INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-Sis-96-R52.5/88.4

Identified by
Project ID 0212000012

PERMITS

PLAC - U.S.D.C., N.O.A.A, National Marine Fisheries Service (NMFS), West Coast Region

Section 7 Biological Opinion
NMFS No. WCR-2015-2682
Dated June 26, 2015

PLAC - NMFS Juvenile Fish Screen Criteria For Pump Intakes (1996)

PLAC - NMFS Water Drafting Specifications (2001)

PLAC - United States Army Corps of Engineers, South Pacific Division

Non-Reporting Nationwide Permit
Application and Conditions for Non-Reporting Nationwide Permit No. 14
Dated February 2, 2016

PLAC - Permit Condition Responsibility (PCR) Summary

WATER QUALITY

PLAC - California Regional Water Quality Control Board, North Coast Region

Water Quality Certification
Water Quality Order No. 2003-0017-DWQ
Dated June 2, 2016

AGREEMENTS

PLAC - California Department of Fish and Wildlife (CDFW), Northern Region

Streambed Alteration Agreement
Notification No. 1600-2016-0030-R1
Dated June 6, 2013

PLAC - FHWG (2013) Underwater Noise Monitoring Plan Template

PLAC - CDFG Guidelines For Temporary Water Drafting From Streams And Rivers Supporting Anadromous Salmonids (2000)

PLAC - California Aquatic Invasive Species Management Plan (CDFG 2008)

MATERIALS INFORMATION

Foundation Report Thompson Creek Bridge (Br. No. 02-0081), Dated June 18, 2015

Foundation Report Seiad Creek Bridge (Br. No. 02-0072), Dated June 18, 2015

MATERIALS INFORMATION (continued)

Foundation Report Beaver Creek Bridge (Br. No. 02-0081), Dated June 18, 2015

Water Source Information

Excerpted Hazardous Waste Report

Final Hydraulic Report, Dated March 7, 2016

Hydrology Summary, Dated July 8, 2016

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

PERMITS

PLAC - U.S.D.C., N.O.A.A., National Marine Fisheries Services, West Coast Region

Section 7 Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation
NMFS No. WCR-2015-2682
Dated June 26, 2015

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1655 Heindon Road
Arcata, California 95521-4573

Refer to NMFS No: WCR-2015-2682

Chris Quiney
Office of Environmental Management
California Department of Transportation
1031 Butte Street
Redding, CA 96001

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Siskiyou Three Bridges Rail Upgrade Project

Dear Mr. Quiney,

Thank you for your letter of April 1, 2015, requesting reinitiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Siskiyou Three Bridges Rail Upgrade Project (Project). NMFS received your request in this office on April 22, 2015, and after the California Department of Transportation (Caltrans) provided additional Project information, NMFS determined that there was sufficient information to reinitiate formal consultation on June 23, 2015.

This letter transmits NMFS final biological opinion and Essential Fish Habitat (EFH) consultation pertaining to Caltrans proposed Project in the Beaver Creek, Seiad Creek, and Thompson Creek watersheds of the Klamath River Basin. Caltrans is the designated representative for the Federal Highway Administration, which is funding and responsible for carrying out the Project.

The biological opinion is based on NMFS' review of information provided within Caltrans' initial June 12, 2014, request for formal consultation, a project biological assessment (BA), additional information provided to NMFS by Caltrans including an April 1, 2015 letter containing "An Amended Biological Assessment".

The biological opinion addresses potential adverse effects on the following listed species Evolutionarily Significant Unit (ESU) and designated critical habitat in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531§ *et seq*.):

Southern Oregon/Northern California Coast (SONCC) ESU of coho salmon (*Oncorhynchus kisutch*)

Threatened (70 FR 37160; June 28, 2005)
Designated critical habitat (64 FR 24049; May 5, 1999)

Based on the best scientific and commercial information available, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of the SONCC ESU of coho salmon and is not likely to result in the destruction or adverse modification of designated critical habitat for the species. NMFS expects the proposed action will result in incidental take of SONCC coho salmon. An incidental take statement is included with the enclosed biological opinion. The incidental take statement includes non-discretionary reasonable and prudent measures and terms and conditions that are expected to further reduce anticipated incidental take of SONCC coho salmon.

The enclosed EFH consultation was prepared pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act. The proposed action includes areas identified as EFH for coho salmon and Chinook salmon, Pacific Salmon species managed under the Pacific Coast Salmon Fishery Management Plan (*revised through* Amendment 18, 2014). Based on our analysis, NMFS concludes that the project would adversely affect EFH for Pacific salmon. The proposed action contains measures to minimize adverse effects to EFH and NMFS provides additional Conservation Recommendations to further minimize adverse effects.

Please contact Rebecca Bernard in the Northern California Office, Arcata, California, 707-825-1622, rebecca.bernard@noaa.gov, if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

, for

William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: ARN151422 WCR2015AR00149

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation.

Siskiyou Three Bridges Rail Upgrade

NMFS Consultation Number (PCTS): WCR-2015-2682

Action Agency: California Department of Transportation (Caltrans)

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
SONCC ESU of coho salmon (*Oncorhynchus kisutch*)	Threatened	Yes	Yes	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: for

William W. Stelle, Jr.
Regional Administrator

Date: June 26, 2015

1. **INTRODUCTION**

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into sections 2 and 3 below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (Opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.) and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

Because the proposed action would modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources, and enabling the Federal agency to give equal consideration with other project purposes, as required under the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.).

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts. A complete record of this consultation is on file at the NMFS Northern California Office in Arcata, California.

1.2 Consultation History

On June 17, 2014, Caltrans requested formal consultation. After clarification of information within the Biological Assessment, consultation was initiated on August 26, 2014. New actions were added extending the consultation completion date and subsequently signed on March 16, 2015.

On April 22, 2015 NMFS received an April 1, 2015 request for *reinitiation* of formal consultation on the Siskiyou Three Bridges Rail Upgrade Project (Project) from California Department of Transportation (Caltrans). After clarification of information within the "amended biological assessment" (BA) submitted by Caltrans (2015b), formal consultation was *reinitiated* on June 23, 2015.

As stated in the original BA and the "Amended Biological Assessment", Caltrans determined that the Project may affect, and is likely to adversely affect the Southern Oregon/Northern California Coast (SONCC) Evolutionarily Significant Unit (ESU) of coho salmon (SONCC coho salmon) and its critical habitat. The request for consultation concerns the effects of the proposed project on threatened SONCC coho salmon (*Oncorhynchus kisutch*), and its designated critical habitat.

This Opinion is based on information provided to NMFS by Caltrans with the submittal of an initial BA and subsequent clarifying information, and submission of an "Amended Biological Assessment" and subsequent clarifying information to reinitiate consultation. NMFS also considered other sources of scientific and commercial information, including journal articles and technical reports, unpublished data, and personal communications. A complete administrative record of this consultation is on file at the NMFS Northern California Coast Office in Arcata, California.

1.3 Proposed Action

"Action" refers to all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

Caltrans proposes to upgrade three rural area bridges located in Siskiyou County, California along State Route (SR) 96 (figure 1) that crosses the drainages Beaver Creek (Post Mile [PM] 88.26, figure 2), Seiad Creek (PM 60.17, figure 3), and Thompson Creek (PM 52.48, figure 4) located in the Seiad Valley between the town of Happy Camp and Interstate 5 within the Klamath River Basin. Construction of the proposed Project is expected to span two construction seasons; construction is scheduled to begin in spring and end in fall of the following year (e.g., April 2017 through October 2018, or April 2018 through October 2019). In-water work activities at each creek will occur during the dry season with a two week expansion (June 1—October 31) to both ends of the "normal" work window of June 15—October 15, to accommodate changes made in foundation types; Seiad Creek Bridge (impact H-shaped pile driving) and Thompson Creek Bridge (spread footings), initially described in the original consultation. Construction site preparation activities may occur prior to in-water work window. Activities within the bridge reach of each of the three creeks include upland, riparian and in-channel work. The proposed permanent action includes:

Beaver, Seiad, and Thompson Creeks (Bridges)

1. widening the existing reinforced concrete bridge piers and abutments;
    a. Beaver Creek Bridge requires spread footings (figure 2)
    b. Seiad Creek Bridge requires H-shaped piles (figure 3)
    c. Thompson Creek Bridge requires spread footings (figure 4)
2. enlarging footings and pile foundations;
3. widening the existing bridge decks, replacing the metal bridge railing;
4. constructing reinforced concrete retaining walls supported on pile foundations;
5. constructing rock slope protection (RSP);
6. widening fill slopes at the ends of the bridges; and
7. reconstructing approximately 100 feet of roadway at both ends of each bridge to conform to bridge widening.

Figure 1. Location of Siskiyou County three bridges proposed for rail upgrade—State Route 96, California.

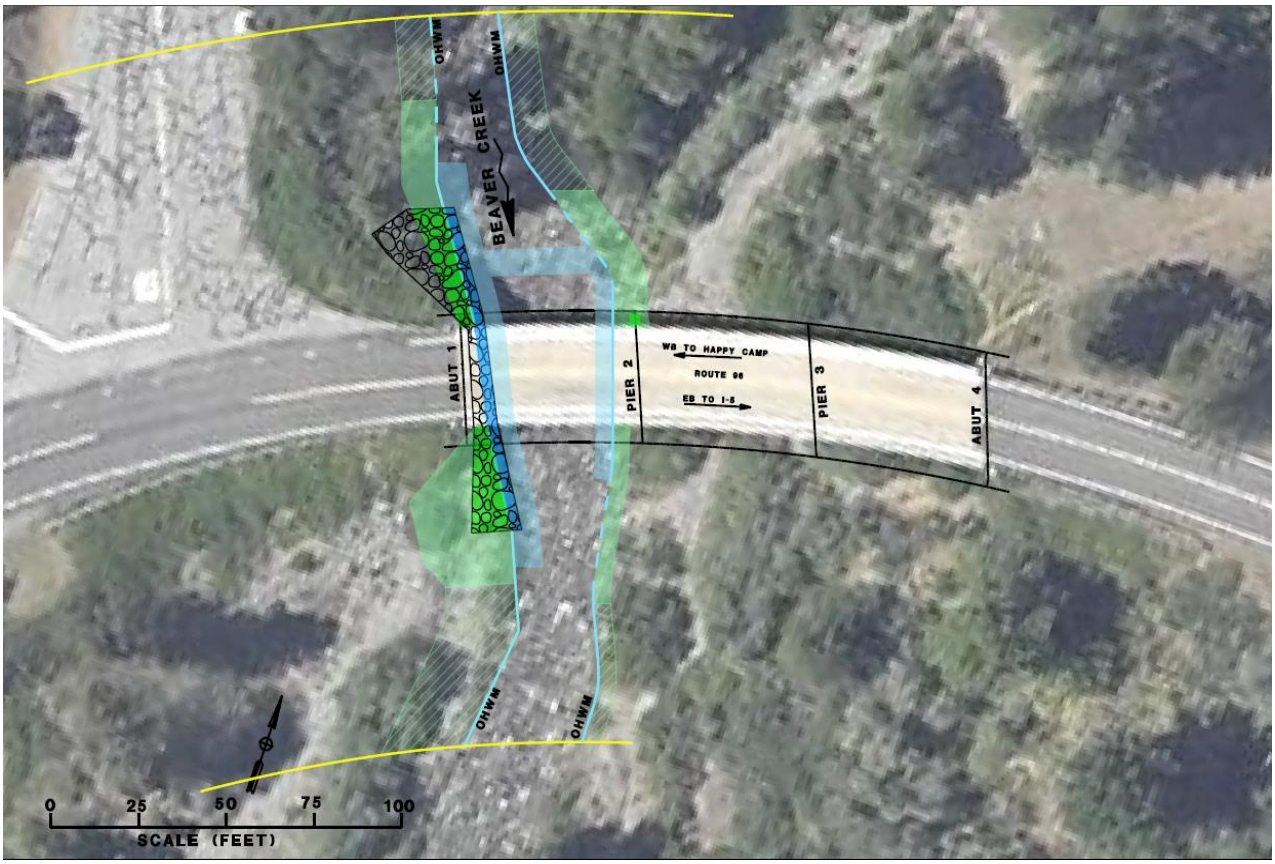

Figure 2. Location of proposed foundation construction on Beaver Creek Bridge (RSP depicted here as circles within a polygon—green and blue colored backgrounds are proposed riparian and in-channel area).

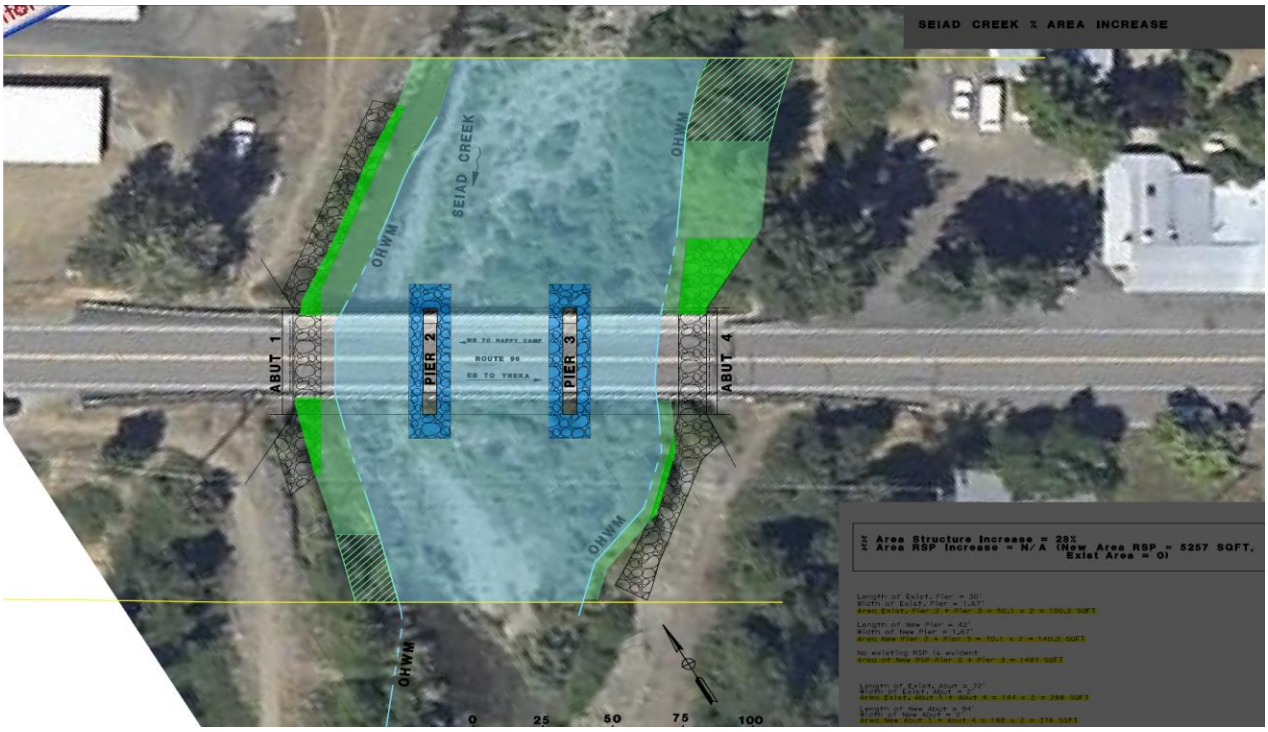

Figure 3. Location of proposed foundation construction on Seiad Creek Bridge (RSP depicted here as circles within a polygon— green and blue colored backgrounds are proposed riparian and in-channel area).

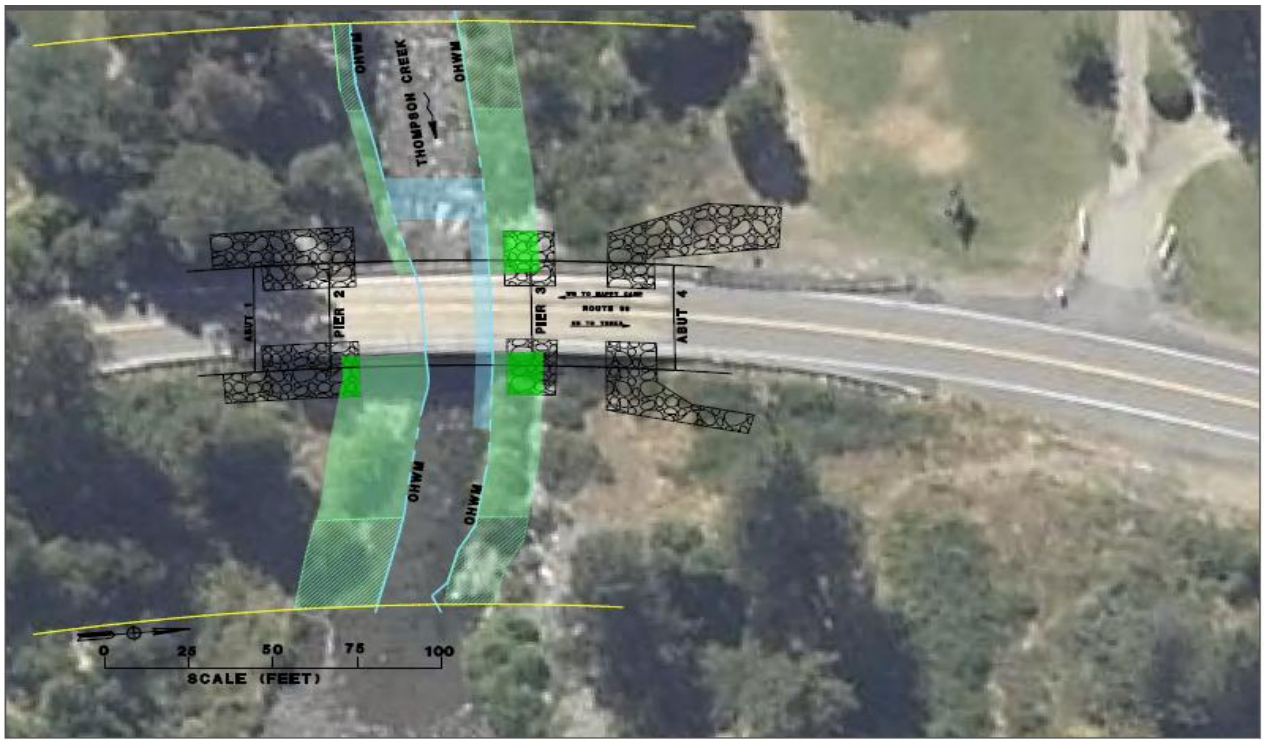

Figure 4. Location of proposed foundation construction on Thompson Creek Bridge (RSP depicted here as circles within a polygon— green and blue colored backgrounds are proposed riparian and in-channel area).

The following temporary construction activities associated with the rail upgrade of each of the Beaver, Seiad, and Thompson creeks bridges include:

1. Construction staging will be identified for materials and equipment storage
2. Temporary access roads will be constructed to the ordinary high water mark (OHWM)
3. Relocation of fish from the work area prior to clear water and stream diversion
4. In-channel (below OHWM) temporary work pads will be constructed
5. Temporary bridges may be used to span across the wetted channel for construction activities
6. Two types of water diversions are anticipated to be utilized to isolate construction stream flow—a) clear water diversion (cofferdam), and b) stream diversion
7. Excavation, shoring and dewatering will be used to construct portions of footings, piers, abutments, and retaining walls that are below the ground water table
8. Sheet piles may be vibrated into the ground to be used as temporary shoring for foundation work
9. Temporary falsework will be constructed to support the concrete bridge deck while under construction
10. Removal of trees and vegetation as needed to gain access for bridge work, removal of vegetation within project limits that impede motorist's visibility of the road in distance, and removal to provide a clear recovery zone of 20-feet from the edge of the travel way
11. Water drafting may be used
12. Grading to restore channel bed to original contour grade
13. Implementation of temporary best management practices for water pollution control
14. Installation of construction signs 1,500 feet from the ends of bridges

Caltrans proposes to widen Beaver Creek, Seiad Creek, and Thompson Creek bridges to reflect current American Association of State Highway and Transportation Officials standards. Proposed construction will increase the width of the bridges, thus increasing surface areas (table 1). Each of the bridges drain storm water through either vertical drains (deck drains) or horizontal drains (scuppers) at the sides of the bridges. The water directly enters the stream below.

As part of the widening activities, the existing bridge piers, pier foundations, and abutments (table 2) will be widened and extended (table 3) to support the wider bridges. Water diversions will be used to create a dry work environment while completing the in-channel work. Riparian vegetation removal will occur within the build zone, as well as the 20-foot clear recovery zone from the edge of the travel way, and vegetation that impedes motorist's ability to see the roadway farther ahead. All construction activities will take place over the course of approximately seventeen months and spanning at least two construction seasons, acknowledging that a third season may be needed to complete the project between the years 2016–2019. No single bridge construction project will take more than one season to complete. All in-water activities will occur between June 1 and October 31—a time period recognizing avoidance of adult migration and spawning, egg incubation, and fry emergence, and further responds to specific criteria that observes onset of rain events that may trigger salmonid movement to project creeks. Clear water and stream diversions may remain in each creek through the entire in-water work window as needed.

Table 1. Existing and proposed Project bridge dimensions and net increase to surface area (impervious surface and resulting shade) as a result of bridge widening activities (Caltrans 2014a, 2014c, 2015b).

	Current Bridge Deck Dimensions			Proposed Bridge Deck Dimensions		Net Increase in Bridge Deck Dimensions	
Location	Length (ft)	Width (ft)	Surface Area (ft^2)	Width (ft^2)	Surface Area (ft^2)	Width (ft)	Surface Area (ft^2) and (% increase)
Beaver Creek Bridge	150.0	25.8	3,874.5	36.0	5,400.0	10.2	1,525.5 (39.4%)
Seiad Creek Bridge	155.5	33.6	5221.7	44.0	6,842.0	10.4	1,620.3 (31.0%)
Thompson Creek Bridge	124.9	28.3	3537.0	36.0	4,494.6	7.7	957.6 (27.1%)
Project Overall			12,633.2		16,736.6		4,103.4 (32.5%)

Table 2. Summary of existing foundation and RSP area footprints at each bridge (Caltrans 2014a, 2014c, 2015b).

	Existing Foundation Area (ft^2)		Existing RSP Area (ft^2)	
Location	Abutments	Piers	Abutments	Piers
Beaver Creek Bridge	159	16	0	0
Seiad Creek Bridge	288	100	0	0
Thompson Creek Bridge	111	93	1,280	1,000
Total	588	209	1,280	1,000

Table 3. Summary of proposed, permanent increases to foundations and RSP area footprints as a result of bridge widening activities at each bridge (Caltrans 2014a, 2014c, 2015b).

	Proposed Foundation Area (ft^2)		Net Increase of Foundation Area (ft^2)		Proposed RSP Area (ft^2)		Net Increase of Area (ft^2)	
Location	Abutments	Piers	Abutments	Piers	Abutments	Piers	Abutments	Piers
Beaver Creek Bridge	181	32	22	16	1,071	0	1,074	0
Seiad Creek Bridge	376	140	88	40	3,770	1,490	3,770	1,490
Thompson Creek Bridge	134	141	23	48	1,724	1,112	444	112
Total	691	313	133	104	6,568	2,602	5,288	1,602

1.3.1 Construction Activities at the Beaver, Seiad, and Thompson Creeks Bridge Sites

1.3.1.1 Temporary Access Roads and Temporary Bridges

Temporary access roads above the OHWM will be constructed to accommodate construction equipment access to the work area; overall widths to 12 feet and composed of angular gravel removed post-project (table 4). These roads may be constructed on both sides of each bridge. A grader will cut in an access road from the shoulder of the highway down to ~~the edge of the creek~~. OHWM Grading depths up to 3 feet are expected in certain areas in order to create an access path for the heavy equipment. Geotextile fabric will be placed on temporary access road beds prior to the placement of clean, washed, crushed rock; crushed rock will be spread across the access road with an excavator. The use of these temporary access roads will reduce sediment transport and erosion into the creek. Temporary access roads will then be stabilized to prevent erosion. These roads will be constructed in previously disturbed upland areas, or areas that have been utilized in the past as temporary roads. Therefore, these areas have no significant riparian vegetation growth that will be removed as a result of the temporary road. Minor vegetation (<1 inch diameter breast height [DBH]), will be removed as needed. Roots will be kept intact for regeneration and geotextile fabric will be used prior to placement of the gravel. The temporary roads will have an overall width of 12 feet.

Table 4. Proposed temporary and permanent post-project area *riparian and upland* habitat footprints (within bridge reach action area) compared to existing riparian habitat area footprints within the Project action area (Caltrans 2014a, 2014c, 2015b)—*riparian vegetation removal is addressed in Section 1.3.1.4*.

	Riparian Area						
	Existing Area (Footprint)			Temporary Riparian Vegetation Loss[1]	Permanent Post-Project Area (Footprint)		
Location	Riparian Area (ft^2)	Bridge Foundation Area Footprint (ft^2)	Bridge Foundation RSP Area Footprint (ft^2)	Temporary Access Roads (ft^2)	Riparian Vegetation Loss (ft^2)	Bridge Foundation Area Footprint (ft^2)	Bridge Foundation RSP Area Footprint (ft^2)
Beaver Creek	4,055	175	0	1,660	449	213	778
Seiad Creek	6,424	288	0	3,744	1,182	376	3,924
Thompson Creek	5,259	204	2,280	3,039	370	275	3,393
Total	15,738	667	2,280	8,443	2,001	864	8,095

[1]Vegetation removal activities include removal of vegetation for temporary access road, motorists' unimpeded sight of roadway, and for a 20-foot clear recovery zone.

To enable construction equipment to move around in the channel bed, temporary access roads will continue into the stream channel below the OHWM where clean, rounded river-run rock will be placed to create a work pad in the stream channel, but outside of the wetted channel. The rock work pad will be used to set up construction scaffolding, and place heavy equipment and construction vehicles, such as a crane, drill rig and potentially a temporary bridge. Work pad material will consist of rounded, river-run rock of spawning size dimensions that has been cleaned and washed.

A single span temporary access bridges may also be installed at each location to provide access for construction vehicles across the wetted channel. Temporary access bridges will span across the wetted creek channel. As with temporary, in-channel work pads, only rounded, clean, and washed, river-run rock will be used to build up and support either side of the bridge. Volumes of approximately 75, 20, and 40 cubic yards (yds^3) of river-run rock will be used in Beaver, Seiad, and Thompson creeks respectively. Temporary access bridges will be in-place only during the seasonal, in-water work window defined as June 1–October 31 and may be in place for that entire time window. At Seiad Creek, there are two channels, though one channel will be diverted away from the work area at a time, equipment may still be required to cross the channel to reach the work area.

100

Caltrans proposes to maintain any and all fuel storage and refueling sites in an upland location at least ~~50~~ feet from surface water, that vehicles and construction equipment be in good working condition, showing no signs of fuel or oil leaks, and that any and all servicing of equipment be conducted in an upland location. The following proposed minimization measures used during construction to prevent chemical contamination during construction include:

- Equipment will be checked daily, prior to use, for leaks. If leaking, equipment cannot be used until leak is fixed. Prior to use, all equipment must be cleaned to remove external oil, grease, dirt or mud.
- Refueling of construction equipment and vehicles will occur outside of the active channel.
- Contractor will prepare a Storm Water Prevention Plan (SWPPP) prior to project construction in accordance with the Caltrans Standard Specifications Section 7-1.01G. A Spill Prevention, Control, and Countermeasures (SPCC) Plan will include in the SWPPP to minimize and avoid the potential of a leak or spill of petroleum or hydraulic products within the channel, which will also include actions to take in the event of a spill or leak.
- Equipment associated with the in-water construction activities must be removed following the completion of all in-water work. ~~If needed, although not anticipated, cofferdams needing to be left in the channel will be designed in such a way that it will not obstruct flow and will be able withstand high flow and volatile fluctuation.~~
- Construction equipment will not operate in anadromous waters unless the channel is dewatered or otherwise dry. Relocation and exclusion of listed fish will be first priority prior to dewatering and will be performed by a qualified fisheries biologist following CDFW and NMFS guidelines.
- Use of RSP will be limited to the minimum necessary to protect infrastructure. RSP, sheet piles, and other erosion control materials will be pre-washed to remove sediment and/or contaminants.

- Temporary material storage piles (e.g., RSP) will not be placed in the 100 year floodplain during the rainy season (October 15 through May 31), unless material can be relocated within (e.g., before) 12 hours of the onset of a storm (NMFS 2013).
- Excavated material will not be stored or stockpiled in the channel. Any excavated material that will not be placed back in the channel or on the bank after construction will be hauled to an approved disposal site.
- Angular crushed rock used for temporary roads will be kept separate from the clean river rock using ~~landscape cloth~~ Heavy geotextile fabric and will be disposed of off-site post-construction at a Caltrans approved disposable site.
- Temporary fills that are left in stream channels will be composed of washed, rounded, spawning-sized gravel between 0.5 to 4 inches in diameter. Gravel in contact with flowing water will be left in place, modified to ensure adequate fish passage for all life stages, and then allowed to disperse naturally by high winter flows. Materials placed above the Ordinary High Water Mark (OHWM) must be clean washed rock or contained to prevent material conveyance to the stream or mixing with clean gravel.
- Construction activities associated with widening of the bridges, including dewatering, stream flow diversion, construction of temporary gravel work pad, and construction of temporary falsework will be conducted during daylight hours.
- NMFS shall be contacted immediately and all project activities that may affect listed coho salmon shall cease if one or more salmonids are found dead, injured, or chemical contamination has been detected within coho salmon critical habitat downstream of proposed project activities. Project activities may resume only after NMFS has reasonable assurances that no additional mortalities of listed Pacific salmonids will occur and that chemical contamination of coho salmon critical habitat has ceased.

After Project construction is completed, all angular, crushed gravel and geotextile fabric used for temporary access road material will be removed completely from the site and disposed of off-site at a Caltrans approved disposable site. Rounded river-run rock used for work pads and temporary bridge shoring below the OHWM, may remain in the stream channel. Hand tools will be used to evenly spread the river-run rock to conform to the pre-construction ground surface across the wetted channel to prevent barriers to migration.

When access roads are removed, where soil compaction is unintended, compacted soils will be loosened after heavy construction activities are complete. Permanent erosion control, vegetation in riparian habitat areas, will consist of native grasses and forbs.

1.3.1.2 Fish Relocation and Water Diversion

Fish relocation will be necessary at all three bridge reach action areas. Prior to and during the placement of diversion structures, Caltrans will use block nets to exclude fish from the work area. Openings in the block nets will not exceed 1/4 inch. After block nets are set, fish remaining within the block net area will be captured and relocated out of the work area. Block nets will be in place for a maximum of three days while diversion structures are placed. During this three-day period, passage will be blocked until diversion structures are in place and a portion, at least 50 percent, of the channel is reopened to fish passage. Sequential activities and use of minimization measures are as follows:

1. Prior to dewatering activities, fish will be excluded from the construction area.
2. The upstream and downstream limits of the work area will be delineated with the use of fish exclusion fencing (block nets).
3. Hand labor will be used to drive t-posts into the ground and attach fence with an opening no greater than 1/4-inch x 1/4-inch.
4. Imported, cleaned river rock, will be utilized to seal around the bottom of the fencing to prevent re-entry of excluded fish.
5. Block nets used to keep fish out of the work area will be installed upstream and downstream of the in-stream work area and maintained until passage is restored to at least 50 percent of the channel; and if one or more salmonids are found dead, injured, or chemical contamination has been detected, all project activities shall cease and NMFS and CDFW shall be contacted immediately
6. Electrofishing may be utilized when other standard fish capture methods are likely to be ineffective or other methods fail to remove all fish from the site; the project biologist must have appropriate training and experience in electrofishing techniques and all electrofishing must be conducted according to the NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act (NMFS 2000) and seining will be performed by a qualified fisheries biologist and will adhere to the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010).
7. All listed salmonids removed from the work area will be relocated either upstream or downstream to a nearby area with suitable pool habitat, determined at the time of relocation responding to the dynamic nature of the channel and influences from beaver activity.
8. After fish and other aquatic species have been removed from the exclusion area, cofferdams will be formed with sheet-piles vibrated in place isolating the bridge structures, and the area inside the cofferdam will be de-watered. A biologist will remain within the coffer dam during dewatering to net any fish that were not initially removed prior to dewatering.
9. Exclusion fencing will be removed by hand crews to allow re-entry of aquatic species once the cofferdams are installed and dewatering is completed—expected up to 3 days.
10. After the project is completed, hand crews will pull the metal t-posts and level out the river-run rock below the fence to match pre-construction conditions.
11. Dewatering the stream channel will be limited to the minimum necessary to support construction activities. When any dam or other artificial obstruction is being constructed, sufficient water velocity (at less than 8ft/s) or water (at least a 10ft wide live stream) shall at all times be kept or allowed to pass downstream to maintain aquatic life below the dam. Stream width, depth, velocity, and slope that provide upstream and downstream passage of adult and juvenile fish will be preserved according to current NMFS and CDFW guidelines and criteria or as developed in cooperation with NMFS and CDFW to accommodate site specific conditions.
12. Diverting the stream channel will proceed from the downstream to the upstream end of the channel. Flow will not be diverted from the stream channel until the temporary channel is complete and all applicable soil stabilization/control measures are in place. Flow will be diverted the minimum distance necessary to isolate the construction area.
13. Water will be released downstream at an appropriate rate to maintain downstream flows at all times and the outlet of all diversions shall be positioned such that the discharge of

water does not result in bank erosion or channel scour and maintains pre-project hydraulic conditions.

14. Modified or disturbed portions of streams, banks, and riparian areas will be restored as nearly as possible to natural and stable contours.

Two types of water diversion, encompassing project areas of each creek, are anticipated to isolate the in-channel construction activities from stream flow: (1) clear water diversion (cofferdams) at Beaver Creek Bridge and Thompson Creek—Bridge, and (2) stream diversion at Seiad Creek Bridge (table 5).

At Beaver Creek Bridge, two cofferdams are needed to isolate active stream flow from abutment 1 and pier 2 while they are being widened. At Thompson Creek Bridge, one clear water diversion (cofferdam) is needed to isolate active stream flow from pier 2 while it is being widened. Clearwater diversion involves pushing the water away from the abutments and piers using sheets of metal or k-rails lined with plastic, without removing the water from the original channel. Beaver Creek and Thompson Creek have an active channel width of approximately 20–25 feet during the summer, which will be reduced by about 50 percent with the clear water diversion. At least a ten-foot stream channel will be maintained for fish passage.

Stream diversion will be used at Seiad Creek Bridge utilizing two, natural, low-flow braided channels at the bridge reach. At low flow, the width of the primary channel upstream of the bridge is approximately 10 feet in width, while the secondary channel is approximately 2 feet in width. Downstream of the bridge, where the channels converge, the width equals approximately 25 feet. In sequence, the *secondary* channel will be completely diverted to the primary channel while clear water access to abutment 4 and pier 3 is attained and subsequent construction is completed, including RSP (re)placement on the secondary channel side of the bridge for foundation and retaining walls. When construction is completed on the secondary channel side of the bridge, the stream channel will then be completely diverted to this previously diverted section, so that clear water access to abutment 1 and pier 2 is attained and subsequent construction is completed, including RSP placement on the *primary* channel side of the bridge for foundations and retaining walls.

No culverts will be used during diversion activities; instead sheet metal or k-rail will be installed at the top of the action area (approximately 50 feet upstream of the bridge) where Seiad Creek braids into two channels, so that the entire stream flow can be directed into either the primary or secondary channel depending on which side of the bridge construction activity is occurring. If groundwater is encountered during construction in the dry work area, the water will be pumped from the site and allowed to infiltrate back into the ground from a filter-lined pit in an upland area outside of the limits of the stream where it can infiltrate back into the ground without increasing turbidity levels in the stream. Other measures may be used, such as a baker tank. Alternatively, if water drafting is necessary, the intruding groundwater will be pumped into and retained in holding tanks where silt can settle prior to using for water drafting, or trucked off-site to an approved disposal site. No diversion structures (e.g., k-rails or sheet metal) used for clear water or stream diversion will be placed prior to June 1; and all stream diversion structures will be removed by October 31. Sections of the streams will not be dewatered longer than the work

Table 5. Proposed temporary and permanent post-project *instream channel* area footprints (within bridge reach action area) compared to existing instream channel area footprints within the Project action area (Caltrans 2014a, 2014c, 2015b).

	Instream Channel Area					
	Existing Area (Footprint)			Temporary Water Diversion and Work Pad[1]	Permanent Post-Project Area (Footprint)	
Location	Instream Channel Area (ft^2)	Bridge Foundation Area Footprint (ft^2)	Bridge Foundation RSP Footprint (ft^2)	Dewatered Area (ft^2)	Bridge Foundation Area Footprint (ft^2)	Bridge Foundation RSP Footprint (ft^2)
Beaver Creek	4,100	0	0	1,164	0	272
Seiad Creek	5,975	100	0	11,950[2]	140[3]	1,487
Thompson Creek	5,075	0	0	757	0	0
Total	15,150	100	0	13,871	140	1,759

[1]Instream work pad is the entire area dewatered beneath the bridge and is composed of washed, river-run rock that will be graded and left instream post-project.
[2]Since Seiad has two low-flow channels that flow through the Seiad Creek action area, only one channel will be dewatered at a time as construction moves from one end of the bridge to the other, therefore only 5,975 ft^2 will be temporarily dewatered at a time—combined 11,950 ft^2.

window indicated above which is the time period with the least impact on life history stages of salmonids. Once fish have been excluded and removed from the action area and all clear water and stream diversion structures are in place, dewatering will take place.

1.3.1.3 Bridge Construction Activities

In-water work activities at each creek will occur during the dry season June 1—October 31. Proposed construction activities include upgrading bridge decks by widening the bridges to provide four-foot shoulders at Beaver and Thompson creeks, and eight-foot shoulders at Seiad Creek. The existing metal beam guardrails will be replaced with new metal beam guard rails. Bridge widening requires H-shaped pile foundations at Seiad Creek Bridge and reinforced concrete spread footing foundations (Beaver Creek Bridge and Thompson Creek Bridge) (tables 4 and 5). Bridge widening includes:

- widening the bridge decks;
- constructing new steel girders underneath the bridge deck (lifted into place with a crane);
- bridge piers and pier foundation will be extended; and
- abutments and retaining walls will be extended to match the wider bridge.

The type of foundation required at each project location is dependent upon geotechnical findings from drill bores into the substrate. Based on geotechnical studies, Caltrans' Office of Geotechnical Design-North recommends the following foundation type per bridge:

- Beaver Creek Bridge will require reinforced concrete spread footings;
- Seiad Creek Bridge will require the use of 14.3-inch diameter steel H-shaped piles that require impact pile driving; and
- Thompson Creek Bridge will reinforced concrete spread footings

The existing abutment retaining walls at Seiad Creek will be removed and replaced with pile foundations. At Beaver Creek, new retaining walls will be constructed behind the existing retaining walls outside the banks of the channel using RSP. RSP will be placed adjacent to the abutments, retaining walls, and piers as needed to protect bridge and roadway embankments from scour. About 100 feet of roadway at both ends of each bridge will be constructed and widened to match widened bridges. Roadway widening will require earthwork in order to widen embankments.

Reinforced Concrete Spread Footing Installation
Spread footing requires excavation and shoring. The top of the footing must be below anticipated scour elevation. The bottom of the footing must be founded on rock or densely compacted soil. Sheet piles may be vibrated into the ground to be used as temporary shoring for foundation work. Sheet piles are usually interlocking steel "AZ"-type piles that are about two feet (0.6 meter) wide and range in length. Footings that are below the ground water table require dewatering. Sheet piles are commonly used to construct walls and cofferdams—cofferdams are used to isolate construction from the water. A vibratory hammer uses an oscillatory hammer that vibrates the pile, causing the sediment surrounding the pile to liquefy and allow pile penetration. Peak sound pressure levels for vibratory hammers can exceed 180 dB; however, the sound from these hammers rises relatively slowly (Caltrans 2009, *updated* 2012).

Steel H-shaped Pile Installation
Steel H-shaped pile installation requires pile-driving. H-shaped piles are dimensionally square structural beams that are driven in the ground for deep foundation applications. Most soils at or near surface do not have the mechanical properties to support large structures. Therefore, driving piles deeper into the earth's geology where there are soil-bearing strata that are capable of providing the support needed to keep large structures in place is required. H-shaped piles are manufactured and designed to transfer structural loads to these good bearing soils. Caltrans does not anticipate the use of any pile driving for the construction of temporary falsework or bridge crossing.

A vibratory hammer may be used to initially set the piles. The next phase then drives the H-shaped piles using an impact hammer. A protective bearing plate is placed over the piles. This plate is needed to prevent damage to the piles. When this plate is struck by the impact hammer a percussive noise is released. Both impact force and impact duration are necessary to overcome friction and drive piles into soils to a sufficient, structurally-sound depth.

Steel H-Shaped Pile Foundations
Per the geotechnical investigation, the H-shaped piles on the existing bridge will be used as a guide in order to match the new H-shaped piles (14.3-inch) with the existing foundation. A pile driving crane with an impact hammer will be used to drive the H-shaped piles into the ground. Driving H-shaped piles at Seiad Creek will take place between June 1 and October 31 when flow

is at its lowest and the wetted-channel is shallow, approximately 0.15 meters (0.5 feet) to 0.45 meters (1.5 feet) deep. Based on the geotechnical investigation, assumptions of approximately 300 strikes per pile are anticipated to drive each pile into the ground (table 6). Additionally, an estimated number of five to six piles per day will be driven, taking approximately six to eight hours to complete; each pile will require approximately one hour to place. An estimated total of 46 piles are estimated will be driven (table 6). Piles may need to be repositioned and time between driving events can range from five to 30 minutes. Actual pile driving will take between 1 to 3 days to complete per bridge foundation location (table 6). Assuming conditions are as outlined and project actions are as proposed, pile driving activities will take approximately eight days in total to accomplish.

Piles will be driven at a minimum distance of 15.24 meters (50 feet) from the wetted-channel within a dry channel bed in a dewatered cofferdam. The pile will be driven approximately 20 feet below the channel bed. Prior to driving piles, a cofferdam will be placed around the footing and dewatered to remove ground water. Ground water will be pumped from the excavated-pile cap bottom. Stream diversion will be placed prior to placement of cofferdam.

Hydroacoustic monitoring will be conducted for H-shaped piles struck with an impact hammer—*see* Fisheries Hydroacoustic Working Group (FHWG) Underwater Noise Monitoring Plan Template (FHWG 2013). A hydroacoustic monitoring plan using the FHWG monitoring template will be developed and submitted prior to project start.

Cofferdams

Cofferdams are temporary structures that are commonly used to isolate an area (e.g., pile footings) from the surrounding water column. They are most commonly constructed from steel sheet piling, but other types of materials have been used. Steel sheet piles may also be used as temporary shoring for foundation work. Shoring is used to temporarily support the side of an excavation to prevent cave-ins when excavation is required. Steel sheet piles will be driven into the ground using either an impact or a vibratory hammer. A vibratory hammer is also generally used to extract the sheet piles. Installation of sheet piles with a vibratory hammer may take up to 15 minutes per sheet.

Steel sheet piling used to form cofferdams can also attenuate noise. Cofferdams typically are dewatered to isolate pile driving from the water, which attenuates sound by providing an air space between the exposed pile and the water column (Caltrans 2009, *updated* 2012). Cofferdams are usually placed one foot outside of the footing dimension. Areas of cofferdams will be approximately 50–75 ft^2. Area within the cofferdam will be dewatered prior to the start of any foundation work.

After clear water diversions are in place and prior to placing RSP, excavation up to 5.5 feet deep will be needed to key-in the RSP. RSP sizing will be selected to ensure it is resilient to flows. Temporary staging areas and stockpiles storage will be necessary during construction. Parking will occur within existing pullouts and roadway shoulders. Staging and storage of equipment and materials will take place in previously disturbed open areas with limited ruderal tree and ground vegetation. Temporary material storage piles (*e.g.*, RSP) will not be placed in the 100

year floodplain during the rainy season (October 15 through May 31), unless material can be relocated within (*i.e.*, before) 12 hours of the onset of a storm (NMFS 2013).

A Storm Water Pollution Prevention Plan (SWPPP) will be developed which contains best management practices (BMPs) from the Storm Water Quality Handbook (Caltrans 2011). During construction activities, minimization measures will be employed to reduce potential inputs of sediment or pollutants to Beaver, Seiad, or Thompson creeks.

These measures include:

- Contractor will use a containment system that will prevent all materials and/or debris from entering the streams, which will include suspending, placing or erecting a platform, tarp, net or combination of these under the bridge structure to catch any fallen debris. In addition, concrete dust will be minimized with the use of water and/or vacuum systems;
- placement of concrete or concrete slurry to construct bridge footings must be conducted in a dry area, within a cofferdam, to prevent contact of wet concrete with water. Concrete or concrete slurry will not come into direct contact with flowing water;
- BMPs such as silt fences, straw wattles, or catch basins will be placed below all construction activities at the edge of surface water features and around the base of stock piles to intercept sediment before it reaches the waterway;
- sediment built up at the base of BMPs will be removed before BMP removal to minimize any accumulated sediment from being mobilized;
- a catchment system such as a platform, net, or tarp will be suspended under the bridge to effectively catch all fallen debris and prevent it from entering the stream; and
- staging areas will occur within existing pullouts and roadway shoulders where all equipment and hazardous materials will be stored at least 100 feet away from surface water features.

1.3.1.4 Riparian Vegetation Removal

The Project area riparian corridor along the banks of Beaver Creek include a few mature trees with marginal overhanging canopy, low lying brush and herbaceous vegetation. Seiad and Thompson creeks' riparian corridor are sparsely vegetated along their banks in the Project area due to previous flood control clearing and provide little shading. Removal of riparian vegetation from the Project area for construction activities will result in both temporary and permanent loss (table 7). Temporary loss of riparian vegetation is expected to occur as a result of clearing stream banks to construct temporary access roads for heavy equipment working on the bridge piers and abutments (tables 4 and 7), as well as loss of upland vegetation, including trees, to provide a clear line of sight along curves in the road at Beaver and Thompson creek project action areas, as well as construction activities at all three bridge action areas (table 8; Caltrans 2014a). Permanent loss of riparian vegetation is expected as a result of widening the bridge abutments and piers, widening roadway approaches to the bridges, and installation of retaining walls with associated placement of RSP (tables 3, 4, and 7).

Table 6. Summary of impact pile driving assumptions for proposed steel H-shaped pile installation at Seiad Creek Bridge. Pounds = lbs. (Caltrans 2015b).

	Hammer		Pile							Duration	
Activity	Size (lbs)	Type	Location	Type	Diameter (inch)	Length (feet)	Total Numbers of Piles	Number of Piles Driven Per Day	Strikes Per Pile	Hours of Pile Driving Per Day	Total of Pile Driving Days
Abutment 1/ Retaining Walls	7,938	D36-32	right bank-- see figure 3	HP 10X57	14.3	20	18	6	300	8	3
Pier 2	7,938	D36-32	See figure 3	HP 10X57	14.3	20	5	5	300	8	1
Pier 3	7,938	D36-32	See figure 3	HP 10X57	14.3	20	5	5	300	8	1
Abutment 4/ Retaining Walls	7,938	D36-32	left bank— see figure 3	HP 10X57	14.3	20	18	6	300	8	3

Following removal of riparian vegetation for temporary access roads at each Project site, geotextile fabric will be installed prior to laying angular gravel access road pads. This strategy will prevent disruption to roots and stumps left intact and flush to the ground, providing an opportunity for regeneration and aid in erosion control. Upon removal of temporary access roads, the existing riparian vegetation may re-grow without outcompeting newly planted saplings if replant is necessary. If, however, natural recruitment is not successful after one growing season, then any disturbed riparian areas and areas along creeks within the action area devoid of riparian vegetation will be replanted at a minimum of 3:1 ratio with riparian vegetation to compensate for the loss (Caltrans 2014 b). Riparian planting will take place during late fall, within 14–16 months post-construction activities (Caltrans 2014b). Erosion control for disturbance from construction activities outside of riparian habitat areas will consist of non-native and/or native grasses best suited for the particular areas needing protection. During the time that grasses establish after seeding and prior to riparian planting, temporary erosion control will be provided by straw much and other erosion BMPs in addition to vegetative cover. Additional measures to reduce impacts to riparian vegetation include:

1. disturbance or removal of vegetation will not exceed the minimum necessary to complete construction activities;
2. areas immediately adjacent to the Project area will be fenced with environmental sensitive area fencing in order to prevent unnecessary disturbance and minimize potential accidental removal of vegetation beyond designated impact areas;
3. vegetated areas which are disturbed will be replanted using native riparian plant species that are part of the baseline of the area;
4. non-native plant species removed during construction will be replaced with native species;
5. measures will be implemented to prevent the spread of invasive, non-native species such as inspecting and removing any vegetation from equipment used in the action area, use of weed free mulches, and re-vegetation seed and plants will consist of native species;
6. a revegetation and monitoring plan (Caltrans 2014b) detailing monitoring and success criteria to assure that riparian vegetation meets or exceeds pre-Project conditions will be implemented following completion of the planting for a three-year period consisting of measures of survival rates, water availability, erosion, human and wildlife disturbance, and overall health of the riparian corridor;
7. temporarily disturbed sections of the creek banks will be re-vegetated with native grasses and forbs to prevent soil slumping, in place riparian vegetation (outside of project sensitive areas—road safety and flood control) will be allowed to stabilize and re-establish itself (e.g., willows), and all riparian areas disturbed will be replanted with local, native riparian species during the late fall as outlined in the re-vegetation and monitoring plan;
8. a layer at least 4–6 inches of saturated soil is required prior to placing new seedlings and saplings in the ground to support successful growth; and
9. a three-year vegetation monitoring plan (Caltrans 2014c) will be implemented to ensure replanting efforts were successful to return native riparian vegetation within the action area to preconstruction conditions.

Table 7. Summary of temporary and permanent area impacts to riparian and instream habitat associated with proposed Project activities (Caltrans 2014a, 2014c, 2015b).

Location	Riparian Habitat					Instream Habitat (Benthic)				
	Temporary		Permanent			Temporary		Permanent		
	Total Acres	Total (ft^2)	Total Acres	Founda-tions (ft^2)	RSP (ft^2)	Total Acres	Total (ft^2)	Total Acres	Founda-tions (ft^2)	RSP (ft^2)
Beaver Creek	0.038	1,660	0.023	213	778	0.027	1,164	0.006	0	272
Seiad Creek	0.086	3,744	0.099	376	3,924	0.274	11,950	0.037	140	1,487
Thompson Creek	0.070	3,039	0.084	275	3,393	0.032	757	0.000	0	0
Project Total	0.194	8,443	0.206	864	8,095	0.333	13,871	0.044	140	1,759

Table 8. Upland trees removed to accommodate construction activities and provide a 20-foot clear recovery zone. Potential impacts to nutrient (N) and shade (S) are referenced with an "x" (Caltrans 2014b). Diameter at breast height (DBH).

Location	Species	DBH (approximate inches)	Proposed Tree Removal (approximate number)	Source of Nutrients (N) and Shade (S)	
				N	S
Beaver Creek Bridge	Oregon White Oak	6	4		
	Incense Cedar	10–12	6		
	Incense Cedar	30	2		
	Oregon Ash	6	1		
	Jeffrey Pine	24–36	3		
	Jeffrey Pine	10	1[1]		X
Seiad Creek Bridge	Big Leaf Maple	10	1		
	Black Cottonwood	10	1		
	Black Walnut	10	1		
	Catalpa	8	1		
Thompson Creek Bridge	Ponderosa Pine	4–30	7		
	Ponderosa Pine	6–12	2[2]		X
	Oregon White Oak	6–12	2[2]		X
	Persimmon	4–7	13		
	Madrone	8–10	3		
	Honey Locust	4–6	2		

[1]Tree is located 20–25 feet from the northwest abutment and approximately 15–20 feet from the edge of the creek on the fill slope.

[2]Trees are located on the southwest side and adjacent to the guardrail. They are on top of the fill slope and in front of the adjacent residential fence.

1.3.1.5 Water Drafting

Some minimization measures in the SWPPP require watering of stock piles, disturbed areas, and road surfaces for dust abatement and erosion control. Water will likely be drafted from nearby water sources. Implementation of the NMFS (2001b) water drafting specifications will prevent injury to fish or significant changes to flow conditions of their habitat.

Implementation consists of (but are not limited to):

1. diversion rate shall not exceed 10 percent of the surface flow and reduction in pool volume will not exceed 10 percent;
2. the intake structure shall be designed to promote uniform velocity distribution at all external mesh surfaces;
3. starting near the hose end with approximately 5–10% average open area, and gradually increasing the porosity toward the length of the screen—at a point where screen length exceeds three times the diameter of the suction hose, the baffling effect tends to diminish rapidly—at this point the baffle porosity may approach 100 percent;
4. the screen mesh size shall be: round openings—maximum 3/32 inch diameter (0.09 inch), square openings—maximum 3/32 inch diagonal (0.09 inch), slotted openings—maximum 1/16 inch width (0.07 inch);
5. the total (unobstructed) surface area of the screen shall be at least 2.5 square feet, based on the upper limit of pumping of 350-gallons per minute, additionally, larger surface areas are recommended where debris buildup is anticipated, and where stream depth is adequate to keep the screen submerged at approximately mid-depth; and
6. drafting operator should actively observe the drafting operation, pumping shall cease and the screen cleaned if it becomes more than 10 percent obstructed by debris.

1.3.1.6 Project Area Clean Up

Removal of construction related materials and debris will require containment systems to ensure that no material enters the stream. The containment system will consist of a platform, netting, tarp, fence, or combination of those items to ensure that debris does not fall into the stream channel. All waste (concrete, asphalt, etc.) generated during construction will be disposed of at an approved Caltrans disposal site. After construction is complete, cofferdams, water diversion structures, falsework, temporary stream crossings, and temporary access roads will be removed and roadway approaches to the new bridge will be reshaped. When removing the temporary access roads, bridges, and associated rock, several minimization measures will be utilized to prevent passage barriers or alteration to benthic habitat including: (1) removal of all crushed angular gravel, used to surface the temporary access roads, from the action area and dispose of at an approved Caltrans disposal site; and (2) evenly spread out remaining river-run rock, used within dewatered channels for access and construction activities, over the bed surface to ensure fish passage is not inhibited.

1.3.1.7 Funding assurances for California Endangered Species Act (Section 2081(b) of the California Fish and Game Code)

Prior to any Project activities that could incidentally take SONCC coho salmon, Caltrans shall provide California Department of Fish and Wildlife (DFW) with written documentation that Caltrans has allocated sufficient funds, acceptable to and approved by DFW, in the Expenditure Authorization for the Project to ensure implementation of all measures to minimize and fully mitigate the incidental take of SONCC coho salmon resulting from construction of the Project. This document (i.e., written document provided by Caltrans), should identify specific project minimization and mitigation components and the costs associated with Project components.

Additional actions, such as mitigation actions identified and proposed by Caltrans after the issuance of this NMFS biological opinion, which may affect ESA-listed species or designated critical habitat, will require reinitiation of consultation.

1.3.2 Interrelated and Interdependent Actions

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). There are no interdependent or interrelated activities identified with the proposed action at the final drafting of this Biological Opinion.

1.4 Action Area

"Action area" is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action area (*Biological Study Area* [Caltrans 2014a]; table 9) for the proposed project is composed of the three separate stream bridge reaches and the surrounding construction area where bridge upgrades will occur (figures 2, 3, 4) as well as staging and stock piles areas. The streams are located in the Klamath River Basin; Beaver Creek (Upper Klamath River—geographic area), and Seiad Creek and Thompson Creek (Middle Klamath River—geographic area). These geographic areas correspond to US Geological Survey hydrologic unit codes (HUC) Upper Klamath—California, Oregon 18010206 (Seiad [latitude 41.8424, longitude -123.1972] and Beaver [latitude 41.8702, longitude -122.8174] creeks), and Lower Klamath—California, Oregon 18010209 (Thompson Creek [latitude 41.8635, longitude -123.3105]). Specifically, each of these stream sites has an action area defined at the State Route 96 bridge crossings that includes all instream work, widening of outside shoulders, approximately 100 feet of riparian areas upstream and downstream of the bridge crossing, temporary access roads, and all of staging areas associated with the bridge construction. The instream action area at each of the three streams will include the stream reach beneath the bridge from the upstream extent of construction and dewatered stream bed, through the construction zone (approximately 200–300 linear feet) and extend downstream an additional 300 feet where mobilized sediment is expected to fall out of suspension (Caltrans 2014a). The action area represents approximately 94,920 square feet (2.2 acres) of total area summed between the three individual watersheds (table 9).

Table 9. Dimensions of the action area associated with construction location (Caltrans 2014a).

Location	Biological Study Area (BSA) (ft^2)	Existing Riparian Area (ft^2)	Existing Stream Area within BSA (ft^2)	Stream Channel BSA Lineal Distance (ft)[1]	Average Width of Low Water Wetted Channel within the BSA (ft)
Beaver Creek	29,350	4,055	4,100	205	20
Seiad Creek	40,450	6,424	5,975	239	25
Thompson Creek	25,120	5,259	5,075	203	25
Total	94,920 (2.2 acres)	15,738 (0.36 acres)	15,150 (0.35 acres)	647	

[1] Does not include the projected 300 lineal feet of sediment dissipation.

Project-related activities define the upstream and upslope extent of the action area, whereas the extent of the downstream action area is determined by the extent the project may temporarily increase turbidity following suspension of sediment as a result of stream diversion and delivery of sediment from upland and riparian areas after the first fall storm.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The adverse modification analysis considers the impacts of the Federal action on the conservation value of designated critical habitat. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[1]

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the range-wide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

Climate change is expected to detrimentally affect SONCC coho salmon in freshwater, estuarine, and ocean habitats (NMFS 2011; NMFC 2014b). Climate change affects the rangewide status of SONCC coho salmon by altering their aquatic habitat through freshwater temperature regimes which are exacerbated when degraded riparian conditions already support fewer coho salmon than historical, unaltered conditions. Climate change can play a major role in the life cycle, productivity, and persistence of coho salmon populations and can cause extreme conditions that can be catastrophic to coho salmon populations. The effects of climate change on Klamath River Basin SONCC coho salmon create the possibility of less-productive ocean conditions and warming of freshwater that increases bioenergetic and disease stresses on anadromous fish. In addition, as climate change reduces the carrying capacity of the habitat within the range of

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

SONCC coho salmon, species viability may be more difficult to achieve (NMFC 2014b). The reduced genetic diversity resulting from depressed population size may limit the ability of individuals to adapt to changing climatic conditions.

NMFS listed the SONCC ESU of coho salmon, which includes populations spawning from the Elk River (Oregon) in the north to the Mattole River (California) in the south, as a threatened species in 1997 (62 FR 24588; May 6, 1997). In 2005, NMFS reaffirmed its status as a threatened species and also listed three hatchery stocks as part of the ESU (70 FR 37160; June 28, 2005). Of the 396 streams that were identified by Brown and Moyle (1991) as historically supporting coho salmon within the SONCC coho salmon ESU, 287 were surveyed in 2001 to determine if coho salmon presence could be detected—of these surveyed streams, presence of coho salmon was confirmed in 121 (42 percent) streams; conversely, presence of coho salmon was not confirmed in 166 (58 percent) streams (CDFG 2002). Williams et al. (2006) described the historical population structure of coho salmon in the SONCC coho salmon ESU based on the location and amount of potential coho salmon habitat, with an assumption that the relative abundance of different populations mirrored the amount of intrinsic habitat potential in each watershed. Williams et al. (2008) described the SONCC coho salmon historical population structure as containing 19 functionally independent populations, 12 potentially independent populations, 17 small dependent populations, and two ephemeral populations. Williams et al. (2008) further organized the independent and dependent populations of coho salmon in the SONCC ESU into diversity strata largely based on the geographical arrangement of these populations and basin-scale environmental and ecological characteristics. Analysis of recent genetic data from coho salmon in this and adjacent ESUs supports the existing boundaries identified for SONCC coho salmon (Stout et al. 2010; Williams et al. 2011).

NMFS completed a status review of the SONCC coho salmon (NMFS 2011) and determined that the ESU, although trending in declining abundance, should remain listed as threatened. The final recovery plan for the SONCC coho salmon (NMFS 2014) reiterated the statue review determinations and further provided recovery criteria for the ESU, specifically prioritization of populations within the diversity strata of the ESU (figure 5), to achieve recovery. Key limiting stressors for the ESU include lack of floodplain and channel structure, stream channelization, altered hydrologic function—the amount of water in streams and rivers is insufficient for coho and salmon needs (NMFS 2014). The primary threats affecting abundance of the SONCC coho salmon appear to be poor ocean conditions, drought, climate change, and small population size (NMFS 2011), and reiterated within the final recovery plan (2014b) which further identified increased water temperature as one of the most widespread (and greatest) stresses in the SONCC coho salmon ESU. The Listing Factors: habitat destruction and modification or curtailment; and inadequate regulatory mechanisms—which contributes to all stresses and threats—captured the most comprehensive suite of threats to the ESU (NMFS 2014).

2.2.1 Life History

Coho salmon adults migrate and spawn in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers (Sandercock 1991; Moyle 2002). Adults migrate upstream to spawning grounds from September through late December, peaking in October and November. Spawning occurs mainly November through December, with fry

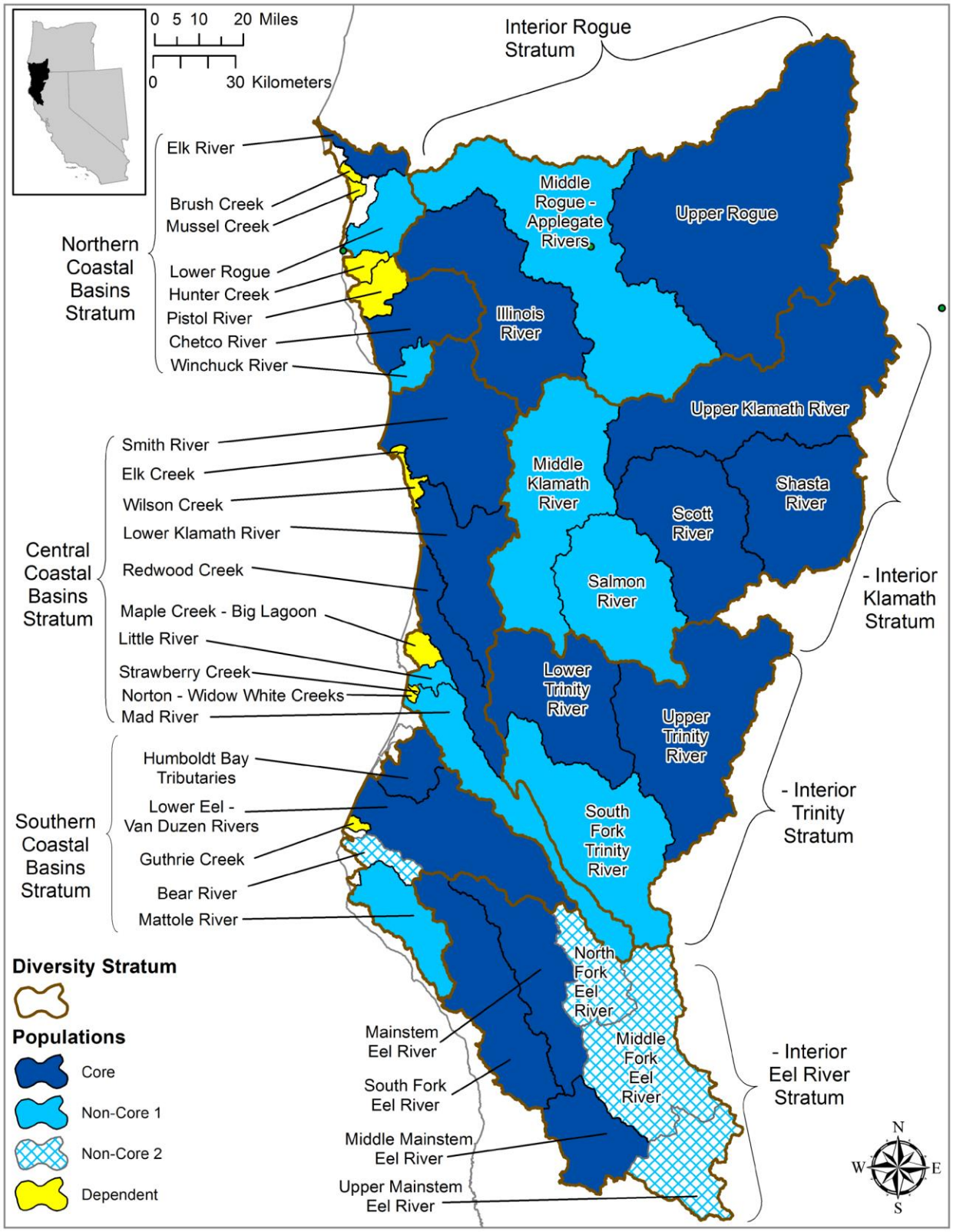

Figure 5. Bounds of the SONCC coho salmon populations and diversity stratums (Figure ES-4, Final Recovery Plan for the SONCC ESU of coho salmon NMFS 2014).

emerging from the gravel in the spring, approximately 3 to 4 months after spawning. Juvenile rearing usually occurs in tributary streams with a gradient of 3 percent or less, although they may move up to streams of 4 percent or 5 percent gradient. Juveniles have been found in streams as small as 1 to 2 meters wide. They may spend 1 to 2 years rearing in freshwater (Bell and Duffy 2007), or emigrate to an estuary shortly after emerging from spawning gravels (Tschaplinski 1988). With the onset of fall rains coho salmon juveniles are also known to redistribute into non-natal rearing streams, lakes, or ponds, where they overwinter (Peterson 1982). At a length of 38–45 mm, fry may migrate upstream a considerable distance to reach lakes or other rearing areas (Sandercock 1991, Nickelson et al. 1992). Emigration from streams to the estuary and ocean generally takes place from March through May.

2.2.2 Current Distribution and Abundance

NMFS identified six coho salmon ESUs in Washington, Oregon, and California (Weitkamp et al. 1995), including those populations within the SONCC ESU. The SONCC ESU of coho salmon is composed of 41 populations between Punta Gorda, California and Cape Blanco, Oregon (NMFS 2014). Reliable, current time series of abundances for naturally produced adult migrants or spawners are limited for SONCC coho salmon rivers (Good et al. 2005; NMFS 2011; NMFS 2014). Historical and current distributions, and characteristics of the population structure of SONCC coho salmon in northern California are described in Williams et al. (2006), the coho salmon status reviews (CDFG 2002; Good et al. 2005; NMFS 2011; NMFS 2014)—figure 5 (NMFS 2014), and the presence and absence update for the northern California portion of the SONCC coho salmon (Brownell et al. 1999).

The distribution of coho salmon within the SONCC ESU is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent (NMFS 2001a; Good et al. 2005; NMFS 2011; NMFS 2014). Scientists at the NMFS Southwest Fisheries Science Center compiled a presence-absence database for SONCC coho salmon ESU-wide, using information for coho salmon streams listed in Brown and Moyle (1991), other streams where NMFS found historical or recent evidence of coho salmon presence, and information assembled in the 2002 Status Review of California coho salmon North of San Francisco (CDFG 2002). Using the NMFS database, Good et al. (2005) compiled information on the presence of coho salmon in streams throughout the SONCC coho salmon ESU, which closely matched the results of Brown and Moyle (1991). Good et al. (2005) also noted that they had strong indications that breeding groups have been lost from a significant percentage of streams within their historical range. Relatively low levels of observed presence in historically occupied coho salmon streams (between 36 and 61 percent from 1986–2000) indicate continued low abundance in the California portion of the SONCC coho salmon ESU (Good et al. 2005). Data reported for the 2001 brood year suggest a strong year class, as indicated by an occupancy rate of more than 75 percent; however, the number of streams for which data were reported was roughly 25 percent of the number surveyed in previous years (Good et al. 2005). The data suggest that, for the period of record, occupancy rates within the SONCC coho salmon ESU were higher, between 54 and 61 percent, from brood years 1991–1997, compared to brood years 1998–2000, between 39 and 51 percent, before increasing in 2001. However, Good et al. (2005) noted that the 2001 brood year appeared to be the strongest of the last decade.

The most recent status review (NMFS 2011) describes that available time series have been downward and that the longest existing time series from the Shasta River exhibited significant negative trends since 2001, as did two extensive time series from the Rogue River Basin. For the 2011 status update, NMFS (2011) describes that none of the time series examined (other than West Branch and East Fork Mill Creek), had a positive short-term trend and further examination of these time series data indicated that the strong 2001 brood year was followed by a decline across the entire ESU.

In addition, of concern to the viability of SONCC coho salmon is that recent favorable marine conditions in 2007 and 2008 *did not* result in improved marine survival resulting in increased adult returns. In 2008, adult spawner populations (fish resulting from the 2005 brood year) within the Oregon Coast coho salmon ESU rebounded from recent declines (Lewis et al. 2009), while escapement of many SONCC coho salmon populations, including those in the Rogue River, declined to near record low numbers (NMFS 2011). However, despite the recent information from the Shasta River indicating increases in adult escapement in 2011, 2012, and 2013 (62, 115, and 151 adults respectively)—likely responding to a period of favorable ocean conditions—the total number of spawning adults remains below recovery levels.

Decreases to baseline include, expected mortalities as referenced in the Klamath Project biological opinion (NMFS and USFWS 2013), where one juvenile each, is expected to die as a result of fish relocation, dewatering, and structural placement.

2.2.3 Factors Responsible for Coho Salmon Decline (ESU Scale)

The factors that caused declines in the SONCC ESU of coho salmon include hatchery practices, climate change, ocean conditions, habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, over-fishing, mining; and severe flood events exacerbated by land use practices (Good et al. 2005, NMFS 2014). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly chronic problems that can reduce the productivity of salmonid populations. Non-native Sacramento pikeminnow (*Ptychocheilus grandis*) have been observed in the Eel River basin and could be acting as predators on juvenile steelhead as thermal conditions lead to niche overlap of the two species (Good et al. 2005). Late 1980s and early 1990s droughts and unfavorable ocean conditions were identified as further likely causes of decreased abundance of SONCC coho salmon (Good et al. 2005). Reduced flows can cause increases in water temperature, resulting in increased heat stress to fish and thermal barriers to migration. The current drought period (since water year 2012), in California, (State of California [http://gov.ca.gov/news.php?id=18379] 2014; NMFS and CDFW 2014), has the potential to desiccate rearing and holding areas, creating migration barriers that could eliminate year-classes or entire populations as it continues into water year 2015—*see* http://www.water.ca.gov/waterconditions/ and http://ca.gov/drought/.

MacFarlane et al. (2008) compared data on adult returns of returning coho salmon in California for return season 2004/05, compared to subsequent adult returns of their progeny in return year 2007/08. The data indicated a 73 percent decline in returning adults in 2007/08 (offspring from 2004/2005 adults), compared to adult returns in 2004/2005. MacFarlane et al. (2008) speculated

that because the spatial extent of the decline observed between coho parent and subsequent returning adult offspring, was wide-ranging throughout California and Oregon, ocean conditions were the main causative mechanism for decline. MacFarlane et al. (2008) further supported their hypothesis with observations of low adult Chinook returns to California that as juveniles, experienced sub-optimal ocean conditions during the same time as did coho juveniles.

NMFS (2014b) describes climate change impacts as detrimental to SONCC coho salmon including altered runoff patterns causing a precipitation shift from snow to rain, earlier snowmelt, lower summer flows, and more intense storms that will increase peak flows as well as ocean acidification is expected to reduce ocean productivity and sea level rise will alter estuarine habitat. Warmer winter air temperatures will decrease the snowpack in northern California and southern Oregon by up to 75% by 2040 and nearly 100% by 2080 (Doppelt et al. 2008) and result in earlier and higher high flows, and earlier and lower low flows.

Battin et al. (2007) predicted that Chinook salmon spawner capacity throughout the Pacific Northwest was proportional to minimum discharge during the spawning period; reduction trends in flow would result in reductions in spawning capacity due to habitat limitations. Widespread declines in springtime snow water equivalent have occurred in much of the North American West since the 1920s, especially since the mid-twentieth century (Knowles and Cayan 2004; Hamlet et al. 2005; Mote et al. 2005; Regonda et al. 2005; Mote 2006). These trends have resulted in earlier onsets of springtime snowmelt and stream flow across western North America (Regonda et al. 2005; Stewart et al. 2005), as well as lower flows in the summer (Stewart et al. 2005). Low flows are also important for juvenile Coho due to space and food limitations, while low flows may be associated with temperature limitations in other areas (Ebersole et al. 2009).

Past forestry practices have harvested canopy-creating trees from stream-side habitat affects cover from predation, water temperature, the watershed's ability to absorb precipitation, water flow timing, erosion, bank stability, retention of in-stream woody debris, recruitment of large woody debris, and habitat complexity. Removal of near-stream vegetation can result in increased water temperature, both short- and long-term (Moring et al. 1994, cited by CDFG 2004). The decrease in habitat complexity, loss of stream function, and loss of access to accessible off-channel habitat, and temperature refugia have contributed to reduced summer and rearing capacity for juvenile coho salmon (CDFG 2002).

Hatchery practices as a causative mechanisms of salmonid decline include hatchery straying and mixing with wild spawners where the resulting progeny exhibit lower survival then their wild stock counterparts (McGinnity et al. 2003; Kostow 2004), ultimately leading to a reduction in the reproductive success of the wild stock (Reisenbichler and McIntyre 1977; Fleming et al. 2000; Chilcote 2003; Araki et al. 2007). Flagg et al. (2000) found that, except in situations of low wild fish density, increasing releases of hatchery fish can negatively impact naturally produced fish through habitat displacement. Kostow et al. (2003) and Kostow and Zhou (2006) found that over the duration of the steelhead hatchery program on the Clackamas River, Oregon, the number of hatchery steelhead in the upper basin regularly caused the total number of steelhead to exceed carrying capacity, triggering density-dependent mechanisms that impacted the natural population. Competition between hatchery and wild salmonids in the ocean can also lead to

density-dependent mechanisms that effect wild salmonid populations (Beamish et al. 1997; Levin et al. 2001; Sweeting et al. 2003), especially during periods of poor ocean productivity (Beamish et al. 1997; Levin et al. 2001; Sweeting et al. 2003).

2.2.4 SONCC ESU of Coho Salmon Critical Habitat

Critical habitat for the SONCC ESU of coho salmon encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between Cape Blanco, Oregon and Punta Gorda, California (64 FR 24049, May 5, 1999). Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding natural impassible barriers (i.e., natural waterfalls in existence for at least several hundred years); and (3) tribal lands. Critical habitat consists of the water, substrate, and river reaches (including off-channel habitats) in specified areas. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of coho salmon. These river habitats are important for a variety of reasons, such as supporting the feeding and growth of juveniles and serving as spawning habitat for adults. Limiting factors identified for this species include loss of channel complexity, connectivity and sinuosity; loss of floodplain and estuarine habitats; loss of riparian habitats and large in-river wood; reduced stream flow; poor water quality, temperature and excessive sedimentation; and unscreened diversions and fish passage structures.

Designated critical habitat for SONCC coho salmon overlaps the action area. In designating critical habitat for SONCC coho salmon, NMFS focused on the known physical and biological features within the designated area that are essential to the conservation of the species. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. Within the essential habitat types (spawning, rearing, migration corridors), essential features of coho salmon critical habitat include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (64 FR 24049, May 5, 1999). The current condition of critical habitat for SONCC coho salmon is discussed below.

2.2.5 Conservation Value of Critical Habitat

The essential habitat types of designated critical habitat for SONCC coho salmon are those accessible freshwater habitat areas that support spawning, incubation and rearing, migratory corridors free of obstruction or excessive predation, and estuarine areas with good water quality and that are free of excessive predation. Timber harvest and associated activities, road construction, urbanization and increased impervious surfaces, migration barriers, water diversions, and large dams throughout a large portion of the freshwater range of the ESU continue to result in habitat degradation, reduction of spawning and rearing habitats, and reduction of stream flows. The result of these continuing land management practices in many locations has limited reproductive success, reduced rearing habitat quality and quantity, and caused migration barriers to both juveniles and adults. These factors limit the conservation value (i.e., limiting the numbers of salmonids that can be supported), of designated critical habitat within freshwater habitats at the ESU scale.

In contrast, watershed restoration activities have improved freshwater critical habitat conditions throughout the range, especially on Federal Lands and within the Seiad Creek watershed. Additionally, the five northern California counties affected by the Federal listing of coho salmon (which includes Siskiyou County) have created a Five Counties Salmonid Conservation Program (5 C Program http://www.5counties.org/) that will establish consistency among the counties for managing anadromous fish stocks. In the last 10 years, the Mid Klamath Watershed Council has worked to restore off channel habitat for salmonids in Seiad Creek. Currently, five ponds have been constructed and are used extensively by juvenile coho salmon. Although watershed restoration activities have improved freshwater critical habitat conditions in some areas, reduced habitat complexity, poor water quality, and reduced habitat availability continues to persist in many locations due to continuing and past land management practices.

2.2.6 Current Condition of the Critical Habitat

The condition of SONCC coho salmon critical habitat, specifically its ability to provide for their conservation, is degraded from conditions known to support viable salmon populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agricultural and mining activities, urbanization, stream channelization, dams, freshwater and estuarine wetland loss, and water withdrawals for irrigation. All of these factors were identified when SONCC coho salmon were listed as threatened under the ESA, and all factors continue to negatively affect this ESU. However, efforts to improve SONCC coho salmon critical habitat have been widespread and are expected to benefit the ESU. Within the SONCC coho salmon recovery domain, from 2000 to 2006, the following improvements were completed: 242 stream miles of habitat have been improved, 31 stream miles of instream habitat were stabilized, 41 cubic feet per second of water has been returned for instream flow, and thousands of acres of upland, riparian, and wetland habitat have been the subject habitat improvement (NMFS 2007). Therefore, the condition of SONCC coho salmon critical habitat is likely improved or trending toward improvement compared to when it was designated in 1999.

Although watershed restoration activities have improved freshwater and estuarine critical habitat conditions in isolated areas such as Seiad Creek, human induced legacy conditions continue to reduce habitat complexity, harbor poor water quality, and reduce habitat availability. Historical and ongoing land management practices persist in many locations, and limit the conservation value of designated critical habitat within these freshwater and estuarine habitats at the ESU scale.

2.3 Environmental Baseline

The “environmental baseline” includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

2.3.1 Status of Listed Species in the Action Area

Within the Interior Klamath River diversity stratum of the SONCC coho salmon, five populations of coho salmon are identified: Upper Klamath River, Middle Klamath River, Shasta River, Scott River, and Salmon River populations (NMFS 2014). Of the five populations within the Interior Klamath Population Stratum, two are at moderate risk of extinction and of those, one is a core population (Scott River), while the remaining are at high risk of extinction. The two populations of coho salmon rearing within the Project action area (Middle Klamath River (MKR) and Upper Klamath River (UKR)) and their contributing recovery role to the Interior Klamath Population Stratum are non-core 1 (potentially independent population) and core (functionally independent population) respectively (NMFS 2014). NMFS (2014) indicated that the MKR population was at moderate risk of extinction and the UKR population was at high risk of extinction at the time the SONCC coho salmon recovery plan was submitted. Williams et al. (2006) characterized the Upper Klamath River, Shasta River and Scott River populations as "Functionally Independent," defined as those populations sufficiently large to be historically viable-in-isolation and whose demographics and extinction risk were minimally influenced by immigrants from adjacent populations. The Middle Klamath River and Salmon River populations were classified as "Potentially Independent," defined as those populations that were potentially viable-in-isolation, but that were demographically influenced by immigrants from adjacent populations (Williams et al. 2006). The action area of this Project is encompassed by two separate coho salmon populations with in the SONCC ESU; UKR and MKR populations. Beaver and Seiad creeks are located within the UKR population bounds, while Thompson Creek is located within the MKR population bounds. In the Upper Klamath River, the key stresses are defined as barriers and altered hydrologic function while in the Middle Klamath River, the key stresses are lack of floodplain and channel structure and impaired water quality. The UKR population is a Core population with high risk of extinction, while the MKR population is a Non-Core 1 population with moderate risk of extinction (NMFS 2014).

Juvenile coho salmon rearing has been documented at each of the three streams in the action area and all have significant amounts of high Intrinsic Potential (IP) habitat (NMFS 2014). Each of the three streams provide spawning habitat for adults and essential cold water refugia for over-summering juvenile coho salmon during the summer months when the mainstem water temperatures in the Klamath River, can potentially rise to lethal levels because of water diversion, hydropower production, agricultural practices, and drought.

There are no current estimates of abundance for the three streams in the action area; however average spawning adult estimates in the Upper Klamath River range from 100 to 4,000 adults, while the Middle Klamath River is thought to range from 1,000 to 1,500 adults during strong year classes and 0-500 during weak year classes (Ackerman et al. 2006).

2.3.2 Salmonid Habitat in the Action Area

The present temperature regime in the Middle and Upper Klamath River Basin is often near the warm limits for salmonid adults July through September and near the warm limits for rearing May through October (Dunne et al. 2011), elevating the importance of tributaries. Each of the three tributaries present in the action area, Beaver, Seiad, and Thompson creeks have been

documented as providing thermally-suitable summer, natal and non-natal, rearing habitats for juvenile coho salmon—thermal refugia from high water temperatures in the Klamath River Basin. A significant proportion of juvenile coho salmon in the Klamath basin display complex movement patterns to seek out suitable habitat. Juveniles migrate as fry out of the systems like the Scott and Shasta rivers where water temperatures climb during the summer months (Adams 2013, cited by NMFS 2014) and seek out cold water streams such as those in the action area to rear in the summer months. Another movement event occurs in the fall as mainstem flows rise and juveniles seek slow off-channel habitat to rear during the winter months (Witmore 2014). Low gradient tributaries that are connected to the floodplain such as those in the action area can provide overwinter habitat. Additionally, these streams provide spawning habitat for adult coho salmon (Corum 2010).

The *Beaver Creek* watershed encompasses about 70,000 acres on the north side of the Klamath River with most of the watershed in California and about one third lying in Oregon. Nearly 70 percent of the watershed is on Klamath National Forest land while the remaining landowners include two timber companies, a very small area (300 acres) managed by the Bureau of Land Management, and private residences near the mouth (USFS 1996). Approximately 440 miles of road are located in the Beaver Creek watershed which contributes to increased levels of turbidity in Beaver Creek (USFS 1996; CDFG 2004). The stream reach present in the action area is relatively shallow, ranging between approximately 0.5 and 1.5 feet deep in the summer and 4–7 feet deep in the winter (Caltrans 2014a). The active channel has a width of 20 feet in the summer during the low flow season. Substrate in the stream reach of the Beaver Creek action area is dominated by large cobble and lacks riparian canopy, deep pools, woody debris, or boulders (Caltrans 2014a); characteristics needed by rearing juvenile coho salmon. Beaver Creek water temperatures measured during summer months ranged from 51 to 60°F and ranged from 41 to 42°F during the fall and spring. The reach does however function as a migratory corridor for both juvenile and adult coho salmon.

The lower *Seiad Creek* watershed includes 3,844 acres with about six miles of low gradient habitat from the mouth upstream. The low gradient reaches of Lower Seiad Creek historically were sinuous and connected to the floodplain, though the linkage has been disconnected due in part to flood control measures. Approximately 83 percent of the watershed is managed by the Klamath National Forest while the rest is private residential and ranching property, or industrial timberland. The lower mainstem of Seiad Creek provides salmonid habitat for SONCC coho salmon, Chinook salmon, winter steelhead trout, and resident rainbow trout, but currently does not support spring Chinook and summer steelhead (USFS 2014). None of the tributaries to mainstem Seiad Creek within the Lower Seiad Creek watershed are fish-bearing and most are intermittent streams. The Seiad Creek stream reach within the action area is shallow, ranging in depth between approximately 0.5 and 1.5 feet deep in the summer and 4–7 feet deep in the winter. The active channel width during the summer low flow period is approximately 25 feet but is split by an island creating a secondary channel. The substrate in the action area is mixed with gravel and cobble (Caltrans 2014a). Seiad Creek water temperatures measured during the summer months ranged from 54 to 60°F and ranged from 41 to 42°F during fall and spring. No overhanging riparian canopy exists in the reach due to flood control maintenance associated with the levee and completed by Caltrans; however some species have regenerated and will likely

provide shade and nutrients to the reach within several years. The stream reach is used for adult coho salmon spawning and migration as well as juvenile coho salmon rearing and migration.

Although all three streams in the action area likely provide over winter rearing habitat for juvenile coho salmon, Seiad Creek provides some of the highest quality rearing habitat in the Upper Klamath basin with five, off-channel ponds constructed to serve as coho salmon rearing habitat Witmore (2014). Additionally, lower Seiad Creek (downstream of SR 96 Bridge) has active beaver presence where seasonal dams are built and provide summer rearing habitat in the mainstem of Seiad Creek. Witmore (2014) studied a population of juvenile coho salmon rearing behind one of these dams immediately downstream of the SR 96 Bridge and within the proposed action area. Nearly 400 juvenile coho salmon were estimated to be rearing behind the beaver dam when it was present during the summer of 2012. During high winter flows, beaver dams typically wash out and may or may not be reconstructed in the same location. Of the tributaries surveyed by the Karuk Tribe, Seiad Creek consistently had the most number of redds and adult coho salmon observed each year from 2007 through 2012, (Corum 2013) of those creeks surveyed.

The *Thompson Creek* watershed encompasses approximately 8,400 acres (USFS 1999) with the majority of the watershed managed by the Klamath National Forest. A small section of private land is located at the mouth of Thompson Creek. The Thompson Creek stream reach in the action area is similar to Beaver Creek and Seiad Creek with shallow depths ranging between 0.5 and 1.5 feet deep in the summer and 5–8 feet deep in the winter. The active channel has a width of 25 feet during the summer low flow period (Caltrans 2014a). The substrate in the action area is dominated by large cobble and no riparian vegetation is present. Thompson Creek water temperatures measured during summer months ranged from 55 to 59°F and ranged from 41 to 42°F during fall and spring. The gradient of the reach is fairly steep with no pools, large wood or boulders to provide rearing habitat to juvenile coho salmon. The presence of juvenile coho salmon rearing in this reach is highly unlikely; however the reach does function as a migratory corridor for fish.

2.3.3 Factors Affecting Species Environment within the Action Area

Each of the three Klamath River tributaries included in the Action Area has a history of timber harvest and gold mining with dense road networks crisscrossing the watersheds. In the late 1800s, mercury and gold were extracted from cinnabar on Beaver Creek, leaving a road network and mining tunnels behind (California State Mining Bureau 1916). During the summer of 2014, a 32,000 acre wildfire (The Beaver Fire) burned the majority of the watershed (Inciweb 2014) and will likely lead to increased overland flow, erosion and turbidity in Beaver Creek, in particular, expected during the 2014/2015 winter season. A small U.S. Forest Service operated campground is currently located in the middle of the basin along the banks of Beaver Creek and likely contributes to degraded riparian conditions and possible toxins entering the stream.

Lower Seiad Creek, including the action area has an extensive history of mining with remnant mine tailings piles still present along the banks of the creek. Today, mine tailings and levees have channelized these reaches and interaction with the floodplain is minimal. Additionally, levees were constructed in Lower Seiad Creek in response to the 2006 flood. Furthermore, the

community of Seiad Valley is developed along the banks of Lower Seiad Creek and encroaches onto the floodplain and impacts riparian vegetation. Seiad Creek is unique in that it has a large alluvial floodplain encompassing three miles upstream of its mouth, though now constrained by flood control berms along lower Seiad Creek have disconnected floodplain habitat, decreasing suitable juvenile rearing habitat. Four diversions on the lower section are subject to damage by winter floods. Diversions in the summer months contribute to low flows and resulting high temperatures which force juveniles upstream or into the Klamath River. Historically, Seiad Creek would meander more than a mile upstream or downstream in relation to the Klamath River, creating complex slow water habitats preferred by coho salmon (Harling 2011). This unique landscape feature has made Seiad Creek a good candidate for restoration activities http://www.mkwc.org/index.php/programs/fisheries/channel-ponds/.

The lower reaches of Thompson Creek are developed with a lodge and cabins along the stream. Further upstream, The Nature Conservancy owns a 66-acre parcel with a conservation easement intended to prevent further subdivision of the watershed and protect the sensitive cold water environment for salmonids (Siskiyou Land Trust 2014). The U.S. Forest Service manages the majority of the watershed.

2.4 Effects of the Action

Under the ESA, "effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

SONCC coho salmon juveniles and their critical habitat will be exposed to construction activities related to the replacement of three bridges located at Beaver, Seiad, and Thompson creeks, as they rear in, or migrate through the action area during summer months, within the proposed construction period. Age classes of SONCC coho salmon exposed to construction activities and the stressors generated by those activities would likely be limited to juvenile coho salmon.

Project activities that may affect SONCC coho salmon and their designated critical habitat include: (1) fish exclusion and relocation, (2) water diversion and dewatering, (3) bridge construction activities, (4) riparian vegetation removal/reduction, (5) increased mobilization of sediment, (6) chemical contaminants, (7) water drafting, (8) augmentation of instream substrate. The following sections, 2.4.1–2.4.8, analyze the anticipated effects of these activities.

2.4.1 Fish Exclusion and Relocation

Fish relocation activities pose a risk of death or injury to any coho salmon juveniles present. Using any fish collection equipment has some associated risk to fish including stress, disease transmission, injury, or death (Hayes et al. 1996). Relocated fish may have to compete with other fish causing increased competition for available resources such as food and habitat (Keeley 2003). The growth rate of fish can be slowed when population density is high. The amount of unintentional injury and mortality attributable to fish capture varies widely depending on the

method used, the ambient conditions, the number of fish present, and the expertise and experience of the field crew.

Electrofishing can kill juvenile salmonids, and researchers have found serious sublethal effects including spinal injuries (Reynolds 1983; Habera et al. 1996; Habera et al. 1999; Nielsen 1998, Nordwall 1999). The long-term effects of electrofishing on salmonids are not well understood. Although chronic effects may occur, most effects from electrofishing occur at the time of capture and handling.

Because fish relocation activities will be conducted by qualified fisheries biologists following both CDFG and NMFS guidelines injury or mortality of juvenile coho salmon during capture should be minimal. Data from two years of similar salmonid relocation activities in Humboldt County indicate that the average mortality rate is below one percent (Collins 2004). This rate is further supported by a synthesis of seven years of project data in California on fish relocation mortality (NOAA Restoration Center 2012 [*Fish Relocation Activities section beginning on page 87 and the percent-injured and percent-killed from dewatering and relocation efforts in past projects summarized in table 5*]).

Adequate data to estimate the number of listed salmonids that will be relocated are not available. However, given the timing (June 1 through October 31) of the Project action, no adult salmonids will be present and only juvenile coho salmon are expected to be present in the action area. There is no pool habitat within the vicinity of Beaver Creek and Thompson Creek bridges, instead riffle habitat characterizes instream habitat both above and below the bridges. Juvenile coho salmon prefer pool habitat and stream reaches upstream and downstream of both bridges lack pool habitat, so we expect there is a lower abundance of coho salmon juveniles that will be subject to capture and relocation. Juvenile fish do use the bridge reaches for migration within the basin. Because there is a lack of preferable habitat in the action area and fish may only seasonally occupy the sites for migration, NMFS estimates up to five juvenile coho salmon at each of these sites are expected to be encountered and relocated based on spot observations made by Whitmore (2014). Because very few fish are expected to be relocated in Beaver and Thompson creeks, overcrowding is not expected to increase competition or result in increased densities of fish as a result of fish relocation.

In Seiad Creek, the project area is located in a low gradient reach where pools are present. Witmore (2014) estimated that 390 juvenile coho salmon were present during the summer of 2012 in a pool immediately downstream of the bridge. Several dozen juvenile coho salmon were observed by a NMFS employee directly under the bridge and in the reach proposed for dewatering during a site visit on August 15, 2014. Activities, with the onset of construction, will elicit a behavior response from some juveniles and they will leave the action area. There is also expected to be some reduction in the number of fish needed to be relocated during the second water diversion at Seiad Creek—one channel to the other—as construction activity will likely have caused fish to move from the area. Using information from previous studies and recent observations, a maximum of 75 juvenile coho salmon are expected in the action are may be relocated as a result of dewatering the reach in Seiad Creek. With the increased amount of off channel habitat that has recently been restored in Lower Seiad Creek, pool habitat is abundant and high densities of fish and competition are not expected.

Fish passage will be temporarily blocked when exclusion nets are in place (up to three days) during fish relocation activities. The effects on fish passage are expected to be minimal as they will be over small areas (203 to 239 lineal feet) and short time periods (up to three days). Though all three creeks are used by coho salmon as migratory corridors, the loss of three days of transit access is expected to have minimal effect to juvenile coho salmon migration, particularly at Seiad Creek as habitat restoration efforts in nearby stream areas include increases in available pool habitat where transiting fish can hold. Adult coho salmon are not expected to be present during the time construction activities take place. Therefore, incidences of decreased fish passage resulting from the Project are not expected to reduce the fitness of individual SONCC coho salmon.

In summary, loss of up to three days of fish passage, and increased competition as a result of increased population density, due to fish relocation, is not expected to result in a reduction in fitness of individual coho salmon in the action area. Therefore, of the total expected number of juvenile coho expected to be in the action areas of all three Project reaches, (75 from Seiad, five from Beaver and five from Thompson—85 juvenile coho), and considering a relocation mortality rate of less than one percent; approximately one fish would die due to relocation activities.

Since block nets will be installed during fish capture and relocation activities, excluding transit through each bridge reach, fish passage will be blocked. However, installation of block nets and will have minimal disruption to the stream bed and the addition of rocks to seal the bottom edge of the net to the streambed will be spread out after the nets are removed. Additionally, the temporary loss of transit access through the exclusion area, for up to three days, is of short duration and not expected to substantially reduce the function of critical habitat.

2.4.2 Water Diversion and Dewatering

The placement of block nets, stream diversions, and cofferdams is expected to result in the temporary loss, alteration, and reduction of critical habitat, and interrupted ability of juvenile fish to transit through the channel while block nets are in place along short segments of stream at Project bridge reach locations. In Seiad Creek, one of the two natural low-flow channels flowing under the bridge will remain free flowing at a time so that any fish transiting through the bridge reach at Seiad creek is not impeded. Each channel will be diverted and dewatered one at a time, to isolate the work area to access bridge piers and abutments during construction. Project sequencing for diverting and dewatering each channel to isolate the work area, will require the same minimization measures to avoid harming fish including block nets and relocation of fish prior to dewatering.

Despite fish exclusion and relocation efforts, and measures used to minimize harm to fish, individual juvenile coho salmon exposed to stream flow diversion activities may become injured or die (Cushman 1985) if fish are not captured during relocation efforts. Coho salmon that avoid capture and relocation efforts could be killed or injured from desiccation or crushing during clear water diversion, stream flow diversion, and construction activities.

Clear water diversion (cofferdam) will be required in Beaver Creek (two cofferdams) and Thompson Creek (one cofferdam) with the potential to kill, or injure fish during placement if fish

have avoided capture and relocation efforts. Seiad Creek will be subject to two stream flow diversions and fish avoiding capture and relocation may become stranded and die during each flow diversion event. Though low numbers of juvenile coho salmon are expected in the Beaver and Thompson Creek action areas, coho salmon avoiding relocation efforts may become crushed during cofferdam placement, or injured, or killed when cofferdams are dewatered. Three juvenile coho salmon are expected to be injured, or killed as a result of clear water diversion activities corresponding with placement and dewatering of each cofferdam; two at Beaver Creek and one at Thompson Creek. Since a larger area of the Seiad Creek (table 5) will be diverted (one channel to the other), death, or injury is likely higher at Seiad Creek for juvenile coho salmon than at Beaver or Thompson Creeks. Moreover, a higher abundance of juvenile coho salmon are expected in the Seiad Creek action area than the other two creeks because of past habitat restoration in the Seiad Creek area and subsequent use by juvenile coho salmon (Witmore 2014). Thus, up to ten juvenile coho salmon are expected to be injured, or killed as a consequence of stream flow diversion activities at Seiad Creek; five each as a result of each of two stream diversions involving both low flow channels in the bridge reach. Therefore, in total, up to thirteen juvenile coho salmon are expected to be killed as a direct result of clear water and stream flow diversion across all creek action areas.

Benthic (i.e., bottom dwelling) and infaunal (in the substrate) aquatic macroinvertebrates within the project site may die during the construction of coffer dams and the dewatering of the stream channel. However, effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because construction activities will be relatively short-lived (~4 months), and rapid recolonization (about one month) of disturbed areas by instream macroinvertebrates is expected to follow (Doeg et al. 1989; Cushman 1985; Thomas 1985; Harvey 1986). In addition, the effect of macroinvertebrate loss to juvenile salmonids is likely to be inconsequential due to the small instream footprint (table 5) of the clear water (Beaver Creek = 15%, Thompson Creek = 15%) and stream diversions (Seiad Creek = 50%) relative to the instream area of each creek. Though up to one half of an action area may be dewatered (i.e., Seiad Creek) at a time, coho salmon will likely relocate to reaches with suitable habitat and food resources as they respond to reductions in benthic macroinvertebrates. As juvenile coho salmon in the upper-Klamath basin are highly mobile, often traveling long distances within and between tributaries (Witmore 2014), the temporary reduction of aquatic macroinvertebrates as a result of dewatering activities is not expected to reduce the fitness of coho salmon expected to reoccupy the site after Project completion. However, diversion activities will result in a temporary loss, alteration, and reduction of aquatic habitat for up to four months while diversion structures are in place each year, and are therefore likely to reduce the function of coho salmon critical habitat during project implementation.

2.4.3 Bridge Construction Activities

Accommodating an extended in-water work window to June 1 through October 31, from a more common time window of June 15 through October 15, runs the risk that the project may experience the onset of the rainy season at the end of October, when adult coho salmon may be migrating upstream—though Klamath River SONCC coho salmon adults are not usually present in the action area during the proposed in-water work window, primarily migrating later in November (CDFG 2002). Additionally, juvenile coho salmon have typically left the action area

before June to begin migration to marine waters (Caltrans 2015b). Moreover, the highest concentration of juvenile coho salmon (fry) and the highest risk of exposure from construction activities is during the warmest periods of the dry season (Caltrans 2015b) as they seek and rear in cold water refugia—however the Beaver and Thompson Creeks action area is not rearing habitat and few juvenile coho salmon are expected in the area. Since project activities occur when the presence of juvenile coho salmon is expected at their lowest and adult coho salmon will not likely be present, extending the in-stream work window to June 1 through October 31 is not expected to be of consequence to juvenile or adult coho salmon. Additionally, the use of minimization measures described in the BA are expected to decrease the likelihood of harm to salmonids.

Beaver and Thompson Creek Bridges

Peak sound pressure levels for vibratory hammers can exceed 180 dB; however, the sound from these hammers rises relatively slowly without accumulating sound exposure levels harmful to fish (Caltrans 2009, updated 2012). Because vibratory sheet pile installation will occur within dewatered cofferdams and in some cases outside of the wetted channel, sound attenuation of the vibratory hammer operation will further act to reduce sound pressure levels. As such, the sound pressure level characteristics of vibratory hammers and the noise attenuation of cofferdams used to construct bridge spread footings is not expected to have adverse effects to individual fish.

Seiad Creek Bridge

Fish may be injured or killed when exposed to high underwater sound pressure levels (SPLs) generated from driving H-shaped piles with impact hammers (Hastings and Popper 2005, Theiss and Buehler 2006, and Buehler et al 2009). Pathologies associated with very high SPLs are collectively known as barotraumas. Common types of barotraumas include hemorrhage and rupture of internal organs such as the swim bladder and kidneys. Death can be instantaneous, occur within minutes after exposure, or occur several days later (Gisiner 1998). If the swim bladder bursts and the air escapes from the body cavity, the fish may sink to the bottom. If the swim bladder bursts but the air stays inside the body cavity, the fish is likely to stay afloat but is disoriented and have limited swimming ability (FHWG 2015). High SPLs can also damage fish's sensory hair and otoliths (Caltrans 2009, *updated* 2012) resulting in hearing loss.

Fish can also die when exposed to lower SPLs for a long time. Even though vibratory hammers are generally much quieter than impact hammers, the accumulated Sound Exposure Level (SEL) could be higher if the vibratory hammer takes considerably more time to install the H-shaped pile (Buehler, D., R. Rodkin et al 2009). According to the Hydroacoustics Guidance Manual (Caltrans 2009, *updated* 2012), a vibratory hammer produces generally 10 to 20 decibel (dB) lower SPLs than driving H-shaped pile with an impact hammer. However, vibratory hammers can produce SPLs that exceed 180 dB, but the sound rises relatively slowly. Buehler et al. (2007) noted that 1-second SELs up to about 155 to 160 dB at 10 meters can be generated from vibratory sheet piles, and within 10-minute it can generate up to 188 dB of accumulated SEL. If either accumulated SEL of 187 dB (183 dB for fish less than 2 grams) or a single strike peak SPL of 206 dB is received by a fish, physical injury may occur (FHWA 2008).

Fish's swimming behavior can change when exposed to SPLs. Fish may display a startle response to the first few strikes of a pile. However, the startle response of a fish is the reaction

similar to quickly swimming away to escape from a predator (Carlson et al. 1997). A fish that displays a startle response may not necessarily be injured, but it is displaying a behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. However, fish do not display a startle response every time they experience a strong hydroacoustic stimulus. From the recent pile driving studies along the west coast, biologists have observed that fish may startle and swim away from the stimulus at the start of pile driving, but that they observed the fish to recover, and in some cases turn around and pass by the area of impact multiple times. Thus, gradually ramping up the frequency of hammering during the initial phase of pile driving is not a suitable or reliable fish avoidance or minimization measure (FHWG 2015).

The underwater sound pressure waves that could potentially have an adverse effect on coho salmon come from the contact of the impact hammer with the top to the H-shaped pile. During pile-driving, the noise travels from the top and down the H-shaped pile in sequence of pulses as the pile is being driven into the channel bed. As the H-shaped pile expands and contracts, it transmits a sound pressure wave through the ground. These sound waves can also be transmitted through water. Levels of underwater sound pressure waves generated from impact driving of H-shaped piles vary with water depth. Thus, the sound created from the H-shaped pile to the receiver (fish) may vary. Noise thresholds from impact pile driving are defined as those causing adverse behavioral effects—150 dB root-mean-square (RMS) pressure and those at the onset of physical injury—187 dB for fish ≥ 2 grams and 183 dB for fish < 2 grams accumulative sound exposure level (SEL) and 206 dB single strike peak pressure. Analysis of acoustic impacts area distance using the pile driving calculations spreadsheet (NMFS 2012), indicate that the impact pile driving project proposal, as outlined in the Amended Biological Assessment (Caltrans 2015), is not expected to exceed the FHWG guidance thresholds (FHWG 2008—*see* http://www.dot.ca.gov/hq/env/bio/files/fhwgcriteria_agree.pdf) for onset of physical injury (peak and accumulated SEL). The impact pile driving peak pressure is anticipated to reach 172 dB and the cumulative SEL dB is reached at a distance of 3 and 6 meters respectively. No impact pile driving will be used for the construction of temporary falsework.

Direct Effects

During pile driving activities, the potential exists for underwater sound pressure waves to be generated in Seiad Creek which potentially could affect coho salmon in the action area. Based on the acoustical impact area calculated for the project, pile driving activities are likely to result in temporary behavioral changes since the sound pressure level is anticipated to exceed 150 dB RMS within 46 m. However, because pile driving will use an attenuation device (i.e., cofferdam) within a dry channel bed and piles will be driven approximately 15.24 m from water, injurious sound pressure levels, those exceeding 183 SEL_{acc} or 187 SEL_{acc} and reached at 3 and 6 meters respectively, are not expected to transmit into the water column. Moreover, pile driving will be restricted in Seiad Creek to the low-flow period of June 1 to October 31 when the juvenile coho salmon abundance is at its lowest in the action area, which is after most smolts have emigrated and before any adults have immigrated to the proposed project location. Since pile driving will only occur during the day, potential exposure to underwater sound pressure waves would also be minimized because transiting juveniles are expected to travel at night. Additionally, hydroacoustic monitoring during pile driving activities will confirm that noise levels stay within those that were expected, otherwise if higher than expected, the project can

respond with additional minimization measures such as stopping pile driving for the day. Based on the contents of the BA and amended BA outlining installation of foundation types, impact pile driving activities, or vibratory sheet pile activities are not expected to result in injury or mortality to salmonids, though some behavior effects are expected, though pile driving activities are of short duration and fish are expected to move from the area of noise transmission. Impact pile driving, as outlined in the amended BA, is not expected to produce underwater pressure wave generation at levels above thresholds that would diminish the function of critical habitat.

2.4.4 Riparian Vegetation Removal

Approximately half of an acre of riparian habitat will be temporarily and permanently disturbed (table 7) over the two years of the project. Large wood recruitment is expected to be delayed in locations where mature riparian habitat is removed and young replacement plants will not attain sufficient size to contribute wood to streams for many years. The area of riparian habitat temporarily disturbed, will be replanted using riparian species native to the action area. Some riparian trees are proposed for removal during construction. However, due to past bridge maintenance, current placement of RSP, flood control, and road safety, very few trees are adjacent to the stream, providing little to no shade or nutrients. Permanent removal of trees associated with the Project will primarily be removed from upland areas (table 8) to address road safety issues and visibility. Riparian vegetation and trees will also be removed where they are deemed to be counter-productive to local flood-control measures. At Beaver Creek, approximately 17 trees will be removed during construction at the bridge, all but one in upland areas. These trees are high on the bank and none of the trees proposed for removal overhang the stream channel and therefore, likely provide little nutrients. Only one tree at Beaver Creek provides shade to the stream (Caltrans 2014a). In Seiad Creek, approximately four trees are proposed for removal and all are less than 10 inches DBH. Due to their position high on the bank and small size, these trees provide little nutrients or shade to the stream. At Thompson Creek, approximately 29 trees are proposed for removal in upland areas along bridge roadway approaches, most due to road safety issues and motorist's visibility. Due to their distance from the stream, these trees provide little nutrients or food subsidies to the stream channel and only four provide shade (Caltrans 2014a, 2014b). The additional bridge foundation structures and retaining walls with placement of RSP at all bridge locations will permanently remove existing riparian vegetation and the potential for it to grow in those areas. At Beaver Creek, Seiad Creek, and Thompson Creek, the additional areas of bridge foundation and retaining wall structure and, RSP will permanently remove 816, 4,012 and 1,184 square feet of natural riparian function respectively (table 4).

The permanent removal of some riparian trees in the action area may degrade riparian vegetation function leading to increased solar radiation—one tree providing shade at Beaver and four at Thompson—to streams in the action area and less availability of food resources. A reduced riparian canopy can expose the water to more insolation and more heat gain (Beschta et al. 1987). Riparian vegetation is also an important source of nutrient inputs to streams such as leaf litter (Cummins et al. 1973) and terrestrial invertebrates that drop into the stream (i.e., allochthonous food subsidies). Leaf litter provides the trophic base for aquatic macroinvertebrate communities that in turn are part of the fundamental food source for salmonids (Hawkins et al. 1982; Beschta 1991; Bretscko and Moser 1993). In general, terrestrial

invertebrates can comprise more than 33 to 50 percent of juvenile salmon diets (Allan et al. 2003). Because there are very few trees proposed for removal in the riparian area that provide shade or food subsidies to the stream (up to 10 percent), the removal of vegetation associated with this project is not likely to increase stream temperature or reduce food subsidies.

The removal of one tree from Beaver Creek and four trees from Thompson Creek that provide some shade to the streams may temporarily increase solar radiation but not to an extent that will increase stream temperature. The implementation of Caltrans' Re-vegetation and Monitoring Plan (2014b) will likely improve the quality of riparian vegetation by removing non-native species, planting only native species, and increasing stem counts beyond pre-construction conditions. Effects of vegetation removal associated with the Project will be temporary until riparian vegetation can be established (approximately three years); except for the areas where additional bridge foundation structure and RSP (foundations and retaining walls) placement is planned (table 4). Because the existing condition of the riparian forest at these sites is poor and continued road, levee, and flood control maintenance are expected to occur, the habitat would likely have remained in a degraded condition. The majority of the trees removed are not in the riparian area and will be removed to conform to road safety issues and regrowth will not likely be allowed. The re-vegetation plan will improve riparian conditions in the long term by removing non-native plants and improving the complexity of the riparian vegetation within the action area. Additionally, the amount of riparian area permanently removed due to RSP added in each action area, is small (table 4) when the entire action area of each bridge is taken as a whole, or singly, and placed in a location with existing degraded riparian forest. The reducing effects to the rearing function of the critical habitat and individual SONCC coho salmon as a result of riparian vegetation removal will be temporary as plants regrow, colonize, and the area is revegetated with native species. The removal of trees from upland areas and along bridge approaches is expected to minimally reduce the rearing function of the critical habitat, as trees will not likely be allowed to recolonize along roadways. However, upland riparian areas at bridges will be replanted with trees and over time, NMFS expects riparian vegetation function to improve.

2.4.5 Increased Mobilization of Sediment

Short-term increases in sediment suspension and turbidity are anticipated during stream diversion activities, during removal of the temporary access roads, heavy equipment operation, from work pads, and from the transport of sediment in storm water runoff following the first significant rainfall. The delivery of sediment will be most pronounced where soil has been disturbed as a result of riparian vegetation removal and construction activities. In-stream and near-stream construction activities, especially those which use heavy equipment or disturb the soil, may cause temporary increases in turbidity through the mobilization of sediment and inputs to the stream (*reviewed in* Furniss et al. 1991; Reeves et al. 1991; and Spence et al. 1996). In high enough concentrations, sediment can affect salmonid feeding behavior and efficiency, resulting in reduced growth rates. High suspended sediment concentrations can reduce dissolved oxygen in the water column, affecting respiratory function. Also, in response to exposure to elevated suspended sediment concentrations, salmonids may disperse from established territories, which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival.

Much of the research described above focuses on high levels of turbidity. Proposed minimization measures in the Project are expected to limit the input of sediment into the stream, which reduce both the likelihood of sediment mobilization and transport to stream courses and results in only minor increases to existing levels of turbidity. Sediment will most likely be mobilized during the placement and removal of diversion structures and during the first rain events in the fall, transporting suspended sediment to the stream. The increase in sediment will be temporary as the sediment becomes diluted in the stream, carried downstream, and then no longer available for transport or equal to background levels of turbidity during the storm event.

The effects of the increased suspended sediment as a result of summer construction activities are expected to be minimal as the baseline levels of turbidity during the summer are extremely low and high concentrations of sediment would have to enter the stream to affect individual fish. Disturbed soil in areas of vegetation removal, riparian planting, and construction activities may erode and mobilize to the channel. However, erosion minimization measures are expected to keep minimal amount of the sediment that erodes from this disturbed soil from reaching the three Project bridge creeks. During the first winter flows that result in mobilization of sediment from disturbed riparian areas, the effects are expected to last no more than several hours and be completely dissipated within 300 feet or less downstream (Caltrans 2014a, 2014b). Beaver Creek may have additional suspended sediment as a result of the Beaver Fire that burned the watershed during the summer of 2014. However, the majority of erosion and associated suspended sediment as a result of the fire will have occurred during the winter of 2014. The construction work at this site will not be scheduled to begin until spring 2017, three seasons after the fire.

The effects of mobilized sediment are expected to be relatively minor due to the small volume of sediment released, the limited scope of the effects (sediment plume extending 300 feet downstream of each bridge), and the short duration of soil mobilization (the length of winter storms). We expect that the proposed minimization measures will effectively reduce the volume of sediment transported to the stream channel in the action area, and will not be more than baseline amounts. Impacts associated with degraded water quality as a result of increased turbidity will likely be limited to behavioral effects, such as temporarily vacating preferred habitat or temporarily reduced feeding efficiency. Therefore, any short-term increases in sediment or turbidity to critical habitat during, or post-implementation are not expected to reduce the rearing function of critical habitat for coho salmon, nor reduce the fitness of individual coho salmon.

2.4.6 Chemical Contamination

Equipment refueling, fluid leakage and equipment maintenance near the stream channel pose some risk of contamination to aquatic habitat. Polycylic aromatic hydrocarbons (PAHs) are a group of chemicals that occur in coal, crude oil, and gasoline. Waterways located near urban centers often receive inputs of these toxic contaminants from municipal and industrial activities (USEPA 1997; Brown et al. 1998), which may be taken up by juvenile salmon and their prey (Johnson et al. 2007; McIntyre et al. 2014) and result in reduced growth and reduced resistance to disease (Arkoosh et al. 1998).

State Route 96 is a rural highway where 700 vehicles on average travel daily, crossing each of the three streams. The remaining roads in the watersheds of the three streams are primarily U.S. Forest Service roads, are not paved, and receive a low volume of traffic. The remote location of the project area lends itself to high water quality with low baseline levels of PAHs and other toxic chemicals when compared to urban environments. Wider bridge(s) will not result in more traffic; therefore the traffic-related PAHs will remain similar to pre-project levels. Resurfacing bridge decks and bridge approaches may result in a slight increase in runoff and associated chemicals, but the "first wash" effect described by Johnson et al. (2007) is expected only at the close of construction activities each year after the onset of the first precipitation event and to a lesser degree thereafter (Hall and Anderson 1988). The potential effects of contaminant delivery from 4,103 square feet of additional impervious surface area of additional roadway runoff, from the three bridges (table 1), on the water quality of the rearing and migratory corridor functions of critical habitat, are likely not much above baseline levels. Loss of rearing and migratory corridor function of the critical habitat is not anticipated, nor is reduction in fitness of juvenile coho salmon residing in the action area.

Equipment refueling, fluid leakage and equipment maintenance near the stream channel pose risk of contamination of aquatic habitat and subsequent injury or death to listed salmonids. However, NMFS anticipates that proposed minimization measures and responses by Caltrans' contractor to any accidental spill of toxic materials should be sufficient to restrict the effects to the immediate area and not enter the waterway. Therefore, localized degradation of water quality from chemical contamination of Beaver, Seiad, or Thompson creeks, as a result of operation of construction equipment, is unlikely to reduce the rearing function of critical habitat for coho salmon, nor reduce the fitness of individual SONCC coho salmon.

2.4.7 Water Drafting

Water drafting may occur at Beaver, Seiad, and Thompson creeks to provide dust abatement at the construction site. If pumps are not screened properly, water drafting can result in the entrainment and death of juvenile salmonids (Moyle and White 2002). Also, water drafting reduces the volume of water in the stream and can reduce the area of pools which represent the primary rearing habitat for juvenile coho salmon in the action area. Juvenile coho salmon require sufficient space, depth of water, and quality of water to successfully rear (Bjornn and Reiser 1991). NMFS Water Drafting Specification (2001b) and the CDFG's Guidelines for Temporary Water Drafting from Streams and Rivers Supporting Anadromous Salmonids (2000) will be used to ensure proper screening and water withdrawal methods are used, therefore minimizing effects to juvenile coho salmon in the action area. No more than 10 percent of the flows will be removed from any stream and there will be less than 10 percent reduction in pool volume.

Because little pool habitat occurs within and downstream of the action area in Thompson and Beaver Creeks, juvenile coho salmon are expected only in low densities and a 10 percent reduction in pool volume will not result in limited space for rearing. At Seiad Creek, pool habitat is plentiful with large ponds immediately downstream of the action area. Water drafting will reduce the velocity of the water, which will affect the amount of prey in suspension delivered to the pools; however, the conditions brought on by water drafting are expected to be

temporary and are not expected to reduce the fitness of rearing juvenile coho salmon. Additionally, screening guidelines will prevent potential injury or death of coho salmon in water drafting activities.

Implementation of NMFS (2001b) and CDFG's (2000) water drafting guidelines are expected to minimize harm to both fish and to critical habitat. NMFS expects water drafting to result in a temporary reduction in the amount of juvenile summer rearing habitat because of the reduction in water quantity. The extent of this habitat reduction, and the resultant effects, are expected to be minor because Caltrans will follow water drafting guidelines, including drafting no more than ten percent of the flow while drafting. This drafting plan is expected to allow adequate remaining flow to support fish, aquatic insects, amphibians, and other biota (NMFS 2001b). Most effects of the water drafting will be felt when removing larger amounts of water at a time, however, episodic drafting for construction use will not likely be of sufficient duration to allow for thermal loading of the waterway from direct sunlight or high ambient temperatures, or for the any organisms in the dewatered area to become desiccated. The amount of water expected to be extracted will be insufficient to have a detectable effect on habitat and limited to ten percent of the flow at any time. Therefore, the impacts of water drafting on SONCC coho salmon critical habitat in Beaver, Seiad, and Thompson Creeks are expected to be minor because drafting episodes will be of short duration, sufficient flow will remain in the stream to support rearing habitat, and the remaining 90 percent of habitat will provide sufficient rearing habitat.

2.4.8 Augmentation of Instream Substrate

After construction is complete, the temporary access roads and temporary stream crossings will be removed. The layer of round, clean washed rock that contacts the stream bed may be left in the stream channel to further avoid disturbing the channel bed. Approximately 75, 205, and 40 cubic yards of imported, rounded river-run rock may be left at Beaver, Seiad, and Thompson creeks respectively. The addition of rock to the substrate can decrease depths, increase velocity, and decrease pool volume. Additionally, macroinvertebrate communities can be disrupted, requiring time for recolonization of the new substrate. Merz and Ochikubo Chan (2005) studied gravel augmentation sites that placed up to 1,570 cubic yards of gravel into stream channels and found that within four weeks, augmented sites had equal levels of macroinvertebrate biomass and species diversity as sites that were not augmented. Although, there may be a short term reduction in available benthic food sources (i.e., macroinvertebrates) at localized sites, overall prey abundance is not expected to limit feeding opportunities for juvenile coho salmon in the stream reaches, particularly because the effect of the short term reduction impacts a low numbers of individuals using the action area.

The rocks remaining in the stream from the temporary bridge abutments will be left in place, though to prevent barriers to passage or accelerated flows; the rocks may need to be spread out evenly across the stream. Because the action area is composed of riffle habitat, the rocks are not anticipated to fill pools, or reduce rearing capacity for juvenile coho salmon. Aquatic macroinvertebrates are expected to quickly redistribute and recolonize the newly rock augmented stream bed (*see* section 2.4.2). During winter flows, rock may re-distribute, however scouring mechanisms during those high flows are expected to maintain pool depth. Effects to critical habitat and to individual coho salmon from the addition of rounded, river-run rock to the action

area are expected to be of short duration as macroinvertebrates recolonize to pre-project levels within four weeks. Rearing juvenile salmon will likely redistribute themselves into the Project action areas as food sources return to baseline and therefore are not likely experience a reduce in fitness.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

NMFS did not identify any future state or private activities that would affect coho salmon or their designated critical habitat within the action area.

2.6 Integration and Synthesis

The *Integration and Synthesis* section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (section 2.4) to the environmental baseline (section 2.3) and the cumulative effects (section 2.5), taking into account the status of the species and critical habitat (section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species.

Rangewide status of SONCC coho salmon is listed as threatened. The proposed project action area overlaps portions of the MKR and UKR populations of SONCC coho salmon within the Interior Klamath population stratum. Expected mortalities of juvenile coho salmon, as a result of implementing this project, are not expected to affect the rangewide status of the ESU or minimize the recovery role potential for the ESU, nor individual populations.

The environmental baseline post-project is not expected to differ widely from pre-project conditions, particularly as the majority of effects to critical habitat are temporary. The combined effects of the action consist of:

- temporary loss of habitat behind cofferdams and stream diversion;
- temporary loss of benthic macroinvertebrates from clear water and stream diversion;
- temporary sound wave generation and noise from foundation pile driving;
- permanent loss of riparian and upland vegetation as a result of RSP placement for retaining walls and foundation structures;
- temporary increased solar radiation as a result of riparian vegetation and tree removal;
- temporary loss of nutrient and food resources as the result of decreased leaf litter from riparian and upland tree removal;
- temporary increased suspended sediment concentrations as a result of sediment inputs to

the stream;

- temporary degraded water quality as a result of chemical contamination;
- temporary reductions in flow from water drafting;
- augmentation of stream bed with imported river-run rock;
- permanent loss of riparian and instream habitat due to increases to foundations, retaining walls, roadway approaches; and
- permanent increase of shade from bridge widening

are not expected to substantially reduce the function of critical habitat or the survival and fitness of individual juvenile SONCC coho salmon. Permanent loss of riparian and instream habitat from construction of larger bridge elements and retaining walls is expected to adversely affect SONCC coho critical habitat. The loss of riparian vegetation and the reduction of riparian habitat as a result of this project are in most cases, temporary. In the case where the permanent loss of riparian and instream habitat occurs from bridge widening actions, those increases to bridge footprints will result in a corresponding loss of critical habitat function. The aggregate effects, of riparian loss, reduction in food, and reduction of rearing habitat adversely affects critical habitat, but is not likely to reduce the value of SONCC coho salmon designated critical habitat, and is not likely to destroy or adversely modify SONCC coho salmon critical habitat or proposed critical habitat for the conservation of individual SONCC coho salmon in their respective populations, or the ESU.

Two components of the Project, fish relocation and clear water diversion (cofferdams and stream diversion) have the potential to kill or injure coho salmon juveniles. Capture and handling of fish, and their subsequent relocation upstream or downstream of Project action areas, are expected to result in one juvenile coho salmon mortality (~one percent), from a total of 85 juvenile coho salmon encountered in the three stream reaches. Additionally, installation and subsequent dewatering of cofferdams, and dewatering stream channels is expected to result in thirteen juvenile coho salmon mortalities; one each from cofferdam installation at Beaver and Thompson Creeks (three total) and five from each of two channel diversions at Seiad Creek (ten total).

The relocation of up to 85 juvenile coho salmon in the action area, with an associated mortality of an assumed one juvenile—most likely from the UKR population of SONCC coho salmon (based on the abundance expected to be encountered at Seiad Creek), *combined* with mortalities associated with clear water (cofferdams) and stream flow diversion—one juvenile coho salmon from the MKR population and twelve juvenile coho salmon from the UKR population—for a total 14 juvenile coho salmon (13 juvenile coho salmon from the UKR population and one juvenile coho salmon from the MKR population), constitutes on average, expected *order(s) of magnitude* less than one percent of each population's juvenile coho salmon abundance. The reduction in the abundance of fourteen juvenile coho salmon from two SONCC coho salmon populations, distributed over two rearing seasons when fish are subject to Project activities, is not likely to reduce appreciably the likelihood of both the survival and recovery of a SONCC coho salmon in the wild by reducing its numbers, reproduction, or distribution.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SONCC coho salmon, and is not likely to destroy or adversely modify its designated critical habitat.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

2.8.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take of juvenile coho salmon would occur in the form of capture during fish relocation and death in the form of desiccation or crushing during water diversion activities as a result of this Project. Up to 85 juvenile coho salmon are expected to be captured and relocated from the project action area of the three bridge sites—specifically, prior to clear water or stream diversion. Of the 85 juvenile coho salmon captured and relocated, five are from Beaver Creek, 75 are from Seiad Creek (UKR population), and five are from Thompson Creek (MKR population). Because mortality resulting from capture and relocation efforts is estimated to be less than one percent, juvenile coho mortalities from relocation are not expected to exceed one individual. Additionally, no more than thirteen juvenile coho mortalities are expected to occur as the direct result of combined clear water diversion activities (cofferdams) in Beaver Creek and Thompson Creek, and stream diversion activities in Seiad Creek (two stream diversions). Therefore, no more than fourteen juvenile coho salmon are expected to be killed as a result of implementing the Project over two years.

2.8.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the amount or extent of incidental take (50 CFR 402.02). NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental taking of SONCC coho salmon:

To be exempt from the prohibitions of Section 9 of the ESA, Caltrans shall comply with all of the reasonable and prudent measures and Terms and Conditions listed below:

1. Increase the capture efficiency of electrofishing;
2. Prepare and submit an Underwater Noise Monitoring Plan prior to project start and implement accepted plan;
3. Prepare and submit daily, and post-project hydroacoustic monitoring data

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary and Caltrans must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). Caltrans or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action may lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:

   A. Prior to installation of block nets, the biologist shall attempt to herd fish away from the exclusion area. Upon electrofishing, the Biologist shall make no less than three passes to electroshock the construction zone. Construction within the exclusion zone shall not proceed until the biologist renders the area clear of listed salmonids to the maximum extent practicable.

   B. Captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream. To avoid predation, the biologist shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators.

   C. If any dead or injured SONCC coho salmon are found, the biologist shall contact NMFS Northern California Office, 1655 Heindon Road, Arcata, California 95521, 707-822-7201. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than NMFS Northern California Office without obtaining prior written approval from the Northern California Office. Any such transfer will be subject to such conditions as NMFS deems appropriate.

D. Prepare and provide a written report to NMFS by December 31 at the completion of each year's project activities. The report shall be submitted to NMFS California Coast Office, Northern California Office, 1655 Heindon Road, Arcata, California 95521. Prepare and submit a report to document fish capture and relocation activities. The report shall contain, at a minimum, the following information pertaining to fish relocation and mortality (if applicable):

1. description of the location from which fish were removed and the release site
2. photographs the area fished,
3. the date and time of the relocation effort
4. amount of time the fish spent out of the stream during the relocation effort
5. description of the equipment and methods used to collect, hold, and transport listed salmonids
6. a measure of the temperature and dissolved oxygen prior to electrofishing
7. electroshocker model and voltage employed
8. copy of the logbook
9. the number of fish relocated by species
10. the number and species of fish injured or killed
11. brief narrative of the circumstances surrounding any listed salmonid injuries or mortalities
12. description of any problems which arose during the relocation activities and a statement as to whether or not the activities had any unforeseen effects

The following term and condition implements Reasonable and Prudent Measure 2.

- Caltrans shall prepare and submit to NMFS an Underwater Noise Monitoring Plan using the FHWG (2013) template at least one week prior to the start of activities. The report shall be submitted to NMFS California Coast Office, Northern California Office, 1655 Heindon Road, Arcata, California 95521. The plan accepted plan will then be implemented.

The following term and condition implements Reasonable and Prudent Measure 3.

a) Submit preliminary results for the daily hydro acoustic monitoring activities to NMFS within 24 hours after monitoring concludes for the day to NMFS Northern California Office, 1655 Heindon Road, Arcata, California 95521, 707-822-7201. Contact NMFS at least one week prior to monitoring to coordinate report submittal.
b) Submit a final draft report including data collected and summarized from all monitoring locations to NMFS within 90 days of the completion of hydroacoustic monitoring. The results must be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile. NMFS may offer comments within 30 days. A final report must be prepared and submitted to NMFS (NMFS Northern California Office, 1655 Heindon Road, Arcata, California 95521) within 60 days following submitted draft report.
c) The report shall contain, at a minimum, the following information pertaining to underwater noise monitoring:

1. Size and type of piles.
2. A detailed description of the cofferdam *(noise attenuation structure)*.
3. The impact hammer energy rating used to drive the piles, make and model of the hammer.
4. A description of the sound monitoring equipment.
5. The distance between hydrophone*(s) or microphone(s)* and the pile.
6. The depth of the hydrophone*(s)* and depth of water at hydrophone locations.
7. The distance from the pile to the water's edge.
8. The depth of water in which the pile was driven.
9. The depth into the substrate that the pile was driven.
10. The physical characteristics of the bottom substrate into which the piles were driven.
11. The total number of strikes to drive each pile and for all piles driven during a 24-hour period.
12. The underwater wideband background sound pressure level reported as the 50% cumulative distribution function *(if applicable)*.
13. The results of the hydroacoustic monitoring as described under Signal Processing of the Underwater Noise Monitoring Plan.
14. The distance at which peak, cSEL, and RMS values exceed the respective threshold values.
15. A description of any observable fish behavior in the immediate area and, if possible, correlation to underwater sound levels occurring at that time.

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). The following are conservation measures recommended by NMFS:

1. To minimize the effects of temporary habitat degradation from dewatering, NMFS recommends that the time the stream channel remains dry is minimized to the maximum extent possible given operational constraints.
2. To minimize the effects of sedimentation Caltrans should include additional monitoring (visual inspections) of the construction site during the first rain event resulting in overland flow. If erosion is noted, Caltrans should take immediate measures to increase erosion control measures (e.g., placement of additional mulching, silt fences, straw wattles).
3. To minimize the effects of water drafting, *if used*, groundwater pumped out of the creek during clear water diversion activities should be stored in tanks and used before water is drafted from streams.
4. To minimize the effects of stormwater runoff contamination to the three creeks from bridge and road surfaces, and subsequently minimize harm to fish, NMFS recommends

that pollutants from highway stormwater runoff be minimized to below biological effects thresholds and proactively achieved using soil bifiltration/bioretention methods (McIntyre et al. 2014). Pollutant concentrations below the biological effects thresholds are as follows:

- Dissolved Cu: 2.0 micrograms per liter (µg/L), (Sandahl et al. 2007) over 60 background levels of 3.0 µg/L or less (Baldwin et al. 2003).
- Dissolved Zn: 5.6 µg/L over background zinc concentrations between 3.0 µg/L and 13 µg/L (Sprague 1968).

Guidance: maintaining pollutant concentrations below the biological thresholds can be accomplished by infiltrating or dispersing the majority of the treated stormwater such that the volume and frequency of discharges affects only a few feet of in-water habitat in the vicinity of the point of discharge. This must be demonstrated via dilution analysis utilizing flow and discharge assumptions that are conservative for listed fish (NMFS 2007b).

5. To minimize and prevent the spread of aquatic invasive species, NMFS recommends that any equipment (including boots/waders) shall be properly sanitized or cleaned, and construction equipment shall be cleaned prior to any channel work according to guidance provided by the State of California Aquatic Invasive Species Management Plan (CDFG 2008) prior to instream work.
6. To minimize harm to relocated fish, NMFS recommends that relocation efforts not take place if air temperatures are greater than 80°F and at all times air bubblers be used to increase oxygen levels in the buckets holding fish. However, as air temperatures during the summer months typically reach higher than 80°F; a time frame can be considered where fish cannot be in a bucket more than 10 minutes during relocation.
7. To minimize harm to fish from stream flow diversion, NMFS recommends that water flow be diverted slowing to allow fish that previously evaded capture and relocation efforts, to pool, or startle as flow recedes, where fish can then be captured and relocated.
8. To minimize potential harm to fish, contractors should have a supply of erosion control materials onsite to facilitate a quick response to unanticipated storm events, containment supplies in the event of fuel or hydraulic fluid spill emergencies, and containment supplies in the event of cement spill emergencies.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Siskiyou Three Bridges Rail Upgrade Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by Caltrans and the Pacific Coast Salmon Fishery Management Plan as revised through Amendment 18 (PFMC 2014), (79 FR 75449, December 18, 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Caltrans proposes to upgrade three bridges along State Route 96 which cross Beaver Creek, Seiad Creek, and Thompson Creek in Siskiyou County, California. These three tributaries to the mainstem Klamath River fall within designated EFH for both coho and Chinook salmon, specifically the SONCC coho salmon ESU, a well as the Upper Klamath-Trinity Rivers Chinook salmon ESU. A detailed description of the proposed action and affected habitat is provided in the associated biological opinion.

3.2 Adverse Effects on Essential Fish Habitat

Effects of the proposed action on coho salmon EFH are as follows:

1. Temporary habitat degradation and loss of benthic macroinvertebrate production from diverting portions of the wetted channel up to five months.
2. Placement of rounded, river-run rock for work pads and temporary crossings resulting in loss of benthic macroinvertebrate production.
3. Increased sedimentation resulting in loss of invertebrate production and degradation of spawning habitat. Increased turbidity due to increased suspension of sediments during construction and removal of temporary crossing and work pads.
4. Removal of riparian vegetation, both temporary and permanent.
5. Permanent increase of bridge piers, footings, abutments, retaining walls, and RSP.
6. Increase of chemical contamination from road run-off due to increase in bridge deck area.

The effects of the above actions on habitat are described in the associated biological opinion in sections 2.4.2 through 2.4.8, respectively and are expected to be the same for Chinook salmon.

After reviewing the effects of the Siskiyou Three-Bridges Rail Upgrade Project, NMFS has determined that the proposed action would adversely Pacific salmon EFH.

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, to approximately 2.2 acres (table 9) of designated EFH for Pacific coast salmon in the action area.

There are no additional recommendations beyond those listed in section 2.9 Conservation Recommendations above (i.e., 1 through 5).

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, Caltrans must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendation, including the scientific justification for any disagreements, with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

Caltrans must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. FISH AND WILDLIFE COORDINATION ACT

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16

USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.

The action agency must give these recommendations equal consideration with the other aspects of the proposed action so as to meet the purpose of the FWCA.

NMFS does not have any recommendations for FWCA considerations.

This concludes the FWCA portion of this consultation.

5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

5.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are Caltrans through FHWA. Individual copies of this opinion were provided to the FWHA and Caltrans. This opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

5.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

5.3 Objectivity

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They

adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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79 FR 75449. National Marine Fisheries Service. Final Rule. Fisheries Off West Coast States: West Coast Salmon Fisheries; Amendment 18 to the Salmon Fishery Management Plan. December 18, 2014.

From: Rebecca Bernard - NOAA Federal [mailto:rebecca.bernard@noaa.gov]
Sent: Friday, July 08, 2016 10:21 AM
To: Benoist, Andre H@DOT
Cc: Clarence Hostler - NOAA Federal; Jeffrey.Jahn@NOAA.GOV
Subject: Re: BO for Siskiyou 3 Bridges.

Hi Andre--
I'm looking over all of the language in the 12 numbered resolutions of "Clarification" and "Additional Clarification" and the only red flag I see might be number 6--where the change in language to "within the live stream" from "but outside the wetted channel" are direct opposites. However in this case as you have written describing use of clean, rounded river rock for "temporary stream diversion and to anchor block nets", I view your clarification as specific to need and supportive of activities that have already been described in the BA and subsequent BO, with refining detail to resolve conflicts between Caltrans' permits and the BO. Therefor, I concur with all 12 points of "Clarification" and "Additional Clarification" as outlined in your 7/7/2016 email "BO for Siskiyou 3 Bridges" and subsequent addition to project documents.

Would be informative to visit the bridges construction sites when the project is underway. Thanks for your attention to detail and examples where all text language matters.

Regards,
Rebecca Bernard

On Thu, Jul 7, 2016 at 3:48 PM, Benoist, Andre H@DOT <andre.benoist@dot.ca.gov> wrote:

> Hello Clarence and Rebecca,

Our Office Engineers (OE), have prepared the information below to point out conflicts between permits and the BO for the Siskiyou 3 Bridges Project.

In the numbered items below, OE has pointed out the conflict and provided a resolution to the conflict, which in all cases specifies compliance with the greater requirement.
If you agree with the resolutions below, please reply with your concurrence and this will become part of the project documents.

Thank you,

Andre' H. Benoist

Andre' H. Benoist, Associate Environmental Planner
North Region, Environmental Management
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***Clarifications within* the NMFS Biological Opinion for 02-4E6501, AND *Resolution of Conflicts with* CA Dept. of Fish and Wildlife Streambed Alteration Agreement and North Coast Regional Water Quality Control Board Certification for 02-4E6501:**

1. In section 1.3, Item 2 in the 3rd paragraph discussing construction activities states "Temporary access roads will be constructed *to the ordinary high water mark (OHWM)*."

In section 1.3.1.1, the 1st sentence of the 1st paragraph states "Temporary access roads *above OHWM* will be constructed...."

In section 1.3.1.1, the 3rd sentence of the 1st paragraph states "A grader will cut in an access road from the shoulder of the highway *to the edge of the creek*."

Clarification - Access roads are only constructed as described by grading, using fabric and angular rock, from edge of highway pavement to OHWM.

Additional Clarification - Section 1.3.1.1, the 3rd sentence of the 1st paragraph "A grader ***or other authorized equipment*** will cut an access road....

2. In section 1.3, Item 8 of the 3rd paragraph states "Sheet piles may be vibrated into the ground to be used as temporary shoring for foundation work."

Clarification - Revise Item 8: "Sheet piles may be vibrated into the ground to be used as temporary shoring for foundation work. Do not impact drive any type of piling within 50 feet of the live stream." ((Requirement of CDFW and NCRWQCB permits))

3. In section 1.3.1.1, the 1st sentence of the 1st paragraph states "...; overall widths of 12 feet and composed of *angular gravel* removed post-project..."

Clarification - Temporary access road material will be clean, washed angular crushed rock.

4. In section 1.3.1.1, the 1st paragraph states "*Geotextile fabric* will be placed on access road beds prior to placement of clean, washed, crushed rock;..."

In section 1.3.1.1, the 9th bullet of the 5th paragraph states "Angular crushed rock used for temporary roads will be kept separate from clean river rock using *landscape cloth* and will be disposed of....."

Clarification - Imported temporary access road materials will be kept separated from native materials by placing a *heavy nonwoven geotextile fabric such as subgrade enhancement fabric or Class 10 RSP fabric* on the prepared roadbed prior to placing clean, washed, angular crushed rock.

Additional Clarification - In the 1st paragraph of section 1.3.1.1 ..."; crushed rock will be spread across the access road with an excavator ***or other authorized equipment*.**"

5. In section 1.3.1.1, The 4th sentence of the 1st paragraph of this section states "...Grading depths up to 3 feet are expected in certain areas...". The 11th sentence of the 1st paragraph of this section states "Roots will be kept intact for regeneration and...".
Clarification - Perform only the minimum grading required for temporary access roads. Keep roots of existing vegetation intact wherever possible to allow regeneration.

6. In section 1.3.1.1, the 4th paragraph states "...where clean, rounded river-run rock will be placed to create a work pad in the stream channel, but outside of the wetted channel. The rock work pad will be used to set up *construction scaffolding*, and place heavy equipment...."
Clarification - Clean, rounded river-run rock may be placed *within the live stream* for temporary stream diversion and to anchor fish block nets, as described in the contract documents.
Additional Clarification - 'Construction scaffolding' includes falsework and any other system used to support or access the bridge from below, during construction activities.

7. In section 1.3.1.1, the 2nd sentence in the 4th bullet of the 5th paragraph states "*If needed, although not anticipated, cofferdams needing to be left in the channel will be designed in such a way that it will not obstruct flow and will be able to withstand high flow and volatile fluctuation.*"
In section 1.3, the 6th sentence of the 5th paragraph states in part "All in-water activities will occur between June 1 and October 31...."
In section 1.3.1.2, the 5th sentence of the 5th paragraph states "No diversion structures (e.g., k-rails or sheet metal) used for clear water or stream diversion will be placed prior to June 1; and all stream diversion structures will be removed by October 31."
Clarification - In section 1.3.1.1, the 2nd sentence in the 4th bullet of the 5th paragraph is r*emoved entirely. No materials or equipment may remain in the channel outside the allowed work window.* ((CDFW permit requirement))

8. In section 1.3.1.1, the 6th bullet of the 5th paragraph states " RSP, sheet piles, and other *erosion control materials* will be pre-washed to remove sediment and/or contaminants."
Clarification - Strike "erosion control". Pre-wash all materials used below OHWM.

9. In section 1.3.1.1, the 5th paragraph states "Caltrans proposes to maintain any and all fuel storage and refueling sites in an upland location *at least 50 feet from surface water*, that...."
In section 1.3.1.3, the 6th bullet of the last paragraph states "staging areas will occur within existing pullouts and roadway shoulders where all equipment and hazardous materials will be *at least 100 feet away from surface water features*."
Clarification - The minimum offset distance from surface waters is 100 feet, not 50 feet.
Additional Clarification - The terms "from surface waters" and "from surface water features" means *"from the edge of the live stream".*

10. In section 1.3.1.1, the 2nd sentence in the 6th paragraph states "Rounded river-run rock used for work pads and temporary bridge shoring below the OHWM, may remain in the stream channel."
Clarification- Revise the 2nd sentence in the 6th paragraph of section 1.3.1.1 to read: *"Imported rounded river-run rock used below OHWM outside the live stream must be removed and original contours restored."* ((CDFW and NCRWQCB permits require removal and contour restoration))

11. In section 1.3.1.4, the 2nd sentence of the 2nd paragraph states in part "This strategy will prevent disruption to roots and stumps left intact and flush to the ground,...."
Clarification - Cut minimal vegetation for access roads, leaving a 2-inch stump. ((NCRWQCB permit requirement))

12. In section 1.3.1.2, fish relocation and electrofishing will be performed by a California Department of Fish and Wildlife Fisheries Biologist. ((Internal agreement with CDFW))

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INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-Sis-96-R52.5/88.4

Identified by
Project ID 0212000012

PERMITS

PLAC - U.S.D.C., N.O.A.A., National Marine Fisheries Service, Southwest Region

Juvenile Fish Screen Criteria For Pump Intakes
Dated May 9, 1996

National Marine Fisheries Service
Southwest Region

JUVENILE FISH SCREEN CRITERIA FOR PUMP INTAKES

Developed by
National Marine Fisheries Service
Environmental & Technical Services Division
Portland, Oregon
May 9, 1996

ADDENDUM
JUVENILE FISH SCREEN CRITERIA FOR PUMP INTAKES

Developed by
National Marine Fisheries Service
Environmental & Technical Services Division
Portland, Oregon
May 9, 1996

The following criteria serve as an addendum to current National Marine Fisheries Service gravity intake juvenile fish screen criteria. These criteria apply to new pump intake screens and existing inadequate pump intake screens, as determined by fisheries agencies with project jurisdiction.

Definitions used in pump intake screen criteria

Pump intake screens are defined as screening devices attached directly to a pressurized diversion intake pipe.

Effective screen area is calculated by subtracting screen area occluded by structural members from the total screen area.

Screen mesh opening is the narrowest opening in screen mesh.

Approach velocity is the calculated velocity component perpendicular to the screen face.

Sweeping velocity is the flow velocity component parallel to the screen face with the pump turned off.

Active pump intake screens are equipped with a cleaning system with proven cleaning capability, and are cleaned as frequently as necessary to keep the screens clean.

Passive pump intake screens have no cleaning system and should only be used when the debris load is expected to be low, and

1) if a small screen (less than 1 CFS pump) is over-sized to eliminate debris impingement, and
2) where sufficient sweeping velocity exists to eliminate debris build-up on the screen surface, and
3) if the maximum diverted flow is less than .01% of the total minimum streamflow, or
4) the intake is deep in a reservoir, away from the shoreline.

Pump Intake Screen Flow Criteria

The **minimum effective screen area** in square feet for an **active** pump intake screen is calculated by dividing the maximum flow rate in cubic feet per second (CFS) by an approach velocity of **0.4 feet per second (FPS)**. The **minimum effective screen area** in square feet for a **passive** pump intake screen is calculated by dividing the maximum flow rate in CFS by an approach velocity of **0.2 FPS.** Certain site conditions may allow for a waiver of the 0.2 FPS approach velocity criteria and allow a passive screen to be installed using 0.4 FPS as design criteria. These cases will be considered on a site-by-site basis by the fisheries agencies.

If fry-sized salmonids (i.e. less than 60 millimeter fork length) are not ever present at the site and larger juvenile salmonids are present (as determined by agency biologists), approach velocity shall not exceed 0.8 FPS for active pump intake screens, or 0.4 FPS for passive pump intake screens. The allowable flow should be distributed to achieve uniform approach velocity (plus or minus 10%) over the entire screen area. Additional screen area or flow baffling may be required to account for designs with non-uniform approach velocity.

Pump Intake Screen Mesh Material

Screen mesh openings shall not exceed **3/32 inch** (2.38 mm) for woven wire or perforated plate screens, or 0.0689 inch (**1.75 mm**) for profile wire screens, with a minimum **27% open area**. If fry-sized salmonids are never present at the site (by determination of agency biologists) screen mesh openings shall not exceed **1/4 inch** (6.35 mm) for woven wire, perforated plate screens, or profile wire screens, with a minimum of **40% open area.**

Screen mesh material and support structure shall work in tandem to be sufficiently durable to withstand the rigors of the installation site. No gaps greater than 3/32 inch shall exist in any type screen mesh or at points of mesh attachment. Special mesh materials that inhibit aquatic growth may be required at some sites.

Pump Intake Screen Location

When possible, pump intake screens shall be placed in locations with **sufficient sweeping velocity** to sweep away debris removed from the screen face. Pump intake screens **shall be submerged** to a depth of at least one screen radius below the minimum water surface, with a minimum of one screen radius clearance between screen surfaces and adjacent natural or constructed features. A **clear escape route** should exist for fish that approach the intake volitionally or otherwise. For example, if a pump intake is located off of the river (such as in an intake lagoon), a conventional open channel screen should be considered, placed in the channel or at the edge of the river. Intakes in reservoirs should be as deep as practical, to reduce the numbers of juvenile salmonids that approach the intake. Adverse alterations to riverine habitat shall be minimized.

Pump Intake Screen Protection

Pump intake screens **shall be protected** from heavy debris, icing and other conditions that may compromise screen integrity. Protection can be provided by using log booms, trash racks or mechanisms for removing the intake from the river during adverse conditions. An **inspection and maintenance plan** for the pump intake screen is required, to ensure that the screen is operating as designed per these criteria.

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

PERMITS

PLAC - U.S.D.C, N.O.A.A., National Marine Fisheries Service, Southwest Region

Water Drafting Specifications
Dated August 2001

WATER DRAFTING SPECIFICATIONS

National Marine Fish Service
Southwest Region

August 2001

"Water-drafting" is a short-duration, small-pump operation that withdraws water from streams or impoundments to fill conventional tank trucks or trailers. Usually, this water is used to control road dust, or for wildfire management.[1] Short term water drafting is also used to temporarily de-water a construction site, or to temporarily divert water around a construction site.

The specifications below are given primarily for the protection of juvenile anadromous salmonids, in waters where they are known to exist; but they also may be applied to protect a host of other aquatic organisms as well. The issue of sufficient in-stream flow for life support of the aquatic ecosystem should be addressed by a local Fish & Game biologist. Temporal and cumulative effects should be considered on a watershed scale. While we give some guidelines in that area, the actual impact of water drafting on stream ecology should be assessed and monitored at the local level by qualified personnel.

The main focus of this guidance is the construction, operation, and maintenance of a fish screen module(s) that must be installed at the in-stream end of the drafting hose to protect small salmon and steelhead fry from being entrained in the hose, or impinged on the surface of the screen. The specifications are based on the critical "approach velocity" at the screen surface[2], and a recognition that many temporary screens will not be outfitted with automatic cleaning devices to remove debris buildup. Since it is difficult to measure water velocities in the field, only the construction, pumping capacities, and operations are specified. Variances from these specifications may be considered on a case-by-case basis.

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[1] In case of emergency wildfire, where human life is in danger, the operator may disregard the screening requirement if a suitable screen is not immediately accessible.

[2] Approach velocity is the horizontal velocity vector component, typically measured at a distance of 3 inches from the screen face.

Operating Guidelines

1. Operations are restricted to one hour after sunrise to one hour before sunset.[3]
2. Pumping rate shall not exceed 350 gallons per minute.
3. The pumping rate shall not exceed ten percent of the stream flow.[4]
4. Seek streams and pools where water is deep and flowing, as opposed to streams with low flow and small isolated pools.
5. Pumping shall be terminated when the tank is full. The effect of single pumping operations, or multiple pumping operations at the same location, shall not result in obvious draw-down of either upstream or downstream pools.
6. Each pumping operation shall use a fish screen. The screen face should be oriented parallel to flow for best screening performance. The screen shall be designed and used such that it can be submerged with at least one-screen-height-clearance above and below the screen.
7. Operators shall keep a log on the truck containing the following information: *Operator's Name, Date, Time, Pump Rate, Filling Time, Screen Cleaned (Y or N), Screen Condition, Comments.* These guidelines should be included as instructions in a logbook with serially numbered pages. This assures each truck operator easy access to this information.

Screen Construction Criteria

1. Surface Area

The total (unobstructed) surface area of the screen shall be at least 2.5 square feet, based on the upper limit of pumping of 350 gpm[5]. Larger surface areas are recommended where debris buildup is anticipated, and where stream depth is adequate to keep the screen submerged at approximately mid-depth.

2. Screen Mesh

Screen Mesh must be in good repair and present a sealed, positive barrier- effectively preventing entry of the "design fish" into the intake. The design fish in this case is a immature (20-30mm) salmon or steelhead fry.

The screen mesh size shall be: Round openings - maximum 3/32 inch diameter (.09 inch)
Square openings - maximum 3/32 inch diagonal (.09 inch)
Slotted openings - maximum 1/16 inch width (.07 inch)

3. Screen Design

Water drafting screens may be off-the-shelf products, but they are often custom-made devices

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[3] Restricting operations to daylight-only prevents the use of lights that will attract fish to the drafting pool

[4] Restricting drafting to ten percent of the stream flow provides adequate downstream flow to support fish, aquatic insects, amphibians, and other biota. Ten percent of flow may be estimated by pump operators.

[5] If larger pumping volumes are needed, or if the pumping application is continuous, refer to http://swr.nmfs.noaa.gov/habitat.htm and review addendum for small pump intakes.

appropriate to the scale and duration of pumping operation. To keep the screen supported and correctly positioned in the water column, adjustable support legs are advised. Screen geometry can be configured either as rectangular or cylindrical, i.e.- as a shallow “box-shape” or tubular.
The intake structure shall be designed to promote uniform velocity distribution at all external mesh surfaces. This can be accomplished with a simple internal baffle device that distributes the flow evenly across the entire surface of the screen. In order to accomplish this, the designer needs to understand the hydraulic characteristics of these devices. There is a tendency for most of the intake water to enter the screen near the hose end, so a typical internal baffle would consist of a pipe (or a manifolded set of pipes) which have variable porosity holes at predetermined spacing. We recommend starting near the hose end with approximately 5-10% average open area, and gradually increasing the porosity toward the length of the screen. At a point where screen length exceeds three times the diameter of the suction hose, the baffling effect tends to diminish rapidly. At this point the baffle porosity may approach 100%. A successful baffle system will functionally distribute flow to all areas of the screen. A poorly designed screen may result in high-velocity “hot spots,” which could lead to fish impingement on the screen face. Hydraulic testing of prototype screen designs is recommended where the application is on-going and extensive.

4. Screen Structure
The screen frame must be strong enough to withstand the hydraulic forces it will experience. However, structural frames, braces, and other elements that block the flow, change flow direction, or otherwise decrease the screen surface area should be minimized.

5. Screen Cleaning
The screen shall be cleaned as often as necessary to prevent approach velocity from exceeding 0.33 feet per second. Operators should withdraw the screen and clean it after each use, or as necessary to keep screen face free of debris. Pumping should stop for screen cleaning when approximately fifteen percent or more of the screen area is occluded by debris. A suitable brush shall be on board the truck for this cleaning operation.

If the operator notes (a) impingement of any juvenile fish on the screen face or (b) entrainment of any fish through the screen mesh, he/she should stop operations and notify the Department of Fish & Game and/or NMFS hydraulic engineering staff :

National Marine Fisheries Service
Engineering Section
777 Sonoma Avenue, Suite 325
Santa Rosa, CA. 95404
(707) 575-6050

_____
Rebecca Lent, Ph.D.
Regional Administrator

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

PERMITS

PLAC - United States Army Corps of Engineers, South Pacific Division

Nationwide Permit General and Regional Conditions
Non-Reporting Nationwide Permit No. 14
Dated February 2, 2016

U. S. Army Corps of Engineers

South Pacific Division

---- Non-Reporting NWP 14 ----

Nationwide Permit Pre-Construction Notification (PCN) Form

This form integrates requirements of the U. S. Army Corps of Engineers Nationwide Permit Program within the South Pacific Division (SPD), including General and Regional Conditions. You MUST fill out all boxes related to the work being done. Fillable boxes in this form expand if additional space is needed.

Box 1 Project Name Siskiyou 3 Bridges, Rail Upgrade Project			
Applicant Name Mike Feakes		**Applicant Title** Project Manager	
Applicant Company, Agency, etc. Caltrans		**Applicant's internal tracking number** (if any) EA: 02-4E650	
Mailing Address 1031 Butte Street MS 30; Redding, CA 96001			
Work Phone with area code 530-225-3180	Mobile Phone with area code	Home Phone with area code	Fax # with area code
E-mail Address Mike.Feakes@dot.ca.gov	Relationship of applicant to property: ☐ Owner ☐ Purchaser ☐ Lessee ☒ Other:		
Application is hereby made for verification that subject regulated activities associated with subject project qualify for authorization under a U.S. Army Corps of Engineers Nationwide Permit or Permits as described herein. I certify that I am familiar with the information contained in this application and, that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities. I hereby grant to the agency to which this application is made the right to enter the above-described location to inspect the proposed, in-progress, or completed work. I agree to start work only after all necessary permits have been received and to comply with all terms and conditions of the authorization.			
Signature of applicant		Date (m/d/yyyy)	

If anyone other than the person named as the Applicant will be in contact with the U. S. Army Corps of Engineers representing the Applicant regarding this project during the permit process, Box 2 MUST be filled out.

Box 2 Authorized Agent/Operator Name André Benoist		**Agent/Operator Title** Associate Environmental Planner	
Agent/Operator Company, Agency, etc. California Department of Transportation		E-mail Address Andre.benoist@dot.ca.gov	
Mailing Address 1031 Butte Street MS 30 Redding, CA 96001			
Work Phone with area code 530-225-3302	Mobile Phone with area code	Home Phone with area code	Fax # with area code
I hereby authorize the above named authorized agent to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application. I understand that I am bound by the actions of my agent and I understand that if a federal or state permit is issued, I, or my agent, must sign the permit.			
Signature of applicant		Date (m/d/yyyy) 2/1/2016	
I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true, complete, and accurate.			
Signature of authorized agent ANDRE' H. BENOIST, AICP		Date (m/d/yyyy) 2/2/16	

Revised March 21, 2012. For the most recent version of this form, visit your Corps District's Regulatory website.

Box 3 Name of property owners(s), if other than applicant: N/A		
Owner Title	**Owner Company, Agency etc.**	
Mailing Address		
Work Phone with area code	Mobile Phone with area code	Home Phone with area code

Box 4 Name of contractor(s) (if known): Unknown at this time.		
Contractor Title	**Contractor Company, Agency, etc.**	
Mailing Address		
Work Phone with area code	Mobile Phone with area code	Home Phone with area code

Box 5 Site Number 1 of 3. Project location(s), including street address, city, county, state, zip code where proposed activity will occur: State Route 96, in Siskiyou County, at postmile 88.26 (Beaver Creek Bridge). Approximately 123 miles northwest of Redding. (see Attachment 1, Project Location Map)	
Waterbody (ies) (if known, otherwise enter "an unnamed tributary to"): Beaver Creek Tributary to what known, downstream waterbody: Klamath River	
Latitude & Longitude (D/M/S, DD, or UTM with Zone): 41.870220, -122.817166	Section, Township, Range: Section 6, Township 46N, Range 08W
County Assessor Parcel Number (include county name): N/A	USGS Quadrangle map name: McKinley Mountain
Watershed (HUC and watershed name[1]): HUC: 18010206 Watershed: Upper Klamath River [1]http://water.usgs.gov/GIS/regions.html	Size of permit area or project boundary:
Directions to the project location and other location descriptions, if known: Take I-5 north to Siskiyou County. Take exit 786 from I-5 and proceed to Highway 96. Head west on Highway 96 for approximately 30 miles to Beaver Creek Bridge	
Access limitations or restrictions (if any): None	

Box 5 Site Number 2 of 3. Project location(s), including street address, city, county, state, zip code where proposed activity will occur: State Route 96, in Siskiyou County, at postmile 60.17 (Seiad Creek Bridge). Approximately 20 miles west of Beaver Creek Bridge.	
Waterbody (if known, otherwise enter "an unnamed tributary to"): Seiad Creek Tributary to what known, downstream waterbody: Klamath River	
Latitude & Longitude (D/M/S, DD, or UTM with Zone): 41.842496, -123.197284	Section, Township, Range: Section 11, Township 46N, Range 12W

Revised March 21, 2012. For the most recent version of this form, visit your Corps District's Regulatory website.

County Assessor parcel number (include county name): N/A	USGS Quadrangle map name: Seiad Valley
Watershed (HUC and watershed name[1]): HUC: 18010206 Watershed: Upper Klamath River [1]http://water.usgs.gov/GIS/regions.html	Size of permit area or project boundary:
Directions to the project location and other location descriptions, if known: From Beaver Creek continue west on Highway 96 for approximately 20 miles to Saied Creek Bridge	
Access limitations or restrictions (if any): None	

Box 5 Site Number 3 of 3. Project location(s), including street address, city, county, state, zip code where proposed activity will occur: State Route 96, in Siskiyou County, at postmile 52.48 (Thompson Creek Bridge). Approximately 8 miles west of Seiad Creek Bridge.	
Waterbody (if known, otherwise enter "an unnamed tributary to"): Thompson Creek Tributary to what known, downstream waterbody: Klamath River	
Latitude & Longitude (D/M/S, DD, or UTM with Zone): 41.863501, -123.310559	Section, Township, Range: Section 17, Township 17N, Range 08E
County Assessor parcel number (include county name): N/A	USGS Quadrangle map name: Slater Butte
Watershed (HUC and watershed name[1]): HUC: 18010209 Watershed: Upper Klamath River	Size of permit area or project boundary: Beaver Creek 0.67 ac., Seiad Creek 0.93 ac., Thompson Creek 0.58.
Directions to the project location and other location descriptions, if known: Continue west on Highway 96 for approximately 8 miles to Thompson Creek Bridge.	

Box 6 Project Purpose (Description of the reason or purpose of the project):

These bridges have been identified as having non-standard bridge rails and have been on the State's Bridge Rail Program list for rail replacement since the early 1990's.
The purpose of the proposed project is to bring the bridge rails up to current design standards.

Box 6 Nature of Activity (Description of the project, include all features):

The project would replace the bridge rails of three bridges on Highway 96 in Siskiyou County. The bridges are located at Beaver Creek (PM 88.26), Seiad Creek (PM 60.17) and Thompson Creek (PM 52.48).

In order to replace the bridge rails, the bridge deck will need to be widened. Bridge widening will require widening of the piers and foundations. After widening is complete, RSP will be added to protect the bridge support structures. The roadway on both ends of the bridge will be widened to conform to the new bridge width, and metal beam guard rail at the ends of the bridge will be replaced.

The use of this Non-Reporting NWP 14 is for the following activities:

- The discharge of temporary fill (clean, washed gravel) within the limits of OHWM at Thompson Creek Bridge. No permanent fill will take place within the limits of OHWM.
- The discharge of temporary fill (clean, washed gravel), and permanent fill (concrete and RSP) within the limits of OHWM at Seiad Creek Bridge and Beaver Creek Bridge.

Revised March 21, 2012. For the most recent version of this form, visit your Corps District's Regulatory website.

Following construction, temporary fills associated with construction access and work pads will be removed, and the area will be restored to pre-project contours and elevations. Permanent fills associated with concrete are limited to the pier and foundation widening for each Bridge. Permanent fills associated with RSP placement are the minimum needed to protect the bridge structure, and all of the RSP will be placed below existing grade.

Construction of the project will last approximately 14 months and span at least two construction seasons.

Box 6 Reason(s) for discharge into Waters of the United States (Description of why dredged and/or fill material needs to be placed in Waters of the United States):

- Temporary discharges will be needed for construction access roads and work pads.
- Permanent discharges include the widened bridge piers and RSP to protect the structures.

Box 6 Proposed discharge of dredge and/or fill material. Indicate total surface area in **acres** and **linear feet** (where appropriate) of the proposed impacts to Waters of the United States, indicate water body type (tidal wetland, non-tidal wetland, riparian wetland, ephemeral stream/river, intermittent stream/river, perennial stream/river, pond/lake, vegetated shallows, bay/harbor, lagoon, ocean, etc.), and identify the impact(s) as permanent and/or temporary for each requested Nationwide Permit[1]:

[1]Enter the intended permit number(s). See Nationwide Permit regulations for permit numbers and qualification information: http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/NationwidePermits.aspx

Water Body Type	**Requested NWP Number: 14**				**Requested NWP Number: 14**				**Requested NWP Number: 14**			
	Permanent		Temporary		Permanent		Temporary		Permanent		Temporary	
	Area	Length	Area	Length	Area	Length	Area	Length	Area	Length	Area	Length
Perennial Waters (Beaver Creek)	0.01 acre	68.5 feet	0.02 acre	135.5 feet								
Perennial Waters (Seiad Creek)					0.02 acre	134 feet	0.56 acre	243.5 feet				
Perennial Waters (Thompson Creek)									0.00 acre	0 feet	0.01 acre	74 feet
Total:	**0.01 acre**	**68.5 feet**	0.05 acre	135.5 feet	**0.02 acre**	**134 feet**	0.56 acre	243.5 feet	**0.00 acre**	**0 feet**	0.01 acre	74 feet

NOTE: All measurements provided are best estimates only.

Revised March 21, 2012. For the most recent version of this form, visit your Corps District's Regulatory website.

Total volume (in cubic yards) and type(s) of material proposed to be dredged from or discharged into Waters of the United States:

Beaver Creek Bridge

Material Type	Total Volume Dredged	Total Volume Discharged
Rock Slope Protection (RSP)	74 cubic yards of excavation[1]	74 cubic yards of fill
Clean spawning gravel	0 cubic yard of excavation	75 cubic yards of fill
River rock		
Soil/Dirt/Silt/Sand/Mud		
Concrete		
Structure	68 cubic yard of excavation[2]	28 cubic yards of fill
Stumps/Root wads		
Other:		
Total:	142 cubic yards of excavation	177 cubic yards of fill

Seiad Creek

Material Type	Total Volume Dredged	Total Volume Discharged
Rock Slope Protection (RSP)	153 cubic yards of excavation	153 cubic yards of fill
Clean spawning gravel	0 cubic yard of excavation	10 cubic yards of fill
River rock		
Soil/Dirt/Silt/Sand/Mud		
Concrete		
Structure	34 cubic yards of excavation	28 cubic yards of fill
Stumps/Root wads		
Other:		
Total:	187 cubic yards of excavation	191 cubic yards of fill

Thompson Creek Bridge

Material Type	Total Volume Dredged	Total Volume Discharged
Rock Slope Protection (RSP)	0 cubic yard of excavation	0 cubic yard of fill
Clean spawning gravel	0 cubic yard of excavation	32 cubic yard of fill
River rock		
Soil/Dirt/Silt/Sand/Mud		
Concrete		
Structure	0 cubic yard of excavation	0 cubic yard of fill
Stumps/Root wads		
Other:		
Total:	0 cubic yard of excavation	32 cubic yard of fill

[1]This volume is excavated not dredged. RSP will fill the excavated area.
[2]After the concrete has been placed, the excavated streambed material will be placed back into the excavated hole to fill it back up.
NOTE: All measurements provided are best estimates.

Activity requires a written waiver to exceed specified limits of the Nationwide Permit? ☐ YES ☒ NO
If yes, provide Nationwide Permit number and name, limit to be exceeded, and rationale for each requested waiver:

Activity will result in the loss of greater than ½-acre of Waters of the United States? ☐ YES ☒ NO

If yes, provide an electronic copy (compact disc) or multiple hard copies (7) of the complete PCN for appropriate Federal and State Pre-discharge Notification (See General Condition #31, Pre-construction Notification, Agency Coordination, Section 2 and 4):

Describe direct and indirect effects caused by the activity and how the activity has been designed (or modified) to have minimal adverse effects on the aquatic environment (See General Condition #31, Pre-construction Notification, District Engineer's Decision, Section 1):

- See Biological Assessment Chapter ~~6~~ 9 for direct and indirect effects.
- See Biological Assessment Chapter ~~6~~ 9 for a complete list of avoidance and minimization measures.

Attached

Potential cumulative impacts of proposed activity (if any): None

Required drawings and figures (see each U. S. Army Corps of Engineers District's Minimum Standards Guidance):

Vicinity map: ☒ Attached (or mail copy separately if applying electronically)

To-scale Plan view drawing(s): ☒ Attached (or mail copy separately if applying electronically)

To-scale elevation and/or Cross Section Drawings(s): ☒ Attached (or mail copy separately if applying electronically)

Numbered and dated pre-project color photographs: ☐ Attached (or mail copy separately if applying electronically)

Sketch drawing(s) or map(s): ☒ Attached (or mail copy separately if applying electronically)

Has a wetland/waters of the U.S. delineation been completed?

☐ Yes, Attached[2] (or mail copy separately if applying electronically) ☒ No

If a delineation has been completed, has it been verified in writing by the Corps?

☐ Yes, Date of approved jurisdictional determination (m/d/yyyy): Corps file number: ☐ No

[2]If available, provide ESRI shapefiles (NAD83) for delineated waters

For proposed discharges of dredged material resulting from navigation dredging into inland or near-shore waters of the U.S. (including beach nourishment), please attach[3] a proposed Sampling and Analysis Plan (SAP) prepared according to Inland Testing Manual (ITM) guidelines (including Tier I information, if available), or if disposed offshore, a proposed SAP prepared according to the Ocean Disposal Manual. ☐ Attached (or mail copy separately if applying electronically)

[3]Or mail copy separately if applying electronically

Is any portion of the work already complete? ☐ YES ☒ NO

If yes, describe the work:

Box 7 Authority

Is Section 10 of the Rivers and Harbors Act applicable?: ☐ YES ☒ NO

Is Section 404 of the Clean Water Act applicable?: ☒ YES ☐ NO

Is the project located in U. S. Army Corps of Engineers property or easement?: ☐ YES ☒ NO

If yes, has Section 408 process been initiated?: ☐ YES ☐ NO

Would the project affect a U. S. Army Corps of Engineers structure?: ☐ YES ☒ NO

If yes, has Section 408 process been initiated?: ☐ YES ☐ NO

Is the project located on other Federal Lands (USFS, BLM, etc.)?: ☒ YES[1] ☐ NO

Is the project located on Tribal Lands?: ☐ YES ☒ NO

[1]Only Beaver Creek Bridge occurs on USFS land.

Box 8 Is the discharge of fill or dredged material for which Section 10/404 authorization is sought part of a larger plan of development?: ☐ YES ☒ NO

If discharge of fill or dredged material is part of development, name and proposed schedule for that larger development (start-up, duration, and completion dates):

- Bridge rail upgrade, to take place summer of 2017 and end fall of 2019.

Location of larger development (if discharge of fill or dredged material is part of a plan of development, a map of suitable quality and detail of the entire project site should be included):

Box 9 Measures taken to avoid and minimize impacts to waters of the United States:

See Biological Assessment Chapter ~~6~~ 9 for a complete list of avoidance and minimization measures. Attached

Box 10 Proposed Compensatory Mitigation related to fill/excavation and dredge activities. Indicate in **acres** and **linear feet** (where appropriate) the total quantity of Waters of the United States proposed to be created, restored, enhanced and/or preserved for purposes of providing compensatory mitigation. Indicate water body type (tidal wetland, non-tidal wetland, riparian wetland, ephemeral stream/river, intermittent stream/river, perennial stream/river, pond/lake, vegetated shallows, bay/harbor, lagoon, ocean, etc.) or non-jurisdictional (uplands[1]). Indicate mitigation type (permittee-responsible on-site/off-site, mitigation bank, or in-lieu fee program). If the mitigation is purchase of credits from a mitigation bank, indicate the bank to be used, if known:

[1] For uplands, please indicate if designed as an upland buffer.

Site Number	Water Body Type	Created		Restored		Enhanced		Preserved		Mitigation Type
		Area	Length	Area	Length	Area	Length	Area	Length	
Total:										

If no mitigation is proposed, provide detailed explanation of why no mitigation would be necessary:

The area affected by permanent fill is 1,307 square feet (0.03 ac.). This area is too small to require mitigation.

If permittee-responsible mitigation is proposed, provide justification for not utilizing a Corps-approved mitigation bank or in-lieu fee program:

Has a draft/conceptual mitigation plan been prepared in accordance with the April 10, 2008 Final Mitigation Rule[2] and District Guidelines?

[2]http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/mitig_info.aspx

[3]**Sacramento and San Francisco Districts**-http://www.spk.usace.army.mil/organizations/cespk-co/regulatory/pdf/Mitigation_Monitoring_Guidelines.pdf

[4]**Los Angeles District**-http://www.spl.usace.army.mil/regulatory/mmg_2004.pdf

[5]**Albuquerque District**-http://www.spa.usace.army.mil/reg/mitigation/SPA%20Final%20Mitigation%20Guidelines_OLD.pdf

☒ Yes, Attached (or mail copy separately if applying electronically) ☐ No

If no, a mitigation plan must be prepared and submitted, if applicable.

Mitigation site(s) Latitude & Longitude (D/M/S, DD, or UTM with Zone):	USGS Quadrangle map name(s):
Assessor Parcel Number(s):	Section(s), Township(s), Range(s): Sec 12, T46N, R11W
Other location descriptions, if known:	
Directions to the mitigation location(s):	

Box 11 Threatened or Endangered Species

Please list any federally-listed (or proposed) threatened or endangered species or critical habitat (or proposed critical habitat) within the project area (include scientific names (e.g., Genus species), if known):

a. Coho, Southern Oregon/Northern California Coasts, ESU (*Oncorhynchus kisutch*) Federal Threatened, designated Critical Habitat

b.

c.

d.

Have surveys, using U.S. Fish and Wildlife Service/NOAA Fisheries protocols, been conducted?
☐ Yes, Report attached (or mail copy separately if applying electronically) ☒ No

If a federal-listed species would be impacted, please provide a description of the impact and a biological evaluation, if available
☒ Yes, Report attached (or mail copy separately if applying electronically) ☐ No

Has Section 7 consultation been initiated by another federal agency?
☐ Yes, Initiation letter attached (or mail copy separately if applying electronically) ☒ No

Has Section 10 consultation been initiated for the proposed project?
☐ Yes, Initiation letter attached (or mail copy separately if applying electronically) ☒ No

Has the USFWS/NOAA Fisheries issued a Biological Opinion?
☒ Yes, Attached (or mail copy separately if applying electronically) ☐ No
If yes, list date Opinion was issued (m/d/yyyy): March 16, 2015 and June 26, 2016

Box 12 Historic properties and cultural resources

Are any cultural resources of any type known to exist on-site? ☐ YES ☒ NO

Please list any historic properties listed (or eligible to be listed) on the National Register of Historic Places:

a.

b.

Has a cultural resource records search been conducted?
☒ Yes, Report attached (or mail copy separately if applying electronically) ☐ No

Has a cultural resource pedestrian survey been conducted for the site?
☒ Yes, Report attached (or mail copy separately if applying electronically) ☐ No

Has another federal agency been designated the lead federal agency for Section 106 consultation?
☐ Yes, Designation letter/email attached (or mail copy separately if applying electronically) ☒ No

Has Section 106 consultation been initiated by another federal agency?
☐ Yes, Initiation letter attached (or mail copy separately if applying electronically) ☒ No

Revised March 21, 2012. For the most recent version of this form, visit your Corps District's Regulatory website.

Has a Section 106 MOA or PA been signed by another federal agency and the SHPO?
☐ Yes, Attached (or mail copy separately if applying electronically) ☒ No
If yes, list date MOA or PA was signed (m/d/yyyy):

Box 13 Section 401 Water Quality Certification:
Applying for certification? ☒ Yes, Attached (or mail copy separately if applying electronically) ☐ No

- Pending

Certification issued? ☐ Yes, Attached (or mail copy separately if applying electronically) ☒ No
Certification waived? ☐ Yes, Attached (or mail copy separately if applying electronically) ☒ No
Certification denied? ☐ Yes, Attached (or mail copy separately if applying electronically) ☒ No

Exempted Activity? ☐ Yes ☒ No
Agency concurrence? ☐ Yes, Attached ☒ No

If exempt, state why:

Box 14 Coastal Zone Management Act
Is the project located within the Coastal Zone? ☐ Yes ☒ No

If yes, applying for a coastal commission-approved Coastal Development Permit?
☐ Yes, Attached (or mail copy separately if applying electronically) ☐ No

If no, applying for separate CZMA-consistency certification?
☐ Yes, Attached (or mail copy separately if applying electronically) ☒ No

Permit/Consistency issued? ☐ Yes, Attached (or mail copy separately if applying electronically) ☐ No

Exempt? ☒ Yes ☐ No
Agency concurrence? ☐ Yes, Attached ☐ No
If exempt, state why: Not in a coastal zone.

Box 15 List of other certification or approval/denials received from other federal, state, or local agencies for work described in this application:

Agency	Type Approval[4]	Identification Number	Date Applied	Dated Approved	Date Denied
CDFW	1602 LSAA		12/1/2015	Pending	
CDFW	Consistency Determination		12/1/2015	Pending	
NCRWQCB	401 Certification		12/1/2015	Pending	
NOAA's NMFS	BO	WCR-2014-1119	6/12/2014	3/16/2015	
NOAA's NMFS	BO (reinitiation of consultation)	WCR-2015-2682	4/1/2015	6/26/2015	

[4]Would include but is not restricted to zoning, building, and flood plain permits

Nationwide Permit General Conditions (GC) checklist:

(http://www.gpo.gov/fdsys/pkg/FR-2012-02-21/pdf/2012-3687.pdf)

Check	General Condition	Rationale for compliance with General Condition
☒	1. Navigation	The proposed project will not have an adverse effect on navigation.
☒	2. Aquatic Life Movements	The proposed project will not disrupt life cycle movements of aquatic species.
☒	3. Spawning Areas	There are no spawning areas within the project limits.
☒	4. Migratory Bird Breeding Areas	Waters within the project area do not provide habitat for breeding migratory birds.
☒	5. Shellfish Beds	There are no shellfish beds within the project limits.
☒	6. Suitable Material	No unsuitable material will be placed in waters of the U.S., and all fill material will be free from toxic pollutants.
☒	7. Water Supply Intakes	There is no public water supply intake in or near the project area.
☒	8. Adverse Effects from Impoundments	The project will not impound water.
☒	9. Management of Water Flows	The project will not alter open waters. The project has been designed to withstand expected high flows and will not impede the passage of normal or high flows.
☒	10. Fills Within 100-Year Floodplains	The activity will comply with applicable FEMA-approved state local floodplain management requirements.
☒	11. Equipment	The proposed project will not require use of heavy equipment in wetlands or mudflats.
☒	12. Soil Erosion and Sediment Controls	Caltrans Construction General Permit and the contractors SWPPP will ensure BMPs are in place at all times.
☒	13. Removal of Temporary Fills	Temporary fills will be removed and the area will be returned to pre-project conditions.
☒	14. Proper Maintenance	Any authorized fill will be properly maintained.
☒	15. Single and Complete Project	The activity is a single and complete project.
☒	16. Wild and Scenic Rivers	There are no National Wild or Scenic Rivers, nor any officially designated study rivers in the project limits.
☒	17. Tribal Rights	Tribal rights will not be impaired.
☒	18. Endangered Species	See Box 11 above
☒	19. Migratory Bird and Bald and Golden Eagle Permits	The project will not result in the Take of migratory birds, bald or golden eagles.
☒	20. Historic Properties	See Box 12 above
☒	21. Discovery of Previously Unknown Remains and Artifacts	The Corps will be notified if any remains or artifacts are discovered.
☒	22. Designated Critical Resource Waters	The project does not contain any designated Critical Resource Waters.
☒	23. Mitigation	See Box 10 above
☒	24. Safety of Impoundment Structures	The project does not include water impoundment structures.
☒	25. Water Quality	See Box 13 above
☒	26. Coastal Zone Management	See Box 14 above
☒	27. Regional and Case-by-Case Conditions	Caltrans will comply with Regional or Case-by-Case conditions added by the Corps.
☒	28. Use of Multiple Nationwide Permits	The proposed project will not require multiple NWPs.
☒	29. Transfer of Nationwide Permit Verifications	Caltrans will retain ownership of the property on which the project will be built.
☒	30. Compliance Certification	No mitigation is required
☒	31. Pre-Construction Notification	A PCN is not required. Caltrans has shared all documentation of its activity with the Corps.

Siskiyou 3 Bridges (02-4E650)
Strike out text does not apply to the project or the project location.

U S Army Corps of Engineers
Sacramento District

Nationwide Permit Summary

33 CFR Part 330; Issuance of Nationwide Permits – March 19, 2012

Non-Reporting

14. Linear Transportation Projects. Activities required for the construction, expansion, modification, or improvement of linear transportation projects (e.g., roads, highways, railways, trails, airport runways, and taxiways) in waters of the United States. For linear transportation projects in non-tidal waters, the discharge cannot cause the loss of greater than 1/2-acre of waters of the United States. ~~For linear transportation projects in tidal waters, the discharge cannot cause the loss of greater than 1/3-acre of waters of the United States.~~ Any stream channel modification, including bank stabilization, is limited to the minimum necessary to construct or protect the linear transportation project; such modifications must be in the immediate vicinity of the project.

This NWP also authorizes temporary structures, fills, and work necessary to construct the linear transportation project. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

This NWP cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if: (1) the loss of waters of the United States exceeds 1/10-acre; or (2) there is a discharge in a special aquatic site, including wetlands. (See general condition 31.) (Sections 10 and 404)

~~**Note**: Some discharges for the construction of farm roads or forest roads, or temporary roads for moving mining equipment, may qualify for an exemption under Section 404(f) of the Clean Water Act (see 33 CFR 323.4).~~

A. **Regional Conditions**

1. **Regional Conditions for California, excluding the Tahoe Basin**

http://www.spk.usace.army.mil/Portals/12/documents/regulatory/nwp/2012_nwps/2012-NWP-RC-CA.pdf

~~2. **Regional Conditions for Nevada, including the Tahoe Basin**~~

~~http://www.spk.usace.army.mil/Portals/12/documents/regulatory/nwp/2012_nwps/2012-NWP-RC-NV.pdf~~

~~3. **Regional Conditions for Utah**~~

~~http://www.spk.usace.army.mil/Portals/12/documents/regulatory/nwp/2012_nwps/2012-NWP-RC-UT.pdf~~

~~4. **Regional Conditions for Colorado.**~~

~~http://www.spk.usace.army.mil/Portals/12/documents/regulatory/nwp/2012_nwps//2012-NWP-RC-CO.pdf~~

B. **Nationwide Permit General Conditions**

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR §§ 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR § 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

☐ 1. **Navigation**.

☐ (a) No activity may cause more than a minimal adverse effect on navigation.

~~☐ (b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.~~

☐ (c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters,

the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

☐ 2. **Aquatic Life Movements.** No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species.

☐ 3. **Spawning Areas**. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

~~☐ 4. **Migratory Bird Breeding Areas.** Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.~~

~~☐ 5. **Shellfish Beds**. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.~~

☐ 6. **Suitable Material**. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

~~☐ 7. **Water Supply Intakes**. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.~~

~~☐ 8. **Adverse Effects From Impoundments**. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.~~

☐ 9. **Management of Water Flows**. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization and storm water management activities, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

☐ 10. **Fills Within 100-Year Floodplains**. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

~~☐ 11. **Equipment**. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.~~

☐ 12. **Soil Erosion and Sediment Controls**. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

☐ 13. **Removal of Temporary Fills**. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

☐ 14. **Proper Maintenance**. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

☐ 15. **Single and Complete Project**. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

~~☐ 16. **Wild and Scenic Rivers**. No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).~~

☐ 17. **Tribal Rights**. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

☐ 18. **Endangered Species**.

☐ (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless Section 7 consultation addressing the effects of the proposed activity has been completed.

☐ (b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. Federal permittees must provide the district engineer with the appropriate documentation to

demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address ESA compliance for the NWP activity, or whether additional ESA consultation is necessary.

☐ ~~(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed work or that utilize the designated critical habitat that might be affected by the proposed work. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the project, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification the proposed activities will have "no effect" on listed species or critical habitat, or until Section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.~~

☐ (d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific regional endangered species conditions to the NWPs.

☐ (e) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. FWS or the NMFS, The Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

☐ (f) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.noaa.gov/fisheries.html respectively.

☐ ~~19. **Migratory Birds and Bald and Golden Eagles**. The permittee is responsible for obtaining any "take" permits required under the U.S. Fish and Wildlife Service's regulations governing compliance with the Migratory Bird Treaty Act or the Bald and Golden Eagle Protection Act. The permittee should contact the appropriate local office of the U.S. Fish and Wildlife Service to determine if such "take" permits are required for a particular activity.~~

☐ 20. **Historic Properties**.

☐ (a) In cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

☐ (b) Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address section 106 compliance for the NWP activity, or whether additional section 106 consultation is necessary.

☐ ~~(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the authorized activity may have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties may be affected by the proposed work or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of Section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted and these efforts, the district engineer shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified~~

~~historic properties on which the activity may have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.~~

☐ ~~(d) The district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA Section 106 consultation is required. Section 106 consultation is not required when the Corps determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR §800.3(a)). If NHPA section 106 consultation is required and will occur, the district engineer will notify the non- Federal applicant that he or she cannot begin work until Section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.~~

☐ ~~(e) Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the~~ impacts to the permitted activity on historic properties.

☐ 21. **Discovery of Previously Unknown Remains and Artifacts**. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

☐ ~~**22. Designated Critical Resource Waters**. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.~~

☐ ~~(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.~~

☐ ~~(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with general condition 31, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.~~

☐ **23. Mitigation**. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that adverse effects on the aquatic environment are minimal:

☐ (a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

☐ (b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

☐ ~~(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal, and provides a project-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment. Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.~~

☐ ~~(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in minimal adverse effects on the aquatic environment.~~

☐ ~~(2) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, wetland restoration should be the first compensatory mitigation option considered.~~

☐ (3)If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) - (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

☐ (4)If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

☐ (5) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan.

☐ (d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation, such as stream rehabilitation, enhancement, or preservation, to ensure that the activity results in minimal adverse effects on the aquatic environment.

☐ (e) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any project resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that a project already meeting the established acreage limits also satisfies the minimal impact requirement associated with the NWPs.

☐ (f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the restoration or establishment, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, riparian areas may be the only compensatory mitigation required. Riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to establish a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or establishing a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

☐ (g) Permittees may propose the use of mitigation banks, in-lieu fee programs, or separate permittee-responsible mitigation. For activities resulting in the loss of marine or estuarine resources, permittee-responsible compensatory mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(h) Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level.

☐ **24. Safety of Impoundment Structures**. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

☐ **25. Water Quality**. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA Section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

☐ **26. Coastal Zone Management**. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

☐ **27. Regional and Case-By-Case Conditions**. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

☐ ~~**28. Use of Multiple Nationwide Permits**. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.~~

☐ ~~**29. Transfer of Nationwide Permit Verifications**. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:~~

> ~~"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."~~
>
> ~~_____~~
>
> ~~(Transferee)~~
>
> ~~_____~~
>
> (Date)

☐ **30. Compliance Certification**. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and any required compensatory mitigation. The success of any required permittee responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

> ☐ (a) A statement that the authorized work was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;
>
> ☐ (b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and
>
> ☐ (c) The signature of the permittee certifying the completion of the work and mitigation.

☐ ~~**31. Pre-Construction Notification**.~~

> ☐ ~~(a) **Timing**. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:~~
>
> > ☐ ~~(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or~~
> >
> > ☐ ~~(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or in the vicinity of the project, or to notify the Corps pursuant to general condition 20 that the activity may have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or Section 106 of the National Historic Preservation (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).~~
>
> ☐ ~~(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:~~
>
> > ☐ ~~(1) Name, address and telephone numbers of the prospective permittee;~~
> >
> > ☐ ~~(2) Location of the proposed project;~~

☐ ~~(3) A description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause, including the anticipated amount of loss of water of the United States expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. The description should be sufficiently detailed to allow the district engineer to determine that the adverse effects of the project will be minimal and to determine the need for compensatory mitigation. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the project and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);~~

☐ ~~(4) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many waters of the United States. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;~~

☐ ~~(5) If the proposed activity will result in the loss of greater than 1/10 acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse effects are minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee~~ may submit a conceptual or detailed mitigation plan.

☐ ~~(6) If any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, for non-Federal applicants the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act; and~~

☐ ~~(7) For an activity that may affect a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, for non-Federal applicants the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.~~

☐ ~~(c) Form of Pre-Construction Notification: he standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is a PCN and must include all of the information required in paragraphs (b)(1) through (7) of this general condition. A letter containing the required information may also be used.~~

☐ ~~(d) Agency Coordination:~~

☐ ~~(1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.~~

☐ ~~(2) For all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States, for NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of intermittent and ephemeral stream bed, and for all NWP 48 activities that require pre-construction notification, the district engineer will immediately provide (e.g., via email, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (U.S. FWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Office (THPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to telephone or fax the district engineer notice that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where~~

there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

☐ (3) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

☐ (4) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

C. District Engineer's Decision

☐ 1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. For a linear project, this determination will include an evaluation of the individual crossings to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to intermittent or ephemeral streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51 or 52, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in minimal adverse effects. When making minimal effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

☐ 2. If the proposed activity requires a PCN and will result in a loss of greater than 1/10- acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for projects with smaller impacts. The district engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the district engineer to be minimal, the district engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

☐ 3. If the district engineer determines that the adverse effects of the proposed work are more than minimal, then the district engineer will notify the applicant either: (a) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the project is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level; or (c) that the project is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period, with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation or a requirement that the applicant submit a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level. When mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

D. **Further Information**

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

Chapter 9. Avoidance, Minimization and Conservation Measures

The following conservation measures shall be implemented as part of the proposed Project to avoid and minimize potential effects to listed salmonids.

1. The contractor will follow the terms and conditions of the regulatory permits and agreements obtained from the California Department of Fish and Wildlife (CDFW), RWQCB, and U.S. Army Corps of Engineers (CORPS), and including NOAA's NMFS.
2. Equipment must be checked daily, prior to use, for leaks. If leaking, equipment cannot be used until leak is fixed. Prior to use, all equipment must be cleaned to remove external oil, grease, dirt or mud.
3. Equipment likely to transport weed or soil must be pressure washed prior to arrival on the project site and/or prior to leaving the project site. Only weed-free equipment is allow in the action area.
4. Refueling of construction equipment and vehicles will occur outside of the active channel.
5. Contractor will prepare a Storm Water Pollution Prevention Plan (SWPPP) prior to project construction in accordance with the Caltrans Standard Specifications Section 7-1.01G. A Spill Prevention, Control, and Countermeasures (SPCC) Plan will be included in the SWPPP to minimize and avoid the potential of a leak or spill of petroleum or hydraulic products within the channel, which will also include actions to take in the event of a spill or leak.
6. Contractor will use a containment system that will prevent all materials and/or debris from entering the streams, which will include suspending, placing or erecting a platform, tarp, net or combination of these under the bridge structure to catch any fallen debris. In addition, concrete dust will be minimized with the use of water and/or vacuum systems.
7. Construction activities associated with widening of the bridges, including dewatering, stream flow diversion, construction of temporary gravel work pad, and construction of temporary falsework will be conducted during daylight hours.
8. All in water construction activities including but not limited to CIDH drilling, vibratory sheet piling, dewatering, stream diversion, and installation of RSP shall be confined to the dry season and occur during the approved construction window of June 15th through October 15th.
9. Equipment associated with the in-water construction activities must be removed following the completion of all in-water work. If needed, although not anticipated, cofferdams needing to be left in the channel will be designed in such a way that it will not obstruct flow and will be able withstand high flow and volatile fluctuation.
10. Construction equipment will not operate in anadromous waters unless the channel is dewatered or otherwise dry. Relocation and exclusion of listed fish will be first priority prior

to dewatering and will be performed by a qualified fisheries biologist following CDFW and NMFS guidelines.

11. Placement of concrete or concrete slurry to construct bridge footings must be conducted in a dry area, within a cofferdam, to prevent contact of wet concrete with water. Concrete or concrete slurry will not come into direct contact with flowing water.
12. Sediment-laden water from the dewatering or water collected in the CIDH casings will be pumped into a settling basin on the bank with no return drainage to the creeks or into a truck or settling tanks for off-site disposal.
13. Use of RSP will be limited to the minimum necessary to protect infrastructure. RSP, sheet piles, and other erosion control materials will be pre-washed to remove sediment and/or contaminants.
14. Temporary material storage piles (e.g., RSP) will not be placed in the 100 year floodplain during the rainy season (October 15 through May 31), unless material can be relocated within (e.g., before) 12 hours of the onset of a storm.
15. Excavated material will not be stored or stockpiled in the channel. Any excavated material that will not be placed back in the channel or on the bank after construction will be hauled to an approved disposal site.
16. Temporary fills that are left in stream channels will be composed of washed, rounded, spawning-sized gravel between 0.5 to 4 inches in diameter. Gravel in contact with flowing water will be left in place, modified to ensure adequate fish passage for all life stages, and then allowed to disperse naturally by high winter flows. Materials placed above the Ordinary High Water Mark (OHWM) must be clean washed rock or contained to prevent material conveyance to the stream or mixing with clean gravel.
17. Where spawning gravel is removed temporarily to facilitate construction, it will be stored adjacent to the site than placed back in the channel post-construction at approximately pre project depth and gradient, thereby avoiding any loss of potential spawning habitat or impacts on potential spawning fish. If necessary, gravels will be cleaned before returning them to the channel.
18. Dewatering the stream channel will be limited to the minimum necessary to support construction activities. When any dam or other artificial obstruction is being constructed, sufficient water velocity (at less than 8ft/s) or water (at least a 10 ft wide live stream) shall at all times be kept or allowed to pass downstream to maintain aquatic life below the dam. Stream width, depth, velocity, and slope that provide upstream and downstream passage of adult and juvenile fish will be preserved according to current NMFS and CDFW guidelines and criteria or as developed in cooperation with NMFS and CDFW to accommodate site-specific conditions.
19. Diverting the stream channel will proceed from the downstream to the upstream end of the channel. Flow will not be diverted from the stream channel until the temporary channel is complete and all applicable soil stabilization/control measures are in place. Flow will be diverted the minimum distance necessary to isolate the construction area.
20. Water will be released downstream at an appropriate rate to maintain downstream flows at all times and the outlet of all diversions shall be positioned such that the discharge of water

does not result in bank erosion or channel scour and maintains pre-project hydraulic conditions.

21. Modified or disturbed portions of streams, banks, and riparian areas will be restored as nearly as possible to natural and stable contours.
22. If water is drafted from a stream channel, water drafting shall take place from June 15 through October 15 and conform to the NOAA Fisheries Water Drafting Specifications, August 2001 (Appendix E).
23. NMFS shall be contacted immediately and all project activities that may affect listed coho salmon shall cease if one or more salmonids are found dead, injured, or chemical contamination has been detected within coho salmon critical habitat downstream of proposed project activities. Project activities may resume only after NMFS has reasonable assurances that no additional mortalities of listed Pacific salmonids will occur and that chemical contamination of coho salmon critical habitat has ceased.
24. Temporary access roads will be constructed outside of wetted channels and rocked or stabilized prior to rainfall events to prevent sediment mobilization. Sediment and debris removed from the roadway will be disposed of off-site, at an approved location, where it cannot enter surface waters.
25. Where unintended soil compaction occurs, compacted soils will be loosened after heavy construction activities are complete.
26. Where vegetation removal is temporary to support construction activities, native species will be re-established that are specific to the project location and that comprise a diverse community of woody and herbaceous plants. Following construction, all disturbed upland areas within the ESL will be stabilized and re-seeded with a native seed mix consisting of common yarrow (*Achillea millefolium*), California brome (*Bromus californicus*), squirrel tail (*Elymus elymoides*), blue wildrye *(Elymus glaucus)*, deerbrush (*Ceanothus integerrimus*), antelope bitterbrush (*Purshia tridentata*), and wood rose *(Rosa gymnocarpa)*. No exotic plants will be used.
27. Removal of existing riparian vegetation shall not exceed the minimum necessary to complete the Project, and tree roots and stumps shall be left intact whenever possible. Roots and stumps will be allowed one-growing season post construction for regeneration. Following a re-growth period of one year, if necessary, all disturbed riparian areas and areas along the creeks devoid of riparian vegetation will be replanted with shining willow *(Salix lasiandra* var. *caudate)*, arroyo willow *(Salix lasiolepis,)*, and sandbar willow *(Salix exigua)* cuttings. Replanting shall be overplanted at a minimum of 3:1 ratio.
28. ESA or exclusionary fencing will be used to minimize potential accidental removal of more vegetation beyond the designated impact areas or approximately 100ft of the abutments on both banks upstream and downstream of each location to avoid additional lost shade.
29. Any disturbed ground must received appropriate erosion control treatment (e.g. mulching, seeding, planting) prior to the end of the construction season, prior to a cessation of operations due to forecasted wet weather, within seven days of project completion, or during the appropriate planting season. Maintenance will use all practicable techniques to prevent sediment from entering any water body.

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-Sis-96-R52.5/88.4

Identified by
Project ID 0212000012

PERMITS

PLAC - PLAC Condition Responsibility (PCR) Summary

PLAC CONDITION RESPONSIBILITY (PCR) SUMMARY

General:
This PCR Summary clarifies various PLAC requirements. Perform all work described in the PLACs on behalf of the Department unless otherwise stated below in Table 2. If a discrepancy exists between the PCR Summary and the PLAC, the PCR Summary governs.

Definitions:
Agency: A board, agency, or other entity that issues a PLAC
Activity: A task, event or other project element
PLAC Condition: a work activity and/or submittal required by a PLAC

Table 1 - Clarification of PLAC Requirements

PLAC Name	Section of the PLAC	PLAC Requirement
All PLACs	Applicable PLAC sections	**Submittals:** Submit to the Engineer when PLAC conditions require: 1. Communications. The Engineer will contact the agencies. 2. Records to be maintained, within 5 working days after the activity. 3. Submittals 5 days before the agencies require them. The Engineer will review and submit to the agencies. 4. If there is a conflict within or between PLACS, the most restrictive condition is implemented on the project.
California Department of Fish and Wildlife (CDFW) Streambed Alteration Agreement Notification No: 1600-2016-0030-R1	Administrative Measures 1.1 and 1.2	The Contractor will make the CDFW Agreement readily available at each project location at all times, as described in section 1.1. The Contractor will provide copies of the CDFW Agreement to all persons working on each project site as described in section 1.2.
	Administrative Measure 1.4	Both the Contractor and Caltrans will agree to allow CDFW personnel to enter the project site at any time, after notifying the Resident Engineer, to verify compliance with the Agreement
	Habitat and Species Protection 2.3	Contractor shall restrict all project activities to the designated work area and shall maintain all fencing, stakes, and flags until the completion of project activities."
	Habitat and Species Protection 2.6	Preconstruction surveys and relocation will be performed by a qualified Contractor-Supplied Biologist.
	Compensatory Measures 3.1	Remove only the minimum amount of riparian vegetation required to perform the work. Leave stems and roots intact wherever possible.
U.S.D.C., N.O.A.A., National Marine Fisheries Services, West Coast Region Section 7 Biological Opinion NMFS No. WCR-2015-2682	1.3	Temporary access roads are constructed/excavated from edge of pavement to OHWM and surfaced with heavy geotextile fabric and clean washed crushed rock described. Below OHWM, access roads and work pads are not excavated and must be surfaced with imported clean washed rounded river-run rock described.
	1.3	Do not impact drive piling within 50 feet of the live stream

Table 1 - Clarification of PLAC Requirements (continued)

PLAC Name	Section of the PLAC	PLAC Requirement
U.S.D.C., N.O.A.A., National Marine Fisheries Services, West Coast Region Section 7 Biological Opinion NMFS No. WCR-2015-2682	1.3	"Stream diversion" is described in the special provisions as "temporary clear water diversion system"; "Clear water diversion (cofferdam)" is described in the special provisions as "temporary stream exclusion".
	1.3.1.1	Temporary access road surfacing above OHWM will be clean, angular crushed rock described
	1.3.1.1	Geotextile fabric for temporary access roads will be a heavy nonwoven subgrade enhancement fabric or nonwoven Class 10 RSP Fabric. Do not use landscape cloth.
	1.3.1.1	For temporary access roads, if removal of vegetation cannot be avoided, cut trees flush and cut brush leaving a 2" stump.
	1.3.1.1	No materials or equipment may remain below OHWM outside the specified work window.
	1.3.1.1	Below OHWM, outside the live stream, imported clean washed river-run gravel described must be removed and original contours restored.
	1.3.1.1	The minimum offset distance to surface waters for storing, fueling or refueling equipment is 100 feet.
	1.3.1.1	Pre-wash all materials used below OHWM to remove dirt, oils and contaminants
	1.3.1.1	Below OHWM, work from the dry streambank or within a dewatered streambed. You may only place clean, washed rounded river-run gravel described into the live stream for temporary stream diversions and anchoring fish block nets. Construction scaffolding includes falsework.
	1.3.1.1	Excavate temporary access roads with a grader or other authorized equipment. Spread clean angular crushed rock for temporary access roads with an excavator or other authorized equipment.
	1.3.1.1	Prior to entering or leaving the job site, clean all equipment to remove dirt, oils, grease, contaminants and vegetation.
	1.3.1.2	Supply, install and remove materials for fish exclusion as described, each time temporary water diversion or temporary stream exclusion is placed or removed.
	1.3.1.4 List of additional measures to reduce impacts to riparian vegetation	Items 1, 2 and 5-equipment cleaning are performed by the Contractor
	2.8.3 Reasonable and Prudent Measures Item 2 2.8.4 Reasonable and Prudent Measure 2	Underwater Noise Monitoring Plan is prepared by the Contractor-Supplied Biologist and submitted to the Engineer

PLAC CONDITION RESPONSIBILITY (PCR) SUMMARY

Table 1 - Clarification of PLAC Requirements (continued)

PLAC Name	Section of the PLAC	PLAC Requirement
U.S.D.C., N.O.A.A., National Marine Fisheries Services, West Coast Region Section 7 Biological Opinion NMFS No. WCR-2015-2682	2.8.3 Reasonable and Prudent Measure Item 3 2.8.4 Reasonable and Prudent Measure 3	Daily and post-project hydroacoustic monitoring data are prepared by the Contractor-Supplied Biologist and submitted to the Engineer
North Coast Regional Water Quality Control Board (NCRWQCB) Water Quality Certification WDID No. 1A5041WNSI	Project Specific Conditions Requiring Reports 4	The Contractor must notify the Engineer at least 7 working days in advance of starting ground-disturbing activities each construction season.
	Standard Condition 7	The Contractor will submit all requests for changes to the project that could significantly affect water quality to the Engineer.
	Standard Condition 11	Item iii is performed by the Contractor.
	Standard Condition 15	Performed by the Contractor.
	Standard Condition 21	Both the Contractor and Caltrans will agree to allow NCRWQCB personnel to enter the project site at any time, after notifying the Resident Engineer, to verify compliance with the Certification
	Standard Condition 23	The Contractor will maintain the log of all personnel trained in conformance with section 13-1.01D(2), and will provide updated logs to the Engineer weekly.
	Standard Condition 28	The Contractor will make the Water Quality Certification IH readily available at each project location at all times, as described in section 1.1. The Contractor will provide copies of the Water Quality Certification IH to all persons working on each project site as described in Standard Condition 28.
	Standard Condition 37	Performed by the Contractor.

Table 2 - Work to be Performed by the Department

PLAC Name	Section of the PLAC	PLAC Requirement
California Department of Fish and Wildlife Streambed Alteration Agreement Notification No: 1600-2016-0030-R1	3. Compensatory Measures	Performed by the Department
	4. Reporting Measures	Performed by the Department
North Coast Regional Water Quality Control Board Water Quality Certification WDID No. 1A5041WNSI	Project Specific Conditions 1 and 2	Performed by the Department
	Project Specific Conditions Requiring Reports 3 and 4	Performed by the Department
	Standard Condition 11	Items i and ii are performed by the Department.
	Standard Condition 23	The Department will maintain the log of all Department personnel trained pursuant to section 13-1.01D(2). The Department will submit combined training logs if requested by the Regional Water Board.
	Standard Conditions 29, 30 and 31	Performed by the Department.

Table 2 - Work to be Performed by the Department (continued)

PLAC Name	Section of the PLAC	PLAC Requirement
U.S.D.C., N.O.A.A., National Marine Fisheries Services, West Coast Region Section 7 Biological Opinion NMFS No. WCR-2015-2682	1.3.1.2	Fish relocation and electrofishing is performed by CA Dept. of Fish and Wildlife Fisheries Biologist.
	1.3.1.4	All references to replanting in this section are performed by the Department.
	1.3.1.4	Revegetation and Monitoring Plan and monitoring work are performed by the Department.
	1.3.1.4 List of additional measures to reduce impacts to riparian vegetation	Items 3, 4, 5-specification of weed-free mulches and use of native species, 6, 7, 8, 9 will be performed by the Department
	1.3.1.7	Funding Assurance
	2.8.3 Reasonable and Prudent Measures Item 1 2.8.4 Reasonable and Prudent Measure 1	Performed by CDFW and the Department.
	2.8.3 Reasonable and Prudent Measures Item 2 2.8.4 Reasonable and Prudent Measure 2	The Department submits the prepared Underwater Noise Monitoring Plan to NMFS.
	2.8.3 Reasonable and Prudent Measures Item3 2.8.4 Reasonable and Prudent Measure 3	The Department submits underwater noise monitoring reports to NMFS.

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

WATER QUALITY

PLAC - California Regional Water Quality Control Board, North Coast Region

Water Quality Certification
Board Order No. 2003-1117-DWQ WDID No. 1A15041WNSI
Dated June 2, 2016

CALIFORNIA
Water Boards

Edmund G. Brown Jr.
Governor

Matthew Rodriquez
Secretary for
Environmental Protection

North Coast Regional Water Quality Control Board

June 2, 2016

In the Matter of
Water Quality Certification

for the

California Department of Transportation
State Route 96 Siskiyou 3 Bridges Rail Upgrade Project
41.870220, -122.817166; 41.842496, -123.197284; 41.863501, -123.310559[1]
WDID No. 1A15041WNSI, ECM PIN CW-815018
Caltrans EA No. 02-4E650, EFIS No. 02-1200-0012

APPLICANT:	California Department of Transportation
RECEIVING WATER:	Thompson Creek, Seiad Creek, Beaver Creek
HYDROLOGIC AREA:	Klamath River, Hydrologic Unit No. 105.32; 105.33; 105.35
COUNTY:	Siskiyou
FILE NAME:	CDOT SIS-96-PM 52.48/60.17/88.26

FINDINGS BY THE EXECUTIVE OFFICER:

1. On January 19, 2016, the North Coast Regional Water Quality Control Board (Regional Water Board) received an application from the California Department of Transportation (Caltrans), requesting Federal Clean Water Act, section 401, Water Quality Certification (certification) for activities related to the proposed State Route 96 3 Bridges Rail Upgrade Project (Project).

2. **Public Notice:** The Regional Water Board provided public notice of the application pursuant to title 23, California Code of Regulations, section 3858 on April 12, 2016, and

[1] WGS84 datum

posted information describing the Project on the Regional Water Board's website. No comments were received.

3. **Receiving Waters:** The proposed Project would cause disturbances to tributaries of Klamath River (Middle Klamath River Hydrologic Area).

4. **Project Description:** The purpose of the proposed project is to bring the bridge rails up to current design standards for three bridges located on State Route 96 (SR 96). The Project locations are located at Thompson Creek, Seiad Creek and Beaver Creek, between the communities of Happy Camp and Gottville in Siskiyou County at post-miles (PM) 52.48, 60.17 and 88.26.

   Proposed Project activities include the following:

   Thompson Creek Bridge (PM 52.48)
   - Widen the foundation system (piers, abutments and retaining walls).
   - Place rock slope protection (RSP) to protect foundations, piers and abutments.
   - Remove existing bridge railing.
   - Widen existing bridge deck by 4-feet and 1-inch on each side to obtain a total bridge width of 36-feet.
   - Construct new bridge railing that meets current safety standards.
   - Replace guardrail on both sides of the bridge to meet current safety standards.
   - Selective vegetation removal along the highway to bring bridge sight distance up to current safety standards.

   Seiad Creek Bridge (PM 60.17)
   - Widen the foundation (piers, abutments and retaining walls).
   - Place RSP to protect foundations, piers and abutments.
   - Remove existing bridge railing.
   - Widen the existing bridge deck by 3-feet and 10-inches on the upstream side and by 7-feet and 1-inch on the downstream side to obtain a total bridge width of 44-feet.
   - Construct new bridge railing that meets current safety standards.
   - Replace guardrail on both sides of the bridge to meet current safety standards.
   - Selective vegetation removal along the highway to bring bridge sight distance up to current safety standards.

   Beaver Creek Bridge (PM 88.26)
   - Widen the foundation (piers, abutments and retaining walls).
   - Place RSP to protect foundations, piers and abutments.
   - Remove existing bridge railing.
   - Widen the existing bridge deck by 5-feet on both sides to obtain a total bridge width of 36-feet.
   - Construct new bridge railing that meets current safety standards.

- Replace guardrail on both sides of the bridge to meet current safety standards.
- Selective vegetation removal along the highway to bring bridge sight distance up to current safety standards.

June 1 - October 31, see attached

5. **Construction Timing:** The Project is expected to require 300 days of construction. The Project is proposed to begin in the spring of 2017, and be completed in the fall of 2019. Work within waters will be conducted in the dry season (~~June 15- October 15~~).

6. **Project Impacts:** The proposed Project would result in approximately 735 linear feet (0.029 acres) of permanent impacts to the stream banks of Beaver Creek, Thompson Creek, and Seiad Creek as a result of bridge widening and RSP placement. The proposed Project would result in approximately 550 linear feet (0.17 acres) of temporary impacts to the riparian areas and stream bed of Beaver Creek, Thompson Creek, and Seiad Creek as a result of construction access and riparian disturbance. There will be no temporary or permanent impacts to jurisdictional wetlands.

7. **Mitigation for Project Impacts:** Caltrans will mitigate for permanent impacts to stream banks by incorporating willow plantings into the RSP at each bridge abutment. All temporary impacts to riparian areas and stream beds will be revegetated as stated in the *Revegetation and Monitoring Plan* dated May 2016.

8. **Post-Construction Storm Water:** This project will add a total of 0.162 acres of new impervious surface at the three bridge locations. Caltrans shall install biofiltration strips at each bridge location to treat a total of 0.173 acres of impervious surface.

9. **Disturbed Soil Area:** Project implementation would result in greater than one acre of disturbed soil area. Caltrans shall apply for coverage under the National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ) and prepare a Stormwater Pollution Prevention Plan detailing best management practices (BMPs) to control pollution from the Project area during construction. All temporarily disturbed areas within the Project area shall be appropriately stabilized and/or replanted with appropriate native vegetation.

10. **Utility Relocations:** Utility relocations affecting jurisdictional waters are not proposed for this Project.

11. **Other Agency Actions:** Caltrans has applied to the U.S. Army Corps of Engineers for either a Nationwide or individual Clean Water Act section 404 permit. Caltrans has applied for a Section 1600 Streambed Alteration Agreement from the California Department of Fish and Wildlife. Caltrans received a Biological Opinion from the National Marine Fisheries Service (NMFS) dated June 26, 2015, that discusses the Project effects on Southern Oregon/Northern California Coast (SONCC) Evolutionary Significant Unit (ESU) of coho salmon. The NMFS found that the project is not likely to

jeopardize the continued existence of the SONCC ESU of coho salmon and is not likely to result in the destruction or adverse modification of designated critical habitat for the species. Caltrans has also applied to NMFS for a Biological Assessment.

12. **CEQA Compliance:** On August 13, 2015, Caltrans signed a Notice of Determination approving a Mitigated Negative Declaration for the Project (State Clearinghouse No. 2015042057) in order to comply with the California Environmental Quality Act.

13. **Total Maximum Daily Load:** Thompson Creek, Beaver Creek and Seiad Creek, are tributaries to the Klamath River. The Klamath River is listed as impaired for cyanobacteria hepatoxic microcystins, organic enrichment/low dissolved oxygen, nutrients, sediment, and temperature, on the Clean Water Act Section 303(d) list. Bank erosion is identified as a source contributing to sediment impairment. Removal of riparian vegetation is identified as a source contributing to temperature impairment. Disturbance of fine sediments within the channel may increase biostimulatory conditions due to release of nutrient rich fine sediment. Activities that will be authorized by this certification are designed to reduce removal of riparian vegetation, reduce sediment discharges from bank erosion, and have no effect on fine sediment within the channel. The project will not impact flow or stagnation which may increase cyanobacteria hepatoxic microcystins or organic enrichment/low dissolved oxygen. Caltrans will utilize appropriate erosion control, sediment control, and site management BMPs to control pollutants during construction, and drainage improvements will result in a net reduction in sediment contributions. Accordingly, this certification does not certify any activities that would contribute to Klamath River cyanobacteria hepatoxic microcystins, organic enrichment/low dissolved oxygen, nutrients, sediment, or temperature impairment.

14. **Antidegradation Policy:** The federal antidegradation policy requires that State water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16. Resolution No. 68-16 incorporates the federal antidegradation policy where the federal policy applies under federal law. Resolution No. 68-16 requires that existing quality of waters be maintained unless degradation is justified based on specific findings. The Regional Water Board's Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies. This certification is consistent with applicable federal and State antidegradation policies, as it does not authorize the discharge of increased concentrations of pollutants or increased volumes of treated wastewater, and does not otherwise authorize degradation of the waters affected by this Project.

15. This discharge is also regulated under State Water Resources Control Board Order No. 2003-0017-DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification," which requires compliance with all conditions of this certification. Order No. 2003-0017-DWQ can be

found here: http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2003/wqo/wqo2003-0017.pdf.

Receiving Water:	Klamath River (105.32, 105.33, 105.35)	
Filled and/or Excavated Areas:	Permanent – jurisdictional waters	735 linear feet (0.14 acres)
	Temporary – jurisdictional waters	550 linear feet (0.17 acres)
Dredge Volume:	none	
Latitude/Longitude:	41.870220, -122.817166; 41.842496, -123.197284; 41.863501, -123.310559	

Accordingly, based on its independent review of the record, the Regional Water Board certifies that the State Route 96 Siskiyou 3 Bridges Rail Upgrade Project (WDID No. 1A15041WNSI), as described in the application will comply with sections 301, 302, 303, 306 and 307 of the Clean Water Act, and with applicable provisions of state law, provided that Caltrans complies with the following terms and conditions:

All conditions of this certification apply to Caltrans (and all its employees) and all contractors (and their employees), sub-contractors (and their employees), and any other entity or agency that performs activities or work on the Project as related to this Water Quality Certification.

Project-Specific Conditions

1. To compensate for the permanent and temporary impacts to riparian areas, Caltrans shall establish 0.20 acres of riparian plantings on-site as described in the *Siskiyou 3 Bridges Rail Upgrade Project Revegetation and Monitoring Proposal*, dated May 2016.

2. Caltrans shall incorporate willow plantings into the banks and riparian areas receiving RSP treatment at the following locations:
   - i) Thompson Creek Bridge – Pier 2
   - ii) Seiad Creek Bridge – Abutment 1 and 4
   - iii) Beaver Creek Bridge – Abutment 1

Project-Specific Conditions Requiring Reports

3. Caltrans shall implement the proposed *Siskiyou 3 Bridges Rail Upgrade Project Revegetation and Monitoring Proposal*, dated May 2016, or any successive document approved by Regional Water Board staff. Caltrans shall submit annual monitoring reports, no later than January 31 following the respective monitoring year. Riparian tree plantings must meet 85% survivorship and not be reliant on supplemental irrigation for the final two years of the monitoring period in order to be deemed

Project-Specific Conditions Requiring Reports (continued)

successful. Post-project monitoring reports shall include the following information:

i) Site location and history;

ii) A current map of all plantings;

iii) Individual plant details (species, and vigor rating);

iv) Locations of photo point stations and photographs from each station;

v) Maintenance record of the site throughout the season;

vi) Record of any problems encountered at the site throughout the season;

vii) Replacement planting details (species, size, number and sources);

viii) Summary of the sites progression towards meeting the success criteria; and

ix) Proposed corrective measures as needed (requires Regional Water Board approval).

4. The Regional Water Board shall be notified in writing (e-mail is acceptable) at least five working days prior to commencement of ground disturbing activities for each construction season.

June 1 and October 31, see attached

5. Work within State waters shall occur only between ~~June 15 and October 15.~~ Any deviation from this timeframe restriction shall be subject to prior acceptance by Regional Water Board staff.

Standard Conditions

6. Herbicides and other pesticides shall not be used within the Project limits. If Caltrans has a compelling case as to why pesticides should be used, then a request for pesticide use and a BMP plan may be submitted to the Regional Water Board staff for review and acceptance.

7. All Project activities and BMPs shall be implemented according to the submitted application package and the findings and conditions of this certification. Subsequent changes to the Project that could significantly impact water quality shall first be submitted to Regional Water Board staff for prior review, consideration, and written concurrence. If the Regional Water Board is not notified of an alteration to the Project that results in an impact to water quality, it will be considered a violation of this certification, and Caltrans may be subject to Regional Water Board enforcement actions.

8. All conditions required by this certification shall be included in the Contract Documents prepared by Caltrans for the contractor. In addition, Caltrans shall require compliance with all conditions included in this certification in the bid contract for this Project.

Standard Conditions (continued)

9. Caltrans is prohibited from discharging waste to waters of the State, unless explicitly authorized by this certification. For example, no debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or concrete washings, welding slag, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature, shall be allowed to enter into State waters.

10. Except for temporary stockpiling of waste generated during demolition operations ("temporary" in this instance means generated and removed during the same working day), waste materials shall not be placed in a manner where the materials may be transported into waters of the State. Waste materials shall not be placed within 100 linear feet of State waters. Exceptions to the 100-foot limit may be granted on a case-by-case basis provided Caltrans first submits a proposal in writing that is found acceptable by Regional Water Board staff.

11. Caltrans is liable and responsible for the proper disposal, reuse, and/or recycling of all Project-generated waste in compliance with applicable State and Federal laws and regulations, and as described in Caltrans 2010 Standard Specifications 13-4.03D, Waste Management. Additionally, when handling, transporting, disposing, reusing, and/or recycling Project-generated waste, Caltrans and their contractors shall:

    i) Provide the Regional Water Board with a copy of the Solid Waste Disposal and Recycling Report prepared for Caltrans by the contractor per Caltrans 2010 Standard Specification 14-10.02A(1), Submittals. These reports shall be provided not later than January 31 for each year work is performed during the previous calendar year. A copy of the final Solid Waste Disposal and Recycling Report shall be submitted to the Regional Water Board within 30 days after being received by Caltrans from the contractor.

    ii) For waste other than solid waste, obtain evidence that waste has been appropriately disposed, reused, and/or recycled. Evidence shall include type and quantity of waste and may include, but not be limited to, property owner agreements, permits, licenses, and environmental clearances. Evidence shall be provided to the Regional Water Board upon request.

    iii) For waste other than solid waste, ensure the Resident Engineer has given written permission for disposal, reuse, and/or recycling, prior to the actual disposal, reuse, and/or recycling.

12. Asphalt-concrete grindings shall not be placed in any location where they may, at any time, be directly exposed to surface waters or seasonally high ground water, except asphalt-concrete grindings may be re-used and incorporated into hot mix asphalt products or encapsulated within the roadway structural section.

Standard Conditions (continued)

13. Caltrans and their contractors shall comply with the activity restrictions detailed in Caltrans 2010 Standard Specifications 13-4.03C(1). In addition, fueling, maintenance, storage and staging of vehicles and equipment shall be prohibited within waters of the State (e.g., gravel bars, seeps, ephemeral streams) and riparian areas.

14. Fueling, maintenance, and/or staging of individual equipment types within waters of the State or riparian areas may be authorized if Caltrans first prepares a plan for review and approval by Regional Water Board staff that:

    i) Identifies the specific piece of machinery that may require fueling, maintenance, and/or staging within waters of the State or riparian areas;

    ii) Provides justification for the need to refuel, maintain, or stage within State waters or riparian areas. The justification shall describe why conducting the activity outside of jurisdictional waters is infeasible; and

    iii) Includes a narrative of specific BMPs that shall be employed to prevent discharges to State waters and riparian areas.

15. Caltrans shall not use leaking vehicles or equipment within State waters or riparian areas.

16. Only 100-percent biodegradable erosion and sediment control products that will not entrap or harm wildlife shall be used. Photodegradable synthetic products are not considered biodegradable. If Caltrans finds that erosion control netting or products have entrapped or harmed wildlife, personnel shall remove the netting or product and replace it with wildlife-friendly biodegradable products. This condition does not prohibit the use of plastic sheeting used in water diversion or dewatering activities. Caltrans shall request approval from the Regional Water Board if an exception to this requirement is needed for a specific location.

17. Work in flowing or standing surface waters, unless otherwise proposed in the project description and approved by the Regional Water Board, is prohibited.

18. Non-stormwater discharges are prohibited unless the discharge is first approved by the Regional Water Board and in compliance with the Basin Plan. If dewatering of groundwater is necessary, then Caltrans shall use a method of water disposal other than disposal to ground or surface waters, such as land disposal. Groundwater disposed of to land shall not enter State waters. Alternatively, Caltrans may apply for coverage under the Low Threat Discharge Permit or an individual National Pollutant Discharge Elimination System (NPDES) Permit. If Caltrans applies for coverage under either of these permits, then discharge is prohibited until Caltrans has received notification of coverage under the respective permit.

Standard Conditions (continued)

19. Gravel bags used within State waters shall:

    i) Comply with Caltrans 2010 Standard Specifications sections 13-5.02G and 88-1.02F;

    ii) Be immediately removed and replaced if the bags have developed or are developing holes or tears; and

    iii) Be filled only with clean washed gravel.

    Exceptions to these criteria are subject to the review and acceptance of Regional Water Board staff.

    See attached.

20. This certification does not authorize drafting of surface waters.

21. Caltrans shall provide access to the Project construction site upon request by Regional Water Board staff.

22. Initial water pollution control training described in Caltrans 2010 Standard Specifications 13-1.01D(2), Training, shall apply to all Caltrans employees, contractors, and sub-contractors. Initial water pollution control training topics shall include Regional Water Board 401 certification and construction general permit requirements, identification of state waters and riparian areas, and violation avoidance and discharge reporting procedures.

23. Caltrans shall maintain logs of all Caltrans staff, contractors, and sub-contractors trained pursuant to the Caltrans 2010 Standard Specifications 13-1.01D(2). The logs shall include the names of trainees, training dates, and summary of the scope of training. Caltrans shall provide evidence of this documentation upon the request of the Regional Water Board.

24. If an unauthorized discharge to surface waters (including wetlands, rivers or streams) occurs, or any other threat to water quality arises as a result of Project implementation, the associated Project activities shall cease immediately until the threat to water quality is otherwise abated. If there is a discharge to State waters, the Regional Water Board shall be notified no more than 24 hours after the discharge occurs.

25. Uncured concrete shall not be exposed to State waters or surface waters that may discharge to State waters. Concrete sealants may be applied to the concrete surface where difficulty in excluding flow for a long period may occur. If concrete sealant is used, water shall be excluded from the site until the sealant is cured. If groundwater comes into contact with fresh concrete, it shall be prevented from flowing towards surface water.

Standard Conditions (continued)

26. Ground and surface water that has come into contact with fresh concrete, and all other wastewater, shall not be discharged to State waters or to a location where it may discharge to State waters; the wastewater shall be collected and re-used or disposed of in a manner approved by the Regional Water Board.

27. All imported fill material shall be clean and free of pollutants. All fill material shall be imported from a source that has the appropriate environmental clearances and permits. The reuse of low-level contaminated solids as fill on-site shall be performed in accordance with all State and Federal policies and established guidelines and must be submitted to the Regional Water Board for review and consideration of acceptance.

28. Caltrans shall provide a copy of this certification and State Water Resources Control Board (SWRCB) Order No. 2003-0017-DWQ (web link referenced below) to the contractor and all subcontractors conducting the work, and require that copies remain in their possession at the work site. Caltrans shall be responsible for work conducted by its contractor and subcontractors.

29. The validity of this certification is conditioned upon total payment of any fee required under title 23, California Code of Regulations, section 3833. The total application fee is $6,218. The Regional Water Board received $6,218 from Caltrans on January 19, 2016.

30. This certification will be subject to annual billing during the construction phase ("Annual Active Discharge Fee") and during the monitoring phase of the Project ("Annual Post Discharge Monitoring Fee"), per the current fee schedule, which can be found on our website: http://www.swrcb.ca.gov/northcoast/water_issues/programs/water_quality_certification.shtml. These fees will be automatically invoiced to Caltrans.

31. Caltrans shall notify the Regional Water Board upon Project construction completion to request termination of the Annual Active Discharge Fee and to receive a "Notice of Completion of Discharges Letter." If the Project is subject to the Annual Post Discharge Monitoring Fee, then Caltrans shall also notify the Regional Water Board at the end of the monitoring period to request termination of the fee and receive a "Notice of Project Complete Letter." Caltrans may be required to submit completion reports at the end of each of these phases. Regional Water Board staff may request site visits at the end of each Project phase to confirm Project status and compliance with this certification.

32. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to title 23, California Code of Regulations, section 3855, subdivision (b) and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

Standard Conditions (continued)

33. In the event of any violation or threatened violation of the conditions of this certification, the violation or threatened violation shall be subject to any remedies, penalties, process or sanctions as provided for under applicable state or federal law. For the purposes of section 401(d) of the Clean Water Act, the applicability of any state law authorizing remedies, penalties, process or sanctions for the violation or threatened violation constitutes a limitation necessary to assure compliance with the water quality standards and other pertinent requirements incorporated into this certification. In response to a suspected violation of any condition of this certification, the State Water Board may require the holder of any federal permit or license subject to this certification to furnish, under penalty of perjury, any technical or monitoring reports the State Water Board deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In response to any violation of the conditions of this certification, the Regional Water Board may add to or modify the conditions of this certification as appropriate to ensure compliance.

34. This certification action is subject to modification or revocation upon administrative or judicial review; including review and amendment pursuant to Water Code section 13330 and title 23, California Code of Regulations, section 3867.

35. In the event of any change in control of ownership of land presently owned or controlled by Caltrans, Caltrans shall notify the successor-in-interest of the existence of this certification by letter and shall forward a copy of the letter to the following email address: NorthCoast@waterboards.ca.gov.

    The successor-in-interest shall e-mail the Regional Water Board Executive Officer at: NorthCoast@waterboards.ca.gov to request authorization to discharge dredged or fill material under this certification. The request must contain the following:

    i) Effective date of ownership change;

    ii) Requesting entity's full legal name;

    iii) The state of incorporation, if a corporation;

    iv) The address and phone number of contact person; and

    v) A description of any changes to the project or confirmation that the successor-in-interest intends to implement the project as described in this certification.

Standard Conditions (continued)

36. Except as may be modified by any preceding conditions, all certification actions are contingent on:

    i) The discharge being limited, and all proposed revegetation, avoidance, minimization, and mitigation measures being completed, in strict compliance with Caltrans's project description and CEQA documentation, as approved herein;

    ii) Caltrans shall construct the Project in accordance with the project described in the application and the findings above; and

    iii) Compliance with all applicable water quality requirements and water quality control plans including the requirements of the Water Quality Control Plan for the North Coast Region (Basin Plan), and amendments thereto.

37. Any change in the design or implementation of the Project that would have a significant or material effect on the findings, conclusions, or conditions of this certification must be submitted to the Executive Officer of the Regional Water Board for prior review, consideration, and written concurrence. If the Regional Water Board is not notified of a significant alteration to the project, it will be considered a violation of this certification, and Caltrans may be subject to Regional Water Board enforcement actions.

38. The authorization of this certification for any dredge and fill activities expires five years from the date of this certification. Conditions and monitoring requirements outlined in this certification are not subject to the expiration date outlined above, and remain in full effect and are enforceable.

Conditions 3, 4, and 5 are requirements for information and reports. Any requirement for a report made as a condition to this certification is a formal requirement pursuant to California Water Code section 13267, and failure or refusal to provide, or falsification of such required report is subject to civil liability as described in California Water Code, Section 13268.

The Regional Water Board may add to or modify the conditions of this certification, as appropriate, to implement any new or revised water quality standards and implementation plans adopted or approved pursuant to the Porter-Cologne Water Quality Control Act or section 303 of the Clean Water Act.

Please contact our staff Environmental Scientist, Brandon Stevens at (707) 576-2377, or via e-mail, at Brandon.Stevens@waterboards.ca.gov, if you have any questions.

Fred Blatt
for

Fred Blatt
2016.06.02
11:55:45 -07'00'

Water Boards

Matthias St. John
Executive Officer

160602_BDS_dp_CDOT_SR96_3Bridges_401

Original to: Mr. Mike Feakes, Caltrans, District 2, 1031 Butte St. Redding, CA 96001
Mike.Feakes@dot.ca.gov

cc: Patricia Goodman, U.S. Army Corps of Engineers
Patricia.K.Goodman@usace.army.mil
Rachelle Pike, California Department of Fish and Wildlife
Rachelle.Pike@.wildlife.ca.gov
State Water Resources Control Board Stateboard401@waterboards.ca.gov
Environmental Protection Agency, Region 9 R9-WTR8-Mailbox@epa.gov
Andre Benoist, Caltrans andre.benoist@dot.ca.gov

STATE WATER RESOURCES CONTROL BOARD

WATER QUALITY ORDER NO. 2003 - 0017 - DWQ

STATEWIDE GENERAL WASTE DISCHARGE REQUIREMENTS FOR DREDGED OR FILL DISCHARGES THAT HAVE RECEIVED STATE WATER QUALITY CERTIFICATION (GENERAL WDRs)

The State Water Resources Control Board (SWRCB) finds that:

1. Discharges eligible for coverage under these General WDRs are discharges of dredged or fill material that have received State Water Quality Certification (Certification) pursuant to federal Clean Water Act (CWA) section 401.

2. Discharges of dredged or fill material are commonly associated with port development, stream channelization, utility crossing land development, transportation water resource, and flood control projects. Other activities, such as land clearing, may also involve discharges of dredged or fill materials (e.g., soil) into waters of the United States.

3. CWA section 404 establishes a permit program under which the U.S. Army Corps of Engineers (ACOE) regulates the discharge of dredged or fill material into waters of the United States.

4. CWA section 401 requires every applicant for a federal permit or license for an activity that may result in a discharge of pollutants to a water of the United States (including permits under section 404) to obtain Certification that the proposed activity will comply with State water quality standards. In California, Certifications are issued by the Regional Water Quality Control Boards (RWQCB) or for multi-Region discharges, the SWRCB, in accordance with the requirements of California Code of Regulations (CCR) section 3830 et seq. The SWRCB's water quality regulations do not authorize the SWRCB or RWQCBs to waive certification, and therefore, these General WDRs do not apply to any discharge authorized by federal license or permit that was issued based on a determination by the issuing agency that certification has been waived. Certifications are issued by the RWQCB or SWRCB before the ACOE may issue CWA section 404 permits. Any conditions set forth in a Certification become conditions of the federal permit or license if and when it is ultimately issued.

5. Article 4, of Chapter 4 of Division 7 of the California Water Code (CWC), commencing with section 13260(a), requires that any person discharging or proposing to discharge waste, other than to a community sewer system, that could affect the quality of the waters of the State,[1] file a report of waste discharge (ROWD). Pursuant to Article 4, the RWQCBs are required to prescribe waste discharge requirements (WDRs) for any proposed or existing discharge unless WDRs are waived pursuant to CWC section 13269. These General WDRs fulfill the requirements of Article 4 for proposed dredge or fill discharges to waters of the United States that are regulated under the State's CWA section 401 authority.

[1] "Waters of the State" as defined in CWC Section 13050(e)

6. These General WDRs require compliance with all conditions of Certification orders to ensure that water quality standards are met.

7. The U.S. Supreme Court decision of *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers*, 531 U.S. 159 (2001) (the *SWANCC* decision) called into question the extent to which certain "isolated" waters are subject to federal jurisdiction. The SWRCB believes that a Certification is a valid and enforceable order of the SWRCB or RWQCBs irrespective of whether the water body in question is subsequently determined not to be federally jurisdictional. Nonetheless, it is the intent of the SWRCB that all Certification conditions be incorporated into these General WDRs and enforceable hereunder even if the federal permit is subsequently deemed invalid because the water is not deemed subject to federal jurisdiction.

8. The beneficial uses for the waters of the State include, but are not limited to, domestic and municipal supply, agricultural and industrial supply, power generation, recreation, aesthetic enjoyment, navigation, and preservation and enhancement of fish, wildlife, and other aquatic resources.

9. Projects covered by these General WDRs shall be assessed a fee pursuant to Title 23, CCR section 3833.

10. These General WDRs are exempt from the California Environmental Quality Act (CEQA) because (a) they are not a "project" within the meaning of CEQA, since a "project" results in a direct or indirect physical change in the environment (Title 14, CCR section 15378); and (b) the term "project" does not mean each separate governmental approval (Title 14, CCR section 15378(c)). These WDRs do not authorize any specific project. They recognize that dredge and fill discharges that need a federal license or permit must be regulated under CWA section 401 Certification, pursuant to CWA section 401 and Title 23, CCR section 3855, et seq. Certification and issuance of waste discharge requirements are overlapping regulatory processes, which are both administered by the SWRCB and RWQCBs. Each project subject to Certification requires independent compliance with CEQA and is regulated through the Certification process in the context of its specific characteristics. Any effects on the environment will therefore be as a result of the certification process, not from these General WDRs. (Title 14, CCR section 15061(b)(3)).

11. Potential dischargers and other known interested parties have been notified of the intent to adopt these General WDRs by public hearing notice.

12. All comments pertaining to the proposed discharges have been heard and considered at the November 4, 2003 SWRCB Workshop Session.

13. The RWQCBs retain discretion to impose individual or general WDRs or waivers of WDRs in lieu of these General WDRs whenever they deem it appropriate. Furthermore, these General WDRs are not intended to supersede any existing WDRs or waivers of WDRs issued by a RWQCB.

IT IS HEREBY ORDERED that WDRs are issued to all persons proposing to discharge dredged or fill material to waters of the United States where such discharge is also subject to the water quality certification requirements of CWA section 401 of the federal Clean Water Act (Title 33 United States Code section 1341), and such certification has been issued by the applicable RWQCB or the SWRCB, unless the applicable RWQCB notifies the applicant that its discharge will be regulated through WDRs or waivers of WDRs issued by the RWQCB. In order to meet the provisions contained in Division 7 of CWC and regulations adopted thereunder, dischargers shall comply with the following:

1. Dischargers shall implement all the terms and conditions of the applicable CWA section 401 Certification issued for the discharge. This provision shall apply irrespective of whether the federal license or permit for which the Certification was obtained is subsequently deemed invalid because the water body subject to the discharge has been deemed outside of federal jurisdiction.

2. Dischargers are prohibited from discharging dredged of fill material to waters of the United States without first obtaining Certification from the applicable RWQCB or SWRCB.

CERTIFICATION

The undersigned, Clerk to the Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on November 19, 2003.

AYE: Arthur G. Baggett, Jr.
Peter S. Silva
Richard Katz
Gary M. Carlton
Nancy H. Sutley

NO: None.

ABSENT: None.

ABSTAIN: None.

Debbie Irvin
Clerk to the Board

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

North Coast Regional Water Quality Control Board

June 13, 2016

California Department of Transportation
Attn: Mr. Mike Feakes
1031 Butte Street
Redding, CA 96001

Dear Mr. Feakes:

Subject: Amendment to the Federal Clean Water Act, Section 401, Water Quality Certification for the State Route 96 Siskiyou 3 Bridges Rail Upgrade Project

Files: CDOT State Route 96 Siskiyou 3 Bridges Rail Upgrade Project
ECM PIN CW-815018, WDID No. 1A15041WNSI
Caltrans EA No. 02-4E650

On June 8, 2016, we received your email requesting an amendment to the June 2, 2016, Federal Clean Water Act, Section 401, Water Quality Certification (certification) for the Siskiyou 3 Bridges Rail Upgrade Project (Project).

In response to your request, this letter serves as an amendment to Finding 5, Standard Condition 15, and Standard Condition 20 of the certification. Finding 5 has been amended to adjust for construction timing. Standard Condition 15 has been amended to include the restriction of use of leaking equipment within the project site and Standard Condition 20 has been amended to allow the use of drafting of surface waters. The certification is hereby amended as described below. Additions and deletions to the original certification are represented by underlined and strikethrough text, respectively.

Finding 5: The Project is expected to require 300 days of construction. The Project is proposed to begin in the spring of 2017, and be completed in the fall of 2019. Work within waters will be conducted in the dry season ~~(June 15- October 15)~~ (June 1 – October 30).

Condition 15: ~~Caltrans shall not use leaking vehicles or equipment within State waters or riparian areas.~~ Fueling, lubrication, maintenance, storage, and staging of vehicles and equipment shall not result in a discharge or threatened

discharge to any waters of the state including dry portions of the shoreline. Caltrans shall not use leaking vehicles and equipment within the project area, state waters, and/or riparian areas.

Condition 20: ~~This certification does not authorize drafting of surface waters.~~ This certification authorizes the drafting of surface waters. Caltrans shall implement water-drafting specifications to prevent injury to fish or significant changes to flow conditions of their habitat, including limiting the diversion rate and reduction in pool volume to no more than 10 percent, and using an appropriate screen mesh as defined by the National Marine Fisheries Service Biological Opinion. Drafting of surface waters from the Klamath River mainstem is prohibited.

I hereby issue an amendment to the project description in Finding 5, Condition 15, and Condition 20 in the Conditions of the certification for the Siskiyou 3 Bridges Rail Upgrade Project (WDID No. 1A15041WNSI) certifying that the remainder of the Water Quality Certification sections of the June 2, 2016, Order are still valid.

If you have any questions or comments, please contact Brandon Stevens at (707) 576-2377 or at Brandon.Stevens@waterboards.ca.gov.

Sincerely,

Matthias St. John
Executive Officer

160613_BDS_er_CDOT_SR96_3Bridges_401amendment

From: Stevens, Brandon D.@Waterboards
Sent: Monday, June 13, 2016 3:26 PM
To: Benoist, Andre H@DOT
Subject: RE: SIS 3 Bridges 401 Amendment

Hi Andre,

The North Coast Regional Water Quality Control Board (NCRWQCB) has reviewed the request for a work period variance to extend working days from June 1 to October 30, to June 1 to October 31. The NCRWQCB accepts the work period variance request provided that all work is conducted as proposed below and attached, and in compliance with the Project water quality certification.

If you have any questions, please contact me.

Brandon Stevens
Environmental Scientist
Nonpoint Source/401 Certification Unit
North Coast Regional Water Board
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403
brandon.stevens@waterboards.ca.gov
Office: 707-576-2377

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

PERMITS

PLAC - California Department of Fish and Wildlife, Northern Region

Streambed Alteration Agreement
No. 1600-2016-0030-R1
Dated June 6, 2016

California Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Region 1 - Northern
601 Locust Street
Redding, CA 96001
www.wildlife.ca.gov

EDMUND G. BROWN, Jr., Governor
CHARLTON H. BONHAM, Director

June 6, 2016

Mr. Mike Feakes
California Department of Transportation
1031 Butte Street, MS 30
Redding, CA 96001

Subject: Final Streambed Alteration Agreement
Notification No. 1600-2016-0030-R1
Siskiyou 3 Bridges Rail Upgrade Project

Dear Mr. Feakes:

Enclosed is the final Streambed Alteration Agreement (Agreement) for the Siskiyou 3 Bridges Rail Upgrade Project (Project). Before the California Department of Fish and Wildlife (Department) may issue an Agreement, it must comply with the California Environmental Quality Act (CEQA). In this case, the Department, acting as a responsible agency, filed a Notice of Determination (NOD) within five working days of signing the Agreement. The NOD was based on information contained in the Negative Declaration prepared by the lead agency.

Under CEQA, the filing of an NOD triggers a 30-day statute of limitations period during which an interested party may challenge the filing agency's approval of the Project. You may begin the Project before the statute of limitations expires if you have obtained all necessary local, state, and federal permits or other authorizations. However, if you elect to do so, it will be at your own risk.

If you have any questions regarding this matter, please contact Rich Lis, Senior Environmental Scientist (Specialist), (530) 225-2142 or richard.lis@wildlife.ca.gov.

Sincerely,

Rachelle Pike
for: Richard Lis
Senior Environmental Scientist (Specialist)

Notice of Determination

TO: ☒ Office of Planning and Research

For U.S. Mail:
P.O. Box 3044
Sacramento, CA 95812-3044

Street Address:
1400 Tenth Street
Sacramento, CA 95814

FROM: California Department of Fish and Wildlife
Region 1 - Northern
601 Locust Street
Redding, CA 96001
Contact: Richard Lis
Phone: (530) 225-2142

LEAD AGENCY (if different from above):
California Department of Transportation
1031 Butte Street
Redding, CA 96001
Contact: Andre' Benoist
Phone: (530) 225-3302

SUBJECT: Filing of Notice of Determination pursuant to § 21108 of the Public Resources Code

State Clearinghouse Number: 2015042057

Project Title: Lake or Streambed Alteration Agreement No. 1600-2016-0030-R1

Project Location: The project is located along State Route 96, at three different bridges where highway 96 crosses the creeks: Beaver Creek Bridge (PM 88.26), Seiad Creek Bridge (PM 60.17) and Thompson Creek Bridge (PM 52.48), between the towns of Happy Camp and Gottville, all occur in the County of Siskiyou, State of California. Locations at T46N, R8W, sec. 6; T46N, R12W, sec. 11; and T17N, R8E, sec. 17; Mt. Diablo Meridian.

Project Description: The project's primary elements are to upgrade the rails of the bridges through the addition of shoulder space ranging from three to seven feet on each side of the bridges, widening the foundation of the bridges, and replacement of adjacent guardrails. Additional construction work includes the widening of the road for 200 feet on each side of the bridge to transition the existing roadway onto the widened bridge deck, installation of rock slope protection (RSP) to protect bridge foundations and abutments.

This is to advise that the California Department of Fish and Wildlife (CDFW), acting as ☐ **the lead agency** / ☒ **a responsible agency** approved the above-described project on the date signed below and has made the following determinations regarding the above described project:

1. The project ☐ **will** / ☒ **will not** have a significant effect on the environment. (This determination is limited to effects within CDFW's jurisdiction when CDFW acts as a responsible agency.)
2. ☐ **An environmental impact report (EIR)** / ☒ **A negative declaration** / ☐ **A timber harvesting plan** was prepared for this project pursuant to CEQA.
3. Mitigation measures ☒ **were** / ☐ **were not** made a condition of CDFW's approval of the project.
4. A Statement of Overriding Considerations ☐ **was** / ☒ **was not** adopted by CDFW for this project.
5. Findings ☐ **were** / ☒ **were not** made by CDFW pursuant to Public Resources Code § 21081(a). CDFW did, however, adopt findings to document its compliance with CEQA.
6. Compliance with the environmental filing fee requirement at Fish and Game Code § 711.4 (check one):
   - ☐ Payment is submitted with this notice.
   - ☒ A copy of a receipt showing prior payment is on file with CDFW.
   - ☐ A copy of the CEQA Filing Fee No Effect Determination Form signed by CDFW is attached to this notice.

☐ Lead Agency certification: CDFW, as Lead Agency, has made the final EIR with comments and responses and record of project approval, or the Negative Declaration, available to the General Public at the CDFW office identified above.

☒ Responsible Agency statement: The final EIR, Negative Declaration, or THP that was prepared by the Lead Agency for this project is available to the General Public at the office location listed above for the Lead Agency. CDFW's record of decision is available at the CDFW office identified above.

Signed: _____ *Date:* 6-6-16

Michael R. Harris
Habitat Conservation Planning Supervisor
Northern Region

Date Received for filing at OPR:

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
CEQA FINDINGS FOR THE
AGREEMENT REGARDING PROPOSED LAKE OR STREAMBED ALTERATION
No. 1600-2016-0030-R1

Introduction

The California Environmental Quality Act (**CEQA**) (Public Resources Code Section 21000, *et seq.*) and the State CEQA Guidelines (**Guidelines**) (Section 15000, *et seq.*, Title 14, California Code of Regulations) require that no public agency shall approve or carry out a project for which a mitigated negative declaration (MND) has been completed that identifies one or more significant effects, unless the agency makes the following finding as to each significant effect:

Changes or alterations have been required in, or incorporated into, the project which mitigate or avoid the significant effects on the environment.

As the lead agency for the project, the California Department of Transportation (Caltrans) adopted the MND for the Project on **June 26, 2015**. Caltrans found that the Project will not result in significant environmental effects with the mitigation measures required in, or incorporated into the Project.

The California Department of Fish and Wildlife (CDFW) is issuing a Lake or Streambed Alteration Agreement (Agreement) to the project applicant, **Mr. Mike Feakes representing Caltrans**. The project is located along State Route 96, at three different bridges where highway 96 crosses the creeks: Beaver Creek Bridge (PM 88.26), Seiad Creek Bridge (PM 60.17) and Thompson Creek Bridge (PM 52.48), between the towns of Happy Camp and Gottville, all occur in the County of Siskiyou, State of California. Locations at T46N, R8W, sec. 6; T46N, R12W, sec. 11; and T17N, R8E, sec. 17; Mt. Diablo Meridian.

Because CDFW is issuing the Agreement, it is a "responsible agency" under CEQA for the Project. As a CEQA Responsible Agency, CDFW is required by Guidelines § 15096 to review the environmental document certified by the lead agency approving the projects or activities addressed in the Agreement and to make certain findings concerning a project's potential to cause significant, adverse environmental effects. However, when considering alternatives and mitigation measures approved by the lead agency, a responsible agency is more limited than the Lead Agency. In issuing the Agreement, CDFW is responsible only for ensuring that the direct or indirect environmental effects addressed in the Agreement are adequately mitigated or avoided. Consequently, the findings adopted or independently made by CDFW with respect to the approval of Agreements regarding proposed Lake or Streambed Alterations are more limited than the findings of the lead agency funding, approving, or carrying out the project activities addressed in such Agreements.

Findings

CDFW has considered the MND adopted by Caltrans. CDFW has independently concluded that the Agreement should be issued under the terms and conditions specified therein. In this regard, CDFW hereby adopts any findings of Caltrans as set forth in the MND and record of project approval, insofar as those findings pertain to the project's impacts on biological resources.

Signature: _____ *Date:* 6-6-16

Michael R. Harris
Habitat Conservation Planning Supervisor
Northern Region

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
NORTHERN REGION
601 LOCUST STREET
REDDING, CA 96001

STREAMBED ALTERATION AGREEMENT
NOTIFICATION NO. 1600-2016-0030-R1
Beaver Creek, Seiad Creek, Thompson Creek, all tributaries to Klamath River.

CALIFORNIA DEPARTMENT OF TRANSPORTATION
Siskiyou Three Bridges Rail Upgrade Project

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Wildlife (DFW) and the California Department of Transportation (Permittee) as represented by Mr. Mike Feakes.

RECITALS

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified DFW on January 29, 2016 that Permittee intends to complete the project described herein;

WHEREAS, pursuant to FGC section 1603, DFW has determined that the project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources;

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources;

WHEREAS, all documents and specifications submitted by the Permittee to DFW, in application for this Agreement, become supporting documentation to DFW and considered as part of this Agreement by reference;

NOW THEREFORE, Permittee agrees to complete the project in accordance with the Agreement.

PROJECT LOCATION

The project is located along State Route 96, at three different bridges where highway 96 crosses the creeks: Beaver Creek Bridge (PM 88.26), Seiad Creek Bridge (PM 60.17) and Thompson Creek Bridge (PM 52.48), between the towns of Happy Camp and Gottville, all occur in the County of Siskiyou, State of California. Locations at T46N, R8W, sec. 6; T46N, R12W, sec. 11; and T17N, R8E, sec. 17; Mt. Diablo Meridian.

PROJECT DESCRIPTION

The project's primary elements are to upgrade the rails of the bridges through the addition of shoulder space ranging from three to seven feet on each side of the bridges, widening the foundation of the bridges, and replacement of adjacent guardrails. Additional construction work includes the widening of the road for 200 feet on each side of the bridge to transition the existing roadway onto the widened bridge deck, installation of rock slope protection (RSP) to protect bridge foundations and abutments. The bridge renovations will occur at three locations (Beaver Creek, Seiad Creek, and Thompson Creek) and are briefly described below (full descriptions can be found in the application materials submitted by the Permittee). These tributaries to the Klamath River support all life stages of the Southern Oregon Northern California Evolutionary Significant Unit of coho salmon (*Oncorhynchus kisutch*) which is listed as Federal Threatened and State Threatened.

Beaver Creek (PM 88.26)

Summary of primary construction activities: widen the foundation (piers, abutments, retaining walls) and protect with RSP, remove existing bridge railing, widen bridge deck by 5 ft 0 in. on both sides of bridge, build new bridge railing, and replace guardrail on roadway leading to bridge, selective vegetation removal to bring sight distance to safety standards.

Seiad Creek (PM 60.17)

Summary of primary construction activities: widen the foundation (piers, abutments, retaining walls) and protect with RSP, remove existing bridge railing, widen bridge deck by 3 ft. 10 in. on upstream side and 7 ft. 1 in. on downstream side, build new bridge railing, and replace guardrail on roadway leading to bridge, selective vegetation removal to bring sight distance to safety standards.

Thompson Creek (PM 52.48)

Summary of primary construction activities: widen the foundation (piers, abutments, retaining walls) and protect with RSP, remove existing bridge railing, widen bridge deck by 3 ft. 1 in. on each side, build new bridge railing, and replace

guardrail on roadway leading to bridge, selective vegetation removal to bring sight distance to safety standards.

PROJECT IMPACTS

Project impacts for the three locations are of the following.

Beaver Creek

Riparian Vegetation
Temporary Impacts: 2,313 ft^2
Permanent Impacts: 358 ft^2

Stream (below OHWM)
Temporary impacts: 679 ft^2
Permanent impacts: 444 ft^2.

Seiad Creek

Riparian Vegetation
Temporary Impacts: 1,967 ft^2
Permanent Impacts: 539 ft^2

Stream (below OHWM)
Temporary impacts: 24,556 ft^2
Permanent impacts: 911 ft^2.

Thompson Creek

Riparian Vegetation
Temporary Impacts: 3,073 ft^2
Permanent Impacts: 333 ft^2

Stream (below OHWM)
Temporary impacts: 429 ft^2
Permanent impacts: 0 ft^2.

Total Impacts

Riparian Vegetation
Temporary Impacts: 7,353 ft^2
Permanent Impacts: 1,230 ft^2
Stream (below OHWM)
Temporary impacts: 25,664 ft^2
Permanent impacts: 1,355 ft^2.

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee shall meet each administrative requirement described below.

1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to DFW personnel, or personnel from another state, federal, or local agency upon request.

1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.

1.3 Notification of Conflicting Provisions. Permittee shall notify DFW if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, DFW shall contact Permittee to resolve any conflict.

1.4 Project Site Entry. Permittee agrees that DFW personnel may enter the project site at any time, after notifying the Resident Engineer, to verify compliance with the Agreement.

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below.

PROJECT TIMING

2.1 General Work Period for Stream Channel and Banks All work on the stream banks or within the stream channel, shall be confined to the period commencing June 1, and ending October 31, of any year in which this Agreement is valid and the stream is in low flow conditions. If weather conditions permit, and the stream remains in low flow conditions, the Permittee may perform work within the stream channel or on the banks after October 31, provided a written request is made to the DFW at least 5 days before the proposed work period variance. Written approval from the DFW for the proposed work period variance must be received by the Permittee prior to the start or continuation of work after October 31.

2.2 Required Measures for Work after October 31. If work is performed within the stream channel or on the banks after October 31, the Permittee shall do all of the following:

a. Stage erosion and sediment control materials at the work site.

b. Monitor the seventy-two (72) hour forecast from the National Weather Service.

c. When the 72-hour forecast indicates a probability of precipitation of 60% or greater, or at the onset of any precipitation, ground disturbing activities shall cease and erosion control measures shall be implemented to stabilize exposed soils and prevent the mobilization of sediment into the stream channel or adjacent wetland or riparian areas.

HABITAT AND SPECIES PROTECTION

2.3 Delineating Limits of Work. Prior to initiating vegetation or ground disturbing Project activities, Permittee shall clearly delineate the upstream and downstream limits of the work area between OHWM and the top of bank, including Environmentally Sensitive Areas. Permittee shall restrict all Project activities to the designated work area and shall maintain all fencing, stakes and flags until the completion of Project activities.

2.4 Minimize Loss of Riparian Vegetation. Removal of existing riparian vegetation shall not exceed the minimum necessary to complete operations.

2.5 Take of State Threatened or Endangered Species. This Agreement does not authorize the take of any State threatened or endangered species. The State

listed Southern Oregon/Northern California Coastal (SONCC) coho salmon (*Oncorhynchus kisutch*) are found in the Klamath River and the tributaries Beaver Creek, Seiad Creek, and Thompson Creek. The Permittee has obtained a Biological Opinion and Incidental Take Statement from The National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) for incidental take of SONCC coho salmon. DFW has issued a Consistency Determination (2080-2016-002-01) for the Biological Opinion prepared by NOAA Fisheries for the project which meets the requirements for protection of SONCC coho salmon under the California Endangered Species Act (CESA).

2.6 Amphibians and Reptiles – Preconstruction Surveys and Relocation. The most likely species to potentially occur within the project locations are: foothill yellow-legged frog (*Rana boylii*), and western pond turtle (Emys marmorata). Pre-construction surveys for this amphibian and reptile will be conducted, by a qualified biologist, in all areas planned for construction activities (including, but not limited to, vegetation removal and soil disturbance) no earlier than two weeks prior to construction activities. If special status amphibians or reptiles are found, a qualified biologist, will relocate them to an appropriate location (safe species specific appropriate habitat nearby, but outside the project environmental study limits) and well outside the construction area as agreed to by DFW prior to relocation.

2.7 Installation of Environmentally Sensitive Area (ESA) Fencing. ESA fencing shall be installed as the first order of work and in accordance with the Project plans and drawings. Inspection of the ESA fencing installation will be conducted by the Caltrans Environmental Construction Liaison to ensure proper placement.

2.8 ESA Fencing Shown on Project Plans. ESA fencing shall consist of temporary orange construction fence or other highly visible material that clearly delineates the limits of Environmentally Sensitive Areas which shall be clearly shown on the Project plans and drawings. The Permittee shall ensure that the contractor, subcontractors, and all personnel working on the Project are instructed on the purpose of the ESA fencing and understand the limits of the work area.

2.9 Vegetation Removal Period and Nesting Birds. Removal of trees and shrubs from the work area shall take place between October 1 and February 15 to avoid impacts to nesting birds. Take of migratory birds will be avoided during construction activities. Active nests of birds are all nests being constructed, maintained, or defended, by one or more parents, whether or not eggs or nestlings are in the nest itself. If active nests are found, a qualified biologist will

coordinate with the DFW to establish species specific buffers for the species, which shall be maintained until the young have fully fledged from the nest and have departed from the territory of the nest.

2.10 Materials for Rock Slope Protection. RSP and energy dissipation materials shall consist of quarry run or equivalent rock, free of mud or soil, competent for the application, sized and properly installed to resist washout. RSP slopes shall be supported with competent boulders keyed into a footing trench with a depth sufficient to properly seat the footing course boulders and prevent instability (typically at least 1/3 diameter of footing course boulders). Excavation spoils shall not be side-cast into the channel nor is any manipulation of the substrate of the channel authorized except as herein expressly provided.

2.11 Executive Order 13112 requires federal agencies to prevent and control the introduction and spread of invasive species, therefore all equipment shall be washed pre – and post - construction to prevent the spread of any noxious weeds. Washing of equipment will occur where the water cannot flow into a watercourse or creek channel. All areas left disturbed at the end of construction will be seeded and mulched to help prevent the establishment of invasive weeds (see section 2.25 below).

PETROLEUM, CHEMICAL AND OTHER POLLUTANTS

2.12 Storage of Materials All construction-related materials and equipment shall be stored at a Caltrans approved designated staging area located outside of the Ordinary High Water Mark (OHWM) of each creek .

2.13 Work Adjacent to Watercourses. As part of the proposed construction activities, heavy equipment (drilling trucks, backhoe, excavator, etc.) may be required to work within and/or adjacent to perennial watercourses. Therefore, there is potential for chemical contamination as a result of a leak or spill of petroleum or hydraulic products into a channel. Measures will be taken to avoid or minimize potential chemical contamination, which will include no staging, storage and re-fueling of vehicles and equipment within 100 feet of the OHWM. In the event of a leak or spill, the project shall cease immediately and the Regional Water Quality Control Board and DFW shall be notified.

2.14 Refueling. Refueling and vehicle maintenance shall be performed at least 100 feet from OHWM unless approved in writing by DFW.

2.15 Use of Equipment Prohibited in Live Streams. No equipment or machinery shall be operated within any flowing stream. Temporary bridges may be used to cross over live streams and water diversions.

2.16 Maintenance and Inspection of Equipment to Prevent Leaks. Any equipment or vehicles driven and/or operated within or adjacent to the stream channel shall be checked and maintained daily to prevent leaks of materials that, if introduced to water, could be deleterious to aquatic life, wildlife, or riparian habitat.

2.17 Drip Pans. Stationary equipment such as motors, pumps, generators, and welders that contain deleterious materials, located adjacent to the stream channel shall be positioned over drip pans, for any part of the equipment that could drip or leak fluids.

2.18 Pollution of Waters of the State Prohibited. No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or washings thereof, asphalt, paint or other coating material, oil or petroleum products or other organic or earthen material from any construction, or associated activity of whatever nature shall be allowed to enter into, or placed where it may be washed by rainfall or runoff into, waters of the State. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the OHWM of any stream or lake.

2.19 Disposal of Waste Water from Concrete Mixing and Application Operations. Water that has been in contact with uncured concrete shall be contained in a sealed concrete washout facility or other impervious container and shall not be discharged to surface or ground waters.

2.20 Fluid Spill Response. In the event of an unexpected fluid spill, the equipment operator will immediately stop work and contain the escaping fluids and mitigate any further potential fluid loss. Any fluid that should leak onto the ground will be collected by placing absorbent pads and absorbent material. These used pads and material will then be placed in 55 gallon drums for disposal.

2.21 Spill Containment, Clean up and Discharge Notification. All construction activities performed in or near the stream shall have absorbent materials designated for spill containment and clean-up activities on-site for use in an accidental spill. In the event of a discharge, the Permittee shall immediately notify the California Emergency Management Agency at 1-800-852-7550 and immediately initiate clean-up activities. DFW shall be notified by the Permittee and consulted regarding clean-up procedures.

EROSION AND SEDIMENT CONTROL

2.22 Erosion Control Measures Required. The project shall, at all times, feature adequate erosion and sediment control devices to prevent the degradation of water quality.

2.23 Installation and Maintenance of Best Management Practices. Soils exposed by project operations shall be treated to prevent sediment runoff and transport. Erosion control measures shall include the proper installation and maintenance of approved Best Management Practices (BMPs) and may include applications of seed, certified weed-free straw, compost, fiber, stabilizing emulsion and mulch, or combinations thereof.

2.24 Soil Stabilization and Sediment Prevention. Soils adjacent to the stream channel that are exposed by project operations shall be adequately stabilized when rainfall is reasonably expected during construction, and immediately upon completion of construction, to prevent the mobilization of such sediment into the stream channel or adjacent riparian areas. National Weather Service forecasts shall be monitored by the Permittee to determine the chance of precipitation.

2.25 Erosion Control Seeding. Prior to the end of construction, all disturbed areas shall be stabilized and re-seeded with a regionally appropriate California native seed mix. During construction, temporary erosion control measures, shall be used in concordance with the authorized Storm Water Pollution Prevention Plan (SWPPP) for the project.

2.26 Spill Prevention Plan. Temporary construction site BMPs shall be implemented using a Spill Prevention Plan (SPP) which will be kept on site, along with all materials and equipment necessary to implement the SPP should it be needed. The temporary BMPs are aimed at reducing erosion and subsequent sediment transport, and preventing accidental spills during construction and may include check dams, straw bales, hydraulic mulch, sediment traps, concrete washouts, fiber rolls, and temporary Hot Mix Asphalt (HMA) dikes.

2.27 Temporary Fill. Temporary fills will be removed within 30 days after completion of work at a given location and/or prior to October 31, and in accordance with the Section 401 and 404 Clean Water Act requirements. These areas will be returned to their pre-construction contours, and treated with erosion control seed mix.

CONSTRUCTION DEWATERING AND INSTREAM STRUCTURES

2.28 Timing of Work. All work below OHWM shall be performed between June 1 and October 31. The Permittee or its contractors may construct a clear water diversion to cleanly route water around the construction area. The clear water diversion shall be installed only during the time period, allowed for work in stream channels, as specified under § 2.1 unless approved with written authorization by DFW. All work shall be performed in isolation from surface flows. Weather conditions should be monitored daily, if the stream has a clear water diversion, and the diversion constructed should be sized to accommodate a minimum of the 25 year storm events; however, this provision does not supersede sub-section 2.30. The clear water diversion and all associated diversion equipment and devices shall be removed from the creek channel by October 31.

2.29 Construction Materials. A temporary clear water diversion shall be constructed to isolate the work area from surface waters. Temporary diversions may be constructed using berms of clean washed gravel, sand bags, K-rail, plastic sheeting, or a combination of these materials upstream from the work area. Flows will then be diverted around the work area with a natural (gravel) bottom and re-enter the stream below the work area.

2.30 Diversion Sizing for Precipitation. The clear water diversion shall be adequately sized to accommodate the full range of flows that may occur during the diversion period without overtopping into the work area and may require sizing above the 25 year storm event (see § 2.29). The Permittee is responsible for sizing the clear water diversion appropriately during the period of operation of the diversion.

2.31 Protection of Watercourse Dependent Aquatic and Terrestrial Wildlife. Dewatering shall be done in a manner that 1) prevents the discharge of material that could be deleterious to fish, plant life, or bird life into any river, stream or lake and, 2) maintains adequate flows to downstream reaches during all times natural flow would have supported aquatic life. Such flows shall be of sufficient quality and quantity to support aquatic life above and below the diversion. Normal flows shall be restored to the affected stream immediately upon completion of work at that location.

2.32 Minimization of Sediment and Turbidity. Dewatering activities shall be conducted in such a manner so as to minimize downstream sedimentation and turbidity, and to minimize channel disturbance to allow flows to run clear

3. Compensatory Measures

To compensate for adverse impacts to fish and wildlife resources identified above that cannot be avoided or minimized, Permittee shall implement all measures currently identified in the Siskiyou 3-Bridges Rail Upgrade Project, Proposed Revegetation and Monitoring Plan (PR&MP), State Route 96, Siskiyou County, subject to final approval by DFW. The draft version PR&MP, updated April 2015, was reviewed for this Agreement and is incorporated by reference, until the final PR&MP is submitted and approved by DFW.

3.1 Riparian Restoration

Temporary Impacts On Site. Riparian vegetation on the project site occurs on both sides of the three bridges of the stream channels at the three project locations. Temporary Impacts will be mitigated through a combination of replanting and encouragement of individuals whose stems and roots remain intact and are capable of re-growth on site. The PR&MP identifies the number of and species that will be planted or encouraged at each location.

Permanent Impacts Off Site. Riparian vegetation that will be permanently lost on the site equals 1,230 ft^2 (0.028) acres and shall be mitigated at a 3:1 ratio at the proposed Horse Creek/Fish Gulch site as currently proposed for coho salmon mitigation, subject to review and approval by DFW. Implementation, monitoring and reporting of the mitigation site will be determined based upon the site selected and restoration options afforded by the site.

4. Reporting Measures

Permittee shall meet each reporting requirement described below.

4.1 Planting Plan, Monitoring, and Reporting. Permittee shall submit a proposed planting plan prior to completion of construction activities that consists of: (a) species to be planted; (b) type of reproductive element for each species (pole cuttings, seed, container stock, etc.); (c) justification for use of species; (d) quantity of plants to be planted; (e) proposed areas to be planted; (f) plan for planting and dates; and (g) plan to ensure that *Phytopthora tentaculata* is not transmitted to site, if container stock is used. Within one month of the completion of all planting, the Permittee shall submit a map of the site and photographic monitoring of the planting site, with notations on the map of photographs and view. Annual reports are to be submitted to document the progress of the replanting of the riparian and upland plantings as defined in the

PR&MP currently in draft form, once approved by DFW. If this site fails to meet expected revegetation success for three successive years and accrues additional monitoring years, then a remediation plan will be required to be prepared and submitted to DFW for review and approval for implementation.

CONTACT INFORMATION

Any communication that Permittee or DFW submits to the other shall be in writing and any communication or documentation shall be delivered to the address below by U.S. mail, fax, or email, or to such other address as Permittee or DFW specifies by written notice to the other.

To Permittee:

Mr. Mike Feakes
Project Manager
Department of Transportation
1031 Butte Street
Redding, CA 96001
Fax: (707) 445-7810
Email: mike.feakes@dot.ca.gov
cc: andre.benoist@dot.ca.gov

To DFW:

Department of Fish and Wildlife
Northern Region
601 Locust Street
Redding, CA 96001
Attn: Lake and Streambed Alteration Program – Dr. Richard Lis
Notification #1600-2016-0030-R1
Fax: (530) 225-2267
Email: richard.lis@wildlife.ca.gov

LIABILITY

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents or contractors and subcontractors, to complete the project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute DFW's endorsement of, or require Permittee to proceed with the project. The decision to proceed with the project is Permittee's alone.

SUSPENSION AND REVOCATION

DFW may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before DFW suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before DFW suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited to a directive to immediately cease the specific activity or activities that caused DFW to issue the notice.

ENFORCEMENT

Nothing in the Agreement precludes DFW from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects DFW's enforcement authority or that of its enforcement personnel.

OTHER LEGAL OBLIGATIONS

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the project or an activity related to it.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the FGC including, but not limited to, FGC sections 2050 et seq. (threatened and endangered species), 3503 (bird nests and eggs), 3503.5 (birds of prey), 5650 (water pollution), 5652 (refuse disposal into water), 5901 (fish passage), 5937 (sufficient water for fish),

and 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

AMENDMENT

DFW may amend the Agreement at any time during its term if DFW determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by DFW and Permittee. To request an amendment, Permittee shall submit to DFW a completed DFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in DFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

TRANSFER AND ASSIGNMENT

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective, unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter DFW approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to DFW a completed DFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in DFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

EXTENSIONS

In accordance with FGC section 1605(b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to DFW a completed DFW "Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in DFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). DFW shall process the extension request in accordance with FGC 1605(b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the project the Agreement covers (Fish & G. Code, § 1605, subd. (f)).

EFFECTIVE DATE

The Agreement becomes effective on the date of DFW's signature, which shall be: 1) after Permittee's signature; 2) after DFW complies with all applicable requirements under the California Environmental Quality Act (CEQA) and California Endangered Species Act (CESA); and 3) after payment of the applicable FGC section 711.4 filing fee listed at: http://www.DFW.ca.gov/habcon/ceqa/ceqa_changes.html.

TERM

This Agreement shall expire on June 1, 2021, unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as FGC section 1605(a) (2) requires.

AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

AUTHORIZATION

This Agreement authorizes only the project described herein. If Permittee begins or completes a project different from the project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify DFW in accordance with FGC section 1602.

CONCURRENCE

The undersigned accepts and agrees to comply with all provisions contained herein.

FOR DEPARTMENT OF TRANSPORTATION

6-1-16

Mike Feakes
Project Manager

Date

FOR DEPARTMENT OF FISH AND WILDLIFE

6-6-16

Michael R. Harris
Habitat Conservation Planning Supervisor

Date

Prepared by: Richard Lis, Ph.D.
Senior Environmental Scientist--Specialist

From: Lis, Richard@Wildlife
Sent: Thursday, July 21, 2016 1:44 PM
To: Benoist, Andre H@DOT; Harris, Michael R.@Wildlife
Subject: RE: Siskiyou 3 Bridges

Dear Andre',

I reviewed the resolutions proposed (below) for the conflicts between requirements of the LSAA 1600 permit and the conflicting sections of the Water Board Permit and NOAA Biological Opinion. I agree with the proposed resolutions for the four listed conflicts.

Thank you for submitting these conflicts and lists of resolutions, they were well presented and the resolutions are all beneficial to the natural resources.

Sincerely,
Rich

Richard Lis, Ph.D.
Senior Environmental Scientist—Specialist
California Department of Fish and Wildlife
2440 Athens Avenue
Redding, California 96001

Telephone: 530-225-2142
Fax: 530-225-2267

From: Benoist, Andre H@DOT
Sent: Thursday, July 07, 2016 3:38 PM
To: Lis, Richard@Wildlife; Harris, Michael R.@Wildlife
Subject: Siskiyou 3 Bridges

Hello Rich and Mike,

Our Office Engineers (OE), have prepared the information below to point out conflicts between permits for the Siskiyou 3 Bridges Project.
The 1600 permit issued for the project required notification of conflicts. (see Section 1.3 of 1600 LSAA)

In the numbered items below, OE has pointed out the conflict and provided a resolution to the conflict, which in all cases specifies compliance with the greater requirement.
If you agree with the resolutions below, please reply with your concurrence and this will become part of the project documents.

Thank you,

Andre' H. Benoist

Andre' H. Benoist, Associate Environmental Planner
North Region, Environmental Management
1031 Butte Street, MS 30
Redding, CA 96001
O: 530-225-3302

***Per Section 1.3 - Notification and resolution of conflicts between* CDFW Streambed Alteration Agreement, North Coast Regional Water Quality Control Board Certification (NC 401 Cert) and NOAA NMFS Section 7 Biological Opinion (NMFS-BO) for 02-4E6501:**

1. Section 2.13 requires a 100 foot setback from OHWM for staging, storing, or refueling of vehicles and equipment
Conflict - NMFS-BO section 1.3.1.3 requires a 100 foot setback, while section 1.3.1.1 requires a 50 foot setback
Resolution - NMFS has been notified to request amendment of the BO, changing the 50 foot setback in section 1.3.1.1 to 100 feet. Caltrans contract special provisions require the 100 foot setback.

2. Section 2.1, general work period for stream channel and banks is June 1 to October 31. This is also the allowable work window in section 1.3 of the NMFS-BO.
Conflict - The original NC 401 Cert Project Specific Condition 4 was issued with an allowable work window of June 15 to October 15.
Resolution - North Coast Regional Water Quality Control Board issued an amendment letter and a further correcting email expanding the allowable work window to June 1 to October 31. The additional letter and email are attached to the back of the original NC 401 Cert. Caltrans is issuing the amended NC 401 Cert with the advertised contract documents.

3. Section 2.27 requires temporary fills to be removed, and work areas returned to pre-construction contours.

Conflict - NMFS-BO section 1.3.1.1 allows rounded river-run rock used for temporary work pads and/or temporary bridge shoring to remain in place below OHWM, evenly spread to restore original ground contours.
Resolution - NMFS has been notified to request amendment of the BO, requiring all imported material below OHWM to be removed and original ground contours restored, *except*, clean washed rounded river-run rock used in the live stream for temporary stream diversions and anchoring fish block nets will be left in place and graded to original streambed contours using hand tools. Caltrans contract special provisions contain the same wording.

4. Section 2.28 requires all associated diversion equipment and devices to be removed from the creek channel by October 31.
Conflict - NMFS-BO sections 1.3 and 1.3.1.2 require all equipment and materials to be removed from the creek channel by October 31. *However,* section 1.3.1.1 states "If needed, although not anticipated, cofferdams needing to be left in the channel will be designed in such a way that it will not obstruct flow and will be able to withstand high flow and volatile fluctuations."
Resolution - NMFS has been notified to request amendment of the BO, removing entirely the referenced statement in section 1.3.1.1 about leaving cofferdams in the channel. Caltrans contract special provisions require all equipment and materials to be removed from the creek channel by October 31.

INFORMATION HANDOUT

For Contract No. 02-4E6504

Identified by
Project ID 0212000012

PERMITS

PLAC - FHWG (2013) Underwater Noise Monitoring Plan Template

Siskiyou 3 Bridges Bridge Widening
02-4E6504
02-Sis-96-R52.5/88.4

UNDERWATER NOISE MONITORING PLAN

*****FHWG (2013) TEMPLATE*****

Replace underlined blue italic text with project information.
Blue italic text is guidance.
Plain, black text *is template language.*
All blue italic text should be replaced or omitted for final production.

Prepared by:
Name and full contact information
Signature Block

Date

INTRODUCTION *(This section will be project specific)*

The *full agency name* proposes to *detailed project description*. See vicinity map (Figure 1).

Figure 1. Vicinity map of *name project*.

PROJECT AREA *(This section will be project specific)*

Describe the location of the project, including all water bodies that are affected. Identify the USGS hydrologic unit, both the name and code, where the project is located. Include detailed maps and figures, when available, relative to environmental features that influence monitoring (e.g., geology, bathymetry, etc.).

PERMIT/ESA CONDITIONS *(This section will be project specific and is applicable only when the ESA consultation is complete or Federal/State/local permits have been issued. Each agency should modify this section to reflect the various types of permit/ESA conditions that they see.)*

Summarize the Federal/State/local permit conditions and the ESA requirements that relate to the underwater noise. Permit conditions include monitoring requirements, timing restrictions, etc. The ESA requirements are found in the Incidental Take Statement and Terms and Conditions sections of the biological opinion. These requirements vary between biological opinions, but can include monitoring requirements, timing restrictions, limits on cumulative sound exposure level (cSEL) at a given distance, description of the area where the thresholds must not be exceeded, the allowable number of piles driven per day, the allowable number of pile strikes per day, or a limit on the single strike SEL.

PILE INSTALLATION LOCATION *(This section will be project specific)*

Figure 2 indicates the location of the *provide location of the structure(s) in need of pile driving*. There will be a total of *XX* piles driven as part of the *name structure(s)*.

Figure 2. Location of *name structure(s)* where pile driving activity will take place. *This information must be in enough detail to allow the reader to assess the monitoring locations.*

PILE INSTALLATION

Impact Pile Driving for Fish Consultations (& listed US FWS, diving sea bird, if relevant)

Provide pile installation information. For example:

Hydroacoustic monitoring will be conducted for *X* piles struck with an impact hammer. Piles chosen to be monitored are driven in water depths that are representative of mid-channel or typical water depths at the project location where piles will be driven.

The number of piles to be monitored will depend on a variety of factors – some projects may require that all piles be monitored, while others may require a representative sample of piles be monitored. If a sample of piles is to be monitored, provide the considerations taken and the rationale used in choosing a representative number of piles, such as, bathymetry, total number of piles to be driven, substrate type, depth of water, distance from shore, river, or stream bank, and

any other considerations, as appropriate. When monitoring a subset, a minimum of 5 piles should be monitored. Additional monitoring to produce a representative sample may be warranted when projects are driving a large number of piles, driving multiple piles of varying diameters in differing substrates, driving different types of piles, or driving piles in widely differing depths.

Hydroacoustic monitoring of *type of pile* with impact driving will include:

- Monitoring *X piles, out of a total of Y piles driven for the project*.
- Testing sound attenuation system effectiveness.
- *Include airborne noise monitoring as bullet here if necessary for other listed species (e.g., marine mammal haul out present, etc.).*

Figure 3 indicates the location of the piles to be monitored and the approximate hydrophone locations for each pile being monitored. All hydrophones will be placed at least 1 m (3.3 feet) below the surface. *If only one hydrophone at one distance is to be used it is acceptable for the hydrophone to be placed 10 meters from the pile at midwater depth. If hydrophones will be placed at more than one distance from the pile and used to calculate transmission loss over distance, water depth should be at least 4m (13 ft) and it is suggested that the additional hydrophone nearest the pile be placed at least 3H from the pile where H is the water depth at the pile and at 0.7 to 0.85H depth from the surface. In waters less than 4m (13 ft) deep, a single hydrophone at midwater depth is sufficient*[1]. Hydrophones will be located *X* meters from each pile with a clear acoustic line-of-sight between the pile and the hydrophone. *Additional distances measured concurrently are desirable, if possible, to estimate the site specific range to the threshold boundary. Include any additional distances or depths where hydrophones will be located. If airborne noise monitoring is required, the primary measurement microphone shall be placed 50 feet (e.g. 15 meters) from the pile at least 6 feet above the ground or water, and shall have an unobstructed view of the length of the pile.*

[1] Some projects may need or require more than one hydrophone to collect real time measurements at multiple locations or multiple distances. In these situations multiple hydrophones can be placed at midwater depths.

Figure 3. Location of the piles that will be monitored on the *Seiad Creek Bridge.*

Replace example below with a project site map

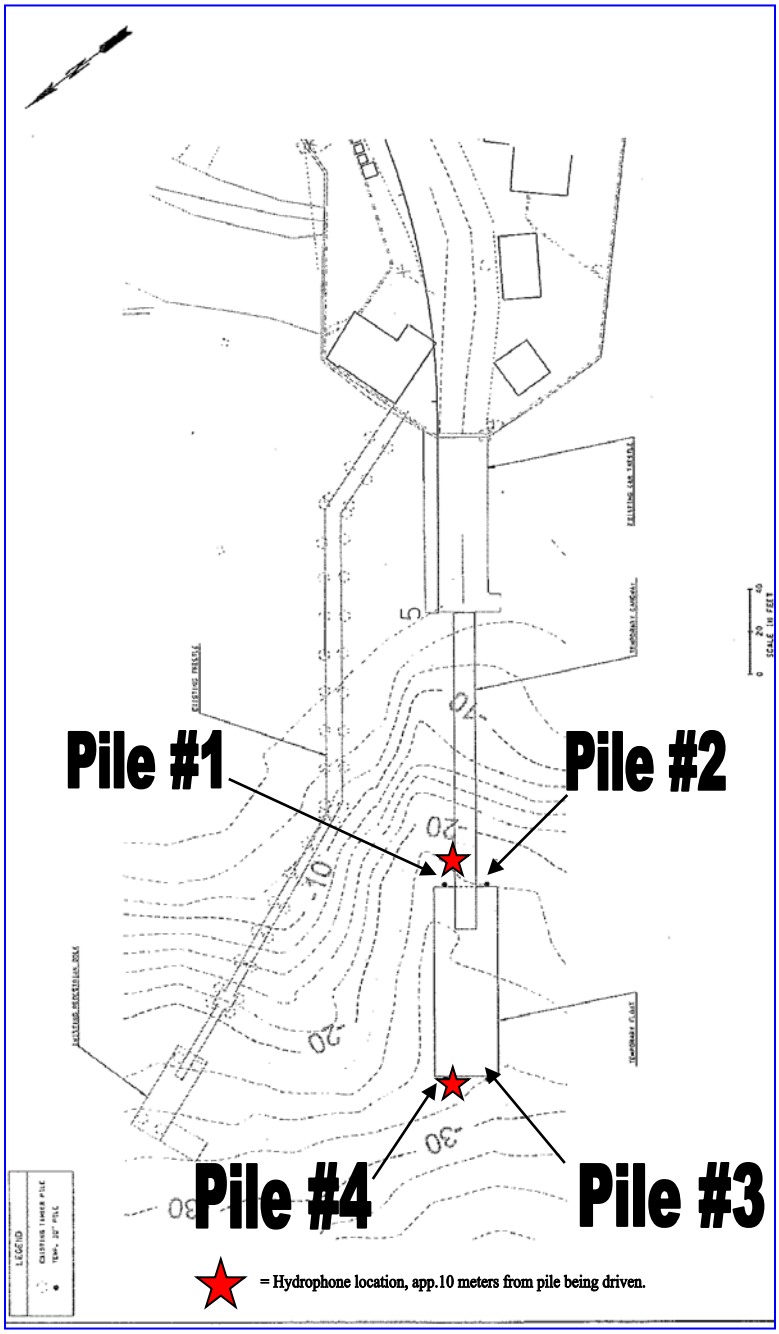

Table 1 lists the *name structure(s)* to be installed, the water depth, and the number and size of piles that will be installed.

Table 1
Depth, Number Piles to be Monitored

Structure	Water Depth	Structural Components Installed
Name structure	*X feet to X feet*	*X - XX-inch diameter type of pile*

Vibratory Pile Driving for Marine Mammal Consultations

Currently, hydroacoustic monitoring of vibratory pile installation is not required for fish or marine mammal consultations. Monitoring of vibratory pile installation is voluntary and is designed to evaluate site specific conditions so that the biological monitoring area for marine mammals may be reduced. In addition to the monitoring requirements above, with the exception of a sound attenuation device, NMFS has provided guidance for measuring background and source sound levels as well as how to evaluate site specific propagation loss (NMFS 2012a, b, c). Please use this guidance to develop a plan for hydroacoustic monitoring of vibratory pile installation if applicable.

CONTRACTOR REQUIREMENTS

The contractor will submit a detailed description of their qualifications, which must include a minimum of a bachelor's degree in a related field[2] and 3 years' experience in noise monitoring and analysis, and monitoring plan based on this template for approval by [INSERT AGENCY NAME]. A list of the contractors' proposed sound level monitoring equipment shall be included along with specifications and a description of the purpose. The measurement range in terms of amplitude (in dB referenced to one micropascal (re: 1 uPa)), sensitivity and frequency shall be stated. A minimum frequency range of 20 Hz to 20 kHz and a minimum sampling rate of 48,000 Hz will be used when monitoring. Sampling rates higher than 48 kHz are preferred. Table 2 describes the minimum requirements of the equipment to be used. In addition to the equipment selection, quality control/quality assurance procedures should be described (e.g., how will system responses be verified and how will data be managed).

Table 2.

Equipment for underwater sound monitoring (hydrophone, signal amplifier, and calibrator). All have current National Institute of Standards and Technology (NIST) traceable calibration. *This table is intended as a guideline and exact specifications can be adjusted to meet the needs of the individual project or contractors' equipment.*

Item	Specifications	Minimum Quantity	Usage

[2] This can include Institute of Noise Control Engineering of the USA (INCE/USA) certification or related fields such as acoustics, physics, oceanography, geology or other physical sciences that have required coursework in physics.

Hydrophone	Receiving Sensitivity- -211dB re 1V/µPa	1	Capture underwater sound pressures near the source and convert to voltages that can be recorded/analyzed by other equipment.
Hydrophone	Receiving Sensitivity – -200dB re 1/µPa	1	Capture underwater sound pressures for background levels and convert to voltages that can be recorded/analyzed by other equipment.
Signal Conditioning Amplifier	Amplifier Gain- 0.1 mV/pC to 10 V/pC Transducer Sensitivity Range- 10-12 to 103 C/MU	1	Adjust signals from hydrophone to levels compatible with recording equipment.
Calibrator (pistonphone-type)	Accuracy- IEC 942 (1988) Class 1	1	Calibration check of hydrophone in the field.
Digital Signal Analyzer	Sampling Rate- 48kHz or greater	1	Analyzes and transfers digital data to laptop hard drive.
Microphone (free field type)	Range- 30 – 120 dBA Sensitivity- -29 dB ± 3 dB (0 dB = 1 V/Pa) Wind Screen	1	Monitoring airborne sounds from pile driving activities (if not raining).
If water velocity ~> 1m/s, Flow shield	Open cell foam cover or functional equivalent	1/hydrophone	Eliminate flow noise contamination.
Laptop computer or Digital Audio Recorder	Compatible with digital signal analyzer	1	Record digital data on hard drive or digital tape.
Real Time and Post-analysis software	-	1	Monitor real-time signal and post-analysis of sound signals.

To facilitate further analysis of data full bandwidth, time-series underwater signal shall be recorded as a text file (.txt) or wave file (.wav) or similar format. Recorded data shall not use data compression algorithms or technologies (e.g. MP3, compressed .wav, etc.).

METHODOLOGY

Impact Pile Driving for Fish Consultations (and listed US FWS, diving sea bird, if relevant)

Underwater background sound level measurements are optional, however, if desired then the NMFS (2012a) guidance should be followed.

If one hydrophone at one distance is to be used it is acceptable for the hydrophone to be placed 10 meters from the pile and at midwater depth. If hydrophones will be placed at more than one distance from the pile it is suggested that the hydrophone nearest the pile be placed at least 3H from the pile where H is the water depth at the pile and 0.7 to 0.85H depth from the surface. The hydrophone*(s)* will be placed at *X meters* depth at a distance of *X meters* from each pile being monitored, in waters of *X meters* depth. *If water velocity is 1 meter/second or greater, 1-3 meters off the bottom may be recommended for near field hydrophones and greater than 5 meters from the surface may be recommended for any far field hydrophones.* A weighted tape measure will be used to determine the depth of the water. The hydrophone*(s)* will be attached to a nylon cord, a steel chain, or other proven anti-strum features if the current is swift enough to cause strumming of the line. The nylon cord or chain will be attached to an anchor that will keep the line the appropriate distance from each pile. The nylon cord or chain will be attached to a float or tied to a static line at the surface. The distances will be measured by a tape measure, where possible, or a range-finder. The acoustic path (line of sight) between the pile and the hydrophone*(s)* should be unobstructed in all cases.

When collecting sound measurements in an area with currents (i.e., in rivers or tidally influenced areas), appropriate measures will be taken, when necessary, to ensure that the flow-induced noise at the hydrophone will not interfere with the recording and analysis of the relevant sounds (NMFS, 2012a). As a general rule, current speeds of 1.5 meters/second or greater are expected to generate significant flow-induced noise, which may interfere with the detection and analysis of low-level sounds such as the sounds from a distant pile driver or background sounds. If such measures are necessary, include a description of those measures. For example:

> *If it becomes necessary to reduce the flow-induced noise at the hydrophone, a flow shield will be described and installed around the hydrophone to provide a barrier between the irregular, turbulent flow and the hydrophone. If no flow shield is used in these situations, the current velocity will be measured and a correlation between the levels of the relevant sounds (background or pile driving) and current speed will be made to determine whether the data is valid and can be included in the analysis.*

The hydrophone calibration*(s)* will be checked at the beginning of each day of monitoring activity. *The method of calibration and calibration equipment used will be described.* NIST traceable calibration forms shall be provided for all relevant monitoring equipment. Prior to the initiation of pile driving, the hydrophone will be placed at the appropriate distance and depth as described above.

The onsite inspector/contractor will inform the acoustics specialist when pile driving is about to start to ensure that the monitoring equipment is operational. Underwater sound levels will be

continuously monitored during the entire duration of each pile being driven with a minimum one-third octave band frequency resolution. The wideband instantaneous absolute peak pressure and Sound Exposure Level (SEL) values of each strike, and daily cumulative SEL should be monitored in real time during construction to ensure that the project does not exceed its authorized take level. Peak and rms pressures will be reported in dB (re:1 µPa). SEL will be reported in dB (re: 1 $\mu Pa^2 \cdot sec$). Wideband time series recording is strongly recommended during all impact pile driving.

Prior to, and during, the pile driving activity, environmental data will be gathered, such as water depth and tidal level, wave height, and other factors that could contribute to influencing the underwater sound levels (e.g. aircraft, boats, etc.). Start and stop time of each pile driving event and the time at which the bubble curtain or functional equivalent[3] is turned on and off will be logged.

The contractor or agency will provide the following information, in writing, to the contractor conducting the hydroacoustic monitoring for inclusion in the final monitoring report: a description of the substrate composition, approximate depth of significant substrate layers, hammer model and size, pile cap or cushion type, hammer energy settingsand any changes to those settings during the piles being monitored, depth pile driven, blows per foot for the piles monitored, and total number of strikes to drive each pile that is monitored.

If airborne noise monitoring is required, background measurements from 20 Hz to 20 kHz will be taken to establish background noise without the pile driver and associated equipment running. Spectral analysis shall be provided showing the frequency content of the background noise spectra using a minimum bandwidth resolution of one-third octave using both A-weighted and unweighted filters. For monitoring pile driving noise, the microphone shall be positioned 50 feet from the driven pile, at least 6 feet above the ground, water, or deck level. The microphone should not be positioned near other noisy equipment, such as the crane engine, compressors, while operating. Equipment used for airborne noise measurements shall demonstrate calibration traceability to NIST standards.

Vibratory Pile Driving for Marine Mammal Consultations

If hydroacoustic monitoring of vibratory pile installation is conducted for marine mammal consultations NMFS (2012a,b,c) guidance should be followed. In addition to the monitoring methodology above, the following differences should be noted:

- *Use of a sound attenuation device is not required*
- *Placement of the hydrophones*

NMFS has provided guidance for measuring background and source sound levels as well as how to evaluate site specific propagation loss (NMFS 2012a, b, c). Please use this guidance to develop a methodology for hydroacoustic monitoring of vibratory pile installation if applicable.

[3] A functional equivalent must function as well as or better than the attenuation device that was proposed during consultation or required by the ESA consultation or applicable permits. It must achieve the same or better sound level reductions that were used in the calculations during ESA consultation or the permitting process.

If marine mammals are present in the project area it is recommended that background sound levels be measured to more accurately determine the site specific range to the threshold using the protocol outlined in NMFS 2012a. Background underwater sound levels will be measured for a minimum of three full 24-hour cycles (i.e., 6 am to 6 am) in the absence of construction activities to determine background sound levels (NMFS, 2012a). Analysis will be conducted using both data from the full range of frequencies recorded (typically 20 Hz to 20 kHz) and using high pass filters at 7 Hz, 75 Hz, and 150 Hz thus eliminating those frequencies below these levels (NMFS, 2012a) which follows the marine mammal functional hearing groups of Southall et al. (2007). Data will be used to calculate 30-second Root Mean Square (RMS) values for each 30 seconds of the three 24-hour cycles measured. These data will be used to calculate and plot a Cumulative Distribution Function (CDF) (NMFS, 2012a). Overall background sound levels will be reported as the 50% CDF and include a spectral analysis of the frequencies (NMFS, 2012a) for a minimum of one hourly cycle. *Alternately, if pile driving will be conducted during the daytime only the background sound levels collected during daytime hours (6am to 6pm) can be used in this analysis.*

If only one hydrophone at one distance is to be used it is acceptable for the hydrophone to be placed 10 meters from the pile at midwater depth. If hydrophones will be placed at more than one distance from the pile it is suggested that the hydrophone nearest the pile be placed at least 3H from the pile where H is the water depth at the pile and at 0.7 to 0.85H depth.

If water velocity is 1 meter/second or greater, 1-3 meters off the bottom may be recommended for near field hydrophones and greater than 5 meters from the surface may be recommended for any far field hydrophones.

Include information on methodology, instrument specifications and settings and measurement location if airborne measurements are to be included for other listed species (e.g., marine mammal haul out present, etc.), as required.

Sound Attenuation Monitoring

All monitored piles may be tested with the sound attenuation system on and off (or presence and absence) to test its effectiveness[4]. To account for varying resistance as the pile is driven; the sound attenuation device will be turned off for *(describe schedule for turning on and off)* periods during the beginning, the middle third, and near the end of the drive. After turning off the attenuation system, pile driving should not resume for at least 2 minutes to allow time for air bubbles to completely disperse. *For piles that require less than 5 minutes to drive, pile driving should occur for only two periods with the bubbles off, one near the beginning and once near the end of the drive.*

[4] Note: There may be circumstances where the U.S. Fish and Wildlife Service determines that unattenuated pile driving (striking the pile with the bubble curtain turned off) would pose a significant risk of injury to species. In those situations, the Service may request that unattenuated pile driving does not occur and that hydroacoustic monitoring be conducted to determine the extent at which certain thresholds are met instead. This will need to be determined on a case by case basis for projects that may affect listed species.

SIGNAL PROCESSING

Impact Pile Driving for Fish Consultations (and any US FWS listed, diving sea bird)

Post-analysis of the underwater pile driving sounds will include:

- Number of pile strikes per pile and per day.
- For each recorded strike (or each strike from a subset), determine the following:
  - The peak pressure, defined as the maximum absolute value of the instantaneous pressure (overpressure or underpressure).
  - The root mean squared sound pressure across 90% of the strikes energy ($RMS_{90\%}$).
  - Sound exposure level, measured across 90% of the accumulated sound energy ($SEL_{90\%}$). Calculation methodology is provided in Appendix A.
- Maximum, mean, and range of the peak pressure, with, and if applicable, without attenuation.
- Maximum, mean, range, and Cumulative Distribution Function (CDF) of the $RMS_{90\%}$, both with and if applicable, without attenuation where the CDF is used to report the percentage of $RMS_{90\%}$ values above the thresholds.
- Maximum, mean, and range of the $SEL_{90\%}$, both with and if applicable, without attenuation.
- Cumulative SEL (cSEL) across all of the pile strikes. If SEL was calculated for all strikes, cSEL is estimated as indicated in Appendix A. If SEL was calculated for a subset of strikes, cSEL is estimated as follows: cSEL = SEL_{mean} + 10*log(total # strikes).
- Where surrogate piles are monitored to represent a larger project, an estimate of the cSEL during a typical day of construction driving must be reported by summing the SEL over the expected number of pile strikes in a typical day for the larger project: cSEL = SEL_{mean} + 10*log(#strikes). The SEL_{mean} used in this calculation must correspond with the actual sound attenuation measures that will be used during construction of the larger project.
- A frequency spectrum both with and, *if applicable*, without attenuation, between a minimum of 20 and 20 kHz for up to eight successive strikes with similar sound levels.

If airborne noise monitoring is required, both A-weighted and unweighted measurements will be acquired. Broadband back-to-back RMS L_{max} (peak) and L_{eq} (average) 5-minute measurements will be made over the duration of pile driving,. L_{max} measurements should be taken with a portable analyzer set for "fast" response (125 msec). For at least one full pile sequence of each pile size and substrate type, frequency spectrum measurements (L_{max} and L_{eq}) using a minimum resolution of one-third octave bands shall be taken to show the spectral content of the impact pile. If measuring background sound levels in the absence of construction is not possible, then report the L_{95} statistic.

Vibratory Pile Driving for Marine Mammal Consultations

Background sound levels will be analyzed by calculating 30-second RMS values and plotting these values on a CDF. The average background sound level will be estimated using the 50% CDF (See Appendix B).

If vibratory installation of piles will be monitored for marine mammals, add the following text: Vibratory monitoring data will be analyzed by calculating 10-second RMS values for every 10 seconds for each pile. The 10-second RMS values will be averaged for the entire pile and reported as the average RMS. The average RMS will be calculated for each marine mammal functional hearing group as reported by Southall et al. (2007) (NMFS, 2012b).

ANALYSIS

Impact Pile Driving for Fish Consultations (and listed US FWS, diving sea bird, if relevant)

Analysis of the data from the San Francisco-Oakland Bay Bridge Pile Installation Demonstration project (PIDP) indicated that 90 percent of the acoustic energy for most pile driving impulses occurred over a 50 to 100 millisecond period with most of the energy concentrated in the first 30 to 50 milliseconds (Illingworth and Rodkin, 2001). The RMS values computed for this project will be computed over the duration between where 5% and 95% of the energy of the pulse occurs. The SEL energy plot will assist in interpretation of the single strike waveform. The single strike SEL associated with the highest absolute peak strike along with the total number of strikes per pile and per day will be used to calculate the cumulative SEL for each pile and each 24-hour period.

In addition a waveform analysis of the individual absolute peak pile strikes will be performed to determine any changes to the waveform with the *name type of noise attenuation device*. A comparison of the frequency content with and without noise attenuation will be conducted. Units of underwater sound pressure levels will be dB (re:1 µPa)and units of SEL will be re:1 $\mu Pa^2 \bullet sec$.

Vibratory Pile Driving for Marine Mammal Consultations

If vibratory installation will be monitored for marine mammals, add the following text: Vibratory monitoring results will include the maximum and average RMS values for each pile monitored and a comparison of the frequency content between piles. The maximum and overall average RMS calculated from 10-second RMS values during the drive of the pile for will be calculated for each of the functional hearing groups of Southall et al. (2007) (NMFS, 2012b).

REPORTING

If sound attenuation devices are used during the monitoring, include the following text and analysis:

An analysis of the change in the waveform and sound levels with and without the *name type of noise attenuation device for impact driving* operating will be conducted.

Preliminary results for the daily monitoring activities, if required, will be submitted/reported to the primary point of contact[5] at each of the Services within *X hours* after monitoring concludes

[5] The primary point of contact is the biologist that conducted the Section 7 consultation for the Service(s). In the event that the consulting biologist is not available, communication regarding monitoring results and reports should be addressed to the manager of the consultation branch or division with a reference to the consultation title.

for the day. In addition a final draft report including data collected and summarized from all monitoring locations will be submitted to the Services within 90 days of the completion of hydroacoustic monitoring. The results will be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile. A final report will be prepared and submitted to the Services within 30 days following receipt of comments on the draft report from the Services. The report shall include:

1. Size and type of piles.
2. A detailed description of the *name type of noise attenuation device*, including design specifications *(if applicable)*.
3. The impact hammer energy rating used to drive the piles, make and model of the hammer.
4. A description of the sound monitoring equipment.
5. The distance between hydrophone*(s) or microphone(s)* and pile.
6. The depth of the hydrophone*(s)* and depth of water at hydrophone locations.
7. The distance from the pile to the water's edge.
8. The depth of water in which the pile was driven.
9. The depth into the substrate that the pile was driven.
10. The physical characteristics of the bottom substrate into which the piles were driven.
11. The total number of strikes to drive each pile and for all piles driven during a 24-hour period.
12. The underwater wideband background sound pressure level reported as the 50% CDF *(if applicable)*.
13. The results of the hydroacoustic monitoring, as described under Signal Processing. An example table is provided in Appendix C for reporting the results of the monitoring.
14. The distance at which peak, cSEL, and rms values exceed the respective threshold values.
15. *If vibratory installation was monitored for marine mammals, add the following text: Vibratory monitoring results will include the maximum and overall average RMS calculated from 10-second RMS values during the drive of the pile for each of the functional hearing groups of Southall et al. (2007) (NMFS, 2012b).*
16. A description of any observable fish, marine mammal, or bird behavior in the immediate area will and, if possible, correlation to underwater sound levels occurring at that time.
17. *If airborne noise monitoring is required, broadband A-weighted and unweighted maximum, minimum, and average Lmax and Leq levels shall be tabulated for every pile. For each pile size and substrate type frequency spectra (one-third octave minimum frequency resolution) charts will be included to show the frequency content of Lmax and Leq signatures. The frequency content of airborne noise background levels shall also be shown. Background sound levels or L95 surrogate for background sound shall be reported.*

REFERENCES

Illingworth and Rodkin, Inc. 2001. Noise and Vibration Measurements Associated with the Pile Installation Demonstration Project for the San Francisco-Oakland Bay Bridge East Span, Final Data Report, Task Order 2, Contract No. 43A0063.

NMFS, 2012a. Guidance Document: Data Collection Methods to Characterize Underwater Background Sound Relevant to Marine Mammals in Coastal Nearshore Waters and Rivers of Washington and Oregon. Memorandum: NMFS Northwest Fisheries Science Center – Conservation Biology Division and Northwest Regional Office – Protected Resources Division, January 31, 2012.

NMFS, 2012b. Guidance Document: Data Collection Methods to Characterize Impact and Vibratory Pile Driving Source Levels Relevant to Marine Mammals. Memorandum: NMFS Northwest Fisheries Science Center – Conservation Biology Division and Northwest Regional Office – Protected Resources Division, January 31, 2012.

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Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals 33(4): 411-521.

APPENDIX A

Calculation of Cumulative SEL

An estimation of individual SEL values can be calculated for each pile strike by calculating the following integral, where T is T_{90}, the period containing 90% of the cumulative energy of the pulse (eq. 1).

$$SEL = 10\log\left(\int_0^T \frac{p^2(t)}{{p_0}^2}\,dt\right) \quad dB \qquad \text{(eq. 1)}$$

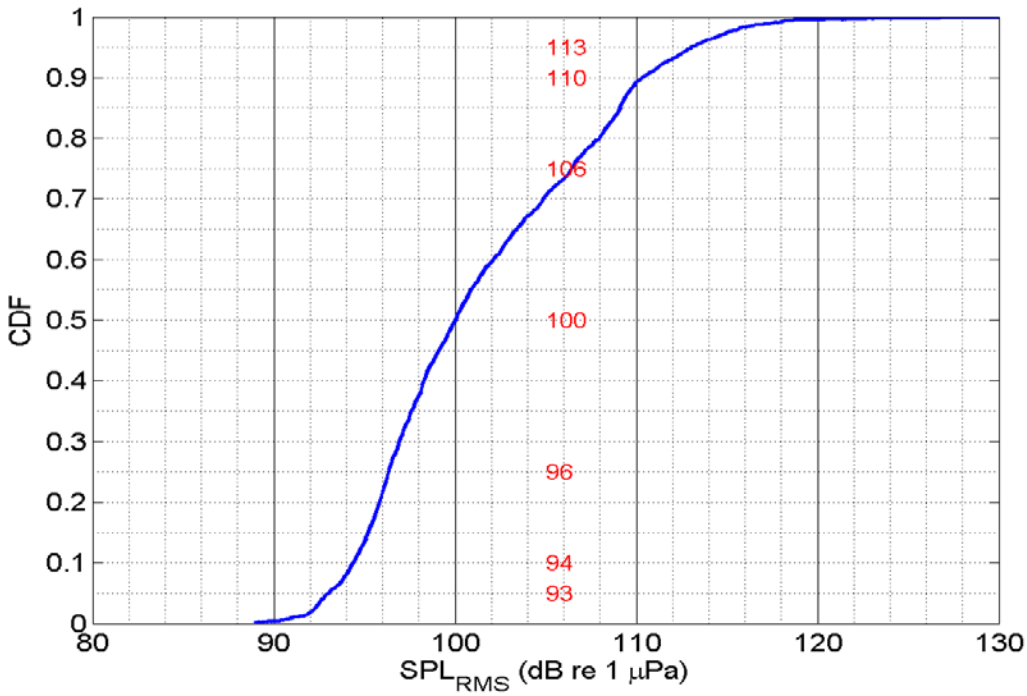
Calculating a cumulative SEL from individual SEL values cannot be accomplished simply by adding each SEL decibel level arithmetically. Because these values are logarithms they must first be converted to antilogs and then accumulated. Note, first, that if the single strike SEL is very close to a constant value (within 1 dB), then cumulative SEL = single strike SEL + 10 times log base 10 of the number of strikes N, i.e, $10\text{Log}_{10}(N)$. However if the single strike SEL varies over the sequence of strikes, then a linear sum of the energies for all the different strikes needs to be computed. This is done as follows: divide each SEL decibel level by 10 and then take the antilog. This will convert the decibels to linear units (or $uPa^2 \bullet s$). Next compute the sum of the linear units and convert this sum back into dB by taking 10Log_{10} of the value. This will be the cumulative SEL for all of the pile strikes.

APPENDIX B

Calculation of a Cumulative Distribution Function and Plot for Background Sound Level Analysis

Data from three full 24-hour underwater measurement cycles (minimum) are used to calculate a 30-second Root Mean Square (RMS) value for each 30-second period for the entire dataset. The RMS should be calculated for both the full frequency range recorded as well as a separate dataset which has been passed through a high pass filter thus eliminating those frequencies below 1000 Hz. These datasets are then grouped into 24-hour periods. To determine if the data is approximately log-normal in distribution, each 24-hour period is plotted as a Probability Density Function (PDF). Each 24-hour period can be plotted on the same PDF plot. The plots should be approximately log normal in distribution and thus can be used in the further analysis. Each day of data should have an approximately Gaussian sigmoid shape, the differences between them and the ideal might be hard to spot, but the sigmoid from day to day will show noticeable variation. Data which does not approximate a log normal distribution should be excluded from further analysis.

The Cumulative Distribution Function (CDF) plot is obtained by plotting the normalized cumulative sum vs. the bin location. You can also get the PDF from plotting the normalized bin count vs. the bin location. The normalized bin count is obtained by dividing the count column by (number of data points multiplied by the space between 2 consecutive bins). This provides the integral of the PDF equal to 1. For instructions on creating a histogram in Microsoft Excel, see: http://www.vertex42.com/ExcelArticles/mc/Histogram.html


CDF
SPL$_{RMS}$ (dB re 1 μPa)
113
110
106
100
96
94
93
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
80
90
100
110
120
130

APPENDIX C

Table 1. Example table for required information for reporting the results of hydroacoustic monitoring of pile driving.

Date and Time	Pile ID	Hammer Impact or Vibratory	# Strikes or Vibratory Seconds	Distance to Pile from Hydrophone (m)	Water Depth (m)		Peak (dB)			$SEL_{90\%}$ (dB)				$RMS_{90\%}$ (dB)			Notes
					At Pile	At H-phone	Max	Min	Mean	Max	Min	Mean	$cSEL_{90\%}$	Max	Min	Mean	

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Identified by
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PERMITS

PLAC - California Department of Fish and Wildlife,

Guidelines for Temporary Water Drafting from Streams and Rivers Supporting Anadromous Salmonids
Dated August 2000

DRAFT

STATE OF CALIFORNIA
Resources Agency
Department of Fish and Game

Guidelines for Temporary Water Drafting from Streams and Rivers Supporting Anadromous Salmonids; Special Application for Timber Harvest Activities

by

Richard Macedo

August 2000

Preliminary Draft - Subject to Revision

The purpose of this paper is to provide concise and updated criteria for protecting anadromous salmonids from impacts associated with water drafting. Criteria in this report are directed at anyone responsible for operating, permitting or overseeing small, temporary water diversion projects associated with timber harvest activities in coastal timberlands supporting salmon, steelhead or other important aquatic resources. Information in this report may not be applicable to water diversion projects in other locations. Criteria in this paper may change as a result of improved biological knowledge and/or changes associated with state or federal regulation.

Laws and policies governing the Department of Fish and Game (Department) in this matter include Section 1600 et seq. and Section 6100 of the Fish and Game Code, Section 703 of the Fish and Game Code (specifically the policies identified as "Salmon", "Steelhead Rainbow Trout", "Endangered and Threatened Species", "Water", and the "Joint Policy Statement on Coho Salmon" between the California State Board of Forestry and the California Fish and Game Commission). Fish and Game Code Section 1600 et seq. requires that the Department enter into an agreement with a person proposing to, among other actions, substantially divert or obstruct the natural flow of a river, stream, or lake. This includes water drafting. Applications can be obtained from a Department office.

Streams and rivers are used as water sources for timber harvest operations in coastal California. Water is used by itself or in combination with additives to minimize dust and improve running conditions on unpaved roads. Watering roads for dust abatement is often an enforceable condition for approved timber harvest plans. In addition to roads, water may be used in conjunction with controlled burns, wildfire suppression and watering for revegetation projects.

The typical water drafting system for a timber harvest operation involves a truck outfitted with a three to four thousand gallon storage tank, a truck-mounted centrifugal pump and an extendable intake hose. Pools are often targeted for diversion sites because they have sufficient volume to permit high diversion rates. Operators often pump at or near maximum rates to limit down time, thereby maximizing the amount of road surface that can be watered in a given period. To prevent damage to the pump, operators avoid entraining rocks or air during pumping. Typically, an operator will back next to or pull alongside a pool, position a hose with the intake end near the bottom of a pool and commence pumping. Depending on the size and condition of the pump, an operator may fill a four thousand gallon water truck in 10 to 20 minutes. For most systems, the drafting rate can be adjusted.

The following three variables should be considered when designing a small, portable water drafting operation; 1) screen size, 2) approach velocity and 3) diversion rate. The following criteria for screen size, approach velocity and diversion rate are designed to protect fry-size salmonids from water diversion activities in California's timberlands. Use of these criteria may protect other species which occupy the same streams and lakes.

<u>Screen Mesh Size</u>:

Openings in perforated plate and woven wire screens shall not exceed 3/32 inches (2.38 millimeters). Slot opening in wedge wire screens shall not exceed 1.75 mm.

To prevent entrainment of fish during water diversion, the pump intake shall be fitted with screen made of woven mesh, perforated plate, wedge wire, or other durable fabric. The screen medium shall be able to withstand forces related to pumping and be of sufficient size to prevent small fish from entering the intake and being pumped along with diverted water.

Approach Velocity:

The velocity of water across the screen surface shall not exceed 0.33 feet/second at any point on the screen surface. To achieve this standard, the screen shall be kept clean and free of accumulated algae, leaves or other debris which could block portions of the screen surface and increase approach velocities at any point on the screen. The screen shall be supported above the bed of the streams so that no part of the screen surface is obstructed. Water truck operators shall move drafting hoses with attached screens in and out of the water after each drafting operation. The screen should be brushed clean and inspected each time it is placed into the water. This practice will usually prevent screens from accumulating significant amounts of debris and essentially replicate the function of a self-cleaning screen. Where a stationary pump is used, the screen should be checked frequently to ensure it is kept clean and free of debris.

Diversion Rate:

Water drafting may cause adverse impacts to juvenile salmonids if flow in source streams is reduced to insufficient levels. For these cases, a specific water drafting plan shall be developed. Concerns over impacts caused by reduced flows and the subsequent need for a water drafting plan may not be necessary if the proposed water diversion conforms to the following standards:

a. Flow in the source stream during water drafting will remain at 2.0 $feet^3$/second or greater, or

b. If diverting from a pool, reduction in pool volume will not exceed 10 percent, or

c. Diversion rate will not exceed 10 percent of the surface flow from the source stream, or

d. Instantaneous diversion rate is less than 350 gallons per minute (0.78 $feet^3$/second)

For water diversion projects that will not meet criteria a through d above, a water drafting plan shall be prepared and approved by the Department through an Agreement pursuant to Section 1600 et seq. of the Fish and Game Code. This plan shall include the following:

v. Determine the instantaneous flow reduction and duration of reduction from the source stream.

vi. Disclose potential impacts associated with both the instantaneous flow reduction and

cumulative flow reduction and total volume removed from the source stream.

vii. Identify proposed recommendations for minimizing adverse impacts such as a reduced hose diameter, decrease in pumping rates, use of alternative sites and/or restrict number of water withdraws from one location.

viii. Require operators to maintain a water diversion log which records the date, time, pump rate, filling time, screen cleaning and inspection, and bypass flow from the source stream.

ix. Conduct a pre-operations briefing with personnel who will be operating water drafting equipment and charged with compliance of the water diversion plan.

Additional Considerations:

While outside the scope of this report, standards for protecting anadromous salmonids may also be sufficient for protecting other species of fish, amphibians, reptiles and invertebrates. These considerations should be made on a case-by-case and species-by-species bases.

In certain situations and at specific sites, the requirement for screen and approach velocity criteria may be disregarded if an approved watering hole or sump is constructed adjacent to a stream or river. Large gravel bars adjacent to streams may be appropriate sites for constructing temporary water drafting holes. Unaltered sections of the gravel bar which lie between the watering hole and the flowing stream may provide the functional equivalent of a screen. In addition, approach velocities along the gravel bar must meet Department standards (e.g. < 0.33 feet/second for fry-size fish). Construction and use of these watering holes will be restricted to summer periods when storms and increasing stream flows are uncommon. Pursuant to Section 1600 et seq. of the Fish and Game Code, construction and use of watering holes will likely require a Lake and Streambed Alteration Agreement.

Example for Calculating Surface Area for Intake Screens:

The purpose of this example is to outline steps for calculating the appropriate screen surface area necessary to meet Department guidelines for approach velocities.

Scenario:

A water drafting operation will use a 4,000 gallon truck to divert water from a small stream which supports fry-size salmon and steelhead. At the maximum rate, the truck can be filled in 15 minutes. Calculate the surface area of screen necessary to comply with Department guidelines for approach velocities not to exceed 0.33 feet/second.

Step 1:

Calculate diversion rate in gallons per minute (gpm) with the pump running at full capacity.

$$\frac{4{,}000 \text{ gallons}}{15 \text{ minutes}} = 266.7 \text{ gpm}$$

Step 2:

Convert diversion rate from gpm to feet^3/second (cfs). Note, to covert gpm to cfs, multiple the gpm figure by 0.00223.

$$266.7 \text{ gpm} \times 0.00223 = 0.59 \text{ cfs}$$

Step 3:

Using the maximum acceptable approach velocity of 0.33 feet/second, calculate how much surface area of screen is needed for a diversion rate of 0.59 cfs.

$$\frac{0.59 \text{ feet}^3/\text{second}}{0.33 \text{ feet/second}} = 1.79 \text{ feet}^2 \text{ (square feet)}$$

Answer: For this example, a screen surface area of 1.79 square feet or larger will satisfy the Department's standard for approach velocity.

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PLAC - California Aquatic Invasive Species Management Plan

(California Department of Fish And Game, 2008)

California Aquatic Invasive Species Management Plan

State of California
Resources Agency
Department of Fish and Game
January 2008

Funded in part by the
Ocean Protection Council
State Coastal Conservancy
and
U.S. Fish and Wildlife Service

State of California

Arnold Schwarzenegger, Governor

Approved:_____ **Date:** 18 Jan 08

Resources Agency

Mike Chrisman, Secretary

Department of Fish and Game

John W. McCamman, Acting Director

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TABLE OF CONTENTS

ACKNOWLEDGMENTS IV

ACRONYM GLOSSARY V

EXECUTIVE SUMMARY XI

1. INTRODUCTION 1

2. AIS ECOLOGICAL & ECONOMIC IMPACTS 7

3. VECTORS OF AIS 16
- Vector 1. Commercial Shipping 19
- Vector 2. Commercial Fishing 21
- Vector 3. Recreational Equipment & Activities 22
- Vector 4. Trade in Live Organisms 23
- Vector 5. Construction in Aquatic Environments 27
- Vector 6. Water Delivery & Diversion System 27

4. MANAGEMENT FRAMEWORK 29
- General Framework 29
- An Overview of Current AIS Management Activities in California 35
- Gaps & Challenges 45

5. SUMMARY OF AIS LAWS, REGULATIONS & AUTHORITIES 46

6. MANAGEMENT OBJECTIVES, STRATEGIES & ACTIONS 50
- OBJECTIVE 1: COORDINATION & COLLABORATION 53
- OBJECTIVE 2: PREVENTION 63
- OBJECTIVE 3: EARLY DETECTION & MONITORING 75
- OBJECTIVE 4: RAPID RESPONSE & ERADICATION 79
- OBJECTIVE 5: LONG-TERM CONTROL & MANAGEMENT 82
- OBJECTIVE 6: EDUCATION & OUTREACH 86
- OBJECTIVE 7: RESEARCH 93
- OBJECTIVE 8: LAWS & REGULATIONS 96

7. PRIORITIES, IMPLEMENTATION & PLAN EVALUATION 98

8. CASE STUDIES IN ERADICATION & CONTROL 117
- 1. CAULERPA 117
- 2. SMOOTH CORDGRASS 119
- 3. BRAZILIAN ELODEA 123

4. EURASIAN WATERMILFOIL 127
5. OTHER AIS SPECIES OF CONCERN 129

9. LITERATURE CITED 132

FIGURES

1: Nonindigenous Species Surveys from California Harbors & Bays....4
2: AIS Invasion Progression, Management and Cost.....15
3: Wetted Surface Area.....21
4: Ballast Water Reporting and Discharge Rates.....42
5: AIS Coordinating Structure.....58

TABLES

1: CAISMP Action Summary xi
2: Common Bioinvasion Vectors 17
3: Species Management Types.....31
4: Lead AIS Agency Contacts in California.....37
5: CAISMP Implementation Table 100
6: Funds Spent on Ongoing AIS Programs and Activities 114

APPENDICES

A: Draft California Rapid Response Plan 2
B: Federal Authorities, Legislation & Agencies.....26
C: State Authorities, Legislation & Agencies 37
D: Other AIS Interests: Coordinating Committees,
Educational Initiatives & Special Interest Groups 46
E: AIS Plan Development & Process 53
F: Executive Summary of *Biological Invasions: Recommendations for U.S. Policy and Management*,
Position Paper of Ecological Society of America.....71
G: List of Regulated Species in California.....74

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2007 Plan

This 2007 final plan was developed by Karen McDowell of the San Francisco Estuary Project (SFEP), with direction provided by Susan Ellis of DFG and Abe Doherty of the SCC. The Invasive Species Program staff, including Julie Horenstein and Dominique Norton, was instrumental to document completion. A number of other key people provided extensive and invaluable input into the plan: Maurya Falkner and Lynn Takata of the California State Lands Commission (SLC), Pat Akers of the California Department of Food and Agriculture (DFA), Marcia Carlock of the California Department of Boating and Waterways (DBW), Marian Ashe and Mary Ann Showers of DFG and Jeff Herod of USFWS. The three 2006 public meetings were ably facilitated by Austin McInery of the Center for Collaborative Policy. The report would not have been possible without the editorial services of Ariel Rubissow Okamoto and her team (including Darren Campeau, Kathryn Ankrum and Kathleen Wong). Additional editing and public meeting support was provided by Paula Trigueros, SFEP. Graphics design, layout and public meeting support was provided by Debbi Egter Van Wissekerke, SFEP.

2004 Plan Draft

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ACRONYM GLOSSARY

This section describes acronyms and other terms concerning entities involved in AIS management, species names used in this plan and a brief glossary.

Acronyms*

AE	Agency Executives (Upper management of state agencies and departments)
AISWG	Aquatic Invasive Species Working Group (see Action 1A3)
ANSTF	Aquatic Nuisance Species Task Force
BML	Bodega Marine Lab
BOE	Board of Equalization
CAAIST	California Agencies Aquatic Invasive Species Team (see Action 1A2)
CAC	County Agricultural Commissioners
CACASA	California Agricultural Commissioners and Sealers Association
CAISMP	California Aquatic Invasive Species Management Plan
CALFED	CALFED Bay-Delta Program
CBC	California Biodiversity Council
CCC	California Coastal Conservancy
CDF	California Department of Forestry and Fire Protection
CeNCOOS	Central and Northern California Ocean Observing System
DBW	California Department of Boating and Waterways
DESP-UCD	Department of Environmental Science and Policy, University of California, Davis
DFG	California Department of Fish and Game
/OSPR	/Office of Spill Prevention and Response
DFA	California Department of Food and Agriculture
DHS	California Department of Health Services
DOE	California Department of Education
DPR	California Department of Pesticide Regulation
DWR	California Department of Water Resources
FA	Federal Agencies
FY	State fiscal year (July 1 through June 30)
ISAC	United States Invasive Species Advisory Committee
ISP	San Francisco Estuary Invasive *Spartina* Project
NGOs	Non-governmental Organizations
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NPDES	National Pollutant Discharge Elimination System
OPC	California Ocean Protection Council
PARKS	California Department of Parks and Recreation
PBWG	Pacific Ballast Water Group
PSMFC	Pacific States Marine Fisheries Commission
RCD	Resource Conservation District
RI	Research Institutions, universities and affiliated programs
RWQCB	Regional Water Quality Control Board
SCC	State Coastal Conservancy
SCCOOS	Southern California Coastal Ocean Observing System
Sea Grant	California Sea Grant College Program
SFEP	San Francisco Estuary Project
SH	Stakeholders
SLC	California State Lands Commission
SWRCB	State Water Resources Control Board
TRPA	Tahoe Regional Planning Agency
TRCD	Tahoe Resource Conservation District
UCCE	University of California Cooperative Extension
USDA	United States Department of Agriculture

/ARS	/Agricultural Research Service
/APHIS	/Animal and Plant Health Inspection Service
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRP	Western Regional Panel

** Acronyms are used largely after the first appearance of an agency name within a chapter. Full names are often spelled out again in subsequent chapters if it has been many pages since the prior mention or if the full name is central to the information presented.*

Important Terms

These terms are used throughout, but especially in Chapter 6 and in the Table 5: CAISMP Implementation Matrix.

Implementing Entity: Since this is a state plan, these are state agencies, programs within state agencies, or groups that include state agencies that fund and have primary accountability and authority for an action being carried out. In Chapter 6, the Implementing Entity appears in **BOLD**. This term is also used in the Implementation Table in Chapter 7.
Cooperating Organizations: Entities whose participation is needed or may be needed to conduct an action. In Chapter 6, cooperating organizations appear in regular, non-bold, type.
Non-governmental Organizations (NGOs): Non-profit organizations directly involved in AIS research or control activities.
Stakeholders: Relevant recreation, industry, local government, landowner representatives and special interest groups.
Plan Implementation and Science Advisory Panels: Panels created per Action 1A5 to help the work of the CAAIST and AISWG.

Species Names

All species names mentioned in this document appear below in full, with their scientific names for reference. Common names are used throughout the document, except in those cases where the scientific name has become the preference for common use (*Arundo, Egeria, Hydrilla, Caulerpa,* etc.). All names appear in full in Appendix G, the Regulated Species List, for the purposes of regulatory clarity.

Invasive Species

1. African clawed frog, *Xenopus laevis*
2. Alligatorweed, *Alternanthera philoxeroides*
3. Asian overbite clam, *Corbula amurensis**
4. Asian swamp eel, *Monopterus albus*
5. Atlantic salmon, *Salmo salar*
6. *Botrylloides diegensis*
7. Brazilian elodea, *Egeria densa* (most commonly called *Egeria*)
8. Bullfrog, *Rana catesbeiana*
9. *Caulerpa taxifolia* (most commonly called *Caulerpa*)
10. Channeled apple snail, *Pomacea canaliculata*
11. Chinese mitten crab, *Eriocheir sinensis*
12. Curly pondweed, *Potamogeton crispus*
13. Dwarf eelgrass, *Nanozostera japonica*
14. English cordgrass, *Spartina anglica*
15. Eurasian watermilfoil, *Myriophyllum spicatum*
16. European frogbit, *Hydrocharis morsus-ranae*
17. European green crab, *Carcinus maenas*
18. Giant reed, *Arundo donax* (most commonly called *Arundo*)
19. Giant salvinia, *Salvinia molesta*
20. Golden mussel, *Limnoperna fortunei*
21. Green sunfish, *Lepomis cyanellus*
22. *Hydrilla verticillata* (most commonly called *Hydrilla*)
23. Japanese seaweed, *Sargassum muticum*
24. Knotted wrack, *Ascophyllum nodosum*
25. Melaleuca, *Melaleuca quinquenervia*
26. *Microcystis* spp.
27. Mosquitofish*, poecliliids*
28. New Zealand mudsnail, *Potamopyrgus antipodarum*
29. Northern Pacific seastar, *Asterias amurensis*
30. Northern pike, *Esox lucius*
31. Northern snakehead, *Channa argus*
32. Paleyellow iris, *Iris pseudacorus*
33. Parrot feather milfoil, *Myriophyllum aquaticum*
34. Perennial pepperweed, *Lepidium latifolium*
35. Purple loosestrife, *Lythrum salicaria*
36. Quagga mussel, *Dreissena bugensis*
37. Sabellid polychaete, *Terebrasabella heterouncinata*
38. Sacramento pikeminnow, *Ptychocheilus grandis*
39. Saltcedar, *Tamarix ramosissima*
40. Saltmeadow cordgrass, *Spartina patens*
41. Sea lamprey, *Petromyzon marinus*
42. Shimofuri goby, *Tridentiger bifasciatus*
43. Shipworm, *Teredo navalis*
44. Small cordgrass*, Spartina maritima*
45. Smooth cordgrass, *Spartina alterniflora*
46. Wakame, *Undaria pinnatifida*
47. Water hyacinth, *Eichhornia crassipes*
48. Water lettuce, *Pistia stratiotes*
49. Yellowfin goby, *Acanthogobius flavimanus*

50. Yellow floating heart, *Nymphoides peltata*
51. Zebra mussel, *Dreissena polymorpha*

Native Species

1. Brown turban snails, *Tegula brunnea*
2. California clapper rail, *Rallus longirostris obsoletus*
3. Chinook salmon, *Oncorhynchus tshawytscha*
4. Dungeness crabs, *Cancer magister*
5. Delta smelt, *Hypomesus transpacificus*
6. Giant kelp, *Macrocystis pyrifera*
7. Green sturgeon, *Acipenser medirostris*
8. Pickleweed, *Salicornia* spp
9. Salt marsh harvest mouse, *Reithrodontomys raviventris*
10. Soft bird's-beak, *Cordylanthus mollis* ssp. *mollis*
11. Steelhead trout, *Oncorhynchus mykiss*

* This document refers to the locally known "Asian clam" as the "Asian overbite clam." Many scientists have begun to call it the "overbite" clam to distinguish it from other invasive clams from the Far East. The species' scientific name is due to be officially modified from *Potamocorbula amurensis* to *Corbula amurensis* in the forthcoming *Light's Manual* and many scientists have begun to use the shorter species name. Other literature citations for the name change can be found on page 5 of the following:
http://www.iep.ca.gov/report/newsletter/2005_newsletters/IEPNews_spring2005final.pdf

Glossary

Accidental introduction: An introduction of nonindigenous species that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as the transport of nonindigenous species in ballast water or in water used to transport fish, mollusks or crustaceans for aquaculture or other purposes.

Biocontrol: The use of living organisms, such as predators, parasites and pathogens, to control pest animals (e.g. insects), weeds or diseases.

Ballast water: Any water and associated sediments used onboard a ship to increase the draft, change the trim, regulate the stability or maintain the stress loads of the vessel.

Control: Eradicating, suppressing, reducing or managing invasive species populations, preventing spread of invasive species from areas where they are present and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

Cryptogenic species: An organism of unknown origin; may be introduced or native.

Ecological integrity: The extent to which an ecosystem has been altered by human behavior; an ecosystem with minimal impact from human activity has a high level of integrity; an ecosystem that has been substantially altered by human activity has a low level of integrity.

Eradicate: For the purpose of this plan, eradication is the complete elimination of an invasive species from a specific part of California or the entire state.

Established: An introduced organism with a permanent population(s), i.e., one that has the ability to reproduce and is not likely to be eliminated by humans or natural causes.

Exotic: Any species or other variable biological material that enters an ecosystem beyond its historic range, including such organisms transferred from one country to another. Also known as nonindigenous or non-native.

Fouling: An accumulation of organisms that attaches to naturally occurring and manmade submerged hard surfaces such as rocks, shells, ships, intake pipes, and other submerged equipment or machinery. Mobile organisms that may be tucked in nooks created by the larger animals are also considered part of the “fouling community”.

Genetic dilution: Genetic dilution occurs when introduced organisms add their genetic material to native populations through hybridization. This can result in populations that are less well adapted to their environment, potentially leading to the decline of those populations.

Host: A living animal or plant that supports parasitic animals, plants or microbes, internally or on its surface.

Incipient infestation: A small colony of an invasive species that has spread to a new area.

Intentional introduction: All or part of the process by which a nonindigenous species is purposefully introduced into a new area.

Introduction: The intentional or unintentional escape, release, dissemination or placement of a species into a California ecosystem as a result of human activity.

Invasive species: For the purpose of this plan, the term refers to species that establish and reproduce rapidly outside of their native range and may threaten the diversity or abundance of native species through competition for resources, predation, parasitism, hybridization with native populations, introduction of pathogens, or physical or chemical alteration of the invaded habitat. Through their impacts on natural ecosystems, agricultural and other developed lands, water

delivery and flood protection systems, invasive species may also negatively affect human health and/or the economy.

Keystone species: A species whose loss would have a disproportionately large effect on its ecosystem relative to its abundance.

Native species: A species within its natural range or natural zone of dispersal, i.e., within the range it would or could occupy without direct or indirect introduction and/or care by humans.

Non-native or Nonindigenous species: A species that enters an ecosystem beyond its historic geographic range. Also known as exotic or alien species. Other taxa can be considered non-native or nonindigenous, such as families, genera, subspecies or varieties.

Nuisance species: For the purpose of this plan, the term is synonymous with invasive species.

Pathogen: A microbe or other organism that causes disease.

Pathways: Natural and human connections that allow movement of species or their reproductive propagules from place to place.

Pioneer infestation: See incipient infestation.

Taxa: Taxa are groups used to classify organisms (e.g. kingdom, phylum, class, order, family, genus and species). Taxa is the plural form of taxon.

Vector: Vector is synonymous with “pathway,” see definition above. As such, vector is defined more broadly in this report than in its narrower more common definition as a pathway solely for pathogens.

Watershed: The geographic area that drains to a single water body or hydrographic unit such as a lake, stream reach or estuary.

EXECUTIVE SUMMARY

Invasion of California Waters

Californians have benefited from the introduction to this state of various fish, plants and other species necessary for food or other human pursuits; however, there are many other introduced species that can wreak havoc on the state's environment and economy. Those species that cause harm and spread quickly from their point of introduction are often called "invasive." For these species, a single individual may produce thousands of seeds, masses of larvae or reproduce from nothing bigger than bits of stems, roots or leaves. Those that live in or near the water – aquatic invasive species – can be easily dispersed to distant water bodies or new ecosystems by currents, tides, river flows, streams, floods and other water flows.

This plan proposes management actions for addressing **aquatic** invasive species (AIS) threats to the State of California. It focuses on the non-native algae, crabs, clams, fish, plants and other species that continue to invade California's creeks, wetlands, rivers, bays and coastal waters. State surveys indicate that at least 607species of aquatic invaders can be found in California's estuarine waters. These invaders cause major impacts: disrupting agriculture, shipping, water delivery, recreational and commercial fishing; undermining levees, docks and environmental restoration activities; impeding navigation and enjoyment of the state's waterways; and damaging native habitats and the species that depend on them. As the ease of transporting organisms across the Americas and around the globe has increased, so has the rate of AIS introductions.

Vectors & Entry Points

Transoceanic shipping is a major source of AIS invaders. The state estimates that about 9.1 million metric tons of ballast water was discharged in California waters in 2005. Hull fouling may rival ballast water discharge as a leading historical cause of harmful AIS introductions. AIS can also be transported from place to place via other pathways or vectors. Invasive species can cling to recreational gear, fishing equipment, drilling platforms, floating debris and docks. They may escape or be released into state waters from aquaculture packing materials, ornamental ponds and aquariums. Shoreline restoration and construction projects, as well as water-based scientific research, also transport species. The threat of aquatic invasions poses major challenges to California's aquatic systems managers and policy makers. Resources must be devoted to preventing new introductions as well as to containing existing populations. Current state resources and programs are far from adequate to perform this task.

Need for Statewide Action

Though a number of state agencies have been individually addressing AIS concerns or coordinating on individual projects, the scope of the problem has now reached a scale, complexity and cost requiring a more comprehensive statewide approach. Thus, the main purpose of this new California plan is to coordinate state programs, create a statewide decision-making structure and provide a shared baseline of data and agreed-upon actions so that state agencies may work together more efficiently. While the plan recognizes and provides for coordination with the federal, regional, local, private and nonprofit efforts to manage AIS, its central actions concern internal state coordination. As such, the plan ensures state action on high priority activities, improves utilization of scarce state resources and helps bridge gaps in coverage. Plan development was directed by the California Department of Fish & Game and includes input from state agencies involved in AIS management, as well as from the public and stakeholders, over a period of five years.

Plan Goals & Chapters

The plan's overall goal is to identify the steps that need to be taken to minimize the harmful ecological, economic and human health impacts of AIS in California. The plan contains background chapters on AIS environmental and economic impacts. It describes vectors of AIS entry into the state including, but not limited to, commercial shipping, trade in live organisms, construction in aquatic habitats, and water deliveries and diversions. Subsequent chapters explain how AIS are managed in general and what the state has been doing to manage them to date. In addition, case studies for managing four specific AIS appear in the last chapter of this plan.

Beyond this background information and context, the heart of the plan lies in 163 different management actions organized under eight objectives (Table 1):

1. Coordination & Collaboration
2. Prevention
3. Early Detection & Monitoring
4. Rapid Response & Eradication
5. Long-term Control & Management
6. Education & Outreach
7. Research
8. Laws & Regulation

The interagency process of developing and discussing each of these actions, and deciding which entities will undertake them, provides a strong foundation for improving state management and coordination in the years ahead. It also supports the state's first rapid response process for high-risk invaders, which is detailed in Appendix A of this plan.

Current Priorities

The highest priorities among the 163 actions identified in this plan are as follows:

1. Formalize the creation of two major new coordinating entities, one entirely for state agencies and one for a broader range of AIS interests (Action 1A2 and 1A3).

2. Formalize a process for the team of state AIS managers to share information with and get input from agency executives (Action 1A1).

3. Secure funding for state AIS staff (Action 1C3).

4. Conduct a statewide assessment of the risk from four specific AIS vectors: commercial fishing, recreational boating, live bait, and live imported seafood (Actions 2B7, 2C1, 2D1, and 2D4).

5. Fund and launch early detection and rapid response actions, including efforts to coordinate various AIS monitoring programs and expand monitoring of freshwater systems (Strategies 3A and 4A, and Appendix A).

If these core actions can be accomplished, it will provide a basis for pursuing the larger list of AIS management priorities in the future.

Conclusion

Aquatic invasive species are already a serious problem for California. Invasions around the world suggest that environmental and economic impacts from AIS will soon become much greater. This plan provides the state's first comprehensive, coordinated effort to prevent new invasions, minimize impacts from established AIS and establish priorities for action statewide. In addition, it proposes a process for annual plan evaluation and improvement so that AIS can continue to be managed in the most efficient manner in the future.

Table 1: CAISMP Action Summary

The actions described in this table are abbreviated to provide a summary. See Chapter 6 for complete and accurate language of these actions.

OB1: COORDINATION & COLLABORATION

Internal State Coordination

1A1. Develop an executive level consultation process.

1A2. Formalize the California Agencies AIS Team (CAAIST).

1A3: Establish, fund and staff an Aquatic Invasive Species Working Group (AISWG).

1A4. Evaluate the need for an invasive species center.

1A5. Form and fund technical advisory panels.

1A6: Draft and update a list of AIS at high risk for introduction.

1A7. Identify lead state agency for particular AIS, water bodies and invasion vectors.

1A8. Identify agency personnel required for AIS management.

1A9. Improve state websites related to AIS.

1A10. Assess effectiveness of and gaps in state AIS programs.

1A11. Coordinate AIS management with SWRCB & RWQCBs.

1A12. Develop and update AIS expert list.

1A13. Develop boilerplate AIS language for official agency comments.

Local, Nat'l & Int'l Coordination

1B1. Identify AIS reps in government agencies and NGOs.

1B2. Identify conflicts and overlaps among government and NGO AIS programs.

1B3. Invite community groups for AIS planning and education.

1B4. Expand participation in local AIS efforts and task forces.

1B5. Expand participation in regional, national and international AIS task forces.

1B6. Partner with Mexico, Canada, Pacific Coast and Colorado River states.

1B7. Participate in national and international conferences.

Funding

1C1. Identify and apply for state and national grant funding.

1C2. Establish stable, long-term funding to help implement this plan.

1C3. Provide state funding for AIS positions.

1C4. Provide funding for AIS rapid response actions.

1C5. Hire a funding development specialist.

1C6. Provide new funding mechanisms.

OB2: PREVENTION

Regional Vector Assessment

2A1. Rank AIS vector importance in different regions of California.

Commercial Vessels & Maritime Activities

2B1. Quantify ballast water and hull fouling vectors and assess invasion risk.

2B2. Continue and improve state ballast water inspection and enforcement program.

2B3. Implement discharge standards for treated ballast water.

2B4. Identify and address gaps in Marine Invasive Species Act.

2B5. Develop a commercial vessel fouling outreach and management program.

2B6. Investigate how moving maritime structures can contribute to AIS dispersal.

2B7. Quantify and assess the role of commercial fishing vessels as AIS vectors.

2B8. Develop a commercial fishing outreach and management program.

Recreation

2C1. Quantify and assess recreational boating as an AIS vector.

2C2. Develop a recreational boating outreach and management program.

2C3. Develop a watercraft inspection program for high priority boat launch sites.

2C4. Quantify and assess recreational fishing as an AIS vector.

2C5. Develop a recreational fishing outreach and management program.

2C6. Develop guidelines for: disposal of invasive species at marinas; cleaning of fishing gear and equipment; disposal of live bait.

Bait, Seafood, Aquaculture & Aquarium

2D1. Quantify and assess bait as an AIS vector.

2D2. Work with the bait industry to develop prevention strategies.

2D3. Develop a bait outreach and management program.

2D4. Quantify and assess imported seafood as an AIS vector.

2D5. Work with the live seafood industry to develop preventative strategies.

2D6. Develop an imported seafood outreach and management program.

2D7. Assess risks posed by water handling systems.

2D8. Educate aquaculture industry on containment systems.

2D9. Develop an aquaculture outreach and management program.

2D10. Quantify and assess how aquarium and aquascaping trades contribute to AIS introductions.

2D11. Work with aquarium, water garden and other industries on accessible disposal.

2D12. Implement an aquarium and aquascaping outreach and management program.

Fisheries Enhancement

2E1. Quantify and assess fisheries enhancement as an AIS vector.

2E2. Review DFG practice of intentional introductions of non-native species for recreational purposes.

2E3. Reduce unauthorized stocking of non-native species.

2E4. Weigh benefits of mosquitofish introduction.

Research, Management & Education

2F1. Quantify and assess research, resource management and educational activities as AIS vectors.

2F2. Establish protocols to minimize spread of AIS by these activities.

2F3. Evaluate regulations and protocols for in-water research.

2F4. Quantify and assess live aquatic species shipments for research as an AIS vector.

Table 1: CAISMP Action Summary (continued)

Construction & Restoration

2G1. Quantify and assess construction activities as an AIS vector.

2G2. Work with industry to develop equipment decontamination guidelines.

2G3. Develop a construction outreach and management program.

2G4. Quantify and assess restoration activities as an AIS vector.

2G5. Encourage the use of native species.

2G6: Develop a restoration outreach program.

Water Diversion

2H1. Quantify and assess the water delivery and diversion system as an AIS vector.

2H2. Develop an outreach and management program for the system.

Enforcement & Inspection

2I1. Increase staffing and hours at DFA Border Protection Stations.

2I2. Develop guidelines for border inspections.

2I3. Increase DFG enforcement of current regulations on prohibited and restricted species.

2I4. Ensure adequate staffing and cargo inspection guidelines for port and airport enforcement.

2I5. Continue disease sampling for shipments and stocks of live aquatic species.

2I6 Identify mail order, online vendors selling California prohibited and restricted species.

OB3: EARLY DETECTION & MONITORING

Early Detection

3A1. Assess current monitoring of state waters for early detection opportunities.

3A2. Assess how the state's Marine Invasive Species Program monitoring can aid early detection.

3A3. Develop a statewide approach to early detection.

3A4. Outreach to those regularly sampling state waters.

3A5. Create and train a statewide citizen monitoring network.

3A6. Engage professional divers in early detection network.

3A7. Review efficacy of the state's AIS early detection systems.

Long-Term Monitoring

3B1. Assess long-term AIS monitoring of state waters.

3B2. Coordinate with ocean observing groups.

3B3. Monitor locations with a high invasion rate.

3B4. Monitor the population growth and dispersal of established AIS.

3B5. Fund the incorporation of DFG's historical stream surveys and report findings into a central database.

3B6. Include maps of existing AIS in California waters in the DFG BIOS system.

3B7. Review the efficacy of long-term monitoring systems.

OB4: RAPID RESPONSE & ERADICATION

Rapid Response

4A1. Develop and implement a statewide rapid response plan.

4A2. Evaluate and coordinate existing systems for reporting AIS sightings.

4A3. Develop species- and/or location-specific rapid response plans.

4A4. Explore permanent funding for rapid response.

Eradication

4B1. Review effectiveness of eradication programs.

4B2. Continue and complete current eradication efforts.

4B3. Standardize criteria for identifying priority species for eradication.

4B4. Develop a method to prioritize sites of AIS invasion concern.

4B5. Identify ecologically sensitive waters requiring additional precautions.

OB5: LONG-TERM CONTROL & MANAGEMENT

Control

5A1. Develop a method or criteria to prioritize control actions.

5A2. Prioritize control efforts for existing and new organisms of concern.

5A3. Continue ongoing control programs.

5A4. Develop species- and site-specific control plans.

5A5. Provide technical assistance to watershed councils, irrigation districts and other groups.

Limit Dispersal to New Areas

5B1. Establish boat washing stations and disposal facilities at infested waters.

5B2. Install AIS warning and information signs in infested areas.

5B3. Use volunteer monitors to conduct AIS inspections.

5B4. Develop criteria for enforcing closures of infested areas.

Protect Natives

5C1. Prioritize ecologically sensitive areas at risk of AIS impacts.

5C2. Coordinate entities to meet AIS protection and restoration objectives.

5C3. Develop GIS maps showing coincidence of AIS and critical ecosystems.

5C4. Establish guidelines for when AIS eradication or control will occur in sensitive areas.

5C5. Adopt guidelines on best practices for timber, agricultural or livestock activities.

5C6. Assess guidelines for preventing AIS spread in habitat restoration and shoreline landscaping projects.

Table 1: CAISMP Action Summary (continued)

OB6: EDUCATION & OUTREACH

Outreach

6A1. Inventory education and outreach efforts and develop a state AIS communication strategy.

6A2. Partner with ongoing outreach campaigns.

6A3. Develop a DFG Communications Plan.

6A4. Develop posters, brochures and articles for industry sectors and user groups.

6A5. Develop permanent interpretive displays at marinas, boat ramps and fishing sites.

6A6. Work directly with industry trade shows to deliver the AIS message.

6A7. Present AIS information at public gatherings.

6A8. Include AIS information in state hunting, fishing and boating regulations and licenses.

6A9. Include AIS information in local fishing and recreational publications.

6A10. Develop and distribute AIS identification cards.

6A11. Encourage industries to offer noninvasive alternatives to AIS.

6A12. Partner with stakeholders and interest groups to broaden education efforts.

6A13. Educate waterfront and shoreline property owners about AIS.

6A14. Develop and offer AIS management classes for professional organizations.

6A15. Continue state education measures concerning ballast water.

Policymakers

6B1. Brief decision makers and legislators on AIS management progress.

6B2. Brief the Fish and Game Commission, SLC, OPC, SCC and CCC.

Resource Managers & Researchers

6C1. Increase AIS awareness among scientific and natural resource managers.

6C2. Educate researchers on AIS containment, disposal methods and legal restrictions.

6C3. Develop an AIS regulatory handbook.

6C4. Share information on current mechanical, chemical, biological and physical control methods.

6C5. Disseminate guidelines to promote use of native plants.

6C6. Encourage the training of more taxonomists.

Schools

6D1. Train speakers to give guest presentations at schools.

6D2. Assess existing K-12 environmental education curricula.

6D3. Integrate AIS issues into service and education projects.

6D4. Inform teachers about proper disposal methods for organisms.

General Public

6E1. Develop press kits.

6E2. Increase local TV, radio and newspaper media coverage.

6E3. Identify state publications and websites to add AIS information.

6E4. Develop multicultural educational materials.

6E5. Develop AIS traveling trunks and portable presentation boards.

OB7: RESEARCH

Baseline Biology

7A1. Host workshops to develop AIS research priorities and identify gaps.

7A2. Assess, continue and complete current studies.

7A3. Develop a strategy to communicate and support research needs.

Economics

7B1. Perform economic impact studies on AIS effects.

7B2. Assess and compare costs of different management techniques.

Management Options

7C1. Evaluate efficacy of AIS management methods.

7C2. Investigate the efficacy of invasion prevention techniques.

7C3. Consider shipboard ballast water treatment testing center.

7C4. Identify opportunities for interagency funding of AIS management research.

OB8: LAWS & REGULATIONS

Laws & Regulations

8A1. Establish a regulatory review committee.

8A2. Identify the potential for improved regulatory coordination.

8A3. Pursue the authority to establish an interagency rapid response program.

8A4. Explore the need for additional state authority for AIS management.

8A5. Develop and pursue the adoption of new AIS legislation.

8A6. Explore how new or modified regulations can bridge authority gaps.

8A7. Develop and pursue the adoption of new regulations.

1. INTRODUCTION

What are Invasive Species?

An invasive species is "a species that is non-native to the ecosystem under consideration, and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health," according to the National Invasive Species Management Plan (National Invasive Species Council 2001). The characteristic of causing, or potentially causing, harm is central to the federal definition because it produces policy and management consequences. In other literature and in legislation, such invaders are also sometimes referred to as "nuisance" species.

From a technical point of view, "invasive" refers to species that rapidly reproduce and spread outside their point of origin. The term "invasive species" is distinct from "non-native," "nonindigenous," "alien" or "exotic" species – the latter terms refer only to the origin of the species and not their rate of reproduction, dispersal or potential to cause harm (see Glossary for further definitions).

This management plan focuses on ***aquatic*** invasive species – algae, insects, crabs, clams, fish, plants and other invaders to California's creeks, wetlands, rivers, bays and coastal waters. Aquatic invasive species (AIS) threaten the diversity and abundance of native species and natural communities, the ecological stability and water quality of infested waters, and the commercial, agricultural, aquacultural and recreational activities dependent on these waters. The economic consequences of AIS impacts can be substantial, from decreased productivity of commercial fisheries to lowered property values and the expenditure of billions of dollars to alleviate AIS impacts in water bodies after they have already become infested (Pimentel et al. 2000).

Geographic Scope

This report proposes AIS management actions and a rapid response plan for the State of California. The diversity of California waters is extensive and includes: the rich coastal waters and estuaries of the Pacific Ocean (approximately 3,500 miles of tidal shoreline); over 210,000 miles of rivers and streams; over two million acres of freshwater wetlands, lakes, ponds and reservoirs; over 400,000 acres of saline lakes; and more than 22,000 miles of ditches and canals (RF3 computerized database; USGS Digital Line Graph traces; SWRCB's 2002 WBS database).

These diverse aquatic resources provide habitat for native marine and freshwater animals and plants including invertebrates, fish, and other aquatic or riparian-dependent species, aesthetic enjoyment, hydropower, irrigation, municipal and industrial water supplies and countless recreational and commercial opportunities.

The authorities and programs outlined in this plan are generally limited to the political boundaries of California; however, it is recognized that there is a need for interstate and international cooperation to prevent the introduction and spread of AIS. The plan prescribes increased coordination with all Western states, Mexico and Canada, as rivers, water delivery systems, and water-based commerce and recreation cross state or national boundaries.

History of Invasions

The introduction of non-native species into the United States has been occurring for centuries, probably beginning with the introduction of human diseases and pests as a result of European settlement. The broad scale introduction of species into California waters most clearly begins with the shipment of tens of thousands of barrels of oysters from the East Coast after the establishment of the transcontinental railway (Barrett 1963). The huge influx of settlers, the establishment of maritime commerce and a multitude of other human activities through the 1900s contributed to continued invasions.

Since then, hundreds of AIS have found their way into California waters, not only via transoceanic ships, but also by other vectors such as aquaculture, the aquarium trade, the bait industry, recreational activities, biological research, environmental restoration projects and even freshwater deliveries up and down the state. Statewide, researchers have now identified 607 introduced, or likely introduced, species in California's estuarine waters (DFG/OSPR 2002 – see Figure 1). In San Francisco Bay, the rate at which AIS are becoming established increased from an average of one new species every 55 weeks prior to 1960, to one new species every 14 weeks between 1961 and 1995 (Cohen and Carlton 1998). To date more than 250 non-native species have been found in the San Francisco Bay-Delta Estuary (Cohen, Pers. Comm. 2006).

Some of the most problematic AIS that have become established in California include the European green crab, the Chinese mitten crab, the Asian overbite clam, and a plethora of aquatic plants with origins as far away as Brazil and Japan (for full scientific references see Acronym Glossary, Species Names page 7). More information on these invasions appears in subsequent chapters. Perhaps the most important issue is not the species that have already invaded but those that might invade in the future, such as the notorious zebra mussel. Quagga mussel, which poses a threat similar to the closely related zebra mussel, was found in Lake Mead, Nevada on January 7, 2007 and subsequently in Lake Havasu in California. Based on the damage caused in the Great Lakes region by zebra and quagga mussels, these European freshwater invertebrates could threaten California's entire water delivery system, irrigation network and freshwater ecosystems.

In general, it is extremely difficult to predict the impacts that most AIS may have on natural resources, human health, infrastructure and the economy. It is clear, however, that biological invasions of California are likely to continue, as global movements of goods and services continue to increase.

In the United States, the number of non-native plant pathogens, insects, and mollusks discovered since 1920 strongly correlates with importation of goods over the same time period, and is forecast to increase by 16-24% over the next 20 years. As the world's largest economy and home to many of the world's richest ecosystems, the United States is particularly vulnerable to additional biological invasions (Lodge et al. 2006). California is equally vulnerable as a Pacific Coast trade hub, immigration and recreation destination and major engine of the American economy.

Figure 1: Nonindigenous Species Surveys from California Harbors and Bays

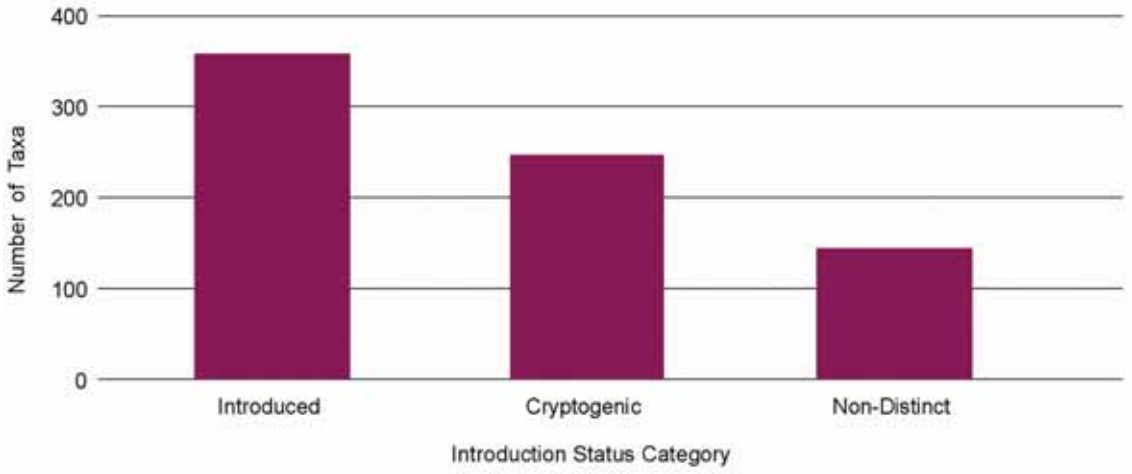
These graphs compile information from surveys that included coastal harbors, bays and estuaries along the length of the state and the Sacramento/San Joaquin Delta (up to Sacramento and Stockton). *Source: DFG-OSPR 2002* . A very small introduction status category in the source document graphs is not shown here for simplification. That category represents the number of species that may have been introduced from one region of California to another.

Outer coastal waters were not included in the surveys that generated the graphs shown here, however a new report on nonindigenous species surveys for outer coastal waters is available at www.dfg.ca.gov/ospr/organizational/scientific/exotic/MISMP.htm

Introduction Status Categories

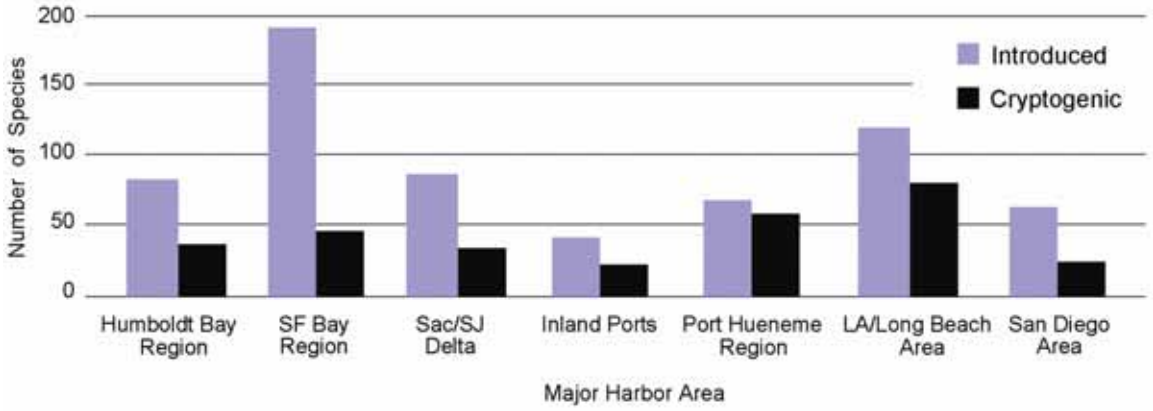
Introduced = Organisms identified to species. Introduced to California.
Cryptogenic = Organisms identified to species. Possibly introduced to California.
Non-Distinct = Organisms not identified to the level of species. Possibly introduced to California.

Numbers of Nonindigenous taxa by introduction status category



Number of Nonindigenous species in 7 major ports of California

This graph shows the number of introduced and cryptogenic species for each major harbor area. Species found in multiple harbor areas are represented more than once on the graph.



Benefits of a Statewide Plan

AIS pose unique challenges to California's water and resource managers, as well as to those developing policies affecting aquatic environments. Unlike other sources of pollution, established AIS populations can reproduce and spread. As a result, resources must be devoted to both the prevention of new introductions and the control of existing ones. The introduction of only a few organisms, or in the case of aquatic plants and algae, a tiny portion of an organism, can result in the infestation of an entire water body or watershed. These introductions can occur through a variety of vectors, further complicating preventative measures.

California's past efforts to address AIS focused on control of those species that most directly impacted boating, agriculture and other human activities. More recently, California's focus has shifted toward prevention, with programs aimed at excluding plant pests and managing AIS-laden ballast water on ships. Current AIS activities involve prevention, eradication, management and education. These activities are not adequately coordinated throughout the state and do not comprehensively manage current established AIS or adequately prepare for new invasions.

The vital importance of California's aquatic resources requires the creation of a more comprehensive management plan for responding to AIS. This management plan targets both marine and freshwater environments and highlights the need for aggressive action on many fronts. Although these pages describe the significant need for AIS management, there is currently no statutory mandate in California for the preparation of this management plan.

The plan meets federal requirements to develop statewide Nonindigenous Aquatic Nuisance Species Management Plans under Section 1204 of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (amended as the National Invasive Species Act of 1996 – see Appendix B). This Act authorizes a 75:25 federal to state match of funds required to achieve objectives and actions outlined in plans approved by the federal Aquatic Nuisance Species Task Force (ANSTF, also established by the 1990 act). In developing this plan, the State of California has closely followed the *Guidance for State and Interstate Aquatic Nuisance Species Management Plans* developed by the ANSTF in 2000. Suggested actions contained in the Western Regional Panel's *Recommendations on State Actions to Improve Our Regional Capacity for Managing Aquatic Invasive Species* (revised June 2003) were also incorporated.

California Plan Goal & Objectives

The California Aquatic Invasive Species Management Plan (CAISMP) provides a common platform of background information from which state agencies and other entities can work together to address the problem of aquatic invasive species. Beyond providing information, the goal of this planning process has been to identify the major objectives and associated actions that need to be attained in order to minimize the harmful ecological, economic and

human health impacts of aquatic invasive species in California.

Eight major objectives have been identified:

1. Improve coordination and collaboration among the people, agencies, and activities involved with AIS.
2. Minimize and prevent the introduction and spread of AIS into and throughout the waters of California.
3. Develop and maintain programs that ensure the early detection of new AIS and the monitoring of existing AIS.
4. Establish and manage systems for rapid response and eradication.
5. Control the spread of AIS and minimize their impacts on native habitats and species.
6. Increase education and outreach efforts to ensure awareness of AIS threats and management priorities throughout California.
7. Increase research on the baseline biology of AIS, the ecological and economic impacts of invasions and control options to improve management.
8. Ensure state laws and regulations promote the prevention and management of AIS introductions.

Each objective is supported by a series of strategic actions with the implementing entities and cooperating organizations identified, and costs included where appropriate. Detailed actions can be found in Chapter 6: Management Actions, Strategies and Objectives and in Table 5: CAISMP Implementation Matrix.

The plan goal, objectives, strategies, and specific actions were developed with input from a series of stakeholder scoping meetings, interagency staff communications and public workshops held in 2002 and 2006 (see Appendix E). These meetings, as well as many individual conversations and extensive review, played a role in making the plan as comprehensive and responsive to AIS issues in California as possible.

2. AIS ECOLOGICAL & ECONOMIC IMPACTS

California currently faces a variety of significant and lasting impacts from aquatic invaders in both fresh and coastal waters. In general, these include:

- Reduced diversity and abundance of native plants and animals (due to competition, predation, parasitism, genetic dilution, introduction of pathogens, smothering and loss of habitat to invasive species).
- Degradation of wildlife habitat.
- Stresses on rare, threatened, and endangered species.
- Alteration of the native food web and declines in productivity.
- Changes in biogeochemical cycles (including nutrient cycling and energy flow).
- Losses in fisheries production.
- Impairment of recreational uses such as swimming, boating, diving and fishing.
- Impairment of agricultural infrastructure such as irrigation canals.
- Impairment of water delivery systems.
- Degradation of water quality.
- Threats to public health and safety (via parasites and disease).
- Diminished property values.
- Loss of coastal infrastructure due to fouling and boring organisms.
- Erosion and destabilization of shorelines, banks and levees.
- Increased costs to business, agriculture, landowners and government of invasive pest control, treatment and clean up.

Ecological Impacts

In terms of ecological impacts, the introduction of invasive species is thought to be second only to habitat loss in contributing to declining native biodiversity throughout the United States. Nationwide, non-native species have contributed to 68% of the fish extinctions in the past 100 years and the decline of 70% of the fish species listed under the Endangered Species Act (Wilcove et al. 1998).

California has been invaded by many aquatic plants and animals which have altered native ecosystems and taken a toll on recreation, commercial fishing and sensitive native species (i.e. species that are listed as endangered or threatened or otherwise considered rare or declining).

California Examples

- ***European green crab*** *likely arrived in seaweed packed with bait worms shipped from the Atlantic to the Pacific Coast. They were first detected on the West Coast in San Francisco Bay in the late 1980s. By 1996 the crab had spread along 300 miles of coastal California (Lafferty and Kuris, 1996). Green crabs may prey upon juvenile Dungeness crabs as well as cultured oysters, clams and mussels (McDonald et al. 2001 & Grosholz and Ruiz, 1995). Clam and native shore crab populations in California have dropped significantly since the arrival of the green crab (Sea Grant 1998). Densities of native clams and shore crabs showed a five to ten-fold decline within three years of the green crab's arrival (Grosholz et al. 2000).*
- ***Arundo*** *is a plant native to the Mediterranean and tropical Asia. In California, it was planted as early as the late 1700s as a windbreak and for erosion control in flood channels. This reed grows in thick, bamboo-like stands that can reach a height of 30 feet. Its monotypic growth displaces native vegetation, increases flooding and siltation, increases water loss from underground aquifers and increases the susceptibility of riparian areas to fire. Despite its sizable height, it does little to shade in-stream habitat. The higher resulting water temperatures harm aquatic wildlife, including protected frogs, turtles and fish (see Appendix D, Team Arundo).*
- ***Asian overbite clam*** *was introduced into San Francisco Bay via ballast water discharge and first collected in 1986. This Asian species has since become the most abundant clam in the northern part of the bay, ultimately reaching densities of nearly 50,000 clams per square meter (Peterson 1996), and has radically altered food-web dynamics and augmented contaminant transfer up the food web (Stewart et al. 2004). It is estimated that clams in the northern portion of San Francisco Bay have the capacity to filter the entire water column at least once and possibly more than twice in a single day (Thompson 2005).*
- ***Wakame,*** *an Asian seaweed, arrived in Los Angeles Harbor in 2000 and has since spread as far north as Monterey Bay (Sanctuary Integrated Monitoring Network 2007). One plant can release millions of spores capable of remaining dormant for many years before sprouting (Fisheries Global Information System 2007). Biologists fear it will either disrupt or hybridize with native giant kelp, endangering a keystone species of the California coast (Chapman 2005).*
- ***Japanese eelgrass*** *first established itself in the Pacific Northwest in the 1950s, probably arriving as packing material for oysters. It has since colonized hundreds of acres of bays in Washington and Oregon, growing in dense mats on formerly unvegetated mudflats. Studies suggest that the eelgrass displaces native burrowing shrimp and reduces habitat quality for feeding shorebirds (Posey 1988). It was discovered in California in 2002 growing on the shores of Indian Island in Humboldt Bay.*

Most of these species are not the only invader in their newfound habitats. In combination, invasive species can have even larger scale impacts on the environment. In the Sacramento-San Joaquin River Delta, for example, a clam and several plant species are all implicated in the sharp decline of endangered Delta smelt. In this small fish's habitat, the Asian overbite clam has recently increased in abundance, possibly due to seasonal changes in outflows and salinity. This invader's higher abundance and presence during more periods of the year than in the past, may be intensifying its impact on the pelagic food web which sustains Delta smelt. Young smelt, not to mention the popular sport fish, striped bass, may also be suffering from changes in habitat, water turbidity and predation levels caused by aquatic invasive weeds (Feyrer et al. in revision).

In sum, AIS may not only have direct ecological impacts on habitats, species and food webs, but can also confound efforts to restore and protect these resources. More details on specific AIS impacts and efforts to manage them can be found in the case studies in Chapters 4 and 8.

Economic Impacts: United States

Most of the environmental impacts described above have associated economic costs as managers invest time and money trying to minimize AIS impacts on native species and habitats. Other economic losses are incurred when AIS invasions hamper or jeopardize human activities. For example, in just three years in the early 20th century, the invasion of a single organism, the shipworm, caused $615 million (1992 dollars) of structural damage to maritime facilities (Cohen, AN and JT Carlton 1995). On a national level, invasions are costing American taxpayers billions of dollars every year in environmental degradation, lost agricultural productivity, expensive prevention and eradication efforts and increased health problems. One nationwide estimate suggests that annual costs in environmental damage and losses, arising from the 50,000 invasive species now in the United States, exceed $120 billion (Pimentel et al. 2005).

Invasives that spread into aquatic environments can be particularly costly to manage. The damage and costs associated with control of AIS in the United States are estimated to be $9 billion annually (Pimentel 2003). A breakdown by type of invader suggests annual costs as follows:

Fish	$5.4 billion
Zebra & quagga mussels	$1 billion
Asiatic clams	$1 billion
West Nile virus	$1 billion
Aquatic plants	$500 million
Shipworm	$205 million
Green crab	$100 million

In an earlier study for the U.S. Congress, the Office of Technology Assessment (OTA) attempted to quantify economic impacts of 111 species of invasive fish and 88 species of invasive mollusks. Of these only four fish species and 15 mollusk species resulted in major negative impacts—including the sea lamprey, zebra mussel, and Asian overbite clam. OTA estimated that the cumulative loss to the U.S. for the period 1906-1991 from three harmful fish species was $467 million (1991 dollars) and $1.3 billion from three aquatic invertebrates. Invasive aquatic and riparian plants can also have costly impacts. OTA reports that spending on aquatic plant control in the U.S. is $100 million per year (Lovell and Stone 2005).

Another indicator of economic impacts is government spending. In 1999 and 2000, the federal government spent $459 million and $556 million, respectively on activities related to invasive species; however, federal funding to address fish and aquatic invertebrates was only $20.4 million in 1999. In 2004, federal funding to the U.S. Coast Guard, largely for programs to limit invasions via ballast water on ships, was $4.5 million (Lovell and Stone 2005). These numbers underscore how limited government spending on aquatic invasions is compared to spending on agricultural and forestry pests, despite the complexity and consequences of these invasions.

One of the most costly and well-studied North American invasions has been the introduction of zebra mussel to the Great Lakes. In 1988, zebra mussel was first discovered in Lake Saint Clair, a small water body connecting Lake Huron and Lake Erie. By 2006, zebra mussels inhabited the waters of at least 20 states. This prolific mussel colonizes pipes, constricting flow and thereby reducing water intake for heat exchangers, condensers, fire-fighting equipment and air conditioning and cooling systems. Zebra mussel densities were as high as 700,000 per square meter at one power plant in Michigan (Kovalak et al. 1993). One estimate puts the cost of scraping mussels from pipes in the Great Lakes region alone at $50-100 million per year (Maryland Sea Grant 2003). Zebra mussels also attach to boat hulls, docks, locks, breakwaters and navigational aids, increasing maintenance costs, impeding transportation and increasing the likelihood of spread of the species.

Economic Impacts: California

AIS could threaten or undermine resources of great economic value to California. Recent statistics shed some light on the importance of California's water resources to residents and visitors alike.

- California has the largest ocean economy in the United States, ranking number one overall for both employment and gross state product. This economy (which includes coastal construction, living resources, offshore minerals, ship and boat building and repair, maritime transportation and ports, and coastal tourism and recreation) generated $42.9 billion in 2000 and provided almost 700,000 jobs (Kildow and Colgan 2005).

- Commercial fish landed in California in 2005 had a value of over $106 million (DFG Marine Fisheries Statistical Unit).
- Marine recreational fishing in California brought in an estimated $768 million in expenditures in 2005 (NOAA Fisheries Service survey, formerly NMFS).
- Sport fishing licenses issued in 2005 were 1,978,143 (DFG License and Revenue Branch).
- In 2005, there were 965,892 boats registered in California. Recreational boating currently contributes $17 billion annually to the California economy (DBW).
- California's travel industry and associated recreation contributes approximately $55.2 billion annually to the state's economy. Much of this recreational activity is centered on water or water-based activities (California Trade and Commerce Agency, Division of Tourism).

AIS can have dramatic impacts on these important state resources and activities. Recreational boating and fishing, in particular, have long been hampered by aquatic weeds. The control of weeds to facilitate the public's enjoyment of these activities has required some of the state's longest-lived and most expensive management programs. Over the past three decades state agencies have spent more than $60 million to keep a handful of aquatic weed species from impeding the navigation of rivers, lakes, bays and other waterways, not to mention their causing other problems for fish, wildlife, agriculture and water quality.

- ***Water hyacinth*** *was introduced into the United States in 1884 as an ornamental plant for water gardens, where its floating showy, lavender-blue flowers attracted many admirers. Water hyacinth can double its size every ten days in hot weather. By 1904, the water hyacinth had made its way into a Yolo County, California slough. Surveys in recent years indicate that by early summer, the infestation can cover up to approximately 4,000 acres of the Sacramento-San Joaquin Delta. At present, aquatic herbicides remain the primary tools available to control water hyacinth. Two weevils and a moth have been introduced as biological controls but have not demonstrated much success. Programs to manage water hyacinth in the Sacramento-San Joaquin Delta, its tributaries and the Suisun Marsh have been the responsibility of the state's Department of Boating and Waterways (DBW). Over the program's 22-year history, DBW's costs for water hyacinth control have mounted to approximately $25 million dollars, with annual spending currently around $2.5 million.*
- ***Hydrilla*** *was imported into the United States from Asia in the late 1950s for aquarium aficionados. The plant, which grows in dense mats, is most likely to spread when fragments are carried into new habitat by recreational watercraft. Hydrilla has been found in 17 of California's 58 counties. Working to eradicate hydrilla – as well as managing other aquatic weeds and wetland plants such as purple loosestrife, giant salvinia, and alligatorweed – is the responsibility of the state's Department of Food and Agriculture (DFA). Since the 1970s, DFA has spent approximately $30 million dollars on aquatic weed control, with most of that money being focused on hydrilla eradication, which costs about $1.5 million per year. Such expenditures have enabled DFA to eradicate the plant from 19 sites in 12 counties, but much work remains to be done.*

DBW and DFA expenditures on aquatic weed control are just the tip of the iceberg (see side bar). The two budgets described in the water hyacinth and *Hydrilla* programs do not take into account the cost of control efforts by other public agencies and private landowners, lost revenue due to decreased property values, impacts on fisheries or decreased use of water for swimming, boating, fishing and other recreational activities. Other costly current infestations of aquatic or riparian plants in California include saltcedar (tamarisk), purple loosestrife, perennial pepperweed, Brazilian elodea, and smooth cordgrass.

Fish, clams, crabs and other AIS can be more costly to control than plants, and in many cases, they cannot be controlled once they become established. The troublesome zebra mussel has yet to be documented in California; however, it has been detected at border inspection stations on dozens of occasions. Research suggests the zebra mussel has a broad potential range in California. Of 160 sites assessed, 44% had a high potential for colonization due to sufficient calcium level, appropriate pH, temperature, salinity range, and constant submersion (Cohen and Weinstein 1998). Most coastal watersheds, the western portion of the Sacramento Valley, the San Joaquin River and the southern Delta, offer conditions suitable for zebra mussel proliferation. Areas with a high potential for colonization encompass many of the state's most important water delivery facilities, including the Delta-Mendota Canal, the California and South Bay Aqueducts, the Los Angeles Aqueduct, the Colorado River Aqueduct, the All American Canal and their reservoirs (Cohen and Weinstein 1998).

In January 2007, quagga mussel, a close relative of zebra mussel, was found in Lake Havasu in the Colorado River in California. Quagga mussel prefers deeper, cooler water than zebra mussel but poses the same serious threat to California's entire water delivery system and irrigation network. Prevention programs for these two species would be almost identical. Until there is time to develop species specific analysis, the economic analyses and potential distribution created for zebra mussel is being used as a guideline for quagga mussel.

Damage to the water delivery system that provides drinking water to millions of southern Californians, or damage to the irrigation network that supports a $30 billion per year agricultural industry, could produce extraordinary economic and social consequences. A recent risk analysis, based on lakes in Michigan, compared optimal spending on zebra mussel prevention to estimated costs of reducing the impacts to local power plants, if it were to become established. The analysis suggests that it would be beneficial to spend up to $324,000 per year to obtain a modest reduction in the probability of a zebra mussel invasion into a single lake with a power plant (Leung et al. 2002).

In spite of the warnings from states already battling zebra mussels and quantitative analyses such as those described above, relatively few resources were directed towards the pending threat to California posed by these and similar organisms. Indeed the first line of defense, border protection stations, where

trailered boats arrive from infested states, were far below adequate staffing and operational hours for consistent inspection and interception, and provided little in the way of AIS information to travelers (see Management Examples, Chapter 5). After the quagga mussel was discovered in Lake Mead and the lower Colorado River, short-term emergency funding was provided to state agencies responding to the incident, and permanent funding was later authorized to provide additional staff for an ongoing program. These measures are a positive step, but additional long-term funding is needed to increase intervention at all border protection stations and provide staff to prevent further introductions.

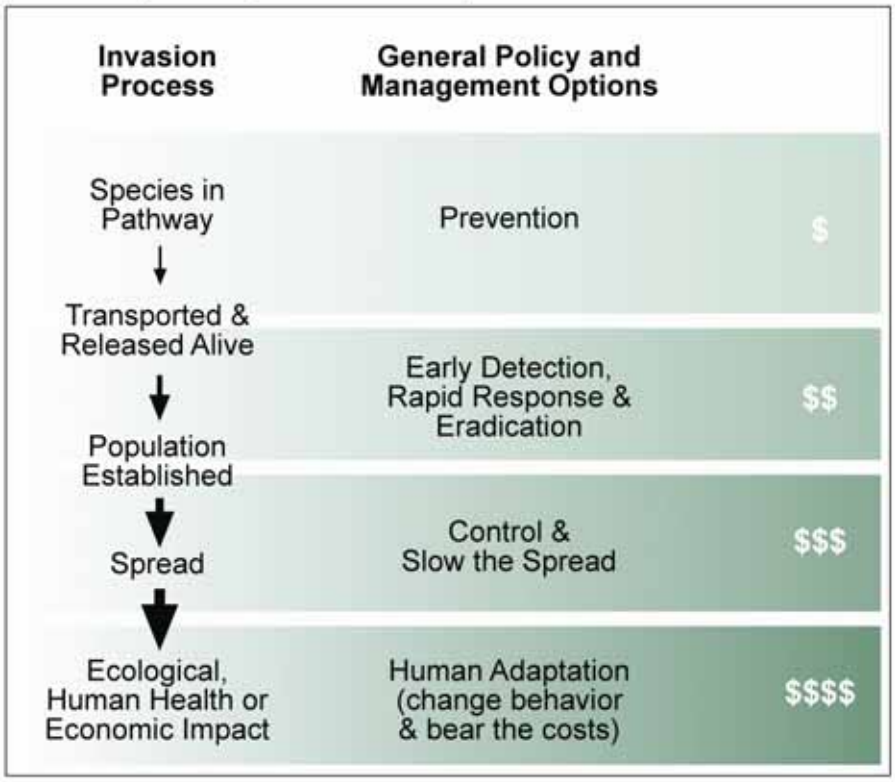
Conclusion

The harm done by invasives is a challenge to quantify. Environmental economists have been struggling to find a systematic method of quantifying human health values, use values, existence values and ecosystem values for decades. Invasive species add a level of complexity to the task that increases difficulties involved in such valuations. Rates of biological propagation, for example, do not always conform neatly with economic variables. Nor do assessments of the level of risk from invasives. Equally challenging can be attempting to quantify the benefits of preventing or controlling invasives (Lovell and Stone 2005).

Whatever the species or impacts, experts agree that the most costly response of all is inaction. Costs mount as management activities shift from prevention to rapid response to eradication to control (see Figure 2) and as invasions spread and become irreversible. While some control programs have been highly successful, many more have not even been attempted due to the perceived challenges and expense. On most management levels, the default response is adaptation – passively adjusting to the damages caused by new species – even when eradication or control would be more cost-effective. Even when the initial funding, the tools, and the political will to launch an AIS control program exists, resources must be made available in perpetuity – not an easy task in the context of government funding cycles (Lodge et al. 2006). California managers have attempted to address some of these challenges as they developed the state AIS action plan described in Chapter 6.

Figure 2: AIS Invasion Progression, Management and Cost

As AIS invasions progress, the cost of management options tends to increase. This is one of the reasons why the California Aquatic Invasive Species Management Plan places an emphasis on prevention and early detection.



Source: Adapted from Lodge et al. 2006.

3. VECTORS OF AIS

Invasive species arrive in California via vectors – the means or agents that transport species from one place to the next. Vectors, also referred to as pathways, include ships, fishing vessels, recreational boats and gear, sea planes, diving gear, drilling platforms, dry docks, and industries that grow and sell fish, plants and other organisms for food, bait, aquariums, pets and water gardens (see Table 2). Shoreline restoration or construction projects and water-based scientific research or monitoring can also inadvertently move organisms from one place to another. Invasive species cling to boat bottoms and recreational or research gear, construction equipment, floating debris and docks. They inhabit ballast water on ships, and escape or are released from aquaculture packing materials, ornamental ponds, and aquariums into the state's waters.

Once a highly invasive species arrives, preventing its rapid spread can be difficult if not impossible. Plants can produce thousands of seeds, which may be carried by wind, water, animals or human activities to distant water bodies. Some aquatic plants can reproduce vegetatively, with small bits of leaves, stems or roots resulting in new plants. Water flows and currents may also deliver these AIS to new ecosystems. Chinese mitten crabs hatch into larvae that spend one to two months drifting as plankton. During this period, the tide can carry these invaders deep into vulnerable estuary systems. Quagga mussels traveled, most likely in their larval form, on trailered recreational boats from the Great Lakes to the Colorado River system. In the past, efforts to control such invasions have focused on managing individual problem species. More recently, however, the concept of focusing on vectors, rather than species, has begun to gain support as a more effective approach for addressing aquatic invaders.

Table 2: Common Bioinvasion Vectors

Invasion Vectors and Types of Organisms Transported

Ships

- Planktonic and nektonic organisms in ballast water
- Attached and free-living fouling organisms on hull, on rudder, on propeller and propeller shaft, in seawater systems, seachests, in ballast tanks, and in ballasted cargo holds
- Organisms associated with anchors, anchor chains, and anchor chain lockers
- Organisms associated with cargo, such as logs that have been floated for loading

Drilling Platforms

- Attached and free-living fouling organisms
- Planktonic and nektonic organisms in ballast water

Dry Docks

- Attached and free-living fouling organisms
- Planktonic and nektonic organisms in ballast water

Navigation Buoys and Marina Floats

- Attached and free-living fouling organisms

Amphibious Planes, Seaplanes

- Attached and free-living fouling organisms
- Organisms in pontoon water

Canals

- Movement of species through sea level, lock, or irrigation canals

Public Aquaria

- Accidental or intentional release of organisms on display
- Accidental or intentional release of organisms accidentally transported with target display species

Research

- Movement and release of invertebrates, fish, seaweeds (algae) and seagrasses used in research (intentional or accidental escape)
- Organisms associated with research and sampling equipment, including SCUBA and other diving or swimming gear

Floating Marine Debris

- Transport of species on human-generated debris, such as floating nets and plastic detritus

Recreational Equipment

- Movement of small recreational craft, snorkeling and SCUBA gear, fins, wetsuits, jet skis, and similar materials

Fisheries, Including Marine Aquaculture (Mariculture)

- Transplantation or holding of shellfish, such as oysters, mussels, clams, crabs, lobsters, and other organisms; fish; or seaweed (algae) in the open sea for growth or freshening (rejuvenation); and other organisms associated with dunnage and containers
- Intentional release of shellfish, fish, and seaweed (algae) species, either as part of an official governmental introduction attempt, or as an illegal private release
- Stock enhancement, often ongoing, as well as accidentally transported associated organisms
- Movement of live seafood intended for sale but then released into the wild
- Processing of fresh or frozen seafood and subsequent discharge of waste materials to environment, which may include associated living or encysted organisms
- Movement of live bait subsequently released into the wild
- Discarding of packing materials—such as seaweed and associated organisms—used with live bait and seafood
- Movement, relocation, or drifting of fisheries gear, such as nets, floats, traps, trawls, and dredges
- Release of organisms as forage food for other species
- Organisms transported intentionally or accidentally in "live well" water, vessel scuppers, or other deck basins
- Release of transgenic stocks—genetically modified organisms (GMOs)
- Movement of algae and associated organisms as substrate for fish egg deposition

Aquarium Pet Industry

- Movement and release of invertebrates, fish, seaweeds (algae) and seagrasses used in the aquarium industry (intentional or accidental escape)

Restoration

- Movement of marsh, dune, or seagrasses as well as associated organisms
- Reestablishment of locally extinct or decimated populations of native species, and accidentally transported associated organisms

Education

- Release of species from schools, colleges, and universities following classroom use

Source: Carlton 2001

Analyzing the risk of specific AIS vectors to the environment, human health and the economy represents a critical first step in preventing invasions. Many factors contribute to the invasion risk posed by a given vector. These include:

- number of nonindigenous species transported;
- number of individuals of each species transported;
- characteristics of the species (including their environmental tolerances);
- number and characteristics of their hitchhiking species (including parasites, pathogens and other associated organisms);
- likelihood and frequency of a species and its hitchhikers reaching suitable habitat;
- feasibility and cost of eradication or control if a species becomes invasive (Lodge et al. 2006).

Any quantitative analysis of invasion risks will not only examine these factors, but also seek the point source of invasions and evaluate opportunities for management of each vector.

Large vectors, such as commercial shipping, are not the only source of large-scale invasions. Seemingly minor vectors can lead to major invasions. For example, the use of seaweed to pack bait worms from the U.S. Atlantic Coast brought the European green crab to the Pacific Coast (Carlton 2001). Preventing introductions from smaller vectors can therefore provide significant ecological and economic benefits.

The live trade, including the pet, aquaculture and horticulture industries, introduces far fewer exotic species than ships and other transportation vectors; however, prevention efforts aimed at this sector are well worth their cost. Providing education and oversight to these purveyors tends to cost less than comparable efforts aimed at transportation vectors and can preclude the far larger costs of stopping an invasion. The burgeoning mail order/Internet trade has only increased the risk from these pathways. Meanwhile, the water garden and live food industries are growing rapidly and will likely become the source of more invasions in the future. These trades frequently put non-native species of plants and animals in close proximity to natural waterways where they are more likely to find conditions suitable for establishment (Lodge et al. 2006).

Raising awareness of the invasion risks from ballast water discharge and hull fouling, as well as among aquarium, pet, nursery, aquaculture and seafood industry groups, has great potential to change public behavior and develop cooperative guidelines for industry practices. In the end, these measures may significantly reduce the likelihood of AIS introductions (Lodge et al. 2006).

California's initial focus may have to be on vectors currently thought to pose the highest risk of invasion. The ultimate goal, however, is to assess all potential vectors and to manage those that present the highest risk of new

invasions. The sections that follow seek to provide general information on some of the diverse vectors by which AIS enter California. Details on the regulation control and management of these vectors appears in subsequent chapters. The general vector categories described below are:

Vector 1: Commercial Shipping
Vector 2: Commercial Fishing
Vector 3: Recreational Equipment & Activities
Vector 4: Trade in Live Organisms
Vector 5: Construction in Aquatic Environments
Vector 6: Water Delivery & Diversion Systems

Vector 1. Commercial Shipping

In coastal environments, commercial shipping is the most important vector for the introduction of AIS (Ruiz et al. 2000, Hewitt et al. 2004). In one study, commercial shipping accounted for one half to three-quarters of nonindigenous introductions to North America (Fofonoff et al. 2003). The steady rise of global commerce, increased shipping activities and shorter transport times suggests that the threat of introductions through this vector is increasing.

California, as a coastal state engaged in significant Pacific Rim trade, cruise-line tourism and commercial fishing, is vulnerable to the global rise in invasions. California hosts 11 major seaports: Hueneme, Humboldt Bay, Long Beach, Los Angeles, Oakland, Redwood City, Richmond, Sacramento, San Diego, San Francisco and Stockton. Three of these ports are among the top four busiest ports in the United States. Two of these ports are located a significant distance inland and are slated for expansion, potentially importing more AIS deeper into the state. These 11 seaports handled 23% of the United State's waterborne trade in 2003. Almost 95% of containerized Asian cargo destined for central and mountain states entered through West Coast ports – highlighting California as a first national line of defense against AIS (PMSA 2004).

Ballast Water

Shipping vessels commonly fill their ballast tanks with water from harbors after unloading cargo and discharge it in another harbor when loading more goods. The added mass of ballast water improves stability, trim, maneuverability and propulsion in large, otherwise empty cargo vessels. Vessels may take on, discharge, or redistribute ballast water during cargo loading and unloading, in rough seas, or while moving through shallow waterways. Live marine organisms ranging from plankton to adult fish are regularly transported from source to destination ports when ballast water is discharged (Carlton and Geller 1993, Cohen and Carlton 1995). Estimates suggest that more than 7,000 species are moved around the world daily in ballast water alone (Carlton 2001).

Ballast water teeming with a wide array of non-native organisms is discharged into U. S. waters at the rate of about two million gallons per hour. In 2005, 9.1 million metric tons were reported to have been discharged in state

waters (Falkner et al. 2006). California requires vessels arriving from outside the United States Exclusive Economic Zone (U.S. EEZ), or engaged in coastal travel, to manage their ballast water. Federal regulations (USCG) also require ballast water management. See Chapters 4 and 5, and Appendices B and C for more information on state and federal regulations and programs. Actions in this AIS management plan recognize and support these ballast water management activities.

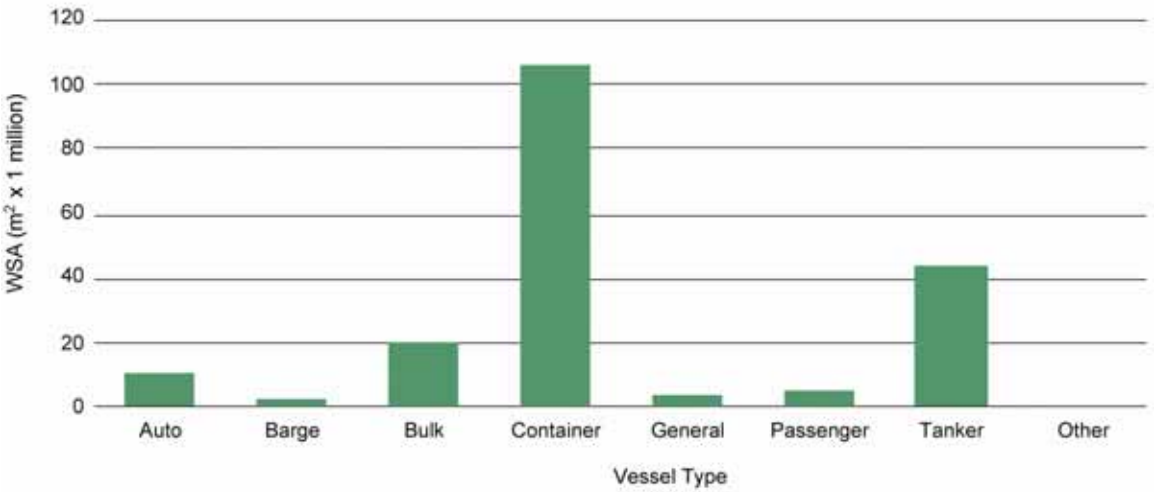
Hull Fouling

Hull fouling may rival ballast water discharge as the leading cause of harmful AIS introductions (Thresher 1999, Hewitt 2002). Organisms such as mussels, seaweed, anemones and sea squirts with sedentary life stages can attach themselves to the hulls of commercial vessels or become entangled in nets, anchors, and other gear. Barnacles, other seaweeds and bryozoans may in turn attach to mussel shells and seaweed fronds, while more mobile species such as shrimps, worms and sea snails may hide in crannies created by larger fouling species (Takata et al. 2006). These organisms can survive for extended periods of time once secured to a vessel. Fouling organisms may then be transferred from the vessel to coastal waters and ports via spawning or egg release, detachment (simply dropping off into the water) or mechanical removal (via scraping, in-the-water cleaning or blasting in dry dock depending on clean up procedures).

Fouling organisms live on wet surface areas such as vessel hulls. One study analyzed the total "wetted surface area" (WSA) of all vessel hulls arriving on the West Coast between July 2003-June 2005 (Takata et al. 2006 – See Figure 3). The goal was to provide some indication of the rate and pattern with which individual organisms may arrive (propagule pressure), and how they may contribute to AIS establishment. The resulting two-year total of WSA entering California waters was 189.5 million square meters, which is 1.5 times the area of San Francisco County.

Figure 3: Wetted Surface Area

Total wetted surface area (WSA) is the estimated total of submerged surface area for each type of commercial vessel shown on this graph, that arrived in California ports between July 2003 and June 2005. Wetted surface area represents potential for fouling accumulation. The potential magnitude of the threat from hull fouling is significant, however, without reliable data on the extent of fouling found on commercial vessels, the ability to determine this risk is limited.



Data courtesy of Ian Davidson, Aquatic Bioinvasion Research and Policy Institute.

Source: Takata et al. 2006

In an expansion of California's ballast water management program, recent legislation directed a team of technical advisors to formulate recommendations to prevent introductions through vessel fouling, among other non-ballast shipping vectors. The team's report documents several factors concerning this vector. For example, the degree of fouling may be affected by environmental conditions, vessel maintenance practices, types of shipping traffic and vessel movement patterns, all factors which may differ from region to region. (Takata et al. 2006). See Chapter 4 and Appendix C.

Vector 2. Commercial Fishing

While commercial fishing vessels do not usually carry ballast water, they can be an important AIS vector. As these vessels sit in harbors, docks, and berths during the off-season for long periods, they are more subject to the hull fouling described under Vector 1 than commercial ships (which travel so constantly through waters of widely varying temperature and salinity that their hulls remain relatively clean). Commercial fishing vessels can also carry AIS from one harbor to another via their fishing gear, lines, tackle, buoys, traps and nets. Researchers believe the Japanese marine algae, wakame, may have been introduced to Monterey Bay by fishing vessels from other California ports. Though the state currently regulates ballast water and may soon regulate hull-fouling, it has no authority over vessels under 300 gross register tons in size, such as commercial fishing vessels. More information is needed on the AIS risk from this vector. Actions in this management plan seek to address this need.

Vector 3. Recreational Equipment & Activities

Boating & Sea Planes

The lakes, ponds, rivers and coastal waters of California provide recreational opportunities for a large population of boaters. The movement of boats along the coast, as well as the overland transport of boats and their trailers between water bodies, can introduce AIS that foul hulls, become entangled on motor propellers, and are small enough to be discharged in bilge pump water. In addition, aquatic invasive plants and other AIS can also be transported from one body of water to another through entanglement on aircraft pontoons. Recreational boats and sea planes can be both the source of an initial introduction (bringing in a species from its native location, into California), or a source of spread of a species once it arrives via other vectors such as ballast water or aquarium releases. This is the case with zebra mussel and quagga mussel, which were thought to have originally entered the US via ballast water, and now have spread throughout many areas in the United States via recreational boats.

Fishing

Recreational fishing is another vector in the introduction and spread of AIS. Initial introductions can occur when bait buckets and live tank contents are dumped. Gear used for fishing (boats, nets, floats, anchors, wading boots, tackle, etc.) can spread AIS. For example, fly fishing gear used in waters infested with New Zealand mudsnails, may be the primary vector associated with the spread of this AIS into California's rivers.

Other Water Sports

Those engaged in California's diverse variety of other water sports – swimming, jet-skiing, windsurfing, parasailing, scuba diving, waterfowl hunting – can all also be potential carriers of hitchhiking AIS as sports gear is moved among coastal and inland recreational spots.

For all recreational water users, clear identification of AIS-infested waters through posted signs and by other means would reduce the risk of the transport of established invaders. This measure, along with vessel inspections and investigating the feasibility of installing washing stations for recreational watercraft, are actions in the management plan. Education of all recreational users – and for non-aquatic equestrians, hikers and cyclists crossing streams and rivers – is also recommended in this management plan.

Vector 4. Trade in Live Organisms

Live Bait Industry

The shipment of live, non-native fishes or invertebrates into California for use as bait may serve as another vector of AIS introduction. Packing materials are frequently comprised of live plants that have the potential to become invasive. Knotted wrack, a seaweed native to the North Atlantic, is the primary packing material for marine baitworms (blood worms and pile worms) and American lobsters shipped to California. This seaweed often harbors a substantial number and variety of non-native marine organisms. Of further concern is live bait that harbors parasites or pathogens that could endanger the health of human populations or native species. The state regulates the culture, import, harvest and sale of fish species sold as bait; however, the sources of invertebrate imports to California for recreational fishing purposes are largely unknown and unregulated. Actions in the plan address the need to evaluate, improve and enforce regulations designed to minimize the invasion threats from both live and frozen bait. Frozen bait has recently gained more attention as a potential vector for AIS because the virus that causes hemorrhagic septicemia, a disease that causes fish to bleed to death, has been found to survive in frozen bait (Bergquist 2007).

Live Imported Seafood

The import, sale and distribution of fresh, live seafood are important component of California's economy. The processing and sale of live fin and shellfish can result in the intentional or unintentional release of live organisms as well as their associated parasites and pathogens. Specific seafood-related introduction pathways include packing materials, as discussed in the prior section, and the following:

Shellfish waste disposal: Shells and other unwanted materials discarded following shellfish processing might harbor shellfish pathogens or live epiphytes (plants that grow on organisms or objects, rather than on the ground), as well as embryos or other developing stages of the shellfish species. Disposal of this material in or near a water body could result in unwanted introductions, as well as other types of water quality impairment.

Bivalve wet storage: Holding shellfish in flow-through systems subjects surrounding surface waters to pathogens and other organisms that may be discharged during tank flushing. Transporting shellfish in nests of algae or other plants also poses the risk of introductions when these packing materials are discarded.

Creation of new fisheries: Several aquatic invaders, such as the Chinese mitten crab, may have been released intentionally in hopes of founding a new and commercially valuable fishery (Whitlatch et al. 1995). Seafood suppliers and commercial and recreational fishers and anglers, who are unaware of the detrimental impacts resulting from these introductions,

may be tempted to release these species into local aquatic systems to establish a self-sustaining population that can be harvested for consumption.

Aquaculture

California has the most diverse aquaculture industry in the United States. Like the seafood industry, aquaculture is an important sector of the California economy and has the potential for significant growth as more limits are imposed on wild fish harvests. While intensive culture of both finfish and shellfish reduces the harvesting pressure on wild stocks, concerns related to water quality impairment, the growth and distribution of pathogens, the escape of non-native species, and genetic dilution indicate a need for careful planning in this industry. The following are examples of how non-native species introductions can occur through intensive aquaculture operations.

Shellfish seed import: Shellfish seed is commonly grown in hatcheries and imported to California for use in commercial operations such as oyster culture. While the state regulates the sources of seed for this industry, there is the potential for the import of shellfish pathogens and other organisms associated with shellfish, such as boring organisms, from outside of the state. An enhanced capacity to identify and manage shellfish diseases will be necessary to minimize the loss of shellfish due to these threats.

Abalone culture: Farmed commercial abalone is a small but productive industry that recently felt the sting of an introduced parasite. The industry's struggles with the South African sabellid worm offer a good example of what can happen when shellfish are transferred among hatcheries across state and national boundaries (see also Management Examples, Chapter 4). Although both abalone aquaculture and stock importations are regulated by the state, new guidelines for the movement of live organisms may be needed.

Shellfish waste: Several shellfish species cultured in California prefer clean, hard surfaces on which to settle and attach. Placement of shellfish waste as substrate in grow-out areas has raised concern over the source and proper disinfection of this waste material and the potential of this practice to transport shellfish pathogens or other associated non-native species.

Finfish culture: Raising finfish in open systems such as raceways, flow-through tanks and net pens exposes surrounding aquatic systems to pathogens commonly associated with cultured fish populations, and introduces the possibility of escape of the aquaculture species into adjacent waters. The state regulates this industry and requires that species cultured in watersheds where they are not already present be isolated from natural systems.

Genetic dilution: Strains of shellfish and finfish used in aquaculture are often imported or represent stocks that have been genetically altered or selected for particular traits such as large size or disease resistance. Cultured stocks are usually at a disadvantage in competition with wild populations in the natural environment; however, farmed Atlantic salmon have been documented to escape and survive in the wild in Pacific Coast waters.

California has addressed many of these concerns through existing laws and regulations; however, several actions related to the prevention of introductions through the shellfish and aquaculture industries have been included in the plan.

Recreational Fisheries Enhancement

It is common practice in the United States for federal and state agencies to import game fish to enhance recreational fishing. Private citizens have also illegally transported and released fish species into waterways in hopes that a viable population would survive. Non-native fish introductions in California peaked in the 1960s, when 13 new species were introduced (Moyle 2002). Illegal fish introductions, including species newly brought to the state and transfers of already-established species to new sites are of increasing concern in California. There are 51 non-native freshwater fishes currently found in California; the majority introduced deliberately, whether legally or illegally, in an attempt to enhance recreational fisheries (Moyle 2002). Non-native fish are now the most abundant fish in many waterways in California, raising concerns about increased competition, predation, habitat interference, disease and hybridization with native species.

Aquarium & Aquascaping (Water Gardens)

Non-native marine and freshwater organisms can be introduced accidentally or purposefully after being imported for use in aquaria and water gardens (Carlton 2001). Aquatic plants available through these industries are often native to temperate regions and are selected for their ability to thrive under adverse environmental conditions. Of additional concern is the mislabeling of imported organisms, particularly aquatic plants, which may then be confused with native or innocuous species and released by the consumer. Careful inspection of stock shipped and received is important; aquatic plants such as water lilies have reportedly been shipped from nurseries still entangled in fragments of invasive hydrilla plants.

Live rock – coral skeleton that has been colonized by marine plants, microorganisms, and algae – poses a similar threat as a means of invasive species transport. Imported from tropical reefs, live rock is becoming a favored means to decorate and improve water quality in aquaria. Live rock is currently not subject to quarantine or other biological regulations, and has the potential to

transport small invasive species ranging from algae to jellyfish (Bolton and Graham 2006).

The state monitors and regulates a limited number of aquarium and aquascaping species. Enforcement can be difficult, as California's nursery industry includes approximately 3,500 growers, 3,000 retail nurseries and 3,500 incidental dealers such as supermarkets, drugstores and other chain-store markets. Many species of concern, particularly freshwater aquatic plants, are also now readily available via the Internet and through mail order catalogs for water gardening. Some of the most popular AIS still commonly sold include water hyacinth, parrot feather milfoil, Brazilian elodea, water lettuce, yellow floating heart, paleyellow iris and European frogbit.

Widespread use of the Internet for commercial sales of non-native aquatic plants and animals is particularly troubling. Federal agencies have the authority to regulate sales of invasive plants and invertebrates through the aquarium and water garden trades; however, California's capacity to monitor and regulate the importation of species is limited to those restricted by statute. The state can play a more active role by encouraging providers to monitor their shipments and by providing recommendations for care and handling. Efforts can be made to provide information to Internet suppliers based in California about the risks of particular species. Educated consumers can provide an added level of security by carefully inspecting shipments, after they are received and prior to release, to make sure they are not contaminated by additional AIS.

For all types of AIS imports – whether into stores, through catalogs or via the Internet – more education and outreach, inspections and enforcement are needed at both the state and federal level. Such steps are among the actions recommended in this management plan.

Research & Educational Activities

Marine and freshwater species can be ordered from research and education supply companies around the world through catalogs or Internet websites. While these organisms are generally supplied for research purposes, many companies also sell species for use in home aquaria. Few suppliers of live organisms, among them marine labs and research facilities, provide guidelines documenting use and handling practices.

Once the organisms are delivered, improper handling techniques may result in the release of non-native species. Both lab and field practices routinely present the opportunity for AIS release through wastewater discharge, disposal of unwanted organisms, poorly contained studies, etc. The invasion of the colonial sea squirt, *Botrylloides diegensis,* in Massachusetts is believed to have occurred via this vector (Whitlach et al. 1995).

Vector 5. Construction in Aquatic Environments

Many types of construction are conducted in aquatic environments, including the maintenance of canals and water delivery systems, the creation of shoreline parks and developments, the dredging of shipping channels and marinas, the control of riparian and levee-bank erosion, and the restoration of wetland, riparian and shallow water ecosystems. All of these activities, and the equipment used to accomplish them, can transfer or introduce AIS.

Construction Equipment: The use of contaminated construction equipment and the transport of sands and sediments during marine construction (building and installation of docks, platforms, bulkheads, breakwaters, artificial reefs, etc.) can lead to the introduction of unwanted AIS. Similarly, the use of heavy machinery, such as harvesters and dredges, to remove AIS and/or sediments from infested water bodies, can spread AIS from one site to another if the equipment is not properly cleaned between projects.

Canals, Channels, and Aqueducts: The building of canals, channels and aqueducts creates artificial connections between waterways, allowing the free movement of species across physical barriers. Increasingly in California, fish are being introduced into new areas by aqueducts that bridge drainages (see below).

Ecosystem Restoration and Erosion Control: Historical examples abound of non-native plants being introduced to California for habitat restoration and/or erosion control with disastrous results, including species of cordgrass, tamarisk and *Arundo*, to name a few. Awareness of this problem needs to be increased and alternative plant choices must be made available and encouraged or required. Equipment used during habitat restoration and subsequent monitoring should be cleaned to avoid transferring AIS from one site to another.

Vector 6. Water Delivery & Diversion System

The state's extensive water delivery, export, transfer and development system, which moves water not only from one watershed to another, but also from one end of the state to another, and even across state lines, can be an important vector of AIS. Water deliveries can spread freshwater-adapted AIS within and out-of-state, and carry species from infested areas to more pristine locales. For example, the yellowfin goby was first found in the San Francisco Estuary, and then in the Delta-Mendota Canal, a feature of the Central Valley Project. The yellowfin goby was later found further south, in the California Aqueduct, which is part of the State Water Project and transports water from northern and central California to the Los Angeles area. More recently, the yellowfin goby has been found in the San Luis Reservoir in the western San Joaquin Valley. The California Aqueduct has transported a number of species, both native and invasive. Scientists have already identified species they predict will travel to new locales on this waterway, such as the Shimofuri goby found in

the Suisun Marsh northeast of San Francisco, and more recently in Pyramid Reservoir, 39 miles from downtown Los Angeles.

A significant amount of water, and whatever AIS are in it, is moved around California each year to supply drinking, irrigation and other water supplies for human activities. The state's two largest water distribution systems, the State Water Project and the federal Central Valley Project, can move up to four and seven million-acre feet of water each year, respectively. At least 7,000 other users also have permits to divert water. During the period 1998 and 2001, approximately 30-37 million acre feet of water were diverted from their original courses annually in California. Of these transfers, between 3.9 and 4 million acre feet of water transfers came from the Colorado River (Messer 2007).

The likelihood of spreading aquatic invaders via water diversion is not proportional to the amount of water that is being transferred. Often, water is moved to a water treatment plant where it will be processed into safe drinking water or to agricultural fields inhospitable to aquatic species. Water turbines may be fatal to invasive species. When an invasive species arrives in a new location, it does not always establish. For instance, Chinese mitten crabs transported to an agricultural canal near Bakersfield, California by the Central Valley Project cannot establish a viable population because they need access to an estuary to complete their life cycle.

Water managers are working to better track AIS in their equipment and systems. State and federal project managers, for example, monitor AIS by counting mitten crabs which clog the fish screens at fish collection facilities in Tracy, California, where water is diverted from the Delta. Native and non- native fish are counted, collected, and salvaged, and new fish species have been noted at these facilities. Less extensive sampling, mostly to determine fish loss, is conducted at other regional water diversion facilities.

Intensive manipulation of natural water paths and flow rates, and other characteristics of the state’s aquatic and adjacent ecosystems, make California particularly vulnerable to AIS. Not only can AIS be more easily transferred via these diversions but they can also find it easier to colonize areas where native species are already stressed by dams, water diversion, altered hydrology and development in their habitats.

Conclusion

The above is only a discussion of the primary vectors of aquatic species invasions. In the past 200 years, the number of vectors available to transport marine species has steadily increased. In the year 1800, ships and the materials carried for ballast were the major mechanisms of introduction. By 2000, there were at least 16 known human-related vectors (Carlton 2001). The increasing diversity of vectors makes the prevention of introductions an even greater challenge.

4. MANAGEMENT FRAMEWORK

Efforts to manage aquatic invasive species began more than a century ago when water hyacinth and alligatorweed began to clog navigable waterways. Early 1900s management efforts involved chemicals that generally proved either ineffective or poisonous to livestock and wildlife and mechanical removal, either by hand with a scythe or with the help of "crusher boats," which smashed floating vegetation between heavy rollers, and "saw boats" which shredded plants with rotating blades (Hoyer and Canfield 1997). Since then, management approaches have changed and become more diverse to include everything from hyperspectral remote sensing, ozone treatment and K-12 education curricula to herbicides, electro-fishing, Internet sales precautions, PowerPoint presentations and border inspections. Numerous international, federal and state laws have been passed aimed at preventing and controlling invasions, and numerous government agencies, NGOs, industry groups and other organizations have become involved in AIS management.

Most long-established programs – both state and federal – are targeted at managing terrestrial agricultural pests, which can spread easily by wind, fog and through the air. Many of these programs are species specific. Efforts to manage invaders living in and around water present a different set of challenges for containment and control and focus on preventing vectors from bringing in new species and on developing early detection networks. This chapter:

- explains the generally accepted management framework and control options for AIS;
- provides a brief overview of AIS programs operating in California;
- summarizes the responsibilities of California state agencies most involved in AIS work;
- lists gaps and challenges in state AIS management.

A summary of AIS-related state and federal laws and authorities can be found in Chapter 5, with a more comprehensive description and more extensive agency information appearing in Appendices B, C and D. A list of regulated AIS species can be found in Appendix G.

General Framework

On a general level, invasive species management involves five basic strategies, often in combination:

- Prevention
- Early Detection & Monitoring
- Rapid Response & Eradication
- Long-Term Control & Management
- Education & Outreach

This basic framework, well established on a national level, is also reflected in California's existing pest prevention programs and weeds management plans. It forms the foundation of management actions described in Chapter 6 of this plan.

In choosing management approaches within this framework, the nature of the invader itself comes into play (see Table 3). Some invaders (such as the zebra mussel) may be known troublemakers in other states or nations but have not yet arrived in California, suggesting a management response focused on monitoring, education and early detection. Other invaders (such as the water hyacinth choking boating channels and lakes) may be so well-established that eradication is infeasible and ongoing chemical and/or mechanical removal is selected to minimize the harmful effects of the infestations. Still others (such as the Asian overbite clam colonizing the floor of Suisun Bay) may present no management option whatsoever since there is no environmentally acceptable way to treat or remove widespread benthic invertebrates in open waters. Whatever the species, the possible human management responses generally narrow as any invasion progresses (Lodge et al. 2006).

Table 3: Species Management Types

SPECIES MANAGEMENT TYPE	REPRESENTATIVE SPECIES	MANAGEMENT RESPONSE
Type 1 Not yet detected in California or eradicated	*Caulerpa* Northern Pacific seastar South African sabellid polychaete snakehead zebra mussel	Monitoring Early detection
Type 2 Limited in extent	Hydrilla channeled apple snail *Salvinia* smooth cordgrass quagga mussel	Early detection Rapid response Eradication
Type 3 Established but manageable	African clawed frog *Egeria* Chinese mitten crab Eurasian watermilfoil European green crab purple loosestrife salt cedar water hyacinth	Localized eradication Impact mitigation Control of spread to other water bodies Research on control technologies
Type 4 Widespread but currently no large-scale control options	Asian overbite clam inland silverside New Zealand mudsnail bullfrog water lettuce pale yellow iris	Monitoring Prevent spread to new water bodies Research
Type 5 Unknown invasion potential	Asian swamp eel green sunfish salt meadowcordgrass	Research and evaluation

The Species Management Type (SMT) characterizes the distribution and degree of establishment of an AIS in California and could be assigned to any AIS species. This characteristic is useful to consider when setting management priorities or planning for a management response to a potential or actual AIS infestation. Representative species are merely examples, as this table is not meant to provide a comprehensive list of species sorted by SMT. Though valid at the time of publication, the status of the species mentioned is likely to change over time. For more examples see Chapter 8.

Prevention

Preventing AIS introductions is the single most cost-effective and environmentally beneficial management approach and is the first line of defense. This approach focuses on preventing the release of AIS into state waters via ballast water, fouled hulls, marine equipment movements, aquatic recreation and research activities, and by the producers and buyers of bait, aquariums, seafood and other live organisms. Pest prevention programs for noxious weeds often refer to this type of prevention as “exclusion” (keeping the species out of the state). Many prevention programs focus on minimizing the introduction of all species into the environment via specific vectors. This is because it is very difficult to predict which species will invade and cause significant impacts. It is also very difficult to identify the actual species of potential aquatic invaders (especially very small invertebrates, internal parasites, and unicellular organisms). Inspection programs, such as those for smaller boats and retail and wholesale businesses, are also part of prevention, but generally target specific species rather than the entire range of species that those vectors could potentially introduce.

Prevention programs may include everything from inspections of stores, industries or facilities that may be harboring or selling AIS to education and outreach. As prevention is the least expensive and most effective management response, every vector deserves state level consideration and coordination.

Monitoring, Early Detection & Rapid Response

Some species will evade prevention programs. A few of these will spread, after a certain lag time and become pests. The lag time between establishment and spread, which could be weeks to years, offers an opportunity for detection and eradication. Taking action while populations are small and localized is extremely important but the effort required to detect a species can be inversely proportional to its population size. Sound management must balance the high costs of surveys aimed at detecting small populations over a wide area against the high costs of eradication if a survey fails to catch an invasion early on. New surveillance technologies and web-based reporting and information networks may help increase the success of early detection efforts (Lodge et al. 2006). Enlisting the help of citizen monitors, watershed groups, professional diving associations, and others often in and out on the water may also prove effective.

Once detected, rapid response often involves an attempt to eradicate the invader by chemical, mechanical or other means. This works best when the invader appears in an isolated lake, creek or other water body where spread can be contained and the environmental impacts of chemicals used to kill the invader is minimized. Eradication may be possible in isolated areas of one part of the state while larger scale control programs may be necessary in others where infestations have spread. For this reason, it is sometimes hard to categorize existing response programs as either “eradication” or “control.” Such measures often go hand-in-hand on a statewide scale.

MANAGEMENT EXAMPLES: BALLAST WATER & HULL FOULING

California law began mandating ballast water management for ships arriving from foreign ports in 1999. During the ballast exchange process for vessels entering the state from outside the U.S. Exclusive Economic Zone (U.S. EEZ), biologically rich water loaded at the last port of call is flushed out of ballast tanks and replaced with the water from the open ocean, beyond 200 nautical miles (nm) from land. For vessels moving along the coast, the exchange is done outside of 50 nm. Organisms are generally less numerous in the open ocean and it is expected that they will be poorly adapted to survive once discharged in the very different environmental conditions of a near shore port. Scientific research indicates that offshore ballast exchange typically eliminates 70% - 95% of the organisms originally taken into a tank while at or near port (Zhang and Dickman 1999, Parsons 1998). Other studies suggest that exchange efficiency is inconsistent and ranges from 50-90% (U.S. Coast Guard 2001). Most experts view ballast water exchange as a short-term solution, with the final resolution being a combination of ship-board treatment technologies and management options such as ballast water retention or the use of freshwater as ballast, among others (Falkner et al. 2006).

Minimizing the release of invasive organisms growing on or clinging to the hulls of oceangoing ships and commercial fishing vessels is also an important frontier of AIS management. Commercial vessel operators have long endeavored to keep fouling to a minimum on their ships for other reasons. Fouling creates drag, increasing fuel consumption, and/or straining the engine; it can also block pipes bringing in seawater to cool machinery. To prevent such problems, commercial vessels periodically clean their hulls and utilize antifouling coatings designed to discourage the attachment of organisms. While these measures do reduce the amount of fouling on a ship, consequently reducing the potential for AIS to be moved to new locations, they can create water quality problems. Most antifouling coatings slowly release toxic substances. Vigorous scraping of a hull while a vessel remains in the water can exacerbate the quantity of toxins and toxic debris released into surrounding waters. Biocide-free anti-fouling alternatives are currently being researched (Anderson). Recommendations for a new state program targeted at reducing the risk of AIS release from hull fouling (including consideration of some of the water quality concerns) were completed in 2006 (Takata et al. 2006). For more information on current California ballast water and hull fouling management programs see SLC section later in this chapter.

In order to effectively respond to the early detection of an AIS occurrence, several states have developed formal interagency rapid response plans. California has recently begun this process and written a draft rapid response plan (Appendix A). The goal of such plans is for agencies and other interests to work together as effectively and efficiently as possible through prior agreements about: roles and responsibilities, chains of command and communications, criteria for initiating rapid response actions, public safety, funding, regulatory permit processes, public information, data collection, implementation and follow-up evaluation. In other words, a rapid response plan lays out how federal, state and local officials should respond if an AIS of particular concern (such as the zebra mussel, see below, or the marine algae *Caulerpa*, see Chapter 8) is detected. Response can be delayed by permitting processes developed for maximum public input and thorough review, rather than for emergency response timelines. Both federal and California agencies have recognized the need for special levels of coordination and cooperation to facilitate rapid response.

MANAGEMENT EXAMPLES: ERADICATION OF SABELLID WORMS & ZEBRA MUSSELS

The South African sabellid worm was imported to the United States in the 1980s in an abalone shipment from South Africa. By 1993, abalone growers in Cayucos, California began to notice defects such as misshapen, stunted and brittle shells in their stock. The worm causes shell lesions that compromise the abalone's overall health and marketability. The worm quickly spread to other abalone farms via seed stock and to rocky intertidal habitat nearby. The resulting infestation spread to native black turban snails. University of California, Santa Barbara researchers removed more than a million infected snails from the area, eradicating the worm from the wild in California. State agencies now closely regulate transfers of abalone between aquaculture facilities and have established a two-year certification program to ensure buyers that shellfish stocks are sabellid-free.

Though not in California, a 2006 success story in early detection marks the first successful extermination of zebra mussels. In 2002, the mollusks were discovered growing in a twelve-acre abandoned rock quarry in Virginia. With neither a native mollusk population nor any surface water outlets, the site was deemed ideal for mussel eradication. In 2006, the quarry was treated for three weeks with twice the concentration of potassium chloride found to be lethal to zebra mussels. Eradication was confirmed by a variety of measurements. Concentrations of potassium chloride in quarry water remained well below levels harmful to other wildlife; turtles, fish, aquatic insects, snails and other wildlife in the quarry do not appear to have been affected by the treatment. Unfortunately, the large volume of potassium chloride required makes the technique impractical to apply in large bodies of water.

Slow the Spread & On-Going Control

When eradication is not feasible, containment or at least a "slow the spread" strategy may be the best choice, particularly when management costs are likely to be exceeded by the environmental, public health or economic losses to businesses dependent on aquatic environments if an invasion is allowed to proceed unmanaged. Control programs often occur over many years, involve multiple sites and waterways, and present a daunting battle to manage the movements of small seeds, spores, larvae and specks of algae across huge landscapes and waterscapes.

Education & Outreach

Regardless of what the management response is, or the scale or type of invasion, it is critical to establish effective, ongoing communication with all those impacted, involved or potentially perpetrating the problem. Education and outreach – whether it is public service announcements and other media campaigns, species identity cards, volunteer training or school programs – play an important role. Education and outreach activities go hand-in-hand with all phases of AIS management, including prevention, early detection and monitoring, rapid response and eradication, and long-term control.

MANAGEMENT EXAMPLES: PURPLE LOOSESTRIFE AND CHINESE MITTEN CRAB IMPACTS

Purple Loosestrife is a wetland invader imported from Europe in the early 1800s for its medicinal value and beautiful purple flowers. A large plant can produce more than two million viable seeds in one season. Purple loosestrife is still sold as an ornamental in nurseries in some states, though at least 24 states, including California, have listed it as a noxious weed and prohibit its sale. In California, it is rapidly expanding its range. State agencies have undertaken an effort to survey state populations and develop management plans. Eradication is the goal where feasible; however, preventing the spread of established populations may be the only alternative in other places. The plant is extremely difficult to eradicate, although a suite of insects has provided effective biological control in some areas.

Although the Chinese mitten crab had previously been found elsewhere in the United States, San Francisco Bay was the first introduction that resulted in the establishment of a population. Burrows excavated by the crabs erode banks and could damage levees. The crab's sharp claws can cut through commercial fishing nets and reduce or damage catch. The mitten crab can also host a human parasite known as the lung fluke, which can cause tuberculosis-like symptoms (the parasite has not been found in California crabs to date). In fall of 1998, as many as 1 million mitten crabs were collected at the federal and state fish salvage facilities in the south delta, which are associated with the California Aqueduct and State Water Project. The crabs clogged the screens, holding tanks and transport trucks used to salvage fish from the pumping stations. The state built "Crabzilla", an 18-foot high traveling fish screen, at its Tracy fish collection facility to scoop up the crabs so they can be hauled off and ground up for fertilizer. Mitten crab numbers declined after 2001 and in 2005 were at very low numbers throughout the watershed (Hieb 2005 in press).

MANAGEMENT EXAMPLES: NATIONAL AWARENESS CAMPAIGNS

Numerous education campaigns seek to improve public awareness of AIS issues on a national level. Habitattitude, for example, was started by the U.S. Fish & Wildlife Service and the national Aquatic Nuisance Species Task Force and the pet industry. This campaign focuses on promoting consumer awareness and responsible behaviors for aquarium and water garden hobbyists and in the industries that serve them. Other national campaigns are already working to educate water users about how to prevent the spread of AIS: Protect Your Waters & Stop Aquatic Hitchhikers is an educational campaign aimed at all recreational users; the 100th Meridian Initiative is a campaign aimed at stopping the spread of the zebra mussel and other AIS into the West. For more information on these national campaigns see Appendices B and D.

An Overview of Current AIS Management Activities in California

Seven state agencies are actively involved in large-scale ongoing AIS management programs. Numerous other local, state and federal agencies, NGOs, universities, research institutions and stakeholder groups, also play a role. Some management programs focus on a specific vector (commercial shipping, aquaculture, etc.), some on specific nuisance species or a group of species (such as agricultural pests) and some on minimizing AIS impacts on protected uses of the state's waters (boating, fishing, wildlife habitat, etc.). More information about the activities of these diverse agencies appears later in this section and in Appendices B, C, and D.

The seven state agencies with lead AIS responsibilities are the California Department of Fish & Game (DFG), the California Department of Food and

Agriculture (DFA), the California Department of Boating and Waterways (DBW), the California State Lands Commission (SLC), the California Department of Water Resources (DWR), the State Coastal Conservancy (SCC), the State Water Resources Control Board (SWRCB) and nine regional water quality control boards (RQWCBs) – see Table 4.

At this time, DFG serves as the coordinating agency for AIS activities, represents the state on the Western Regional Panel (see Appendix D), and as such, has organized the development of this plan and other statewide initiatives to improve AIS management. State weed control programs are managed primarily by DFA, with federal help from the USDA and critical input and cooperation from research, education and related business organizations. As part of this program, DFA, with the help of County Agricultural Commissioners, also manages an exclusion program both at borders and at entry points. Other state agencies manage specific in-the-water and on-the-ground aquatic weed programs – including DBW and SCC.

SLC is the lead implementing agency for the state's ballast water management program. This program implements California regulations requiring vessels arriving from outside the U.S. EEZ and engaged in coastwise travel, to manage their ballast water. As part of this program, DFG/Office of Spill Prevention and Response (DFG/OSPR) conducts biological surveys in port/harbor areas and open coastal areas.

Other state agencies undertake invasive species management activities to enforce mandates such as the protection of commercial fisheries and sensitive wildlife by DFG, in cooperation with federal agencies such as USFWS, the maintenance of state water supplies and protection from flooding by DWR and the protection of the beneficial uses of state waters and water quality by SWRCB and RWQCBs. Across the state, local districts work to control mosquito populations to protect human and livestock health. All these state efforts to manage AIS are supported by the cooperative work and research provided by universities, NGOs, federal agencies, local agencies and stakeholder groups.

Table 4: Lead AIS Agency Contacts in California (as of April 2007)		Vectors	Invaders
California Department of Boating and Waterways (DBW)	Marcia Carlock mcarlock@dbw.ca.gov (916) 263-8142 http://www.dbw.ca.gov/	Recreational boating	water hyacinth Brazilian elodea
California Department of Fish and Game (DFG)	Susan Ellis sellis@dfg.ca.gov (916)653-8983 http://www.dfg.ca.gov/	Aquaculture Commercial Fishing Live fish and animal transportation and imports	fish aquatic organisms and plants algae (*Caulerpa*)
	Marian Ashe mashe@ospr.dfg.ca.gov (916)324-9803 http://www.dfg.ca.gov/ospr/	Ballast water (biological surveys)	estuarine and marine invasives
California Department of Food and Agriculture (DFA)	Patrick Akers pakers@cdfa.ca.gov (916)654-0768 http://www.cdfa.ca.gov/	Nurseries Agriculture	Hydrilla and other regulated aquatic weeds agricultural pests
California State Lands Commission (SLC)	Maurya Falkner falknem@slc.ca.gov (916)574-2568 http://www.slc.ca.gov/Spec_Pub/MFD/Ballast_Water/Ballast_Water_Default.html	Commercial shipping: Ballast water Vessel fouling	estuarine and marin invasives
	Eric Gillies gilliee@slc.ca.gov (916)574-1897	Construction Restoration	freshwater, estuarine and marine invasives
California Department of Water Resources (DWR)	Jeff Janik jjanik@water.ca.gov (916) 653-5688 http://www.water.ca.gov/	Water supply and delivery systems Flooding	riparian weeds mitten crab aquatic food web
The State Coastal Conservancy (SCC)	Abe Doherty adoherty@scc.ca.gov (510)286-4183 http://www.coastalconservancy.ca.gov/	Coastal preservation Restoration	*Spartina* *Arundo* wetland invasives
State Water Resources Control Board (SWRCB)	Dominic Gregorio dgregorio@waterboards.ca.gov (916)341-5488 http://www.waterboards.ca.gov/	Discharges Runoff	general exotics

For detailed information on these and other state, federal and local agencies involved in AIS management see Appendices B, C & D.

As this plan is intended primarily for internal state coordination, the focus of the following sections of this chapter is on state agency activities. This section is intended as an overview. A more comprehensive description of state agency responsibilities appears in Appendix C and overlaps somewhat with the overview below.

Biological Surveys, Environmental Planning & Enforcement

DFG is the state trustee agency for fish, wildlife and native plants and plays a major role in managing invasive species that have negative impacts on these resources. Numerous programs and laboratories within DFG work on AIS detection and/or control, including DFG's Invasive Species Program which coordinates statewide AIS activities and undertook the development of this statewide AIS management plan and the associated rapid response plan. DFG is responsible for enforcement of regulations concerning: the aquaculture industry; recreational fishing; commercial fishing; the importation and transport of live wild animals, aquatic plants and fish into the state; and the placement of any such animals in state waters. Recent programs have focused on *Caulerpa* (see Chapter 8), northern pike (see below), quagga mussel, and New Zealand mudsnail, among others.

DFG is also responsible for conducting biological surveys to assess the amount and types of AIS present in state waters. Starting in 1999 with ballast management legislation, DFG/OSPR conducted biological surveys to determine the degree of success of ballast water management activities. The first survey of major ports, harbors and bays of California helped determine a baseline of nonindigenous aquatic species introduced from the ballast of ocean-going vessels. The survey revealed that all areas of the California coast have experienced some level of invasion by species not native to California. Since then, DFG/OSPR has revisited baseline monitoring sites and expanded monitoring to include intertidal and subtidal habitats at 22 outer coast sites. DFG/OSPR also manages the California Aquatic Non-Native Organism Database (CANOD) for marine and estuarine species and is working to establish consistency among the various major databases being used to analyze similar types of AIS-related information. Lastly, DFG has been an active manager or partner in numerous AIS eradication and control programs – especially those AIS that threaten or undermine the health of endangered species or the conservation and restoration of the aquatic ecosystem.

Aquatic Weed Control & Plant Pests

DFA has long regulated and managed aquatic and terrestrial weeds, with a particular emphasis on those that are agricultural pests or cause economic harm. DFA activities and regulatory authority include quarantine, exterior pest exclusion (border protection stations and inspections), interior pest exclusion (pet/aquaria stores, aquatic plant dealers, and nurseries), and detection and control/eradication programs. DFA maintains a rated list of noxious weed species, which, depending on the rating, require various levels of eradication,

containment or holding actions. For all plants, the DFA Plant Pest Diagnostic Center identifies plant species and assigns plant pest ratings. In 2005, DFA and the California Invasive Weed Awareness Coalition completed the state's first comprehensive *Noxious and Invasive Weed Action Plan* (CDFA and CALIWAC 2005), whose recommendations as they relate to aquatic weeds have been taken into account in this AIS plan. One of DFA's largest aquatic weed management programs is a statewide effort to eradicate the escaped aquarium plant *Hydrilla* (see Chapter 2). The County Agricultural Commissioners (CACs) work closely with the state's pest prevention program. In northern California, CACs carry out many quarantine inspections and manage a weed eradication program.

MANAGEMENT EXAMPLE: CONTROLLING NORTHERN PIKE

California's northern pike infestation is currently limited to just one lake. This native of northern waters from Asia to Europe and from Alaska to the Great Lakes Region, is a voracious predator that can grow up to 40 pounds in North America. It uses sharp teeth to eat creatures ranging from smaller fish such as juvenile salmonids to frogs, crayfish and even ducks. After introduction, it has the potential to dominate water bodies such as lakes, by both preying on and out-competing trout and other game fish. The northern pike poses a major threat to California's aquatic ecosystems, in particular the freshwater species of the Sacramento-San Joaquin Delta. The northern pike was introduced to California on at least two occasions, possibly by anglers hoping to establish a local population of this popular game fish. It was first found in Frenchman Lake, Plumas County, in 1988.

In 1991, Frenchman Lake and its tributaries were treated with rotenone; subsequent testing indicated no pike survived. In 1994, the pike was discovered again in nearby Lake Davis, another Sierra Nevada reservoir. In 1995, DFG proposed to treat Lake Davis with rotenone in order to protect the area's thriving trout fishery, as well as downstream aquatic resources, by eliminating the chance of pike escaping to other waters. Residents strenuously opposed the plan, citing contamination of their drinking water supply. By 1997, the lake's trout population had been virtually eliminated by pike predation. Local businesses, many of which depend on visiting fishermen, began to suffer. Despite the controversy surrounding the proposed project, a treatment occurred in October 1997. Over 55,000 dead pike were removed from the lake and the treatment was declared successful. In 1999, just 17 months after treatment, more pike were found in Lake Davis. It is unknown whether fish survived the treatment or pike were illegally introduced after the treatment. After the fish were rediscovered in Lake Davis, DFG commenced trapping, electrofishing, netting, and increased law enforcement and education on the dangers of pike introduction. Yet fish numbers in the lake have continued to rise. In 2005, DFG proposed a project to eradicate northern pike in Lake Davis. The proposed project includes application of rotenone in combination with a significant reservoir drawdown; the drawdown would reduce the amount of chemical needed to kill the pike. DFG, in cooperation with the U.S. Forest Service, Plumas National Forest, are currently engaged in a joint state and federal environmental review process for the proposed project and seven alternatives. Both agencies are working closely with the local community and local, state and federal agencies to avoid the controversial nature of the chemical treatment that occurred in 1997.

MANAGEMENT EXAMPLE: QUARANTINES & INSPECTIONS

California has a long history of state-imposed quarantines and exclusionary practices dating back over a century. These quarantines have prevented or limited the entry of many invasive species and diseases such as Mediterranean fruit fly and exotic diseases that developed from farmed salmon and other fish. At the height of California's quarantine and inspection programs, DFA operated 16 full-time Border Protection Stations (BPS), staffed by over 150 inspectors, to inspect all vehicles entering the state for quarantine compliance. Additionally, the CACs conducted enforcement activities at plant and produce import sites and aquaculture facilities. In recent years, funding for these programs has diminished and resources are not available to keep up with increases in invasions due to growth in U.S. and global travel and mail order and Internet sales of live organisms and plants. DFA funding for BPS alone dropped from $11 million in 2002 to $9.2 million in 2005 and private vehicle inspections (including trailered boats and other watercraft) had until recently been eliminated.

Zebra mussel infested watercraft were intercepted at the BPS 68 times between 1993 and 2006. Over half of these finds were from private vehicles, which are not being inspected today. DFA is in the process of conducting a pilot project at one station (Needles on I-40) to determine the pest introduction risk presented by private vehicles. Since this project began on July 5, 2006, zebra mussel has been intercepted four times on private vehicles. Hydrilla has also been intercepted from a private vehicle during this pilot. Increased levels of inspection and enforcement are critical to the prevention of new AIS introductions (Leslie, Pers. Comm. 2007). The discovery of quagga mussel in Lake Mead in January 2007 allowed state agencies to access emergency funds to increase staffing, and permanent funding became available July 1, 2007.

DBW manages the state's largest and oldest aquatic weed control program, working with other public agencies to control the widespread water hyacinth (see Chapter 2) – and more recently Brazilian elodea – in the Sacramento-San Joaquin Delta, its tributaries and the Suisun Marsh. In addition to managing these weed control programs and attempting to keep waterways free of the navigational problems they pose, DBW also manages the recreational boating vector of AIS in California (although currently there is not funding and staff for a comprehensive program). DBW leads the California Clean Boating Network – a collaboration of government, business, boating and academic organizations working to increase and improve clean boating education efforts, including invasive species education, across the state.

SCC has been involved for over twenty years in the control and eradication of aquatic invasives, particularly plants. Most recently, its management focus has been on developing, funding and operating the Invasive Spartina Project in San Francisco Bay (see Chapter 8 and Appendix B). The project's aim is to eradicate four invasive species of *Spartina* (and their hybrids), which threaten to destroy marsh and mudflats and clog drainage channels. SCC is also heavily involved in efforts to control *Arundo* in many coastal watersheds and has been a partner in developing this state AIS management plan.

Commercial Shipping Management (Ballast Water and Vessel Fouling)

SLC oversees management of AIS introductions through commercial shipping as directed by the 2003 Marine Invasive Species Act. This program implements regulations governing ballast water management for vessels arriving or operating on the West Coast of North America. Commission inspectors board approximately 25% of all vessels that arrive to California to verify compliance with regulations and to disseminate outreach materials to vessels and crews new to California (Falkner et al. 2007). Monitoring results suggest that vessel compliance with the requirement to report ballast management and discharge practices is very high (see Figure 4) and has risen dramatically since the inception of the program. The majority of non-compliant ballast water discharge originating from outside U.S. waters is from Mexico (Falkner et al. 2007).

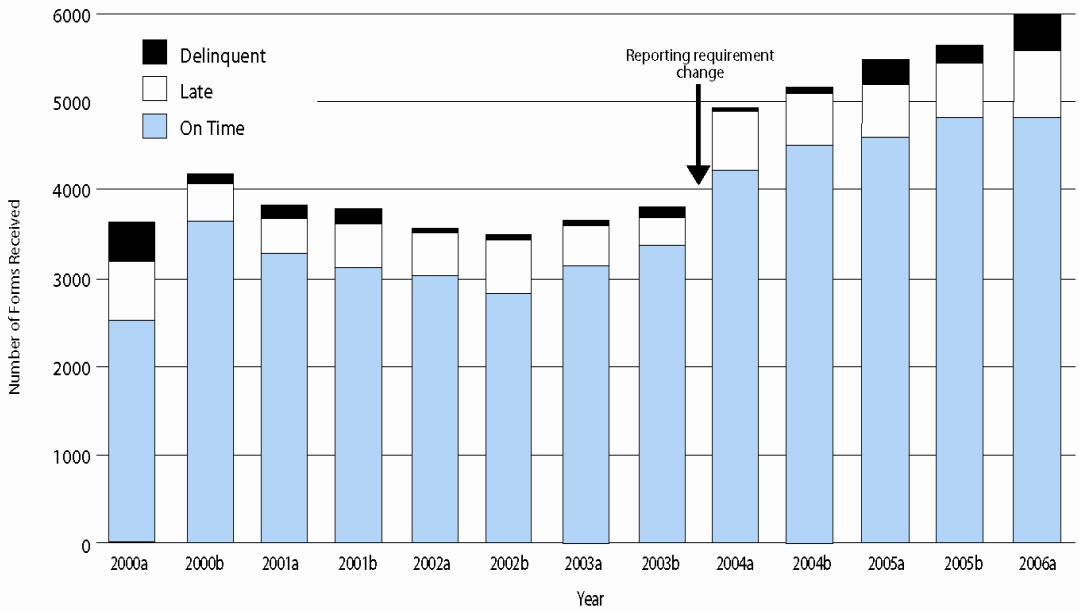
The high compliance rates are attributable to the multi-pronged outreach and communication activities undertaken by SLC. Inspectors distribute information about regulations verbally and in print to crews. Agents are notified monthly of their vessels' reporting compliance or non-compliance. Multi-agency, multi-interest advisory groups are regularly convened and consulted regarding evolving policy considerations. New legislation (2006) directs SLC to develop regulations requiring vessel owners and operators to implement certain interim and final performance standards for the discharge of ballast water. In addition to the regulatory activities described above, SLC facilitates scientific research and technology development to enhance management efforts of the ballast water program and to inform policymakers.

SLC has also developed recommendations for preventing AIS release from hull fouling on commercial vessels. In follow up to the Marine Invasive Species Act of 2003, which directed SLC to formulate these recommendations, SLC collaborated with the California Sea Grant Extension Program on a May 2005 workshop. This workshop was designed to discuss the vessel fouling issue with stakeholders from both the recreational boating and commercial shipping communities (Gonzalez and Johnson 2005). Information gathered from this workshop and from several additional advisory group meetings, was incorporated into a set of final recommendations presented to the state legislature in 2006 (Takata et al. 2006). In addition to its commercial shipping-related activities, SLC is also engaged in regional AIS projects that affect waters that fall under their jurisdiction, such as coordinating interagency efforts to manage Eurasian watermilfoil in Lake Tahoe (see Chapter 8).

Figure 4: Ballast Water Reporting and Discharge Rates

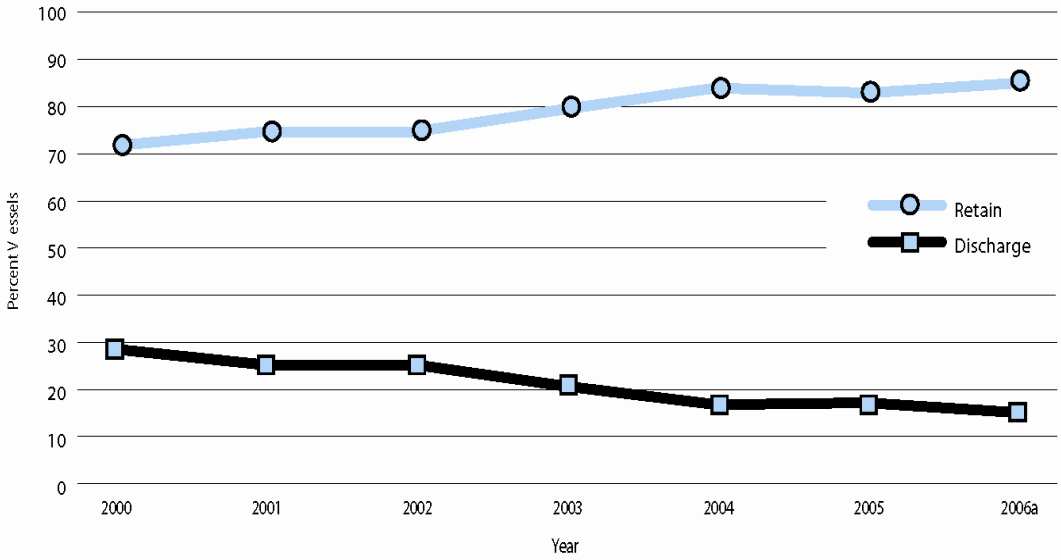
Ballast Water Reporting

Vessel compliance with requirement to submit information on ballast water management practices to the State Lands Commission. The x-axis is divided into 6-month intervals (a = January-June; b = July-December). Since 2004, compliance has remained above 94% with approximately 85 % of vessels reporting on time (upon departure from port). (Source: Falkner et al. 2007)



Ballast Water Discharge vs. Retention

Percent of vessels discharging in CA waters (squares) compared to percent of vessels that retain ballast water (circles). Only the first 6 months of 2006 are represented in this graph. Since 2000, the percentage of vessels discharging has steadily decreased. Ballast water retention is currently the most protective management option available. (Source: Falkner et al. 2007)



Monitoring & Managing AIS Impacts on Water Quality & Supply

DWR addresses invasive species issues that impact water supply and delivery and flood control. Recent management activities have focused largely on monitoring AIS within the water column and food web, developing key early detection programs and undertaking structural improvements such as a barrier at Lake Davis (to prevent northern pike escape) and a screen at the State Water Project (to collect Chinese mitten crabs). In terms of monitoring, DWR conducts monthly monitoring of benthic (bottom-dwelling) invertebrates, zooplankton and phytoplankton throughout the upper San Francisco Estuary. DWR also documents the distribution of the invasive algal species *Microcystis* spp. (both toxic and non-toxic strains) in this estuarine region. DWR is also investigating the impacts of the Chinese mitten crab on the benthic invertebrate community in the Sacramento-San Joaquin Delta. On the early detection front, DWR was most recently responsible for implementing the California Zebra Mussel Watch Program (which included risk assessment, early detection, public outreach and the development of a rapid response plan for the Central Valley watershed and a centralized reporting system for mussel sightings). DWR also participates in programs aimed at controlling invasive weeds along eroding Sacramento River banks, within flood control and water conveyance structures and along urban streams. The agency coordinates its activities with other state and federal agencies as a member of the CALFED Non-Native Invasive Species Advisory Council.

The SWRCB, and the nine affiliated regional boards, have no specific policies and programs related to AIS but have been working in support of and in an advisory capacity to, other state agencies on various related activities such as hull fouling and ballast water management. AIS come under SWRCB purview as part of the state's responsibilities under the federal Clean Water Act (CWA, see Appendix B). A 2005 federal court ruling defined nonindigenous species as "pollutants" present in discharges from vessels and found that such discharges are not exempt from permitting requirements (see National Pollutant Discharge Elimination System (NPDES) permits in discussion of the CWA in Appendix B).

In terms of AIS management activities, some of the regional boards have also sought to place specific water bodies within their regions on the CWA's 303(d) list, as impaired by "exotics" (see Glossary). San Francisco Bay was listed in 1998. In 2006, the State Board also listed the Delta, the upper San Joaquin River and the Cosumnes River. Once on the 303(d) list, the regional boards are required to develop discharger/source based programs for managing pollutant loads (called Total Maximum Daily Loads or TMDLs), which in the case of AIS have proved somewhat difficult to develop. Trying to allocate loads or goals for zero loads, among dischargers, water users and municipalities is challenging when most of the water bodies in question are already heavily invaded. Despite the implementation challenges, the S.F. Bay RWQCB's work on the state's first exotics TMDL did widely publicize the problem and led to other successful AIS management and legislative programs.

Other regional boards have become involved in AIS-related water quality issues through watershed management projects, non-point source pollution management programs and wetland mitigation and restoration programs (raising issues about the use of non-native aquatic plant species for these programs, and the control of invasives, for example). The SWRCB has also participated in AIS management activities concerning the use of aquatic pesticides and the nine regional water quality control boards enforce the statewide NPDES permit for use of aquatic pesticides for weed and vector control.

Education & Outreach

Most of the AIS management programs described in this chapter involve some education and outreach. There are many other outreach activities, large and small, conducted by public and private organizations interested in the prevention and control of AIS infestations. The University of California Cooperative Extension (UCCE) and California Sea Grant Programs (Sea Grant), for example, are active and successful leaders in invasive species outreach and education. They have built substantial stakeholder networks and brought media attention to AIS concerns. Other groups engaged in AIS outreach and education include CALFED, the San Francisco Estuary Project, the San Francisco Estuary Institute, National Estuarine Research Reserves and Marine Sanctuaries, the Pacific States Marine Fisheries Commission and the California Invasive Plant Council, among others (see Appendix D).

Partnerships with NGOs, Business & User Groups

Many of the state's AIS management activities are undertaken through partnerships with local agencies, non-governmental organizations (NGOs), private landowners and various interest groups. Those currently active range from large environmental and land-holding organizations such as the Nature Conservancy to smaller county land trusts, Native American tribes, watershed management organizations, and special interest groups (fishing, hunting, boating, etc.). Business groups affected by AIS management activities (shippers, aquarium trade, habitat restoration companies, etc.) have also been active partners in AIS management. A number of task forces and projects are dedicated to very specific invaders (see Appendix D). Such groups and organizations can greatly help state and federal efforts to manage AIS.

Partnerships with Universities, Research Institutes, Industry & Consulting Firms

The management activities mentioned in the preceding sections were possible because of the research conducted by universities, relevant industries public/private research and resource management organizations. Increased knowledge of the biology of invasive species and associated control methods allows for the most effective management of AIS. Research is needed to quantify and clarify the effects that non-native species are having on native plants, animals and their habitats. It is also important to know what economic effects AIS are having and whether there are any human health and safety

concerns resulting from an infestation. These partnerships are necessary in order for agencies to develop their management programs with scientific input.

Gaps & Challenges

Factors such as the large size of the state, the number of organizations/ constituencies involved and other geographic and water management issues complicate California's efforts to prevent AIS introduction and manage their spread. California, like other states, suffers from the following challenges to effective AIS management:

- Difficulty in balancing negative environmental impacts of chemical treatment with positive protection of native habitats and listed species
- Difficulty in timely permitting for rapid response, eradication and control
- Lack of adequate long-term funding
- Difficulty coordinating diverse state activities, agencies and programs, and ensuring communication and high-level priority setting to optimize limited management resources
- Lack of awareness of, and enforcement of, existing laws
- Limited detection and treatment technologies, and coordination among detection efforts
- Limited public awareness of the threats posed by AIS, and costs of managing AIS, versus the threats from pesticides used to control them

This management plan is a substantial step toward addressing these challenges. It emphasizes coordination, communication and prevention; suggests actions to fill management gaps and provides a foundation for California's first comprehensive state-wide approach to AIS.

5. SUMMARY OF AIS LAWS, REGULATIONS & AUTHORITIES

The primary authority for state efforts to prevent AIS introduction and manage the spread and impacts of AIS in state waters derives from California's Fish and Game Code, the Food and Agriculture Code, and the Public Resources Code. Other significant statutes discussed below are found in the California Water Code and the Harbors and Navigation Code. These codes are the actual state laws passed by the legislature. Relevant state commissions are charged with adopting regulations that are necessary to carry out the intent of these laws. The regulations are added to the relevant divisions within the California Code of Regulations. Various federal laws also impact management activities. For a more comprehensive description see Appendices B & C.

California Authorities

Fish and Game Code & Title 14 of the California Code of Regulations

At least five code sections and their associated regulations address or relate to AIS. The intent of these code sections are to regulate the importation and transportation of live wild animals and plants; restrict the placement of live aquatic animals or plants in state waters; and regulate the operation of aquaculture industries. DFG is the state agency responsible for implementing these statutes.

F & G Code §§ 2080–2089, 2118, 2270-2272, 2300, 6400-6403,15000 et seq.
http://www.fgc.ca.gov/html/regs.html

California Food and Agriculture Code

Over 30 different code sections address the state's mandates to prevent the introduction and spread of injurious animal pests, plant diseases and noxious weeds. These codes describe procedures and regulations concerning, among other things: plant quarantines; emergency pest eradications to protect agriculture; pests as public nuisances; vectors of infestation and infection; the sale, transport and propagation of noxious weeds; and the protection of native species and forests from weeds. Most of these statutes and their associated regulations (Title 3 of the California Code of Regulations) are enforced by DFA.

F & A Code §§ 403, 461, 5004, 5021-5027, 5301-5310, 5321-5323, 5401-54204, 5421, 5430-5432, 5434, 5761-5763, 7201, 7206-7, 7501-2
www.leginfo.ca.gov

California Water Code

The Porter-Cologne Water Quality Control Act (California Water Code, Division 7) lists a number of types of pollutants that are subject to regulation. Section 13050, for example, specifically includes the regulation of "biological" pollutants by defining them as relevant characteristics of water quality subject to regulation by the SWRCB and the affiliated RWQCBs. AIS are an example of this kind of pollutant if they are discharged to receiving waters. The Water Code generally regulates more substances occurring in discharges and also defines discharges to receiving waters more broadly than the federal CWA.

Water Code §13050

Harbors & Navigation Code

This code authorizes DBW to manage aquatic weeds impeding the navigation and use of state waterways.
Article 2, Section 64

Public Resources Code

Sections of this code address the state's mandates to prevent nonindigenous species introductions through ballast water of commercial vessels. These sections were promulgated by the three laws described below. The SLC and the DFG have primary responsibility for carrying out these statutes and associated regulations.

The Ballast Management for Control of Nonindigenous Species Act of 1999 required that commercial vessels over 300 gross register tons (GRT) originating from outside the U.S. EEZ carry out mid-ocean exchange (at least 200 nautical miles offshore) or use an approved ballast water treatment method, before discharging in California state waters. State enforcement of the act took the form of monitoring ballast discharges and reports, inspecting vessels for compliance and assessing vessel reporting rates and compliance.

The Marine Invasive Species Act was passed in 2003, widening the scope of the original program. The 2003 act requires ballast water management for all vessels that intend to discharge ballast water in California waters, though the regulations differ depending on voyage origin. All qualifying vessels coming from ports within the Pacific Coast region must conduct an exchange (in waters at least 50 nautical miles offshore and 200 meters deep), or retain all ballast water and associated sediments. All vessels must complete and submit a ballast water report form upon departure from each port of call in California. They must also comply with good housekeeping practices, ranging from avoiding discharge near marine sanctuaries to rinsing anchors and removing fouling organisms from the hull. They must also keep logs of ballast management activities, conduct crew training and pay a fee for each qualifying voyage at their first port of call in California. To determine the effectiveness of the management provisions of the act, the legislation also requires state agencies to conduct a series of biological surveys to monitor new introductions to coastal and estuarine waters.

The Coastal Ecosystems Protection Act of 2006 deleted the sunset provision of the prior statute making the Marine Invasive Species Program permanent. The new law also requires adoption of regulations that will require vessel owners to implement certain interim and final performance standards for the discharge of ballast water and establishes an on-going coastal AIS monitoring program to be implemented by DFG.
PR Code §§ 71200-72423; CC 2271; RT 44008

Regulated Species

For a list of AIS plant and animal species regulated by the state see Appendix G.

Primary Federal Authorities & Agencies

California's AIS management efforts must also be coordinated with the federal government's extensive efforts on the same front. No single federal agency has comprehensive authority for all aspects of aquatic invasive species management. Federal agencies with regulatory authority over the introduction or transport of aquatic species that may be invasive or noxious include the U.S. Department of Agriculture, Animal Plant Health Inspection Service, the U.S. Department of Agriculture, Agricultural Marketing Service, the U.S. Fish and Wildlife Service (USFWS), the U.S. Department of Commerce and the U.S. Coast Guard (USCG). Additionally, many other agencies have programs and responsibilities that address components of AIS, such as importation, interstate transport, exclusion, control and eradication. One of the earliest authorities derives from the 19th-century Rivers & Harbors Act, which enables the U.S. Army Corps of Engineers to control aquatic weeds.

The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA) established the first major federal program to prevent the introduction and control the spread of introduced aquatic nuisance species. The act provides an institutional framework that promotes and coordinates research, develops and applies prevention and control strategies, establishes national priorities, educates and informs citizens and coordinates public programs. The act also calls upon states to develop and implement comprehensive state AIS management plans, such as this California plan. In 1996, the National Invasive Species Act (NISA) amended the 1990 act to mandate ballast water exchange for vessels entering the Great Lakes and to implement voluntary ballast water exchange guidelines for all vessels with ballast on board that enter U.S. waters from outside the U.S. EEZ. The act also authorized the USCG to toughen requirements if compliance proved unsatisfactory, which it did in 2004. As a result, the USCG has since established mandatory ballast water management requirements for all ships entering U.S. waters and penalties for non-compliance.

The NANPCA/NISA does not affect state authority to adopt or enforce AIS control measures. Several states have elected to undertake such measures. In addition to reporting requirements, California, Oregon and Washington have ballast water exchange requirements. California law (2006) requires the state to adopt a ballast water discharge standard.

The Executive Order on Invasive Species signed by President William J. Clinton on February 3, 1999, expanded federal efforts to address AIS. The order intended to build upon existing laws, such as the National Environmental Policy Act, the Nonindigenous Aquatic Nuisance Prevention and Control Act, the Lacey Act, the Plant Pest Act, the Federal Noxious Weed Act and the Endangered Species Act. The order creates a National Invasive Species Council charged with developing a comprehensive plan to minimize the economic, ecological and human health impacts of invasive species and determine the steps necessary to prevent the introduction and spread of additional invasive species. Federal

activities are now coordinated through this council and through the National Aquatic Nuisance Species Task Force (ANSTF).

Beyond authorities and legislation, some of the other major federal activities related to AIS management in California include:

- USFWS' 100th Meridian Initiative to stop the zebra mussel from spreading west.
- NOAA's Sea Grant Program, and its support for the West Coast Ballast Outreach Project (which educates the maritime industry about the ecological impacts of aquatic invasive species), as well as funding research on key invasive species.
- USDA's federal noxious weed list, maintained through the APHIS Cooperative Agricultural Pest Survey, and its Agricultural Research Service (ARS) units at Davis and Albany, California, whose work includes improving management of invasive aquatic and riparian weeds affecting agriculture and natural resources.
- USEPA's recent commitment to providing federal coordination for AIS rapid response planning and associated permitting.
- USGS' ongoing research and data bases on invasive species.
- NPS inventories and monitors invasive species and, where feasible, strives to eradicate them.

For more detailed information on federal AIS authorities, agencies and programs, see Appendix B or visit http://www.anstaskforce.gov and www.invasivespecies.org.

6. MANAGEMENT OBJECTIVES, STRATEGIES & ACTIONS

PLAN GOAL: Minimize the harmful ecological, economic and human health impacts of aquatic invasive species.

To assist in attaining the goal of the California AIS Management Plan (CAISMP), eight major objectives have been identified:

1. **COORDINATION & COLLABORATION:** Improve coordination and collaboration among the people, agencies, and activities involved with AIS.

2. **PREVENTION:** Minimize and prevent the introduction and spread of AIS into and throughout the waters of California.

3. **EARLY DETECTION & MONITORING:** Develop and maintain programs that ensure the early detection of new AIS and the monitoring of existing AIS.

4. **RAPID RESPONSE & ERADICATION:** Establish and manage systems for rapid response and eradication.

5. **LONG-TERM CONTROL & MANAGEMENT:** Control the spread of AIS and minimize their impacts on native habitats and species.

6. **EDUCATION & OUTREACH:** Increase education and outreach efforts to ensure awareness of AIS threats and management priorities throughout California.

7. **RESEARCH:** Increase research on the baseline biology of AIS, the ecological and economic impacts of invasions, and control options to improve management.

8. **LAWS & REGULATIONS:** Ensure state laws and regulations promote the prevention and management of AIS introductions.

Associated strategies and specific actions pertaining to each of the above objectives are presented in this chapter. These actions have been identified as being key tasks necessary to more effectively manage aquatic invasive species. The proposed objectives, strategies and actions in this plan should be regularly reviewed and incorporate annual opportunities for updates and adaptation to new knowledge and circumstances.

Plan Development Process

The plan goal, objectives, strategies, and specific actions were developed with input from a series of stakeholder scoping meetings, interagency staff communications and public workshops held in 2002 and 2006 (Appendix E).

Implementing Entities & Cooperating Organizations

The entities listed as acronyms, in bold type, in parentheses after each action represent the suggested key implementing entities (see the acronym list in the front material of this plan). In most cases, this refers to those state entities that have the responsibility and/or authority to implement the appropriate actions. Federal, regional and local agencies will, in most cases, not be listed as implementing agencies, since this is a state plan. The acronyms of cooperating organizations, who can participate in implementation efforts, are listed in normal type.

State agencies will coordinate with federal, regional, and local agencies whenever appropriate. The need for particular coordination with federal agencies is noted with an "FA" in the list of implementing entities and cooperating organizations. When an action requires input or products from universities, colleges, academic institutions or research organizations, the generic label "RI" (research institutions) will be used. These include the state government's primary research arms – California State Universities and the University of California – as well as the California Sea Grant program. Some of these entities are listed specifically after appropriate actions per their request, rather than being listed generically as RI. For many actions the Aquatic Invasive Species Working Group (AISWG) is included as a responsible entity. This implies that representatives of all AISWG entities will have the opportunity to be involved in these actions.

The CAISMP Implementation Matrix (Table 5, Chapter 7) lists implementing entities and cooperating organizations. The listings presented here are only a guideline, and as implementation progresses, the implementing entities may change.

Year & Funding

The year associated with each of the tasks indicates the suggested year in which to begin implementation. Year 1 indicates that funding and personnel resources are already available for FY 2007/2008, or that the action is a high priority for which resources need to be secured as quickly as possible. For some of these actions, suggested implementation years may seem overly optimistic, especially those that require funding beyond what is currently available. Like many other states across the nation, California is currently undergoing budgetary restrictions and financial support for many of these actions is uncertain. The purpose of this plan however, is to represent what should, rather than what is likely to, happen if California is to adequately address its aquatic invasive species problems on a statewide basis. Actions aimed at securing more funding appear under Objective 1.

Discussion

Many details are included with the following actions. “Discussion” statements are included with many of the following actions to provide more specific direction to implementing agencies.

OBJECTIVE 1: COORDINATION & COLLABORATION

Improve coordination and collaboration among the people, agencies and activities involved with AIS.

AIS management activities conducted by the state spread across multiple agencies. State managers coordinate specific AIS activities through a variety of venues and networks, but without the benefit of a formal coordinating framework. The actions under this objective seek to describe a new coordinating framework that will allow for the comprehensive assessment of AIS activities and ensure action on high priorities. This coordinating framework includes: an executive level consultation process through which state agencies may gain policy level direction and support for AIS management; the establishment of an Aquatic Invasive Species Working Group (AISWG) made up of representatives from various agencies, research institutions and stakeholder groups; and the formal creation of a California AIS Team (CAAIST) of lead AIS managers from each state agency and/or department. The work of the AISWG and the CAAIST will be assisted by the development of technical advisory panels. These panels will provide forums for federal agencies, local agencies, research institutions, NGOs, Native American organizations, and stakeholders to address questions within a specific topic (such as management techniques, specific species or particular geographic areas). In addition to these standing technical advisory committees, several ad hoc committees are likely to be formed.

STRATEGY 1A: INTERNAL STATE COORDINATION

Identify and coordinate agencies, programs and representatives within state government involved with AIS.

ACTIONS

1A1. Develop an executive level consultation process for state agencies involved with AIS management.

(**AE**, CAAIST, RI, NGOs, SH) Year 1

Discussion: Coordination and consultation at the executive level are central to statewide policy level direction and planning. This direction could include legislation, funding and program direction for all state departments responsible for addressing invasive species issues. This can be accomplished by regular briefings to agency and department directors by key state AIS managers. Alternatively, it could be accomplished by the formation of an AIS or Invasive Species Council made up of department and agency upper management. If such a council for executive level coordination and consultation were pursued, the costs and benefits should first be assessed. In the absence of an AIS or Invasive Species Council, coordination could be accomplished through the California Biodiversity Council. In addition, periodic briefings should be made to the Ocean Protection Council and Fish and Game Commission. Briefing agency and

department executives and involving them more routinely in decision making should improve statewide coordination.

1A2. Formalize the California Agencies AIS Team (CAAIST) made up of representatives from each state agency involved with AIS, and have the team meet regularly.

(**AE**) Year 1

Discussion: Each state agency and/or department has identified a lead representative for AIS work. This team will meet regularly to coordinate implementation of the state AIS plan. This team will report to executive level managers to implement actions in the plan (Action 1A1) and be led by DFG's State Invasive Species Coordinator.

1A3: Establish, fund and staff an Aquatic Invasive Species Working Group (AISWG) made up of representatives from state and federal agencies, NGOs, stakeholder groups and research institutions, and have the group meet regularly.

(**AE**, CAISST, RI, NGOs, SH) Year 2

Discussion: The complexity of aquatic invasive species management demands regular peer review to ensure that research, monitoring, prevention and management actions are using the best available approaches. It also demands some broader public and private involvement in forums in which the status of invasive species, control efforts, funding opportunities and criteria for setting priorities are discussed. Forming this new working group could increase the level of collaboration and coordination on AIS throughout the state by creating a regular venue to discuss priorities, pool expertise and reduce redundancies. Any such group would require staff to set up meetings, follow up on action items and handle time-sensitive inquiries and issues that need to be addressed between scheduled meetings. The AISWG is listed as an implementing entity or cooperating organization for many actions in this plan. If the AISWG is not formed, the CAAIST (see 1A2) will become the responsible entity and integrate input from research institutions, NGOs and stakeholder groups into appropriate actions.

1A4. Evaluate the need for an invasive species center.

(**AE**, NGOs, RI, SH, CAAIST) Year 1

Discussion: Statewide coordination of research and outreach activities could improve by establishing a research network which could incorporate an invasive species center. Defined goals and roles and dedicated funding would be essential to the success of any such entity.

1A5. Form and fund technical advisory panels to provide input to the AISWG and CAAIST and to address specific issues within the plan.

(**CAAIST**, **AISWG**) Year 2

Discussion: This plan proposes to convene technical advisory panels to address specific research, management and implementation issues. In addition to state agency staff, the panels will be made up of representatives from the following groups: federal agencies, local agencies, research institutions, NGOs, Native American organizations and stakeholders. It is anticipated that Plan Implementation and Science Advisory panels will be the first to be formed, with other panels created as necessary over time.

1A6. Draft and regularly review working lists of AIS of high-priority concern for early detection actions 3A1-6, rapid response action 4A3 (also see Appendix A, Section IV, Task 7) and control actions such as 5B4.

(**CAAIST**, FA, RI, Sea Grant, UCCE, NGOs, SH) Year 1 and ongoing

Discussion: One approach would be for the appropriate technical advisory panel (Action 1A5) to review existing national lists, filter these lists through state screening criteria and edit the list based on California-specific conditions and constraints. Draft lists could be circulated for peer review, subsequently finalized by the panel, and submitted to the CAAIST and the AISWG for approval. Lists could then be posted on state websites and updated biennially.

1A7. Clarify which state agencies have lead jurisdiction for more specific AIS issues related to particular species, habitats, water bodies or invasion vectors.

(**AE**, CAAIST) Year 1

Discussion: Current agency mandates and jurisdictions need to be reviewed, clarified and documented in the context of this statewide plan and discussed by the CAAIST, AISWG and Agency Executives. State AIS managers, local governments, NGOs, stakeholders and others involved in AIS activities, need to be clear about which state agency handles what and why. Such a clarification exercise is an important step in documenting different agency mandates, integrating the many different programs addressing diverse AIS issues, avoiding duplication and ensuring cost-effective use of limited resources. The results of this clarification exercise will be documented and distributed in a report.

1A8. Identify personnel needs within appropriate agencies. Employ needed personnel, to focus on high priority AIS issues and plan implementation.

(**AE**, CAAIST) Years 1-3

Discussion: This action is already underway. The Governor approved an allocation of $5.7 million that includes the establishment of 16 new positions in DFG and a $2.5 million allotment to DFA to work on aquatic invasive species, focusing on quagga mussel prevention, control, eradication, research and outreach.

1A9. Improve state websites to make information on AIS management activities, and research and data, more accessible.

(**CAAIST**) Year 2

Discussion: State websites and databases on AIS are diverse and reflect different agency mandates and capabilities. To the extent possible, state websites should be improved and linked to facilitate access to current information on management activities statewide, as well as on the latest AIS related technological improvements, data and research. Such accessibility improvements to websites and databases, and linkages among state and other AIS databases, will improve statewide coordination and assist managers and researchers with revisions of this plan and setting action priorities. Efforts under this action will be coordinated with early detection and monitoring actions under Objective 3 and with education and outreach actions under Objective 6, to the greatest extent possible. In addition, whenever possible and useful, biological surveys and other data collected in California databases should be provided, and or developed in compatible formats with, national AIS databases managed by USGS and the Smithsonian Environmental Research Center.

1A10. Assess the effectiveness of AIS programs and projects undertaken by state agencies. Identify and address any gaps in these activities.

(**AISWG**, Plan Implementation Panel) Year 2

Discussion: The Implementation Panel will review and assess the effectiveness of ongoing AIS management activities in the context of the plan, and in subsequent years (2 and 5) the effectiveness of the plan itself. This assessment will bring together the more program-specific assessments called for in Actions 3A1, 3B1, 4A2, 4B1, 5A1-3, 6A1, 7A1 and 7C1. The Implementation Panel will make recommendations to CAAIST and AISWG. The CAAIST or AISWG will forward the recommendations to the executive managers, the Biodiversity Council, the Ocean Protection Council, and the AIS or Invasive Species Council (if formed).

1A11. Coordinate state AIS management activities with the State Water Resources Control Board (SWRCB) **and the Regional Water Quality (**RWQCBs) **Control Boards.**

(**CAAIST**, SWRCB, RWQCBs) Year 2

Discussion: AIS often exacerbate or complicate pollution control and water quality management. State AIS management activities should be coordinated, through CAAIST, SWRCB and RWQCBs, with state Watershed and Basin Plans, TMDLs for water bodies on the 303 (d) list, and the NPDES permitting process.

1A12. Develop and annually or biennially update a list of AIS experts in California.

(**CAAIST**, Science Advisory Panel) Year 1

Discussion: The federal ANSTF, USGS, USFWS and NOAA are currently working on developing a list of experts. State agencies should collaborate with the federal agencies on developing and updating the list and making it available to AIS resource managers. Experts are needed in taxonomy, vector management, eradication techniques and ecological impacts.

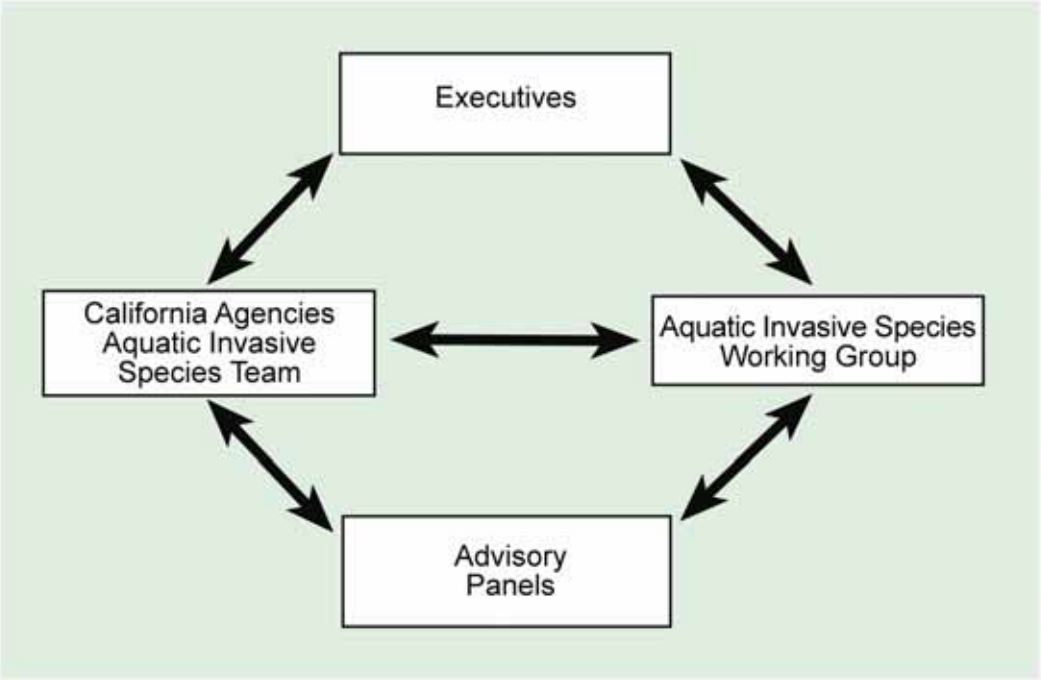
1A13: Develop boilerplate AIS language for agency comments on project plans and other activities.

(**CAAIST**) Year 2

Discussion: Boilerplate language addressing the need to prevent AIS introduction, or control AIS spread, should be available to agencies commenting on environmental documents, landscape plans, restoration plans and research proposals. Such language should be distributed to all appropriate state, federal and local agency staff.

Figure 5: AIS Coordinating Structure

This figure illustrates the flow of communication about coordination on AIS work. The entities in each box are defined below. As is evident from the definitions, this diagram emphasizes state agency participation. That is because the state has major responsibilities with regard to AIS, and because a primary purpose of the California Aquatic Invasive Species Management Plan is to provide information and guidance to state agencies. It is not meant to diminish the importance of the state's partners in dealing with this issue.



Definitions:

Executives – Representatives of upper level management of state agencies being reported to individually or as a group organized to address invasive species concerns.

California Agencies Aquatic Invasive Species Team (CAAIST) – Representatives from programs in state agencies that meet to coordinate their work on AIS.

Aquatic Invasive Species Working Group (AISWG) - Representatives from state and federal agencies, NGOs, stakeholder groups and research institutions that meet to coordinate efforts among the larger AIS community.

Advisory Panels – Panels that may include people both within and outside of the CAAIST and the AISWG, to help address specific issues or tasks being worked on by those groups.

STRATEGY 1B: LOCAL, NATIONAL & INTERNATIONAL COORDINATION

Continue and improve collaboration among local, regional, state and federal agencies addressing AIS issues; communication with non-governmental organizations, community groups and business interests affected by AIS management; and participation in local, national and international AIS task forces and conferences.

1B1. Identify AIS representatives within key regional agencies, federal agencies and NGOs and provide this information to state managers.

(**CAAIST**, RI, FA, NGOs, SH) Year 1

Discussion: This action should be completed in collaboration with regional agencies, federal agencies and NGOs. The resulting information should then be posted or distributed to facilitate greater federal, state and local coordination and to provide a springboard for 1B2.

1B2. Identify conflicts and overlaps between state programs and local and federal programs, and between state programs and NGOs, if any.

(**CAAIST**, RI, FA, NGOs, SH) Year 1

Discussion: This task should be completed in collaboration with regional and federal agencies, NGOs and local watershed management groups. Any significant conflicts and overlaps should be brought to the attention of agency executives and department managers.

1B3. Invite community groups (Native American organizations and industry, business, professional and other groups impacted by AIS management efforts) to participate in planning activities, and to learn more about their role in AIS introduction and dispersal.

(**AISWG**, SH) Year 2 and Ongoing

1B4. Continue and expand participation in localized efforts and task forces focusing on AIS issues.

(**AISWG**) Ongoing

Discussion: Participation should extend to the Southern California Caulerpa Action Team, the Lower Colorado River Giant Salvinia Task Force, Team Arundo, and the CALFED Bay-Delta Authority Non-native Invasive Species Program, among others (see Appendix D).

1B5. Continue and expand participation in regional, national and international efforts and task forces focusing on AIS issues.

(**AE**, **CAAIST**, **RI**) Ongoing

Discussion: Participation should extend to the federal ANSTF, the Western Regional Panel, federal ballast water and hull fouling activities, the Pacific Ballast Water Group, the Pacific States Marine Fisheries Commission, the Global Invasive Species Programme, the Invasive Species Advisory Council, the 100th Meridian Project, among others (see also Appendix D).

1B6. Form partnerships with Mexico, Canada, Oregon, Washington, Nevada, Arizona and Colorado River states and secure their input and assistance with AIS issues affecting the Pacific Coast.

(**AE**, **RI**, AISWG) Ongoing

1B7. Participate in national and international conferences concerning the management and control of AIS.

(**AE**, **CAAIST**, **RI**) Ongoing

Discussion: AIS conferences increase knowledge of efforts and successes elsewhere, as well as ensure out-of-state awareness of California's issues and activities. Authorization for key out-of-state and out-of-country travel should be promoted.

STRATEGY 1C: FUNDING

Increase funding sources for AIS management and obtain dedicated long-term funding to implement AIS Management Plan tasks and provide matching funds for federal grants.

1C1. Identify and apply for grant funding available in California and nationally.

(**CAAIST**, **RI**, **NGOs**) Year 1-5

Discussion: The federal Nonindigenous Aquatic Nuisance Prevention and Control Act enables state governors to request federal assistance for up to 75 percent of the cost incurred to implement state aquatic invasive species management plans. Currently, the USFWS has a limited budget for grants for this purpose. California should also identify other federal programs that can be used to address invasive species issues (Coastal Zone Management Act etc.), pursue diverse sources of state funding (State Bonds, Sea Grant, etc.) and NGO support (conservation organizations etc.).

1C2. Establish stable, long-term funding to assist in the implementation of the AIS management activities identified in this plan.

(**AE**, CAAIST) Year 1-3

Discussion: This action should be coordinated with the identification of gaps in 1A10 and 1B2.

1C3. Provide state funding for the AIS positions as detailed in Action 1A8.

(**AE**, CAAIST) Year 1

Discussion: As noted in 1A8, significant funding has already been allocated.

1C4. Provide funding for AIS rapid response actions when warranted.

(**AE**) Year 1

Discussion: In Year 1, the Governor approved the expenditure of money for the Quagga Mussel Incident Command. The state's proposed rapid response programs, and some funding issues, are described under Strategy 4A and in Appendix A.

1C5. Finance the hiring of a funding development specialist.

(**AE**, CAAIST) Year 2

Discussion: Hiring a specialist for 2-3 years to explore and develop funding sources would free up the AIS coordinator to focus on establishing the program necessary to carry out the plan.

1C6. Provide a mechanism to obtain funding to implement additional tasks referred to in this AIS Management Plan, including education, control, monitoring and research.

(**AISWG**) Years 2-5

Discussion: This mechanism could draw on user fees, visitor taxes, general funds, etc., and build on participation from industries that contribute to, and/or are impacted by, AIS.

The Case for Permanent Funding

Dedicated permanent funding to support permanent staff and agency programs will be a key to effectively addressing AIS issues in California. Though many AIS activities are currently underway throughout the state, almost all of these are operating on 'soft' (short-term/grant) money – a very inefficient approach in the long-term because so much time and effort must be spent soliciting grants rather than managing invasive species. Such grants also result in high staff turnover (including short-term hiring and rehiring); the need to write various status reports to comply with grant requirements; and gaps in eradication and control efforts between funding opportunities, allowing for the recovery of AIS. Thus while soft monies can be very effective for short-term projects such as research studies, they may compromise long-term program operations. There is a clear need for dedicated permanent funding to address aquatic invasive species issues in California.

OBJECTIVE 2: PREVENTION

Minimize and prevent the introduction and spread of AIS into and throughout California waters.

Prevention is the most cost effective and environmentally sensitive method of managing AIS. Prevention revolves around the interception of AIS at the point of entry or release. The movement of AIS into and within California not only takes place via transoceanic ships, but also via other vectors such as aquaculture, the aquarium trade, the bait industry, recreational activities, biological research, environmental restoration projects, and even freshwater diversions to farms and cities up and down the state. California management occurs on both the species and vector level. The actions suggested below seek to: identify high priority vectors and improve programs aimed at addressing them; strengthen enforcement and inspection at entry points; and sustain and expand the state's current ballast water management program and proposed hull-fouling control program. Prevention is a central focus of this plan and it is expected that universities, research institutions and stakeholder groups will be integrally involved in state activities. In addition, prevention efforts targeted at specific vectors will be coordinated with broader outreach and education efforts described under Objective 6.

STRATEGY 2A: REGIONAL VECTOR ASSESSMENT

Identify possible vectors and pathways of AIS introductions into and throughout California and assess the risks and impacts of each.

ACTIONS

2A1. Develop comprehensive regional vector assessments to rank the importance of different AIS vectors in different regions of California.

(**RI**, DFG) Year 3

Discussion: Some of the vectors California must manage are described in the "Pathways Report" developed by the Aquatic Nuisance Species Task Force and National Invasive Species Council (National Invasive Species Council 2005). The report not only provides a comprehensive vector list, but also criteria for ranking their importance. The information in this report will be used as a foundation for California's regional vector assessment. Comprehensive analysis of vectors in California have occurred for noxious weeds and in areas potentially impacted by ballast water discharges. DFG/OSPR conducts the biological surveys in port/harbor areas and in open coastal areas as directed by the Marine Invasive Species Act. The results of the biological surveys are analyzed for possible vectors of introduction so that high risk vectors can be identified and targeted by prevention programs. Surveys and assessments should be extended to include all waters of the state (i.e. lakes, rivers and streams) so that all potential high risk vectors can be identified. Once a high risk vector is

identified, a detailed assessment of that specific vector is usually needed to quantify the risks and identify potential management options.

STRATEGY 2B: COMMERCIAL VESSELS & MARITIME ACTIVITIES

Reduce the introduction and transfer of marine AIS via ballast water, ballast sediment and hull fouling from commercial vessels and maritime structures.

2B1. Quantify the ballast water and hull fouling vectors, and assess the risk of introduction and dispersal of AIS throughout California from these vectors.

(**SLC**, RI) Ongoing

Discussion: In 2000, SLC began collecting ballast water report forms from all vessels coming into California from outside the U.S. EEZ. These reports include information about port of origin, how the ballast water was managed (e.g. open ocean exchange) and how much ballast water was discharged. In 2004, SLC expanded their program to require ballast water reports from all vessels, regardless of the last port of call. This comprehensive reporting program is essential to help quantify the extent of the ballast water problem and how it may change over time due to changes in trade routes and/or ballast water management requirements. In addition, in April 2006, SLC approved the following report: "Commercial Vessel Fouling in California: Analysis, Evaluation and Recommendations to Reduce Nonindigenous Species Release from the Non-Ballast Water Vector" (Takata et al. 2006). This report includes recommendations on how commercial vessel fouling should be managed. The recommendations in this report should be adopted. See also Chapter 3.

2B2. Continue to implement and improve California's current ballast water inspection and enforcement program.

(**SLC**) Ongoing

Discussion: SLC should continue current ballast water inspection and enforcement program. Training for inspectors should be evaluated and updated as necessary. Technologies such as the handheld Ballast Exchange Assurance Meter, now being developed and tested by the USCG, may prove useful to California's programs.

2B3. Implement performance standards for the discharge of treated ballast water.

(**SLC**) Ongoing

Discussion: In January 2006, the SLC approved the report titled "California State Lands Commission Report on Performance Standards for Ballast Water Discharges in California Water" (Falkner et al. 2006). This

report includes interim performance standards, an implementation schedule, final discharge standards and other programmatic recommendations. The report was forwarded to the California Legislature on January 30, 2006 for consideration. In September 2006, legislation based on the report, Senate Bill 497, became law and requires SLC to adopt the interim standards and implementation schedule outlined in the report. Regulations now need to be created and implemented based on the new legislation.

2B4. Identify and address gaps in the Marine Invasive Species Program not addressed by either federal or state law.

(**AISWG**, SLC, DFG) Ongoing

Discussion: The 2003 Marine Invasive Species Act charged SLC with oversight of the state's program to prevent nonindigenous species introductions through commercial shipping. In recognition of the uncertainties surrounding the development of an effective ballast water management program for the state, the law requires that on or before January 2005, and updated biennially, SLC submit to the legislature and make available to the public, a report that summarizes vessel ballast water activities as they relate to the act and put forward recommendations to improve the state's program. Likewise, DFG is charged with oversight of studies to determine the location and geographic range of AIS in California estuaries and coastal areas and to assess the effectiveness of the ballast water controls implemented pursuant to the law. DFG reports their study results to the public annually.

2B5. Develop a commercial vessel fouling outreach and management program based on results from action 2B1.

(**SLC**, Sea Grant) Year 1

Discussion: The recommendations of the fouling report described under 2B1 should be adopted and implemented. Options for resolving policy conflicts between efforts to control hull fouling with copper-based anti-fouling paints and efforts to protect water quality need to be explored. Such a resolution may also benefit the implementation of actions related to recreational boats under Strategy 2C.

2B6. Investigate the degree to which moving maritime industry structures, such as oil drilling platforms and barges, may contribute to AIS dispersal.

(**DFG**, **SLC**, RI, FA) Year 3

2B7. Quantify and assess the role of commercial fishing vessels as AIS vectors and identify potential management options.

(**DFG**, RI, NGOs, SH, FA) Year 1

2B8. Develop commercial fishing outreach and management program based on results from action 2B7.

(**DFG**, AISWG, FA) Year 2

STRATEGY 2C: RECREATION

Limit new AIS introductions through recreational boating, fishing, diving and other water-based activities.

2C1. Quantify and assess the role of recreational boating as an AIS vector and identify potential management options.

(**DBW**, **DFG**, RI, SH) Year 1

Discussion: The assessment should examine both the movement of boats over land (trailered boats) and the movement of boats in the water. The assessments should make use of existing data from border protection stations (DFA) and boater surveys (DBW and 100th Meridian Initiative); determine patterns and frequency of watercraft use and transport routes between waterways; and link boater survey results to hull fouling studies (amount of fouling, type of antifouling paint, etc). Information derived from DBW's Boating Facility Needs Assessment may also prove useful.

2C2. Develop a comprehensive recreational boating outreach and management program based on results from action 2C1.

(**DBW**, UCCE, Sea Grant) Year 2

2C3. Develop a watercraft inspection program for high priority boat launch sites.

(**DBW**, **DFG**, **DPR**, SH) Year 1

Discussion: Unless new funding for agency staff is provided, such a program may need to be volunteer- or NGO-based, or undertaken by a citizen monitoring network as described in 3A5.

2C4. Quantify and assess the role of recreational fishing as an AIS vector and identify potential management options.

(**DFG**, **DBW**, RI, SH) Year 3

2C5. Develop a recreational fishing outreach and management program based on results from action 2C4.

(**DFG**, UCCE, Sea Grant) Year 3

2C6. Develop and distribute guidelines for: disposal of invasive species removed from marina areas (including from hull cleaning); the cleaning of fishing gear and equipment; and disposal of bait.

(**DFG**, **DBW**, Sea Grant) Ongoing

Discussion: Collecting fouling organisms removed from larger vessels that are kept in the water poses significant infrastructure and economic challenges that this plan's commitment to statewide collaboration can help address (hauling boats for hull cleaning is nine times more expensive than in-water cleaning). In terms of fishing, contaminated recreational fishing gear and waders function as mechanisms for the introduction and dispersal of AIS throughout California. The angling community is particularly interested in curbing the dispersal of AIS. DFG and DBW will continue to work closely with these stakeholders to identify and publicize methods to decontaminate equipment.

STRATEGY 2D: BAIT, LIVE SEAFOOD, AQUACULTURE & AQUARIUM

Work with appropriate industry representatives to ensure awareness of the threats and prevent introductions.

Discussion: The definition of aquarium may include hobby aquarists, public aquaria (such as Monterey Bay Aquarium) and research aquaria (such as UC Davis Bodega Marine Lab)

2D1. Quantify and assess the role of bait as an AIS vector and identify potential management options.

(**DFG**, RI) Year 1

2D2. Work with the bait industry to develop preventative strategies, identify education needs and implement permitting of bait imports, collection and sales.

(**DFG**, UCCE, SH) Year 2

Discussion: Guidelines need to be developed on the use of packing materials for live bait transport. An implementation plan needs to be developed to facilitate permitting bait imports. Input from pathologists is needed to develop prevention strategies and the management program referred to in action 2D3.

2D3. Develop a bait outreach and management program based on results from actions 2D1 and 2D2.

(**DFG**, UCCE, SH) Year 3

2D4. Quantify and assess the role of live imported seafood as an AIS vector and identify potential management options.

(**DFG**, **DFA**) Year 1

2D5. Work with the live imported seafood industry to develop preventative strategies and identify education needs.

(**DFG**, **DFA**, UCCE, Sea Grant) Year 2

Discussion: Guidelines need to be developed for use of plants and other live packing materials for seafood transport and linked to education and outreach efforts under Objective 6. Input from pathologists is needed to develop prevention strategies and the management program referred to in action 2D6.

2D6. Develop a live imported seafood outreach and management program based on results from actions 2D4 and 2D5.

(**DFG**, **DFA**, UCCE, Sea Grant) Year 3

2D7. Perform an inventory and associated risk assessment of the discharge, overflow systems and storm/flood containment systems of aquaculture, public aquariums and research facilities to determine the potential risks of effluents and propose remedies for remediation and monitoring requirements.

(**SWRCB**, **DFG**, RI, SH) Year 3

Discussion: The level of risk currently posed by these facilities in not known and must be more accurately assessed. Though containment procedures must be outlined in the permit process of such facilities, follow-up has been inadequate to ensure procedures and systems are in place and effective. Methods already exist to evaluate the risks associated with this pathway such as those presented in the Aquatic Nuisance Species Hazard Analysis Critical Control Point (ANS-HACCP) planning process. USFWS has adopted ANS-HACCP as a national tool for use by federal fish hatcheries and developed guidance materials and training to facilitate its use.

2D8. Work with the aquaculture industry to ensure understanding of the importance of containment systems as well as the threat escapees may pose to native species and habitats.

(**DFG**, SH, UCCE) Year 2

Discussion: DFG should provide ANS-HACCP training and assist in development of ANS-HACCP plans.

2D9. Develop an aquaculture outreach and management program based on results from actions 2D7 and 2D8.

(**DFG**, UCCE) Year 4

2D10. Quantify and assess the ways the aquarium and aquascaping (water garden) trades contribute to AIS introductions in addition to the discharge issue addressed in 2D7 and evaluate potential management options.

(**DFG**, **DFA**, RI) Year 1

2D11. Work with aquarium, water garden, and other target industries to ensure that there are easily accessible, appropriate locations and methods for disposal of aquatic organisms.

(**DFA**, **DFG**, UCCE, FA) Year 1

2D12. Implement an aquarium and aquascaping outreach and management program based on results from action 2D10.

(**DFA**, **DFG**, UCCE, FA) Year 2

STRATEGY 2E: FISHERIES ENHANCEMENT

Assess and minimize activities related to planned, authorized introduction of non-native species into inland water systems.

2E1. Quantify and assess the role of fisheries enhancement as an AIS vector and identify potential management options.

(**DFG**, RI) Year 1-3

2E2. Review DFG's authorized practice of intentional introductions of non-native species into aquatic habitats for recreational purposes.

(**DFG**, RI) Year 1-3

Discussion: DFG is currently writing an Environmental Impact Report (EIR) that will examine DFG operated hatchery stocking throughout the State. The anticipated completion date is December 2008.

2E3. Explore ways to reduce the amount of unauthorized stocking of non-native species into aquatic habitats.

(**DFG**) Year 2

2E4. Assess the efficacy of, versus threats from, authorized introductions of *Poecliliids* into native habitats for mosquito control.

(**DFG**, RI) Year 2

Discussion: The practice of stocking streams, ditches and other inland waterways with *Poecliliids* (i.e. mosquitofish) to control mosquitoes should be evaluated. Though mosquito control to address human health concerns is certainly important, *Poecliliids* may not be the most effective method, harbor parasites and can be harmful to native insect and fish species.

STRATEGY 2F: RESEARCH, MANAGEMENT & EDUCATION

Minimize AIS introductions and transfers by researchers, resource managers and others involved in field activities.

2F1. Quantify and assess the role of research, resource management and educational activities as AIS vectors and identify potential management options.

(**AISWG**) Year 2

2F2. Establish and make available protocols to minimize the spread of AIS into the wild from research, monitoring and control activities, and incorporate protocols into permits and funding requests.

(**DFG**, **AISWG**, RI) Year 3

Discussion: With the rise in AIS work suggested by this plan, there will be a corresponding increase in the chance of transferring AIS during research or management activities. Protocols addressing this task have been developed by the ANSTF and could be adapted to meet the state's needs. Such protocols should be a standard component of all field activities that involve AIS or infested waters, as well as a required component of AIS grant proposals. Other protocols already exist such as those presented in the ANS-HACCP planning process.

2F3. Evaluate existing, or establish new, regulations and protocols for in-water (non-lab) based research experiments that could potentially introduce or involve the culture or movement of non-native species into areas where they do not currently exist.

(**DFG**, SWRCB, RI) Year 4

Discussion: Information on gaps in existing protocols and any new protocols developed under this action should be distributed to researchers in coordination with 6C1 and 6C2. Researchers also need to understand that these activities are regulated by Private Stocking Permits. In addition, permit evaluation should include scrutiny of potential AIS issues.

2F4. Quantify and assess the role of the shipment of live aquatic species for use in research or educational activities as an AIS vector.

(**DFG**, RI) Year 4

Discussion: Marine and freshwater species can be ordered from research and educational supply companies around the world through catalogs or the Internet. Once the organisms are delivered, improper handling techniques may result in the release of non-native species.

STRATEGY 2G: CONSTRUCTION & RESTORATION

Limit new introductions of AIS as a result of restoration, landscaping and construction activities.

2G1. Quantify and assess the role of construction activities as an AIS vector and identify potential management options.

(**DFG**, RI) Year 3

2G2. Work with industry and consultants to develop guidelines for decontamination of construction equipment, tools and protective clothing.

(**DFG**, **SLC**, **DPR**, **FA**) Year 2-3

2G3. Develop a construction outreach and management program based on results from actions 2G1 AND 2G2.

(**DFG**, **SLC**, **DPR**, **FA**, UCCE) Year 4

2G4. Quantify and assess the role of restoration activities as an AIS vector and identify potential management options.

(**AISWG**, RI) Year 2

Discussion: Construction equipment used for restoration work, as well as soil from nurseries and dredged material used for restoration, can be vectors for AIS.

2G5. Work with consultants and other groups conducting habitat restoration projects or landscaping projects to encourage the use of native species (with propagules from appropriately local stock) or noninvasive non-native species to minimize the transfer of AIS.

(**DFG**, **SCC**, AISWG) Year 2-3

Discussion: Non-native species should not be used in habitat restoration and mitigation projects. Approved mitigation and restoration projects should include a program for periodic site monitoring for non-native species and a program for control and, if appropriate and feasible, eradication if an introduction occurs. The use of non-native plant species in public access landscape improvements should be avoided where a potential exists for non-native plants to spread into waterbodies or transition zones between tidal and upland habitats.

2G6. Develop a restoration outreach and management program based on results from actions 2G4 and 2G5.

(**AISWG**, UCCE) Year 3

STRATEGY 2H: WATER DELIVERY & DIVERSION SYSTEM

Limit new introductions of AIS as a result of water delivery systems.

2H1. Quantify and assess the role of the water delivery and diversion system as an AIS vector and identify potential management options.

(**DWR**) Year 2

Discussion: The state's extensive water delivery, export, transfer and development system, which moves water not only from one watershed to another, but also from one end of the state to another, and even across state lines, can be an important vector of AIS. Water deliveries can spread freshwater-adapted AIS within and out of state, and carry species from infested areas to more pristine locales. Intensive manipulation of natural water paths and flows in support of these water diversions and deliveries, and of the aquatic ecosystem in general, makes California particularly vulnerable to AIS. Not only can AIS be more easily transferred via all these diversions, but they may also find it easier to colonize areas where native species are already stressed by the loss of habitat caused by dams, water diversion, altered hydrology and development.

2H2. Develop an outreach and management program for the water delivery and diversion system based on results from actions 2H1.

(**DWR**, UCCE, Sea Grant) Year 3

STRATEGY 2I: ENFORCEMENT & INSPECTION

Increase enforcement of existing regulations controlling the transport, propagation, sale, collection, possession, importation, purchase, cultivation, distribution and introduction of AIS.

Discussion: State resources directed toward interdiction and inspections at major points of entry for invasive species are inadequate. This plan seeks to improve inspections at both interior and coastal borders and increase monitoring efforts to ensure compliance with current regulations.

2I1. Increase staffing and hours of operation at DFA Border Protection Stations.

(**DFA**, SH) Year 1

Discussion: DFA operates 16 border protection stations (BPS) on major highways entering California. When BPS stations perform boat inspections, they remove any quagga or zebra mussels found on infested boats, place the boat under quarantine and coordinate with DFG personnel to supervise final cleaning at destination points. Before 2003, DFA inspectors checked all watercraft entering California through these stations for AIS, including zebra mussel and *Hydrilla*. However, in 2003, the program was subject to severe budget cuts and the ability to inspect small, privately transported watercraft was lost. At 15 of the 16 BPS, only watercraft transported by commercial vehicles were inspected from 2003 through the end of 2006. At the end of December, 2006, only nine of the stations were open 24/7, while the other seven were open only eight hours a day. DFA suggests that in order to prevent AIS invasions, all boats should be inspected, all check stations should be open 24 hours a day and all staff (and the CHP) should be trained in zebra mussel, quagga mussel, aquatic weed and other AIS identification, disposal and reporting to other state agencies. The recent quagga mussel discovery in January 2007 in Lake Mead allowed state agencies to get funds to increase staffing in southern California. Additional funding and staff are needed to reopen all stations and inspect private vehicles.

2I2. Develop and distribute comprehensive guidelines for border inspections of boats, boat trailers and water-based equipment entering California.

(**DFA**, **DFG**) Year 1

2I3. Increase DFG staffing to more effectively enforce current regulations on prohibited and restricted species, and on movement of aquatic species.

(**DFG**, SH) Year 1-2

Discussion: Various regulations exist to protect valuable resources against the introduction of prohibited and restricted species. In Year 1, the Governor approved additional staffing for enforcement laws related to quarantine of vessels infested with prohibited species.

2I4. Ensure adequate staffing and clear cargo inspection guidelines for inspectors and enforcement officers at maritime ports and at airports.

(**FA**, AISWG, SLC) Year 3-5

Discussion: Inspecting cargo is a critical step in preventing unwanted species from entering the state. Adequate staffing and clear guidelines are needed for inspectors to be effective. Close coordination and collaboration with federal inspectors (including USCG, USFWS, USDA, and DHS) will be required. Training for inspectors should be evaluated and updated as necessary.

2I5. Continue disease sampling for shipments and stocks of live fish and other species. Assess whether current systems are adequate to keep contaminated stocks from being distributed via aquaculture, the aquarium and bait trade, terminal food markets, research activities and government stocking programs.

(**DFG**) Ongoing

2I6. Develop a program to identify mail order and online vendors who are selling California prohibited and restricted species, and work with these vendors to keep AIS from being imported into the state.

(**AISWG**, RI) Year 2

Discussion: There are multiple cases of restricted and prohibited stocks being sold without detection by government regulators, not only in local venues, but also through mail order or from on-line sources. Any California enforcement should integrate with efforts such as USDA's current development of a WebCrawler designed to identify online vendors of federally listed noxious weeds and regulated plant species.

OBJECTIVE 3: EARLY DETECTION & MONITORING

Develop and maintain programs that ensure the early detection of new AIS and the monitoring of existing AIS.

Early detection of introductions and quick, coordinated responses can eradicate or contain invasive species at much lower cost than long-term control. In many cases, control may not only be prohibitively expensive but also infeasible. Thus detection of non-native arrivals, before they become established, should be a priority for any AIS management effort. The purpose of this section is to acknowledge the importance of continuing current monitoring programs and to identify gaps and areas for improvement. Significant improvements will clearly come from coordination at multiple levels in both planning and implementation. As such, some of the following actions aim to better link the many different natural resource and AIS monitoring programs conducted by diverse agencies and academic institutions to improve AIS detection. Actions also seek to better integrate Geographic Information System (GIS) mapping into AIS management, and to make state databases more compatible with, and responsive to, AIS management needs. Actions under Objective 3 should be coordinated with research efforts under Objective 7 and with priority lists developed under 1A6.

STRATEGY 3A: EARLY DETECTION

Develop a standardized monitoring system focused on early detection for high priority AIS.

ACTIONS

3A1. Assess all current monitoring of the state's coastal, marine and inland waters for opportunities to incorporate early detection of AIS.

(**CAAIST**, RI, CeNCOOS, SCCOOS) Year 1

Discussion: High priority AIS for early detection may include zebra mussel, quagga mussel, Northern Pacific seastar, snakehead, *Caulerpa*, *Hydrilla*, *Salvinia*, golden mussel and others. A more complete and up-to-date list for use in any assessment will be developed under Action 1A6.

3A2. Assess how current monitoring under the state's Marine Invasive Species Program could assist with early detection.

(**SLC**, DFG, RI) Ongoing

3A3. Develop a statewide integrated approach to early detection based on the assessment in 3A1 and 3A2. The approach should address any gaps and link directly with the centralized reporting system and rapid response program described in 4A2 and Appendix A.

(**CAAIST**, AISWG) Year 1

3A4. Conduct outreach to entities regularly sampling coastal, marine and inland waters for other purposes so they can easily identify and report high priority AIS.

(**CAAIST**, UCCE, Sea Grant) Year 2-3

Discussion: Those already conducting field work or surveys – researchers, graduate students, resource managers, water quality monitors, law enforcement personnel and others – should be encouraged and trained to identify high priority AIS (as defined under 1A6). Special identification materials for high priority AIS should be developed and distributed to support the early detection effort.

3A5. Create and train a statewide citizen monitoring network to assist in the detection and monitoring of AIS distribution.

(**CAAIST**, UCCE, SH) Year 3

Discussion: Trained volunteers and knowledgeable water users already working near or in the water can provide relevant information on the occurrence of new species. To be effective, this network will need a direct link into an early warning system that incorporates follow-up. Some elements necessary to the development of an effective citizen-monitoring network may include: a structured training program; expansion of current monitoring and restoration programs to better engage community groups; outreach to existing watershed councils, diver associations, flood control districts, reclamation districts and other monitoring efforts; distribution of key species pictures and descriptions (as defined under 1A6); and the creation of a website to allow volunteers and water users to report their AIS sightings (see 4A2).

3A6. Create a program to engage professional divers in the early detection network.

(**CAAIST**, AISWG, NGOs) Year 1

Discussion: Involve and educate professional divers – who are frequently in the water and under boats cleaning hulls – in AIS detection and management, among them the California Professional Divers Association. Link with 3A5 and with appropriate educational and outreach activities in Objective 6 (such as 6A9 and 6A13).

3A7. Regularly review the efficacy of the state's AIS early detection monitoring systems and pursue any necessary improvements, in conjunction with 3B7.

(**AISWG**) Ongoing

Discussion: State AIS staff should review the type, intensity, frequency and distribution of monitoring activities on a regular basis to assess continued relevance and effectiveness. Such a review should occur at a minimum on a biennial basis.

STRATEGY 3B: LONG-TERM MONITORING

Improve and standardize the long term monitoring program for AIS.

3B1. Assess current long-term AIS monitoring efforts for the state's coastal, marine and inland waters; identify gaps, and recommend improvements for a more integrated approach.

(**AISWG**, CeNCOOS, SCCOOS, DFG/OSPR) Year 2-3

Discussion: Within the current agency management framework, monitoring occurs, and will continue to occur, on two parallel tracks: DFA monitors specific target species in order to undertake early detection or eradication; DFG/OSPR monitors populations over time, and notes new populations or changes in species abundance. Both types of monitoring are critical to sound management and provide building blocks for a more integrated approach.

3B2. Coordinate with ocean observing groups.

(**AISWG**, CeNCOOS, SCCOOS) Ongoing

Discussion: Monitoring of invasives in the marine and coastal areas of California should be coordinated with the regional ocean observing systems (SCCOOS-Southern California Coastal Ocean Observing System and CeNCOOS-Central and Northern California Coastal Ocean Observing System).

3B3. Identify and monitor locations with a high invasion rate.

(**AISWG**, DFG/OSPR, RI) Ongoing

Discussion: High risk locations may include ports, ballast water release sites, popular recreational lakes and marinas near state borders, as well as areas with high density AIS populations.

3B4. Identify and monitor the population growth and dispersal of established AIS.

(**AISWG**, DFG/OSPR, RI) Ongoing

Discussion: Species-specific monitoring is needed for those species identified as high risk or high priority (see 1A6). Examples of established species that may require monitoring appear in Table 3 and Chapter 8.

3B5. Obtain funding to incorporate DFG's historical stream surveys and report findings into a central database.

(**DFG**) Year 1

Discussion: These historical surveys document areas where rare or native fish occur, and where incipient populations of AIS could cause extirpation of local fish populations. Funding has been obtained for new surveys of some streams in southern California in 2007.

3B6. Include maps of existing AIS in California's coastal and inland waters in the DFG Biogeographic Information and Observation System (BIOS).

(**DFG**, DFA) Year 2-5

Discussion: Mapping is an important step in determining the spatial distribution of AIS, and could help with the completion of other early detection and monitoring tasks. BIOS is available to the public and contains user-friendly, Internet-based maps.

3B7. Regularly review the efficacy of the state's AIS long-term detection and monitoring systems, and pursue any necessary improvements, in conjunction with 3A7.

(**AISWG**) Year 2-5

Discussion: Such a review such should occur at a minimum on a biennial basis.

OBJECTIVE 4: RAPID RESPONSE & ERADICATION

Establish and manage systems for rapid response and eradication.

Once AIS are established, complete eradication is often infeasible. Eradication or containment of pioneering populations is generally much more feasible, making rapid response a key AIS management strategy. Rapid response is facilitated by formal advance agreements between likely participants that address roles, responsibilities and procedures. As such, it requires a pre-planned collaborative effort on the part of government agencies, academic institutions and private interest groups.

STRATEGY 4A: RAPID RESPONSE

Implement a coordinated system for rapid response efforts to contain newly detected AIS.

ACTIONS

4A1. Develop and implement a statewide rapid response plan.

(**DFG**, AISWG) Year 1

Discussion: The Rapid Response Plan for AIS in California appears in Appendix A. This DRAFT plan was written in accordance with the federal guidelines for rapid response systems (USEPA 2005) and includes concepts presented in DFA's Model Rapid Response Plan for Aquatic Nuisance Species (see bibliography in Appendix A for references). It includes a proposed rapid response procedure that is based on formal interagency agreements. It also includes a planning section that discusses coordination among interested parties, issues that must be addressed to finalize the plan, funding and the need to develop interim rapid response protocols prior to plan completion.

4A2. Evaluate how existing systems for reporting AIS sightings or other natural resource problems (e.g. poaching, pollution discharge, birds infected with West Nile Virus) can either be used directly or as a blueprint for an AIS reporting system in California and coordinate systems as in 3A3.

(**CAAIST**, AISWG) Year 1

Discussion: Based on the results of this evaluation, utilize an existing system or develop a new system for the public to report AIS sightings. This reporting system needs to feed into the first steps of the rapid response procedure (Appendix A) which requires obtaining a definite identification of the species, determining whether it is a detrimental invasive species and notifying the appropriate authorities. Currently there are a number of options for submitting reports of possible aquatic invasive

species sightings, but focusing outreach efforts on one website/hotline destination may prove more efficient in the future. Current general reporting options include: 1) sending an e-mail to invasives@dfg.ca.gov; 2) submitting a form to the federal Nonindigenous Aquatic Species Program – http://nas.er.usgs.gov (click on Alert System); 3) calling their hotline – 1-877-STOP-ANS. The federal system passes information on to DFG and USFWS.

4A3. Develop species- and/or location-specific rapid response plans.

(**AISWG**) Ongoing

Discussion: A generic plan, described in Task 4A1, is necessary because it is not possible to write a plan for every species or location that may require rapid response to an AIS infestation. Species or location specific rapid response plans can include information that makes them more efficient to implement than a generic plan. The state needs to prioritize which species (using the list developed in 1A6) and locations warrant specific rapid response plans and develop these plans. Models already developed, such as the Non-Native Invasive Pest Intervention Team model (Anderson 2005) may be of value in creating such plans.

4A4. Explore the establishment and administration of permanent funding to implement rapid response plans, in conjunction with 1C4.

(**AE**, NGOs, SH) Year 2

Discussion: Washington, Massachusetts and other states have established emergency funds reserved for the containment/eradication of pioneering AIS infestations. California lacks emergency funding for immediate species identification and control actions. Without such funding, rapid response may not occur. The Ocean Protection Council's Strategic Plan identifies establishment of such a fund for coastal AIS as a high priority.

STRATEGY 4B: ERADICATION

Eradicate targeted populations of AIS.

4B1. Review and evaluate the effectiveness of eradication programs.

(**AISWG**) Year 2

Discussion: Eradication programs often compete for limited resources, and sometimes result in conflicts and trade offs among different public mandates. Regular evaluation and discussion among state agencies and the AISWG, with major conflicts brought to the attention of agency executives, will help streamline state eradication efforts. Findings and recommendations from research on the economic benefits and efficacy of

various management and prevention approaches developed under Actions 7B1-2 and 7C1-2 and 7C4 would be incorporated in the review.

4B2. Continue and complete effective current eradication efforts, in coordination with 4B1 and conduct follow-up monitoring to ensure eradication.

(**AISWG**) Ongoing

Discussion: As of fall 2006, recent or ongoing eradication programs within the state of California included, but were not limited to, *Hydrilla*, giant salvinia, smooth cordgrass, *Arundo*, alligatorweed, Japanese eelgrass and Northern pike. More information on some of these eradication efforts and species appears in Chapters 2, 4 and 8.

4B3. Standardize and apply sets of criteria that can be used to identify priority species for eradication under rapid response scenarios or more long-term efforts.

(**CAAIST**, RI, Science Advisory Panel) Year 1-2

Discussion: It would be helpful establish criteria to answer questions such as: Is it feasible and appropriate to attempt to eradicate a particular AIS infestation? Is it worthwhile to attempt a statewide eradication effort for a given species? These criteria would provide tools for DFA and DFG to reconcile their current screening strategies for AIS importation, help streamline decision making during the rapid response process and categorize AIS species into different management classes for planning purposes.

4B4. Develop and implement a method to identify priority sites of AIS invasion concern, in order to better prepare for rapid response and eradication.

(**AISWG**, Science Advisory Panel) Year 2

4B5. Identify ecologically sensitive waters as targets of additional precautionary protocols.

(**AISWG**, Science Advisory Panel) Year 2 and Ongoing

Discussion: To the extent possible, existing designations (e.g. National Estuarine Research Reserves, National Marine Sanctuaries, Marine Reserves, Critical Coastal Areas, etc.) should be used to compile locations and maps of ecologically sensitive waters. This action should also be coordinated with BIOS mapping efforts under 3B6.

OBJECTIVE 5: LONG-TERM CONTROL & MANAGEMENT

Control the spread of AIS and minimize their impacts on native habitats and species.

Long-term control and management activities should be focused on populations of established species where there is a clear and significant impact on economically important species, native species, human health, infrastructure, recreation and navigation, and where the control of specific populations is both technically and economically feasible. In many cases, past control efforts occurred as the result of a local management priority such as a weed clogging a favorite fishing spot, swimming hole or creek habitat, and the control measures undertaken by local groups and entities, sometimes with state support. State control programs tend to focus on larger scale impacts (water hyacinth in Delta waterways, for example), or AIS that threaten sensitive species, protected areas or water conveyance systems. As such, some control programs are coordinated among state, regional and local agencies, and some are not. The actions in this objective seek to prioritize control efforts; coordinate state control efforts with local and federal efforts; interface with appropriate researchers; provide technical assistance to local watershed groups, irrigation districts and others undertaking AIS management; and address AIS concerns in habitat restoration planning, landscape construction and maintenance projects.

STRATEGY 5A: CONTROL

Control known AIS populations where economically and technically feasible.

ACTIONS

5A1. Develop a method or criteria to prioritize control actions based on both the threat level and the anticipated efficacy of control actions.

(**CAAIST**, **FA**, RI) Year 2

Discussion: Criteria developed under 4B3 may be of some help in this endeavor.

5A2. Prioritize control efforts for all organisms, including new organisms of concern.

(**CAAIST**, **FA**, RI) Year 2

Discussion: With limited resources, prioritization of control efforts is a necessary part of addressing AIS issues throughout California. Statewide staff must coordinate priorities with local and regional staff and other agencies. A decision tree should be developed for determining whether to implement a control program, what types of control actions to use and how to accomplish the necessary permitting. Species could be placed in the

species management categories mentioned in Table 3, in coordination with lists developed under 1A6.

5A3. Continue ongoing control programs, following program review and in coordination with 5A1, 5A2 & 5A4.

(**DFA**, **DFG**, **SCC**, **FA**, RI) Ongoing

Discussion: Agencies can request that one of the AIS technical panels review an ongoing program and provide advice on what future actions should be. In addition, panels and agencies should take into consideration any findings from the Action 5A1 and 5A2 prioritization, the high-priority species lists developed under 1A6 and any findings and recommendations from research on efficacy of various management approaches developed under Objective 7.

5A4. Develop new species- and site-specific control plans as necessary for projects that are implemented by state agencies based on 5A1-3 above and on lessons learned from relevant projects inside and outside California. Coordinate with AISWG regarding plans being developed for entities other than state agencies.

(CAAIST, **FA**, RI) Year 2

5A5. Provide technical assistance to watershed councils, irrigation districts and other local boards for development of AIS management plans.

(**AISWG**, UCCE, CACASA, RCD) Year 3-5

STRATEGY 5B: LIMIT DISPERSAL TO NEW AREAS

Limit the dispersal of established AIS to new water bodies or to new areas within inland water bodies.

5B1. Establish boat washing stations and disposal facilities at infested water bodies.

(**DFG**, **DBW**, **DFA**, SH) Year 1

5B2. Install warning and information signs in infested areas at local kiosks, boat ramps and on floating buoys to limit the spread of existing AIS by boats, personal watercraft, movement of live fish and bait buckets.

(**DBW**, **DFG**, **DPR**, SH) Year 1

5B3. Use volunteer monitors to conduct AIS inspections at heavily used boat access areas.

(**DFG**, **DBW**, NGOs, SH, FA) Year 1

5B4. Develop criteria and a plan for enforcing the temporary or long-term closure of specific areas infested with high priority AIS, as defined in 1A6.

(**DFA**, **DFG**, **DBW**, SH) Year 2

STRATEGY 5C: PROTECT NATIVES

Protect areas of special ecological significance, and state and federally listed rare, threatened and endangered species, from AIS invasions.

5C1. Coordinate among appropriate state, federal and local government agencies, existing relevant coalitions such as the Weed Management Areas and private land management organizations, to prioritize ecologically sensitive areas most at risk due to AIS impacts.

(**AISWG**) Years 2-5

5C2. Coordinate the entities discussed in 5C1 to meet protection and restoration objectives with respect to AIS.

(**AISWG**) Years 3-5

5C3. Develop GIS-based maps that show coincidence of AIS and critical ecosystems.

(**DFG**, **DFA**, RI, DFG/OSPR) Years 3-5

Discussion: Mapping should be in coordination with other mapping actions under 3B6 and 4B5. These GIS layers will assist in setting priorities for eradication and control projects.

5C4. Establish and disseminate clear guidelines for action when AIS eradication or control efforts will take place in areas of special ecological significance.

(**AISWG**) Year 2

5C5. Adopt guidelines on best management practices for timber, crop production and livestock activities around water in order to prevent invasions.

(**AISWG)** Year 2

5C6. Assess any existing guidelines, and where necessary develop new guidelines, for preventing AIS spread through projects involving riparian, wetland and shallow water habitat restoration and/or shoreline landscaping.

(CAAIST) Year 1

Discussion: Newly cleared and created habitats can easily and immediately be colonized by opportunistic invasives. Measures are often necessary to prevent such invasions. Some work to gather existing guidelines for invasive plant species has been conducted by USFWS' Non-Native Invasive Species Program on behalf of the California Interagency Noxious and Invasive Plant Committee (L. McLaughlin, Personal Communication).

OBJECTIVE 6: EDUCATION & OUTREACH

Develop a comprehensive education and outreach program to ensure awareness of AIS threats and management priorities throughout California.

Most people do not recognize the threat that aquatic invasive species pose and how their own actions may lead to new infestations. The strategies and actions listed below are some of the elements that should be included in a comprehensive AIS education and outreach program. For many of these strategies and associated tasks, similar efforts are being undertaken in other states and on an international level. California should link with these existing efforts and use tools and methods proven effective elsewhere. Many outreach efforts and materials are developed outside of state or federal agencies, particularly by University of California and Sea Grant extension programs. Agencies should utilize the expertise and products available as much as possible. These programs should, in turn, seek agency input in product development. In addition to the many general outreach actions described below, several targeted outreach actions are listed under other objectives in this plan (2C6, 2D2-3, 2D5-6, 2D9, 2D12, 2G2-3, 2G5-6, 2H2, 3A4-6, 5B2, 5C1 and 5C5-6).

STRATEGY 6A: OUTREACH

Increase education of, and outreach to, those who may be potential sources for AIS introductions.

ACTIONS

6A1. Inventory existing education and outreach efforts in order to prioritize future strategies and develop a statewide AIS communication strategy.

(**CAAIST**, UCCE, Sea Grant) Year 2

Discussion: A dedicated effort is needed to inventory diverse existing education and outreach programs so that gaps and overlaps can be addressed and priorities for new programs identified. This effort should be closely coordinated with activities under Objective 2: Prevention.

6A2. Partner with ongoing outreach campaigns.

(**CAAIST**, UCCE, Sea Grant) Year 1

Discussion: National campaigns now underway include *Habitattitude* (pet industry and pet owner outreach) and *Stop Aquatic Hitchhikers* (boating and recreational outreach). Other state and NGO programs have established AIS outreach efforts and campaigns within California or in specific regions. Future partners for state education efforts may include industry groups, UCCE, Sea Grant and NGO programs. See Appendix D.

6A3. Develop a DFG Communications Plan.

(**DFG**) Year 2

Discussion: Currently, DFG staff develops brochures, posters, articles and press releases in an ad hoc manner. A communications plan will provide stakeholders and the general public with ongoing coordinated exposure to AIS issues.

6A4. Develop and distribute printed material (posters, brochures and articles) for specific industry sectors and user groups.

(**AISWG**, UCCE, Sea Grant) Year 1-5

Discussion: Target audiences may include the owners and employees of pet and aquarium stores, nurseries; wholesalers and shippers dealing in aquarium organisms; operators of water-based businesses (such as boat charter operators, marinas, angling guides, fishing tournament organizers, harbormasters, dive shops, seaplane operators, and dredging contractors).

6A5. Develop permanent interpretive displays at appropriate marinas, boat ramps and state fishing access sites.

(**AISWG**, SH) Year 2-5

Discussion: Educational signage should also be developed for important stream/river crossings on major recreational trails. Non-aquatic outdoor sports that involve aquatic crossings (equestrian trails, hiking and bicycle trails, 4-wheel drive dirt roads) can be targeted through information posted at trailheads and other high use areas.

6A6. Work directly with promoters of industry trade shows to deliver the AIS message.

(**DFG**, **DFA**, **DBW**, **SLC**, Sea Grant, RI, SH) Ongoing

Discussion: Some initial work done by DFG, DFA, DBW, SLC, Sea Grant, UCCE, and other organizations, can contribute to a comprehensive outreach program.

6A7. Present and distribute AIS information at various conferences, tournaments, fairs and other public gatherings.

(**AISWG**, Sea Grant, SH) Ongoing

Discussion: The ongoing efforts should reach as many venues as possible and avoid duplication.

6A8. Continue to include information on AIS in state hunting, fishing and boating regulations and licenses.

(**DFG**, **DBW**) Ongoing

6A9. Publish information about AIS in fishing and recreational newspapers, magazines, and newsletters.

(**DFG**, **DBW**, **UCCE**, **Sea Grant**, **NGOs**) Year 2-5

6A10. Develop AIS identification cards to be distributed to all appropriate audiences.

(**AISWG**, SH, Sea Grant) Ongoing

6A11. Encourage industries to offer noninvasive alternatives to AIS whenever possible and to educate their consumers about the availability of such alternatives.

(**AISWG**, SH) Year 3-5

Discussion: To aid with this effort, develop "California-friendly" or "green species" lists for specific user groups and industries.

6A12. Partner with diverse stakeholders and interest groups to multiply education efforts and distribute some of the materials developed in 6A4-6A10.

(**AISWG**, SH) Ongoing

Discussion: Work can be done, for example, with aquarium, water garden and other target industries to educate consumers, retailers and wholesalers of the importance of preventing the release of unwanted organisms into aquatic systems.

6A13. Educate waterfront and shoreline property owners, including those on lakes, rivers and streams, about AIS.

(**DBW**, **SCC**, NGOs, SH) Year 3-5

6A14. Develop and offer AIS management classes for professional organizations.

(**AISWG**, UCCE, SH) Year 4

Discussion: Training programs are needed for professionals such as pest control applicators, diving instructors, water/irrigation engineers and habitat restoration planners.

6A15. Continue state education measures concerning ballast water.

(**SLC**, Sea Grant) Ongoing

STRATEGY 6B: POLICYMAKERS

Engage policymakers and legislative staff in AIS policy and outreach efforts.

6B1. Provide decision makers and legislators with educational briefings on AIS threats and economic impacts, site visits showcasing impacts and controls and regular updates on AIS management progress.

(**CAAIST**, **FA**, RI, NGOs, SH) Years 1-3

6B2. Periodically update the Fish and Game Commission, SLC, OPC, SCC and CCC on invasive species activities.

(**DFG**, CAAIST) Years 1-5

STRATEGY 6C: RESOURCE MANAGERS & RESEARCHERS

Increase AIS awareness and support for management within the scientific community and natural resource agency staff.

6C1. Increase awareness of AIS among scientific and natural resource management interests.

(**RI**, CAAIST, FA, NGOs, SH) Ongoing

Discussion: This effort should promote greater awareness and information-sharing among those working in the field and in resource management projects that may be impacted by AIS. Possible avenues for this networking include: supporting symposia, workshops and conferences (highlighting new findings and activities discussed at local, national and international conferences); developing a centralized AIS communication forum for California (such as a species-specific list serve); and engaging managers and scientists in identifying, monitoring and reporting AIS as described in 3A4. Classes in AIS management (such as those offered by UCCE and Sea Grant) should be offered through public agency training programs, and held in locations resource managers can easily attend, or be offered on-line or in video.

6C2. Work with institutions and agencies conducting scientific research to ensure awareness of proper AIS containment and disposal methods, as well as legal restrictions.

(**DFA**, **DFG**, RI) Year 2

Discussion: Such an effort may be coordinated with the interests listed under 3A4.

6C3. Develop an AIS regulatory handbook.

(**CAAIST**, **FA**) Year 3

Discussion: The handbook should explain laws, regulations and permitting processes aimed at people that plan or practice various AIS control measures.

6C4. Share and disseminate information on current mechanical, chemical, biological and physical control methods.

(**AISWG**, SH) Ongoing

6C5. Disseminate guidelines developed in 5C4-6 and promote the use of native plants and/or non-invasive species in restoration, shoreline landscaping, and for timber, agricultural, or livestock activities around waterways.

(**CAAIST**, UCCE, Sea Grant) Year 2

Discussion: California-friendly species lists developed under 6A11 can be used.

6C6. Encourage the training of more taxonomists.

(**AISWG**, NGOs, SH, RI) Year 3

Discussion: A lack of professionally trained taxonomists is becoming a bottleneck in early detection efforts. Universities and colleges have significantly cut taxonomist positions and classes in recent years. AISWG and stakeholder groups, with a vested interest in protection from AIS, should address this problem and seek funding for training.

STRATEGY 6D: SCHOOLS

Increase AIS awareness within the educational system.

6D1. Train speakers to give guest presentations on AIS issues at schools, and develop resource packets for them to use when visiting classrooms, in coordination with 6E5.

(**AISWG**, NGOs, SH) Year 2-5

6D2. Assess existing K-12 environmental education curricula for opportunities to integrate AIS information, and develop new curricula as necessary.

(**UCCE**, **Sea Gran**t, DOE) Year 3-5

Discussion: AIS related curricula should be integrated into in-service training and continuing education programs for teachers. California may be able to build on existing curricula, and other school and educational materials, developed through Sea Grant programs in other states.

6D3. Further integrate AIS issues into service and education projects that involve students as part of a science class, science club or for community service credit offered at some schools.

(**UCCE**, **Sea Gran**t, DOE) Year 3-5

6D4. Educate teachers about proper disposal methods for organisms used in the classroom and at science fairs to prevent release or transfer of AIS.

(**UCCE**, **Sea Gran**t, DOE) Year 2

Discussion: ANSTF protocols for science fairs can be adapted to in-classroom disposals and other education activities.

STRATEGY 6E: GENERAL PUBLIC

Raise awareness, concern and achieve buy-in on AIS issues by all California residents and visitors.

6E1. Develop a press kit and work with the media to ensure the accuracy of any information published.

(**DFA**, **DFG**) Year 1

6E2. Increase local television, radio and newspaper media coverage of California's AIS threats and management priorities using the press kit described in 6E1 and other outreach techniques.

(**CAAIST**, UCCE, Sea Grant, NGOs, RI) Year1

6E3. Identify key state publications and websites to which AIS information can be added.

(**CAAIST**, UCCE, Sea Grant, NGOs, RI) Ongoing

Discussion: Ensure website links are established so that public information on AIS is easy to find and gets wide exposure. Coordinate with efforts under 1A9.

6E4. Develop multi-cultural educational materials on AIS that can engage California's diverse population.

(**UCCE**, **Sea Grant**, AISWG) Year 2-5

6E5. Develop a variety of presentations, including AIS traveling trunks and portable presentation boards, for use in both public and private venues, and train presenters.

(**UCCE**, **Sea Grant**, AISWG) Year 1

Discussion: Venues might include state parks, schools, libraries, natural history museums, aquariums, coastal access points and other recreational facilities.

OBJECTIVE 7: RESEARCH

Increase research on the baseline biology of AIS, the ecological and economic impacts of invasions, and options for control to improve management.

Increased knowledge of the biology of invasive species and associated control methods will improve AIS management. The state would benefit from the development of a comprehensive research agenda that sets priorities and guides researchers towards important topics. Such important topics include: quantifying and clarifying the effects of non-native species on native plants and animals and their habitats; examining economic effects of AIS; pinpointing any human health and safety concerns resulting from infestations; and exploring improved methods of restoring invaded habitats to their native condition, during and after the effective management of AIS. Partnerships with universities, research institutes, consulting firms and others conducting such research are necessary so that agencies can develop their management programs with scientific input. In addition, given the plethora of organizations involved in AIS issues in California, it is important that any available research funds are allocated competitively, based on a research group's specialized ability. Actions under Objective 7 should be coordinated with monitoring efforts under Objective 3.

STRATEGY 7A: BASELINE BIOLOGY

Increase our knowledge about AIS in order to develop effective prevention, control and management programs.

Discussion: Management must be based on solid scientific information on AIS population dynamics, reproductive biology and ecological conditions fostering growth. Many of these factors are not yet fully understood for both the AIS that are already in California and the AIS that are at high risk of being introduced in the foreseeable future.

ACTIONS

7A1. Host workshops to develop AIS research priorities and identify research gaps.

(**RI**, AISWG) Ongoing

Discussion: In 2005, two research priority workshops were held, one that addressed freshwater invasive plants and another that looked at invasive seaweed research needs.

7A2. Baseline biological studies on AIS and biological invasions should continue in coordination with 7A1 and 7C4.

(**RI**, AISWG) Ongoing

7A3. Develop a strategy to communicate and support research needs.

(**AISWG**, RI) Year 3

Discussion: Research needs could be communicated to the scientific community and institutions that support research in several ways: through networking among existing or new interagency committees, through a new research center that deals specifically with AIS or, through an existing center with an AIS component or emphasis.

STRATEGY 7B: ECONOMICS

Increase knowledge of economic impacts of AIS.

7B1. Perform economic impact studies on the effects of AIS on California, including costs and benefits of vector prevention.

(**CAAIST**, RI) Year 1

Discussion: A small number of studies around the world have begun to document the economic impacts of AIS but California-specific studies are needed. In many cases, economic impacts will be the driving force for change in personal and business actions, management and policy. Prevention is often more cost-effective than control when addressing AIS concerns. Economic analysis can help determine priorities for use of limited funds. Results of these studies should be communicated to those responsible for 4B1-2, and 5A1-3, and 6A1.

7B2. Conduct an economic assessment of different AIS management techniques, in support of Strategy 7C.

(**RI**, AISWG) Year 2

STRATEGY 7C: MANAGEMENT OPTIONS

Research current and potential management alternatives and determine their efficacy in controlling invasions and their effects on native species.

7C1. Evaluate and research current AIS management methods to improve their efficacy, safety and efficiency.

(**AISWG**, RI) Ongoing

Discussion: This should include a review of public health and environmental risks associated with various management options so that decision makers can take those constraints into account and be better prepared to answer inquiries about any risks. Results of these studies should be communicated to those responsible for Actions 4B1-2, and 5A1-3, and 6A1.

7C2. Investigate the efficacy of invasion prevention techniques.

(**AISWG**, RI) Year 2

Discussion: Different prevention techniques need to be investigated in terms of their efficacy in achieving the goals of this plan. For example, antifouling techniques available for larger ships are often inappropriate for smaller recreational boats and boats that travel different routes. Anti-fouling techniques need to be examined, compared and tested, as one method is unlikely to work in all instances. Results of these studies should be communicated to those responsible for developing prevention programs under Objective 2.

7C3. Consider the establishment of a testing and evaluation center for shipboard ballast water treatment technology.

(**SLC**) Year 1 and Ongoing

Discussion: The existing state program does not have the expertise, equipment, facilities or financial resources necessary for the testing and certification of treatment technologies for discharged ballast water. A new center would substantially improve the implementation of performance standards and the ongoing evaluation of technologies once approved. USCG and Naval Research Labs have recently established a testing and evaluation center in Key West, Florida; however, this single facility will only be able to consider three or four systems annually, once testing and verification protocols are established. Discussions between SLC staff and USCG have identified the need for additional testing and evaluation centers. Complementary California and Key West facilities could subject technologies to an array of environmental conditions that may be more reflective of the range of conditions vessels encounter during the course of international trade. The budget to establish such a facility, including capitol start-up cost, personnel, operating expenses and equipment is estimated at approximately $10 million over three years.

7C4. Identify and communicate opportunities for interagency funding of research necessary for improved management.

(**AISWG**) Year 3

Discussion: Consider developing a grant program administered by managers that pools money on an annual basis to do directed research studies.

OBJECTIVE 8: LAWS & REGULATIONS

Ensure state laws and regulations promote the prevention and management of AIS introductions.

Currently, California has numerous laws, regulations and policies that pertain to the introduction, distribution, importation, transportation, possession, propagation, planting, sale and release of non-native plants and animals. These authorities are spread over several agencies. This objective aims to review regulations for gaps and overlaps, and explore the need for new AIS laws and regulations. This section will likely be expanded in the next version of the plan to include specific legislative and regulatory actions, as well as new policy directions.

STRATEGY 8A: LAWS & REGULATIONS

Review the laws and regulations governing AIS in California for gaps and overlaps, compare them to other state and federal AIS laws, and recommend changes to improve our ability to protect California's waters from the introduction and spread of AIS.

ACTIONS

8A1. Establish a regulatory review committee.

(**CAAIST**, **FA**, RI, SH) Year 2

Discussion: This committee, to be comprised of representatives from agencies and non-governmental organizations, among others, will emphasize working in a coordinated fashion with existing state, federal and international programs. The committee will invite input from all groups affected by any proposed vector control measures and undertake step 8A2.

8A2. Identify the potential for improved regulatory coordination among state agencies.

(**CAAIST**) Ongoing

Discussion: The regulatory review committee will also coordinate this effort with tasks under Objective 1.

8A3. Pursue the authority to establish an interagency California AIS rapid response program, as detailed in Strategy 4A.

(**AE**, SH) Year 1

8A4. Explore the need for new legislation to address gaps in the state's authority to manage AIS and to strengthen California's AIS-related statutes.

(**CAAIST**, AISWG) Ongoing

Discussion: Legislation may be needed to address the results of the vector assessments and resulting management recommendations, developed under Objective 2.

8A5. Perform an interagency review to assess the current system for regulating plant and animal importations and the necessity of further restrictions.

(**DFA**, **DFG**, **FA**, AISWG) Year 1 and Ongoing

8A6. Explore the need for new or modified regulations to address gaps in the state's authority to manage AIS and to strengthen California's AIS-related statutes, taking into account any findings of Action 8A6.

(**CAAIST**, AISWG) Ongoing

8A7. Based on findings from Action 8A7, develop new regulations and pursue adoption.

(**AE**, DFA, DFG) Ongoing

7. PRIORITIES, IMPLEMENTATION & PLAN EVALUATION

Priorities

During the development of this plan, the state agencies with primary AIS responsibilities discussed their priorities for AIS management. They considered the more than 80 actions identified (out of 163 total) that were identified as high priorities by various attendees at the three 2006 public meetings (see Appendix E). The priorities of agencies and public meeting attendees overlapped.

In December 2006, representatives of these agencies met to determine which actions should be implemented during state fiscal years 2007-2008 and 2008-2009 (i.e. July 2007 through June 2009) and which entities should have primary responsibility for each of the actions. The results of that meeting are shown in the CAISMP Implementation Matrix (Table 5). At that meeting it was also decided to develop a separate table showing the amount of funds expended on actions during fiscal years 2005-2006 and 2006-2007. This information is shown in Table 6. Both tables are included at the end of this chapter. DFG's effort to collect expenditure information for ongoing projects met with limited success, and therefore, Table 6 is not complete. It is, however, a start at tracking this information in a comprehensive manner. A more thorough table will be developed in future years to assist with assessment and planning.

In more general terms, the highest priorities of this plan are as follows:

1. Formalize the creation of two major new coordinating entities, one entirely for state agencies and one for a broader range of AIS interests (Action 1A2 and 1A3).

2. Formalize a process for the team of state AIS managers to share information with, and get input from agency executives (Action 1A1).

3. Secure funding for state AIS staff (Action 1C3).

4. Conduct a statewide assessment of the risk from four specific AIS vectors: commercial fishing, recreational boating, live bait, and live imported seafood (Actions 2B7, 2C1, 2D1, and 2D4).

5. Fund and launch early detection and rapid response actions, including efforts to coordinate various AIS monitoring programs and expand monitoring of freshwater systems (Strategies 3A and 4A, and Appendix A).

If these core actions can be accomplished, it will provide a basis for pursuing the larger list of AIS management priorities in the future.

Plan Evaluation

To evaluate the effectiveness of the plan, formal evaluation will be conducted on a regular basis. Systematic monitoring and evaluation of the progress made toward implementation of actions and their effectiveness will be undertaken by the agencies designated as leads on the implementation table. Updates will be compiled by DFG on an annual basis.

In addition to an evaluation of efforts and implementation, the objectives, strategies and actions will also come under regular review, as this plan is intended to adapt to changing circumstances. It is envisioned that this evaluation will be conducted by a Plan Implementation Panel under the direction of the CAAIST. Evaluations will be conducted following years one, two and five; and on an “as needed” basis after that. Before updating the plan and Implementation Matrix, performance based criteria will be established to determine if the agencies and entities included are appropriate.

Table 5
California Aquatic Invasive Species Management Plan
IMPLEMENTATION TABLE
(see Chapter 6 for complete descriptions of actions)

Explanation of Terms

1) Implementing Entity: Since this is a state plan, these are state agencies, entities within state agencies, or groups that include state agencies that fund and have primary accountability and authority for an action being carried out.
2) Cooperating Organizations: Entities whose participation is needed or may be needed to conduct an action.
3) Non-governmental Organizations (NGOs): Non-profit organizations directly involved in AIS research or control activities.
4) Stakeholders: Relevant recreation, industry, local government, landowner representatives and special interest groups.
5) Plan Implementation and Science Advisory Panels: Panels created per Action 1A5 to help the work of the CAAIST and AISWG.

Acronyms

AISWG	Aquatic Invasive Species Working Group (see Action 1A2)
BOE	Board of Equalization
CAAIST	California Agencies Aquatic Invasive Species Team (see Action 1A3)
CACASA	California Agricultural Commissioners and Sealers Association
CAISMP	California Aquatic Invasive Species Management Plan
CALFED	CALFED Bay-Delta Program
CeNCOOS	Central and Northern California Ocean Observing System
DBW	California Department of Boating and Waterways
DFA	California Department of Food and Agriculture
DFG	California Department of Fish and Game
/OSPR	/Office of Spill Prevention and Response
DOE	California Department of Education
DPR	California Department of Parks and Recreation
DWR	California Department of Water Resources
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SCC	State Coastal Conservancy
SCCOOS	Southern California Coastal Ocean Observing System
Sea Grant	California Sea Grant College Program
SLC	California State Lands Commission
SWRCB	State Water Resources Control Board
UCCE	University of California Cooperative Extension
WCB	Wildlife Conservation Board

Other Abbreviations

AE Agency Executives (Upper management of state agencies and departments)
SH Stakeholders
FA Federal Agencies
FY State fiscal year (July 1 through June 30)
RI Research Institutions (e.g. Public and private universities, government research organizations, etc)

Implementation Year

	Starts Year 1 (FY 2007/2008)
	Ongoing (started during or before FY 2006/2007)

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 1. COORDINATION AND COLLABORATION **Improve coordination and collaboration among the people, agencies and activities involved with AIS.**								
INTERNAL STATE COORDINATION								
1A1	Develop an executive level consultation process.		AE	CAAIST, RI, NGOs, SH				
1A2	Formalize the California Agencies AIS Team (CAAIST).		AE					
1A3	Establish, fund and staff an Aquatic Invasive Species Working Group (AISWG).		AE	CAAIST, RI, NGOs, SH				
1A4	Evaluate the need for an invasive species center.		AE	NGOs, RI, SH, CAAIST				
1A5	Form and fund technical advisory panels.		CAAIST, AISWG					
1A6	Draft and update a list of AIS at high risk for introduction.		CAAIST	FA, RI, Sea Grant, UCCE, NGOs, SH				
1A7	Identify lead state agency for particular AIS, water bodies and invasion vectors.		AE	CAAIST				
1A8	Identify agency personnel required for AIS management.		AE	CAAIST				
1A9	Improve state websites related to AIS.		CAAIST					
1A10	Assess effectiveness of and gaps in state AIS programs.		AISWG	Plan Imp. Panel				
1A11	Coordinate AIS management with SWRCB & RWQCBs.		CAAIST	SWRCB, RWQCBs				
1A12	Develop and update AIS expert list.		CAAIST	Science Advisory Panel				
1A13	Develop boilerplate AIS language for official agency review.		CAAIST					

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 1. COORDINATION AND COLLABORATION (continued)								
LOCAL, NATIONAL AND INTERNATIONAL COORDINATION								
1B1	Identify AIS reps in government agencies and NGOs.		CAAIST	RI, FA, NGOs, SH				
1B2	Identify conflicts and overlaps among government and NGO AIS programs.		CAAIST	RI, FA, NGOs, SH				
1B3	Invite community groups for AIS planning and education.		AISWG					
1B4	Expand participation in local AIS efforts and task forces.		AISWG	SH				
1B5	Expand participation in regional, national and international AIS task forces.		AE, CAAIST, RI					
1B6	Partner with Mexico, Canada, Pacific Coast and Colorado River states.		AE, RI	AISWG				
1B7	Participate in national and international conferences.		AE, CAAIST, RI					
FUNDING								
1C1	Identify and apply for state and national grant funding.		CAAIST, RI, NGOs					
1C2	Establish stable, long-term funding to help implement this plan.		AE	CAAIST				
1C3	Provide state funding for AIS positions.		AE	CAAIST				
1C4	Provide state funding for rapid response actions.		AE					
1C5	Hire a funding development specialist.		AE	CAAIST				
1C6	Provide new funding mechanisms.		AISWG					

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 2. PREVENTION **Minimize the introduction and spread of AIS into and throughout California waters.**								
REGIONAL VECTOR ASSESSMENT								
2A1	Rank AIS vector importance in different regions of California.		RI	DFG				
COMMERCIAL VESSELS & MARITIME ACTIVITIES								
2B1	Quantify ballast water and hull fouling vectors and assess invasion risk.		SLC	RI	2,013*	2,593*		
2B2	Continue and improve state ballast water inspection and enforcement program.		SLC					
2B3	Implement discharge standards for treated ballast water.		SLC					
2B4	Identify and address gaps in the Marine Invasive Species Act.		AISWG	SLC, DFG				
2B5	Develop a commercial vessel fouling outreach and management program.		SLC	Sea Grant				
2B6	Investigate how moving maritime structures can contribute to AIS dispersal.		DFG, SLC	RI, FA				
2B7	Quantify and assess the role of commercial fishing vessels as AIS vectors.		DFG	RI, NGOs, SH, FA		100		100
2B8	Develop a commercial fishing outreach and management program.		DFG	AISWG, FA				
*SLC contracts with BOE to collect the Fee from qualifying voyages. The numbers above do NOT include BOE's budget.								
RECREATION								
2C1	Quantify and assess recreational boating as an AIS vector.		DBW, DFG	RI, SH		150		150
2C2	Develop a recreational boating outreach and management program.		DBW	UCCE, Sea Grant				
2C3	Develop a watercraft inspection program for high priority boat launch sites.		DBW, DFG, DPR	SH				

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 2. PREVENTION (continued)								
2C4	Quantify and assess recreational fishing as an AIS vector.		DFG, DBW	RI, SH				
2C5	Develop a recreational fishing outreach and management program.		DFG	UCCE, Sea Grant				
2C6	Develop guidelines for: disposal of invasive species, cleaning of gear and equipment, disposal of bait.		DFG, DBW	Sea Grant				
BAIT, LIVE SEAFOOD, AQUACULTURE & AQUARIUM								
2D1	Quantify and assess bait as an AIS vector.		DFG	RI		125		125
2D2	Work with the bait industry to develop prevention strategies.		DFG	UCCE, SH				
2D3	Develop a bait outreach and management program.		DFG	UCCE, SH				
2D4	Quantify and assess imported live seafood as an AIS vector		DFG, DFA			125		125
2D5	Work with live seafood industry to develop preventative strategies.		DFG, DFA	UCCE, Sea Grant				
2D6	Develop an imported live seafood outreach and management program.		DFG, DFA	UCCE, Sea Grant				
2D7	Assess risks posed by water handling systems.		SWRCB, DFG	RI, SH				
2D8	Educate aquaculture industry on containment systems.		DFG	SH, UCCE				
2D9	Develop an aquaculture outreach and management program.		DFG	UCCE				
2D10	Quantify and assess how aquarium and aquascaping trades contribute to AIS introductions.		DFG, DFA	RI		125		125
2D11	Work with aquarium, water gardens and other industries on accessible disposal.		DFG, DFA	UCCE, FA		20		20

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 2. PREVENTION (continued)								
2D12	Implement an aquarium and aquascaping outreach and management program.		DFG, DFA	UCCE, FA				
FISHERIES ENHANCEMENT								
2E1	Quantify and assess fisheries enhancement as an AIS vector.		DFG	RI		50		50
2E2	Review DFG practice of intentional introduction of non-native species for recreational purposes.		DFG	RI				
2E3	Reduce unauthorized stocking of non-natives species.		DFG					
2E4	Weigh benefits of mosquitofish introduction.		DFG	RI				
RESEARCH, MANAGEMENT & EDUCATION								
2F1	Quantify and assess research, resource management and educational activities as AIS vectors.		AISWG			125		125
2F2	Establish protocols to minimize spread of AIS by these activities.		DFG, AISWG	RI				
2F3	Evaluate regulations and protocols for in-water research.		DFG	SWRCB, RI				
2F4	Quantify and assess live aquatic species shipments for research as an AIS vector.		DFG	RI				
CONSTRUCTION & RESTORATION								
2G1	Quantify and assess construction activities as an AIS vector.		DFG	RI				
2G2	Work with industry to develop equipment decontamination guidelines.		DFG, SLC, DPR, FA	RI				
2G3	Develop a construction outreach and management program.		DFG, SLC, DPR, FA	UCCE				
2G4	Quantify and assess restoration activities as an AIS vector.		AISWG	RI				

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 2. PREVENTION (continued)								
2G5	Encourage the use of native species.		DFG, SCC	AISWG				
2G6	Develop a restoration outreach program.		AISWG	UCCE				
WATER DELIVERY & DIVERSION SYSTEM								
2H1	Quantify and assess the water delivery and diversion system as an AIS vector.		DWR					
2H2	Develop an outreach and management program for the system.		DWR	UCCE, Sea Grant				
ENFORCEMENT & INSPECTION								
2I1	Increase staffing and hours at DFA Border Protection Stations.		DFA	SH				
2I2	Develop guidelines for border inspections.		DFA, DFG			1		
2I3	Increase DFG enforcement of current regulations on prohibited and restricted species.		DFG	SH				
2I4	Ensure adequate staffing and cargo inspection guidelines for port and airport enforcement.		FA	AISWG, SLC				
2I5	Continue disease sampling for shipments and stocks of live aquatic species.		DFG					
2I6	Identify mail order, online vendors selling CA prohibited and restricted species.		AISWG	RI				
OBJECTIVE 3. EARLY DETECTION & MONITORING **Develop and maintain programs that ensure the early detection of new AIS and the monitoring of existing AIS.**								
EARLY DETECTION								
3A1	Assess current monitoring of state waters for early detection opportunities.		CAAIST	RI, CeNCOOS, SCCOOS		100		100

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 3. EARLY DETECTION & MONITORING (continued)								
3A2	Assess how the state's Marine Invasive Species Program monitoring can aid early detection.		SLC	DFG, RI				
3A3	Develop a statewide approach to early detection.		CAAIST	AISWG		100		100
3A4	Outreach to those regularly sampling state waters.		CAAIST	UCCE, Sea Grant				
3A5	Create and train a statewide citizen monitoring network.		CAAIST	UCCE, SH				
3A6	Engage professional divers in the early detection network.		CAAIST	AISWG, NGOs		100		100
3A7	Review efficacy of the state's AIS early detection systems.		AISWG					
LONG-TERM MONITORING								
3B1	Assess long-term AIS monitoring of state waters.		AISWG	CeNCOOS, SCCOOS, DFG/OSPR				
3B2	Coordinate with ocean observing groups.		AISWG	CeNCOOS, SCCOOS				
3B3	Monitor locations with a high invasion rate.		AISWG	DFG/OSPR, RI				
3B4	Monitor the population growth and dispersal of established AIS.		AISWG	DFG/OSPR, RI				
3B5	Fund the incorporation of DFG's historical stream surveys and report findings into a central database.		DFG					
3B6	Include maps of existing AIS in California waters in DFG BIOS system.		DFG	DFA				
3B7	Review the efficacy of long-term monitoring systems.		AISWG					

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 4. RAPID RESPONSE & ERADICATION **Establish systems for rapid response and eradication.**								
RAPID RESPONSE								
4A1	Develop and implement a statewide rapid response plan.		DFG	AISWG				100
4A2	Evaluate and coordinate existing systems for reporting AIS sightings.		CAAIST	AISWG				10
4A3	Develop species- and/or location-specific rapid response plans.		AISWG					
4A4	Explore permanent funding to implement rapid response.		AE	NGOs, SH				
ERADICATION								
4B1	Review effectiveness of eradication programs.		AISWG					
4B2	Continue and complete current eradication efforts.		AISWG					
4B3	Standardize criteria for identifying priority species for eradication.		CAAIST	RI, Science Advisory Panel				
4B4	Develop a method to prioritize sites of AIS invasion concern.		AISWG	Science Advisory Panel				
4B5	Identify ecologically sensitive waters requiring additional precautions.		AISWG	Science Advisory Panel				
OBJECTIVE 5. LONG-TERM CONTROL & MANAGEMENT **Control the spread of invasives and minimize their impacts on native habitats and listed species.**								
CONTROL								
5A1	Develop a method or criteria to prioritize control actions.		CAAIST, FA	RI				
5A2	Prioritize control efforts for existing and new organisms of concern.		CAAIST, FA	RI				

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 5. LONG-TERM CONTROL & MANAGEMENT (continued)								
5A3	Continue ongoing control programs.		DFA, DFG, SCC, FA	RI				
5A4	Develop species- and site-specific control plans.		CAAIST, FA	RI				
5A5	Provide technical assistance to watershed councils, irrigation districts and other groups.		AISWG	UCCE, CACASA, RCD				
LIMIT DISPERSAL TO NEW AREAS								
5B1	Establish boat washing stations and disposal facilities at infested waters.		DFG, DBW, DFA	SH				
5B2	Install AIS warning and information signs in infested areas.		DBW, DFG, DPR	SH				
5B3	Use volunteer monitors to conduct AIS inspections.		DFG, DBW	NGOs, SH, FA				
5B4	Develop criteria for enforcing closure of infested areas.		DFA, DFG, DBW	SH				
PROTECT NATIVES								
5C1	Prioritize ecologically sensitive areas at risk of AIS impacts.		AISWG					
5C2	Coordinate entities to meet AIS protection and restoration objectives.		AISWG					
5C3	Develop GIS maps showing coincidence of AIS and critical ecosystems.		DFG, DFA	DFG/OSPR, RI				
5C4	Establish guidelines for when AIS eradication or control will occur in sensitive areas.		AISWG					
5C5	Adopt guidelines on best practices for timber and agricultural activities.		AISWG					
5C6	Assess guidelines for preventing AIS spread in habitat restoration and shoreline landscaping projects.		CAAIST			10		10

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 6. EDUCATION & OUTREACH **Increase education and outreach efforts to ensure awareness of AIS threats and management priorities throughout California.**								
OUTREACH								
6A1	Inventory education and outreach efforts and develop a state AIS communication strategy.		CAAIST	UCCE, Sea Grant				
6A2	Partner with ongoing outreach campaigns.		CAAIST	UCCE, Sea Grant				
6A3	Develop a DFG Communications Plan.		DFG					
6A4	Develop posters, brochures and articles for industry sectors and user groups.		AISWG	UCCE, Sea Grant				
6A5	Develop permanent interpretive displays at marinas, boat ramps and fishing sites.		AISWG	SH				
6A6	Work directly with industry trade shows to deliver the AIS message.		DFG, DFA, DBW, SLC	Sea Grant, RI, SH				
6A7	Present AIS information at public gatherings.		AISWG	Sea Grant, SH				
6A8	Include AIS information in state hunting, fishing and boating regulations and licenses.		DFG, DBW					
6A9	Include AIS information in local fishing and recreational publications.		DFG, DBW, UCCE, Sea Grant, NGOs					
6A10	Develop and distribute AIS identification cards.		AISWG	SH, Sea Grant				
6A11	Encourage industries to offer noninvasive alternatives to AIS.		AISWG	SH				
6A12	Partner with stakeholders and interest groups to broaden education efforts.		AISWG	SH				
6A13	Educate waterfront and shoreline property owners about AIS.		DBW, SCC	NGOs, SH				

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 6. EDUCATION & OUTREACH (continued)								
6A14	Develop and offer AIS management classes for professional organizations.		AISWG	UCCE, SH				
6A15	Continue state education measures concerning ballast water.		SLC	Sea Grant				
POLICYMAKERS								
6B1	Brief decision makers and legislators on AIS management progress.		CAAIST, FA	RI, NGOs, SH				
6B2	Brief the Fish and Game Commission, SLC, OPC, SCC and CCC.		DFG	CAAIST				
RESOURCE MANAGERS & RESEARCHERS								
6C1	Increase AIS awareness among scientific and natural resource managers.		RI	CAAIST, FA, NGOs, SH				
6C2	Educate researchers on AIS containment, disposal methods and legal restrictions.		DFA, DFG	RI				
6C3	Develop an AIS regulatory handbook.		CAAIST, FA					
6C4	Share information on current mechanical, chemical, biological and physical control methods.		AISWG	SH				
6C5	Disseminate guidelines to promote use of native plants.		CAAIST	UCCE, Sea Grant				
6C6	Encourage the training of more taxonomists.		AISWG	NGOs, SH, RI				
SCHOOLS								
6D1	Train speakers to give guest presentations at schools.		AISWG	NGOs, SH				
6D2	Assess existing K-12 environmental education curricula.		UCCE, Sea Grant	DOE				

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 6. EDUCATION & OUTREACH (continued)								
6D3	Integrate AIS issues into service and education projects.		UCCE, Sea Grant	DOE				
6D4	Inform teachers about proper disposal methods for organisms.		UCCE, Sea Grant	DOE				
GENERAL PUBLIC								
6E1	Develop press kits.		DFA, DFG			100		100
6E2	Increase local TV, radio and newspaper media coverage.		CAAIST	UCCE, Sea Grant, NGOs, RI				
6E3	Identify state publications and websites to add AIS information.		CAAIST	UCCE, Sea Grant, NGOs, RI				
6E4	Develop multicultural educational materials.		UCCE, Sea Grant	AISWG				
6E5	Develop AIS traveling trunks and portable presentation boards.		UCCE, Sea Grant	AISWG				
OBJECTIVE 7. RESEARCH **Increase research on the baseline biology of AIS, the ecological and economic impacts of invasions, and control options to improve management.**								
BASELINE BIOLOGY								
7A1	Host workshops to develop AIS research priorities and identify gaps.		RI	AISWG				
7A2	Assess, continue and complete current studies.		RI	AISWG				
7A3	Develop a strategy to communicate and support research needs.		AISWG	RI				
ECONOMICS								
7B1	Perform economic impact studies on AIS effects.		CAAIST	RI		200		200

Table 5. CAISMP Implementation Table

Tasks		Priority *	Implementing Entity	Cooperating Organizations	Year 1 Planned Efforts (FY07-08)		Year 2 Planned Efforts (FY08-09)	
Number	Title/Summary				Dedicated	Requested	Dedicated	Requested
					$1,000	$1,000	$1,000	$1,000
OBJECTIVE 7. RESEARCH (continued)								
7B2	Assess and compare costs of different management techniques.		RI	AISWG				
MANAGEMENT OPTIONS								
7C1	Evaluate efficacy of AIS management methods.		AISWG	RI				
7C2	Investigate the efficacy of invasion prevention techniques.		AISWG	RI				
7C3	Consider test center to evaluate ballast water treatment technologies.		SLC					
7C4	Identify opportunities for interagency funding of AIS management research.		AISWG					
OBJECTIVE 8. LAWS & REGULATIONS **Ensure State laws and regulations promote the prevention and control of AIS.**								
LAWS & REGULATIONS								
8A1	Establish a regulatory review committee.		CAAIST, FA	RI, SH				
8A2	Identify the potential for improved regulatory coordination.		CAAIST					
8A3	Pursue the authority to establish an interagency rapid response program.		AE	SH				
8A4	Explore the need for additional state authority for AIS management.		CAAIST	AISWG				
8A5	Review current system for regulating plant and animal importations.		DFA, DFG, FA	AISWG				
8A6	Explore how new or modified regulations can bridge authority gaps.		CAAIST	AISWG				
8A7	Develop and pursue the adoption of new regulations.		AE	DFA, DFG				

Table 6 – Funds Spent on Ongoing AIS Programs and Activities

Name of Program or Activity	Implementing Entity[1]	CAISMP Action Number(s)	FY 05/06[2]	FY 06/07
Aquatic and Riparian Invasive Species Control on DFG Lands (One Time Funding)	DFG	5A2		$720,000
Aquatic and Riparian Invasive Species Control on DFG Lands (Regular Funding)	DFG	5A2	$160,000	$160,000
Wetlands Invasive Plant Control	WCB	5A2		$3,610,000
Riparian Invasive Plant Control	WCB	5A2		$1,000,000
Santa Clara River Invasive Species Control (Santa Clara River Trustee Council Grants)	DFG	5A2		$507,700
Santa Clara River Invasive Species Research (Santa Clara River Trustee Council Grants)	DFG	7C1		$100,000
Santa Clara River - Education for Restoration Workers	DFG	2G2, 2G3		$24,734
Santa Clara River Invasive Species Monitoring	DFG	3B4		$200,285
Santa Clara River - Public Outreach and Education (est. portion for Invasive Species)	DFG	6E5,6A4, 6A7		$25,000
Shellfish Health Laboratory	DFG	2D1	$10,000	$10,000
Shellfish Health Laboratory	DFG	2D4	$10,000	$10,000
Shellfish Health Laboratory	DFG	2D7	$70,000	$70,000
Shellfish Health Laboratory	DFG	2D8	$10,000	$10,000
Shellfish Health Laboratory	DFG	2D10	$20,000	$20,000
Shellfish Health Laboratory	DFG	2F2	$10,000	$10,000
Marine Invasive Species Program – Invasive Species Monitoring	DFG/OSPR	3B3, 7C2	$1,080,000	$1,080,000
Marine Invasive Species Program – Commercial Vessel Vectors	SLC	2B1	$1,531,000	$2,013,000
Quagga Mussel Response – Unified Command participation, planning and logistics, dive and surface surveys, border inspection stations, public outreach	DFG, DFA	4A3, 2I1 & many others		$1,048,119
Quagga Mussel Response – Unified Command participation, eradication planning, dive inspections	DWR	4A3, 5A4,2H1		$36,320

[1] See “Explanation of Terms” and “Acronyms” above Table 5.
[2] This table shows funds that were allocated in the 05/06 and 06/07 fiscal years. There were additional AIS projects being worked on in 05/06 and 06/07 that were not included in the table because they were funded in previous years.

Table 6 – Funds Spent on Ongoing AIS Programs and Activities

Name of Program or Activity	Implementing Entity[1]	CAISMP Action Number(s)	FY 05/06[2]	FY 06/07
Quagga Mussel Response – Training surface survey units	DWR	4A3		$3,624
Quagga Mussel Response – Outreach to boaters	DBW	4A3		$400,000
Aquatic Weed Control (water hyacinth and *Egeria densa*)	DBW	5A3	$7,000,000	$7,000,000
Hydrilla Eradication Program	DFA	3B4, 4B2,5A3	$2,100,000	$2,100,000
Coordination and Collaboration Activities	Sea Grant	1A4, 1C1, 1C2, 1C3	$9,000	$9,000
Commercial Vessels and Maritime Activities	Sea Grant	2B1, 2B2, 2B3, 2B6	$137,250	$137,250
Reduce AIS introductions related to recreational activities	Sea Grant	2C1, 2C4, 2C6	$9,000	$9,000
Reduce AIS introductions related to the live seafood industry	Sea Grant	2D5, 2D6	$4,500	$4,500
Early detection program development	Sea Grant	3A4, 3A6	$11,250	$11,250
Identify and monitor locations with high AIS invasion rates	Sea Grant	3B3	$50,000	$50,000
Work with volunteers to conduct AIS inspections at heavily used boat access areas	Sea Grant	5B3	$4,500	$4,500
Education and outreach to groups that may be a source of AIS introductions	Sea Grant	6A1, 6A2, 6A4, 6A5, 6A6, 6A7, 6A10, A12, 6A13	$29,250	$29,250
Increase awareness of AIS among, and share information on control methods with, scientific and natural resource management interests	Sea Grant	6C1, 6C4	$4,500	$4,500
Increase awareness of AIS in the educational system	Sea Grant	6D2, 6D4	$4,500	$4,500
Increase awareness and knowledge of AIS by the general public	Sea Grant	6E2, 6E3, 6E4, 6E5	$9,000	$9,000
Baseline biological studies on AIS	Sea Grant	7A2	$60,000	$60,000
Economic assessment of different AIS management techniques	Sea Grant	7B2	$9,000	$9,000

[1] See "Explanation of Terms" and "Acronyms" above Table 5.
[2] This table shows funds that were allocated in the 05/06 and 06/07 fiscal years. There were additional AIS projects being worked on in 05/06 and 06/07 that were not included in the table because they were funded in previous years.

Table 6 – Funds Spent on Ongoing AIS Programs and Activities

Name of Program or Activity	Implementing Entity[1]	CAISMP Action Number(s)	FY 05/06[2]	FY 06/07
Northern Pike Containment System at Lake Davis	CALFED	5A3	$2,000,000	
Lake Davis Pike Eradication Project: Planning Feasibility Phase	CALFED	4B2		$5,800,000
Lake Davis Pike Eradication Project: Implementation Phase	CALFED	4B2		$11,700,000
Invasive Spartina Monitoring	CALFED	3B4,5A3		$1,234,396
	Total of Reported Activities		$14,342,750	$39,234,928

[1] See "Explanation of Terms" and "Acronyms" above Table 5.
[2] This table shows funds that were allocated in the 05/06 and 06/07 fiscal years. There were additional AIS projects being worked on in 05/06 and 06/07 that were not included in the table because they were funded in previous years.

8. CASE STUDIES IN ERADICATION & CONTROL

See also the explanation of species names in the introductory matter.

1. RAPID RESPONSE IN SAN DIEGO: CAULERPA

Invasion: *Caulerpa taxifolia* is a marine alga native to the warm waters of the Red, Indo-Pacific and Caribbean seas. The bright-green plant, which has feathery, fern-like fronds extending upward from a main stem, is fast-growing and easy to cultivate. *C. taxifolia* gained popularity as an aquarium plant in the 1970s. In the early 1980s, a strain of *C. taxifolia* that had adapted to temperate waters escaped from Germany's Stuttgart Aquarium into the northern Mediterranean. By 2001, the temperate strain of *C. taxifolia* carpeted more than 30,000 acres of coastal waters from Spain to Italy, moved into the Croatian Adriatic, and from there, spread to Northern Africa. As the plant spread, it excluded native plants and animals.

Nearly twenty years after it's introduction into the Mediterranean Ocean, C. taxifolia was observed in the Americas. In July 2000, biologists conducting an eelgrass restoration project in Carlsbad, California, near San Diego, found monoculture patches of *C. taxifolia* covering approximately 1,100 square meters of a coastal estuary known as Agua Hedionda Lagoon. The resulting press coverage brought attention to a previously known second infestation of scattered individual plants over seven acres of Huntington Harbour near Los Angeles. Genetic tests confirmed that both areas had been invaded by clones of the aquarium strain, suggesting aquarists had dumped the contents of their saltwater tanks into California waters.

Concern: *C. taxifolia* is one of the world's most notorious marine invasives. Though tropical in origin, the clone cultivated in home aquaria has adapted to waters as cool as 50 degrees F. The aquarium strain can grow on rock, sand and mud, and increase in size by an inch per day, developing in monoculture patches that are both taller and more vigorous than its wild ancestor, which is genetically distinct from the aquarium strain and is not known to be invasive. Sexual reproduction has not been documented, but *C. taxifolia* reproduces easily, regenerating from small fragments broken off from the main plant. *C. taxifolia* is not particularly vulnerable to predation. Chemicals in its tissues make it unpalatable to most animals. In the laboratory, *C. taxifolia* has survived a wide array of kill techniques, including high doses of herbicides and algicides as well as light exclusion for more than one month.

Response: The plant's notoriety helped galvanize an immediate response to the California infestations. Plant samples taken from Agua Hedionda Lagoon were identified literally overnight as *C. taxifolia*. A task force consisting of representatives from more than ten state, federal and local agencies plus local stakeholders and experts met within days to determine how to manage the outbreaks. Given the speed with which *C. taxifolia* had invaded the

Mediterranean and the ecological havoc that ensued, the task force approved a plan calling for an immediate eradication response. Regulatory agencies agreed in advance to green-light permits for eradication work to begin within two weeks.

Both infestations occurred in bodies of water with restricted ocean access. This enabled kill procedures to take place in areas sheltered from ocean waves, and made surveys for regrowth safer and easier to conduct. In Agua Hedionda, divers surveyed the lagoon and mapped patches of the alga. The patches were covered by tarpaulins and the edges secured by sandbags and rebar. Solid chlorine pucks were placed beneath the tarps to make up a five percent bleach solution. Before the tarpaulins were lifted, sediment cores were grown out in the laboratory to determine whether any viable *C. taxifolia* remnants remained. Meanwhile, teams of divers continuously resurveyed the 200-acre lagoon to ensure no other plants had been missed. A similar tarp, bleach, and survey protocol was followed at Huntington Harbour. The last specimens of *C. taxifolia* were found outside the tarpaulins at both sites in fall of 2002. The alga was officially declared eradicated in July 2006. All told, the eradication effort cost $7.7 million, including planning, field work, monitoring and reports.

Lessons: Several factors contributed to the success of *C. taxifolia* eradication in southern California. Rapid identification, an expedited process and cooperation among stakeholders, plus adequate funding and follow-up, all contributed to eradication. Biologists were aware of *C. taxifolia's* invasion of the Mediterranean and rapidly identified the problem. Concern over a similar outbreak in California spurred the prompt formation of an invasion task force. Stakeholders were identified within days and agreed to participate in response plan discussions. The specter of the alga's escape prompted task force members to aim for eradication despite the fact that some native species, such as eelgrass and estuary invertebrates, would be harmed. Team members divided tasks, some turning their full attention to eradication while others concentrated on permitting applications and approval. Regulatory agencies agreed to cooperate with the eradication plans and expedite permitting. Financing was adequate to maintain a sustained response. Intensive monitoring surveys were conducted for least three years to guard against any regrowth.

Background Studies:

Merkel & Associates, Inc. 2006. *Final report on eradication of the invasive seaweed Caulerpa taxifolia from Agua Hedionda Lagoon and Huntington Harbour, California.* Prepared for the Steering Committee of the Southern California Caulerpa Action Team.

2. ERADICATION EFFORT IN THE SAN FRANCISCO BAY ESTUARY: SMOOTH CORDGRASS

Invasion: Intentionally introduced to the San Francisco Bay Estuary in the 1970s to stabilize shorelines, smooth cordgrass spread rapidly, hybridized with Pacific cordgrass and today threatens thousands of acres of tidal marshes and restoration projects around the Bay. In 2000, surveyors tallied 470 acres of hybrid smooth cordgrass, while the original introduced parent had become quite rare. By 2003, the hybrids covered 2000 acres. The smooth cordgrass was not confined to certain areas; the invader was widely dispersed through 69,000 acres of tidal marsh and mudflats and had invaded every marsh restoration project in the Bay.

Concern: The hybridization between smooth and Pacific cordgrass resulted in a high degree of genetic variation, which allowed individual plants to survive in different parts of the marsh and to exploit open niches. Some hybrids grow well in higher marsh elevations while others flourish on open mudflats. Other adaptive qualities of the smooth cordgrass hybrids include the ability to produce up to 23 times more seed than the native, to grow taller and/or faster, and to tolerate higher or lower salinity. The hybrid cordgrass tends to grow in dense stands, turning diverse marshes into monocultural meadows, crowding out the meandering tidal channels used by native salt marsh species, and reducing fish habitat. This invasion sequence can also transform open mudflats into uniform expanses of cordgrass, destroying foraging habitat for shorebirds. Flood control channels are also threatened, as the cordgrass can significantly impede flow with increased siltation rates and biomass accumulation, threatening adjacent residential and commercial areas with flooding.

Response: In 2000, SCC began to organize a multi-agency, region-wide control effort in the San Francisco Estuary called the Invasive Spartina Project (ISP). With substantial funding from CALFED Bay Delta Program (CALFED), ISP surveyed and mapped the invasive cordgrass, evaluated a wide range of potential treatment strategies and methods, prepared environmental review documents under CEQA and NEPA, developed extensive partnerships with regional marsh owners and managers, obtained necessary permits (e.g., ESA Section 7 and CWA Section 402/NPDES), and prepared site-specific treatment plans for over 130 known infested marshes. ISP also coordinated funding from CALFED through SCC to the land owner/manager partners. In 2004, ISP partners initiated treatment efforts, which consisted of spraying selected infested marshes with glyphosate (Aquamaster(r), the aquatic version of Roundup(r)), and using light mechanical removal methods.

ISP faced a number of constraints as it attempted to respond to the fast-moving invasion of hybridized smooth cordgrass. Mechanical removal methods, such as mowing, sometimes aggravated the problem. Spraying was slow, difficult work. It had to be limited to days with no rain, low wind and periods of low tides, so as to minimize drift issues and keep the herbicide from washing off

of the surface of the plants. Targeted plants had to be entirely coated with the glyphosate herbicide to achieve maximum efficacy, which in most cases proved to be around 50% at best. Another problem was that glyphosate tends to become deactivated when it binds with sediment; since these bay waters contain a great deal of suspended sediment which is deposited on the cordgrass twice daily, much of the applied herbicide was rendered inactive before it even entered plant tissue.

To add to the difficulty, herbicide application had to take place in the late summer before the plants set seed and go dormant, but also had to be scheduled so as not to interfere with the breeding season of a federally endangered species, California clapper rail (February through August). Mowing and other mechanical removal methods could not be used in marshes frequented by the clapper rail.

In November 2004, ISP and USEPA hosted the Third International Conference on Invasive Spartina, where ISP shared its experiences with *Spartina* experts from around the world. At this meeting, ISP requested guidance regarding the feasibility and approach to controlling the hybrid cordgrass invasion. Conference participants were impressed by the level and complexity of the invasion problem and advised that control could potentially be achieved if the ISP proceeded immediately with an aggressive regional control program.

Before such a program could get underway, surveys for California clapper rails in the infested marshes had to be performed, as well as an analysis of the potential impacts of treating each site where the rail was present. ISP partnered with local bird, park and fish and wildlife groups to conduct coordinated annual Bay-wide clapper rail surveys. Their results directly informed treatment approaches.

In 2005, ISP targeted 132 infested areas, with a goal of treating 70-80 percent of the infestation in that year. ISP began using a new herbicide, imazapyr (Habitat(r)), which had been registered for use on August 30, 2005 in California and was known to be highly effective in eradicating invasive cordgrass in Willapa Bay, Washington. Imazapyr has several advantages over glyphosate. It does not require a 6-12 hour post-application period without tidal inundation, it is less toxic to aquatic organisms than glyphosate, and it can be used more sparingly and with greater success. One drawback is that it can damage non-target plants if it is over-sprayed, though preliminary observations of treated sites show normal seasonal regrowth of native marsh plants such as pickleweed.

In 2005, imazapyr was applied to 1,010 acres of invasive cordgrass, sprayed from amphibious tracked vehicles, helicopters, airboats, backpacks and trucks. Because the new herbicide requires less spray volume than glyphosate, application time was reduced by as much as one-third, and 2006 monitoring showed that it killed from 40-90% of the treated plants. Also, the 2005 results showed that helicopter application provided the best efficacy (up to 90% kill) and

lowest cost ($250-$350 per acre). In 2006, ISP partners treated more than 1,700 acres (including retreatment of the previous years sites), with 60% of that by helicopter. Based on the 2005 results and the demonstrated coordination and aggressive action of ISP partners in 2006, ISP envisions that, given continued adequate funding, non-native cordgrass could be effectively eradicated from the San Francisco Estuary within the next several years.

ISP and affected resource agencies are also starting to develop an "exit strategy" for ISP, whereby long-term monitoring and treatment responsibilities will be turned over to a network of informed land managers around the S.F. Bay Estuary.

Lessons: Years of frustrated attempts by individual landowners to manage invasive cordgrass on their properties demonstrated the need for a coordinated regional approach. Landowners could not control reinfestation from adjacent properties and had nearly given up by the time SCC initiated efforts through ISP. At the outset of ISP in 2000, non-native cordgrass infestation in the Bay was roughly one-third the area mapped in 2005. In the five years it took to develop the necessary budgeting, permitting and scientific framework to comprehensively tackle the problem, the infestation grew significantly. Because of substantial and reliable support from SCC, CALFED, the Bay Area environmental community and regional land managers, the ISP was able to adapt to the expanding scope of the problem, despite setbacks along the way.

One of the most difficult aspects of controlling an invasive species in a region that is highly urbanized and carefully monitored for its unique environmental values is coming up with a sufficiently rapid response. Environmental regulation around sensitive tidal marshlands had been instituted in response to urban growth, or in some cases, was designed to reflect specific issues: endangered species protection, or water use. By contrast, the cordgrass invasion in the Bay encompassed multiple jurisdictions, habitat types, developmental zones, political mindsets, animal and plant species and levels of enthusiasm. Currently there is no overarching mechanism to cut through the permitting process for an effort that is, in essence, aimed at controlling the rapid spread of a biological pollutant, and enhancing and maintaining the health of the environment. The experience of ISP shows that having a coordinated regional effort is critical for overcoming budgetary and regulatory obstacles. When that kind of alignment is absent, worthy projects of lesser scale would likely be unsuccessful.

Background Studies:

Daehler, CC and DR Strong. 1997. “Hybridization between introduced smooth cordgrass (*Spartina alterniflora; Poaceae*) and native California cordgrass (*S. foliosa*) in San Francisco Bay”. *American Journal of Botany* 84(5): 607-611.

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San Francisco Estuary Invasive Spartina Project. 2004-2006 Studies covering site specifics, tidal marsh carrying capacity for clapper rails, rail distribution, field operations and an aquatic pesticide application plan, as well as EIRs and endangered species consultations, among other topics. Go to www.spartina.org/project_documents/.

3. CONFOUNDING COMPLICATIONS IN THE DELTA: BRAZILIAN ELODEA

Invasion: Brazilian elodea, commonly referred to as *Egeria,* is a fast-growing shallow-water submerged aquatic plant that now infests approximately 12,000 acres of the 50,000 surface acres of the San Joaquin/Sacramento River Delta (Delta). This species is a native of Brazil and Argentina, has also become widespread in New Zealand, Australia, Japan and Chile. In the U.S., it has invaded lakes and ponds along the western coast from Washington to California, through the South, and as far north as New Hampshire and Vermont in the Northeast. The plant, which has individual strands that resemble a long, furry brush, was identified in the Delta approximately 40 years ago. *Egeria's* introduction is believed to have resulted from someone cleaning an aquarium and discarding the plant into the Delta.

The first recorded complaints by boaters in the Delta about *Egeria* mats impeding navigation are from 1988. The initial infestation appeared limited to a relatively small area. In 1999 aerial surveys indicated *Egeria* covered approximately 4,000 surface acres, or about 8% of the Delta. Six years later, in 2005, *Egeria* coverage had tripled to 12,000 acres, or about 24 percent of the Delta. *Egeria* is currently estimated to be spreading at a rate of about 1,000 acres per year. Some of the most heavily infested areas of the Delta are Rhode Island, where almost the entire 66 acres of the island are covered, and Franks Tract State Recreation Area, where the invader covers approximately 700 of the 900 acres. Thousands of acres of the Delta remain at risk; much of the ecosystem consists of freshwater areas less than 10 feet deep, the habitat in which *Egeria* thrives.

Concern: *Egeria* grows in subsurface mats that can be several feet thick. *Egeria* is a visible and immediate problem for boaters but an *Egeria* infestation also has a host of broader impacts. *Egeria* can obstruct waterways -- forcing boaters to stop frequently to clear propellers – or in more extreme cases, prevent passage of large and small vessels. The San Joaquin County Sheriff's Office has reported that underwater vegetation may have contributed to a fatal boating accident. The plant can also impede migration of anadromous and pelagic fish. *Egeria* changes the architecture of shallow water ecosystems, forming walls between deepwater and inter-tidal habitat. Impenetrable mats of *Egeria* can force fish such as salmon and Delta smelt into more open waterways, where food resources may be scarce and where fish are more vulnerable to predators. The mats of *Egeria* can also impede water flows, crowd out native plants, entrap sediments, alter the food web by impeding light access, and clog agricultural and municipal water intakes.

Response: Legislative delays, treatment complexity and conflicts between herbicide application and native species protection have all been ongoing problems in the effort to eradicate *Egeria*. The initial response to the *Egeria* invasion was not rapid. Complaints of waterway obstruction by *Egeria* went on for nine years before state legislation authorizing DBW to address the invasion

passed in 1997. Two additional years passed before the legislature authorized funding to study *Egeria*. During this period, *Egeria* continued to expand in the Delta. A plant that had once been a localized nuisance soon became the most widespread aquatic weed in the Delta.

Once it was authorized to deal with the problem, DBW explored many different treatment and control options. These included a variety of herbicide types as well as mechanical harvesting. Department officials discovered that the harvesting of *Egeria* causes fragments to escape and freely float to new areas where they can take hold and sprout new growth elsewhere. Mechanical harvesting's unintended consequences made it a tool only to be used in an emergency.

Herbicides based on chelated copper have proven the most effective at destroying *Egeria*. Chelation helps prevent copper from entering the food web, and causing preferential binding to sediments; however, concerns over adding more heavy metals to the Delta forced DBW to turn to another herbicide, fluridone.

Fluridone treatment had its share of problems too. The herbicide is most effective against *Egeria* during the growth cycle of the plant. The peak growth period for *Egeria* is in early spring; however, spring in the Delta coincides with the spawning and migration of several protected species, including chinook salmon (out migration), steelhead trout (in-migration, spawning and out-migration), delta smelt (spawning) and candidate species green sturgeon (spawning).

Federal agencies, including NOAA's National Marine Fisheries Service (NOAA Fisheries Service) and USFWS have requested numerous toxicity tests to ascertain whether fluridone is harmful to these species. Research thus far has confirmed that the concentration of fluridone used to treat Egeria does not harm these species. For example, Chinook salmon fingerlings showed no toxic effects at or below concentration levels used by DBW. However, continued concern over the health of migrating and spawning species has led to limitations in fluridone treatment timing.

During the 2001 treatment season, DBW applied the herbicide during the summer months of July through September instead of during the optimum time frame of April through June as recommended by the manufacturer and other scientific studies. While the herbicide did prevent proliferation of some of the *Egeria*, it failed to substantially reduce the total acreage covered.

Monitoring during applications has been extensive. The fluridone treatments at each site are monitored using immunoassays analyzed to ensure applications are occurring at an efficacious rate and are within all published (agricultural and municipal) limits. The immunoassays are collected within the

treatment area, receiving waters and at all agricultural and municipal water intakes on a bi-weekly basis. DBW also takes water samples and monitors water quality of the treatment area to comply with its NPDES General Permit.

In 2005, NOAA Fisheries agreed for the first time to permit *Egeria* treatment to begin in spring in a few select sites. The new treatment schedule proved extremely effective. At one site, the treatment appears to have eliminated populations of *Egeria*, suggesting fluridone may only need to be applied in the future every second or third year to maintain control of the plant.

Treatment success has been measured using two relatively new methods. The plant grows in dense mats just below the surface of the water, where it is difficult to determine whether treatments have had an effect. DBW uses hydroacoustic measurements to determine biomass/volume of the plants prior to and after treatments have occurred. In addition, a new technique known as hyperspectral analysis now permits more refined estimates of *Egeria* coverage in the Delta. Each type of plant species, including *Egeria*, produces a unique spectrum of infrared reflectance. Aerial images of the Delta are taken before and after treatment using digital broad spectrum photographs. The light wavelengths captured in these images are then analyzed to determine a percentage of *Egeria* in a given waterway. Some analysis has been completed on watermilfoil, pepperweed, and purple loosestrife, as well. DFA, DFG, and DBW have all used hyperspectral analysis to measure the extent of coverage for these plants and other species since 2002.

In 2005, DBW treated 14 sites comprising 648 acres. The relatively small area reflects treatment crew limitations and other restrictions placed on the program. Additional funding for application crews and continued easing of restrictions on start dates could enhance DBW *Egeria* Control Program.

Lessons: First, delays in early identification, authorization and funding permitted *Egeria* to expand from a local waterway nuisance to an invasion widespread throughout the Delta. Second, new analytical tools have allowed scientists to gather basic data about the plant's growth characteristics and response to herbicide application. The information should help managers fine-tune future treatment methods. Third, toxicity testing is critical to prevent damaging resident wildlife populations and municipal water supplies and should be balanced against the need to control an invader known to be detrimental.

Background Studies:

Residues of Fluridone in Chinook Salmon Smolts from the Sacramento-San Joaquin Delta, California, 2005 conducted for DBW by the California Department of Fish and Game.

Fluridone (4AS) Dissipation During Typical Applications of Sonar (4AS), December 2004, Lars W.J. Anderson, Ph.D, conducted for DBW by the USDA-ARS Exotic and Invasive Weed Research, Davis, CA.

Residues of Fluridone and Diquat Dibromide in Sediment from the Sacramento-San Joaquin Delta, California, 2002-2005 - conducted for DBW by the California Department of Fish and Game.

Monitoring Aquatic Herbicide Treatment Efficacy on Egeria densa, Sacramento-San Joaquin Delta, California 2004-2006, conducted for DBW by ReMetix LLC.

4. STRATEGY FOR TAHOE BASIN: EURASIAN WATERMILFOIL

Invasion: Eurasian watermilfoil was first found to occur on the south shore of Lake Tahoe in 1975. By 1980, it became well established in the Tahoe Keys, a large marina complex on the south shore built out of a marshland. From 1994 to 1997 USDA/ARS confirmed the presence of Eurasian watermilfoil outside the Keys and found it to be spreading rapidly elsewhere in the lake. In 1997, it was reported that out of 200 acres of Eurasian watermilfoil in Lake Tahoe, 170 acres were in the Tahoe Keys. Aerial and boat surveys since 1995 indicate the plant continues to spread to new locations in the near shore zone and has established in several marinas and natural areas including Emerald Bay, which is leased to the California Department of Parks and Recreation (PARKS) as an underwater park. In addition to Eurasian watermilfoil, an equally aggressive aquatic weed, curly pondweed has recently been detected in Lake Tahoe.

Concern: Eurasian watermilfoil and other invasive aquatic weeds grow prolifically and aggressively invade native aquatic plant communities. Native aquatic plant communities provide many ecological benefits such as food and habitat for waterfowl, fish and other aquatic organisms. They also help maintain water quality by absorbing nutrients, providing oxygen and reducing shoreline erosion; however, when Eurasian watermilfoil is introduced, it dominates fresh water ecosystems quickly by way of buds and surface runners when fragmented by boat propellers. It also tolerates a wide range of environmental conditions, including low light levels, high or low nutrient waters, and freezing water temperatures. Eurasian watermilfoil also creates its own habitat by trapping sediment and initiating a favorable environment for further establishment. For these reasons, Eurasian watermilfoil can out-compete and eliminate native aquatic plants.

Aquatic weeds in Lake Tahoe impact several of Tahoe Regional Planning Agency (TRPA) thresholds including water quality, fish habitat, vegetation and recreation. Impacts pushing the limits of these thresholds include accelerated nutrient cycling, contributing to algae growth and decreased water clarity; lost or impaired fisheries habitat, including feed and cover; threats to native aquatic vegetation; and restrictions to boating, water skiing, fishing, and swimming due to dense matting (Eurasian watermilfoil has been linked to drowning deaths in other areas of the U.S.).

Response: In 2002, the Lahontan RWQCB began providing fact sheets to interested parties and agencies to promote awareness of Eurasian watermilfoil in Lake Tahoe, share information about options for controlling the growth and proliferation of this weed, and present the regulatory requirements applicable to weed management activities. Because Lake Tahoe is a bi-state water of the U.S. that has been federally adopted as an Outstanding National Resource Water, Lahontan RWQCB has taken the position that chemical treatment to control invasive aquatic weeds is not justified at this time and other non-chemical means of control should be explored. Currently, the only efforts to control

Eurasian watermilfoil have been mechanical harvesting in the Tahoe Keys to clear areas for boat traffic. This method, however, is likely one of the contributing factors to the increased spread watermilfoil in Lake Tahoe.

In 2005, SLC funded and implemented a pilot project in Emerald Bay to examine control methods outside of the Tahoe Keys. The methods included diver-assisted hand and suction removal in the infested portions of Emerald Bay. The initial effort had limited success because the work was conducted too early in the season (late May). Many plants were not observed and emerged later in the season following the removal efforts. Follow-up surveys in the fall, however, found that areas where plants were removed previously were free of Eurasian watermilfoil. Removal activities in Emerald Bay will continue in 2006 and will be expanded to include an infestation in one of the smaller south shore marinas.

The Tahoe Resource Conservation District (TRCD) is currently applying for an approximate $500,000 multi-year grant (2007-2010) to survey and remove invasive aquatic weeds throughout Lake Tahoe using the methodology of the pilot project.

Lessons: The initiative of one agency to fund and implement efforts to remove an invasive weed in a sensitive environment like Lake Tahoe through a pilot removal project has encouraged other key agencies (e.g. TRPA and TRCD) to increase their role in the management of invasive aquatic weeds in Lake Tahoe. This has expanded participation and increased cooperation within the existing Lake Tahoe Basin Weed Coordinating Group and led to the formation of an Aquatic Weed Subcommittee.

Background Studies:

Lahontan RWQCB. 2002. Fact Sheet: *Control of the invasive aquatic weed Eurasian Watermilfoil in Lake Tahoe.* South Lake Tahoe, California.

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For more information and contacts on some of these case studies, see Appendices B-D.

OTHER AIS SPECIES OF CONCERN

The following is a representative, rather than comprehensive, list of AIS species not previously mentioned in this report. Some are already here in California and widespread, some are fairly limited in their distribution and some are yet to arrive. The list is merely meant to convey some of the variety of challenges that must be addressed by state management programs. Full scientific names appear in the "Species Names" section of the introductory pages of this plan.

African clawed frog: Shipped around the globe for use in human pregnancy testing during the 1940s and 1950s, populations of African clawed frogs have been introduced into parts of Europe, North America, and South America. Although its impacts to native fauna have undergone little scrutiny, this voracious and prolific frog has shown a remarkable capacity to colonize a broad range of aquatic habitats. In southern California, it occupies more than a 300-mile long range through seven counties. In 2003, the African clawed frog was found in a pond at Golden Gate Park in San Francisco.

Asian swamp eel: The swamp eel is a fish found in brackish and fresh waters from South America, Africa, and India east to Australia. U.S. populations have been found in Hawaii, Florida and Georgia. It is a voracious predator that poses a threat to native frogs, fish, and aquatic insects. The Asian swamp eel has the ability to live out of water for a considerable length of time, allowing it to move from one body of water to another. The Asian swamp eel was most likely introduced through the Asian food market and/or as an aquarium pet later released. There are no known populations in California.

Bullfrog: The North American bullfrog was introduced to California in the early 1900s. A voracious predator, the bullfrog feeds on snakes, worms, insects, crustaceans and other frogs and tadpoles. The female can lay as many as 20,000 eggs in a single breeding season. The bullfrog may be having impacts on native frogs, such as the red-legged frog and has also been implicated as a leptospirosis vector and may pose a threat to human health.

Channeled apple snail: In the United States, this South American apple snail has invaded the southern states of Florida, North Carolina, Texas and central Ohio. There have been reports of at least two populations in California. The apple snail is a common aquarium snail also cultured for sale to restaurants, making its spread through these pathways likely. It has a voracious appetite and will eat most types of vegetation. In Hawaii, the apple snail is considered to be problematic in some natural and agricultural wetlands, most notably in the taro fields which play an important role in Hawaiian culture. The snail's potential as a rice pest as well as a pest of natural wetland ecosystems has spurred the USDA to list them as a high priority threat should they spread or be introduced more widely.

Golden Mussel: A freshwater mussel native to the rivers and streams of China and southeast Asia, the golden mussel was first found in the Americas in 1991, at the mouth of Argentina's Rio de la Plata. It has subsequently spread up the river basin into Uruguay, Paraguay and Brazil. The first colonies are thought to have arrived as larvae in the ballast water of shipping vessels. Like its relative the zebra mussel, the golden mussel readily colonizes hard surfaces including logs and silt, colonies of other bivalves, walls, and piers. Because it settles on floating vegetation, fouls boat hulls and fishing equipment, and can survive for more than 120 hours out of water, it is easily transported to new waterways. Though primarily aquatic, the golden mussel also tolerates slightly brackish waters. It has been found in aggregations of more than 80,000 mussels per square meter. At such high densities, these filter feeders can deplete local waters of plankton and starve or suffocate native filter feeders. Golden mussel infestations can also clog or foul and cooling pipes, intake screens and other aquatic machinery.

Green sunfish: The green sunfish was mistakenly introduced to California from the Midwest in the late 1800s to early 1900s. Green sunfish spawn in shallow waters and have enormous reproductive potential. They compete with native fishes by feeding on insects and small fish and are adaptable to varying lake conditions and climates.

New Zealand mudsnail*:* Native to freshwater lakes and streams of New Zealand, this snail has spread to six Western states, reaching California's Owens River in the Eastern Sierra in 1999. Since then, it has spread up and down the Owens River as well as into seven other sites scattered throughout Northern California and to multiple sites in southern California. The snail's tight-fitting operculum permits it to survive out of water in damp conditions for several weeks. It likely hitchhiked into California within waders or other equipment used in infested streams. The New Zealand mudsnail has a prodigious reproductive capacity, competes with native mollusks for resources, and offers virtually no nutritional value to aquatic predators. Population levels in California's Putah Creek have been estimated excess of 100,000 snails per square meter. To date, limited research has documented decreases in native macroinvertebrate populations in several rivers where the mudsnail has invaded.

Northern Pacific seastar: Native to the coasts of northern China, Korea, Russia and Japan, this five-armed seastar has spread to many other countries. Its arrival has been linked to ballast water discharges. It is a voracious predator, attacking fleshy organisms such as shellfish. Able to detect food from a distance, it digs shallow pits into the seabed to extract prey. The northern Pacific seastar was the focus of extensive eradication efforts by the Australian government in the mid-1990s and remains on their watch list because of the threat it poses to shellfish production.

Saltcedar (Tamarisk): Saltcedar is native to southeastern Europe and much of central Asia and was introduced to the United States as a landscape ornamental and soil stabilizer. In California, it occurs in the southern Klamath Ranges, Central Valley, eastern Sierra Nevada, Tehachapi Mountains, western Transverse Ranges, South Coast deserts to over 6,000 ft in elevation (DiTomaso and Healy 2003), and the southeastern corner of the state. It is now the dominant plant in the riparian forests of the lower Colorado River. Saltcedar is able to colonize small stream channels where it traps sediments and alters the hydrology. True to its name, the tree concentrates salts in its leaves, and when the leaves drop, local soil salinities may increase. Saltcedar's ability to colonize degraded river systems has allowed it to grow in places where cottonwood and other native riparian vegetation may not. Yet its presence also offers cover, shade and nesting habitat to the endangered southwestern willow flycatcher and other native animal species.

Salvinia: Native to tropical South America, Salvinia Complex consists of four closely-related, free-floating aquatic fern species that can be difficult to distinguish from one another. Giant salvinia is considered one of the world's worst aquatic pests: in favorable environments, plants may double in volume within a week. Giant salvinia forms extensive mats that can completely cover water surfaces, shadowing out native plants, reducing available dissolved oxygen, and creating large amounts of decaying plant material. It can also clog water intakes, interfering with irrigation, drainage and electric power generation. Its arrival in the U.S. has been linked to commercial nurseries and pet stores, where it is sold for ornamental ponds and aquariums. Giant salvinia tends to spread locally because the plants adhere to boats, wheels, and recreational gear entering infested waters. It reproduces so rapidly that infestations quickly become impossible to eradicate. Giant salvinia mats may grow up to three feet thick, hindering the effectiveness of chemical controls. In California, giant salvinia populations have naturalized in the Colorado River drainage and have invaded some canals in the Sonoran Desert and San Luis Obispo County (DiTomaso and Healy 2003). It has also been detected in two ponds in San Diego County.

Northern snakehead: The northern snakehead is a fish native to China that was most likely imported from Asia to the United States as a food fish. It is also sold in the aquarium trade. It can be found in a variety of habitats, and can breathe air with a bladder that works like a primitive lung. The northern snakehead is a voracious predator with no natural enemies. It disrupts native aquatic ecosystems and transmits diseases and parasites, including several species that can infect humans. Its impact on local economies dependent on fishing and other related resources is significant. All 28 species of snakehead are on the federal list of injurious wildlife species, and their importation and transportation across state lines is illegal. See also federal risk assessment at http://fisc.er.usgs.gov/Snakehead_circ_1251/html/risk_assessment_process.html.

Waterlettuce: Waterlettuce is a floating aquatic plant native to South America and is considered to be one of the worst weeds in subtropical and tropical regions of the world. Under optimal environmental conditions, waterlettuce can double its population size in less than three weeks. Seed production makes this plant resilient to adverse environmental conditions such as drought. Waterlettuce populations often form large, impenetrable floating mats, limiting boat traffic, recreation, flood control and wildlife use. It is a popular species for pond landscaping and is frequently sold through nursery mail order catalogs and on the Internet. In California, it has only been reported from the eastern Sonoran Desert (Colorado River drainage), but its range is expected to expand (DiTomaso and Healy 2003).

Paleyellow Iris (Yellowflag Iris): A hearty perennial that grows from tuberous rhizomes, yellowflag iris can grow to 5 feet tall. It is a European native that has adapted well to conditions throughout the U.S., where it can now be found in at least 40 states. It typically grows in wetlands, along river and stream banks, in irrigation ditches and on the margins of lakes and ponds. It was first found in California in the 1970s. It now occurs in the San Francisco Bay region, southern San Joaquin Valley, Central Coast, and South Coast (DiTomaso and Healy 2003). When consumed in large quantities, paleyellow iris can be toxic to livestock. A resinous substance from the leaves and rhizomes can irritate the skin of those removing the rhizomes by hand. Pulling the rhizomes can cause extensive damage to the substrate, inviting the establishment of other unwanted plants. Control techniques such as burning are not recommended because the rhizomes re-sprout. Cutting followed by herbicide applications may be the best method to control this plant.

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INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

MATERIALS INFORMATION

Foundation Report for Thompson Creek Bridge (Br. No. 02-0068)

Dated June 18,2015

State of California
Department of Transportation

Business, Transportation and Housing Agency

M e m o r a n d u m

Serious Drought.
Help Save Water

To: JOSEPH E DOWNING, CHIEF
Bridge Design Branch 3
Office of Bridge Design Services
Structure Design
Division of Engineering Services

Date: June 18, 2015

File: 02-SIS-96-PM 52.48
Thompson Creek Bridge (Widen)
Br. No. 02-0068
EA 02-4E6501
EFIS 0212000012

Attn: Mufeed Khalaf

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

Subject: Foundation Report for Thompson Creek Bridge (Widen)

Scope of Work

A Foundation Report (FR) is provided for the above referenced project. The proposed project is located in rural Siskiyou County. Widening of the Thompson Creek Bridge is proposed. Review of published geologic data and previous geotechnical reports, field reconnaissance, and design calculations were performed to prepare this Foundation Report. This Foundation Report supersedes any previous planning or design communications.

The purpose of this report is to document geotechnical conditions and provide foundation recommendations.

Our Office has evaluated the site conditions and geology based on a review of the existing As-Built Plans, available geologic literature and mapping, aerial photograph interpretation, multiple site visits and a subsurface investigation completed during September and October 2014.

The following publications were used to assist in the preparation of this Foundation Report:

1. *Caltrans Seismic Design Criteria 1.7, Office of Earthquake Engineering, April 2013*.
2. *Regional Geologic Map Series, Weed Sheet*, 1:250,000, California Division of Mines and Geology, D.L Wagner and G. J. Saucedo, 1987.
3. *Geotechnical Services Design Manual, Version 1.0*, (Division of Engineering Services, August 2009).
4. *Foundation Report Preparation for Bridge Foundations, December 2009.*

Project Description

According to the general plan sheet (dated 4/3/2014) the existing 3 span bridge will be widened 3'10" to the left and 3'10" to the right. The widening will be supported on shallow foundations to match the existing foundation type.

The foundation recommendations and elevations provided in this report are based on the NAVD 88 (vertical datum) and horizontal coordinates are based on the NAD83 (horizontal datum), unless otherwise noted. The "as-built" elevations were converted from NGVD 29 to NAVD 88 by using a conversion factor of +3.56 ft.

Exceptions to Policy

There are no requested exceptions to Geotechnical Services policy.

Field Investigation and Testing Program

Field investigations performed at the project site included two geotechnical borings and geologic reconnaissance.

The Office of Geotechnical Design-North conducted a subsurface investigation during September and October 2014. Two mud rotary borings were drilled for the design of the bridge foundation. The mud rotary borings were advanced using mud rotary drill methods with diamond coring, and a self-cased wire line drilling apparatus that provided soil samples and rock cores. Soils were visually classified in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2010).

Standard penetration tests (SPT), ASTM test method 1586, were performed at selected depth intervals to estimate in-place density of the native soil. Empirical correlations of soil strength parameters with SPT blow counts were used to estimate strength parameters of in-situ cohesionless soils. Gravel, cobbles and in-place rock were sampled by coring techniques. The maximum depth of investigation was 80 feet.

A summary of the borings drilled during the 2014 subsurface investigation is provided in Table 1.

Table 1: 2014 Subsurface Investigation Summary

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
RC-14-001	10/1/2014	Acker	Automatic	67	1259.8	35.0
RC-14-002	10/1/2014	Acker	Automatic	71	1260.4	80.0

Laboratory Testing Program

Laboratory testing was performed on selected samples of the subsurface materials obtained from the 2014 subsurface investigation. Soil samples were collected and submitted to the Headquarters Geotechnical Laboratory for grading analyses (CT 202) and corrosion potential testing (CT 643). The corrosion test results for the soil samples may be found in the Corrosion Evaluation section of this report.

Site Geology and Subsurface Conditions

Regional Setting and Area Geology

Preliminary information regarding the site characteristics was obtained from published geologic maps and previous geotechnical investigations and reports for construction of the bridge at the proposed project.

The project is located within the Klamath Mountains geomorphic province of California. The Klamath Mountains are an area of rugged topography with prominent peaks and ridges reaching 6,000 to 8,000 feet above sea level. The Klamath Mountain Geomorphic Province is bounded to the west by the Coast Range and to the east by the Cascade Range geomorphic provinces.

The Regional Geologic Map of California, Weed Sheet (CDMG, 1987), was reviewed to determine the geologic features within the project limits. The map indicates that the geologic unit underlying the project consists of Mesozoic or Paleozoic metamorphic rocks. The rock is locally described as part of the Western Paleozoic and Triassic Belt and consists of phyllitic quartzite with some blueschist.

There are no known active or potentially active faults within the project limits.

Subsurface Conditions

Based on the recent borings, the foundation materials at the site generally consist of 15 to 17 feet of loose to medium dense silty sand with gravel, sandy silt with gravel and cobbles overlying extremely hard metamorphic rock.

Rock similar to that shown on the Weed Regional Geologic Map was found beneath the alluvial soils at borings RC-14-001 and RC-14-002. Rock is also visible within the channel bottom and sides, beneath, upstream and downstream of the existing bridge. These rock outcrops provide valuable information for determining the excavation characteristics of the rock.

The Log of Test Borings (LOTBs) will be provided at a future date and are to be attached to the plans.

Groundwater

During the 2014 subsurface investigation, wet soils were encountered in boring RC-14-002 below approximately elevation 1250 feet. A water level of approximately elevation 1243.8 feet was observed in boring RC-14-001 during the drilling process. The creek water surface in the Thompson Creek channel was measured at 1241 feet on October 1, 2014. No attempt was made to observe water levels during the drilling or after the completion of boring RC-14-002.

Groundwater surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on seasonal conditions and water levels at the time of construction.

Scour Evaluation

Thompson Creek Bridge crosses a water course. The Final Hydraulics Report provides an analysis of predicted scour at the four bridge foundations. The scour elevations provided by Structure Design are summarized in the Spread Footing Design Data provided by Structure Design (Attachment 2).

Corrosion Evaluation

Representative soil samples taken during the subsurface investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

The results of the laboratory test determined that the composite sample was considered to be non-corrosive. Refer to Table 2 for test results.

Table 2: Corrosion Test Summary of Composite

TL 101 Number	Boring Number	Sample Depth (ft)	pH	Minimum Resistivity (ohm-cm)	Chloride Content (ppm)	Sulfate Content (ppm)
C837046	R-14-002	0 – 5.8	8.01	3981	N/A	N/A

Seismic Recommendations

Ground Motion

In accordance with the *2009 Caltrans Seismic Design Procedure*, the following active and potentially active faults are located in the vicinity of the project site. The Caltrans ARS Online Tool, analytical spreadsheets and the 2009 USGS Probabilistic Seismic Hazard Analysis Interactive Deaggregation Tool were used to develop ARS curves for deterministic and probabilistic seismic prediction models. An average shear wave velocity of 2500 ft/sec (760 m/s) was calculated for the upper 100 feet (30 meters) of subsurface conditions observed at the project site. The calculations were based on soil shear wave velocities derived from correlations to SPT data. A basin factor of 1.0 was utilized.

The resulting design envelope ARS curve is based on the 5% probability of exceedance in 50 years (corresponding to a 975 year return period). The estimated peak ground acceleration is 0.23g. The ARS curve is presented in Figure 1. Recommended design spectral acceleration curve data points are provided in Attachment 1.

Table 3: Active and Potentially Active Fault

Fault Name	Fault Type	Moment magnitude of maximum credible earthquake	Distance from fault to project site (miles)	Deterministic Peak ground acceleration (gravity)
Cascadia Subduction Zone	Reverse	8.3	69	0.10

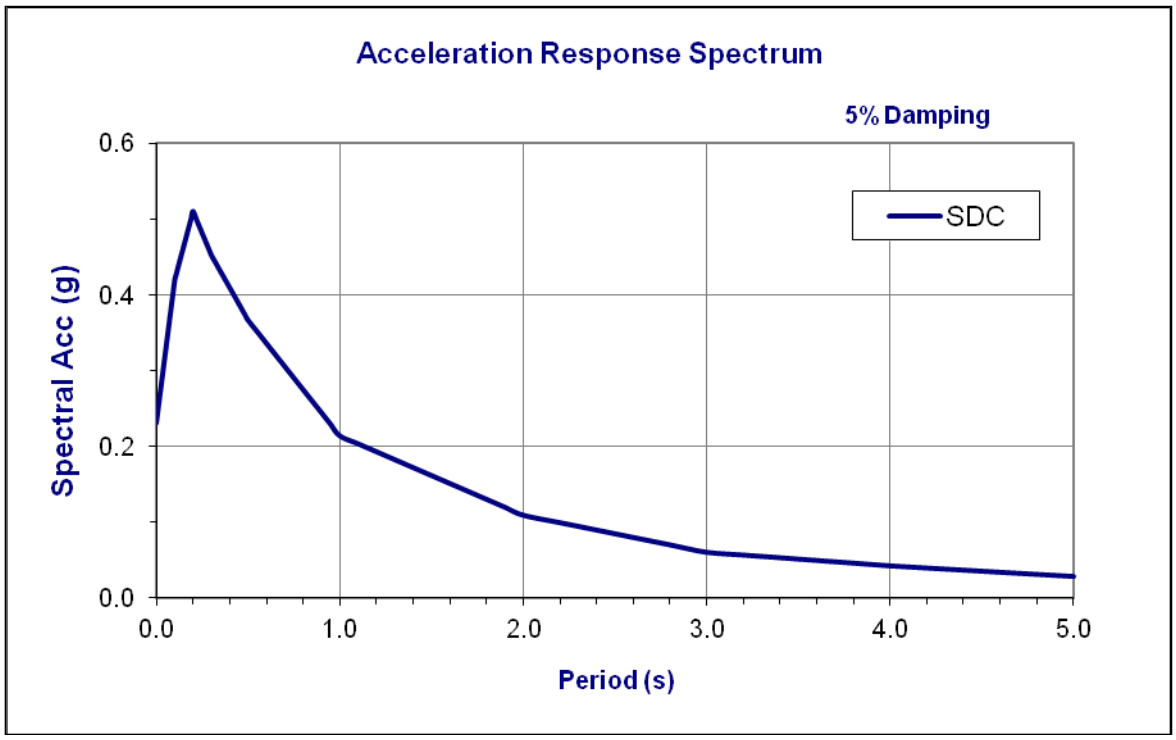

Figure 1: Design ARS Curve

Ground Rupture

The potential for surface fault rupture at the site is absent because there are no known faults that are Holocene or younger in age that fall within 1,000 feet of the structure. The structure does not fall within an Alquist-Priolo Earthquake Fault Zone.

Liquefaction

Liquefaction is a near-total loss of soil strength due to an increase in pore water pressure during cyclic loading, such as occurs during an earthquake. Loose sands and gravels with 20 percent fines or less that have the potential of being saturated are susceptible to liquefaction. Liquefaction potential at the project site is considered negligible.

As-built Foundation Data

The existing bridge is supported on spread footings. The 1951 As-Built General Plan indicates that Abutment 1 and Abutment 4 footings were founded on fill materials. The 1951 As-Built Abutment Details sheet indicates that the "footing pressure" used at both abutments was 1.0 TSF.

Abutment 4 was reconstructed and Span 3 was extended from 27 feet to 41 feet in 1965 due to the damage caused by a 1964 winter flood. The new Abutment 4 spread footing was lowered to elevation 1241.56 feet. According to the 1965 As-Built Foundation Plan, the allowable footing pressure was 5 TSF. According to the Resident Engineer's field report dated November 22,

1965, the bedrock was encountered at elevation 1247.36 feet in the left footing pad and at elevation 1244.36 feet in the right footing pad. The "as-built" elevations shown above have been converted from NGVD 29 to NAVD 88 by using a conversion factor of +3.56 ft.

Pier 2 and Pier 3 are supported on spread footings, but there is no information regarding the foundation materials and bearing capacity available at the Pier 2 and Pier 3 locations. Based on the As-Built plans and our recent borings, it is reasonable to assume that the Pier 2 and Pier 3 spread footings were founded on bedrock and the allowable footing pressure 5 TSF.

Foundation Recommendations

The following recommendations are for the proposed widening of the Thompson Creek Bridge, Br. No. 02-0068, as indicated on the General Plan sheet dated April 3, 2014. The spread footing recommendations for the widening are based on the foundation geometry and load data in the Foundation Design Data Sheet provided by Structure Design (Attachment 2). The groundwater level for design of all four bridge support locations is elevation 1252 feet. Bearing resistance, settlement and overall stability analyses were based on the assumption of fully drained conditions in the foundation. The load demand and foundation data was provided for the additional footing widths. Data was not provided for the evaluation of the geotechnical behavior of the integrated footings at Abutment 1, Pier 2 and Pier 3. At Piers 2 and 3 the footing widening will be at the same elevation as the original footings.

The permissible gross contact stress, the allowable gross bearing capacity and the factored gross nominal bearing resistances were calculated using the methods presented in the AASHTO LRFD Bridge Design Specifications (2012) and FHWA Shallow Foundation Manual (FHWA-NHI-01-023, June 2001). Per your request, a permissible displacement under service load of 1.0 inch was utilized to determine the permissible gross contact stress. Footing stability for sliding failure should be analyzed using a foundation soil friction angle of 33 degrees.

Abutment Locations

The bridge widening at Abutment 1 and 4, left and right can be supported on spread footings. Abutment 1 will be founded on soil and Abutment 4 will be founded on rock. The Foundation recommendations are based on the spread footing design loading and footing geometry provided by Structure Design. Abutment support foundations were designed using the Working Stress Design (WSD) method.

The recommended permissible gross contact stresses, allowable gross bearing capacities and bottom of footing elevations for Abutments 1 and 4 are listed in Table 4.

Table 4: Spread Footing Recommendations for Abutments 1 and 4

Support Location	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth (ft)	Total Permissible Support Settlement (inches)	Working Stress Design (WSD)	
	B	L				Permissible Gross Contact Stress (Settlement) (ksf)	Allowable Gross Bearing Capacity (ksf)
Abutment 1	6.5	7.0	1250.0	3.1	1.0	40.0	6.0
Abutment 4	4.0	4.0	1245.0 (left) 1242.0 (right)	2.0	1.0	40.0	8.3

Pier Locations

The bridge widening at Piers 2 and 3, left and right can be supported on spread footings. Piers 2 and 3 will be founded on rock. The foundation recommendations are based on the spread footing design loading and footing geometry provided by Structure Design. Pier support foundations were designed using the Load Factor Design (LFD) method.

The recommended permissible gross contact stresses, factored gross nominal bearing resistances and bottom of footing elevations for Piers 2 and 3 are listed in Table 5 below.

Table 5: Spread Footing Recommendations for Piers 2 and 3

Support Location	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth (ft)	Total Permissible Support Settlement (inches)	LFD (Load Factor Design)		
	B	L				Permissible Net Contact Stress (ksf)	Factored Gross Nominal Bearing Resistance (Groups I through VI) $\varphi_b = 0.50$ (ksf)	Factored Gross Nominal Bearing Resistance (Group VII) $\varphi_b = 1.00$ (ksf)
Pier 2	6.0	6.0	1244.58	0	1.0	40.0	10.0	14.0
Pier 3	6.0	6.0	1240.31	0	1.0	40.0	10.0	14.0

The Spread Footing Data Table for the Abutment and Pier supports is provided in Table 6.

Table 6: Spread Footing Data Table for Thompson Creek Br. widening

Support Location	Working Stress Design (WSD)		Load Factor Design (LFD)		
	Permissible Gross Contact Stress (Settlement) (ksf)	Allowable Gross Bearing Capacity (ksf)	Permissible Net Contact Stress (Settlement) (ksf)	Factored Gross Nominal Bearing Resistance (Groups I through VI) $\varphi_b = 0.50$ (ksf)	Factored Gross Nominal Bearing Resistance (Group VII) $\varphi_b = 1.00$ (ksf)
Abutment 1	40.0	6.0	N/A	N/A	N/A
Pier 2	N/A	N/A	40.0	10.0	14.0
Pier 3	N/A	N/A	40.0	10.0	14.0
Abutment 4	40.0	8.3	N/A	N/A	N/A

The spread footings are to be constructed at or below the recommended bottom of footing elevations shown in Tables 4 and 5. Contact the Office of Geotechnical Design North for re-evaluation if any of the following change:

- The footing size (B) is reduced.
- The loading conditions change.
- The bottom of footing elevation is raised.
- The minimum vertical footing embedment depths are reduced.

Approach Fill Earthwork

No sliver fills are anticipated at the approaches to Abutments 1 and 4. If fill placement is required, it is expected that fill height will be less than 5 feet. Any resulting settlement of the approach fills and underlying foundation soils is expected to be immediate due to the absence of cohesive soils. Settlement amounts are expected to be minimal, less than 0.2 inch. No fill delay period is required between placement of the sliver fills and construction of the abutment spread footings.

The resistance factor for static global stability of the abutment slopes is less than the maximum value of 0.65 stipulated in the Bridge Design Specifications.

Construction Considerations

At the Pier 2, Pier 3 and Abutment 4 support locations, the footing will be founded on metamorphic rock. If it is found during construction that any portion of the bottom of footing is on alluvial soil, the soil is to be sub-excavated to metamorphic rock, and the sub-excavation backfilled with lean concrete up to the bottom of footing elevation.

Extremely hard metamorphic rock was encountered during the drilling of test borings and was observed along the creek channel in close proximity to Pier 2 and Pier 3. Hard rock excavation should be anticipated by the contractor at Pier 2, Pier 3 and Abutment 4.

At all support locations, the excavations/subexcavations are to be inspected and approved by a representative of the Office of Geotechnical Design North, prior to placing any lean concrete or structure concrete. The purpose of the required inspection is to verify that the material at the bottom of the excavation/subexcavation is suitable soil at Abutment 1 and metamorphic rock at Pier 2, Pier 3 and Abutment 4, as required in this report. Once the excavation/subexcavation has been completed to the specified elevations, the contractor is to allow the Office of Geotechnical Design North, seven (7) days to perform the inspection(s). The structures representative is to provide the Office of Geotechnical Design North a one-week notification prior to beginning the seven day contractor waiting period.

Water will be encountered during excavation for footings at Pier 2, Pier 3 and Abutment 4. It is expected that the contractor will encounter groundwater conditions that will require one or several of the following control measures: sumps, pumps, well points, tremie seals and cofferdams. Techniques other than those listed here may be proposed.

Project Information

Standard Specifications Section 2-1.06B, "Supplemental Project Information," indicates that the special provisions will make supplemental project information to bidders. Items listed to be included in the information handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans include:

A. Log of Test Borings (Thompson Creek Bridge (Widen), Br. No. 02-0068).

Data and Information included in the Information Handout include:

A. Foundation Report (Thompson Creek Bridge (Widen), Br. No. 02-0068), dated June 18, 2015.

The Foundation Recommendations included in this Foundation Report are based on specific project information regarding structure type and structure location that has been provided by the Office of Bridge Design Services. Once the project plans are available, the Office of Geotechnical Design North should review the information to determine if this Foundation Report is still applicable. If you have any questions or comments, please contact Tim Alderman (916) 227-1035 or Ron Richman (805) 549-3385.

Report by:

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Office of Geotechnical Design-North

c: Job File / Branch D Records
Traci Menard / GDN Records

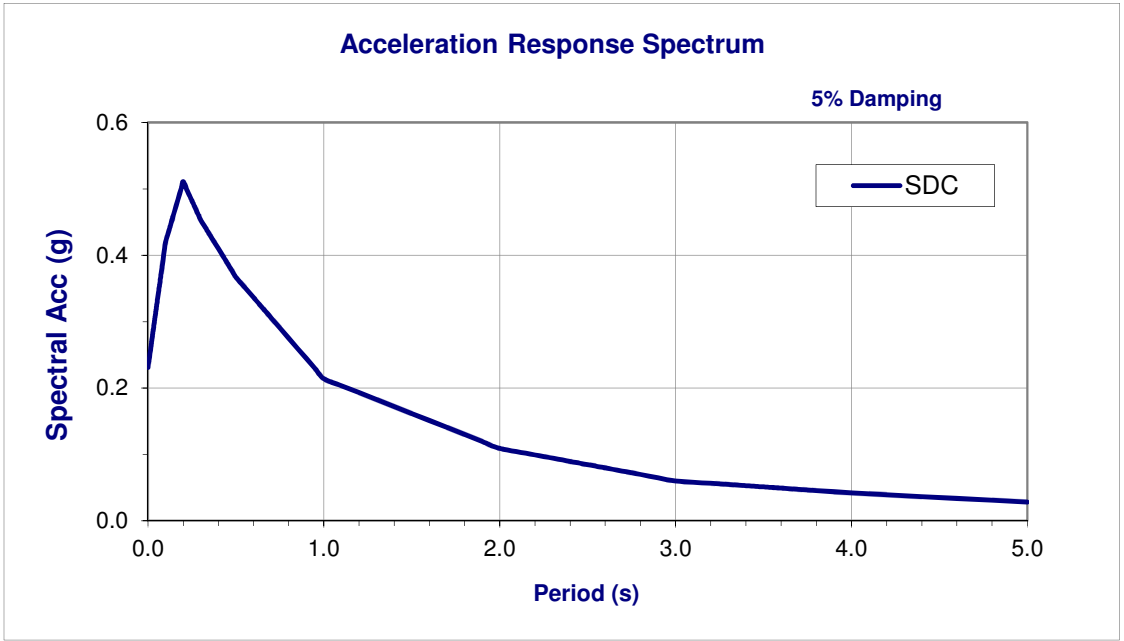
LIST OF ATTACHMENTS

Design ARS Curve Data	Attachment 1
Foundation Design Data Sheets	Attachment 2

Thompson Creek Bridge

Bridge No. 02-0068 **SDC Controlling Procedure :** **Probabilistic**

Period (s)	SDC
0.010	0.231
0.020	0.269
0.030	0.288
0.050	0.326
0.075	0.373
0.100	0.420
0.120	0.438
0.150	0.466
0.200	0.511
0.250	0.482
0.300	0.453
0.400	0.410
0.500	0.367
0.750	0.291
1.000	0.214
1.500	0.162
2.000	0.109
3.000	0.060
4.000	0.042
5.000	0.028



Deterministic Procedure Data

Fault	Cascadia Subduction Zone		R_{rup}	101.00	km
Fault ID	5		R_{jb}	101.00	km
Style	Reverse		R_x	101.00	km
Mmax	8.3		V_{S30}	760	m/s
Dip	15	deg	$Z_{1.0}$	N/A	m
Z_{TOR}	5	km	$Z_{2.5}$	N/A	km

Notes

Probablistic ARS controls.

Thompson Creek Bridge (Widen) Br. No. 02-0068

Foundation Design Data Sheet						
Support No.	Design Method	Finished Grade Elevation (ft)	BOF Elevation (ft)	Footing Size (ft)		Permissible Settlement under Service Load (in)
				B	L	
Abut 1	WSD	1256.0	1250.00	7.0	6.5	1
Pier 2	LFD	1248.0	1244.58	7.0	6.0	1
Pier 3	LFD	1246.5	1240.31	7.0	6.0	1
Abut 4	WSD	1256.0	1249.25	4.0	4.0	1

Scour Data		
Support No.	Long Term (Degradation and Contraction) Scour Elevation (ft)	Short Term (Local) Scour Depth (ft)
Abut 1	1253.10	NA
Pier 2	1244.58	NA
Pier 3	1240.31	NA
Abut 4	1251.29	NA

Attachment 2

Thompson Creek Bridge (Widen) Br. No. 02-0068

Foundation Design Loads – Service I limit state loads							
Support No.	Total Load				Permanent Load*		
	Vertical Load (kip)	Effective Dimensions (ft)		Horizontal Load in Long. Direction (kip)	Vertical Load (kip)	Effective Dimensions (ft)	
		B’	L’			B’	L’
Abut 1	98	7.0	6.5	16	80	7.0	6.5
Pier 2	184	6.0	6.0	N/A	112	6.0	6.0
Pier 3	207	6.0	6.0	N/A	133	6.0	6.0
Abut 4	149	8.0	6.5	25.6	128	4.0	4.0

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Foundation Design Loads						
Support No.	Group Loads I through VI			Group Load VII		
	Vertical Load (kip)	Effective Dimensions (ft)		Vertical Load (kip)	Effective Dimensions (ft)	
		B’	L’		B’	L’
Pier 2	207	6.0	6.0	95	3.58	6.0
Pier 3	248	6.0	6.0	113	5.00	6.0

Attachment 2

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

MATERIALS INFORMATION

Foundation Report for Seiad Creek Bridge (Br. No. 02-0072)

Dated June 18, 2015

State of California
Department of Transportation

Business, Transportation and Housing Agency

M e m o r a n d u m

Serious Drought.
Help Save Water

To: JOSEPH E DOWNING, CHIEF
Bridge Design Branch 3
Office of Bridge Design Services
Structure Design
Division of Engineering Services

Date: June 18, 2015

File: 02-SIS-96-PM 60.17
Seiad Creek Bridge (Widen)
Br. No. 02-0072
EA 02-4E6501
EFIS 0212000012

Attn: Mufeed Khalaf

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

Subject: Foundation Report for Seiad Creek Bridge (Widen)

Scope of Work

A Foundation Report (FR) is provided for the above referenced project. The proposed project is located in rural Siskiyou County. Widening of the Seiad Creek Bridge is proposed. Review of published geologic data and previous geotechnical reports, field reconnaissance, and design calculations were performed to prepare this Foundation Report. This Foundation Report supersedes any previous planning or design communications.

The purpose of this report is to document geotechnical conditions and provide foundation recommendations.

Our Office has evaluated the site conditions and geology based on a review of the existing As-Built Plans, available geologic literature and mapping, aerial photograph interpretation, multiple site visits and a subsurface investigation completed during September and October 2014.

The following publications were used to assist in the preparation of this Foundation Report:

1. *Caltrans Seismic Design Criteria 1.7, Office of Earthquake Engineering, April 2013*.
2. *Regional Geologic Map Series, Weed Sheet*, 1:250,000, California Division of Mines and Geology, D.L Wagner and G. J. Saucedo, 1987.
3. *Geotechnical Services Design Manual, Version 1.0*, (Division of Engineering Services, August 2009).
4. *Foundation Report Preparation for Bridge Foundations, December 2009.*

Project Description

According to the General Plan sheet number 2 (dated 1/13/2015) the existing 3 span bridge will be widened 3'7" to the left and 6'10" to the right. The widening will be supported on driven steel piles to match the existing foundation type.

The foundation recommendations provided in this report are based on the NAVD 88 (vertical datum) and horizontal coordinates are based on the NAD83 (horizontal datum), unless otherwise noted.

Elevations used in this report are based on the NAVD 88 vertical datum. The "as-built" elevations can be converted from NGVD 29 to NAVD 88 by using a conversion factor of +4.06 ft.

Exceptions to Policy

There are no requested exceptions to Geotechnical Services policy.

Field Investigation and Testing Program

The field investigation performed at the project site included three geotechnical borings.

The Office of Geotechnical Design-North conducted a subsurface investigation during September and October 2014. Three mud rotary borings were drilled for the design of the bridge foundation. The mud rotary borings were advanced using both conventional mud rotary drill methods with diamond coring, and a self-cased wire line drilling apparatus that provided soil samples and rock cores. Soils were visually classified in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2010).

Standard penetration tests (SPT), ASTM test method 1586, were performed at selected depth intervals to estimate in-place density of the native soil. Empirical correlations of soil strength parameters with SPT blow counts were used to estimate strength parameters of in-situ cohesionless soils. Gravel, cobbles and in-place rock were sampled by coring techniques. The maximum depth of investigation was 85.0 feet.

A summary of the borings drilled during the 2014 subsurface investigation is included below in Table 1.

Table 1: 2014 Subsurface Investigation Summary

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
RC-14-001	9/24/2014	Acker	Automatic	67	1372.8	65.0
RC-14-002	10/03/2014	Acker	Automatic	67	1372.0	85.0
RC-14-003	10/05/2014	Acker	Automatic	67	1373.1	75.0

Laboratory Testing Program

Laboratory testing was performed on selected samples of the subsurface materials obtained from the 2014 subsurface investigation. Soil samples were collected and submitted to the Headquarters Geotechnical Laboratory for grading analyses (CT 202) and corrosion potential testing (CT 643). The corrosion test results for the soil samples may be found in the Corrosion Evaluation section of this report.

Site Geology and Subsurface Conditions

Regional Setting and Area Geology

Preliminary information regarding the site characteristics was obtained from published geologic maps and previous geotechnical investigations and reports for construction of the bridge at the proposed project.

The project is located within the Klamath Mountains geomorphic province of California. The Klamath Mountains are an area of rugged topography with prominent peaks and ridges reaching 6,000 to 8,000 feet above sea level. The Klamath Mountain Geomorphic Province is bounded to the west by the Coast Range and to the east by the Cascade Range geomorphic provinces.

The Regional Geologic Map of California, Weed Sheet (CDMG, 1987), was reviewed to determine the geologic features within the project limits. The geologic map indicates that the site is immediately underlain by Quaternary Age Holocene alluvium. The geologic unit underlying the alluvium consists of Cretaceous/Jurassic (Mesozoic) igneous rocks. The rock is locally described as part of the Slinkard Pluton and consists of dioritic rocks.

There are no known active or potentially active faults within the project limits.

Subsurface Conditions

The borehole data and the foundation plan suggest that there is very little embankment material at the abutments. The natural surficial soils encountered beneath the roadbed and in the creek channel at the borehole locations consists of alluvial deposits. All of the alluvial soils observed in

the boreholes are cohesionless. The alluvial soils observed are mixtures of silt, sand, gravel, cobbles and boulders. Little clay was observed in the alluvial soils.

Rock similar to that shown on the Weed Regional Geologic Map was found beneath the alluvial soils at boreholes RC-14-001, RC-14-002 and RC-14-003. The LOTB shows the elevations of rock where encountered by the boreholes. The rock is diorite, with much of the material encountered varying between decomposed and moderately weathered. Complete descriptions of the rock can be found on the Log of Test Borings.

The Log of Test Borings (LOTBs) will be provided at a future date and are to be attached to the plans.

Groundwater

Wet soils were encountered in borehole RC-14-001 below approximately elevation 1362, in borehole RC-14-002 below approximately elevation 1358, and in borehole RC-14-003 approximately below elevation 1358. The water level observed in borehole RC-14-002 within a day of its completion to full depth, is shown on the Log of Test Borings. The water level observed in the borehole is consistent with the elevation of the saturated soils observed in that borehole. Surface water was observed in the creek channel at approximately elevation 1361 on September 25, 2014.

Groundwater surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on seasonal conditions and water levels at the time of construction.

Scour Evaluation

Seiad Creek Bridge crosses a water course. The Final Hydraulics Report dated January 6, 2015 provides an analysis of predicted scour at the four bridge foundations.

Corrosion Evaluation

Representative soil samples taken during the subsurface investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

The results of the laboratory tests determined that the composite samples were considered to be non-corrosive for this site. Refer to Table 2 for test results.

Table 2: Corrosion Test Summary of Composite Samples

TL 101 Number	Boring Number	Sample Depth (ft)	pH	Minimum Resistivity (ohm-cm)	Chloride Content (ppm)	Sulfate Content (ppm)
C837044	R-14-002	5 - 10	8.51	6156	N/A	N/A
C837045	R-14-002	10 - 15	7.6	10282	N/A	N/A

Seismic Recommendations

Ground Motion

In accordance with the *2009 Caltrans Seismic Design Procedure*, the following active and potentially active faults are located in the vicinity of the project site. The Caltrans ARS Online Tool, analytical spreadsheets and the 2009 USGS Probabilistic Seismic Hazard Analysis Interactive Deaggregation Tool were used to develop ARS curves for deterministic and probabilistic seismic prediction models. An average shear wave velocity of 1840 ft/sec (560 m/s) was calculated for the upper 100 feet (30 meters) of soil observed at borehole RC-14-003. The calculations were based on soil shear wave velocities derived from correlations to SPT data. A basin factor of 1.0 was utilized.

The resulting design envelope ARS curve is based on the 5% probability of exceedance in 50 years (corresponding to a 975 year return period). The estimated peak ground acceleration is 0.2g. The ARS curve is presented in Figure 1. Recommended design spectral acceleration curve data points are provided in Attachment 1.

Table 3: Active and Potentially Active Fault

Fault Name	Fault Type	Moment magnitude of maximum credible earthquake	Distance from fault to project site (miles)	Peak ground acceleration (gravity)
Cascadia Subduction Zone	Reverse	8.3	69	0.10

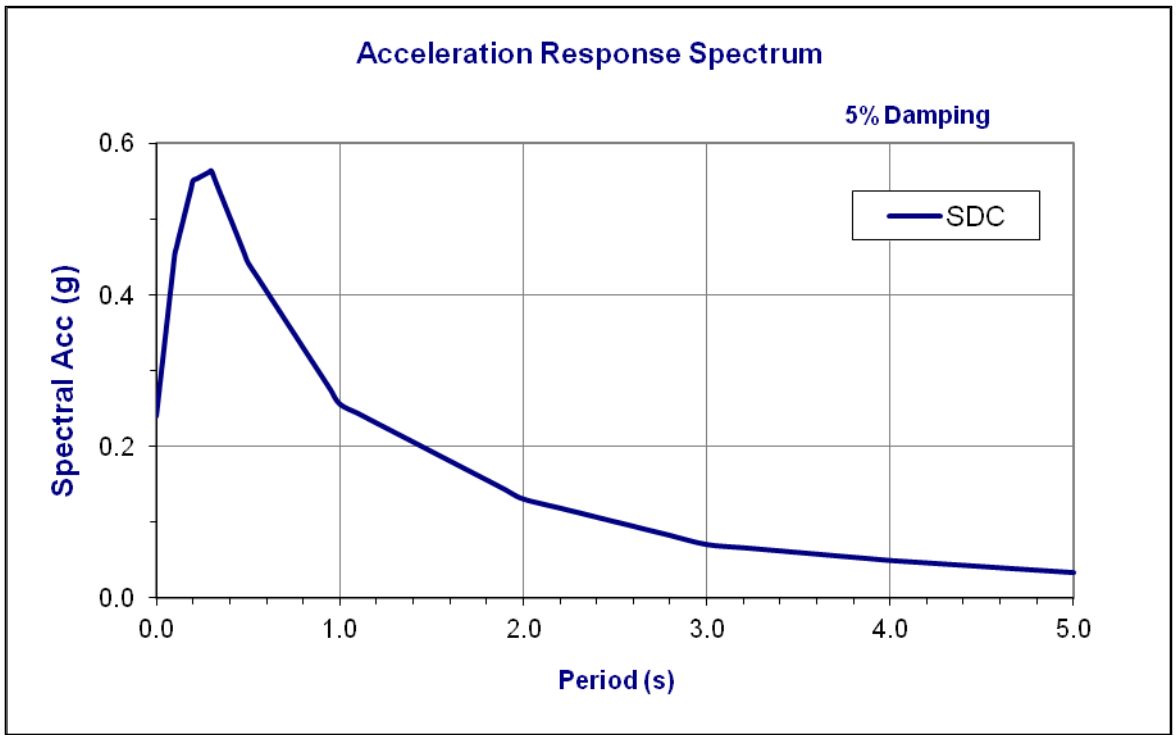

Figure 1: Design ARS Curve

Ground Rupture

The potential for surface fault rupture at the site is absent because there are no known faults that are Holocene or younger in age that fall within 1,000 feet of the structure. The structure does not fall within an Alquist-Priolo Earthquake Fault Zone.

Liquefaction

Liquefaction is a near-total loss of soil strength due to an increase in pore water pressure during cyclic loading, such as occurs during an earthquake. Loose sands and gravels with 20 percent fines or less that have the potential of being saturated are susceptible to liquefaction. Liquefaction potential at the project site is considered negligible.

As-Built Foundation Data

The existing structure was constructed in 1953. All four bridge supports and the retaining walls at Abutment 1 left, Abutment 1 right, Abutment 4 left and Abutment 4 right are supported on driven 10BP42 steel piles as indicated on the corrected as-built plans dated December 1959. The piles are both vertical and battered at a 1:4 ratio. The plans indicate the “Pile Loading” is 37 tons per pile.

Foundation Recommendations

The following recommendations are for the proposed widening of the Seiad Creek Bridge, Br. No. 02-0072, as indicated on the General Plan sheet dated February 11, 2015 and Foundation Plan sheet dated June 12, 2015. The load demands, foundation locations and pile cut-off elevations were provided by Structure Design for the bridge abutment and pier widenings, and abutment retaining walls.

The bridge widening on the left and right side of Abutments 1 and 4, and Piers 2 and 3 may be supported on driven steel H piles. The piles at all support locations will be driven through soil to the underlying rock. Abutment and retaining wall support foundations were designed using the Working Stress Design (WSD) method, and the pier support foundations were designed using the Load Factor Design (LFD) method. Structure Design has communicated that a design loading of 90 kips is required for the Abutment 1 and 4 bridge foundation and retaining wall locations. Structure Design has also indicated that a nominal resistance of 180 kips is required for the piles supporting the Pier 2 and 3 widenings.

Design tip elevations for nominal resistance in compression were calculated using the methods presented in the AASHTO LRFD Bridge Design Specifications (2012) and FHWA Design and Construction of Driven Pile Foundations Manual (FHWA-NHI-05-043, April 2006).

The pile data table for all foundation locations is provided as Table 4.

Table 4: Pile Data Table for Seiad Creek Bridge (Widen)

Location	Pile Type	Design Loading	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
			Compression	Tension			
Abut. 1	HP10 X 57	90 kips	180	0	1341(a)	1341	180
Bent 2	HP10 X 57	N/A	180	0	1341(a)	1341	180
Bent 3	HP10 X 57	N/A	180	0	1341(a)	1341	180
Abut. 4	HP10 X 57	90 kips	180	0	1341(a)	1341	180
Abut. 1 retaining wall	HP10 X 57	90 kips	180	0	1341(a)	1341	180
Abut. 4 retaining wall	HP10 X 57	90 kips	180	0	1341(a)	1341	180

Notes:

1) *Specified tip elevations for Abutments, Piers and Retaining Walls are controlled by: (a) Compression*

Approach Fill Earthwork

Minor grading may be necessary to construct the bridge approaches. Any settlement of the approach fills and underlying foundation soils is expected to be immediate due to the absence of cohesive soils. Settlement amounts are expected to be minimal, less than 0.1 inch. No fill delay period is required between placement of the sliver fills and construction of the abutment or the retaining foundations.

Construction Considerations

1. At the Engineer's option, any driven steel "H" piles which refuse within 8 feet of specified tip elevation may be considered adequate and the excess pile length cut-off. Refusal for this project shall be defined as two times the required pile acceptance criteria. Refer to the Caltrans Standard Specifications 49-2.01A(4)(b) (2010) for information concerning the pile acceptance criteria.

Project Information

Standard Specifications Section 2-1.06B, "Supplemental Project Information," indicates that the special provisions will make supplemental project information to bidders. Items listed to be included in the information handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans include:

A. Log of Test Borings (Seiad Creek Bridge (Widen), Br. No. 02-0072).

Data and Information included in the Information Handout include:

A. Foundation Report (Seiad Creek Bridge (Widen), Br. No. 02-0072), Dated June 18, 2015.

The Foundation Recommendations included in this Foundation Report are based on specific project information regarding structure type and structure location that has been provided by the Office of Bridge Design Services. Once the project plans are available, the Office of Geotechnical Design North should review the information to determine if this Foundation Report is still applicable. If you have any questions or comments, please contact Tim Alderman (916) 227-1035 or Ron Richman (805) 549-3385.

Report by:

TIM ALDERMAN
Engineering Geologist
Office of Geotechnical Design-North

REGISTERED PROFESSIONAL ENGINEER
RONALD L. RICHMAN
No. CE039869
Exp. 12/31/15
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STATE OF CALIFORNIA

RON RICHMAN, P.E., C.E. No. 039869
Senior Materials & Research Engineer
Office of Geotechnical Design-North

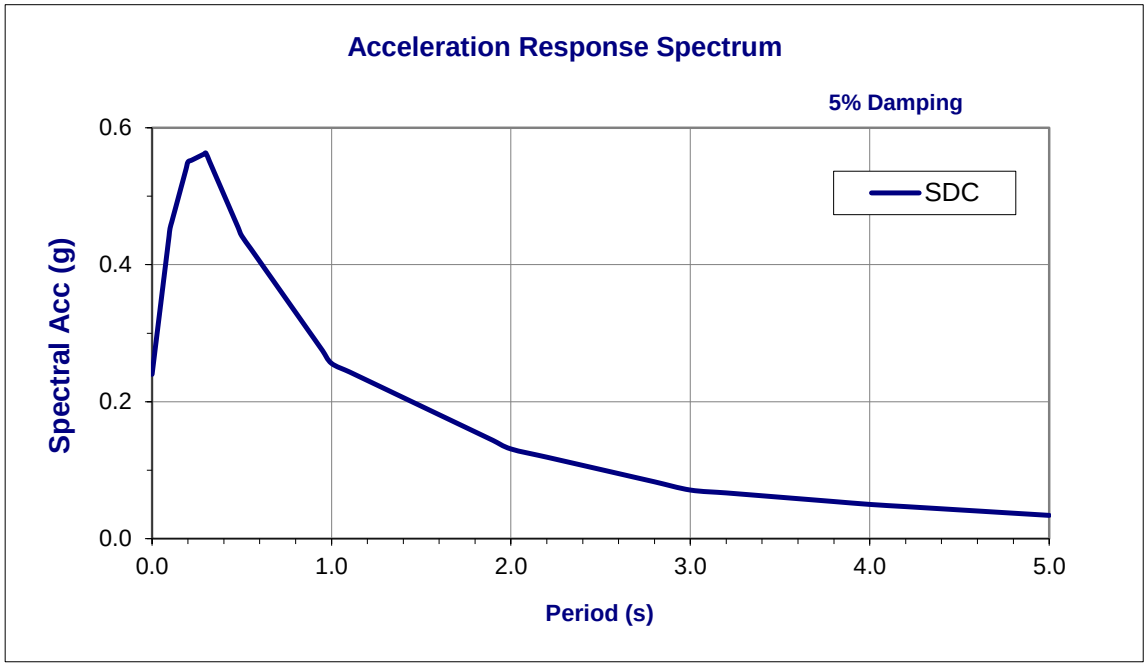
Attachment: Design ARS Curve Data

c: Job File / Branch D Records
Traci Menard / GDN Records

Seiad Creek Bridge

Bridge No. 02-0072 **SDC Controlling Procedure :** **Probabilistic**

Period (s)	SDC
0.010	0.240
0.020	0.283
0.030	0.304
0.050	0.347
0.075	0.400
0.100	0.453
0.120	0.472
0.150	0.502
0.200	0.550
0.250	0.557
0.300	0.563
0.400	0.503
0.500	0.442
0.750	0.349
1.000	0.256
1.500	0.194
2.000	0.131
3.000	0.071
4.000	0.050
5.000	0.034



Deterministic Procedure Data

Fault	Cascadia Subduction Zone		R_{rup}	110.00	km
Fault ID	5		R_{jb}	110.00	km
Style	Reverse		R_x	110.00	km
Mmax	8.3		V_{S30}	560	m/s
Dip	15	deg	$Z_{1.0}$	N/A	m
Z_{TOR}	5	km	$Z_{2.5}$	N/A	km

Notes

Probablistic ARS controls.

Attachment 1

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

MATERIALS INFORMATION

Foundation Report for Beaver Creek Bridge (Br. No. 02-0081)

Dated June 18, 2015

State of California
Department of Transportation

Business, Transportation and Housing Agency

M e m o r a n d u m

Serious Drought.
Help Save Water

To: JOSEPH E DOWNING, CHIEF
Bridge Design Branch 3
Office of Bridge Design Services
Structure Design
Division of Engineering Services

Date: June 18, 2015

File: 02-SIS-96-PM 88.26
Beaver Creek Bridge (Widen)
Br. No. 02-0081
EA 02-4E6501
EFIS 0212000012

Attn: Mufeed Khalaf

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

Subject: Foundation Report for Beaver Creek Bridge (Widen)

Scope of Work

A Foundation Report (FR) is provided for the above referenced project. The proposed project is located in rural Siskiyou County. Widening of the Beaver Creek Bridge is proposed. Review of published geologic data and previous geotechnical reports, field reconnaissance, and design calculations were performed to prepare this Foundation Report. This Foundation Report supersedes any previous planning or design communications.

The purpose of this report is to document geotechnical conditions and provide foundation recommendations.

Our Office has evaluated the site conditions and geology based on a review of the existing As-Built Plans, available geologic literature and mapping, aerial photograph interpretation, multiple site visits and a subsurface investigation completed during September and October 2014.

The following publications were used to assist in the preparation of this Foundation Report:

1. *Caltrans Seismic Design Criteria 1.7, Office of Earthquake Engineering, April 2013.*
2. *Regional Geologic Map Series, Weed Sheet*, 1:250,000, California Division of Mines and Geology, D.L Wagner and G. J. Saucedo, 1987.
3. *Geotechnical Services Design Manual, Version 1.0*, (Division of Engineering Services, August 2009).
4. *Foundation Report Preparation for Bridge Foundations, December 2009.*

Project Description

According to the General Plan sheet (dated 1/13/2015) the existing 3 span bridge will be widened 5'1" to the left and 5'1" to the right. The widening will be supported on shallow foundations to match the existing foundation type.

The foundation recommendations provided in this report are based on the NAVD 88 (vertical datum) and horizontal coordinates are based on the NAD83 (horizontal datum), unless otherwise noted.

Exceptions to Policy

There are no requested exceptions to Geotechnical Services policy.

Field Investigation and Testing Program

The field investigation performed at the project site included four geotechnical borings.

The Office of Geotechnical Design-North conducted a subsurface investigation during September and October 2014. Four mud rotary borings were drilled for the design of the bridge foundation. The mud rotary borings were advanced using mud rotary drill methods with diamond coring, and a self-cased wire line drilling apparatus that provided soil samples and rock cores. Soils were visually classified in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2010).

Standard penetration tests (SPT), ASTM test method 1586, were performed at selected depth intervals to estimate in-place density of the native soil. Empirical correlations of soil strength parameters with SPT blow counts were used to estimate strength parameters of in-situ cohesionless soils. Gravel, cobbles and in-place rock were sampled by coring techniques. The maximum depth of investigation was 87.5 feet.

A summary of the borings drilled during the 2014 subsurface investigation is included below in Table 1.

Table 1: 2014 Subsurface Investigation Summary

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
RC-14-001	9/18/2014	Acker	Automatic	67	1755.1	85.0
RC-14-002	9/21/2014	Acker	Automatic	67	1761.2	87.5
RC-14-003	9/22/2014	Acker	Automatic	67	1759.5	10.3
RC-14-004	10/7/2014	Acker	Automatic	67	1774.2	74.0

Laboratory Testing Program

Laboratory testing was performed on selected samples of the subsurface materials obtained from the 2014 subsurface investigation. Soil samples were collected and submitted to the Headquarters Geotechnical Laboratory for grading analyses (CT 202) and corrosion potential testing (CT 643). The corrosion test results for the soil samples may be found in the Corrosion Evaluation section of this report.

Site Geology and Subsurface Conditions

Regional Setting and Area Geology

Preliminary information regarding the site characteristics was obtained from published geologic maps and previous geotechnical investigations and reports for construction of the bridge at the proposed project.

The project is located within the Klamath Mountains geomorphic province of California. The Klamath Mountains are an area of rugged topography with prominent peaks and ridges reaching 6,000 to 8,000 feet above sea level. The Klamath Mountain Geomorphic Province is bounded to the west by the Coast Range and to the east by the Cascade Range geomorphic provinces.

The Regional Geologic Map of California, Weed Sheet (CDMG, 1987), was reviewed to determine the geologic features within the project limits. The map indicates that the geologic unit underlying the project consists of Carboniferous (Paleozoic) metamorphic rocks. The rock is locally described as part of the Western Paleozoic and Triassic Belt and consists of undifferentiated amphibolite and greenshcist.

There are no known faults within the project limits.

Subsurface Conditions

The approach embankments consist of approximately 25 feet of fill at Abutment 1 and 12 feet of fill at Abutment 4. At Abutment 1, the fill consists of medium stiff to very stiff lean clay with gravel. The natural surficial soils encountered beneath the approach embankments and below the creek channel in the vicinity of the piers consists of alluvial deposits. The majority of the alluvial soils observed in the boreholes are cohesionless. Among the soil types observed are poorly graded gravel and cobbles, very dense poorly graded gravel, very dense well graded gravel with sand and silt, very dense silty sand with gravel, loose poorly graded sand, very loose and loose silty sand, medium dense well graded sand with silt and clayey sand.

Rock similar to that shown on the Weed Regional Geologic Map was found beneath the alluvial soils at boreholes RC-14-001, RC-14-002 and RC-14-004. The LOTB shows the elevations of rock where encountered by the boreholes. Similar rock is exposed in road cuts to the east and west of the Beaver Creek Bridge.

The Log of Test Borings (LOTBs) will be provided at a future date and are to be attached to the plans.

Groundwater

Wet soils were encountered in borehole RC-14-004 below elevation 1759, in borehole RC-14-001 below elevation 1751, and in borehole RC-14-002 below elevation 1750. Water levels observed in the boreholes during the drilling process are shown on the Log of Test Borings and summarized in Table 2. The water levels observed in the boreholes generally match the observed uppermost elevations of the wet soils.

Table 2: Groundwater Level Observations

Borehole ID	Date	Ground Surface Elevation (feet)	Depth to Groundwater (feet)	Groundwater Elevation (feet)
RC-14-001	9/18/2014	1755.1	4.0	1751.1
RC-14-002	9/19/2014	1761.2	11.0	1750.2

Groundwater surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on seasonal conditions and water levels at the time of construction.

Scour Evaluation

Beaver Creek Bridge crosses a water course. The Final Hydraulics Report dated 1-6-2015 provides an analysis of predicted scour at the four bridge foundations. The scour elevations provided by Structure Design are summarized in Attachment 2.

Corrosion Evaluation

Representative soil samples taken during the subsurface investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

The results of the laboratory tests determined that the composite samples were considered to be non-corrosive for this site. Refer to Table 3 for test results.

Table 3: Corrosion Test Summary of Composite Samples

TL 101 Number	Boring Number	Sample Depth (ft)	pH	Minimum Resistivity (ohm-cm)	Chloride Content (ppm)	Sulfate Content (ppm)
C837042	R-14-002	6 - 10	7.33	9373	N/A	N/A
C837043	R-14-004	15 - 20	8.16	2887	N/A	N/A

Seismic Recommendations

Ground Motion

In accordance with the *2009 Caltrans Seismic Design Procedure*, the following active and potentially active faults are located in the vicinity of the project site. The Caltrans ARS Online Tool, analytical spreadsheets and the 2009 USGS Probabilistic Seismic Hazard Analysis Interactive Deaggregation Tool were used to develop ARS curves for deterministic and probabilistic seismic prediction models. An average shear wave velocity of 1100 ft/sec (330 m/s) was calculated for the upper 100 feet (30 meters) of soil observed at borehole RC-14-002. The calculations were based on soil shear wave velocities derived from correlations to SPT data. A basin factor of 1.0 was utilized.

The resulting design envelope ARS curve is based on the 5% probability of exceedance in 50 years (corresponding to a 975 year return period). The estimated peak ground acceleration is 0.3g. The ARS curve is presented in Figure 1. Recommended design spectral acceleration curve data points are provided in Attachment 1.

Table 4: Active and Potentially Active Fault

Fault Name	Fault Type	Moment magnitude of maximum credible earthquake	Distance from fault to project site (miles)	Peak ground acceleration (gravity)
Cedar Mountain (Ikes Mtn Section)	Normal	7.0	34	0.06

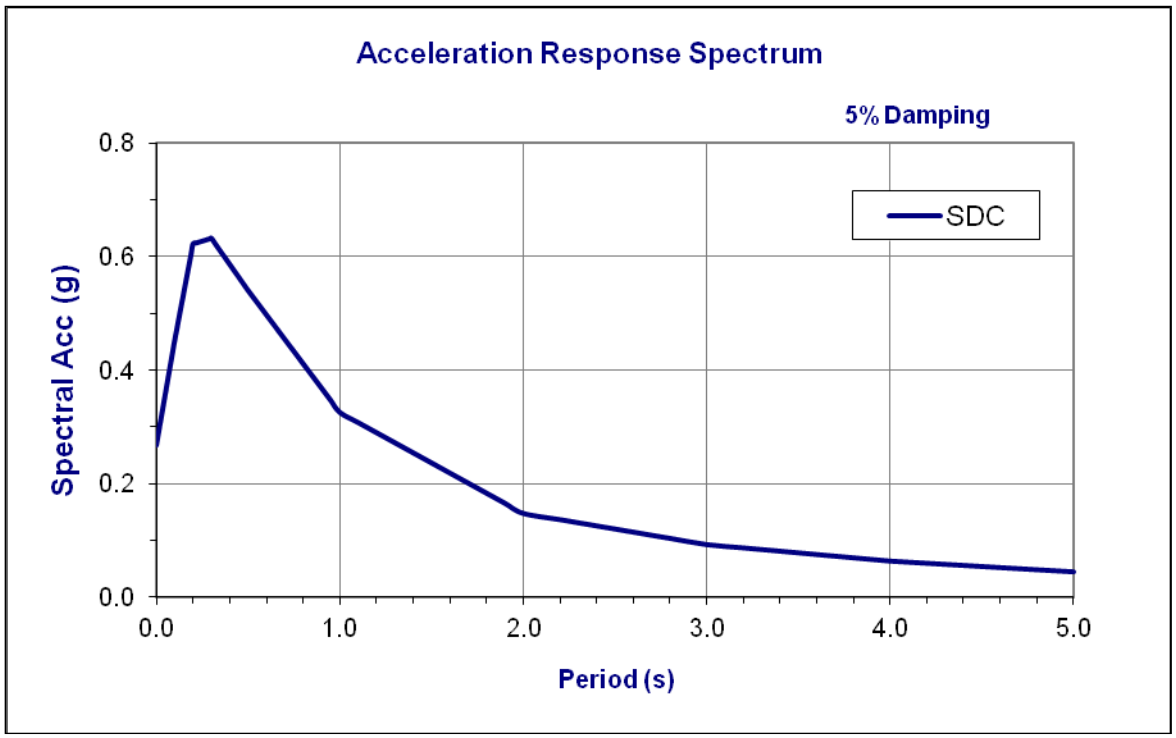


Figure 1: Design ARS Curve

Ground Rupture

The potential for surface fault rupture at the site is absent because there are no known faults that are Holocene or younger in age that fall within 1,000 feet of the structure. The structure does not fall within an Alquist-Priolo Earthquake Fault Zone.

Liquefaction

Liquefaction is a near-total loss of soil strength due to an increase in pore water pressure during cyclic loading, such as occurs during an earthquake. Loose sands and gravels with 20 percent fines or less that have the potential of being saturated are susceptible to liquefaction. Liquefaction potential at the project site is negligible.

As-built Foundation Data

The existing structure was constructed in 1932. All bridge foundations are supported on spread footings as indicated on the As-Built plans dated August 1931. The plans do not indicate the bearing resistance of the foundation materials or the applied footing pressure or stress.

Foundation Recommendations for Beaver Creek Bridge (Widen)

The following recommendations are for the proposed widening of the Beaver Creek Bridge, Br. No. 02-0081, as indicated on the General Plan sheet dated January 13, 2015. The spread footing recommendations for the widening are based on the foundation geometry and load data provided in the Foundation Design Data Sheet received February 12, 2015 (Attachment 2). The groundwater level for design of all four bridge support locations is elevation 1760 feet. Bearing resistance, settlement and overall stability analyses were based on the assumption of fully drained conditions in the foundation. The load demand and foundation data was provided for the additional footing widths. Data was not provided for the evaluation of the geotechnical behavior of the integrated footing, the connected future footing that will consist of the existing footing and the incremental widening.

The bridge widening on the left and right side of Abutments 1 and 4, and Piers 2 and 3 may be supported on spread footings. The footings at all support locations will be founded within soil. Abutment support foundations were designed using the Working Stress Design (WSD) method, and the Pier support foundations were designed using the Load Factor Design (LFD) method.

The permissible gross contact stress, the allowable gross bearing capacity and the factored gross nominal bearing resistances were calculated using the methods presented in the AASHTO LRFD Bridge Design Specifications (2012) and FHWA Shallow Foundation Manual (FHWA-NHI-01-023, June 2001). Per your request, a permissible displacement under service load of 1.0 inch was utilized to determine the permissible gross contact stress. Footing stability for sliding failure should be analyzed using a foundation soil friction angle of 33 degrees.

Abutment Locations

The bridge widening at Abutments 1 and 4, left and right can be supported on spread footings. The Spread Footing Design Data provided by Structure Design is provided in Attachment 2. The Foundation recommendations are based on the spread footing design loading and footing geometry provided by Structure Design.

The recommended permissible gross contact stress, allowable gross bearing capacities and bottom of footing elevations for Abutments 1 and 4 are listed in Table 5.

Table 5: Spread Footing Recommendations for Abutments 1 and 4

Support Location	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth (ft)	Total Permissible Support Settlement (inches)	Working Stress Design (WSD)	
	B	L				Permissible Gross Contact Stress (Settlement) (ksf)	Allowable Gross Bearing Capacity (ksf)
Abutment 1	10.0	16.5	1745.0	0.37	1.0	13.0	4.0
Abutment 4	10.0	19.0	1741.0	17.11	1.0	13.0	4.0

Pier Locations

The bridge widening at Piers 2 and 3, left and right can be supported on spread footings. The Spread Footing Design Data provided by Structure Design is provided in Attachment 2.

The recommended permissible gross contact stresses, factored gross nominal bearing resistances and bottom of footing elevations for Piers 2 and 3 are listed in Table 6. The foundation recommendations are based on the spread footing design loading and footing geometry provided by Structure Design.

Table 6: Spread Footing Recommendations for Piers 2 and 3

Support Location	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth (ft)	Total Permissible Support Settlement (inches)	LFD (Load Factor Design)		
	B	L				Permissible Net Contact Stress (ksf)	Factored Gross Nominal Bearing Resistance (Groups I through VI) $\varphi_b = 0.50$ (ksf)	Factored Gross Nominal Bearing Resistance (Group VII) $\varphi_b = 1.00$ (ksf)
Pier 2	6.0	6.0	1743.0	2.66	1.0	40.0	15.0	10.0
Pier 3	6.0	6.0	1743.0	9.93	1.0	40.0	15.0	10.0

The Spread Footing Data Table for the Abutment and Pier supports is provided in Table 7.

Table 7: Spread Footing Data Table for Beaver Creek Bridge (Widen)

Support Location	Working Stress Design (WSD)		Load Factor Design (LFD)		
	Permissible Gross Contact Stress (Settlement) (ksf)	Allowable Gross Bearing Capacity (ksf)	Permissible Net Contact Stress (Settlement) (ksf)	Factored Gross Nominal Bearing Resistance (Groups I through VI) $\varphi_b = 0.50$ (ksf)	Factored Gross Nominal Bearing Resistance (Group VII) $\varphi_b = 1.00$ (ksf)
Abutment 1	13.0	4.0	N/A	N/A	N/A
Pier 2	N/A	N/A	40.0	15.0	10.0
Pier 3	N/A	N/A	40.0	15.0	10.0
Abutment 4	13.0	4.0	N/A	N/A	N/A

Foundation Recommendations for Abutment Type 1 Retaining Walls

The following recommendations are for the proposed retaining walls at the left and right side of both Abutments 1 and 4, as indicated on the Retaining Wall Details No. 1 and No. 2 Sheets dated February 2, 2015. Type 1 Caltrans standard plan retaining walls (Caltrans 2010 Standard Plans) are proposed for the left and right side of both Abutments 1 and 4. The locations, design heights and footing elevations of the retaining walls are summarized in Table 9. Table 9 also provides the load demands and the foundation resistances and settlement behavior. The analysis indicates that all four retaining walls may be supported on spread footings.

The soil conditions used for design and analysis of the retaining walls can be found in Table 8. The soil strength parameters were developed using correlation methods found in the AASHTO LRFD Bridge Design Specifications 6th Edition (2012), the FHWA Soils and Foundation Manual (FHWA HI-88-009, July 1993) and the FHWA Shallow Foundation Manual (FHWA NHI-01-023, June 2001).

The slope condition in the retained zone behind all four retaining walls is level with a traffic surcharge (case 1). The Foundation Plan sheet (2/3/2015) indicates that the slope in front of all four retaining walls consists of a bench of unspecified width, and a descending slope declined at a slope ratio of 1.5:1. It was assumed for geotechnical analyses that the lateral distance from the footing toe to the slope was a minimum of four feet. The groundwater level for design of all four retaining walls is elevation 1760 feet. Bearing resistance, settlement and overall stability analyses were based on the assumption of fully drained conditions in the retained zone and foundation. To assure that this condition is met, the ERS must be provided with weep holes and back-of-wall drainage systems.

Table 8: Design analysis soil parameters for Abutment 1 and 4 Retaining Walls

Support Location	Footing elevation	Soil Type	Estimated Soil Engineering Parameters
Abutment 1 Left	Elevation 1770.00	Lean clay with gravel	ϕ = 24 degrees, c = 0.80 ksf , γ_m = 118 pcf
Abutment 1 Right	Elevation 1765.32	Lean clay with gravel	ϕ = 20 degrees, c = 0.60 ksf , γ_m = 115 pcf
Abutment 4 Left	Elevation 1761.60 to 1768.50	Lean clay with gravel	ϕ = 27 degrees, c = 1.20 ksf , γ_m = 120 pcf
Abutment 4 Right	Elevation 1765.0	Lean clay with gravel	ϕ = 27 degrees, c = 1.20 ksf , γ_m = 120 pcf

Bearing resistance and settlement analyses:

Bearing resistances for the strength and extreme event limit states were determined using conventional bearing capacity theory. Settlement calculations used the Hough Method for elastic compression of cohesionless soil. The analyses utilized the minimum footing embedment as shown in the standard plans. The results of the calculations are provided in Table 9. The results indicate that the foundation conditions are suitable for a Caltrans Type 1 retaining wall standard plan design (RSP B3-1A) if the existing foundation soil is improved. At the Abutment 1 and 4 Type 1 Retaining Wall locations, removal and replacement of the foundation soils to a depth of 3 feet below the proposed footing elevations is required to meet requirements for bearing resistance and global stability. The soil should be removed and replaced with structure backfill compacted to 95% RC. The sub-excavation should extend three feet beyond both the toe and heal of the footings.

Table 9: Spread Footing Data Table for Abutment 1 and 4 Retaining Walls

Retaining Wall Location	Design Height (ft)	Bottom of Footing Elevation (ft)	Footing Width (ft)	Minimum Footing Embedment Depth (ft)	Strength Limit Factored Gross Uniform Bearing Stress (psf) q_0	Strength Limit Factored Bearing Resistance (psf) ϕq_N ϕ=0.45	Extreme Limit Factored Gross Uniform Bearing Stress (psf) q_0	Extreme Limit Factored Bearing Resistance (psf) ϕq_N ϕ=1.0	Service Limit State Net Bearing Stress (psf) q'_0	Calculated Settlement at Net Bearing Pressure (inches)	Permissible Settlement (inches)
Abutment 1 Left	6	1770.00	7.00	3.33	1800	1800	1500	1800	1000	0.4	1.0
Abutment 1 Right	6	1765.32	7.00	3.33	1800	1800	1500	1500	1000	0.4	1.0
Abutment 4 Left	12	1761.60	8.33	3.50	4000	4000	4800	4800	2000	0.7	1.0
Abutment 4 Left	10	1764.00	7.58	3.33	3300	3300	3400	3400	1600	0.6	1.0
Abutment 4 Left	8	1766.50	7.25	3.33	2300	2300	2200	2200	1300	0.6	1.0
Abutment 4 Left	6	1768.50	7.00	3.33	1800	1800	1500	1500	1000	0.4	1.0
Abutment 4 Right	6	1765.00	7.00	3.33	1800	1800	1500	1500	1000	0.4	1.0

The spread footings for the bridge and retaining walls are to be constructed at or below the recommended bottom of footing elevations shown in Tables 4, 5 and 8. Contact the Office of Geotechnical Design North for re-evaluation if any of the following change:

- The footing size (B) is reduced.
- The loading conditions change.
- The bottom of footing elevation is raised.
- The minimum vertical footing embedment depths are reduced.

Approach Fill Earthwork

The sliver fills at the approaches to Abutments 1 and 4 will be supported by the abutment retaining walls. Settlement of the sliver fills and underlying foundation soils is expected to be negligible. Settlement amounts are expected to be minimal, less than 0.2 inch. No fill delay period is required between placement of the sliver fills and construction of the abutment spread footings or the retaining wall spread footings.

Construction Considerations

At all bridge support locations, the excavations/subexcavations are to be inspected and approved by a representative of the Office of Geotechnical Design North, prior to placing structure concrete. The purpose of the required inspection is to verify that the material at the bottom of the excavation has the characteristics required to meet the recommendations in this report. Once the excavation has been completed to the specified elevations, the contractor is to allow the Office of Geotechnical Design North, seven (7) days to perform the inspection. The structures representative is to provide the Office of Geotechnical Design North a one-week notification prior to beginning the seven day contractor waiting period.

At the Abutment 1 and 4 Type 1 Retaining Wall locations, removal and replacement of the foundation soils to a depth of 3 feet below the proposed footing elevations is required to meet requirements for bearing resistance and global stability. The soil should be removed and replaced with structure backfill compacted to 95% RC. The sub-excavation should extend three feet beyond both the toe and heal of the footings.

Water will be encountered during excavation for footings at Abutment 1, Pier 2, Pier 3 and Abutment 4. It is expected that the contractor will encounter groundwater conditions that will require one or several of the following control measures: sumps, pumps, well points, tremie seals and cofferdams. Techniques other than those listed here may be proposed.

Project Information

Standard Specifications Section 2-1.06B, "Supplemental Project Information," indicates that the special provisions will make supplemental project information to bidders. Items listed to be included in the information handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans include:

A. Log of Test Borings (Beaver Creek Bridge (Widen), Br. No. 02-0081).

Data and Information included in the Information Handout include:

A. Foundation Report (Beaver Creek Bridge (Widen), Br. No. 02-0081), Dated June 18, 2015.

The Foundation Recommendations included in this Foundation Report are based on specific project information regarding structure type and structure location that has been provided by the Office of Bridge Design Services. Once the project plans are available, the Office of Geotechnical Design North should review the information to determine if this Foundation Report continues to be applicable. If you have any questions or comments, please contact Tim Alderman (916) 227-1035 or Ron Richman (805) 549-3385.

Report by:

TIM ALDERMAN
Engineering Geologist
Office of Geotechnical Design-North

RON RICHMAN, P.E., C.E. No. 039869
Senior Materials & Research Engineer
Office of Geotechnical Design-North

c: Job File / Branch D Records
Traci Menard / GDN Records

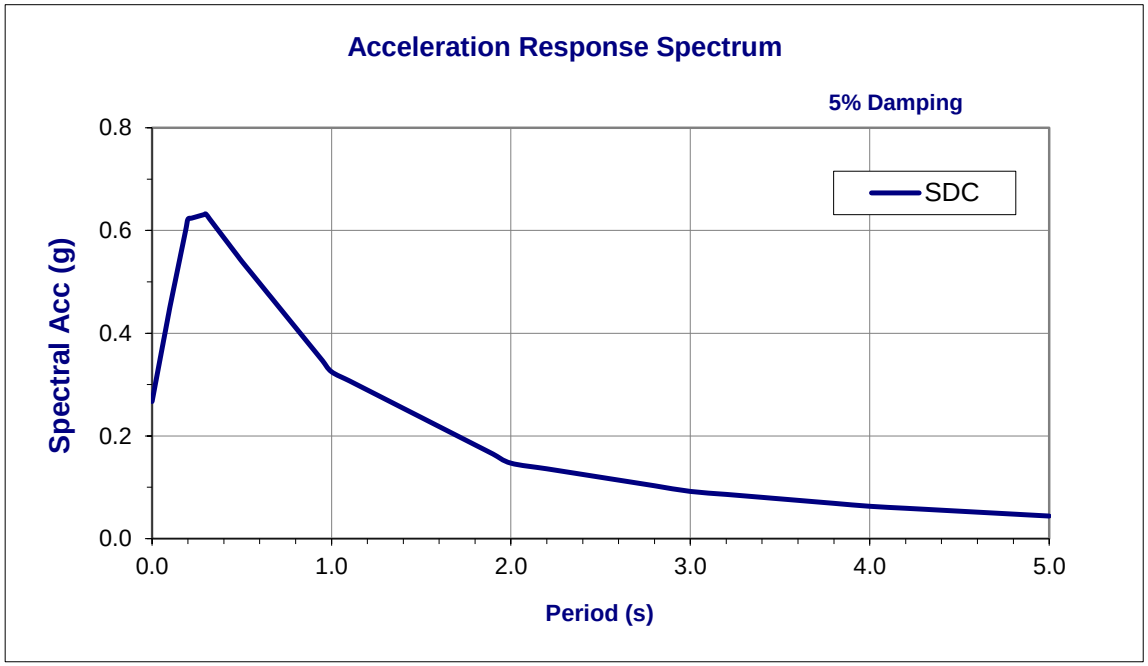
LIST OF ATTACHMENTS

Design ARS Curve Data	Attachment 1
Foundation Design Data Sheets	Attachment 2

Beaver Creek Bridge

Bridge No. **02-0081** **SDC Controlling Procedure :** **Probabilistic**

Period (s)	SDC
0.010	0.267
0.020	0.304
0.030	0.323
0.050	0.360
0.075	0.406
0.100	0.452
0.120	0.486
0.150	0.537
0.200	0.622
0.250	0.627
0.300	0.632
0.400	0.586
0.500	0.540
0.750	0.433
1.000	0.325
1.500	0.236
2.000	0.147
3.000	0.092
4.000	0.063
5.000	0.044



Deterministic Procedure Data

Fault	Cedar Mountain Fault System (Ikes Mtn Section)		R_{rup}	54.70	km
Fault ID	13		R_{jb}	54.70	km
Style	Normal		R_x	54.70	km
Mmax	7		V_{S30}	330	m/s
Dip	60	deg	$Z_{1.0}$	N/A	m
Z_{TOR}	0	km	$Z_{2.5}$	N/A	km

Notes

Probablistic ARS controls.

Attachment 1

General Foundation Information to be sent from SD to GS

Foundation Design Data Sheet						
Support No.	Design Method	Finished Grade Elevation (ft)	BOF Elevation (ft)	Footing Size (ft)		Permissible Settlement under Service Load (in)*
				B	L	
Abut 1	WSD	1752	1745	16.5	10	1
Pier 2	LFD	1755	1743	6	6	1
Pier 3	LFD	1759	1743	6	6	1
Abut 4	WSD	1761	1741	19	10	1

* Based on CALTRANS' current practice, the total permissible settlement for a shallow footing is one inch for multi-span structures with continuous spans or multi-column bents, one inch for single span structures with diaphragm abutments, and two inches for single span structures with seat abutments. Different permissible settlement under service loads may be allowed if a structural analysis verifies that required level of serviceability is met.

*

Scour Data to be sent from SD to GS

Scour Data		
Support No.	Long Term (Degradation and Contraction) Scour Elevation (ft)	Short Term (Local) Scour Depth (ft)
Abut 1	1745.37	NA
Pier 2	1745.66	NA
Pier 3	1752.93	NA
Abut 4	1758.11	NA

Design Loads to be sent from SD to GS

Foundation Design Loads – Service I limit state loads							
Support No.	Total Load				Permanent Load*		
	Vertical Load (kip)	Effective Dimensions (ft)		Horizontal Load in Long. Direction (kip)	Vertical Load (kip)	Effective Dimensions (ft)	
		B’	L’			B’	L’
Abut 1	380	16.5	10	30	150	16.5	10
Pier 2	200	6	6	N/A	150	6	6
Pier 3	200	6	6	N/A	150	6	6
Abut 4	435	19	10	30	150	19	10

*See Table 3.4.1-2 in the AASHTO LRFD Bridge Design Specifications for components of permanent load. Total and Permanent Loads are NET for Bents and GROSS for Abutments.

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Design Loads to be sent from SD to GS

Foundation Design Loads						
Support No.	Group Loads I through VI			Group Load VII		
	Vertical Load (kip)	Effective Dimensions (ft)		Vertical Load (kip)	Effective Dimensions (ft)	
		B’	L’		B’	L’
Pier 2	260	6	6	115	6	6
Pier 3	260	6	6	115	6	6

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

MATERIALS INFORMATION

Water Source Information

Non-Potable Water Sources

Memorandum

Serious drought.
Help Save Water!

To: CONTRACTOR
INFORMATION HANDOUT

Date: March 22, 2016

File: 02-4E650
Sis-96-R52.6/88.4

From: LORI EWENS
Project Engineer

Subject: **NON POTABLE WATER SOURCES**

Near Thompson Creek (Location 1), there is a U.S.F.S. access road and ramp to Seattle Creek at PM 51. Near Seiad Creek (Location 2), there is a U.S.F.S. access road and ramp to Sluice Box at PM 58. Near Beaver Creek (Location 3), there is a U.S.F.S. access road and ramp to Gotville River at PM 92.25. There is also water access to a place called Community Hall at PM 85.59. It is unclear if this access is through U.S.F.S. or not. All these sources the contractor will have to clear with U.S.F.S and California Department of Fish and Wildlife.

There is also a 14,000-gallon non-potable water tank currently being built at the Caltrans Seiad Maintenance Yard that is scheduled to be completed prior to the start date of construction, which the contractor may be able to have access to.

For more information, please contact Lori Ewens (Caltrans Project Engineer) at (530) 225-3353 or Ryan Gomes (Caltrans Maintenance Supervisor) at (530) 496-3608.

Water drafting is allowed by the the Agency permits obtained for the project at Thompson Creek, Seiad Creek and Beaver Creek. The Contractor is responsible for obtaining necessary permits for water drafting at any other location.
Project permits expressly forbid drafting water from the Klamath River.

GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. S9805-01-70
March 7, 2016

Mr. Rajive Chadha
California Department of Transportation - District 3
Environmental Engineering Office
703 B Street
Marysville, California 95901

Subject: ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT
HIGHWAY 96 BRIDGES
SISKIYOU COUNTY, CALIFORNIA
CONTRACT NO. 03A2132, ~~E-FIS 02-1500-0021-1 (EA 02-4F58U1)~~ 02-4E6501
TASK ORDER NO. 70, 02-SIS-96, POST MILES 52.48, 60.17, AND 88.29

Dear Mr. Chadha:

In accordance with California Department of Transportation Contract No. 03A2132 and Task Order No. 70, we have performed asbestos and lead-containing paint surveys of three bridges in Siskiyou County, California. Our scope of services included surveying the structures for suspect asbestos-containing materials and lead-containing paint, collecting bulk samples, and submitting the samples to laboratories for analyses.

PROJECT DESCRIPTION

The project consists of the Thompson Creek (02-0068), Seiad Creek (02-0072), and Beaver Creek (02-0081) bridges at Post Miles (PM) 52.48, 60.17, and 88.29, respectively, on Highway 96 in Siskiyou County, California. We performed asbestos and LCP survey activities at the project locations. The bridges are depicted in the attached photographs.

GENERAL OBJECTIVES

The scope of services outlined in TO-70 included the determination of the presence and quantity of asbestos and LCP at the project location prior to bridge widening. The information obtained from this investigation will be used by Caltrans for waste profiling, determining California Occupational Safety and Health Administration (Cal/OSHA) applicability, and coordinating asbestos and LCP disturbance activities.

BACKGROUND

Asbestos

The Code of Federal Regulations (CFR), 40 CFR 61, Subpart M, NESHAP and Federal Occupational Safety and Health Administration (FED OSHA) classify asbestos-containing material (ACM) as any material or product that contains *greater than* 1% asbestos. Nonfriable ACM is classified by NESHAP as either Category I or Category II material defined as follows:

- **Category I** – asbestos-containing packings, gaskets, resilient floor coverings, and asphalt roofing products.
- **Category II** – all remaining types of nonfriable asbestos-containing material not included in Category I that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Regulated asbestos-containing material (RACM), a California hazardous waste when friable, is classified as any manufactured material that contains *greater than* 1% asbestos by dry weight *and* is:

- Friable (can be crumbled, pulverized, or reduced to powder by hand pressure); or
- Category I material that has become friable; or
- Category I material that has been subjected to sanding, grinding, cutting, or abrading; or
- Category II nonfriable material that has a high probability of becoming crumbled, pulverized, or reduced to a powder during demolition or renovation activities.

Activities that disturb materials containing *any* amount of asbestos are subject to certain requirements of the Cal/OSHA asbestos standard contained in Title 8, California Code of Regulations (CCR) §1529. Typically, removal or disturbance of more than 100 square feet of material containing more than 0.1% asbestos must be performed by a registered asbestos abatement contractor, but associated waste labeling is not required if the material contains 1% or less asbestos. When the asbestos content of a material exceeds 1%, virtually all requirements of the standard become effective.

Materials containing more than 1% asbestos are also subject to NESHAP regulations (40 CFR Part 61, Subpart M). RACM (friable ACM and nonfriable ACM that will become friable during demolition operations) must be removed from structures prior to demolition. Certain nonfriable ACM and materials containing 1% or less asbestos may remain in structures during demolition; however, there are waste handling/disposal issues and Cal/OSHA work requirements that must be addressed. Contractors are responsible for segregating and characterizing waste streams prior to disposal.

With respect to potential worker exposure, notification, and registration requirements, Cal/OSHA defines asbestos-containing construction material (ACCM) as construction material that contains more than 0.1% asbestos (Title 8, CCR 341.6).

Lead

Construction activities (including demolition) that disturb materials or paints containing *any* amount of lead are subject to certain requirements of the Cal/OSHA lead standard contained in Title 8, CCR, Section 1532.1. Deteriorated paint is defined by Title 17, CCR, Division 1, Chapter 8, §35022 as a surface coating that is cracking, chalking, flaking, chipping, peeling, non-intact, failed, or otherwise separating from a substrate. Demolition of a deteriorated LCP component would require waste characterization and appropriate disposal. Intact LCP on a component is currently accepted by most landfills and recycling facilities; however, contractors are responsible for segregating and characterizing waste streams prior to disposal.

For a solid waste containing lead, the waste is classified as California hazardous when: 1) the total lead content equals or exceeds the respective Total Threshold Limit Concentration (TTLC) of 1,000 milligrams per kilogram (mg/kg); or 2) the soluble lead content equals or exceeds the respective Soluble Threshold Limit Concentration (STLC) of 5 milligrams per liter (mg/l) based on the standard Waste Extraction Test (WET). A waste has the potential for exceeding the lead STLC when the waste's total lead content is greater than or equal to ten times the respective STLC value since the WET uses a 1:10 dilution ratio. Hence, when total lead is detected at a concentration greater than or equal to 50 mg/kg, and assuming that 100 percent of the total lead is soluble, soluble lead analysis is required. Lead-containing waste is classified as "Resource, Conservation, and Recovery Act" (RCRA) hazardous, or Federal hazardous, when the soluble lead content equals or exceeds the Federal regulatory level of 5 mg/l based on the Toxicity Characteristic Leaching Procedure (TCLP).

The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability; however, for the purposes of this investigation, toxicity (i.e., lead concentration) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or other criteria. Waste that is classified as either California-hazardous or RCRA-hazardous requires management as a hazardous waste.

Potential hazards exist to workers who disturb LCP coatings during renovation or demolition. Dust containing hazardous concentrations of lead may be generated during scraping or cutting materials coated with lead-containing paint. Torching of these materials may produce lead oxide fumes. Therefore, air monitoring and/or respiratory protection may be required during the disturbance of materials coated with LCP. Guidelines regarding regulatory provisions for construction work where workers may be exposed to lead are presented in Title 8, CCR, Section 1532.1.

SCOPE OF SERVICES

Mr. David Watts, a California-Certified Asbestos Consultant (CAC), certification No. 98-2404 (expiration September 16, 2016), and Certified Lead Paint Inspector/Assessor and Project Monitor with the California Department of Public Health (DPH), certification numbers I-1734 and M-1734 (expiration December 4, 2016), performed the asbestos and LCP survey on January 25, 2016.

Asbestos

Suspect ACM were grouped into homogeneous areas with representative samples randomly collected from each. In addition, each potential ACM was evaluated for friability. A total of eighteen bulk asbestos samples representing nine suspect components were collected from the three bridges.

Our procedures for inspection and sampling in accordance with TO-70 are discussed below:

- Collected bulk asbestos samples after first wetting friable materials with a light mist of water. The samples were then cut from the substrate and transferred to labeled containers.
- Relinquished bulk asbestos samples to EMSL Analytical, Inc., a California-licensed and Caltrans-approved subcontractor, for asbestos analysis in accordance with United States Environmental Protection Agency (EPA) Test Method 600/R-93/116 using polarized light microscopy (PLM) under chain-of-custody protocol. EMSL Analytical, Inc. is a laboratory accredited by the National Institute of Standards and Technology National Voluntary Laboratory Accreditation Program (NIST-NVLAP) for bulk asbestos fiber analysis. The laboratory analyses were requested on a turnaround period of five days.

Bridge and asbestos sample identification numbers, material descriptions, approximate quantities, and friability assessments are summarized below. Materials represented by the samples collected are shown in the attached photographs.

Lead

A total of ten bulk paint samples were collected from suspect LCP observed at the three bridges. Mr. Watts field-composited the suspect LCP samples into five paint schemes prior to submittal to the laboratory. We did not observe deteriorated LCP during our survey. Our sampling procedures in accordance with TO-70 are discussed below:

- Collected bulk samples of suspect LCP using techniques presented in HUD guidelines. In addition, the painted areas were evaluated for evidence of deterioration such as flaking or cracking.
- Relinquished bulk LCP samples under chain-of-custody protocol to Advanced Technology Laboratories, a California-licensed and Caltrans-approved subcontractor, for lead analysis in accordance with EPA Test Method 6010B. Advanced Technology Laboratories is accredited by the DPH for lead analysis. The laboratory analyses were requested on a turnaround period of five days.

Bridge and paint sample identification numbers, material descriptions, approximate quantities, and friability assessments are summarized below. Materials represented by the samples collected are shown in the attached photographs.

INVESTIGATIVE RESULTS

Asbestos

No asbestos was detected in samples of the suspect materials collected during our survey. A summary of the analytical laboratory test results for asbestos is presented below. Reproductions of the laboratory report and chain-of-custody documentation are attached.

Polarized Light Microscopy (PLM) - EPA Test Method 600/R-93/116					
Bridge No.	**Sample No.**	**Description of Material**	**Approximate Quantity**	**Friable**	**Asbestos Content**
0068	1A and B	Concrete	NA	NA	ND
	2A and B	Asphalt	NA	NA	ND
	3A and B	Joint fill material	NA	NA	ND
0072	1A and B	Concrete	NA	NA	ND
	2A and B	Asphalt	NA	NA	ND
	3A and B	Joint fill material	NA	NA	ND
0081	1A and B	Concrete	NA	NA	ND
	2A and B	Asphalt	NA	NA	ND
	3A and B	Joint fill material	NA	NA	ND

NA = Not applicable
ND = Not detected

Lead

A summary of the analytical laboratory test results for lead is presented below. Reproductions of the laboratory report and chain-of-custody documentation are attached.

Total and Soluble Lead					
Bridge No.	Sample No.	Paint Description	Approximate Quantity Peeling/Flaking	Total Lead (mg/kg)	TCLP Lead (mg/l)
0068	P1A/B	Green (steel girders)	Intact	19,000	54
	P2A/B	Gray (barriers/posts)	Intact	310,000	1,900
0072	P1A/B	White (barriers)	Intact	27,000	24
0081	P1A/B	Gray (steel girders)	Intact	110,000	110
	P2A/B	White (barriers)	Intact	39	---

mg/kg = milligrams per kilogram (EPA Test Method 6010B)
TCLP = Toxicity Characteristic Leaching Procedure (EPA Test Method 1311)
mg/l = milligrams per liter (EPA Test Method 6010B)
--- = Not analyzed

RECOMMENDATIONS

Asbestos

Since no asbestos was detected, the Cal/OSHA asbestos standard does not apply for planned activities affecting materials represented by samples collected during our survey. In addition, associated debris would not be considered a California hazardous waste based on asbestos content. Written notification to the U.S. EPA Region IX and the California Air Resources Board is required ten working days prior to commencement of *any* demolition activity (whether asbestos is present or not).

Lead

With the exception of the white bridge barrier paint at Beaver Creek (02-0081), paints represented by samples collected during our survey would be classified as California and Federal hazardous based on lead content if stripped, blasted, or otherwise separated from the substrate.

We recommend that all paints at the three bridges (graffiti, signage, etc.) be treated as lead-containing for purposes of determining the applicability of the Cal/OSHA lead standard during maintenance, renovation, and demolition activities. This recommendation is based on LCP sample results and the fact that lead was a common ingredient of paints manufactured before 1978 and is still an ingredient of some paints. In accordance with Title 8, CCR, §1532.1(p), written notification to the nearest Cal/OSHA district office is required at least 24 hours prior to certain lead-related work. Compliance and training requirements regarding construction activities where workers may be exposed to lead are presented in Title 8, CCR, §1532.1, subsections (e) and (l), respectively. Contractors are responsible for segregating and characterizing waste streams prior to disposal.

REPORT LIMITATIONS

This survey was conducted in conformance with generally accepted standards of practice for identifying and evaluating asbestos and LCP in structures. The survey addressed only the structures and materials identified above. Due to the nature of structure surveys, asbestos and LCP use, and laboratory analytical limitations, some ACM and/or LCP at the project locations may not have been identified. Spaces such as cavities, voids, crawlspaces, and pipe chases may have been concealed to our investigator. Previous renovation work may have concealed or covered spaces or materials or may have partially demolished materials and left debris in inaccessible areas. Additionally, renovation activities may have partially replaced ACM with indistinguishable non-ACM. Asbestos and/or LCP may exist in areas of the structures that were not accessible or sampled in conjunction with this TO.

During renovation or demolition operations, suspect materials may be uncovered which are different from those accessible for sampling during this assessment. Personnel in charge of renovation/demolition should be alerted to note materials uncovered during such activities that differ substantially from those included in this or previous assessment reports. If suspect materials are found, additional sampling and analysis should be performed to determine if the materials contain asbestos or lead.

This report has been prepared exclusively for Caltrans. The information contained herein is only valid as of the date of the report and will require an update to reflect additional information obtained.

This report is not a comprehensive site characterization and should not be construed as such. The findings as presented in this report are predicated on the results of the limited sampling and laboratory testing performed. In addition, the information obtained is not intended to address potential impacts related to sources other than those specified herein. Therefore, the report should be deemed conclusive with respect to only the information obtained. We make no warranty with respect to the content of this report or any subsequent reports, correspondence or consultation. Geocon strived to perform the services summarized herein in accordance with the local standard of care in the geographic region at the time the services were rendered.

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Please contact us should you have any questions concerning the contents of this report or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS INC.

David A. Watts, CAC
Senior Project Scientist

John E. Juhrend, PE, CEG
Project Manager

(2 + 2 CD) Addressee

Attachments: Site Photographs (1 through 9)
Analytical Laboratory Report and Chain-of-custody Documentation

Photo 1 – Thompson Creek Bridge (02-0068) at PM 52.48 on Highway 96 in Siskiyou County, California

Photo 2 – Bridge deck and barriers

Photo 3 – South abutment

GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

PHOTOGRAPHS 1, 2, & 3		
Highway 96 Bridges Siskiyou County, California		
S9805-01-70		March 2016

Photo 4 – Seiad Creek Bridge (02-0072) at PM 60.17 on Highway 96 in Siskiyou County, California

Photo 5 – Bridge deck and barriers

Photo 6 – North abutment

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PHOTOGRAPHS 4, 5, & 6		
Highway 96 Bridges Siskiyou County, California		
S9805-01-70		March 2016

Photo 7 – Beaver Creek Bridge (02-0081) at PM 88.29 on Highway 96 in Siskiyou County, California

Photo 8 – Bridge deck and barriers

Photo 9 – North abutment

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PHOTOGRAPHS 7, 8, & 9		
Highway 96 Bridges Siskiyou County, California		
S9805-01-70		March 2016

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-SIS-96-R52.5/88.4

Identified by
Project ID 0212000012

MATERIALS INFORMATION

Final Hydraulic Report

Dated January 6, 2015

Memorandum

To: Joseph E. Downing
Branch Chief
Structure Design Branch 3
Office of Bridge Design West
Att: Mufeed Khalaf

Date: January 6, 2015

File: 02-Sis-96-PM Var.
Thompson Creek, Seiad Creek
and Beaver Creek
Br. No. 02-0068, 0072, 0081
Project ID 02 1200 0012

From: **Department of Transportation**
Engineering Service Center MS #9
Structure Hydraulics and Hydrology

Subject: Final Hydraulic Report

Attached is the Final Hydraulic Report for the Thompson, Seiad and Beaver Creek Bridge's. This report supersedes all previous reports sent to you.

If you have any questions please call me at (916) 227-0444 or my cell at (916) 224-9640.

Sincerely,

Neal Alie, P.E.
Hydrology/Hydraulics Engineer
Structure Hydraulics

State of California – Department of Transportation
Division of Engineering Services
Structure Design Services

Structure Hydraulics and Hydrology

FINAL HYDRAULIC REPORT

Thompson Creek
Seiad Creek
Beaver Creek

Located in Siskiyou County
Bridge No. 02-0068, 02-0072, 02-0081

Bridge Widening

02-SIS-96-PM Var.

EFIS 02 1200 0012

January 6, 2015

WRITTEN BY:
Neal Alie

REVIEWED BY:
Steve Ng

This report has been prepared under my direction as the professional engineer in responsible charge of the work, in accordance with the provisions of the Professional Engineers Act of the State of California

REGISTERED ENGINEER

C 56398

REGISTRATION NUMBER

REGISTERED PROFESSIONAL ENGINEER
NEAL ALIE
C 56398
EXP. 06/30/2015
CIVIL
STATE OF CALIFORNIA

Hydrology/Hydraulic Report

General

Structure Design is proposing a number of safety improvements for the following bridges-Thompson Creek Bridge (Br. No. 02-0068), Seiad Creek Bridge, (Br. No. 02-0072) and Beaver Creek Bridge (Br. No. 02-0081). The structures are located on State Route 96 in Siskiyou County with a project scope that includes the following:

- Widen all three bridges.
- Replace non-standard bridge rails
- Replace all approach metal beam guard railing (MBGR) and replace terminal sections to meet current standards.
- Place additional RSP to protect abutments.
- Reconstruct approach pavement and shoulders to conform to widened structures and profile changes.
- Install joint seals on all three bridges.
- Construct five- foot sidewalks on the right side of Seiad Creek Bridge.
- Remove existing asphalt concrete from Seiad Creek Bridge, and apply polyester overlay on deck.
- All proposed foundations to match existing.

The Thompson Creek Bridge (Br. No. 02-0068) is located at PM 52.48 on State Route 96 in Siskiyou County. The Thompson Creek Bridge, built in 1952 and widened in 1965, has rolled steel girder spans with RC deck on RC piers and RC open seat Abutment 1 and RC open end diaphragm on RC column at Abutment 4, all founded on spread footings. The bridge has a length of 125.0 feet and a width of 28.2 feet. In 1965, Span 3 was replaced and Abutment 4 was completely reconstructed on bedrock after the original abutment had been undermined and settled substantially following a major flood in December 1964.

The Seiad Creek Bridge, (Br. No. 02-0072), is located at PM 60.17 on State Route 96 in Siskiyou County. The Seiad Creek Bridge, built in 1953, has a length of 155.8 feet and a width of 35.1 feet. The bridge has continuous RC girder on RC piers and open-end seat abutments. Existing abutments and piers are constructed on short steel piles driven to a partially decomposed granitic layer with overlying alluvium of dense sands and cobbles.

The Beaver Creek Bridge (Br. No. 02-0081) is located at PM 88.26 on State Route 96 in Siskiyou County. The Beaver Creek Bridge, built in 1932, has steel stringer spans with RC closed end backfilled counterfort seat type abutments all on spread footings. The bridge has a length of 150.0 feet and a total width of 28.0 feet.

This report makes extensive reference to the (1) Caltrans Bridge Maintenance Reports, (2) General plans and profiles submitted by structures, (3) Caltrans As-Built Plans (4) District Hydraulic Studies, 7/16/2001 (5) Office of Geotechnical Design, dated 1/17/2013, (6) Bureau of Reclamation Report, dated April, 2001, (7) District Hydraulics Memo, dated 2/26/2014.

All Elevations used in this report are based on NAVD 1988.

The following datum conversion was provided by Structure Design to convert from the 1929 NGVD datum (Thompson Creek, +3.56 feet) (Seiad Creek, +4.0 feet), (Beaver Creek, 3.15 feet).

Drainage Basin

Thompson Creek

Thompson Creek drains a watershed of approximately 36.3 square miles above the bridge site. The watershed is located almost entirely within the Klamath National Forest and stretches north into the State of Oregon. The watershed has an elevation range of 1260 feet at the bridge site to 6432 feet at its highest peak.

The majority of the watershed is forested lands with the longest flow path of 13.6 miles and an average stream slope of 0.0723 ft/ft. The stream slope at the bridge site is approximately 0.0214 ft/ft.

The average annual precipitation based on the Oregon Climate Service Prism Program (Annual normal from 1981 to 2010) is approximately 65.9 inches.

Seiad Creek

Seiad Creek drains a watershed of approximately 27.0 square miles above the bridge site. The watershed has an elevation range of 1359.0 feet at the bridge site to 6740 feet at its highest elevation.

The majority of the watershed is within the Klamath National Forest which is heavily vegetated with Conifers with an understory of shrub, chaparral and grasses. The longest flow path is 10.1 miles with an average stream slope of 0.0646 ft/ft. The stream slope at the bridge site is approximately 0.0125 ft/ft.

The average annual precipitation based on the Oregon Climate Service Prism Program (Annual normal from 1981 to 2010) is approximately 52 inches.

Beaver Creek

Beaver Creek drains a watershed of approximately 109.0 square miles above the bridge site. The watershed is located almost entirely within the Klamath National Forest and stretches north into the State of Oregon. The watershed has an elevation range of 1750 feet at the bridge site to 7150 feet at its highest peak at Mt. Ashland in the State of Oregon.

The majority of the watershed is forested lands with the longest flow path of 19.9 miles and an average stream slope of 0.0514 ft/ft. The stream slope at the bridge site is approximately 0.021 ft/ft.

The average annual precipitation based on the Oregon Climate Service Prism Program (Annual normal from 1981 to 2010) is approximately 38 inches.

Discharge

Thompson Creek

The watershed modeling system, "WMS" program in conjunction with the National Flood Frequency Equation, "NFF" was used to calculate a 50-year discharge of 9935 cubic feet per second and a 100-year discharge of 12,205 cubic feet per second.

Seaid Creek

The watershed modeling system, "WMS" program in conjunction with the National Flood Frequency Equation, "NFF" was used to calculate a 50-year discharge of 6155 cubic feet per second and a 100-year discharge of 7513 cubic feet per second.

Beaver Creek

The watershed modeling system, "WMS" program in conjunction with the National Flood Frequency Equation, "NFF" was used to calculate a 50-year discharge of 15,154 cubic feet per second and a 100-year discharge of 18,576 cubic feet per second.

Stage, Velocity and Waterway

Thompson Creek

The Thompson Creek Bridge is located approximately 600 feet upstream from the Klamath River. During major storm events the Thompson Creek Bridge will experience

back water effects from the Klamath River reducing the waterway capacity of the bridge. The bridge was modeled with and without the backwater effects from the Klamath River.

The U.S. Army Corps of Engineers Hydrologic Engineering Center-River Analysis System (HEC-RAS) program was used to perform a one-dimensional hydraulic analysis to calculate the water surface elevations and velocity for the existing structure.

The General Plans submitted by Structure Design was referenced to acquire the planned deck elevation height. The proposed freeboard is measured from the water surface elevation to the lowest chord of the soffit of the structure, 1255.91 feet. The parameters used to model the existing structure included a 50 and 100-year discharge of 9935 and 12,205 cubic feet per second respectively; a manning's roughness coefficient of 0.045 for the main channel and a channel slope of 0.0214 ft/ft. The results are as follows:

Existing Thompson Creek bridge without backwater effects.

	WSEL	Average Velocity	Available Freeboard
50-year Design Flood 9935 cfs	1255.29 ft	11.79 fps	**0.62 ft**
100-year Base Flood 12,205 cfs	1256.66 ft	12.44 fps	**-0.75 ft**

With a minimum soffit elevation of 1255.91 feet, the existing structure does not have adequate freeboard for both the design flood (50-year discharge) and the base flood (100-year discharge). There is a history of heavy debris with drift getting caught at all piers and on several girder flanges which confirms little to no freeboard during major storm events.

Existing Thompson Creek bridge with backwater effects from Klamath River.

	WSEL	Average Velocity	Available Freeboard
50-year Design Flood 9935 cfs	1262.96 ft	8.63 fps	**-7.05 ft**

100-year Base Flood 12,205 cfs	1263.35 ft	10.60 fps	**-7.44 ft**

The Thompson Creek Bridge will be submerged for both the 50 and 100- year flood events due to the backwater effects from the Klamath River. Structure Hydraulics recommends that all associated widening should maintain the existing minimum soffit elevation. It is essential that the existing waterway area not be reduced.

Seaid Creek

The Seaid Creek Bridge is located approximately 500 feet upstream from the Klamath River. During major storm events the Seiad Creek Bridge will experience back water effects from the Klamath River reducing the waterway capacity of the bridge. The Seaid Creek bridge is located within the FEMA 100-year flood plain which is above the bridge deck. The bridge was modeled with and without the backwater effects from the Klamath River.

The U.S. Army Corps of Engineers Hydrologic Engineering Center-River Analysis System (HEC-RAS) program was used to perform a one-dimensional hydraulic analysis to calculate the water surface elevations and velocity for the existing structure.

The General Plans submitted by Structure Design was referenced to acquire the planned deck elevation height. The proposed freeboard is measured from the water surface elevation to the lowest chord of the soffit of the structure, 1368.70 feet. The parameters used to model the existing structure included a 50 and 100-year discharge of 6155 and 7513 cubic feet per second respectively; a manning's roughness coefficient of 0.045 for the main channel and a channel slope of 0.0125ft/ft. The results are as follows:

Existing Seiad Creek bridge without backwater effects.

	WSEL	Average Velocity	Available Freeboard
50-year Design Flood 6155 cfs	1370.73 ft	6.89 fps	**-2.03 ft**
100-year Base Flood 7513 cfs	1371.32 ft	8.40 fps	**-2.62 ft**

With a minimum soffit elevation of 1368.70 feet, the existing structure does not have adequate freeboard for both the design flood (50-year discharge) and the base flood (100-year discharge).

Existing Seiad Creek bridge with backwater effects from Klamath River.

	WSEL	Average Velocity	Available Freeboard
50-year Design Flood 6155 cfs	1376.03 ft	2.35 fps	**-7.33 ft**
100-year Base Flood 7513 cfs	1376.10 ft	2.83 fps	**-7.40 ft**

A large portion of the lower Seiad Valley will be submerged including the bridge for both the 50 and 100- year flood events due to backwater effects from the Klamath River.

Structure Hydraulics recommends that all associated widening should maintain the existing minimum soffit elevation. It is essential that the existing waterway area is not be reduced.

Beaver Creek

The Beaver Creek Bridge is located approximately 500 feet upstream from the Klamath River. During major storm events the Beaver Creek Bridge will experience back water effects from the Klamath River reducing the waterway capacity of the bridge. The bridge was modeled with and without the backwater effects from the Klamath River.

The U.S. Army Corps of Engineers Hydrologic Engineering Center-River Analysis System (HEC-RAS) program was used to perform a one-dimensional hydraulic analysis to calculate the water surface elevations and velocity for the existing structure

The General Plans submitted by Structure Design was referenced to acquire the planned deck elevation height. The proposed freeboard is measured from the water surface elevation to the lowest chord of the soffit of the structure, 1768.75 feet. The parameters used to model the existing structure included a 50 and 100-year discharge of 15,154 and 18,576 cubic feet per second respectively; a manning's roughness coefficient of 0.045 for the main channel and a channel slope of 0.021 ft/ft.

Existing Beaver Creek bridge without backwater effects.

	WSEL	Average Velocity	Available Freeboard
50-year Design Flood 15,154 cfs	1766.80 ft	22.07 fps	**1.95 ft**
100-year Base Flood 18,576 cfs	1768.31 ft	23.47 fps	**0.44 ft**

With a minimum soffit elevation of 1768.75 feet, the existing structure appears to have adequate freeboard for both the design flood (50-year discharge) and the base flood (100-year discharge). The freeboard may not be adequate due to the historical heavy debris in this area.

Existing Beaver Creek bridge with backwater effects from Klamath River

	WSEL	Average Velocity	Available Freeboard
50-year Design Flood 15,154 cfs	1767.83 ft	9.39 fps	**0.92 ft**
100-year Base Flood 18,576 cfs	1769.61 ft	9.95 fps	**-0.86 ft**

With a minimum soffit elevation of 1768.75 feet, the existing structure does not have adequate freeboard for both the design flood (50-year discharge) and the base flood (100-year discharge) due to the backwater effects from the Klamath River.

Structure Hydraulics recommends that all associated widening should maintain the existing minimum soffit elevation. It is essential that the existing waterway area is not reduced.

Streambed and Scour

Thompson Creek

According to a Preliminary Report from the Office of Geotechnical Engineering Services dated January 17, 2013, the streambed materials consists of a layer of alluvium of slightly compact to compact sandy gravel, cobbles, and boulders. Green,

slightly fractured to fractured serpentine with quartz veins underlies the alluvium.

According to the Caltrans Maintenance Records and a review of the historic stream sections the bridge at this site has experienced the following:

- In 1965, Span 3 was replaced extending it from 27 to 41 feet and Abutment 4 was completely reconstructed on bedrock after the original abutment had been undermined and settled substantially following a major flood in December 1964.

- In January, 1974 a major storm event washed out approximately 13.0 feet of the east approach embankment at Abutment 4, causing roadway closure. There was no structural damage and the embankment was replaced.

- The bridge has experienced scour with various levels of footing exposure at Abutment 1 and 4, Pier 2, and Pier 3, since 1965. Grouted RSP was installed at Abutment 1 in 1965 and at the Abutment 4 footing and upstream wing wall in 1974. Some channel improvement work at the bridge site as well as upstream and downstream of the channel was completed in 1997. All flows, except very high flows, have been channeled to flow through Span 2. Grouted RSP was also installed around Pier 2 and Pier 3 footings in 1997.

- There is a history of drift problems, especially at the top of the piers and on the bottom girder flanges, indicating high flows.

- In October 9, 2006 the Bridge's scour potential was assessed in accordance with FHWA Technical Advisory T5140.23, "Evaluating Scour at Bridges" and within current Caltrans guidelines. After consulting with Geotechnical support it was determined the foundation material supporting Piers 2, 3 and Abutment 4 were founded on serpentine bedrock and not scour critical. Furthermore grouted rock slope protection (GRSP) was installed at Abutment 1 following the 1964 flood and continues to be in good condition. The (GRSP) has performed adequately especially during major storm events and provides adequate protection for Abutment 1 against scour. Therefore the bridge was determined to be not scour critical. The item 113 code was changed to 5, "Bridge foundations determined to be stable for assessed or calculated scour condition. Scour determined to be within the limits of footing or piles by assessment, (i.e. bridge foundations are on rock formation that have been determined to resist scour within the service life of the bridge), or by installation of properly designed countermeasure".

The potential local pier scour was calculated with the results tabulated below:

	Scour	Total Scour Elevation
Abutment 1- if countermeasure fails	4.0 ft	1253.10 ft

Pier 2	10.8 ft	1244.58 ft-Bottom of footing
Pier 3	9.23 ft	1240.31 ft-Bottom of footing
Abutment 4	4.0 ft	1251.29 ft

It is important to note that the material under Abutment 1 is not scour resistant and if the countermeasure would fail the Abutment could be undermined. The existing countermeasure should be inspected on a regular basis, especially during major storm events. Structure Design should consider lowering the bottom of the footing at Abutment 1 for the proposed widening by 5 feet, (elevation 1250 feet) to accommodate for any future abutment scour. The existing scour countermeasure should also be extended to accommodate the proposed widening. The potential local pier scour for Pier 2 and 3 was below the bottom of the footing elevations, but because they are on competent rock the scour would not undermine the footings.

According to correspondence received on 12/30/2014 from Mr. Ronald Richman with the Division of Geotechnical Services, the location of rock is tabulated below:

	Elevation of Rock
Abutment 1	1243 ft and below
Pier 2	1243 ft and below
Pier 3	1244 ft and below
Abutment 4	1244 ft and below

All new foundations for Pier 2, 3 and Abutment 4 should be founded on competent bedrock and the final footing elevations should be consulted with the Structure Foundations Branch. The Structure Foundations Branch should also be consulted for additional information on how competent is the foundation material. If the Structure Foundations Branch confirms that the material under the footings are all supported on bedrock than Structure Hydraulics does not have any scour concerns.

District Hydraulics has completed a Preliminary Rock Slope Protection Recommendation, dated 2/26/2014. They have recommended that 1/4 ton RSP be installed at the Abutments and Piers of the proposed widening.

Seiad Creek

According to a Preliminary Report from the Office of Geotechnical Engineering Services dated January 17, 2013, the streambed materials consists of a layer of alluvium of sand gravel, cobbles and boulders. Bedrock described as "partially decomposed granitic intrusive" was encountered at approximately 17 to 23 feet from the surface.

According to the Caltrans Maintenance Records and a review of the historic stream sections from 1954 to present, the bridge at this location has experienced the following:

- The bridge has a history of aggradation requiring the channel to be excavated to provide for adequate clearance. According to the maintenance records the channel was previously excavated in 1955, 1964 and 1986.

- The bridge has a history of scour at the upstream wingwalls and the pile caps at Abutment 1, Piers 2 and 3 have experienced different levels of exposure. Most recently Pier 2 has approximately 8 inches of footing exposure and Pier 3 approximately 6 inches of footing exposure.

- Large amounts of drift getting caught up at Abutment 1, Pier 2 and 3 has been a continuous problem.

- A flood of record occurred in January, 1997 coming within inches of overtopping the deck. The historical flood caused substantial deposition under the bridge, the road approaches were inundated and large amounts of drift accumulated at the face of the bridge. There was an emergency contract that consisted of excavating the channel, removing all the drift and installing rock slope protection at the abutments and piers.

- The existing channel is heavily vegetated, with steep berms on both upstream and downstream banks. There is active erosion along the stream bank upstream of Abutment1 and downstream of Abutment 4. The low flow portion of the channel follows an "S" curve through the bridge with erosion outside of each bend.

Seiad Creek is subject to back water effects due to its proximity to the Klamath River. Typically high flows tend to cause deposition while low flows tend to cause scour, mainly at the bridge piers.

The Structure Maintenance Ratings Section had reviewed this structure and concluded as follows: "the bridge foundations were stable if both piers no longer resisted lateral loading and pier scour had occurred to elevation 1349.0 feet. However, it is imperative for the stability of the structure that the abutment foundations and surrounding material remain intact. Future consideration for countermeasures should be made if scour or degradation occurs below the abutment footings".

In March, 1998 the Bridge's scour potential was assessed in accordance with FHWA Technical Advisory T5140.23, "Evaluating Scour at Bridges" and within current Caltrans guidelines, the bridge was determined to be not scour critical. The item 113 code was changed to 5, "Bridge foundations determined to be stable for calculated scour

conditions, scour within limits of footing or piles."

The potential local pier scour was calculated with the results tabulated below:

	Scour	Total Scour Elevation
Abutment 1	6.0 ft	1357.58 ft
Pier 2	9.37 ft	1351.99 ft
Pier 3	9.79 ft	1350.89 ft
Abutment 4	6.0 ft	1357.25 ft

Structure Hydraulics recommends that all new foundations for the proposed widening should be designed assuming no ground support (lateral or vertical) as a result of soil loss due to possible future scour calculated above. Structure Design should confirm the competence of the material supporting the piles if they are to be embedded into the bedrock.

According to correspondence received on 12/30/2014 from Mr. Ronald Richman with the Division of Geotechnical Services, the location of rock is tabulated below:

	Elevation of Rock
Abutment 1	1348 ft and below
Pier 2	1346 ft and below
Pier 3	1346 ft and below
Abutment 4	1348 ft and below

District Hydraulics has completed a Preliminary Rock Slope Protection Recommendation, dated 2/26/2014. They have proposed installing 1/4 Ton RSP for the existing Abutments and Piers, at the lower half of the stream bank upstream of Abutment 1 and downstream of Abutment 4. The RSP would also extend to cover the proposed widening.

Beaver Creek

According to the Preliminary Report from the Office of Geotechnical Engineering , the streambed materials consists of a layer of alluvium of sand gravel, cobbles and boulders. A serpentnite outcrop along the road cut was observed approximately 300 feet east of the bridge site. Based on this observation the Geotechnical Branch assumed that the bedrock depth was shallow at this site. No field investigation or testing was conducted and there is no As-Built Log of Test Borings for this site.

According to the Caltrans Maintenance Records and a review of the historic stream

sections the bridge at this site has experienced the following:

- The main channel flow is within span 1 between Abutment 1 and Pier 2. There is re-occurring minor scour at Abutment 1. In 1987 the right edge of the Abutment 1 footing was exposed. It appears that this minor scour problem never worsened and no scour problems were ever mentioned after 1987.

- According to the historical stream sections, since 1931 there has approximately 10 feet of aggradation in span 2 and 3.

- Large amounts of drift getting caught up at Pier 2 has been a continuous problem requiring removal.

- In May, 1996 the Bridge's scour potential was assessed in accordance with FHWA Technical Advisory T5140.23, "Evaluating Scour at Bridges" and within current Caltrans guidelines, the bridge was determined to be not scour critical. The item 113 code was changed to 8, "Bridge foundations determined to be stable for assessed or calculated scour conditions; calculated scour is above top of footing."

The potential local pier scour was calculated with the results tabulated below:

	Scour	Total Scour Elevation
Abutment 1	6.11 ft	1745.37 ft
Pier 2	8.57 ft	1745.66 ft
Pier 3	6.28 ft	1752.93 ft
Abutment 4	3.12 ft	1758.11 ft

According to correspondence received on 12/30/2014 from Mr. Ronald Richman with the Division of Geotechnical Services, the location of rock is tabulated below:

	Elevation of Rock
Abutment 1	1718 ft and below
Pier 2	1706 ft and below
Pier 3	1749 ft and below
Abutment 4	1682 ft and below

Structure Hydraulics recommends that all new foundations to be designed assuming no ground support (lateral or vertical) as a result of soil loss due to possible scour. The footings should be founded on competent material and the final footing elevations should be consulted with the Structure Foundations Branch.

The Structure Foundations Branch should also be consulted for additional information on how competent is the foundation material.

District Hydraulics has completed a Preliminary Rock Slope Protection Recommendation, dated 2/26/2014. They have proposed installing 1/2 Ton RSP at Abutment 1 and the proposed widening.

Drift

Thompson Creek

Thompson Creek Bridge has a high risk of debris loading attributed to the large forested areas. According to the maintenance Records, there is a history of drift consisting of trees and tree branches accumulating at Abutment 1 and Piers 2 and 3. Drift has also been noted at the tops of all bents and on several girder flanges indicating high water flow. The accumulation of drift at the piers could increase the local pier scour and could reduce the waterway area. It is recommended that Caltrans Maintenance remove any accumulation of drift, especially during major storm events.

Seiad Creek

Seiad Creek Bridge has a high risk of debris loading attributed to the large forested areas. According to the maintenance Records, there is a history of drift consisting of trees and tree branches accumulating at Abutment 1 and Piers 2 and 3. It is recommended that Caltrans Maintenance remove any accumulation of drift, especially during major storm events.

Beaver Creek

Beaver Creek Bridge has a high risk of debris loading attributed to the large forested areas. According to the maintenance Records, there is a history of drift consisting of trees and tree branches accumulating at Piers 2. The accumulation of drift at the piers could increase the local pier scour and could reduce the waterway area. It is recommended that Caltrans Maintenance remove any accumulation of drift.

Bank Protection

Thompson Creek

Any RSP to protect the banks will be designed by the District to protect the roadway approach fills, if required. The average velocity (See "Stage, Velocity and Waterway" section above) is provided to assist the District hydraulic engineers in the design of bank protection if necessary.

Seiad Creek

Rock Slope Protection was recommended after the flood of 1997 as part of the emergency repair contract. The RSP was either washed away due to inadequate design or never installed. Any additional RSP to protect the banks will be designed by the District to protect the roadway approach fills, if required. The average velocity (See "Stage, Velocity and Waterway" section above) is provided to assist the District hydraulic engineers in the design of bank protection if necessary.

Beaver Creek

There is no existing Bank protection at this bridge. Any additional RSP to protect the banks will be designed by the District to protect the roadway approach fills, if required. The average velocity (See "Stage, Velocity and Waterway" section above) is provided to assist the District hydraulic engineers in the design of bank protection if necessary.

Hydrologic Summary for Design Engineer

HYDROLOGIC SUMMARY FOR THOMPSON CREEK Br. No. 02-0068			
Drainage Area: 36.3 sqmi			
	Design Flood	**Base Flood**	**Overtopping Flood/Flood of Record**
Frequency	50-yr	100-yr	N/A
Discharge	9935 cfs	12,205 cfs	N/A
Water Surface Elevation at Bridge	1262.96 ft	1263.35 ft	N/A
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

HYDROLOGIC SUMMARY FOR SEIAD CREEK Br. No. 02-0072			
Drainage Area: 27.0 sqmi			
	Design Flood	**Base Flood**	**Overtopping Flood/Flood of Record**
Frequency	50-yr	100-yr	N/A
Discharge	6155 cfs	7513 cfs	N/A
Water Surface Elevation at Bridge	1376.03 ft	1376.10 ft	N/A
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

HYDROLOGIC SUMMARY FOR BEAVER CREEK Br. No. 02-0081			
Drainage Area: 109.0 sqmi			
	Design Flood	**Base Flood**	**Overtopping Flood/Flood of Record**
Frequency	50-yr	100-yr	N/A
Discharge	15,154 cfs	18,576 cfs	N/A
Water Surface Elevation at Bridge	1767.83 ft	1769.61 ft	N/A
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

INFORMATION HANDOUT

For Contract No. 02-4E6504
At 02-Sis-96-R52.5/88.4

Identified by
Project ID 0212000012

MATERIALS INFORMATION

Hydrology Summary

Dated July 8, 2016

Hydrology Summary

02-4E6504
0212000012
Sis-96-R52.5/88.4

Calculated By: Brett Ditzler, P.E.
Date: 7/8/16

REGISTERED PROFESSIONAL ENGINEER
BRETT L. DITZLER
No. 74085
Exp. 06-30-17
CIVIL
STATE OF CALIFORNIA

The following flows were calculated based on daily gage data within the June 1 to October 31 work window for Indian Creek, Beaver Creek, and Cottonwood Creek.

Work Window (June 1 to October 31) Return Period Flows

Return Period (years)	Thompson Creek (cfs)	Seiad Creek (cfs)	Beaver Creek (cfs)
2	170	130	240
5	300	230	270
10	410	310	300
25	570	440	330
50	720	560	360
100	890	690	380