pathogen free, reuse or dispose of it at an upland site, to the extent possible. Trash and debris should be disposed at an appropriate offsite disposal location, potentially including a landfill (for human debris).
- Where it is not possible to remove or setback all portions of dikes and berms, or in areas where existing berms, dikes and levees support abundant riparian vegetation, and their removal or setback is not part of the project design, openings may be created with carefully planned and approved breaches. Timing and spacing of breaches should be planned for maximum positive environmental outcomes.
- When necessary for plant establishment, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain, only if pathogen free (where feasible), to create set-back dikes and fill anthropogenic holes provided that floodplain function is not impeded.

Piling and Other In-Water Structure Removal

Design guidelines for this project type includes:

- ♦ Removing an intact pile:
 - Install a floating surface boom to capture floating surface debris, as necessary.
 - To the extent possible, keep all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water level and low current conditions.
 - Dislodge the piling with an excavator bucket (through pushing and pulling) or vibratory hammer, whenever feasible. Never intentionally break a pile by twisting or bending.
 - Slowly lift piles from the sediment and through the water column.
 - Place chemically treated piles in a containment basin on a barge deck, pier or shoreline without attempting to clean or remove any adhering sediment. A containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment.
 - Fill the holes left by each piling with clean, native sediments located from the project area if available, as needed.
 - Dispose of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted disposal site.
 - Pile cutting should be considered a last resort following multiple attempts to fully extract piling using other methods. If cutting piles, piles should be cut below the mudline to provide more habitat and ensure that as much debris is

removed as possible. Areas with low levels of contamination, wave and/or currents conducive to mixing (i.e., high energy environments), and/or small numbers of piles removed may not need to be cut to prevent remobilization of contaminants.

♦ Removing a broken pile:

- If dredging is likely in the area of piling removal, use a global positioning device (GPS) to note the location of all broken piles for future use in site debris characterization. Test soil prior to conducting any dredging to determine if sediments are contaminated and manage dredged materials appropriately based on testing results.
- If a pile breaks above the surface of uncontaminated sediment, or less than 2 feet below the surface, every attempt short of excavation should be made to remove it entirely.
- If a pile breaks above presumed, or known contaminated sediment, saw the stump off at the sediment line; if a pile breaks within contaminated sediment, make no further effort to remove it and cover the hole with a cap of clean substrate appropriate for the site, as applicable.

Non-Native Terrestrial and Aquatic Invasive Species Removal and Native Plant Revegetation

Design guidelines for this project types includes:

- ♦ Design species palette for revegetation based on the species that naturally or historically occur in the project area, have the best chance of survival considering current site conditions, and can provide required habitat elements for special-status species.
- ♦ Control weed species, except for non-native annual grasses, with a Cal-IPC invasiveness rating of high, and any non-native vegetation that will compete with plantings. This could include clearing and maintaining a 24" diameter weed-free buffer around plantings.
- ♦ Where appropriate, test and prepare the soil prior to planting. The soil in planting and seeding areas should be finish graded, pathogen-free, weed-free, de-compacted and amended as appropriate given the habitat and site conditions. Decompaction to a minimum depth of 6 inches is recommended.
- ♦ Revegetation that is not dependent on irrigation systems is generally preferred; however, there can be instances where irrigation is desirable. If an irrigation system is necessary for plant reestablishment, install and have the system operational prior to installation of planting, or prior to any periods where the weather forecast may jeopardize successful establishment of plants.
- ♦ Acquire native seed or plant sources as close to the project site as possible. Keep seed in a cool dry place during delivery and when temporarily stored

onsite, protect seed from moisture, wind, heat, vandalism, rodents, insects, weather, and other conditions that would damage or impair viability of seed.

- ◆ For installation of pole cuttings, source cuttings from healthy plants, limiting collection to no more than 30% of individual plants or populations. Pole cuttings should be taken from live wood at least one-year-old or older. Keep cuttings moist until planted.
- ◆ Appropriately size prefabricated vegetated mats (i.e., sedge and rush mats) within riparian zone, channels, floodplains, and areas with high runoff, to prevent their movement during high flow events.
- ◆ Plant cuttings when dormant and within 48 hours of collection, if possible. Do not allow cuttings to dry out. Pole cuttings should be installed at a depth sufficient to allow root growth into the groundwater table, or as necessary to provide long-term survival of the planting.
- ◆ Enclose plantings with fencing, cages, tubex or other protective measure, as appropriate, in areas where plantings are subject to browse by animals, such as deer, elk, beavers, livestock, gophers, or moles. Remove any non-biodegradable fencing material after plantings are adequately established.

Tidal, Subtidal, and Freshwater Wetland Establishment, Restoration, and Enhancement

Design guidelines for this project types includes:

- ◆ Implement projects to repair or restore estuary functions, while not putting adjacent landowners at increased flood risk once dikes/levees are breached and the project area is flooded.
- ◆ Where possible, recreate historic channel morphology that supports wetland function. Channel designs may be based on aerial photograph interpretation, literature, topographic surveys, and nearby undisturbed channels. Channel dimensions (width and depth) are based on measurements of similar types of channels and the drainage area. For example, channels may have varied topography throughout their length to encourage sinuosity of the developing channel.
- ◆ To the extent possible, prior to restoration, remove or decommission infrastructure or ditches that were installed historically to drain wetlands or unwanted historical structures, such as duck blinds, docks, or boat hides. Restore contours created through the drain tile removal by backfilling the ditch with clean fill.
- ◆ Remove temporary access roads and decompact soils as necessary to support desired revegetation.
- ◆ Restore wetlands to elevations necessary to support the desired vegetation communities, accounting for anticipated natural sediment accumulation. Appropriate dredge material or other clean fill material may be imported to raise

subsidized landscapes, depending on the desired habitat to be restored. Overfill may be necessary to accommodate settling. When projects involve dredge material, conduct a pre-application consultation.

- ♦ If grading of intertidal plain (landform) is required, implement the following measures, to the extent feasible, to avoid and/or minimize adverse effects to water quality, aquatic resources, and/or special-status species:
 - after grading of tidal plane is complete, implement water management activities to re-vegetate and stabilize exposed soils on the plane prior to removing cofferdam and/or breaching dikes or levees;
 - install fish screens that meet NMFS, USFWS, and CDFW criteria, as applicable, on any new pump intakes that could be used for pre-breach water management activities; and
 - implement the following pre-breach water management measures:
 - release on-site water gradually; water from the project area should be released gradually to reduce the effect of potentially low dissolved oxygen (DO) and high temperature water on the surrounding water body; this would allow the plume of degraded water to dissipate without harmful effects to aquatic life;
 - limit water level management activities during migration periods for special-status species such as salmon to reduce the potential effects upon these species; and
 - maintain short water residence time (high water exchange rate) to reduce the opportunity for adverse water quality conditions (i.e. high temperature or anaerobic) to develop; residence time is controlled by the rate at which water is exchanged between the managed area and its adjacent tidal source; projects should utilize appropriate water control structures that allow flexibility in management to avoid and/or minimize adverse water quality conditions.
- ♦ For projects that include the use of donor vegetation beds for use in restored marsh and/or emergent or submerged vegetation sites, no more than five percent of the below ground biomass of an existing donor bed should be harvested for transplanting purposes. Plants harvested should be taken in a manner that thins an existing bed without leaving any noticeable bare areas. Harvesting of flowering shoots for seed buoy techniques should occur only from widely separated plants and only a certain percent of the donor stock may be used per year. This percent is site dependent and prior to restoration requires intimate knowledge of the genetics and population dynamics of the donor site.
 - Shellfish substrate should be placed to encourage oyster larval recruitment. Substrate could be placed on hard substrate that represents former reef habitat, if the hard substrate is not currently producing oysters at a sustainable level. Natural substrate (oyster or clam shells) is preferred due to

the oysters' affinity for it, but is not always available. Shells are most often deployed loose or in mesh bags. Artificial substrate should be used when there is not enough shell substrate available to create larger reef areas or when the bottom substrate is unstable and substantial sinking of the reef is likely to occur. Common artificial substrates include limestone rock and baycrete (e.g., Reef Balls, Oyster Castles, etc.). Regardless of type, most substrate is deployed from a boat or barge, but in some shallow water situations, restoration practitioners and community volunteers may carry the substrate to the reef location.

- If the local oyster population is not large enough to produce viable larvae or has been fully extirpated from the area, live shellfish should be released into the restoration area. Release single oysters or oyster spat on shell. Release non-reef-forming organisms such as clams and abalone as individuals, caged as necessary (e.g., to reduce predation).
- Shell sources – Shell or other substance used for substrate enhancement should be procured from clean sources that do not deplete the existing supply of shell bottom. Shells should be left on dry land for a minimum of one month before placement in the aquatic environment. Shells from the local area should be used whenever possible.
- Native species and disease – When possible, species native to the project area should be used. Any shellfish transported across state lines or grown through an aquaculture facility should be certified disease free.

Stream and Riparian Habitat Establishment, Restoration, and Enhancement

Design guidelines for this project types includes:

- ♦ Where appropriate, the CDFW Manual and Fluvial Habitat Center at Utah State, Low-Tech Process-Based Restoration Design Manual (<http://lowtechpbr.restoration.usu.edu/>) should be consulted during the planning and design process.
- ♦ Large wood
 - For the purposes of large wood placement, trees may be felled or pulled/pushed over, if tree felling does not significantly degrade the habitat of special-status species (i.e., an active nest site), create excessive stream bank erosion, destabilize stream banks, create temperature increases in waterbodies, concentrate surface runoff.
 - Where feasible, retain trees killed through fire, insects, disease, blow-down and other means rather than felling live trees for the project. Retain snags and trees with broad, deep crowns ("wolf" trees), damaged tops or other abnormalities that may provide a valuable wildlife habitat component.
 - Stabilizing or key pieces of large wood should be intact, hard, with little decay, and if possible, have root wads (untrimmed) to provide functional refugia habitat for fish.

- Orient key pieces such that the hydraulic forces upon the large wood increase stability. Wood pieces that are oriented parallel to flow are typically more stable than pieces oriented at 45 or 90 degrees to the flow.
- Place large wood and boulders in areas where they would naturally occur and in a manner that closely mimic natural accumulations for that stream type. For example, boulder placement may not be appropriate in low gradient meadow streams. Engineered logjams should be patterned after stable natural log jams in the project area, either present or historical.
- Project design should simulate log jams, debris flows, wind throw, tree breakage, and other disturbance events.
- For engineered logjams that occupy >25% of the cross-sectional bankfull area, fish passage should be maintained consistent with NMFS and CDFW guidelines.
- Operating tractors, vehicles, or equipment on soils with high or extreme erosion hazard rating, known slides, or unstable areas, including slopes greater than 50% grade, should be avoided. On these high erosion soils with grades greater than 60%, aerial or cable operations may be necessary to retain bank stability.
- If large wood anchoring is required, a variety of methods could be used. These including buttressing the wood between riparian trees, and the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning or bolted connections could be used. Clean rock could be used for ballast but is limited only to that the extent needed to anchor the large wood.
- ◆ Stream Channel Reconstruction
 - In situations where excessive sediment releases from the project site or surrounding watershed currently pose a threat to downstream habitat and organisms, use stream simulations following NMFS Stream Simulation Design to inform the project design. Stream simulation designs should:
 - identify a suitable reference reach;
 - quantify the average cross-sectional shape, bankfull width, bed and bank sediment grain size distributions, and the geomorphic features of the channel (e.g. pool-riffle sequences, meander lengths, step pools, etc.); and
 - reproduce the geomorphic features found within the reference reach in the project reach.
- ◆ Porous boulder structures and vanes
 - Design and construct boulder step structures to allow upstream and downstream passage of fish species and life stages that occur in the stream.

- Size and select rock for boulder step structures that is durable and of suitable quality to assure long-term stability in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
- Couple full spanning boulder step structure placement with measures to improve habitat complexity and protection of riparian areas to provide long-term inputs of large wood. Install full channel spanning boulder structures only where appropriate, such as:
 - in highly uniform, incised, bedrock-dominated channels to enhance or provide fish habitat;
 - in stream reaches where log placements are not practicable due to channel conditions (not feasible to place logs of sufficient length, bedrock dominated channels, deeply incised channels, artificially constrained reaches, etc.);
 - where damage to infrastructure on public or private lands is of concern;
 - where private landowners will not allow log placements due to concerns about damage to their streambanks or property; or
 - in parts of the state where boulders rather than large wood may typically be the predominant instream habitat feature.
- Avoid use of gabions, cable, or other means of non-natural structure to prevent the movement of individual boulders in a boulder step structure.
- Place boulder step structures diagonally across the channel or in more traditional upstream pointing “V” or “U” configurations with the apex oriented upstream.
- Install boulder structures low in relation to channel dimensions so that they are completely overtopped during channel-forming flow event (approximately a 1.5-year flow event).
- The project designer or an inspector experienced in these structures should be present on-site during installation.
- ♦ Gravel augmentation
 - Limit gravel augmentation to locations where the natural supply has either been eliminated, significantly reduced through anthropogenic disruptions, or where it can be used to initiate gravel accumulations in conjunction with other projects, such as simulated log jams and debris flows.
 - Size gravel with the proper gradation for the stream, using non-angular rock. When possible use gravel of the same lithology as found in the watershed.

- Do not mine gravel from the floodplain at elevations above bankfull in a manner that would cause stranding during future flood events. Avoid use of crushed rock.
- Use imported gravel that is free of invasive species and non-native seeds.
- Place gravel directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural debris flows and erosion.
- ◆ Road and trail erosion control and decommissioning
 - Road and trail erosion control and decommissioning should use the Handbook for Forest, Ranch, and Rural Roads; A Guide for Planning, Designing, Constructing, Reconstructing, Maintaining and Closing Wildland Roads (Weaver et al. 2014) and any subsequent editions.
 - When demolishing or removing road segments immediately adjacent to a stream, use sediment control barriers between the project and stream.
 - Where feasible, use existing vegetative buffers along access roads or trails to avoid or minimize runoff of sediment and other pollutants to surface waters.
 - Minimize disturbance of existing native vegetation in ditches and at stream crossings.
 - Space drainage features used for stormproofing and erosion treatment projects to hydrologically disconnect road surface runoff from stream channels. If grading and resurfacing is required, use clean, permeable materials for resurfacing.
 - To the extent feasible and appropriate, avoid or minimize activities that compact soil.
 - Dispose of slide and waste material in stable sites out of the flood-prone area. Clean material may be used to restore natural or near-natural contours.
 - For projects within riparian areas, recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
 - For permanent decommissioning of roads, complete excavation of stream crossing fills, including 100-year flood channel bottom widths and stable side slopes. Excavate unstable or potential unstable sidecast and fill slope materials that could otherwise fail and deliver sediment to a stream. Perform road surface drainage treatments (e.g., ripping, outsloping, and/or cross draining) to disperse and reduce surface runoff.
- ◆ Road relocation
 - When a road is decommissioned in a floodplain and future vehicle access through the area is still required, relocate the road away from the stream, as far as practical. New road construction should be outside of waters of the state.

- The drainage network should not be increased through a road relocation. Keep relocated road drainage features disconnected from the stream network to the extent practical. New cross drains should discharge to stable areas where the outflow will quickly infiltrate the soil and not develop a channel to a stream.
- ◆ Livestock fencing, stream crossings and off-channel livestock watering
 - Livestock fencing to protect, restore, or establish aquatic or riparian resources
 - Design fence placement to allow for lateral movement of a stream, migration or dispersal of special-status species through the area, and establishment of riparian plant species. To the extent possible, fences should be placed outside the channel migration zone. Install cross-stream fencing at fords, with breakaway wire, swinging floodgates, hanging electrified chain, or other devices to allow the passage of floodwater and large woody material during high flows.
 - Fence posts and bracing (e.g., dead men) should not be set with wet concrete in waters of the state.
 - Where appropriate, construct fences at water gaps in a manner that allows passage of large wood and other debris.
 - Avoid use of riparian fencing to create livestock containment or handling facilities.
 - To protect the habitat, construct wildlife-friendly fences around springs to prevent livestock damage.
 - If pressure treated lumber is used for fence posts, complete all cutting and drilling outside the area of expected inundation so that treated wood chips and debris do not enter the channel.
 - Avoid and minimize vegetation removal when constructing fence lines, to the extent feasible. Large, established vegetation should not be removed.
 - Livestock stream crossings to protect, restore, or establish aquatic or riparian habitat:
 - Design and construct essential livestock stream crossings to handle reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails.
 - Use existing access roads and stream crossings whenever possible, unless new construction would result in less habitat disturbance and the old trail or crossing is retired. Locate new livestock stream crossings or water gaps where streambanks are naturally low. Avoid placement of stream crossings in or near aquatic habitats for special-status species; livestock crossings or water gaps should not be in areas where

compaction or other damage can occur to sensitive soils and vegetation (e.g., wetlands) due to congregating livestock.

- Minimize the number of stream crossings within a single reach and across a watershed for livestock to limit vegetation disturbance and erosion.
- Stream crossings and water gaps should be designed and constructed to the narrowest width adequate for expected use to minimize the time livestock will spend in the crossing or riparian area.
- Discourage livestock loafing in the stream by locating crossings, where possible, out of shady riparian areas or by including gates in the design. Livestock-only crossing should be no less than 6 feet wide and no more than 30 feet wide, as measured from the upstream end to the downstream end of the stream crossing, not including the side slopes.
- Use appropriate rock sizes that accommodate the intended traffic without causing injury to livestock or people, or damage to vehicles using the crossing. For a rock livestock crossing, use a hoof contact zone or alternative surfacing method over the rock.
- Off-Channel Livestock Watering
 - Limit the use of springs for livestock source water to ways that do not significantly damage the function of the spring (e.g., piping, fencing to keep out livestock), and do not degrade habitat for special-status species such that existing population would be permanently negatively affected.
 - Withdrawals for livestock watering should not dewater habitats, cause stream flow conditions that adversely affect special-status species, or significantly reduce habitat value.
 - Each livestock water development should have a float valve or similar device, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion.
 - If water intakes are placed in native fish-bearing streams, screen surface water intakes to meet current NMFS, USFWS, and CDFW fish screen criteria. Screens should be self-cleaning, or regularly maintained by removing debris buildup. Conduct regular inspection and as needed maintenance on pumps and screens.
 - Place troughs or tanks far enough from a stream or surround with a protective surface to prevent mud and sediment delivery to the stream. Avoid steep slopes and areas where compaction or damage could occur to sensitive soils, slopes, or vegetation due to congregating livestock.
 - Troughs and other water capture and storage tanks that are accessible by wildlife should be equipped with properly designed and sized wildlife escape ramps to prevent wildlife from drowning.

- Avoid and minimize removal of vegetation around springs and wet areas.
- Part X of the CDFW Manual, *Upslope Assessment and Restoration Practices*, describes methods for identifying and assessing erosion, evaluating appropriate treatments, and implementing erosion control treatments.

E.7 References

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