DRAFT Project Report

Swain Slough Bridge on Pine Hill Road

Federal Project No. BRLO-5904 (112)
Existing Bridge No. 04C0173
New Bridge No. 04C0260

Prepared For:

County of Humboldt
Department of Public Works

Prepared By:

QUINCY ENGINEERING

October 2019

developing YOUR vision | delivering YOUR project

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VICINITY MAP

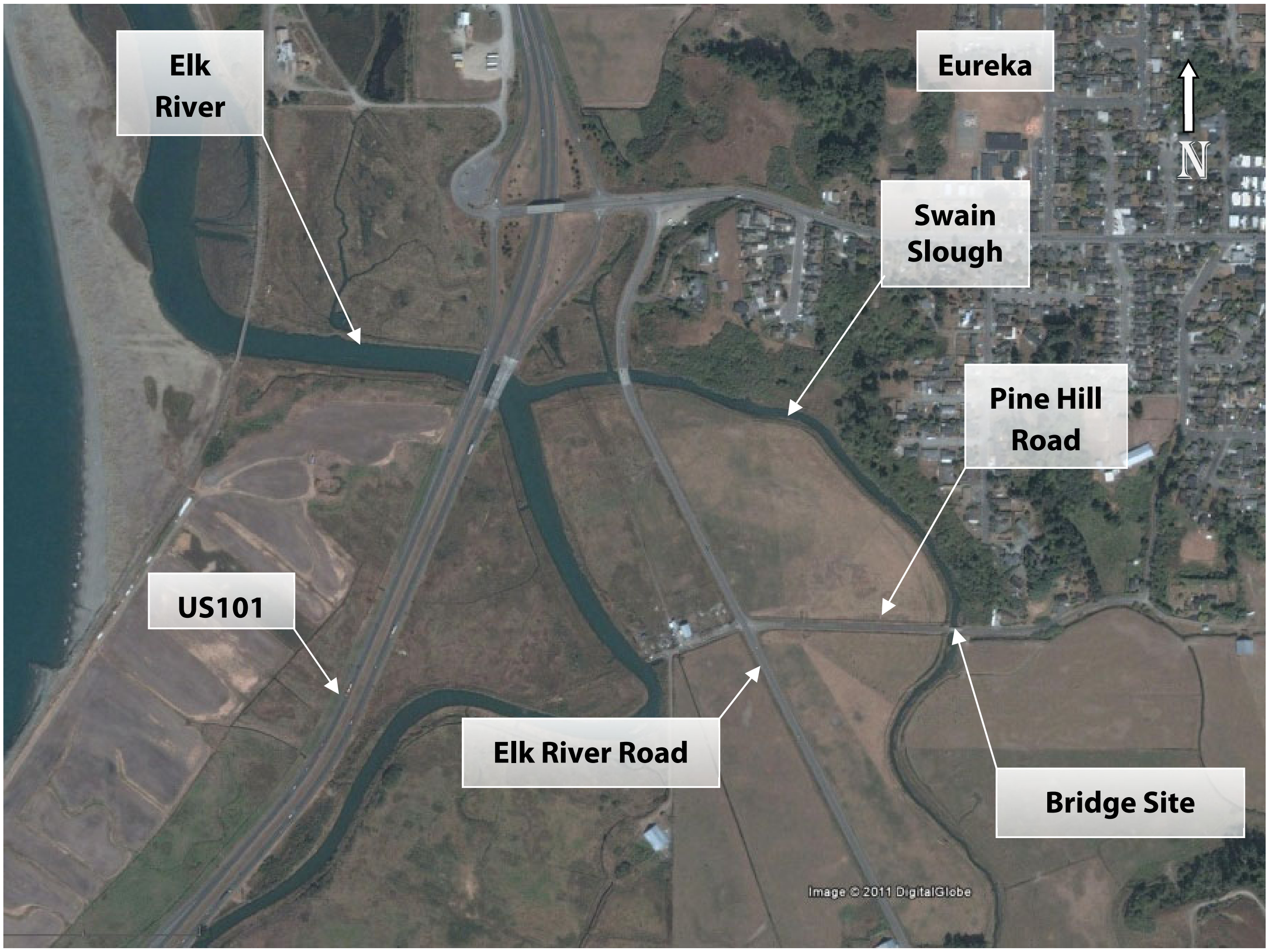

Photo 1 – Aerial View of Project Site (From Google Earth)

EXECUTIVE SUMMARY

Humboldt County Department of Public Works is proposing to replace the Swain Slough Bridge (Bridge No. 04C-0173) at Pine Hill Road. The existing bridge is located just south of Eureka on Pine Hill Road (a local rural two-lane road) approximately 0.2 miles east of Elk River Road. Pine Hill Road provides the access across Swain Slough for local residences to Elk River Road.

The purpose of this project is to improve public safety by providing a safe and permanent solution for traffic to cross Swain Slough. This will be accomplished by replacing the existing structurally deficient, three-span timber-stringer bridge with a new single-span concrete structure. The existing bridge has been in service since 1955 and is currently classified as structurally deficient. Due to poor sufficiency rating, the existing bridge qualifies for Federal funding.

Pine Hill Road is classified as a Local Road which qualifies for 100% reimbursement of the bridge replacement cost from federal aid. Other costs of the rehabilitation project such as preliminary engineering, right-of-way, and others are funded by the Federal Highway Bridge Program (HBP) which will provide approximately 100% of the total project cost.

This project is currently scheduled to begin construction of the new bridge in spring of 2020. Traffic will be detoured 1.6 miles during construction while the new bridge is constructed on the existing roadway alignment. Full closure of Pine Hill Road at the location of the bridge is anticipated for construction, which allows the use of the paved approach roadways to be used as construction staging area. This allows minimal construction footprints reducing environmental impacts to Swain Slough. Traffic will then be permanently shifted onto the new structure once construction is completed.

The existing facility consists of a three-span simply supported timber-stringer structure, with concrete deck and curbs. According to the latest Bridge Inspection Report (BIR), the bridge length is approximately 63’ long with three equal length spans of approximately 21’ and the bridge width is approximately 20’. The substructure consists of reinforced concrete abutments and reinforced concrete bent cap on pile extensions. The BIR also notes the deteriorating condition of the bridge; with 11 out of the 20 timber bridge railing posts as well as the top 1” of the north exterior girder showing signs of rot and moderate to severe vertical cracking on concrete piles extensions. The existing facility has been designated as structurally deficient with a 2017 sufficiency rating of 42.6 and a superstructure rating of 4.

This project will improve public safety by replacing this structurally deficient bridge. It will also improve traffic operations by widening the bridge to provide 10’ lanes and 5’ shoulders in each direction and replace all traffic safety features to meet current standards. Rehabilitation and widening of the existing bridge is cost prohibitive and not considered feasible.

Replacing the bridge on the existing alignment was chosen due to the lowest construction cost, least environmental impacts, speed of construction, and least new right-of-way needs. With the detour only being approximately 1.6 miles, the most practical and cost-effective roadway alignment was to close Pine Hill Road for one construction season and replace the bridge on its existing alignment.

There were two bridge types considered for this project location:

- The Single-Span Precast Wide-Flange Concrete Girder bridge is recommended as it will not require falsework to construct and will eliminate the need for any piers within the limits of the Slough. This alternative will reduce construction time due to wide flange girders precast off project location and available for erection immediately. Precast manufacturer has confirmed the viability of shipping this length of girders to project site. In addition, this alternative lends to a structure depth that will conform to the proposed roadway profile and will not encroach on the channel hydraulic highwater surface elevation. Furthermore, this alternative will decrease the environmental impacts on an environmentally sensitive area. Based on constructability, functionality, economic considerations and local boundary conditions, a single span precast- prestressed concrete girder is a viable structure alternative for this project.
- A Single-Span Cast in Place Post-Tensioned Box Girder bridge was also considered for this project because it can provide the same minimum structure depth to adhere to the hydraulic requirements without raising the proposed profile. Similar to the preferred precast alternative, this option is also single span and would preclude the need for piers within the slough. However, the cast in place construction would require falsework which will most likely require driven piles during construction which will further disturb the environmentally sensitive slough. A bridge General Plan for this option is included in Appendix G for further reference.

Based on the information contained in this project report, the project development team recommends replacing the bridge on existing alignment utilizing a Single-Span Precast Prestressed Reinforced Concrete Wide Flange Girder bridge. This alternative meets the project goals, reduces construction schedule duration, is cost competitive, and minimizes temporary and permanent environmental and right-of-way impacts from the project.

The project costs for constructing the recommended structure type/alignment is summarized as follows:

Project Construction Cost	
Structure Construction	$1,206,000
Bridge Removal	$50,4000
Slope Protection	$25,000
Channel Work	$40,000
Detour	$10,000
Approach Roadway	$499,000
Mobilization	$183,000
Total	**$2,013,000**

Project Costs	
PE	$500,000
CON	$2,000,000
CE	$300,000
CONT	$500,000
RW	$50,000
TOTAL	**$3,350,000**

The project development schedule is summarized as follows:

Project Milestone	Proposed Delivery Date
Environmental Document Approval	July 2016
Plans, Specifications & Estimate	January 2020
Project Permits Secured	December 2019
Utility Coordination and Right-of-Way	December 2019
Advertise Project	March 2020
Award Contract	May 2020
Project Construction	June 2020 – October 2020

The project team recommends approval of the project report and continuing the project to develop the final PS&E package leading to construction of a replacement bridge.

INTRODUCTION

Humboldt County Department of Public Works is proposing to replace the Swain Slough Bridge (Bridge No. 04C-0173) at Pine Hill Road. The existing bridge is located just south of Eureka on Pine Hill Road (a local rural two-lane road) approximately 0.2 miles east of Elk River Road. Pine Hill Road provides the access across Swain Slough for local residences to Elk River Road.

The purpose of this project is to improve public safety by providing a safe and permanent solution for traffic to cross Swain Slough. This will be accomplished by replacing the existing structurally deficient, three-span timber-stringer bridge with a new single span concrete structure. The existing bridge has been in service since 1955 and is currently classified as structurally deficient. Due to poor sufficiency rating, the existing bridge qualifies for Federal funding.

Pine Hill Road is classified as a Local Road which qualifies for 100% reimbursement of the bridge replacement cost from federal aid. Other cost of the rehabilitation project such as preliminary engineering, right-of-way, and others are funded by the Federal Highway Bridge Program (HBP) which will provide approximately 100% of the total project cost.

This project is currently scheduled to begin construction of the new bridge in spring of 2020. Traffic will be detoured 1.6 miles during construction while the new bridge is constructed on the existing roadway alignment. Full closure of Pine Hill Road at the location of the bridge is anticipated for construction, which allows the use of the paved approach roadways to be used as construction staging area. This allows minimal construction footprints reducing environmental impacts to Swain Slough. Traffic will then be permanently shifted onto the new structure once construction is completed.

EXISTING FACILITY

The existing facility consists of a three-span simply-supported timber-stringer structure, with concrete deck and curbs. According to the latest Bridge Inspection Report (BIR), the bridge length is approximately 63' long with three equal length spans of approximately 21' and the bridge width is approximately 20'. The substructure consists of reinforced concrete abutments and reinforced concrete bent cap on pile extensions. The BIR also notes the deteriorating condition of the bridge; with 11 out of the 20 timber bridge railing posts as well as the top 1" of the north exterior girder showing signs of rot and moderate to severe vertical cracking on concrete piles extensions, as shown in Figure 1. The existing facility has been designated as structurally deficient with a 2017 sufficiency rating of 42.6 and a superstructure rating of 4.

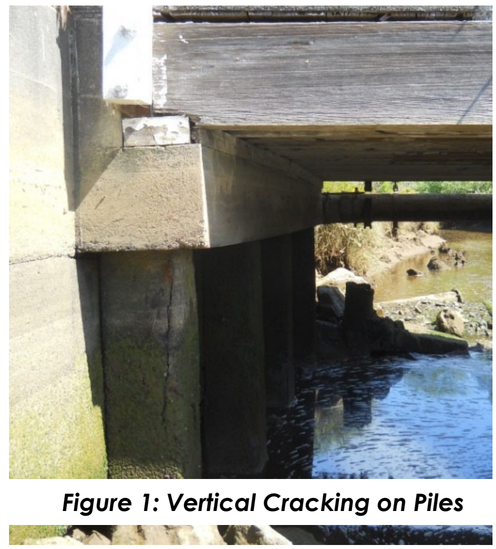

Figure 1: Vertical Cracking on Piles

DESIGN CRITERIA

All alternatives must meet the following criteria:

- **<u>Roadway Design</u>**
  Roadway design will be based on *"**AASHTO Policy on Geometric Design of Highways and Streets 2011, 6th Edition Green Book**"* along with County standards where appropriate.

- **<u>Bridge Design</u>**
  Final bridge design will be performed in accordance with ***"AASHTO LRFD Bridge Design Specifications, Sixth Edition, and the Caltrans Amendments preface dated November 2011"***. The latest updated versions of Caltrans bridge design manuals will also be utilized when applicable.

- **<u>Seismic Design</u>**
  Seismic design will be performed in accordance with the Caltrans ***"Seismic Design Criteria Version 1.6 November 2010"*** and the latest information available from Caltrans Earthquake Research.

- **<u>Hydraulic Analysis</u>**
  The ***Caltrans "Local Assistance Procedures Manual"*** requires that the bridge soffit be 2' above the 50-year flood elevation and that the bridge be capable of conveying the 100-year flood or the flood of record.

ROADWAY ALTERNATIVES

Figure 2: Looking East & West on Pine Hill Road

Replacing the bridge on the existing alignment was chosen due to the lowest construction cost, least environmental impacts, speed of construction, and least new right-of-way needs. With the detour only being approximately 1.6 miles, the most practical and cost-effective roadway alignment was to close Pine Hill Road for one construction season and replace the bridge on its existing alignment. Building the new bridge either upstream or downstream of the existing bridge, or staging the new bridge construction to keep the existing bridge open during construction would result in significantly more impacts to the channel, wetlands, and farmlands.

The existing roadway has 10’ traffic lanes with minimal shoulders. The 2009 traffic counts recorded an Average Daily Traffic (ADT) of 341 vehicles per day, which increases to 582 vehicles per day in 2036 at a 2% per year increase. The proposed road and bridge cross section will consist of 10’ lanes, 5’ shoulders, 2' choker, and 2' for barrier railing for a total width of 34'. This is 14' wider than the existing 20' wide structure. 1.5:1 side slopes will be utilized to further reduce impacts to the adjacent wetlands and farmlands. This configuration is in conformance with AASHTO’s *Guidelines for Geometric Design of Highways and Streets* and the *2012 Humboldt County General Plan*. This 30' clear width meets the minimum design standard when considering functional classification, design speed, and terrain for the project location.

The roadway classification for Pine Hill Road is a local rural road in flat terrain. Given the context of the existing roadway within the project limits and the need to raise the vertical profile for hydraulic concerns, a 35-mph proposed design speed is appropriate. This speed satisfies AASHTO standards Exhibit 5-1 for local roads and satisfies AASHTO’s *Policy on Geometric Design of Highways and Streets* guidelines.

The general alignment of Pine Hill Road through the project site is an east-west direction. There are no significant obstacles or small radius curves to reduce the stopping sight distance. This allows for the bridge to be constructed on the existing alignment with no skew.

The existing profile along the bridge deck must be raised approximately 3’ vertically to meet the slough hydraulic and tidal change requirements. The minimum soffit elevation is required to be at or above the King Tide elevation of 8.5’, per WRECO’s hydraulics evaluations. In order to accomplish vertical change and stay within the AASHTO guidance for profile grade and vertical curves that meet the 35-mph design speed, the proposed roadway profile uses a 120’ long sag curve leading into a 180’ long crest curve and ending with a 160’ long sag curve.

Levees are located at the southeast, northwest, and southwest corners of the existing bridge. These levees are maintained by the property owners and the project will not be making improvements to the levees. A minimal amount of conforming at the levees to accommodate the raising of the bridge grade is anticipated.

Approach Guardrail

The existing bridge has no approach guard railings or attached end treatments. This bridge replacement project will significantly improve the roadway approach features by protecting each corner of the new bridge with a conventional end treatment system.

STRUCTURE ALTERNATIVES

Single-Span Precast Prestressed Reinforced Concrete Wide-Flange Girder

The single-span precast wide-flange concrete girder bridge is recommended as it will not require falsework to construct and will eliminate the need for any piers within the limits of the slough. This alternative will reduce construction time due to wide flange girders precast off-project location and available for erection immediately. The precast manufacturer has confirmed the viability of shipping this length of girders to project site. In addition, this alternative lends to a structure depth that will conform to the proposed roadway profile and will not encroach on the channel hydraulic highwater surface elevation. Furthermore, this alternative will decrease the environmental impacts on an environmentally sensitive area. Based on constructability, functionality, economic considerations and local boundary conditions, a single-span precast prestressed concrete girder is a viable structure alternative for this project.

Rejected Structure Alternative

A single-span cast in place post-tensioned concrete box girder bridge was also considered for this project because it can provide the same minimum structure depth to adhere to the hydraulic requirements without raising the proposed profile. Similar to the preferred precast alternative, this option is also single-span and would preclude the need for piers within the slough. However, the cast in place construction would require falsework which will most likely require driven piles during construction which will further disturb the environmentally sensitive slough. A bridge General Plan for this option is included in Appendix G for further reference.

Based on the information contained in this project report, the project development team recommends replacing the bridge on existing alignment utilizing a single-span precast prestressed reinforced concrete wide flange girder bridge. This alternative meets the project goals, reduces construction schedule duration, is cost competitive, and minimizes temporary and permanent environmental, and right-of-way impacts from the project.

A permanent sheet piling system will be constructed around the new bridge footing which will eliminate the need for Rock Slope Protection (RSP) to protect the abutment. The width between the abutments of the existing bridge is approximately 58.5'. The width between the sheet piling is 65.5' for an overall channel widening of 7.0'. The channel will be widened 1.7' on the easterly bank and 5.3' on the westerly bank. All existing RSP will be removed from the channel.

Bridge Railing

With the proposed 35 mph design speed along Pine Hill Road, metal bridge railing is proposed instead of conventional concrete barriers which are more commonly associated with higher speed conditions. Concrete Bridge Railing (Type 85 Modification) will be mounted on top of the bridge edge of deck. To accommodate the thickness of the metal rail elements and still maintain a 30' clear width, the overall proposed structure width will be 34' – 0".

DESIGN EXCEPTIONS

A single design exception for hydraulic freeboard will be required. The basic rule for hydraulic design of bridges is that they should be designed to pass the two percent (2%) probability flood or tide (Q50) or the flood-of-record, whichever is greater without causing objectionable backwater, excessive flow velocities, or encroaching on through traffic lanes. Sufficient freeboard, the vertical clearance between the lowest structural member, and the water surface elevation of the design flood should be provided. A minimum freeboard of 2' is often assumed for preliminary bridge design. An evaluation should be performed to determine, if horizontal and vertical driftway requirements warrant a modified freeboard. The freeboard for controlled flow waterways, such as irrigation canals, shall be required by the regulatory agency having jurisdiction.

- The final design should be able to convey the base flood, Q100.
- The base flood (Q100) or overtopping flood, whichever is greater shall be used to evaluate the costs, risks and impacts associated with encroachments on the 100-year base flood plain.
- Construction projects in areas vulnerable to Sea Level Rise to begin planning for potential impacts by considering a range of SLR scenarios for the years 2050 and 2100

The non-standard design element is hydraulic clearance. The bridge deck has been designed to remain dry during the 100-year flow. Swain Slough, Martin Slough, and Elk River all become one large backwater during high flow events. This backwater is made worse during a high flow coupled with a Humboldt Bay high tide. Conveyance under the bridge is not a factor as each of these waterways go out of bank during the high flows. The bridge as designed does not cause objectionable backwater and does not provide freeboard due to drift.

The approach roadways leading to the bridge become inundated during the high flows. The bridge is not accessible from the adjacent County roads during flood events and the County has no plans to improve the approach roadways to meet standard flood elevation.

The bridge has been designed to accommodate a future raise if Sea Level Rise becomes an issue in the future. The footing has been sized for a taller bridge and jacking points have been detailed to facilitate raising this single span bridge.

DRAINAGE

Existing drainage patterns will generally be preserved. Drainage along the northeastern side of Pine Hill Road generally flows to the northeast corner of the bridge and into Swain Slough. An existing ditch will be re-graded with a new pipe and energy dissipating device added to enhance this system. The drainage patterns at the southeast corner of the bridge will not change as it currently sheet flows off the roadway and into Martin Slough. The existing pipe beneath the westerly approach will be replaced with a new 18" pipe which will maintain the existing drainage patterns. Water flows into the southwest field through a breech in the levee and flows towards the bridge. A portion of the flow crosses into the northwest field via the existing pipe, and a portion overtops the road at the midpoint between the Swain Slough Bridge and Elk River Road. The water then flows to a depressed area along the northwest levee before re-entering Swain Slough midway between the Swain Slough Bridge and the Elk River Road Bridge. The construction of the Swain Slough Bridge will not alter these preexisting drainage patterns.

TRAFFIC CONTROL/DETOUR

The County has indicated that it will be acceptable to close the existing roadway and detour traffic during construction of the replacement bridge and the approach roadway. Detour to Meyers Avenue, just northeast of the facility, may be used by local residence living near the existing facility during construction.

CONSTRUCTION METHODS AND CONTRACTOR ACCESS

It is anticipated that excavators, dozers, cranes, dump trucks, concrete trucks, concrete pumps, pile driving hammers, and pile drilling equipment may be required to remove the existing bridge and construct the new bridge. Construction is anticipated to be completely within one construction season. With a full road closure in place, contractor will have access to the project site from both embankments. The Contractor will use the approach roadways as the staging area which will reduce the environmental impacts to the project area. No staging of equipment will occur in the wetland or agricultural areas.

Some dewatering of the sheetpile cofferdam will be required. The contractor will utilize temporary tanks that will be staged on the existing asphalt roadway approaches. The water that is collected will be disposed of offsite.

Settlement due to embankment construction is anticipated. The contractor will add approximately 1' of additional fill to the each of the approaches along with a settlement monitoring system to determine the quantity and duration of settlement. Once the settlement has occurred, the additional fill will be removed.

Removal of the concrete bridge piers will be accomplished at a very low tide by excavating around each pier, pulling each pier over with an excavator, breaking it off below the mud line, and removing them from the slough channel. No concussive hammering of the existing concrete piers during demolition is required. The excavated pier pits will be backfilled with the sediment removed or with clean gravel after demolition. Installing sheet piling around the piers to contain sediment was investigated but was discarded as this will cause more disturbance to the channel than the described method.

In-channel work is limited and will consist of removal of the existing columns, removal of trash and debris from the channel, and the removal of sediment from in front of the sheet piling. All in-channel work will be performed at low tide with minimal flow in Swain Slough. There is no work and/or impacts to Martin Slough.

Work is anticipated to occur during daylight hours.

RIGHT-OF-WAY

The project site is located adjacent to four parcels that have several owners. Right-of-way will be required from three of the four parcels and will include Temporary Construction Easements (TCEs) and Permanent Roadway Easements (PREs). The following table details the APN, Owners, and needed R/W types:

APN	OWNER	R/W Type
302-181-008-000	PRIOR ROBERT D TR	PRE, TCE
302-151-019-000	CHAMBERLAIN ANDREW SUCTR	PRE, TCE
302-151-020-000	JACOBSON LOU & ELIZABETH	TCE

UTILITIES

The Humboldt Community Services District (HCSD) owns and operates a 12" water line that is connected to the north side of the existing Swain Slough Bridge. This water line serves the Humboldt Hill area. HCSD requires this water line remain in service due to the lack of a redundant loop facility within their system.

Figure 3: Existing Water Line

HCSD will be relocating this waterline using Horizontal Directional Drilling (HDD) that will occur before the construction of the new bridge. The alignment of the new water line has been coordinated with the design of the new bridge and will not be in conflict once it has been relocated. HCSD will include BMPs in the project and will provide details of the process to address the Coastal Commission concerns including “frac-out”.

ENVIRONMENTAL/PERMITS

The replacement of the Swain Slough Bridge will require both CEQA and NEPA clearances. As the delegated Federal Highway Administration lead agency due to the use of federal funds, Caltrans has determined that the project is a NEPA Categorical Exclusion under 23 CFR 771.117(d): activity (d)(13). Humboldt County as the CEQA lead agency has determined that this project fits the definition of a Class 2 Categorical Exemption (CEQA Guidelines, Section 15302) as it involves the replacement of an existing public facility on the same site with the same purpose and capacity as the structure being replaced. Furthermore, this project has been analyzed under both CEQA and NEPA and it has been determined that the project, as designed, will not adversely impact air quality, water quality, historical or cultural resource, or any other environmental area. The project will improve vehicular/pedestrian/bicyclist safety and reduce the potential of accidents and injuries. This project fits within the definition of the Class 2 Categorical Exemption as set forth in CEQA Guidelines, Section 15302. Additionally, Humboldt County has determined that none of the exceptions to the Categorical Exemptions set forth in CEQA Guidelines, Section 15300.2, apply. As such, Humboldt County has concluded that this Categorical Exemption applies to this project.

The technical studies to support these determinations include:

Cultural Resources

An Archaeological Study Report (ASR) and Historic Property Study Report (HPSR) were prepared in January of 2013 and it was determined that there are no cultural or historical resources within the project area, therefore there will be No Historic Properties Affected by the project.

Biological Resources

A Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) was submitted to the National Marine Fisheries Service (NMFS) to address potential impacts to federally listed fish species. NMFS completed the Section 7 consultation and issued a Biological Opinion on September 25, 2015 which concluded that the project is likely to adversely affect Northern California DPS steelhead, SON CC ESU coho salmon, and California Coastal ESU Chinook salmon, but is not likely to jeopardize the species. NMFS also concluded the project is likely to result in an adverse effect to critical habitat for the Coastal SON CC ESU coho salmon, California ESU Chinook salmon ESU, and the Northern California DPS steelhead. The project is not likely to destroy or adversely modify critical habitat. In the Biological Opinion (BO), the National Marine Fisheries Service determined that incidental take would occur to all three salmonid species in the form of capture during fish relocation and by exposure to lethal noise levels resulting from pile driving. NMFS expects no more than one juvenile of each species to be injured and no more than two juveniles of each species will be killed as a result of constructing the project. NMFS also concluded that the project would adversely affect Essential Fish Habitat for Pacific salmon species. While the proposed action contains measures to minimize adverse effects to EFH, NMFS provided additional conservation measures to further offset the adverse effects.

The BA/EFHA was also submitted to the U.S. Fish and Wildlife Service (USFWS) to address potential impacts to the federally listed tidewater goby. The USFWS completed the Section 7 consultation and issued a Biological Opinion on September 24, 2015 which concluded that the project is likely to adversely affect the species but is not likely to jeopardize the species. They also concluded the project action area is not located within designated critical habitat for the species. In the BO, USFWS determined that incidental take would occur to tidewater goby in the form of capture during fish relocation and/or during dewatering activities. The USFWS expects no more than five adult gobies to be injured or killed as a result of constructing the Project. Conservation measures to reduce impacts to salmonids and gobies will be followed and are included in the attached Environmental Commitment Record (ECR).

A Natural Environment Study was prepared in October 2014 and included a wetland delineation. The delineation found that U.S. jurisdictional waters and three-parameter wetlands occupy 0.989 acres of the BSA. State jurisdictional waters and two- and one-parameter coastal wetlands occupy 1.165 acres of the BSA. The project design minimized impacts on wetlands to the extent practicable. All other design considerations would have a greater impact on wetlands. Since the project design with the least impact on wetlands was selected, the project is in compliance with the Wetlands Only Practicable Finding Alternative. Minimization measures to reduce impacts on wetlands and waters are included in the ECR. A Wetlands Mitigation and Monitoring Plan shall be prepared and provided to the U.S. Army Corps of Engineers, North Coast RWQCB, California Coastal Commission, and the CDFW for review and approval.

Farmlands

The project will have no permanent impact on prime or unique farmland. Temporary impacts on non-prime agricultural land will be less than significant.

Floodplain

The project will not result in any longitudinal or significant encroachment on the 100-year flood plain.

Other Environmental Considerations

Review of the project site and project plans indicate that the project would not result in substantial adverse impacts to the visual environment. Other than a temporary increase in ambient noise from heavy equipment working during construction hours there are no long-term sound impacts associated with the project. Upon project completion, noise levels will return to pre-construction ambient levels. There are no known hazardous waste issues in the project area.

Permits

• 404 Permit from the U.S. Army Corps of Engineers

• 401 from the Regional Water Quality Control Board

• 1602 from the Department of Fish and Wildlife

• Coastal Development Permit from the California Coastal Commission

GEOTECHNICAL/FOUNDATIONS

SHN Consulting Engineers & Geologist submitted a preliminary foundation memorandum for the proposed bridge on September of 2012 shown in Appendix I. Foundations for the abutments will most likely consist of Caltrans Class-45 standard driven pile foundations. A Preliminary Foundation Report will be provided prior to the design phase of the project.

SEISMIC

The project site is located within one of the most seismically active areas of the State. Caltrans Seismic Design Criteria version 1.6 (November 2010) will be utilized for the bridge design. Quincy will perform an equivalent static seismic analysis of the proposed bridge. The recommended ARS curve for seismic design will be provided by the geotechnical engineer and included in the foundation report.

FALSEWORK

Falsework will not be required within the limits of the slough for the preferred precast concrete girder alternative. This will be a great advantage to minimize impact to the project site compared to other cast in place alternatives. This will also benefit the construction schedule by reducing the overall time needed to construct the bridge.

DECK PROTECTION

This project is located within a marine environment, therefore additional corrosion mitigation techniques is required. Special protection measures such as thicker concrete cover and epoxy coated reinforcement are required to provide proper protection.

HYDRAULICS

Figure 4: Profile view looking north

The clear span of the proposed bridge is longer than the current structure and will improve the existing hydraulic condition. Furthermore, the vertical profile of the proposed bridge is being raised such that the entire superstructure will clear the anticipated King Tide elevation. A draft design hydraulic and location hydraulic study report has been prepared and is included in Appendix J.

The Pine Hill Road over Swain Slough Bridge Replacement Project (Project) site crosses over Swain Slough immediately downstream of its confluence with Martin Slough. The mouth of Martin Slough is separated from Swain Slough by a levee and tide gates. The confluence of Swain Slough with Elk River is 0.5 mi downstream of the Project site. Elk River eventually drains into Humboldt Bay approximately 1.5 mi further downstream. Because of its close proximity to Humboldt Bay, the project is tidally influenced.

The peak discharges for Swain/Martin sloughs were estimated using a rainfall/runoff model. The 100-year and 50-year peak discharge values for Swain/Martin sloughs were estimated to be 2,490 cubic feet per second (cfs) and 2,200 cfs, respectively. The hydraulic characteristics at the Project site were evaluated using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) modeling software, Version 4.1.0 developed by the U.S. Army Corps of Engineers (USACE).

100-Year Water Surface Elevations and Freeboard at Upstream Face of Bridges

Alternative	Lowest Bridge Soffit Elevation (ft*)	Water Surface Elevation (ft*)	Available Freeboard (ft)
Existing	9.3	12.1	-2.8
Proposed	8.9	12.1	-3.2

Note: * The elevations reference the North American Vertical Datum of 1988 (NAVD 88)

50-Year Water Surface Elevations and Freeboard at Upstream Face of Bridges

Alternative	Lowest Bridge Soffit Elevation (ft*)	Water Surface Elevation (ft*)	Available Freeboard (ft)
Existing	9.3	11.5	-2.2
Proposed	8.9	11.5	-2.6

Note: * The elevations reference the North American Vertical Datum of 1988 (NAVD 88)

The proposed bridge is designed based on the tidal elevations at Humboldt Bay and there are provisions to raise the bridge in the future to address sea level rise, but the currently proposed bridge is not designed to account for sea level rise. The bridge foundations are designed for the superstructure to be able to be raised in the future to accommodate sea level rise. Sea level rise estimates for the Project site were estimated using information from the following three studies:

- The Probability of Sea Level Rise (Environmental Protection Agency [EPA]1995)
- Climate Change Scenarios and Sea Level Rise Estimates for the California 2009
- Climate Change Scenarios Assessment (Cayan 2009), and
- The Proceedings of National Academy of Science (PNAS) (Vermeer and Rahmstorf 2009)

Sea Level Rise Estimates for the Year 2100 near Humboldt Bay, California

Method/Source	Sea Level Rise (ft)	
	High	Low
EPA	3.0	-0.8
CAYAN	4.6	3.3
PNAS	4.9	1.3

CHANNEL SCOUR/SLOPE PROTECTION

Based on field reviews and the maintenance report history, scour is a concern that needs to be addressed at this site. Appropriate protective countermeasures include placement of rock slope protection along each embankment slope in order to provide a more stable slough and reduce erosion along the abutment slopes. Vibrated permanent sheet piling will be installed to a depth that is below the anticipated scour which will protect the abutments in the future. The new abutments will be placed further apart to improve flow characteristics in the stream channel.

CONSTRUCTION COSTS

The bridge construction cost for the preferred alternative is based on the 30% level design which is estimated to be $1,206,000. A 10% mobilization and 25% contingency was assumed when computing the total cost from the current level of design. Construction cost estimates for the preferred alternative is detailed and shown on Table 1. The construction costs analysis estimates have been presented based on Caltrans Comparative Bridge Cost and preliminary roadway quantities with unit prices from similar projects. Table 2 includes cost estimates associated with utility coordination/relocation, right-of-way, environmental mitigation, or construction engineering that are eligible for federal aid.

Table 1: Structure Construction Cost

Alternative	Bridge Square Footage	Total Construction Cost
Preferred Alt. – PC/PS W-Flange Girder	2,720 sq. ft.	$1,206,000

Table 2: Construction Cost Analysis

Construct Bridge	Bridge Removal	Slope Protection	Channel Work	Detour	Approach Roadway	Utility Relocation	Mobilization	Total Construction
$1,206,000	$50,400	$25,000	$40,000	$10,000	$499,000	$0	$183,000	$2,013,000

CONCLUSIONS

An 80' single-span precast-prestressed concrete wide flange girder built on the existing horizontal alignment is the preferred structure type. With many bridge type comparison issues such as cost, foundations, and constructability being considered, precast-prestressed concrete wide flange girder is the most ideal replacement type at this site.

ATTACHMENTS

A. Preliminary Environmental Study
B. Type Selection Memo
C. NEPA Determination
D. CEQA Determination
E. Natural Environment Study
F. Archaeological Study Report (ASR)
G. Historic Property Study Report (HPSR)
H. Preferred Alternative
I. Preliminary Project Cost Estimates
J. Preliminary Foundation Report
K. Hydraulics Information
L. Bridge Inspection Records Information System Report

APPENDIX

Appendix A - Preliminary Environmental Study

DEPARTMENT OF TRANSPORTATION
DISTRICT 1, P. O. BOX 3700
EUREKA, CA 95502-3700
PHONE (707) 445-6410
FAX (707) 441-2048
TTY 711

Flex your power!
Be energy efficient!

February 23, 2012

Andrew Bundschuh
County of Humboldt
Department of Public Works
1106 Second Street
Eureka, CA 95501

01-HUM-CR-0
File: BRLO-5904(112)
EA 924965L

Signed Preliminary Environmental Study (PES) form for the Swain Slough (Pine Hill Rd) Bridge Replacement project.

Dear Mr. Bundschuh:

We have received the PES form for the Swain Slough (Pine Hill Rd) Bridge Replacement project. Attached you will find a copy of the signed form which was approved by myself (Caltrans Environmental Senior), Suzanne Theiss (District Local Assistance Engineer) and Tim Keefe (Caltrans PQS). The following studies will be required before the NEPA process is complete:

- Farmlands Analysis – Form AD 1006 will need to be done if construction easements or acquisition occurs on adjacent farmland and it is designated as Prime or Unique. This land will also need to be evaluated to see if it falls under Williamson Act.
- Floodplain Analysis – Since work is occurring within the 100 year floodplain a Location Hydraulics Study and a Summary Floodplain Encroachment Report will need to be completed.
- Section 106 Studies
    - Area of Potential Effects (APE) Map
    - Archaeological Survey Report (ASR)
    - Historic Property Survey Report (HPSR)
- Biological Assessment (BA) – Most likely for impacts to Salmonids and Tidewater Goby.
- Natural Environment Study (NES) – Should include the following
    - State and Federally listed species
    - Avoidance and Minimization measures
    - Wetland Delineation
    - Water Quality
    - Environmental Commitments and BMPs

The following permits will be required:
- Coastal Development Permit (CDP) - CCC
- 1602 Streambed Alteration Agreement – CA DFG
- 404 Nationwide Permit – ACOE
- 401 Water Quality Certification - RWQCB

DEPARTMENT OF PUBLIC WORKS
COUNTY OF HUMBOLDT
MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

ARCATA-EUREKA AIRPORT TERMINAL
McKINLEYVILLE
FAX 839-3596
AVIATION 839-5401

PUBLIC WORKS BUILDING
SECOND & L ST., EUREKA
FAX 445-7409
ADMINISTRATION 445-7491
BUSINESS 445-7652
ENGINEERING 445-7377
FACILITY MAINTENANCE 445-7493
NATURAL RESOURCES 445-7741
PARKS 445-7651
ROADS & EQUIP. MAINT. 445-7421

CLARK COMPLEX
HARRIS & H ST., EUREKA
FAX 445-7388
LAND USE 445-7205

To: Department of Transportation
District 1, P.O. Box 3700
Eureka, CA 95502-3700
Attn: Brandon Larsen
Senior Environmental Planner

Date: January 25, 2012
Project: Swain Slough (Pine Hill Rd) Bridge Replacement
Federal Project #: BRLO-5904(112)
Description: Bridge Replacement

Dear Mr. Larsen,

Humboldt County Public Works is proposing to replace a structurally deficient and functionally obsolete bridge on Pine Hill Road just south of Eureka.

The following items are provided for your review and consideration.

- ☒ Fully completed PES Form
- ☒ Required attachments:
- ☒ Regional Map
- ☒ Project Location Map
- ☐ Project Footprint Map (showing existing and proposed R/W)
- ☒ Engineering drawings (plan views and existing and proposed cross sections, if available)
- ☐ Borrow/Disposal Site Location Map (if applicable)
- ☒ Preliminary Environmental Investigation Notes to support conclusion of this checklist
- ☐ Any field notes and correspondence from resource agencies
- ☒ Completed Field Review Form (first two pages)

I've also included a project description with photos as well as copies of biological resource information and a map showing the coastal zone and flood regions in the project area.

If additional information is needed, please contact me at 707-445-7741.

Sincerely,

Andrew Bundschuh

Andrew Bundschuh
Senior Environmental Analyst
Humboldt County Public Works

Exhibit 6-A Preliminary Environmental Study (PES) Form

Federal Project No.: BRLO-5904(112) *(Federal Program Prefix-Project No., Agreement No.)*
Final Design: 2012-13 *(Expected Start Date)*

To: Brandon Larsen, Senior Environmental Planner *(District Local Assistance Engineer)*
Department of Transportation, District 1 *(District)*
P.O. Box 3700, Eureka, CA 95502 *(Address)*
Brandon_larsen@dot.ca.gov *(E-mail Address)*

From: Humboldt County Public Works *(Local Agency)*
Andrew Bundschuh, 707-268-2699 *(Project Manager's Name and Telephone No.)*
1106 Second Street, Eureka, CA 95501 *(Address)*
abundschuh@co.humboldt.ca.us *(E-mail Address)*

Is this Project "ON" the State Highway System? ☐ Yes ☒ No
IF YES, STOP HERE and contact the District Local Assistance Engineer regarding the completion of other environmental documentation.

Federal State Transportation Improvement Program (FSTIP) http://www.dot.ca.gov/hq/transprog/fedpgm.htm: N/A *(Currently Adopted Plan Date)* N/A *(Page No.___ attach to this form)*

Programming for FSTIP:

	Preliminary Engineering		Right of Way		Construction	
	N/A *(Fiscal Year)*	$ *(Dollars)*	N/A *(Fiscal Year)*	$ *(Dollars)*	N/A *(Fiscal Year)*	$ *(Dollars)*

Project Description as Shown in RTP and FSTIP:

Detailed Project Description: *(Describe the following, as applicable: purpose and need, project location and limits, required right of way acquisition, proposed facilities, staging areas, disposal and borrow sites, construction activities, and construction access.)*
The proposed project consists of replacing the existing 3 span simply supported timber stringer with a reinforced concrete deck structure over Swain Slough. See attached Project Description for more details.

(Continue description on "Notes" sheet, last page of this Exhibit, if necessary)

Preliminary Design Information:
Does the project involve any of the following? Please check the appropriate boxes and delineate on an attached map, plan, or layout including any additional pertinent information.

Yes	No		Yes	No		Yes	No	
☒	☐	Widen existing roadway	☒	☐	Ground disturbance	☒	☐	Easements
☐	☒	Increase number of through lanes	☒	☐	Road cut/fill	☒	☐	Equipment staging
☐	☒	New alignment	☒	☐	Excavation: anticipated maximum depth 8 ft	☒	☐	Temporary access road/detour
☐	☒	Capacity increasing—other (e.g., channelization)				☒	☐	Utility relocation
						☒	☒	Right of way acquisition (if yes, attach map with APN)
			☐	☒	Drainage/culverts			
☐	☒	Realignment	☐	☒	Flooding protection			
☒	☐	Ramp or street closure	☒	☐	Stream channel work	☒	☐	Disposal/borrow sites
☒	☐	Bridge work						
			☒	☒	Pile driving #4 indicates No pile driving	☐	☒	Part of larger adjacent project
☒	☐	Vegetation removal						
☐	☒	Tree removal	☒	☐	Demolition	☐	☒	Railroad

Required Attachments:

☒ Regional map ☒ Project location map ☒ Project footprint map (existing/proposed right of way)
☒ Engineering drawings (existing and proposed cross sections), if available ☐ Borrow/disposal site location map, if applicable
(Note: all maps (except project location map and regional maps) should be consistent with the project description (minimum scale: 1" = 200').)
☒ Notes to support the conclusions of this checklist/project description continuation page (attached)

Examine the project for potential effects on the environment, direct or indirect and answer the following questions. The "construction area," as specified below, includes all areas of ground disturbance associated with the project, including staging and stockpiling areas and temporary access roads.

Each answer must be briefly documented on the "Notes" pages at the end of the PES Form.

A. Potential Environmental Effects	Yes	To Be Determined	No
General			
1. Will the project require future construction to fully utilize the design capabilities included in the proposed project?	☐	☐	☒
2. Will the project generate public controversy?	☐	☐	☒
Noise			
3. Is the project a Type I project as defined in 23 CFR 772.5(h); "construction on new location or the physical alteration of an existing highway, which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes"?	☐	☒	☐
4. Does the project have the potential for adverse construction-related noise impact (such as related to pile driving)?	☐	☒	☐
Air Quality			
5. Is the project in a NAAQS non-attainment or maintenance area?	☐	☐	☒
6. Is the project exempt from the requirement that a conformity determination be made? (If "Yes," state which conformity exemption in 40 CFR 93.126, Table 2 applies): repair of damage caused by natural disaster	☒	☐	☐
7. Is the project exempt from regional conformity? (If "Yes," state which conformity exemption in 40 CFR 93.127, Table 3 applies): __________	☐	☐	☒
8. If project is not exempt from regional conformity, (If "No" on Question #7)			
Is project in a metropolitan non-attainment/maintenance area?	☐	☐	☒
Is project in an isolated rural non-attainment area?	☐	☐	☒
Is project in a CO, PM10 and/or PM2.5 non-attainment/maintenance area?	☐	☐	☒
Hazardous Materials/Hazardous Waste			
9. Is there potential for hazardous materials (including underground or aboveground tanks, etc.) and/or hazardous waste (including oil/water separators, waste oil, asbestos-containing material, lead-based paint, ADL, etc.) within or immediately adjacent to the construction area?	☐	☐	☒
Water Quality/Resources			
10. Does the project have the potential to impact water resources (rivers, streams, bays, inlets, lakes, drainage sloughs) within or immediately adjacent to the project area?	☒	☐	☐
11. Is the project within a designated sole-source aquifer?	☐	☐	☒
Coastal Zone			
12. Is the project within the State Coastal Zone, San Francisco Bay, or Suisun Marsh?	☒	☐	☐
Floodplain			
13. Is the construction area located within a regulatory floodway or within the base floodplain (100-year) elevation of a watercourse or lake?	☒	☐	☐
Wild and Scenic Rivers			
14. Is the project within or immediately adjacent to a Wild and Scenic River System?	☐	☐	☒
Biological Resources			
15. Is there a potential for federally listed threatened or endangered species, or their critical habitat or essential fish habitat to occur within or adjacent to the construction area?	☒	☐	☐
16. Does the project have the potential to directly or indirectly affect migratory birds, or their nests or eggs (such as vegetation removal, box culvert replacement/repair, bridge work, etc.)?	☒	☐	☐

17. Is there a potential for wetlands to occur within or adjacent to the construction area?	☒	☐	☐
18. Is there a potential for agricultural wetlands to occur within or adjacent to the construction area?	☒	☐	☐
19. Is there a potential for the introduction or spread of invasive plant species?	☐	☒	☐

Sections 4(f) and 6(f)

20. Are there any historic sites or publicly owned public parks, recreation areas, wildlife or waterfowl refuges (Section 4[f]) within or immediately adjacent to the construction area?	☐	☐	☒
21. Does the project have the potential to affect properties acquired or improved with Land and Water Conservation Fund Act (Section 6[f]) funds?	☐	☐	☒

Visual Resources

22. Does the project have the potential to affect any visual or scenic resources?	☐	☒	☐

Relocation Impacts

23. Will the project require the relocation of residential or business properties?	☐	☐	☒

Land Use, Community, and Farmland Impacts

24. Will the project require any right of way, including partial or full takes? Consider construction easements and utility relocations.	☐	☒	☐
25. Is the project inconsistent with plans and goals adopted by the community?	☐	☐	☒
26. Does the project have the potential to divide or disrupt neighborhoods/communities?	☐	☐	☒
27. Does the project have the potential to disproportionately affect low-income and minority populations?	☐	☐	☒
28. Will the project require the relocation of public utilities?	☐	☒	☐
29. Will the project affect access to properties or roadways?	☒	☐	☐
30. Will the project involve changes in access control to the State Highway System (SHS)?	☐	☐	☒
31. Will the project involve the use of a temporary road, detour, or ramp closure?	☒	☐	☐
32. Will the project reduce available parking?	☐	☐	☒
33. Will the project construction encroach on state or federal lands?	☐	☐	☒
34. Will the project convert any farmland to a different use or impact any farmlands?	☐	☐	☒

Cultural Resources

35. Is there National Register listed, or potentially eligible historic properties, or archaeological resources within or immediately adjacent to the construction area? *(Note: Caltrans PQS answers question #35)*	☐	☒	☐
36. Is the project adjacent to, or would it encroach on Tribal land?	☐	☐	☒

For Sections B, C, and D, check appropriate box to indicate required technical studies, coordination, permits, or approvals.

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/Approvals
☒ **Traffic**		
Check one:		
☐ Traffic Study	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☒ Discussion in ED Only	☒ Caltrans	☒ Approval
☒ **Noise**		
Check as applicable:		
☐ Traffic Related		
☐ Construction Related		
Check one:		
☐ Noise Study Report [handwritten: unless pile driving occurs. If PD occurs then →]	☐ Caltrans	☐ Approval
☐ NADR	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☒ Discussion in ED Only	☒ Caltrans	☒ Approval
☒ **Air Quality**		
Check as applicable:		
☐ Traffic Related		
☐ Construction Related		
Check one:		
☐ Air Quality Report	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☒ Discussion in ED Only	☒ Caltrans	☒ Approval
	☐ FHWA	☐ Conformity Finding (6005 CEs, EAs, EISs)
	☐ Caltrans	☐ Conformity Finding (6004 CEs)
	☐ Regional Agency	☐ PM10/PM2.5 Interagency Consultation
☐ **Hazardous Materials/ Hazardous Waste**		
Check as applicable:		
☐ Initial Site Assessment (Phase 1)	☐ Caltrans	☐ Approval
☐ Preliminary Site Assessment (Phase 2)	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
	☐ Cal EPA DTSC	☐ Review Database
	☐ Local Agency	☐ Review Database
☒ **Water Quality/Resources**		
Check as applicable:		
☐ Water Quality Assess. Report	☐ Caltrans	☐ Approval
☒ Technical Memorandum [handwritten: in NES →]	☒ Caltrans	☒ Approval
☒ Discussion in ED Only	☒ Caltrans	☒ Approval
☐ **Sole-Source Aquifer (Districts 5, 6 and 11)**	☐ EPA (S.F. Regional Office)	☐ Approval of Analysis in ED
☒ **Coastal Zone**	☒ CCC	☒ Coastal Zone Consistency Determination

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/Approvals
☐ **Section 6(f)**	☐ Agency with Jurisdiction ☐ NPS	☐ Determines Consistency with Long-Term Management Plan
	☐ NPS	☐ Approves Conversion
☒ **Visual Resources** *Check one:*		
☐ Visual Impact Assessment	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☒ Discussion in ED Only	☒ Caltrans	☒ Approval
☐ **Relocation Impacts** *Check one:*		
☐ Relocation Impact Memo	☐ Caltrans	☐ Approval
☐ Relocation Impact Study	☐ Caltrans	☐ Approval
☐ Relocation Impact Report	☐ Caltrans	☐ Approval
☐ **Land Use and Community Impacts** *Check one:*		
☐ CIA	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
☐ **Construction/Encroachment on State Lands** *Check as applicable:*		
☐ SLC Jurisdiction	☐ SLC	☐ SLC Lease
☐ Caltrans Jurisdiction	☐ Caltrans	☐ Encroachment Permit
☐ SP Jurisdiction	☐ SP	☐ Encroachment Permit
☐ **Construction/Encroachment on Federal Lands**	☐ Federal Agency with Jurisdiction	☐ Encroachment Permit
☐ **Construction/Encroachment On Indian Trust Lands**	☐ Bureau of Indian Affairs	☐ Right of Way Permit
☒ **Farmlands** *Check one:*		
☐ CIA	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
Check as applicable: ☒ Form AD 1006	☒ NRCS	☒ Approves Conversion
	☐ CDOC	☐ Approves Conversion
☐ Conversion to Non-Agri Use	☐ ACOE	

Only if Prime or unique

Williamson Act?

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/Approvals
☒ **Floodplain**		
Check as applicable:		
☒ Location Hydraulic Study	☒ Caltrans	☒ Approval
☐ Floodplain Evaluation Report	☐ Caltrans	☐ Approval
☒ Summary Floodplain Encroachment Report	☒ Caltrans	☒ Approval
	☐ Caltrans	☐ Only Practicable Alternative Finding
	☐ FHWA	☐ Approves significant encroachments and concurs in Only Practicable Alternative Findings
☐ **Wild and Scenic Rivers**	☐ River Managing Agency	☐ Wild and Scenic Rivers Determination
☒ **Biological Resources**		
Check as applicable:		
☐ NES, Minimal Impact	☒ Caltrans	☒ Approval
☒ NES		
☒ BA	☒ Caltrans	☒ Approves for Consultation
Tidewater Goby / Salmonids	☒ USFWS ☒ NOAA Fisheries	☒ Section 7 Informal/Formal Consultation
☐ EFH Evaluation	☐ NOAA Fisheries	☐ MSA Consultation
☐ Bio-Acoustic Evaluation	☐ NOAA Fisheries	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☒ **Wetlands**		
Check as applicable:		
☒ WD and Assessment	☒ Caltrans	☒ Approval
Info can be included in NES.	☒ ACOE	☒ Wetland Verification
	☐ NRCS	☐ Agricultural Wetland Verification
	☒ Caltrans	☒ Wetlands Only Practicable Alternative Finding
☒ **Invasive Plants**		
☒ Discussion in ED Only	☒ Caltrans	☒ Approval
☐ **Section 4(f)**		
Check as applicable:	☐ Caltrans	☐ Determine Temporary Occupancy
☐ De minimis	☐ Caltrans	☐ De minimis finding
☐ Programmatic 4(f) Evaluation Type: ________________	☐ Caltrans	☐ Approval
☐ Individual 4(f) Evaluation	☐ Caltrans	☐ Approval
	☐ Agency with Jurisdiction ☐ SHPO ☐ DOI ☐ HUD ☐ USDA	

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/ Approvals
☒ **Cultural Resources** (PQS completes this section) *Check as applicable:*		
	☐ Caltrans PQS	☐ Screened Undertaking
☒ APE Map	☒ Caltrans PQS and DLAE	☒ Approves APE Map
	☐ Local Preservation Groups and/or Native American Tribes	☐ Provides Comments Regarding Concerns with Project
☒ HPSR ☒ ASR ☐ HRER	☒ Caltrans	☒ Approves for Consultation
☐ Finding of Effect Report	☐ Caltrans	☐ Concurs on No Effect, No Adverse Effect with Standard Conditions
	☐ SHPO	☐ Letter of Concurrence on Eligibility, No Adverse Effect without Standard
☐ MOA	☐ Caltrans	☐ Approves MOA
	☐ SHPO	☐ Approves MOA
	☐ ACHP (if requested)	☐ Approves MOA
☒ **Permits** Copies of permits and a list of mitigation commitments are mandatory submittals following NEPA approval.		
	☒ ACOE	☒ Section 404 Nationwide Permit
	☐ ACOE	☐ Section 404 Individual Permit
	☐ Caltrans/ACOE/EPA ☐ USFWS ☐ NOAA Fisheries	☐ NEPA/404 Integration MOU
	☐ ACOE	☐ Rivers and Harbors Act Section 10 Permit
	☐ USCG	☐ USCG Bridge Permit
	☒ RWQCB	☒ Section 401 Water Quality Certification
	☒ CDFG	☒ Section 1602 Streambed Alteration Agreement
	☐ RWQCB	☐ NPDES Permit
	☒ CCC ☐ Local Agency	☒ Coastal Zone Permit
	☐ BCDC	☐ BCDC Permit

Notes: Additional studies may be required for other federal agencies.

ACHP	=	Advisory Council on Historic Preservation
ACOE	=	U.S. Army Corps of Engineers
ADL	=	Aerially Deposited Lead
APE	=	Area of Potential Effect
APN	=	Assessor Parcel Number
ASR	=	Archaeological Survey Report
BA	=	Biological Assessment
BCDC	=	Bay Conservation and Development Commission
BE	=	Biological Evaluation
BO	=	Biological Opinion
Cal EPA	=	California Environmental Protection Agency
CCC	=	California Coastal Commission
CDFG	=	California Department of Fish and Game
CDOC	=	California Department of Conservation
CE	=	Categorical Exclusion
CIA	=	Community Impact Assessment
CWA	=	Clean Water Act
DLAE	=	District Local Assistance Engineer
DOI	=	U.S. Department of Interior
DTSC	=	Department of Toxic Substances Control
EA	=	Environmental Assessment
ED	=	Environmental Document
EFH	=	Essential Fish Habitat
EIS	=	Environmental Impact Statement
EPA	=	U.S. Environmental Protection Agency
FEMA	=	Federal Emergency Management Agency
FHWA	=	Federal Highway Administration
FONSI	=	Finding of No Significant Impacted
FTIP	=	Federal Transportation Improvement Program
HPSR	=	Historic Property Survey Report
HRER	=	Historical Resources Evaluation Report
HUD	=	U.S. Housing and Urban Development
MOA	=	Memorandum of Agreement
MSA	=	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	=	National Environmental Policy Act
NADR	=	Noise Abatement Decision Report
NES	=	Natural Environment Study
NHPA	=	National Historic Preservation Act
NOAA	=	National Oceanic and Atmospheric Administration
NMFS		National Marine Fisheries Service
NPDES	=	National Pollutant Discharge Elimination System
NPS	=	National Park Service
NRCS	=	Natural Resources Conservation Service
PM10	=	Particulate Matter 10 Microns in Diameter or Less
PM2.5	=	Particulate Matter 2.5 Microns in Diameter or Less
PMP	=	Project Management Plan
PQS	=	Professionally Qualified Staff
ROD	=	Record of Decision
RTIP	=	Regional Transportation Improvement Program
RTP	=	Regional Transportation Plan
RWQCB	=	Regional Water Quality Control Board
SER	=	Standard Environmental Reference
SEP	=	Senior Environmental Planner
SHPO	=	State Historic Preservation Officer
SLC	=	State Lands Commission
SP	=	State Parks
TIP	=	Transportation Improvement Program
USCG	=	U.S. Coast Guard
USDA	=	U.S. Department of Agriculture
USFWS	=	U.S. Fish and Wildlife Service
WD	=	Wetland Delineation

E. Preliminary Environmental Document Classification (NEPA)

Based on the evaluation of the project, the environmental document to be developed should be:

Check one:

- ☐ Environmental Impact Statement (*Note: Engagement with participating agencies in accordance with SAFETEA-LU Section 6002 required)*
  - ☐ Compliance with SAFETEA-LU Section 6002 regarding Participating Agencies required
- ☐ Complex Environmental Assessment
- ☐ Routine Environmental Assessment
- ☐ Categorical Exclusion without required technical studies.
- ☒ Categorical Exclusion with required technical studies

(if Categorical Exclusion is selected, check one of the following):

- ☒ Section 6004
  - ☐ 23 CFR 771 activity (c)(_____)
  - ☒ 23 CFR 771 activity (d) (3)
  - ☐ Activity _____ listed in the Section 6004 MOU
- ☐ Section 6005

This may change pending on findings of tech studies.

F. Public Availability and Public Hearing

Check as applicable:

- ☐ Not Required
- ☒ Notice of Availability of Environmental Document → This will be conducted through the CEQA process. Unless a higher level NEPA Doc is required. CEQA IS/MND is anticipated
- ☐ Public Meeting
- ☐ Notice of Opportunity for a Public Hearing
- ☐ Public Hearing Required

G. Signatures

Local Agency Staff and/or Consultant Signature

[signature]	1-25-2012	268-2699
(Signature of Preparer)	*(Date)*	*(Telephone No.)*

Andrew Bundschuh, Senior Environmental Analyst
(Name)

Local Agency Project Engineer Signature

This document was prepared under my supervision, in accordance with the *Local Assistance Procedures Manual,* Exhibit 6-B, "Instructions for Completing the Preliminary Environmental Study Form."

[signature]	1/25/2012	(707) 445-7377
(Signature of Local Agency)	*(Date)*	*(Telephone No.)*

Caltrans District Professionally Qualified Staff (PQS) Signature

☐ Project does not meet definition of an "undertaking"; no further review is necessary under Section 106 ("No" Section A, #35).

☐ Project is limited to the type of activity listed in Attachment 2 of the Section 106 PA and based on the information provided in the PES Form, the project does not have the potential to affect historic properties ("No" Section A, #35).

☐ Project is limited to the type of activity listed in Attachment 2 of the Section 106 PA, but the following additional procedures or information is needed to determine the potential for effect ("To Be Determined" Section A, #35):
☐ Records Search ☐ ______ ☐ ______ ☐ ______

☐ Project meets the definition of an "undertaking"; all properties in the project area are exempt from evaluation per Attachment 4 of the Section 106 PA ("No" Section A, #35).

☒ The proposed undertaking is considered to have the potential to affect historic properties; further studies for 106 compliance are indicated in Sections B, C, and D of this PES Form ("Yes" Section A, #35).

[signature] 2/7/12 707 441 2022
(Signature of Professionally Qualified Staff) *(Date)* *(Telephone No.)*

The following signatures are required for all CEs, routine and complex EAs, and EISs:

Caltrans District Senior Environmental Planner (or Designee) and DLAE Signatures

I have reviewed this Preliminary Environmental Study (PES) Form and determined that the submittal is complete and sufficient. I concur with the studies to be performed and the recommended NEPA Class of Action.

[signature] 02/22/12 (707) 445-6410
(Signature of Senior Environmental Planner or Designee) *(Date)* *(Telephone No.)*

Brandon Larsen
(Name)

[signature] 2/22/12 707/445-6399
(Signature of District Local Assistance Engineer or Designee) *(Date)* *(Telephone No.)*

Suzanne Theiss
(Name)

☐ HQ DEA Environmental Coordinator concurrence ______________. E-mail concurrence attached.
(date)

Preliminary Environmental Investigation
Notes to Support the Conclusions of the PES Form
(May Also Include Continuation of Detailed Project Description)

Brief Explanation of How Project Complies, or Will Comply with Applicable Federal Mandate (Part A):

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Distribution 1) Original - DLAE, 2) Local Agency Project Manager, 3) DLA Environmental Coordinator
4) Senior Environmental Planner (or designee), 5) District PQS

Updated: 05/15/08

PES DOCUMENTATION

Project: **Swain Slough Bridge Replacement [BRLO-5904(0112)]**
Applicant: **Humboldt County Department of Public Works**
Date: **January 25, 2012**

Location
The project is located on Pine Hill Road at post mile 0.20. It is 2 miles south of Eureka in Section 4, Township 4 North, Range 1 West, and can be seen on the Eureka 7.5' USGS quadrangle map (see attached maps). GPS Coordinates: Latitude: 40.7525568N; Longitude: 124.1827002W.

Background
The Swain Slough Bridge is a 63-foot, three-span structure with a concrete deck on timber stringers. The bridge, constructed in 1955, is located on Pine Hill Road approximately 0.2 miles east of Elk River Road just south of Eureka, CA. Pine Hill Road provides access across Swain Slough to residential neighborhoods and connects to Herrick Street, a major arterial out of southern Eureka. The existing timber stringers are in poor condition as are the concrete support columns and the bridge has been categorized as both Structurally Deficient and Functionally Obsolete.

Project Description
The proposed project is replacement of an existing concrete bridge with a new, single-span, cast in place, pre-stressed concrete slab or box girder bridge. The new bridge will include two standard road widths (11-12-ft) and adjacent shoulder/bike lanes (4-6-ft). A Request For Proposals (RFP) has been initiated by the County to find a consultant for design engineering and project development. The consultant will prepare design for roadway bridge approaches and bridge structure for the selected alternative for the new Swain Slough crossing. This work will also include the preparation of traffic control plans, construction plans and specifications utilizing Caltrans Standards, detailed cost estimates, and bid documents utilizing standard County construction contract provisions. The design will also contain identification of any utilities that may need to be relocated as a result of the new crossing.

General Construction Details
Once the consultant develops an approved final design, the County will have a better understanding of construction details. Construction will basically be done in two phases; first being demolition of the existing bridge and second being construction of the new bridge. Activities will also involve water diversion or separation from the bridge site.

Environmental Impacts
Once the consultant develops an approved final design, the County will have a better understanding of environmental impacts. Since the project is surrounded by wetlands and involves a bridge over a slough containing ESA species, special studies and reports will be required to analyze potential impacts and corresponding mitigation measures if necessary.

Traffic Control
It will be necessary to close Pine Hill Road and detour traffic away from the construction site. Traffic will be restricted from access to the bridge location and a detour will be in place. The prime detour route for traffic during construction will be approximately 1.6 miles, and will affect

only a limited number of residencies adjacent to the bridge. The detour will result in temporary, minor traffic delays.

Erosion/Sediment Control Measures

The project will require the contractor to submit a Water Pollution Control Plan (WPCP) or Stormwater Pollution Protection Plan (SWPPP) for approval before construction begins. Adequate implementation of BMPs, monitoring, and reporting methodologies will be required.

As a general rule, to minimize erosion, sediment, and pollutant contribution to Swain Slough and surrounding wetlands, best management practices such as the following measures will be part of the WPCP or SWPPP.

- Construction will be done during summer months when the chance of precipitation is lowest.
- Construction equipment will be cleaned and inspected prior to use. Equipment maintenance and fueling will be done at designated staging areas.
- On-site stockpiles will be isolated with silt fence, filter fabric, and/or straw bales/fiber rolls.
- Silt fence or fiber rolls will be placed below the project areas to contain loose rolling rocks and sediment. Silt fence/fiber rolls will be kept in place and maintained during the entire project. Any sediment caught by the fence or rolls will be removed before the fence/rolls are pulled.
- Ground disturbed by construction work will be revegetated with fast-growing native grasses and sterile hybrids and mulched when work is complete.
- The site will be monitored by Public Works personnel during winter rains and any evidence of erosion (rilling, gullies, etc.) will be repaired immediately. In addition, areas where revegetation is not successful will be reseeded and re-mulched to ensure vegetative ground cover.

PES Documentation

General

1. The project consists of the replacement of a structurally deficient bridge. It will not require future construction; however, future road improvements on either side of the bridge may be instituted in the future (road widening and shoulder/bike lane development).

2. The bridge is structurally deficient and contains narrow lanes with no shoulder or bike lanes. The public most likely supports safety improvements to roadways and bridges. To date, there has been no public comment regarding the project, and no public controversy is anticipated.

Noise

3. This is not a Type I project. There will be no significant change in horizontal or vertical alignment, and no increase in the number of through lanes. The proposal is to place the new bridge at the same location, both horizontally and vertically. However, the new bridge may be slightly elevated than the existing bridge, but it is unknown at this time until final design plans have been developed.

4. Other than a temporary increase in ambient noise from heavy equipment working during construction, it is unlikely that there will be any excessive noise related impacts. The proposed new bridge will be single span and therefore no pile driving is anticipated. However, once a final design has been developed, all noise impacts associated with the project will be analyzed.

Air Quality

5. The project is not in a NAAQS non-attainment or maintenance area.

6. The project is exempt from the requirement to determine project level conformity. Widening narrow pavements/reconstructing bridges with no additional traffic lanes is listed in Section 93.126, Table 2.

7. The project is not listed in Section 93.127, Table 3-Projects Exempt from Regional Emissions Analyses.

8. The project is not located in an "isolated rural" area. Humboldt County (North Coast Unified Air Quality District) is not in non-attainment for particulate matter smaller than 10 microns (PM10) and particular matter smaller than 2.5 microns (PM2.5) as per National ambient air quality standards. It is in non-attainment for PM10 according to California ambient air quality standards, but not in non-attainment for PM2.5 as per California standards.

Hazardous Materials/Hazardous Waste

9. There is no evidence of development activities in the project area. The Humboldt County Department of Public Health, Division of Environmental Health is unaware of any hazardous material spills in the area. There is no lead based paint Co. Just Replaced rails and repainted w/ Later Paint.

Water Quality/Resources

10. The project is located over Swain Slough, a tributary to Elk River. Erosion/sediment control measures will be used to prevent adverse water quality impacts. The contractor will be required to develop either a WPCP or a SWPPP.

11. The project is in Humboldt County and therefore is not within a designated sole-source aquifer.

Coastal Zone

12. The project is located within the State Coastal Zone (see attached map).

Floodplain

13. The project is located within a regulatory floodplain or within the base floodplain elevation (FEMA FIRM Map #060060-0775C, July 1982).

Wild & Scenic Rivers

14. The project is not located near a Wild and Scenic River.

Biological Resources

15. The U.S. Fish & Wildlife Service has listed the following plants and animal species as threatened or candidate for listing for the Eureka 7.5' USGS quadrangle:

Listed/Proposed Threatened and Endangered Species for the EUREKA Quad (Candidates Included)

January 25, 2012

Document Number: 72463906-16332

TYPE	SCIENTIFIC NAME	COMMON NAME	CATEGORY	CRITICAL HABITAT
Plants				
	Erysimum menziesii	Menzies' wallflower	E	N
	Layia carnosa	beach layia	E	N
	Lilium occidentale	western lily	E	N
Invertebrates				
*	*Haliotis cracherodii*	black abalone	E	N
Fish				
*	*Acipenser medirostris*	green sturgeon	T	Y
	Eucyclogobius newberryi	tidewater goby	E	Y
*	*Oncorhynchus kisutch*	S. OR/N. CA coho salmon	T	Y
*	*Oncorhynchus mykiss*	Northern California steelhead	T	Y
*	*Oncorhynchus tshawytscha*	CA coastal chinook salmon	T	Y
Reptiles				
*	*Caretta caretta*	loggerhead turtle	T	N
*	*Chelonia mydas (incl. agassizi)*	green turtle	T	N
*	*Dermochelys coriacea*	leatherback turtle	E	Y
*	*Lepidochelys olivacea*	olive (=Pacific) ridley sea turtle	T	N
Birds				
	Brachyramphus marmoratus	marbled murrelet	T	Y
	Charadrius alexandrinus nivosus	western snowy plover	T	Y
	Coccyzus americanus	Western yellow-billed cuckoo	C	N
	Phoebastris albatrus	short-tailed albatross	E	N
	Strix occidentalis caurina	northern spotted owl	T	Y
	Synthliboramphus hypoleucus	Xantus's murrelet	C	N
Mammals				
*	*Balaenoptera borealis*	sei whale	E	N
*	*Balaenoptera musculus*	blue whale	E	N
*	*Balaenoptera physalus*	fin whale	E	N
*	*Eumetopias jubatus*	Steller (=northern) sea-lion	T	Y
*	*Megaptera novaeangliae*	humpback whale	E	N
*	*Orcinus orca*	killer whale, S. resident	E	Y
*	*Physeter macrocephalus*	sperm whale	E	N

KEY:

(PE) Proposed Endangered	Proposed in the Federal Register as being in danger of extinction
(PT) Proposed Threatened	Proposed as likely to become endangered within the foreseeable future
(E) Endangered	Listed in the Federal Register as being in danger of extinction
(T) Threatened	Listed as likely to become endangered within the foreseeable future
(C) Candidate	Candidate which may become a proposed species
Critical Habitat	Y = Designated, P = Proposed, N = None Designated
*	Denotes a species Listed by the National Marine Fisheries Service

Swain Slough is located at the project site and contains habitat for Southern Oregon/Northern California coho salmon, Northern California steelhead, California coastal chinook salmon, and tidewater goby. The project may affect listed fish and/or their habitats since the proposed work includes water diversion and work within the channel. The project area does not contain habitat for marbled murrelet, northern spotted owl, or Western yellow-billed cuckoo; thus the proposed project will have no effect to these species.

The CNDDB was queried on January 25, 2012, for the species listed above. Federally listed fish species (Coho and tidewater goby) and their critical habitats occur within or adjacent to the project area (see attached CNDDB map). Ambient noise in the project vicinity is relatively high due to the close proximity of Elk River Road, Highway 101 and the city of Eureka.

16. The project will require the removal of the existing bridge that could be used by migratory birds (Swallows). No suitable vegetation is proposed to be removed, and thus only the bridge itself may be used by migratory birds. It is unknown if swallows currently use the bridge for nesting.

17. The project area is surrounded by agricultural and 3-parameter wetlands. It is likely that there will be temporary impacts to wetlands. Potential permanent impacts are unknown until final design and further studies are completed.

18. The project area is surrounded by agricultural and 3-parameter wetlands. It is likely that there will be temporary impacts to wetlands. Potential permanent impacts are unknown until final design and further studies are completed.

19. Upon completion of construction, all disturbed areas will be seeded with a mix of fast-growing native grass species and sterile hybrids, and mulched with weed-free straw. The heavy equipment used for project construction will be cleaned and inspected prior to transport to the project site, reducing the potential for invasive weed introduction.

<u>Sections 4(f) & 6(f)</u>

20. There are no publicly owned state or federal parks, recreation areas, wildlife or waterfowl refuges within or adjacent to the project area. All surrounding land is privately owned.

21. The project will not result in the conversion of lands acquired or developed through the Land and Water Conservation Fund Act [Section 6(f)].

<u>Visual Resources</u>

22. The project has the potential to temporarily affect the visual environment during construction as it will be visible from Elk River Road and some residences in the surrounding area. The project will not result in permanent visual impacts because post-construction topography will be similar to those currently existing.

Relocation Impacts

23. There are no residential or business properties in the project area that will need to be relocated.

Land Use, Community, & Farmland Impacts

24. The project may require the acquisition of permanent right-of-way. Most, if not all work will be performed in the existing county road right-of-way. It may require temporary construction easements for equipment staging. Right-of-way issues will not be known until final design plans have been completed.

25. The project is consistent with the Humboldt County General Plan road standards.

26. The project is not located within a cohesive community. It will not disrupt a neighborhood/community.

27. The project vicinity has not been identified as being particularly low-income or having high minority population.

28. The project may require relocation of utilities. There is a sewer main pipe that currently runs alongside the existing bridge. It is unknown if the sewer main will be relocated, abandoned or replaced.

29. The project will affect access to nearby properties or roadways since the bridge location will be closed during construction. However, there will be a temporary detour that will cause minor delays for the traveling public.

30. The project does not involve a change in access control.

31. It will be necessary to close Pine Hill Road and detour traffic away from the construction site. Traffic will be restricted from access to the bridge location and a detour will be in place. The prime detour route for traffic during construction will be approximately 1.6 miles, and will affect only a limited number of residencies adjacent to the bridge. The detour will result in temporary, minor traffic delays.

32. There is currently no parking available in the project area. The project will not create or reduce parking availability.

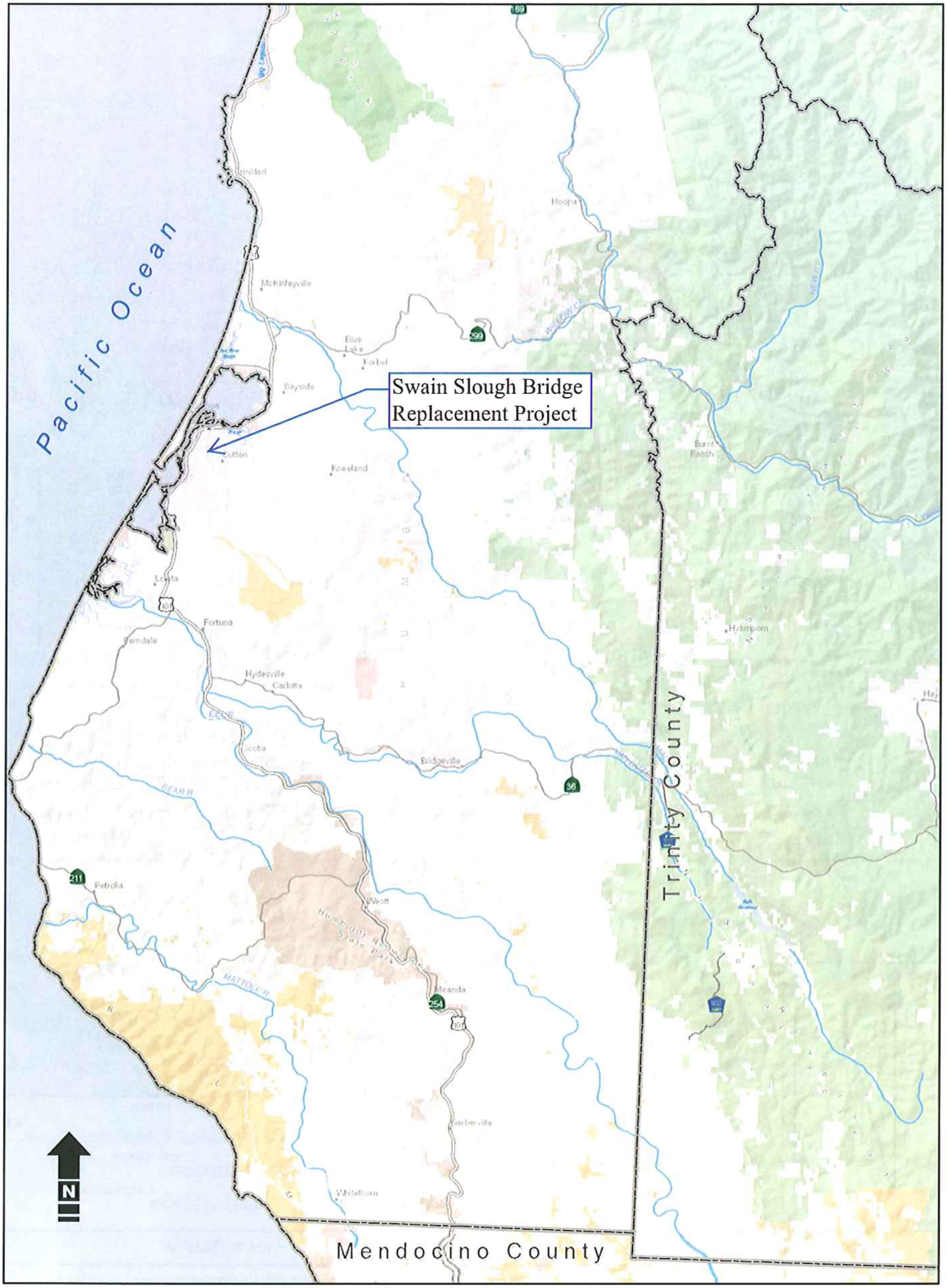
33. The project will not encroach on state or federal land as all surrounding property is privately owned.

34. The project area does contain agricultural land used for cattle grazing. However, the project will not convert any farmland to a different use nor should the project impact any of the agricultural properties. Prime or Unique farmland?
Williamson Act Land?
If so. an AD 1006 form will need to be filled out.

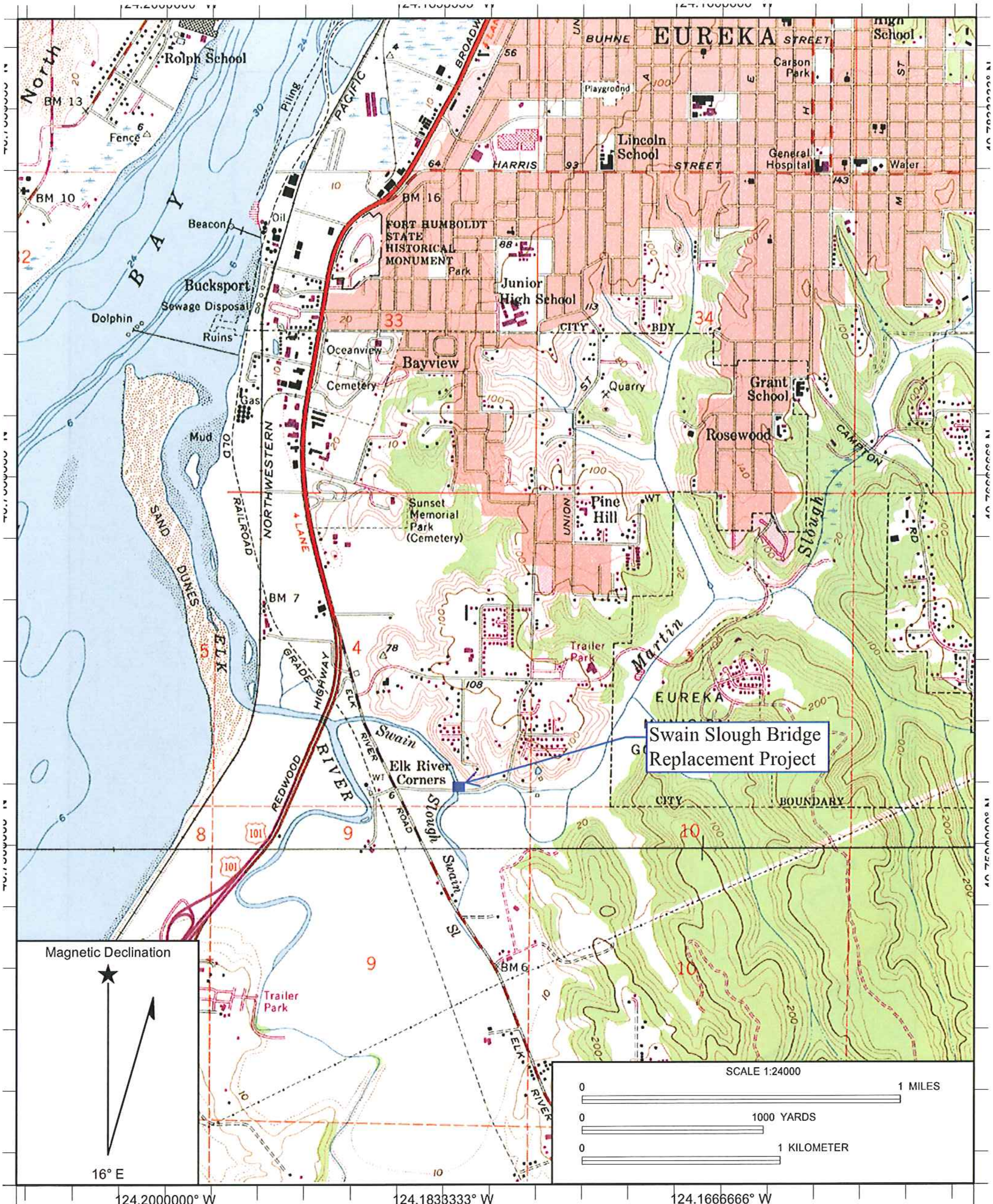
Cultural Resources

35. The Public Works Natural Resources Division archaeological databank does not contain any records of archaeological sites in the project area. Review of aerial photographs from 1941 to 1988 did not reveal any historic development in the project area.

36. There is no Tribal land in the project area or vicinity.



Vicinity Map



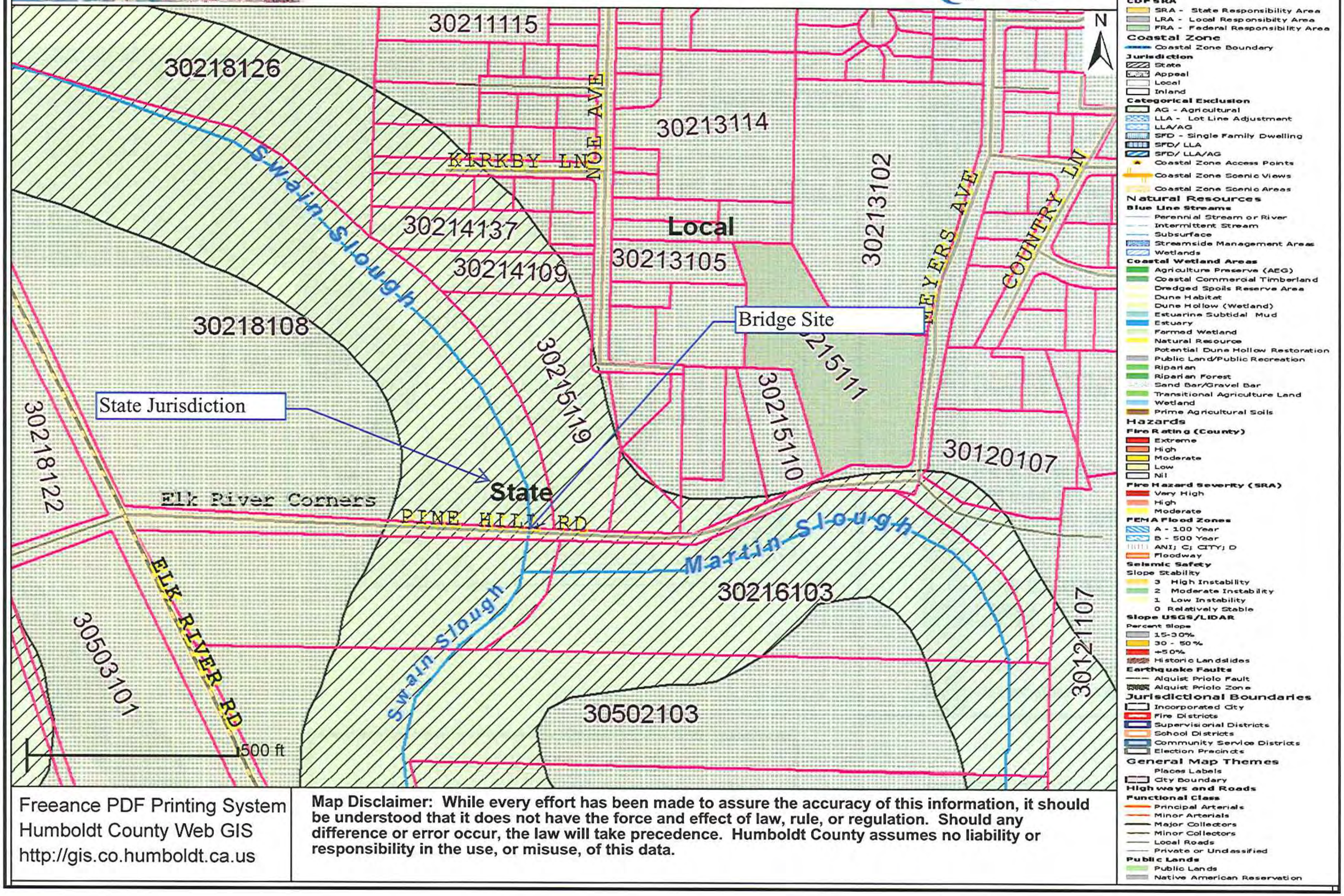
Name: EUREKA
Date: 1/24/2012
Scale: 1 inch equals 2000 feet

Location: 040.7610211° N 124.1801865° W NAD 83
Caption: Swain Slough Bridge Replacement - Pine Hill Rd PM 0.20

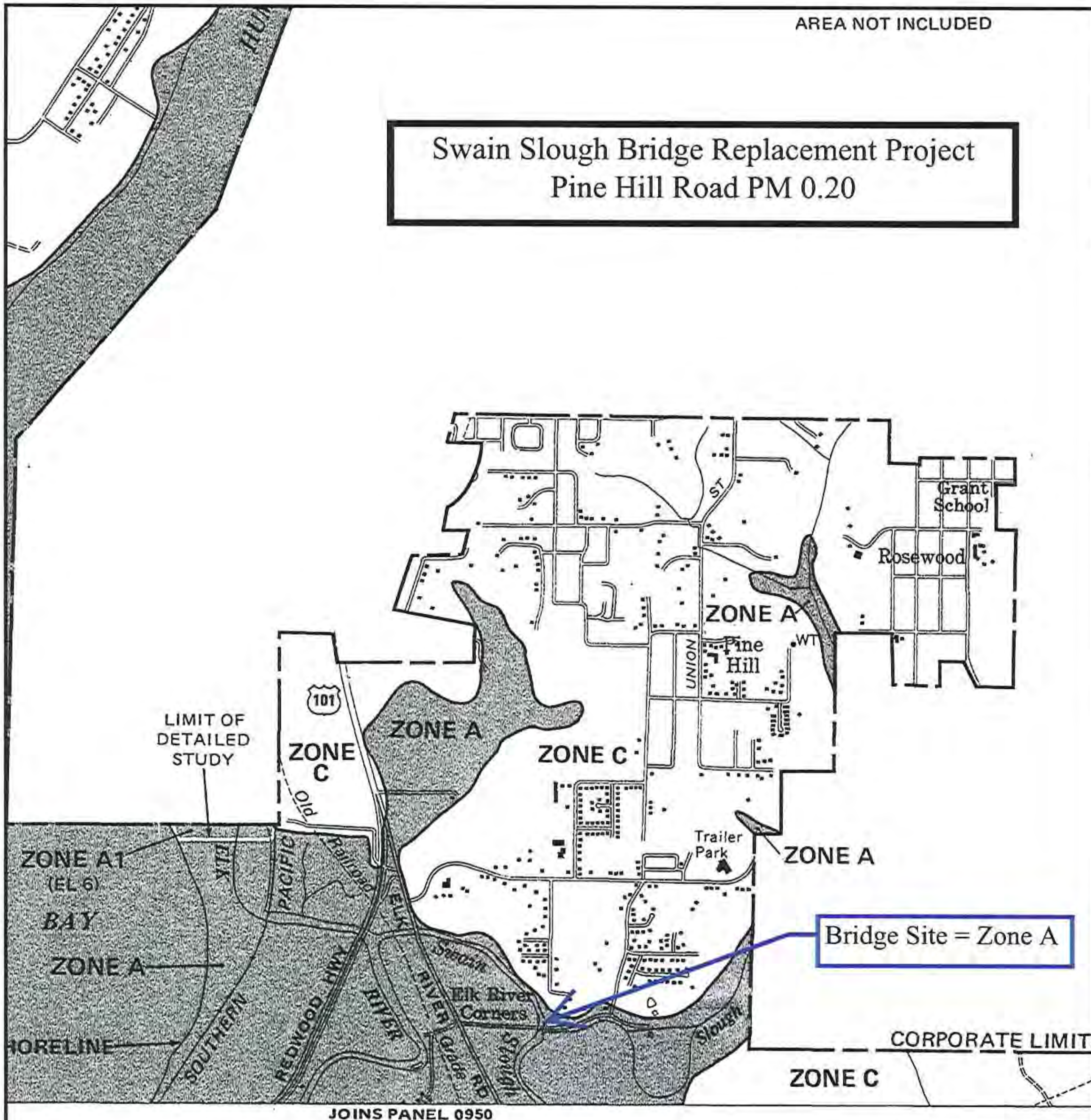
HUMBOLDT COUNTY
GEOGRAPHIC INFORMATION SYSTEMS
ONLINE MAPPING

Humboldt County Web GIS Map

Prosperity!



Freeance PDF Printing System
Humboldt County Web GIS
http://gis.co.humboldt.ca.us



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

HUMBOLDT COUNTY, CALIFORNIA (UNINCORPORATED AREAS)

PANEL 775 OF 1900
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060060 0775 C

MAP REVISED:
AUGUST 5, 1986

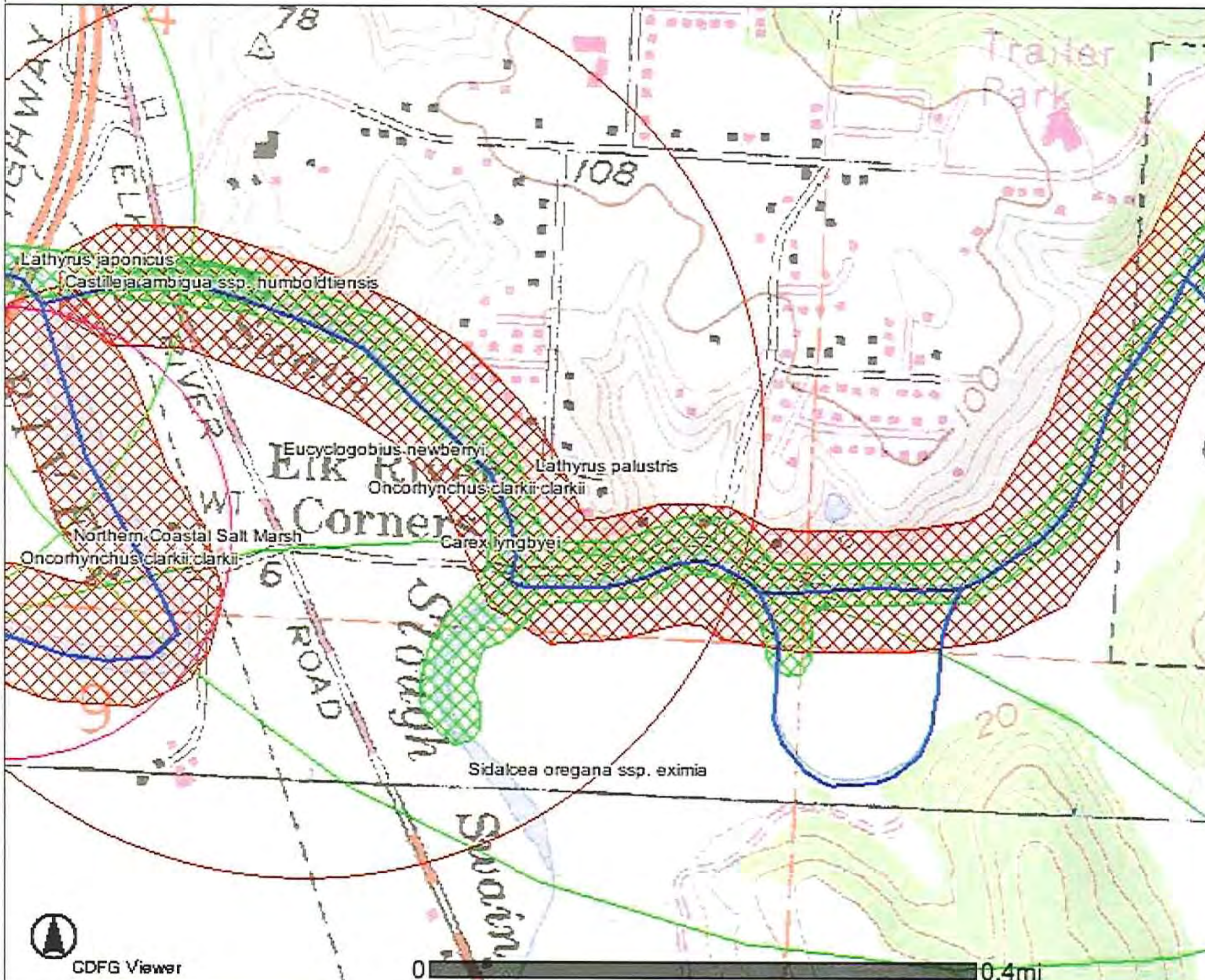
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Swain Slough Bridge Replacement - Pine Hill Rd PM 0.20

Info: Site available at http://imaps.dfg.ca.gov

Author: Enter Name Here
Date: 1/25/2012 3:36 PM



Map Legend

- Coho Distribution [ds326]
- Chinook Abundance - Linear Features [ds181]

California Natural Diversity Database (gov ed) [ds45]

- Plant (80m)
- Plant (specific)
- Plant (non-specific)
- Plant (circular)
- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)
- Terr. Comm. (80m)
- Terr. Comm. (specific)
- Terr. Comm. (non-specific)
- Terr. Comm. (circular)
- Aqu. Comm. (80m)
- Aqu. Comm. (specific)
- Aqu. Comm. (non-specific)
- Aqu. Comm. (circular)
- Western States
- Mexico

Occurrence Report

California Department of Fish and Game

California Natural Diversity Database

Map Index Number:	06801	**EO Index:**	9469
Key Quad:	Eureka (4012472)	**Element Code:**	AFCHA0208A
Occurrence Number:	42	**Occurrence Last Updated:**	1997-03-27

Scientific Name: *Oncorhynchus clarkii clarkii*

Common Name: coast cutthroat trout

Listing Status: **Federal:** None

State: None

CNDDB Element Ranks: **Global:** G4T4

State: S3

Rare Plant Rank:

Other Lists: AFS_VU-Vulnerable
DFG_SSC-Species of Special Concern
USFS_S-Sensitive

General Habitat:

SMALL COASTAL STREAMS FROM THE EEL RIVER TO THE OREGON BORDER.

Micro Habitat:

SMALL, LOW GRADIENT COASTAL STREAMS & ESTUARIES. NEED SHADED STREAMS WITH WATER TEMPS <18C, & SMALL GRAVEL FOR SPAWNING

Last Date Observed:	1980-XX-XX	**Occurrence Type:**	Natural/Native occurrence
Last Survey Date:	1980-XX-XX	**Occurrence Rank:**	Unknown
Owner/Manager:	PVT	**Trend:**	Unknown
Presence:	Presumed Extant		

Location:

MARTIN SLOUGH; TRIB TO SWAIN SLOUGH WHICH IS A TRIB TO ELK RIVER (HUMBOLDT BAY).

Detailed Location:

2 MILES OF OCCUPIED OR ACCESSIBLE HABITAT.

Ecological:

POPULATIONS TEND TO BE HIGHER IN STREAM SECTIONS WITHOUT OTHER SALMONIDS.

Threats:

CHANNELIZATION, POLLUTION, SILTATION, FLAPGATES, RECLAMATION OF MARSHLAND WITH DIKES (SOME OR ALL OF THESE MAY APPLY).

General:

ELECTROFISHING SURVEYS OF HUMBOLDT BAY TRIBS, INDICATE GENERALLY LOW NUMBERS, LESS THAN 6 CT-C/KM, OCCUR IN MOST BAY TRIBS. LARGER NUMBERS, OVER 125/KM, HAVE BEEN OBSERVED IN SOME HEADWATER STREAMS.

PLSS: T04N, R01W, Sec. 04 (H)		**Accuracy:**	specific area	**Area (acres):**	118
UTM: Zone-10 N4512435 E401074		**Latitude/Longitude:**	40.75693 / -124.17195	**Elevation (feet):**	20

County Summary:	**Quad Summary:**
Humboldt	Eureka (4012472)

Sources:

GER80U0001	GERSTUNG, ERIC (CALIFORNIA DEPARTMENT OF FISH AND GAME) - LOCALITIES FOR ENDANGERED SALMONIDS: ONCORHYNCHUS AGUABONITA WHITEI, O. CLARKI CLARKI, O. CLARKI HENSHAWI, O. CLARKI SELENIRIS, SALVELINUS CONFLUENTUS 1980-XX-XX
GER85M0001	GERSTUNG, E. (CALIFORNIA DEPARTMENT OF FISH AND GAME) - MAPS OF HUMBOLDT AND DEL NORTE COUNTIES. 1985-XX-XX
GER96U0001	GERSTUNG, E. (CALIFORNIA DEPARTMENT OF FISH AND GAME) - LIST OF STREAMS AND WHEN THEY WERE SURVEYED, AND UPDATES TO RAREFIND PRINTOUTS FOR ONCORHYNCHUS CLARKI CLARKI (COAST CUTTHROAT TROUT). 1996-06-XX

Map Index Number:	81225	**EO Index:**	82215
Key Quad:	Eureka (4012472)	**Element Code:**	AFCQN04010
Occurrence Number:	119	**Occurrence Last Updated:**	2010-12-29

Scientific Name: *Eucyclogobius newberryi*

Common Name: tidewater goby

Listing Status: **Federal:** Endangered; **State:** None

Rare Plant Rank:

Other Lists: AFS_EN-Endangered
DFG_SSC-Species of Special Concern
IUCN_VU-Vulnerable

CNDDB Element Ranks: **Global:** G3; **State:** S2S3

General Habitat:

BRACKISH WATER HABITATS ALONG THE CALIF COAST FROM AGUA HEDIONDA LAGOON, SAN DIEGO CO. TO THE MOUTH OF THE SMITH RIVER.

Micro Habitat:

FOUND IN SHALLOW LAGOONS AND LOWER STREAM REACHES, THEY NEED FAIRLY STILL BUT NOT STAGNANT WATER & HIGH OXYGEN LEVELS.

Last Date Observed:	2006-08-28	**Occurrence Type:**	Natural/Native occurrence
Last Survey Date:	2006-08-28	**Occurrence Rank:**	Unknown
Owner/Manager:	UNKNOWN	**Trend:**	Unknown
Presence:	Presumed Extant		

Location:

VICINITY OF SWAIN SLOUGH AND ELK RIVER. SOUTH OF EUREKA.

Detailed Location:

LAT-LONG GIVEN IS IN ELK RIVER BUT DESCRIPTION GIVES LOCATION AS "AN UNNAMED SLOUGH TRIBUTARY TO THE MAINSTEM ELK RIVER". MAPPED TO INCLUDE BOTH ELK RIVER AND SWAIN SLOUGH.

Ecological:

Threats:

General:

ONE 26 MM TL GOBY COLLECTED ON 28 AUG 2006. GOBY HAD AN ATTACHED 4 MM PARASITIC CYMOTHOID ISOPOD ON ITS GILL. THIS IS THE FIRST REPORT OF A CYMOTHOID ON A TIDEWATER GOBY. DEPOSITED IN HUMBOLDT STATE UNIV FISH COLLECTION (HSU 4275).

PLSS: T04N, R01W, Sec. 04 (H)		**Accuracy:**	2/5 mile	**Area (acres):**	0
UTM: Zone-10 N4512133 E399882		**Latitude/Longitude:**	40.75406 / -124.18602	**Elevation (feet):**	12

County Summary:

Humboldt

Quad Summary:

Fields Landing (4012462), Eureka (4012472)

Sources:

FRI07A0001 FRIMODIG, A. & G. GOLDSMITH (CALIFORNIA DEPARTMENT OF FISH AND GAME) - FIRST RECORD OF A CYMOTHOID ISOPOD FROM A TIDEWATER GOBY AND THREE NEW TIDEWATER GOBY LOCALITIES IN HUMBOLDT COUNTY, CALIFORNIA: CALIFORNIA FISH AND GAME 94(4): 194-199. 2008. 2007-09-17

Occurrence Report

California Department of Fish and Game

California Natural Diversity Database

Map Index Number:	27975	**EO Index:**	24270
Key Quad:	Eureka (4012472)	**Element Code:**	PDFAB250P0
Occurrence Number:	2	**Occurrence Last Updated:**	1996-05-30

Scientific Name: *Lathyrus palustris* **Common Name:** marsh pea

Listing Status: **Federal:** None **Rare Plant Rank:** 2.2

State: None **Other Lists:**

CNDDB Element Ranks: **Global:** G5

State: S2S3

General Habitat:

BOGS & FENS, LOWER MONTANE CONIF. FOREST, MARSHES & SWAMPS, N. COAST CONIFEROUS FOREST, COASTAL PRAIRIE, COASTAL SCRUB.

Micro Habitat:

MOIST COASTAL AREAS. 1-100M.

Last Date Observed:	1949-08-03	**Occurrence Type:**	Natural/Native occurrence
Last Survey Date:	1949-08-03	**Occurrence Rank:**	Unknown
Owner/Manager:	UNKNOWN	**Trend:**	Unknown
Presence:	Presumed Extant		

Location:

SOUTHERN OUTSKIRTS OF EUREKA.

Detailed Location:

MAPPED IN THE VICINITY OF THE MOUTH OF THE EEL RIVER AND MARTIN SLOUGH. EXACT LOCATION UNKNOWN.

Ecological:

MARSH AND BOG LAND.

Threats:

General:

ONLY SOURCE OF INFORMATION FOR THIS SITE IS 1949 COLLECTION BY NOBS AND SMITH.

PLSS: T04N, R01W, Sec. 03 (H)	**Accuracy:** 1 mile	**Area (acres):**	0
UTM: Zone-10 N4513041 E400758	**Latitude/Longitude:** 40.76235 / -124.17580	**Elevation (feet):**	50

County Summary:

Humboldt

Quad Summary:

Fields Landing (4012462), Eureka (4012472)

Sources:

NOB49S0006 NOBS, M. & S. SMITH - NOBS #1187 DS #415212, UC #1191473, POM #312874 1949-08-03

Occurrence Report

California Department of Fish and Game

California Natural Diversity Database

Map Index Number:	26633	**EO Index:**	1305
Key Quad:	Fields Landing (4012462)	**Element Code:**	PDMAL110K9
Occurrence Number:	3	**Occurrence Last Updated:**	2004-01-21

Scientific Name: *Sidalcea oregana ssp. eximia* **Common Name:** coast sidalcea

Listing Status:	**Federal:**	None	**Rare Plant Rank:**	1B.2
	State:	None	**Other Lists:**	BLM_S-Sensitive
CNDDB Element Ranks:	**Global:**	G5T1		
	State:	S1.2		

General Habitat:

MEADOWS AND SEEPS, NORTH COAST CONIFEROUS FOREST, LOWER MONTANE CONIFEROUS FOREST.

Micro Habitat:

NEARS MEADOWS, IN GRAVELLY SOIL. 0-1800M.

Last Date Observed:	1907-06-25	**Occurrence Type:**	Natural/Native occurrence
Last Survey Date:	1907-06-25	**Occurrence Rank:**	Unknown
Owner/Manager:	UNKNOWN	**Trend:**	Unknown
Presence:	Presumed Extant		

Location:

ELK PRAIRIE, VALLEY OF THE ELK RIVER.

Detailed Location:

MAPPED NORTHEAST OF FIELDS LANDING.

Ecological:

ALONG DITCH IN VALLEY OF RIVER 0-500'

Threats:

General:

ONLY SOURCE OF INFORMATION FOR THIS SITE IS COLLECTION BY TRACY #2578 CITED IN "A STUDY OF THE PERENNIAL SPECIES OF SIDALCEA" IN U WASH PUBL BIOL VOL 18 BY HITCHCOCK (1957).

PLSS: T04N, R01W, Sec. 09 (H)		**Accuracy:**	1 mile	**Area (acres):**	0
UTM: Zone-10 N4510388 E400106		**Latitude/Longitude:**	40.73838 / -124.18310	**Elevation (feet):**	100

County Summary:	**Quad Summary:**
Humboldt	Fields Landing (4012462), Eureka (4012472)

Sources:

HIT57A0001	HITCHCOCK, C. - A STUDY OF THE PERENNIAL SPECIES OF SIDALCEA, PART I: TAXONOMY. UNIV. WASH. PUBL. BIOL. 18:56-58, 67, 79, 3-12. 1957-XX-XX
JEP36B0001	JEPSON, W. - A FLORA OF CALIFORNIA - VOLUME 2 1936-XX-XX
TRA07S0007	TRACY, J. - TRACY #2578 UC #146131 & #146134 1907-06-25

Occurrence Report

California Department of Fish and Game

California Natural Diversity Database

Map Index Number:	58540	**EO Index:**	45798
Key Quad:	Eureka (4012472)	**Element Code:**	PMCYP037Y0
Occurrence Number:	9	**Occurrence Last Updated:**	2005-07-07

Scientific Name: *Carex lyngbyei* **Common Name:** Lyngbye's sedge

Listing Status:	**Federal:**	None	**Rare Plant Rank:**	2.2
	State:	None	**Other Lists:**	
CNDDB Element Ranks:	**Global:**	G5		
	State:	S2.2		

General Habitat:

MARSHES AND SWAMPS (BRACKISH OR FRESHWATER).

Micro Habitat:

0M.

Last Date Observed:	2002-07-19	**Occurrence Type:**	Natural/Native occurrence
Last Survey Date:	2002-07-19	**Occurrence Rank:**	Good
Owner/Manager:	UNKNOWN	**Trend:**	Unknown
Presence:	Presumed Extant		

Location:

SOUTH OF EUREKA, ALONG MARTIN SLOUGH AND SWAIN SLOUGH.

Detailed Location:

SCATTERED ALONG PORTIONS OF MARTIN SLOUGH AND SWAIN SLOUGH, WITH ONE OUTLYING SUBPOPULATION WEST OF HIGHWAY 101. MAPPED AS TWO POLYGONS EXTENDING FROM THE SW 1/4 OF SECTION 4 TO FAR NORTHERN SECTION 9 TO THE SW 1/4 OF SECTION 3.

Ecological:

SALT MARSH, FRESHWATER MARSH/STREAM, AND SLOW-MOVING BRACKISH WATER. ASSOCIATED WITH POTENTILLA ANSERINA SSP. PACIFICA, SPARTINA DENSIFLORA, TYPHA LATIFOLIA, GLYCERIA PAUCIFLORA, ALOPECURUS SACCATUS, DISTICHLIS SPICATA, ETC.

Threats:

GRAZING, NON-NATIVE SPARTINA DENSIFLORA.

General:

VERY LARGE NUMBER OF PLANTS SEEN IN 2002. HABITAT VARIES FROM EXCELLENT TO POOR. OLD COLLECTIONS FROM "NEAR MOUTH OF ELK RIVER" BY TRACY ALSO ATTRIBUTED HERE.

PLSS:	T04N, R01W, Sec. 04 (H)	**Accuracy:**	specific area	**Area (acres):**	38
UTM:	Zone-10 N4511952 E400236	**Latitude/Longitude:**	40.75248 / -124.18181	**Elevation (feet):**	10

County Summary:	**Quad Summary:**
Humboldt	Eureka (4012472)

Sources:

EIC99U0001	EICHER, R. & A. EICHER - EMAIL TO D. TIBOR REGARDING CAREX LYNGBYEI 1999-04-29
LOV02F0001	LOVELACE, B. - FIELD SURVEY FORM FOR CAREX LYNGBYEI WITH OBSERVATION OF CASTILLEJA AMBIGUA SSP. HUMBOLDTIENSIS 2002-07-19
TRA15S0003	TRACY, J. - TRACY #4646 UC #194811 1915-06-06
TRA27S0004	TRACY, J. - TRACY #8248 JEPS #79849, UC #562333 1927-07-16
TRA38S0012	TRACY, J.P. - TRACY #16069 JEPS #26004, UC #1115809 1938-07-15

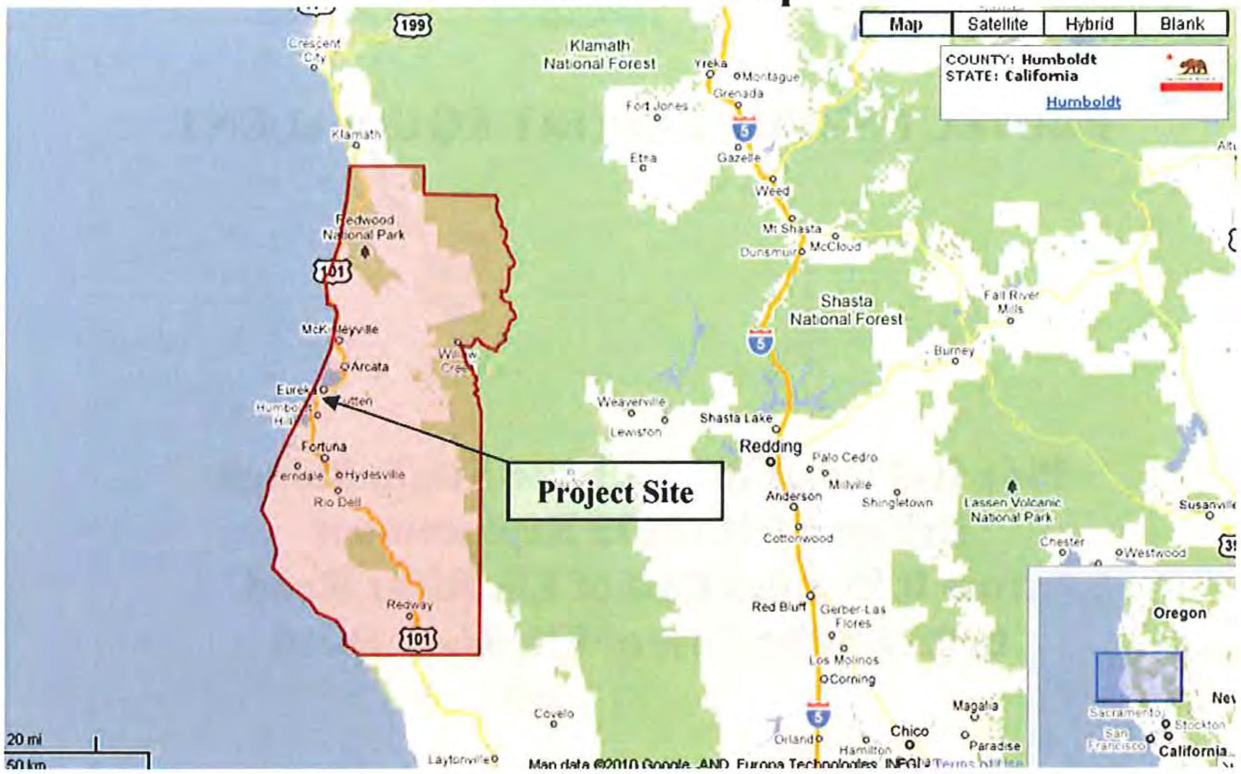
PROJECT STUDY REPORT EQUIVALENT

Pine Hill Road Bridge Over Swain Slough
Bridge # 04C-0173 Replacement
from 0.15 miles East of Elk River Road
to 0.23 miles East of Elk River Road

APPROVED: ______________________________ ______________

Chris Whitworth, PE *DATE*
County of Humboldt
Deputy Director

Location Map



Vicinity Map

This Project Study Report Equivalent has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

Jason P. Jurrens — 9/29/10

REGISTERED CIVIL ENGINEER — *DATE*

PROFESSIONAL ENGINEER
REGISTERED
Jason P. Jurrens
No. 62458
Exp. 9/30/11
CIVIL
STATE OF CALIFORNIA

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1. INTRODUCTION

The County of Humboldt is proposing to replace the existing 3 span simply supported timber stringer with a reinforced concrete deck structure (Bridge No. 04C-0173) over Swain Slough. The existing bridge is located on Pine Hill Road approximately 0.2 miles east of Elk River Road just south of Eureka, CA. Pine Hill Road provides access across Swain Slough to several residences east of Swain Slough. The existing timber structure is poor condition and is considered both Structurally Deficient and Functionally Obsolete.

See the Cost estimate for specific work items included in this project.

Project Limits	01-Hum-CR
Applicant:	County of Humboldt
Funding Source:	100% Federal Highway Bridge Program (HBP) Utilizing Toll Credits
Construction Capital Costs:	$1,051,000
Support Costs (Including construction engineering and contingencies):	$937,000
Right of Way Costs:	$50,000
Total Project Costs:	$2,038,000
Number of Alternatives:	2
Proposed Alternative:	Cast In Place Prestressed Slab
Type of Facility (conventional, expressway, freeway):	2-Lane Rural Local Road
Number of Structures:	One - Br No. 04C-0173 over Swain Slough
Anticipated Environmental Document	To be determined
Legal Description	The existing bridge is located on Pine Hill Road 0.2 mi east of Elk River Road south of Eureka, CA

A project report will serve as approval of the "selected" alternative.

2. BACKGROUND

It is anticipated that the proposed structure will be replaced on the current tangent alignment. Horizontal alignment constraints are not expected to control the roadway design. The replacement profile will likely be driven by structure type and hydraulic requirements. Sight distance standards will be easily achievable at this location due to the flat configuration of the roadway.

The County has indicated that it will be acceptable to close the existing roadway and detour traffic during construction of the replacement bridge and approach roadway.

There is a sewer line that runs along the north edge of Pine Hill Road and is fastened to the structure as it crosses Swain Slough. Replacement of the existing structure will encroach on this utility and it is anticipated that construction of the new bridge will require relocation of the existing utility.

It is our current understanding that the existing roadway is within existing County right-of-way. It is anticipated that any additional need for right-of-way acquisition, rights of entry, or temporary construction easements will be minimized by maintaining the existing roadway alignment. The increased width of the new bridge may require some minor right of way acquisition adjacent to the new bridge.

Right of way requirements or construction easements should be assessed for detour alternatives as well. It appears that prime detour route for traffic during construction would be approximately 1.6 miles, yet would affect only a limited number of residencies adjacent to the bridge.

A detailed hydraulic study would be required and could affect the vertical profile, bridge type and lengths, and most importantly costs. The existing bridge crosses Swain Slough just upstream of its confluence with Elk River and is primarily controlled by tidal flow. The channel appears to have a good alignment with the current bridge configuration.

The primary component that affects bridge costs is the required bridge length. The existing timber stringer structure is approximately 63 feet long. Based upon unknown historic hydraulic performance, discussions with County staff, and review of the aerial photograph, it is anticipated that the replacement structure will be approximately 70 feet long. Once topographic mapping and a hydraulic analysis has been completed, the final structure length can be finalized. For comparison purposes all structure alternatives presented in this memo assume a 70 foot bridge length.

Local County road standards defer to most AASHTO requirements. According to AASHTO the minimum clear width for new or reconstructed bridges for an ADT greater than 400 but less than 1,500 vehicles per day is an 11' traveled way plus 5' of shoulder on each side. This results in a minimum clear width of 32' across the bridge. Since the design speed along Pine Hill Road is relatively high (45 mph) and the road alignment is long and straight, it is anticipated that a conventional concrete barrier such as Type 736 associated with higher speeds should be used rather than a metal tube bridge railing. A conventional concrete bridge railing would be mounted on top of the bridge structure. This results in an increased structure width beyond the preferred minimum clear road width. The proposed structure width is 35' and assumes the use of a concrete bridge railing 1'-6" thick. The additional 3' is required to accommodate the thickness of the concrete bridge elements and still maintain a 32' clear width.

3. PURPOSE AND NEED STATEMENT

Need:

The project need is to provide a safe permanent crossing over Swain Slough on Pine Hill Road since the existing structure is Structurally Deficient. The two outside timber stringers are decaying and have extensive rot. The reinforced concrete deck is moderately to severely cracked both transversely and longitudinally, and there are moderate to severe vertical cracks as well as spalls in the concrete piles. The existing timber bridge rail is deteriorating and does not meet current standards.

Purpose:

The primary objective is to replace a Structurally Deficient load posted structure to improve public safety since the exiting bridge has reached the end of its lifespan and a repair/rehabilitation would represent a questionable investment of limited long term value to the County.

4. DEFICIENCIES

The existing timber structure has been rated Structurally Deficient. It is a 65 year old timber structure that exhibits extensive deterioration and decay to its timber stringers, girders, and piles. The reinforced concrete deck shows significant cracking. The bridge has been rated Structurally Deficient due to the deteriorating girders and the overall sufficiency rating for the structure is 44.6. The amount of work required to repair the bridge to a satisfactory condition is considerable and costly.

There are currently timber bridge railings with no approach guard railings. The proposed structure will satisfy the current deck geometry standards as well as providing approved bridge railing and approach guard railing. There does not appear to be any considerable scour impacts on the existing piers.

5. CORRIDOR AND SYSTEM COORDINATION

Pine Hill Road is not listed on the Caltrans Highway Performance Monitoring System (HPMS) functional classification list. Pine Hill Road is functionally classified as a local road. The future ADT (2029) is 419 vehicles per day and the project is located in flat terrain. Based upon AASHTO criteria the minimum width of traveled way is 22' feet with five foot shoulders.

6. ALTERNATIVES

Two build alternatives have been studied.

Alternative 1 – Single Span Cast-In-Place Prestressed Concrete Slab

A single span cast-in-place prestressed concrete slab is desirable due to the ease of superstructure construction. Prestressing would allow for longer spans for the shallow superstructure depth that matches the existing bridge. This structure depth should not impinge on the channel hydraulic water surface elevation and allows for longer spans relative to the reinforced concrete slab option. Also, a shallow superstructure will limit changes to the roadway profile and reduce approach fills. A slab bridge type construction represents one of the most economical superstructure types to construct. The single span alternative will eliminate the need for supports within the channel and will decrease the environmental impacts.

Advantages

- Prestressed superstructure maximizes span length and reduces costly pier foundations
- Reduced superstructure construction time and costs due to ease of forming
- Lowest superstructure depth of all presented alternatives
- Least expensive bridge type for this bridge replacement project

Disadvantages

- Possible increased superstructure construction time due to prestressing operations
- Joint seals and seat abutments required for prestressed slab alternative

Alternative 2 – Two Span Cast-In-Place Reinforced Concrete Slab

A 2 span cast-in-place reinforced concrete slab would minimize structure depth and provide ease of superstructure construction. A reinforced concrete option would require shorter spans for the shallow superstructure depth that matches the existing bridge. This structure depth should not impinge on the controlling hydraulic water surface elevation but requires shorter spans relative to the prestressed concrete concrete slab option. Also, a shallow superstructure will limit changes to the roadway profile and reduce approach fills. It is anticipated that these intermediate piers would be founded on some type of concrete displacement pile since the existing piles demonstrate that pile driving is suitable for this bridge site. It is unlikely that costly pierwalls will be required instead of pile extensions due to the low flow volumes and debris level anticipated.

Advantages

- No prestressing operation will reduce superstructure complexity and construction time
- Less complex and lower costing diaphragm type abutments than for prestressed concrete slab
- Reduced superstructure construction time and costs due to ease of forming

Disadvantages

- Increased foundation construction time and costs as a result of additional bridge support
- Additional support may increases the potential of debris getting trapped on the piers
- Will be more expensive than the prestressed concrete slab type bridge

No Build Alternative

This alternative would provide no improvements to the existing crossing. All existing deficiencies and safety issues will remain. Eventually, decay and deterioration of the structure could cause a collapse. Therefore, this alternative is not considered feasible.

7. FUNDING

A construction cost estimate range for each concept alternative has been developed. The estimated construction cost analysis has been performed using Caltrans square foot cost data for similar structure types constructed recently. The recommended bridge structure construction cost for programming purposes is $1,051,000 which includes bridge removal, slope protection, channel work, detour, approach roadway, utility relocation, and 10% Mobilization. At this time a CIP Prestressed Concrete Slab is the preferred alternative, however since this study was conducted with limited site data, other alternatives should not be eliminated. It is important to estimate costs at the high end of the price range to insure adequate funding is programmed for this project. All proposed alternatives should be considered further during the preliminary engineering phase.

A 25% contingency should be included for programming purposes to account for the preliminary nature of the estimates. The County is cautioned that the cost estimates are based upon available square foot prices for similar structure types, and actual construction costs may vary. Several unknown factors such as hydraulic design constraints and geotechnical design data could significantly affect bridge length and costs. This unknown may also affect which alternative is the most cost effective. Additionally, this project is located within the jurisdiction of the California Coastal Commission which will require an additional level of coordination above and beyond what is typically required for bridge replacement projects. The following is a tabulation of the expected costs for this project:

Alternative	Structure Construction Cost
1 - CIP/PS Slab	$465,500
2 - CIP/RC Slab	$490,000

Construct Bridge	Bridge Removal	Slope Protection	Channel Work	Detour	Approach Roadway	Utility Relocation	Mobilization	Total Construction
$465,500	$20,000	$10,000	$20,000	$10,000	$400,000	$30,000	$95,500	**$1,051,000**

PE Component	PE Component Cost (Est)
1 – Environmental	$150,0000
2 - Geotechnical	$45,000
3- Hydraulics	$18,000
4-Surveying	$25,000
7- Preliminary Design	$70,000
8-Final Design	$120,000
9- Indirect Costs	$64,000
Total	$492,000

PE	R/W	CON	CE	Cont	Total Cost
$492,000	$50,000	$1,051,000	$182,000	$263,000	**$2,038,000**

8. SCHEDULE

Milestones	Delivery Date (Month, Day, Year)
Begin Environmental	6/01/2011
Circulate DED	5/01/2011
PA & ED	8/01/2012
Begin Right of Way	9/01/2012
Project PS&E	1/01/2013
Right of Way Certification	4/01/2013
Ready to Advertise	5/01/2013
Begin Construction	8/01/2013
End Construction	11/01/2013
End Project	02/01/2014

9. FHWA COORDINATION

This project will utilize Federal HBP funding. Caltrans will provide project oversight through Caltrans Local Assistance. All aspects of the project will meet federal and state requirements. Caltrans will approve the NEPA document under current delegation authority from FHWA.

10. LOCAL ENTITY CONTACTS/DISTRICT CONTACTS

Tom Mattson	Director of Public Works, Humboldt County	707.445.7491
Chris Whitworth	Deputy Director of Public Works, Humboldt County	707.445.7491
Suzanne Theiss	Caltrans Local Assistance	707.445.6399
Jim Foster	Project Manager, Quincy Engineering, Inc.	916.368.9181
Jason Jurrens	Project Engineer, Quincy Engineering, Inc.	916.368.9181

11. ATTACHMENTS

A. Site Photos
B. Preliminary General Plan
C. Preliminary Cost Estimate
D. Bridge Inspection Report with Structure Inventory and Appraisal Report

Attachment A

Figure 1: Looking east on Pine Hill Road.

Figure 2: Looking west on Pine Hill Road.

Figure 3: Profile of bridge looking north.

Figure 4: Profile of bridge looking north.

Figure 5: Looking north from bridge.

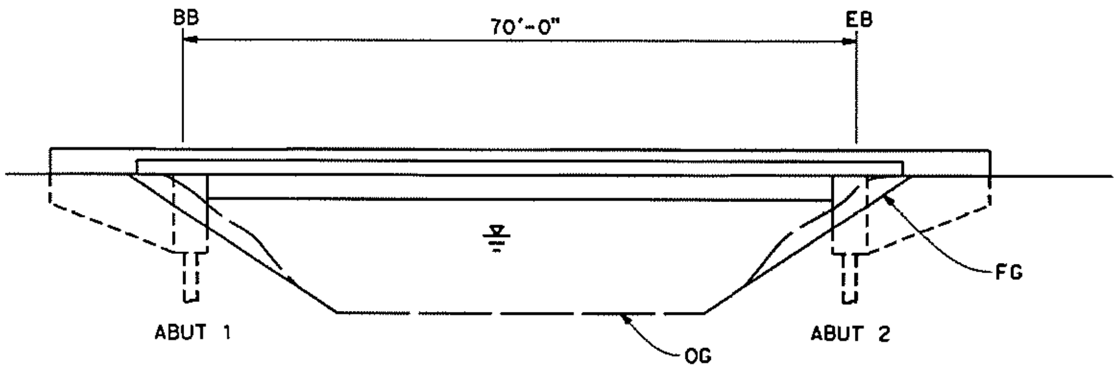
Figure 6: Looking s from bridge.

Figure 7: Approach road, looking east.

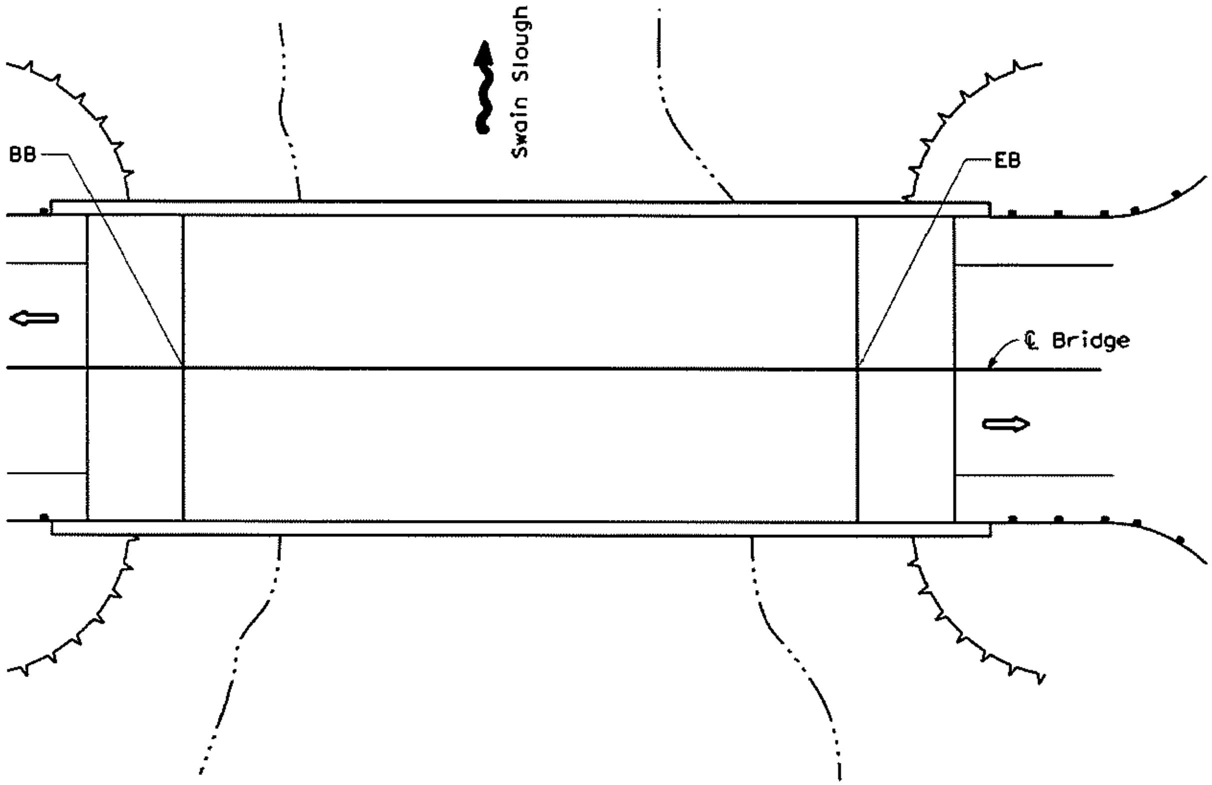
Figure 8: Approach road, looking west.

Figure 9: Sewer line attached to north side of bridge.

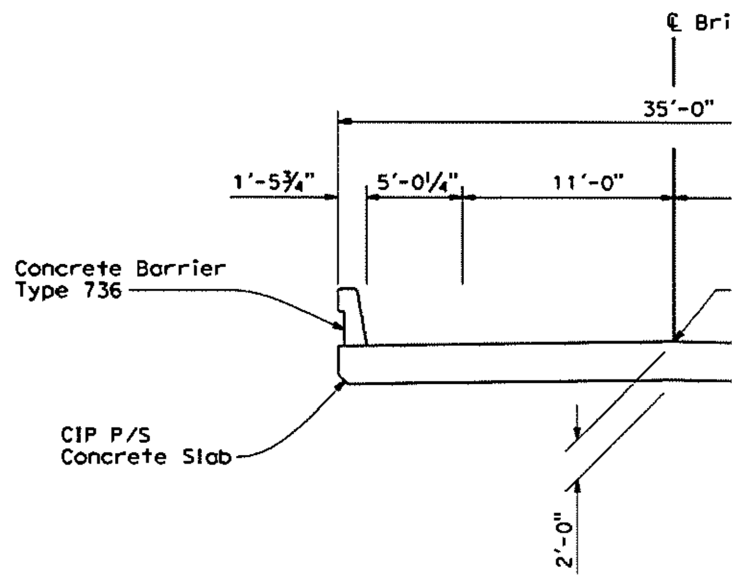
No Scale



ELEVATION
1"=10'



PLAN



TYPICAL SE
1"=5'

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Bridge Remov
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Length
Width
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Cost / ft2

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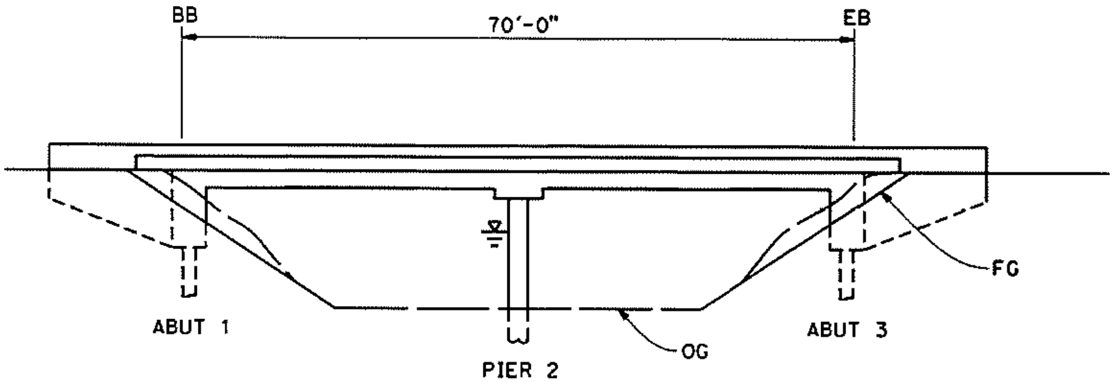
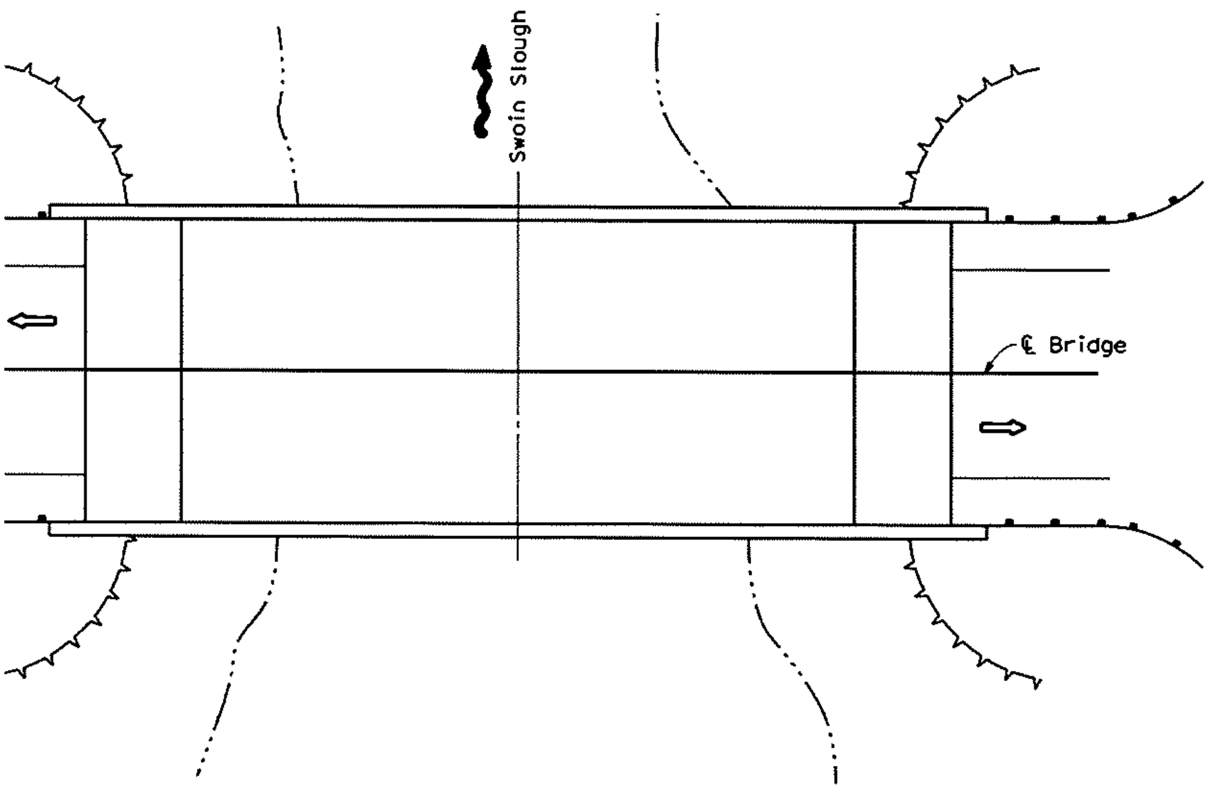
25% Continge
Grand Totol

No Scale

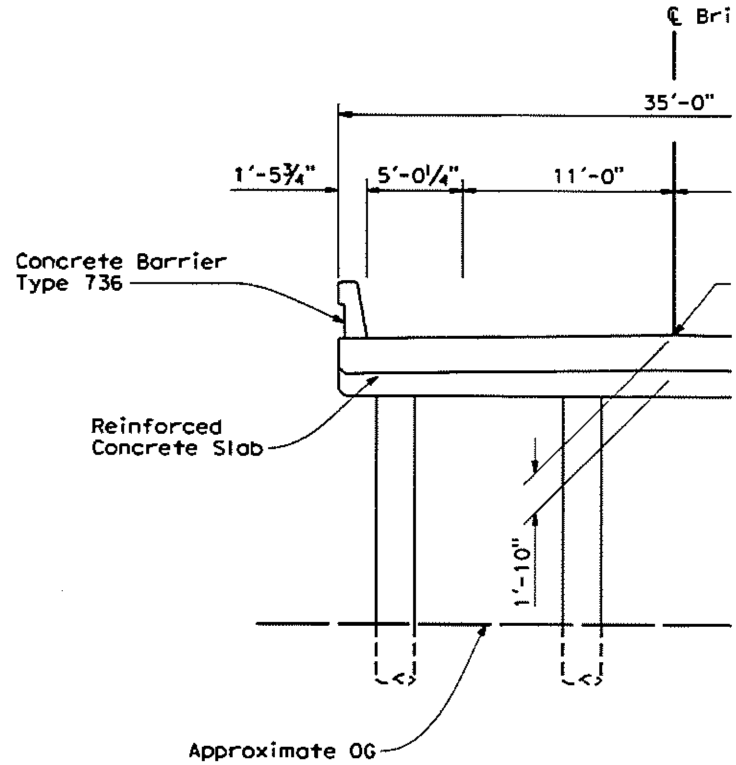


ELEVATION

1"=10'



PLAN



TYPICAL SE

1"=5'

Date of Esti
Bridge Remov
Structure De
Length
Width
Areo
Cost / ft2

Totol Cost w
10% Mobilizat
25% Continge
Grand Total

Assuming New Bridge per Exhibit B — J. Jurrens — 9/27/2010

Replace on existing alignment using staged construction
Bridge length 70'
Min opening width due to drift - NA
Structure width - 2-1.5' rails, 2-5' shoulders, 2-11 lanes = 35'
Design ADT=1880 vpd

Item	Length ft	Width ft	Area sq ft	Cost $/sq ft	HBP Participating	Not HBP Participating
Replace Bridge PC/PS Slab	70	35	2450	190 *	$ 465,500.00	$ -
Bridge Removal RC Slab	63	20	1260	15.873	$ 20,000.00	$ -
Slope Protection	Liner repair Assuming $10k				$ 10,000.00	$ -
Channel Work	Channel restoration - Assume $20k				$ 20,000.00	$ -
Detour - Stage construction - Assume $10k (Closure)					$ 10,000.00	
Approach Roadway (Assuming 400' each end @ $16/sq ft)	800	32	25600	15.625	$ 400,000.00	$ -
Utilities	Assume $30k sewer				$ 30,000.00	
Mobilization (10%)					$ 95,550.00	$ -
				Total	$ 1,051,050.00	$ -
			Construction	Programming Total	$ 1,051,000.00	$ -

PE Rate 41% Assuming $150K environmental, $25K Surveying, $45K Geotech, $18K Hydraulics, $190K Design/PS&E — 260
CE Rate 15%
Contingency Rate 25%

	Direct Cost	Indirect Costs	HBP Participating Costs	Target Dates	
PE	$ 428,000.00	$ 64,200.00	$ 492,200.00	11/1/2010	
R/W			$ 50,000.00	10/1/2012	
CON	$ 1,051,000.00				
CE	$ 157,650.00	$ 23,647.50			$ 181,297.50
Cont	$ 262,750.00				
Subtotal	$ 1,471,400.00	$ 23,647.50	$ 1,495,047.50	5/1/2013	$ 1,313,750.00
		Total Participating	$ 2,037,247.50		

HBP % 88.53%
Toll Match % 11.47%

		Federal Fiscal Year (FFY)				Total		Check Total
		10/11	11/12	12/13	13/14	HBP	Local/Toll	
PE		25%	25%	50%	0%			
	HBP	**$ 108,936.17**	**$ 108,936.17**	**$ 217,872.33**		**$ 435,744.66**		
	Toll	**$ 14,113.84**	**$ 14,113.84**	**$ 28,227.67**			**$ 56,455.34**	$ 492,200.00
RW			0%	100%	0%			
	HBP			**$ 44,265.00**		**$ 44,265.00**		
	Toll			**$ 5,735.00**			**$ 5,735.00**	$ 50,000.00
Con		0%	0%	0%	100%			
	HBP				**$ 1,323,565.55**	**$ 1,323,565.55**		
	Toll				**$ 171,481.95**		**$ 171,481.95**	$ 1,495,047.50
	Total	$ 123,050.00	$ 123,050.00	$ 296,100.00	$ 1,495,047.50	**$ 1,803,575.21**	**$ 233,672.29**	$ 2,037,247.50
						88.53%	11.47%	$ 2,037,247.50

Schedule Assumptions

NEPA CE and CEQA IS/MND w/ Studies	2 years
Final Design + RW	1 years
Construction	1 years

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
DIVISION OF STRUCTURE EARTHQUAKE ENGINEERING & DESIGN SUPPORT
OFFICE OF SPECIFICATIONS & ESTIMATES
P. O. BOX 942874
SACRAMENTO, CA 94274-0001

COMPARATIVE BRIDGE COSTS

JANUARY 2010

The following tabular data gives some **general guidelines** for structure type selection and its relative cost. These costs should be used just for **preliminary estimates** until more detailed information is developed.

These costs reflect the **'bridge cost'** only and ***do not*** include items such as: time related overhead, mobilization, bridge removal, approach slabs, slope paving, soundwalls or retaining walls.

The following factors *must* be taken into account when determining a price within the cost range:

Factors for Lower end of Price Range	Factors for Higher end of Price Range
Short spans, Low Structure Height, No Environmental Constraints, Large Project, No Aesthetic Issues, Dry Conditions, No Bridge Skew	Long spans, High Structure Height, Environmental Constraints, Small Project, Aesthetic Issues, Wet Conditons (cofferdams required), Skewed Bridges
Urban Location	Remote Location
Seat Abutment	Cantilever Abutment
Spread Footing	Pile Footing (Large Diameter Piling)
No Stage Construction	2 Stage Construction

Factors that will increase the price over the high end of the Price Range 25%-150%

Structures with more than 2 construction stages
Unique substructure construction
Widenings less than 15 Ft.

STRUCTURAL SECTION	(STR. DEPTH / MAX SPAN) SIMPLE	CONTINUOUS	COMMON SPAN RANGE **feet**	**COST RANGE **$ / Square foot**	REMARKS
RC SLAB	0.06	0.045	16 - 44	90-200	THESE ARE THE MOST COMMON TYPES AND ACCOUNT FOR ABOUT 80% OF BRIDGES ON CALIFORNIA STATE HIGHWAYS.
RC T-BEAM	0.07	0.065	40 - 60	120-150	
RC BOX	0.06	0.055	50 - 120	115-200	
CIP/PS SLAB	0.03	0.03	40 - 65	90-190	
CIP/PS BOX	0.045	0.04	100 - 250	90-190	
PC/PS SLAB	0.03 (+3" AC)	0.03 (+3" AC)	20 - 50	190-270	NO FALSEWORK REQUIRED.
PC/PS T, TT, ⊥	0.06 (+3" AC)	0.055 (+3" AC)	30 - 120	180-250	
BULB T GIRDER	0.05	0.045	90 - 145	120-240	
PC/PS I	0.055	0.05	50 - 120	120-200	
PC/PS BOX	0.06	0.045	120 - 200	120-300	
STRUCT STEEL I GIRDER	0.045	0.04	60 - 300	180-300	NO FALSEWORK REQUIRED.

NOTE: Removal of a box girder structure costs from $8 - $15 per square foot.

**Average Cost/SQFT are calculated using "Bridge Costs Only" as defined by the Federal Highway Administration

DEPARTMENT OF TRANSPORTATION
Structure Maintenance & Investigations

Caltrans

Bridge Number : 04C0173
Facility Carried: PINE HILL RD.
Location : 0.2 MI E/O ELK RIVER RD
City :
JAN 19 2010
Inspection Date : 07/22/2009

Bridge Inspection Report

Inspection Type

Routine	FC	Underwater	Special	Other
X				

STRUCTURE NAME: MARTIN SLOUGH

CONSTRUCTION INFORMATION

Year Built : 1955
Year Widened: N/A
Length (m) : 19.2

Skew (degrees): 0
No. of Joints : 0
No. of Hinges : 0

Structure Description: Three-span simply-supported timber stringer (17) structure, with concrete deck, concrete curbs and timber rail on reinforced concrete abutments and reinforced concrete bent caps on reinforced concrete piles (8).

Span Configuration : 3 @ 6.10 m

LOAD CAPACITY AND RATINGS

Design Live Load: OTHER OR UNKNOWN
Inventory Rating: 23.7 metric tonnes — Calculation Method: ALLOWABLE STRESS
Operating Rating: 39.5 metric tonnes — Calculation Method: ALLOWABLE STRESS
Permit Rating : PPPPP
Posting Load : Type 3: Legal — Type 3S2: Legal — Type 3-3: Legal

DESCRIPTION ON STRUCTURE

Deck X-Section: 0.06 m br, 0.09 m cu, 5.79 m 0.09 m cu, 0.06 m br
Total Width: 6.1 m — Net Width: 5.8 m — No. of Lanes: 2
Rail Description: Timber railing on timber posts — Rail Code : 0000
Min. Vertical Clearance: Unimpaired

DESCRIPTION UNDER STRUCTURE

Channel Description: Mud with heavy vegetation growth along the banks. The channel appears to have a good alignment with the bridge opening. The channel appears to have a flat slope with no hydraulic skew. Tidal flow.

CONDITION TEXT

SCOPE OF INSPECTION

At the time of this inspection, the maximum water depth was approximately 450 mm under Spans 2 and 3. The portions of Abutment 4 and Bent 3 under water were visually inspected. Only Span 1 and the sides of Abutment 4 could be inspected at this time.

CONDITION OF STRUCTURE

The timber bridge railing is deteriorating. Eleven out of 20 posts are showing signs of rot.

There are moderate (0.5 - 2 mm wide) longitudinal and transverse cracks spaced approximately 1 m apart in the deck. The cracking is concentrated in the center of the structure over the full length of the bridge.

The top 25 - 50 mm of the left exterior girders are rotten. The top 12 - 25 mm of the right exterior girders are rotten. In addition, the timber sill plates and ends of the timber stringers are rotten at Abutment 1 right and left, Bent 2 left, Bent 3 right and

CONDITION TEXT

Abutment 4 right. Girder 17 at Abutment 1 is bearing on a 25 mm x 150 mm area of the timber sill plate below.

There are moderate to severe (>0.5 mm wide) vertical cracks in most of the concrete piles. There are also spalls on the corners of the piles.

SCOUR

Abutment 4 is undermined approximately 1 m vertically x 1.2 m horizontally under along the entire length of the abutment.

The left wingwall at Abutment 4 is undermined approximately 200 mm vertically x 300 mm horizontally under along the entire length of the wingwall.

ELEMENT INSPECTION RATINGS

F#	Elem	Element Description	Env	Total Qty	Units	St. 1	St. 2	St. 3	St. 4	St. 5
						Qty in each Condition State				
101	12	Concrete Deck - Bare	2	110	sq.m.	110	0	0	0	0
101	117	Timber Stringer	2	290	m.	0	254	0	36	0
101	205	Reinforced Conc Column or Pile Extension	4	16	ea.	0	6	10	0	0
101	215	Reinforced Conc Abutment	4	12	m.	12	0	0	0	0
101	227	Reinforced Conc Submerged Pile	2	1	ea.	1	0	0	0	0
101	234	Reinforced Conc Cap	2	24	m.	24	0	0	0	0
101	304	Open Expansion Joint	2	30	m.	30	0	0	0	0
101	332	Timber Bridge Railing	2	38	m.	17	21	0		
101	358	Deck Cracking	2	1	ea.	0	0	1	0	0
101	361	Scour	2	1	ea.	0	1	0	0	0

WORK RECOMMENDATIONS

RecDate: 05/09/2007
Action : Sub-Scour Mitigate
Work By: LOCAL AGENCY
Status : PROPOSED
EstCost:
StrTarget: 2 YEARS
DistTarget:
EA:
Protect the scoured locations at Abutment 4.

RecDate: 12/03/2004
Action : Super-Rehab
Work By: LOCAL AGENCY
Status : PROPOSED
EstCost:
StrTarget: 1 YEAR
DistTarget:
EA:
Replace all the exterior timber stringers along with any rotten bearing plates.

RecDate: 01/13/1999
Action : Sub-Rehab
Work By: LOCAL AGENCY
Status : PROPOSED
EstCost:
StrTarget: 2 YEARS
DistTarget:
EA:
Jacket the deteriorated columns.

Inspected By : SA.Silveira

Summer A. Silveira

Registered Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
SUMMER A SILVEIRA
No. 66913
Exp. 9/30/10
CIVIL
STATE OF CALIFORNIA

STRUCTURE INVENTORY AND APPRAISAL REPORT

**************** IDENTIFICATION ***************

(1) STATE NAME- CALIFORNIA 069
(8) STRUCTURE NUMBER 04C0173
(5) INVENTORY ROUTE(ON/UNDER) - ON 140000000
(2) HIGHWAY AGENCY DISTRICT 01
(3) COUNTY CODE 023 (4) PLACE CODE 00000
(6) FEATURE INTERSECTED- MARTIN SLOUGH
(7) FACILITY CARRIED- PINE HILL RD
(9) LOCATION- 0.2 MI E/O ELK RIVER RD
(11) MILEPOINT/KILOMETERPOINT 0
(12) BASE HIGHWAY NETWORK- NOT ON NET 0
(13) LRS INVENTORY ROUTE & SUBROUTE 00
(16) LATITUDE 40 DEG 45 MIN 10 SEC
(17) LONGITUDE 124 DEG 10 MIN 55 SEC
(98) BORDER BRIDGE STATE CODE % SHARE %
(99) BORDER BRIDGE STRUCTURE NUMBER

******** STRUCTURE TYPE AND MATERIAL ********

(43) STRUCTURE TYPE MAIN:MATERIAL- WOOD OR TIMBER
TYPE- STRINGER/MULTI-BEAM OR GDR CODE 702
(44) STRUCTURE TYPE APPR:MATERIAL- OTHER/NA
TYPE- OTHER/NA CODE 000
(45) NUMBER OF SPANS IN MAIN UNIT 3
(46) NUMBER OF APPROACH SPANS 0
(107) DECK STRUCTURE TYPE- CIP CONCRETE CODE 1
(108) WEARING SURFACE / PROTECTIVE SYSTEM:
A) TYPE OF WEARING SURFACE- NONE CODE 0
B) TYPE OF MEMBRANE- NONE CODE 0
C) TYPE OF DECK PROTECTION- NONE CODE 0

*************** AGE AND SERVICE ***************

(27) YEAR BUILT 1955
(106) YEAR RECONSTRUCTED 0000
(42) TYPE OF SERVICE: ON- HIGHWAY 1
UNDER- WATERWAY 5
(28) LANES:ON STRUCTURE 02 UNDER STRUCTURE 00
(29) AVERAGE DAILY TRAFFIC 250
(30) YEAR OF ADT 1979 (109) TRUCK ADT 3 %
(19) BYPASS, DETOUR LENGTH 2 KM

*************** GEOMETRIC DATA ***************

(48) LENGTH OF MAXIMUM SPAN 6.1 M
(49) STRUCTURE LENGTH 19.2 M
(50) CURB OR SIDEWALK: LEFT 0.1 M RIGHT 0.1 M
(51) BRIDGE ROADWAY WIDTH CURB TO CURB 5.8 M
(52) DECK WIDTH OUT TO OUT 6.1 M
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS) 5.8 M
(33) BRIDGE MEDIAN- NO MEDIAN 0
(34) SKEW 0 DEG (35) STRUCTURE FLARED NO
(10) INVENTORY ROUTE MIN VERT CLEAR 99.99 M
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR 5.8 M
(53) MIN VERT CLEAR OVER BRIDGE RDWY 99.99 M
(54) MIN VERT UNDERCLEAR REF- NOT H/RR 0.00 M
(55) MIN LAT UNDERCLEAR RT REF- NOT H/RR 0.0 M
(56) MIN LAT UNDERCLEAR LT 0.0 M

*************** NAVIGATION DATA ***************

(38) NAVIGATION CONTROL- NO CONTROL CODE 0
(111) PIER PROTECTION- CODE
(39) NAVIGATION VERTICAL CLEARANCE 0.0 M
(116) VERT-LIFT BRIDGE NAV MIN VERT CLEAR M
(40) NAVIGATION HORIZONTAL CLEARANCE 0.0 M

****

SUFFICIENCY RATING = 44.6
STATUS STRUCTURALLY DEFICIENT
HEALTH INDEX 74.1
PAINT CONDITION INDEX = N/A

************* CLASSIFICATION ************* CODE

(112) NBIS BRIDGE LENGTH- YES Y
(104) HIGHWAY SYSTEM- NOT ON NHS 0
(26) FUNCTIONAL CLASS- LOCAL RURAL 09
(100) DEFENSE HIGHWAY- NOT STRAHNET 0
(101) PARALLEL STRUCTURE- NONE EXISTS N
(102) DIRECTION OF TRAFFIC- 2 WAY 2
(103) TEMPORARY STRUCTURE-
(105) FED.LANDS HWY- NOT APPLICABLE 0
(110) DESIGNATED NATIONAL NETWORK - NOT ON NET 0
(20) TOLL- ON FREE ROAD 3
(21) MAINTAIN- COUNTY HIGHWAY AGENCY 02
(22) OWNER- COUNTY HIGHWAY AGENCY 02
(37) HISTORICAL SIGNIFICANCE- NOT ELIGIBLE 5

**************** CONDITION **************** CODE

(58) DECK 5
(59) SUPERSTRUCTURE 4
(60) SUBSTRUCTURE 5
(61) CHANNEL & CHANNEL PROTECTION 5
(62) CULVERTS N

********* LOAD RATING AND POSTING ********* CODE

(31) DESIGN LOAD- OTHER OR UNKNOWN 0
(63) OPERATING RATING METHOD- ALLOWABLE STRESS 2
(64) OPERATING RATING- 39.5
(65) INVENTORY RATING METHOD- ALLOWABLE STRESS 2
(66) INVENTORY RATING- 23.7
(70) BRIDGE POSTING- EQUAL TO OR ABOVE LEGAL LOADS 5
(41) STRUCTURE OPEN, POSTED OR CLOSED- A
DESCRIPTION- OPEN, NO RESTRICTION

**************** APPRAISAL **************** CODE

(67) STRUCTURAL EVALUATION 4
(68) DECK GEOMETRY 3
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL N
(71) WATER ADEQUACY 8
(72) APPROACH ROADWAY ALIGNMENT 8
(36) TRAFFIC SAFETY FEATURES 0000
(113) SCOUR CRITICAL BRIDGES 5

********** PROPOSED IMPROVEMENTS **********

(75) TYPE OF WORK- MISC STRUCTURAL WORK CODE 38
(76) LENGTH OF STRUCTURE IMPROVEMENT 19.2 M
(94) BRIDGE IMPROVEMENT COST $100,620
(95) ROADWAY IMPROVEMENT COST $20,124
(96) TOTAL PROJECT COST $120,744
(97) YEAR OF IMPROVEMENT COST ESTIMATE 2009
(114) FUTURE ADT 419
(115) YEAR OF FUTURE ADT 2029

*************** INSPECTIONS ***************

(90) INSPECTION DATE 07/09 (91) FREQUENCY 24 MO
(92) CRITICAL FEATURE INSPECTION: (93) CFI DATE
A) FRACTURE CRIT DETAIL- NO MO A)
B) UNDERWATER INSP- NO MO B)
C) OTHER SPECIAL INSP- NO MO C)

EXHIBIT 7-B FIELD REVIEW FORM

Local Agency Humboldt County Dept. of Public Works Field Review Date
Project Number To Be Determined Locator (Dst/Co/Rte/PM/A 01-HUM-CR

Project Name Swain Slough Bridge over Pine Hill Road Bridge No.(s) 04C-0173

1. PROJECT LIMITS (see attached list for various locations) Swain Slough Bridge on Pine Hill Road 0.2 mi north of Elk Creek Road, including 400' east and west of the existing bridge.

Net Length 0.1 (mile)

2. WORK DESCRIPTION Replace existing Structurally Deficient timber stringer bridge with a new concrete slab bridge.

ITS project or ITS element: Yes No X
If yes, choose: High-Risk (formerly "Major") ITS ___, Low-Risk (formerly "Minor") ITS ___, Exempt ITS ___

3. PROGRAMMING DATA FTIP (MPO/RTPA) FY Page
Amendment No. FTIP PPNO FHWA/FTA Approval Date
Federal Funds Phases PE X R/W X Const X
Air Basin: ______ (CMAQ only)

4. FUNCTIONAL CLASSIFICATION:

URBAN ______
Principal Arterial: ______
Minor Arterial: ______
Collector: ______
Local: ______

RURAL X
Principal Arterial: ______
Minor Arterial: ______
Major Collector: ______
Minor Collector: ______
Rural Local: __X__

5. STEWARDSHIP CATEGORY
FHWA Full Oversight (Stewardship): Yes __ No X

State-Authorized (Stewardship): Yes __ No X (a) DLAE oversight: Yes X No __
(b) District Construction Yes __ No X
ITS High-Risk project or element requiring FHWA oversight per stewardship: Yes __ No X

6. CALTRANS ENCROACHMENT PERMIT Is it required? Yes ______ No X

7. COST ESTIMATE BREAKDOWN (Including Structures)

		$1,000's	Fed. Participation Yes	No
PE	Environmental Process	150	X	
	Design	342	X	
	ITS System Manager or Integrator			
CONST	Const. Contract	1,314	X	
	Const. Engineering	182	X	
R/W	Preliminary R/W Work			
	Acquisition:			
	(No. of Parcels ____)			
	(Easements 4)	30	X	
	(Right of Entry 4)	20	X	
	RAP (No. Families)			
	RAP (No. Bus. ____)			
	Utilities (Exclude if included in contract items)			

TOTAL COST $ 2,038,000

7a. Value Engineering Analysis Required? Yes ____ No X
(Yes, if total project costs are $25M or more on the Federal-aid System, or $20M or more for bridges)

8. PROPOSED FUNDING

		Total Cost		Cost Share		
Grand Total		$ 2,038,000				
Federal Program	#1 HBP	$ ______	Fed.	$1,804,241	Reimb. Ratio	88.53%
(Name/App. Code)	#2 Toll Credit	$ ______	Fed.	$233,759	Reimb. Ratio	11.47%
Matching Funds Breakdown	Local:			$ ______	____%	
	State:			$ ______	____%	
	Other:			$ ______	____%	

State Highway Funds? Yes ____ Source ____________ No X
State CMAQ/RSTP Match Eligible Yes ____ No X Partial ____
Is the Project Underfunded? (Fed $ < Allowed Reimb.) Yes ____ No X

9. PROJECT ADMINISTRATION

		Agency	Consultant	State
PE	Environ Process	X	X	
	Design	X	X	
	System Man./Integ. ____			
R/W	All Work			
CONST ENGR	Contract	X	X	
CONSTRUCTION	Contract	X	X	
MAINTENANCE		X		

Will Caltrans be requested to review PS&E? Yes ____ No X

10. SCHEDULES: PROPOSED ADVERTISEMENT DATE 5/1/2013
Other critical dates: Environmental clearance by 8/1/2012

11. PROJECT MANAGER'S CONCURRENCE

Local Entity Chris Whitworth, PE Date: 9/28/2010

Signature & Title [signature] Deputy Director Phone No. 707.445.~~6399~~ 7377

Is field review required? Yes X No ____

Caltrans (District): District 1 Date: ____

Signature & Title: ____________

12. LIST OF ATTACHMENTS (Include all appropriate attachments if field review is required. See the "[ ]" notation for minimum required attachments for non-NHS projects)
X Field Review Attendance Roster or Contacts Roster
X Vicinity Map (Required for Construction Type Projects)

IF APPLICABLE (Complete as required depending on type of work involved)

X	Roadway Data Sheets [Req'd for Roadway projects]		
X	Typical Roadway Geometric Section(s) [Req'd for Roadway projects]		
X	Major Structure Data Sheet [Req'd for HBRR]	_____	Signal Warrants
_____	Railroad Grade Crossing Data Sheet	_____	Collision Diagram
_____	Airport Data Sheet (if within 10,000 feet)		
_____	Sketch of Each Proposed Alternate Improvement	_____	CMAQ/RSTP State STIP Match
_____	TE Application Document	_____	Systems Engineering Review Form (SERF)
_____	Existing federal, state, and local ADA deficiencies not included on other Attachments		Req'd for High-Risk (formerly "Major") and Low-Risk (formerly "Minor") ITS projects

13. DLAE FIELD REVIEW NOTES:

A. MINUTES OF FIELD REVIEWS

B. ISSUES OR UNUSUAL ASPECTS OF PROJECT

(Attachment to Field Review Form)

Distribution: Original with attachments – Local Agency
Copy with attachments (2 copies if HBRR) - DLAE

If the project scope changes it may be necessary to re-evaluate the PES as additional studies may be required. This is a preliminary assessment of the studies required to comply with NEPA and may be subject to change based on findings during the environmental process. If you have any questions please feel free to contact me.

Sincerely,

Brandon Larsen
Senior Environmental Planner
Office of Local Assistance

cc. Suzanne Theiss
Jen Buck

Appendix B - Type Selection Memo

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

STRUCTURE TYPE SELECTION

PROJECT IDENTIFICATION						DATE
Swain Slough Bridge Replacement Project						12/9/2013
DIST 01	CO HUM	RTE CR	PM	CU	EA	DESIGN GROUP QEI

BRIDGE NAME(S)	BR NO(S)	CONSTRUCTION COST - $	
Swain Slough Bridge	04C-0173	$688,000	
Area = 33'-4" X 80'-0" = 2,666 S.F.			

TYPES CONSIDERED: Single Span 80' Roadway Alignment Alternative

1. PC/PS Concrete I-Girder $688,000
2. ~~CIP/PS Concrete Box Girder $688,000~~

PREVIOUS COMMUNITY AESTHETIC OR ECOLOGICAL COMMITMENTS AND OTHER CONSIDERATIONS:

- Support within slough not allowed due to biological sensitive area neighboring Humboldt Bay.
- Falsework not required within limits of channel for precast ~~alternative.~~
- Removal of existing bridge structure to be done during low tide.
- Temporary stream diversion required during bridge construction.
- Stream protection required during bridge construction.
- Rock slope protection provided to reduce erosion and increase slough flow stability.

ARCHITECTURAL RECOMMENDATIONS (SKETCH ELEV & X-SECT: GIVE STD. COL NO.) AND COMMENTS FROM PUBLIC MEETING:

- None.

ENGINEERING AND ARCHITECTURAL SUMMARY:

- Type selected due to economy, constructability, and least long term maintenance.
- Full road closure is anticipated during construction.
- Existing, redundant, water line utility will be shut down during construction.
- Temporary sheet pile shoring and dewatering anticipated for construction of new abutments.
- Anticipated driven pile foundation.
- Thicker concrete cover and epoxy coated reinforcement required.

PROJECT ENGINEER
PROJECT MANAGER

Appendix C - NEPA Determination

DEPARTMENT OF TRANSPORTATION
DISTRICT 1, P. O. BOX 3700
EUREKA, CA 95502-3700
PHONE (707) 445-6410
FAX (707) 441-2048
TTY 711

Serious drought.
Help save water!

December 7, 2015

Andrew Bundschuh
County of Humboldt
Department of Public Works
1106 Second Street
Eureka, CA 95501

01-HUM-CR-0
BRLO 5904 (112)

SUBJECT: **Signed CE for Pine Hill Rd. (Swain Slough) Bridge Project**

Dear Mr. Bundschuh:

Attached is the signed CE for the Pine Hill Rd. Bridge Project. See the attached CE and ECR for environmental commitments required during and after construction. If the project scope changes please notify us as the CE may no longer be valid and will require a revalidation. If you have any questions please feel free to contact me (707) 441-4566.

The following permits will be required and a copy of the permits must be sent to our office before construction begins:

- 404 Permit from the Army Corps
- 401 from the Regional Water Quality Control Board
- 1602 from the Department of Fish and Wildlife
- Coastal Development Permit from Humboldt County

Sincerely,

Jenna Larson
Associate Environmental Planner
Office of Local Assistance

cc. Suzanne Theiss
Brett Gronemeyer

CATEGORICAL EXEMPTION/CATEGORICAL EXCLUSION DETERMINATION FORM

01-HUM-0-CR			BRLO 5904(112)
Dist.-Co.-Rte. (or Local Agency)	P.M./P.M.	E.A/Project No.	Federal-Aid Project No. (Local Project)/Project No.

PROJECT DESCRIPTION: (Briefly describe project including need, purpose, location, limits, right-of-way requirements, and activities involved in this box. *Use Continuation Sheet, if necessary.)*

Pine Hill Road (Swain Slough) Bridge Replacement. See Continuation Sheet.

CEQA COMPLIANCE *(for State Projects only)*

Based on an examination of this proposal and supporting information, the following statements are true and exceptions do not apply (See 14 CCR 15300 et seq.):

- If this project falls within exempt class 3, 4, 5, 6 or 11, it does not impact an environmental resource of hazardous or critical concern where designated, precisely mapped and officially adopted pursuant to law.
- There will not be a significant cumulative effect by this project and successive projects of the same type in the same place, over time.
- There is not a reasonable possibility that the project will have a significant effect on the environment due to unusual circumstances.
- This project does not damage a scenic resource within an officially designated state scenic highway.
- This project is not located on a site included on any list compiled pursuant to Govt. Code § 65962.5 ("Cortese List").
- This project does not cause a substantial adverse change in the significance of a historical resource.

CALTRANS CEQA DETERMINATION (Check one)

☐ **Exempt by Statute.** (PRC 21080[b]; 14 CCR 15260 et seq.)

Based on an examination of this proposal, supporting information, and the above statements, the project is:

☐ **Categorically Exempt. Class** . (PRC 21084; 14 CCR 15300 et seq.)

☐ **Categorically Exempt. General Rule exemption.** [This project does not fall within an exempt class, but it can be seen with certainty that there is no possibility that the activity may have a significant effect on the environment (CCR 15061[b][3].)

N/A		**N/A**	
Print Name: Environmental Branch Chief		Print Name: Project Manager/DLA Engineer	
Signature	Date	Signature	Date

NEPA COMPLIANCE

In accordance with 23 CFR 771.117, and based on an examination of this proposal and supporting information, the State has determined that this project:

- does not individually or cumulatively have a significant impact on the environment as defined by NEPA and is excluded from the requirements to prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS), and
- has considered unusual circumstances pursuant to 23 CFR 771.117(b).

CALTRANS NEPA DETERMINATION (Check one)

☒ **23 USC 326:** The State has determined that this project has no significant impacts on the environment as defined by NEPA, and that there are no unusual circumstances as described in 23 CFR 771.117(b). As such, the project is categorically excluded from the requirements to prepare an environmental assessment or environmental impact statement under the National Environmental Policy Act. The State has been assigned, and hereby certifies that it has carried out the responsibility to make this determination pursuant to Chapter 3 of Title 23, United States Code, Section 326 and a Memorandum of Understanding dated June 07, 2013, executed between the FHWA and the State. The State has determined that the project is a Categorical Exclusion under:

- ☐ **23 CFR 771.117(c): activity (c)(__)**
- ☒ **23 CFR 771.117(d): activity (d)(_13_)**
- ☐ **Activity ___ listed in Appendix A of the MOU between FHWA and the State**

☐ **23 USC 327:** Based on an examination of this proposal and supporting information, the State has determined that the project is a CE under 23 USC 327.

Brandon Larsen		**Suzanne Theiss**	
Print Name: Environmental Branch Chief		Print Name: Project Manager/DLA Engineer	
[signature]	12/07/15	[signature]	12/7/15
Signature	Date	Signature	Date

Date of Categorical Exclusion Checklist completion: 11/19/15	Date of ECR or equivalent : 10/21/15

Briefly list environmental commitments on continuation sheet. Reference additional information, as appropriate (e.g., CE checklist, additional studies and design conditions).

CATEGORICAL EXEMPTION/CATEGORICAL EXCLUSION DETERMINATION FORM
Continuation Sheet

01-HUM-0-CR			BRLO 5904(112)
Dist.-Co.-Rte. (or Local Agency)	P.M./P.M.	E.A/Project No.	Federal-Aid Project No. (Local Project)/Project No.

Continued from page 1:

Pine Hill Road Bridge Replacement Project [BRLS 5904(112)] (Humboldt County)

Project Description

The project is located on Pine Hill Road at post mile 0.20. It is 2 miles south of Eureka in Section 4, Township 4 North, Range 1 West, and can be seen on the Eureka 7.5' USGS quadrangle map. GPS Coordinates: Latitude: 40.7525568N; Longitude: 124.1827002W.

The Swain Slough Bridge is a 63-foot, three-span structure with a concrete deck on timber stringers. The bridge, constructed in 1955, is located on Pine Hill Road approximately 0.2 miles east of Elk River Road just south of Eureka, CA. Pine Hill Road provides access across Swain Slough to residential neighborhoods and connects to Herrick Street, a major arterial out of southern Eureka. The existing timber stringers are in poor condition as are the concrete support columns and the bridge has been categorized as both Structurally Deficient and Functionally Obsolete.

The preferred alternative is to replace the existing bridge on the existing alignment. In accordance with County requirements, the bridge will provide two 10-ft traffic lanes and 5-ft shoulders, in addition to barrier rails along both sides. The replacement structure will be designed for the standard and permit live loading as specified in Caltrans *Bridge Design Specifications* (BDS) as well as the current *Seismic Design Criteria Version 1.7*, April 2013. The bridge elevation will need to be raised in order to meet federal hydraulic clearance requirements. The proposed bridge type is a single-span precast concrete I-girder, and will be slightly longer than the existing bridge to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the slough channel, eliminating potential impacts to fish passage. The recommended new roadway would consist of two 10-ft lanes and two 5-ft shoulders. Based on the roadway classification, flat terrain, and daily traffic volumes, it is anticipated that a roadway design speed of 35 mph will be used.

The existing bridge, including decking, abutments, and piers, would be removed and disposed of offsite to allow the construction of the new structure. The roadway would be closed to through traffic as the detour is approximately 1.6 miles. A row of sheet piles would be vibrated into the Swain Slough channel in order to divert the tidal flow and to allow for removal of a portion of the existing abutments and footings; the work area will never be totally dry, but the intent is to separate physical activities from the slough to the extent practicable.

The new abutment footings would be constructed on approximately 22 24-inch impact driven piles. Falsework is not required for the single-span precast structure. The precast girders will span Swain Slough and will be placed utilizing a crane that will be staged behind the new westerly abutment. Once the girders are in place, deck forms will be constructed between the girders and the new concrete deck will be cast. All new work on the bridge superstructure will be performed without the need for vehicular access from the Swain Slough channel.

The new bridge and the approach embankments would not encroach into the Swain Slough channel, though rock slope protection (RSP) at the face and adjacent to the bridge will be required (primarily for the western abutment). Scour protection of the abutments from Swain Slough flows will be required and is expected to consist of ¼–ton RSP. The RSP is expected to consist of a 3-4 foot minimum thickness ¼–ton layer over a 1-3 foot thick No. 2 backing layer with RSP fabric underneath. The depth of the toe end of the RSP keyway trench is expected to be approximately 6-feet deep and will slope back to the bottom of the abutment front footing face. Approximately 205 cubic yards of RSP, equating to an area of 1,900 square feet will be placed in front of and around the new abutment footings. Installation will partially occur while the slough is diverted and will consist of digging a keyway trench and installing RSP by Method B placement so that the top surface of the RSP will be at the approximate elevation of the original channel grade. This will avoid impinging hydraulic flow within the channel and not adversely impact the upstream flooding characteristics of the river.

Existing overhead utilities are present east of the project site and serve the Humboldt Community Services District (HCSD) sewage pump plant and the Brown residence. A 12- inch water line is located on the north side of Pine Hill Road and is attached to the outside edge of the existing bridge. The overhead electric lines and sewage pump plant located to the east of the project will not be affected. The underground waterline will need relocation. Coordination will begin early and will conform to the latest Caltrans procedural guidelines for relocation.

Traffic Control

It will be necessary to close Pine Hill Road and detour traffic away from the construction site. Traffic will be restricted from access to the bridge location and a detour will be in place. The prime detour route for traffic during construction will be approximately 1.6 miles, and will affect only a limited number of residencies adjacent to the bridge. The detour will result in temporary, minor traffic delays.

Erosion and Sediment Control

The project will require the contractor to submit a Water Pollution Control Plan (WPCP) or Stormwater Pollution Protection Plan (SWPPP) for approval before construction begins. Adequate implementation of BMPs, monitoring, and reporting methodologies will be required. Best management practices (BMPs) for erosion and sediment control will consist of the following:

- Construction will be done during summer months when the chance of precipitation is lowest.
- Construction equipment will be cleaned and inspected prior to use. Equipment maintenance and fueling will be done at designated staging areas.
- On-site stockpiles will be isolated with silt fence, filter fabric, and/or straw bales/fiber rolls.
- Silt fence or fiber rolls will be placed below the project areas to contain loose rolling rocks and sediment. Silt fence/fiber rolls will be kept in place and maintained during the entire project. Any sediment caught by the fence or rolls will be removed before the fence/rolls are pulled.
- Ground disturbed by construction work will be re-vegetated with fast-growing native grasses and sterile hybrids and mulched when work is complete.

•The site will be monitored by Public Works personnel during winter rains and any evidence of erosion (rilling, gullies, etc.) will be repaired immediately. In addition, areas where revegetation is not successful will be reseeded and re-mulched to ensure vegetative ground cover.

Environmental Analysis

Cultural Resources

An Archaeological Study Report (ASR) and Historic Property Study Report (HPSR) were prepared in January of 2013 and it was determined that there are no cultural or historical resources within the project area, therefore there will be No Historic Properties Affected by the project.

Biological Resources

A Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) was submitted to the National Marine Fisheries Service (NMFS) to address potential impacts to federally listed fish species. NMFS completed the Section 7 consultation and issued a Biological Opinion on September 25, 2015 which concluded that the project is likely to adversely affect Northern California DPS steelhead, SONCC ESU coho salmon, and California Coastal ESU Chinook salmon, but is not likely to jeopardize the species. NMFS also concluded the project is likely to result in an adverse effect to critical habitat for the Coastal SONCC ESU coho salmon, California ESU Chinook salmon ESU, and the Northern California DPS steelhead. The project is not likely to destroy or adversely modify critical habitat. In the BO, NFMS determined that incidental take would occur to all three salmonid species in the form of capture during fish relocation and by exposure to lethal noise levels resulting from pile driving. NMFS expects no more than one juvenile of each species to be injured and no more than two juvenile of each species will be killed as a result of constructing the project. NMFS also concluded that the project would adversely affect Essential Fish Habitat for Pacific salmon species. While the proposed action contains measures to minimize adverse effects to EFH, NMFS provided additional conservation measures to further offset the adverse effects.

The BA/EFHA was also submitted to the U.S. Fish and Wildlife Service (USFWS) to address potential impacts to the federally listed tidewater goby. The USFWS completed the Section 7 consultation and issued a Biological Opinion on September 24, 2015 which concluded that the project is likely to adversely affect the species but is not likely to jeopardize the species. They also concluded the project action area is not located within designated critical habitat for the species. In the BO, USFWS determined that incidental take would occur to tidewater goby in the form of capture during fish relocation and/or during dewatering activities. The USFWS expects no more than five adult gobies to be injured or killed as a result of constructing the Project. Conservation measures to reduce impacts to salmonids and gobies will be followed and are included in the attached Environmental Commitment Record (ECR).

A Natural Environment Study was prepared in October 2014 and included a wetland delineation. The delineation found that U.S. jurisdictional waters and three-paremeter wetlands occupy 0.989 acres of the BSA. State jurisdictional waters and two- and one-parameter coastal wetlands occupy 1.165 acres of the BSA. The project design minimized impacts on wetlands to the extent practicable. All other design considerations would have a greater impact on wetlands. Since the project design with the least impact on wetlands was selected, the project is in compliance with the Wetlands Only Practicable Finding Alternative. Minimization measures to reduce impacts on wetlands and waters are included in the ECR. A Wetlands Mitigation and Monitoring Plan shall be prepared and provided to the Army Corps, North Coast RWQCB, California Coastal Commission, and the CDFW for review and approval.

Farmlands
The project will have no permanent impact on prime or unique farmland. Temporary impacts on non-prime agricultural land will be less than significant.

Floodplain
The project will not result in any longitudinal or significant encroachment on the 100-year flood plain.

Other Environmental Considerations
Review of the project site and project plans indicate that the project would not result in substantial adverse impacts to the visual environment. Other than a temporary increase in ambient noise from heavy equipment working during construction hours there are no long term sound impacts associated with the project. Upon project completion, noise levels will return to pre-construction ambient levels. There are no known hazardous waste issues in the project area.

Environmental Commitments

See the attached Environmental Commitments Record

Permits

- 404 Permit from the Army Corps
- 401 from the Regional Water Quality Control Board
- 1602 from the Department of Fish and Wildlife
- Coastal Development Permit from the California Coastal Commission

Categorical Exclusion Checklist

Dist/Co/Rte/PM: 01-HUM-0-CR	**Fed. Aid No. (Local Project):** BRLO 5904 (112)	**EA/Project No.:**

SECTION 1: TYPE OF CE: Use the information in this section to determine the applicable CE and corresponding activity for this project.

1. Project is a CE under CE Assignment 23 USC 326. ☒ Yes ☐ No

If "yes", check applicable activity in one of the three tables below (activity must be listed in 23 CFR 771.117 (c) or (d) list or included in activities listed in Appendix A of the CE Assignment MOU to be eligible for 23 USC 326).

	Activity Listed in 23 CFR 771.117(c)
1 ☐	Activities which do not involve or lead directly to construction such as planning and research activities; grants for training; engineering to define the elements of a proposed action or alternatives so that social, economic, and environmental effects can be assessed; and Federal-aid system revisions which establish classes of highways on the Federal-aid highway system.
2 ☐	Approval of utility installations along or across a transportation facility.
3 ☐	Construction of bicycle and pedestrian lanes, paths, and facilities.
4 ☐	Activities included in the State's *highway safety plan* under 23 U.S.C 402.
5 ☐	Transfer of Federal lands pursuant to 23 U.S.C 107(d) and/or 23 U.S.C 317 when the land transfer is in support of an action that is not otherwise subject to FHWA review under NEPA.
6 ☐	The installation of noise barriers or alterations to existing publicly owned buildings to provide for noise reduction.
7 ☐	Landscaping.
8 ☐	Installation of fencing, signs, pavement markings, small passenger shelters, traffic signals, and railroad warning devices where no substantial land acquisition or traffic disruption will occur.
9[1]	The following actions for transportation facilities damaged by an incident resulting in an emergency declared by the Governor of the State and concurred in by the Secretary, or a disaster or emergency declared by the President pursuant to the Robert T. Stafford Act (42 U.S.C 5121)[2]:
☐	(i) Emergency repairs under 23 U.S.C 125;
☐	(ii) The repair, reconstruction, restoration, retrofitting, or replacement of any road, highway, bridge, tunnel, or transit facility (such as a ferry dock or bus transfer station), including ancillary transportation facilities (such as pedestrian/bicycle paths and bike lanes), that is in operation or under construction when damaged and the action: (A) Occurs within the existing right-of-way and in a manner that substantially conforms to the preexisting design, function, and location as the original (which may include upgrades to meet existing codes and standards as well as upgrades warranted to address conditions that have changed since the original construction); and (B) Is commenced within a 2-year period beginning on the date of the declaration.
10 ☐	Acquisition of scenic easements.
11 ☐	Determination of payback under 23 U.S.C 156 for property previously acquired with Federal-aid participation.
12 ☐	Improvements to existing rest areas and truck weigh stations.
13 ☐	Ridesharing activities.
14 ☐	Bus and rail car rehabilitation.
15 ☐	Alterations to facilities or vehicles in order to make them accessible for elderly and handicapped persons.
16 ☐	Program administration, technical assistance activities, and operating assistance to transit authorities to continue existing service or increase service to meet routine changes in demand.
17 ☐	The purchase of vehicles by the applicant where the use of these vehicles can be accommodated by existing facilities or by new facilities which themselves are within a CE.
18 ☐	Track and railbed maintenance and improvements when carried out within the existing right-of-way.
19 ☐	Purchase and installation of operating or maintenance equipment to be located within the transit facility and with no significant impacts off the site.

[1] On the CE form, distinguish between c9i or c9ii

[2] Include copy of the emergency declaration in the file

Categorical Exclusion Checklist

Dist/Co/Rte/PM: 01-HUM-0-CR	Fed. Aid No. (Local Project): BRLO 5904 (112)	EA/Project No.:

20 ☐	Promulgation of rules, regulations, and directives.
21 ☐	Deployment of electronics, photonics, communications, or information processing used singly or in combination, or as components of a fully integrated system, to improve the efficiency or safety of a surface transportation system or to enhance security or passenger convenience. Examples include, but are not limited to, traffic control and detector devices, lane management systems, electronic payment equipment, automatic vehicle locaters, automated passenger counters, computer-aided dispatching systems, radio communications systems, dynamic message signs, and security equipment including surveillance and detection cameras on roadways and in transit facilities and on buses.
22[3] ☐	"Projects, as defined in 23 U.S.C. 101, that would take place entirely within the existing operational right-of-way. Existing operational right-of-way refers to right-of-way that has been disturbed for an existing transportation facility or is maintained for a transportation purpose. This area includes the features associated with the physical footprint of the transportation facility (including the roadway, bridges, interchanges, culverts, drainage, fixed guideways[4], mitigation areas, etc.) and other areas maintained for transportation purposes such as clear zone, traffic control signage, landscaping, any rest areas with direct access to a controlled access highway, areas maintained for safety and security of a transportation facility, parking facilities with direct access to an existing transportation facility, transit power substations, transit venting structures, and transit maintenance facilities. Portions of the right-of-way that have not been disturbed or that are not maintained for transportation purposes are not in the existing operational right-of-way." Existing operational right-of-way also does not include areas outside those areas necessary for existing transportation facilities such as uneconomic remnants, excess right-of-way that is secured by a fence to prevent trespassing, *or that are acquired and held for a future transportation project.* A transportation facility must already exist at the time of the review of the proposed project being considered for the CE. This precludes the acquisition of right-of-way and the subsequent use of this CE to build within that right-of-way.
23[5]	Federally-funded projects: Enter project cost $ and Federal funds $
☐	(i) That receive less than $5,000,000 of Federal funds; or
☐	(ii) With a total estimated cost of not more than $30,000,000 and Federal funds comprising less than 15 percent of the total estimated project cost.
24 ☐	Localized geotechnical and other investigation to provide information for preliminary design and for environmental analysis and permitting purposes, such as drilling test bores for soil sampling; archeological investigations for archeology resources assessment or similar survey; and wetland surveys.
25 ☐	Environmental restoration and pollution abatement actions to minimize or mitigate the impacts of any existing transportation facility (including retrofitting and construction of stormwater treatment systems to meet Federal and State requirements under sections 401 and 402 of the Federal Water Pollution Control Act (33 U.S.C. 1341; 1342)) carried out to address water pollution or environmental degradation.
26 ☐	Modernization of a highway by resurfacing, restoration, rehabilitation, reconstruction, adding shoulders, or adding auxiliary lanes (including parking, weaving, turning, and climbing lanes), if the action meets the constraints in paragraph (e) of this section [771.117(e)]. **Note: In order to use this CE, certain constraints must be met. Complete Section 1, Item 3 below.**
27 ☐	Highway safety or traffic operations improvement projects, including the installation of ramp metering control devices and lighting, if the project meets the constraints in paragraph (e) of this section [771.117(e)]. **Note: In order to use this CE, certain constraints must be met. Complete Section 1, Item 3 below.**
28 ☐	Bridge rehabilitation, reconstruction, or replacement or the construction of grade separation to replace existing at-grade railroad crossings, if the actions meet the constraints in paragraph (e) of this section [771.117(e)]. **Note: In order to use this CE, certain constraints must be met. Complete Section 1, Item 3 below.**
29 ☐	Purchase, construction, replacement, or rehabilitation of ferry vessels (including improvements to ferry vessel safety, navigation, and security systems) that would not require a change in the function of the ferry terminals and can be accommodated by existing facilities or by new facilities which themselves are within a CE.
30 ☐	Rehabilitation or reconstruction of existing ferry facilities that occupy substantially the same geographic footprint, do not result in a change in their functional use, and do not result in a substantial increase in the existing facility's capacity. Example actions include work on pedestrian and vehicle transfer structures and associated utilities, buildings, and terminals.
	Activity Listed in Examples in 23 CFR 771.117(d)
1	*Reserved.*
2	*Reserved.*
3	*Reserved.*
4 ☐	Transportation corridor fringe parking facilities.

[3] On the CE form, identify in the project description that all work is within operation right-of-way.

[4] "Fixed Guideway" means a public transportation facility using and occupying a separate right-of-way for the exclusive use of public transportation such as rail, a fixed catenary system (light rail, trolley, etc.) passenger ferry system, or for a bus rapid transit system.

[5] On the CE form, distinguish between c23i or c23ii.

Categorical Exclusion Checklist

Dist/Co/Rte/PM: 01-HUM-0-CR	Fed. Aid No. (Local Project): BRLO 5904 (112)	EA/Project No.:

5 ☐	Construction of new truck weigh stations or rest areas.
6 ☐	Approvals for disposal of excess right-of-way or for joint or limited use of right-of-way, where the proposed use does not have significant adverse impacts.
7 ☐	Approvals for changes in access control.
8 ☐	Construction of new bus storage and maintenance facilities in areas used predominantly for industrial or transportation purposes where such construction is not inconsistent with existing zoning and located on or near a street with adequate capacity to handle anticipated bus and support vehicle traffic.
9 ☐	Rehabilitation or reconstruction of existing rail and bus buildings and ancillary facilities where only minor amounts of additional land are required and there is not a substantial increase in the number of users.
10 ☐	Construction of bus transfer facilities (an open area consisting of passenger shelters, boarding areas, kiosks and related street improvements) when located in a commercial area or other high activity center in which there is adequate street capacity for projected bus traffic.
11 ☐	Construction of rail storage and maintenance facilities in areas used predominantly for industrial or transportation purposes where such construction is not inconsistent with existing zoning and where there is no significant noise impact on the surrounding community.
12 ☐	Acquisition of land for hardship or protective purposes. Hardship and protective buying will be permitted only for a particular parcel or a limited number of parcels. These types of land acquisition qualify for a CE only where the acquisition will not limit the evaluation of alternatives, including shifts in alignment for planned construction projects, which may be required in the NEPA process. No project development on such land may proceed until the NEPA process has been completed. (i) Hardship acquisition is early acquisition of property by the applicant at the property owner's request to alleviate particular hardship to the owner, in contrast to others, because of an inability to sell his property. This is justified when the property owner can document on the basis of health, safety or financial reasons that remaining in the property poses an undue hardship compared to others. (ii) Protective acquisition is done to prevent imminent development of a parcel which may be needed for a proposed transportation corridor or site. Documentation must clearly demonstrate that development of the land would preclude future transportation use and that such development is imminent. Advance acquisition is not permitted for the sole purpose of reducing the cost of property for a proposed project
13 ☒	Actions described in paragraphs (c)(26), (c)(27), and (c)(28) of this section that do not meet the constraints in paragraph (e) of this section.
Activity Listed in Appendix A of the CE Assignment MOU for State Assumption of Responsibilities for Categorical Exclusions	
1 ☐	Construction, modification, or repair of storm water treatment devices (e.g., detention basins, bioswales, media filters, infiltration basins), protection measures such as slope stabilization and other erosion control measures throughout California.
2 ☐	Replacement, modification, or repair of culverts or other drainage facilities.
3 ☐	Projects undertaken to assure the creation, maintenance, restoration, enhancement, or protection of habitat for fish, plants, or wildlife (e.g., revegetation of disturbed areas with native plant species; stream or river bank revegetation; construction of new, or maintenances of existing fish passage conveyances or structures; restoration or creation of wetlands).
4 ☐	Routine repair of facilities due to storm damage, including permanent repair, to return the facility to operational condition that meets current standards of design and public health and safety without expanding capacity (e.g., slide repairs, construction or repair of retaining walls).
5 ☐	Routine seismic retrofit of facilities to meet current seismic standards and public health and safety standards without expansion of capacity.
6 ☐	Air space leases that are subject to Subpart D, Part 710, title 23, Code of Federal Regulations.
7 ☐	Drilling of test bores/soil sampling to provide information for preliminary design and for environmental analyses and permitting purposes.

2. Project is a CE for a highway project under NEPA Assignment 23 USC 327. ☐ Yes ☒ No

(Use only if project does not qualify under CE Assignment 23 USC 326 [activities not included in three previous lists above].)

Categorical Exclusion Checklist

Dist/Co/Rte/PM: 01-HUM-0-CR **Fed. Aid No. (Local Project):** BRLO 5904 (112) **EA/Project No.:**

3. This section must be completed in order to use a CE under 771.117(c)(26), (c)(27), or (c)(28). If any of the answers are "Yes" the action MAY NOT be processed under 771.117(c)(26), (c)(27), or (c)(28. These constraints are found in 771.117(e). If these constraints cannot be met, the action MAY NOT be processed under 771.117(c)(26), (c)(27), or (c)(28); however, the project may qualify for a CE under 771.117(d)(13).

Does the action include any of the following?

A. ☐ Yes ☒ No: An acquisition of more than a minor amount of right-of-way or that would result in any residential or nonresidential displacements;

B. ☐ Yes ☒ No: A bridge permit from the U.S. Coast Guard; OR
An action that does not meet the terms and conditions of a U.S. Army Corps of Engineers nationwide or general permit under section 404 of the Clean Water Act (i.e., does the project require a Standard 404 permit [Individual Permit or Letter of Permission]?) AND/OR
A permit required under Section 10 of the Rivers and Harbors Act of 1899

C. ☒ Yes ☐ No: A finding of "adverse effect" to historic properties under the National Historic Preservation Act; OR
The use of a resource protected under 23 U.S.C. 138 or 49 U.S.C. 303 (section 4(f)) except for actions resulting in *de minimis* impacts; OR
A finding of "may affect, likely to adversely affect" threatened or endangered species or critical habitat under the Endangered Species Act;

D. ☐ Yes ☒ No: Construction of temporary access, or the closure of existing road, bridge, or ramps, that would result in major traffic disruptions;

E. ☐ Yes ☒ No: Changes in access control;

F. ☐ Yes ☒ No: A floodplain encroachment other than functionally dependent uses (*e.g.,* bridges, wetlands) or actions that facilitate open space use (*e.g.,* recreational trails, bicycle and pedestrian paths); OR
Construction activities in, across or adjacent to a river component designated or proposed for inclusion in the National System of Wild and Scenic Rivers.

4. Independent Utility and Logical Termini

☒ The project complies with NEPA requirements related to connected actions and segmentation (i.e. the project must have independent utility, connect logical termini when applicable, be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made and not restrict further consideration of alternatives for other reasonably foreseeable transportation improvements). (FHWA Final Rule, "Background," *Federal Register* Vol. 79, No. 8, January 13, 2014.)

5. Categorical Exclusions Defined (23 CFR 771.117[a]).

FHWA regulation 23 CFR 771.117(a) defines categorical exclusions as actions which:

- do not induced significant impacts to planned growth or land use for the area;
- do not require the relocation of significant numbers of people;
- do not have a significant impact on any natural, cultural, recreational, historic or other resources;
- do not involve significant air, noise, or water quality impacts;
- do not have significant impacts on travel patterns; or
- do not otherwise, either individually or cumulatively, have any significant environmental impacts.

☒ Checking this box certifies that project meets the above definition for a Categorical Exclusion.

6. Exceptions to Categorical Exclusions/Unusual Circumstances (23 CFR 771.117[b]).

FHWA regulation 23 CFR 771.117(b) provides that any action which normally would be classified as a CE but could involve *unusual circumstances* requires the Department to conduct appropriate environmental studies to determine if the CE classification is proper. Unusual circumstances include actions that involve:

- Significant environmental impacts;
- Substantial controversy on environmental grounds;
- Significant impact on properties protected by section 4(f) of the DOT Act or section 106 of the National Historic Preservation Act; or
- Inconsistencies with any Federal, State, or local law, requirement or administrative determination relating to the environmental aspects of the action.

All of the above unusual circumstances have been considered in conjunction with this project. (Please select one.)

☒ Checking this box certifies that **none of the above conditions apply** and that the project qualifies for a Categorical Exclusion.

☐ Checking this box certifies that unusual circumstances **are involved.** However, the appropriate studies/analysis have been completed, and it has been determined that the CE classification is still appropriate.

Dist/Co/Rte/PM: 01-HUM-0-CR **Fed. Aid No. (Local Project):** BRLO 5904 (112) **EA/Project No.:**

SECTION 2: Compliance with FHWA NEPA policy to complete all other applicable environmental requirements[6] prior to making the NEPA determination:

During the environmental review process for which this CE was prepared, all applicable environmental requirements were evaluated. Outcomes for the following requirements are identified below and fully documented in the project file.

Air Quality

☒ Air Quality Conformity Findings Checklist has been completed and project meets all applicable AQ requirements.
☐ For 23 USC 326 projects which require an air quality conformity determination (certain projects under 23 CFR 771.117(c)(22) and (23), list the date of the Caltrans conformity determination: _____
☐ For 23 USC 327 projects, list date of FHWA concurrence on conformity determination: _____

Cultural Resources

☒ Section 106 compliance is complete-select appropriate finding:
☐ Screened Undertaking ☒ No Historic Properties Affected ☐ No Adverse Effect ☐ Adverse Effect/MOA

Noise

23 CFR 772
☒ Is this a Type 1 project? ☐ Yes; ☒ No (skip this section.)
☐ Future noise levels with project either approach or exceed NAC or result in a substantial increase
If yes, ☐ Abatement is reasonable and feasible ☐ Abatement is not reasonable or feasible

Waters, Wetlands

- Section 404 of the Clean Water Act
  Impacts to Waters of the US: ☒ Yes ☐ No
  If yes, approval anticipated:
  ☒ Nationwide Permit ☐ Individual Permit ☐ Regional General Permit ☐ Letter of Permission
- Wetland Protection (Executive Order #11990)
  ☐ No wetland impact
  ☒ Wetland Impact; Only Practicable Alternative Finding is included in a separate document in the project file
- Section 401 of the Clean Water Act
  ☐ Exemption ☒ Certification

Floodplains

- Floodplains (Executive Order #11988)
  ☐ No Floodplain Encroachment ☒ No Significant Encroachment ☐ Significant Encroachment

Biology

☐ No Section 7 Needed
- Section 7 (Federal Endangered Species Act) Consultation Findings (Effect determination)
  ☐ No Effect ☐ Not Likely to Adversely Affect with FWS/NOAA Concurrence Date: _____
  ☒ Likely to Adversely Affect with Biological Opinion Date: 9/25/15
- Essential Fish Habitat (Magnuson-Stevens Act) Findings (Effect determination):
  ☐ No Effect ☐ No Adverse Effect ☒ Adverse Effect and consultation with NOAA Fisheries

[6] Please consult the SER for a complete list of applicable laws, statutes, regulations, and executive orders that must be considered before completing the CE.

Section 4(f) Transportation Act (23 CFR 774)

- Section 4(f) regulation was considered as a part of the review for this project and a determination was made:

  ☒ Section 4(f) does not apply
  (*Project file includes documentation that property is not a Section 4(f) property, that project does not use a Section 4(f) property, or that the project meets the criteria for the temporary occupancy exception.)*

  ☐ Section 4(f) applies
  ☐ De Minimis
  ☐ Programmatic: Type _____ (List one of the five appropriate categories as defined in 23 CFR 774.3)
  ☐ Individual: ☐ Legal Sufficiency Review complete ☐ HQ Coordinator Review Complete

  Section 6(f)—Was the above property purchased with grant funds from the Land and Water Conservation Fund?

  ☒ No, Section 6(f) does not apply. No additional documentation required.
  ☐ Yes ☐ Documentation of approval from National Park Service Director (through California State Parks) has been received for the conversion/and replacement of 6(f) property.

Coastal Zone

Coastal Zone Management Act of 1972

☐ Not in Coastal Zone ☐ Qualifies for Exemptions ☐ Qualifies for Waiver ☒ Coastal Permit Required
☐ Consistent with Federal State and Local Coastal Plans ☐ Federal Consistency Determination

Relocation and Right of Way

☒ No Relocations
☐ Project involves _____ (#) relocations and will follow the provisions of the Uniform Relocation Act.
☐ No right of way acquisitions or easements.
☒ Project involves _____ (#) acquisitions and 6 (#) easements.

Hazardous Waste and Materials

- Are hazardous materials or contamination exceeding regulatory thresholds (as set by U.S. EPA, Cal EPA, County Environmental Health, etc) present? ☐ Yes ☒ No
- If yes, is the nature and extent of the hazardous materials or contamination fully known? ☐ Yes ☐ No
  If no, briefly discuss the plan for securing information:

SECTION 3: Certification

Based on the information obtained during environmental review process and included in this checklist, the project is determined to be a Categorical Exclusion pursuant to the National Environmental Policy Act and is in compliance with all other applicable environmental laws, regulations, and Executive Orders.

Prepared by (print name): Jenna Larson

Title: Associate Environmental Planner

Signature[7]: Jenna Larson Date: 11/19/15

[7] Please note that this form cannot be completed by the Senior Environmental Planner or Branch Chief that is signing the CE/CE form.

Pine Hill Road Bridge Replacement Project

Environmental Commitment Record

Project Name	Pine Hill Road Bridge Replacement Project	Federal Project No.	BRLO-5904(112)	Notes:
Contact	Andrew Bundschuh, 707-445-7741	County Project No.	594020	

Project Description: *The Humboldt County Public Works Department (County) is planning to replace the Bridge No. 04C-0173 on Pine Hill Road over Swain Slough. The existing two-lane, 63-foot, three-span timber stringer structure was built in 1955 and is considered structurally deficient and functionally obsolete with a sufficiency rating of 44.6. The County is proposing to replace the existing bridge with a modern two-lane precast concrete girder bridge that meets current structural, geometric and hydraulic standards.*

NOTE: This following table is intended as a summary guide to environmental commitments and is meant to be a living document. Much of the information presented was gathered during the NEPA process prior to the issuance of regualtory permits. It does not replace or supersede any environmental commitments made in technical studies or correspondence prior to NEPA clearance. If there are any discrepancies between this table and technical studies/permits then the technical studies/permits will take precedence. Typically, environmental commitments related to regulatory permits will be added to this document once permits are authorized.

PERMITS REQUIRED	Agency	Permit Number	Date of Permit	Project Component
Section 7 ESA; Biological Opinion	NMFS	WCR-2015-2927	9/25/2015	Stream Channel
Section 7 ESA; Biological Opinion	USFWS	AFWO-15B0056-15F0148	9/25/2015	Stream Channel
Section 404 Nationwide Permit 14	USACE	Pending	Pending	Stream Channel/Wetlands
Section 401 Water Quality Certification	RWQCB	Pending	Pending	Stream Channel/Wetlands
Section 1602 Streambed Alteration Agreement	CDFW	Pending	Pending	Stream Channel
Coastal Development Permit - State	CCC	Pending	Pending	Entire Project

Task and Brief Description	Document	Timing/ Phase	Actions to Comply with Task	Task Completion	
				Initial	Date
Pine Hill Road Bridge Replacement Project (spanning Swain Slough)					
Condition #1 - Work Period					
Regulatory permitting will require a restricted work period for activities that impact the stream channel, including water diversion. The seasonal work period will be July 1 - October 15.	NEPA documents; NMFS BO; USFWS BO; Permits	Construction	Work beyond October 15 may be extended but prior authorization from regulatory agencies will be required. Activities occuring in the wetted channel shall be approved by County staff prior to commencement.		
Condition #2 - Vegetation Impacts / Protection of Riparian Habitat					
Vegetation removal shall not exceed the minimum necessary to complete the project. All vegetation adjacent to or within the Swain Slough corridor will be protected to the extent feasible as a means of preserving maximum ecological function. Any areas disturbed during construction will be restored to pre-existing conditions following utility relocation work.	NEPA documents; All permits	Pre-, During, and Post-Construction;	Contractor will work with County RE on minimizing impacts to vegetation.		
Condition #3 - Waters of the U.S. and State, including Wetlands					
To the extent practicable, the discharge of dredged or fill material into "waters of the United States," including wetlands shall be avoided. • Impacts on jurisdictional waters will be compensated on site at a minimum 1:1 ratio or other ratio as agreed by the County and the Corps, North Coast RWQCB, California Coastal Commission, and the CDFW. • Temporary impacts to wetlands shall be avoided through implementation of avoidance and minimization measures. All construction staging activities will be located in upland areas, away for wetland features. Temporary barriers to intrusion (e.g., exclusionary fencing) shall be placed at the edge of the verified wetland boundaries to ensure that construction equipment and access do not encroach on jurisdictional waters.	NEPA documents; All permits	Pre-, During, and Post-Construction;	Contractor will work with County RE on minimizing impacts to wetlands. All wetland impacts will be compensated on site by re-creating and expanding ditches. Planting and Revegetation will be completed by specialists.		

Task and Brief Description	Document	Timing/ Phase	Actions to Comply with Task	Task Completion	
				Initial	Date
Pine Hill Road Bridge Replacement Project (spanning Swain Slough)					
Condition #4 - Special-Status Plant Species					
The proposed project may impact habitat supporting Lyngbye's sedge along the banks of Martin Slough. Protection measures will be put in place to minimize and avoid impacts to sedge plants and habitat. • Prior to the start of construction activities in the proposed project area, the edges and endpoints of the patches of Lyngbye's sedge patches adjacent to the existing bridge will be identified with flagging, as practicable—exclusionary fencing should not be used as much of the sedge is within the mean high tide line. A qualified botanist shall be present to assist with identifying the populations. The flagging shall be periodically inspected throughout each period of construction and be repaired as necessary. All pedestrian and vehicular entry into these patches shall be avoided as practicable.	NEPA documents; All permits	Pre-, During, and Post-Construction;	Patches of Lyngbye's sedge that are in the footprint of the proposed RSP will be salvaged and relocated to designated areas along Swain Slough. Planting and Revegetation will be completed by specialists.		
Condition #5 - Listed Fish Species					
The following measures shall be implemented to avoid or minimize project-related impacts upon listed anadromous salmonids, tidewater goby and their habitat occurring in the project area. • All instream work shall be completed between July 1st and October 15th. • Fish relocation activities shall be performed only by qualified fisheries biologists who have experience with fish capture and handling and have the necessary authorizations for the purposes of relocation. (See Condition #9) • Prior to October 15th (unless work window extensions are granted), the temporary slough protection system and sheet piles shall be removed from the channel. It shall not impede, or tend to impede, the passage of fish at any time, pursuant to Fish and Game Code Section 5901. • Any structure placed within a stream where fish do/may occur shall be designed, constructed, and maintained such that they do not constitute a barrier to upstream or downstream movement of aquatic life or cause an avoidance reaction by fish that impedes their upstream or downstream movement.	NEPA documents; NMFS BO; USFWS BO; Permits	Pre-, During, and Post-Construction;	The proposed action has been designed such that the conservation measures and proposed avoidance and minimization measures will avoid or minimize the potential effects to coho salmon, Chinook salmon, Northern California DPS steelhead, tidewater goby, and designated critical habitat to the greatest extent possible. No additional mitigation is required.		
Condition #6 - Nesting Birds					
Any potential nesting habitat (e.g., shrubs and trees) that will be removed by the project should be removed before the onset of the nesting season (March 1 through August 30), if practicable. If construction occurs outside of the breeding season, no further mitigation is necessary. If the breeding season cannot be completely avoided, the following mitigations will be implemented: (1) A qualified biologist will conduct a minimum of one pre-construction survey for songbirds within the API, including the bridge for swallow activity. The surveys should be conducted no more than 15 days prior to the initiation of construction in any given area. The pre-construction survey should be used to ensure that no nests of these species occur within or immediately adjacent to the API and would be disturbed during project implementation. If an active nest is found, the biologist will either determine the extent of a construction-free buffer zone to be established around the nest or postpone the project until the young have fledged. (2) Regarding swallow nesting underneath the bridge: Previous surveys have identified signs of swallow activity (old/active nests) at the bridge site. The County will take appropriate measures to remove nests before they become active. These activities will need to be authorized by DFW.	NEPA documents; DFW 1602; MBTA	Pre-Construction	The County plans to have any potential nesting habitat removed prior to March 1 of the construction year. If this cannot be accomplished, then survey protocols will be followed.		
Condition #7 - Erosion and Sediment Control					
• To the maximum extent practicable, activities that increase the erosion potential in the project area shall be restricted to the relatively dry summer and early fall period to minimize the potential for rainfall events to transport sediment to surface water features. If these activities must take place during the late fall, winter, or spring, then temporary erosion and sediment control structures shall be in place and operational at the end of each construction day and maintained until permanent erosion control structures are in place. • Areas where wetland and upland vegetation need to be removed shall be identified in advance of ground disturbance and limited to only those areas that have been approved by the County. • Suitable BMPs, such as silt fences, straw wattles, or catch basins, shall be placed below all construction activities at the edge of surface water features to intercept sediment before it reaches the waterway. These structures shall be installed prior to any clearing or grading activities. • If spoil sites are used, they shall be located such that they do not drain directly into a surface water feature, if possible. If a spoil site drains into a surface water feature, catch basins shall be constructed to intercept sediment before it reaches the feature. Spoil sites shall be graded and vegetated to reduce the potential for erosion. • Sediment control measures shall be in place prior to the onset of the rainy season and will be monitored and maintained in good working condition until disturbed areas have been revegetated. • All dewatering activities will be conducted in compliance with the Caltrans Field Guide for Construction Site Dewatering and Section 13-4.03G of the Caltrans Standard Specifications. Water removed from coffered work areas required for construction of the new abutments shall be pumped to a temporary sediment retention basin outside of the channel, through a mechanized water filtration system, or into Baker tanks or similar storage system and trucked offsite to an authorized disposal site.	All permits; SWPPP or WPCP	Construction / Post Construction	Contractor wil be required to submit either a SWPPP or WPCP for approval. If disturbance is over an acre and a SWPPP is required, then the contractor shall comply with all conditions under the Water Board's General Construction Permit and SWPPP requirements.		

Task and Brief Description	Document	Timing/ Phase	Actions to Comply with Task	Task Completion Initial	Task Completion Date
Pine Hill Road Bridge Replacement Project (spanning Swain Slough)					
Condition #8 - Spill Prevention, Equipment Fueling and Maintenance Activities					
• A site-specific spill prevention plan shall be implemented for potentially hazardous materials. • Equipment and hazardous materials shall be stored 50 ft away from surface water features. • Vehicles and equipment used during construction shall receive proper and timely maintenance to reduce the potential for mechanical breakdowns leading to a spill of materials. Maintenance and fueling shall be conducted in an area at least 50 feet away from Swain Slough or within an adequate fueling containment area. • Equipment shall use non-toxic vegetable oil for operating hydraulic equipment instead of traditional hydraulic fluids. • Place plastic materials under asphaltic concrete (AC) paving equipment while not in use, to catch and/or contain drips and leaks. • Minimize sand and gravel from new asphalt from getting into storm drains, streets, and creeks by sweeping. Old or spilled asphalt must be recycled or disposed as approved by the Resident Engineer. • AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drain or watercourses. Install silt fence until structure is stabilized or permanent controls are in place. • Collect and remove all broken asphalt and recycle when practical; otherwise, dispose in accordance with Standard Specification 7-1.13. • During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Use silt fence until installation is complete. • Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment. • Drainage inlet structures and manholes shall be covered with filter fabric during application of seal coat, tack coat, slurry seal, and/or fog seal. • Seal coat, tack coat, slurry seal, or fog seal shall not be applied if rainfall is predicted to occur during the application or curing period. • If dewatering is not required for other purposes, removal of seepage water in the coffered work areas may be ceased after new abutment concrete is poured and is curing (for at least 72 hours after pour) within the form structures, provided that pH of the water inside the cofferdam enclosures and in contact with the concrete forms does not exceed a difference of 0.5 pH units from that of ambient water quality in main slough channel outside of the cofferdams (e.g., 50 ft upstream and downstream of the new bridge alignment) . If the difference in pH within the cofferdam exceeds 0.5 units, water levels within the coffered area will be kept below the level of the concrete abutment forms and pumped to temporary retention basins or Baker tanks and treated as above for erosion and sediment control.	NEPA documents; All permits; SWPPP	Construction	Contractor wil be required to submit a SWPPP for approval. Contractor shall comply with all conditions under the Water Board's General Construction Permit and SWPPP requirements. Contractor will be responsible for monitoring pH levels within the cofferdam enclosure. Appropriate actions relating to pH levels will be directed to Contractor by County RE.		
Condition #9 - Fish Rescue & Exclusion					
• Prior to pile-driving of CISS piles, Swain Slough will be seined at low-tide, with a 0.125-inch mesh seine, and a net barrier installed at least 100-ft upstream and downstream of the existing structure (acoustic impact area for physical injury). • Barrier nets will be monitored daily and additional seine passes may be required if fish continue to be encountered over the 10-12 day CISS pile-driving period. • In order to minimize potentially adverse effects to special-status fishes, all translocation/removal of fishes will be conducted by qualified fisheries biologists. See Conditon #5 as well. • Any fish that cannot be simply herded by seines from the action area and must be physically handled will be released at a suitable habitat upstream or downstream of the project area, with comparable habitat and water quality conditions. • Immediately following completion of CISS pile driving, the block nets will be removed allowing free fish passage through the action area during the remainder of the construction period.	NEPA documents; All permits	Construction			
Condition #10 - Prevention of Fish Barotrauma					
• To protect the most vulnerable life stages that occur within the project area, salmon fry/juveniles and spawning goby, in-water work would be restricted to the period between July 1st and October 15th. • Sheet piles will be driven in an isolated ad mostly dewatered or very shallow areas of the slough channel between the latter 1/3 of the outgoing tide and beginning 1/3 of the incoming tide. • CISS piles will be driven mostly landward of the slough channel within dewatered cofferdam enclosures, isolating the piles and reducing the transmission of sound pressure waves into and through the water column of the main slough channel. • In advance of the project a Hydroacoustic Monitoring Plan will be prepared and submitted to the appropriate agency(s) and a final report including all data collected from the selected monitoring locations will be submitted to the USFWS and NMFS within 90 days of the completion of hydroacoustic monitoring.	NEPA documents; All permits	Construction	Potential impacts from underwater noise will need to be monitored by the County (a qualified specialist will need to be contracted out for the monitoring work and development of Hydroacoustic Monitoring Plan). Contractor will need follow orders from the County relating to work activities (start/stop) based on real-time monitoring results.		
Condition #11 - Air Quality/Dust Control					
If dust becomes a nuisance to public traffic or local residents, or if dust has the potential to compromise the health of employees working at the site, it will be controlled with water on an as-needed basis	SWPPP; Construction site management	Construction	Proper BMPs		

Task and Brief Description	Document	Timing/ Phase	Actions to Comply with Task	Task Completion Initial	Task Completion Date
Pine Hill Road Bridge Replacement Project (spanning Swain Slough)					
Condition #12 - Noise					
The project has the potential to cause excessive noise during construction activities. The folowing recommended abatment measures should be considered: • Project construction activities should be limited to the daytime hours of 7 am to 7 pm. • Local residents should be given advanced notice of project construction schedules, and should be notified that there will be substantial temporary increases in local noise levels during project construction at the nearest residences to the construction activities. • To the extent feasible, separation between construction staging areas and the nearest residences should be maximized. • If concerns are expressed by local residents regarding excessive noise during project construction, the potential for installation of temporary, localized noise barriers should be discussed with the resident and implemented if feasible. Such barriers could take the form of hay bales, acoustic curtains, or temporary wood fencing. • All internal combustion engines used for construction shall be fitted with mufflers. • Generators and compressors required during project construction should be located as far as possible from existing residents and, if necessary, shielded from view of those residences by portable noise barriers.	NEPA documents; Construction Noise Memo	Construction	Proper BMPs; County RE will communicate with local residents about construction schedule and possibility of increase noise. County RE and Contractor will work together to minimize noise impacts.		
Condition #13 - Prevention of Spread of Invasive Species					
All equipment used for off-road construction activities will be weed-free prior to entering the BSA/API. If project implementation calls for mulches, it will be weed-free. Any seed mixes or other vegetative material used for re-vegetation of disturbed sites will consist of locally adapted native plant materials to the extent practicable.	NEPA documents; All permits	Construction/ Post Construction	Proper BMPs		
Cultural/Historic BMPs					
Condition #14 - Inadvertent Discovery of Cultural Resources					
If cultural resources, such as chipped or ground stone, historic debris, building foundations, or bone are discovered during ground-disturbance activities, work shall be stopped within 20 meters (66 feet) of the discovery, per the requirements of CEQA (Title 14 CCR 15064.5 (f) and Section 106 (36 CFR 800.13). Work near the archaeological finds shall not resume until a professional archaeologist, who meets the Secretary of the Interior's Standards and Guidelines, has evaluated the materials and offered recommendations for further action.	ASR/HPSR	Construction			
Condition #15 - Inadvertent Discovery of Human Remains					
If human remains are discovered during project construction, work will stop at the discovery location, within 20 meters, and any nearby area reasonably suspected to overlie adjacent to human remains (Public Resources Code, Section 7050.5). The Humboldt County coroner will be contacted to determine if the cause of death must be investigated. If the coroner determines that the remains are of Native American origin, it is necessary to comply with state laws relating to the disposition of Native American burials, which fall within the jurisdiction of the Native American Heritage Commission (NAHC) (Public Resources Code, Section 5097). The coroner will contact the NAHC. The descendants or most likely descendants of the deceased will be contacted, and work will not resume until they have made a recommendation to the landowner or the person responsible for the excavation work for means of treatment and disposition, with appropriate dignity, of the human remains and any associated grave goods, as provided in Public Resources Code, Section 5097.98. Work may resume if NAHC is unable to identify a descendant or the descendant failed to make a recommendation.	ASR/HPSR	Construction			

Appendix D - CEQA Determination

HUMBOLDT COUNTY

NOTICE OF EXEMPTION

TO: ____ **Secretary for Resources**
1416 Ninth Street, Room 1311
Sacramento, CA 95814

APPLICANT: Humboldt County Public Works
1106 Second St.
Eureka, CA 95501
707-445-7741

__X__ **County Clerk**
County of Humboldt

Project Title: Pinc Hill Road at Swain Slough Bridgc Rcplaccmcnt Projcct

Project Location-Specific: Township 4 North, Range 1 West, Section 4; Lat. 40.7525568N; Long. 124.1827002W

Project Location-County: Pine Hill Road Post Mile 0.20, Eureka, Humboldt County

Description of Nature, Purpose, and Beneficiaries of Project: Humboldt County proposes to replace the Pine Hill Road Bridge at Swain Slough under the federal-aid Highway Bridge Program (HBP). The existing bridge has a classification of functionally obsolete and structurally deficient per the 2013 Caltrans bridge inspection report. The proposed new bridge will be a single-span precast concrete I-girder, and will be slightly longer than the existing bridge to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the slough channel. The recommended new roadway would consist of two 10-ft lanes and two 5-ft shoulders.

Name of Public Agency Approving Project: Humboldt County Public Works Department

Name of Person or Agency Carrying Out Project: Humboldt County Public Works Department

Exempt Status: (Check One)

_____**Ministerial (Sec. 15268)**
_____**Declared Emergency (Sec. 15269[a])**
_____**Emergency Project (Sec. 15269[b] and [c])**
__X__**Categorical Exemption. State type and section number:**

- 15301 – Existing Facilities
- 15302 – Replacement or Reconstruction

Reason why project is exempt: *This is a Class 1 project to maintain an existing public roadway facility, and a Class 2 project consisting of replacing existing structures on the same site with the same purpose and capacity as the structure being replaced.*

Contact Person: ANDREW BUNDSCHUH
HUMBOLDT COUNTY PUBLIC WORKS

Telephone: 707-445-7741

FILED
County of Humboldt
Kelly E. Sanders
County Clerk
12-2016-016
05/19/2016
lh

POSTED THROUGH
JUL 05 2016
Humboldt County Clerk

Signatu

Title

Date re

Andrew Bundschuh

Signature of Humboldt Co. Rep.

Senior Environmental Analyst
Title

May 18, 2016
Date Signed

COUNTY OF HUMBOLDT

DEPARTMENT OF PUBLIC WORKS
NATURAL RESOURCES DIVISION

1106 SECOND STREET
EUREKA, CA 95501-0579
(707) 445-7741 / FAX (707) 445-7409

DATE: May 18, 2016

TO: Engineering Department

FROM: Natural Resources Division

SUBJECT: Pine Hill Road / Swain Slough Bridge Replacement Project; CEQA Determination

Background
The County of Humboldt is planning on replacing the bridge that spans Swain Slough located on Pine Hill Road Post Mile (PM) 0.20 (Bridge No. 4C-0173) just east of Highway 101 and roughly one mile south of the City of Eureka. Pine Hill Road is a Rural Local Road that connects Elk River road with Meyers Avenue and Herrick Road.

The existing bridge was built in 1955, and is structurally deficient and functionally obsolete with a sufficiency rating of 44.6. The County nominated the bridge for replacement under the federal-aid Highway Bridge Program (HBP) administered by the Federal Highway Administration (FHWA) through Caltrans Local Assistance.

The existing bridge is a 63-foot (ft) timber stringer structure with a concrete deck and concrete abutments and was built in 1955. The existing timber stringers are in poor condition as are the concrete support columns; the bridge has been categorized as both structurally deficient and functionally obsolete. The proposed new bridge will be a single-span precast concrete I-girder, and will be slightly longer than the existing bridge to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the slough channel. The recommended new roadway would consist of two 10-ft lanes and two 5-ft shoulders.

CEQA Determination
Staff has determined that this project fits the definition of a Class 2 Categorical Exemption (CEQA Guidelines, Section 15302) as it involves the replacement of an existing public facility on the same site with the same purpose and capacity as the structure being replaced. Furthermore, this project has been analyzed under both CEQA and NEPA and it has been determined that the project, as designed, will not adversely impact air quality, water quality, historical or cultural resource, or any other environmental area. The project will improve vehicular/pedestrian/bicyclist safety and reduce the potential of accidents and injuries. This project fits within the definition of the Class 2 Categorical Exemption as set forth in CEQA Guidelines, Section 15302. Additionally, staff has determined that none of the exceptions to the Categorical Exemptions set forth in CEQA Guidelines, Section 15300.2, apply. As such, staff has concluded that this Categorical Exemption applies to this project.

Andrew Bundschuh
Senior Environmental Analyst

Appendix E - Natural Environment Study

Pine Hill Road at Swain Slough
Bridge Replacement Project NES

Natural Environment Study

Humboldt County, California
Township 04 North, Range 01 West, Section 4
USGS Eureka, California 7.5-Minute Quadrangle
Bridge No. 04C-0173
01-HUM-CR-0
Federal Project No. BRLO-5904(112)

October 2015

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

Pine Hill Road at Swain Slough Bridge Replacement Project NES

Natural Environment Study

Humboldt County, California
Township 04 North, Range 01 West, Section 4
USGS Eureka, California 7.5-Minute Quadrangle
Bridge No. 04C-0173
01-HUM-CR-0
Federal Project No. BRLO-5904(112)

STATE OF CALIFORNIA
Department of Transportation

Prepared by: ______________________ Date: 10-15-15

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(530) 222-5347, Ext. 128
North State Resources, Inc.
5000 Bechelli Lane, Suite 203, Redding, CA 96002

Local Agency Approved by: ______________________ Date: 10-15-15

Andrew Bundschuh, Project Manager
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(707) 445-7741

Caltrans Approved by: ______________________ Date: 10/21/15

Michael Kelly, Environmental Planner Natural Sciences, Biologist
(707) 441-4548
District 1, Caltrans Office of Local Assistance

Caltrans SEP Approved by: ______________________ Date: 10/21/15

Brandon Larsen, Senior Environmental Planner
(707) 445-6410
District 1, Caltrans Office of Local Assistance

Summary

The Humboldt County Public Works Department (County) is planning to replace the Bridge No. 04C-0173 on Pine Hill Road over Swain Slough. The existing two-lane, 63-foot, three-span timber stringer structure was built in 1955 and is considered structurally deficient and functionally obsolete with a sufficiency rating of 44.6. The County is proposing to replace the existing bridge with a modern two-lane precast concrete girder bridge that meets current structural, geometric and hydraulic standards. The new bridge would meet all Caltrans Local Programs Manual and Highway Bridge (HBP) Program requirements.

This Natural Environment Study (NES) report has been prepared by the County to evaluate the potential effects of implementation of the proposed Pine Hill Road over Swain Slough Bridge Replacement Project (Project) on special-status plant and animal species, waters of the United States, and other sensitive biological resources (e.g., migratory birds).

Based upon the review of habitat requirements and the results of the field assessments, the biological study area (BSA) contains habitat for 12 special-status plant species, and one sensitive natural community: coastal marsh milk-vetch (*Astragalus pycnostachyus* var. *pycnostachyus*), bristle stalked sedge (*Carex leptalea*), Lyngbye's sedge (*Carex lyngbyei*), northern meadow sedge (*Carex praticola*), Humboldt Bay owl's-clover (*Castilleja ambigua* ssp. *humboldtiensis*), Point Reyes bird's-beak (*Chloropyron maritimum* ssp. *palustre*), Pacific gilia (*Gilia capitata* ssp. *pacifica*), short-leaved evax (*Hesperevax sparsiflora* var. *brevifolia*), marsh pea (*Lathyrus palustris*), Wolf's evening primrose (*Oenothera wolfii*), dwarf alkali grass (*Puccinellia pumila*), and western sand-spurrey (*Spergularia canadensis* var. *occidentalis*); and Northern Coastal Salt Marsh. The Project study area also contains potential habitat for 12 special-status animal species: five federally and/or state-listed species including Southern Oregon/Northern California Coast Environmentally Significant Unit (ESU) coho salmon (*Oncorhynchus kisutch*), California Coastal ESU Chinook salmon (*O. tshawytscha*), steelhead Northern California DPS (*O. mykiss*), longfin smelt (*Spirinchus thaleichthys*), and tidewater goby (*Eucyclogobius newberryi*); and seven other special-status species including coastal cutthroat trout (*Oncorhynchus clarkii clarkii*), Northern red-legged frog (*Rana aurora*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*), yellow-breasted chat (*Icteria virens*), and yellow warbler (*Setophaga petechia brewsteri*). Swain Slough within the BSA is designated critical habitat for Southern Oregon/Northern

California Coast ESU coho salmon and Northern California DPS steelhead. The County will implement a range of avoidance and minimization measures to ensure that the project does not adversely affect any special-status species or any designated critical habitat.

A Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) was submitted to the National Marine Fisheries Service (NMFS) to address potential impacts to federally listed fish species and to Essential Fish Habitat (EFH) for Pacific salmon. NMFS completed the Section 7 consultation and issued a Biological Opinion on September 25, 2015 which concluded that the Project is likely to adversely affect Northern California DPS steelhead, SONCC ESU coho salmon, and California Coastal ESU Chinook salmon, but is not likely to jeopardize the species. NMFS also concluded the project is likely to result in an adverse effect to critical habitat for the Coastal SONCC ESU coho salmon, California ESU Chinook salmon ESU, and the Northern California DPS steelhead; the Project is not likely to destroy or adversely modify critical habitat. In the BO, NFMS determined that incidental take would occur to all three salmonid species in the form of capture during fish relocation and by exposure to lethal noise levels resulting from pile driving. NMFS expects no more than one juvenile of each species to be injured and no more than two juvenile of each species will be killed as a result of constructing the Project. NMFS, as part of the Section 305(b) Magnuson-Stevens Fishery Conservation and Management Act consultation, concluded that the Project would adversely affect essential fish habitat for Pacific salmon species (e.g., SONCC ESU coho salmon, and California Coastal ESU Chinook salmon).

The Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) was also submitted to the U.S. Fish and Wildlife Service (USFWS) to address potential impacts to the federally listed tidewater goby. The USFWS completed the Section 7 consultation and issued a Biological Opinion on September 24, 2015 which concluded that the Project is not likely to jeopardize the species. The also concluded the Project action area is not located within designated critical habitat for the species. In the BO, USFWS determined that incidental take would occur to tidewater goby in the form of capture during fish relocation and or during dewatering activities. The USFWS expects no more than five adult gobies to be injured or killed as a result of constructing the Project.

A delineation of "waters of the United States" concluded that jurisdictional features in the BSA include perennial stream (Martin and Swain sloughs), seasonal wetland, and vegetated ditch. These features occupy a total 0.989 acre of waters of the United States and 1.165 acres of waters of the state. Placement of rock slope protection around the abutments and widening of the road would result in permanent impacts on approximately 0.079 acre of waters of the United States. Placement of sheet piling and the temporary relocation of a waterline would result in temporary impacts on approximately 0.017 acre of waters of the United States. The project design minimized impacts on wetlands to the extent practicable. All other design considerations would have a greater impact on wetlands. The project design with the least impact on wetlands was selected and, the project is in compliance with the Wetlands Only Practicable Finding Alternative pursuant to Executive Order 11990, Protection of Wetlands (1977).

To the extent practicable, the discharge of dredged or fill material into waters of the United States, including wetlands, shall be avoided—including waters not subject to Corps jurisdiction, but subject to California Regional Water Quality Control Board (RWQCB) or California Coastal Commission jurisdiction. If discharge of fill into a waters of the United States or waters of the State cannot be completely avoided, the City will apply for the appropriate permits from the Corps, North Coast RWQCB, California Coastal Commission, and the California Department of Fish and Wildlife, and will comply with the conditions of each respective permit. Impacts on jurisdictional waters would be compensated at a ratio specified by the permitting agency, and would be completed though on-site creation, restoration, enhancement, and/or preservation.

Environmentally Sensitive Habitat Areas (ESHA) within the Project study area include all waters of the United States and waters of the state identified above and these jurisdictional features extend into a 100-foot buffer around the Project study area. Implementation of the proposed Project would potentially result in the direct loss and indirect disturbance of ESHA, including the permanent impacts on waters of the United States noted above. The proposed project would potentially result in temporary impacts of up to 0.01 acre of upland riparian vegetation (note – impact acreage may be further reduced during the final project design phase). Recommended avoidance/minimization measures are provided in Section 4.1.4.

Cliff swallows *(Petrochelidon pyrrhonota),* barn swallows (*Hirundo rustica*), and other migratory birds are known to build nests under artificial structures such as bridges. Bats also can roost in certain crevices under bridges. The existing bridge structure was visually surveyed for evidence of previous migratory bird nesting activity (e.g., remnant mud nests) and for bat roosts during the field assessment. An unoccupied black phoebe (*Sayornis nigricans*) and barn swallow nests were observed. Potential impacts to occupied nests and recommended avoidance/minimization measures are addressed in Section 4.4.1.

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List of Abbreviated Terms

BA	Biological Assessment
BMP	Best Management Practices
BSA	biological study area
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
CWHR	California Wildlife Habitat Relationships
DPS	Distinct Population Segment
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
ºF	degrees Fahrenheit
ft	foot/feet
in	inch/inches
MBTA	Migratory Bird Treaty Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (now NOAA Fisheries)
OHWM	ordinary high water mark
Q_{100}	100-Year-Flood
RWQCB	Regional Water Quality Control Board
RSP	rock slope protection
SWPPP	Storm Water Pollution Prevention Plan
USFWS	U.S. Fish and Wildlife Service

Chapter 1. Introduction

This Natural Environment Study (NES) report has been prepared by Humboldt County Public Works Department (County) to evaluate the potential effects of implementation of the proposed Pine Hill Road over Swain Slough Bridge Replacement Project (Project) on sensitive biological resources.

1.1. Project History

The County is planning to replace the Bridge No. 04C-0173 on Pine Hill Road over Swain Slough. The existing bridge was built in 1955, and is structurally deficient and functionally obsolete with a sufficiency rating of 44.6. The County nominated the bridge for replacement under the federal-aid Highway Bridge Program (HBP) administered by the Federal Highway Administration (FHWA) through Caltrans Local Assistance.

1.1.1. Existing Facility Conditions

The bridge, constructed in 1955, is located on Pine Hill Road approximately 0.2 miles (mi) east of Elk River Road just south of Eureka, California. Pine Hill Road provides access across Swain Slough to residential neighborhoods and connects to Herrick Street, a major arterial out of southern Eureka. The existing bridge is a 63-foot (ft) timber stringer structure with a concrete deck and concrete abutments and was built in 1955. The two bent caps are constructed of reinforced concrete on 8 reinforced concrete piles. The bridge clear width is 19 ft with a 6-inch (in) curb/rail on each side for a total bridge width of 20 ft. The railing is constructed of painted timbers and there is no end protection at the bridge corners. The existing timber stringers are in poor condition as are the concrete support columns; the bridge has been categorized as both structurally deficient and functionally obsolete.

1.2. Project Description

1.2.1. Project Overview

1.2.1.1. LOCATION

The project is located south of Eureka, Humboldt County, California; east of U.S. Highway 101. Pine Hill Road is a Rural Local Road that connects Elk River road with Meyers Avenue and Herrick Road. Swain Slough, which is located in the Elk River watershed, confluences with the Elk River 0.5 mile downstream (northwest) of the bridge. Elk River drains into Humboldt Bay approximately 1.5 miles further downstream; Swain Slough is a tidally influenced stream.

The project biological study area (BSA) is in the *Eureka, California* 7.5-minute U.S. Geological Survey (USGS) topographic quadrangle (Figure 1). Specifically, the BSA is located along Pine Hill Road, east of the Pine Hill/Elk River Road intersection. The BSA is shown on the *Eureka, California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle; the bridge is identified by the following coordinates: Township 4 North, Range 1 West, Section 4, Humboldt Base and Meridian; and Latitude 40.752536 North by Longitude -124.182588 West, WGS84 datum.

1.2.1.2. PROPOSED PROJECT AREA

The 2.43-acre BSA includes the 1.77-acre Caltrans approved area of potential effects (APE) near the bridge, and an additional length of the County right-of-way (ROW) along Pine Hill Road west of the bridge, between the western end of the APE and the intersection with Elk River Road. This additional area is included in the BSA to provide a potential wetland mitigation area. The APE extends beyond the ROW north and south of Pine Hill Road on both sides of the bridge. The County will need to acquire both permanent roadway easements and temporary construction easements from the adjacent private landowners.

The BSA is located on the coastal plain in the Elk River floodplain. The elevation of the bridge is less than 10 feet above mean sea level, and Swain Slough is subject to tidal influence. A second waterway, Martin Slough, flows from the east, and confluences with Swain Slough within the BSA. Martin Slough parallels Pine Hill Road east of the bridge, but this stream has a tide gate that prevents inflow of normal tidewaters.

1.2.1.3. REPLACEMENT OF EXISTING STRUCTURE

The preferred alternative is to replace the existing bridge on the existing alignment. In accordance with County requirements, the bridge will provide two 10-ft traffic lanes and 5-ft shoulders, in addition to barrier rails along both sides (Figure 2). The replacement structure will be designed for the standard and permit live loading as specified in Caltrans *Bridge Design Specifications* (BDS) as well as the current *Seismic Design Criteria Version 1.7*, April 2013. The bridge elevation will need to be raised in order to meet federal hydraulic clearance requirements. The proposed bridge type is a single-span precast concrete I-girder, and will be slightly longer than the existing bridge to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the slough channel, eliminating potential impacts to fish passage. The recommended new roadway would consist of two 10-ft lanes and two 5-ft shoulders. Based on the

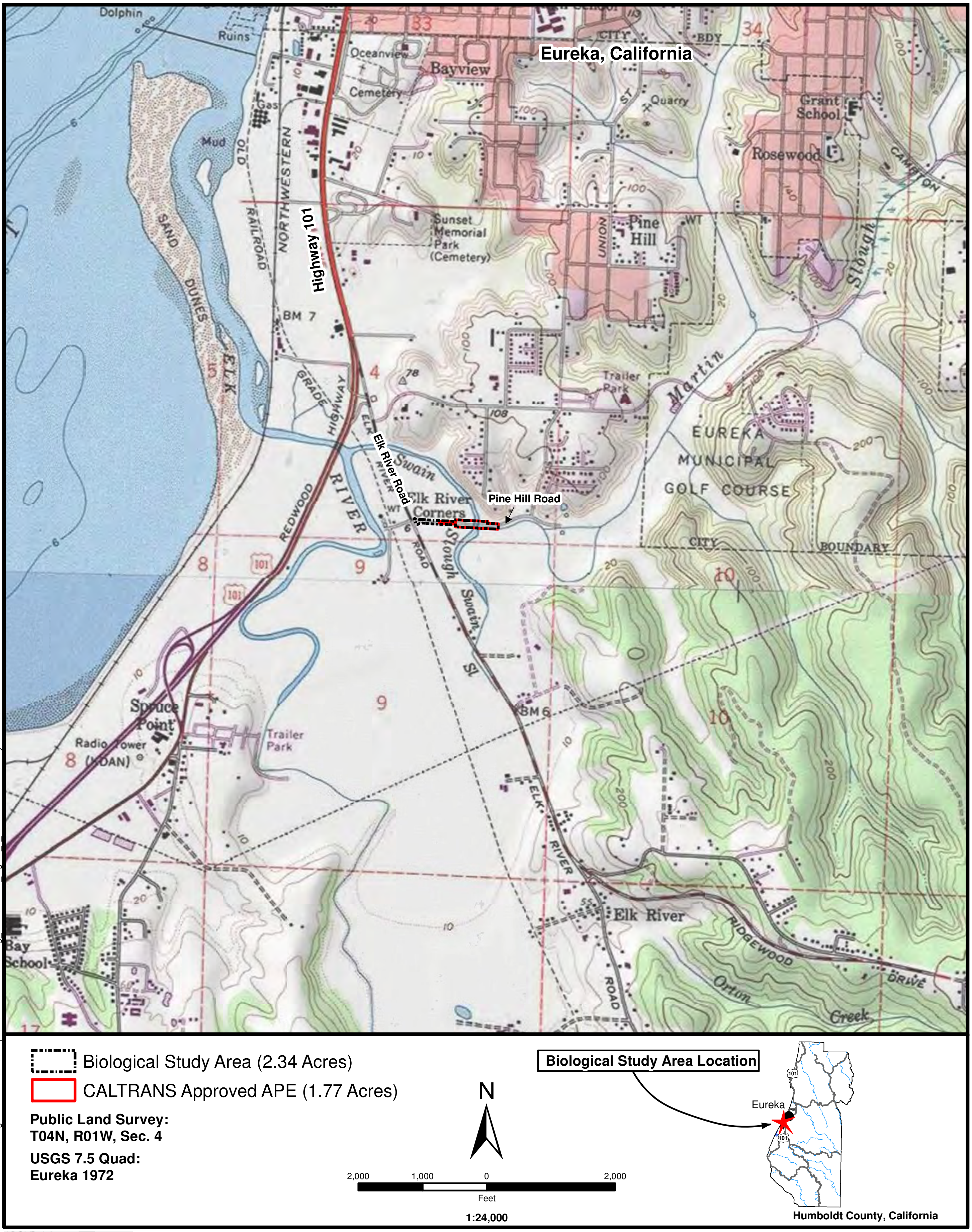

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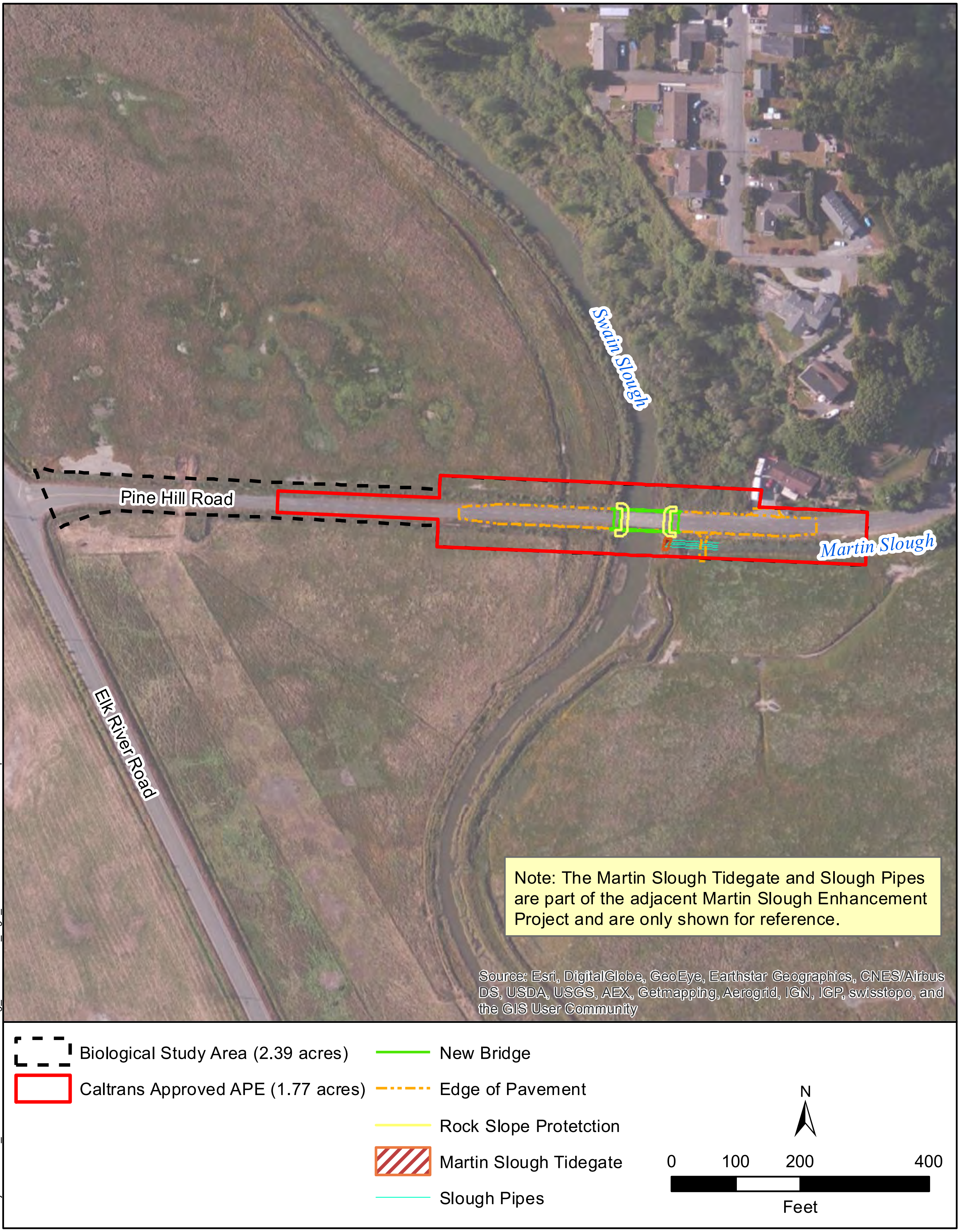
Figure 1
Biological Study Area Location and Vicinity



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North State Resources, Inc.

Foothill Trunk Replacement Project

Figure 2
Proposed Project Features

roadway classification, flat terrain, and daily traffic volumes, it is anticipated that a roadway design speed of 35 miles per hour (mph) will be used.

The design of the replacement structure will be in accordance with AASHTO LRFD Bridge Design Specifications, 6th Edition, and the Caltrans Amendments preface dated November 2013. The new single-span bridge is expected to be approximately 80-ft long (Figure 2). Mainline roadway approach construction will include fills of up to 3.5 ft. Construction of the bridge abutments will require two excavation areas each measuring approximately 30-ft long by 12-ft wide and up to 15-ft deep. Excavation will require dewatering of the work areas since the temporary stream diversion will fall below the local water table elevation. The Hydraulic Design Criteria established in the Caltrans Local Procedures Manual prescribe that the facility be capable of conveying the base or 100-year flood (Q_{100}) and passing the 50-year flood (Q_{50}) "without causing objectionable backwater, excessive flow velocities or encroaching on through traffic lanes." Due to the very flat nature of the project site and the configuration of the Elk River floodplain, obtaining 2-ft of freeboard beyond the Q_{50} is not feasible as the approach roadways would become very long and the bridge would be unnecessarily elevated.

The existing bridge, including decking, abutments, and piers, would be removed and disposed of offsite to allow the construction of the new structure. The roadway would be closed to through traffic as the detour is approximately 1.6 mi. A row of sheet piles would be vibrated into the Swain Slough channel in order to divert the tidal flow and to allow for removal of a portion of the existing abutments and footings; the work area will never be totally dry, but the intent is to separate physical activities from the slough to the extent practicable. A sheet pile enclosure (100-ft total length) surrounding the front and sides of the westerly abutment will be installed first. A second sheet pile enclosure (95-ft total length) around the front and sides of the easterly abutment will then be installed. Sheet piles will be vibrated into the bed of the slough. Sheets will be 60-ft in length, vibrated down to a depth of 48-ft. Sheet piles will be installed during low-tide so as not to occur "in-water" or capture water behind the sheet piles. Essentially, the slough water will be confined between the existing westerly abutment and the westerly row of piers by the sheet pilings. This temporary channel diversion is expected to be in place for approximately 6-weeks.

The new abutment footings would be constructed on driven piles (Table 1). Falsework is not required for the single-span precast structure. The precast girders will span Swain Slough and will be placed utilizing a crane that will be staged behind the new westerly abutment. Once the girders are in place, deck forms will be constructed between the girders and the new concrete deck will be cast. All new work on the bridge superstructure will be performed without the need for vehicular access from the Swain Slough channel.

Table 1. Pile driving information for the Pine Hill Road over Swain Slough Bridge Replacement Project.

Structure	Driver type	Pile type	Pile size		Maximum number of Piles	Piles installed per day/ strikes per day
			Diameter	Length		
Bridge Abutment Piles	Impact	Steel Pipe	24-inch	100-ft	22	2/1,600
Sheet pile (potential)	Vibratory	Sheet pile	24-inch	60-ft	100	Unknown

The new bridge and the approach embankments would not encroach into the Swain Slough channel, though rock slope protection (RSP) at the face and adjacent to the bridge will be required (primarily for the western abutment). Scour protection of the abutments from Swain Slough flows will be required and is expected to consist of ¼–ton RSP. The RSP is expected to consist of a 3-4 foot minimum thickness ¼–ton layer over a 1-3 foot thick No. 2 backing layer with RSP fabric underneath. The depth of the toe end of the RSP keyway trench is expected to be approximately 6-feet deep and will slope back to the bottom of the abutment front footing face. Approximately 150 cubic yards of RSP, equating to an area of 1,900 square feet will be placed in front of and around the new abutment footings. Installation will partially occur while the slough is diverted and will consist of digging a keyway trench and installing RSP by Method B placement so that the top surface of the RSP will be at the approximate elevation of the original channel grade. This will avoid impinging hydraulic flow within the channel and not adversely impact the upstream flooding characteristics of the river.

The County currently has a prescriptive right-of-way on Pine Hill Road for the existing roadway and bridge alignment. It is anticipated that both permanent roadway easements and temporary construction easements (TCE) will also be required to construct the new bridge. The approach railing at the southeast corner will be compact in order to provide permanent access across Martin Slough via a recently completed tide gate structure. This tide gate structure was installed as part of the State of California's Martin Slough Enhancement Project and replaced three aging culverts and flap gates in 2014. Access across the tide gate structure is not anticipated for bridge construction activities.

Existing overhead utilities are present east of the project site and serve the Humboldt Community Services District (HCSD) sewage pump plant and the Brown residence. A 12-in water line is located on the north side of Pine Hill Road and is attached to the outside edge of the existing bridge. The overhead electric lines and sewage pump plant located to the east of the project will not be affected. The existing waterline attached to the bridge will be permanently relocated beneath Swain Slough utilizing a horizontally drilled direction HDPE pipe prior to bridge construction (note: HCSD is responsible for completing this work as part of a separate project with a separate contractor). Coordination will begin early and will conform to the latest Caltrans procedural guidelines for relocation.

1.2.2. Construction Overview

Construction specifications would be in accordance with approved Caltrans Standard Specifications and Standard Special Provisions at the time the construction contract is awarded. The following paragraphs describe the in-water construction activities associated with the bridge replacement in more detail. The new bridge will be fully constructed in one season and the work is expected to occur during daylight hours in the summer of 2016. In-water construction activities associated with the bridge replacement at Swain Slough will occur in the following sequence:

- HCSD, as part of a separate project, will permanently relocate the waterline beneath Swain Slough utilizing a horizontally drilled directional HDPE pipe.
- Detour traffic and close Pine Hill Road to through traffic.
- Construct slough protection system, consisting of nets and tarps to prevent debris from falling into the slough, which will be required to remove and dispose of the existing bridge.
- Remove existing bridge superstructure and piers starting with the center span and then moving to the end spans.
- Due to the structural characteristics and age of the existing concrete bridge piers, removal will be accomplished at a very low tide by excavating around each pier, pulling each pier over with an excavator, breaking it off below the mud line, and removing them from the slough channel. No concussive hammering of the existing concrete piers during demolition is required. The excavated pier pits will be backfilled with the sediment removed or with clean gravel after demolition.

- Vibrate sheet piles into slough bed to form cofferdam enclosure around the front and sides of existing Abutment 1. Excavate material between existing Abutment 1 and new sheet piling. Remove existing Abutment 1, primarily with excavators and excavator-mounted hoe ram.
- Vibrate sheet piles into slough bed to form cofferdam enclosure around the front and sides of existing Abutment 2. Remove existing Abutment 2, primarily with excavators and excavator-mounted hoe ram.
- Within cofferdams, excavate bank material to bottom of new abutment footing depth, including possible dewatering of seepage.
- Drive 22 CISS piles (11 per abutment) in the abutment excavations, within dewatered cofferdams.
- Within the cofferdam, place a cobble and gravel work platform around the base of the CISS piles to provide a stable base for construction workers and to control water seepage. If a gravel work platform does not provide sufficient work area or control water seepage, then a concrete seal course will be poured around the base of the CISS piles (i.e., Tremie seal).
- Construct concrete forms and pour abutment footings.
- Construct abutment stems.
- Backfill behind abutments (gravel work platforms and/or Tremie seal concrete will be buried by backfill of native soil and sediment materials and RSP around abutments).
- Grade and install RSP behind sheet piling.
- Remove sheet piling.
- Install single-span precast girders utilizing cranes located behind the newly constructed abutment.
- Construct bridge deck and railing.
- Construct roadway approaches to new bridge.
- Remove the detour.

Equipment and materials will be staged on the existing asphalt concrete roadway approaches.

1.2.3. Construction Practices and Conservation Measures

The following conservation measures are incorporated into the project to minimize potential effects on state- or federally-listed species and other biological resources. This section describes conservation measures proposed to minimize the anticipated temporary and permanent effects associated with the proposed project. The bridge structure has been designed to minimize permanent in-water impacts to the greatest extent practicable while retaining the design criteria in place for seismic, structural and hydraulic requirements.

1.2.3.1. Conservation Measure #1 – Prevention of Fish Barotrauma

To protect the most vulnerable life stages that occur within the project area, salmon fry/juveniles and spawning goby, in-water work would be restricted to the period between July 1st and October 15th. This seasonal work window correlates to the seasonal period when juveniles of the listed salmonids are not likely to occur in the estuarine portion of Swain Slough and fewer spawning goby may be present. To further reduce the potential impacts to all fish in the project area from hydroacoustic barotrauma, sheet piles will be driven in an isolated ad mostly dewatered or very shallow areas of the slough channel between the latter 1/3 of the outgoing tide and beginning 1/3 of the incoming tide, reducing the amount of water, transmission of sound waves, and potentially the number of aquatic organisms in the project area. CISS piles will be driven mostly landward of the slough channel within dewatered cofferdam enclosures, isolating the piles and reducing the transmission of sound pressure waves into and through the water column of the main slough channel.

To monitor and collect data on the actual underwater noise levels generated during pile-driving of the steel sheet and CISS piles, a Hydroacoustic Monitoring Plan, detailing monitoring locations, methods, and schedules, will be prepared and submitted to the appropriate agency(s), in advance of construction. Hydroacoustic monitoring will take place at the closest practical location to the actual pile driving. A final report including all data collected from the selected monitoring locations will be submitted to the USFWS and NMFS within 90 days of the completion of hydroacoustic monitoring.

1.2.3.2. Conservation Measure #2 – Fish rescue and Exclusion/In-water avoidence

Prior to pile-driving of CISS piles, Swain Slough will be seined at low-tide, with a 0.125-inch mesh seine, and a net barrier installed at least 100-ft upstream and downstream of the existing structure (acoustic impact area for physical injury). Barrier nets will be monitored daily and additional seine passes may be required if fish continue to be encountered over the 10-12 day CISS pile-driving period. In order to minimize potentially adverse effects to special-status fishes, all translocation/removal of fishes will be conducted by qualified fisheries biologists. Any fish that cannot be simply herded by seines from the action area and must be physically handled will be released at a suitable habitat upstream or downstream of the project area, with comparable habitat and water quality conditions. Immediately following completion of CISS pile driving, the block nets will be removed allowing free fish passage through the action area during the remainder of the construction period.

1.2.3.3. CONSERVATION MEASURE #3 - EROSION AND SEDIMENTATION CONTROL

Erosion control measures shall be implemented during construction of the proposed project. These measures shall conform to the provisions in Section 20-2 and 20-3 of the Caltrans Standard Specifications and the special provisions included in the contract for the project. Such provisions include the preparation of a Storm Water Pollution Prevention Plan (SWPPP), which describes and illustrates the best management practices (BMPs) in the project site. Erosion control measures to be included in the SWPPP or to be implemented by the County include, but are not limited to, the following:

- To the maximum extent practicable, activities that increase the erosion potential in the project area shall be restricted to the relatively dry summer and early fall period to minimize the potential for rainfall events to transport sediment to surface water features. In-water construction will be conducted from July 1st–October 15th and upland construction will likely occur throughout the year as long as work activities comply with the conservation and avoidance and minimization measures identified herein and for the protection of other sensitive or special-status plant or animal species. For upland construction activities that must take place during the late fall, winter, or spring (e.g., vegetation removal prior to avian nesting periods), then temporary erosion and sediment control structures shall be in place and operational at the end of each construction day and maintained until permanent erosion control structures are in place.
- Areas where wetland and upland vegetation need to be removed shall be identified in advance of ground disturbance and limited to only those areas that have been approved by the County. Exclusionary fencing will be installed around areas that do not need to be disturbed.
- Within 10 days of completion of construction in those areas where subsequent ground disturbance will not occur for 10 calendar days or more, weed-free mulch shall be applied to disturbed areas to reduce the potential for short-term erosion. Prior to a rain event or when there is a greater than 50 percent possibility of rain within the next 24 hours, as forecasted by the National Weather Service, weed-free mulch shall be applied to all exposed areas upon

completion of the day's activities. Soils shall not be left exposed during the rainy season.

- Suitable BMPs, such as silt fences, straw wattles, or catch basins, shall be placed below all construction activities at the edge of surface water features to intercept sediment before it reaches the waterway. These structures shall be installed prior to any clearing or grading activities. Further, sediment built up at the base of BMPs will be removed before BMP removal to avoid any accumulated sediments from being mobilized post-construction.
- If spoil sites are used, they shall be located such that they do not drain directly into a surface water feature, if possible. If a spoil site drains into a surface water feature, catch basins shall be constructed to intercept sediment before it reaches the feature. Spoil sites shall be graded and vegetated with native species to reduce the potential for erosion.
- Sediment control measures shall be in place prior to the onset of the rainy season and will be monitored and maintained in good working condition until disturbed areas have been revegetated with native species.
- All dewatering activities will be conducted in compliance with the Caltrans Field Guide for Construction Site Dewatering and Section 13-4.03G of the Caltrans Standard Specifications. Water removed from coffered work areas required for construction of the new abutments shall be pumped to a temporary sediment retention basin outside of the channel, through a mechanized water filtration system, or into Baker tanks or similar storage system and trucked offsite to an authorized disposal site.

1.2.3.4. Conservation Measure #4 - Prevention of Accidental Spills

Construction specifications shall include the following measures to reduce potential impacts to vegetation and aquatic habitat resources in the project area associated with accidental spills of pollutants (e.g., fuel, oil, and grease). All work will be conducted in accordance with Caltrans Storm Water Quality Handbook for Construction Site Best Management Practices Manual, including, but not limited to the following measures:

- A site-specific spill prevention plan shall be implemented for potentially hazardous materials. The plan shall include the proper handling and storage of all potentially hazardous materials, as well as the proper procedures for cleaning up and reporting any spills. If necessary, containment berms shall be constructed to prevent spilled materials from reaching surface water features.

- Equipment and hazardous materials shall be stored 50 ft away from surface water features.
- Vehicles and equipment used during construction shall receive proper and timely maintenance to reduce the potential for mechanical breakdowns leading to a spill of materials. Maintenance and fueling shall be conducted in an area at least 50 feet away from Swain Slough or within an adequate fueling containment area.
- Equipment shall use non-toxic vegetable oil for operating hydraulic equipment instead of traditional hydraulic fluids.
- Place plastic materials under asphaltic concrete (AC) paving equipment while not in use, to catch and/or contain drips and leaks.
- Minimize sand and gravel from new asphalt from getting into storm drains, streets, and creeks by sweeping. Old or spilled asphalt must be recycled or disposed as approved by the Resident Engineer.
- AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drain or watercourses. Install silt fence until structure is stabilized or permanent controls are in place.
- Collect and remove all broken asphalt and recycle when practical; otherwise, dispose in accordance with Standard Specification 7-1.13.
- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Use silt fence until installation is complete.
- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.
- Drainage inlet structures and manholes shall be covered with filter fabric during application of seal coat, tack coat, slurry seal, and/or fog seal.
- Seal coat, tack coat, slurry seal, or fog seal shall not be applied if rainfall is predicted to occur during the application or curing period.
- If dewatering is not required for other purposes, removal of seepage water in the coffered work areas may be ceased after new abutment concrete is poured and is curing (for at least 72 hours after pour) within the form structures, provided that pH of the water inside the cofferdam enclosures and in contact with the concrete forms does not exceed a difference of 0.5 pH units from that of ambient water quality in main slough channel outside of the cofferdams (e.g., 50 ft upstream and downstream of the new bridge alignment)[1]. If the

[1] The 0.5 pH unit criteria is consistent with the pH objective of the Water Quality Control Plan for the North Coast Region (NCRWQCB 2011).

difference in pH within the cofferdam exceeds 0.5 units, water levels within the coffered area will be kept below the level of the concrete abutment forms and pumped to temporary retention basins or Baker tanks and treated as above for erosion and sediment control.

1.2.3.5. Conservation Measure #5 - Replacement of Lost Riparian Habitat

The following measures shall be implemented to reduce potential impacts to riparian habitat in the project area:

- The width of the construction disturbance zone within the riparian habitat shall be minimized through careful pre-construction planning.
- Exclusionary fencing shall be installed along the boundaries of all riparian areas to be avoided to ensure that impacts to riparian vegetation outside of the construction area are minimized.
- Riparian habitat (which is limited to wet meadow) areas temporarily disturbed shall be replanted using grasses and forbs found in the project area.
- Plant spacing intervals will be determined as appropriate based on site conditions following construction.
- Revegetation monitoring would be implemented in compliance with regulatory permit conditions and be initiated immediately following completion of the planting. Consideration may need to be given to the species selected and appropriate protection measures from grazing activities. Monitoring surveys will consist of a general site walkover evaluating the survival and health of riparian plantings, signs of drought stress, weed or herbivory problems, and the presence or trash or other debris. Within the mitigation area, less than 50 percent total mortality of planted species (including container stock and hardwood cuttings) would be considered a success. Greater than 50 percent mortality of planted species will be considered acceptable if "volunteer" native species provide complete vegetation coverage in the mitigation area. If monitoring results indicate that revegetation efforts are not meeting established success criteria, corrective measures would be implemented.

1.2.3.6. Conservation Measure #6 - Prevention of Spread of Invasive Species

The following measures shall be implemented to prevent the spread of invasive species in the project area:

- All equipment used for off-road construction activities will be weed-free prior to entering the project area.
- If project implementation calls for mulches or fill, they will be weed free.

- Any seed mixes or other vegetative material used for re-vegetation of disturbed sites will consist of locally adapted native plant materials to the extent practicable.
- Any gravels or materials used for the temporary stream diversion shall be new, from a local source, or properly cleaned prior to installation.
- Any equipment (including boots/waders) and construction equipment shall be properly disinfected or cleaned according guidance provided by the State of California Aquatic Invasive Species Management Plan (California Department of Fish and Game 2008a; U.S. Bureau of Reclamation 2012) prior to in-water work to prevent the spread of aquatic invasive species.

1.2.3.7. Conservation Measure #7 - Air Quality/Dust Control

The County shall include provisions in the construction bid documents that the contractor shall implement a dust control program to limit fugitive dust emissions. The dust control program shall include, but not be limited to, the following elements, as appropriate:

- Water inactive construction sites and exposed stockpile sites at least twice daily, including non-work days, or until soils are stable.
- In accordance with California Vehicle Code (State of California 2009), all trucks hauling soil and other loose material to and from the construction site shall be covered or should maintain at least 6 in. of freeboard (i.e., minimum vertical distance between top of load and the trailer).
- Any topsoil that is removed for the construction operation shall be stored on-site in piles not to exceed 4 ft in height to allow development of microorganisms prior to resoiling of the construction area. These topsoil piles shall be clearly marked and flagged. Topsoil piles that will not be immediately returned to use shall be revegetated with a non-persistent erosion control mixture.
- Soil piles for backfill shall be marked and flagged separately from native topsoil stockpiles. These soil piles shall also be surrounded by silt fencing, straw wattles, or other sediment barriers or covered unless they are to be immediately used.
- Equipment or manual watering shall be conducted on all stockpiles, dirt/ gravel roads, and exposed or disturbed soil surfaces, as necessary, to reduce airborne dust.

1.2.3.8. Conservation Measure #8 – Protection for Nesting Migratory Birds

The following measures shall be implemented to avoid or minimize the potential for project-related impacts on migratory birds that have no other special-status:

- Grading and other construction activities shall be scheduled to avoid the nesting season to the extent possible. The nesting season for these species extends from March through August. If construction occurs outside of the breeding season, no further mitigation is necessary. If the breeding season cannot be completely avoided, the remainder of this mitigation measure shall be implemented.
- Pre-construction surveys for migratory birds shall be conducted by a qualified biologist to ensure that no nests will be disturbed during project implementation. These surveys shall be conducted no more than 7 days prior to the initiation of construction activities, or re-initiation of construction activities if they have ceased for more than 7 days. During this survey, the biologist shall inspect all potential nesting habitat for migratory bird nests where project activities could potentially result in disturbance to migratory birds, including areas of direct impact plus an area extending at least 100 feet from the perimeter of the project area for migratory birds.
- If an active nests is found within the survey area, or beyond the survey area but in a location where there could be potential disturbance associated with construction activities, the biologist, in consultation with the CDFW, shall determine the extent of a construction-free buffer zone to be established around the nest, or shall develop and agree upon construction methods that will allow work to continue without disturbing an active nest. Active nests may not be removed until after the young have fledged (based on field verification). A qualified biologist shall monitor the nest for disturbance and evidence of fledging during construction and until the young have fledged, and submit status reports to the CDFW throughout the nesting season. If evidence of disturbance to an active nest is observed as a consequence of construction activities, construction activities shall immediately cease until such time as the birds have fledged or construction protocol is revised so as not to disturb nesting birds or fledglings. If vegetation is to be removed by the project and all necessary approvals have been obtained, potential nesting habitat (e.g., shrubs and trees) that will be removed by the project should be removed outside the nesting season, if feasible. This will help preclude nesting and substantially decrease the likelihood of direct impacts.

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Chapter 2. Study Methods

2.1. Federal Regulatory Requirements

2.1.1. Federal Endangered Species Act

Section 9 of the federal Endangered Species Act of 1973 prohibits acts of disturbance that result in the "take" of threatened or endangered species. As defined by the federal Endangered Species Act, “endangered” refers to any species that is in danger of extinction throughout all or a significant portion of its current range. The term “threatened” is applied to any species likely to become endangered within the foreseeable future throughout all or a significant portion of its current range. Take is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." Violation of this section can result in penalties of up to $50,000 and up to one year of imprisonment. Sections 7 and 10 of the federal Endangered Species Act provide a method for permitting an action that may result in "incidental take" of a federally listed species. Incidental take refers to take of a listed species that is incidental to, but not the primary purpose of, an otherwise lawful activity. Incidental take is permitted under Section 7 for projects on federal land or involving a federal action, while Section 10 provides a method for permitting incidental take resulting from state or private action.

2.1.2. Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a federal fisheries management plan. The MSA requires federal agencies to consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agencies that may adversely affect EFH (MSA section 305[b][2]). A component of this consultation process is the preparation and submittal of an Essential Fish Habitat Assessment (EFHA).

The EFH mandate applies to all species managed under a fisheries management plan. For the Pacific coast (excluding Alaska), there are three fisheries management plans covering groundfish, coastal pelagic species, and Pacific salmon.

2.1.3. Federal Clean Water Act Section 404

The objective of the Clean Water Act (CWA, 1977, as amended) is to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters. In

1987, the U.S. Army Corps of Engineers (Corps) published a manual standardizing the manner in which wetlands were to be delineated nationwide. To determine whether areas that appear to be wetlands are subject to Corps jurisdiction (i.e., are "jurisdictional" wetlands), a wetlands delineation must be performed that maps the areas meeting the three-parameter wetland definition (i.e., presence of dominant hydrophytic vegetation, hydric soils, and wetland hydrology) and the resulting map of the wetland boundaries verified in writing by the Corps (compared to the one-parameter wetland definition under the California Coastal Commission section below). Wetlands generally include riparian, swamps, marshes, bogs, and similar areas.

In addition to verifying wetlands for potential jurisdiction, the Corps is responsible for the issuance of permits for projects that propose the filling of wetlands. Any permanent loss of a jurisdictional wetland as a result of project construction activities is considered a significant impact. Permits under Section 404 of the CWA, as amended, are required for the placement of dredged or fill materials into all waters of the United States, including wetlands and "other waters." Projects are permitted under either individual or general (e.g., nationwide) permits.

2.1.4. Federal Clean Water Act Section 401

The California Regional Water Quality Control Board (RWQCB), North Coast Region, is responsible for enforcing water quality criteria and protecting water resources in the project area. The RWQCB is responsible for controlling discharges to surface waters of the state by issuing waste discharge requirements.

Section 401 of the CWA requires that a project proponent obtain a water quality certification or a waiver for projects requiring a federal permit to allow for discharges of dredged or fill material (i.e., Corps Section 404 permits).

2.1.5. Federal Migratory Bird Treaty Act

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 CFR Part 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 CFR 21).

2.1.6. Marine Mammal Protection Act

Congress passed the Marine Mammal Protection Act (MMPA) in 1972. The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. Take is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal." Harassment is defined as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption or behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering."

2.1.7. Executive Order 11990 (Wetlands)

Executive Order 11990 is an overall wetlands policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. It requires federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands. This project will not be able to completely avoid impacts to wetlands and a Wetlands Only Practicable Alternative Finding is provided in Section 4.1.3.3.

2.1.8. Executive Order 13112 (Invasive Species)

Executive Order 13112 directs federal agencies to use relevant programs and authorities to:

- prevent the introduction of invasive species;
- detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner;
- monitor invasive species populations accurately and reliably;
- provide for restoration of native species and habitat conditions in ecosystems that have been invaded;
- conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species;
- promote public education on invasive species and the means to address them; and
- not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, In accordance with guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

2.1.9. Executive Order 11988 (Floodplain Management)

Executive Order 11988 requires federal agencies to avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and avoid direct and indirect support of floodplain development.

2.2. California Regulatory Requirements

2.2.1. Department of Fish and Game Code Section 2081, California Endangered Species Act

Under the California Endangered Species Act (CESA), the California Department of Fish and Wildlife (CDFW) has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code 2070). Additionally, CDFW maintains a list of "candidate species" which are species that CDFW has formally recognized as being under review for inclusion on the state's list of endangered or threatened species. The CDFW also maintains lists of "species of special concern" which serve as "watch lists." In accordance with the requirements of the CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the project area and determine whether the proposed project will have a potentially significant impact on such species. In addition, the CDFW encourages informal consultation on any proposed project that may impact a candidate species. Project-related impacts to species on the CESA endangered or threatened list would be considered significant and would require avoidance. State-listed species are fully protected under the mandates of CESA. "Take" of protected species incidental to otherwise lawful management activities may be authorized under Section 2081 of the Fish and Game Code of California.

2.2.2. Department of Fish and Game Code Section 3503, Birds of Prey

Under Section 3503.5 of the California Fish and Game Code, it is unlawful to take, possess, or destroy any birds in the orders of Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird, except as otherwise provided by this code or any regulation adopted pursuant thereto.

2.2.3. Department of Fish and Game Code Section 3513, Migratory Birds

Migratory birds are also protected in California. The State Fish and Game Code Section 3513 states that it is unlawful to take or possess any migratory nongame bird as designated in the MBTA or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the MBTA. Under Code Section 3513 the CDFW may considerer impacts similar to those described above under the MBTA a significant impact. Implementation of the measures identified in Section 4.4.1.3 will ensure compliance with Fish and Game Code Section 3513.

2.2.4. Department of Fish and Game Code, "Fully Protected" Species

California statutes also accord "fully protected" status to a number of specifically identified birds, mammals, reptiles, amphibians, and fish. These species cannot be "taken," even with an incidental take permit (California Fish and Game Code, Sections 3505, 3511, 4700, 5050, and 5515

2.2.5. Department of Fish and Game Code Section 1600, Lake or Streambed Alteration

Any entity proposing an activity that will substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by the CDFW, may require a discretionary Streambed Alteration Agreement from the CDFW (Region 1). As a general rule, this requirement applies to any work undertaken within the 100-year floodplain of a stream or river containing fish or wildlife resources.

2.2.6. California Coastal Act

The California Coastal Act was enacted by the State Legislature in 1978 to provide long-term protection of California's coastal zone. The Coastal Act also made permanent the California Coastal Commission (Coastal Commission). The Coastal Commission plans and regulates development and natural resource use along the coast in partnership with local governments and in keeping with the requirements of the Coastal Act. Under the Coastal Act, new development that requires a coastal development permit either from the Coastal Commission or the appropriate local government includes, but is not limited to, any project in the coastal zone that results in a change in the density or intensity of use of land and any project that results in a change in the intensity of use of water, or of access thereto. The Coastal Act requires every city and county lying partly or wholly within the designated coastal zone to prepare a Local Conservation Plan (LCP). Coastal Act policies constitute the standards used by the Coastal Commission in its coastal development permit decisions and for the review of LCPs. These policies are also used by the Commission to review federal activities that affect the coastal zone.

The California Coastal Act requires that most development avoid and buffer wetland resources. Policies include:

- **Section 30231**, which requires the maintenance and restoration (if feasible) of the biological productivity and quality of wetlands appropriate to maintain optimum populations of marine organisms and for the protection of human health.
- **Section 30233**, which limits the filling of wetlands to identified high priority uses, including certain boating facilities, public recreational piers, restoration, nature study, and incidental public services (such as burying cables or pipes). Any wetland fill must be avoided unless there is no feasible less environmentally damaging alternative, and authorized fill must be fully mitigated.

The Coastal Commission regulations (California Code of Regulations Title 14) establish a "one parameter definition" that only requires evidence of a single parameter to establish wetland conditions:

> *Wetland shall be defined as land where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep-water habitats (14 CCR Section 13577).*

The California Coastal Act also provides for the designation of Environmentally Sensitive Habitat Areas (ESHAs). An ESHA is any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments. The California Coastal Act states that ESHA shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas. Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.

2.3. Humboldt County Regulatory Requirements

2.3.1. Humboldt Bay Area Plan of the Humboldt County Local Coastal Program

In the early 1980's, Humboldt County developed an LCP, covering six geographic subunits, in accordance with the California Coastal Act. The Humboldt Bay Area Plan (HBAP) of the Humboldt County LCP was certified by the Coastal Commission in 1982, and has been subsequently revised to include amendments and revisions (Humboldt County Planning Department 1995). Humboldt County is in the process of revising the Humboldt County General Plan, and recent amendments will be incorporated, including the *Humboldt County LCP Amendment No. HUM-MAJ-1-08 (Samoa)* per the conditions of the Coastal Commission certification (California Coastal Commission 2012). The current HBAP provides regionally specific guidelines regarding ESHA and wetlands regulated by the Coastal Commission. The BSA is within the Humboldt Bay geographic subunit, and the HBAP identifies Eureka and Martin Sloughs as ESHA.

2.3.2. Humboldt Bay Management Plan

The purpose of the Humboldt Bay Management Plan is to serve as a management guide, planning tool, and policy strategy, as well as to be a reference document for the Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD) and other resource management agencies and organizations interested in Humboldt Bay. The management plan is intended to guide new projects around the Bay, such as project planning, master plans, mitigation strategy development, compliance with CEQA, NEPA, Coastal Zone Management Act, and CWA, and to assist in daily resource management work.

This plan is formulated in such a way as to set objectives for resource management and identify recommend approaches that will reduce the potential for future problems and user conflicts. The proposed Project lies within the HBHRCD Sphere of Interest. This area generally includes the region that was subject to tidal action when California became a state; this is, conceptually, the area behind levees and tidegates that would be subject to HBHRCD jurisdiction if the levees were not present. However, HBHRCD does not have regulatory authority within this secondary area of concern.

2.3.3. Humboldt Bay Watershed Salmon and Steelhead Conservation Plan

The *Humboldt Bay Watershed Salmon and Steelhead Conservation Plan* (SSCP) is a compilation of watershed information; a report on the evaluation of that information; and a list of high priority goals and objectives aimed at protecting and/or restoring watershed processes in order to preserve and enhance salmon and steelhead habitat. The SSCP was developed by the Humboldt Bay Watershed Advisory Committee, a diverse group of watershed stakeholders whose mission is “to improve the Humboldt Bay watershed’s anadromous salmonid populations and related resources while considering regional ecological and socioeconomic needs.” The SSCP was developed to encourage cooperative planning, education, implementation, and evaluation of watershed projects for protecting, maintaining, and restoring salmonid habitat and natural watershed processes. The BSA is within the area covered by the SSCP.

2.4. Studies Required

2.4.1. Database Search and Informational Review

Plant and animal special-status species and/or other special habitats having the potential to occur in the BSA were determined, in part, using several database searches and review of an official species list provided by the USFWS. Prior to conducting field assessments, the following information sources were reviewed:

- *Eureka, California,* USGS 7.5-minute quadrangle;
- Aerial photography of the BSA and vicinity;
- USFWS list of endangered and threatened species that may occur in the *Eureka, California* USGS 7.5-minute quadrangle (Appendix A);
- California Natural Diversity Data Base (CNDDB) and California Native Plant Society (CNPS) records for the *Eureka, California* USGS 7.5-minute quadrangle and the six surrounding quadrangles (Appendix B);
- California Wildlife Habitat Relationships (CWHR) System (California Department of Fish and Game 2008b); and
- Pertinent literature, including the online *Inventory of Rare and Endangered Vascular Plants of California* (California Native Plant Society 2013), *The Jepson Manual, Vascular Plants of California*, *2nd edition* (Baldwin et al. 2012), *Selected Rare Plants of Northern California* (Nakamura and Nelson 2001), the California’s Wildlife series Volumes I, II and III (Zeiner et al. 1989; Zeiner et al. 1990b, 1990a), *California Bird Species of Special Concern* (Shuford and Gardali 2008), and *Fish Species of Special Concern in California* (Moyle et al. 1995)

- Relevant websites including Calflora (http://www.calflora.org/), California Herps (http://www.californiaherps.com/), and The North American Breeding Bird Survey Results and Analysis (https://www.pwrc.usgs.gov/bbs/).

2.4.2. Studies Conducted

NSR Biologists, Julian Colescott and Sarah Tona, conducted a series of site assessments on July 29 and 30, 2013, and these are described below.

A field delineation of jurisdictional wetlands was performed to document and map the three-parameter wetlands and other waters that fall under the jurisdiction of the Corps, according to methodology described in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987)and the and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (U.S. Army Corps of Engineers 2010). The field survey also identified and mapped waters of the state that fall under the jurisdiction of the Coastal Commission. Separate reports were generated to reflect the different methodologies used in the mapping. A copy of each report is included as Appendix E.

A protocol-level botanical survey was conducted in general accordance with the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009). Per the 2009 CDFG guidelines, a target list of special-status plant species with the potential to occur on the site was developed prior to the survey through interpretation of the CNDDB and CNPS query results. The target list is presented in Appendix C, Table C-1. A list of all plant species observed is provided in Appendix D. All plants were categorized as native or non-native according to *The Jepson Manual*, *2nd edition* (Baldwin et al. 2012).

An aquatic habitat site assessment was conducted to determine the suitability of habitat for federally-listed fish species, and presence of EFH. The stream channel was surveyed for general morphological characteristics and habitat quality, presence and extent of suitable spawning gravel, and other notable habitat features. This information was used in conjunction with existing information on the contemporary status and condition of aquatic habitat and fish populations to characterize the environmental setting in the project area.

An assessment of the suitability of the habitat to support special-status wildlife was conducted by walking throughout the BSA to characterize and evaluate distinct habitats occurring within the BSA for their potential to support regionally occurring special-status wildlife species. The NSR biologists recorded the presence of special habitat features (e.g., streams, shrubs), dominant plant species observed within each vegetation community, habitat complexity or connectivity, and other factors (e.g., human disturbance, traffic) occurring within the BSA. Botanical taxonomic nomenclature and identification followed *The Jepson Manual*, *2nd edition* (Baldwin et al. 2012).

2.5. Personnel and Survey Dates

Following is a list of personnel and tasks performed during visits to the project site:

- Wirt Lanning, CEQA/NEPA Program Manager/Senior Environmental Analyst, NSR. Technical review and project management;
- Julian Colescott, Wildlife Biologist and Professional Wetland Scientist, NSR. Wetland delineation (Corps and CCC), biological suitability assessment, and aquatic habitat assessment;
- Sarah Tona, Botanist, NSR. Botanical survey and wetland delineation;
- Mike Gorman, Fisheries Biologist, NSR. Fisheries assessment.
- Paul Kirk, Biologist, NSR. Technical review.

2.6. Agency Coordination and Professional Contacts

On July 7, 2014 a list [Document No. 327179038-9408 (Appendix A)] of federally listed species with the potential to occur in the *Eureka, California* USGS 7.5-minute quadrangle was electronically obtained from the USFWS. An updated listed was obtained on October 5, 2015 [Consultation Code 08EACT00-2016-SLI-0002 (Appendix A)].

On August 20, 2014 Jenna Larson, Caltrans, exchanged emails with Steve Kramer, USFWS, regarding the presence and approach to assessing impacts to tidewater goby. Mr. Kramer indicated it would likely require formal consultation given the in-water and acoustic impacts. Mr. Kramer also provided a list of USFWS recommended conservation measures for projects that may adversely affect tidewater gobies.

On December 12, 2012 the County, Caltrans, Quincy Engineering Inc., North State Resources, Inc., NMFS Section 7 Coordinator Chuck Glasgow and USFWS biologist Gregory Schmidt met in the field to discuss the proposed project design and construction. On March 17, 2015, a follow-up field site visit to verify the project design, construction techniques, and conservation measures was conducted between the County, Caltrans, Quincy Engineering Inc., North State Resources, Inc., and NMFS biologist Rebecca Bernard.

On May 13, 2015 and May 15, 2015, a BA/EFHA was submitted by Caltrans District 1 to NMFS and the USFWS, respectively, for section 7 consultation under the ESA and for EFH consultation under the MSA. On September 25, 2015 NMFS issued a biological opinion (BO) (WCR-2015-2927). On September 24, 2015, the USFWS issued a BO (AFWO-15B0056-15F0148).

2.7. Limitations That May Influence Results

All field studies were conducted in accordance with applicable protocols. Therefore, no limitations that may influence the results of field studies associated with this project are known to have occurred.

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Chapter 3. Results: Environmental Setting

3.1. Description of Existing Physical and Biological Conditions

3.1.1. Study Area

The 2.43-acre BSA is located on the coastal plain in the Elk River floodplain. The elevation of the bridge is less than 10 feet above mean sea level, and Swain Slough is subject to tidal influence. Land use in the area is a mix of privately owned rural and residential parcels. The open grassland northwest, southwest, and southeast of the bridge is grazed by cattle, including the lands south of Pine Hill Road that are owned by the North Coast Regional Land Trust. A private residence is adjacent to the northeast section of the study area.

3.1.2. Physical Conditions

3.1.2.1. Hydrology, Topography, and Soils

The elevation within the BSA is between approximately 8 and 12 feet above mean sea level, with the highest point being northeast of the bridge. The topography of the BSA is nearly level with the exceptions of the levees around Swain Slough, the slightly elevated Pine Hill Road, and the excavated ditches. The northeast corner of the BSA is gently sloped at the base of a small bluff.

The Humboldt Bay region typically has two distinct seasons. The fall and winter season is mild, but wet and the spring and summer season is cool and dry. The monthly mean temperature is lowest in January, 47.3 °F, and highest in August, 56.7 °F (Barnhart et al. 1992). The annual precipitation in Eureka averages 38.5 inches (Barnhart et al. 1992).

The BSA is situated on the coastal plain at the base of a bluff and west of the foothills of the Coast Range that rise to the northeast. West of the bridge, Pine Hill Road is lined by roadside ditches that drain into larger ditches that parallel the west bank of Swain Slough. East of the bridge, Martin Slough is directly south of Pine Hill Road. The ditches and Martin Slough drain to Swain Slough, which flows to Humboldt Bay, via the Elk River. Swain Slough is tidally influenced.

The BSA is at the edge of coastal salt marsh at the confluence of Martin Slough which is the primary drainage of a small coastal watershed. Swain Slough is tidally influenced and the tidal influence on Martin Slough is muted by tide gates. The aquatic habitats in Swain and Martin sloughs support anadromous, estuarine, and freshwater fish species. Although low levees present along the banks of Swain Slough prevent normal high tide water from entering the surrounding flat coastal plain, salt marsh vegetation is prevalent in ditches and depressions in and adjacent to the BSA. Habitat connectivity and vegetation communities in and adjacent to the BSA are discussed below.

3.1.3. Biological Conditions

Vegetation communities were classified according to vegetation descriptions provided in *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer Jr. 1988). The vegetation communities within the BSA include wet meadow, estuarine montane riparian, and barren, which includes ruderal vegetation on the road shoulders.

3.1.3.1. Wet Meadow

The wet meadow community occurs west of the bridge on both the north and south sides of Pine Hill Road, and east of the bridge south of Martin Slough. This wet meadow is grazed by cattle and appears to be seasonally wet, with ponded water evident in winter photographs reviewed as part of this report. Drier conditions occur in the summer months. The wet meadow is dominated by non-natives including creeping bentgrass (*Agrostis stolonifera*), tall fescue (*Festuca arundinacea*), velvet grass (*Holcus lanatus*), Bermuda grass (*Cynodon dactylon*), bird's-foot trefoil (*Lotus corniculatus*), rye grass (*Festuca perennis*), red and white clover (*Trifolium pratense, T. repens*), buttercup (*Ranunculus repens*), Kentucky bluegrass (*Poa pratensis*), queen Anne's lace (*Daucus carota*), and sticky cinquefoil (*Drymocallis glandulosa*).

The vegetated drainage ditches that occur on either side of Pine Hill Road west of the bridge are included as part of the wet meadow. These ditches are excavated to a depth of several feet below the elevation of the surrounding meadow; and are dominated by vegetation that is indicative of saturated and brackish conditions; including pickleweed (*Salicornia bigelovii*), arrow grass (*Triglochin maritima*), tall fescue, lamb's quarters (*Chenopodium album*), and brass-buttons (*Cotula coronopifolia*). The berm that is located between these ditches and the meadow has drier soil conditions and the dominant vegetation includes by coyote brush (*Baccharis pilularis*), tufted hair grass (*Deschampsia cespitosa* ssp. *cespitosa*), and lamb's quarters.

3.1.3.2. Montane Riparian

The montane riparian community is present only along the bank of Swain Slough northeast of the bridge at the toe of a well-drained, gentle hillslope. The dominant vegetation in this community is coastal willow (*Salix hookeriana*), coyote brush (*Baccharis pilularis*), Himalayan blackberry (*Rubus armeniacus*), coast twinberry

(*Lonicera involucrata*), Oregon grape (*Berberis* sp.), cow parsnip (*Heracleum maximum*), and rose (*Rosa* sp.).

3.1.3.3. ESTUARINE

Estuarine refers to tidal, brackish water wetlands. Small reaches of both Swain Slough and Martin Slough occur within the BSA, and both of these constitute the estuarine community. These two sloughs primarily have unconsolidated bottoms characterized by the lack of large stable surfaces for plant and animal attachment. The banks of the both of these tidal features are lined by narrow vegetated areas of emergent wetlands.

Swain Slough is an approximately 60- to 80-foot-wide water feature that drains the eastern portion of the Elk River floodplain and the surrounding hills to the east (see Figure 1). Waters within the feature are assumed to be brackish based on observed low-tide flow (i.e., fresh water) going out to Humboldt Bay, and high-tide flow (salt water) filling the feature as it flows inland. The feature has an unvegetated mud bottom except near the banks, where it is vegetated with Lyngbye's sedge (*Carex lyngbyei*) and dense flowered cordgrass (*Spartina densiflora*) within the ordinary high water mark (OHWM). This tidally-influenced emergent vegetation constitutes a fragment of salt marsh habitat.

Martin Slough is very similar to Swain Slough in that it has an unvegetated mud bottom feature except for the banks near the OHWM, which are also vegetated with Lyngbye's sedge and dense flowered cordgrass. The difference between the two sloughs is that the reach of Martin Slough within the BSA has been channelized and is straight.

3.1.3.4. BARREN

The barren areas include the paved road surface and the road shoulders supporting ruderal vegetation. The road is built on a road base that is slightly elevated above the level of the seasonally wet meadow described above. The vegetation on the road shoulders is regularly mowed, and is dominated by non-native grasses and forbs including ryegrass, Bermuda grass, and rough cat's ear (*Hypochaeris radicata*).

3.1.3.5. INVASIVE SPECIES

Noxious weeds and invasive plant species are undesirable, non-native plants that commonly invade disturbed sites. They generally have been introduced from Europe and Asia and degrade wildlife and native plant habitats. When disturbance results in the creation of habitat openings or in the loss of intact native vegetation, noxious weeds and invasive plant species may colonize the site and spread, often outcompeting native plants. Once established, they are very difficult to eradicate and could pose a threat to native species. Invasive plant species with a California Invasive Plant Council rating of “High” that were found in the BSA include Himalayan blackberry (*Rubus armeniacus*), dense-flowered cord grass (*Spartina densiflora*), and fennel (*Foeniculum vulgare*).

3.1.3.6. HABITAT CONNECTIVITY

The coastal plain in and adjacent to the BSA is partially separated from Humboldt Bay by US 101 and by Elk River Road. Pine Hill Road is built on a road base elevated several feet above the adjacent coastal plain and this also reduces habitat connectivity for terrestrial animals. Each of the above-mentioned roadways has a bridge over Swain Slough that allows the slough to retain strong connectivity with Humboldt Bay. The newly installed tide gates on Martin Slough are currently being managed to allow partial tidal influence in the Martin Slough in the BSA.

3.2. Habitats and Natural Communities of Concern and Regional Species

3.2.1. Habitats and Natural Communities of Concern

In addition to inventorying reported occurrences of special-status species, the CNDDB serves to inventory the locations of rare natural communities. Communities respond to environmental changes and can be thought of as an indicator of the overall health of an ecosystem and its component species. Rare natural communities are those communities that are of highly limited distribution. They may or may not contain rare, threatened, or endangered species. The CNDDB ranks natural communities according to their rarity and endangerment in California.

CDFW designates Northern Coastal Salt Marsh as a sensitive natural community (California Department of Fish and Wildlife 2014). Coastal salt marshes develop along the intertidal shores of bays and estuaries. Estuaries occur where a river meets the sea, and the water is somewhat brackish. In general, salt marshes along the Northern California coast have a relatively low salinity because of substantial river runoff. Salt marsh plants are adapted to a harsh, semi-aquatic environment and saline soils. Salt marshes are about twice as photo-synthetically productive as corn fields and provide critical nursery grounds for numerous organisms (California Environmental Resources Evaluation System 2007).

Northern Coastal Salt Marsh in the BSA and vicinity exists solely as fragments along the banks of the Swain and Martin sloughs. Potential adverse effects to and avoidance and minimization measures for Northern Coastal Salt Marsh are discussed in Chapter 4.

3.2.1.1. RIPARIAN HABITAT

Riparian habitat is present only along the bank of Swain Slough northeast of the bridge at the toe of a well-drained, gentle hillslope. The dominant vegetation of the riparian habitat includes coastal willow, coyote brush, Himalayan blackberry, and coast twinberry. Potential adverse effects to and avoidance and minimization measures for riparian habitat are discussed in Chapter 4.

3.2.1.2. WATERS OF THE UNITED STATES AND WATERS OF THE STATE

NSR conducted a delineation of waters of the United States within the BSA on July 29, 2013. The BSA is within the California Coastal Zone, and therefore the wetland delineation was conducted to identify both the three-parameter wetlands under the jurisdiction of the Corps, and the two- and single-parameter wetlands that also are under the jurisdiction of the Coastal Commission (i.e., waters of the state). Verification of the boundaries of the respective wetland and water features by the Corps and the Coastal Commission is pending.

Potential waters of the United States include perennial stream (Swain Slough and Martin Slough), vegetated ditch, and seasonal wetland. These same features also are under jurisdiction of the Coastal Commission; however, the extent of the one-parameter seasonal wetland is greater than that of the corresponding Corps jurisdictional feature type. Table 2 provides a summary of acreage and linear distance by feature type and by jurisdiction. The boundaries of waters of the United States within the BSA are illustrated in Figure 3. Waters of the state are shown in Figure 4 along with other ESHA. Potential adverse effects to and avoidance and minimization measures for waters of the United States are discussed in Chapter 4.

Table 2. Summary of Waters of the United States and Waters of theState

Feature Type	Total Acreage (U.S.)	Total Linear Feet (U.S.)	Total Acreage (State)
Seasonal Wetland	0.505	—	0.681
Vegetated Ditch	0.197	—	0.197
Perennial Stream	0.287	387	0.287
Total Waters of the U.S.	**0.989**	**387**	**—**
Total Waters of the State	**—**	**—**	**1.165**

3.2.1.3. ENVIRONMENTALLY SENSITIVE HABITAT AREAS

The Humboldt Bay Area Plan (HBAP) of the Humboldt County LCP identifies Eureka and Martin Sloughs as ESHA and the portions of the these two sloughs that are within the BSA. ESHA within the BSA also includes the Northern California Salt Marsh, riparian habitat, and waters of the state, summarized above, and all of the grazed grasslands on the both sides of Pine Hill Road (Figure 4). These grasslands are considered "transitional agricultural lands" which are defined in the HBAP as follows:

> *"Transitional agricultural lands shall be identified as diked former tidal marshes and clearly defined tidal sloughs now farmed."*

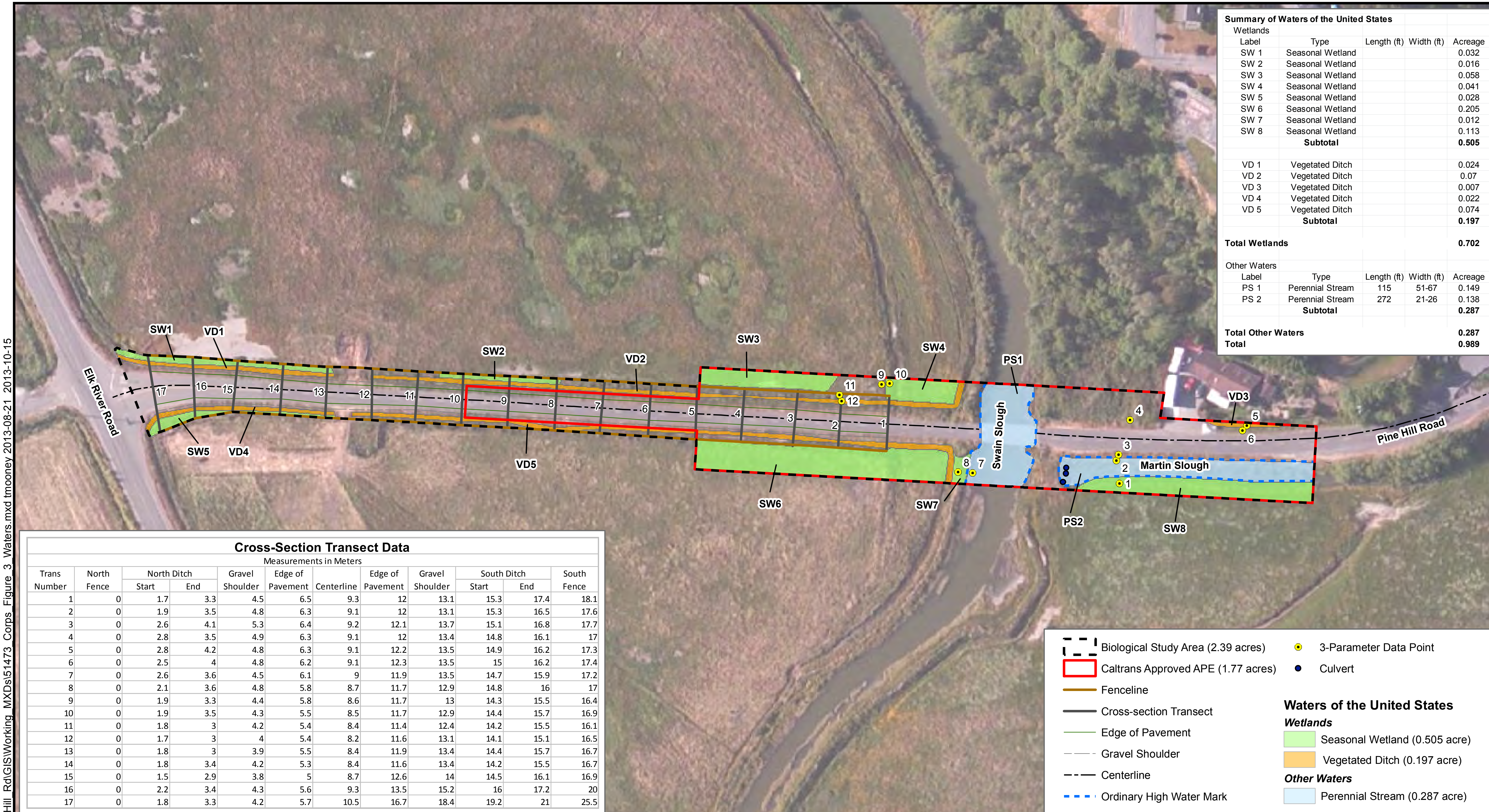
Potential adverse effects to and avoidance and minimization measures for ESHA are discussed in Chapter 4.

3.2.2. Special-Status Plants

For the purpose of this evaluation, special-status plant species include plants that are (1) listed as threatened or endangered under the California Endangered Species Act (CESA) or the ESA; (2) designated as rare by the CDFW; (3) state or federal candidate or proposed species for listing as threatened or endangered; and/or (4) have a California Rare Plant Rank (RPR) of 1A, 1B, 2A or 2B (see Table C-1 for definitions).

A list of regionally occurring special-status plant species was compiled based on a review of pertinent literature, the results of the field surveys, and the review of the USFWS species list, and CNDDB and CNPS database records. For each species, habitat requirements were assessed and compared to the habitats within the BSA and immediate vicinity in order to determine whether or not suitable habitat was present within the BSA (Appendix C, Table C-1). Based on this review of habitat requirements and the results of the field assessment, it was determined that the BSA and vicinity provides suitable habitat for twelve special-status plant species (Table 3).

Survey results, potential adverse effects to the species, and avoidance and minimization measures for these special-status species are discussed in Chapter 4.



Summary of Waters of the United States

Wetlands

Label	Type	Length (ft)	Width (ft)	Acreage
SW 1	Seasonal Wetland			0.032
SW 2	Seasonal Wetland			0.016
SW 3	Seasonal Wetland			0.058
SW 4	Seasonal Wetland			0.041
SW 5	Seasonal Wetland			0.028
SW 6	Seasonal Wetland			0.205
SW 7	Seasonal Wetland			0.012
SW 8	Seasonal Wetland			0.113
	Subtotal			**0.505**
VD 1	Vegetated Ditch			0.024
VD 2	Vegetated Ditch			0.07
VD 3	Vegetated Ditch			0.007
VD 4	Vegetated Ditch			0.022
VD 5	Vegetated Ditch			0.074
	Subtotal			**0.197**
Total Wetlands				**0.702**

Other Waters

Label	Type	Length (ft)	Width (ft)	Acreage
PS 1	Perennial Stream	115	51-67	0.149
PS 2	Perennial Stream	272	21-26	0.138
	Subtotal			**0.287**
Total Other Waters				**0.287**
Total				**0.989**

Cross-Section Transect Data

Measurements in Meters

Trans Number	North Fence	North Ditch Start	North Ditch End	Gravel Shoulder	Edge of Pavement	Centerline	Edge of Pavement	Gravel Shoulder	South Ditch Start	South Ditch End	South Fence
1	0	1.7	3.3	4.5	6.5	9.3	12	13.1	15.3	17.4	18.1
2	0	1.9	3.5	4.8	6.3	9.1	12	13.1	15.3	16.5	17.6
3	0	2.6	4.1	5.3	6.4	9.2	12.1	13.7	15.1	16.8	17.7
4	0	2.8	3.5	4.9	6.3	9.1	12	13.4	14.8	16.1	17
5	0	2.8	4.2	4.8	6.3	9.1	12.2	13.5	14.9	16.2	17.3
6	0	2.5	4	4.8	6.2	9.1	12.3	13.5	15	16.2	17.4
7	0	2.6	3.6	4.5	6.1	9	11.9	13.5	14.7	15.9	17.2
8	0	2.1	3.6	4.8	5.8	8.7	11.7	12.9	14.8	16	17
9	0	1.9	3.3	4.4	5.8	8.6	11.7	13	14.3	15.5	16.4
10	0	1.9	3.5	4.3	5.5	8.5	11.7	12.9	14.4	15.7	16.9
11	0	1.8	3	4.2	5.4	8.4	11.4	12.4	14.2	15.5	16.1
12	0	1.7	3	4	5.4	8.2	11.6	13.1	14.1	15.1	16.5
13	0	1.8	3	3.9	5.5	8.4	11.9	13.4	14.4	15.7	16.7
14	0	1.8	3.4	4.2	5.3	8.4	11.6	13.4	14.2	15.5	16.7
15	0	1.5	2.9	3.8	5	8.7	12.6	14	14.5	16.1	16.9
16	0	2.2	3.4	4.3	5.6	9.3	13.5	15.2	16	17.2	20
17	0	1.8	3.3	4.2	5.7	10.5	16.7	18.4	19.2	21	25.5

Biological Study Area (2.39 acres)
Caltrans Approved APE (1.77 acres)
Fenceline
Cross-section Transect
Edge of Pavement
Gravel Shoulder
Centerline
Ordinary High Water Mark
3-Parameter Data Point
Culvert

Waters of the United States

Wetlands

Seasonal Wetland (0.505 acre)
Vegetated Ditch (0.197 acre)

Other Waters

Perennial Stream (0.287 acre)

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(Fax) (707) 445-7409

Notes:

Delineator: Julian Colescott (PWS No. 1920)
Delineation Date: July 29, 2013
Orthophotography: Bing Maps Aerial

This delineation of waters of the United States is subject to verification by the U.S. Army Corps of Engineers (Corps). NSR advises all parties that the delineation is preliminary until the Corps provides a written verification.

N

0 50 100 200

Feet

Pine Hill Bridge Replacement Project

Figure 3
Waters of the United States
October 15, 2013

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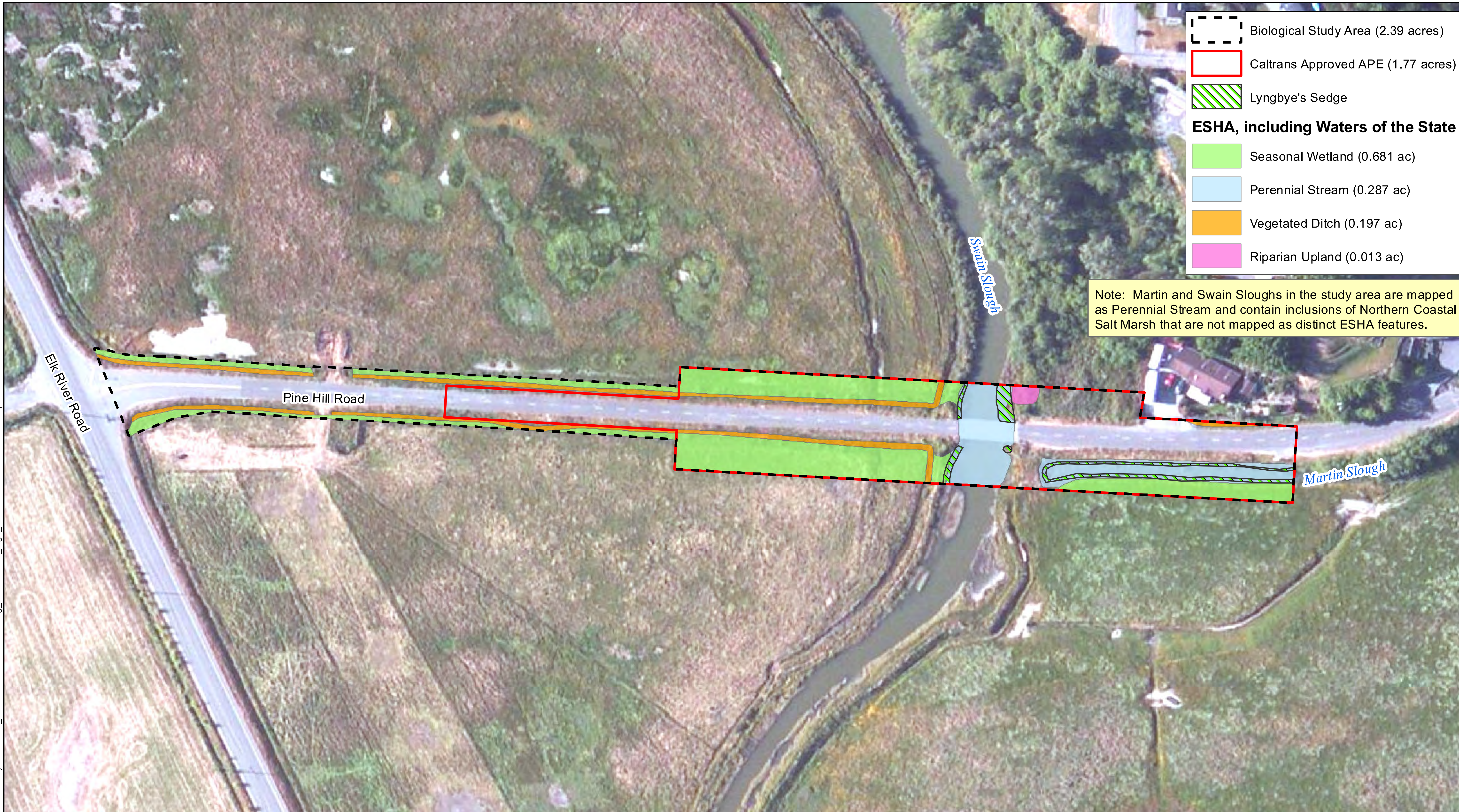

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Delineation Date: July 29, 2013
Orthophotography: Bing Maps Aerial 2013

Environmentallly Senstive Habitat Areas (ESHA) depicted in this figure include features delineated as waters of the State that are subject to regulation by the California Coastal Commission (CCC). NSR advises all parties that the delineation is preliminary until the CCC provides a written verification.

1 inch = 100 feet N *1:1,200*

0 50 100 200
Feet

Pine Hill Bridge Replacement Project

Figure 4
Environmentally Sensitive Habitat Areas, Including Waters of the State, and Rare Plants

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Table 3. Special-Status Plants Determined to Have Suitable Habitat in the BSA and Vicinity

Common Name *(Scientific Name)*	Status[1] (F/S/RPR)	General Habitat Description and Blooming Period	Habitat Assess-ment[2]	Rationale
Coastal marsh milk-vetch *(Astragalus pycnostachyus* var. *pycnostachyus)*	—/—/1B.2	Mesic coastal dunes, coastal scrub, marshes and swamps (coastal salt, streamsides). Elevation: 0-100 feet. Bloom: April-October.	**HP**	The BSA is located on the Coastal plain and the ditches provide suitable mesic and wetland habitat for this species.
Bristle-stalked sedge (*Carex leptalea*)	—/—/2B.2	Bogs and fens, mesic meadows and seeps, marshes and swamps. Elevation: 0-2300 feet. Bloom: March-July.	**HP**	Suitable wetland habitat is present.
Lyngbye's sedge (*Carex lyngbyei*)	—/—/2B.2	Marshes and brackish or freshwater swamps. Elevation: 0-30 feet. Bloom: April-August.	**P**	Suitable wetland habitat is present.
Northern meadow sedge (*Carex praticola*)	—/—/2B.2	Moist to wet meadows. Elevation: 0-10,500 feet. Bloom: May-July.	**HP**	Suitable wetland habitat is present.
Humboldt Bay owl's-clover (*Castilleja ambigua* var*. humboldtiensis*)	—/—/1B.2	Marshes and coastal salt swamps. Elevation: 0-30 feet. Bloom: June-October.	**HP**	Suitable wetland habitat is present.
Point Reyes bird's-beak (*Chloropyron maritimum* ssp. *palustre*)	—/—/1B.2	Marshes and coastal salt swamps. Elevation: 0-30 feet. Bloom: April-August.	**HP**	Suitable wetland habitat is present.
Pacific gilia (*Gilia capitata* ssp. *pacifica*)	—/—/1B.2	Coastal bluff scrub, chaparral, and other openings, coastal prairie, valley and foothill grassland. Elevation: 20-3120 feet. Bloom: April-August.	**HP**	The BSA provides suitable coastal prairie habitat.
Short-leaved evax *(Hesperevax sparsiflora* var.*brevifolia)*	—/—/1B.2	Coastal bluff scrub (sandy), coastal dunes, and coastal prairie. Elevation: 0-710 feet. Bloom: March-June.	**HP**	The BSA provides suitable coastal prairie habitat. .
Marsh pea (*Lathyrus palustris*)	—/—/2B.2	Bogs and fens, coastal prairie, coastal scrub, lower montane coniferous forest, marshes and swamps, and mesic North Coast coniferous forest. Elevation: 0-330 feet. Bloom: March-August.	**HP**	Suitable wetland and coastal prairie habitat is present.

Common Name *(Scientific Name)*	Status[1] (F/S/RPR)	General Habitat Description and Blooming Period	Habitat Assess-ment[2]	Rationale
Wolf's evening-primrose (*Oenothera wolfii*)	—/—/1B.1	Coastal bluff scrub, coastal dunes, coastal prairie, sandy lower montane coniferous forest, usually mesic. Elevation: 10-2620 feet. Bloom: May-October.	**HP**	The BSA provides suitable coastal prairie habitat.
Dwarf alkali grass (*Puccinellia pumila*)	—/—/2B.2	Marshes and coastal salt swamps. Elevation: 0-30 feet. Bloom: July.	**HP**	Suitable wetland habitat is present.
Western sand-spurrey (*Spergularia canadensis* var. *occidentalis*)	—/—/2.1	Marshes and coastal salt swamps. Elevation: 0-10 feet. Bloom: June-August.	**HP**	Suitable wetland habitat is present.

1 Status Codes: Federal (F); State (S); and Rare Plant Rank (RPR).
RPR Codes and Extensions:
- 1B Plants rare, threatened, or endangered in California and elsewhere.
- 2B Plants rare, threatened, or endangered in California, but more common elsewhere.
- xx.2 Moderately threatened in California
- xx.1 Seriously threatened in California

2 Absent (A): No habitat present and no further work needed. Habitat Present (HP): Habitat is, or may be present. The species may be present. Present (P): The species is present within 100 feet of BSA. Critical Habitat (CH): BSA is located within a designated critical habitat unit, but does not necessarily mean that appropriate habitat is present.

3.2.3. Special-Status Animals

Special-status animal species include species that are (1) listed as threatened or endangered under the CESA or the ESA; (2) proposed for federal listing as threatened or endangered; (3) state or federal candidates for listing as threatened or endangered; and/or (4) identified by the CDFW as Species of Special Concern or California Fully Protected Species.

A list of regionally occurring special-status animal species was compiled based on a review of pertinent literature, the results of the field surveys, and the review of the USFWS species list, and CNDDB database records. For each species, general habitat requirements were assessed and compared to the habitats within the BSA and immediate vicinity in order to determine their potential to be adversely affected by the proposed project (Appendix C, Table C-2). Based on this review of general habitat requirements and the results of the field assessment, 12 special-status animal species were determined to potentially occur or are known to occur in the BSA and vicinity (Table 4). Potential adverse effects to, and avoidance and minimization measures for these special-status species are discussed in Chapter 4.

Table 4 Special-Status Animals Determined to Have Suitable Habitat in the BSA and Vicinity

Common Name Scientific Name	Status[1] (Fed/State)	General Habitat Description	Habitat Assess-ment[2]	Rationale
Federal or State Listed Species				
Southern Oregon Northern California Coasts ESU coho salmon *(Oncorhynchus kisutch)* Critical Habitat/Essential Fish Habitat	FT/ST, SSC	Spawn and rear in freshwater rivers and streams. Juveniles prefer deep (> 1 m) pools with dense overhead cover, and clear water. Found over a range of substrates from silt to bedrock. Requires cool water temperatures for spawning, egg-incubation, and juvenile rearing. Spawn in riffles with gravel and cobble substrates.	**P, CH**	SONCC coho salmon are known to occur in Humboldt Bay tributaries, including Swain Slough. Swain Slough in the BSA is designated critical habitat.
California Coastal ESU Chinook salmon *(Oncorhynchus tshawytscha)* Critical Habitat/Essential Fish Habitat	FT/—	Spawn and rear in freshwater rivers and streams. Requires cool water temperatures for spawning, egg-incubation and juvenile rearing. Spawn in riffles with gravel and cobble substrates. The California Coastal ESU includes occurs in rivers and streams south of the Klamath River to the Russian River.	**P**	No established spawning population off CC Chinook salmon occurs in Swain Slough watershed and it is not designated critical habitat; but this species does occur in the Elk River and Humboldt Bay (both of which are designated critical habitat).
Northern California DPS steelhead *(Oncorhynchus mykiss)* Critical Habitat/Essential Fish Habitat	FT/SSC	Spawn and rear in freshwater rivers and streams. Juveniles prefer deep (> 1 m) pools with dense overhead cover, and clear water. Requires cool water temperatures for spawning, egg-incubation and juvenile rearing. Spawn in riffles with gravel and cobble substrates. This DPS occurs in coastal streams from Redwood Creek south to the Russian River. Adults migrate upstream during the fall and spawn from December to April.	**P, CH**	No established spawning population off NC steelhead occurs in the Swain Slough watershed; but this species does occur in the Elk River and Humboldt Bay. Swain Slough in the BSA is designated critical habitat.
Tidewater goby *(Eucyclogobius newberryi)* Critical Habitat	FE/SSC	Shallow lagoons and coastal streams with brackish to fresh and slow-moving or fairly still water.	**HP**	The BSA is within the current known range of this species and has been documented near the BSA. BSA is not within designated critical habitat.

Common Name Scientific Name	Status[1] (Fed/State)	General Habitat Description	Habitat Assess-ment[2]	Rationale
Longfin smelt *(Spirinchus thaleichthys)*	FC/ST, SSC	Adult and juvenile longfin smelt occur in salt or brackish water within estuaries of major rivers. Spawning occurs in fresh water over sandy, gravelly, or areas vegetated with aquatic vegetation. In California, occur in Sacramento-San Joaquin estuary, Humboldt Bay, the Eel River estuary, and the Klamath River estuary. Not known from the Smith River.	**HP**	No suitable spawning habitat in BSA, but known to occur in Humboldt Bay.
Other Special-Status Species				
Coastal cutthroat trout *(Oncorhynchus clarkii clarkii)*	—/SSC	Found in low gradient coastal streams and estuaries. Optimal streams are cool and shady, with a lot of instream cover. Spawn in reaches with small to moderate sized gravels. Must have well oxygenated water with low turbidity. Occur in coastal streams from the Eel River north to the Oregon border.	**HP**	Swain and Martin sloughs provide seasonal habitat for the species. The CNDDB shows a record of the species occurring in both sloughs.
Northern red-legged frog *(Rana aurora)*	—/SSC	Found in humid forests, woodlands, grasslands, ponds, and streams in northwestern California. Generally near permanent water, but can be found far from water. In damp woods and meadows during non-breeding season.	**HP**	The BSA provides suitable ponded (upland ditches) and moist habitat types to support this species. Nearest CNDDB record is 1.5 miles southeast of the BSA in similar habitat type.
white-tailed kite (*Elanus leucurus*)	—/FP	White-tailed kites are locally common residents and breeders in northern California, especially in agricultural and riparian areas of the coastal plain.	**HP**	Foraging and potential nesting habitat is present and the species has been observed in the BSA.
northern harrier (*Circus cyaneus*)	—/SSC	Harriers are found primarily in open grassland habitats, primarily lowland pastures and marshlands of the coastal plain.	**HP**	Foraging and potential nesting habitat is present and the species has been observed in the BSA.

Common Name Scientific Name	Status[1] (Fed/State)	General Habitat Description	Habitat Assess-ment[2]	Rationale
short-eared owl (*Asio flammeus*)	—/SSC	Occupy open habitats such as overgrown grasslands and scrub, prairies, meadows, dunes, irrigated lands, ungrazed pastures, and both fresh and saltwater marshes.	**HP**	Migrant and winter visitors and accidental breeders in northwestern California. Suitable habitat is present in the BSA, and they are known from wetland and agricultural areas surrounding Humboldt Bay.
Yellow-breasted chat (*Icteria virens*)	—/SSC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**HP**	Riparian vegetation in northeast corner of BSA provides suitable nesting and foraging habitat.
Yellow warbler *(Setophaga petechia brewsteri)*	—/SSC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**HP**	Riparian vegetation in northeast corner of BSA provides suitable nesting and foraging habitat.

1 Federal and State Codes: Federal Endangered (FE); Federal Threatened (FT); Federal Candidate (FC); State Threatened (ST); State Fully Protected (FP); State Species of Special Concern (SSC).
2 Absent (A): No habitat present and no further work needed. Habitat Present (HP): Habitat is, or may be present. The species may be present. Present (P): The species is present within 100 feet of BSA. Critical Habitat (CH): BSA is located within a designated critical habitat unit, but does not necessarily mean that appropriate habitat is present.

3.3. Other Sensitive Biological Resources

Migratory birds and their nests are protected under the federal MBTA (50 CFR 10 and 21). Cliff swallows (*Petrochelidon pyrrhonota*), barn swallows (*Hirundo rustica*), black phoebes (*Sayornis nigricans*), and other migratory birds are known to build nests under artificial structures such as bridges. The existing bridge structure was visually surveyed for evidence of previous migratory bird nesting activity (e.g., remnant mud nests) during the field assessment. One unoccupied black phoebe nest and a small colony of barn swallow nests were observed. Given that the existing bridge structure provides suitable nesting habitat for migratory birds, there is a potential for active nests to be disturbed during project construction. Potential adverse effects to and avoidance and minimization measures for nesting migratory birds are discussed in Section 4.4.1.

Humboldt County protects fish and wildlife resources associated with streams, and water quality within the streams by establishing Streamside Management Areas

(SMAs) [section 3432(5) of the Humboldt County 1984 General Plan] around perennial and intermittent streams. The width of SMAs around Swain Slough and Martin Slough is 100 feet measured as the horizontal distance from the stream transition line on either side of the perennial stream. To comply with the restrictive development restrictions from the County, the project has incorporated many mitigation measures that greatly reduce the adverse effects of the project and make the proposed project the least environmentally damaging feasible project (see Section 1.2.3). In addition, the project is necessary due to the age and structural defects of the existing bridge structure make the proposed project "essential", thereby allowing for it to proceed within the SMA.

South of the County easement (some of which is within the BSA), the pasture land is owned by the North Coast Regional Land Trust (NCRLT), who in conjunction with the Redwood Community Action Agency Natural Resource Services Division and California State Coastal Conservancy, purchased the 43-acre parcel as part of the Martin Slough Enhancement Project. The project is a two-phase fish passage improvement, wetland enhancement, and flood reduction project that will (1) include replacement of the defunct tide gate at the mouth of Martin Slough with a more fish-friendly and functional tide gate; (2) widen of the lower Martin Slough channel to increase flow capacity; (3) construct four acres of tidal wetland; (4) establish riparian habitat along the slough; and (5) enhance 28 acres of productive coastal pasture for grazing. The tide gates were replaced during the fall of 2014 and became fully operational in January 2015. The earthwork for the channel and pond excavation in Martin Slough may occur in 2016, depending on the availability of funding, completing the requirement environmental compliance processes, and coordination over utilities occurring in the restoration area. The Pine Hill Bridge Replacement Project will avoid the lands associated with the NCRLT restoration project.

Chapter 4. Results: Biological Resources, Discussion of Impacts and Mitigation

4.1. Habitats and Natural Communities of Concern

4.1.1. Natural Communities

Northern Coastal Salt Marsh in the BSA and vicinity exists solely as fragments along the banks of the Swain and Martin sloughs. Project impacts to this natural community and appropriate avoidance and minimization measures are described in section 4.1.3 which addresses waters of the United States and waters of the state.

4.1.2. Riparian Habitat

4.1.2.1. Survey Results

Riparian habitat occurs in the BSA northeast of the bridge along the bank above Swain Slough. This small patch of riparian habitat is outside of the County ROW, and is a non-wetland dominated by Himalayan blackberry, coast twinberry, Oregon grape, coyote brush, coastal willow, cow parsnip, and rose. The riparian habitat is an ESHA.

4.1.2.2. Project Impacts

The proposed project may temporarily affect this small patch of riparian habitat (e.g., up to 0.01 acre; will be refined as part of final project design) as part of the pipeline relocation activities. Ground disturbance from the proposed project will avoid this patch of riparian vegetation to fullest extent practicable by limiting construction activities to the existing roadway, road shoulder, and vegetated area on the roadside of the ROW fence.

4.1.2.3. Avoidance and Minimization Efforts

The majority of the proposed project construction activities will avoid the riparian vegetation by staying on the Pine Hill Road side of the existing fence. The "avoided" riparian habitat will be clearly identified in the construction drawings and contractor work plans. The existing fence shall function as exclusionary fencing to mark boundaries of all avoided riparian areas. All pedestrian and vehicular traffic into the avoided areas delineated by the fencing shall be prohibited during construction.

4.1.2.4. Compensatory Mitigation

Any areas disturbed during construction will be restored to pre-existing conditions following utility relocation work. The County will implement any compensatory requirements identified in the Coastal Development Permit to be issued by the California Coastal Commission.

4.1.2.5. Cumulative Effects

Cumulative effects are those impacts of future state, local, and private actions affecting endangered and threatened species that are reasonably certain to occur in the BSA. Future projects that result in a federal action will be subject to the consultation requirements established in Section 7 of the ESA and, therefore, are not considered cumulative to the proposed action. One reasonably foreseeable project within the current project's project area is known at this time; the Martin Slough Enhancement Project. This project was designed to improve fish access (replace tide gates at Martin/Swain Slough – completed in 2014), enhance aquatic habitat, and improve sediment transport, and reduce flooding impacts to land use activities within the Martin Slough watershed.

All Martin Slough Enhancement Project activities will take place on the south side of Pine Hill Road and would not impact the small patch of riparian habitat along the Swain Slough bank northeast of the bridge.

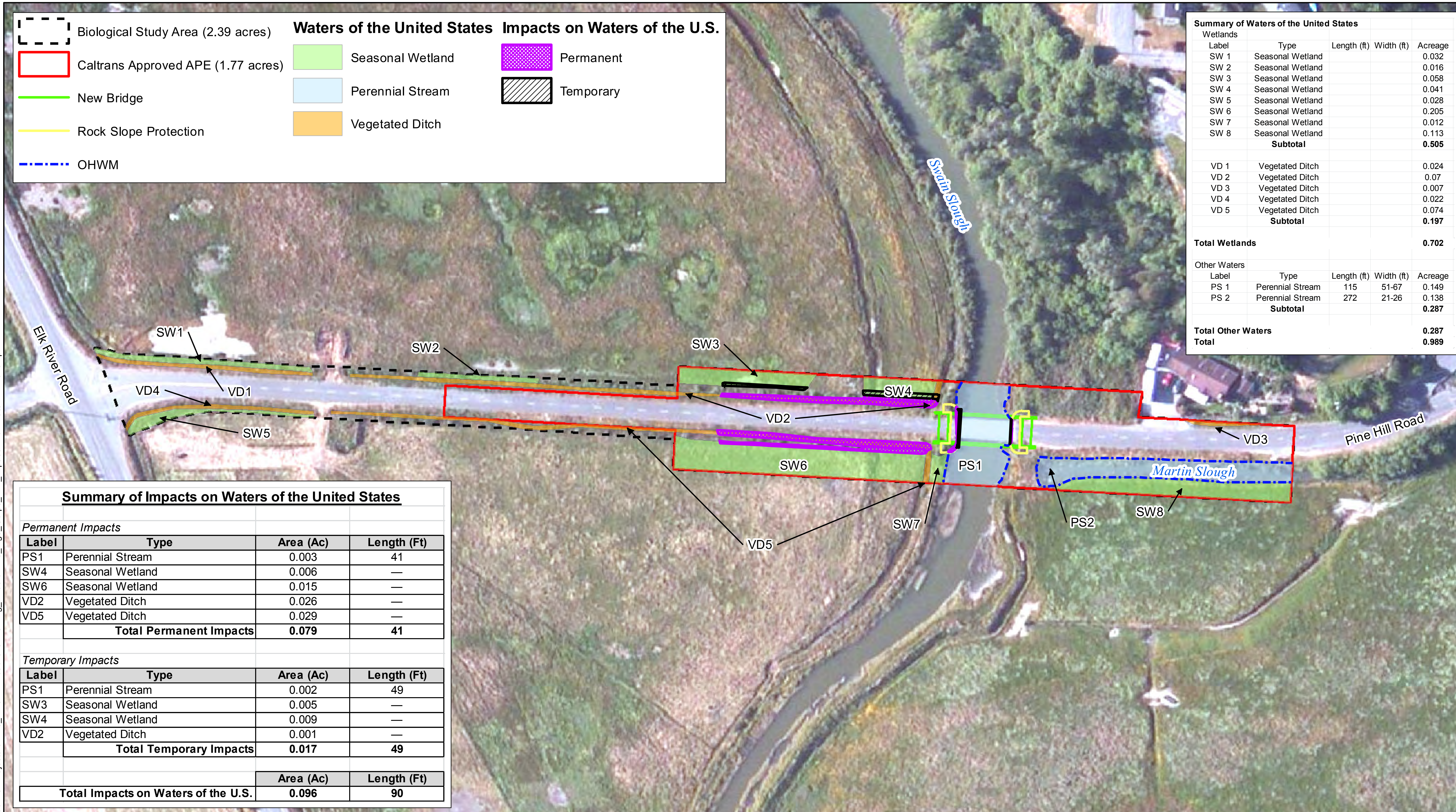
4.1.3. Waters of the United States and Waters of the State

4.1.3.1. Survey Results

The field delineation was conducted by NSR on July 29 and 30, 2013. A total of 0.989 acre of waters of the United States was mapped in the BSA (Figure 3). A total of 1.165 acres of waters of the state was mapped in the BSA (Figure 4). Waters of the United States and waters of the state occurred as seasonal wetland, vegetated ditch, and perennial stream, including Martin and Swain sloughs.

4.1.3.2. Potential Impacts

Implementation of the proposed project will potentially result in permanent impacts on up to 0.079 acre and temporary impacts on up to 0.017 acre of waters of the United States (note: impact acreage calculation is a worst-case assumption; County will try to further reduce impacts during the final design phase for the project) (See Table 5 and Figure 5).



Summary of Waters of the United States

Wetlands

Label	Type	Length (ft)	Width (ft)	Acreage
SW 1	Seasonal Wetland			0.032
SW 2	Seasonal Wetland			0.016
SW 3	Seasonal Wetland			0.058
SW 4	Seasonal Wetland			0.041
SW 5	Seasonal Wetland			0.028
SW 6	Seasonal Wetland			0.205
SW 7	Seasonal Wetland			0.012
SW 8	Seasonal Wetland			0.113
	Subtotal			**0.505**
VD 1	Vegetated Ditch			0.024
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VD 3	Vegetated Ditch			0.007
VD 4	Vegetated Ditch			0.022
VD 5	Vegetated Ditch			0.074
	Subtotal			**0.197**
Total Wetlands				**0.702**

Other Waters

Label	Type	Length (ft)	Width (ft)	Acreage
PS 1	Perennial Stream	115	51-67	0.149
PS 2	Perennial Stream	272	21-26	0.138
	Subtotal			**0.287**
Total Other Waters				**0.287**
Total				**0.989**

Summary of Impacts on Waters of the United States

Permanent Impacts

Label	Type	Area (Ac)	Length (Ft)
PS1	Perennial Stream	0.003	41
SW4	Seasonal Wetland	0.006	—
SW6	Seasonal Wetland	0.015	—
VD2	Vegetated Ditch	0.026	—
VD5	Vegetated Ditch	0.029	—
	Total Permanent Impacts	**0.079**	**41**

Temporary Impacts

Label	Type	Area (Ac)	Length (Ft)
PS1	Perennial Stream	0.002	49
SW3	Seasonal Wetland	0.005	—
SW4	Seasonal Wetland	0.009	—
VD2	Vegetated Ditch	0.001	—
	Total Temporary Impacts	**0.017**	**49**

	Area (Ac)	Length (Ft)
Total Impacts on Waters of the U.S.	**0.096**	**90**

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Orthophotography: Bing Maps Aerial 2013

Potential impacts on waters of the United States are based on project design data (CAD) dated 12/15/2014 provided by Quincy Engineering. Waters of the United States features depicted in this figure are subject to verification by the U.S. Army Corps of Engineers (Corps). NSR advises all parties that the delineation is preliminary until the Corps provides a written verification.

1 inch = 100 feet N *1:1,200*

0 50 100 200
Feet

Pine Hill Bridge Replacement Project

Figure 5
Impacts on Waters of the United States

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Table 5. Permanent and Temporary Impacts on Waters of the United States

Waters Type	Permanent (ac)	Temporary (ac)
Perennial Stream (Swain Slough)	0.003	0.002
Seasonal Wetland	0.021	0.014
Vegetated Ditch	0.055	0.001
Total	**0.079**	**0.017**

Potential impacts on waters of the state additionally take into account 1- and 2-parameter seasonal wetlands on the north side of Pine Hill Road that were determined to not qualify as waters of the United States. Implementation of the proposed project will result in permanent impacts on up to 0.119 acre and temporary impacts on up to 0.029 acre of waters of the state (See Table 6).

Table 6. Permanent and Temporary Impacts on Waters of the State

Waters Type	Permanent (ac)	Temporary (ac)
Perennial Stream (Swain Slough)	0.003	0.002
Seasonal Wetland	0.060	0.026
Vegetated Ditch	0.056	0.001
Total	**0.119**	**0.029**

Project activities resulting in permanent impacts to Corps jurisdictional waters and waters of the state include cut and fill along the road embankment and the placement of RSP in Swain Slough to protect the new abutments from scour. Temporary impacts would result from the placement of the sheet piles and temporary routing of a utility pipe along the north side of the road.

4.1.3.3. WETLANDS ONLY PRACTICABLE ALTERNATIVE FINDING

Executive Order 11990, Protection of Wetlands (1977), calls for no net loss of habitats referred to as wetlands and established a national policy to avoid adverse effects on wetlands wherever there is a practicable alternative.

The new bridge and the approach embankments would not encroach into the Swain Slough channel. Due to the tidal flow in Swain Slough, scour protection of the new abutments will be required. Approximately 150 cubic yards of RSP, equating to an area of 1,900 square feet will be installed behind sheet piles located in front of and around the new abutment footings. Installation will partially occur while the slough is diverted; and the top surface of the RSP will be at the approximate elevation of the original channel grade. This will avoid impinging hydraulic flow within the channel and not adversely impact the upstream flooding characteristics of the river. Avoidance and minimization measures outlined in Section 4.1.3.4 include all practicable measures to minimize harm to wetlands and waters of the Unites States.

The project design minimized impacts on wetlands to the extent practicable. All other design considerations would have a greater impact on wetlands. Because the project design with the least impact on wetlands was selected, the project is in compliance with the Wetlands Only Practicable Finding Alternative pursuant to Executive Order 119900, Protection of Wetlands (1977).

4.1.3.4. Avoidance and Minimization Efforts

To the extent practicable, the discharge of dredged or fill material into "waters of the United States," including wetlands shall be avoided (this also includes waters not subject to Corps jurisdiction, but subject to Coastal Commission and RWQCB jurisdiction). However, complete avoidance is not feasible due to the need for the placement of RSP and for road widening, thus the following measures shall be implemented to avoid or minimize the potential for project-related impacts on "waters of the United States" and "waters of the state":

- To the maximum extent practicable, activities that increase the erosion potential in the project area shall be restricted to the relatively dry summer and early fall period to minimize the potential for rainfall events to transport sediment to surface water features. If these activities must take place during the late fall, winter, or spring, then temporary erosion and sediment control structures shall be in place and operational at the end of each construction day and maintained until permanent erosion control structures are in place.
- Areas where wetland and upland vegetation need to be removed shall be identified in advance of ground disturbance and limited to only those areas that have been approved by the County.
- Within 10 days of completion of construction in those areas where subsequent ground disturbance will not occur for 10 calendar days or more, weed-free mulch shall be applied to disturbed areas to reduce the potential for short-term erosion. Prior to a rain event or when there is a greater than 50 percent possibility of rain within the next 24 hours, as forecasted by the National Weather Service, weed-free mulch shall be applied to all exposed areas upon

completion of the day's activities. Soils shall not be left exposed during the rainy season.

- Suitable BMPs, such as silt fences, straw wattles, or catch basins, shall be placed below all construction activities at the edge of surface water features to intercept sediment before it reaches the waterway. These structures shall be installed prior to any clearing or grading activities.
- If spoil sites are used, they shall be located such that they do not drain directly into a surface water feature, if possible. If a spoil site drains into a surface water feature, catch basins shall be constructed to intercept sediment before it reaches the feature. Spoil sites shall be graded and vegetated to reduce the potential for erosion.
- Sediment control measures shall be in place prior to the onset of the rainy season and will be monitored and maintained in good working condition until disturbed areas have been revegetated.
- Any new or previously excavated gravel material placed in the channel shall washed at least once and have a cleanliness value of 85 or higher based on Caltrans Test No. 227.
- A site-specific spill prevention plan shall be implemented for potentially hazardous materials. The plan shall include the proper handling and storage of all potentially hazardous materials, as well as the proper procedures for cleaning up and reporting any spills. If necessary, containment berms shall be constructed to prevent spilled materials from reaching surface water features.
- Equipment and hazardous materials shall be stored 50 ft away from surface water features.
- Vehicles and equipment used during construction shall receive proper and timely maintenance to reduce the potential for mechanical breakdowns leading to a spill of materials. Maintenance and fueling shall be conducted in an area at least 50 ft away from both Martin and Swain sloughs or within an adequate fueling containment area.

4.1.3.5. COMPENSATORY MITIGATION

- Impacts on jurisdictional waters will be compensated on site at a minimum 1:1 ratio or other ratio as agreed by the County and the Corps, North Coast RWQCB, California Coastal Commission, and the CDFW. The project site contains areas of adequate size that provide necessary conditions to accomplish the potential mitigation requirements (Appendix F). The County plans to acquire additional right-of-way near the project to accommodate proposed mitigation activities, including widening of the slough channel and widening of existing vegetated ditches (Appendix F).

- A Wetlands Mitigation and Monitoring Plan shall be prepared and provided to the Corps, North Coast RWQCB, California Coastal Commission, and the CDFW for review and approval. This Plan shall include the following elements: description and size of mitigation area; site preparation and design; plant species; planting design and techniques; maintenance activities; plant storage; irrigation requirements; success criteria; monitoring schedule; and remedial measures. Following approval by the pertinent regulatory agencies, the Plan will be implemented by the County.
- Temporary impacts to wetlands shall be avoided through implementation of avoidance and minimization measures. All construction staging activities will be located in upland areas, away for wetland features. Temporary barriers to intrusion (e.g., exclusionary fencing) shall be placed at the edge of the verified wetland boundaries to ensure that construction equipment and access do not encroach on jurisdictional waters.

4.1.3.6. CUMULATIVE EFFECTS

Cumulative effects are those impacts of future state, local, and private actions affecting endangered and threatened species that are reasonably certain to occur in the BSA. Future projects that result in a federal action will be subject to the consultation requirements established in Section 7 of the ESA and, therefore, are not considered cumulative to the proposed action. The Martin Slough Enhancement Project is the only reasonably foreseeable project within the BSA. The Martin Slough project was designed to improve fish access (replace tide gates at Martin/Swain Slough), enhance aquatic habitat, and improve sediment transport, and reduce flooding impacts to land use activities within the Martin Slough watershed. The tide gates were replaced during the fall of 2014 and became fully operational in January 2015. The earthwork for the channel and pond excavation in Martin Slough may occur in 2016, depending on the availability of funding, completing the requirement environmental compliance processes, and coordination over utilities occurring in the restoration area. Construction of the new bridge will begin in 2016.

In-channel construction associated with restoration and habitat improvements to Martin Slough, particularly in the lowest reaches of Martin Slough, have the potential to mobilize sediments and affect water quality in the project area. Further, activities occurring there also have the potential to result in permanent and/or temporary impacts on waters of the United States. The County and the Natural Resources

Services Division of the Redwood Community Action Agency will coordinate to the extent practicable to implement measures to avoid and minimize impacts on waters of the United States. Although both projects will likely result in localized and temporary impacts to aquatic habitat, the long-term benefits will far outweigh any temporary impacts to waters of the United States.

4.1.4. Environmentally Sensitive Habitat Areas

4.1.4.1. Survey Results

ESHA within the BSA includes Northern California Salt Marsh, riparian habitat, waters of the United States, and waters of the state described above in Sections 4.1.1 to 4.1.3. The Northern California Salt Marsh is a component of the perennial stream (Swain and Martin sloughs) delineated as waters of the United States. ESHA features are depicted in Figure 4.

4.1.4.2. Project Impacts

Potential impacts to ESHA include all of the potential impacts on waters of the state described above in Sections 4.1.2.2 and 4.1.3 and summarized in Table 5. Additionally the relocation of the HCSD water line may temporarily impact on up to 0.01 acre of riparian upland located along Swain Slough northeast of the existing bridge (note – impact acreage may be further reduced during the final project design phase; this work is being undertaken by the HCSD as part of a separate project).

4.1.4.3. Avoidance and Minimization Efforts

In addition to the Conservation Measures included in the project description, avoidance and minimization measures identified above in Sections 4.1.2.3 and 4.1.3.4 shall be implemented.

4.1.4.4. Compensatory Mitigation

ESHA that may be impacted by the project is primarily the waters of the U.S., described in Section 4.1.3.2, and riparian vegetation, as described in 4.1.2.2. Compensatory mitigation for these potential impacts is described in Sections 4.1.2.4 and 4.1.3.5.

4.1.4.5. Cumulative Effects

Cumulative effects to ESHA would be similar to those previously described for waters of the United States and waters of the state in section 4.1.3.6.

4.2. Special-Status Plant Species

Based on the review of habitat requirements and the results of the field assessment, twelve special-status plant species were determined to have suitable habitat within the BSA. To determine if any of these plants (or any other rare plant) is present in the BSA, a rare plant survey was conducted within the BSA on July 29 and 30, 2013. The following special-status plant species have the potential to occur within the BSA:

Coastal marsh milk-vetch (*Astragalus pycnostachyus* var. *pycnostachyus*)
Federal status: None State status: None RPR: 1B.2
Occurs at elevations between 0 and 100 feet in moist coastal dunes, coastal scrub, marshes and swamps. Potential habitat within the BSA includes the ditches, swales, and the banks of the sloughs.

Bristle-stalked sedge (*Carex leptalea*)
Federal status: None State status: None RPR: 2B.2
Occurs at elevations between 0 and 2,300 feet in bogs and fens, moist meadows and seeps, and marshes and swamps. Potential habitat within the BSA includes the ditches, swales, and the banks of the sloughs.

Lyngbye's sedge (*Carex lyngbyei*)
Federal status: None State status: None RPR: 2B.2
Occurs at elevations between 0 and 30 feet in marshes and freshwater swamps. Potential habitat within the BSA includes the ditches, swales, and the banks of the sloughs.

Northern meadow sedge (*Carex praticola*)
Federal status: None State status: None RPR: 2B.2
Occurs at elevations between 0 and 10,500 feet in moist to wet meadows. Potential habitat within the BSA includes the ditches, swales, and pasture areas.

Humboldt Bay owl's clover (*Castilleja ambigua* var. *humboldtiensis*)
Federal status: None State status: None RPR: 1B.2
Occurs at elevations between 0 and 30 feet in coastal marshes and swamps. Potential habitat within the BSA includes the patches of salt marsh along the sloughs and seasonally saturated portions of the ditches and pasture.

Point Reyes bird's-beak (*Castilleja maritimum* ssp. *palustre*)
Federal status: None State status: None RPR: 1B.2
Occurs at elevations between 0 and 10 feet in coastal marshes and swamps. Potential habitat within the BSA includes the patches of salt marsh along the sloughs and seasonally saturated portions of the ditches and pasture.

Point Reyes bird's-beak (*Chloropyron maritimum* ssp. *palustre*)
Federal status: None State status: None RPR: 1B.2
Occurs at elevations between 0 and 30 feet in marshes and salt swamps. Potential habitat within the BSA includes the ditches, swales, and the banks of the sloughs.

Pacific gilia (*Gilia capitata* ssp. *pacifica*)
Federal status: None State status: None RPR: 1B.2
Occurs at elevations between 20 and 3,120 feet in coastal bluff scrub, chaparral, coastal prairie and valley and foothill grasslands. Potential habitat within the BSA includes the grassland pastures.

Short-leaved evax (*Hesperevax sparsiflora* var. *brevifolia*)
Federal status: None State status: None RPR: 1B.2
Occurs at elevations between 0 and 710 feet in coastal bluff scrub, coastal dunes, and coastal prairie. Potential habitat within the BSA includes the grassland pastures.

Marsh pea (*Lathyrus palustris*)
Federal status: None State status: None RPR: 2B.2
Occurs at elevations between 0 and 330 feet in bogs and fens, coastal prairie, coastal scrub, lower montane coniferous forest, marshes and swamps, and moist North Coast coniferous forests. Potential habitat within the BSA includes the grassland pastures.

Wolf's evening primrose (*Oenothera wolfii*)
Federal status: None State status: None RPR: 1B.1
Occurs at elevations between 10 and 2,620 feet in moist coastal bluff scrub, coastal dunes, coastal prairie, and sandy lower montane coniferous forest. Potential habitat within the BSA includes the grassland pastures.

Dwarf alkali grass (*Puccinellia pumila*)
Federal status: None State status: None RPR: 2B.2
Occurs at elevations between 0 and 30 feet in marshes and coastal swamps. Potential habitat within the BSA includes the ditches, swales, and the banks of the sloughs.

Western sand-spurrey (*Spergularia canadensis* var. *occidentalis*)
Federal status: None State status: None RPR: 2B.1
Occurs at elevations between 0 and 10 feet in marshes and coastal salt swamps. Potential habitat within the BSA includes the ditches, swales, and the banks of the sloughs.

4.2.1.1. SURVEY RESULTS

One special-status plant, Lyngbye's sedge (*Carex lyngbyei*), was observed during the July 29 and 30, 2013 rare plant survey. The plant was observed consistently on all of the banks of Martin Slough within the BSA, and near the bridge on the banks of Swain Slough (See Figure 4). The areas where Lyngbye's sedge grows are primarily areas identified as Northern California Salt Marsh.

4.2.1.2. PROJECT IMPACTS

Implementation of the proposed project will potentially result in permanent impacts of up to 0.005 acre of habitat supporting Lyngbye's sedge along the banks of Martin Slough. These impacts would result from the excavation and placement of RSP around the new abutments. The project may also result in up to 0.001 acre of temporary and indirect direct impacts to Lyngbye's sedge due to equipment access and debris removal. Construction activities typically include the refueling of construction equipment on location. As a result, fuel and oil spills might occur during construction, which could result in an indirect effect to these plants.

4.2.1.3. AVOIDANCE AND MINIMIZATION EFFORTS

- Prior to the start of construction activities in the proposed project area, the edges and endpoints of the patches of Lyngbye's sedge patches adjacent to the existing bridge will be identified with flagging, as practicable—exclusionary fencing should not be used as much of the sedge is within the mean high tide line. A qualified botanist shall be present to assist with identifying the populations. The flagging shall be periodically inspected throughout each period of construction and be repaired as necessary. All pedestrian and vehicular entry into these patches shall be avoided as practicable.
- Implementation of Conservation Measure #4(Prevention of Accidental Spills) will reduce potential impacts associated with accidental spills of pollutants (i.e., fuel, oil, grease, etc.).

4.2.1.4. COMPENSATORY MITIGATION

Prior to the start of construction activities in the proposed project area, the patches of Lyngbye's sedge that are in the footprint of the proposed RSP will be salvaged and relocated to designated areas along Swain Slough that are associated with the Martin Slough Enhancement Project.

4.2.1.5. Cumulative Effects

Cumulative effects are those impacts of future state, local, and private actions affecting endangered and threatened species that are reasonably certain to occur in the BSA. Future projects that result in a federal action will be subject to the consultation requirements established in Section 7 of the ESA and, therefore, are not considered cumulative to the proposed action. One reasonably foreseeable project within the current project's project area is known at this time; the Martin Slough Enhancement Project. Being that the long-term goal of the Martin Slough Enhancement Project is to greatly diminish the tidal influence on Martin Slough, this slough will become primarily a fresh water system and Lyngbye's sedge will die out in Martin Slough. Swain Slough will continue to be tidally-influenced in the future and maintain suitable conditions to support the species.

4.3. Special-Status Animal Species

4.3.1. Anadromous Fish

A Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) was submitted to NMFS (listed salmonids) and USFWS (tidewater goby) for review under Section 7 of the Federal Endangered Species Act. According to the BA/EFHA, the Project "may affect, but is not likely to adversely affect" California Coastal ESU Chinook salmon and Northern California DPS steelhead and "may affect, likely to adversely affect" SONCC ESU coho salmon and tidewater goby. Furthermore, the project impacts to critical habitat "may affect, but are not likely to adversely affect" designated critical habitat for SONCC ESU coho salmon, California Coastal ESU Chinook salmon, Northern California Coast DPS steelhead. Swain Slough in the project area is not designated critical habitat for tidewater goby; therefore, there will be no effect on critical habitat for this species.

Additionally, it is determined that the proposed action "will not affect" (i.e., eliminate or significantly diminish or disrupt) EFH for Pacific salmon inhabiting Swain Slough.

NMFS completed the Section 7 consultation and issued a Biological Opinion on September 25, 2015 which concluded that the Project is likely to adversely affect Northern California DPS steelhead, SONCC ESU coho salmon, and California Coastal ESU Chinook salmon, but is not likely to jeopardize the species. NMFS also concluded the project is likely to result in an adverse effect to critical habitat for the

Coastal SONCC ESU coho salmon, California ESU Chinook salmon ESU, and the Northern California DPS steelhead; the Project is not likely to destroy or adversely modify critical habitat. In the BO, NFMS determined that incidental take would occur to all three salmonid species in the form of capture during fish relocation and by exposure to lethal noise levels resulting from pile driving. NMFS expects no more than one juvenile of each species to be injured and no more than two juvenile of each species will be killed as a result of constructing the Project. NMFS, as part of the Section 305(b) Magnuson-Stevens Fishery Conservation and Management Act consultation, concluded that the Project would adversely affect essential fish habitat for Pacific salmon species (e.g., SONCC ESU coho salmon, and California Coastal ESU Chinook salmon).

Southern Oregon/Northern California Coasts ESU Coho salmon (*Oncorhynchus kisutch*)

Federal Status: Endangered State Status: Endangered

On July 19, 1995, NMFS publicly announced its status finding and intent to propose coho salmon as threatened under the federal ESA. Its finding was published in the Federal Register on July 25, 1995 (60 FR 38011) and made final on April 25, 1997. NMFS published its final decision to list coho salmon as threatened under the federal ESA on May 6, 1997 (62 FR 24588). The coho salmon threatened status was reaffirmed August 15, 2011 (76 FR 50447). On May 5, 1999, NMFS announced designation of critical habitat for coho salmon in the Federal Register (64 FR 24049-24062). Designated critical habitat includes all river reaches accessible to listed coho salmon between Cape Blanco, Oregon and Punta Gorda, California. Accessible reaches are those within the historic range of the ESU that can still support any life stage of coho salmon. Designated critical habitat also includes the adjacent riparian zone, which is defined as the area adjacent to a stream that provides shade, sediment, nutrient or chemical regulation, stream bank stability, and is a source of large woody debris or organic matter (64 FR 24049-24062). Essential Fish Habitat is defined as those waters and substrate necessary to the spawning, breeding, feeding, and growth to maturity of commercially important fish, including coho salmon. The Magnuson-Stevens Fishery Conservation Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires all federal agencies to consult with NMFS on actions permitted, funded, or undertaken by the agency that may adversely affect EFH. Swain Slough in the project area is both designated critical habitat and EFH for Pacific salmon.

Estuaries are important habitat for juvenile salmonids and other popular sport fish species. Numerous studies have documented extended estuarine residence by juvenile coho salmon (Tschaplinski 1982; Nielson 1992; Miller and Sadro 2003). Wallace (Wallace 2006) reported that juvenile salmonids, especially young-of-the-year (YOY) coho salmon, rear in Freshwater Creek Slough (a nearby perennial tributary to Humboldt Bay) for significant periods of time making this tidal area important rearing habitat for juvenile salmonids. An ongoing study by CDFW's Anadromous Fisheries Resource Assessment and Monitoring Program (AFRAMP) made observations that suggest YOY coho salmon and age 1 steelhead may rear downstream of the head of the tide during the spring and summer, then migrate back into Freshwater Creek to over-winter before emigrating to the ocean the following (Wallace and Allen 2007). Based upon the multi-year/multi-location Humboldt Bay tributaries surveys, CDFW concluded that juvenile coho throughout the Humboldt Bay watershed redistribute themselves, primarily downstream, to over-winter in low-gradient habitat in the stream-estuary ecotone ringing Humboldt Bay. This project has observed the arrival of smaller "stream-rearing" coho to the stream-estuary ecotone in Martin Slough (upstream of Swain Slough) and other Humboldt Bay tributaries (Wallace 2010).

California Coastal ESU Chinook salmon (*Oncorhynchus tshawytscha*)
Federal Status: Threatened State Status: None
The California Coastal Evolutionarily Significant Unit (ESU) Chinook salmon was federally listed as a threatened species on September 16, 1999 (64 FR 50394). Their threatened status was reaffirmed August 15, 2011 (76 FR 50447). The California Coastal ESU includes all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River to and including the Russian River, California (64 FR 50394). Seven artificial propagation programs are considered to be part of the ESU: the Humboldt Fish Action Council (Freshwater Creek), Yager Creek, Redwood Creek, Hollow Tree, Van Arsdale Fish Station, Mattole Salmon Group, and Mad River Hatchery fall-run Chinook hatchery programs. NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (70 FR 37160).

The California Coastal ESU Chinook salmon are fall-run, ocean-type fish. California Coastal ESU Chinook salmon usually enter rivers from August to January. These fall-run Chinook salmon typically enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the main stem or lower tributaries of rivers, and spawn within a few weeks of freshwater entry (Healey 1991). Run timing is, in part, a response to stream flow characteristics, with most spawning occurring in November and December. In California, ocean-type Chinook salmon tend to use estuaries and coastal areas for rearing more extensively than stream-type Chinook salmon (Thorpe 1994).

The Elk River, to which Swain Slough is tributary to, represents only one of several Chinook-bearing streams that make up the Humboldt Bay population defined by the TRT. Several fisheries population studies have been conducted in the Elk River, although they have ranged in timing, scope and effort, similar to coastal watersheds identified above, the Elk River appears to support a small spawning population of Chinook salmon during most years. Chinook numbers between 1986 and 2002 ranged from 0 to 108 (The Humboldt Bay Watershed Advisory Committee and The Natural Resources Division of Redwood Community Action Agency 2005).

Northern California DPS steelhead (*Oncorhynchus mykiss*)
Federal Status: Threatened State Status: None

The Northern California Distinct Population Segment (DPS) steelhead was federally listed as a threatened species on June 7, 2000 (65 FR 36074). Its threatened status was reaffirmed on January 5, 2006, and took effect on February 6, 2006 (71 FR 834). West coast steelhead populations were determined to comprise 10 DPSs (Good et al. 2005). The Northern California DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in California coastal river basins from Redwood Creek southward to, but not including, the Russian River, as well as two artificial propagation programs: the Yager Creek Hatchery and North Fork Gualala River Hatchery (Gualala River Steelhead Project) steelhead hatchery programs. Steelhead in this DPS include both winter and summer run types, including what is presently considered to be the southernmost population of summer steelhead in the Middle Fork Eel River. The half-pounder[2] life history also occurs within the range of this DPS, in the Mad and Eel rivers.

Steelhead possess one of the most complex life history patterns of the Pacific salmonid species. Steelhead typically refers to the anadromous form of rainbow trout. Similar to other Pacific salmon, steelhead adults spawn in freshwater and spend a part of their life history at sea. However, unlike Chinook salmon, steelhead exhibit a variety of life history strategies during their freshwater rearing period, and adults may spawn more than once during their life. The typical life history pattern for steelhead is to rear in freshwater streams for two years, followed by up to two or three years of residency in

2 A half-pounder is an immature steelhead that returns to freshwater within or about four months of ocean entry.

the marine environment. However, juvenile steelhead may rear in freshwater from one to four years (Moyle 2002).

Steelhead spawn in gravel and small cobble substrates usually associated with riffle and run habitat types. Cover is extremely important in determining distribution; more cover leads to more fish (Meehan and Bjornn 1991).

The Elk River, to which Swain Slough is tributary to, represents one of several steelhead streams that make up the Humboldt Bay population. Several fisheries population studies have been conducted in the Elk River, although they have ranged in timing, scope and effort, similar to coastal watersheds identified above, the Elk River supports a small spawning population of steelhead.

4.3.1.1. SURVEY RESULTS

Southern Oregon/Northern California Coasts ESU Coho salmon

The BSA is located in the coastal plain at the confluence of Swain Slough and Martin Slough (Figure 2). Swain Slough flows approximately 0.5 mile northeast before joining the Elk River, which drains directly into Humboldt Bay. The project area includes the confluence of Martin Slough with Swain Slough; water flowing into and out of Martin Slough is controlled by three 72-inch tide gates and a small auxiliary door[3]. Low levees are present along the banks of Swain Slough that prevent normal high water from entering the surrounding flat coastal plain. Pine Hill Road is also elevated several feet above the normal high tide level. Much of the watershed is low-lying and subject to seasonal flooding during wet weather due largely to backwater effects caused by tides and high water in Elk River (Coastal Analysis LLC et al. 2006).

The brackish-tidally influenced habitat in the project area is unsuitable for salmonid spawning. The aquatic habitat in the project area is primarily migratory habitat for adult coho and migratory and rearing habitat for juvenile coho. In general, high quality, complex rearing habitat that is most preferred by juvenile coho for summer rearing is absent in the project area. The quality of rearing habitat for coho salmon in the project area is marginal due to the lack of deep structural complexity, slow water habitats or overhanging vegetation, and warmer water temperatures.

[3] The auxiliary door is currently being held open to allow for some brackish water to enter Martin Slough to maintain the conditions in lower Martin Slough following the dysfunctional tide gate replacement completed in fall 2014.

Humboldt Bay tributaries support some of the last significant populations of wild coho salmon remaining in California (Brown et al. 1994). Coho occur in all of the significant Humboldt Bay tributary streams including Swain Slough a tributary to Elk River (Wallace 2006, 2010). There is no information on the size for either the historical or existing coho populations in Swain Slough. The available information suggests that small numbers of adult coho salmon spawn and rear in Martin Slough/Creek (T.R. Payne & Associates 2003). According to Wallace (2006), juvenile coho rear throughout the winter in Martin Slough; it is hypothesized that the vast majority of the rearing is non-natal (Wallace Pers comm.). Juvenile coho originally tagged in Elk River Slough were re-captured in Martin Slough and provide further evidence that juvenile coho throughout the Humboldt Bay watershed redistribute themselves, primarily downstream, to over-winter in low gradient habitat in the freshwater-estuary ecotone ringing Humboldt Bay. This "fall redistribution" of coho salmon searching for winter habitat has been observed by other researchers throughout the Pacific Northwest including the Klamath River basin (Lestelle 2007). Wallace (2006) also noted that the coho captured in Martin Slough are among the largest from estuaries and sloughs around the bay suggesting favorable conditions for rearing.

California Coastal ESU Chinook salmon

No Chinook salmon spawning has been documented in the Swain Slough watershed and this species is not known to regularly occur there. Chinook salmon are known to spawn and rear in the Elk River (The Humboldt Bay Watershed Advisory Committee and The Natural Resources Division of Redwood Community Action Agency 2005; Wallace and Allen 2007; Wallace 2010), which is only 0.5-mi from the project area. Juvenile Chinook salmon have been irregularly captured in small numbers in Martin Slough and presumed to have moved up through Swain Slough to rear (Wallace Pers comm.). Because the project area occurs in an area influenced by tides and is subject to regular flooding it is possible that non-natal juvenile Chinook salmon periodically occur in the project area, although they are likely to be limited in number and their residence time given their ocean-type life history. The in-water work window corresponds to the time of the year in which the probability of this species occurring in the project area is very, very small. By conducting all instream work activities during the summer period, the potential for direct effects to non-natal rearing Chinook salmon will minimized since this species and life stage is only believed to occur seasonally in the project area in small numbers, if at all.

Critical habitat in estuaries (e.g. San Francisco-San Pablo-Suisun Bay, Humboldt Bay, and Morro Bay) is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater (70 FR 52537). Although a Chinook salmon population has not been documented in Swain Slough, it is within the elevation of extreme high water and is therefore considered critical habitat. These PCEs in the project area are limited to estuarine rearing habitat.

Northern California DPS steelhead

No steelhead spawning has been observed in the Swain Slough watershed and this species is not known to regularly occur there; however, small numbers of juvenile steelhead have been periodically captured from Martin and Swain sloughs (Wallace Pers comm.). Much like Chinook and coho salmon, steelhead are expected to seasonally occur in small numbers in the project area and the habitat in the project area is predominantly used as transitory migration and rearing habitat for these non-natal rearing juveniles.

4.3.1.2. PROJECT IMPACTS

The proposed project may cause take of a federally-listed fish species if it results in any one of the following: direct mortality of a federally listed fish species; temporary impacts to habitats such that federally listed species suffer increased mortality or lowered reproductive success; permanent loss of habitat critical to a federally listed fish species; substantial reductions in the size of a special-status fish species population; or substantial reduction in the quantity or value of fish habitat in which a federally listed fish population occurs. The proposed project includes a number of activities that could pose a potential for the take of federally-listed fish species including anadromous salmonids. Project-related stressors that may occur include fish relocation, barotrauma (due to pile driving), increased turbidity, spills of hazardous materials, placement of bank protection, and removal or damage to riparian habitat. In-water construction (e.g., demolition of a portion of the existing structures and construction of new) will occur within an area isolated by sheet piles reducing the potential direct effects from direct physical injury or mortality, although, pile driving and fish rescue activities still pose a small potential to result in take.

Southern Oregon/Northern California Coasts ESU Coho salmon

The project area includes tidally influenced brackish water slough habitat that is seasonally suitable for migratory and rearing juvenile coho salmon, but due to the lack of freshwater pool habitat suitable for summer rearing and daily tidal fluctuations in

Swain Slough, and seasonal distribution of coho salmon in Humboldt Bay tributaries, the probability of juvenile coho salmon being present during the construction period is very low. Based on the life history of juvenile coho salmon in Humboldt Bay, it is highly unlikely that juvenile coho salmon would occur in the project area during the construction period (July 1st–October 15th).

California Coastal ESU Chinook salmon

The project effects for Chinook salmon and its habitat will be very similar to those described for coho salmon above; except the probability of Chinook salmon occurring in the project area during the in-water work window is even smaller. Swain Slough is seasonally used as non-natal transitory rearing habitat for juvenile Chinook salmon; when they occur, it is for short periods of time during their transitional rearing period between freshwater residency and migration into Humboldt Bay and out into the Pacific Ocean. The proposed project activities would not cause measurable changes to the waters and substrates necessary for migration, feeding and growth of Chinook salmon, either during or after project construction, therefore impacts to Chinook salmon and its designated critical habitat in the project area would be insignificant.

Northern California DPS steelhead

The project effects to steelhead and its designated critical habitat will be very similar to those described in detail for coho salmon above. The proposed project activities have a very small potential to directly affect steelhead since the project is timed to avoid the period of the year when any life stage of steelhead is likely to occur and would not cause measurable changes to the PCEs of estuarine migration and rearing habitat in the project area

4.3.1.3. Avoidance and Minimization Efforts

In addition to the Conservation Measures included in the project description, the following measures shall be implemented to avoid or minimize project-related impacts upon listed anadromous salmonids and their habitat occurring in the project area.

- All instream work shall be completed between July 1st and October 15th.
- Fish relocation activities shall be performed only by qualified fisheries biologists who have experience with fish capture and handling and have the necessary authorizations for the purposes of relocation. Methods to be used for capturing fish shall include seining and/or dip-netting. Captured fish shall be held in a container, with a lid, that contains cool and aerated water. Aeration shall be administered using fine bubble diffusers and all fish-holding containers will be kept in the shade. Netted live cars constructed of PVC

materials can be used as an optional means to contain fish, provided that suitable habitat conditions exist within the stream channel (e.g., water is of sufficient depth, flow velocities are not too high). Fish shall not be subjected to jostling or excess noise, shall not be overcrowded in the containers, and water temperature in the container shall not be allowed to exceed levels two degrees greater than ambient water temperatures. Multiple holding containers shall be available to segregate young-of-the-year fish from larger fish to avoid predation. Fish are not expected to be abundant, but if they are, the biologist shall periodically cease capture and relocate fish to the pre-selected release location upstream or downstream of the project area. Fish shall not be otherwise removed from the fish-holding container until released.

- Prior to October 15th, the temporary slough protection system and sheet piles shall be removed from the channel. It shall not impede, or tend to impede, the passage of fish at any time, pursuant to Fish and Game Code Section 5901.
- Any structure placed within a stream where fish do/may occur shall be designed, constructed, and maintained such that they do not constitute a barrier to upstream or downstream movement of aquatic life or cause an avoidance reaction by fish that impedes their upstream or downstream movement. This includes, but is not limited to, the supply of water at an appropriate depth, temperature, and velocity to facilitate upstream and downstream fish migration. For this project, this equates to designing the new bridge to allow the free movement of tidal waters through the project area and exert minimal influence on hydro-geomorphic processes. It also includes providing for free flow and passage during the in-water work period when the channel is restricted by sheet pile to isolate the work areas. It excludes the period during pile driving when block nets will be installed and maintained to preclude fish from the area for greatest risk of physical injury and death while pile driving occurs.

4.3.1.4. Compensatory Mitigation

The proposed action has been designed such that the conservation measures and proposed avoidance and minimization measures will avoid or minimize the potential effects to coho salmon, Chinook salmon, Northern California DPS steelhead, and designated critical habitat to the greatest extent possible. No additional mitigation is required.

4.3.1.5. CUMULATIVE EFFECTS

Cumulative effects are those impacts of future state, local, and private actions affecting endangered and threatened species that are reasonably certain to occur in the BSA. Future projects that result in a federal action will be subject to the consultation requirements established in Section 7 of the ESA and, therefore, are not considered cumulative to the proposed action. One reasonably foreseeable project within the current project's project area is known at this time; the Martin Slough Enhancement Project. This project was designed to improve fish access (replaced tide gates at Martin/Swain Slough), enhance aquatic habitat, and improve sediment transport, and reduce flooding impacts to land use activities within the Martin Slough watershed. The tide gates were replaced during the fall of 2014 and became fully operational in January 2015. The earthwork for the channel and pond excavation in Martin Slough may occur in 2016, depending on the availability of funding, completing the requirement environmental compliance processes, and coordination over utilities occurring in the restoration area. Construction of the new bridge will begin in 2016.

In-channel construction associated with restoration and habitat improvements to Martin Slough, particularly in the lowest reaches of Martin Slough, have the potential to mobilize sediments and affect water quality in the project area. Further, activities occurring there also have the potential to displace fish seasonally rearing in Martin Slough into the project area where they would not otherwise occur and put them at greater risk of take; however, the likelihood for any increased take is very small given recent sampling and water quality measurements that indicate very few coho are likely to occur in the project area during the in-water work windows for both projects. The County and the Natural Resources Services Division of the Redwood Community Action Agency will coordinate to the extent practicable to implement avoidance and minimization measures to protect special-status fish and their habitats in Swain and Martin sloughs during any overlapping construction. During the construction phase of these projects, there may be an increase in the mobilization of suspended sediments, temporary impacts to riparian vegetation and water quality; however, both projects include several measures to avoid and minimize impacts to fishes and their habitat and ultimately the Martin Slough Enhancement, in particular, will improve fish access, enhance aquatic habitat, improve sediment transport and reduce flooding impacts. Although both projects will likely result in localized and temporary impacts to aquatic habitat, the long-term benefits will far outweigh any temporary impacts to aquatic habitat.

4.3.2. Tidewater Goby

The USFWS completed the Section 7 consultation and issued a Biological Opinion on September 24, 2015 which concluded that the Project is not likely to jeopardize tidewater goby. The also concluded the Project action area is not located within designated critical habitat for the species. In the BO, USFWS determined that incidental take would occur to tidewater goby in the form of capture during fish relocation and or during dewatering activities. The USFWS expects no more than five adult gobies to be injured or killed as a result of constructing the Project.

The U.S. Fish and Wildlife Service, listed the tidewater goby (*Eucyclogobius newberryi*) as endangered on March 7, 1994 (59 FR 5494) and designated critical habitat on November 20, 2000 (67 FR 67803). On June 24, 1999, they published a proposed rule to remove the northern populations of the tidewater goby from the endangered species list (64 FR 33816). The proposed rule (67 FR 67803) was withdrawn on November 7, 2002 (U.S. Fish and Wildlife Service 2006). Their endangered status was re-affirmed in a 2007 status review (U.S. Fish and Wildlife Service 2007).

The tidewater goby is a small fish that inhabits coastal brackish water habitats entirely within California, ranging from Tillas Slough (mouth of the Smith River, Del Norte County) near the Oregon border south to Agua Hedionda Lagoon (northern San Diego County). The tidewater goby is known to have formerly inhabited at least 134 localities. Presently 23 (17 percent) of the 134 documented localities are considered extirpated and 55 to 70 (41 to 52 percent) of the localities are naturally so small or have been degraded over time that long-term persistence is uncertain(U.S. Fish and Wildlife Service 2005, 2007). No long-term monitoring program is available for the tidewater goby, and population dynamics are not well documented for this species. Deriving population size estimates for the tidewater goby is difficult because of the variability in local abundance. In addition, seasonal changes in distribution and abundance further hamper efforts to estimate population size, especially for a short-lived species. Tidewater goby populations also vary greatly with the varying environmental conditions (e.g., drought, El Niño) among years; this environmental variation is a normal (USFWS 2005).

Tidewater gobies generally select habitat in the upper estuary, usually within the fresh-saltwater interface. Tidewater gobies range upstream a short distance into fresh water, and downstream into water of up to about 75 percent sea water (28 parts per thousand). The species is typically found in salinities of less than 12 parts per thousand (Swift et al. 1989). Reproduction/spawning typically occurs in slack, shallow waters in seasonally disconnected (from the ocean) or tidally muted lagoons, estuaries, and sloughs. Flood refugia for juveniles/adults include "perched" habitats, off-channel sloughs, and pockets of still water. Juveniles and adults can be found year-round, although they are most abundant in summer/fall. Juvenile/adult life stages can tolerate flooding/breaching in late fall/winter. Substrate preference is for sand, mud, gravel, and silt, particularly associated with submerged vegetation that is likely used for cover.

4.3.2.1. Survey Results

Regular, systematic or quantitative fishery surveys for tidewater goby have not been performed in Swain Slough. Surveys by USFWS only detected 1 goby from 10 sample sites of Elk River upstream and downstream of the Swain Slough Confluence (Chamberlain 2011). Several tidewater goby have been captured from Martin Slough upstream of the project area (Wallace 2010) during surveys conducted by CDFW. According to Mike Wallace, CDFW fishery biologist, tidewater goby have been captured from Martin and Swain sloughs, near the Martin Slough tidegates and Pine Hill Road Bridge (Wallace Pers comm.). The extent, abundance, and regularity to which tidewater goby utilize Swain Slough in the project area unknown, but given their recent capture in and upstream of the project area it is presumed that tidewater goby are present in the project area. Swain Slough in the project area is near the current freshwater interface (Martin Slough) and likely provides suitable habitat through the summer/fall.

4.3.2.2. Project Impacts

Potential impacts to tidewater goby will be very similar to those described for anadromous salmonids in section 4.3.1.2 above. The project activities with the greatest potential to adversely affect and result in the take of tidewater goby are pile driving and fish rescue activities. The project area includes tidally influenced brackish water slough habitat that is generally suitable, although it does not consistently provide the preferred water quality condition for goby. Based on the best scientific data available, tidewater goby have the potential to occur in the project area during the seasonal in-water work window, although, this period does correspond to the period of the year during which the fewest number of tidewater goby are expected to occur because of higher salinities and tidal fluctuations. Although most tidewater goby captured in the vicinity are further up into the system (i.e., Martin Slough) a small but unknown number of tidewater goby could be captured and released during fish rescue activities prior to pile driving and they are subject sub-lethal and behavioral effects during pile driving. The project area is generally considered marginal habitat for tidewater goby and the proposed project will not alter the available habitat in the project area such that their survival and population recovery would be measurably reduced. The proposed project will result in temporary effects to water quality. Replacement of the tide gate structure at Martin Slough and associated proposed restoration and habitat improvements at that site, as well as better sediment routing and hydraulic conditions beneath Pine Hill Road, will ultimately improve water quality conditions, habitat access, and habitat quality in the project area.

4.3.2.3. AVOIDANCE AND MINIMIZATION EFFORTS

In addition to the Conservation Measures included in the project description, avoidance and minimization measures identified above in section 4.3.1.3 shall be implemented.

4.3.2.4. COMPENSATORY MITIGATION

The proposed project has been designed such that the conservation measures and proposed avoidance and minimization measures will avoid or minimize the potential effects to tidewater goby, and designated critical habitat to the greatest extent possible. No additional mitigation is required.

4.3.2.5. CUMULATIVE EFFECTS

Cumulative effects to tidewater goby and their habitat would be similar to those previously described for anadromous salmonids in section 4.3.1.5. The proposed project would not adversely affect primary constituent elements of aquatic habitat such that the survival of tidewater goby would be measurably reduced in the project area.

4.3.3. Longfin Smelt (*Spirinchus thaleichthys*)

Federal Status: Candidate State Status: Threatened and Species of Special Concern.

Longfin smelt range from the Gulf of Alaska to Monterey Bay. Adult and juvenile longfin smelt occupy mostly the middle or bottom of the water column in salt or brackish water portions of estuaries. Spawning takes place in fresh water, over sandy-gravel substrates, rocks, and aquatic plants (California Department of Fish and Game 1995b). The cause of the decline in this species in Humboldt Bay in unknown.

4.3.3.1. SURVEY RESULTS AND POTENTIAL FOR OCCURRENCE

Historically, the longfin smelt was common in Humboldt Bay. However, no longfin smelt have been collected from Humboldt Bay in recent years despite extensive sampling of the estuary (California Department of Fish and Game 1995b).

4.3.3.2. PROJECT IMPACTS

The project area includes tidally influenced brackish water slough habitat that is seasonally suitable for migratory and rearing longfin smelt, but due to the lack of freshwater habitat and the lack of any recent detection of longfin smelt in Humboldt Bay, it is highly unlikely that longfin smelt would be impacted by the project.

4.3.3.3. AVOIDANCE AND MINIMIZATION EFFORTS

In addition to the Conservation Measures included in the project description, avoidance and minimization measures identified above in section 4.3.1.3 shall be implemented.

4.3.3.4. COMPENSATORY MITIGATION

None required.

4.3.3.5. CUMULATIVE EFFECTS

Cumulative effects to longfin smelt and their habitat would be similar to those previously described for anadromous salmonids in section 4.3.1.5.

4.3.4. Coastal cutthroat trout (*Oncorhynchus clarkii*)

Federal Status: None. **State Status: Species of Special Concern.**

Coastal cutthroat trout are found in coastal streams from the Eel River, Humboldt County, to Seward in southeastern Alaska. Some coastal cutthroat trout may spend their entire lives in fresh water, but most are anadromous, spending the summers in saltwater habitats. They prefer small, low gradient coastal streams and estuarine habitats. In northern California, coastal cutthroat trout begin to migrate up spawning streams in August-October following the first substantial rainfall (California Department of Fish and Game 1995a). Stream sections with small or moderate-sized gravel substrates are essential for spawning. The greatest threat to coastal cutthroat trout populations in California is habitat alteration and destruction, particularly for the developing embryos and fry in small streams.

4.3.4.1. SURVEY RESULTS

Coastal cutthroat trout only rarely enter Humboldt Bay as they are primarily a freshwater species (Fritzsche and Cavanagh 1995) occurring in the streams in the Humboldt Bay basin. Coastal cutthroat trout are known to occur in low numbers in Martin Slough and Swain Slough (California Department of Fish and Wildlife 2014).

4.3.4.2. PROJECT IMPACTS

Potential impacts to coastal cutthroat will be very similar to those described for anadromous salmonids in section 4.3.1.2 above.

4.3.4.3. Avoidance and Minimization Efforts

In addition to the Conservation Measures included in the project description, avoidance and minimization measures identified above in section 4.3.1.3 shall be implemented.

4.3.4.4. Compensatory Mitigation

None required.

4.3.4.5. Cumulative Effects

Cumulative effects to coastal cutthroat and their habitat would be similar to those previously described for anadromous salmonids in section 4.3.1.5.

4.3.5. Northern red-legged frog (*Rana aurora*)

Federal Status: None. State Status: Species of Special Concern.

The northern red-legged frog is found in humid forests, woodlands, grasslands, and streamsides with plant cover, and is commonly found in lowlands or foothills. Breeding habitat is typically at permanent or temporary water sources bordered by dense herbaceous or shrubby vegetation.

Like most ranid frogs in California, northern red-legged frog can be found in upland habitats adjacent to aquatic sites, and may travel away from them on wet or rainy nights (Jennings and Hayes 1994). Egg-laying usually occurs in January to March. Clusters of eggs are attached to emergent vegetation in or near pools and tadpoles metamorphose in four to five months. Suitable habitat within the BSA includes the freshwater ditches found adjacent to Pine Hill Road and in the pasture areas near the bridge. The species is not likely to use the water found in Swain Slough or Martin Slough due to the high salinity found in the brackish water (Jennings and Hayes 1994).

4.3.5.1. Survey Results and Potential for Occurrence

No frogs were observed during wildlife habitat assessment and wetland delineation conducted on July 29 and 30, 2013. Those surveys were conducted during the dry season, and the ditch features and other depressions (e.g., cattle wallows) were dry or moist, but not ponded, and it is assumed that the adults were in estivation. Review of wet season photographs suggest that both the ditches and wallows are full of water for the duration of the winter wet season extending into spring or early summer. Unless Swain Slough overtops its banks and floods these ponded features with brackish water, the ditches in particular, and the wallow to some degree, provide suitable freshwater aquatic environment for egg laying and tadpole rearing. Dense emergent vegetation is present within and overhanging the ditches. The CNDDB contains five occurrence records for the northern red-legged frog within 10 miles of the BSA. The most relevant is 1.5 mile southwest of the BSA, north of Fields Landing. This 2006 record is relevant due to the similar elevation and habitat conditions (as determined from review of aerial photographs).

4.3.5.2. PROJECT IMPACTS

The Project could adversely affect northern red-legged frogs if individuals are present in the Project area during construction. Potential direct effects include harassment, injury, and mortality of individual adult, tadpole and eggs due to equipment and vehicle traffic and construction-related ground disturbance. These direct effects are limited to the freshwater ditches located within the proposed project area (the wallows are within the BSA, but outside of the project disturbance footprint). The species may be indirectly affected if construction activities result in degradation of aquatic habitat and water quality due to erosion and sedimentation, accidental fuel leaks, and spills.

The proposed project has the potential to result in adverse impacts on northern red-legged frogs as identified below:

- Direct loss (e.g., mortality) of egg masses, tadpoles, or adult northern red-legged frogs due to operation of equipment in or adjacent to the ditches or other ponded channel when flowing or standing water is present. Implementation of Conservation Measure #3 (construction during the dry season) will minimize the potential for direct take of all life stages.
- Direct loss of adult northern red-legged frogs may occur if they are present in ground disturbance areas during the dry season. Sufficient moisture is present in the ditches to support adult northern red-legged frogs throughout the dry season. Implementation of the Avoidance and Minimization Measures (e.g., pre-construction survey) will reduce this potentially adverse effect.
- Indirect effects to northern red-legged frog may result from the loss of vegetation, alteration of ponded ditch features, or loss of breeding habitat from sedimentation or accidental spills of toxic materials. Removal of vegetation also removes structure used to attach egg masses; decreases availability of potential food items including aquatic and terrestrial invertebrates; eliminates material to hide under to evade predation, or that provides shade for thermoregulation; and can accelerate erosion processes in the BSA that reduces water, and thus habitat, quality. Implementation of Conservation Measure #5 (Replacement of Lost Riparian Habitat) will fully mitigate for any loss of ditch habitat, implementation of Conservation Measure #3 (Erosion and Sediment

Control) will ensure that disturbed areas are stabilized and appropriate erosion control measures (i.e., silt fencing) have been implemented during, as well as immediately following, construction to minimize and/or prevent erosion and sedimentation effects.

- Construction activities typically include the refueling of construction equipment on location. As a result, minor fuel and oil spills may occur, with a risk of larger releases. Without rapid containment and clean up, these materials could be potentially toxic depending on the location of the spill in proximity to surface water features, including the roadside ditches. Implementation of Conservation Measure #4 (Prevention of Accidental Spills) will limit the potential for this impact by requiring that the contractor stage equipment and fuels a minimum of 50 feet from water features, maintaining spill containment equipment at the site, and by maintaining construction equipment to avoid mechanical breakdown and potential for fluid leaks.

4.3.5.3. Avoidance and Minimization Efforts

In addition to the Conservation Measures included in the project description, the following measures shall be implemented to avoid or minimize project-related impacts on the northern red-legged frog:

- A pre-construction survey for the species shall be conducted to confirm presence or absence of northern red-legged frogs on the site immediately prior to the onset of project construction. A qualified biologist shall conduct a minimum of one survey of the BSA for these frogs. The survey shall be conducted a maximum of one week prior to construction. If one of these frogs is found within a construction impact zone, the biologist shall move it to a safe location within similar habitat.
- If a northern red-legged frog is encountered during construction, activities in the vicinity shall cease until appropriate corrective measures have been implemented or it has been determined that the frog will not be harmed. Any frogs encountered during construction shall be allowed to move away on their own. Any trapped, injured, or killed frogs shall be reported immediately to CDFW.

4.3.5.4. Compensatory Mitigation

None required.

4.3.5.5. Cumulative Effects

The proposed bridge replacement will not facilitate further development in the area. Further, impacts on northern red-legged frogs in the BSA would be relatively minor due to the limited nature of the project, implementation of the Conservation Measures and Avoidance Measures. Thus, the proposed project would not result in cumulatively considerable adverse effects on the northern red-legged frogs.

4.3.6. White-Tailed Kite (*Elanus leucurus*)

Federal Status: None. State Status: Fully Protected.

California supports the largest number of white-tailed kites in North America. They can be found in association with the herbaceous and open stages of a variety of habitat types, including open grasslands, meadows, emergent wetlands, and agricultural lands. Nests are constructed in dense stands located adjacent to foraging areas. The species forages in undisturbed open grasslands, meadows, farmlands, and emergent wetlands, and is seldom observed more than 0.5 mile from an active nest during the breeding season (Zeiner et al. 1990b).

4.3.6.1. Survey Results

White-tailed kites occur regularly in the BSA due to the presence of suitable foraging habitat in the wet meadow and along the sloughs.

4.3.6.2. Project Impacts

White tailed kite may nest in or adjacent to the BSA. Thus, construction disturbance during the breeding season could result in the loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Loss of fertile eggs or nesting raptors, or any activities resulting in nest abandonment, may adversely affect these species. The Project may also result in a small, temporary reduction of foraging and/or roosting habitat for these species. However, due to the regional abundance of similar habitats, temporary habitat loss is not expected to result in an adverse effect on these species.

4.3.6.3. Avoidance and Minimization Efforts

The following measures are recommended to avoid or minimize the potential for project-related impacts to raptor species including white-tailed kite:

- Pre-construction surveys for nesting raptors shall be conducted by a qualified biologist within the BSA and a 250-ft buffer around the BSA to ensure that no nests will be disturbed during project implementation. These surveys shall be conducted no more than 7 days prior to the initiation of construction activities, or re-initiation of construction activities if they have ceased for more than 7 days. During this survey, the biologist should inspect all trees immediately adjacent to the impact areas for raptor nests. If an active raptor nest is found close enough (i.e., within 250 ft) to the construction area to be disturbed by these activities, the biologist (in consultation with the CDFW) shall determine the extent of a construction-free buffer zone to be established around the nest. The County will inform Caltrans when such an activity occurs.

- If all necessary approvals have been obtained, potential nesting substrate (e.g., shrubs and trees) that will be removed by the project should be removed before the onset of the nesting season (February 15 through September 30), if practicable. This will help preclude nesting and substantially decrease the likelihood of direct impacts.

4.3.6.4. COMPENSATORY MITIGATION

None required.

4.3.6.5. CUMULATIVE EFFECTS

The Martin Slough Enhancement Project is the only reasonably foreseeable project within the BSA. The potential cumulative effects due to the Martin Slough Enhancement Project—described in Section 4.1.3.6—are expected to be a benefit to raptors including white-tailed kite. The proposed bridge replacement will not facilitate further development in the area. Further, due to the small nature of the proposed Project, impacts to raptors in the BSA will be relatively minor. Thus, with implementation of the recommended avoidance and minimization measures, the proposed Project would not result in cumulatively considerable adverse effects to raptors including white-tailed kite.

4.3.7. Northern harrier (*Circus cyaneus*)

Federal Status: None. **State Status: Species of Special Concern.**

In California, the northern harrier is distributed throughout the state, primarily in open habitats, nesting in coastal fresh and saltwater marshes. Nests are built on the ground in areas where long grasses or marsh plants provide cover and protection. Harriers hunt for a variety of prey, including rodents, birds, frogs, reptiles, and insects by flying low and slow in a traversing manner utilizing both sight and sound to detect prey items. Current threats to this species include habitat destruction resulting from agricultural and urban development.

4.3.7.1. SURVEY RESULTS

Locally, the northern harrier is a common migrant and winter resident, found in coastal marshes and grasslands near Humboldt Bay and in the BSA. It occurs in the area year around, but more commonly in winter.

4.3.7.2. PROJECT IMPACTS

Northern harrier may nest in or adjacent to the BSA. Potential impacts to northern harrier are similar to those described for white-tailed kite in Section 4.3.6.2.

4.3.7.3. AVOIDANCE AND MINIMIZATION EFFORTS

In addition to the Conservation Measures included in the project description, avoidance and minimization measures identified above in Section 4.3.6.3 shall be implemented.

4.3.7.4. COMPENSATORY MITIGATION

None required.

4.3.7.5. CUMULATIVE EFFECTS

The Martin Slough Enhancement Project is the only reasonably foreseeable project within the BSA. The potential cumulative effects due to the Martin Slough Enhancement Project—described in Section 4.1.3.6—are expected to be a benefit to raptors including northern harrier. The proposed bridge replacement will not facilitate further development in the area. Further, due to the small nature of the proposed Project, impacts to raptors in the BSA will be relatively minor. Thus, with implementation of the recommended avoidance and minimization measures, the proposed Project would not result in cumulatively considerable adverse effects to raptors including northern harrier.

4.3.8. Short-eared owl (*Asio flammeus*)

Federal Status: None **State Status: Species of Special Concern**

In California, they nest at only a few of their former breeding locations, and in northwestern California breed only in coastal areas where prime conditions occur. The short-eared owl is a ground nester and occurs in open country, including grasslands, wet meadows, and cleared forests. In migration it may appear in alpine meadows (Fix and Bezener 2000). Current threats to short-eared owls are primarily decline and degradation of marsh and tall grassland habitat resulting from grazing pressure.

4.3.8.1. Survey Results

Short-eared owls are known from wetland and agricultural areas surrounding Humboldt Bay, including the Humboldt Bay National Wildlife Refuge and Fay Slough and Mad River Slough Wildlife Areas. Nesting is very rare, but displaying birds have been seen at Humboldt Bay National Wildlife Refuge bordering the bay (LeValley 2004). Short-eared owls may occur in the BSA as suitable habitat is present.

4.3.8.2. Project Impacts

Due to the low detection rate of nesting short-eared owl in the Humboldt Bay area and the small footprint of the proposed project, it is unlikely that the project would impact nesting short-eared owl. The Project may also result in a small, temporary reduction of foraging and/or roosting habitat for these species. However, due to the regional abundance of similar habitats, temporary habitat loss is not expected to result in an adverse effect on these species.

4.3.8.3. Avoidance and Minimization Efforts

In addition to the Conservation Measures included in the project description, avoidance and minimization measures identified above in Section 4.3.6.3 shall be implemented.

4.3.8.4. Compensatory Mitigation

None required.

4.3.8.5. Cumulative Effects

The Martin Slough Enhancement Project is the only reasonably foreseeable project within the BSA. The potential cumulative effects due to the Martin Slough Enhancement Project—described in Section 4.1.3.6—are expected to be a benefit to raptors including short-eared owl. The proposed bridge replacement will not facilitate further development in the area. Further, due to the small nature of the proposed Project, impacts to raptors in the BSA will be relatively minor. Thus, with implementation of the recommended avoidance and minimization measures, the proposed Project would not result in cumulatively considerable adverse effects to raptors including short-eared owl.

4.3.9. Songbirds

Yellow-breasted chat (*Icteria virens*).

Federal Status: None. State Status: Species of Special Concern.

The yellow-breasted chat is a very large warbler with a robust build. A Neotropical migrant, it usually arrives in California in April and departs by late September. In

California, they typically occur in early successional riparian habitats with a well-developed shrub layer and an open canopy (Shuford and Gardali 2008). Nesting habitat is usually restricted to the narrow border of streams, creeks, sloughs, and rivers (Shuford and Gardali 2008). Breeding occurs from early May to early August. Nests are built low to the ground, often in dense shrubs along streams. Clutch size generally varies from 3–5 eggs and, typically, only one clutch is produced per year. Foraging patterns usually involve gleaning insects, spiders, and berries from the foliage of shrubs and low trees.

Yellow warbler (Setophaga petechia brewsteri).
Federal Status: None. State Status: Species of Special Concern.
The yellow warbler is a Neotropical migrant that principally occurs in California as a migratory summer resident from late March through early October (Shuford and Gardali 2008). It is found in dense riparian deciduous habitats with cottonwoods, willows, alders, and other small trees and shrubs typical of open-canopy riparian woodlands. The species breeds from March through August, building an open cup nest in a tree or shrub. They typically produce one clutch size of 4–5 eggs per year. Foraging patterns typically involve gleaning and hovering for insects and spiders.

4.3.9.1. Survey Results and Potential for Occurrence

Neither yellow warbler nor yellow-breasted chat was observed during the July 29 and 30, 2013 field surveys. There are no CNDDB occurrence records of either species within 10 miles of the BSA, although that likely reflects a lack of reporting, not an absence of the species. The small patch of riparian habitat in the northeast corner of the BSA is considered suitable nesting habitat for either species.

4.3.9.2. Project Impacts

Construction activities are not proposed within the riparian habitat in the northeast corner of the BSA. This is the only yellow warbler or yellow-breasted chat nesting habitat, thus avoidance of this area will not result in direct effects to the species. Indirect effects (e.g., nest abandonment, incubation or feeding interruptions) from constructing within close proximity of the suitable nesting habitat are possible if construction involves frequent loud noise or percussive tools within the nesting season (March through August).

4.3.9.3. Avoidance and Minimization Efforts

The following measures shall be implemented to avoid or minimize the potential for project-related impacts on nesting yellow warblers and yellow-breasted chats:

- A qualified biologist shall conduct a minimum of one pre-construction survey for yellow warblers and yellow-breasted chats within the BSA and a 250-ft buffer around the BSA. These surveys shall be conducted no more than 7 days prior to the initiation of construction activities, or re-initiation of construction activities if they have ceased for more than 7 days. If an active nest is found, the qualified biologist should determine the extent of a construction-free buffer zone to be established around the nest. The nest should be monitored to determine when nesting is complete so that any construction activities within the buffer area can be completed.

4.3.9.4. Compensatory Mitigation

None required.

4.3.9.5. Cumulative Effects

The proposed bridge replacement will not facilitate further development in the area. Further, impacts on yellow warblers and yellow-breasted chats in the project area will be relatively minor due to the small nature of the project. Thus, with implementation of the recommended avoidance and minimization measures, the proposed project would not result in cumulatively considerable adverse effects on the yellow warbler or yellow-breasted chat.

4.4. Other Sensitive Biological Resources

4.4.1. Nesting Migratory Birds

4.4.1.1. Survey Results

One black phoebe bird nest and a small colony of barn swallow nests were observed within the BSA during the July 29 and 30, 2013 wetland delineation and biological surveys. These species are protected under the MBTA, and if construction occurs during the summer nesting period (March through August) they would be adversely affected by the project.

4.4.1.2. Project Impacts

The project will demolish the existing bridge prior to building the new one. The demolition process would result in adverse effects (e.g., nest destruction and mortality of nestlings) to migratory birds nesting under the bridge during project construction.

4.4.1.3. Avoidance and Minimization Efforts

The following measures are recommended to avoid or minimize project-related impacts on migratory birds nesting under the bridge:

- Construction activities on, and removal of, the existing bridge should be scheduled to avoid the nesting season to the extent feasible. The typical nesting season in northern California extends from March through August. Thus, if bridge demolition can be scheduled to occur between September and December, or the period before nesting begins and after nesting is complete, the nesting season would be avoided, and no impacts would be expected.
- If it is not possible to schedule bridge removal to avoid nesting, any existing unoccupied and inactive nests shall be removed from the existing bridge before March 1 of the construction year. Removal of empty or unfinished nests should be repeated as frequently as necessary (can be up to three times per week) to prevent nest completion. Alternatively, a nest exclusion device can be installed (e.g. tarp or similar barrier that keeps birds from building nests) prior to March 1 or after August 31. Any nest exclusion devices should be approved by CDFW prior to installation. Exclusion efforts should be continued until the initiation of bridge removal.

4.4.1.4. Compensatory Mitigation

None required.

4.4.1.5. Cumulative Effects

The proposed project will not facilitate further development in the area. Thus, with implementation of the above measures, the proposed project would not result in cumulatively considerable adverse effects.

Chapter 5. Results: Conclusions and Regulatory Determinations

5.1. Federal Endangered Species Act Consultation Summary

A Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) was submitted to the National Marine Fisheries Service (NMFS) to address potential impacts to federally listed fish species. NMFS completed the Section 7 consultation and issued a Biological Opinion on September 25, 2015 which concluded that the Project is likely to adversely affect Northern California DPS steelhead, SONCC ESU coho salmon, and California Coastal ESU Chinook salmon, but is not likely to jeopardize the species. NMFS also concluded the project is likely to result in an adverse effect to critical habitat for the Coastal SONCC ESU coho salmon, California ESU Chinook salmon ESU, and the Northern California DPS steelhead; the Project is not likely to destroy or adversely modify critical habitat. In the BO, NFMS determined that incidental take would occur to all three salmonid species in the form of capture during fish relocation and by exposure to lethal noise levels resulting from pile driving. NMFS expects no more than one juvenile of each species to be injured and no more than two juvenile of each species will be killed as a result of constructing the Project.

The Biological Assessment/Essential Fish Habitat Assessment (BA/EFHA) was also submitted to the U.S. Fish and Wildlife Service (USFWS) to address potential impacts to the federally listed tidewater goby. The USFWS completed the Section 7 consultation and issued a Biological Opinion on September 24, 2015 which concluded that the Project is not likely to jeopardize the species. The also concluded the Project action area is not located within designated critical habitat for the species. In the BO, USFWS determined that incidental take would occur to tidewater goby in the form of capture during fish relocation and or during dewatering activities. The USFWS expects no more than five adult gobies to be injured or killed as a result of constructing the Project.

5.2. Federal Fisheries and Essential Fish Habitat Consultation Summary

NMFS, as part of the Section 305(b) Magnuson-Stevens Fishery Conservation and Management Act consultation, concluded that the Project would adversely affect essential fish habitat for Pacific salmon species (e.g., SONCC ESU coho salmon, and

California Coastal ESU Chinook salmon) and provided EFH conservation recommendations (i.e., minimize effects of temporary habitat loss from block nets and sheet piles by minimizing the maximum extent possible the duration to which migratory and rearing habitat is excluded).

5.3. Migratory Bird Treaty Act

The avoidance and minimization measures described above would be implemented to avoid adverse effects on migratory birds. These measures are outlined in Section 4.3.9 (Songbirds) and Section 4.4.1 (Migratory Birds) above. Implementation of these measures will minimize adverse effects to migratory birds. No permits or authorizations are anticipated to be required.

5.4. California Endangered Species Act Consultation Summary

The Project has the potential to affect the Southern Oregon Northern California Coast coho salmon. Potential impacts to and avoidance and minimization measures for this species are addressed in the BA/EFHA and summarized in Section 4.3.1 of this NES. No other plant or wildlife species listed under the California Endangered Species Act will be affected by the proposed project. Therefore, consultation with the CDFW is not anticipated.

5.5. California Fish and Game Code

The proposed project would involve work within the bed and bank of Swain Slough, a perennial stream. Prior to any activities that would obstruct the flow of, or alter the bed, channel, or bank of such a perennial stream, the County will provide notification of streambed alteration to the CDFW. If required by the CDFW, the County will obtain a streambed alteration agreement and will ensure that all conditions of the agreement are implemented.

Avoidance and minimization measures will be implemented to avoid adverse effects on species of special concern, migratory birds, and fully protected species as specified in both Chapter 4.

5.6. Wetlands and Other Waters Coordination Summary

NSR prepared a delineation of waters of the United States report on November 13, 2013 (Appendix E). The delineation of waters of the United States will be submitted to the Corps after Caltrans reviews and approves the delineation. Jurisdictional waters occupy a total of 0.989 acre of the BSA.

5.6.1. Corps Section 404 Permit

To ensure compliance with terms and conditions of Section 404 of the federal Clean Water Act (CWA), the County will submit a Pre-Construction Notification to the Corps requesting verification of authorization to proceed with construction of the proposed project under the Nationwide Permit program (likely Nationwide Permit 14 - Linear Transportation Crossings). The Pre-Construction Notification will be submitted to the Corps prior to any discharge of dredged or fill material into waters of the United States.

5.6.2. Section 401 Water Quality Certification

Section 401 of the CWA requires that a Water Quality Certification be obtained from the North Coast RWQCB prior to any discharge of dredged or fill material into waters of the United States. The County will obtain a Water Quality Certification from the North Coast RWQCB prior to any discharge of dredged or fill material into waters of the United States.

5.7. Invasive Species

Implementation of Conservation Measure #6 – Prevention of Spread of Invasive Species will avoid and minimize the spread of invasive species as required by Executive Order 13112.

5.8. Floodplain Management

The proposed bridge will span Swain Slough and will not affect the function of the current floodplain. Therefore, the project complies with this executive order.

5.9. California Coastal Act

The proposed project could result in direct and indirect impacts to ESHA that is regulated by the CCC, and regionally regulated by the LCP adopted by the County. The following natural communities and areas identified as ESHA occur within the 100-foot buffer around the BSA: perennial stream, including Northern Coastal Salt Marsh; seasonal wetland; and riparian upland.

Avoidance and minimization measures would be implemented to avoid and minimize indirect impacts to ESHA. These measures are identified in Sections 4.1.2 and 4.1.3, and 4.1.4. Compensatory mitigation measures are outlined in Section 4.1.4.4.

5.10. Wetlands Only Practicable Alternative Finding

Executive Order 119900, Protection of Wetlands (1977), established a national policy to avoid adverse effects on wetlands wherever there is a practicable alternative. The project design minimized impacts on wetlands to the extent practicable Section 4.1.3.3). All other design considerations would have a greater impact on wetlands. Because the project design with the least impact on wetlands was selected, the project is in compliance with the Wetlands Only Practicable Finding Alternative pursuant to Executive Order 119900, Protection of Wetlands (1977).

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Appendix A USFWS List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Arcata Fish and Wildlife Office
1655 HEINDON ROAD
ARCATA, CA 95521
PHONE: (707)822-7201 FAX: (707)822-8411

Consultation Code: 08EACT00-2016-SLI-0002 October 05, 2015
Event Code: 08EACT00-2016-E-00003
Project Name: Pine Hill Road Over Swain Slough Bridge Replacement

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

Official Species List

Provided by:

Arcata Fish and Wildlife Office
1655 HEINDON ROAD
ARCATA, CA 95521
(707) 822-7201

Consultation Code: 08EACT00-2016-SLI-0002
Event Code: 08EACT00-2016-E-00003

Project Type: BRIDGE CONSTRUCTION / MAINTENANCE

Project Name: Pine Hill Road Over Swain Slough Bridge Replacement
Project Description: The Humboldt County Department of Public Works is proposing to replace Bridge No. 04C-0173 on Pine Hill Road over Swain Slough in Eureka, Humboldt County, California. The proposed bridge type is a single-span precast concrete I-girder, and will be slightly longer than the existing bridge to better fit the site conditions. Work will take place between June 15 and October 15, in 2016.

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

Project Location Map:

Project Coordinates: MULTIPOLYGON (((-124.18227285146712 40.75250346103289, -124.18240427970886 40.752407963021284, -124.18249547481537 40.752403899273055, -124.18262422084808 40.752507524775034, -124.18242573738098 40.75267007425662, -124.18227285146712 40.75250346103289)))

Project Counties: Humboldt, CA

United States Department of Interior
Fish and Wildlife Service

Project name: Pine Hill Road Over Swain Slough Bridge Replacement

Endangered Species Act Species List

There are a total of 9 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	**Status**	**Has Critical Habitat**	**Condition(s)**
Marbled murrelet *(Brachyramphus marmoratus)* Population: CA, OR, WA	Threatened	Final designated	
Northern Spotted owl *(Strix occidentalis caurina)* Population: Entire	Threatened	Final designated	
western snowy plover *(Charadrius nivosus ssp. nivosus)* Population: Pacific coastal pop.	Threatened	Final designated	
Yellow-Billed Cuckoo *(Coccyzus americanus)* Population: Western U.S. DPS	Threatened	Proposed	
Fishes			
Tidewater goby *(Eucyclogobius newberryi)* Population: Entire	Endangered	Final designated	
Flowering Plants			
Beach layia *(Layia carnosa)*	Endangered		

Menzies' wallflower *(Erysimum menziesii)*	Endangered		
Western lily *(Lilium occidentale)*	Endangered		
Mammals			
fisher *(Martes pennanti)* Population: West coast DPS	Proposed Threatened		

Critical habitats that lie within your project area

There are no critical habitats within your project area.

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Listed/Proposed Threatened and Endangered Species for the EUREKA Quad (Candidates Included)

July 7, 2014

Document number: 327179038-9408

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KEY:

(PE) Proposed Endangered Proposed in the Federal Register as being in danger of extinction
(PT) Proposed Threatened   Proposed as likely to become endangered within the foreseeable future
(E) Endangered Listed in the Federal Register as being in danger of extinction
(T) Threatened Listed as likely to become endangered within the foreseeable future
(C) Candidate Candidate which may become a proposed species Habitat Y = Designated, P = Proposed, N = None Designated
* Denotes a species Listed by the National Marine Fisheries Service

Type		Scientific Name	Common Name	Category	Critical Habitat
Plants					
		Erysimum menziesii	Menzies' wallflower	E	N
		Layia carnosa	beach layia	E	N
		Lilium occidentale	western lily	E	N
Invertebrates					
	*	*Haliotis cracherodii*	black abalone	E	N
Fish					
	*	*Acipenser medirostris*	green sturgeon	T	Y
		Eucyclogobius newberryi	tidewater goby	E	Y
	*	*Oncorhynchus kisutch*	S. OR/N. CA coho salmon	T	Y
	*	*Oncorhynchus mykiss*	Northern California steelhead	T	Y
	*	*Oncorhynchus tshawytscha*	CA coastal chinook salmon	T	Y
Reptiles					
	*	*Caretta caretta*	loggerhead turtle	T	N
	*	*Chelonia mydas (incl. agassizi)*	green turtle	T	N
	*	*Dermochelys coriacea*	leatherback turtle	E	Y
	*	*Lepidochelys olivacea*	olive (=Pacific) ridley sea turtle	T	N
Birds					
		Brachyramphus marmoratus	marbled murrelet	T	Y
		Charadrius alexandrinus nivosus	western snowy plover	T	Y
		Coccyzus americanus	Western yellow-billed cuckoo	PT	N
		Phoebastris albatrus	short-tailed albatross	E	N
		Strix occidentalis caurina	northern spotted owl	T	Y
		Synthliboramphus hypoleucus	Xantus's murrelet	C	N
Mammals					
	*	*Balaenoptera borealis*	sei whale	E	N
	*	*Balaenoptera musculus*	blue whale	E	N
	*	*Balaenoptera physalus*	fin whale	E	N
	*	*Eumetopias jubatus*	Steller (=northern) sea-lion	T	Y
	*	*Megaptera novaeangliae*	humpback whale	E	N

*	*Orcinus orca*	killer whale, S. resident	E	Y
*	*Physeter macrocephalus*	sperm whale	E	N

Appendix B CNDDB and CNPS Results

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Taxonomic Group is (Dune or Scrub or Herbaceous or Marsh or Riparian or Woodland or Forest or Alpine or Inland Waters or Marine or Estuarine or Riverine or Palustrine or Fish or Amphibians or Reptiles or Birds or Mammals or Mollusks or Arachnids or Crustaceans or Insects or Ferns or Gymnosperms or Monocots or Dicots or Lichens or Bryophytes) and Quad is (Eureka (4012472) or Tyee City (4012482) or Arcata North (4012481) or Arcata South (4012471) or McWhinney Creek (4012461) or Fields Landing (4012462) or Cannibal Island (4012463))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Abronia umbellata var. breviflora pink sand-verbena	PDNYC010N4	None	None	G4G5T2	S1	1B.1
Accipiter striatus sharp-shinned hawk	ABNKC12020	None	None	G5	S3	WL
Acipenser medirostris green sturgeon	AFCAA01030	Threatened	None	G3	S1S2	SSC
Arborimus albipes white-footed vole	AMAFF23010	None	None	G3G4	S2S3	SSC
Arborimus pomo Sonoma tree vole	AMAFF23030	None	None	G3	S3	SSC
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Ardea herodias great blue heron	ABNGA04010	None	None	G5	S4	
Ascaphus truei Pacific tailed frog	AAABA01010	None	None	G4	S2S3	SSC
Astragalus pycnostachyus var. pycnostachyus coastal marsh milk-vetch	PDFAB0F7B2	None	None	G2T2	S2	1B.2
Bryoria spiralifera twisted horsehair lichen	NLTEST5460	None	None	G3	S1S2	1B.1
Cardamine angulata seaside bittercress	PDBRA0K010	None	None	G5	S1	2B.1
Carex arcta northern clustered sedge	PMCYP030X0	None	None	G5	S2	2B.2
Carex leptalea bristle-stalked sedge	PMCYP037E0	None	None	G5	S1	2B.2
Carex lyngbyei Lyngbye's sedge	PMCYP037Y0	None	None	G5	S2	2B.2
Carex praticola northern meadow sedge	PMCYP03B20	None	None	G5	S2S3	2B.2
Castilleja ambigua var. humboldtiensis Humboldt Bay owl's-clover	PDSCR0D402	None	None	G4T2	S2	1B.2
Castilleja litoralis Oregon coast paintbrush	PDSCR0D012	None	None	G4G5T4	S3	2B.2
Charadrius alexandrinus nivosus western snowy plover	ABNNB03031	Threatened	None	G3T3	S2	SSC

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Chloropyron maritimum ssp. palustre Point Reyes salty bird's-beak	PDSCR0J0C3	None	None	G4?T2	S2	1B.2
Cicindela hirticollis gravida sandy beach tiger beetle	IICOL02101	None	None	G5T2	S1	
Coastal Terrace Prairie Coastal Terrace Prairie	CTT41100CA	None	None	G2	S2.1	
Egretta thula snowy egret	ABNGA06030	None	None	G5	S4	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Erysimum menziesii Menzies' wallflower	PDBRA160R0	Endangered	Endangered	G1	S1	1B.1
Erythronium revolutum coast fawn lily	PMLIL0U0F0	None	None	G4	S2S3	2B.2
Eucyclogobius newberryi tidewater goby	AFCQN04010	Endangered	None	G3	S2S3	SSC
Fissidens pauperculus minute pocket moss	NBMUS2W0U0	None	None	G3?	S1	1B.2
Gilia capitata ssp. pacifica Pacific gilia	PDPLM040B6	None	None	G5T3T4	S2	1B.2
Gilia millefoliata dark-eyed gilia	PDPLM04130	None	None	G2	S2	1B.2
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S2	FP
Hesperevax sparsiflora var. brevifolia short-leaved evax	PDASTE5011	None	None	G4T2T3	S2S3	1B.2
Lathyrus japonicus seaside pea	PDFAB250C0	None	None	G5	S2	2B.1
Lathyrus palustris marsh pea	PDFAB250P0	None	None	G5	S2S3	2B.2
Layia carnosa beach layia	PDAST5N010	Endangered	Endangered	G2	S2	1B.1
Lilium occidentale western lily	PMLIL1A0G0	Endangered	Endangered	G1	S1	1B.1
Lycopodium clavatum running-pine	PPLYC01080	None	None	G5	S3	4.1
Martes caurina humboldtensis Humboldt marten	AMAJF01012	None	None	G5T1	S1	SSC
Mitellastra caulescens leafy-stemmed mitrewort	PDSAX0N020	None	None	G5	S4.2	4.2
Monotropa uniflora ghost-pipe	PDMON03030	None	None	G5	S2	2B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Montia howellii Howell's montia	PDPOR05070	None	None	G3G4	S3	2B.2
Myotis evotis long-eared myotis	AMACC01070	None	None	G5	S4?	
Northern Coastal Salt Marsh Northern Coastal Salt Marsh	CTT52110CA	None	None	G3	S3.2	
Northern Foredune Grassland Northern Foredune Grassland	CTT21211CA	None	None	G1	S1.1	
Nycticorax nycticorax black-crowned night heron	ABNGA11010	None	None	G5	S3	
Oenothera wolfii Wolf's evening-primrose	PDONA0C1K0	None	None	G1	S1	1B.1
Oncorhynchus clarkii clarkii coast cutthroat trout	AFCHA0208A	None	None	G4T4	S3	SSC
Oncorhynchus kisutch coho salmon - southern Oregon / northern California ESU	AFCHA02032	Threatened	Threatened	G4T2Q	S2?	SSC
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S3	WL
Phalacrocorax auritus double-crested cormorant	ABNFD01020	None	None	G5	S3	WL
Puccinellia pumila dwarf alkali grass	PMPOA531L0	None	None	G4?	SH	2B.2
Rallus longirostris obsoletus California clapper rail	ABNME05016	Endangered	Endangered	G5T1	S1	FP
Rana aurora northern red-legged frog	AAABH01021	None	None	G4	S2?	SSC
Rana boylii foothill yellow-legged frog	AAABH01050	None	None	G3	S2S3	SSC
Rhyacotriton variegatus southern torrent salamander	AAAAJ01020	None	None	G3G4	S2S3	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2S3	
Sidalcea malachroides maple-leaved checkerbloom	PDMAL110E0	None	None	G3G4	S3S4.2	4.2
Sidalcea malviflora ssp. patula Siskiyou checkerbloom	PDMAL110F9	None	None	G5T2	S2	1B.2
Sidalcea oregana ssp. eximia coast sidalcea	PDMAL110K9	None	None	G5T1	S1	1B.2
Sitka Spruce Forest Sitka Spruce Forest	CTT82110CA	None	None	G1	S1.1	
Spergularia canadensis var. occidentalis western sand-spurrey	PDCAR0W032	None	None	G5T4?	S1	2B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	SSC
Thaleichthys pacificus eulachon	AFCHB04010	Threatened	None	G5	S3	SSC
Trichodon cylindricus cylindrical trichodon	NBMUS7N020	None	None	G4G5	S2	2B.2
Usnea longissima Methuselah's beard lichen	NLLEC5P420	None	None	G4	S4	4.2
Viola palustris alpine marsh violet	PDVIO041G0	None	None	G5	S1S2	2B.2

Record Count: 65

Inventory of Rare and Endangered Plants - 7th edition interface

v7-13jul 7-8-13

Status: search results - Mon, Jul. 29, 2013 10:14 ET c

{QUADS_123} =~ m/672C|654A|654B|655A|672D|672A|6 Search

Tip: `+Lathyrus +"coastal dunes"` returns only those Lathyrus in coastal dunes. Note the "+" and quotes.[all tips and help.][search history]

Your Quad Selection: Eureka (672C) 4012472, Mcwhinney Creek (654A) 4012461, Fields Landing (654B) 4012462, Cannibal Island (655A) 4012463, Arcata South (672D) 4012471, Arcata North (672A) 4012481, Tyee City (672B) 4012482

Hits 1 to 29 of 29

Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Abronia umbellata var. breviflora**	pink sand-verbena	Nyctaginaceae	List 1B.1
		1	**Astragalus pycnostachyus var. pycnostachyus**	coastal marsh milk-vetch	Fabaceae	List 1B.2
		1	**Cardamine angulata**	seaside bittercress	Brassicaceae	List 2B.1
		1	**Carex arcta**	northern clustered sedge	Cyperaceae	List 2B.2
		1	**Carex leptalea**	bristle-stalked sedge	Cyperaceae	List 2B.2
		1	**Carex lyngbyei**	Lyngbye's sedge	Cyperaceae	List 2B.2
		1	**Carex praticola**	northern meadow sedge	Cyperaceae	List 2B.2
		1	**Castilleja ambigua var. humboldtiensis**	Humboldt Bay owl's-clover	Orobanchaceae	List 1B.2
		1	**Castilleja litoralis**	Oregon coast paintbrush	Orobanchaceae	List 2B.2
		1	**Chloropyron maritimum ssp. palustre**	Point Reyes bird's-beak	Orobanchaceae	List 1B.2
		1	**Erysimum menziesii**	Menzies' wallflower	Brassicaceae	List 1B.1
		1	**Erythronium revolutum**	coast fawn lily	Liliaceae	List 2B.2
		1	**Fissidens pauperculus**	minute pocket moss	Fissidentaceae	List 1B.2
		1	**Gilia capitata ssp. pacifica**	Pacific gilia	Polemoniaceae	List 1B.2
		1	**Gilia millefoliata**	dark-eyed gilia	Polemoniaceae	List 1B.2
		1		short-leaved evax	Asteraceae	

			Hesperevax sparsiflora var. brevifolia			List 1B.2
		1	**Lathyrus japonicus**	seaside pea	Fabaceae	List 2B.1
		1	**Lathyrus palustris**	marsh pea	Fabaceae	List 2B.2
		1	**Layia carnosa**	beach layia	Asteraceae	List 1B.1
		1	**Lilium occidentale**	western lily	Liliaceae	List 1B.1
		1	**Monotropa uniflora**	ghost-pipe	Ericaceae	List 2B.2
		1	**Montia howellii**	Howell's montia	Montiaceae	List 2B.2
		1	**Oenothera wolfii**	Wolf's evening-primrose	Onagraceae	List 1B.1
		1	**Puccinellia pumila**	dwarf alkali grass	Poaceae	List 2B.2
		1	**Sidalcea malviflora ssp. patula**	Siskiyou checkerbloom	Malvaceae	List 1B.2
		1	**Sidalcea oregana ssp. eximia**	coast checkerbloom	Malvaceae	List 1B.2
		1	**Spergularia canadensis var. occidentalis**	western sand-spurrey	Caryophyllaceae	List 2B.1
		1	**Trichodon cylindricus**	cylindrical trichodon	Ditrichaceae	List 2B.2
		1	**Viola palustris**	alpine marsh violet	Violaceae	List 2B.2

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

No more hits.

Appendix C Review of Regionally Occurring Special-Status Species

Table C-1. Review of Regionally Occurring Special-Status Plant Species

Common Name Scientific Name	Status[1] (F/S/RPR)	General Habitat Description and Blooming Period	Habitat Assessment[2]	Rationale
Federal or State Listed Plant Species				
Menzies' Wallflower *(Erysimum menziesii)*	FE/SE/1B.1	Coastal dunes. Elevation: 0-110 feet. Bloom: March-September.	A	Habitat is not present. Species was not observed during botanical field surveys.
Beach layia *(Layia carnosa)*	FE/SE/1B.1	Coastal dunes and sandy coastal scrub. Elevation: 0-200 feet. Bloom: March-July.	A	Habitat is not present. Species was not observed during botanical field surveys.
Western lily *(Lilium occidentale)*	FE/SE/1B.1	Coastal scrub or prairie, gaps in conifer forest. Elevation: 0-1000 ft. Bloom: June-August.	A	Habitat is not present. Species was not observed during botanical field surveys.
Other Special-Status Plant Species				
Pink sand-verbena (*Abronia umbellata var. breviflora*)	—/—/1B.1	Coastal dunes. Elevation: 0-30 feet. Bloom: June-October.	A	Coastal dune habitat is not present. Species was not observed during botanical field surveys.
Coastal marsh milk-vetch (*Astragalus pycnostachyus var. pycnostachyus*)	—/—/1B.2	Mesic coastal dunes, coastal scrub, marshes and swamps (coastal salt, streamsides). Elevation: 0-100 feet. Bloom: April-October.	**HP**	The BSA is located on the Coastal plain and the ditches provide suitable mesic and wetland habitat for this species. Species was not observed during botanical field surveys.
Seaside bittercress (*Cardamine angulata*)	—/—/2B.1	Wet areas, streambanks in lower montane coniferous forest, and North Coast coniferous forest Elevation: 210-3000 feet. Bloom: March-July.	A	The BSA is below the elevational level of the species. Species was not observed during botanical field surveys.
Northern clustered sedge (*Carex arcta*)	—/—/2B.2	Bogs and fens, mesic North Coast coniferous forest. Elevation: 200-4590 feet. Bloom: June-September.	A	The BSA is lower than the elevation level of the species. Species was not observed during botanical field surveys.
Bristle-stalked sedge (*Carex leptalea*)	—/—/2B.2	Bogs and fens, mesic meadows and seeps, marshes and swamps. Elevation: 0-2300 feet. Bloom: March-July.	**HP**	Suitable wetland habitat is present. Species was not observed during botanical field surveys.

Common Name Scientific Name	Status[1] (F/S/RPR)	General Habitat Description and Blooming Period	Habitat Assessment[2]	Rationale
Lyngbye's sedge (*Carex lyngbyei*)	—/—/2B.2	Marshes and brackish or freshwater swamps. Elevation: 0-30 feet. Bloom: April-August.	**P**	Suitable wetland habitat is present. Species was observed during botanical field surveys.
Northern meadow sedge (*Carex praticola*)	—/—/2B.2	Moist to wet meadows. Elevation: 0-10,500 feet. Bloom: May-July.	**HP**	Suitable wetland habitat is present. Species was not observed during botanical field surveys.
Humboldt Bay owl's-clover (*Castilleja ambigua var. humboldtiensis*)	—/—/1B.2	Marshes and coastal salt swamps. Elevation: 0-30 feet. Bloom: June-October.	**HP**	Suitable wetland habitat is present. Species was not observed during botanical field surveys.
Oregon coast paintbrush (*Castilleja litoralis*)	—/—/2B.2	Coastal bluff scrub, coastal dunes, sandy coastal scrub. Elevation: 50-330 feet. Bloom: June.	A	Suitable coastal dune habitat is not present. Species was not observed during botanical field surveys.
Point Reyes bird's-beak (*Chloropyron maritimum ssp. palustre*)	—/—/1B.2	Marshes and coastal salt swamps. Elevation: 0-30 feet. Bloom: June-October.	**HP**	Suitable wetland habitat is present. Species was not observed during botanical field surveys.
Coast fawn lily (*Erythronium revolutum*)	—/—/2B.2	Bogs and fens, broad-leafed upland forest, North Coast coniferous forest. Elevation: 0-3,500 feet. Bloom: March-August.	A	Suitable wetland habitat is not present. Species was not observed during botanical field surveys.
Minute pocket moss (*Fissidens pauperculus*)	—/—/1B.2	North Coast mesic coniferous forest. Elevation: 30-3360 feet.	A	North Coast coniferous forest habitat is not present. Species was not observed during botanical field surveys.
Pacific gilia (*Gilia capitata ssp. pacifica*)	—/—/1B.2	Coastal bluff scrub, chaparral, and other openings, coastal prairie, valley and foothill grassland. Elevation: 20-3120 feet. Bloom: April-August.	**HP**	The BSA provides suitable coastal prairie habitat. Species was not observed during botanical field surveys.
Dark-eyed gilia (*Gilia millefoliata*)	—/—/1B.2	Coastal dunes. Elevation: 10-100 feet. Bloom: April-July.	A	Coastal dune habitat is absent. Species was not observed during botanical field surveys.
Short-leaved evax (*Hesperevax sparsiflora var.brevifolia*)	—/—/1B.2	Coastal bluff scrub (sandy), coastal dunes, and coastal prairie. Elevation: 0-710 feet. Bloom: March-June.	**HP**	The BSA provides suitable coastal prairie habitat. Species was not observed during botanical field surveys.

Common Name Scientific Name	Status[1] (F/S/RPR)	General Habitat Description and Blooming Period	Habitat Assessment[2]	Rationale
Seaside pea (*Lathyrus japonicus*)	—/—/2B.1	Coastal dunes. Elevation: 0-100 feet. Bloom: May-August.	A	Coastal dune habitat is absent. Species was not observed during botanical field surveys.
Marsh pea (*Lathyrus palustris*)	—/—/2B.2	Bogs and fens, coastal prairie, coastal scrub, lower montane coniferous forest, marshes and swamps, and mesic North Coast coniferous forest. Elevation: 0-330 feet. Bloom: March-August.	HP	Suitable wetland and coastal prairie habitat is present. Species was not observed during botanical field surveys.
Ghost-pipe (*Monotropa uniflora*)	—/—/2B.2	Broad-leafed upland forest, North Coast coniferous forest. Elevation: 30-1800 feet. Bloom: June-August (September).	A	The BSA does not provide suitable forest habitat. Species was not observed botanical field surveys.
Howell's Montia (*Montia howellii*)	—/—/2B.2	Meadows and seeps, North Coast coniferous forest, vernal pools/vernally mesic, sometimes roadsides. Elevation: 0-2740 feet. Bloom: (February), March-May.	A	The BSA does not provide suitable mesic habitat. Species was not observed during botanical field surveys.
Wolf's evening-primrose (*Oenothera wolfii*)	—/—/1B.1	Coastal bluff scrub, coastal dunes, coastal prairie, sandy lower montane coniferous forest, usually mesic. Elevation: 10-2620 feet. Bloom: May-October.	HP	The BSA provides suitable coastal prairie habitat. Species was not observed during botanical field surveys.
Dwarf alkali grass (*Puccinellia pumila*)	—/—/2B.2	Marshes and coastal salt swamps. Elevation: 0-30 feet. Bloom: July.	**HP**	Suitable wetland habitat is present. Species was not observed during botanical field surveys.
Siskiyou Checkerbloom (*Sidalcea malviflora ssp. patula*)	—/—/1B.2	Coastal bluff scrub, coastal prairie, North Coast coniferous forest/often roadcuts. Elevation: 50-2890 feet. Bloom: May-August.	A	The BSA is below the elevational range of the species. The species was not observed during botanical field surveys.
Coast Sidalcea (*Sidalcea oregana ssp. eximia*)	—/—/1B.2	Lower montane coniferous forest, meadows and seeps, North Coast coniferous forest. Elevation: 20-4400 feet. Bloom: June-August.	A	Coniferous forest is not present. The species was not observed during botanical field surveys.
Western sand-spurrey (*Spergularia canadensis var. occidentalis*)	—/—/2.1	Marshes and coastal salt swamps. Elevation: 0-10 feet. Bloom: June-August.	**HP**	Suitable wetland habitat is present. Species was not observed during botanical field surveys.

Common Name Scientific Name	Status[1] (F/S/RPR)	General Habitat Description and Blooming Period	Habitat Assessment[2]	Rationale
Alpine marsh violet (*Viola palustris*)	—/—/2.2	Serpentine bogs and fens, marshes and swamps. Elevation: 330-3250 feet. Bloom: April-September.	A	None. Serpentine habitat is not present. Species was not observed during the botanical field surveys.

1 Status Codes: Federal Endangered (FE); State Endangered (SE).
RPR Codes and Extensions:
1B Plants rare, threatened, or endangered in California and elsewhere.
2B Plants rare, threatened, or endangered in California but more common elsewhere.
xx.2 Fairly endangered in California
xx.1 Seriously endangered in California

2 Absent (A): No habitat present and no further work needed.
Habitat Present (HP): Habitat is, or may be present. The species may be present.
Present (P): The species is present.
Critical Habitat (CH): BSA is located within a designated critical habitat unit, but does not necessarily mean that appropriate habitat is present.

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Table C-2. Review of Regionally Occurring Special-Status Animal Species

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Habitat Assessment[2]	Rationale
Federal or State Listed Species				
Southern DPS green sturgeon (*Acipenser medirostris*) Critical Habitat	FT/SSC	Anadromous species that spawn and rear in freshwater rivers. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock. The southern DPS occur south of the Eel River. Humboldt Bay is designated Critical Habitat for this species.	A	The BSA is outside the known range of this DPS. The BSA is outside of the boundaries of Critical Habitat for this species.
Tidewater goby (*Eucyclogobius newberryi*)	FE/SSC	Shallow lagoons and coastal streams with brackish to fresh and slow-moving or fairly still water.	**HP**	The BSA is within the current known range of this species and has been documented near the action area.
Southern Oregon Northern California Coasts ESU coho salmon (*Oncorhynchus kisutch*) Critical Habitat/Essential Fish Habitat	FT/ST, SSC	Spawn and rear in freshwater rivers and streams. Juveniles prefer deep (> 1 m) pools with dense overhead cover, and clear water. Found over a range of substrates from silt to bedrock. Requires cool water temperatures for spawning, egg-incubation, and juvenile rearing. Spawn in riffles with gravel and cobble substrates.	**P, CH**	SONCC coho salmon are known to occur in Humboldt Bay tributaries, including Swain Slough. Swain Slough in the action area is designated critical habitat.
Northern California DPS steelhead (*Oncorhynchus mykiss*) Critical Habitat/Essential Fish Habitat	T/SSC	Spawn and rear in freshwater rivers and streams. Juveniles prefer deep (> 1 m) pools with dense overhead cover, and clear water. Requires cool water temperatures for spawning, egg-incubation and juvenile rearing. Spawn in riffles with gravel and cobble substrates. This DPS occurs in coastal streams from Redwood Creek south to the Russian River. Adults migrate upstream during the fall and spawn from December to April.	**P**	No established spawning population off NC steelhead occurs in the Swain Slough watershed; but this species does occur in the Elk River and Humboldt Bay. Swain Slough in the action area is designated critical habitat.
California Coastal ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat/Essential Fish Habitat	T/—	Spawn and rear in freshwater rivers and streams. Requires cool water temperatures for spawning, egg-incubation and juvenile rearing. Spawn in riffles with gravel and cobble substrates. The California Coastal ESU includes occurs in rivers and streams south of the Klamath River to the Russian River.	**P**	No established spawning population off CC Chinook salmon occurs in Swain Slough watershed and it is not designated critical habitat; but this species does occur in the Elk River and Humboldt Bay (both of which are designated critical habitat).

Common Name ***Scientific Name***	**Status[1] (Fed/State)**	**General Habitat Description**	**Habitat Assessment[2]**	**Rationale**
Longfin smelt (*Spirinchus thaleichthys*)	—/ST, SSC	Adult and juvenile longfin smelt occur in salt or brackish water within estuaries of major rivers. Spawning occurs in fresh water over sandy, gravelly, or areas vegetated with aquatic vegetation. In California, occur in Sacramento-San Joaquin estuary, Humboldt Bay, the Eel River estuary, and the Klamath River estuary. Not known from the Smith River.	**HP**	No suitable spawning habitat in BSA, but known to occur in Humboldt Bay.
Southern eulachon DPS (*Thaleichthys pacificus*)	FT/SSC	Spend most of their life in salt water. Spawning occurs in the lower reaches of rivers or tributaries with small gravel or in semi-sandy areas with debris.	**HP**	No suitable spawning habitat in BSA, but known to occur in Humboldt Bay.
Marbled murrelet (*Branchyramphus marmoratus*) Critical Habitat	FT/SE	Marine subtidal and pelagic habitats; requires dense, mature forests of redwood and Douglas-fir for breeding.	A	The BSA does not support suitable mature forest to support breeding.
Western snowy plover (*Charadrius alexandrinus nivosus*) Critical Habitat	FT/SSC	Nesting and foraging habitat is the sandy marine and estuarine shorelines. Occurs along the California Coast in Humboldt County.	A	BSA does not provide suitable breeding habitat and is not within designated critical habitat. Currently known to nest on Clam Beach, the south spit of Humboldt Bay, on the Eel River sandpits, and on gravel bars along the lower Eel River.
Western yellow-billed cuckoo (*Coccyzus americanus*)	PT/SE	Nesting habitat is cottonwood/willow riparian forest. In California, occurs in scattered Sacramento Valley riparian forests. Also occurs at one known location (Cock Robin Island) on the North Coast.	A	The small area of riparian habitat within the BSA is not extensive enough to support this species.
Bald eagle (*Haliaeetus leucocephalus*)	FD/SE, SFP	Forages on live and dead fish and nests in large trees or snags. Requires large bodies of water, including ocean shorelines, lake margins, and large, open river courses for foraging, nesting, and wintering habitat.	A	Swain Slough and Marten Slough are too small to support foraging, and no nesting trees occur within or near the BSA. The nearest CNDDB record of a bald eagle nest is 13 miles east northeast on the Mad River.

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Habitat Assessment[2]	Rationale
California clapper rail (*Rallus longirostris obsoletus*)	FE/SE	Tidewater and brackish marshes, and coastal sloughs in the San Francisco Bay area. Also present in scattered locations inland.	A	The wetlands and the two sloughs provide suitable foraging but extensive marsh habitat suitable for nesting is absent from the BSA and surrounding area. Humboldt County CNDDB occurrences from 1930's are extirpated.
Northern spotted owl (*Strix occidentalis caurina*) Critical Habitat	FT/SCT, SSC	In northern California, resides in large stands of old growth, multi-layered mixed conifer, redwood, and Douglas-fir habitats	A	The BSA does not support suitable nesting or foraging habitat for the species.
Other Special-Status Species				
Fish				
Pacific-northern DPS green sturgeon (*Acipenser medirostris*)	FSC/SSC	Spawn and rear in freshwater rivers. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock.	A	The BSA is outside the known range of this DPS.
Pacific-northern DPS Green sturgeon (*Acipenser medirostris*)	FSC/SSC	Anadromous species that spawn and rear in freshwater rivers. In California, spawning occurs in the Sacramento, Klamath, and Eel Rivers, and the Rogue in Oregon. Spawn in deep pools in larger rivers.	A	The BSA does not provide suitable spawing habitat, and the species is not known to occur in Swain Slough or the Elk Creek drainage.
Coastal cutthroat trout (*Oncorhynchus clarkii clarkii*)	—/SSC	Found in low gradient coastal streams and estuaries. Optimal streams are cool and shady, with a lot of instream cover. Spawn in reaches with small to moderate sized gravels. Must have well oxygenated water with low turbidity. Occur in coastal streams from the Eel River north to the Oregon border.	**HP**	Swain Slough and Martin Slough provide suitable habitat for the species. The CNDDB shows a record of the species occurring in both sloughs.
Amphibians				
Pacific tailed frog (*Ascaphus truei*)	—/SSC	Restricted to perennial montane streams. Montane hardwood-conifer, redwood, Douglas-fir, ponderosa pine habitats.	A	Montane streams not present in the BSA.

Common Name ***Scientific Name***	**Status[1] (Fed/State)**	**General Habitat Description**	**Habitat Assessment[2]**	**Rationale**
Northern red-legged frog (*Rana aurora*)	—/SSC	Found in humid forests, woodlands, grasslands, ponds, and streams in northwestern California. Generally near permanent water, but can be found far from water. In damp woods and meadows during non-breeding season.	**HP**	The BSA provides suitable ponded (upland ditches) and moist habitat types to support this species. Nearest CNDDB record is 1.5 miles southeast of the BSA in similar habitat type.
Foothill yellow-legged frog (*Rana boylii*)	—/SSC	Requires partly shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Need at least some cobble-sized substrate for egg laying.	A	The BSA does not support suitable rocky stream habitat to support this species.
Southern torrent salamander (*Rhyacotriton variegatus*)	—/SSC	In California, this species occurs throughout humid coastal drainages from near Pt. Arena in southern Mendocino Co., to the Oregon border along the coast and inland into the Cascade Mountains. Found in shallow, cold, clear, well-shaded streams, waterfalls and seepages, particularly those running through talus and under rocks all year, in mature to old-growth forests	A	The BSA does not provide suitable clear, cold aquatic habitat and talus to support this species.
Reptiles				
Western pond turtle (*Actinemys marmorata*)	—/SSC	Slow water aquatic habitat with emergent vegetation, or vegetated banks, and available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site. Pond turtles are not tolerant of salt-water environments.	A	The brackish water chemistry of the streams within the BSA are not suitable for this species.
Birds				
California brown pelican (*Pelecanus occidentalis californicus*)	FD/SD, FP	Nest on coastal islands of small to moderate size which afford immunity from attack by ground-dwelling predators. Roost on coastal islands and open beaches.	A	Brown pelicans use Humboldt Bay extensively in the non-breeding season for foraging, loafing, and roosting habitat. No nesting sites are known north of Monterey Bay.
white-tailed kite (*Elanus leucurus*)	—/FP	White-tailed kites are locally common residents and breeders in northern California, especially in agricultural and riparian areas of the coastal plain.	**HP**	Foraging and potential nesting habitat is present and the species has been observed in the BSA.

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Habitat Assessment[2]	Rationale
northern harrier (*Circus cyaneus*)	—/SSC	Harriers are found primarily in open grassland habitats, primarily lowland pastures and marshlands of the coastal plain.	**HP**	Foraging and potential nesting habitat is present and the species has been observed in the BSA.
short-eared owl (*Asio flammeus*)	—/SSC	Occupy open habitats such as overgrown grasslands and scrub, prairies, meadows, dunes, irrigated lands, ungrazed pastures, and both fresh and saltwater marshes.	**HP**	Migrant and winter visitors and accidental breeders in northwestern California. Suitable habitat is present in the BSA, and they are known from wetland and agricultural areas surrounding Humboldt Bay.
Yellow-breasted chat (*Icteria virens*)	—/SSC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**HP**	Riparian vegetation in northeast corner of BSA provides suitable nesting and foraging habitat.
Yellow-breasted chat (*Icteria virens*)	—/SSC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	**HP**	Riparian vegetation in northeast corner of BSA provides suitable nesting and foraging habitat.
Yellow warbler (*Setophaga petechia brewsteri*)	—/SSC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	**HP**	Riparian vegetation in northeast corner of BSA provides suitable nesting and foraging habitat.
Mammals				
Pallid bat (*Antrozous pallidus*)	—/SSC	Forages over many habitats; roosts in buildings, large oaks or redwoods, rocky outcrops and rocky crevices in mines and caves, and under bridges. Roosts must protect from high temperatures	A	BSA does not provide suitable roosting (cave, cavern, or large crevice) habitat.
White-footed vole (*Arborimus albipes*)	—/SSC	Occurs in mature coastal forests near clear streams with well-developed riparian communities in Humboldt and Del Norte Counties.	A	Mature forests do not occur within the BSA.
Sonoma tree vole (*Arborimus pomo*)	—/SSC	Mature Douglas-fir, redwood, and mixed evergreen trees in fog belt.	A	Suitable mature forest habitat is not present in the BSA.
Townsend’s big-eared bat (*Corynorhinus townsendii*)	—/SSC	Roosts in colonies in caves, mines, tunnels, or buildings in mesic habitats. The species forages along habitat edges, gleaning insects from bushes and trees. Habitat must include appropriate roosting, maternity and hibernacula sites free from disturbance by humans.	A	BSA does not provide suitable roosting (cave, cavern, or large crevice) habitat.

Common Name *Scientific Name*	Status[1] (Fed/State)	General Habitat Description	Habitat Assessment[2]	Rationale
Western red bat (*Lasiurus blossevillii*)	—/SSC	Typically roost solitarily in dense tree foliage, particularly in willows, cottonwoods, and sycamores. Typically found in riparian habitats, particularly mature stands of cottonwood/sycamore near openings over meadows. May hibernate in the duff under the deciduous riparian roost trees.	A	The BSA lacks suitable riparian and other deciduous roosting trees.
Humboldt marten (*Martes caurina humboldtensis*)	—/SSC	Humboldt marten occur in the coastal redwood forest belt from southern Oregon to Sonoma County. They are associated with mature conifer forests, and use riparian areas and stream channels as travel corridors.	A	The BSA lacks mature forest cover and does not provide suitable denning habitat.

1 Federal and State Codes: Federal Endangered (FE); Federal Threatened (FT); Federal Proposed (FP); Federal Candidate (FC), Federal Delisted (FD); Federal Species of Concern (FSC); State Endangered (SE); State Threatened (ST); State Rare (SR); State Delisted (SD); State Fully Protected (SFP); State Species of Special Concern (SSC).

2 Absent (A): No habitat present and no further work needed.
Habitat Present (HP): Habitat is, or may be present. The species may be present.
Present (P): The species is present.

Appendix D Plant Species Observed

PLANTS OBSERVED AT THE PINE HILL ROAD BRIDGE REPLACEMENT PROJECT BSA HUMBOLDT COUNTY, CALIFORNIA

Sarah Tona and Julian Colescott, Field Visit Dates: July 29–30, 2013

Scientific Name	Common Name	Family	Nativity[1]
Achillea millefolium	yarrow	Asteraceae	Native
Agrostis stolonifera	creeping bent	Poaceae	Naturalized
Angelica lucida	seacoast	Apiaceae	Native
Avena fatua	wild oat	Poaceae	Naturalized
Baccharis pilularis ssp. pilularis	coyote brush	Asteraceae	Native
Berberis sp.	Oregon grape	Berberidaceae	Native
Briza maxima	rattlesnake grass	Poaceae	Naturalized
Carex lyngbyei[2]	Lyngbye's sedge	Cyperaceae	Native
Chenopodium album	lamb's quarters	Chenopodiaceae	Naturalized
Cirsium vulgare	bull thistle	Asteraceae	Naturalized
Cotula coronopifolia	brass-buttons	Asteraceae	Naturalized
Cynodon dactylon	bermuda grass	Poaceae	Naturalized
Daucus carota	queen Anne's lace	Apiaceae	Naturalized
Deschampsia cespitosa ssp. cespitosa	tufted hairgrass	Poaceae	Native
Drymocallis glandulosa var. wrangelliana	sticky cinquefoil	Rosaceae	Native
Eleocharis macrostachya	spikerush	Cyperaceae	Native
Equisetum arvense	common horsetail	Equisetaceae	Native
Festuca arundinacea	tall fescue	Poaceae	Naturalized
Festuca perennis	rye grass	Poaceae	Naturalized
Foeniculum vulgare	fennel	Apiaceae	Naturalized
Grindelia stricta	gumweed	Asteraceae	Native
Helminthotheca echioides	bristly ox-tongue	Asteraceae	Naturalized
Heracleum maximum	cow parsnip	Apiaceae	Native
Holcus lanatus	common velvet grass	Poaceae	Naturalized
Hordeum brachyantherum	meadow barley	Poaceae	Naturalized
Hordeum marinum ssp. gussoneanum	Mediterranean barley	Poaceae	Naturalized
Hypochaeris radicata	rough cat's-ear	Asteraceae	Naturalized
Juncus bufonius	toad rush	Juncaceae	Native
Juncus effusus	soft rush	Juncaceae	Native
Leontodon taraxacoides	lesser hawkbit	Asteraceae	Naturalized
Leucanthemum vulgare	ox-eye daisy	Asteraceae	Naturalized
Lonicera involucrata var. ledebourii	coast twinberry	Caprifoliaceae	Native
Lotus corniculatus	bird's-foot trefoil	Fabaceae	Naturalized
Lupinus sp.	lupine	Fabaceae	Native
Matricaria discoidea	pineapple weed	Asteraceae	Naturalized
Plantago lanceolata	English plantain	Plantaginaceae	Naturalized
Plantago maritima	goose tongue	Plantaginaceae	Native
Poa palustris	fowl blue grass	Poaceae	Naturalized
Poa pratensis	Kentucky bluegrass	Poaceae	Naturalized

Scientific Name	Common Name	Family	Nativity[1]
Pteridium aquilinum var. pubescens	bracken fern	Dennstaedtiaceae	Native
Ranunculus repens	buttercup	Ranunculaceae	Naturalized
Raphanus sativus	radish	Brassicaceae	Naturalized
Rosa sp.	rose	Rosaceae	—
Rubus armeniacus	Himalayan blackberry	Rosaceae	Naturalized
Rumex acetosella	sheep sorrel	Polygonaceae	Naturalized
Rumex crispus	curly dock	Polygonaceae	Naturalized
Salicornia bigelovii	pickleweed	Chenopodiaceae	Native
Salix hookeriana	coastal willow	Salicaceae	Native
Scirpus microcarpus	panicled bulrush	Cyperaceae	Native
Spartina densiflora	dense-flowered cord grass	Poaceae	Naturalized
Spergularia rubra	red sand-spurrey	Caryophyllaceae	Naturalized
Symphyotrichum chilense	Pacific aster	Asteraceae	Native
Trifolium pratense	red clover	Fabaceae	Naturalized
Trifolium repens	white clover	Fabaceae	Naturalized
Triglochin maritima	common arrow-grass	Juncaginaceae	Native
Vicia sp.	vetch	Fabaceae	Naturalized

Notes:

1 Nativity designation per The Jepson Manual, 2nd edition (Baldwin et al. 2012)

2 California Rare Plant Rank (CRPR) 2.2

Appendix E Delineation of Waters of the United States and State

Pine Hill Road at Swain Slough Bridge Replacement Project

Delineation of Waters of the United States

November 2013

Prepared for:

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NSR Project No. 51473

Delineation of Waters of the United States
Pine Hill Road at Swain Slough Bridge Replacement Project

Humboldt County, California

Township 4 North, Range 1 West, Section 4

USGS Eureka, California 7.5-Minute Quadrangle

01-HUM-CR-0

BRLO 5904 (112)

November 2013

STATE OF CALIFORNIA
Department of Transportation

Prepared by: ______________________ Date: November 13, 2013
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Pine Hill Road at Swain Slough Bridge Replacement Project

Delineation of Waters of the United States

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Appendix A Routine Wetland Determination Data Forms
Appendix B Representative Photographs

1. Summary

On behalf Quincy Engineering, and the Humboldt County Department of Public Works (County), North State Resources, Inc. (NSR) conducted a delineation of waters of the United States occurring in the approximately 2.39-acre Pine Hill Road at Swain Slough Bridge Replacement Project biological study area (study area). The study area is located south of the city of Eureka, Humboldt County, California.

The field delineation was conducted on July 29, 2013. A total of 0.989 acre of waters of the United States was mapped within the study area. Waters of the United States occur as seasonal wetland (0.505 acre), vegetated ditch (0.197 acre), perennial stream (0.287 acre, 387 feet).

The purpose of this delineation is to document and describe waters of the United States in order to support a Preliminary Jurisdictional Determination from the United States Army Corps of Engineers (Corps). This delineation of waters of the United States is subject to initial review and approval by the California Department of Transportation (Caltrans) and verification by the Corps, San Francisco District. NSR advises all parties to treat the information contained herein as preliminary until the Corps provides written verification of the boundaries of its jurisdiction.

2. Project Location

The study area is located south of the city of Eureka, Humboldt County, California, southeast of the intersection of U.S. Highway 101 and Herrick Road (Attachment A, Figure 1). Specifically, the study area is located along Pine Hill Road, east of the Pine Hill/Elk River Road intersection. The study area is shown on the *Eureka, California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle; the bridge is identified by the following coordinates: Township 4 North, Range 1 West, Section 4, Humboldt Base and Meridian, and Latitude 40.752536 North by Longitude -124.182588 West, WGS84 datum.

2.1 Acreage

The study area encompasses approximately 2.39 acres.

2.2 Proximity to Major Highways and Streets

To find the study area from downtown Eureka, California, drive south on U.S. Route 101 to exit 702. Go east on Herrick Road for 0.1 mile, then turn south on Elk River Road. Turn left on Pine Hill Road and into the study area (Figure 1).

3. Environmental Setting

The study area is located in the coastal plain at the confluence of Swain Slough and Martin Slough. Swain Slough flows approximately 0.5 mile northeast before joining the Elk River, which drains directly into Humboldt Bay. Swain Slough is subject to the rise and fall of the tides, but there is a tidal gate preventing normal tidewaters from entering Martin Slough. Low levees are present along the banks of Swain Slough that prevent normal high water from entering the surrounding flat coastal plain. Pine Hill Road is also elevated several feet above the normal high tide level, but according to local residents, the road floods periodically in winter.

3.1 Current/Recent Land Use

Land use in the area is a mix of privately owned rural and residential parcels. The open grassland northwest, southwest, and southeast of the bridge is grazed by cattle, including the lands south of Pine Hill Road that are owned by the North Coast Regional Land Trust. One residence is located in the northeast section of the study area.

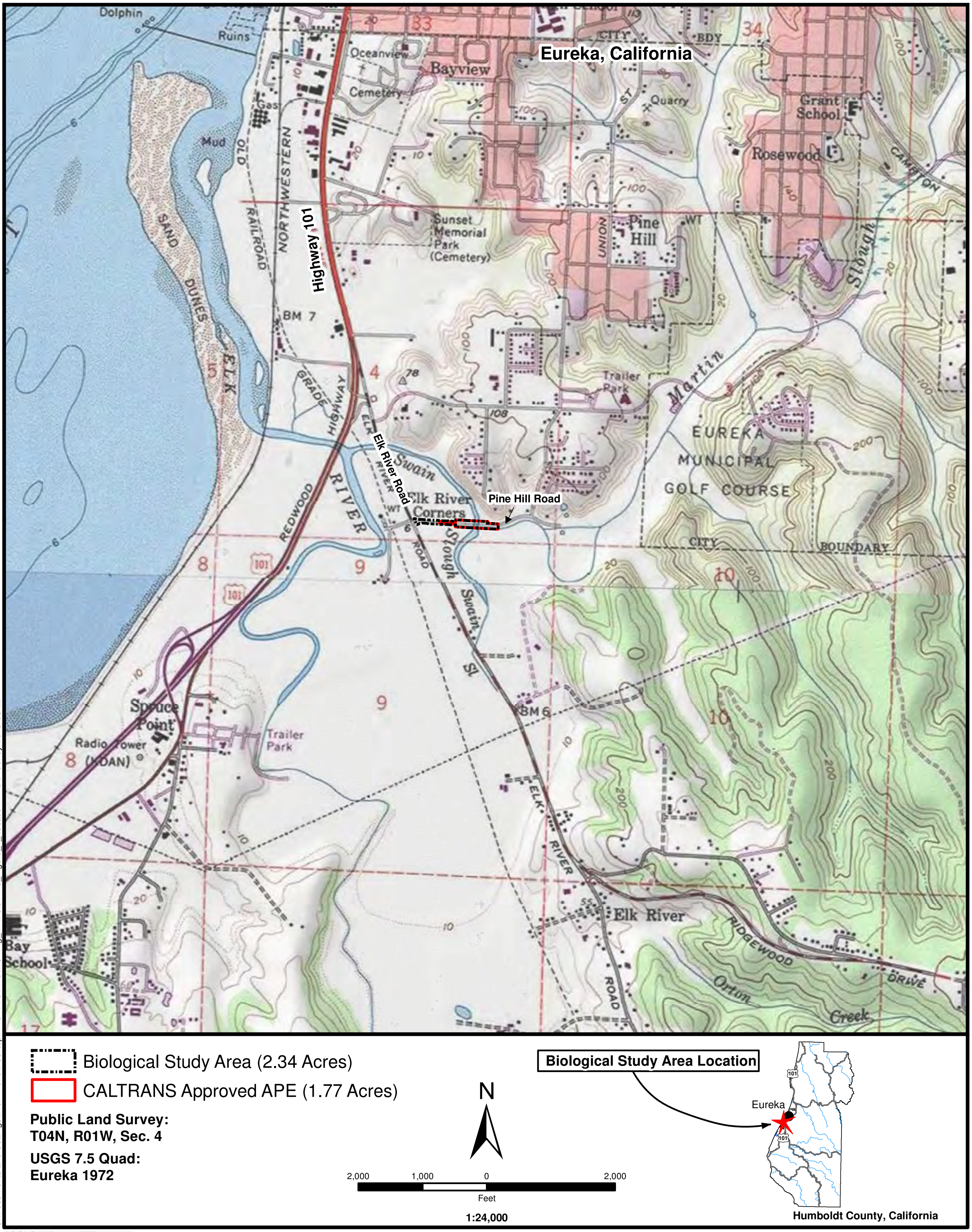
3.2 Site Topography and Elevation

The elevation within the study area is between approximately 8 and 12 feet above mean sea level, with the highest point being northeast of the bridge. The topography of the study area is nearly level with the exceptions of the levees around Swain Slough, the elevated Pine Hill Road, and the excavated ditches. The northeast corner of the study area is gently sloped at the base of a small bluff.

3.3 Climate

The climate within the study area as described below is based on information provided in the *Atlas of the Biodiversity of California* (California Department of Fish and Game 2003), historical data collected between 1948 and 2005 at Eureka, Humboldt County, California (Western Regional Climate Center 2013), and on National Weather Service statistics as reported on the Weather Underground website (Weather Underground 2013):

- *Type*: The climate within the study area is characterized by a Mediterranean Summer Fog with cool wet winters and cool foggy summers (California Department of Fish and Game 2003).
- *Precipitation*: Average annual precipitation is approximately 39.5 inches. Most precipitation falls as rain between the months of October and April (Western Regional Climate Center 2013).
- *Air Temperature*: Air temperatures range between an average January high of 55 degrees Fahrenheit (ºF), and an average September high of 63 ºF. The year-round average high temperature is approximately 59 ºF (Western Regional Climate Center 2013).
- *Growing Season*: The growing season (i.e., 50 percent probability of air temperature 28 ºF or higher) is 365 days. The soil temperature regime is Isomesic (mean soil temperature of about



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North State Resources, Inc.

Pine Hill Bridge Replacement Project

Figure 1
Biological Study Area Location and Vicinity

46 ºF with minimal fluctuation between summer and winter) (Western Regional Climate Center 2013).

- *Current Weather Condition:* No rain fell in the ten days prior to the July 30, 2013 field visit (Weather Underground 2013). The most recent rains, totaling 0.84 inch, fell between June 1 and June 20, 2013, approximately six weeks prior to the field visit.

3.4 Hydrology/Hydrologic Features

The study area is situated in the coastal plain at the base of a bluff and the foothills of the Coast Range that rise to the northeast. Swain Slough drains to Humboldt Bay, via the Elk River. Pine Hill Road is lined by roadside ditches west of the bridge. These ditches lead to larger ditches that parallel the west bank of Swain Slough.

3.5 Soil Map Units

The USDA National Resources Conservation Service (NRCS) Web Soil Survey reports the soil survey of the area has not been completed (i.e., "NOTCOM") (Figure 2).

3.6 Vegetation Communities

The vegetation communities within the study area include wet meadow, montane riparian (Meyer and Laudenslayer 1988), the roadway, and the two sloughs.

The wet meadow community occurs west of the bridge on both the north and south sides of Pine Hill Road, and east of the bridge south of the road. This herbaceous plant community is grazed by cattle and appears to be seasonally wet, with ponded water evident in winter photographs reviewed as part of this report. Drier conditions occur in the summer months. Dominant plant species observed in the wet meadow community include: tall fescue (*Festuca arundinacea*), velvetgrass (*Holcus lanatus*), Bermudagrass (*Cynodon dactylon*), creeping bentgrass (*Agrostis stolonifera*), bird's-foot trefoil (*Lotus corniculatus*), rye grass (*Festuca perennis*), red and white clover (*Trifolium pratense, T. repens*), buttercup (*Ranunculus repens*), Kentucky bluegrass (*Poa pratensis*), queen Anne's lace (*Daucus carota*), sticky cinquefoil (*Drymocallis glandulosa*), and brass-buttons (*Cotula coronopifolia*). The grazing activities have produced several large wallows (depressions) and cattle droppings. The area has several irrigation/drainage ditches that crisscross the community.

The montane riparian community is present only in a small area northeast of the bridge, between Swain Slough and a house located north of the narrower eastern end of the study area. This community is an impenetrable patch of vegetation, dominated by Himalayan blackberry (*Rubus armeniacus*), coast twinberry (*Lonicera involucrata*), Oregon grape (*Berberis* sp.), coyote brush (*Baccharis pilularis*), coastal willow (*Salix hookeriana*), cow parsnip (*Heracleum maximum*), and rose (*Rosa sp.*). This community is sloped toward Swain Slough and is well drained.

The roadway includes the paved road surface, the shoulders and the ditches on either side of the road. The road is built on a road base that is slightly elevated above the level of the wet meadow described above, and the ditches are excavated to a depth of several feet below the elevation of the surrounding wet meadow. Barbed wire fence is constructed at the outer edges of the Pine Hill Road easement, and

Biological Study Area
CALTRANS Approved APE
Soils
NOT COM -- Mapping not complete

N

200 100 0 200
Feet
1 inch equals 200 feet

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North State Resources, Inc.

Pine Hill Bridge Replacement Project

Figure 2
Soils

there is a slight rise between the roadside ditches and the fence that is largely vegetated by coyote brush, tufted hair grass (*Deschampsia cespitosa* ssp *cespitosa*), and lamb's quarters (*Chenopodium album*). The ditch vegetation is more emergent due to the continuously saturated conditions found there. Species observed in the ditch include: saltwort (*Salicornia bigelovii*), arrow grass (*Triglochin maritima*), tall fescue, lamb's quarters, and brass-buttons.

Small reaches of both Swain Slough and Martin Slough occur within the study area. Swain Slough is an approximately 60- to 80-foot-wide water feature that drains the eastern portion of the Elk River floodplain and the surrounding hills to the east (see Figure 1). Waters within the feature are assumed to be brackish based on observed low-tide flow (i.e., fresh water) going out to Humboldt Bay, and high-tide flow (salt water) filling the feature as it flows inland. The feature has an unvegetated mud bottom except near the banks, where it is vegetated with Lyngbye's sedge (*Carex lyngbyei*) and dense flowered cordgrass (*Spartina densiflora*) within the ordinary high water mark (OHWM).

Martin Slough is very similar to Swain Slough in that it is an unvegetated mud bottom feature except for the banks near the OHWM, which are also vegetated with Lyngbye's sedge and dense flowered cordgrass. The difference between the two sloughs is that the reach of Martin Slough within the study area has been channelized and is straight, and the tidal influence is limited by a tide gate located at the confluence with Swain Slough.

4. Methods

4.1 Field Delineation

The on-site routine delineation of wetlands and other waters of the United States was based on field observations of positive indicators for wetland vegetation, hydrology, and soils; and indicators of an OHWM. This methodology is consistent with the approach outlined in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (U.S. Army Corps of Engineers 2010). Taxonomic nomenclature for plant species is in accordance with *The Jepson Manual: Vascular Plants of California* (Baldwin et al. 2012). Wetland indicator status for plant species was confirmed using *The National Wetland Plant List* (Lichvar 2012), and the "50/20 Rule" was applied to determine plant dominance (U.S. Army Corps of Engineers 2010). Presence of primary and secondary wetland hydrology indicators were documented for each wetland feature.

A soil pit was dug in each representative wetland feature. Soil pits were dug to a depth sufficient to document the presence or confirm the absence of hydric soil or hydrology indicators. Soils were examined in order to assess field indicators of hydric soils. Positive indicators of hydric soils were observed in the field in accordance with the criteria outlined in *Field Indicators of Hydric Soils in the United States* (Vasilas et al. 2010). Soil colors were determined using a Munsell® soil color chart. At least one set of data points was selected to best represent the wetland feature type and the adjacent uplands. Data points were also placed in suspect areas to confirm wetland or upland status.

Other waters are Traditional Navigable Waters and their tributaries. Delineation of other waters was based on presence of an OHWM as defined in Corps regulations (33 CFR 328.3 and 33 CFR 328.4) and whether the feature qualifies as tributary to waters of the United States. Physical characteristics of an OHWM include, but are not limited to, a natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, presence of litter and debris, leaf litter disturbed or washed away, scour, deposition, presence of bed and bank, and water staining. At least one data point was selected to best represent the OHWM of other waters for each other waters type.

Twelve data points were selected to characterize and document each wetland or other water feature type, and the adjacent upland. Field observations were conducted on July 30, 2013.

The boundaries of delineated features and the associated data points were mapped using a Trimble Pathfinder Pro XH Global Positioning System (GPS) capable of sub-foot accuracy. All data points were also mapped using the Trimble GPS unit. The GPS and hand-drawn location data were overlaid onto an aerial photograph of the study area to develop the delineation map.

To assist with project planning, seventeen cross section transects were installed at 50-foot intervals starting 100 feet west of the bridge. Each transect corresponds to the width of the County's right-of-way (i.e., fence to fence). The transect start and end points were recorded with the GPS unit, and the start and end intersect points of each wetland feature along the transects were measured with a meter measuring tape and recorded. The GPS location data and the measurements were overlaid onto the delineation map (Figure 3).

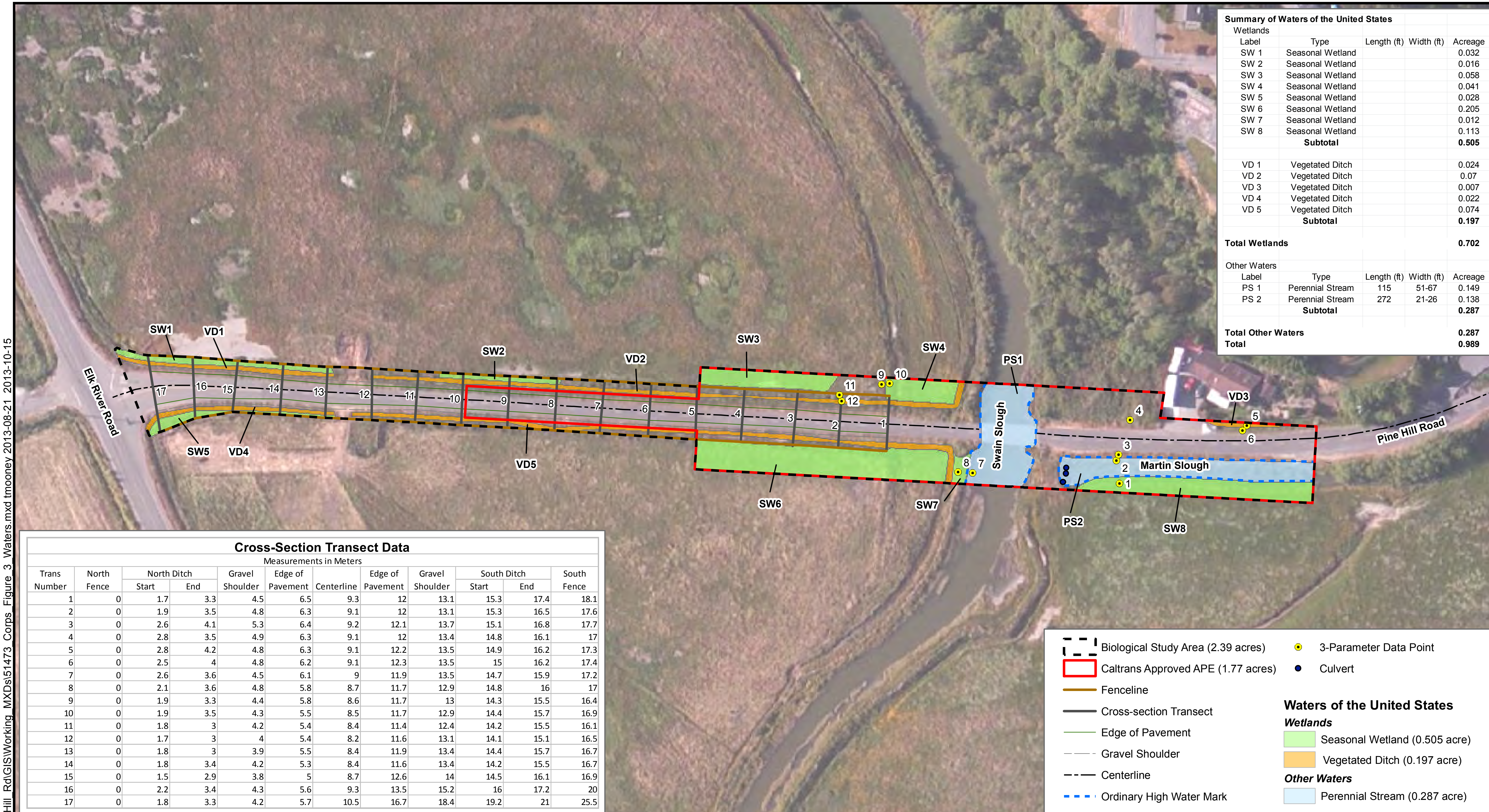
5. Results and Discussion

Three types of wetland features were delineated within the study area including: 1) the two sloughs (totaling 0.287 acres and 387 linear feet); 2) seasonal wetland (0.505 acres); and 3) vegetated ditch (0.197 acres). Representative photographs of the wetland features are provided in Appendix A; wetland determination data forms are provided in Appendix B.

Swain Slough and Martin Slough

The physical characteristics of Swain Slough and Martin Slough are described above. The boundaries of these features were delineated using the three-parameter data collected, focusing on the hydrological indicators. The work spanned the period between low and high tide, so the inflow and retreat of tidal waters was observed. The high tide crest fell very near to the sediment stain on vegetation along the bank; the high water mark was delineated at the upper extent of this staining (Appendix B, Photograph 6).

Data Point (DP) 7 and 8 document Swain Slough and the adjacent seasonal wetland feature. DP 7 documents the vegetated bank of the slough below the high water mark. This location is vegetated with Lyngbye's sedge, and has silty clay hydric soils with a strong sulfidic odor. As mentioned above, the vegetation along the bank is stained by sediment that identifies the high tide level and OHWM. The July tide table for Eureka (available at http://tides.mobilegeographics.com) reveals that



Summary of Waters of the United States

Wetlands

Label	Type	Length (ft)	Width (ft)	Acreage
SW 1	Seasonal Wetland			0.032
SW 2	Seasonal Wetland			0.016
SW 3	Seasonal Wetland			0.058
SW 4	Seasonal Wetland			0.041
SW 5	Seasonal Wetland			0.028
SW 6	Seasonal Wetland			0.205
SW 7	Seasonal Wetland			0.012
SW 8	Seasonal Wetland			0.113
	Subtotal			**0.505**
VD 1	Vegetated Ditch			0.024
VD 2	Vegetated Ditch			0.07
VD 3	Vegetated Ditch			0.007
VD 4	Vegetated Ditch			0.022
VD 5	Vegetated Ditch			0.074
	Subtotal			**0.197**
Total Wetlands				**0.702**

Other Waters

Label	Type	Length (ft)	Width (ft)	Acreage
PS 1	Perennial Stream	115	51-67	0.149
PS 2	Perennial Stream	272	21-26	0.138
	Subtotal			**0.287**
Total Other Waters				**0.287**
Total				**0.989**

Cross-Section Transect Data

Measurements in Meters

Trans Number	North Fence	North Ditch Start	North Ditch End	Gravel Shoulder	Edge of Pavement	Centerline	Edge of Pavement	Gravel Shoulder	South Ditch Start	South Ditch End	South Fence
1	0	1.7	3.3	4.5	6.5	9.3	12	13.1	15.3	17.4	18.1
2	0	1.9	3.5	4.8	6.3	9.1	12	13.1	15.3	16.5	17.6
3	0	2.6	4.1	5.3	6.4	9.2	12.1	13.7	15.1	16.8	17.7
4	0	2.8	3.5	4.9	6.3	9.1	12	13.4	14.8	16.1	17
5	0	2.8	4.2	4.8	6.3	9.1	12.2	13.5	14.9	16.2	17.3
6	0	2.5	4	4.8	6.2	9.1	12.3	13.5	15	16.2	17.4
7	0	2.6	3.6	4.5	6.1	9	11.9	13.5	14.7	15.9	17.2
8	0	2.1	3.6	4.8	5.8	8.7	11.7	12.9	14.8	16	17
9	0	1.9	3.3	4.4	5.8	8.6	11.7	13	14.3	15.5	16.4
10	0	1.9	3.5	4.3	5.5	8.5	11.7	12.9	14.4	15.7	16.9
11	0	1.8	3	4.2	5.4	8.4	11.4	12.4	14.2	15.5	16.1
12	0	1.7	3	4	5.4	8.2	11.6	13.1	14.1	15.1	16.5
13	0	1.8	3	3.9	5.5	8.4	11.9	13.4	14.4	15.7	16.7
14	0	1.8	3.4	4.2	5.3	8.4	11.6	13.4	14.2	15.5	16.7
15	0	1.5	2.9	3.8	5	8.7	12.6	14	14.5	16.1	16.9
16	0	2.2	3.4	4.3	5.6	9.3	13.5	15.2	16	17.2	20
17	0	1.8	3.3	4.2	5.7	10.5	16.7	18.4	19.2	21	25.5

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(Fax) (707) 445-7409

Notes:

Delineator: Julian Colescott (PWS No. 1920)
Delineation Date: July 29, 2013
Orthophotography: Bing Maps Aerial

This delineation of waters of the United States is subject to verification by the U.S. Army Corps of Engineers (Corps). NSR advises all parties that the delineation is preliminary until the Corps provides a written verification.

Pine Hill Bridge Replacement Project

Figure 3
Waters of the United States
October 15, 2013

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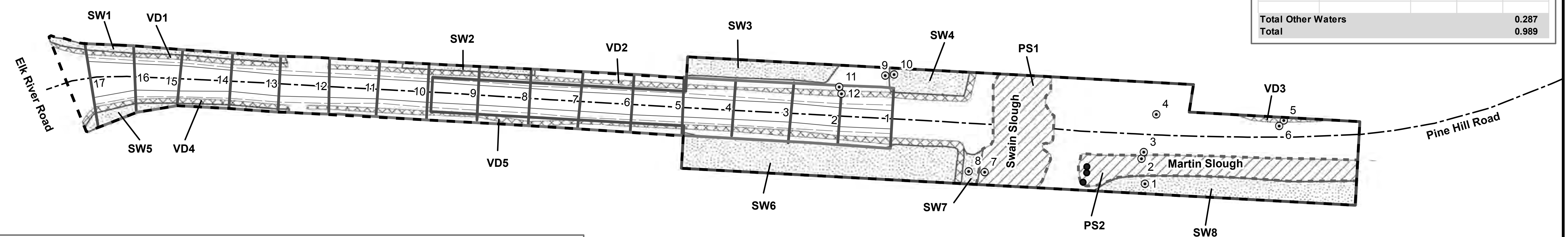
Summary of Waters of the United States				
Wetlands				
Label	Type	Length (ft)	Width (ft)	Acreage
SW 1	Seasonal Wetland			0.032
SW 2	Seasonal Wetland			0.016
SW 3	Seasonal Wetland			0.058
SW 4	Seasonal Wetland			0.041
SW 5	Seasonal Wetland			0.028
SW 6	Seasonal Wetland			0.205
SW 7	Seasonal Wetland			0.012
SW 8	Seasonal Wetland			0.113
	Subtotal			**0.505**
VD 1	Vegetated Ditch			0.024
VD 2	Vegetated Ditch			0.07
VD 3	Vegetated Ditch			0.007
VD 4	Vegetated Ditch			0.022
VD 5	Vegetated Ditch			0.074
	Subtotal			**0.197**
Total Wetlands				**0.702**
Other Waters				
Label	Type	Length (ft)	Width (ft)	Acreage
PS 1	Perennial Stream	115	51-67	0.149
PS 2	Perennial Stream	272	21-26	0.138
	Subtotal			**0.287**
Total Other Waters				**0.287**
Total				**0.989**



Cross-Section Transect Data											
Measurements in Meters											
Trans Number	North Fence	North Ditch		Gravel Shoulder	Edge of Pavement	Centerline	Edge of Pavement	Gravel Shoulder	South Ditch		South Fence
		Start	End						Start	End	
1	0	1.7	3.3	4.5	6.5	9.3	12	13.1	15.3	17.4	18.1
2	0	1.9	3.5	4.8	6.3	9.1	12	13.1	15.3	16.5	17.6
3	0	2.6	4.1	5.3	6.4	9.2	12.1	13.7	15.1	16.8	17.7
4	0	2.8	3.5	4.9	6.3	9.1	12	13.4	14.8	16.1	17
5	0	2.8	4.2	4.8	6.3	9.1	12.2	13.5	14.9	16.2	17.3
6	0	2.5	4	4.8	6.2	9.1	12.3	13.5	15	16.2	17.4
7	0	2.6	3.6	4.5	6.1	9	11.9	13.5	14.7	15.9	17.2
8	0	2.1	3.6	4.8	5.8	8.7	11.7	12.9	14.8	16	17
9	0	1.9	3.3	4.4	5.8	8.6	11.7	13	14.3	15.5	16.4
10	0	1.9	3.5	4.3	5.5	8.5	11.7	12.9	14.4	15.7	16.9
11	0	1.8	3	4.2	5.4	8.4	11.4	12.4	14.2	15.5	16.1
12	0	1.7	3	4	5.4	8.2	11.6	13.1	14.1	15.1	16.5
13	0	1.8	3	3.9	5.5	8.4	11.9	13.4	14.4	15.7	16.7
14	0	1.8	3.4	4.2	5.3	8.4	11.6	13.4	14.2	15.5	16.7
15	0	1.5	2.9	3.8	5	8.7	12.6	14	14.5	16.1	16.9
16	0	2.2	3.4	4.3	5.6	9.3	13.5	15.2	16	17.2	20
17	0	1.8	3.3	4.2	5.7	10.5	16.7	18.4	19.2	21	25.5

Biological Study Area (2.39 acres)
Caltrans Approved APE (1.77 acres)
Fenceline
Cross-section Transect
Edge of Pavement
Gravel Shoulder
Centerline
Ordinary High Water Mark
3-Parameter Data Point
Culvert

Waters of the United States

Wetlands

Seasonal Wetland (0.505 acre)
Vegetated Ditch (0.197 acre)

Other Waters

Perennial Stream (0.287 acre)

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Notes:

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N

0 50 100 200
Feet

Pine Hill Bridge Replacement Project

Figure 4
Waters of the United States
October 15, 2013

the afternoon high tide on July30, 2013 was 6.91 feet, 1.70 feet lower than the high tide for the month of 8.61 feet, which occurred nine days earlier on July 21.

For the purposes of this wetland delineation, the OHWM of Swain Slough is considered the upper most staining on the streambank vegetation (Appendix B, Photograph 6). This level of inundation likely occurs several times per year or more frequently depending on the tides. Looking under the bridge, sediment deposits and water stains indicating high tide or high freshwater flows are evident almost at the bottom of the bridge decking (Appendix B, Photograph 10). Stream flow data could not be located for Swain Slough, but residents of the area walking past the project site were interviewed, and reported that Pine Hill Road floods occasionally and becomes impassible. These higher flows are assumed to be "flooding events" that are above the OHWM that occurs at the high tide level.

The seasonal wetland documented by DP 8 is actually the top of the levee adjacent Swain Slough. The height of the OHWM is approximately two feet lower than the top of this levee (Appendix B, Photograph 7). This level of inundation, or perhaps the higher levels of inundation occurring with the 8.61-foot tides, appears to hydrate the feature sufficiently to maintain facultative hydrophytic vegetation, wetland hydrology (oxidized root channels), and hydric soils (depleted matrix). The seasonal wetland is further described below.

Physically, Martin Slough is similar to Swain Slough, but Martin Slough drains a larger watershed east of the study area, and has the tide gates preventing daily tidal influx. Data points 2 and 3 document Martin Slough and the adjacent upland near Pine Hill Road. Data point 1 documents the transition to seasonal wetland south of Martin Slough. The OHWM of Martin Slough is not as evident due to the blockage of tidal flows by the tide gates. Instead of sediment staining from tidal flows, shelving and changes in vegetation indicate the OHWM (Appendix B, Photograph 2).

Seasonal Wetland

Seasonal wetland occurs west of the bridge north and south of Pine Hill Road. The seasonal wetland terminates at the roadside ditch on both sides of the road. Seasonal wetland is also present east of the bridge, south of Martin Slough. The seasonal wetland was documented by DPs 1, 8, 9, 10, and 11. Data point 1 documents dominance of facultative plant species (e.g., tall fescue, rye grass, and white clover), hydric soils indicated by the depleted matrix, and marginal wetland hydrology met by oxidized root channels.

Data point 8 is described above. The significance of DP 8 is that it is located on top of the low levee next to Swain Slough and still meets the three-parameter wetland definition. The soils in that location have clay loam consistency. Smaller soil particle size results in greater capillary flow, and the wetland indicators observed at this location are assumed present due to capillary flow during high water (i.e., high tide or high winter flows) events.

Data points 9, 10, and 11 describe the seasonal wetland north of Pine Hill Road, west of the bridge. These data points document conditions on a small topographic rise west of DP 10 and north of DP 12. The rise corresponds with the line of coyote brush that parallels the roadside ditch, and is relatively narrow except in the vicinity of DP 9 where the rise is also found in the grassland north of the fence line. At DP 9 and DP 11, hydric soil indicators (depleted matrix) are present but hydrophytic vegetation is not, and this small area is shown on Figure 3 as a non-wetland on Figure 3.

Vegetated Ditch

Vegetated ditches occur in two locations: west of the bridge along the north and south sides of Pine Hill Road, and east of the bridge on the north side of the road. The ditches west of the bridge (VD1, VD2, VD3, and VD4) are one to two feet deep, vegetated, and had small pools of standing water during the July 30, 2013 site visit. Data point 12 is representative of conditions in the ditches on the west side of the bridge, and documents the dominance of obligate plant species (i.e., saltwort, arrowgrass), wetland hydrology indicators including ponding and saturation within the upper 12 inches, and hydric soils that released a hydrogen sulfide odor upon shovel entry. An OHWM was not observed in these ditches, and they are considered wetlands, not "other waters."

The vegetated ditch on the east side of the bridge (VD 5) is very different from the ditches on the west side of the bridge, because it occurs within a very shallow depression, the vegetation is mowed, and it is not clearly evident or well defined as a wetland. During the site visit, there was no ponded water or saturated soils, and the observed plants were facultative wetland species (e.g., tall fescue and buttercup) which are as likely to occur in uplands as they are in wetlands. Pine Hill Road disrupts sheetflow to Martin Slough by being located between the hillslope to the north and Martin Slough to the south. As a result, water ponds in the shallow ditch feature. In addition, a layer of clay occurs at about 16 inches below the soil surface that likely reduces the permeability of the soils helping to hold the shallow inundation that occurs during precipitation events. Hydric soils are indicated by depleted matrix; wetland hydrology is indicated by the presence of oxidized rhizospheres.

Table 1. Acreage Summary

Waters of the United States	Total Acreage	Total Linear Feet
Wetlands		
Seasonal Wetland	0.505	N/A
Vegetated Ditch	0.197	N/A
Other Waters		
Perennial Stream	0.287	387
Total Waters of the United States	**0.989**	**387**

6. Conclusion

Waters of the United States delineated within the study area occupy a total of 0.989 acre and include: seasonal wetland, vegetated ditch, and perennial stream.

The determinations concerning waters of the United States, including wetlands, were based on current conditions (i.e., normal circumstances) and made in accordance with relevant U.S. Environmental Protection Agency and Corps guidance. The determinations are subject to verification by the Corps. NSR advises all interested parties to treat the information contained herein as preliminary pending written verification of jurisdictional boundaries by the Corps.

7. References

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APPENDIX A

Routine Wetland Determination Data Forms

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 1

Feature Type SEASONAL WTLD

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/29/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) TERRACE Local relief (concave, convex, (none)) Slope % 0 - 1

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM 1 Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings
(Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? Y / N

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: MARTIN SLOUGH

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks HISTORIC FLOODPLAIN. VERY FLAT + POORLY DRAINED. SOILS HAVE HIGH CLAY CONTENT + LIKELY HOLD MOISTURE FOR LONG DURATION DURING WET SEASON 3 PARAMETER + 1 PARAMETER WTLD CRITERIA MET.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20' r)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Herb Stratum (Plot Size: 10' r)	% Cover	Species?	Status
1. Festuca arundinacae	35	Y	FAC
2. Festuca perenne	25	Y	FAC
3. Trifolium repens	20	Y	FAC
4. Cynodon dactylon	12	N	FACU
5. Lotus corniculatus	5	N	FAC
6.			
7.			
8.			
50%= 20%= Total Cover:	97		

Woody/Vine Stratum (Plot Size:)	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum 3 **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 3 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

- ____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- ____ Prevalence Index is ≤ 3.0[1]
- ____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ____ Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes:

Data Point 1

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-24"	10YR 4/2	80	7.5YR 4/6	20	C	PL	SILTY CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
__X__ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches) — Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
_____ Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
__X__ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No __✓__ Depth (inches) _____
Water Table Present? Yes _____ No __X__ Depth (inches) _____
Saturation Present? Yes _____ No __X__ Depth (inches) _____ *(includes capillary fringe)*

Wetland Hydrology? (Y) / N

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks WETLAND HYDROLOGY MET.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 2
Feature Type DITCH/STREAM

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/25/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) ______ Local relief (concave, convex, none) ______ Slope % ______
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)
Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? (Y) / N ✓

USACE Jurisdiction
Adjacent to Waters ______ Tributary to Waters X Isolated (with interstate commerce) ______ Isolated (non jurisdictional) ______
Explain: SLOUGH

Evaluation of features designated "Other Waters of the United States" MARTIN SLOUGH
Indicators: Defined bed and bank X Scour ______ Ordinary High Water Mark Mapped X Stream Width 15-18
Feature Designation: Perennial X Intermittent ______ Ephemeral ______ Blue-line on USGS Quad X Substrate MUD
Natural Drainage X Artificial Drainage ______ Navigable Water ______

Remarks CHANNELIZED STREAM AT EDGE OF FLOODPLAIN/ROAD BOUNDARY. TIDAL INFLUENCE. 15-20' WIDE. NARROW (2-4') FRINGE WILL NOT MAPPED AS SEPARATE FEATURE. (SEE PHOTOS). DP DOCUMENTS THE "OTHER WATERS" FEATURE

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20 X 10)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ______ 20%= ______ Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20 X 10')

	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= ______ 20%= ______ Total Cover:			

Herb Stratum (Plot Size: 20 X 10)

	% Cover	Species?	Status
1. Carex lyngbye	20	Y	OBL
2.			
3.			
4.			
5.			
6.			
7			
8.			
50%= 10 20%= 4 Total Cover:	20		

Woody/Vine Stratum (Plot Size: ______)

	% Cover	Species?	Status
1.			
2.			
50%= ______ 20%= ______ Total Cover:			

% Bare Ground in Herb Stratum 80 (WATER) **% Cover of Biotic Crust** Ø

Dominance Test Worksheet
Number of dominant species that are OBL, FACW, or FAC: 1 (A)
Total number of dominant species across all strata: 1 (B)
Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	______	x 1 =	______
FACW Species	______	x 2 =	______
FAC Species	______	x 3 =	______
FACU Species	______	x 4 =	______
UPL Species	______	x 5 =	______
Column Totals	______ (A)		______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators
______ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
______ Prevalence Index is ≤ 3.0[1]
______ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
______ Wetland Non-Vascular Plants[1]
______ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? (Y) / N
Notes: VEG PRESENT IN PATCHES ALONG DITCH BANK - BUT W/I OHWM. NOT DELINEATED AS SEPARATE WETLAND FEATURE.

Data Point 2

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
	NO	PIT	DUG	IN	FLOODED	DITCH	CHANNEL	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
__X__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) — Hydric Soil Present? (Y) N

Remarks SOILS FLOODED. ASSUMED HYDRIC DUE TO LONG DURATION FLOODING

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

__X__ Surface Water (A1)
__X__ High Water Table (A2)
__X__ Saturation (A3)
__X__ Water Marks (B1)
__X__ Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A**)
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A**)
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes __X__ No ____ Depth (inches) 0 - 2'
Water Table Present? Yes __X__ No ____ Depth (inches) 0
Saturation Present? Yes __X__ No ____ Depth (inches) 0 *(includes capillary fringe)*

Wetland Hydrology? (Y) / N

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks MARTIN SLOUGH. TIDE GATE EFFECTIVE IN BLOCKING TIDAL WATERS. PERENNIAL.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 3
Feature Type UPLAND

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/29/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) ROAD PRISM Local relief (concave, (convex), none) Slope % 45

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*

Are vegetation (Y) / N, soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N VEG IS MOWED

Are vegetation Y / (N), soil Y / (N) or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? Y / (N) Wetland hydrology? Y / (N) Is sampled area a wetland? Y / (N) Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks UPLAND PAIR TO DP's 1 & 2. DP LOCATED ON ROAD PRISM ABOVE MARTIN SLOUGH.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20x5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20x5)	% Cover	Species?	Status
1. Baccharis pilularis	5	Y	UPL
2. Rosa californica	2	Y	FAC
3.			
4.			
50%= 3.5 20%= 1.4 Total Cover:	7		

Herb Stratum (Plot Size: 10x5)	% Cover	Species?	Status
1. Holcus lanatus	35	Y	FAC
2. Calystegia subacaulis	20	Y	UPL
3. Festuca arundinacae	35	Y	FAC
4. Plantago lanceolata	5	N	FACU
5. Foeniculum vulgare	5	N	UPL
6.			
7			
8.			
50%= 20%= Total Cover:	100		

Woody/Vine Stratum (Plot Size: 20x5)	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum 0 **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)
Total number of dominant species across all strata: 5 (B)
Percent of dominant species that are OBL, FACW, or FAC: 60 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes: HYDROPHYTES (FAC) ARE DOMINANT.

Data Point 3

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	100	—	—	—	—	GRAVELLY LOAM - ROAD BASE	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
_____ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: __________ Depth (Inches) ______ Hydric Soil Present? Y / (N)

Remarks NON-HYDRIC SOILS IN ROAD BASE.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
_____ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No X Depth (inches) _____ Wetland Hydrology? Y (N)
Water Table Present? Yes _____ No X Depth (inches) _____
Saturation Present? Yes _____ No X Depth (inches) _____ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks NO WTLD HYDRO. INDICATORS.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 4
Feature Type UPLANDS

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) ROADSIDE Local relief (concave, convex, (none)) Slope % 3

Subregion (LRR): LRR A Lat 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N (If no, explain in Remarks.)

Are vegetation (Y) / N, soil Y / (N) or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N MOWED VEG.

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings
(Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? Y / (N) Wetland hydrology? Y / (N) Is sampled area a wetland? Y / (N) Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks SMALL SUSPECT WETLAND. DESPITE PRESENCE OF HYDROPHYTIC VEG, LOCATION IS WELL DRAINED W/ NO WETLAND HYDROLOGY OR HYDRIC SOIL INDICATORS. NON-WTLD FOR CCC OR CORPS.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10x5) IN ROADSIDE

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			

50%= ____ 20%= ____ Total Cover: ____

Sapling/Shrub Stratum (Plot Size: 10x5)

Sapling/Shrub Stratum	% Cover	Species?	Status
1. Rubus armeniacus	15	Y	FACU
2. Rosa californica	5	Y	FAC
3.			
4.			

50%= 10 20%= 4 Total Cover: 20

Herb Stratum (Plot Size: 10x5)

Herb Stratum	% Cover	Species?	Status
1. Scirpus microcarpus	30	Y	OBL
2. Ranunculus repens	15	Y	FAC
3. Holcus lanatus	5	N	FAC
4.			
5.			
6.			
7			
8.			

50%= 25 20%= 10 Total Cover: 50

Woody/Vine Stratum (Plot Size: ____)

Woody/Vine Stratum	% Cover	Species?	Status
1.			
2.			

50%= ____ 20%= ____ Total Cover: ____

% Bare Ground in Herb Stratum 50 **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 4 (B)

Percent of dominant species that are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by
OBL Species		x 1 =
FACW Species		x 2 =
FAC Species		x 3 =
FACU Species		x 4 =
UPL Species		x 5 =
Column Totals	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

- ____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- ____ Prevalence Index is ≤ 3.0[1]
- ____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ____ Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes: HYDROPHYTES DOMINATE. 50% BARE GROUND B/W VEG CLUMPS. CURRENTLY FILLED W/ MOWED CLIPPINGS.

Data Point 4

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2	100	Ø	–	–	–	LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ____ 2 cm Muck (A10)
- ____ Red Parent Materials (TF21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Vegetated Sand/Gravel Bars
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: CONCRETE - LIKE CEMENTUM Depth (Inches) 6" Hydric Soil Present? Y / (N)

Remarks CEMENTIUM HIT @ 6". NO INDICATORS OF HYDRIC SOIL.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) (**LRR A**)
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Netural Test (D5)
- ____ Raised Ant Mounds (D6) (**LRR A**)
- ____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No X Depth (inches) ____

Water Table Present? Yes ____ No X Depth (inches) ____

Saturation Present? Yes ____ No X Depth (inches) ____ *(includes capillary fringe)*

Wetland Hydrology? Y (N)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks NO INDICATORS OF WETLAND HYDROLOGY, DESPITE CEMENTUM, SLOPE IS TO THE ROAD AND MARTIN SLOUGH. LOCATION IS WELL DRAINED.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 5
Feature Type DITCH

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) ROADSIDE Local relief (concave, convex, none) DITCH Slope % 1-3
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) N *(If no, explain in Remarks.)*
Are vegetation (Y) N, soil Y /(N), or hydrology Y /(N) significantly disturbed? Are normal circumstances present? (Y) / N – VEG IS MOWED.
Are vegetation Y /(N) soil Y /(N) or hydrology Y /(N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)
Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? Y / (N)

USACE Jurisdiction
Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain:

Evaluation of features designated "Other Waters of the United States"
Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DEPRESSIONAL DITCH IN ROADSIDE. 3 PARAMETERS MEET CORPS DEFINITION AND CCC. NO OHWM OBSERVED, SO THIS IS NOT AN OTHER WATERS.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10 X 5 → IN DITCH)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 10 X 5)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Herb Stratum (Plot Size: 10 X 5)	% Cover	Species?	Status
1. Festuca arundinacea	20	Y	FAC
2. Ranunculus repens	20	Y	FAC
3. Lotus corniculatus	20	Y	FAC
4. Holcus lanatus	15	N	FAC
5. Trifolium repens	15	N	FAC
6. Equisetum arvense	2	N	FAC
7. Plantago elongata	4	N	FACW
8.			
50%= 20%= Total Cover:	100		

Woody/Vine Stratum (Plot Size:)	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum ____ **% Cover of Biotic Crust** ____

Dominance Test Worksheet
Number of dominant species that are OBL, FACW, or FAC: 3 (A)
Total number of dominant species across all strata: 3 (B)
Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators
____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? (Y) / N
Notes: DOMINANCE OF FAC HYDROPHYTES.

Data Point 5

Soils

Profile Description. (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100	—	—	—	—	COBBLE LOAM	
4-16	10YR 4/1	80	7.5YR 5/6	20	C	PL	SILTY CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
__X__ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: CLAY Depth (Inches) 16 Hydric Soil Present? (Y) / N

Remarks HYDRIC SOIL INDICATOR F3 STARTS @ 4 INCHES.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
_____ Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
__X__ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No __X__ Depth (inches) _____
Water Table Present? Yes _____ No __X__ Depth (inches) _____
Saturation Present? Yes _____ No __X__ Depth (inches) _____ *(includes capillary fringe)*

Wetland Hydrology? (Y) / N

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:
Ø

Remarks WETLAND HYDRO MET.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 6
Feature Type UPLAND

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) ROADSIDE Local relief (concave, convex, **(none)**) Slope % 1-3
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? **(Y)** N *(If no, explain in Remarks.)*
Are vegetation **(Y)** / N, soil Y / **(N)**, or hydrology Y / **(N)** significantly disturbed? Are normal circumstances present? **(Y)** / N MOWED VEG.
Are vegetation Y / **(N)**, soil Y / **(N)**, or hydrology Y / **(N)** naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)
Hydrophytic vegetation? **(Y)** / N Hydric soil? Y / **(N)** Wetland hydrology? Y / **(N)** Is sampled area a wetland? Y / **(N)** Other waters? Y / **(N)**

USACE Jurisdiction

Adjacent to Waters _____ Tributary to Waters _____ Isolated (with interstate commerce) _____ Isolated (non jurisdictional) _____
Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank _____ Scour _____ Ordinary High Water Mark Mapped _____ Stream Width _____
Feature Designation: Perennial _____ Intermittent _____ Ephemeral _____ Blue-line on USGS Quad _____ Substrate _____
Natural Drainage _____ Artificial Drainage _____ Navigable Water _____

Remarks DESPITE THE PRESENCE OF HYDROPHYTIC VEG, SOILS + HYDRO ARE NOT MET + THE DP DOCUMENTS UPLAND CONDITIONS WITH RESPECT TO CORPS JURISDICTION. CCC DETERMINATION IS ALSO NON-WETLAND DUE TO LACK OF CLEAR INDICATIONS OF WETLAND HYDROLOGY.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10 x 5 — ROADSIDE STRIP)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			

50%= _____ 20%= _____ Total Cover: _____

Sapling/Shrub Stratum (Plot Size: 10 x 5)

	% Cover	Species?	Status
1.			
2.			
3.			
4.			

50%= _____ 20%= _____ Total Cover: _____

Herb Stratum (Plot Size: 10 x 5)

	% Cover	Species?	Status
1. Cynodon dactylon	25	Y	FACU
2. Trifolium repens	20	Y	FAC
3. Lotus corniculatus	20	Y	FAC
4. Festuca arundinacea	20	Y	FAC
5. Plantago elongata	5	N	FAC
6. Rumex crispus	2	N	FAC
7. Holcus lanatus	4	N	FAC
8.			

50%= _____ 20%= _____ Total Cover: 100

Woody/Vine Stratum (Plot Size: _____)

	% Cover	Species?	Status
1.			
2.			

50%= _____ 20%= _____ Total Cover: _____

% Bare Ground in Herb Stratum Ø **% Cover of Biotic Crust** —

Dominance Test Worksheet
Number of dominant species that are OBL, FACW, or FAC: 3 (A)
Total number of dominant species across all strata: 4 (B)
Percent of dominant species that are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	_____	x 1 =	_____
FACW Species	_____	x 2 =	_____
FAC Species	_____	x 3 =	_____
FACU Species	_____	x 4 =	_____
UPL Species	_____	x 5 =	_____
Column Totals	_____ (A)		_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators
_____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
_____ Prevalence Index is ≤ 3.0[1]
_____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
_____ Wetland Non-Vascular Plants[1]
_____ Problematic Hydrophytic Vegetation[1] (Explain)
[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y)/ N
Notes:

Data Point 6

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/2	100	–	–	–	–	SANDY, GRAVELLY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
_____ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: PACKED GRAVEL Depth (Inches) 6 Hydric Soil Present? Y / (N)

Remarks SHOVEL RESISTANCE @ 6". DP IS IN ROAD SHOULDER SUBSTRATE, NON-HYDRIC.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
_____ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No X Depth (inches) _____ Wetland Hydrology? Y / (N)
Water Table Present? Yes _____ No X Depth (inches) _____
Saturation Present? Yes _____ No X Depth (inches) _____ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks NO WETLAND HYDRO INDICATORS.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 7
Feature Type SLOUGH

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) DRAINAGE Local relief (concave, convex, none) (circled: concave) Slope % 0-100
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: R2UBH

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N (If no, explain in Remarks.)
Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N
Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? (Y) / N

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters X Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain: ELK RIVER TO HUMBOLDT BAY

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank X Scour X Ordinary High Water Mark Mapped X Stream Width 40' -GPS'd
Feature Designation: Perennial X Intermittent ____ Ephemeral ____ Blue-line on USGS Quad X Substrate MUD
Natural Drainage X Artificial Drainage ____ Navigable Water ____

Remarks DP DOCUMENTS SWAIN SLOUGH. EDGES ARE VEGETATED IN MANY LOCATIONS. BANKS VARY FROM STEEP (VERTICAL) TO GRADUAL. DP IS W/I THE OHWM OF THE SLOUGH FEATURE.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20X10' - IN FEATURE)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20X10)

	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Herb Stratum (Plot Size: 20X10')

	% Cover	Species?	Status
1. Carex lyngbyei	100	Y	OBL
2.			
3.			
4.			
5.			
6.			
7			
8.			
50%= 20%= Total Cover:			

Woody/Vine Stratum (Plot Size: ____)

	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum 0 **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 1 (A)
Total number of dominant species across all strata: 1 (B)
Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] *Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) N
Notes: DP DOCUMENTS THE VEGETATED BANK OF THE SLOUGH.

Data Point 7

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	— SEE NOTES						SILTY CLAY	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
X Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) — Hydric Soil Present? (Y) / N

Remarks STRONG SULPHIDIC ODOR IN TOP 4 INCHES. SUFFICIENT TO INDICATE HYDRIC SOILS. DID NOT MAKE COLOR DETERMINATIONS.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

X Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
X Water Marks (B1)
X Sediment Deposits (B2)
X Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A**)
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A**)
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes X No ____ Depth (inches) 0 – 10' Wetland Hydrology? (Y) / N
Water Table Present? Yes X No ____ Depth (inches) 0
Saturation Present? Yes X No ____ Depth (inches) 0 *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:
Ø

Remarks OBSERVED FEATURE DURING HIGH + LOW TIDES. OHWM IS PRESENT AT TOP OF STAINING.

North State Resources, Inc.

Data Point 8
Feature Type SEASONAL WTLD

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) DITCH SPOIL PILE Local relief (concave, (convex) none) Slope % 0 - 10

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*

Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: SLOUGH

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DP ON TOP OF SPOILS PILE BETWEEN SMALL INTERIOR DITCH AND SLOUGH. ALL THREE INDICATORS MET; MEETS CCC + CORPS DEFINITION.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Herb Stratum (Plot Size: ____)	% Cover	Species?	Status
1. Pedicularis glandulosa	10	N	UPL
2. Juncus balticus	10	N	FACW
3. Lolium perennis	25	Y	FAC
4. Plantago lanceolata	10	N	FACU
5. Lotus corniculatus	20	Y	FAC
6. Rumex crispus	5	N	FAC
7. Calamagrostis rubescens	25	Y	FAC*
8. Daucus carota	10	N	FACU
50%= 57.5 20%= 23.0 Total Cover:	115		

Woody/Vine Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum Ø **% Cover of Biotic Crust** —

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 3 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	____	x 1 =	____
FACW Species	____	x 2 =	____
FAC Species	____	x 3 =	____
FACU Species	____	x 4 =	____
UPL Species	____	x 5 =	____
Column Totals	____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

- ____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- ____ Prevalence Index is ≤ 3.0[1]
- ____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ____ Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? (Y) / N

Notes: Calamagrostis is NOT LISTED IN LICHVAR, BUT OTHER CALAMAGROSTIS ARE FAC OR FACW. BPJ USED IN "FAC" DETERMINATIONS.

Data Point 4

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/2	100	—	—	—	—	PEATY LOAM	
2-20	10YR 4/2	80	7.5YR 4/6	20	C	PL	CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ____ Loamy Gleyed Matrix (F2)
- _X_ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ____ 2 cm Muck (A10)
- ____ Red Parent Materials (TF21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Vegetated Sand/Gravel Bars
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches) — Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS UNDER THIN PEAT LAYER.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- _X_ Oxidized Rhizospheres (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) (**LRR A**)
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Netural Test (D5)
- ____ Raised Ant Mounds (D6) (**LRR A**)
- ____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No _X_ Depth (inches) ____ Wetland Hydrology? (Y) / N

Water Table Present? Yes ____ No _X_ Depth (inches) ____

Saturation Present? Yes ____ No _X_ Depth (inches) ____ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks HYDROLOGY PARAMETER IS MET.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point: 9
Feature Type: UPLAND - SEE NOTES.

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range: Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.): terrace (circled) Local relief (concave, convex, none): convex (circled) Slope %: 3-5

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM 1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? Y (circled) / N (If no, explain in Remarks.)

Are vegetation Y / N (circled), soil Y / N (circled), or hydrology Y / N (circled) significantly disturbed? Are normal circumstances present? Y (circled) / N

Are vegetation Y / N (circled), soil Y / N (circled), or hydrology Y / N (circled) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? Y / N (circled) Hydric soil? Y (circled) / N Wetland hydrology? Y (circled) / N Is sampled area a wetland? Y / N (circled) Other waters? Y / N (circled)

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DP DOES NOT MEET VEG. PARAMETER, BUT DOES MEET SOILS + HYDROLOGY. THEREFORE, THIS SMALL "BUMP" IN THE PASTURE IS NOT A CORPS WTLD, BUT IS A CCC REGULATED FEATURE.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10 x 10')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 10 x 10)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Herb Stratum (Plot Size: 10 x 10)	% Cover	Species?	Status
1. Achillea millefolium	20	Y	FACU
2. Daucus carota	25	Y	FACU
3. Lotus corniculatus	15	Y	FAC
4. Festuca perennis	15	Y	FAC
5. Agrostis stolonifera	10	N	FAC
6. Aster chilensis	5	N	UPL
7. Calamagrostis rubescens	10	N	FAC*
8.			
50%= 50 20%= 20 Total Cover:	100		

Woody/Vine Stratum (Plot Size:)	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum 10 **% Cover of Biotic Crust** 0

* SEE note on DP8

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 4 (B)

Percent of dominant species that are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	0	x 1 =	0
FACW Species	0	x 2 =	0
FAC Species	50	x 3 =	150
FACU Species	45	x 4 =	180
UPL Species	5	x 5 =	25
Column Totals	100 (A)		355 (B)

Prevalence Index = B/A = 3.55

Hydrophytic Vegetation Indicators

___ Rapid Test for Hydrophytic Vegetation
N Dominance Test is >50%
N Prevalence Index is ≤ 3.0[1]
___ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
___ Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Y / N (circled)

Notes:

Data Point 9

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	98	7.5YR 4/6	2	C	PL	Clay Loam	
6-16	10YR 4/2	85	7.5YR 4/6	15	C	PL	Clay loam	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ____ Loamy Gleyed Matrix (F2)
- _X_ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ____ 2 cm Muck (A10)
- ____ Red Parent Materials (TF21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Vegetated Sand/Gravel Bars
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) Ø Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- _X_ Oxidized Rhizospheres (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) (**LRR A**)
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Netural Test (D5)
- ____ Raised Ant Mounds (D6) (**LRR A**)
- ____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No _X_ Depth (inches) ____ Wetland Hydrology? (Y) / N

Water Table Present? Yes ____ No _X_ Depth (inches) ____

Saturation Present? Yes ____ No _X_ Depth (inches) ____ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks WETLAND HYDROLOGY MET.

North State Resources, Inc.

Data Point 10

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Feature Type SEASONAL WTLD

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, (terrace), etc.) Local relief (concave, convex, (none)) Slope % 3

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM 1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*

Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: SLOUGH

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks 3 PARAMETERS MET.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Herb Stratum (Plot Size: 10x10)	% Cover	Species?	Status
1. Cynodon dactylon	50	Y	FACU
2. Calamagrostis rubescens	20	Y	FAC*
3. Lotus corniculatus	20	Y	FAC
4. Triglochin maritimum	10	N	OBL
5. Lolium perenne	5	N	FAC
6. Calystegia subacaulis	10	N	UPL
7. Potentilla glandulosa	5	N	FAC
8.			
50%= 60 20%= 24 Total Cover:	120		

Woody/Vine Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

* See note in DP8

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 3 (B)

Percent of dominant species that are OBL, FACW, or FAC: 66.6 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	____	x 1 =	____
FACW Species	____	x 2 =	____
FAC Species	____	x 3 =	____
FACU Species	____	x 4 =	____
UPL Species	____	x 5 =	____
Column Totals	____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation

Y Dominance Test is >50%

____ Prevalence Index is ≤ 3.0[1]

____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)

____ Wetland Non-Vascular Plants[1]

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes: VEG DOMINATED BY FACU, BUT 2 FAC SPECIES ALSO DOMINANT. VEG IS MARGINALLY HYDROPHYTIC.

Data Point 10

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/2	80	7.5YR 4/6	20	C	PL	SILTY CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches): — Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
X Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A**)
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A**)
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No X Depth (inches) ____
Water Table Present? Yes ____ No X Depth (inches) ____
Saturation Present? Yes ____ No X Depth (inches) ____ *(includes capillary fringe)*

Wetland Hydrology? (Y) / N

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks HOLE DUG ADJ. TO FLOODED DITCH, BUT NO SATURATION OBSERVED. REGARDLESS, HYDRO PARAMETER IS MET BY INDICATOR C3.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point: 11
Feature Type: upland

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7-30-13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range: Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): convex Slope %: 0
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: PEM 1 Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N (*If no, explain in Remarks.*)
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? (*If needed, explain in Remarks.*)

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? Y / (N) Hydric soil? (Y) / N Wetland hydrology? Y / (N) Is sampled area a wetland? Y / (N) Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ______
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ______
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DP represents a high point located between Pine Hill Road and a pasture (seasonal wetland). Coyote brush grows in a strip alongside Pine Hill Rd and a vegetated ditch. Feature has hydric soils, but does not have hydrophytic vegetation or hydrology.

Vegetation (Use Scientific Names)

Stratum / Species	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: ____)			
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			
Sapling/Shrub Stratum (Plot Size: 10' x 10')			
1. Baccharis pilularis	50	Y	UPL
2. Rubus ursinus	10	N	FACU
3.			
4.			
50%= 30 20%= 12 Total Cover:	60		
Herb Stratum (Plot Size: 10 by 10)			
1. Deschampsia cespitosa	50	Y	FACW
2. Cirsium vulgare	5	N	UPL
3. Achillea millefolium	5	N	FACU
4.			
5.			
6.			
7.			
8.			
50%= 30 20%= 12 Total Cover:	60		
Woody/Vine Stratum (Plot Size: ____)			
1.			
2.			
50%= ____ 20%= ____ Total Cover			

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust 0

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 1 (A)
Total number of dominant species across all strata: 2 (B)
Percent of dominant species that are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	–	x 1 =	–
FACW Species	50	x 2 =	100
FAC Species	–	x 3 =	
FACU Species	15	x 4 =	60
UPL Species	55	x 5 =	275
Column Totals	120 (A)		435 (B)

Prevalence Index = B/A = 3.6

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation
____ Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? Y / (N)
Notes: NON-HYDROPHYTIC VEG IS DOMINANT

Data Point 11

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	7.5YR 3/2	90	5YR 4/6	10	C	PL	clay loam	
5-16	7.5YR 3/2	60	5YR 4/6	40	C	PL	Clay loam	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
__X__ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) ______ Hydric Soil Present? (Y) / N

Remarks Hydric soils present

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
_____ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain In Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No X Depth (inches) — Wetland Hydrology? Y / (N)
Water Table Present? Yes _____ No X Depth (inches) —
Saturation Present? Yes _____ No X Depth (inches) — *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks Hydrology indicators are absent.

North State Resources, Inc.

Data Point 12
Feature Type ROADSIDE DITCH

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) DITCH Local relief (concave, convex, none) [concave circled] Slope % 0 - 10

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM 1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) N *(If no, explain in Remarks.)*

Are vegetation Y (N), soil Y (N), or hydrology Y (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y (N), soil Y (N), or hydrology Y (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) N Hydric soil? (Y) N Wetland hydrology? (Y) N Is sampled area a wetland? (Y) N Other waters? Y (N)

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters X Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: TO SLOUGH

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks NO OHWM OBSERVED. THIS ROADSIDE DITCH APPEARS TO FLOW VERY SLOWLY IF AT ALL, SO IT IS DELINEATED AS A WETLAND, NOT AN OTHER WATERS.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20x4 – IN DITCH)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			
Sapling/Shrub Stratum (Plot Size: 20x4)	**% Cover**	**Species?**	**Status**
1.			
2. NO SHRUBS IN DITCH			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			
Herb Stratum (Plot Size: ____)	**% Cover**	**Species?**	**Status**
1. Arthrocnemum subterminale	35	Y	OBL
2. Triglochin maratima (ARROW GRASS)	35	Y	OBL
3. Festuca arundinacea	15	N	FAC
4. Agrostis stolonifera	10	N	FAC
5. Calystegia subacaulis	5	N	UPL
6.			
7.			
8.			
50%= ____ 20%= ____ Total Cover:	100		
Woody/Vine Stratum (Plot Size: ____)	**% Cover**	**Species?**	**Status**
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum Ø % Cover of Biotic Crust Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 2 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	____	x 1 =	____
FACW Species	____	x 2 =	____
FAC Species	____	x 3 =	____
FACU Species	____	x 4 =	____
UPL Species	____	x 5 =	____
Column Totals	____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

- ____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- ____ Prevalence Index is ≤ 3.0[1]
- ____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ____ Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) N

Notes: VEG DATA FROM W/I DITCH.

Data Point 12

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	— SEE NOTES —							

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
X Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches) Ø Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

X Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
____ Water Marks (B1)
X Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A**)
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A**)
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes X No ____ Depth (inches) 0-5" Wetland Hydrology? (Y) / N
Water Table Present? Yes X No ____ Depth (inches) 0
Saturation Present? Yes X No ____ Depth (inches) 0 *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:
Ø

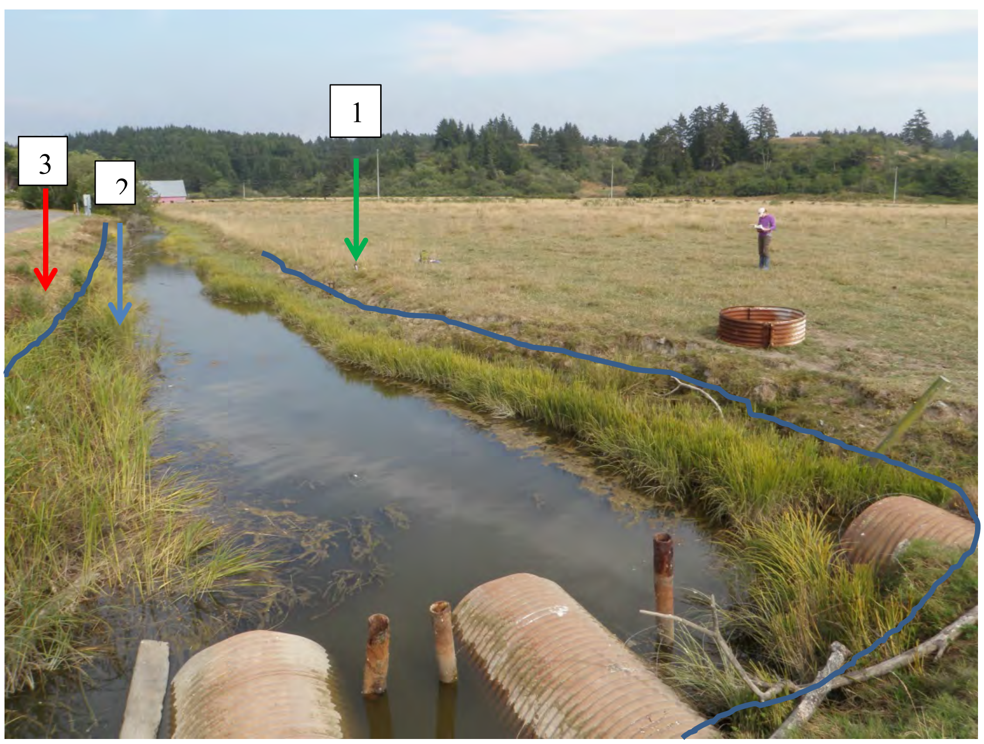
Remarks WETLAND HYDRO MET.

APPENDIX B

Representative Photographs

Photographs taken July 30, 2013

Photograph 1. Looking west. Data point 1 (shovel) documents seasonal wetland above the Martin Slough OHWM.



Photograph 2. Looking east southeast at Martin Slough. DPs 1, 2 and 3 (arrows) document seasonal wetland (No. 1), Martin Slough (No. 2), and adjacent upland (No. 3). The blue line indicates the OHWM of Martin Slough.

Photograph 3. Looking west at Martin Slough and DP 2 (shovel) and DP 3 (orange GPS case).

Photograph 4. Looking west at DP 4. This suspect wetland area is dominated by marginal hydrophytic plants, but lacks evidence of hydric soils or wetland hydrology. The non-wetland area drains toward the road and Martin Slough.

Photograph 5. Looking west at DP 5 (shovel) and DP 6 (bookbag) which document the vegetated ditch (VD 5) on the east end of the study area. The bridge is in the background.

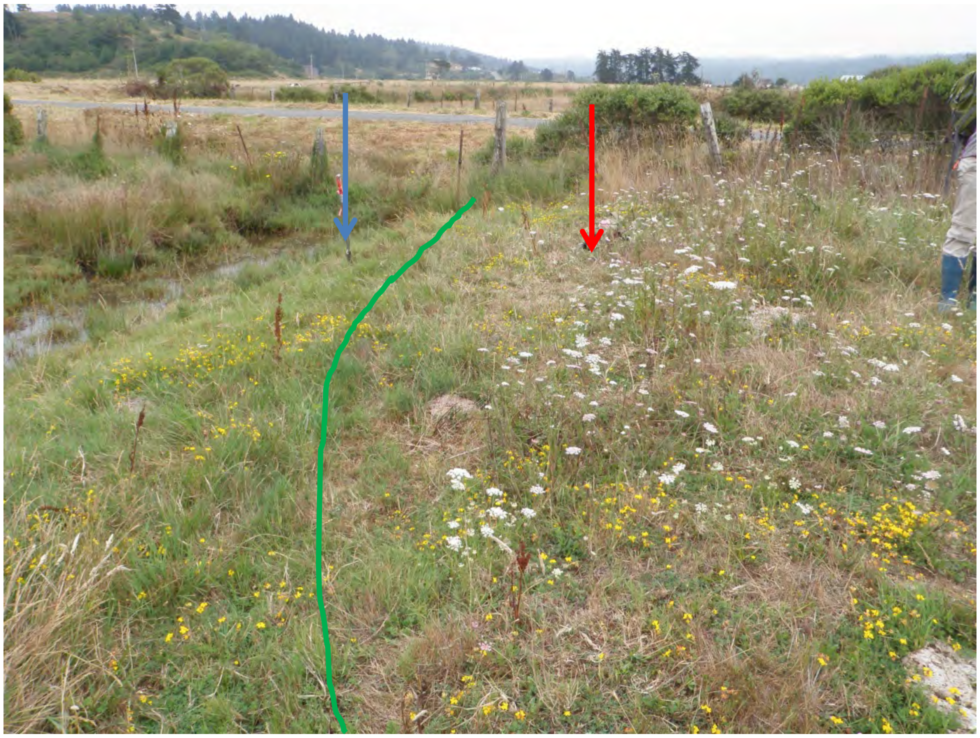
Photograph 6. Looking south at Swain Slough from the bridge. The sediment staining on the vegetation marks the high tide line and identifies the OWHM within the channel.

Photograph 7. Looking north northeast at DP 7 (blue arrow) and 8 (green arrow) documenting Swain Slough and the adjacent seasonal wetland, respectively.

Photograph 8. Soils from DP 8. The depleted matrix and redox features are clearly evident.

Photograph 9. Looking south. High tide.

Photograph 10. Looking north at the west bridge footing. Note the sediment deposits and watermarks (blue arrow), and the drift on the pipe in the background. These high marks indicate the monthly high tide of 8.61 feet. The green arrow indicates the 6.91-foot high tide observed on July 30, 2013. This photograph was taken between high and low tide.



Photograph 11. Looking southeast. Data Points 9 (red arrow) and 10 (blue arrow) document the seasonal wetland (left) – upland (right) boundary. Hydric soil and wetland hydrology indicators are present at DP 9, but at a depth (6 inches) that does not support dominant hydrophytic vegetation.

Photograph 11. Looking northwest. Data Points 11 (red arrow) and 12 (shovel) document the coyote brush covered upland and the roadside ditch, respectively.

North State Resources, Inc.

November 13, 2013

Humboldt County Department of Public Works
Attn: Andrew Bundschuh
1106 Second Street
Eureka, CA 95501-0579

SUBJECT: Preliminary Determination of Wetland Status Under the California Coastal Act for the Pine Hill Road at Swain Slough Bridge Replacement Project Study Area in Humboldt County, California (NSR Project No. 51473)

Dear Mr. Bundschuh:

North State Resources, Inc. (NSR) conducted a delineation of wetlands that may be subject to regulation under the California Coastal Act of 1976 (Coastal Act) for the approximately 2.39-acre Pine Hill Road at Swain Slough Bridge Replacement Project biological study area (study area). The study area is located south of the city of Eureka on Pine Hill Road, east of U.S. Highway 101 and Elk River Road, Humboldt County, California (Attachment A, Figure 1).

Summary

The study area is geographically located at the confluence of Swain Slough and Martin Slough; both are slow moving features of brackish water that are subject to the rise and fall of the tides. The slough confluence occurs within a low elevation coastal plain that is frequently flooded. As a result, much of the land within the study area meets the Corps three-parameter wetland criteria, and the one-parameter criteria under the Coastal Act definition. Based on field observations and data evaluated in this report, it was determined that the wetland boundaries for purposes of the Coastal Act exceed the wetland boundaries for purposes of the Clean Water Act. Coastal Act wetland features include both Swain Slough (0.149 acre; 115 linear feet) and Martin Sloughs (0.138 acre; 272 linear feet), seasonal wetlands (totaling 0.681 acre), and vegetated ditch (0.197 acre) located adjacent to the road east and west of the bridge.

Background

One of the roles of the California Coastal Commission (CCC) in implementing the Coastal Act is to regulate the diking, filling, or dredging of wetlands within the coastal zone. Section 30121 of the Coastal Act defines the term “wetland” as:

> *Lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens.*

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The CCC has provided further specificity for the definition of wetlands, and the CCC administrative regulations (14 CCR Section 13577) define wetlands as:

> *Wetlands shall be defined as land where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitats.*

In practice, the CCC definition establishes a "one parameter" approach that only requires evidence of a single parameter to establish wetland conditions (i.e., hydrology, hydrophytic vegetation, or hydric soils). This contrasts with the Corps' approach which requires all three parameters to be present to qualify an area as a wetland. It is important to note, however, that the 1981 *Statewide Interpretive Guidelines* prepared by the CCC state that hydric soils and hydrophytic vegetation "are useful indicators of wetland conditions, but the presence or absence of hydric soils and/or hydrophytes alone are not necessarily determinative when the CCC identifies wetlands under the Coastal Act." This acknowledges that determination of wetland status is not always easily identifiable by a simple one-parameter approach, and provides the CCC with the discretion to consider multiple factors (e.g., soil characteristics, hydrology, size, landscape position) and to rely on professional judgment in making wetland determinations.

Location of the Study Area

The study area is located south of the city of Eureka, Humboldt County, California, southeast of the intersection of U.S. Highway 101 and Elk River Road (Attachment A, Figure 1). Specifically, the study area is located along Pine Hill Road, east of the Pine Hill/Elk River Road intersection. The study area is shown on the *Eureka, California* U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle; the bridge is identified by the following coordinates: Township 4 North, Range 1 West, Section 4, Humboldt Base and Meridian, and Latitude 40.752536 North by Longitude -124.182588 West, WGS84 datum.

Environmental Setting

The study area is located in the coastal plain at the confluence of Swain Slough and Martin Slough. Swain Slough flows approximately 0.5 mile northeast before joining the Elk River, which drains directly into Humboldt Bay. Swain Slough is subject to the rise and fall of the tides, but there is a tidal gate preventing normal tidewaters from entering Martin Slough. Low levees are present along the banks of Swain Slough that prevent normal high water from entering the surrounding flat coastal plain. Pine Hill Road is also elevated several feet above the normal high tide level, but according to local residents, the road floods periodically in winter.

Land use in the area is a mix of rural and residential. The open grassland on the northwest, southwest, and southeast sides of the bridge is grazed by cattle. Lands south of Pine Hill Road are owned by the North Coast Regional Land Trust. One residence is located in the northeast section of the study area.

Elevation and Topography

The elevation within the study area is between approximately 8 and 12 feet above mean sea level, with the highest point being northeast of the bridge. The topography of the study area is nearly level with the exceptions of the levees around Swain Slough, the elevated Pine Hill Road, and the excavated ditches. The northeast corner of the study area is gently sloped at the base of a small bluff.

Climate

The climate within the study area as described below is based on information provided in the *Atlas of the Biodiversity of California* (California Department of Fish and Game 2003), historical data collected between 1948 and 2005 at Eureka, Humboldt County, California (Western Regional Climate Center 2013), and on National Weather Service statistics as reported on the Weather Underground website (Weather Underground 2013):

- *Type*: The climate within the study area is characterized by a Mediterranean Summer Fog with cool wet winters and cool foggy summers (California Department of Fish and Game 2003).
- *Precipitation*: Average annual precipitation is approximately 39.5 inches. Most precipitation falls as rain between the months of October and April (Western Regional Climate Center 2013).
- *Air Temperature*: Air temperatures range between an average January high of 55 degrees Fahrenheit (ºF), and an average September high of 63 ºF. The year-round average high temperature is approximately 59 ºF (Western Regional Climate Center 2013).
- *Growing Season*: The growing season (i.e., 50 percent probability of air temperature 28 ºF or higher) is 365 days. The soil temperature regime is Isomesic (mean soil temperature of about 46 ºF with minimal fluctuation between summer and winter) (Western Regional Climate Center 2013).
- *Current Weather Condition:* No rain fell in the 10 days prior to the July 30, 2013 field visit (Weather Underground 2013). The most recent rains, totaling 0.84 inch, fell between June 1 and June 20, 2013, approximately six weeks prior to the field visit.

Hydrology/Hydrologic Features

The study area is situated in the coastal plain at the base of a bluff and foothills of the Coast Range that rise to the northeast. Swain Slough drains to Humboldt Bay, via the Elk River. Pine Hill Road is lined by roadside ditches west of the bridge. These ditches lead to larger ditches that parallel the west bank of Swain Slough.

Soil Map Units

The USDA National Resources Conservation Service (NRCS) Web Soil Survey reports the soil survey of the area has not been completed (i.e., "NOTCOM") (Figure 2).

Vegetation Communities

The vegetation communities within the study area include wet meadow, montane riparian (Meyer and Laudenslayer 1988), the roadway, and the two sloughs.

The wet meadow community occurs west of the bridge on both the north and south sides of Pine Hill Road, and east of the bridge south of the road. This herbaceous plant community is grazed by cattle and appears to be seasonally wet, with ponded water evident in winter photographs reviewed as part of this report. Drier conditions occur in the summer months. Dominant plant species observed in the wet meadow community include: tall fescue (*Festuca arundinacea*), velvetgrass (*Holcus lanatus*), Bermudagrass (*Cynodon dactylon*), creeping bentgrass (*Agrostis stolonifera*), bird's-foot trefoil (*Lotus corniculatus*), rye grass (*Festuca perennis*), red and white clover (*Trifolium pratense, T. repens*), buttercup (*Ranunculus repens*), Kentucky bluegrass (*Poa pratensis*), queen Anne's lace (*Daucus carota*), sticky cinquefoil (*Drymocallis glandulosa*), and brass-buttons (*Cotula coronopifolia*). The grazing activities have produced several large wallows (depressions) and cattle droppings. The area has several irrigation/drainage ditches that crisscross the community.

The montane riparian community is present only in a small area northeast of the bridge, between Swain Slough and a house located north of the narrower eastern end of the study area. This community is an impenetrable patch of vegetation, dominated by Himalayan blackberry (*Rubus armeniacus*), coast twinberry (*Lonicera involucrata*), Oregon grape (*Berberis* sp.), coyote brush (*Baccharis pilularis*), coastal willow (*Salix hookeriana*), cow parsnip (*Heracleum maximum*), and rose (*Rosa sp.*). This community is sloped toward Swain Slough and is well drained.

The roadway includes the paved road surface, the shoulders and the ditches on either side of the road. The road is built on a road base that is slightly elevated above the level of the wet meadow described above, and the ditches are excavated to a depth of several feet below the elevation of the surrounding wet meadow. Barbed-wire fence is constructed at the outer edges of the Pine Hill Road easement, and there is a slight rise between the roadside ditches and the fence that is largely vegetated by coyote brush, tufted hair grass (*Deschampsia cespitosa* ssp *cespitosa*), and lamb's quarters (*Chenopodium album*). The ditch vegetation is more emergent due to the continuously saturated conditions found there. Species observed in the ditch include: saltwort (*Salicornia bigelovii*), arrow grass (*Triglochin maritima*), tall fescue, lamb's quarters, and brass-buttons.

Small reaches of both Swain Slough and Martin Slough occur within the study area. Swain Slough is an approximately 60- to 80-foot-wide water feature that drains the eastern portion of the Elk River floodplain and the surrounding hills to the east (see Figure 1). Waters within the feature are assumed to be brackish based on observed low-tide flow (i.e., fresh water) going out to Humboldt Bay, and high-tide flow (salt water) filling the feature as it flows inland. The feature has an unvegetated mud bottom except near the banks, where it is vegetated with Lyngbye's sedge (*Carex lyngbyei*) and dense flowered cordgrass (*Spartina densiflora*) within the ordinary high water mark (OHWM).

Martin Slough is very similar to Swain Slough in that it is an unvegetated mud bottom feature except for the banks near the OHWM, which are also vegetated with Lyngbye's sedge and dense flowered cordgrass. The difference between the two sloughs is that the reach of Martin Slough within the study area has been channelized and is straight, and the tidal influence is limited by a tide gate located at the confluence with Swain Slough.

Methods

The field delineation utilized the routine field wetland delineation methodology prescribed by the U.S. Army Corps of Engineers (Corps) in the *Wetland Delineation Manual* (Environmental Laboratory 1987), and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region (Version 2.0)* (U.S. Army Corps of Engineers 2010) to determine and document whether any of the three wetland parameters (dominant hydrophytic vegetation, hydric soils, and/or wetland hydrology are present in the suspect wetland features within the study area. The wetland delineation was conducted on July 30, 2013by NSR biologist Julian Colescott (SWS Professional Wetland Scientist No. 1920) and NSR botanist Sarah Tona. Three-parameter wetland data collected in the field was analyzed further to determine which of the data collected satisfy the "one-parameter" wetland definition under the Coastal Act definition.

The boundaries of delineated features and the associated data points were mapped using a Trimble Pathfinder Pro XH Global Positioning System (GPS) capable of sub-foot accuracy. All data points were also mapped using the Trimble GPS unit. The GPS and hand-drawn location data were overlaid onto an aerial photograph of the study area to develop the delineation map.

To assist with project planning, seventeen cross section transects were installed at 50-foot intervals starting 100 feet west of the bridge. Each transect corresponds to the width of the County's right-of-way (i.e., fence to fence). The transect start and end points were recorded with the GPS unit, and the start and end intersect points of each wetland feature along the transects were measured with a meter measuring tape and recorded. The GPS location data and the measurements were overlaid onto the delineation map (Figure 3).

Delineation Results and Discussion

Three types of wetland features were delineated within the study area including: 1) the two sloughs (totaling 0.2.87 acre and 387 linear feet); 2) seasonal wetland (0.681 acre); and 3) vegetated ditch (0.197 acre). A delineation map of the study area is provided as Figure 3 (Attachment A). Representative photographs of the wetland features are provided in Attachment B. Wetland determination data forms are provided in Attachment C.

Swain Slough and Martin Slough

The physical characteristics of Swain Slough and Martin Slough are described above. The boundaries of these features were delineated using the three-parameter data collected, focusing on the hydrological indicators. The work spanned the period between low and high tide, so the inflow and retreat of tidal waters was observed. The high tide crest fell within the sediment stain on vegetation along the bank; the high water mark was delineated at the upper extent of this staining (Attachment B, Photograph 6).

Data Point (DP) 7 and 8 document Swain Slough and the adjacent seasonal wetland feature. DP 7 documents the vegetated bank of the slough below the high water mark. This location is vegetated with Lyngbye's sedge and has silty clay hydric soils with a strong sulfidic odor. As mentioned above, the vegetation along the bank is stained by sediment that identifies the high tide level and OHWM. The July tide table for Eureka (available at http://tides.mobilegeographics.com/calendar/year/1845.html) reveals that the afternoon high tide on July30, 2013 was 6.91 feet, 1.70 feet lower than the high tide for the month of 8.61 feet, which occurred nine days earlier on July 21.

For the purposes of this wetland delineation, the OHWM of Swain Slough is considered the upper most staining on the streambank vegetation (Attachment B, Photograph 6). This level of inundation likely occurs several times per year or more frequently depending on the tides. Looking under the bridge, sediment deposits and water stains indicating high tide or high freshwater flows are evident almost at the bottom of the bridge decking (Attachment B, Photograph 10). Stream flow data could not be located for Swain Slough, but residents of the area walking past the project site were interviewed, and reported that Pine Hill Road floods occasionally and becomes impassible. These higher flows are assumed to be "flooding events" that are above the OHWM that occurs at the high tide level.

The seasonal wetland documented by DP 8 is actually the top of the levee adjacent Swain Slough. The height of the OHWM is approximately two feet lower than the top of this levee (Attachment B, Photograph 7). The level of inundation that occurs with high tides (i.e., the 8.61-foot tides), appears to hydrate the feature sufficiently to maintain facultative hydrophytic vegetation, and indicators of wetland hydrology (oxidized root channels), and hydric soils (depleted matrix). The seasonal wetland is further described below.

Physically, Martin Slough is similar to Swain Slough, but Martin Slough drains a larger watershed east of the study area, and has the tide gates preventing daily tidal influx. Data points 2 and 3 document Martin Slough and the adjacent upland near Pine Hill Road. Data point 1 documents the transition to seasonal wetland south of Martin Slough. Instead of sediment staining from tidal flows, shelving and changes in vegetation indicate the location of the OHWM (Attachment B, Photograph 2).

Seasonal Wetland

Seasonal wetland occurs west of the bridge, north and south of Pine Hill Road. The seasonal wetland terminates at the roadside ditch on both sides of the road. Seasonal wetland is also present east of the bridge, south of Martin Slough. The seasonal wetland was documented by DPs 1, 8, 9, 10, and 11. Data point 1 documents dominance of facultative plant species (e.g., tall fescue, rye grass, and white clover), hydric soils indicated by the depleted matrix, and marginal wetland hydrology met by oxidized root channels. This evidence satisfies both a three-parameter or one-parameter wetland definition.

Data point 8 is described above. The significance of DP 8 is that it is located on top of the low levee next to Swain Slough and still meets the three-parameter wetland definition. The soils in that location are of clay loam consistency. Smaller soil particle size results in a greater capillary fringe, and the wetland indicators observed at this location are assumed present due to saturation from within the capillary fringe during high water (i.e., high tide or high winter flows) events.

Data points 9, 10 and 11 describe the seasonal wetland north of Pine Hill Road, west of the bridge. These data points are in a cluster because there is a topographic rise west of DP 10 and north of DP 12. The rise corresponds with the line of coyote brush that parallels the roadside ditch, and is relatively narrow except in the vicinity of DP 9 where the rise is also found in the grassland north of the fence line. The three wetland parameters comprising the Corps wetland definition are not met within the rise as is documented by DP 9 and 11. However, at both of these points hydric soil indicators (depleted matrix) are present. The depleted matrix suggests that despite the lack of hydrophytic vegetation at both points, there is at least seasonal saturation close to the ground surface for sufficient duration that redoximorphic features have formed. The presence of this ground water is sufficient to meet the Coastal Commission wetland definition and, as a result, the area corresponding with the rise is shown as seasonal wetland on Figure 3.

Vegetated Ditch

Vegetated ditches occur in two locations: west of the bridge along the north and south sides of Pine Hill Road, and east of the bridge on the north side of the road. The ditches west of the bridge (VD1, VD2, VD3,and VD4) are one to two feet deep, vegetated, and had small pools of standing water during the July 30, 2013 site visit. Data point 12 is representative of conditions in the ditches on the west side of the bridge, and documents the dominance of obligate plant species (saltwort, arrowgrass), wetland hydrology indicators including ponding and saturation within the upper 12 inches, and hydric soils that released a hydrogen sulfide odor upon shovel entry. An OHWM was not observed in these ditches, and they are considered wetlands, not "other waters."

The vegetated ditch on the east side of the bridge (VD 5) is very different from the ditches on the west side of the bridge, because it occurs within a very shallow depression, the vegetation is mowed, and it is not clearly evident or well defined as a wetland. During the site visit, there was no ponded water or saturated soils, and the observed plants were facultative wetland species (e.g., tall fescue and buttercup). Pine Hill Road disrupts sheetflow to Martin Slough by being located between the hillslope to the north and Martin Slough to the south. As a result, water ponds in the shallow ditch feature. In addition, a layer of clay occurs at about 16 inches below the soil surface that likely reduces the permeability of the soils helping to hold the shallow inundation that occurs during precipitation events. Hydric soils are indicated by depleted matrix; and wetland hydrology is indicated by the presence of oxidized rhizospheres.

Conclusions

The purpose of the wetland delineation was to identify the boundaries of wetlands that may be subject to regulation by the CCC under the Coastal Act. The field delineation utilized the methodology prescribed by the Corps, with additional consideration given to the different definitions of wetlands as recognized by the Corps and CCC.

Three types of Coastal Act wetland features were delineated within the study area including: 1) both Swain Slough (0.149 acre; 115 linear feet) and Martin Sloughs (0.138 acre; 272 linear feet); 2) seasonal wetlands (totaling 0.681 acre), and 3) vegetated ditch (0.197 acre). Please note that the determinations made in this report are preliminary and are subject to verification by the CCC. NSR advises all interested parties to treat the information contained herein as preliminary pending written verification of jurisdictional determination by the CCC.

Thank you for providing NSR with the opportunity to assist with your project needs. Please contact me if you have any questions or require additional information. I can be reached by telephone at (530) 926-3595 ext. 201, or by e-mail at colescott@nsrnet.com.

Sincerely,

NORTH STATE RESOURCES, INC.

Julian Colescott
SWS Professional Wetland Scientist (PWS No. 1920)

Attachments:
Attachment A: Figures
Attachment B: Representative Photographs
Attachment C: Wetland Determination Data Forms

References

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ATTACHMENT A

Figures

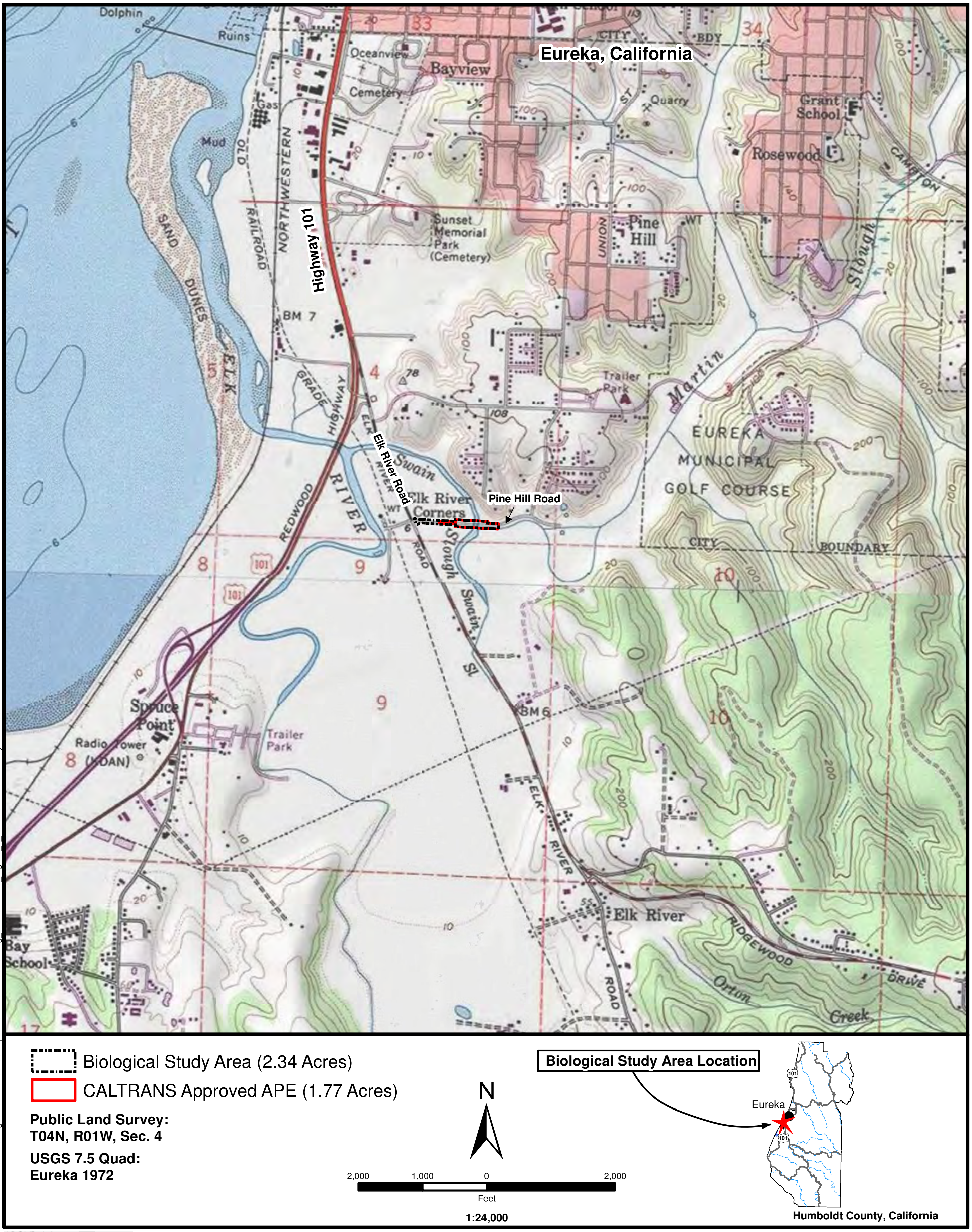
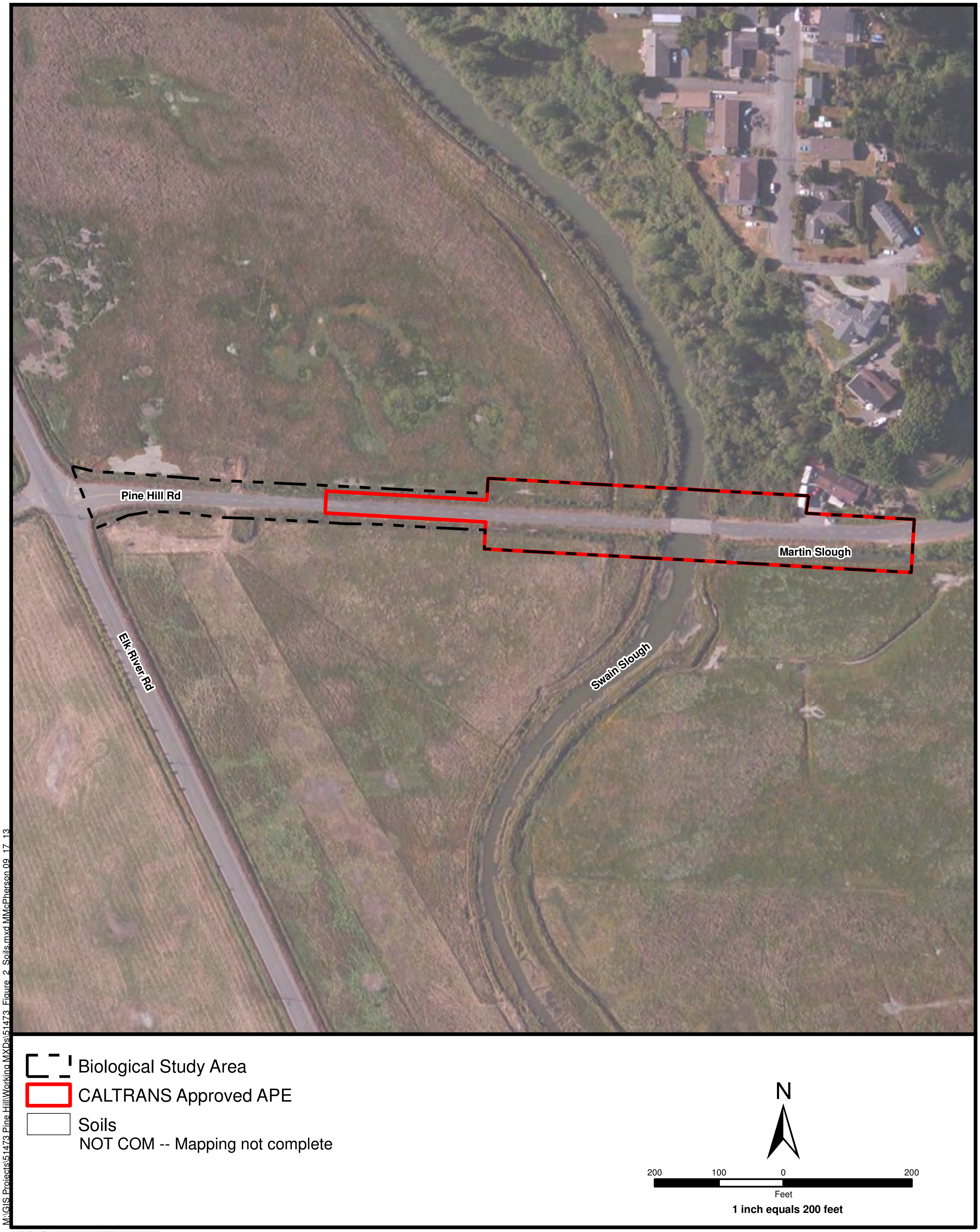


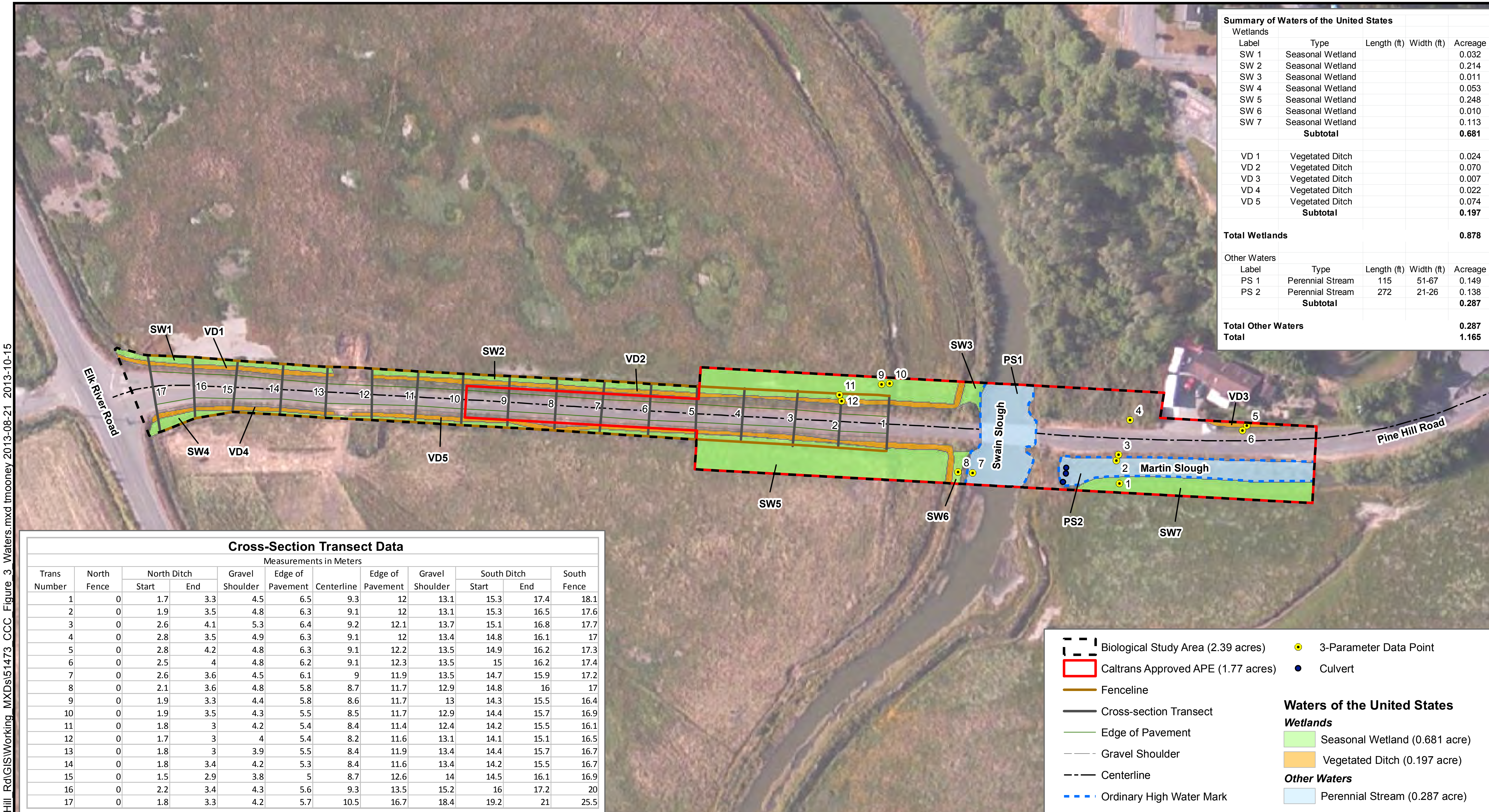
Figure 1
Biological Study Area Location and Vicinity



North State Resources, Inc.

Pine Hill Bridge Replacement Project

Figure 2
Soils



Summary of Waters of the United States				
Wetlands				
Label	Type	Length (ft)	Width (ft)	Acreage
SW 1	Seasonal Wetland			0.032
SW 2	Seasonal Wetland			0.214
SW 3	Seasonal Wetland			0.011
SW 4	Seasonal Wetland			0.053
SW 5	Seasonal Wetland			0.248
SW 6	Seasonal Wetland			0.010
SW 7	Seasonal Wetland			0.113
	Subtotal			**0.681**
VD 1	Vegetated Ditch			0.024
VD 2	Vegetated Ditch			0.070
VD 3	Vegetated Ditch			0.007
VD 4	Vegetated Ditch			0.022
VD 5	Vegetated Ditch			0.074
	Subtotal			**0.197**
Total Wetlands				**0.878**
Other Waters				
Label	Type	Length (ft)	Width (ft)	Acreage
PS 1	Perennial Stream	115	51-67	0.149
PS 2	Perennial Stream	272	21-26	0.138
	Subtotal			**0.287**
Total Other Waters				**0.287**
Total				**1.165**

Cross-Section Transect Data

Measurements in Meters

Trans Number	North Fence	North Ditch Start	North Ditch End	Gravel Shoulder	Edge of Pavement	Centerline	Edge of Pavement	Gravel Shoulder	South Ditch Start	South Ditch End	South Fence
1	0	1.7	3.3	4.5	6.5	9.3	12	13.1	15.3	17.4	18.1
2	0	1.9	3.5	4.8	6.3	9.1	12	13.1	15.3	16.5	17.6
3	0	2.6	4.1	5.3	6.4	9.2	12.1	13.7	15.1	16.8	17.7
4	0	2.8	3.5	4.9	6.3	9.1	12	13.4	14.8	16.1	17
5	0	2.8	4.2	4.8	6.3	9.1	12.2	13.5	14.9	16.2	17.3
6	0	2.5	4	4.8	6.2	9.1	12.3	13.5	15	16.2	17.4
7	0	2.6	3.6	4.5	6.1	9	11.9	13.5	14.7	15.9	17.2
8	0	2.1	3.6	4.8	5.8	8.7	11.7	12.9	14.8	16	17
9	0	1.9	3.3	4.4	5.8	8.6	11.7	13	14.3	15.5	16.4
10	0	1.9	3.5	4.3	5.5	8.5	11.7	12.9	14.4	15.7	16.9
11	0	1.8	3	4.2	5.4	8.4	11.4	12.4	14.2	15.5	16.1
12	0	1.7	3	4	5.4	8.2	11.6	13.1	14.1	15.1	16.5
13	0	1.8	3	3.9	5.5	8.4	11.9	13.4	14.4	15.7	16.7
14	0	1.8	3.4	4.2	5.3	8.4	11.6	13.4	14.2	15.5	16.7
15	0	1.5	2.9	3.8	5	8.7	12.6	14	14.5	16.1	16.9
16	0	2.2	3.4	4.3	5.6	9.3	13.5	15.2	16	17.2	20
17	0	1.8	3.3	4.2	5.7	10.5	16.7	18.4	19.2	21	25.5

Biological Study Area (2.39 acres)
Caltrans Approved APE (1.77 acres)
Fenceline
Cross-section Transect
Edge of Pavement
Gravel Shoulder
Centerline
Ordinary High Water Mark
3-Parameter Data Point
Culvert

Waters of the United States

Wetlands

Seasonal Wetland (0.681 acre)
Vegetated Ditch (0.197 acre)

Other Waters

Perennial Stream (0.287 acre)

G:\Projects\51473 Pine Hill Rd\GIS\Working MXDs\51473 CCC Figure 3 Waters.mxd tmooney 2013-08-21 2013-10-15

Prepared by:

North State Resources, Inc.

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Redding, CA 96002 Phone (530) 222-5347
Fax (530) 222-4958 www.nsrnet.com

Prepared for:

Humboldt County Public Works
1106 Second Street
Eureka, CA 95501-0579
Attn: Andrew Bundschuh, Senior Environmental Analyst
(Phone) (707) 445-7741
(Fax) (707) 445-7409

Notes:

Delineator: Julian Colescott (PWS No. 1920)
Delineation Date: July 29, 2013
Orthophotography: Bing Maps Aerial

This wetland delineation is subject to verification by the California Coastal Commission (CCC). NSR advises all parties that the delineation is preliminaryuntil the CCC provides a written verification.

N

0 50 100 200

Feet

Pine Hill Bridge Replacement Project

Figure 3
Waters of the United States
October 15, 2013

ATTACHMENT B

Representative Photographs

Photographs taken July 30, 2012

Photograph 1. Looking west. Data point 1 (shovel) documents seasonal wetland above the Martin Slough OHWM.

Photograph 2. Looking east southeast at Martin Slough. DPs 1, 2 and 3 (arrows) document seasonal wetland (No. 1), Martin Slough (No. 2), and adjacent upland (No. 3). The blue line indicates the approximate OHWM of Martin Slough.

Photograph 3. Looking west at Martin Slough and DP 2 (shovel) and DP 3 (orange GPS case).

Photograph 4. Looking west at DP 4. This suspect wetland area is dominated by marginal hydrophytic plants, but lacks evidence of hydric soils or wetland hydrology. The area drains toward the road and Martin Slough and is a non-wetland.

Photograph 5. Looking west at DP 5 (shovel) and DP 6 (bookbag) which document the vegetated ditch (VD 5) on the east end of the study area. The bridge is in the background.

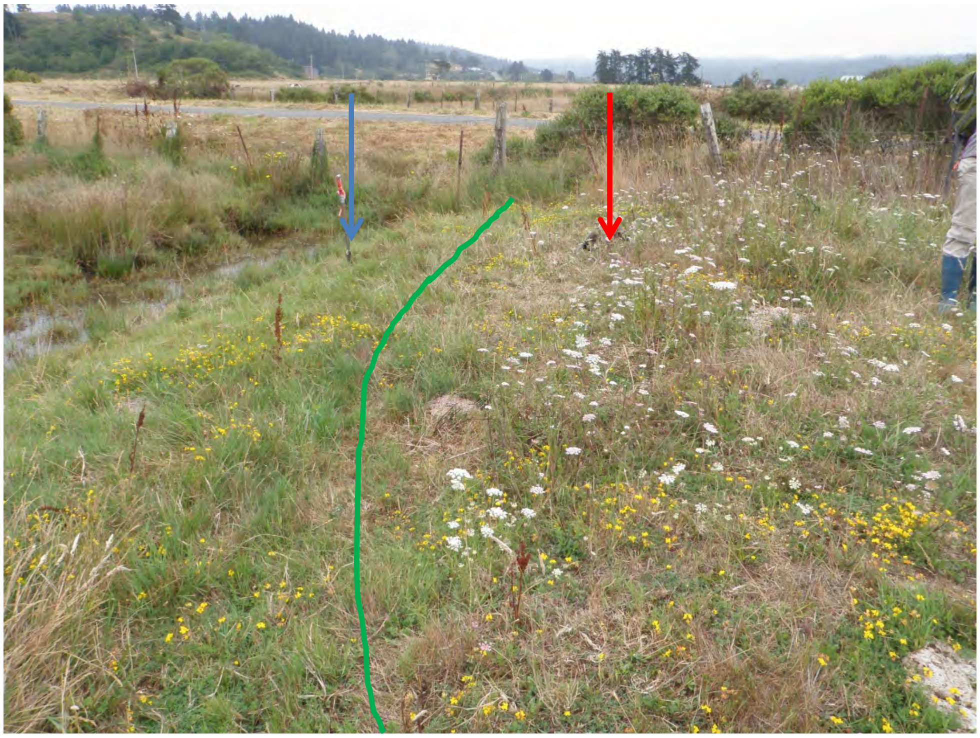
Photograph 6. Looking south at Swain Slough from the bridge. The sediment staining on the vegetation marks the high tide line and the OWHM within the channel.

Photograph 7. Looking north northeast at DP 7 (blue arrow) and 8 (green arrow) documenting Swain Slough and the adjacent seasonal wetland, respectively.

Photograph 8. Soils from DP 8. The depleted matrix and redox features are clearly evident.

Photograph 9. Looking south. High tide.

Photograph 10. Looking north at the west bridge footing. Note the sediment deposits and watermarks (blue arrow), and the drift on the pipe in the background. These high marks indicate the monthly high tide of 8.61 feet. The green arrow indicates the 6.91-foot high tide observed on July 30. This photograph was taken between high and low tide.



Photograph 11. Looking southeast. Data Points 9 (red arrow) and 10 (blue arrow) document dominance of non-hydrophytic vegetation and hydrophytic vegetation, respectively, within the seasonal wetland. Both sides of the green line satisfy the Coastal Act one-parameter wetland definition.

Photograph 11. Looking northwest. Data Points 11 (red arrow) and 12 (shovel) document that the coyote brush covered rise between the roadside ditch and seasonal wetland to the north is still a wetland under the CCC definition. The dominant vegetation at DP 11 is non-hydrophytic, but indicators of hydric soils and wetland hydrology are still present.

ATTACHMENT C

Wetland Determination Data Forms

North State Resources, Inc.

Data Point 1

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Feature Type SEASONAL WTLD

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/29/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) TERRACE Local relief (concave, convex, (none)) Slope % 0 - 1

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM 1 Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? Y / N

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: MARTIN SLOUGH

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks HISTORIC FLOODPLAIN. VERY FLAT + POORLY DRAINED. SOILS HAVE HIGH CLAY CONTENT + LIKELY HOLD MOISTURE FOR LONG DURATION DURING WET SEASON 3 PARAMETER + 1 PARAMETER WILD CRITERIA MET.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%=	Total Cover:		

Sapling/Shrub Stratum (Plot Size: 20' r)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= 20%=	Total Cover:		

Herb Stratum (Plot Size: 10' r)	% Cover	Species?	Status
1. Festuca arundinacae	35	Y	FAC
2. Festuca perenne	25	Y	FAC
3. Trifolium repens	20	Y	FAC
4. Cynodon dactylon	12	N	FACU
5. Lotus corniculatus	5	N	FAC
6.			
7.			
8.			
50%= 20%=	Total Cover: 97		

Woody/Vine Stratum (Plot Size:)	% Cover	Species?	Status
1.			
2.			
50%= 20%=	Total Cover:		

% Bare Ground in Herb Stratum 3 **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 3 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

- ____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- ____ Prevalence Index is ≤ 3.0[1]
- ____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ____ Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes:

Data Point 1

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-24"	10YR 4/2	80	7.5YR 4/6	20	C	PL	SILTY CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
__X__ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches) — Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
_____ Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
__X__ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No __X__ Depth (inches) _____
Water Table Present? Yes _____ No __X__ Depth (inches) _____
Saturation Present? Yes _____ No __X__ Depth (inches) _____ *(includes capillary fringe)*

Wetland Hydrology? (Y) / N

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks WETLAND HYDROLOGY MET.

North State Resources, Inc.

Data Point 2

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Feature Type DITCH/STREAM

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/25/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) ______ Local relief (concave, convex, none) ______ Slope % ______

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N (*If no, explain in Remarks.*)

Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? (*If needed, explain in Remarks.*)

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? (Y) / N ✓

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters X Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: SLOUGH

Evaluation of features designated "Other Waters of the United States" MARTIN SLOUGH

Indicators: Defined bed and bank X Scour ____ Ordinary High Water Mark Mapped X Stream Width 15-18

Feature Designation: Perennial X Intermittent ____ Ephemeral ____ Blue-line on USGS Quad X Substrate MUD

Natural Drainage X Artificial Drainage ____ Navigable Water ____

Remarks CHANNELIZED STREAM AT EDGE OF FLOODPLAIN/ROAD BOUNDARY. TIDAL INFLUENCE. 15-20' WIDE. NARROW (2-4') FRINGE WILD NOT MAPPED AS SEPARATE FEATURE. (SEE PHOTOS). DP DOCUMENTS THE "OTHER WATERS" FEATURE

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20 X 10)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20 X 10')

	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Herb Stratum (Plot Size: 20 X 10)

	% Cover	Species?	Status
1. Carex lyngbye	20	Y	OBL
2.			
3.			
4.			
5.			
6.			
7			
8.			
50%= 10 20%= 4 Total Cover:	20		

Woody/Vine Stratum (Plot Size: ____)

	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum 80 (WATER) **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 1 (A)

Total number of dominant species across all strata: 1 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

____ Prevalence Index is ≤ 3.0[1]

____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)

____ Wetland Non-Vascular Plants[1]

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes: VEG PRESENT IN PATCHES ALONG DITCH BANK - BUT W/I OHWM. NOT DELINEATED AS SEPARATE WETLAND FEATURE.

Data Point 2

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
	NO PIT DUG IN FLOODED DITCH CHANNEL							

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ____ 2 cm Muck (A10)
- ____ Red Parent Materials (TF21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Vegetated Sand/Gravel Bars
- X Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) — Hydric Soil Present? (Y) N

Remarks SOILS FLOODED. ASSUMED HYDRIC DUE TO LONG DURATION FLOODING

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- X Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) (**LRR A**)
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Netural Test (D5)
- ____ Raised Ant Mounds (D6) (**LRR A**)
- ____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes X No ____ Depth (inches) 0 - 2' Wetland Hydrology? (Y) / N

Water Table Present? Yes X No ____ Depth (inches) 0

Saturation Present? Yes X No ____ Depth (inches) 0 *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks MARTIN SLOUGH. TIDE GATE EFFECTIVE IN BLOCKING TIDAL WATERS. PERENNIAL.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 3
Feature Type UPLAND

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/29/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) ROAD PRISM Local relief (concave, (convex), none) ______ Slope % 45

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N (*If no, explain in Remarks.*)

Are vegetation (Y) / N, soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N VEG IS MOWED

Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? (*If needed, explain in Remarks.*)

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? Y / (N) Wetland hydrology? Y / (N) Is sampled area a wetland? Y / (N) Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks UPLAND PAIR TO DP'S 1 & 2. DP LOCATED ON ROAD PRISM ABOVE MARTIN SLOUGH.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20 x 5)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20 x 5)	% Cover	Species?	Status
1. Baccharis pilularis	5	Y	UPL
2. Rosa californica	2	Y	FAC
3.			
4.			
50%= 3.5 20%= 1.4 Total Cover:	7		

Herb Stratum (Plot Size: 10 x 5)	% Cover	Species?	Status
1. Holcus lanatus	35	Y	FAC
2. Calystegia subacaulis	20	Y	UPL
3. Festuca arundinacae	35	Y	FAC
4. Plantago lanceolata	5	N	FACU
5. Foeniculum vulgare	5	N	UPL
6.			
7			
8.			
50%= ____ 20%= ____ Total Cover:	100		

Woody/Vine Stratum (Plot Size: 20 x 5)	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum 0 **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 5 (B)

Percent of dominant species that are OBL, FACW, or FAC: 60 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	____	x 1 =	____
FACW Species	____	x 2 =	____
FAC Species	____	x 3 =	____
FACU Species	____	x 4 =	____
UPL Species	____	x 5 =	____
Column Totals	____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes: HYDROPHYTES (FAC) ARE DOMINANT.

Data Point 3

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	100	—	—	—	—	GRAVELLY LOAM - ROAD BASE	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: ________ Depth (Inches) ______ Hydric Soil Present? Y / (N)

Remarks NON-HYDRIC SOILS IN ROAD BASE.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No X Depth (inches) ______ Wetland Hydrology? Y (N)
Water Table Present? Yes ____ No X Depth (inches) ______
Saturation Present? Yes ____ No X Depth (inches) ______ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks NO WTLD HYDRO. INDICATORS.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 4
Feature Type UPLANDS

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) ROADSIDE Local relief (concave, convex, (none)) Slope % 3

Subregion (LRR): LRR A Lat 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N (If no, explain in Remarks.)

Are vegetation (Y) / N, soil Y / (N) or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N MOWED VEG.

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? Y / (N) Wetland hydrology? Y / (N) Is sampled area a wetland? Y / (N) Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks SMALL SUSPECT WETLAND. DESPITE PRESENCE OF HYDROPHYTIC VEG, LOCATION IS WELL DRAINED W/ NO WETLAND HYDROLOGY OR HYDRIC SOIL INDICATORS. NON-WTLD FOR CCC OR CORPS.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10×5) IN ROADSIDE

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: 10×5)

Sapling/Shrub Stratum	% Cover	Species?	Status
1. Rubus armeniacus	15	Y	FACU
2. Rosa californica	5	Y	FAC
3.			
4.			
50%= 10 20%= 4 Total Cover:	20		

Herb Stratum (Plot Size: 10×5)

Herb Stratum	% Cover	Species?	Status
1. Scirpus microcarpus	30	Y	OBL
2. Ranunculus repens	15	Y	FAC
3. Holcus lanatus	5	N	FAC
4.			
5.			
6.			
7			
8.			
50%= 25 20%= 10 Total Cover:	50		

Woody/Vine Stratum (Plot Size: ____)

Woody/Vine Stratum	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum 50 **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 4 (B)

Percent of dominant species that are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

- ____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- ____ Prevalence Index is ≤ 3.0[1]
- ____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ____ Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N

Notes: HYDROPHYTES DOMINATE. 50% BARE GROUND B/W VEG CLUMPS. CURRENTLY FILLED W/ MOWED CLIPPINGS.

Data Point 4

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2	100	Ø	–	–	–	LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: CONCRETE - LIKE CEMENTUM Depth (Inches) 6" Hydric Soil Present? Y / (N)

Remarks CEMENTIUM HIT @ 6". NO INDICATORS OF HYDRIC SOIL.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A**)
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A**)
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No X Depth (inches) ________ Wetland Hydrology? Y (N)
Water Table Present? Yes ____ No X Depth (inches) ________
Saturation Present? Yes ____ No X Depth (inches) ________ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks NO INDICATORS OF WETLAND HYDROLOGY, DESPITE CEMENTUM, SLOPE IS TO THE ROAD AND MARTINS SLOUGH. LOCATION IS WELL DRAINED.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 5
Feature Type DITCH

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) ROADSIDE Local relief (concave, convex, none) DITCH Slope % 1-3
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) N (If no, explain in Remarks.)
Are vegetation (Y) N, soil Y (N), or hydrology Y (N) significantly disturbed? Are normal circumstances present? (Y) N – VEG IS MOWED.
Are vegetation Y (N), soil Y (N), or hydrology Y (N) naturally problematic? (If needed, explain in Remarks.)

Summary of Findings

(Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) N Hydric soil? (Y) N Wetland hydrology? (Y) N Is sampled area a wetland? (Y) N Other waters? Y (N)

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DEPRESSIONAL DITCH IN ROADSIDE. 3 PARAMETERS MEET CORPS DEFINITION AND CCC. NO OHWM OBSERVED, SO THIS IS NOT AN OTHER WATERS.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10 X 5 → IN DITCH)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: 10 X 5)

	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Herb Stratum (Plot Size: 10 X 5)

	% Cover	Species?	Status
1. Festuca arundinacea	20	Y	FAC
2. Ranunculus repens	20	Y	FAC
3. Lotus corniculatus	20	Y	FAC
4. Holcus lanatus	15	N	FAC
5. Trifolium repens	15	N	FAC
6. Equisetum arvense	2	N	FAC
7. Plantago elongata	4	N	FACW
8.			
50%= ____ 20%= ____ Total Cover:	100		

Woody/Vine Stratum (Plot Size: ____)

	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum ____ **% Cover of Biotic Crust** ____

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)
Total number of dominant species across all strata: 3 (B)
Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	____	x 1 =	____
FACW Species	____	x 2 =	____
FAC Species	____	x 3 =	____
FACU Species	____	x 4 =	____
UPL Species	____	x 5 =	____
Column Totals	____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? (Y) N
Notes: DOMINANCE OF FAC HYDROPHYTES.

Data Point 5

Soils

Profile Description. (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100	—	—	—	—	COBBLE LOAM	
4-16	10YR 4/1	80	7.5YR 5/6	20	C	PL	SILTY CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: CLAY Depth (Inches) 16 Hydric Soil Present? (Y) / N

Remarks HYDRIC SOIL INDICATOR F3 STARTS @ 4 INCHES.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

____ Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
_X_ Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A**)
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A**)
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No _X_ Depth (inches) ________ Wetland Hydrology? (Y) / N
Water Table Present? Yes ____ No _X_ Depth (inches) ________
Saturation Present? Yes ____ No _X_ Depth (inches) ________ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:
Ø

Remarks WETLAND HYDRO MET.

North State Resources, Inc.

Data Point 6

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Feature Type UPLAND

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) ROADSIDE Local relief (concave, convex, none) [none circled] Slope % 1-3

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: Ø

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) N *(If no, explain in Remarks.)*

Are vegetation (Y) N, soil Y (N), or hydrology Y (N) significantly disturbed? Are normal circumstances present? (Y) N MOWED VEG.

Are vegetation Y (N), soil Y (N), or hydrology Y (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) N Hydric soil? Y (N) Wetland hydrology? Y (N) Is sampled area a wetland? Y (N) Other waters? Y (N)

USACE Jurisdiction

Adjacent to Waters _____ Tributary to Waters _____ Isolated (with interstate commerce) _____ Isolated (non jurisdictional) _____

Explain:

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank _____ Scour _____ Ordinary High Water Mark Mapped _____ Stream Width _____

Feature Designation: Perennial _____ Intermittent _____ Ephemeral _____ Blue-line on USGS Quad _____ Substrate _____

Natural Drainage _____ Artificial Drainage _____ Navigable Water _____

Remarks DESPITE THE PRESENCE OF HYDROPHYTIC VEG, SOILS + HYDRO ARE NOT MET + THE DP DOCUMENTS UPLAND CONDITIONS WITH RESPECT TO CORPS JURISDICTION. CCC DETERMINATION IS ALSO NON-WETLAND DUE TO LACK OF CLEAR INDICATIONS OF WETLAND HYDROLOGY.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10 x 5 —) ROADSIDE STRIP

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= _____ 20%= _____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: 10 x 5)

	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= _____ 20%= _____ Total Cover:			

Herb Stratum (Plot Size: 10 x 5)

	% Cover	Species?	Status
1. Cynodon dactylon	25	Y	FACU
2. Trifolium repens	20	Y	FAC
3. Lotus corniculatus	20	Y	FAC
4. Festuca arundinacea	20	Y	FAC
5. Plantago elongata	5	N	FAC
6. Rumex crispus	2	N	FAC
7. Holcus lanatus	4	N	FAC
8.			
50%= _____ 20%= _____ Total Cover:	100		

Woody/Vine Stratum (Plot Size: _____)

	% Cover	Species?	Status
1.			
2.			
50%= _____ 20%= _____ Total Cover:			

% Bare Ground in Herb Stratum Ø **% Cover of Biotic Crust** —

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 4 (B)

Percent of dominant species that are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	_____	x 1 =	_____
FACW Species	_____	x 2 =	_____
FAC Species	_____	x 3 =	_____
FACU Species	_____	x 4 =	_____
UPL Species	_____	x 5 =	_____
Column Totals	_____ (A)		_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators

- _____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- _____ Prevalence Index is ≤ 3.0[1]
- _____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- _____ Wetland Non-Vascular Plants[1]
- _____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) N

Notes:

Data Point 6

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/2	100	–	–	–	–	SANDY, GRAVELLY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
_____ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: PACKED GRAVEL Depth (Inches) 6 Hydric Soil Present? Y / (N)

Remarks SHOVEL RESISTANCE @ 6". DP IS IN ROAD SHOULDER SUBSTRATE, NON-HYDRIC.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
_____ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No X Depth (inches) _____ Wetland Hydrology? Y / (N)
Water Table Present? Yes _____ No X Depth (inches) _____
Saturation Present? Yes _____ No X Depth (inches) _____ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks NO WETLAND HYDRO INDICATORS.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 7
Feature Type SLOUGH

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) DRAINAGE Local relief (concave, convex, none) (concave circled) Slope % 0-100
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: R2UBH

Are climatic/hydrologic conditions on the site typical for this time of year? (Y circled) / N (If no, explain in Remarks.)
Are vegetation Y / (N circled) soil Y / (N circled) or hydrology Y / (N circled) significantly disturbed? Are normal circumstances present? (Y circled) / N
Are vegetation Y / (N circled) soil Y / (N circled) or hydrology Y / (N circled) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y circled) / N Hydric soil? (Y circled) / N Wetland hydrology? (Y circled) / N Is sampled area a wetland? (Y circled) / N Other waters? (Y circled) / N

USACE Jurisdiction

Adjacent to Waters ____ Tributary to Waters X Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain: ELK RIVER TO HUMBOLDT BAY

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank X Scour X Ordinary High Water Mark Mapped X Stream Width 40' -GPS'd
Feature Designation: Perennial X Intermittent ____ Ephemeral ____ Blue-line on USGS Quad X Substrate MUD
Natural Drainage X Artificial Drainage ____ Navigable Water ____

Remarks

DP DOCUMENTS SWAIN SLOUGH. EDGES ARE VEGETATED IN MANY LOCATIONS. BANKS VARY FROM STEEP (VERTICLE) TO GRADUAL. DP IS W/I THE OHWM OF THE SLOUGH FEATURE.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20X10' - IN FEATURE)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20X10)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Herb Stratum (Plot Size: 20X10')	% Cover	Species?	Status
1. Carex lyngbyei	100	Y	OBL
2.			
3.			
4.			
5.			
6.			
7			
8.			
50%= 20%= Total Cover:			

Woody/Vine Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 1 (A)
Total number of dominant species across all strata: 1 (B)
Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y circled) N
Notes: DP DOCUMENTS THE VEGETATED BANK OF THE SLOUGH.

Data Point 7

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	— SEE NOTES						SILTY CLAY	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ____ 2 cm Muck (A10)
- ____ Red Parent Materials (TF21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Vegetated Sand/Gravel Bars
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) — Hydric Soil Present? (Y) / N

Remarks STRONG SULPHIDIC ODOR IN TOP 4 INCHES. SUFFICIENT TO INDICATE HYDRIC SOILS. DID NOT MAKE COLOR DETERMINATION.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- X Sediment Deposits (B2)
- X Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) (**LRR A**)
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Netural Test (D5)
- ____ Raised Ant Mounds (D6) (**LRR A**)
- ____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes X No ____ Depth (inches) 0 - 10'

Water Table Present? Yes X No ____ Depth (inches) 0

Saturation Present? Yes X No ____ Depth (inches) 0 *(includes capillary fringe)*

Wetland Hydrology? (Y) / N

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks OBSERVED FEATURE DURING HIGH + LOW TIDES. OHWM IS PRESENT AT TOP OF STAINING.

North State Resources, Inc.

Data Point 6
Feature Type SEASONAL WTLD

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) DITCH SPOIL PILE Local relief (concave, (convex) none) Slope % 0 - 10
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: PEM1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) N *(If no, explain in Remarks.)*
Are vegetation Y (N), soil Y (N), or hydrology Y (N) significantly disturbed? Are normal circumstances present? (Y) N
Are vegetation Y (N), soil Y (N), or hydrology Y (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)
Hydrophytic vegetation? (Y) N Hydric soil? (Y) N Wetland hydrology? (Y) N Is sampled area a wetland? (Y) N Other waters? Y (N)

USACE Jurisdiction
Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain: SLOUGH

Evaluation of features designated "Other Waters of the United States"
Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DP ON TOP OF SPOILS PILE BETWEEN SMALL INTERIOR DITCH AND SLOUGH. ALL THREE INDICATORS MET; MEETS CCC + CORPS DEFINITION.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Herb Stratum (Plot Size: ____)	% Cover	Species?	Status
1. Pedicularis glandulosa	10	N	UPL
2. Juncus balticus	10	N	FACW
3. Lolium perennis	25	Y	FAC
4. Plantago lanceolata	10	N	FACU
5. Lotus corniculatus	20	Y	FAC
6. Rumex crispus	5	N	FAC
7. Calamagrostis rubescens	25	Y	FAC*
8. Daucus carota	10	N	FACU
50%= 57.5 20%= 23.0 Total Cover:	115		

Woody/Vine Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum Ø % Cover of Biotic Crust —

Dominance Test Worksheet
Number of dominant species that are OBL, FACW, or FAC: 3 (A)
Total number of dominant species across all strata: 3 (B)
Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators
____ Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)
[1]*Indicators of hydric soil and wetland hydrology must be present.*

Hydrophytic Vegetation Present? (Y) / N
Notes: Calamagrostis IS NOT LISTED IN LICHVAR, BUT OTHER Calamagrostis ARE FAC OR FACW. BPJ USED IN "FAC" DETERMINATIONS.

Data Point 4

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/2	100	–	–	–	–	PEATY LOAM	
2-20	10YR 4/2	80	7.5YR 4/6	20	C	PL	CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
____ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

____ 2 cm Muck (A10)
____ Red Parent Materials (TF21)
____ Very Shallow Dark Surface (TF12)
____ Vegetated Sand/Gravel Bars
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches) — Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS UNDER THIN PEAT LAYER.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

Surface Water (A1)
____ High Water Table (A2)
____ Saturation (A3)
____ Water Marks (B1)
Sediment Deposits (B2)
____ Drift Deposits (B3)
____ Algal Mat or Crust (B4)
____ Iron Deposits (B5)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Sparsely Vegetated Concave Surface (B8)
____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Salt Crust (B11)
____ Aquatic Invertebrates (B13)
____ Hydrogen Sulfide Odor (C1)
X Oxidized Rhizospheres (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Tilled Soils (C6)
____ Stunted or Stressed Plants (D1) (**LRR A)**
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Saturation Visible on Aerial Imagery (C9)
____ Geomorphic Position (D2)
____ Shallow Aquitard (D3)
____ FAC-Netural Test (D5)
____ Raised Ant Mounds (D6) (**LRR A)**
____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ____ No X Depth (inches) ____ Wetland Hydrology? (Y) / N
Water Table Present? Yes ____ No X Depth (inches) ____
Saturation Present? Yes ____ No X Depth (inches) ____ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:
Ø

Remarks HYDROLOGY PARAMETER IS MET.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 9
Feature Type UPLAND - SEE NOTES.

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, (terrace), etc.) ______ Local relief (concave, (convex), none) ______ Slope % 3-5
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: PEM 1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings
(Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? Y / (N) Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? Y / (N) Other waters? Y / (N)

USACE Jurisdiction
Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain:

Evaluation of features designated "Other Waters of the United States"
Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DP DOES NOT MEET VEG. PARAMETER, BUT DOES MEET SOILS + HYDROLOGY. THEREFORE, THIS SMALL "BUMP" IN THE PASTURE IS NOT A CORPS WTLD, BUT IS A CCC REGULATED FEATURE.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 10x10')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 10x10)

	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Herb Stratum (Plot Size: 10x10)

	% Cover	Species?	Status
1. Achillea millefolium	20	Y	FACU
2. Daucus carota	25	Y	FACU
3. Lotus corniculatus	15	Y	FAC
4. Festuca perennis	15	Y	FAC
5. Agrostis stolonifera	10	N	FAC
6. Aster chilensis	5	N	UPL
7. Calamagrostis rubescens	10	N	FAC*
8.			
50%= 50 20%= 20 Total Cover:	100		

Woody/Vine Stratum (Plot Size: ______)

	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum 10 **% Cover of Biotic Crust** 0

* SEE note on DP8

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)
Total number of dominant species across all strata: 4 (B)
Percent of dominant species that are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	0	x 1 =	0
FACW Species	0	x 2 =	0
FAC Species	50	x 3 =	150
FACU Species	45	x 4 =	180
UPL Species	5	x 5 =	25
Column Totals	100	(A)	355 (B)

Prevalence Index = B/A = 3.55

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation
N Dominance Test is >50%
N Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Y / (N)
Notes:

Data Point 9

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	98	7.5YR 4/6	2	C	PL	Clay Loam	
6-16	10YR 4/2	85	7.5YR 4/6	15	C	PL	Clay loam	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

_____ Histosol (A1)
_____ Histic Epipedon (A2)
_____ Black Histic (A3)
_____ Hydrogen Sulfide (A4)
_____ Depleted Below Dark Surface (A11)
_____ Thick Dark Surface (A12)
_____ Sandy Mucky Mineral (S1)
_____ Sandy Gleyed Matrix (S4)
_____ Sandy Redox (S5)
_____ Stripped Matrix (S6)
_____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
_____ Loamy Gleyed Matrix (F2)
__X__ Depleted Matrix (F3)
_____ Redox Dark Surface (F6)
_____ Depleted Dark Surface (F7)
_____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

_____ 2 cm Muck (A10)
_____ Red Parent Materials (TF21)
_____ Very Shallow Dark Surface (TF12)
_____ Vegetated Sand/Gravel Bars
_____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) Ø Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

_____ Surface Water (A1)
_____ High Water Table (A2)
_____ Saturation (A3)
_____ Water Marks (B1)
Sediment Deposits (B2)
_____ Drift Deposits (B3)
_____ Algal Mat or Crust (B4)
_____ Iron Deposits (B5)
_____ Surface Soil Cracks (B6)
_____ Inundation Visible on Aerial Imagery (B7)
_____ Sparsely Vegetated Concave Surface (B8)
_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Salt Crust (B11)
_____ Aquatic Invertebrates (B13)
_____ Hydrogen Sulfide Odor (C1)
__X__ Oxidized Rhizospheres (C3)
_____ Presence of Reduced Iron (C4)
_____ Recent Iron Reduction in Tilled Soils (C6)
_____ Stunted or Stressed Plants (D1) (**LRR A**)
_____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
_____ Drainage Patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Geomorphic Position (D2)
_____ Shallow Aquitard (D3)
_____ FAC-Netural Test (D5)
_____ Raised Ant Mounds (D6) (**LRR A**)
_____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes _____ No __X__ Depth (inches) _____
Water Table Present? Yes _____ No __X__ Depth (inches) _____
Saturation Present? Yes _____ No __X__ Depth (inches) _____ *(includes capillary fringe)*

Wetland Hydrology? (Y) / N

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks WETLAND HYDROLOGY MET.

North State Resources, Inc.

Data Point 10

Feature Type SEASONAL WTLD

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, (terrace), etc.) Local relief (concave, convex, (none)) Slope % 3

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM 1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y / (N) soil Y / (N) or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) / N Hydric soil? (Y) / N Wetland hydrology? (Y) / N Is sampled area a wetland? (Y) / N Other waters? Y / (N)

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: SLOUGH

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks 3 PARAMETERS MET.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Herb Stratum (Plot Size: 10x10)	% Cover	Species?	Status
1. Cynodon dactylon	50	Y	FACU
2. Calamagrostis rubescens	20	Y	FAC*
3. Lotus corniculatus	20	Y	FAC
4. Triglochin maritimum	10	N	OBL
5. Lolium perennis	5	N	FAC
6. Calystegia subacaulis	10	N	UPL
7. Potentilla glandulosa	5	N	FAC
8.			
50%= 60 20%= 24 Total Cover:	120		

Woody/Vine Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover:			

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

* See note in DP8

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 3 (B)

Percent of dominant species that are OBL, FACW, or FAC: 66.6 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	____	x 1 =	____
FACW Species	____	x 2 =	____
FAC Species	____	x 3 =	____
FACU Species	____	x 4 =	____
UPL Species	____	x 5 =	____
Column Totals	____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

____ Rapid Test for Hydrophytic Vegetation

Y Dominance Test is >50%

____ Prevalence Index is ≤ 3.0[1]

____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)

____ Wetland Non-Vascular Plants[1]

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? (Y) / N

Notes: VEG DOMINATED BY FACU, BUT 2 FAC SPECIES ALSO DOMINANT. VEG IS MARGINALLY HYDROPHYTIC.

Data Point 10

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/2	80	7.5YR 4/6	20	C	PL	SILTY CLAY LOAM	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ___ Loamy Gleyed Matrix (F2)
- _X_ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ___ 2 cm Muck (A10)
- ___ Red Parent Materials (TF21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Vegetated Sand/Gravel Bars
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches): — Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- _X_ Oxidized Rhizospheres (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Netural Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes ___ No _X_ Depth (inches) ___ Wetland Hydrology? (Y) / N
Water Table Present? Yes ___ No _X_ Depth (inches) ___
Saturation Present? Yes ___ No _X_ Depth (inches) ___ *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks HOLE DUG ADJ. TO FLOODED DITCH, BUT NO SATURATION OBSERVED. REGARDLESS, HYDRO PARAMETER IS MET BY INDICATOR C3.

North State Resources, Inc.

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Data Point 11
Feature Type upland

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7-30-13
Applicant/Owner: Humboldt County Department of Public Works State: California
Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W
Landform (hillslope, terrace, etc.) ________ Local relief (concave, convex, none) convex Slope % 0
Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84
Soil Map Unit Name: No soil data available NWI Classification: PEM 1 Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) / N *(If no, explain in Remarks.)*
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) significantly disturbed? Are normal circumstances present? (Y) / N
Are vegetation Y / (N), soil Y / (N), or hydrology Y / (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)
Hydrophytic vegetation? Y / (N) Hydric soil? (Y) / N Wetland hydrology? Y / (N) Is sampled area a wetland? Y / (N) Other waters? Y / (N)

USACE Jurisdiction
Adjacent to Waters ____ Tributary to Waters ____ Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____
Explain:

Evaluation of features designated "Other Waters of the United States"
Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____
Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____
Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks DP represents a high point located between Pine Hill Road and a pasture (seasonal wetland). Coyote brush grows in a strip alongside Pine Hill Rd and a vegetated ditch. Feature has hydric soils, but does not have hydrophytic vegetation or hydrology.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= ____ 20%= ____ Total Cover:			

Sapling/Shrub Stratum (Plot Size: 10' x 10')	% Cover	Species?	Status
1. Baccharis pilularis	50	Y	UPL
2. Rubus ursinus	10	N	FACU
3.			
4.			
50%= 30 20%= 12 Total Cover:	60		

Herb Stratum (Plot Size: 10 by 10)	% Cover	Species?	Status
1. Deschampsia cespitosa	50	Y	FACW
2. Cirsium vulgare	5	N	UPL
3. Achillea millefolium	5	N	FACU
4.			
5.			
6.			
7			
8.			
50%= 30 20%= 12 Total Cover:	60		

Woody/Vine Stratum (Plot Size: ____)	% Cover	Species?	Status
1.			
2.			
50%= ____ 20%= ____ Total Cover			

% Bare Ground in Herb Stratum 40 **% Cover of Biotic Crust** 0

Dominance Test Worksheet
Number of dominant species that are OBL, FACW, or FAC: 1 (A)
Total number of dominant species across all strata: 2 (B)
Percent of dominant species that are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species	–	x 1 =	–
FACW Species	50	x 2 =	100
FAC Species	–	x 3 =	
FACU Species	15	x 4 =	60
UPL Species	55	x 5 =	275
Column Totals	120 (A)		435 (B)

Prevalence Index = B/A = 3.6

Hydrophytic Vegetation Indicators
____ Rapid Test for Hydrophytic Vegetation
____ Dominance Test is >50%
____ Prevalence Index is ≤ 3.0[1]
____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
____ Wetland Non-Vascular Plants[1]
____ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Y / (N)
Notes: NON-HYDROPHYTIC VEG IS DOMINANT

Data Point 11

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	7.5YR 3/2	90	5YR 4/6	10	C	PL	clay loam	
5-16	7.5YR 3/2	60	5YR 4/6	40	C	PL	Clay loam	

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ____ Loamy Gleyed Matrix (F2)
- _X_ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ____ 2 cm Muck (A10)
- ____ Red Parent Materials (TF21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Vegetated Sand/Gravel Bars
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: — Depth (Inches) ____ Hydric Soil Present? (Y) / N

Remarks Hydric soils present

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) (**LRR A**)
- ____ Other (Explain In Remarks)

Secondary Indicators (2 or more required)

- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Netural Test (D5)
- ____ Raised Ant Mounds (D6) (**LRR A**)
- ____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present?	Yes ____	No X	Depth (inches) —	Wetland Hydrology? Y / (N)
Water Table Present?	Yes ____	No X	Depth (inches) —	
Saturation Present?	Yes ____	No X	Depth (inches) —	(includes capillary fringe)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks Hydrology indicators are absent.

North State Resources, Inc.

Data Point 12

Feature Type ROADSIDE DITCH

Wetland Determination Data Form–Western Mountains, Valleys, & Coast Region

Project/Site: Pine Hill Bridge Replacement City/County: Humboldt Date: 7/30/13

Applicant/Owner: Humboldt County Department of Public Works State: California

Investigator(s): Julian Colescott Section, Township, Range Sec. 4, T4N, R1W

Landform (hillslope, terrace, etc.) DITCH Local relief (concave, convex, none) (concave) Slope % 0-10

Subregion (LRR): LRR A Lat: 40.752536 Long: -124.182588 Datum: WGS84

Soil Map Unit Name: No soil data available NWI Classification: PEM 1Cd

Are climatic/hydrologic conditions on the site typical for this time of year? (Y) N *(If no, explain in Remarks.)*

Are vegetation Y (N), soil Y (N), or hydrology Y (N) significantly disturbed? Are normal circumstances present? (Y) / N

Are vegetation Y (N), soil Y (N), or hydrology Y (N) naturally problematic? *(If needed, explain in Remarks.)*

Summary of Findings (Attach site map showing sampling point locations, transects, important features, etc.)

Hydrophytic vegetation? (Y) N Hydric soil? (Y) N Wetland hydrology? (Y) N Is sampled area a wetland? (Y) N Other waters? Y (N)

USACE Jurisdiction

Adjacent to Waters X Tributary to Waters X Isolated (with interstate commerce) ____ Isolated (non jurisdictional) ____

Explain: TO SLOUGH

Evaluation of features designated "Other Waters of the United States"

Indicators: Defined bed and bank ____ Scour ____ Ordinary High Water Mark Mapped ____ Stream Width ____

Feature Designation: Perennial ____ Intermittent ____ Ephemeral ____ Blue-line on USGS Quad ____ Substrate ____

Natural Drainage ____ Artificial Drainage ____ Navigable Water ____

Remarks NO OHWM OBSERVED. THIS ROADSIDE DITCH APPEARS TO FLOW VERY SLOWLY IF AT ALL, SO IT IS DELINEATED AS A WETLAND, NOT AN OTHER WATERS.

Vegetation (Use Scientific Names)

Tree Stratum (Plot Size: 20x4 - IN DITCH)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50%= 20%= Total Cover:			

Sapling/Shrub Stratum (Plot Size: 20x4)

	% Cover	Species?	Status
1.			
2. NO SHRUBS IN DITCH			
3.			
4.			
50%= 20%= Total Cover:			

Herb Stratum (Plot Size: ____)

	% Cover	Species?	Status
1. Arthrocnemum subterminale	35	Y	OBL
2. Triglochin maratima (ARROW GRASS)	35	Y	OBL
3. Festuca arundinacea	15	N	FAC
4. Agrostis stolonifera	10	N	FAC
5. Calystegia subacaulis	5	N	UPL
6.			
7			
8.			
50%= 20%= Total Cover:	100		

Woody/Vine Stratum (Plot Size: ____)

	% Cover	Species?	Status
1.			
2.			
50%= 20%= Total Cover:			

% Bare Ground in Herb Stratum Ø **% Cover of Biotic Crust** Ø

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 2 (A)

Total number of dominant species across all strata: 2 (B)

Percent of dominant species that are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by	
OBL Species		x 1 =	
FACW Species		x 2 =	
FAC Species		x 3 =	
FACU Species		x 4 =	
UPL Species		x 5 =	
Column Totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators

- ____ Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- ____ Prevalence Index is ≤ 3.0[1]
- ____ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ____ Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? (Y) N

Notes: VEG DATA FROM W/I DITCH.

Data Point 12

Soils

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	— SEE NOTES —							

[1]Types: C = Concentration D = Depletion RM = Reduced Matrix [2]Location: PL = Pore Lining M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (**except MLRA 1**) (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]

- ____ 2 cm Muck (A10)
- ____ Red Parent Materials (TF21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Vegetated Sand/Gravel Bars
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present): Type: Ø Depth (Inches) Ø Hydric Soil Present? (Y) / N

Remarks HYDRIC SOILS.

Hydrology

Wetland Indicators

Primary Indicators (Minimum of one is required. Check all that apply.)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- X Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Surface Soil Cracks (B6)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Salt Crust (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Stunted or Stressed Plants (D1) (**LRR A**)
- ____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Stained Leaves (B9) **except MLRA 1,2,4A, and 4B)**
- ____ Drainage Patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ FAC-Netural Test (D5)
- ____ Raised Ant Mounds (D6) (**LRR A**)
- ____ Frost-Heave Hummocks (D7)

Field Observations

Surface Water Present? Yes X No ____ Depth (inches) 0-5" Wetland Hydrology? (Y) N

Water Table Present? Yes X No ____ Depth (inches) 0

Saturation Present? Yes X No ____ Depth (inches) 0 *(includes capillary fringe)*

Describe Recorded Data (stream gauge, monitoring well, aerial photos, and previous inspections), if available:

Ø

Remarks WETLAND HYDRO MET.

Appendix F Wetland Mitigation Concept and Right-of-Way Needs

		EXISTING	CREATED
(cyan)	PERENNIAL STREAM	3,677 SF	
(orange)	PERENNIAL STREAM		1,007 SF
TOTAL POST CONSTRUCTION PERENNIAL STREAM 4,684 SF			

REGISTERED PROFESSIONAL ENGINEER
JASON P. JURRENS
No. C612458
Exp. 09/30/15
CIVIL
STATE OF CALIFORNIA

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

ROAD NAME: PINE HILL ROAD		DESIGNED BY:	KP
ROAD NO.: 3J430	MILE POST: 0.19	DRAWN BY:	KP
PROJECT NO.: BRLO-5904(112)	EA NO.:	REVIEWED BY:	JJ
CONTRACT NO.: 594020	PPNO.:	APPROVED BY:	
DRAWING FILE NAME: S:\Client\Humboldt\H07-300 Pine Hill\CAD\Roadway\H07300 Wetland Post-			
PLOT DATE: 5-21-2015	REVISON DATE:		

QUINCY ENGINEERING

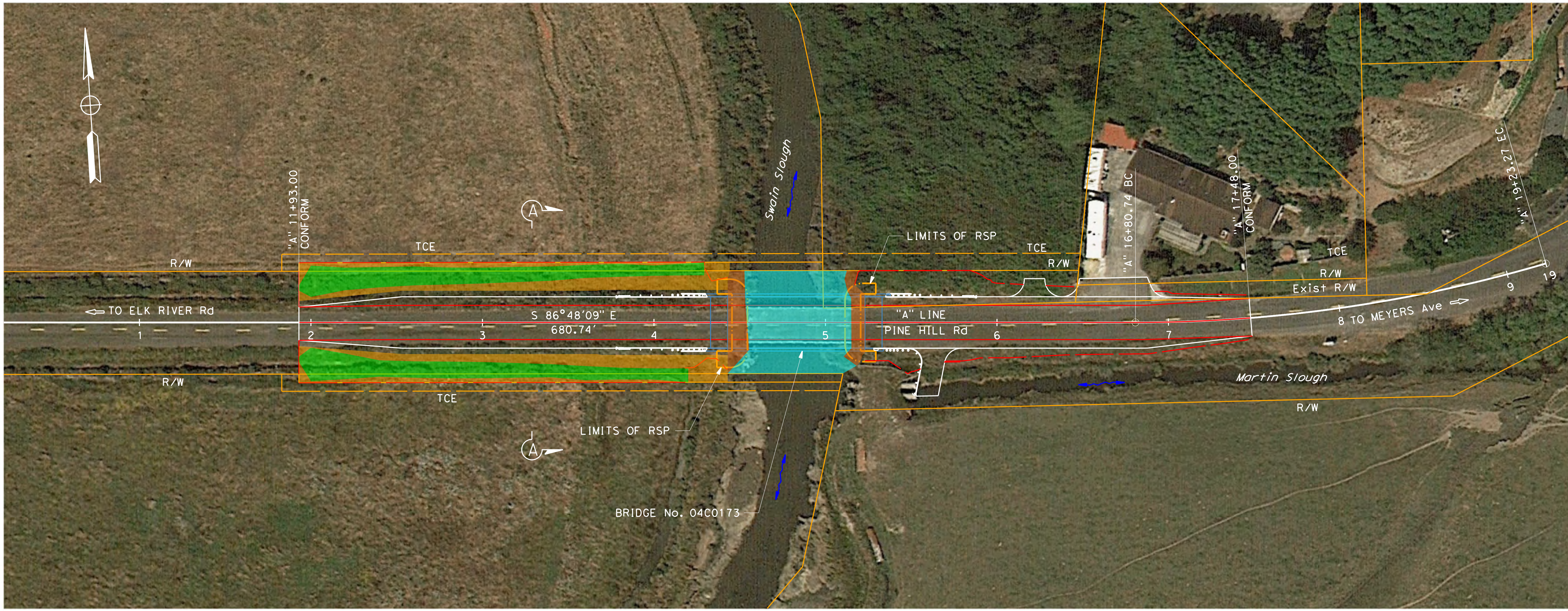
COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS

PINE HILL ROAD BRIDGE OVER SWAIN SLOUGH

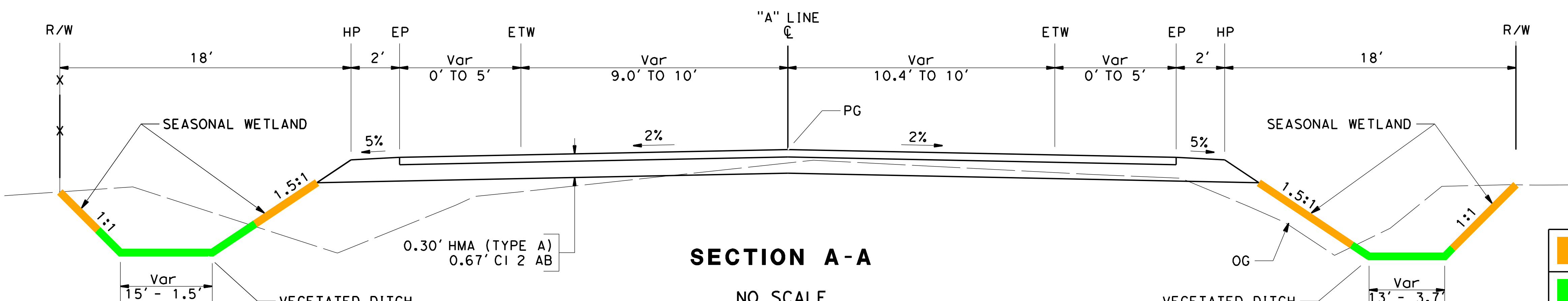
WETLAND

SHEET

OF



SCALE: 1"=30'



SECTION A-A

NO SCALE

		PRE-CONSTRUCTION	POST-CONSTRUCTION
(orange)	SEASONAL WETLAND	5,868 SF	4,084 SF
(green)	VEGETATED DITCH	3,054 SF	4,441 SF

JASON P. JURRENS
No. C612458
Exp. 09/30/15
CIVIL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

ROAD NAME: PINE HILL ROAD			
ROAD NO.: 3J430	MILE POST: 0.19		
PROJECT NO.: BRLO-5904(112)	EA NO.:	DESIGNED BY:	KP
CONTRACT NO.: 594020	PPNO.:	DRAWN BY:	KP
DRAWING FILE NAME: S:\Client\Humboldt\H07-300 Pine Hill\CAD\Roadway\H07300rRW Map.dgn		REVIEWED BY:	JJ
PLOT DATE: 5-21-2015	REVISON DATE: 5-21-2015	APPROVED BY:	

QUINCY ENGINEERING

COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS

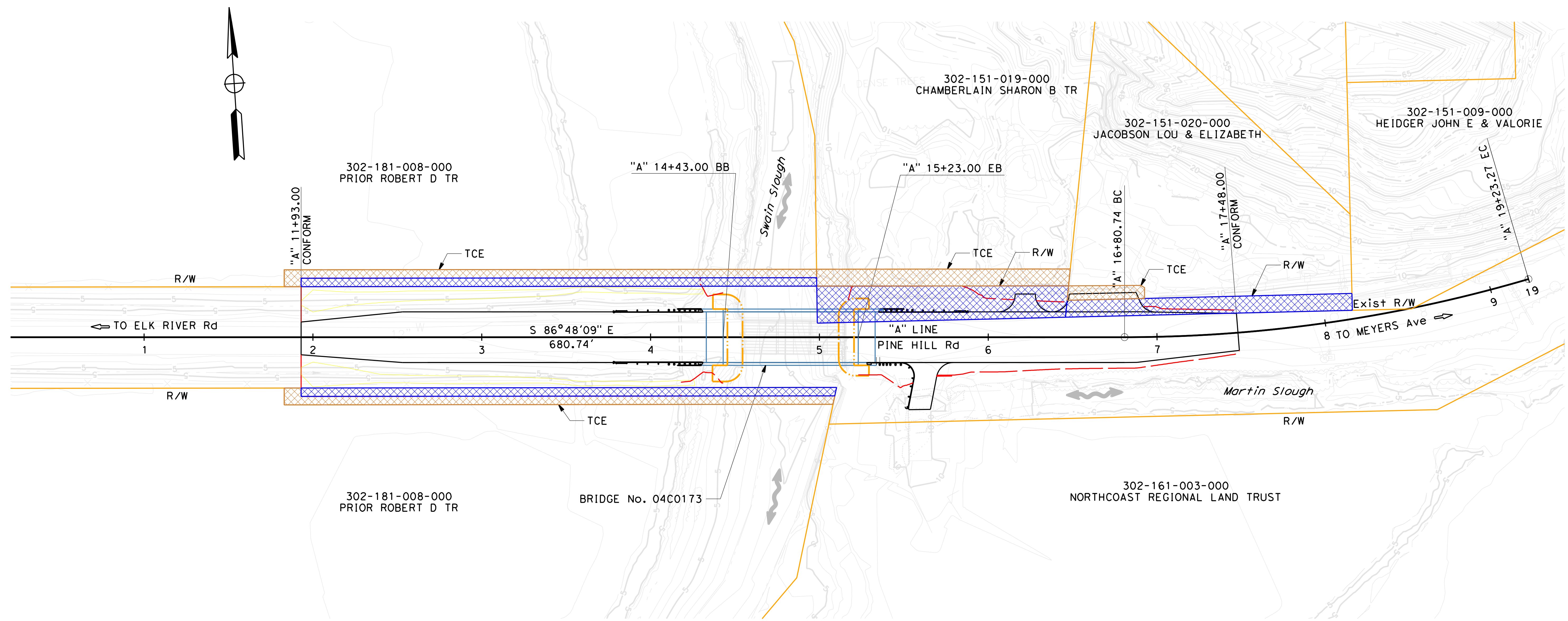
PINE HILL ROAD BRIDGE OVER SWAIN SLOUGH

RIGHT OF WAY NEEDS

LEGEND:

TEMPORARY CONSTRUCTION EASEMENT

PERMANENT ROADWAY EASEMENT



APN	OWNER	TOTAL PARCEL	PERMANENT ROADWAY EASEMENT	TEMPORARY CONSTRUCTION EASEMENT	REMAINDER
		SF	SF	SF	SF
302-181-008-000	PRIOR ROBERT D TR	914,760	3,110	3,310	911,650
302-151-019-000	CHAMBERLAIN SHARON B TR	110,642	2,995	1,500	107,647
302-151-020-000	JACOBSON LOU & ELIZABETH	20,909	1,695	370	19,214

RIGHT OF WAY NEEDS

SCALE: 1"=30′

RW-1

Appendix F - Archaeological Study Report (ASR)

An Archaeological Survey Report for the Swain Slough Bridge Replacement Project at Pine Hill Road Located near Eureka, Humboldt County, California

Prepared For:
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Reviewed By: ______________________
Timothy Keefe, Office of Local Assistance Archaeologist &
Local Assistance Native American Coordinator PQS, Caltrans District 2

Approved By: ______________________
District Environmental Branch Chief
Caltrans District 1
P. O. Box 3700
Eureka, CA 95502-3700

USGS 7.5' Topographic Quadrangle Maps: Eureka, CA
Acreage of Survey: 2.7 acres
No Historic Properties/Resources Identified

January 2013

CONFIDENTIAL INFORMATION

Archaeological and other heritage resources can be damaged or destroyed through uncontrolled public disclosure. Archaeological site locations and culturally sensitive information is considered confidential and public access to such information is restricted by state and federal law.

Information regarding the location, character or ownership of a historic resource is exempt from the Freedom of Information Act pursuant to 16 U.S.C. 470w-3; Section 304 of the National Historic Preservation Act, 36 CFR 800(6)(a)(5) and 36 CFR 800.11(c); Section 9(a) of the Archaeological Resources Protection Act; Executive Order 13007; Section 6254.10 of the California State Government Code: and the 2005 California Senate Bill 922.

SUMMARY OF FINDINGS

During the fall of 2012, Roscoe and Associates completed a Phase I archaeological survey at the location of the Swain Slough Bridge (#04C-0173) Replacement Project at Pine Hill Road approximately 300 meters east of Elk River Road, near Eureka, Humboldt County California. Swain Slough Bridge is a 63-foot long, three span structure constructed in 1955, which is now proposed for replacement. Roscoe and Associates conducted this investigation under contract with the Humboldt County Department of Public Works who is working with California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA) with funding from the Highway Bridge Program and the Toll Credit Bridge Replacement Fund. This project qualifies as a federal undertaking subject to review under the January 2004 Programmatic Agreement (PA) among the FHWA, the Advisory Council on Historic Preservation California, the California State Historic Preservation Officer and Caltrans regarding compliance with Section 106 of the National Historic Preservation Act (Section 106 PA).

Caltrans is the lead federal agency, following the provisions of the Memorandum of Understanding (MOU) between the Federal Highway Administration and the California Department of Transportation concerning the State of California's participation in the Surface Transportation Project Delivery Program, which became effective on October 1, 2012 pursuant to 23 USC 326 or 23 USC 327. As a result, the State of California has assumed FHWA's responsibilities under NEPA, as well as, consultation and coordination responsibilities. In that, this project is covered by the above referenced MOU, FHWA has assigned, and Caltrans has assumed, FHWA responsibility for environmental review, consultation, and coordination on this project. The Humboldt County Department of Public Works is the lead agency for the California Environmental Quality Act (CEQA).

The purpose of this report is to document whether historic properties/resources are present within the proposed project area pursuant to Section 15064.5 of CEQA, 36 CFR 800.4(b), and Section 106 PA. This report describes the proposed project, the APE description, background historical information, correspondence with knowledgeable individuals, investigation methods and results.

The North Coastal Information Center (NCIC) records indicate that the project APE had been subject to a previous archaeological investigation by Roscoe and Associates in 2002 (NCIC Survey #24019). The NCIC base and primary maps, however, show that no cultural resources have been recorded in the project APE.

Background research indicates that the project area is situated in the historical territory of the Wiki subdivision of the Wiyot Tribe. The closest know village, CA-HUM-77 is at the mouth of Elk River, approximately one mile to the northwest (Loud 1918). Loud (1918) also reports of a Wiyot village and fishing place further to the southeast near Elk River School. Although no sites are known in the specific project area, Swain Slough is navigable, and would have provided access to the Elk River Valley and upstream areas. Based on the historic research conducted during this investigation, Pine Hill Road has crossed Swain Slough at this location since c.1890s,

when the road was used to connect Elk River Corner and Humboldt Hill. The specific project location was under agriculture by the 1870s, with an early building, probably a barn, being mapped at the confluence of Martin Slough and Swain Slough, approximately 100 meters to the south. There is no mapping of ownership of the project area until 1886, at which time it appears that the property was owned by S. F. Pine. The nearby Lorensen Ranch buildings were subject to a preliminary historical significance evaluation in 2002 (Roscoe and Van Kirk) and found eligible for listing.

Local Native American tribes were contacted. This was initiated with the Native American Heritage Commission (NAHC) who provided a list of Native American individuals and tribes with ancestral interest in this portion of Humboldt County. Correspondence was ultimately conducted with representatives of the Bear River Band of the Rohnerville Rancheria, Blue Lake Rancheria and the Wiyot Tribe. Ms. Erika Collins, Tribal Historic Preservation Officer for the Bear River Band of the Rohnerville Rancheria was present during the field survey.

An archaeological field survey was conducted on August 24, 2012, September 2 and 20, 2012 by James Roscoe and William Rich. The field survey was conducted under fair conditions. Archaeological material was sought in exposures of mineral soils which were found along the margins of the APE and in the adjacent areas. This low profile bridge crossing over Swain Slough is situated on the flat bottom of lower Elk River valley where recent sediment aggregation has filled in the historic channel causing an increase in flooding. The areas of existing ground disturbance from levy construction along Swain Slough, and a tide gate on Martin Slough provided ample mineral soil exposure to survey for expected archaeological site indicators that could be present in the project APE.

No cultural resources were identified during this investigation. The Swain Slough Bridge (#04C-0173) itself exceeds 50 years of age; however, the structure was previously included in Caltrans's Statewide Bridge Inventory and evaluated as ineligible for listing on the California Register of Historic Resources. Therefore, this investigation supports a finding of "No Historic Properties Affected" (36 CFR 800.4(d)(1)) and "No Adverse Effects to Historical Resources" (Public Resource Code 5020.1). At this time, no further archaeological studies are recommended. If, however, the APE changes to include areas not previously surveyed, additional investigation would be required.

It is Caltrans' policy to avoid cultural resources whenever possible. If however, buried cultural materials are encountered during project construction, work shall stop in the immediate vicinity of the find(s) until the Humboldt County Public Works Department can follow Caltrans' procedures for discovery of cultural resources during implementation of an undertaking, as described at 36 CFR 800.13.

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APPENDIX C - Native American Correspondence

APPENDIX D - North Coastal Information Center Record Search Results

1.0 INTRODUCTION AND PROJECT DESCRIPTION

During September and October of 2012, Roscoe and Associates completed a Phase I archaeological survey for the Swain Slough Bridge Replacement Project near Eureka, Humboldt County, California (Appendix A-Figure 1). The Swain Slough Bridge (#04C-0173) provides access between lower Elk River Road and Herrick Street. The project is designed to replace the existing 1955 bridge, which has been classified as structurally deficient and functionally obsolete due to aging timber and concrete foundation. The existing bridge will be replaced with a new single span, post tensioned slab, which will be cast in place.

The existing bridge will be removed with heavy equipment while working from the road surface and disposed of offsite. A row of sheet piles will be vibrated into the Swain Slough channel in order to divert the tidal flow and allow for removal of the existing abutments and footings. The new abutment footings will be constructed on driven piles. Construction of the bridge abutments will require two excavation areas each measuring approximately 30 feet long by 12 feet wide. The falsework for the bridge construction will use the newly constructed abutments and will not require supports within the channel. Rock slope protection at the face and adjacent to the bridge will be required. Mainline roadway approach construction will include fills of up to 5 feet.

A 12" water line is located on the north side of Pine Hill Road and is attached to the outside edge of the existing bridge. The overhead electric lines and sewage pump plant located to the east of the project will not be affected. The underground waterline will need relocation. Coordination will conform to the latest Caltrans procedural guidelines for relocation.

Humboldt County has 66' of maintenance easement along the centerline of Pine Hill Road. It is anticipated that the permanent improvements can be accommodated within this existing area. The detour and temporary construction areas (including staging areas) will likely be located outside of the maintenance easement area. Coordination and agreements with the neighboring landowner(s) for these temporary uses will be required. Equipment and materials will be staged on the existing asphalt concrete roadway approaches.

Humboldt County currently has prescriptive right-of-way on Pine Hill Road for the existing roadway and bridge alignment. It is anticipated that temporary construction easements (TCE) will also be required to construct the new bridge. The new bridge rail and end protection is likely to affect access to the field at the southeast corner of the bridge. There is currently an access gate immediately adjacent to the existing bridge that would likely need to be relocated to the east. This existing access crosses Martin Slough via metal culverts that have flap gates attached to the downstream ends. A new access to the east may be required and would likely require new metal culverts.

The new bridge will accommodate two 10 foot traffic lanes and 5 foot shoulders with railing along both sides. Construction will take place during daylight hours using heavy equipment which may include an excavator, front end loader and/or a bulldozer. During project implementation, traffic will be restricted from access to the bridge location and a detour will be set in place. Silt fence and or fiber rolls will be used to reduce erosion and staging and stockpiling will occur on the roadway to the west of the bridge.

The project APE is situated in the south half of the southeast quarter of Section 4 of Township 4 North, Range 1 West (HBM). This location is shown on the 7.5' USGS Eureka, California Topographic Quadrangle Map (Appendix A - Figure 2). The bridge is located at UTM coordinates (NAD 83, UTM Zone 10) 400,166mE / 4,511,971mN. The elevation of this location is approximately 20 feet above sea level.

Roscoe and Associates is a cultural resource management consulting firm working in northwest California for over 30 years. All key staff meet the Secretary of Interior's Professional Qualifications Standards for Archaeology (Title 36 Code of Federal Regulations Part 61, and 48 Federal Regulation 44716). Principal Investigator James Roscoe, M.A., and Registered Professional Archaeologist (RPA) William Rich, M.A., conducted the archaeological field survey and prepared this report. Jerry Rohde, M.A. prepared the background history section.

1.1 AREA OF POTENTIAL EFFECT

The horizontal APE boundary is rectangular in shape and aligned with the center of the roadway. This APE boundary measures 300 meters in length and varies in width from 15 to 30 meters. The APE includes locations of the existing Swain Slough Bridge, Pine Hill Road and the proposed staging area in the west end of the APE. The vertical limits of the APE will be greatest for the construction of the bridge abutments and piers. Footing construction is expected to occur at the location of the existing footings, and reach depths of 3 meters or more. It is expected that geotechnical boring will be conducted prior to final project design. All equipment and materials staging will occur within the boundaries of the APE. The map provided in Appendix A -Figure 3 shows a detailed plan of the APE. The county project plans and description have also been included as Appendix B.

2.0 ENVIRONMENTAL AND CULTURAL SETTING

2.1 NATURAL SETTING

The project location is approximately two miles upstream from the mouth of Elk River at Humboldt Bay and is influenced by the semidiurnal tides of the Pacific Ocean. Swain Slough drains all of Martin Slough and the small watersheds on the east side of the lower Elk River Valley. The project setting is relatively flat, dominated by the low gradient, slow moving water of the slough which makes a mild sweeping turn at the project location. The mouth of Martin Slough has been altered to enter Swain Slough at a tide gate along Pine Hill Road. Formerly it would have entered 100 meters to the south, upstream on Swain Slough. During the historic period, Swain Slough, and others around the bay, were lined with an earthen levee to control flooding. The surface geology of the project location is of relatively recent age, less than 10,000 years old (Strand 1962). The sediments at the project location are fine grained clay silt, and sand, typical of this upper estuarine environment. This location may have been inundated during the tsunami of 1700 (State of California Tsunami Inundation Map 2009).

The land surrounding the project location is currently maintained as open pasture for cattle and horse grazing. Before these intensive agricultural practices, this landscape would have hosted a dense riparian woodland. Sitka spruce would have dominated, with a varying mosaic of willow, alder, and other trees tolerant of exposure to the coast. Animals that frequent this vegetation community include a variety of large and small mammals, various birds, several fish species and invertebrate resources. Prior to the contact period, grizzly bear, elk and condor were present but are now extirpated. The large and small mammals currently present in this environment include black-tailed deer, black bear, mountain lion, coyote, bobcat, ground squirrels, rabbits and many other small mammals. It is probable that high numbers of anadromous fish and eel were present in Swain and Martin Slough, and that these species and others were utilized by neighboring Wiyot villages. These fish are still present and the focus of several restoration efforts in the Elk River Watershed (Raskin and Roscoe 2011).

2.2 PREHISTORY

The prehistory of the north coast region of California is often described with reference to northwest interior and has a deep prehistoric record reaching to the early Holocene Period over 7,000 years ago. This is an environment where the persistent coastal moisture and the arid interior converge. Coupled with the geologic complexity of the Franciscan formation, this area had a unique prehistoric cultural expression. Archaeological research in this general region has hypothesized a continuous prehistoric cultural chronology for the last 7,800 years before present.

The oldest is the Borax Lake Pattern ***(8,000 to 3,000 B.P.)***, attributed to the earliest known prehistoric occupation for this portion of northwest California. These remains are thought to represent the activities of small, highly mobile family groups who ranged over wide areas

(Fitzgerald and Hildebrandt 2001). The early period assemblages have been documented on the ridgelines east of Humboldt Bay and at a coastal terrace overlooking Little River, in Dows Prairie (Hildebrandt and Hayes 1983, 1984, Roscoe 1995).

The Middle Period ***(5,000 to 2,500 B.P.)*** is represented by the Mendocino Pattern, an adaptive orientation toward the use of low elevations, along salmon bearing streams near acorn crops and which could be occupied by larger concentrations of people during the winter months (Hildebrandt and Hayes 1983, 1984, Bickel 1979). Archaeological sites associated with middle period assemblages have been located in the coastal hills adjacent to Humboldt Bay and at bay margin sites in Arcata (Eidsness 1993).

The late period Tuluwat (formerly Gunther) Pattern is generally dated after 1,100 years ago and presumed to represent a continuation of the Middle Archaic Period with a particular focus on coastal resources. Sites dating to this time are found throughout the western North Coast Ranges in moderate density. The environments around Humboldt Bay are marked by ethnographically described sites of this period, but generally seem to lack any archaeological deposits of the middle or early period occupations. Late period archaeology has been investigated at the Wiyot Village of Tuluwat (CA-HUM-67), on Indian (Gunther) Island in Humboldt Bay, among others, and more recently at an archaeological site owned by the Blue Lake Rancheria in Manila (Loud 1918, Tushingham 2011)

2.3 Ethnogeography

The study area lies within the traditional territory of the Wiki division of the Wiyot Indian tribe. This group occupied lands adjacent to Humboldt Bay (Nomland and Kroeber 1936, Curtis 1970, and Merriam 1998), while other divisions of the tribe inhabited areas to the north and south. The Wiyot language has been categorized as Algonquian-based. In it, the Wiyots called themselves the Soo-lah-te-luk (Merriam 1998). The name "Wiyot" itself is derived from the Yurok term "weyet or "weyot" (Loud 1918:297); the Yurok, who lived to the north, also spoke a language classified as Algonkian (Teeter 1964). Although the Wiyot and Yurok languages are distinctly different, linguists have linked the two in "a provisional group called Ritwan" that is alternatively classified as Algic (Elsasser 1978:155). Linguistic research implies that the two groups are distantly related, and this "unlikely Yurok-Wiyot proximity" has been hypothetically explained as "parallel migrational responses by two similar but separate groups at different times to similar geographic and ecological pressures and/or opportunities" (Moratto 1984:483, 564-564).

According to Humboldt State University linguist Victor Golla, the Wiyots arrived in the Humboldt Bay area approximately 2,000 years ago, inhabiting a lagoon environment that afforded the use of coastal resources. The Yuroks then came "at a much later date," sometime subsequent to the arrival of the first Athabascan speakers, who came after 600 CE (Common Era) (Golla 2003).

The living habits of the Wiyots have been summarized most notably by Curtis (1970), Loud (1918) Nomland and Kroeber (1936), and Elsasser (1978). Interviews with Wiyots born near the time of white arrival have provided at least a partial picture of what traditional tribal life was like. The photographer and ethnographer Edward S. Curtis relates that "Wiyot houses were like those of the Klamath river tribes, with plank walls and gabled roof, and a deep excavation occupying the greater part of the enclosed square" (Curtis 1970:71). Archaeologist L. L. Loud describes a slightly different structure with a shallow pit in the center, and also tells of sweat houses that were half subterranean and "at least sixteen feet square" (Loud 1918:267). Wiyot redwood canoes were similar to those of the Yuroks and were used primarily on the bay and rivers, although "in calm weather [the Wiyots] sometimes fished outside the heads" (Curtis 1970:72-76). They mainly hunted two marine mammals from canoes:

> A seal sleeping on the water was warily approached by two men in a canoe, who remained quiet while the animal's nose was above water and paddled when it was submerged. When the canoe was a few yards distant, the man in the bow launched the harpoon (Curtis 1970:73).

Sea lions, on the other hand,

> were harpooned as they lay on the rocks. The victim plunged into the water, carrying the harpoon along, and the hunter then rejoined his men in the canoe and gave chase. Other small harpoons were planted in the animal as opportunity was offered, and at last when it was somewhat exhausted the line was drawn in while one of the men stood ready with a heavy club and another with an additional harpoon. The largest sea-lions were dangerous, and would attempt to seize the canoe in their teeth (Curtis 1970:73).

Other animals were hunted or caught in various ways. Elk were pursued by a hunter and his dogs in a running chase that could last as much as two days. Deer and sometimes elk were caught in rope snares. Bears were trapped in deadfalls, or, if hibernating in a hollow log, suffocated by smoke after the openings had been partially blocked. Waterfowl were hunted from blinds; the expenditure of "thirty to forty wooden-pointed arrows would succeed in killing perhaps six or eight waterfowl out of a flock" (Curtis 1970:73). Salmon might be taken in gill nets or in either of two types of fish weirs. Smelt were caught in surf nets and other fish by other means.

Clothing was mostly made from deer skins. Women and girls wore basketry caps. Basket-making materials included spruce and willow roots, bear grass, maidenhair and Woodwardia ferns, and a dye made from alder bark juice (Curtis 1970:71-72). The women wove twine baskets for carrying and cooking foods (Curtis 1970:76-77).

The Wiyot lived in villages that were uniformly close to water, for they were people of the wetlands, where their sustenance often came from bay or river, and where their way could often most easily be made by canoe rather than on foot. Although the Wiyot were "as 'coastal' in residence as a people could be...they used the ocean very little for either subsistence or travel" (Nomland and Kroeber 1936:45). On the other hand, "[e]very bay settlement was on tidewater" (Nomland and Kroeber 1936:45).

The main Wiyot travel route extended from the mouth of the Mad River to the mouth of the Eel, running down Mad River Slough and part of the Samoa peninsula before crossing the bay to Indian Island (travelers on the peninsula would shout or build a fire to attract a boatman from the island) (Loud 1918:231), continuing across to Eureka, arcing down and around the bay, crossing Elk River near its mouth, to the end of Table Bluff, and then down McNulty Slough to the Eel. Two side trails, one from White's Slough and one from Hookton Slough, forked southeast to connect with the area near Fernbridge (Nomland and Kroeber 1936:43, 47. The Wiyot, "though they rarely slept beyond the smell of salt water, managed their lives so as to avoid more than an occasional putting to sea" (Nomland and Kroeber 1936:45-47).

2.3.1 Ethnogeography of the Project Area and Surroundings

The closest known Wiyot village site to the project area is Loud site 77, *iksori*, which he claims was among those used by the tribe in 1850 (Loud 1918:286, Plate 1). The Wiyots also called Elk River iksori, and the village of that name was at the river's mouth. The tribe's most noted leader at the time of white arrival, Ki-we-lat-tah, "lived here part of the time". *Iksori* lay on a sandspit between the river and Humboldt Bay. Loud indicates that *iksori* was subsequently "washed away," and his field map of village sites shows iksori located in the waters of Humboldt Bay slightly northwest of the mouth of Elk River (Loud 1913; 1918:270, 277, 286, Plate 1).

The location of *iksori* is approximately three-quarters of a mile northwest of the project area. Given the lifestyle patterns of the Wiyot, it is likely that *iksori* residents and perhaps other Wiyots used Swain Slough for canoe travel for hunting, fishing, and/or gathering. The slough may also have provided access to Martins Slough and the bluff top area to the northeast of the slough. It is also possible that there were habitation areas adjacent the slough at locations of higher ground near fresh water. This would fit with the characteristic south-facing, hillside locations favored by most local tribal groups. The incomplete record of Wiyot habitation in the Elk River drainage leaves this possibility in the realm of speculation, however.

Although there may have been several villages up river (Rohde 2010), only one other community on iksori river was spoken of: *chwanochkok*, which was located near the Elk River School. Wiyot camped there to catch salmon and dry them. The Gregg Party stayed at this location (Loud 1918:273, 286, Plate 1) on their way south—perhaps lost, perhaps looking for an easy crossing of the river. The sudden arrival of this group of heavily armed outsiders was a portent of the mass immigration that followed a few months later. Soon the new settlers were pushing the Wiyot out of many village locations. Within a few years *iksori* was one of only three Indian settlements left along the bay (Loud 1918:323). In February 1852 the murder of two white men living on Eel River was blamed on the Wiyots. Enraged community members met at various towns and deployed parties to mete out retribution. *Iksori* village came under one of a series of attacks that resulted in several deaths (Loud 1918:323-324).

The river iksori was a travel route for the Wiyots. They would paddle their canoes upstream to a point opposite the ridgeline north of Elk River's North Fork. From there they took a trail up the ridge to the western portion of Kneeland prairie, on Barry Ridge, where they would hunt and gather in the summertime and attempt to avoid conflicts with the Athabaskan tribes that came to Kneeland from the Mad River and Yager Creek drainages (Loud 1918:230-231, 255, Plate 1).

There likely were more Wiyot trails in the area, but they have not been recorded. The settlers of central Humboldt Bay, using either an existing Indian trail or building a new one of their own, developed a route through the Elk River drainage to the inland mines. By 1854-1855 the government survey had mapped the "Eureka and Trinity Trail" that came south from today's Cutten area. It followed the approximate course of Walnut Drive and then, at Ridgewood Heights, continued south along the ridgeline, above the east side of the Elk River valley. At a point north of the North Fork of Elk River, this trail turned left, following the Wiyot route up to Kneeland and then continuing on its way to Trinity County (Surveyor General's Office 1854a, 1855a, 1890a, 1890b, Doolittle 1865).

In early 1860 an association of white ranchers committed a series of massacres against the local Indians. Over a dozen villages were attacked, including *iksori* and others on Elk River. Many of the surviving Indians, who were mostly Wiyots, were removed to distant Indian reservations (Rohde 2010). It is likely that at this time the Indian population in the Elk River drainage was virtually eliminated. By the early 1900s, no Indians were listed as inhabiting the area (Kelsey 1971).

2.4 HISTORY

A survey of historic maps showing the project area reveals the following information:

- 1852: A bare outline of lower Elk River is shown with no depiction of either Swain or Martin sloughs. The nearest cultural features are the communities of Humboldt [City] and Bucksport, each approximately two miles away (U. S. Coast Survey 1852).
- 1855: Elk River is again shown with no subsidiary sloughs. The project area is shown as apparently being within "R. M. William's [*sic*] School Location," a reference to a large parcel (part of the boundary is not rendered) that was probably school warrant land belonging to R. M. Williams. No structures are shown in the area. (Surveyor General's Office 1855a).
- 1865: Land north of the project area is shown in the ownership of R. M. Williams. Land west of the project area, across a road going up Elk River valley, is shown being owned by J. K. Shanahan. Land just south of Martin Slough, in the vicinity of the project area, belongs to A. Swain (Doolittle 1865).

- 1870: Both Swain and Martin sloughs are now depicted. What appear to be two ranches, with barns and orchards, are shown on the blufftop north and northeast of the project area. A road runs up the Elk River valley west of the project area (following the approximate course of today's Elk River Road. The "Road from Eureka to Rohnerville Hydesville and Eel River" comes down from Humboldt Hill, runs along the north side of Elk River, and then crosses the river at the later site of Elk River Corners. One structure is shown immediately northwest of the river crossing. This road then reaches a "T" junction with the road up Elk River. East of the latter road are cultivated areas west of Swain Slough and south of Martin slough. A structure is shown just south of the confluence of the two sloughs. At this time the project area is shown as being in the cultivated area west of Swain Slough and in an unmarked area east of the slough (U. S. Coast Survey 1870).
- 1886: The Bucksport and Elk River Railroad is shown running west of the Elk River Road past what became Elk River Corners. The project area apparently belongs to S. F. Pine (Forbes 1886).
- 1890: The cultural features appear similar to those depicted on the 1870 map. The section of Pine Hill Road east of Elk River Road does not appear on the map (United States Coast and Geodetic Survey 1894).
- 1898: Property boundaries are incomplete, but the project area appears to still be owned by S. F. Pine. The road from Humboldt Hill now forms a four-way intersection with the Elk River road at a community labeled Elk River, but which is actually Elk River Corners. A new road section to the east (Pine Hill Road) crosses Swain Slough and then runs northeast (and uphill) into the "Myers Tr[act]" (Lentell 1898). This new section is what is now called Pine Hill Road.
- 1911: The road configuration remains the same. The crossroads community is still called Elk River. The project area is now shown as belonging to "Myers," while land to the northwest is owned by "J. Pine" (Denny 1911).
- 1916: The structure immediately south of the confluence of Martin and Swain sloughs is still present. Several structures are shown on the hillside northeast of the project area, above the bend where Pine Hill Road turns into Myers Road (Laird 2007).
- 1921: The "State Highway" has replaced the road down Humboldt Hill as the main route to and from Eureka. A remnant of the old road runs from the highway east to the Elk River Corners intersection. The portion of the project area west of what is called "Martin's Slough" but is depicted on current maps as Swain Slough is owned by Ira L. Tooby. The project area portion east of the slough appears to be part of the Myers Tr[act] north of the road and owned by Cornelius Lorenson south of the road (Belcher 1921:6).

- 1949: The old road that crossed Elk River just west of Elk River Corners now stops at the east side of the river, with a new road extending south from this endpoint approximately one-quarter mile. The project area west of Swain Slough is owned by Ira L. Tooby. East of the slough crossing, the area south of the road is owned by E. H. Lorensen and the area to the north is part of the Myers Tract (Metsker 1949:19).

Research of historic maps listed above indicates that the project area was under cultivation at least as early as 1870 (Appendix A-Figure 4). At that time there was one building, perhaps a barn or large shed, adjacent to or within the project area. It was located just south of the confluence of Martin and Swain sloughs and thus also just south of Pine Hill Road. The mouth of Swains Slough has since been moved to the north.

There is no mapping of ownership of the project area until 1886, at which time it appears that the property was owned by S. F. Pine. Pine was a business owner, rancher, and elected official. In 1890 Pine was listed as the proprietor of the Eureka Dairy (Hamm 1890:132), member of the Ninth District Board of Agriculture (Hamm 1890:viii), clerk of the Bucksport School District (Hamm 1890:21), and as "silent partner" in the Eureka Foundry and Machine Shop (Hamm 1890:205). His "milk ranch" comprised 350 acres of land that had been "subject to overflow on the occasion of high tides." Pine, however, diked the land after he purchased it in 1880. The ranch included a house on "a lofty bluff," with orchards and gardens around it. At the foot of the bluff were horse and milk cow "stables," the latter accommodating 116 dairy animals. There were two pastures for the farm animals (Hamm 1890:191, 193).

A comparison of the 1898 Lentell map, which shows property ownership, with the 1894 Coast and Geodetic Survey map, which shows cultural features, indicates that Pine's property ran from a line just east of the mouth of Elk River eastward to encompass part of the blufftop across which Herrick Avenue now runs. The property extended south to Elk River, included the area east of the river down to Elk River Corners; its line then followed the eastern side of Elk River Road to a point southeast of the confluence of Martin and Swain sloughs. The line then ran easterly some distance before turning north and west to gain the top of the bluff. A ranch road that approximates the route of today's Herrick Avenue went east from the main road to climb the bluff and reach the ranch house and orchards. The structure at the confluence of Martin and Swain sloughs that appears on the 1870 map is still present. It appears to be within Pine's property and may have been one of "stables" or barns referred to in the 1890 report (Lentell 1898; United States Coast and Geodetic Survey 1894). The configuration of ranch buildings and roads appears to be the same as that shown on the 1870 Coast Survey map (U. S. Coast Survey 1870). In 1904 Pine is listed as the chairman of the Humboldt County Board of Supervisors (Times Publishing Co. 1904).

By 1921-1922 Ira L. Tooby has taken over the Pine property as part of a parcel that extends on both sides of Elk River and that includes the project area. Ira was the son of George J. Tooby, a "pioneer merchant and stock rancher of southern Humboldt" (Humboldt Standard 1927).
A review of basic information sources did not uncover information about the other land owners.

The map information cited above indicates that the section of Pine Hill Road that runs through the project area was constructed between 1894 and 1898. No further information was located about the road.

3.0 METHODS

3.1 BACKGROUND RESEARCH AND CONSULTATION

3.1.1 North Coastal Information Center Records Search

Background research for the cultural resources survey at Swain Slough Bridge included a records search at the North Coastal Information Center (NCIC) and a background literature review. The literature review for this project included an examination of historical maps, records and published documents at the Humboldt County Historical Society, Humboldt State University Library, and the Humboldt County Library.

William Rich conducted a records search at the NCIC located in Klamath, California on July 24, 2012. This included searching an area considered the investigation "study area" as measured by a ½ mile buffer from the boundaries of the APE. Previous survey areas and recorded site locations were copied onto a blank USGS topographic map. This records search included the direct project area with a 500 meter radius buffer. Within this record search area, all past surveys were plotted. All previously recorded cultural resources were also plotted and the site records were copied. Also searched at the NCIC were files on the Humboldt County NRHP-Listed Properties and Determined Eligible Properties, California Register of Historical Resources, California Points of Historical Interest, California Inventory of Historical Resources, and the listing of the California Historical Landmarks.

3.1.2 Background Archival Research

Background archival research was aimed at obtaining information pertinent to the prehistoric and historical uses of the survey area. It was also hoped that this would generate specific geographic information about archaeological and historic sites in the survey area and its vicinity. Background research also provided an understanding of the types of cultural resources that were likely to be encountered in each of the project's APE. Ethnohistoric research included an examination of historical maps, records and published and unpublished ethnographic documents at the Humboldt County Historical Society, Humboldt State University Library as well as the author's personal libraries.

3.1.3 Consultation with Native Americans

On August 7, 2012 written correspondence regarding the cultural resources investigation was sent to the Native American Heritage Commission (NAHC) requesting a search of the Sacred Lands Inventory File (Appendix C). Roscoe and Associates also requested the current list of local Native American groups and individuals who may have interests and/or concerns about cultural resources in the project site. The NAHC responded on August 14, 2012 with a current Native American contact list for the region. Letters were sent to all those listed on August 14, 2012. This included The Wiyot Tribe, Bear River Band of the Rohnerville Rancheria and the Blue Lake Rancheria. Notification letters included a brief project description, investigation methodology, and a project location map. A written emailed response was received from Erika Collins, Tribal Historic Preservation Officer (THPO) from the Bear River Band of the

Rohnerville Rancheria on August 15, 2012, in which she commented on the sensitivity of the area. A follow-up phone call was made and Ms. Collins participated in a field visit with Roscoe and Associates on September 20, 2012, where the bridge abutments and other areas of expected ground disturbance is occurring. We discussed the potential vertical APE for the project and Ms. Collins was satisfied and had no further concerns. Janet Eidsness, THPO for the Blue Lake Rancheria and Monique Sonoquie, THPO for the Wiyot Tribe responded by email August 22, 2012 and September 24, 2012, respectively. Both THPO's requested that they be notified if any cultural resources were found. No other concerns were noted. (Appendix C).

3.2 Survey Methods

3.2.1 Survey Expectations

Historical research indicated that the project vicinity had low potential for Native American archaeological sites, as it occurs in the bottom lands surrounding Humboldt Bay and associated sloughs and may have also been subject to the past tsunami inundation. Historic period cultural resources associated with homesteading, and ranching could be located in the project vicinity. Prehistoric archaeological site indicators would predominantly include stone tools of chert and obsidian, stone tool manufacturing debitage, ground stone implements, milling stone features, locally darkened midden soils with marine shell and/or bone debris, pit features and rock alignments. Expected historic period cultural resource indicators include standing or ruined buildings; ceramic, glass, or metal artifacts; structures; trails; tailings and pits.

3.2.2 Field Investigation

James Roscoe and William Rich conducted a pedestrian survey at the project APE on August 24, 2012, September 2 and 20, 2012 (Appendix A – Figure 5 and Figure 6). The APE was surveyed with an intensive pedestrian approach where close spaced (less than 5 meters) zig-zag transects were utilized while visually scanning the ground surface. Exposures of mineral soils were closely examined. Special attention was given to the slough levees and the road margin of Pine Hill Road. Extensive surface scraping was not conducted.

4.0 FINDINGS

4.1 PRE-FIELD SEARCH RESULTS

The NCIC record search included the project APE and a 500-meter buffer around its perimeter. The record search results and map are attached to this report as Appendix D.

4.1.1 Results of North Coastal Information Center Records Search

A records search was conducted by Roscoe and Associates at the NCIC in Klamath, California on July 24, 2012 (Appendix D). This search revealed that the project area had been subject to a past cultural resources investigation by Roscoe and Van Kirk (2002) but that no cultural resources were identified in the current project APE. This report does however document the recordation efforts and historical significance evaluation of the Lorensen house and ranch Buildings within the 500 meter buffer. Roscoe and Van Kirk (2002) provided a preliminary opinion that the buildings are eligible for listing on the California Register of Historical Resources because of their high level of historic integrity and association with early dairy ranching around Humboldt Bay. The NCIC lists two additional surveys within 500 meters of the project area (Roscoe 1989, Roscoe 1995), and one written overview of the Humboldt Bay Area (Benson 1977) (Table 1). Roscoe's past surveys were for private development and widening of Elk River Road. No cultural resources were identified in the project area as a result of these past surveys.

Table 1. Previous archaeological surveys within the project area and ½ mile of the project APE.

NCIC Report #	Author/Date	Report Title	Results
10975	Roscoe, J. 1989	An Archaeological Investigation of the Proposed Widening of Elk River Road, Humboldt County, CA	Negative
17643	Roscoe J. 1995	A Cultural Resources Study of the Hales Property APN 302-131-07, Humboldt County, CA	Negative
24019	Roscoe J. and S. Van Kirk 2002	A Cultural Resources Investigation of the Proposed Martins Slough Sewer Connector Route, City of Eureka, Humboldt County, CA	Lorensen Ranch Buildings Identified and Evaluated
886	Benson, J. 1977	Archaeological Reconnaissance of the Humboldt Bay Area for the Humboldt Waste Management Authority	Negative

In conclusion, the background literature search (Section 2.0) and NCIC records search provided no information regarding the proximity of ancestral Native American cultural resources at or near the project area. A review of Loud (1918) indicates that the closest known village, CA-HUM-77 is at the mouth of Elk River, approximately one mile to the northwest. This site is located outside of the 500-meter buffer and was not specifically reviewed and/or visited during this investigation. Information regarding the proximity of historic period features and or buildings is limited to what is shown on historic maps. The roadway which became the current project area at Pine Hill Road first appears on the 1870 U.S. Coast Survey Map of Humboldt

Bay. A possible building is also shown approximately 100 meters to the south. The nearby Lorensen house and ranch buildings evaluated by Roscoe and Van Kirk (2002) are also located outside of the APE.

4.2 Field Survey Results

The cultural resources field survey at the Swain Slough Bridge was conducted over a five-hour period. Conditions during the field survey were optimal with clear, bright skies and ample lighting. Fair visibility of mineral soil was encountered throughout the survey areas. Survey was focused at the levee along both sides of Swain Slough and the bridge foundation areas. No cultural resources were identified during this investigation.

5.0 CONCLUSIONS

This investigation has determined that no historic properties/resources are present in or adjacent to the APE. This supports a finding of "No Historic Properties Affected" (36 CFR 800.4(d)(1)) and "No Adverse Effects to Historical Resources" (Public Resource Code 5020.1).

No further archaeological studies are recommended at this time. It is the opinion of Roscoe and Associates that this investigation constitutes a reasonable and good faith effort to identify cultural resources in and near the project location. It is unlikely, given the project setting, background research and intensive field survey that significant cultural resources will be discovered during project implementation. If, however any archaeological materials are uncovered during project activities, the following pages offer recommendations for ensuring that potential project impacts to significant cultural resources are eliminated or reduced to less than significant levels.

5.1 PROTOCOLS FOR INADVERTENT DISCOVERIES

5.1.1 Inadvertent Discovery of Cultural Resources

If cultural resources, such as chipped or ground stone, historic debris, building foundations, or bone are discovered during ground-disturbance activities, work shall be stopped within 20 meters (66 feet) of the discovery, per the requirements of CEQA (January 1999 Revised Guidelines, Title 14 CCR 15064.5 (f)) and Section 106 (36 CFR 800.13). Work near the archaeological finds shall not resume until a professional archaeologist, who meets the Secretary of the Interior's Standards and Guidelines, has evaluated the materials and offered recommendations for further action.

Prehistoric materials which could be encountered include: obsidian and chert flakes or chipped stone tools, grinding implements, (e.g., pestles, handstones, mortars, slabs), bedrock outcrops and boulders with mortar cups, locally darkened midden, deposits of shell, dietary bone, and human burials. Historic materials that could be encountered include: ceramics/pottery, glass, metal, can and bottle dumps, cut bone, barbed wire fences, building pads, structures, trails/roads, railroad rails and ties, trestles, etc.

5.1.2 Inadvertent Discovery of Human Remains

If human remains are discovered during project construction, work will stop at the discovery location, within 20 meters (66 feet), and any nearby area reasonably suspected to overlie adjacent to human remains (Public Resources Code, Section 7050.5). The Humboldt County coroner will be contacted to determine if the cause of death must be investigated. If the coroner determines that the remains are of Native American origin, it is necessary to comply with state laws relating to the disposition of Native American burials, which fall within the jurisdiction of the Native American Heritage Commission (NAHC) (Public Resources Code, Section 5097). The coroner will contact the NAHC. The descendants or most likely descendants of the deceased will be contacted, and work will not resume until they have made a recommendation to the landowner or the person responsible for the excavation work for means of treatment and disposition, with appropriate dignity, of the human remains and any associated grave goods, as provided in Public Resources Code, Section 5097.98. Work may resume if NAHC is unable to identify a descendant or the descendant failed to make a recommendation.

The following text details procedures for treatment of an inadvertent discovery of Human Remains:

- Immediately following discovery of known or potential human remains all ground-disturbing activities at the point of discovery shall be halted,

    - No material remains shall be removed from the discovery site, a reasonable exclusion zone shall be cordoned off,

    - The Humboldt County Public Works Department Project Manager and property owner shall be notified and the Department Public Works Project Manager shall contact the county coroner.

    - It is highly recommended that the Humboldt County Public Works Department retain the services of a professional archaeologist to immediately examine the find and assist the process.

- All ground-disturbing construction activities in the discovery site exclusion area shall be suspended.

- The discovery site shall be secured to protect the remains from desecration or disturbance, with 24-hour surveillance, if prudent.

- Discovery of Native American remains is a very sensitive issue, and all project personnel shall hold any information about such a discovery in confidence and divulge it only on a need-to-know basis.

- The Coroner has two working days to examine the remains after being notified. If the remains are Native American, the Coroner has 24 hours to notify the Native American Heritage Council (NAHC) in Sacramento (telephone (916) 653-4082).

- The NAHC is responsible for identifying and immediately notifying the Most Likely Descendant (MLD) of the deceased Native American.

- Within 24 hours of their notification by the NAHC, the MLD shall be granted permission by the landowner's authorized representative to inspect the discovery site, if they so choose.

- Within 24 hours of their notification by the NAHC, the MLD shall recommend to the landowner and Humboldt County Public Works Department Project Manager means for treating or disposing, with appropriate dignity, the human remains and any associated grave goods. The Recommendation may include the scientific removal and non-destructive or destructive analysis of human remains and items associated with Native American burials.

- Whenever the NAHC is unable to identify a MLD, or the MLD identified fails to make a recommendation, or the landowner or his/her authorized representative rejects the recommendation of the MLD and mediation between the parties by the NAHC fails to provide measures acceptable to the landowner, the landowner or his/her authorized representatives shall re-inter the human remains and associated grave offerings with appropriate dignity on the property in a location not subject to further subsurface disturbance.

- Following final treatment measures, the Humboldt County Public Works Department shall ensure that a report is prepared that describes the circumstances, nature and location of the discovery, its treatment, including results of analysis (if permitted), and final disposition, including a confidential map showing the reburial location. Appended to the report shall be a formal record about the discovery site prepared to current California standards on DPR 523 form(s). Humboldt County Public Works Department shall ensure that report copies are distributed to the NCIC, NAHC and MLD.

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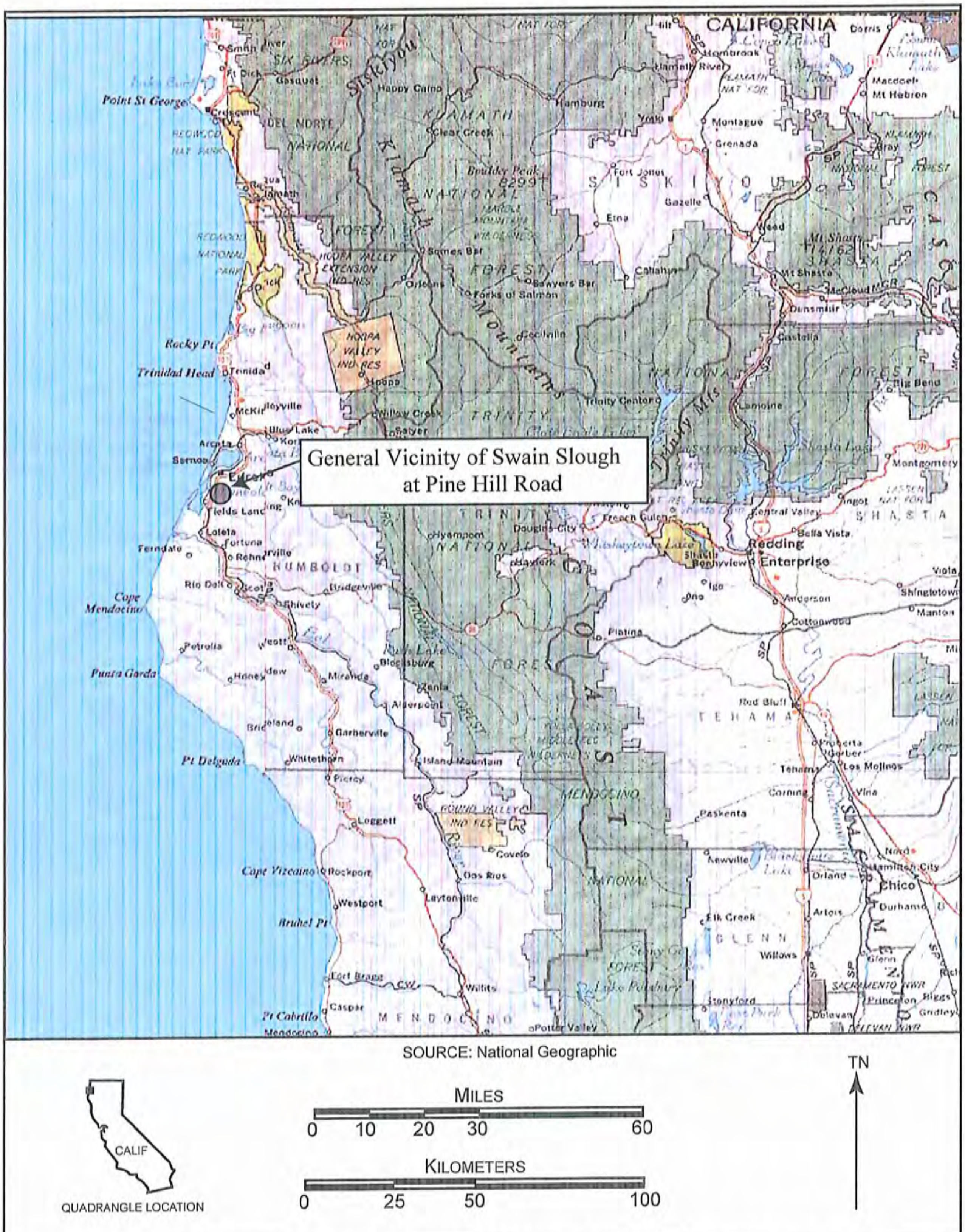
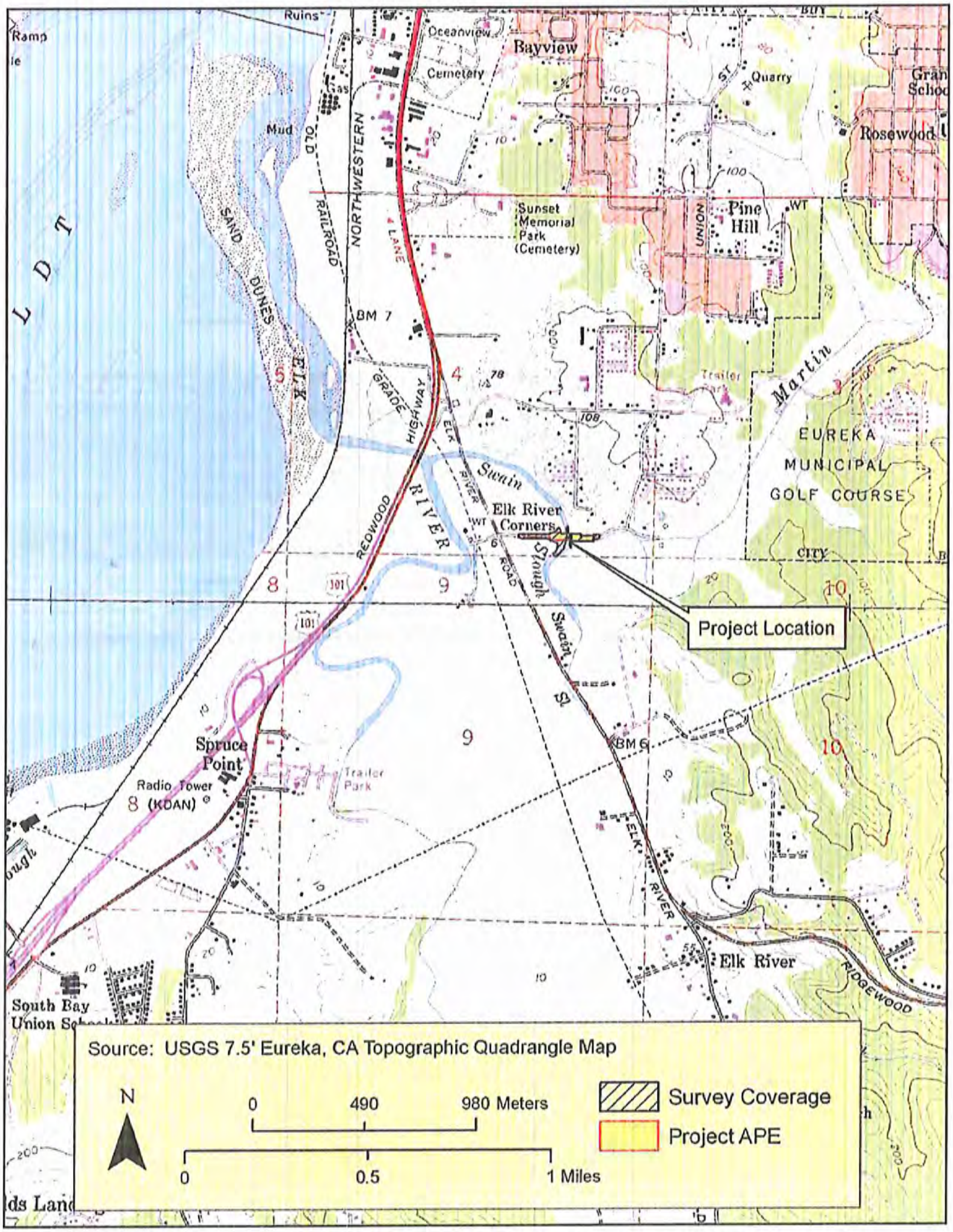
Appendix A
Report Figures

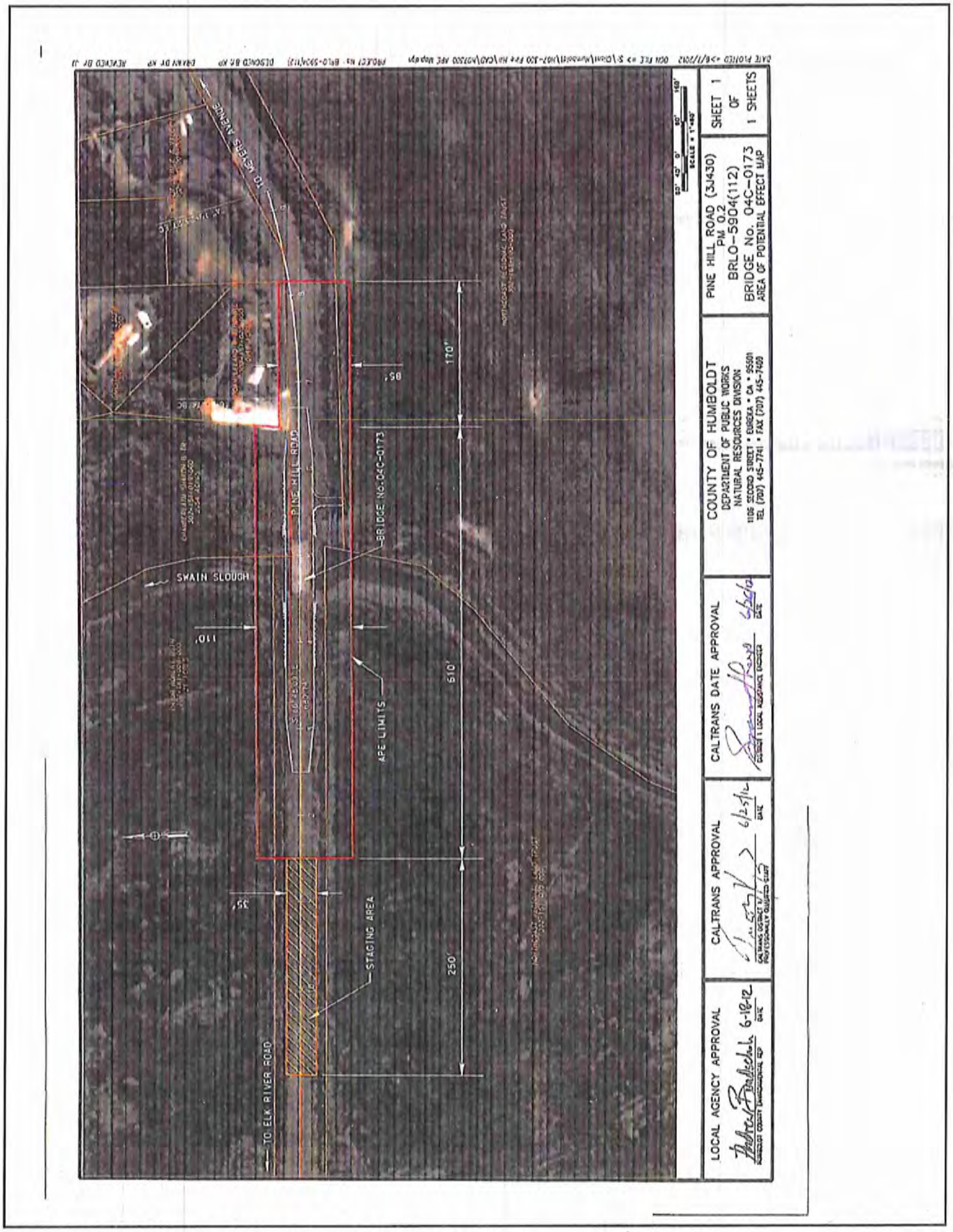
Figure 1. General Vicinity Map
Figure 2. Project Location Map
Figure 3. Area of Potential Effect Map
Figure 4. 1870 U.S. Coast Survey Map
Figure 5. Cultural Resources Survey Coverage shown on 2009 Air Photo
Figure 6. Field Photos



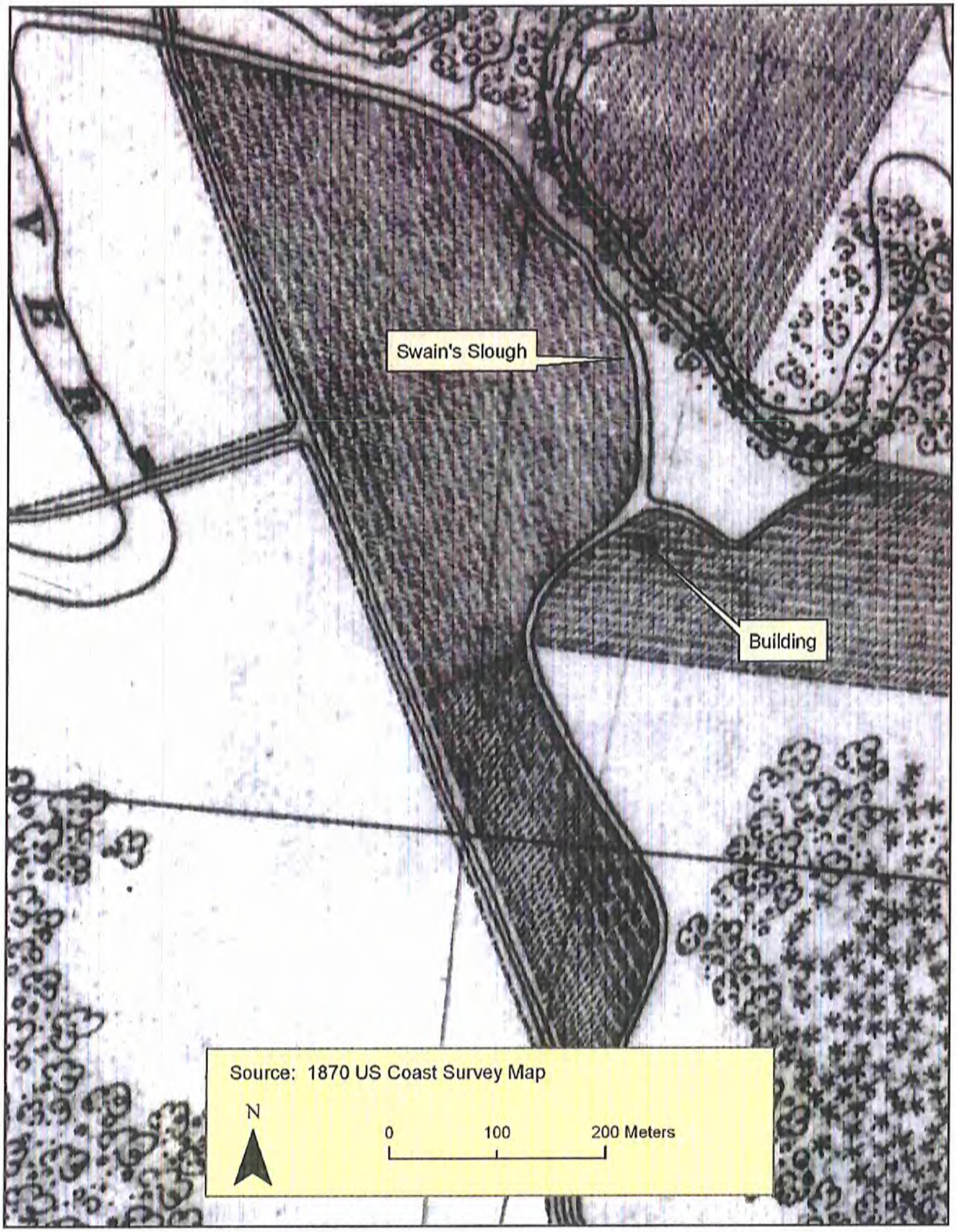
Appendix A-Figure 1. General vicinity map for Swain Slough Bridge at Pine Hill Road



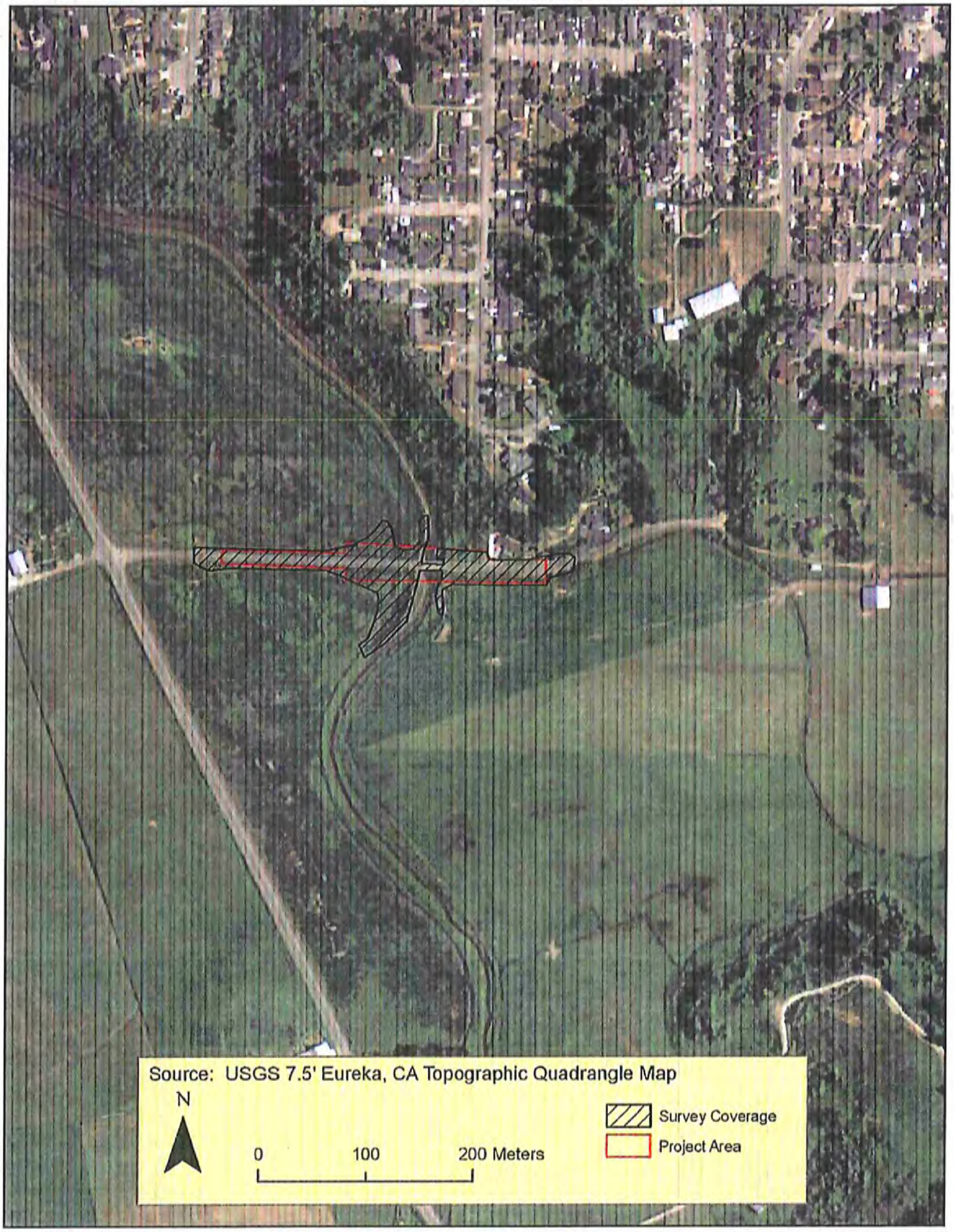
Appendix A-Figure 2. Project location map showing Swain Slough Bridge at Pine Hill Road



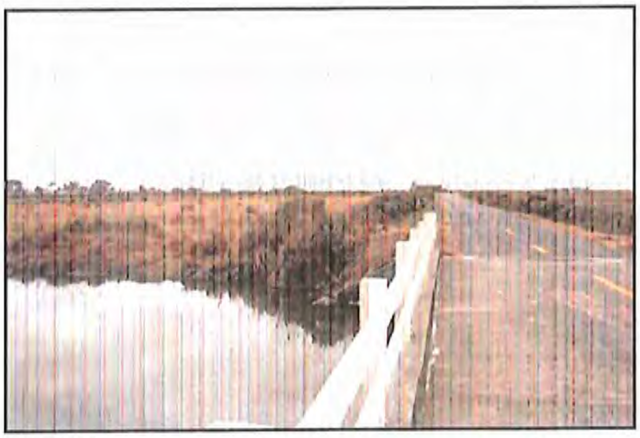
Appendix A-Figure 3. Area of Potential Effects Map



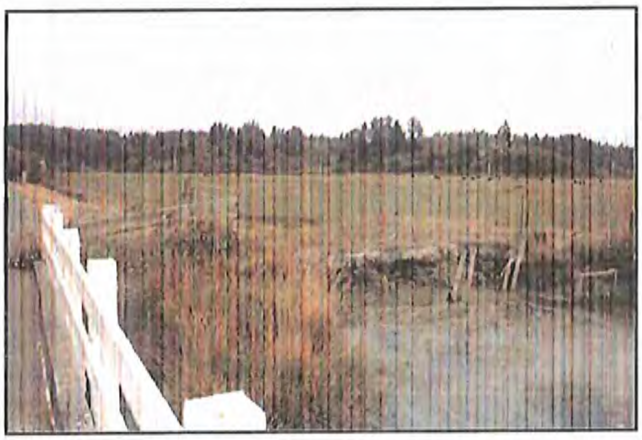
Appendix A-Figure 4. Portion of the 1870 US Coast Survey Map of Humboldt Bay showing Swain Slough and possible building south of the confluence with Martin Slough



Appendix A-Figure 5. Cultural Resources Survey Coverage Map with project APE



View to the west of Pine Hill Road and the southern bank of Swain Slough at high tide



View to the southeast of Pine Hill Road and the tide gate of Martin Slough

View to the north of Swain Slough and Pine Hill Road from levy

Appendix A-Figure 6. Photos of survey area from July 20, 2012

Appendix B
Humboldt County Department of Public Works
Project Plans and Project Description for the Construction of the Swain Slough Bridge

Project Description

The Humboldt County Department of Public Works is proposing to replace Bridge No. 04C-0173 Pine Hill Road over Swain Slough. The project site is located just south of Eureka and north of Elk River. Currently, the project is scheduled to begin construction in 2014. The project is funded through the Federal Aid Highway Bridge Program (HBP) utilizing Toll Credits as the match. The bridge was inspected by Caltrans in 2011 and is classified 'Structurally Deficient' with a sufficiency rating of 44.6. This bridge is eligible for replacement under the HBP guidelines.

The existing bridge is a 63 foot timber stringer structure with a concrete deck and concrete abutments and was built in 1955. The two bent caps are constructed of reinforced concrete on 8 reinforced concrete piles. The bridge clear width is 19 feet with a 6" curb/rail on each side for a total bridge width of 20 feet. The railing is constructed of painted timbers and there is no end protection at the bridge corners.

The overall roadway alignment is consistent with the flat terrain of the Elk River Valley. The asphalt concrete approach roadway is approximately 19' in width. The bridge is located on a tangent segment of the roadway. There is a slight vertical curve both east and west of the bridge though the bridge itself is flat.

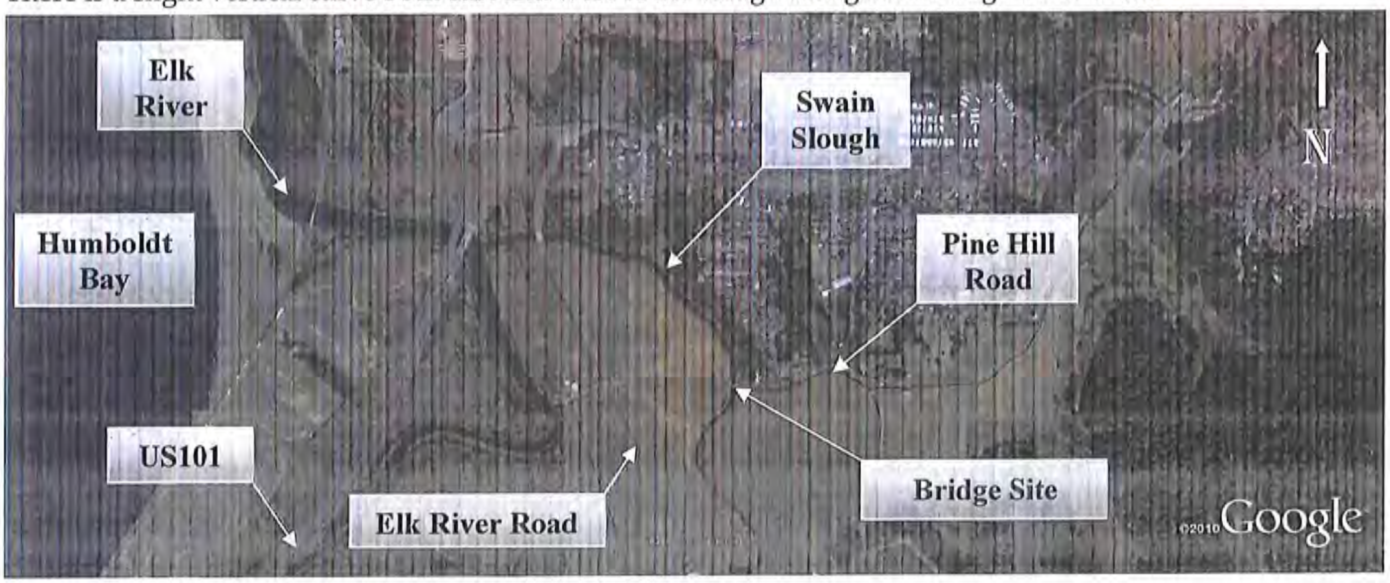


Photo 1 – Aerial View of project site (from Google Earth)

The preferred alternative is to replace the existing bridge on the existing alignment. In accordance with County requirements, the bridge will provide two 10' traffic lanes and 5' shoulders, in addition to barrier rails along both sides. The bridge elevation will need to be raised in order to meet federal hydraulic clearance requirements. The proposed bridge type is a single-span post-tensioned cast–in-place voided slab, and will be slightly longer than the existing for constructibility. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the creek channel.

As part of the HBP guidelines, the environmental review will be required in accordance with the Caltrans Local Assistance Procedures Manual (LAPM) and subject to both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). The County will be developing the environmental documentation with support from the engineering consultant.

Under CEQA, the bridge project would require preparation of an Initial Study/Mitigated Negative Declaration (IS/MND) as measures may be needed to mitigate potentially significant impacts. This presumes that all impacts can be mitigated to levels below significance and that public controversy will not elevate the environmental review to a higher level of analysis. Under NEPA, the rehabilitation or replacement of a bridge project would qualify for a Categorical Exclusion (CE). The following tasks are anticipated for this project:

- Conduct field studies
- Prepare technical studies & reports
- Conduct public meeting
- Prepare environmental documentation
- Obtain agency clearances and concurrences
- Process environmental documents
- Apply for and obtain permits from regulatory agencies

The Pine Hill Road Bridge is located in a very biologically sensitive area adjacent to Humboldt Bay. US Army Corps of Engineers jurisdictional waterways and wetlands are present at each of the four corners of the bridge. Sensitive fish species including the Tidewater Goby and Coho Salmon are present within Swain Slough. Any bridge replacement option will need to minimize impacts to these resources and protected species.

The bridge site is also within the jurisdiction of the California Coastal Commission. A permit considering the project effects to the coastal scenery will be required. Aesthetic enhancements to the bridge and rail will help minimize these impacts.

Photo 2 – Profile of existing bridge looking north

The project is within the Elk River watershed and crosses Swain Slough immediately downstream of its confluence with Martin Slough. The mouth of Martin Slough is separated from Swain Slough by a levee and tidegates. The Martin Slough Enhancement Project was proposed and funded by the California State Water Quality Control Board, California Department of Water Resources, and the California State Coastal

Conservancy. Alternatives were evaluated in the Martin Slough Enhancement Feasibility Study in 2006. The preferred alternative consists of removing the existing tidegates and installing new tidegates with a habitat door designed to create a muted tide cycle and facilitate fish passage. Also included in the project is increasing the size of existing ponds, creating new ponds, and making channel modifications throughout the project area. These project modifications have the potential to affect the hydrology at Swain Slough.

The Hydraulic Design Criteria established in the Caltrans Local Procedures Manual prescribe that the facility be capable of conveying the base or 100-year flood (Q_{100}) and passing the 50-year flood (Q_{50}) "without causing objectionable backwater, excessive flow velocities or encroaching on through traffic lanes." Due to the very flat nature of the project site and the configuration of the Elk River floodplain, obtaining 2' of freeboard beyond the Q_{50} is not feasible as the approach roadways would become very long and the bridge would be unnecessarily elevated. The County has requested the bridge convey the Q_{100}.

Photo 3 – Looking east at tide gates

The existing bridge would be removed and disposed of offsite to allow the construction of the new structure. The roadway would be closed to through traffic as the detour is approximately 1.6 miles. A row of sheet piles would be vibrated into the Swain Slough channel in order to divert the tidal flow and to allow for removal of the existing abutments and footings. The new abutment footings would be constructed on driven piles. The falsework for the bridge construction would use the newly constructed abutments and would not require supports within the channel. The new bridge and the approach embankments would not encroach into the Swain Slough channel, though rock slope protection at the face and adjacent to the bridge will be required. Mainline roadway approach construction will include fills of up to 5 feet. Construction of the bridge abutments will require two excavation areas each measuring approximately 30 feet long by 12 feet wide.

The design of the replacement structure will be in accordance with AASHTO LRFD Bridge Design Specifications, Fourth Edition, and the Caltrans Amendments preface dated November 2011, as well as the current *Seismic Design Criteria Version 1.4*, June 2006. The span length would be set based on the proximity of the existing concrete foundations. It is anticipated that the span length would be about 70 feet.

Humboldt County currently has prescriptive right-of-way on Pine Hill Road for the existing roadway and bridge alignment. It is anticipated that temporary construction easements (TCE) will also be required to construct the new bridge. The new bridge rail and end protection is likely to affect access to the field at the southeast corner of the bridge. There is currently an access gate immediately adjacent to the existing bridge that would likely need to be relocated to the east. This existing access crosses Martin Slough via metal culverts that have flap gates attached to the downstream ends. A new access to the east may be required and would likely require new metal culverts. Any option to revise the access across Martin Slough that effects the culverts and flap gates would need to be compatible with the State of California's Martin Slough Enhancement Project. Existing overhead utilities are present east of the project site and serve the Humboldt Community Services District (HCSD) sewage pump plant and the Brown residence. A 12" water line is located on the north side of Pine Hill Road and is attached to the outside edge of the existing bridge. The overhead electric lines and sewage pump plant located to the east of the project will not be affected. The underground waterline will need relocation. Coordination will begin early and will conform to the latest Caltrans procedural guidelines for relocation.

Photo 4 – Looking east at 12" water line

Humboldt County has 66' of maintenance easement along the centerline of Pine Hill Road. It is anticipated that the permanent improvements can be accommodated within this existing area. The detour and temporary construction areas (including staging areas) will likely be located outside of the maintenance easement area. Coordination and agreements with the USFS for these temporary uses will be required.

The recommended new roadway would consist of two 10′-foot lanes and two 5′-foot shoulders. Based on the roadway classification, flat terrain, and daily traffic volumes, it is anticipated that a roadway design speed of 35 mph will be used.

Scour protection of the abutments from Swain Slough flows will be required and is expected to consist of ¼ ton rock slope protection (RSP). Installation will occur while the slough is diverted and will consist of digging a keyway trench and installing RSP by Method B placement so that the top surface of the RSP will be at the approximate elevation of the original channel grade. This is will avoid impinging hydraulic flow within the on the channel and not adversely impacted the upstream flooding characteristics of the river. The RSP is expected to consist of a 3′-4″ minimum thickness ¼ ton layer over by a 1′-3″ thick No. 2 Backing layer with RSP fabric underneath. The depth of the end of the RSP key is expected to be approximately 6′-0″ deep and will slope back to the bottom of the abutment front footing face. Installation will occur while the river is diverted and will consist of digging a keyway trench and installing the RSP.

In-river construction activities associated with the bridge replacement at Swain Slough will occur in the following sequence:

- Detour traffic and close Pine Hill Road to through traffic.
- Construct slough protection system required to remove and dispose of the existing bridge.
- Vibrate sheet piles to divert slough, remove existing abutment footings, and to allow for new footing excavation.
- Construct abutments which are located outside of the low-flow channel. Abutments are constructed from cast-in-place concrete founded on driven piles. Piles will be driven in an isolated condition to reduce hydroacoustic effects. These will be constructed from the new approaches which are outside of the low-flow channel.
- Install new RSP along on both banks of Swain Slough from at an existing ground slope.
- Remove sheet piling
- Construct falsework that is attached to the newly constructed abutments.
- Construct bridge deck.
- Remove falsework for new bridge.
- Construct roadway approaches to new bridge.
- Remove the detour

Equipment and materials will be staged on the existing asphalt concrete roadway approaches.

Appendix C
Native American Correspondence

FAX COVER SHEET

DATE: August 7, 2012

TO: Debbie Pilas-Treadway
Native American Heritage Commission

FAX: 916-657-5390

FROM: James Roscoe, M.A.

SUBJECT: Native American Contact List and Sacred Lands Database Search:
Pine Hill -Swain Slough Bridge Replacement Project, Humboldt County, CA

PAGES: 2 (cover and 1 map)

Dear Debbie,

Roscoe and Associates will be conducting a cultural resources investigation for the Pine Hill -Swain Slough Bridge Replacement. The project is located on Pine Hill Road two miles south of Eureka in Section 4, Township 4 North, Range 1 West, and is shown on the accompanying Eureka 7.5' USGS quadrangle map.

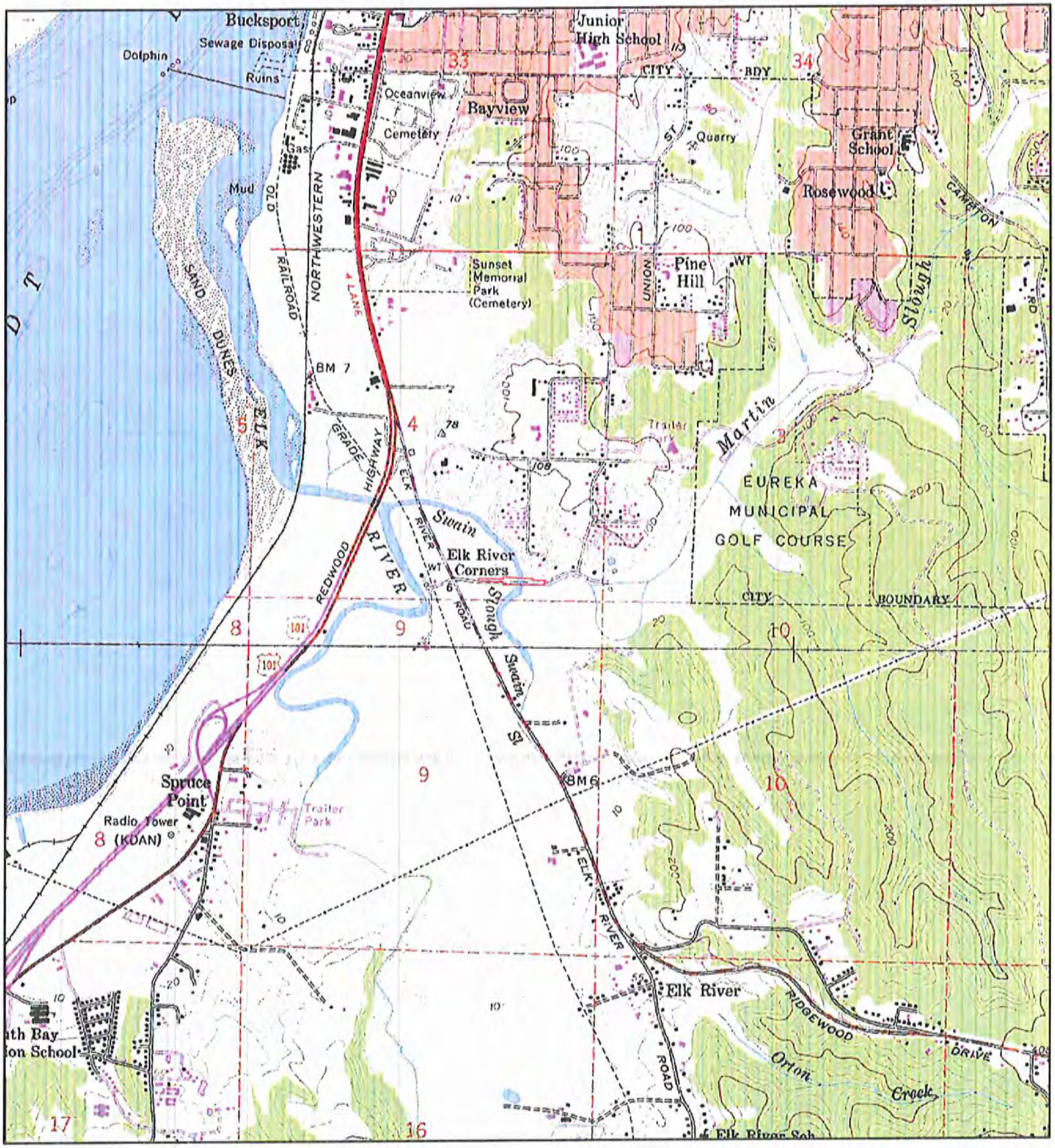
The proposed project is replacement of an existing concrete bridge with a new, single-span, cast in place, pre-stressed concrete slab or box girder bridge. The new bridge will include two standard road widths (11-12-ft) and adjacent shoulder/bike lanes (4-6-ft).

I would greatly appreciate a list of Native American contacts and a search of the sacred lands database for previously identified sites of concern within the project area or a one-half mile radius.

Thank you for your assistance.

Sincerely,

James Roscoe, M.A.
Roscoe and Associates
3781 Brookwood Drive
Bayside, CA 95524
Voice (707) 845-5239
Fax (707) 826-4336

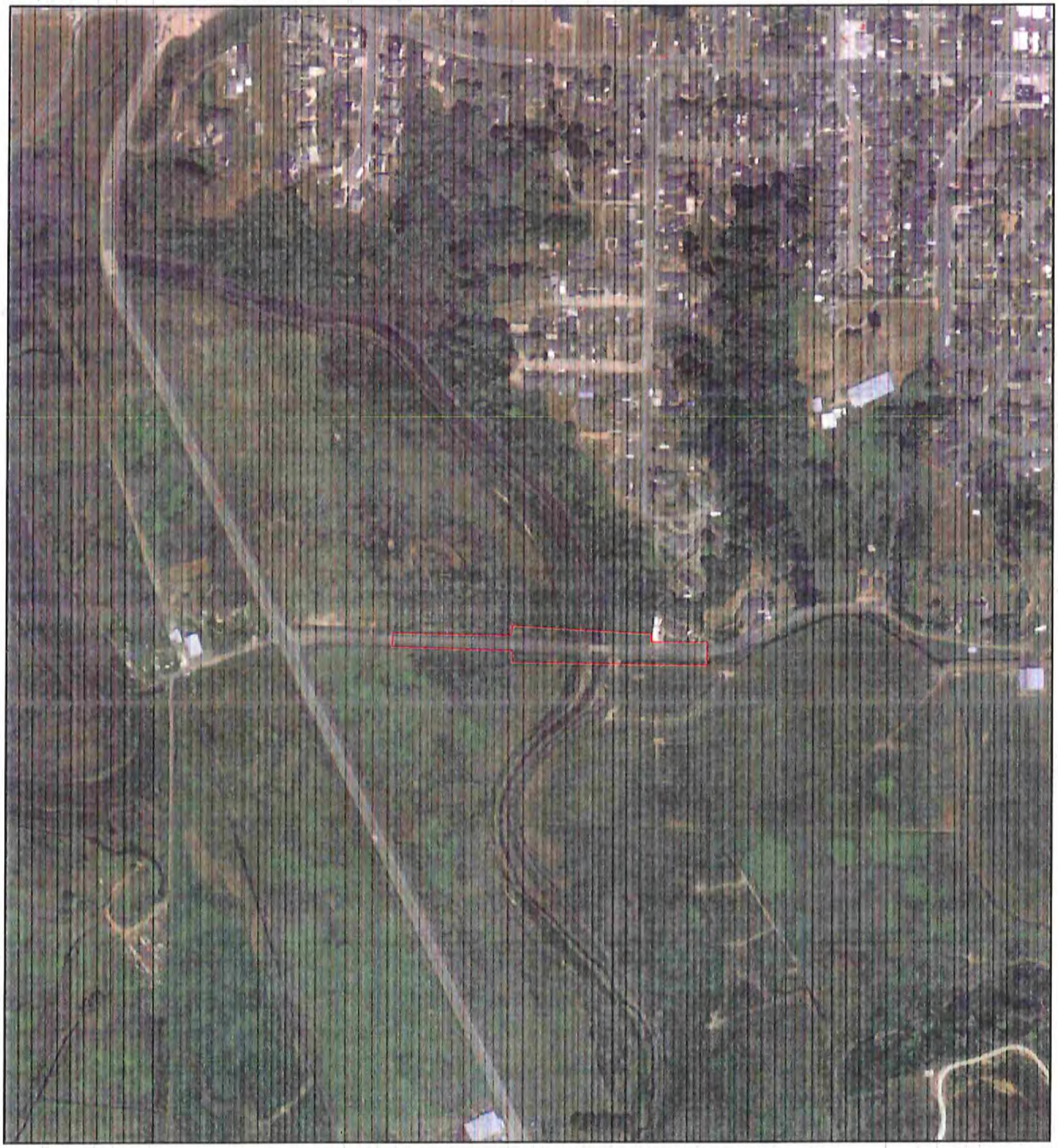


Proposed Pine Hill Road Bridge Replacement Project
Roscoe and Associates 2012
7.5" USGS Eureka, Ca Topographic Quadrangle Map 1:24,000
Section 4 of Township 4 North, Range 1 West (HBM)

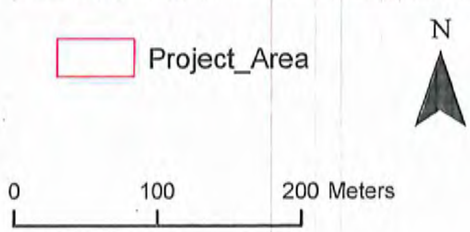
Project_Area

N

0 500 1,000 Meters



Proposed Pine Hill Road Bridge Replacement Project
Roscoe and Associates 2012
2009 USDA Air Photo
Section 4 of Township 4 North, Range 1 West (HBM)



NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390

August 14, 2012

James Roscoe
Roscoe and Associates
3781 Brookwood Drive
Bayside, CA 95524

Sent by Fax: 707-826-4336
Number of Pages: 2

Re: Pine Hill—Swain Slough Bridge Replacement Project, Humboldt County.

Dear Mr. Roscoe:

A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the sacred lands file does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Enclosed is a list of Native Americans individuals/organizations who may have knowledge of cultural resources in the project area. The Commission makes no recommendation or preference of a single individual, or group over another. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe or group. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at (916) 653-4038.

Sincerely,

Debbie Pilas-Treadway
Environmental Specialist III

Native American Contacts
Humboldt County
August 13, 2012

Bear River Band of Rohnerville Rancheria
Len Bowman, Jr., Chairperson
27 Bear River Drive — Wiyot
Loleta , CA 95551 — Mattole
lbowman@bearriver.com
(707) 733-1900
(707) 733-1972 Fax

Bear River Band of Rohnerville Rancheria
Erika Collins, THPO
27 Bear River Drive — Wiyot
Loleta , CA 95551 — Mattole
thpo@bearrivertribe.com
(707) 733-1900 ext 233

(707) 733-1972 (FAX)

Bear River Band of Rohnerville Rancheria
Edwin Smith, Environmental Coordinator/Cultural
27 Bear River Drive — Wiyot
Loleta , CA 95551 — Mattole
(707) 733-1900
(707) 733-1972 (FAX)

Blue Lake Rancheria
Claudia Brundin, Chairperson
P.O. Box 428 — Wiyot
Blue Lake , CA 95525 — Yurok
(707) 668-5101 — Tolowa
(707) 668-4272 Fax

Blue Lake Rancheria
Arla Ramsey, Tribal Administrator
P.O. Box 428 — Wiyot
Blue Lake , CA 95525 — Yurok
bmobbs@bluelakerancheria- — Tolowa
(707) 668-5101
(707) 668-4272 Fax

Blue Lake Rancheria
Diane Holliday
P.O. Box 645 — Wiyot
Blue Lake , CA 95525 — Yurok
(707) 668-5635 — Tolowa

Blue Lake Rancheria THPO
Janet Eidsness, Historic Preservation Officer
P.O. Box 428 — Wiyot
Blue Lake , CA 95525
jeidsness@bluelakerancheria-nsn.
(707) 668-5101 ext 329
707-668-4272

Wiyot Tribe
Ted Hernandez, Chairperson
1000 Wiyot Drive — Wiyot
Loleta , CA 95551
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe
Andrea Davis, Environmental Coordinator
1000 Wiyot Drive — Wiyot
Loleta , CA 95551
stephen@wiyot.us
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe THPO
Monique Sonoquie, Tribal Historic Preservation
1000 Wiyot Drive — Wiyot
Loleta , CA 95551
monique@wiyot.us
(707) 733-5055
(707) 733-5601 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed Pine Hill Swain Slough Bridge Replacement project, Humboldt County

August 14, 2012

Distribution List
1. Blue Lake Rancheria – Arla Ramsey, Tribal Administrator; Claudia Brundin, Chairperson; Janet Eidsness, THPO; Diane Holliday
2. Wiyot Tribe – Brian Mead, Tribal Administrator; Ted Hernandez, Chairperson; Monique Sonoquie, THPO; Andrea Davis, Environmental Coordinator
3. Bear River Band of Rohnerville Rancheria – Len Bowman Jr., Chairperson; Edwin Smith, Environmental Coordinator/Cultural; Erika Collins, THPO

Dear Tribal Representative,

Under contract with the Humboldt County Public Works Department, Roscoe and Associates will be conducting a cultural resources investigation for the Pine Hill -Swain Slough Bridge Replacement Project. This project is located on Pine Hill Road, two miles south of Eureka in Section 4, Township 4 North, Range 1 West, as shown on the accompanying Eureka 7.5' USGS quadrangle map. This project is occurring on private and Northcoast Regional Land Trust property.

This project proposes to replace the existing 63-foot long, three span structure with a concrete deck on timber stringers. This bridge, constructed in 1955, provides access over Swain Slough, connecting Elk River Road with Herrick Street via Pine Hill Road. The existing timber stringers and concrete support columns are in poor condition. The bridge is listed by the County to be structurally deficient and functionally obsolete. A new, single-span, concrete slab or box girder bridge is proposed for this location along the existing road alignment. The new bridge will include two standard road widths (11-12-ft) with adjacent shoulder/bike lanes (4-6-ft). The bridge (#04C0173) has been evaluated as ineligible for inclusion to the National Register on the statewide historic bridge inventory maintained by Caltrans.

Because the project will be funded by Caltrans, a project Area of Potential Effects (APE) has been delineated. The horizontal limits of this area are aligned with the existing roadway and measure approximately 1000 feet long, with varying width between 35, 85 and 110 feet. This APE includes the bridge replacement and staging areas and is aligned with the existing roadway.

We plan to conduct a cultural resources investigation of the APE in late August and would appreciate any information the tribe might have regarding Native American cultural resources in or near to this project area. If you have any information, concerns or questions please contact James Roscoe. Any culturally sensitive information that you may disclose to Roscoe and Associates or any Native American cultural sites that may be identified during the field inspection will be held under strict confidentiality and will not be made available to the public. All cultural sites will be documented in accordance to the guidelines established by the Office of Historic Preservation. A copy of the final report and any completed archaeological site records will be submitted to Humboldt County Department of Public Works and the California Historical Resources Information Systems' regional North Coastal Information Center.

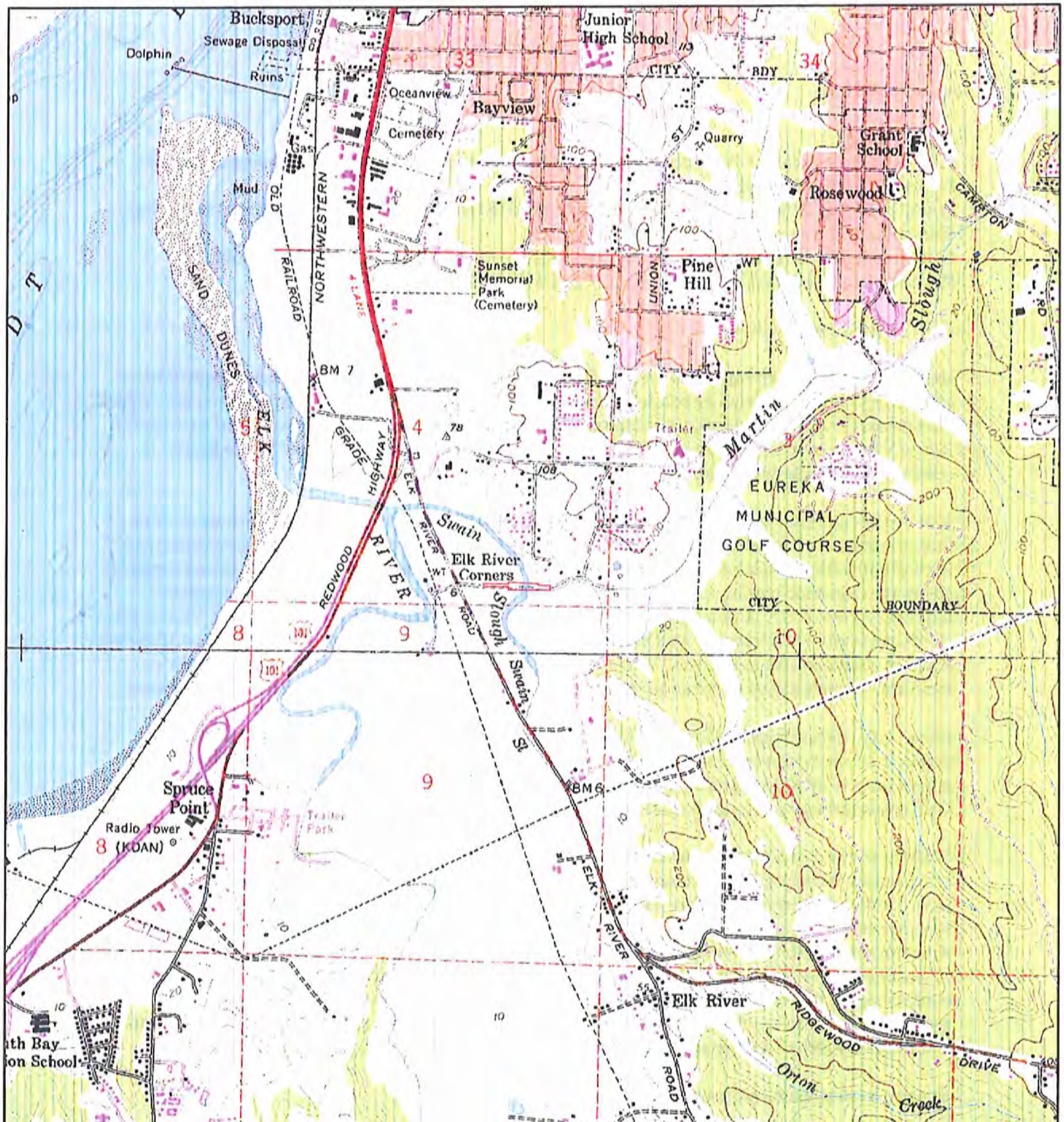
Thank you in advance for your assistance.

Sincerely,

James Roscoe, M.A.

Enclosures (2)

Roscoe and Associates- Cultural Resources Consultants
3781 Brookwood Drive, Bayside, CA 95524
(707) 845-5239 cell; (707) 826-4336 fax



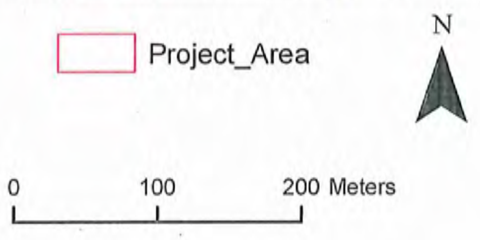
Proposed Pine Hill Road Bridge Replacement Project
Roscoe and Associates 2012
7.5" USGS Eureka, Ca Topographic Quadrangle Map 1:24,000
Section 4 of Township 4 North, Range 1 West (HBM)

Project_Area

N

0 500 1,000 Meters

Proposed Pine Hill Road Bridge Replacement Project
Roscoe and Associates 2012
2009 USDA Air Photo
Section 4 of Township 4 North, Range 1 West (HBM)



Gmail by Google

James Roscoe <jmr4@humboldt.edu>

FW: Blue Lake Rancheria THPO comments on Pine Hill road Bridge Replacement (Elk river/Swain Slough) in south Eureka

2 messages

James Roscoe <jkroscoe@suddenlink.net> Sat, Aug 25, 2012 at 3:22 PM
To: James.Roscoe@humboldt.edu

From: Janet Eidsness [mailto:JEidsness@bluelakerancheria-nsn.gov]
Sent: Wednesday, August 22, 2012 3:01 PM
To: jkroscoe@suddenlink.net
Cc: erikacollins@brb-nsn.gov; monique@wiyot.us
Subject: Blue Lake Rancheria THPO comments on Pine Hill road Bridge Replacement (Elk river/Swain Slough) in south Eureka

Dear Jamie,

Thank you for notifying the Tribe in your letter dated 8/14/12 about the subject project and your plan to conduct a cultural resources investigation for the County Public Works Dept.

Our confidential database does not show any known Wiyot cultural resources in or adjacent to the project APE. Please keep me informed if prehistoric artifacts or sites are discovered during your study.

Regards,

Janet P. Eidsness, M.A., RPA

Tribal Heritage Preservation Officer (THPO)

Blue Lake Rancheria

P.O. Box 428 (428 Chartin Road)

Blue Lake, CA 95525

Office (707) 668-5101 ext. 1037

Fax (707) 668-4272

Gmail by Google

Kimberly Rich <ksm6@humboldt.edu>

FW: Roscoe and Associates-Consultation Letters (2)
1 message

William Rich <wcr@2xtreme.net> Mon, Oct 29, 2012 at 8:00 AM
To: ksm6@humboldt.edu

From: Erika Collins [mailto:erikacollins@brb-nsn.gov]
Sent: Wednesday, August 15, 2012 3:26 PM
To: wcr@2xtreme.net; Jamie Roscoe
Subject: Re: Roscoe and Associates-Consultation Letters (2)

Hi Bill and Jamie,

Thanks for the letters, I have a quick question about the Pine Hill Bridge Replacement project. You mention that Caltrans has delineated the APE, and describe and depict the horizontal APE, but what is the vertical APE? The location of the project is pretty sensitive for buried deposits...

Erika

On Tue, Aug 14, 2012 at 10:55 AM, wcr@2xtreme.net <wcr@2xtreme.net> wrote:

Hello Erika,

Attached are two consultation letters from Roscoe and Associates. Hard copies have also been sent out.

Thank you!

Bill

--
Erika Collins, M.A.

Tribal Historic Preservation Officer

Bear River Band of Rohnerville Rancheria

27 Bear River Drive

Loleta, CA 95551

707-733-1900 x233 Office

707-502-5233 Cell

707-733-1972 Fax

erikacollins@brb-nsn.gov

James & Kimberley Roscoe

From: Monique Sonoquie [monique@wiyot.us]
Sent: Monday, September 24, 2012 8:09 AM
To: 'Janet Eidsness'; jkroscoe@suddenlink.net
Cc: erikacollins@brb-nsn.gov
Subject: RE: Blue Lake Rancheria THPO comments on Pine Hill road Bridge Replacement (Elk river/Swain Slough) in south Eureka

He'válou'

This letter is in response to the above referenced project. After reviewing the project location, the Wiyot Tribe has no known cultural sites in the area.

We will not be requesting a monitor at this time. However *we request that we are contacted as soon as possible if any cultural resources are found during or after the implementation of this project.* If you have any questions or concerns, you may contact me at the number below. Alternately, I can be reached via e-mail at monique@wiyot.us.

We appreciate your patience and understanding regarding this project and look forward to working with you in the future.

Hou'

Monique Sonoquie,
Cultural Director/THPO
Wiyot Tribe
1000 Wiyot Drive
Loleta, CA 95551

Phone: 707.733.5055
Fax: 707.733.5601
Web: <www.wiyot.us>
Monique@wiyot.us

From: Janet Eidsness [mailto:JEidsness@bluelakerancheria-nsn.gov]
Sent: Wednesday, August 22, 2012 3:01 PM
To: jkroscoe@suddenlink.net
Cc: erikacollins@brb-nsn.gov; monique@wiyot.us

Appendix D
Record Search Results

Appendix G - Historic Property Study Report (HPSR)

State of California | Department of Transportation

HISTORIC PROPERTY SURVEY REPORT

1. UNDERTAKING DESCRIPTION AND LOCATION

District	County	Route *(Local Agency)*	*Local Assistance Project Prefix*	Post Miles *(Project No.)*	Charge Unit *(Agreement)*	Expenditure Authorization *(Location)*
1	HUM					

(For Local Assistance projects off the highway system, use headers in italics)

Project Description:

The Federal Highway Administration and California Department of Transportation (Caltrans), in conjunction with Humboldt County Public Works Department (County), propose to replace Swain Slough Bridge (#04-0173) located at Pine Hill Road near Eureka, Humboldt County, California (HSPR Appendix A - Figure 1). The project is situated in the south half of the southeast quarter of Section 4 of Township 4 North, Range 1 West (HBM). This location is shown on the 7.5' USGS Eureka, California Topographic Quadrangle Map (HPSR Appendix A - Figure 2). The bridge is located at UTM coordinates (NAD 83, UTM Zone 10) 400,166mE / 4,511,971mN. The elevation of this location is approximately 20 feet above sea level.

The Swain Slough Bridge (#04C-0173) provides access between lower Elk River Road and Herrick Street. The project is designed to replace the existing 1955 bridge, which has been classified as structurally deficient and functionally obsolete due to aging timber and concrete foundation. The existing bridge will be replaced with a new single span, post tensioned slab, which will be cast in place.

The existing bridge will be removed with heavy equipment while working from the road surface and disposed of offsite. A row of sheet piles will be vibrated into the Swain Slough channel in order to divert the tidal flow and allow for removal of the existing abutments and footings. The new abutment footings will be constructed on driven piles. Construction of the bridge abutments will require two excavation areas each measuring approximately 30 feet long by 12 feet wide. The falsework for the bridge construction will use the newly constructed abutments and will not require supports within the channel. Rock slope protection at the face and adjacent to the bridge will be required. Mainline roadway approach construction will include fills of up to 5 feet.

A 12" water line is located on the north side of Pine Hill Road and is attached to the outside edge of the existing bridge. The overhead electric lines and sewage pump plant located to the east of the project will not be affected. The underground waterline will need relocation. Coordination will conform to the latest Caltrans procedural guidelines for relocation.

Humboldt County has 66' of maintenance easement along the centerline of Pine Hill Road. It is anticipated that the permanent improvements can be accommodated within this existing area. The detour and temporary construction areas (including staging areas) will likely be located outside of the maintenance easement area. Coordination and agreements with the neighboring landowner(s) for these temporary uses will be required. Equipment and materials will be staged on the existing asphalt concrete roadway approaches.

Humboldt County currently has prescriptive right-of-way on Pine Hill Road for the existing roadway and bridge alignment. It is anticipated that temporary construction easements (TCE) will also be required to construct the new bridge. The new bridge rail and end protection is likely to affect access

For the federal undertaking described in Part 1: To minimize redundancy and paperwork for the California Department of Transportation and the State Historic Preservation Officer, and in the spirit intended under the federal Paperwork Reduction Act (U.S.C. 44 Chapter 35), this document also satisfies consideration under California Environmental Quality Act Guidelines Section §15064.5(a) and, as appropriate, Public Resources Code §5024 (a)(b) and (d).

to the field at the southeast corner of the bridge. There is currently an access gate immediately adjacent to the existing bridge that would likely need to be relocated to the east. This existing access crosses Martin Slough via metal culverts that have flap gates attached to the downstream ends. A new access to the east may be required and would likely require new metal culverts.

The new bridge will accommodate two 10 foot traffic lanes and 5 foot shoulders with railing along both sides. Construction will take place during daylight hours using heavy equipment which may include an excavator, front end loader and/or a bulldozer. During project implementation, traffic will be restricted from access to the bridge location and a detour will be set in place. Silt fence and or fiber rolls will be used to reduce erosion and staging and stockpiling will occur on the roadway to the west of the bridge.

2. AREA OF POTENTIAL EFFECTS

The horizontal APE boundary is rectangular in shape and aligned with the center of the roadway. This APE boundary measures 300 meters in length and varies in width from 15 to 30 meters. The APE includes locations of the existing Swain Slough Bridge, Pine Hill Road and the proposed staging area in the west end of the APE. The vertical limits of the APE will be greatest for the construction of the bridge abutments and piers. Footing construction is expected to occur at the location of the existing footings, and reach depths of 3 meters or more. It is expected that geotechnical boring will be conducted prior to final project design. All equipment and materials staging will occur within the boundaries of the APE. The map provided in HPSR Appendix A -Figure 3 shows a detailed plan of the APE. The county project plans and description are included in the ASR as Appendix B.

3. CONSULTING PARTIES / PUBLIC PARTICIPATION

X Local Government *(Head of local government, Preservation Office / Planning Department)*

- Hank Seemann, Environmental Services Manager, Humboldt County Public Works Department

X Native American Tribes, Groups and Individuals

On August 7, 2012 correspondence was sent to the Native American Heritage Commission (NAHC) requesting a search of the Sacred Lands Inventory File. The NAHC responded on August 14, 2012 with the results of the Sacred Lands File Search and a current list of individuals/organizations who might have knowledge of cultural resources in the project area. Those groups and individuals indicated by the NAHC were consulted by writing on August 14, 2012 and included the Blue Lake Rancheria, Wiyot Tribe and Bear River Band of the Rohnerville Rancheria. Notification letters included a brief project description, investigation methodology, and a project location map. A written emailed response was received from Erika Collins, Tribal Historic Preservation Officer (THPO) from the Bear River Band of the Rohnerville Rancheria on August 15 2012, in which she commented on the sensitivity of the area. A follow-up phone call was made and Ms. Collins participated in a field visit with Roscoe and Associates on September 20, 2012, where the bridge abutments and other areas of expected ground disturbance is occurring. We discussed the potential vertical APE for the project and Ms.

Collins was satisfied and had no further concerns. Janet Eidsness, THPO for the Blue Lake Rancheria and Monique Sonoquie, THPO for the Wiyot Tribe responded by email August 22, 2012 and September 24, 2012, respectively. Both THPO's requested that they be notified if any cultural resources were found. No other concerns were noted.

X Native American Heritage Commission

- Debbie Pilas-Treadwell - Letter sent August 7, 2012

_ Local Historical Society / Historic Preservation Group *(also if applicable, city archives, etc.)*

-

_ Public Information Meetings *(list locations, dates below and attach copies of notices)*

-

_ Other

4. SUMMARY OF IDENTIFICATION EFFORTS

X	National Register of Historic Places	Month & Year: 1979-2002 & supplements
X	California Register of Historical Resources	Year: 1992 & supplemental information to date
X	California Inventory of Historic Resources	Year: 1976
X	California Historical Landmarks	Year: 1995 & supplemental information to date
X	California Points of Historical Interest	Year: 1992 & supplemental information to date
_	State Historic Resources Commission	Year: 1980-present, minutes from quarterly meetings
X	Caltrans Historic Highway Bridge Inventory	Year: 2006 & supplemental information to date

_ Archaeological Site Records [*List names of Institutions & date below*]

-

_ Other sources consulted *[e.g., historical societies, city archives, etc. List names and dates below]*

-

X Results: *(provide a brief summary of records search and research results, as well as inventory findings)*

Records Search/Literature Review

A records search was conducted by Roscoe and Associates at the NCIC in Klamath, California on July 24, 2012 (Appendix C). This search revealed that the project area had been subject to a past cultural resources investigation by Roscoe and Van Kirk (2002) but that no cultural resources were identified in the current project APE. This report does however document the recordation efforts and historical significance evaluation of the Lorensen house and ranch Buildings within the 500 meter buffer. Roscoe and Van Kirk (2002) provided a preliminary opinion that the buildings are eligible for listing on the California Register of Historical Resources because of their high level of historic integrity and association with early dairy ranching around Humboldt Bay. The NCIC lists two additional surveys within 500 meters of the project area (Roscoe 1989, Roscoe 1995), and one written overview of the Humboldt Bay Area (Benson 1977) (Table 1). Roscoe's past surveys were for private development and widening of

Elk River Road. No cultural resources were identified in the project area as a result of these past surveys.

Background research indicates that the project area is situated in the historical territory of the Wiki subdivision of the Wiyot Tribe. A review of Loud (1918) indicates that the closest known village, CA-HUM-77 is at the mouth of Elk River, approximately one mile to the northwest. This site is located outside of the 500-meter buffer and was not specifically reviewed and/or visited during this investigation.

Based on the historic research conducted during this investigation, Pine Hill Road has crossed Swain Slough at this location since c.1890s, when the road was used to connect Elk River Corner and Humboldt Hill. The specific project location was under agriculture by the 1870s, with an early building, probably a barn, being mapped at the confluence of Martin Slough and Swain Slough, approximately 100 meters to the south. There is no mapping of ownership of the project area until 1886, at which time it appears that the property was owned by S. F. Pine.

Field Results

The cultural resources field survey at the Swain Slough Bridge was conducted over a five-hour period. Conditions during the field survey were optimal with clear, bright skies and ample lighting. Fair visibility of mineral soil was encountered throughout the survey areas. Survey was focused at the levee along both sides of Swain Slough and the bridge foundation areas. No cultural resources were identified during this investigation. (HSPR Appendix A-Figure 4).

5. PROPERTIES IDENTIFIED

X **No cultural resources** in project APE.

6. LIST OF ATTACHED DOCUMENTATION

X Project Vicinity, Location, and APE Maps
X Archaeological Survey Report (ASR)

7. HPSR to File

_ Not applicable.
X **No properties requiring evaluation are** present within the project's APE.
X As Assigned by FHWA , Caltrans has determined a Finding of No Historic Properties Affected, according to Section 106 PA Stipulation IX.A and 36 CFR 800.4(d) (1), is appropriate for this undertaking.

8. HPSR to SHPO

X Not applicable.

9. Findings for State-Owned Properties

X Not applicable; project does not involve Caltrans right-of-way or Caltrans-owned property.

10. CEQA Impact Findings

X Not applicable; Caltrans is not the lead agency under CEQA.

_ Caltrans has determined a **finding of no impact** is appropriate because there are no historical resources within the Project Area limits, or there are no impacts to historical resource(s), pursuant to CEQA Guidelines §15064.5(b)(3).

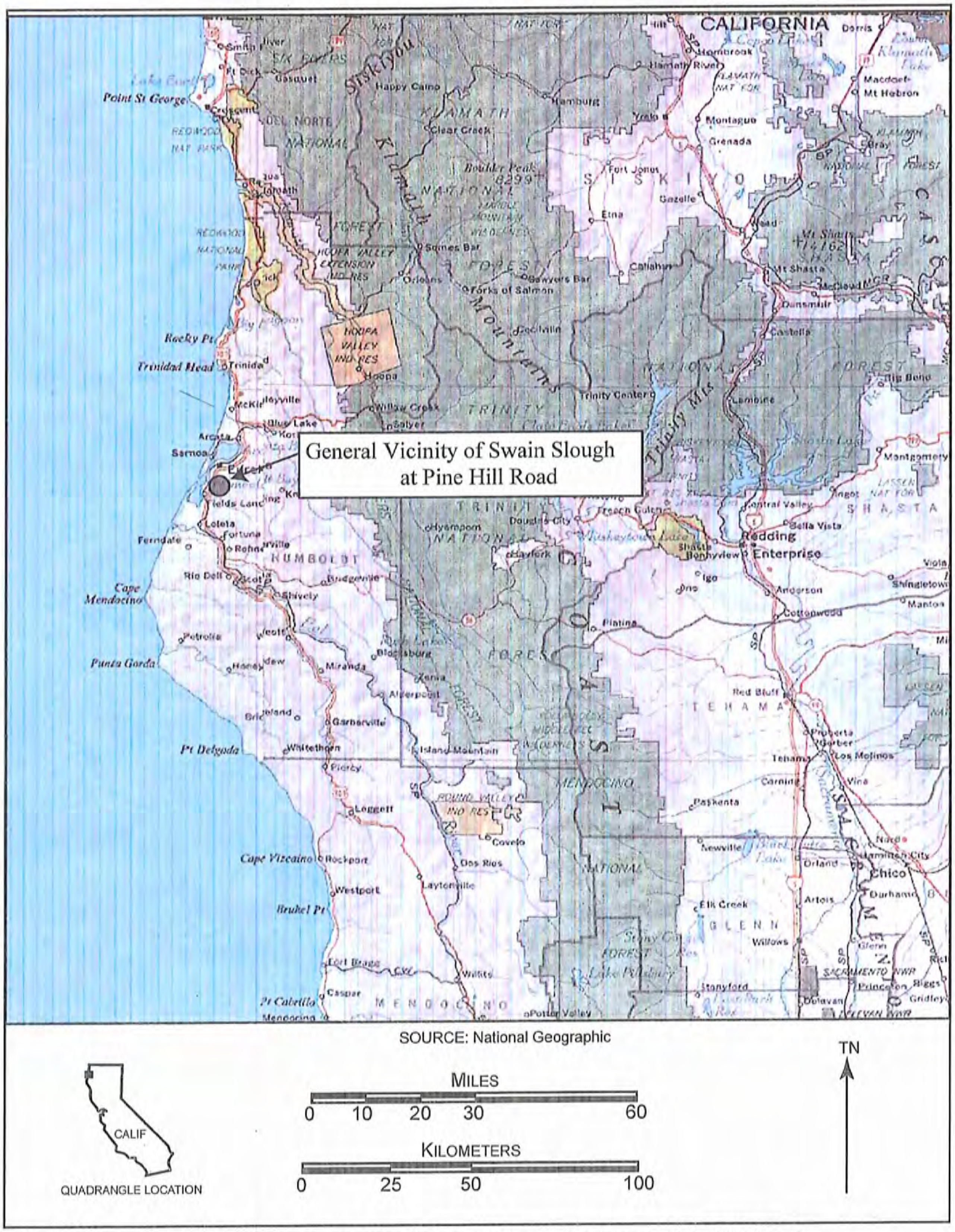
11. HPSR PREPARATION AND DEPARTMENT APPROVAL

Prepared by *(sign on line)*: District ___ Caltrans PQS:	*PQS level and discipline]*	Date
Prepared by: *(sign on line)* Consultant / discipline:	James Roscoe *[Appropriate PQS discipline]*	1/8/2013 Date
Affiliation	Roscoe and Associates *[Firm/company and location]*	
Reviewed for approval by: *(sign on line)* District 1 Caltrans PQS discipline/level:	(Tim Keefe) *[PQS certification level]* Co - PI Prehistoric	1/14/13 Date
Approved by: *(sign on line)* District___ EBC:	*[Environmental Branch name]*	01/14/13 Date

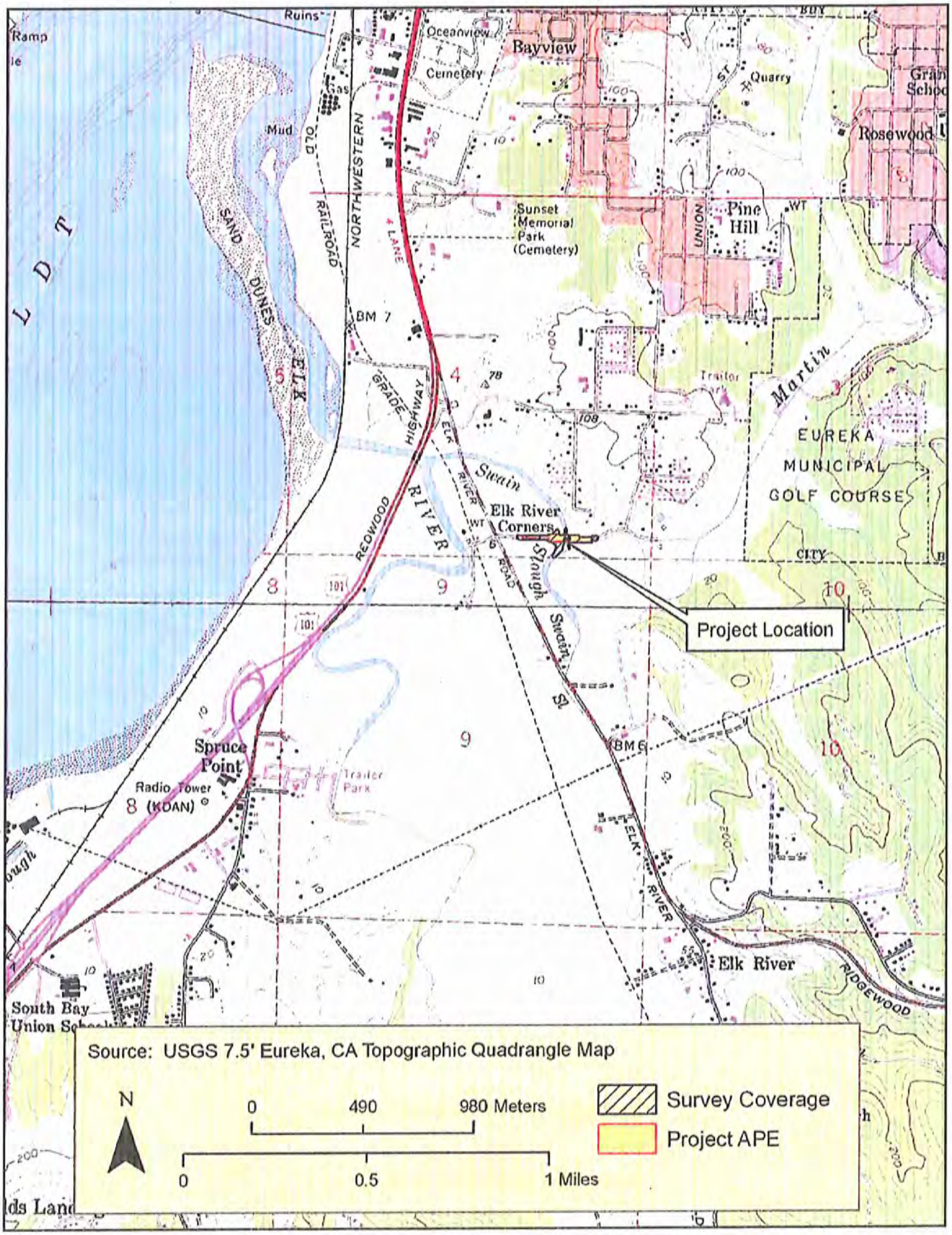
APPENDIX A

Project Vicinity, Project Location, APE and Survey Coverage Maps

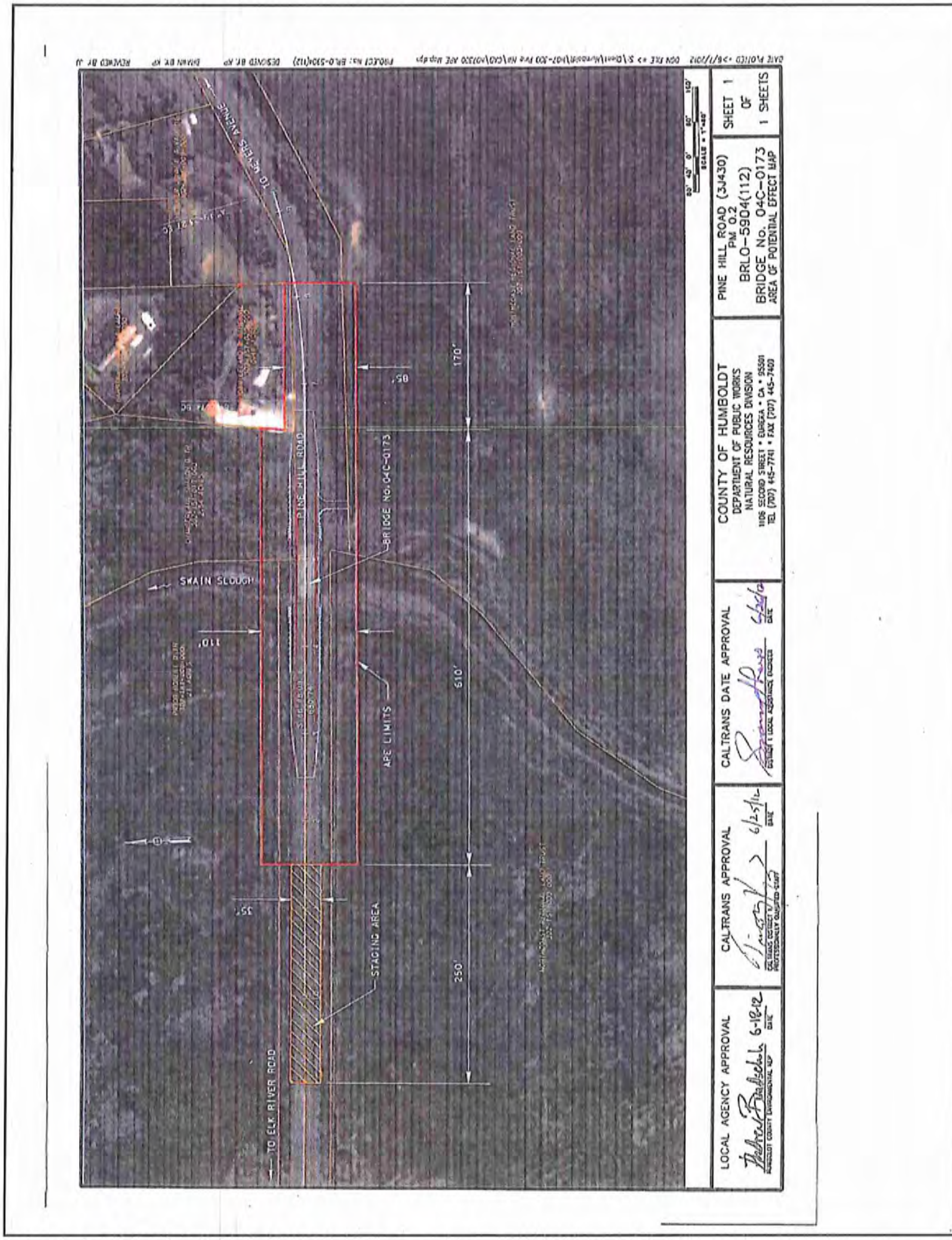
Figure 1. General Vicinity Map
Figure 2. Project Location Map
Figure 3. Area of Potential Effects Map
Figure 4. Cultural Resources Survey Coverage shown on 2012



Appendix A-Figure 1. General vicinity map for Swain Slough Bridge at Pine Hill Road



Appendix A-Figure 2. Project location map showing Swain Slough Bridge at Pine Hill Road



Appendix A-Figure 3. Area of Potential Effects Map

Appendix A-Figure 4. Cultural Resources Survey Coverage Map with project APE

Appendix H - Preferred Alternative

ROAD NAME: PINE HILL ROAD		QUINCY ENGINEERING		COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS	SHEET 1 OF 28
ROAD NO.: 3J430	MILE POST: 0.19	DESIGNED BY:	KP	PINE HILL ROAD BRIDGE OVER SWAIN SLOUGH	
PROJECT NO.: BRLO-5904(112)	EA NO.:	DRAWN BY:	KP	COVER SHEET, SHEET INDEX AND DETAILS	
CONTRACT NO.: 594020	PPNO.:	REVIEWED BY:	JJ		
DRAWING FILE NAME: S:\Client\Humboldt\H07-300 Pine Hill\CAD\Roadway\H07300rab001.dgn		APPROVED BY:			
PLOT DATE: 1-21-2018	REVISON DATE: 1-21-2018				

REGISTERED PROFESSIONAL ENGINEER JASON P. JURRENS No. C62458 Exp. 09/30/21 CIVIL STATE OF CALIFORNIA

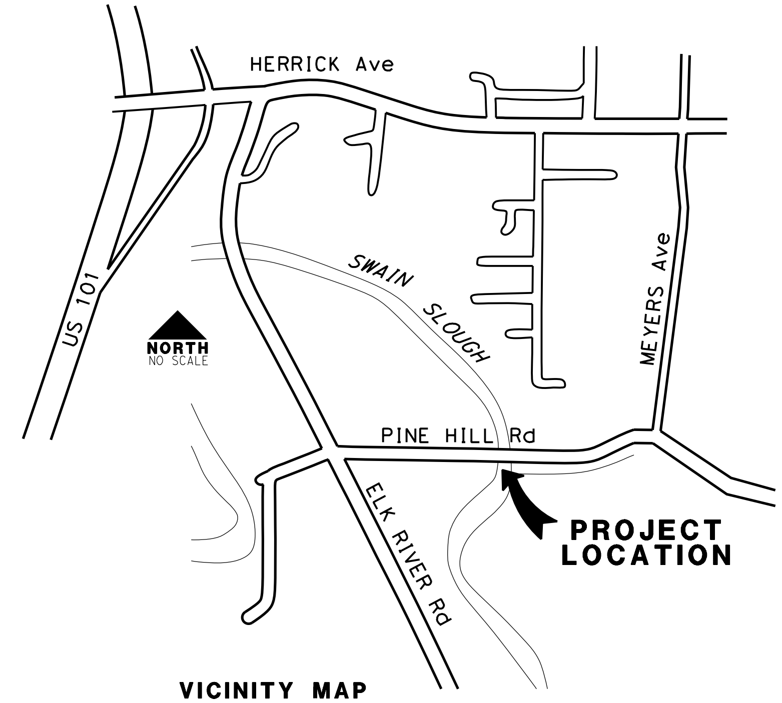
BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS

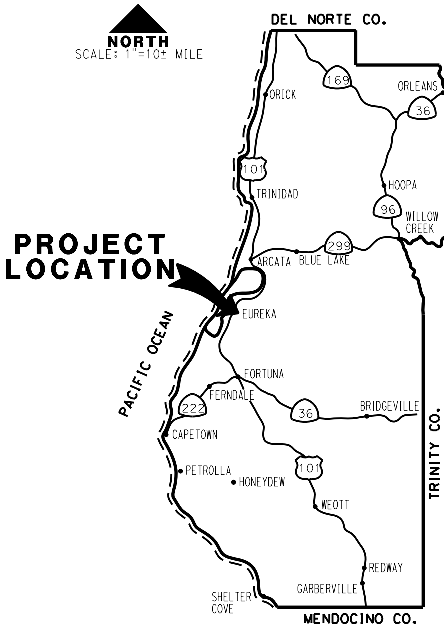
PROJECT PLANS FOR CONSTRUCTION OF

PINE HILL ROAD
OVER SWAIN SLOUGH BRIDGE No. 04C0260
FEDERAL PROJECT NO. BRLO-5904[112]



VICINITY MAP

NOT TO SCALE



LOCATION MAP

SCALE: 1"=10± MILE

APPLICABLE STANDARD PLANS

CALTRANS STANDARD PLANS DATED 2015.
(SEE SPECIAL PROVISIONS STANDARD PLAN LIST)

NOTES

THE CONTRACTOR SHALL HAVE A CLASS "A" LICENSE FOR THIS PROJECT.

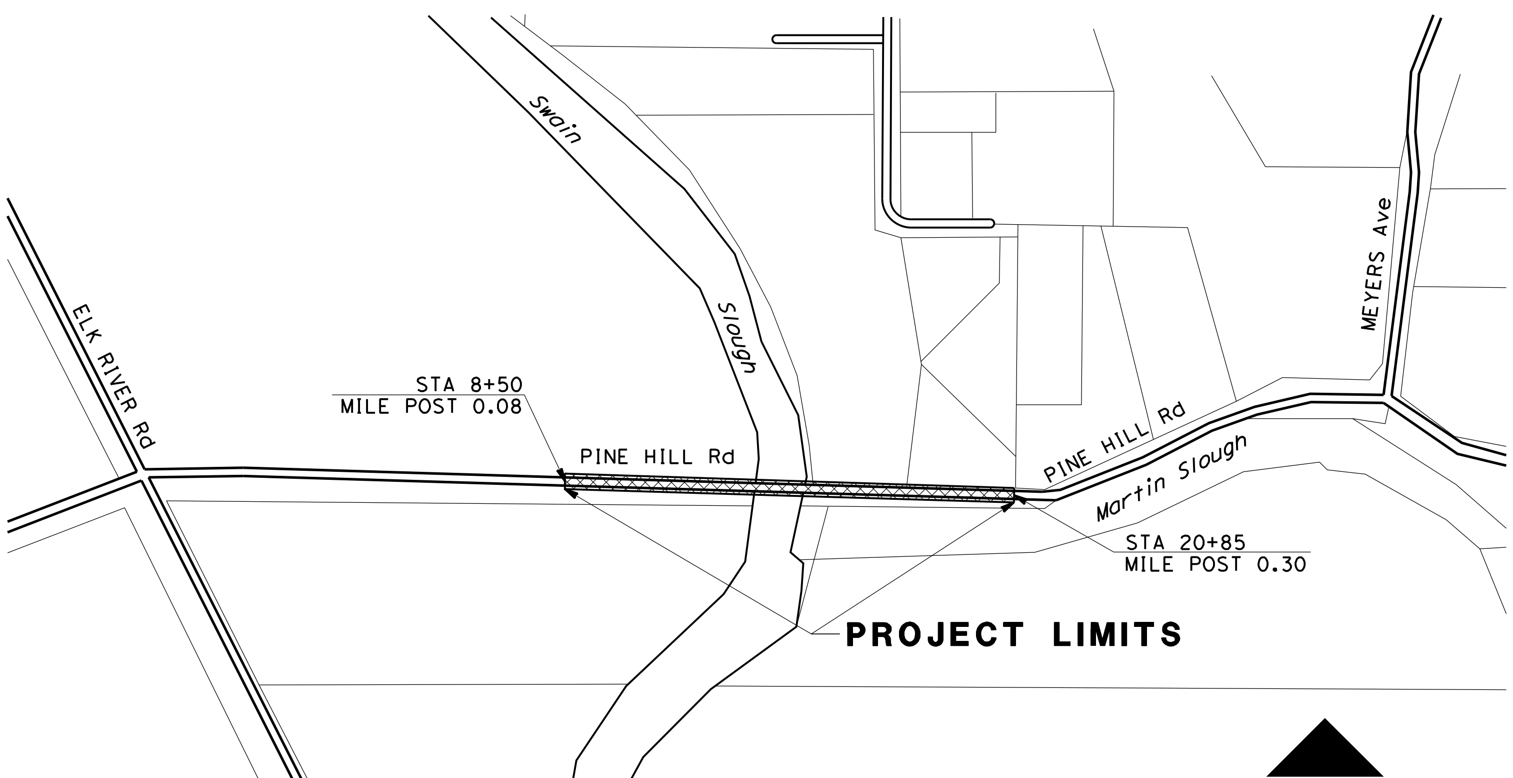
INDEX OF SHEETS

ROADWAY PLANS

1	COVER SHEET
2	TYPICAL CROSS SECTIONS
3	LAYOUT
4	PROFILE
5	CONSTRUCTION DETAILS
6	EROSION CONTROL PLAN
7	CONTOUR GRADING AND ROCK SLOPE PROTECTION
8	DRAINAGE PLAN
9	DRAINAGE PROFILES
10	DRAINAGE DETAILS
11	UTILITY PLAN
12	DETOUR PLAN
13	SUMMARY OF QUANTITIES

STRUCTURE PLANS

14	GENERAL PLAN
15	DECK CONTOURS
16	FOUNDATION PLAN
17	ABUTMENT LAYOUT
18	ABUTMENT DETAILS No.1
19	ABUTMENT DETAILS No.2
20	TYPICAL SECTION
21	GIRDER LAYOUT
22	WIDE FLANGE GIRDER DETAILS No.1
23	WIDE FLANGE GIRDER DETAILS No.2
24	CONSTRUCTION SEQUENCE
25	MISCELLANEOUS DETAILS
26-28	LOG OF TEST BORINGS



VICINITY MAP

BASIS OF BEARINGS

CC83 EPOCH 2007.00 BASED ON CONTROL BY BRIAN SOUSA, PLS FOR LIDAR SURVEY (PT NOS. 1510 & 1512)

CONVERGENCE ANGLE 01°25'43"
COMBINATION FACTOR 0.999900144

BASIS OF ELEVATION

NAVD88 BASED ON SAME SOUSA SURVEY (WHICH WAS VIA STATIC GPS TIES TO NGS CONTROL AT MURRAY FIELD)

RECOMMENDED

90% SUBMITTAL ______________ DATE

REGISTERED PROFESSIONAL ENGINEER JAMES L. FOSTER No. 45695 Exp. 12/31/20 CIVIL STATE OF CALIFORNIA

APPROVED

______________ HUMBOLDT COUNTY ______________ DATE

REGISTERED PROFESSIONAL ENGINEER TONY R. SEGHETTI No. 63714 Exp. 9/30/20 CIVIL STATE OF CALIFORNIA

ORIGINAL LOW BID PRICE	CONSTRUCTED BY	RESIDENT ENGINEER
	PROJECT COMPLETED / /	CONSTRUCTION COST $

ROAD NAME: PINE HILL ROAD		QUINCY ENGINEERING	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS	SHEET 2 OF 28
ROAD NO.: 3J430	MILE POST: 0.19	DESIGNED BY: KP	PINE HILL ROAD BRIDGE OVER SWAIN SLOUGH	
PROJECT NO.: BRLO-5904(112)	EA NO.:	DRAWN BY: KP	TYPICAL CROSS SECTIONS	
CONTRACT NO.: 594020	PPNO.:	REVIEWED BY: JJ		
DRAWING FILE NAME: S:\Client\Humboldt\H07-300 Pine Hill\CAD\Roadway\H07300rca001.dgn		APPROVED BY:		
PLOT DATE: 1-21-2018	REVISON DATE: 1-21-2018			

REGISTERED PROFESSIONAL ENGINEER — JASON P. JURRENS — No. C62458 — Exp. 09/30/21 — CIVIL — STATE OF CALIFORNIA

BAR IS ONE INCH ON ORIGINAL DRAWING

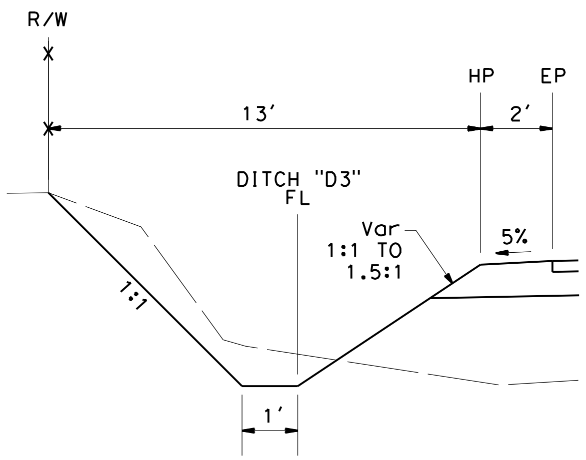
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

NOTES:

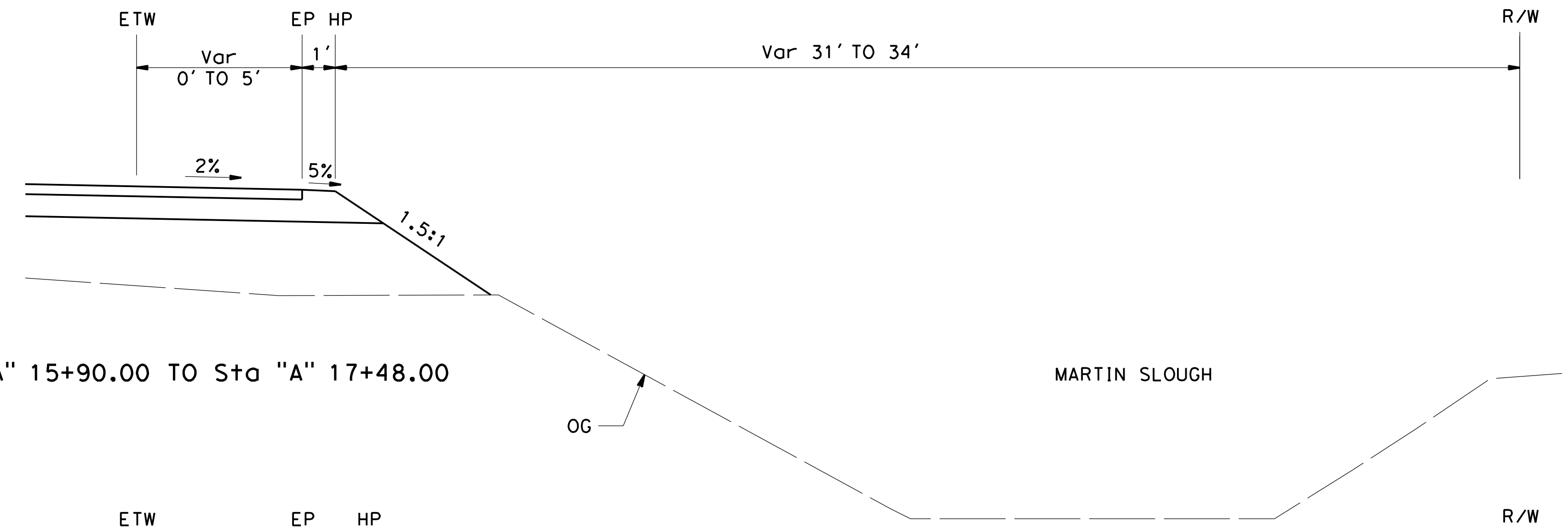
1. DIMENSIONS OF THE PAVEMENT STRUCTURES (STRUCTURAL SECTIONS) ARE SUBJECT TO TOLERANCES SPECIFIED IN THE STANDARD SPECIFICATIONS.
2. CLASS 2 AGGREGATE BASE EXTENDED AT SAME DEPTH UNDER APPROACH SLAB.
3. FOR DITCH FLOW ELEVATIONS, SEE DRAINAGE DETAILS

DESIGN DESIGNATION (COUNTY ROAD)

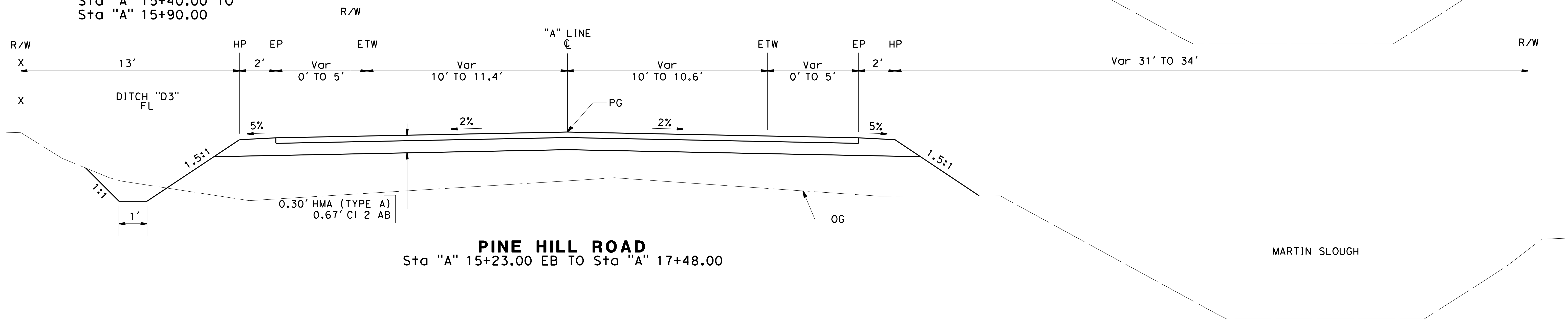
2009 ADT = 341
2036 ADT = 582
TRUCKS= 3% V = 35 MPH
LOCAL RURAL ROAD



Sta "A" 15+40.00 TO Sta "A" 15+90.00

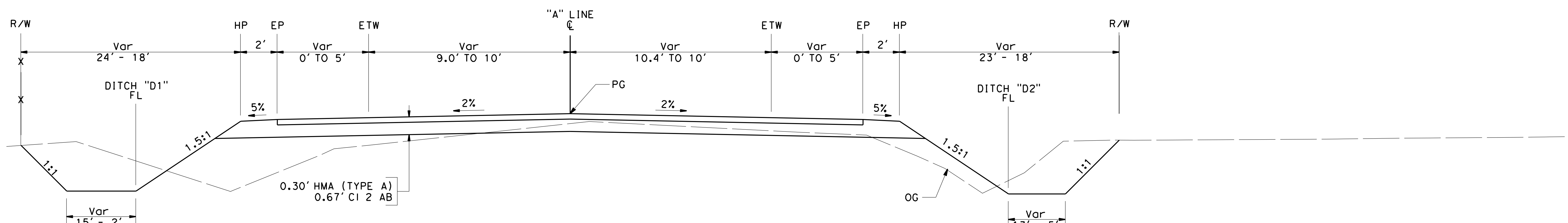


Sta "A" 15+90.00 TO Sta "A" 17+48.00



PINE HILL ROAD

Sta "A" 15+23.00 EB TO Sta "A" 17+48.00



PINE HILL ROAD

Sta "A" 11+93.00 TO Sta "A" 14+43.00 BB

NO SCALE

X-1

REGISTERED PROFESSIONAL ENGINEER
JASON P. JURRENS
No. C62458
Exp. 09/30/21
CIVIL
STATE OF CALIFORNIA

BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

ROAD NAME: PINE HILL ROAD		QUINCY ENGINEERING		
ROAD NO.: 3J430	MILE POST: 0.19			
PROJECT NO.: BRLO-5904(112)	EA NO.:	DESIGNED BY:	KP	
CONTRACT NO.: 594020	PPNO.:	DRAWN BY:	KP	
DRAWING FILE NAME: S:\Client\Humboldt\H07-300 Pine Hill\CAD\Roadway\H07300rea001.dgn		REVIEWED BY:	JJ	
PLOT DATE: 1-21-2018	REVISON DATE: 1-21-2018	APPROVED BY:		

COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS

PINE HILL ROAD BRIDGE OVER SWAIN SLOUGH

LAYOUT

NOTES:

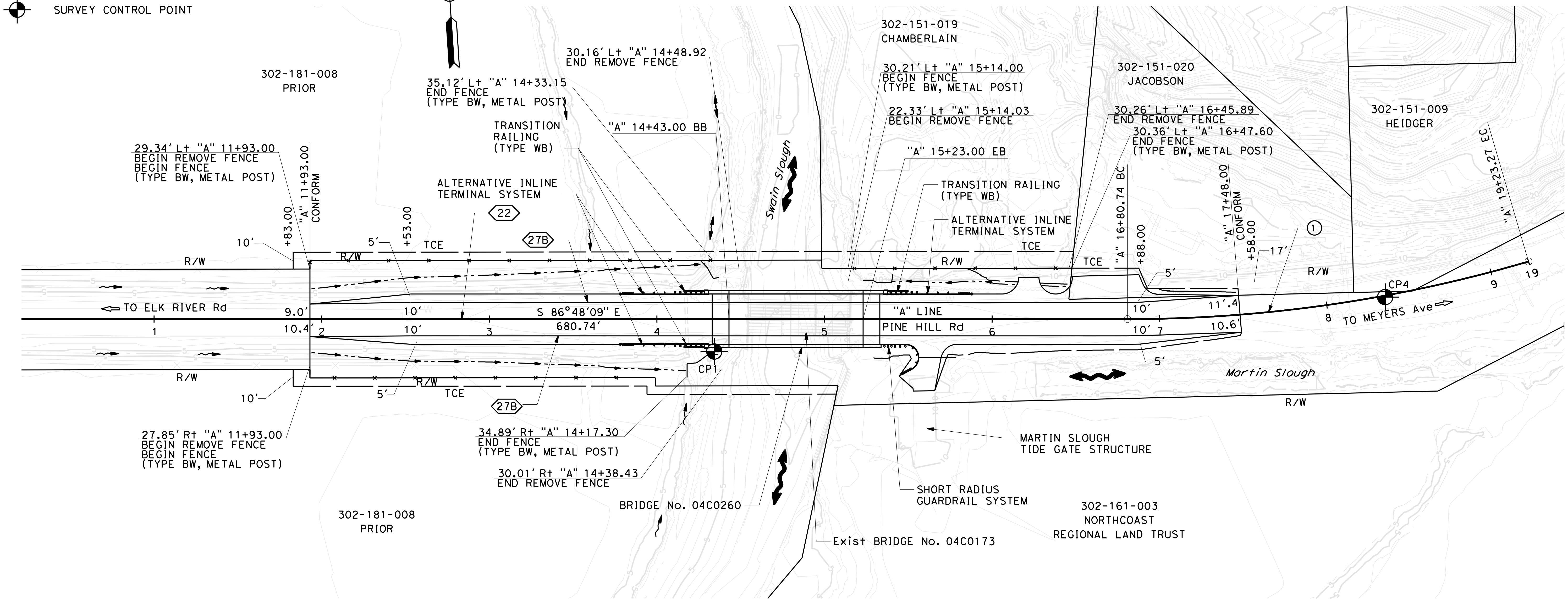
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT THE COUNTY OFFICE.
2. PINE HILL ROAD TO MYERS (MEYERS) AVE - 60' WIDE PER 62 DEEDS 372 UNABLE TO LOCATE POINT OF BEGINNING-HELD EXISTING ROAD AS BEST EVIDENCE OF DEEDED R/W.
3. ALSO 60' WIDE PER BOOK 6 OF MAPS PAGE 40 (PT NOS. 417, 418, 421 & 422) NOTE THIS DOES NOT FIT EXISTING ROAD VERY WELL.
4. IMPLIED COMMON LAW DEDICATION FOR OTHER AREAS FALLING WITHIN MAINTAINED ROAD VIA LONG TERM PUBLIC USE AND MAINTENANCE BY THE COUNTY.

LEGEND:

- DIRECTION OF TRAFFIC
- (XX) CURVE DATA NUMBER
- <XXX> PAVEMENT DELINEATION DETAIL
- DIRECTION OF DITCH FLOW
- SURVEY CONTROL POINT

CURVE DATA

No. ◯	R	Δ	T	L
1	850.00'	16° 20' 53"	122.09'	242.53'



SURVEY CONTROL DATA

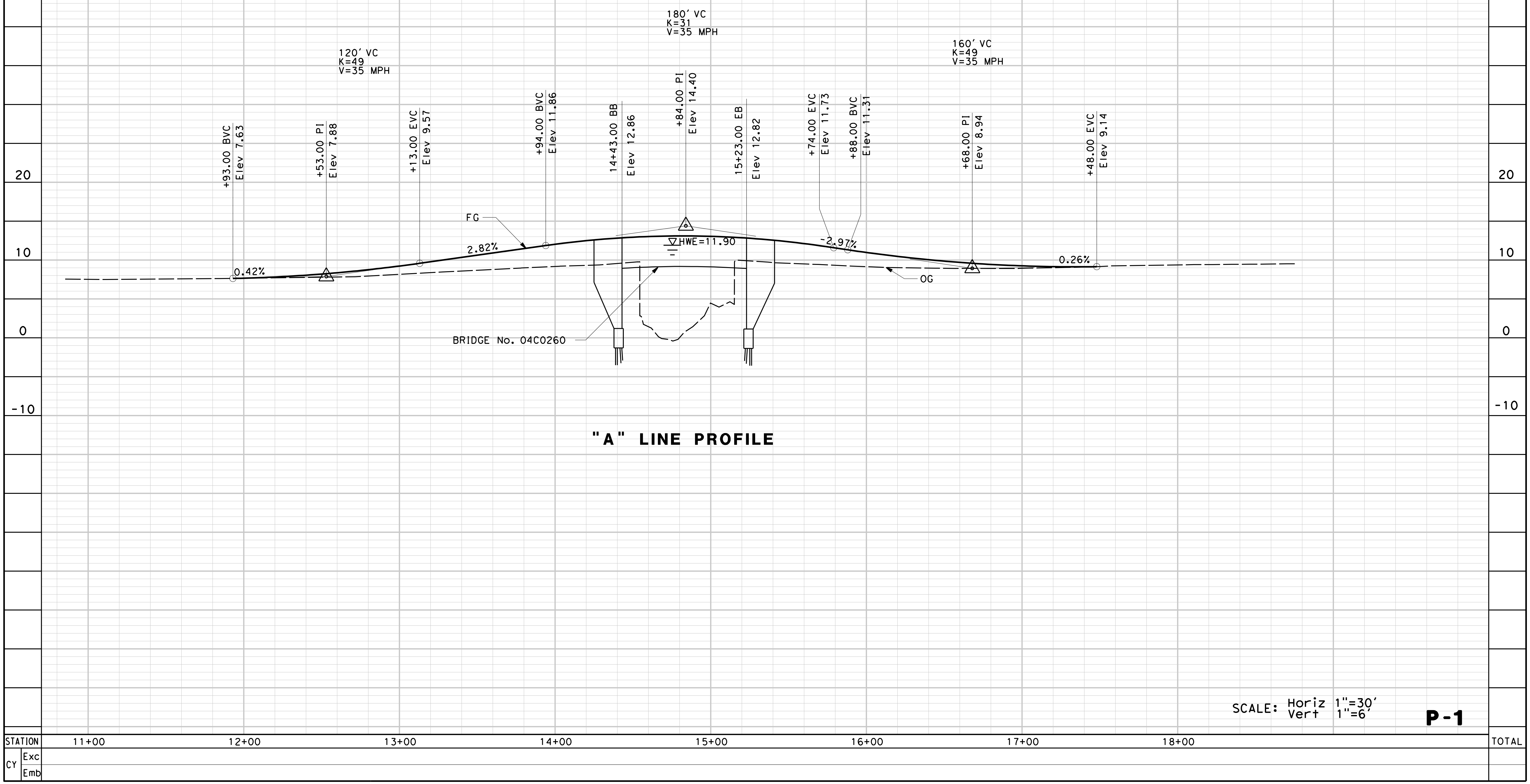
No.	NORTHING	EASTING	ELEV	LINE	STATION	OFFSET	DESCRIPTION
CP1	2164937.002	5957031.194	10.172	"A"	14+34.23	19.36' Rt	SET80DSPIKE
CP2	2165008.312	5956085.236	9.142	"A"			BRASSCAPHUMCORE19203
CP4	2164947.122	5957432.660	9.366	"A"	18+35.19	0.88' Rt	SETMAGNAIL&DPWTAG
CP5	2165073.438	5957926.179	8.956	"A"			FD1510

SCALE: 1"=30'

NOTES:

1. HWE IS Q100.

JASON P. JURRENS No. C62458 Exp. 09/30/21 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA	BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	ROAD NAME: PINE HILL ROAD		QUINCY ENGINEERING	COUNTY OF HUMBOLDT DEPARTMENT OF PUBLIC WORKS	SHEET 4 OF 28
		ROAD NO.: 3J430	MILE POST: 0.19			
		PROJECT NO.: BRLO-5904(112)	EA NO.:	DESIGNED BY: KP	PINE HILL ROAD BRIDGE OVER SWAIN SLOUGH	
		CONTRACT NO.: 594020	PPNO.:	DRAWN BY: KP		
		DRAWING FILE NAME: S:\Client\Humboldt\H07-300 Pine Hill\CAD\Roadway\H07300rfa001.dgn		REVIEWED BY: JJ	PROFILE	
		PLOT DATE: 1-21-2018	REVISON DATE: 1-21-2018	APPROVED BY:		



SCALE: Horiz 1"=30' Vert 1"=6'

P-1

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Hum	CR	0.19	14	27

REGISTERED CIVIL ENGINEER DATE

90% SUBMITTAL

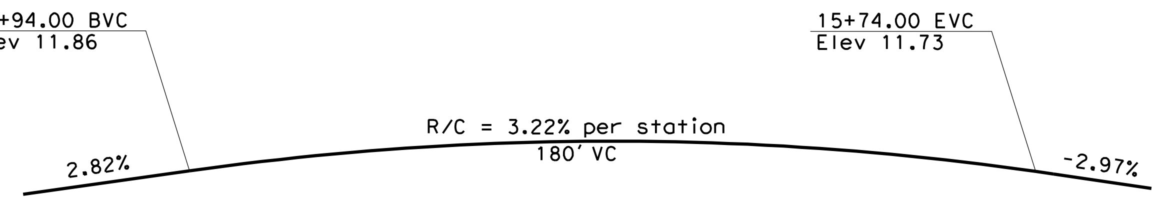
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Lacey J. Smith No. C78363 Exp. CIVIL STATE OF CALIFORNIA

The County or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

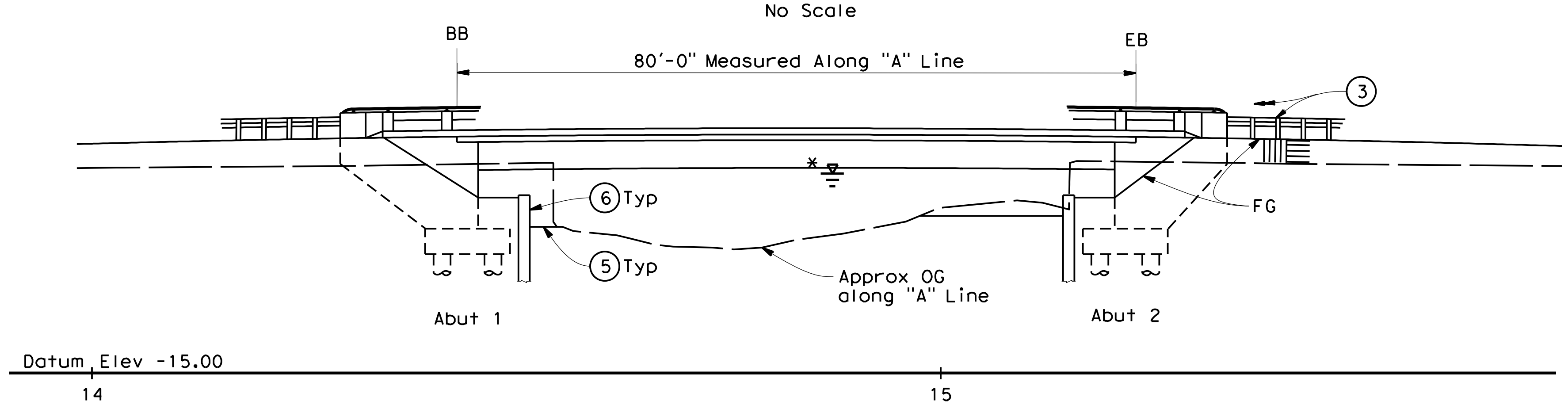
QUINCY ENGINEERING, INC
11017 Cobblerock Drive, Suite 100
Rancho Cordova, CA 95670

COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS
1106 2nd Street
Eureka, CA 95501



PROFILE GRADE

No Scale

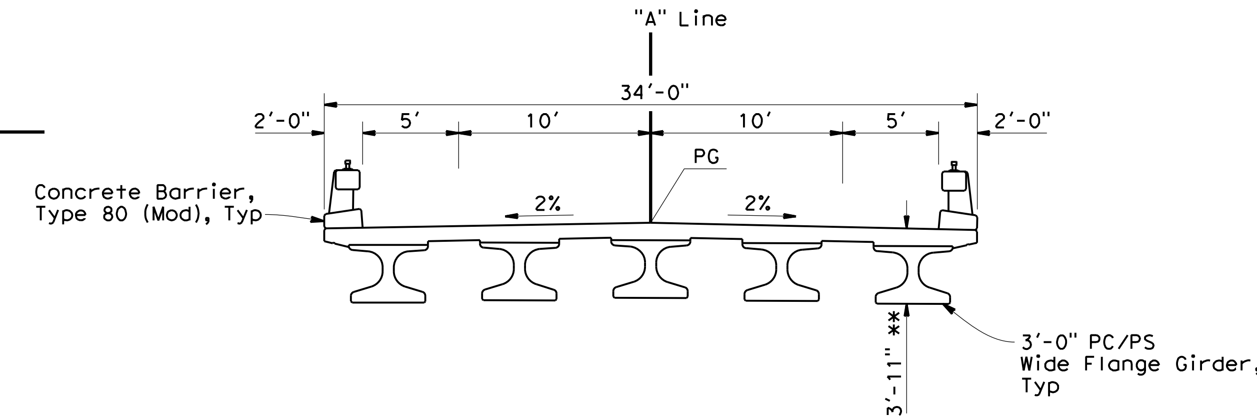


ELEVATION

1"=10'

INDEX TO PLANS

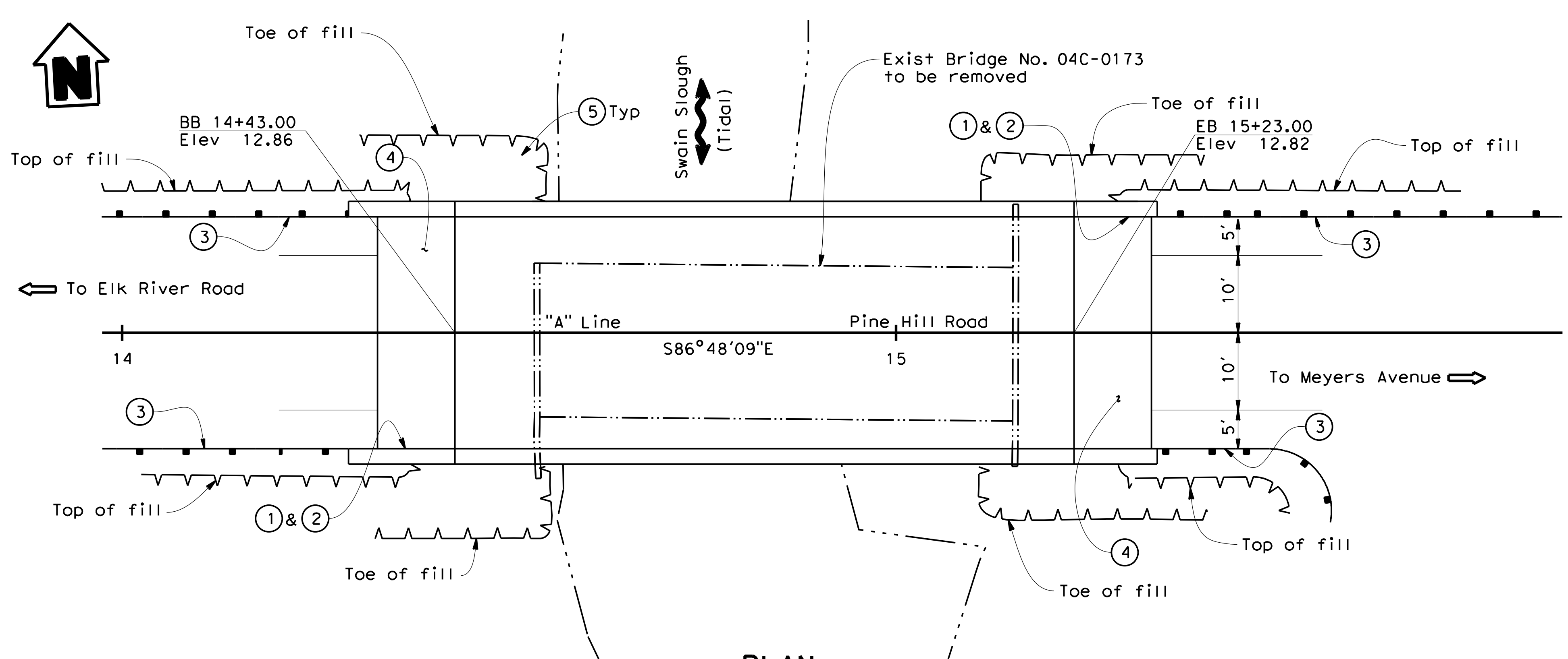
Sheet No.	Title
1	General Plan
2	Deck Contours
3	Foundation Plan
4	Abutment Layout
5	Abutment Details No. 1
6	Abutment Details No. 2
7	Typical Section
8	Girder Layout
9	Wide Flange Girder Details No. 1
10	Wide Flange Girder Details No. 2
11	Construction Sequence
12	Miscellaneous Details sheet
13	Log of Test Borings No. 1
14	Log of Test Borings No. 2
15	Log of Test Borings No. 3



** Structure Depth at centerline girder at midspan

TYPICAL SECTION

1"=5'



PLAN

1"=10'

Notes:

1. Paint Bridge Number "Bridge No. 04C0260
2. Paint "Swain Slough Bridge"
3. MGS, see Road Plans
4. Structure Approach Type EQ(10)
5. Contour Grading, see Road Plans
6. Permanent Sheet Pile shoring, see "Miscellaneous Details" sheet.

* King Tide water surface elevation = 8.5' NAVD

-··—·— Existing structure, Br. No. 04C0173, to be removed

DESIGN OVERSIGHT	DESIGN	BY L. Smith	CHECKED J. Chou	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 AND PERMIT DESIGN VEHICLE	
	DETAILS	BY B. Maechler	CHECKED J. Chou	LAYOUT	BY L. Smith	CHECKED J. Chou
SIGN OFF DATE	QUANTITIES	BY J. Cruz	CHECKED H. Chou	SPECIFICATIONS	BY S. McCauley	PLANS AND SPECS COMPARED

PREPARED FOR THE **COUNTY OF HUMBOLDT** DEPARTMENT OF PUBLIC WORKS

Scott McCauley
PROJECT ENGINEER

BRIDGE NO. 04C0260
POST MILES 0.19

SWAIN SLOUGH BRIDGE
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT:
PROJECT NUMBER & PHASE:
CONTRACT NO.:

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 5/22/15

SHEET 1 OF 14

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USERNAME => scottm DATE PLOTTED => 10/24/2019 TIME PLOTTED => 10:28:48 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
1	Hum	CR			

REGISTERED CIVIL ENGINEER DATE

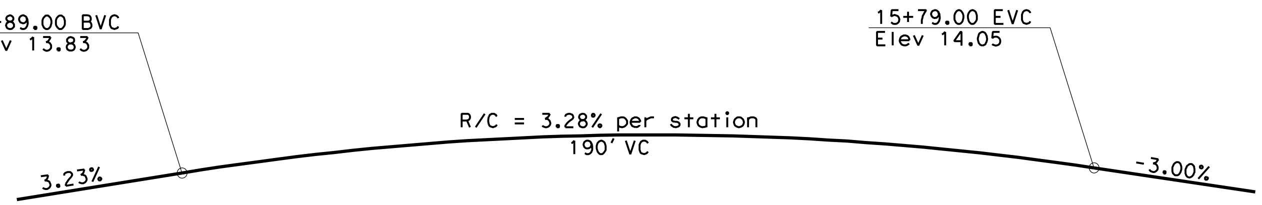
PLANS APPROVAL DATE

The Identity or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

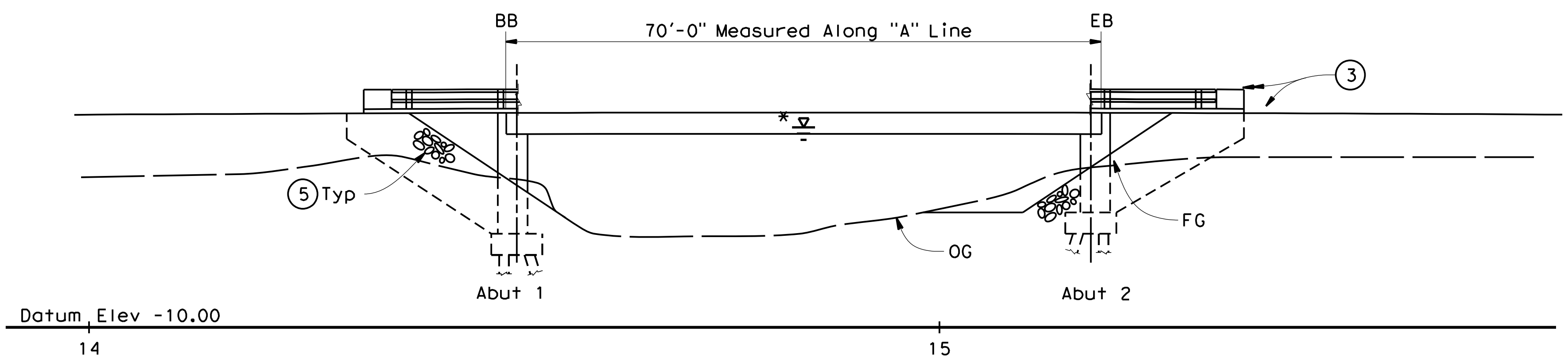
REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

QUINCY ENGINEERING, INC
3247 Ramos Circle
Sacramento, CA 95827 - 2501

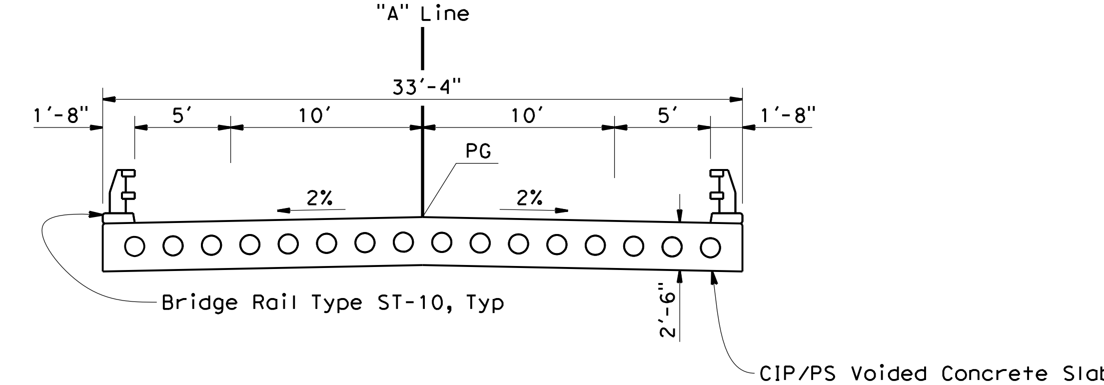
COUNTY OF HUMBOLDT
DEPARTMENT OF PUBLIC WORKS
1106 2nd Street
Eureka, CA 95501



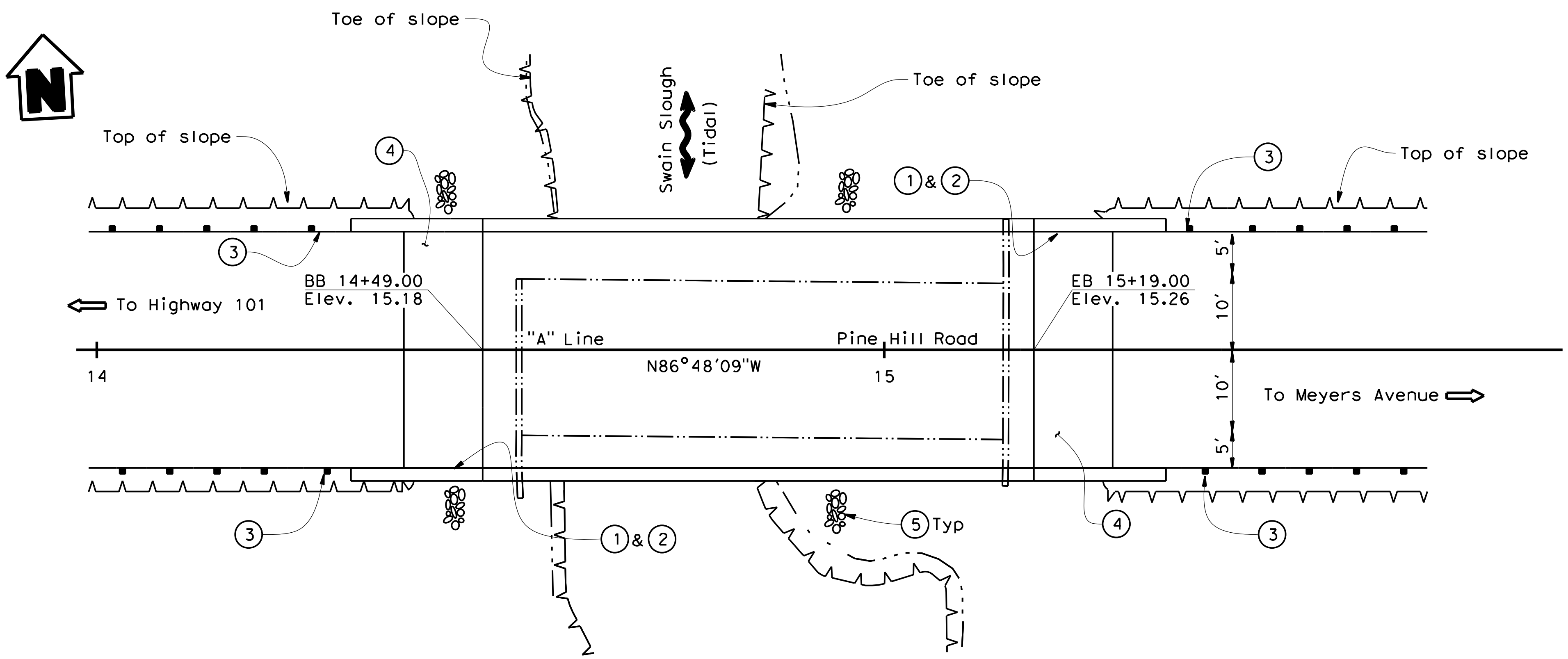
PROFILE GRADE
No Scale



ELEVATION
1"=10'



TYPICAL SECTION
1"=5'



PLAN
1"=10'

Date of Estimate = 11/28/12
Bridge Removal = $30,000
Length = 70'-0"
Width = 33'-4"
Area = 2333 ft^2
Cost / ft^2 = 290 $/$ft^2$

Total Cost with
10% Mobilization\
25% Contingency
Grand Total = $675,000

Notes:

1. Paint Bridge Number
2. Paint "Swain Slough Bridge"
3. MBGR, see Road Plans
4. Stucture Approach Type EQ(10)
5. Rock Slope Protection

* Highwater elevation

—··—··— Existing structure

DESIGN OVERSIGHT	DESIGN	BY S. McCauley	CHECKED	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	BY S. McCauley	CHECKED	LAYOUT	BY S. McCauley	CHECKED
SIGN OFF DATE	QUANTITIES	BY	CHECKED	SPECIFICATIONS	BY	PLANS AND SPECS COMPARED

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Jason Jurrens
PROJECT ENGINEER

BRIDGE NO. 04C-0173
POST MILES

PINE HILL ROAD BRIDGE
GENERAL PLAN

UNIT:
PROJECT NUMBER & PHASE: CONTRACT NO.:

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET 1 OF 1

FILE => S:\Client\Humboldt\H07-300 Pine Hill\CAD\Bridge\H07300a-a-gp01.dgn

USERNAME => _USERNAME DATE PLOTTED => 12/10/2012 TIME PLOTTED => 10:54:19 AM

Appendix I - Preliminary Project Cost Estimates

Quincy Engineering, Inc.

90% PS&E 10% CONTINGENCY

Project Name	SWAIN SLOUGH BRIDGE REPLACEMENT AT PINE HILL ROA	Date	2/12/2018
		Project. No.	H07-300
Bridge Name	SWAIN SLOUGH BRIDGE	Road Q's By	K. Panayotov
Bridge. No.	04C0260	Road Check Q's By	A. Mitchell

Item No.		Item Code	Item Description	Unit	Quantity	Unit Price	Total
1		022776	HYDROACOUSTIC MONITORING	LS	LUMP SUM	$ 15,000.00	$ 15,000.00
2		028284	SETTLEMENT AND MONITORING	LS	LUMP SUM	$ 15,000.00	$ 15,000.00
3		120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM	$ 6,000.00	$ 6,000.00
4		120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM	$ 5,000.00	$ 5,000.00
5		120120	TYPE III BARRICADE	EA	6	$ 160.00	$ 960.00
6		130100	JOB SITE MANAGEMENT	LS	LUMP SUM	$ 20,000.00	$ 20,000.00
7		130200	PREPARE WATER POLLUTION CONTROL PROGRAM	LS	LUMP SUM	$ 3,000.00	$ 3,000.00
8		130640	TEMPORARY FIBER ROLL	LF	926	$ 7.00	$ 6,482.00
9		130680	TEMPORARY SILT FENCE	LF	984	$ 6.00	$ 5,904.00
10		130710	TEMPORARY CONSTRUCTION ENTRANCE	EA	2	$ 3,000.00	$ 6,000.00
11		130900	TEMPORARY CONCRETE WASHOUT	LS	LUMP SUM	$ 4,000.00	$ 4,000.00
12		146002	CONTRACTOR-SUPPLIED BIOLOGIST (LS)	LS	LUMP SUM	$ 30,000.00	$ 30,000.00
13		170103	CLEARING AND GRUBBING (LS)	LS	LUMP SUM	$ 10,000.00	$ 10,000.00
14		190101	ROADWAY EXCAVATION	CY	634	$ 150.00	$ 95,100.00
15	F	192008	STRUCTURE EXCAVATION (TYPE A)	CY	358	$ 250.00	$ 89,500.00
16	F	193003	STRUCTURE BACKFILL (BRIDGE)	CY	135	$ 150.00	$ 20,250.00
17		198010	IMPORTED BORROW (CY)	CY	346	$ 80.00	$ 27,680.00
18		210430	HYDROSEED	SQFT	10441	$ 0.50	$ 5,220.50
19		260203	CLASS 2 AGGREGATE BASE (CY)	CY	451	$ 120.00	$ 54,120.00
20		390132	HOT MIX ASPHALT (TYPE A)	TON	315	$ 200.00	$ 63,000.00
21		480600	TEMPORARY SHORING	LS	LUMP SUM	$ 50,000.00	$ 50,000.00
22		490550	FURNISH 24" STEEL PIPE PILING	LF	2094	$ 85.00	$ 177,990.00
23		490555	DRIVE 24" STEEL PIPE PILE	EA	22	$ 1,300.00	$ 28,600.00
24		510000	SEAL COURSE CONCRETE	CY	112	$ 300.00	$ 33,600.00
25	F	510051	STRUCTURAL CONCRETE, BRIDGE FOOTING	CY	67	$ 800.00	$ 53,600.00
26	F	510053	STRUCTURAL CONCRETE, BRIDGE	CY	85	$ 1,000.00	$ 85,000.00
27	F	510054	STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)	CY	98	$ 1,100.00	$ 107,800.00
28	F	510085	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE EQ)	CY	23	$ 1,200.00	$ 27,600.00
29		512206	FURNISH PRECAST PRESTRESSED CONCRETE GIRDER (70-80')	EA	5	$ 18,000.00	$ 90,000.00
30		512500	ERECT PRECAST PRESTRESSED CONCRETE GIRDER	EA	5	$ 5,000.00	$ 25,000.00
31		519081	JOINT SEAL (MR 1/2")	LF	67	$ 70.00	$ 4,690.00
32	F	520106	BAR REINFORCING STEEL (EPOXY COATED)	LB	42297	$ 1.75	$ 74,019.75
33		600097	BRIDGE REMOVAL	LS	LUMP SUM	$ 40,000.00	$ 40,000.00
34		650010	12" REINFORCED CONCRETE PIPE	LF	18	$ 150.00	$ 2,700.00
35		650014	18" REINFORCED CONCRETE PIPE	LF	78	$ 200.00	$ 15,600.00
36		705201	12" CONCRETE FLARED END SECTION	EA	2	$ 1,000.00	$ 2,000.00
37		705204	18" CONCRETE FLARED END SECTION	EA	4	$ 1,200.00	$ 4,800.00
38		710136	REMOVE PIPE (LF)	LF	37	$ 30.00	$ 1,110.00
39		723060	ROCK SLOPE PROTECTION (300 lb, Class IV, METHOD B) (CY)	CY	178	$ 300.00	$ 53,400.00
40		723070	ROCK SLOPE PROTECTION (150 lb, Class III, METHOD B) (CY)	CY	4	$ 260.00	$ 1,040.00
41		729011	ROCK SLOPE PROTECTION FABRIC (CLASS 8)	SQYD	425	$ 20.00	$ 8,500.00
42		800001	FENCE (TYPE BW, METAL POST)	LF	612	$ 30.00	$ 18,360.00
43		803020	REMOVE FENCE	LF	638	$ 10.00	$ 6,380.00
44		810230	PAVEMENT MARKER (RETROREFLECTIVE)	EA	48	$ 15.00	$ 720.00
45		820134	OBJECT MARKER (TYPE P)	EA	4	$ 100.00	$ 400.00
46		820220	REMOVE MARKER	EA	4	$ 30.00	$ 120.00
47		839001	SHORT RADIUS GUARDRAIL SYSTEM	EA	1	$ 12,000.00	$ 12,000.00

48		839543	TRANSITION RAILING (TYPE WB-31)	EA	3	$ 6,000.00	$ 18,000.00
49		839584	ALTERNATIVE IN-LINE TERMINAL SYSTEM	EA	3	$ 4,500.00	$ 13,500.00
50	F	839740	CALIFORNIA ST-10 BRIDGE RAIL	LF	209	$ 300.00	$ 62,700.00
51		840501	THERMOPLASTIC TRAFFIC STRIPE	LF	2220	$ 2.00	$ 4,440.00
52		999990	MOBILIZATION	LS	LUMP SUM	$150,588.63	$ 150,588.63
			SUBTOTAL CONTRACT				$ 1,656,474.88
		SUPPLEMENTAL WORK					
53		066015	FEDERAL TRAINEE PROGRAM	LS	LUMP SUM	$ 800.00	$ 800.00
54		066596	ADDITIONAL WATER POLLUTION CONTROL	LS	LUMP SUM	$ -	$ -
55						$ -	
56						$ -	
57						$ -	
			SUBTOTAL SUPPLEMENTAL WORK				$ 800.00
			SUBTOTAL				$ 1,657,274.88
			CONTINGENCIES			10.0%	$ 165,725.13
			TOTAL				**$ 1,823,000.00**

Appendix J - Preliminary Foundation Report

Final Foundation Report

Pine Hill Road Bridge at Swain Slough, Eureka, Humboldt County, California

Prepared for:

Quincy Engineering Inc.
11017 Cobblerock Drive, Suite 100
Rancho Cordova, California 95670
and
Humboldt County Public Works
1106 Second Street
Eureka, California 95501

SHN Consulting Engineers & Geologists, Inc.
812 W. Wabash Ave.
Eureka, CA 95501-2138
707-441-8855

December 2015
012163

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
812 W. Wabash Ave. • Eureka, CA 95501-2138 • 707-441-8855 • FAX: 707-441-8877 •shninfo@shn-engr.com

Reference: 012163

December 29, 2015

Mr. Jason Jurrens, PE
Quincy Engineering, Inc.
11017 Cobblerock Drive, Suite 100
Rancho Cordova, CA 95670

Subject: Final Foundation Report, Pine Hill Road Bridge at Swain Slough, Eureka, Humboldt County, California

Dear Mr. Jurrens:

Enclosed is our final foundation report for the Pine Hill Road Bridge at Swain Slough in Eureka, California. This report contains the findings of our subsurface exploration, conclusions, and recommendations for foundation design and roadway approaches for the new bridge.

We appreciate this opportunity to work with you on this project. If there are any questions as to the content of this report, please feel free to contact any of the undersigned.

Sincerely,

SHN Consulting Engineers & Geologists, Inc.

John H. Dailey, PE, GE
Senior Geotechnical Engineer

Gary D. Simpson, CEG
Senior Engineering Geologist

JHD:GDS:amg

Enclosure: Final Foundation Report

Reference: 012163

Final Foundation Report

Pine Hill Road Bridge at Swain Slough
Eureka, Humboldt County, California

Prepared for:

Quincy Engineering Inc.
11017 Cobblerock Drive, Suite 100
Rancho Cordova, California 95670
and
Humboldt County Public Works
1106 Second Street
Eureka, California 95501

REGISTERED PROFESSIONAL ENGINEER JOHN H. DAILEY No. 256 Exp. 3/31/16 GEOTECHNICAL STATE OF CALIFORNIA

REGISTERED GEOLOGIST GARY D. SIMPSON No. 2107 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

12/29/15

John H. Dailey, PE, GE

Gary D. Simpson, CEG

Prepared by:

SHN
Consulting Engineers & Geologists, Inc.
812 W. Wabash Ave.
Eureka, CA 95501-2138
707-441-8855

December 2015

QA/QC: GDS___

\\Eureka\projects\2012\012163-PineHillbridg\PUBS\rpts\20151229-PineHillFinalGeotechnicalRpt.doc

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Abbreviations and Acronyms

pcf	pounds per cubic foot
psf	pounds per square foot
AASHTO	American Association of State Highway and Traffic Officials
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials-International
BH-#	bore hole-number
Cal-OSHA	California Occupational Heath and Safety Administration
Caltrans	California Department of Transportation
CBC	California Building Code
CGS	California Geological Survey
CDMG	California Department of Mines and Geology
CPT	cone penetration test
CRR	cyclic resistance ratio
CSR	cyclic stress ratio
CSZ	Cascadia Subduction Zone
EFZ	Earthquake Fault Zone
FEMA	Federal Emergency Management Agency
LRFD	load and resistance factor design
M	magnitude
M_w	moment magnitude
MRfz	Mad River fault zone
OSHA	U.S. Occupational Health and Safety Administration
SHN	SHN Consulting Engineers & Geologists, Inc.
SPT	Standard Penetration Test
USGS	U.S. Geologic Survey

1.0 Introduction

1.1 General Information

SHN Consulting Engineers & Geologists, Inc. prepared this Final Foundation Report for the Pine Hill Road Bridge at Swain Slough in Eureka, Humboldt County, California. The general site location is shown on Figure 1, Location Map. This report presents our findings, conclusions, and recommendations for design of the new bridge foundations and roadway approaches.

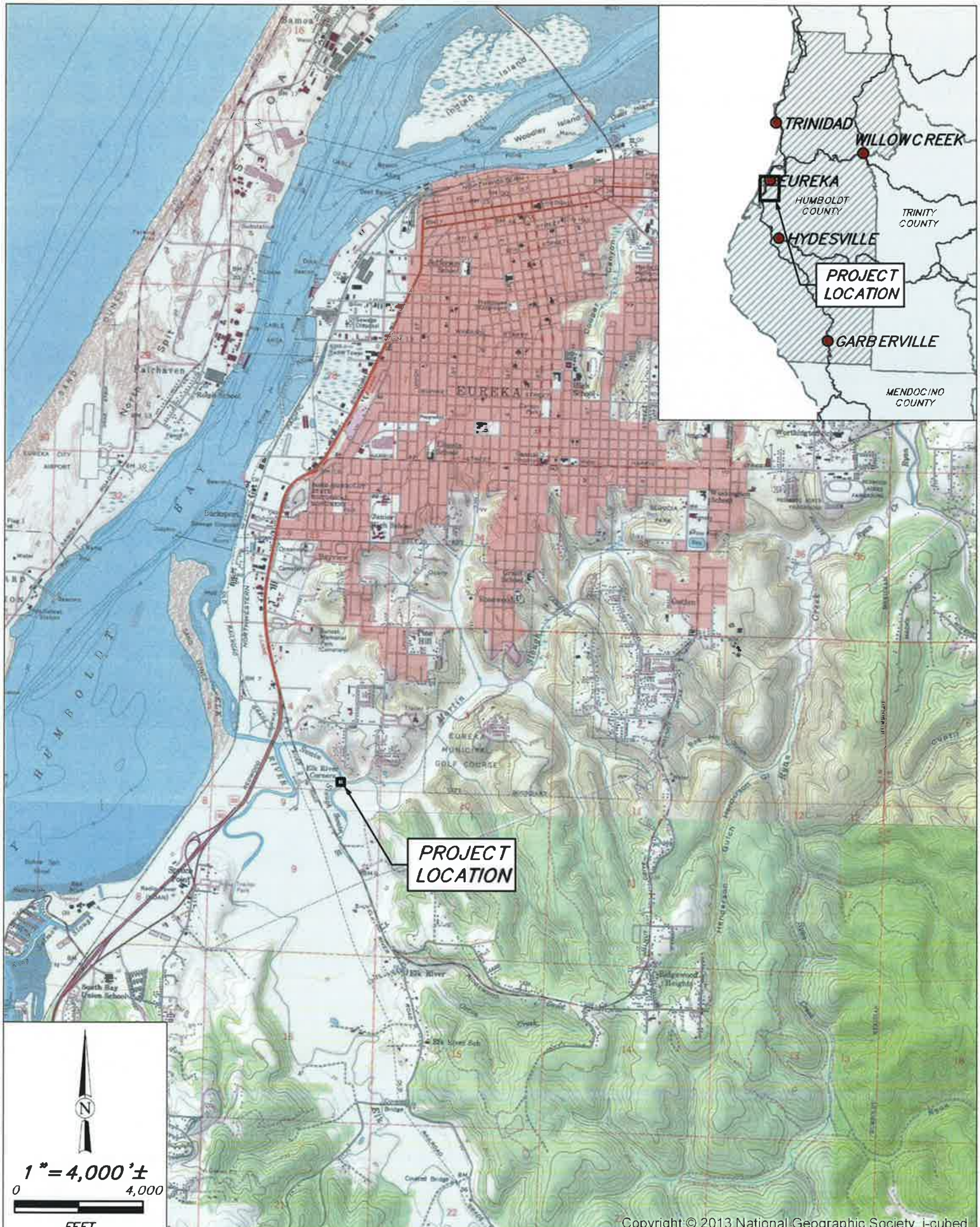
This report is intended for Quincy Engineering, Inc. (QEI) and the Humboldt County Department of Public Works to use during design and construction of the bridge. The foundation and retaining wall recommendations presented in this report are based on load and resistance design (LRFD) factors outlined in the AASHTO LRFD Bridge Design Specifications–Sixth Edition (2012) with modifications based on the California Amendments to the AASHTO LRFD Bridge Design Specifications – Sixth Edition, dated January 2014. This report is prepared in English units.

1.2 Purpose and Scope

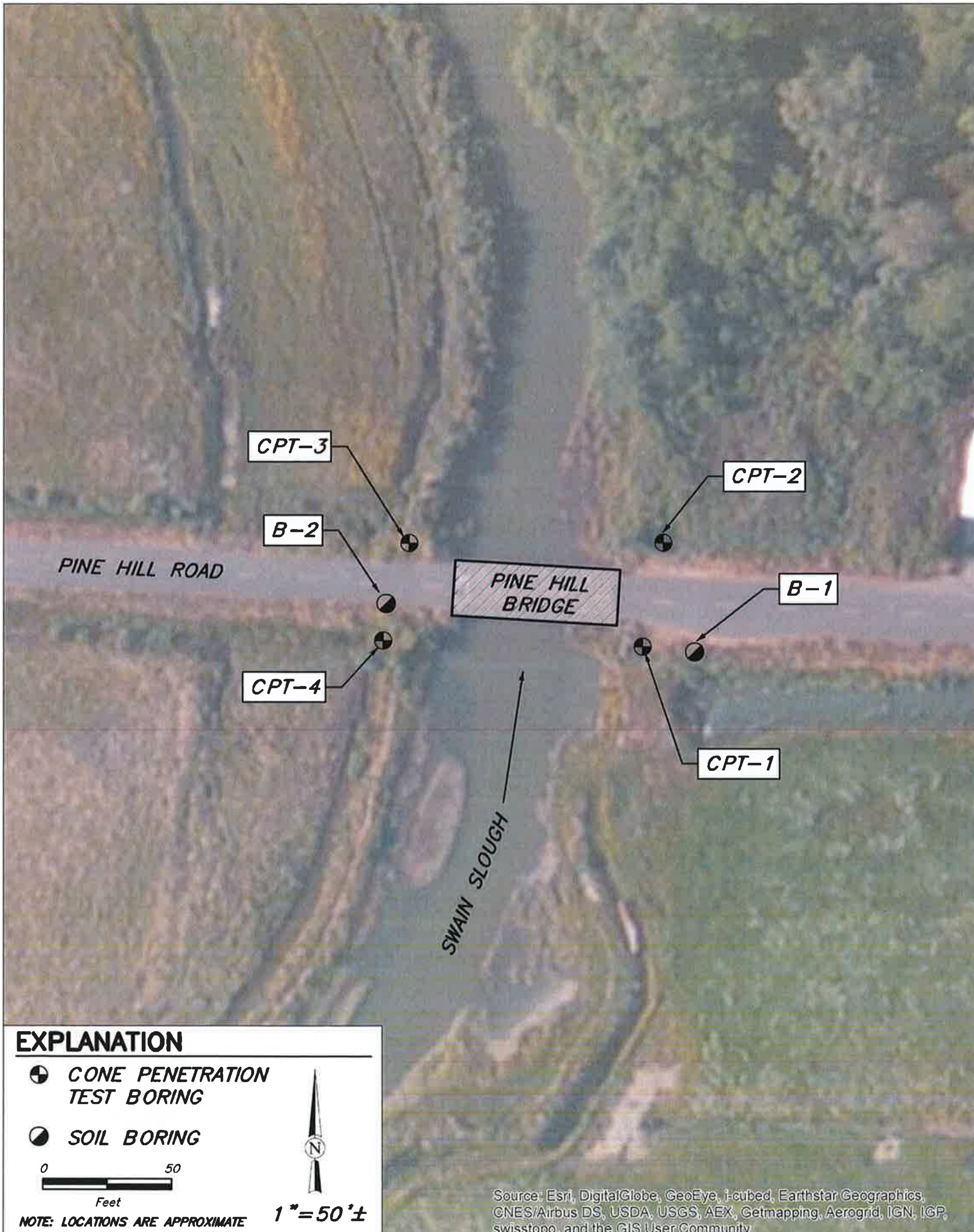
The primary purposes of this investigation were to explore and evaluate subsurface soil and bedrock conditions at the site and to develop geotechnical recommendations and design criteria for earthwork and foundation support for the proposed structure.

The scope of services included reviewing available subsurface information, conducting cone penetrometer tests (CPT), excavating one machine boring, performing laboratory tests on selected soil samples, and developing recommendations for site grading and foundation design. Specifically, the following information, recommendations, and design criteria are presented in this report:

- Description of site terrain and local geology;
- Description of subsurface soil, bedrock, and groundwater conditions interpreted based on our field exploration, laboratory testing, and review of existing geotechnical information;
- Logs of Test Borings (LOTB) including four CPT soundings and two machine borings, and the results of laboratory tests conducted for this investigation;
- Assessment of potential earthquake-related geologic/geotechnical hazards (e.g. surface fault rupture, liquefaction, differential settlement, site instability) and discussion of possible mitigation measures, as necessary;
- Completion of a site-specific ground motion analysis;
- Evaluation of corrosion potential based on corrosion testing of a representative soil sample obtained from the machine boring completed at the site;
- Recommendations for earthwork, including site and subgrade preparation, fill material, placement and compaction requirements for roadway approaches;
- Discussion of appropriate foundation options;
- Recommendations regarding foundation elements including:
    - allowable pile capacities (dead, live, and seismic loads)



SHN Consulting Engineers & Geologists, Inc.	Quincy Engineering Pine Hill Bridge Eureka, California	Project Location SHN 012163
	January 2016	Figure1_ProjectLocation2015	**Figure 1**



SHN Consulting Engineers & Geologists, Inc.	Quincy Engineering Pine Hill Bridge Eureka, California		Site Map SHN 012163
	December 2015	Figure2_SiteMap2015	Figure 2

- estimates of settlement (total and differential)
- lateral pile capacities and top of pile deflections

- lateral earth pressures for design of retaining structures;
- Recommendations for observation of site preparation and grading and driven pile installation, materials testing and inspection, and other construction considerations.

2.0 Site and Project Description

The site coordinates are approximately: latitude 40.75255º north and longitude 124.18264º west. At this location, Pine Hill Road is aligned in a general east-west orientation where it crosses Swain Slough. The existing 63 foot long three span timber bridge, which is approximately 65 years old, crosses Swain Slough about 0.2 miles east of Elk River Road, just south of Eureka, California. It is proposed to replace the existing structurally deficient and functionally obsolete bridge with an approximately 80 foot long precast wide-flange girder bridge structure. We understand that preliminary Service – Limit State Loads (LRFD) are 1,180 kips at each abutment. The roadway approaches are anticipated to be raised by up to about 3 feet, to elevation 12.8 feet, with engineered fill. In order to minimize impacts to sensitive areas, retaining walls may be utilized to contain the new approach roadway fills.

3.0 Field Exploration and Laboratory Testing

General descriptions of the field and laboratory testing programs performed for the current site investigation are presented below. More detailed descriptions of the subsurface explorations and laboratory testing programs including the final CPT and boring logs, and laboratory test data are presented in Appendices A and B, respectively.

3.1 Field Exploration Program

The field exploration program for this investigation consisted of installing four CPT soundings and two machine borings, logging the soils encountered and obtaining samples of the subsurface materials, and performing geotechnical laboratory tests on selected representative samples. The locations of the CPT soundings and machine borings are shown on Figure 2, Site Map Showing Test Locations, and the attached Log of Test Borings (LOTB) in Appendix A.

3.2 Cone Penetrometer Tests

CPT soundings were advanced on September 28, 2012 using a GeoProbe 6600 operated by Fisch Drilling of Hydesville, California. The CPT soundings were advanced to depths of between 72.5 feet and 103.5 feet below ground surface. The CPT locations were approximately located in the field to encompass the four corners of the proposed bridge abutments. Digital CPT logs indicating the soil behavior type were prepared by Fisch Drilling on behalf of SHN. Electronic text files of the CPT data were also supplied to SHN for the quantitative liquefaction potential analysis. Shear wave velocities were measured in two of the CPT soundings (CPT1 and CPT3), at each abutment location, to be used for evaluating the site response spectra.

3.3 Machine Borings

Two machine borings, denoted as B-1 and B-2 on the LOTB, were excavated by Taber Drilling of West Sacramento, California. On October 16, 2012 a geotechnical engineer from SHN logged and sampled the soils encountered in boring B-1, which was located near the southeast corner of the existing bridge (Abutment 2). The machine boring was excavated to a maximum depth of 90.5 feet using hollow-stem auger (0- 40 feet) and mud rotary wash (40 – 90.5 feet) drilling equipment. On September 30, 2015 a certified engineering geologist from SHN logged and sampled the soils encountered in boring B-2, which was located near the southwest corner of the existing bridge (Abutment 1). The machine boring for B-2 was excavated to a maximum depth of 150.5 feet using mud rotary wash drilling equipment. The completed borings were both backfilled with cement/bentonite slurry.

Relatively undisturbed soil samples submitted for laboratory testing were obtained with a 3.0-inch inside-diameter (ID) Shelby tube sampler pushed into the soft clays and highly plastic silts. We also collected samples of the firmer underlying soils using a 2.5-inch ID California Modified Sampler and/or a 1.4-inch ID Standard Penetration Test (SPT) sampler. Penetration resistance during sample driving using these two samplers was recorded as the two borings were advanced. Where shown on the LOTB, the blow counts record the number of blows required to drive the sampler 18 inches (in 6 inch increments) by a 140-pound hammer dropping 30 inches inside the boring, controlled with an auto-hammer. Sampler types are noted on the LOTB, in Appendix A. Soils encountered in the machine boring were logged in general accordance with ASTM D2488 (Visual-Manual Procedure).

3.4 Laboratory Testing

Selected soil samples were tested in SHN's certified materials testing laboratory to evaluate their physical characteristics and engineering properties. Samples were tested for their moisture content and unit weight, Atterberg Limits (liquid limit and plasticity index), gradation, percent passing the #200 sieve (combined silt and clay), consolidation, unconfined compression and consolidated-undrained triaxial shear strength. Laboratory test results are presented in Appendix B and adjacent to the corresponding sample intervals on the LOTB in Appendix A.

4.0 Site Conditions

The following sections describe the proposed bridge site and current surface conditions, the geologic and seismic settings of the site, and subsurface soil and groundwater conditions encountered at the time of our field exploration.

4.1 Geologic Setting

The project is located within Martin Slough, a broad estuarine valley that opens into the eastern shore of Humboldt Bay at the southern margin of the City of Eureka. The Humboldt Bay region occupies a complex geologic environment characterized by very high rates of active tectonic deformation and seismicity. The area lies just north of the Mendocino Triple Junction, the intersection of three crustal plates (the North American, Pacific, and Gorda plates). North of Cape Mendocino, the Gorda plate is being actively subducted beneath the North American plate, forming what is commonly referred to as the Cascadia Subduction Zone. In the Humboldt Bay region, the subduction zone is manifested on-land as a series of northwest-trending, southwest-vergent thrust faults, and intervening folds ("fold and thrust belt"). The geomorphic landscape of the Humboldt Bay region is largely a manifestation of the active tectonic processes in this dynamic coastal environment.

Basement rock beneath Humboldt Bay is the Paleocene-Eocene Yager terrane, a part of the Coastal belt of the Franciscan Complex (Blake et al., 1985; Clarke, 1992). The Franciscan Complex is a regional bedrock unit that consists of a series of "terranes," which are discrete blocks of highly deformed oceanic crust that have been welded to the western margin of the North American plate over the past 140 million years. The Yager terrane consists of as much as 9,800 feet of well-indurated marine mudstone and thin-bedded siltstone. Yager terrane bedrock is in excess of 1,000 feet below the ground surface in the vicinity of Humboldt Bay, based on a deep exploratory well south of Eureka (Woodward-Clyde Consultants, 1980).

Basement rock in the Humboldt Bay region is unconformably overlain by a late Miocene to middle Pleistocene age sequence of marine and terrestrial deposits referred to as the Wildcat Group (Ogle, 1953). The marine portion of the Wildcat Group includes some 6,000 to 8,000 feet of mudstone and lesser amounts of sandstone that were deposited in a deep coastal basin (for example, the Eel River basin). Gradationally overlying the marine portion of the Wildcat Group are 2,500 to 3,250 feet of nonmarine sandstone and conglomerate, which represent the uppermost part of the Wildcat depositional sequence. The Wildcat Group is truncated at its top by an unconformity of middle Pleistocene age, and is overlain by coastal plain and fluvial deposits of middle to late Pleistocene age. In the Eureka area, these middle and late Pleistocene age deposits are referred to as the Hookton Formation (Ogle, 1953). Hookton Formation sediments are described as gravel, sand, silt, and clay which have a characteristically yellow-orange color (Ogle, 1953).

Along the coast of northern California between Cape Mendocino on the south and Big Lagoon, about 60 miles (100 kilometers [km]) to the north, a sequence of uplifted late Pleistocene age marine terraces are preserved The terraces are preserved as erosional remnants of raised shore platforms and associated cover sediments. Sea level has fluctuated throughout the late Pleistocene in response to the advance and retreat of large continental ice sheets. Marine terraces preserved along the coast represent surfaces eroded during the highest levels of these sea level fluctuations, superimposed on a coastline being uplifted by regional tectonics. Marine terraces in the region range in age from about 64,000 years old, to as much as 240,000 years old.

Beneath Humboldt Bay, and along its margins, the Hookton Formation and marine terrace deposits are overlain by late Holocene age (younger than about 5,000 to 6,000 years old) bay muds and associated littoral and estuarine deposits. Near alluvial sources at the fringes of the bay, bay muds are intermixed with terrestrial alluvial deposits. These youthful, unconsolidated deposits vary in thickness and composition around the bay and in the adjacent coastal valleys, often exhibiting large amounts of lateral variation over very small distances. Bay deposits typically consist of silty clays or clayey silts (bay muds) interbedded with clean sand lenses and beds.

Martin Slough and other coastal valleys around Humboldt Bay represent sediment-filled estuaries that reflect the late Quaternary history of sea level changes and tectonic deformation. Formation of these coastal valleys likely post-dates the formation of the adjacent marine terrace platforms, the youngest of which in the Martin Slough area is thought to be some 83,000 years old. Because of its coastal setting, Martin Slough is sensitive to base level fluctuations associated with the rise and fall of sea level. During most of the late Quaternary, sea level was lower than its present position, resulting in a shoreline located farther to the west, and a lower fluvial base level to which all coastal streams would be graded. During these low sea levels, streams within the coastal valleys around Humboldt Bay would be incised. Subsequent sea level fluctuations would result in cycles of filling and incision in these coastal valleys, depending on the relative base level (the ocean shoreline). Sea level apparently reached its current high level in the mid-Holocene, about 6,000 years ago. As such, at least the uppermost part of the sediment filling the Martin Slough valley would be anticipated to be mid-Holocene in age, or younger.

Sediment filling Martin Slough is generally fine-grained (silt, with lesser amounts of clay). The material is derived from alluvial sources (overbank/floodplain deposits) in the upper part of the canyon, and estuarine sources (tidal marine deposits, etc.) in the lower reaches of the valley nearest the bay. Evidence of marine influence (deposits with marine shells for example) does not appear to extend very far up the Martin Slough valley, based on subsurface investigations for previous studies for various projects, indicating that most of the sediment in the valley is derived from alluvial sources. Valley fill sediments are uniformly soft, unconsolidated materials that locally contain a high amount of organic materials. Sandy deposits are present locally, particularly near alluvial sources and approaching the bay margins.

4.2 Seismicity

The project site is located in a region of high seismicity. Over sixty earthquakes have produced discernible damage in the region since the mid-1800s (Dengler et al., 1992). Historic seismicity and paleoseismic studies in the area suggest there are six distinct sources of damaging earthquakes in the Eureka region: (1) the Gorda Plate; (2) the Mendocino fault; (3) the Mendocino Triple Junction; (4) the northern end of the San Andreas fault; (5) faults within the North American Plate (including the Little Salmon fault and Mad River fault zone); and (6) the Cascadia Subduction Zone (Dengler et al., 1992).

Earthquakes originating within the Gorda Plate account for the majority of historic seismicity. These earthquakes occur primarily offshore along left-lateral faults, and are generated by the internal deformation within the plate as it moves toward the subduction zone. Significant historic Gorda Plate earthquakes have ranged from magnitude 5 to 7.5. The November 8, 1980, earthquake (magnitude 7.2) was generated 30 miles (48 km) off the coast of Trinidad on a left-lateral fault within the Gorda Plate. Other recent Gorda Plate earthquakes include the 2010 event with a magnitude of 6.5, and a magnitude 6.8 earthquake that occurred in March 2014.

The Mendocino fault is the second most frequent source of earthquakes in the region. The fault represents the plate boundary between the Gorda and Pacific plates, and typically generates right lateral strike-slip displacement. Significant historic Mendocino fault earthquakes have ranged from magnitude 5 to magnitude 7.5. The September 1, 1994, magnitude 7.2 event originating west of Petrolia was generated along the Mendocino fault. The Mendocino triple junction was identified as a separate seismic source only after the August 17, 1991 magnitude 6.0 earthquake. Significant seismic events associated with the triple junction are shallow onshore earthquakes that appear to range from magnitude 5 to 6. Raised Holocene age marine terraces near Cape Mendocino suggest larger events are possible in this region.

Earthquakes originating on the northern San Andreas fault are extremely rare, but can be very large. The northern San Andreas fault is a right lateral strike-slip fault that represents the plate boundary between the Pacific and North American plates. The fault extends through the Point Delgada region and terminates at the Mendocino triple junction. The 1906 San Francisco earthquake (magnitude 8.3) caused the most significant damage in the north coast region, with the possible exception of the April 1992 Petrolia earthquake (Dengler et. al., 1992).

Earthquakes originating within the North American plate can be anticipated from a number of intraplate sources, including the Mad River fault zone and Little Salmon fault. There have been no large magnitude earthquakes associated with faults within the North American plate, although the December 21, 1954, magnitude 6.5 event may have occurred in the Mad River fault zone. The Little Salmon fault is the closest known active fault to the project area (Wills, 1990). The Little Salmon fault is a northwest-trending, southwest-vergent reverse fault (the northeast side of the fault slides up and over the southwest side of the fault along a northeast-dipping fault plane). Paleoseismic studies of the Little Salmon fault indicate that the fault deforms late Holocene sediments at the southern end of Humboldt Bay (Clarke and Carver, 1992). Estimates of the amount of fault slip for individual earthquakes along the fault range from 15 to 23 feet (4.5 to 7 meters). Radiocarbon dating suggests that earthquakes have occurred on the Little Salmon fault about 300, 800, and 1,600 years ago. Average slip rate for the Little Salmon fault for the past 6,000 years is between 6 and 10 mm/yr. Based on currently available fault parameters, the maximum magnitude earthquake for the Little Salmon fault is thought to be between 7.0 (CDMG/USGS, 1996) and 7.3 (Geomatrix Consultants, 1994).

The Cascadia Subduction Zone (CSZ) represents the most significant potential earthquake source in the north coast region. The CSZ is the location where the oceanic crust of the Gorda and Juan de Fuca plates are being subducted beneath the continental crust of the North American Plate. A great subduction event may rupture along 200 km or more of the coast from Cape Mendocino to British Columbia, may be up to magnitude 9.5, and could result in extensive tsunami inundation in low-lying coastal areas. The April 25, 1992, Petrolia earthquake (magnitude 7.1) appears to be the only historic earthquake involving slip along the subduction zone, but this event was confined to the southernmost portion of the fault. It is estimated that there have been 6 significant subduction zone events along the CSZ in the last 3,000 years (Darienzo and Peterson, 1995). Paleoseismic studies along the subduction zone suggest that great earthquakes are generated along the zone every 300 to 500 years. Historic records from Japan describing a tsunami thought to have originated along the Cascadia Subduction Zone suggest the most recent great subduction event occurred on January 27, 1700. A great subduction earthquake would generate long duration, very strong ground shaking throughout the north coast region. Available mapping indicates that the surface expression of the subduction zone is located some 30 to 35 miles west of the project site (Clarke, 1992; McLaughlin et al., 2000). Seismic profiles suggest that the subduction interface dips landward at an angle of about 11 degrees (McPherson, 1992), which would place it at a depth of about 6 miles beneath the project area (using right angle projection).

4.3 Subsurface Conditions

The results of our subsurface exploration indicate that the site is underlain by soft, organic-rich, estuarine deposits of lean clays and high plasticity silts, with intermittent thin lenses/layers of loose sands, interpreted to extend to a depth of about 66 feet. The estuarine deposits, in turn, overlie Pleistocene age sediments associated with the Hookton Formation, consisting of consolidated medium dense to very dense sands, and medium stiff to stiff silts and clays, which exist to the maximum depths explored of 150.5 feet below the existing ground surface. Based on the results of the subsurface investigation, it appears that the contact between the estuarine deposits and underlying sediments associated with the Hookton Formation slopes down to the southwest.

Ground water was encountered at a depth of about 5 feet in the machine boring B-1; boring B-2 was excavated using rotary-wash drilling method and water levels could not be measured. Ground water levels adjacent to Swain Slough are influenced by tidal fluctuations, such that the water table rises during high tides. During the rainy season, water frequently ponds on the ground surface throughout the Martin Slough Valley.

4.4 Seismic Data and Evaluation

4.4.1 Ground Motion Study

Based on the results of the subsurface exploration, including shear wave velocity measurements indicating an average shear wave velocity (V_{S30}) from the CPT soundings equal to 140 meters per second for the upper 100 feet of soil profile, Caltrans design criteria requires the development of a site-specific response spectra. Quincy Engineering requested that the site-specific analyses include the nonlinear response of any soft clays subjected to high levels of shaking present at the site and a nonlinear effective stress analysis, taking into consideration the potential pore pressure generation and dissipation during liquefaction. We subcontracted with Langan Treadwell Rollo of San Francisco, California to perform the analyses and prepare a report presenting the development of a site-specific response spectrum for the bridge site. Their analyses indicate a maximum magnitude earthquake (M_{max}) of 7.25±0.25 with corresponding peak ground acceleration (PGA) of 0.3g. The results of their analyses were presented in their report dated July 22, 2014, which is attached as Appendix C.

4.4.2 Liquefaction and Cyclic Failure Potential of Silts and Clays

Liquefaction is a soil behavior phenomenon in which a soil loses a substantial amount of strength due to high excess pore-water pressure generated by strong earthquake ground shaking. Relatively young (i.e. deposited within last few thousand years) and unconsolidated soils and artificial fills located below the groundwater surface are considered susceptible to liquefaction (Youd and Perkins, 1978). Typically, the soils that are most susceptible to liquefaction include relatively clean, loose, uniformly graded sand, silty sand, and non-plastic deposits.

As previously discussed in this report, the CPT and machine boring data collected during this investigation indicates that the soils underlying the site are soft, organic-rich, estuarine deposits of lean clays and high plasticity silts, with intermittent thin lenses of loose sands, to a depth of about 66 feet. Underlying the estuarine deposits are Pleistocene age sediments associated with the Hookton Formation, consisting of consolidated medium dense to very dense sands, and medium stiff to stiff silts and clays, which exist to the maximum depths explored of 150.5 feet below the existing ground surface.

The potential for liquefaction and liquefaction-induced settlement was evaluated for the project site using the data collected from the CPT soundings. The evaluation was performed in accordance with the methodology presented in *Evaluating Cyclic Liquefaction Potential Using the Cone Penetration*

*Test, Canadian Geotechnical Journal, Volume 35 (*Robertson and Wride, 1998*)* combined with the recommendations presented in the publications *Soil Liquefaction During Earthquakes, Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA (* Idriss and Boulanger, 2008) and *CPT and SPT Based Liquefaction Triggering Procedures; Center for Geotechnical Modeling, University of California Davis, Report No. UCD/CGM-14/01* (Boulanger and Idriss, 2014), using the software program CLiq, version 1.7.6.34, by GeoLogismiki, Inc. An earthquake magnitude M_{max} of 7.50 and PGA of 0.30 times gravity were used in our analyses. Graphical results of the analyses are presented in Appendix D.

The results of the liquefaction analyses indicate that intermittent thin intervals identified in the CPT soundings (inferred to be sand layers) are susceptible to liquefaction. The intervals susceptible to liquefaction are relatively thin (typically less than 1-foot in thickness) and discrete, and are bounded by non-liquefiable layers with a factor of safety (FOS) greater than 2.0. The cumulative amount of potential liquefaction-induced settlement calculated at each CPT location is 0.58 inches at CPT1, 0.31 inches at CPT2, 2.7 inches at CPT3, and 2.2 inches at CPT4.

The soft silts and clays underlying the site are not considered to be susceptible to "classic cyclically induced liquefaction". However, they may be susceptible to cyclic failure potential where their strength is reduced during earthquake shaking sufficiently strong to trigger a drop to remolded or residual shear strengths. Comparison of a soil's natural water content (w_n) to its Atterberg limits can provide useful information on the potential for strength loss following cyclic failure during earthquake shaking. This comparison has been shown to provide reasonable correlations to a soil's sensitivity (S_t), which is the ratio of the soil's peak undrained shear strength (s_u) to its fully remolded (residual) undrained shear strength (s_{ur}). Based on the results of the laboratory testing performed, the underlying silts and clays appear to have a medium to very sensitive potential for strength loss.

We provide a discussion of the liquefaction potential and cyclic failure potential of the silts and clays, and their associated risks in Section 5.2, below.

4.4.3 Lateral Spreading

Lateral spreading is the displacement of soil that can occur when a continuous soil layer liquefies and the overlying soil layers move toward an unsupported slope face. The depth of the liquefiable layers are about 50 feet or greater in CPT 1 and CPT2, and about 45 feet in CPT4; however, in CPT3 the uppermost liquefiable layer appears to be at about 10 feet below the existing ground surface. The unsupported slope face is about 10 feet in height. The depth of the liquefiable layer is well below the unsupported slope face in CPT1, CPT2, and CPT4. Based on the Lateral Spreading Index (LDI) from the liquefaction assessment results for CPT3, there is a potential for about two inches of lateral spreading to occur in the soil layer overlying the liquefiable layer at a depth of 10 feet; the deeper liquefiable layers are well below the unsupported slope face. We judge the overall potential for lateral spreading to occur to be very low based on the liquefiable layer at 10 feet in CPT3 not being a continuous layer and the depth of the remaining liquefiable layers, and the results of the analyses.

We provide a discussion of the risk of lateral spreading in Section 5.2, below.

4.4.4 Tsunami Inundation

Tsunamis are long-period sea waves caused by sea floor deformation associated with submarine fault rupture or submarine landslides, sometimes from sources hundreds or thousands of miles away. Because the project is located in a low-lying coastal area in a seismically active region, the bridge site is subject to tsunami inundation. The hazard associated with tsunami inundation is increased in the Humboldt County area due to the proximity of the Cascadia Subduction Zone and other active offshore seismic sources that are capable of generating very large earthquakes.

Tsunamis have been observed along the northern California coastline following large earthquakes in the recent past. The most significant historical tsunami inundation in the region occurred in Crescent City in 1964 following a magnitude 9.2 earthquake in Alaska. Inundation associated with this tsunami generated over seven million dollars of damage in Crescent City and resulted in ten fatalities. Over 1,000 automobiles were also destroyed. The 1964 tsunami resulted in run-up of 6 feet (about 2 meters) in Humboldt Bay (Lander and Lockridge, 1989), but caused no significant damage. The tsunami resulted in fourteen knot currents near the bay entrance, and the bay was filled with logs and other debris. A ten-foot-high sea wall was breached at the Eureka Boat Basin (Lander et al., 1993). More recently, on April 25, 1992, a series of strong earthquakes occurred near Cape Mendocino. The main shock was magnitude 7.1, and was followed by strong aftershocks with magnitudes of 6.6 and 6.7. The magnitude 7.1 main shock generated a small tsunami that was recorded by tide gauges from Oregon to southern California (Bernard et al., 1994), including at Humboldt Bay. The wave was 0.7 to 1 foot (20 to 30 centimeters [cm]) high at the Humboldt Bay entrance, and caused no damage.

The Pine Hill Road Bridge is located in an area that is highly susceptible to tsunami inundation in the event of a moderate to large tsunami event. The site is within the "Tsunami Inundation Area" shown on the State Tsunami Inundation Map for Emergency Planning (Humboldt Bay sheet; 2009). It is located directly inboard of the Humboldt Bay entrance, and therefore has high exposure to waves as they first enter the bay. The dynamics of tsunami waves in Humboldt Bay are not well understood, but it is reasonable to assume that the site may be subject to significant flow velocity during an inundation event and, therefore, scour potential.

5.0 Geotechnical Site Conditions

5.1 General

Soils underlying the site are soft, organic-rich, estuarine deposits of lean clays and high plasticity silts, with intermittent thin lenses/layers of loose sands, interpreted to extend to a depth of about 66 feet below the bridge site. The estuarine deposits, in turn, overlie Pleistocene age sediments associated with the Hookton Formation, consisting of consolidated medium dense to very dense sands, and medium stiff to stiff silts and clays, which exist to the maximum depths explored of 150.5 feet below the existing ground surface.

Ground water was encountered at a depth of about 5 feet in the machine boring B-1. Ground water levels adjacent to Swain Slough are influenced by tidal fluctuations, such that the water table rises during high tides.

The principal geologic/geotechnical engineering considerations affecting design and construction of the project include the following:

1) Strong earthquake ground shaking.
2) Tsunami inundation.
3) The presence of underlying stratigraphic layers which are potentially susceptible to liquefaction and lateral spreading during relatively infrequent, upper-bound seismic events. Our quantitative liquefaction analysis indicates that up to about 2 inches of seismically-induced differential settlement may occur during these rare events, as well as a very low probability of lateral spreading.
4) The presence of soft, organic-rich, estuarine deposits of lean clays and high plasticity silt within the upper about 66 feet of the ground surface that have the potential for strength loss following cyclic failure during earthquake shaking and are prone to consolidation settlement (both total and differential) under new structural and approach fill material loads.

Recommendations presented in Section 6 below include design parameters for site preparation and grading, and the foundation system, which will reduce the hazard associated with seismically-induced settlement and lateral spreading, and static settlement (consolidation).

5.2 Liquefaction, Cyclic Failure Potential of the Silts and Clays, and Lateral Spreading

The liquefaction potential and risk of lateral spreading appears relatively low (based on our quantitative models) at the project site. The potential risk of strength loss of the underlying soft silts and clays during earthquake shaking depends on the intensity and duration of the earthquake shaking to trigger a drop to remolded or residual shear strengths. However, due to the inherent uncertainties, it is prudent to evaluate the potential mitigation strategies relative to the acceptable level of risk. This risk should be commensurate with that of other bridges in the Eureka area. The bridge should be able to resist a major level of earthquake ground motion having an intensity equal to the strongest either experienced or forecast for the site, without collapse, but possibly with some structural as well as nonstructural damage.

Within the recommendations section we have provided criteria for foundation design that is appropriate for mitigating the potential risk of strength loss in the upper more sensitive silts and clays, and the potential for differential settlement of approximately 2 inches during a seismic event. In our professional judgment, this is likely to result in a relatively conservative foundation design. However, the risk will be mitigated to a low level if the recommended foundation design criteria presented below are adhered to.

5.3 Settlement under Static Conditions

The upper approximately 66 feet of the soil profile beneath the bridge site is typically composed of soft, organic-rich, estuarine deposits of lean clays and high plasticity silts. These deposits are relatively compressible, and are subject to settlement under new proposed loads associated with the bridge structure and approach fills.

The proposed bridge foundations would experience unacceptable settlement if founded on shallow foundations, and will need to be founded in the firmer Hookton Formation at depth using a deepened foundation system. It is our opinion, that under normal static conditions the risk of significant post-construction foundation settlement will be mitigated to a low level if the recommended foundation design criteria presented below are adhered to.

Based on the results of laboratory consolidation tests from representative samples of the soft, lean clays and highly plastic silts, the up to 3 foot wedge of engineered fill being placed for the bridge approaches, we calculated that up to about 4 inches of settlement (consolidation) should be anticipated. Based on time rate of settlement calculations from laboratory consolidation tests performed, we estimate that over fifty percent of the settlement will occur in the first six months, sixty seven percent will occur in about 1 year, and ninety percent will occur in about 3 years. If piles are installed before this settlement is complete, negative skin friction or downdrag on the pile can develop in the soil zone that is settling, imposing additional loading on the pile.

Allowing the embankment fill and foundation soils to settle before constructing the CISS piles can effectively reduce negative skin friction. Placing an additional surcharge of approximately 3 feet of soil in the vicinity of the approach fills and CISS foundations could reduce the settlement period by half. During construction, settlement should be carefully monitored using a system of settlement plates and monuments that can measure deflections at the top and base of the fill. The CISS piles could be installed after a sufficient amount of settlement has occurred, for example fifty percent or 2 inches.

Maintenance may be required over the first few years following construction to prevent a "step" from forming at the contact between the bridge structure and approach. Presumably, this "maintenance" would include placement of additional asphalt material to raise the approach to meet the bridge grade.

5.4 Scour Condition

We understand that the bridge site has been identified as being susceptible to significant scour by WRECO analysis. Below is the plan by QEI to meet scour condition criteria at the bridge site.

Table 1 Design Level Scour Conditions

	Low Tailwater		High Tailwater	
Scour Component	**Abutment 1**	**Abutment 2**	**Abutment 1**	**Abutment 2**
Contraction Scour Depth (ft)	4.4	4.4	3.1	3.1
Local Scour Depth (ft)	10.1	11.0	13.5	4.4
Total Scour Depth (ft)	14.5	15.4	16.6	17.5
Thalweg (ft)	0	0	0	0
Scour Elevation w/ RSP (ft)	-4.4	-4.4	-3.1	-3.1
Scour Elevation w/o RSP (ft)	-14.5	-15.4	-16.6	-17.5

Elevations are referenced to North American Vertical Datum of 1988 (NAVD 88)

The bridge design by QEI includes Rock Slope Protection (RSP) at the abutments to minimize scour. Therefore, SHN is designing the foundations for the scour elevation with RSP at the abutments.

6.0 Recommendations

We recommend the bridge structure be designed to withstand strong seismic shaking in accordance with the seismic design requirements outlined in the Caltrans Seismic Design Guidelines. Because there is a potential for some liquefaction-induced settlement, potential cyclic loss of strength in the underlying silts and clays during a severe earthquake event, and possible minor lateral spreading, we believe the bridge structure should be supported on a deepened foundation system consisting of driven cast-in-place-steel-shell (CISS) piles. Reinforced concrete is placed inside the steel shell for the upper portion of the pile to enhance lateral pile performance, especially during a seismic event. One of the main advantages of using steel shells, especially in seismic regions like Humboldt County, is the satisfactory performance of the steel casings to enhance the ductile capacity of the reinforced concrete section through confinement of the concrete core. Based on our Preliminary Foundation Report, QEI selected CISS 24PPX0.75 piles for the proposed bridge structure.

6.1 Earthwork

Earthwork for construction of the proposed bridge structure will require preparation of an Erosion and Sedimentation Control Plan. This is especially relevant for the Pine Hill Bridge replacement project due to the narrow, confined work area and the proximity to both Swain Slough and Martin Slough, each of which maintain populations of protected Salmonids. Preparation and implementation of this plan are the sole responsibility of the Contractor. The Plan should identify the likely sources of construction related erosion and define mitigations to prevent movement of sediment outside the general working area. The Plan should be reviewed, and the project construction contract should require its implementation.

As appropriate, notify Underground Service Alert (USA) prior to commencing site work to provide utility clearance.

6.1.1 Site Preparation

In graded areas, all surficial vegetation and deleterious, organic, and oversized materials (greater than 4 inches in maximum dimension) should be stripped and isolated from the site prior to removal of any potentially useable soils.

Areas to receive fill should be stripped of loose or soft earth materials until a firm subgrade is exposed, or should be stabilized so that the subgrade is firm and unyielding. The stripping work should include the removal of existing uncompacted fill (if present), topsoil, and any other material that, in the judgment of the Geotechnical Engineer, is compressible or contains significant voids. The subgrade soils exposed at the bottom of stripping or other excavations should be observed by the Geotechnical Engineer or qualified representative from our office prior to placement of any fill.

Soft and yielding subgrade is likely to be encountered. It is recommended that the exposed subgrade be stabilized prior to initiating construction operations or placement of engineered fill so that, in the judgment of the Geotechnical Engineer, the subgrade is capable of adequately supporting the specific project improvements. If the subgrade cannot be stabilized through aeration/moisture conditioning and recompaction of soils, then the soils will need to be stabilized using other methods. The Contractor should have the sole responsibility for design and implementation of subgrade stabilization techniques.

Some methods that we have observed to be effective in stabilizing subgrades have included the following:

- use of ¾–inch to 1½-inch floatrock worked into the subgrade and covered with a geotextile fabric such as Mirafi 500X; and
- placement of a geotextile fabric, such as Mirafi 500X, on the subgrade and covered with at least one foot of compacted processed miscellaneous base (PMB) conforming to the requirements of Section 200-2.5 of the Greenbook, latest edition.

Prior to placement of engineered fills, the approved native subgrade should be scarified to a minimum depth of 6 inches, uniformly moisture-conditioned or aerated to near optimum moisture content and compacted to at least 90 percent relative compaction[1]. Care should be exercised in moisture conditioning the near surface soils, as excess moisture may cause a pumping condition. Subgrades stabilized with floatrock or geotextile will not require scarification.

6.1.2 Fill Placement and Compaction

We expect that the majority of the existing earth materials encountered at the proposed bridge site are generally too high in plasticity to be suitable for use as engineered fill. Engineered fill material should be free of debris, rocks over 4 inches in diameter, organic material, have a plasticity index less than 14 percent, and be evenly graded. All imported fill materials should be observed, tested, and approved by SHN prior to transportation to the site.

Soil used as engineered fill should be uniformly moisture conditioned to within 2-percent of the optimum moisture content. Engineered fill should be placed in lifts less than 8 inches in loose thickness, and compacted to at least 90 percent relative compaction.

6.1.2.1 Compaction Adjacent to Walls

Backfill within 5 feet, measured horizontally, behind retaining structures should be compacted with relatively lightweight, hand-operated compaction equipment to reduce the potential for creation of relatively large compaction-induced stresses. If large or heavy compaction equipment is used, compaction-induced stresses could result in increased lateral earth pressures on the retaining walls in addition to those presented in this report.

6.1.2.2 Excavation Stability Considerations

We anticipate that the Contractor will need to use temporary excavations during construction of the bridge structure. The excavations will require the Contractor to either slope the excavation walls or install shoring or caisson systems to support the temporary cut slopes during construction. Since the soils are indicated to be unconsolidated and are of generally soft to very soft consistency, and likely to be saturated to near the ground surface, sloping the excavations may be physically and environmentally impractical.

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[1] Relative compaction refers to the in-place dry density of a soil expressed as a percentage of the maximum dry density of the same soil, as determined by the ASTM D1557 Test Method. Optimum moisture content is the water content (percentage by dry weight) corresponding to the maximum dry density.

Approximate stability analyses of the site soils, based on assumed soil parameters, indicate that excavation cut slopes are likely to be unstable, even at the OSHA mandated 1.5:1 (horizontal:vertical) cut slope gradients for Type C soils. For example, total stress analysis of very soft site soils with an estimated cohesion of 200 pounds per square foot and an angle of internal friction of zero indicate instability where 1.5:1 cut slopes exceed approximately 10 to 15 feet in height. These results are based on estimated soil parameters, and actual conditions may vary, but they suggest potential instability at typical cut slope gradients in the site's weak soils.

The Contractor shall be responsible for the stability of all temporary excavations and should comply with applicable Occupational Safety and Health Administration (OSHA) regulations (California Construction Safety Orders, Title 8). The Contractor should periodically monitor all open cuts for evidence of incipient stability failures. According to the OSHA specifications, excavations deeper than 4 feet below existing grades (or shallower if excavations appear unsafe) should be laid back to a safe slope inclination, or mechanically supported, and in accordance with the Contractor's judgment of safe working conditions. In addition, slopes for excavations deeper than 20 feet are required to be designed by an engineer licensed to practice in the State of California. It should be noted that the Contractor is solely responsible for site safety and safe working conditions during construction. A logical alternative to laying back the excavation side slopes would be a temporary shoring system installed in a configuration that would allow vertical side slopes. The Contractor should select the type of shoring system to be used and should be solely responsible for the design and performance of the shoring system.

For the type of soil conditions encountered, temporary braced excavation shoring systems may be designed using typical procedures for braced excavations made into soft, normally consolidated clay. In addition, the shoring should be designed to withstand hydrostatic pressure assuming the water table at the ground surface. Passive pressure below the bottom of the excavation may be taken as an equivalent fluid pressure of 175 and 225 pounds per cubic foot (pcf) for the design, under static and dynamic loading conditions, respectively, for drained soil conditions. For undrained conditions, the soil passive component is 50 and 65 pcf, respectively. In undrained conditions, water pressure would also be applicable. We recommend the Contractor submit shoring plans, along with supporting geotechnical data used for those plans, for review and approval prior to construction. SHN should be retained to review and comment on the geotechnical data provided by the Contractor.

6.1.2.3 Fill Slopes

Permanent fill slopes may be made as steep as 2H:1V for slopes meeting the above recommendations for engineered fills. If more steeply inclined fill slopes are desired, these fills should be reinforced with geogrids, or should be mechanically stabilized earth (MSE). An MSE slope is typically used for applications where slope inclinations range from 1.5H:1V to 1H:1V, and no segmental block facing is used. Where vertical or near vertical faces are desired or required, then MSE walls with a segmental block facing are used. Recommendations can be provided if future plans call for the use of MSE slopes and/or walls.

6.2 Utility Trench Backfill

Excavations should be made in accordance with OSHA specifications and conditions. According to those specifications, excavations deeper than 4 feet below existing grades (or shallower if excavations appear unsafe) should be laid back to a safe slope inclination, and in accordance with the Contractor's judgment of safe working conditions. It should be noted that the Contractor is solely responsible for site safety and safe working conditions during construction.

Unless lean concrete bedding is required around utilities, bedding should consist of sand having a Sand Equivalent of at least 30. The bedding should extend from 6 inches below to 1 foot above the conduit or pipe. Sand bedding should not be jetted or ponded into place and should be mechanically compacted to a minimum of 90 percent relative compaction.

In areas to support improvements such as pavements and adjacent to structure foundations, backfill placed above the bedding in utility trenches should be properly placed and adequately compacted to minimize settlement and provide a stable subgrade. If possible, the trench backfill should be compacted following rough grading but prior to final grading and compaction. On-site inorganic soils meeting the requirements for engineered fill may be used as trench backfill. Backfill consisting of on-site soils should be placed in layers not exceeding 8 inches in loose thickness, moisture-conditioned, and compacted to at least 90 percent relative compaction as described for engineered fill. Trench backfill need only be compacted to 85 percent relative compaction in landscape areas or in areas more than 5 feet beyond the limits of buildings, pavements, concrete slabs-on-grade, sidewalks, or other flatwork. The upper 6 inches of trench backfill under pavements should be compacted to at least 95 percent relative compaction.

Special care should be given to ensuring that adequate compaction is made beneath the haunches of utility pipes (that area from the pipe springline to the pipe invert) and that no voids remain in this space.

All temporary excavations must comply with applicable local, state, and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards. Construction site safety generally is the responsibility of the Contractor, who should be solely responsible for the means, methods, and sequencing of construction operations so that a safe working environment is maintained.

Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within a 1:1 (horizontal to vertical) projection from the toe of open excavations to the ground surface. Support systems such as shoring or bracing should be used to provide structural stability and to protect personnel working within the excavation in accordance with good construction practices and all applicable safety regulations. Soils that are subject to caving should be anticipated within trenches at the project site.

Shallow or perched groundwater may be encountered within the depths of typical trench excavations, depending upon the depth of excavation and the season of construction. The contractor should install measures to divert groundwater, or channel groundwater to flow towards collection points to be removed from the trench and disposed of at an approved area.

6.3 Foundations

Because there is a potential for liquefaction-induced settlement, cyclic softening of the soft silts and clays, local and contraction scour, and lateral spreading, we recommended that the bridge structure be supported on a deepened foundation system consisting of driven cast-in-place-steel-shell (CISS) piles. We understand that QEI proposes to use PP24X0.75 CISS pipe piles for support of the proposed structure.

To evaluate the recommended abutment piles for the bridge structure, SHN used the following information in Table 2 below, provided by QEI.

Table 2 Foundation Design Data

Support No.	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)	Number of Piles per Support
				B	L		
Abut 1	CISS 24PPX0.75	12.8	-0.58	10	34	2	11
Abut 2	CISS 24PPX0.75	12.8	-058	10	34	2	11

Abutments protected with RSP

6.3.1 Axial Capacity

In order to assess the vertical capacity of the proposed CISS pile foundations, we used the computer program APILE 2015 by ENSOFT, Inc. and undrained shear strength values. The undrained shear strength values were based on laboratory strength tests of samples from the machine borings, and interpreted from the CPT data using the software program CPeT-IT, version 1.7.6.42, by GeoLogismiki, Inc. The analyses used a resistance factor of 0.7, based on the California Amendments to the AASHTO LRFD Bridge Design Specifications – Sixth Edition, January 2014 (Caltrans, 2014). QEI provided the following foundation design loads.

Table 3 Foundation Design Loads

Support No.	Service-1 Limit State (kips)		Strength/Construction Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load Per Support	Permanent Load per Support	Compression		Tension		Compression		Tension	
			Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile
Abut 1	760	650	1050	125	0	0	660	90	0	0
Abut 2	760	650	1050	125	0	0	660	90	0	0

The design capacity is based on a combination of skin friction and end bearing using a resistance factor of 0.7, and a scour elevation of -4.4 ft (NAVD 88). The results of our analyses are presented in Table 4 below.

Table 4 Pile Data Table

Support No.	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft.)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	PP24X0.75	160	0	-106.0 (a), -106.0 (b)	-106.0	200
Abut 2	PP24X0.75	160	0	-88.0 (a), -88.0 (b)	-90.0	200

1) Design tip elevations for abutments are controlled by (a) Compression, (b) Lateral Load
2) Do not raise specified tip elevation
3) Considers unsuitable soil layers (cyclic softened, liquefiable, and scourable, etc.) that do not contribute to nominal resistance.

A minimum 15 feet of undisturbed soil plug should be maintained in the CISS piles during cleanout for installation of the cage reinforcement and placement of the concrete core.

Under static loading conditions, total settlements of less than 1-inch are anticipated for single piles designed in accordance with the preceding recommended capacities. This pertains to soil compressibility only, and is in addition to the elastic compression of the pile itself.

6.3.2 Drag Loads

When designing driven piles it is important to understand that two separate loading conditions must be considered; dead plus drag load, without live or transient loads, and dead and live or transient loads, without drag load.

There are two events that may cause drag load on the piles, settlement due to consolidation of the foundation soils due to placement of engineered fill for the bridge approaches, and during an earthquake event when any loose sand layers experience compression and induce negative skin friction as they move downward relative to the pile. The accumulated negative skin friction will result in a drag load on the pile. As indicated in Section 3.11.8 of the AASHTO LRFD Specifications, liquefaction-induced downdrag shall not be combined with the downdrag induced by consolidation settlements. In order to assess the magnitude of the drag load from either event, the neutral plane must be determined. The neutral plane is located where the negative skin friction changes over to positive shaft resistance (the point of equilibrium). The location is determined by the requirement that the sum of the applied dead load plus the drag load is in equilibrium with the sum of the positive shaft resistance and the toe resistance. Provided the shear stress along the pile does not diminish with depth, the neutral plane lies below the midpoint of the pile. If the soil below the neutral plane is strong, the neutral plane lies near the pile toe.

With a dead load of 125 kips per pile, we anticipate that the depth range of the neutral plane will vary from about 75 to 90 percent of the pile depth, and the drag force will not exceed about 50 kips due to consolidation settlement, assuming the abutment areas (where bridge approach fill is placed) are not surcharged prior to pile installation. The geotechnical capacity of the piles will be governed by the extreme case of dead load plus earthquake load; the drag load should not be included in the consideration of the geotechnical capacity.

Liquefaction of the soil layers above the static neutral plane (i.e., the neutral plane that exists prior to liquefaction) will have a minor effect on the piles regardless of the magnitude of the liquefaction-induced settlement. The effect of the liquefaction is limited to a loss of skin friction in the liquefied zones (which are anticipated be small), and a slight reduction of the drag load and geotechnical axial capacity.

6.3.3 Lateral Capacity

We estimated the lateral response of single piles due to laterally displacing soil using the computer program LPILE 2015 by Ensoft Inc., and the strength/construction limit state axial load of 125 kips, presented in Table 3 above, to the top of the pile. Analyses were performed for a fixed-head condition assuming scour conditions (-4.4 feet) and an average pile spacing of 5 pile diameters, center-to-center (CTC), for a single row of piles. For two rows of piles with a spacing of 3 pier diameters center-to-center, use a P-multiplier of 0.75 for piles in the first row and 0.55 for piles in the second row. For a ¼-inch top-of-pile deflection we calculated a lateral resistance of 27.8 kips, with a maximum bending moment at the fixed-head connection of about 3,150 kip-inches; and for a 1-inch top-of-pile deflection we calculated a lateral resistance of 60.0 kips, with a maximum bending moment at the fixed-head connection of about 8,000 in-kips.

Deflection, moment, and shear curves for PP24X0.75 CISS piles are presented in Appendix E.

6.4 Retaining Walls

Retaining walls should be designed to resist static earth pressures, seismic earth pressures, and surcharge pressures. Retaining wall backfill should be placed and compacted according to the recommendations in Section 6.1.2, and drainage should be provided behind walls according to the recommendations that follow.

The recommended lateral earth pressures and geotechnical design parameters given in this section may be used for design of the wall alternatives. Retaining wall foundations should be designed according to the recommendations given in Section 6.3, Foundations.

Active earth pressures may be used for design of unrestrained retaining walls where the top of the wall is free to translate or rotate. To develop active earth pressures, the walls should be capable of deflecting by at least 0.004H (where H is the height of the wall). At-rest earth pressures should be used for design of retaining walls where the wall top is restrained such that the deflections required to develop active soil pressures cannot occur or are undesirable. Cantilever walls retaining engineered fill may be designed for active or at-rest lateral earth pressures for various backfill slopes using the equivalent fluid unit weights presented in Table 5.

Table 5
Equivalent Fluid Unit Weight
(pcf)[1]

Backfill Slope	At-Rest Conditions	Active Conditions
Level	62	36
3H:1V	81	46
2H:1V	89	55

1. pcf: pounds per cubic foot

Lateral earth pressures for backfill slopes other than those given above can be estimated by interpolation. The lateral earth pressures should be applied to a plane extending vertically upward from the base of the heel of the retaining wall to the ground surface.

The lateral earth pressures given above apply where the wall backfill is fully drained, is not subject to traffic or other surcharge loads, and the backfill is not subject to heavy compaction equipment within a distance of one-third the height of the backfill. Lateral surcharge pressures are discussed later in this section. Drainage behind walls should be placed in accordance with Caltrans "Standard Plans and Specifications."

In addition to the active or at-rest lateral soil pressures, retaining walls should be designed to resist additional dynamic earth pressures during earthquake loading. The additional dynamic pressure increment may be calculated using an equivalent fluid pressure of 17 pcf for back slopes up to 3H:1V. The dynamic pressure increment should be applied to the wall as a triangular distribution so the resultant force acts at a distance of 0.33H above the base of the wall (where H is the height of the wall). Under the combined effects of static and dynamic loading, a factor of safety of 1.1 against sliding or overturning is acceptable. The dynamic component of the lateral earth pressure was calculated using the Mononabe-Okabe equation (k_h was calculated using the equation in Section 11.6.5 of the AASHTO LRFD Bridge Design Specifications) and, therefore, assumes that sufficient deformation of the wall will occur during seismic loading to develop active soil conditions. For walls that are restrained at the top, the walls should be designed using the most critical condition, either at-rest lateral pressure or the combined effects of static active and seismic loading.

Where retaining wall backfill will be subject to traffic loading within a distance of H/2 from the top of the wall (where H is the wall height), the wall should be designed to resist an additional uniform lateral pressure of 72 psf applied to the back of yielding walls (active conditions), or 124 psf applied to the back of non-yielding walls (at-rest conditions).

6.5 Soil Corrosion Potential

The corrosion potential of the onsite soils was evaluated by means of resistivity, pH, and chemical analysis of a selected soil sample taken from boring B-1 at a depth of 11 feet. Results of the corrosion tests are presented in Appendix F, and summarized in Table 6 below.

Table 6
Soil Corrosion Test Summary

Sample Description	Minimum Resistivity (ohm-cm)[1]	pH	Chloride Content (ppm)[2]	Sulfate Content (ppm)
B-1 @11'	172	7.2	2,889	1,709

1. ohm-cm: ohm centimeter
2. ppm: parts per million

While a comprehensive discussion or evaluation of the site corrosivity or mitigation measures is outside the scope of this study, these corrosion test results suggest the site soil is corrosive. Caltrans corrosion guidelines considers a site to be corrosive if one or more of the following conditions exist for the representative soil samples taken at a site; *chloride concentration is 500 ppm or greater, sulfate concentration is 2,000 ppm or greater, or the pH is 5.5 or less*. Buried metal and reinforced concrete should be designed to resist corrosion based on the test results. In addition, corrosion testing should be performed on any imported fill that will be in contact with buried metal and concrete.

7.0 Additional Services

We suggest communications be maintained during the design phase between the design team and SHN to optimize compatibility between the design and soil and groundwater conditions. We also recommend that SHN be retained during the construction phase to verify the implementation of our recommendations related to earthwork.

7.1 Plan and Specification Review

We have assumed, in preparing our recommendations, that SHN will be retained to review those portions of the plans and specifications that pertain to earthwork and foundations. The purpose of this review is to confirm that our earthwork and foundation recommendations have been properly interpreted and implemented during design. If we are not provided this opportunity for review of the plans and specifications, our recommendations could be misinterpreted.

7.2 Construction Phase Monitoring

In order to assess construction conformance with the intent of our recommendations, it is important that a representative of SHN perform the following tasks:

- Monitor site stripping, including removal any unsuitable material if it is determined that this is required;
- Monitor subgrade preparation;
- Observe and test placement of structural fill and backfill;
- Observe placement and compaction of retaining wall backfill and installation of drainage; and
- Observe pile foundation installation.

This construction phase monitoring is important as it provides the stakeholders and SHN the opportunity to verify anticipated site conditions, and recommend appropriate changes in design or construction procedures if site conditions encountered during construction vary from those described in this report. It also allows SHN to recommend appropriate changes in design or construction procedures if construction methods adversely affect the competence of on-site soils to support the structural improvements.

8.0 Closure and Limitations

The analyses, conclusions, and recommendations contained in this report are based on site conditions that we observed at the time of our investigation, data from our subsurface explorations and laboratory tests, our current understanding of proposed project elements, and on our experience with similar projects in similar geotechnical environments. We have assumed that the information obtained from our limited subsurface explorations is representative of subsurface conditions throughout the areas of proposed development addressed in this report.

We recommend a representative of our firm confirm site conditions during the construction phase. If subsurface conditions differ significantly from those disclosed by our investigation, we should be given the opportunity to re-evaluate the applicability of our conclusions and recommendations. Some alteration of recommendations may be appropriate.

If the scope of the proposed construction, including the proposed loads, grades, or structural locations, changes from that described in this report, our recommendations should also be reviewed.

If there is a substantial lapse of time between the submission of our report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we should review our report to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse. This report is applicable only to the project and site studied.

The conclusions and recommendations presented in this report are professional opinions derived in accordance with current standards of professional practice. Our recommendations are tendered on the assumption that design of the improvements will conform to their intent. No representation, express or implied, of warranty or guarantee is included or intended.

The field and laboratory work was conducted to investigate the site characteristics specifically addressed by this report. Assumptions about other site characteristics, such as hazardous materials contamination, or environmentally sensitive or culturally significant areas, should not be made from this report.

9.0 References

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A

Log of Test Borings

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	HUM	CR			

10-31-2014
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PROFESSIONAL GEOLOGIST
Gary Simpson
No. 2107
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

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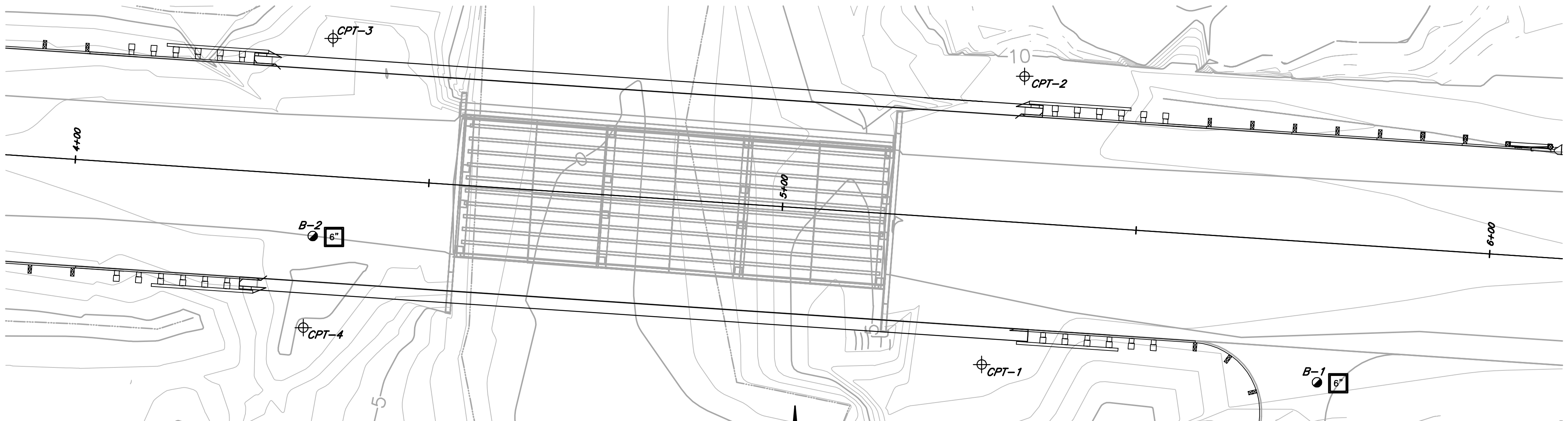

PLAN
1"=10'

NOTES:

1. THIS LOTB SHEET WAS PREPARED IN ACCORDANCE WITH THE "CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL" (2010).
2. FIELD CLASSIFICATION OF SOILS WAS IN ACCORDANCE WITH ASTM D2488-06 "DESCRIPTION AND IDENTIFICATION OF SOILS (VISUAL-MANUAL PROCEDURE).
3. STANDARD PENETRATION TESTS WERE COMPLETED IN ACCORDANCE WITH ASTM D 1586-11 USING A HAMMER WITH AN AUTOMATED DROP SYSTEM. DRILL RODS WERE 1 5/8-INCH DIAMETER "A" RODS; 1.4-INCH INSIDE DIAMETER SPLIT SPOON SAMPLER WAS DRIVEN WITHOUT BRASS LINERS.
4. 2.5-INCH INSIDE DIAMETER MODIFIED CALIFORNIA SAMPLER WAS DRIVEN IN THE SAME MANNER AS SPT, BUT WITH BRASS LINERS.
5. 3.0-INCH SHELBY TUBE WAS PUSHED INTO SOFT SOILS.
6. THE LENGTH OF EACH SAMPLES INTERVAL IS SHOWN GRAPHICALLY ON THE BORING LOG. WHOLE NUMBER BLOW COUNTS ("N") REPRESENT THE "STANDARD PENETRATION RESISTANCE" INTERVAL IN ACCORDANCE WITH ASTM D1586-11. WHERE LESS THAN 1 FOOT OF PENETRATION IS ACHIEVED, THE BLOW COUNT SHOWN IS FOR THAT FRACTION OF THE INTERVAL ACTUALLY PENETRATED AND THE AMOUNT OF PENETRATION IS SHOWN IN INCHES.
7. SPT HAMMER ENERGY MEASUREMENTS WERE NOT TAKEN DURING FIELD EXPLORATION.
8. GROUNDWATER SURFACE (GWS) ELEVATIONS IN THE BORINGS INDICATED ON THE LOG OF TEST BORINGS SHEETS REFLECT THE FLUID LEVEL IN THE BORING ON THE SPECIFIED DATE.
9. SEISMIC CONE PENETRATION TESTING LOGS SHOW SHEAR WAVE VELOCITY IN FEET PER SECOND.
10. ELECTRONIC MEDIA FOR PLAN VIEW PROVIDED BY QUINCY ENGINEERING.
11. BORING AND CPT ELEVATIONS ESTIMATED FROM TOPOGRAPHY PROVIDED BY QUINCY ENGINEERING.

DESIGN OVERSIGHT	DRAWN BY	C. NEWELL	John Dailey, G.E. FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Jason P. Jurrens PROJECT ENGINEER	BRIDGE NO. 04C-0173	PINE HILL BRIDGE
SIGN OFF DATE	CHECKED BY	G.D. SIMPSON	DATE: October 2012			POST MILES	LOG OF TEST BORINGS

GS GEOLOGIST LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X
PROJECT NUMBER & PHASE: X
CONTRACT NO.: X

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REVISION DATES	SHEET	OF
X	1	5

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
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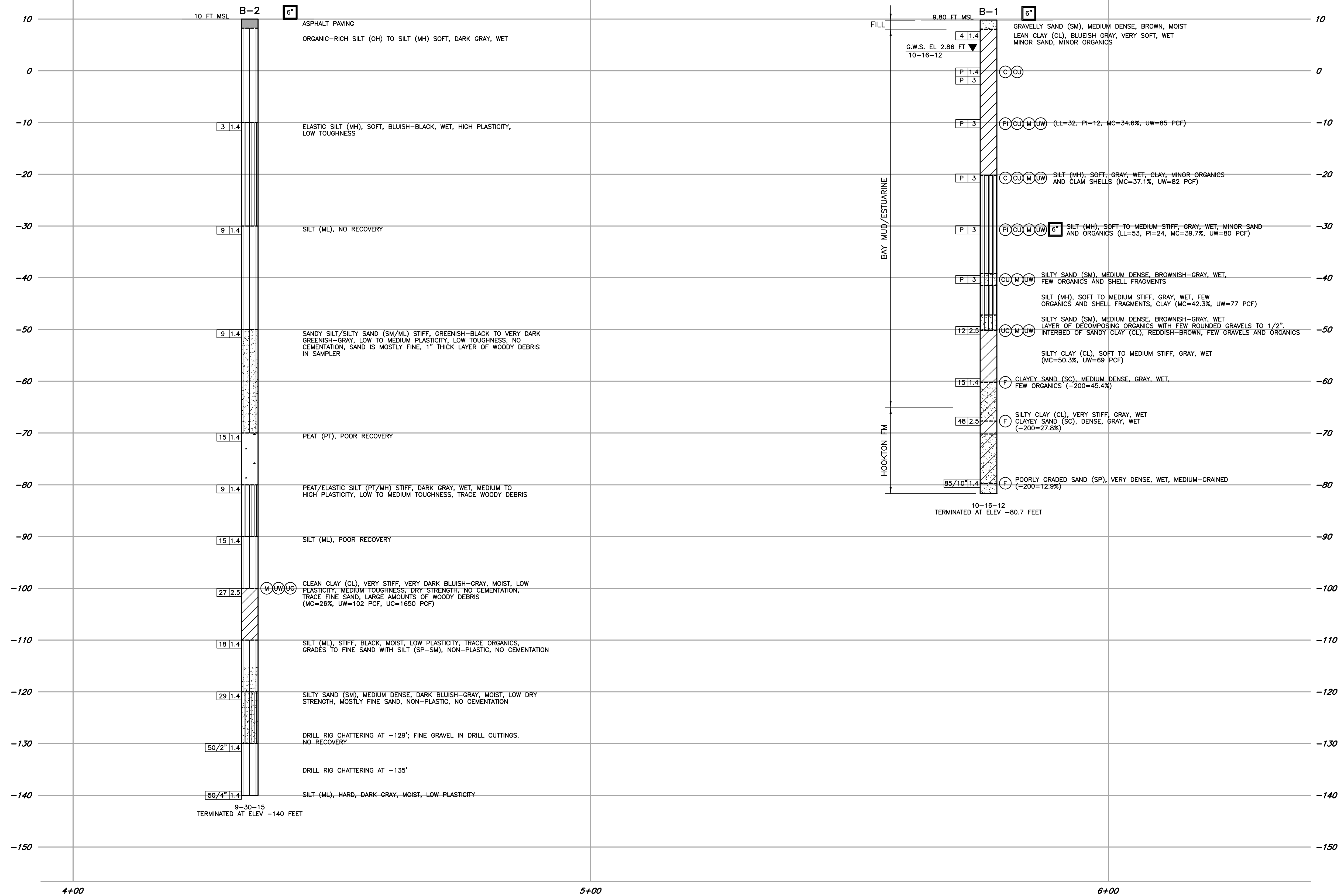

PROFILE

NTS

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PROJECT ENGINEER

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POST MILES

PINE HILL BRIDGE
LOG OF TEST BORINGS

UNIT: X
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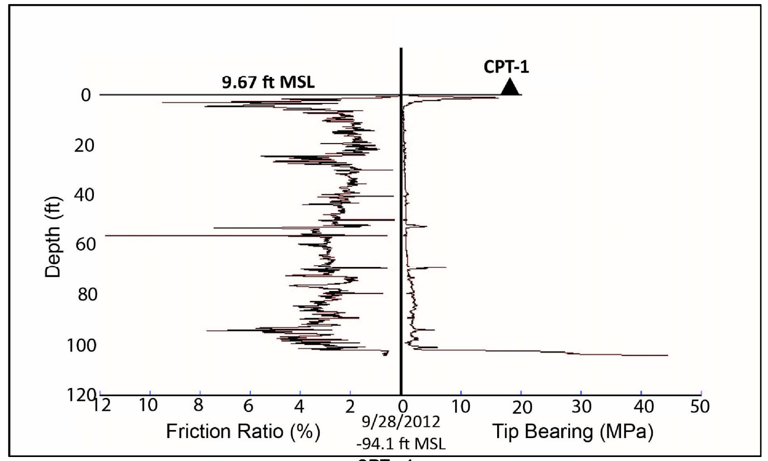

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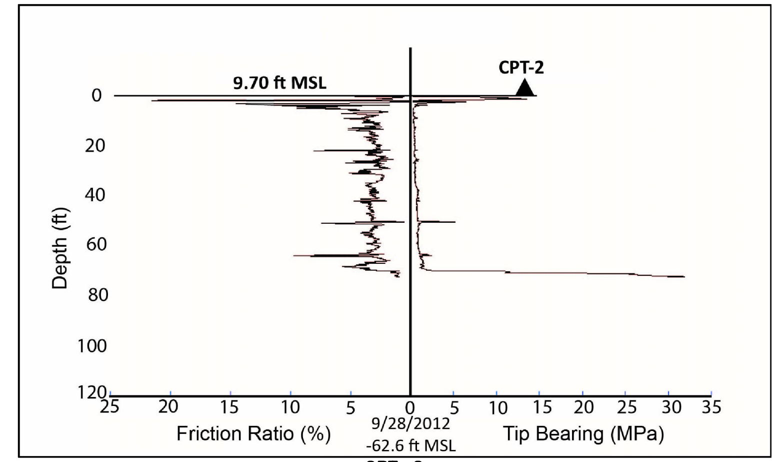

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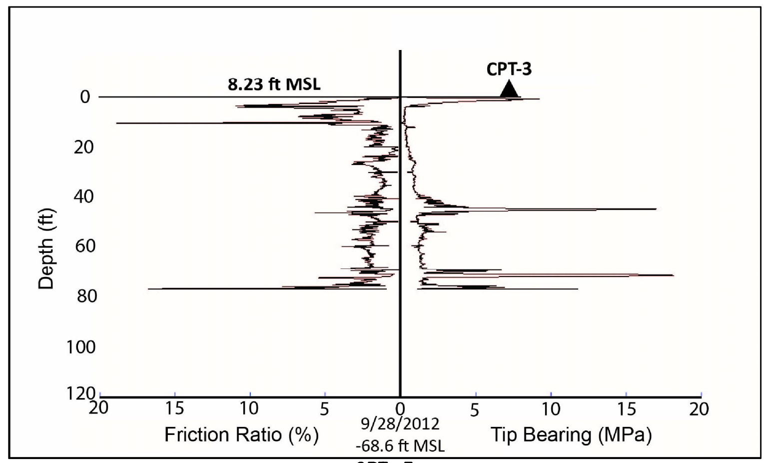

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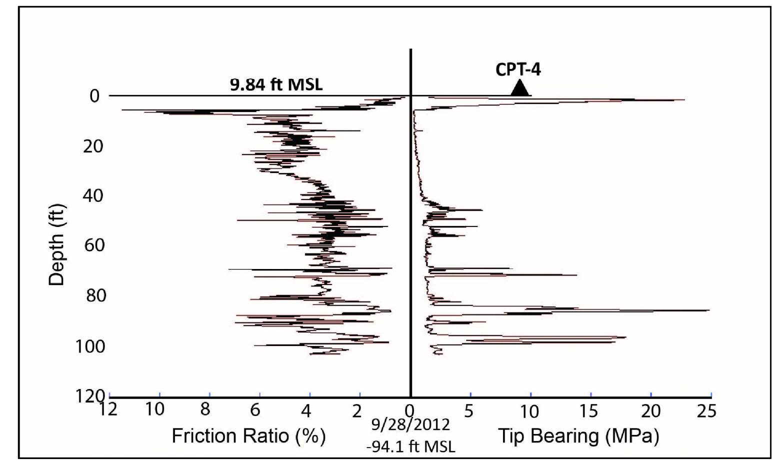
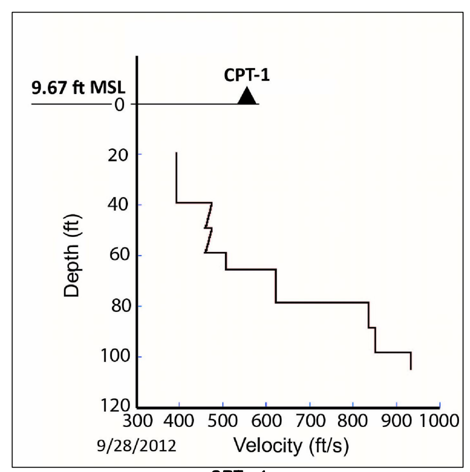


CPT-4

CONE PENETRATION TEST (CPT) BORINGS



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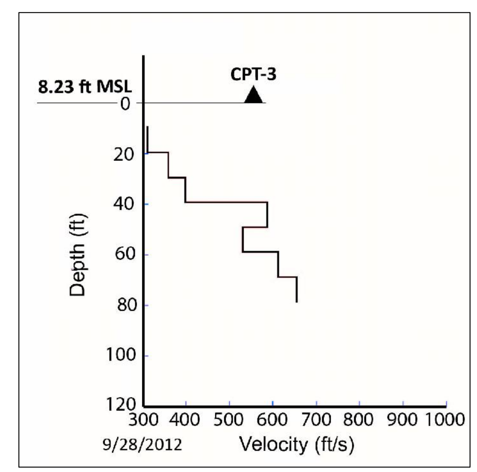

CPT-3

SEISMIC CONE PENETRATION BORINGS

DESIGN OVERSIGHT

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CHECKED BY: G.D. SIMPSON

John Dailey, G.E.
FIELD INVESTIGATION BY:
DATE: October 2012

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Jason P. Jurrens
PROJECT ENGINEER

BRIDGE NO. 04C-0173
POST MILES

PINE HILL BRIDGE
LOG OF TEST BORINGS

GS GEOLOGIST LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X
PROJECT NUMBER & PHASE: X
CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES x | SHEET 3 | OF 5

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

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CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

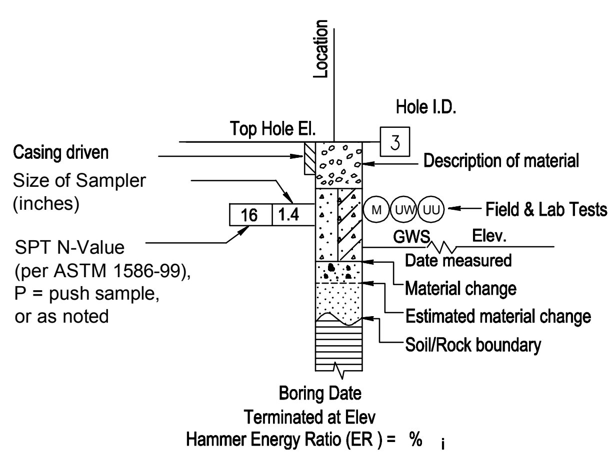
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size (square, double border)	A	Auger Boring (hollow or solid stem bucket)
Size (square)	R RW RC P	Rotary drilled boring (conventional) Rotary drilled with self-casing wire-line Rotary core with continuously-sampled, self-casing wire-line Rotary percussion boring (air)
Size (diamond)	R	Rotary drilled diamond core
Size (rectangle)	HD HA	Hand driven (1-inch soil tube) Hand Auger
◕	D	Dynamic Cone Penetration Boring
⌖	CPT	Cone Penetration Test (ASTM D 5778)
□	O	Other (note on LOTB)

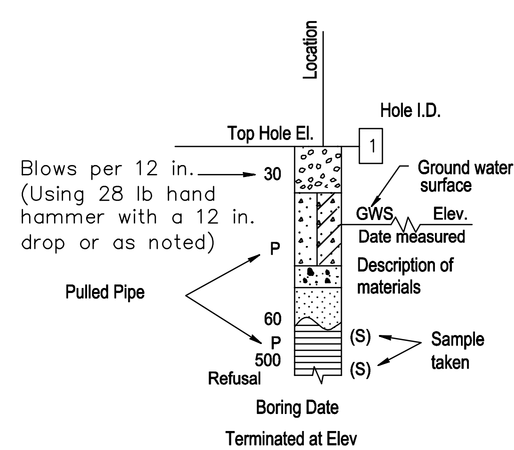
Note: Size in inches.

CONSISTENCY OF COHESIVE SOILS

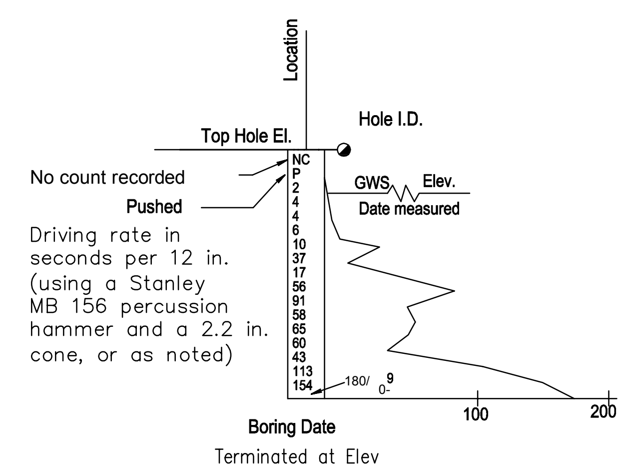
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
Stiff	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
Very Stiff	1 - 2	2 - 4	1 - 2	1 - 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



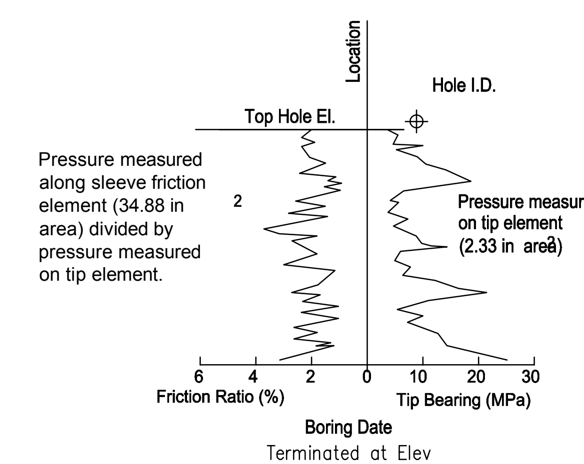
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

DESIGN OVERSIGHT	DRAWN BY	C. NEWELL	John Dailey, G.E. — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	G.D. SIMPSON	DATE: October 2012

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Jason P. Jurrens — PROJECT ENGINEER

BRIDGE NO. 04C-0173

POST MILES

PINE HILL BRIDGE

LOG OF TEST BORINGS

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ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X

PROJECT NUMBER & PHASE: X

CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES x

SHEET 4 OF 5

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	HUM	CR			

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SACRAMENTO, CA 95827-2501

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly-graded GRAVEL Poorly-graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly-graded GRAVEL with SILT Poorly-graded GRAVEL with SILT and SAND
GP-GC	Poorly-graded GRAVEL with CLAY (or SILTY CLAY) Poorly-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly-graded SAND Poorly-graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly-graded SAND with SILT Poorly-graded SAND with SILT and GRAVEL
SP-SC	Poorly-graded SAND with CLAY (or SILTY CLAY) Poorly-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

C	Consolidation (ASTM D 2435)
CL	Collapse Potential (ASTM D 5333)
CP	Compaction Curve (CTM 216)
CR	Corrosivity Testing (CTM 643, CTM 422, CTM 417)
CU	Consolidated Undrained Triaxial (ASTM D 4767)
DS	Direct Shear (ASTM D 3080)
EI	Expansion Index (ASTM D 4829)
F	% Passing #200 sieve
M	Moisture Content (ASTM D 2216)
OC	Organic Content-% (ASTM D 2974)
P	Permeability (CTM 220)
PA	Particle Size Analysis (ASTM D 422)
PI	Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
PL	Point Load Index (ASTM D 5731)
PM	Pressure Meter
R	R-Value (CTM 301)
SE	Sand Equivalent (CTM 217)
SG	Specific Gravity (AASHTO T 100)
SL	Shrinkage Limit (ASTM D 427)
SW	Swell Potential (ASTM D 4546)
UC	Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850)
UW	Unit Weight (ASTM D 4767)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 in.)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Greater than 50

MOISTURE

Description	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5% - 10%
Little	15% - 25%
Some	30% - 45%
Mostly	50% - 100%

PARTICLE SIZE

Description		Size (in.)
Boulder		Greater than 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		Less than 1/300

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY C. NEWELL

CHECKED BY G.D. SIMPSON

John Dailey, G.E.
FIELD INVESTIGATION BY:
DATE: October 2012

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Jason P. Jurrens
PROJECT ENGINEER

BRIDGE NO. 04C-0173
POST MILES

PINE HILL BRIDGE
LOG OF TEST BORINGS

GS GEOLOGIST LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X
PROJECT NUMBER & PHASE: X

CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES

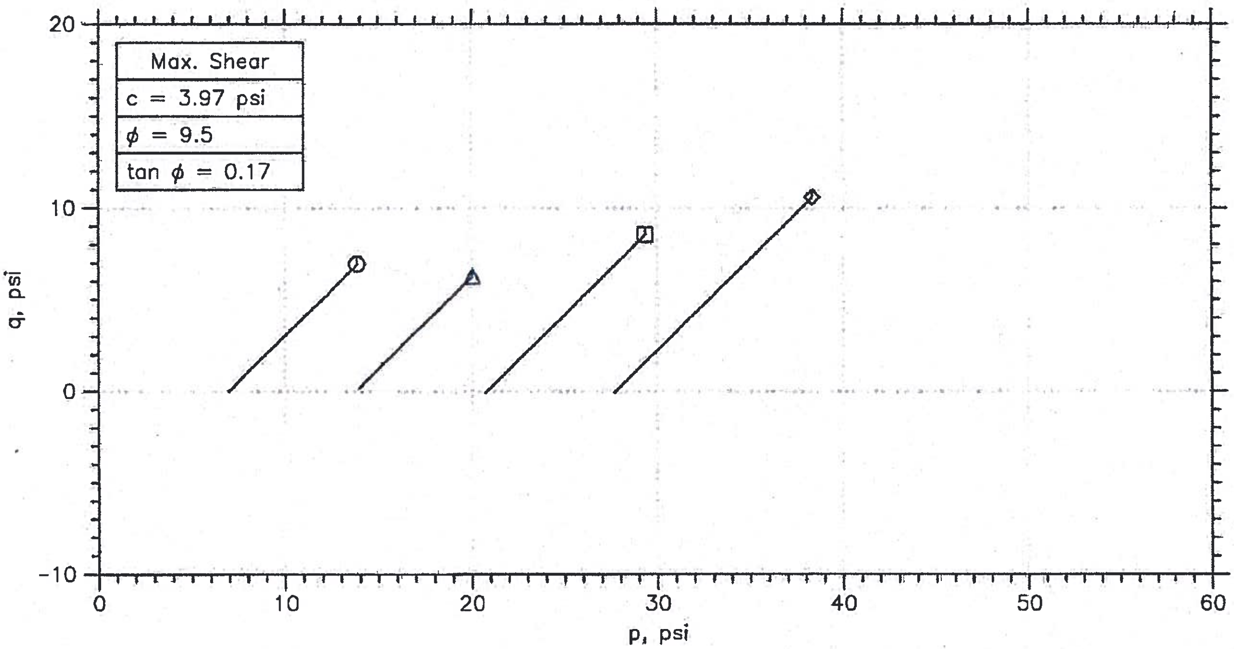
REVISION DATES X

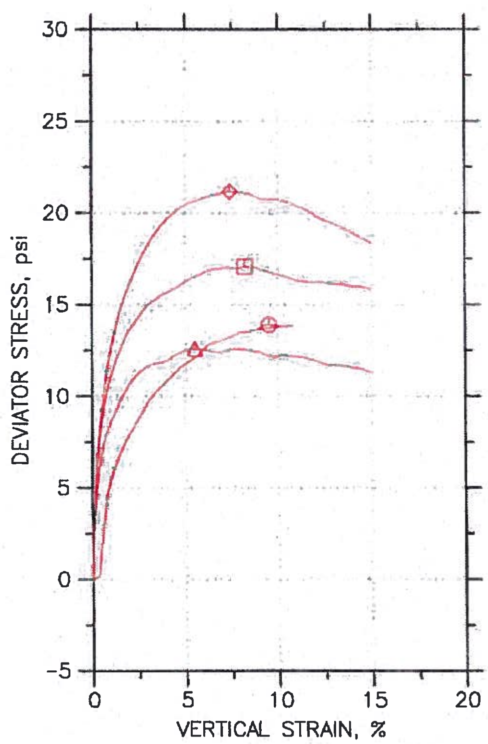
SHEET 5 OF 5

B

Laboratory Test Data

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Symbol	○	△	□	◇
	Sample No.	12-830	12-831	12-832	12-833
	Test No.	12-830	12-831	12-832	12-833
	Depth	11'	21'	31'	41'
Initial	Diameter, in	2.82	2.82	2.82	2.82
Initial	Height, in	6.05	6.6	6.1	5.85
Initial	Water Content, %	35.2	38.2	41.5	55.3
Initial	Dry Density, pcf	88.96	83.18	79.91	70.57
Initial	Saturation, %	111.4	104.7	105.2	111.1
Initial	Void Ratio	0.818	0.944	1.02	1.29
Before Shear	Water Content, %	31.4	34.6	37.1	39.7
Before Shear	Dry Density, pcf	89.15	85.33	82.38	79.63
Before Shear	Saturation*, %	100.0	100.0	100.0	100.0
Before Shear	Void Ratio	0.814	0.895	0.96	1.03
Before Shear	Back Press., psi	29.99	44.98	29.99	45.
	Ver. Eff. Cons. Stress, psi	6.939	13.9	20.84	27.77
	Shear Strength, psi	6.957	6.293	8.537	10.58
	Strain at Failure, %	9.52	5.51	8.23	7.41
	Strain Rate, %/min	0.16	0.08	0.08	0.08
	B-Value	0.98	0.95	0.97	0.96
	Estimated Specific Gravity	2.59	2.59	2.59	2.59
	Liquid Limit	---	32	---	53
	Plastic Limit	---	20	---	29

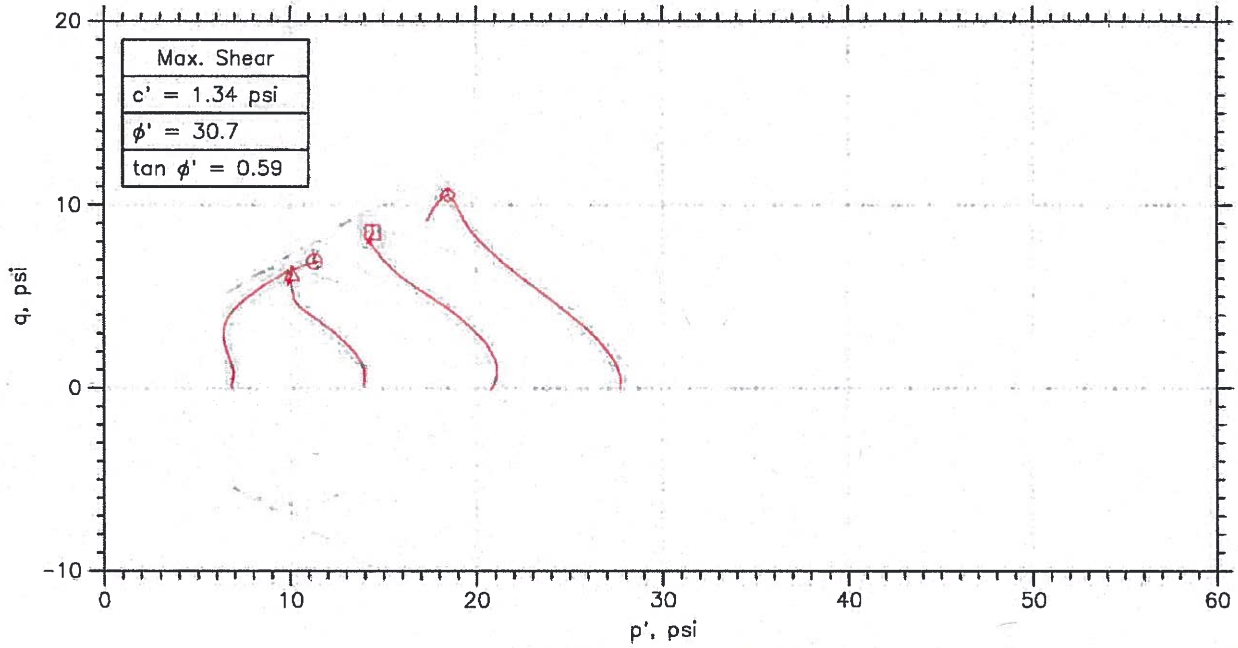
Project: Pine Hill Road Bridge
Location: Eureka
Project No.: 012163
Boring No.: B1
Sample Type: 3" shelby
Description: Gray SILT
Remarks:

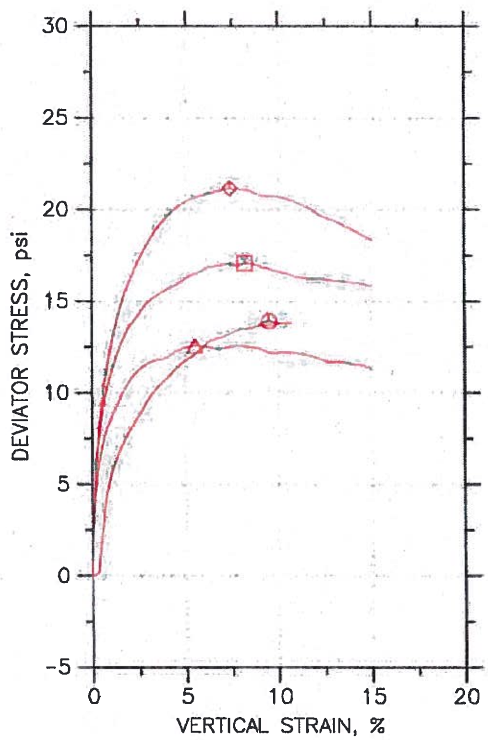
Phase calculations based on start and end of test.

* Saturation is set to 100% for phase calculations.

Mon, 26-NOV-2012 13:12:26

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	◇
Sample No.		12-830	12-831	12-832	12-833
Test No.		12-830	12-831	12-832	12-833
Depth		11'	21'	31'	41'
Initial	Diameter, in	2.82	2.82	2.82	2.82
	Height, in	6.05	6.6	6.1	5.85
	Water Content, %	35.2	38.2	41.5	55.3
	Dry Density, pcf	88.96	83.18	79.91	70.57
	Saturation, %	111.4	104.7	105.2	111.1
	Void Ratio	0.818	0.944	1.02	1.29
Before Shear	Water Content, %	31.4	34.6	37.1	39.7
	Dry Density, pcf	89.15	85.33	82.38	79.63
	Saturation*, %	100.0	100.0	100.0	100.0
	Void Ratio	0.814	0.895	0.96	1.03
	Back Press., psi	29.99	44.98	29.99	45.
Ver. Eff. Cons. Stress, psi		6.939	13.9	20.84	27.77
Shear Strength, psi		6.957	6.293	8.537	10.58
Strain at Failure, %		9.52	5.51	8.23	7.41
Strain Rate, %/min		0.16	0.08	0.08	0.08
B-Value		0.98	0.95	0.97	0.96
Estimated Specific Gravity		2.59	2.59	2.59	2.59
Liquid Limit		---	32	---	53
Plastic Limit		---	20	---	29

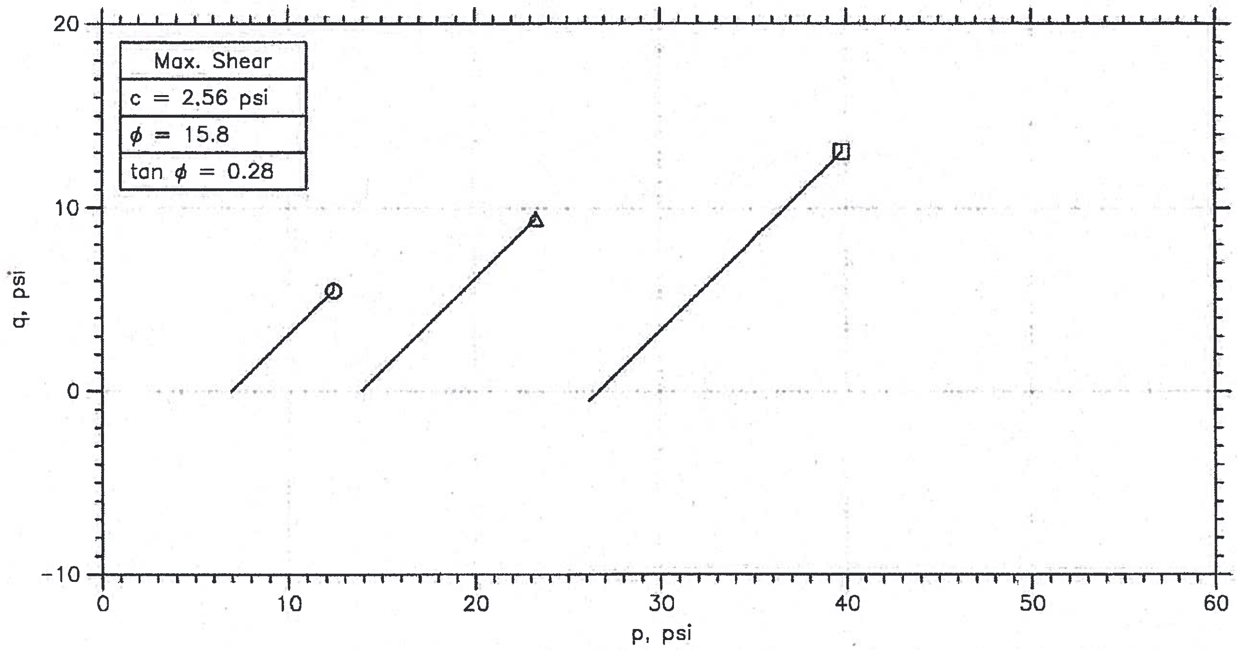
Project: Pine Hill Road Bridge	
Location: Eureka	
Project No.: 012163	
Boring No.: B1	
Sample Type: 3" shelby	
Description: Gray SILT	
Remarks:	

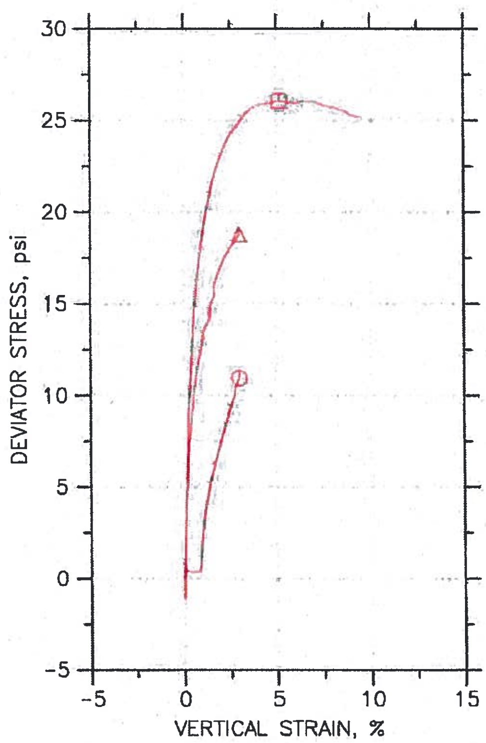
Phase calculations based on start and end of test.

Mon, 26-NOV-2012 13:13:12

* Saturation is set to 100% for phase calculations.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





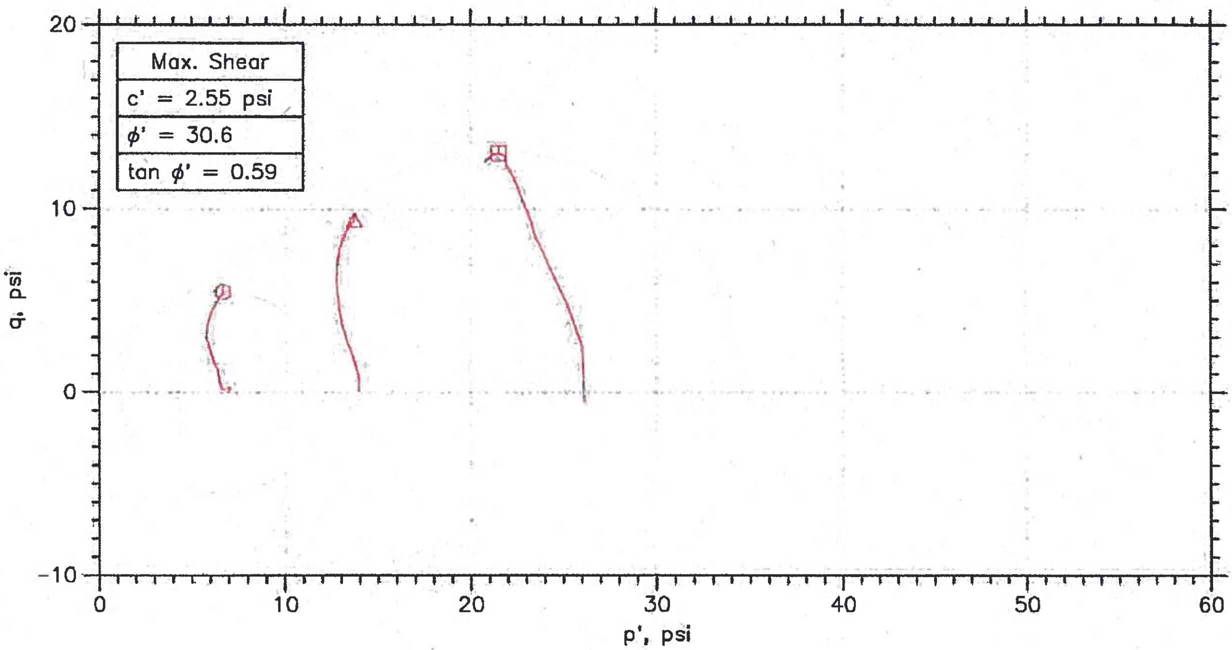
Symbol		○	△	□	
Sample No.		12-834A	12-834B	12-834C	
Test No.		12-834A	12-834B	12-834C	
Depth		51'	51'	51'	
Initial	Diameter, in	2.82	2.82	2.82	
	Height, in	6.28	6.28	6.28	
	Water Content, %	46.3	46.3	46.3	
	Dry Density, pcf	76.67	76.67	76.67	
	Saturation, %	108.1	108.1	108.1	
	Void Ratio	1.11	1.11	1.11	
Before Shear	Water Content, %	42.3	42.3	42.3	
	Dry Density, pcf	77.12	77.12	77.12	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.1	1.1	1.1	
	Back Press., psi	77.99	93.31	109.2	
Ver. Eff. Cons. Stress, psi		6.943	13.89	27.74	
Shear Strength, psi		5.484	9.397	13.04	
Strain at Failure, %		3	3	5.19	
Strain Rate, %/min		0.08	0.08	0.08	
B-Value		0.95	---	---	
Estimated Specific Gravity		2.59	2.59	2.59	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

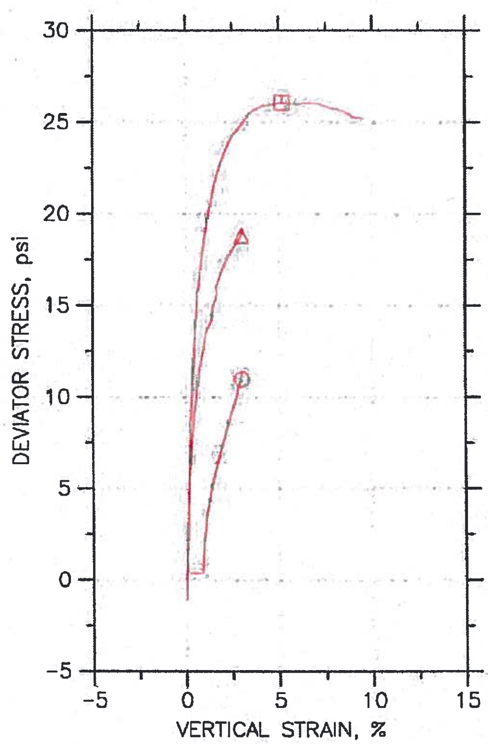
Project: Pine Hill Road Bridge	
Location: Eureka	
Project No.: 012163	
Boring No.: B1	
Sample Type: 3" shelby	
Description: Stiff Gray SILT	
Remarks:	

Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Mon, 26-NOV-2012 13:36:38

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





		Symbol	○	△	□	
		Sample No.	12-834A	12-834B	12-834C	
		Test No.	12-834A	12-834B	12-834C	
		Depth	51'	51'	51'	
Initial		Diameter, in	2.82	2.82	2.82	
		Height, in	6.28	6.28	6.28	
		Water Content, %	46.3	46.3	46.3	
		Dry Density, pcf	76.67	76.67	76.67	
		Saturation, %	108.1	108.1	108.1	
		Void Ratio	1.11	1.11	1.11	
Before Shear		Water Content, %	42.3	42.3	42.3	
		Dry Density, pcf	77.12	77.12	77.12	
		Saturation*, %	100.0	100.0	100.0	
		Void Ratio	1.1	1.1	1.1	
		Back Press., psi	77.99	93.31	109.2	
		Ver. Eff. Cons. Stress, psi	6.943	13.89	27.74	
		Shear Strength, psi	5.484	9.397	13.04	
		Strain at Failure, %	3	3	5.19	
		Strain Rate, %/min	0.08	0.08	0.08	
		B-Value	0.95	---	---	
		Estimated Specific Gravity	2.59	2.59	2.59	
		Liquid Limit	---	---	---	
		Plastic Limit	---	---	---	

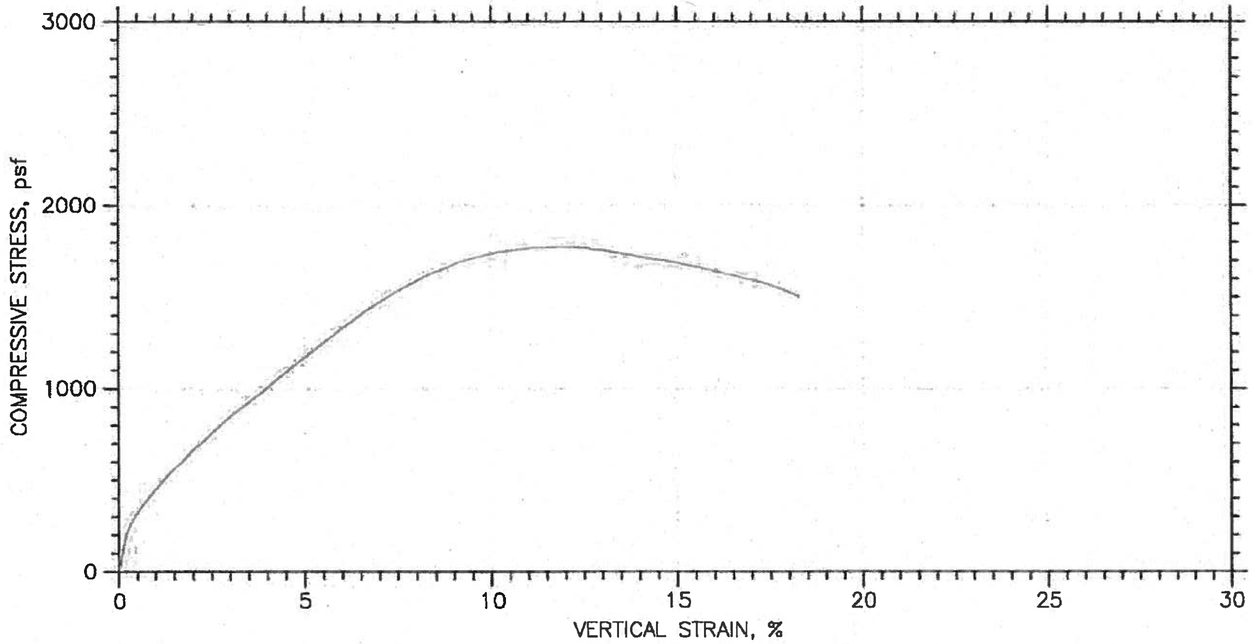
	Project: Pine Hill Road Bridge
	Location: Eureka
	Project No.: 012163
	Boring No.: B1
	Sample Type: 3" shelby
	Description: Stiff Gray SILT
	Remarks:

Phase calculations based on start and end of test.

* Saturation is set to 100% for phase calculations.

Mon, 26-NOV-2012 13:37:31

UNCONFINED COMPRESSION TEST REPORT



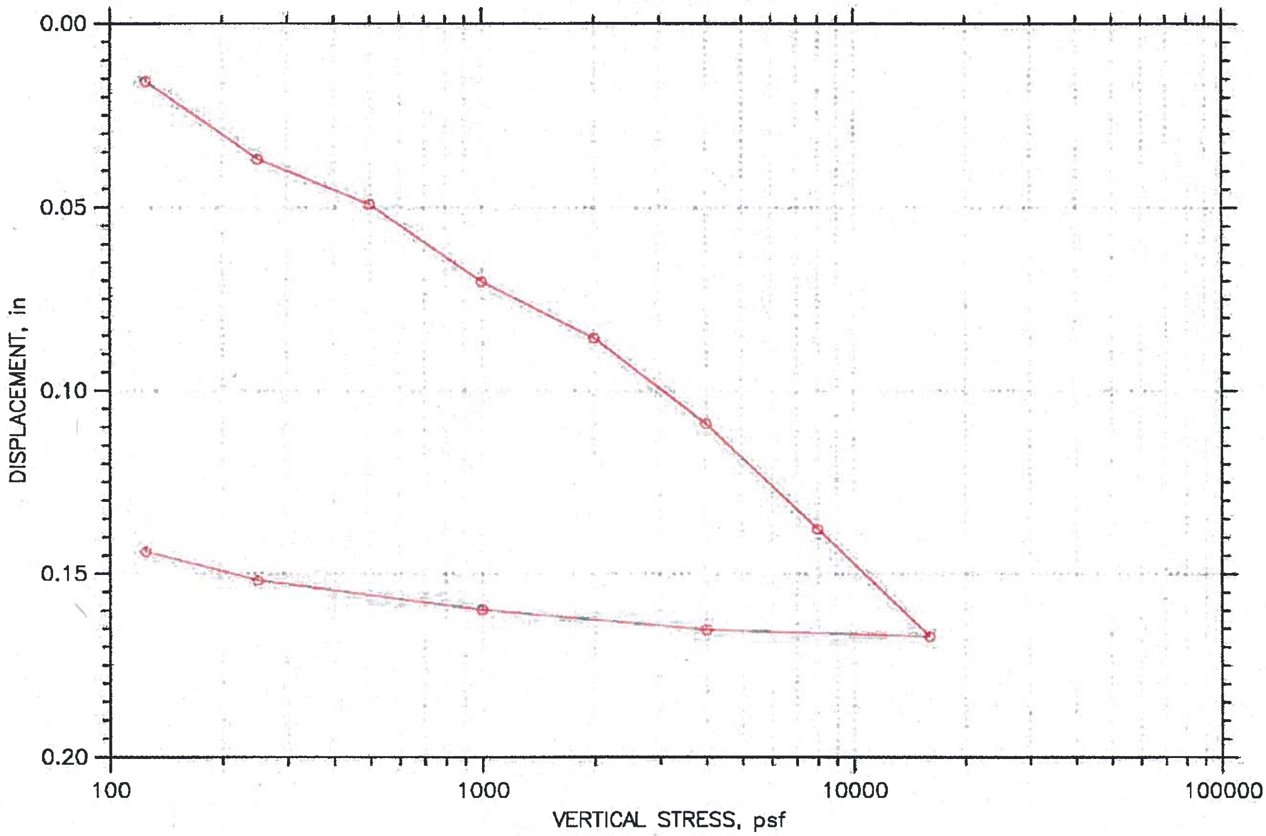
Symbol					
Test No.		12-835			
Initial	Diameter, in	2.42			
	Height, in	5.7			
	Water Content, %	50.34			
	Dry Density, pcf	68.574			
	Saturation, %	94.44			
	Void Ratio	1.4125			
Unconfined Compressive Strength, psf		1776.6			
Undrained Shear Strength, psf		888.28			
Time to Failure, min		12.75			
Strain Rate, %/min		1			
Specific Gravity		2.65			
Liquid Limit		0			
Plastic Limit		0			
Plasticity Index		0			
Failure Sketch					

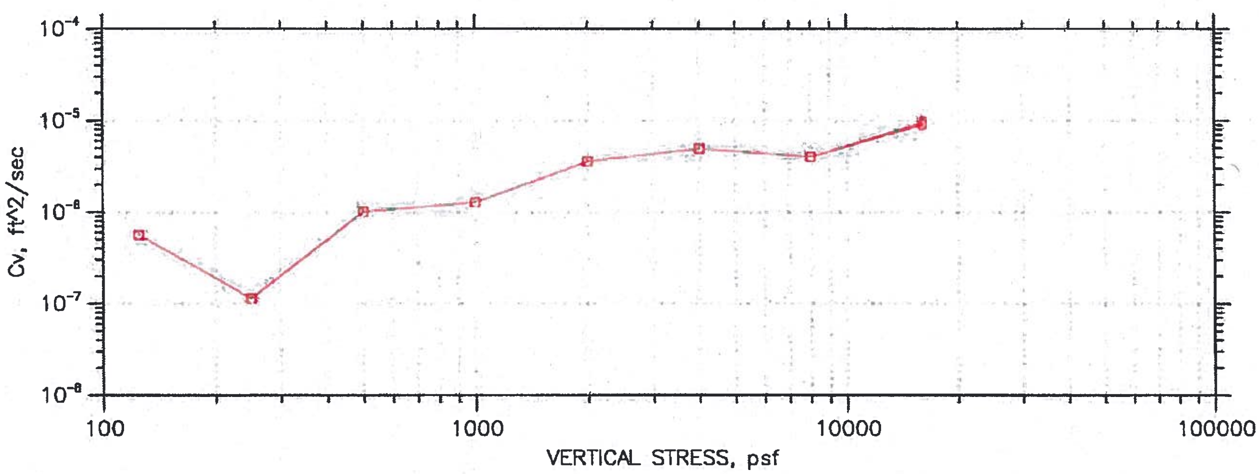
Project: Pine Hill Road Bridge
Location: Eureka
Project No.: 012163
Boring No.: BH1 @ 61'
Sample Type: 2.5"cal brl
Description: Gray Silt
Remarks:

Mon, 03-DEC-2012 09:47:21

CONSOLIDATION TEST DATA

SUMMARY REPORT



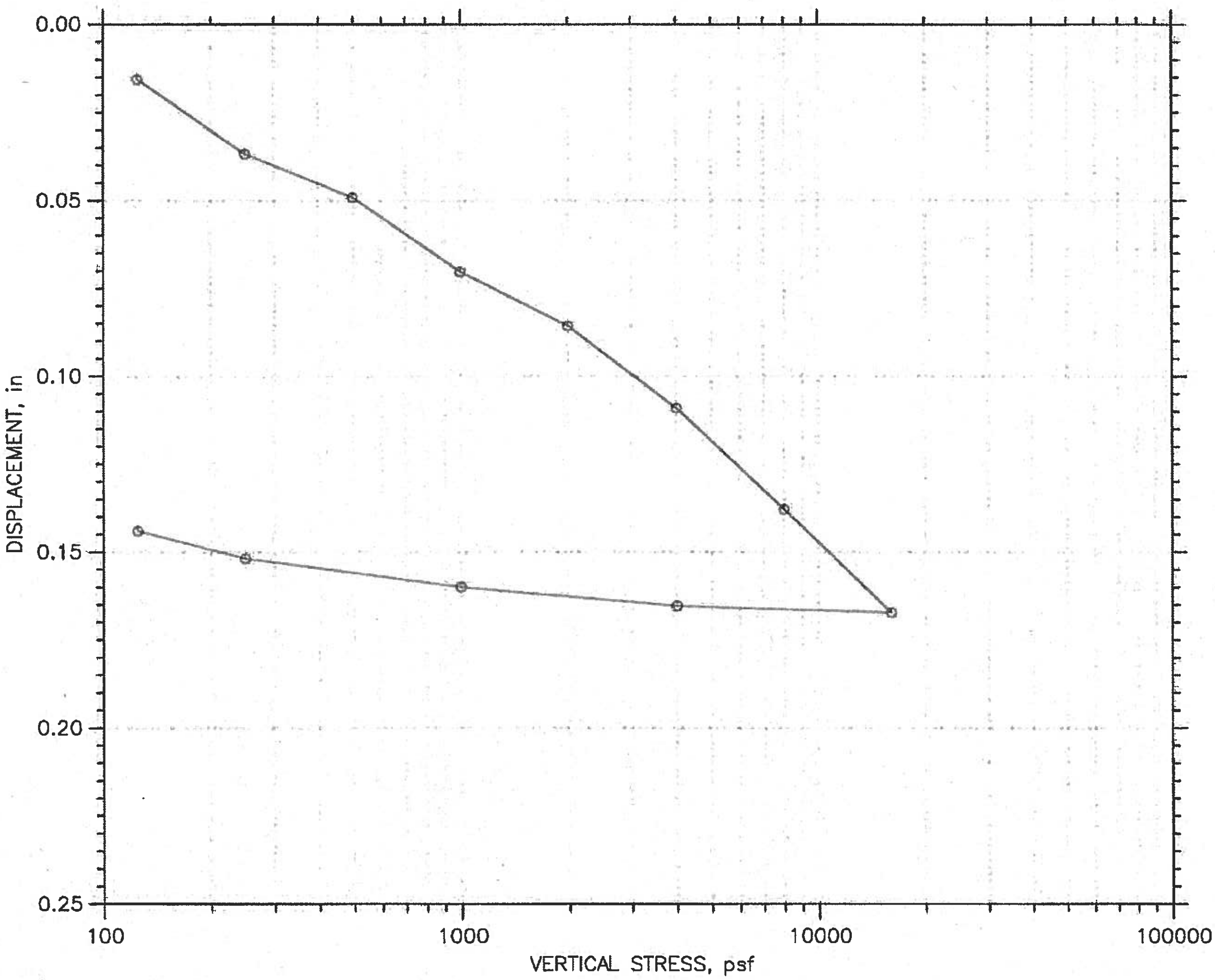


Project: Pine Hill Road Bridge	Location: Eureka	Project No.: 012163
Boring No.: B1 @ 11'	Tested By: JMA	Checked By: DL 12/4/12
Sample No.: 12-830	Test Date: 11/8/12	Depth: 11'
Test No.: 12-830	Sample Type: 3" shelby	Elevation:
Description: Soft Gray Silt		
Remarks:		

Mon, 26-NOV-2012 14:06:40

CONSOLIDATION TEST DATA

SUMMARY REPORT



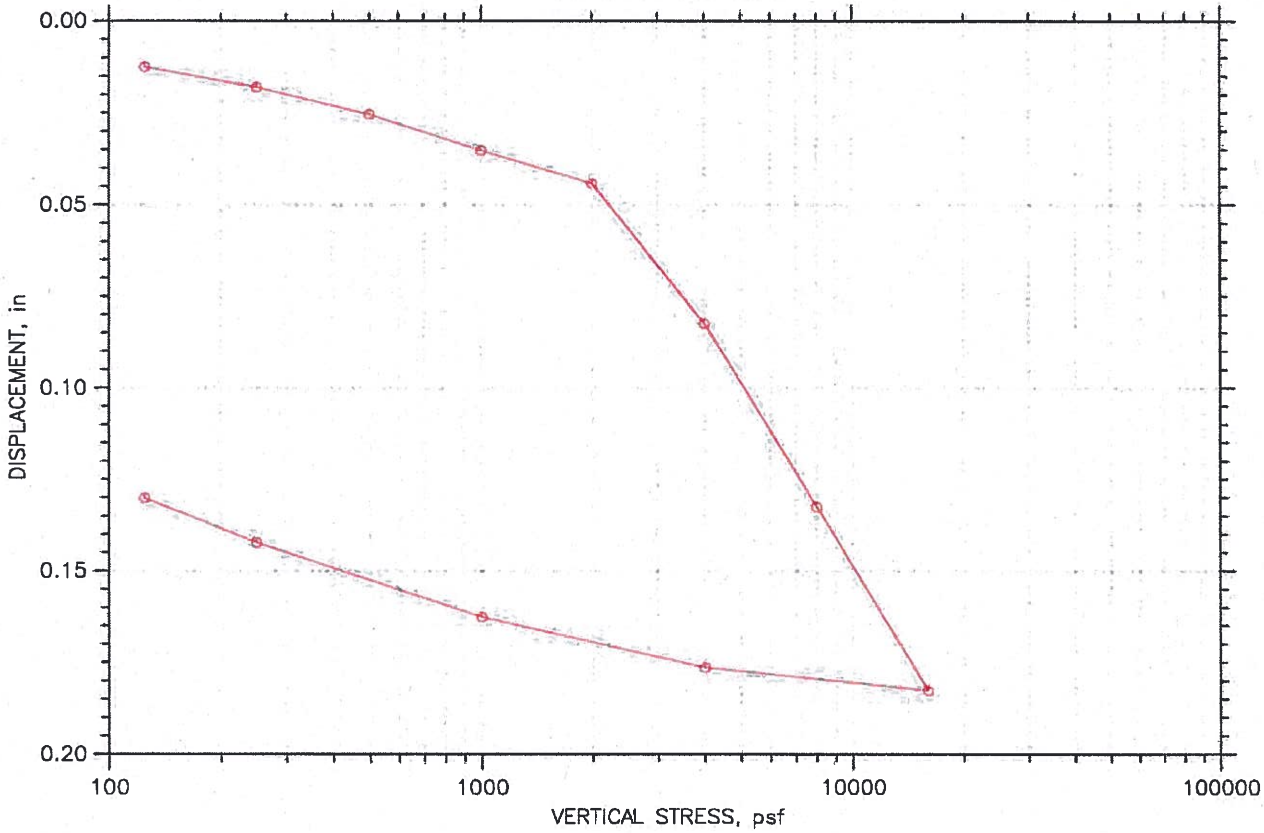
					Before Test	After Test
Overburden Pressure, psf:				Water Content, %	41.37	30.78
Preconsolidation Pressure, psf:				Dry Unit Weight, pcf	79.16	92.479
Compression Index:				Saturation, %	102.40	105.99
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.05	0.76
LL: 0	PL: 0	PI: 0	GS: 2.60			

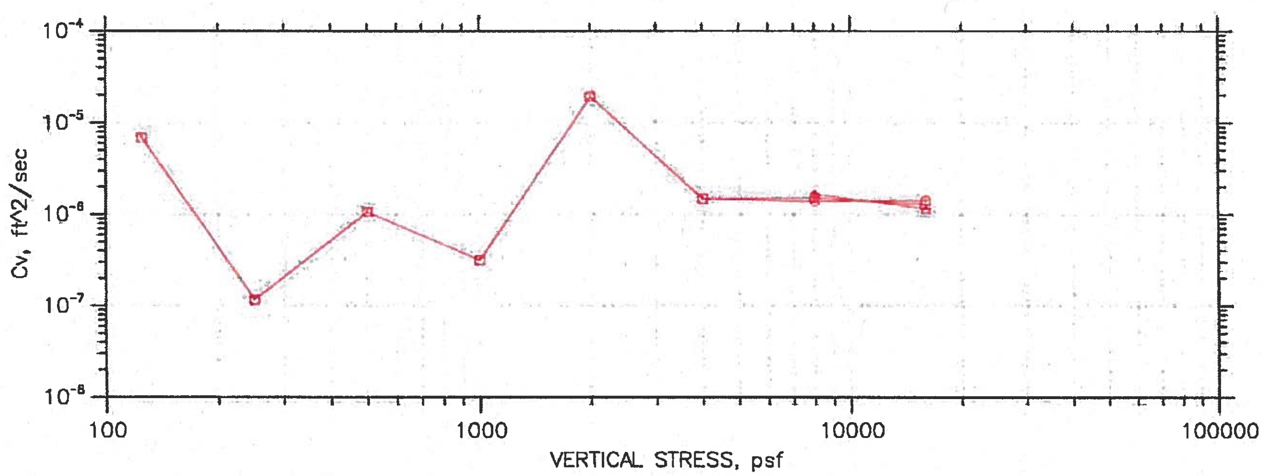
Project: Pine Hill Road Bridge	Location: Eureka	Project No.: 012163
Boring No.: B1 @ 11'	Tested By: JMA	Checked By:
Sample No.: 12-830	Test Date: 11/8/12	Depth: 11'
Test No.: 12-830	Sample Type: 3" shelby	Elevation:
Description: Soft Gray Silt		
Remarks:		

Mon, 26-NOV-2012 14:06:41

CONSOLIDATION TEST DATA

SUMMARY REPORT



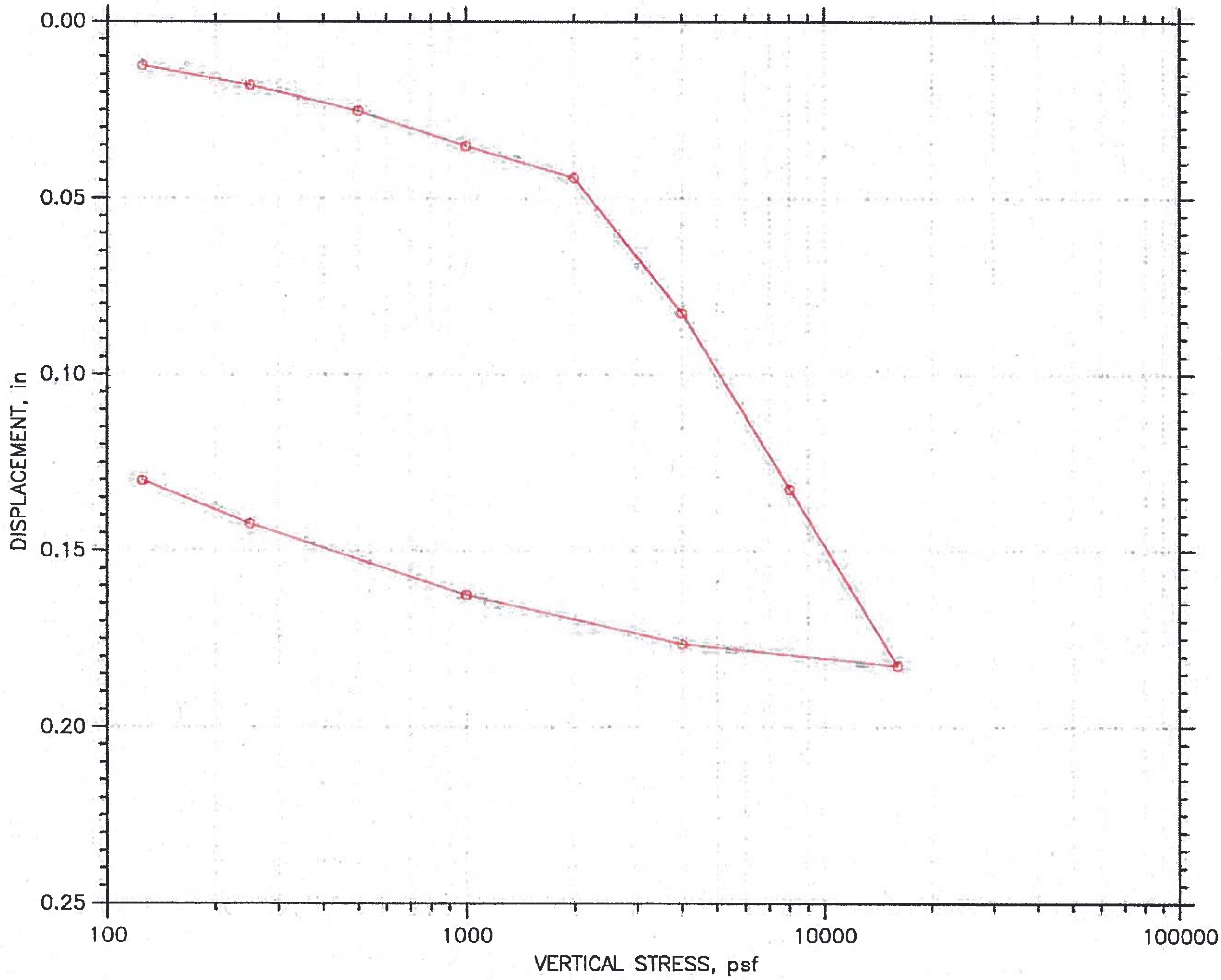


Project: Pine Hill Road Bridge	Location: Eureka	Project No.: 012163
Boring No.: B1@ 31'	Tested By: JMA	Checked By: DL 12/3/12
Sample No.: 12-832	Test Date: 11/12/12	Depth: 31'
Test No.: 12-832	Sample Type: 3" shelby	Elevation:
Description: Soft Gray Silt		
Remarks:		

Mon, 26-NOV-2012 14:12:11

CONSOLIDATION TEST DATA

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure, psf:				Water Content, %	43.05	35.63
Preconsolidation Pressure, psf:				Dry Unit Weight, pcf	75.358	86.625
Compression Index:				Saturation, %	97.00	106.03
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.15	0.87
LL: 0	PL: 0	PI: 0	GS: 2.60			

Project: Pine Hill Road Bridge	Location: Eureka	Project No.: 012163
Boring No.: B1@ 31'	Tested By: JMA	Checked By:
Sample No.: 12-832	Test Date: 11/12/12	Depth: 31'
Test No.: 12-832	Sample Type: 3" shelby	Elevation:
Description: Soft Gray Silt		
Remarks:		

Mon, 26-NOV-2012 14:12:11

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.

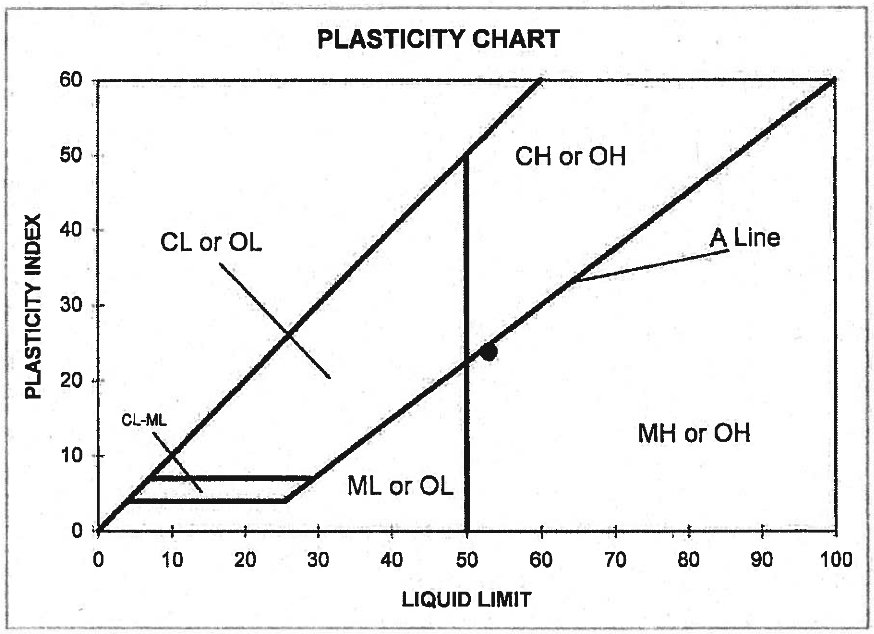
812 W. Wabash Eureka, CA 95501-2138 Tel: 707/441-8855 FAX: 707/441-8877 E-mail: shninfo@shn-engr.com

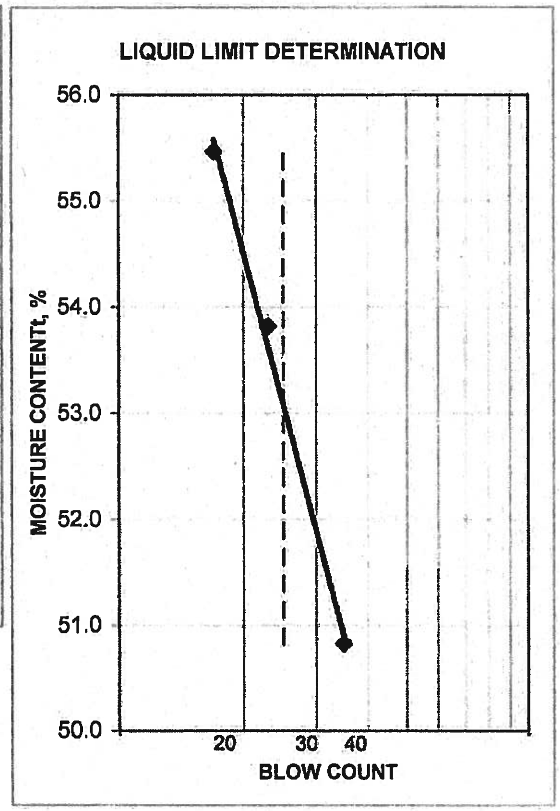
LIQUID LIMIT, PLASTIC LIMIT, and PLASTICITY INDEX (ASTM-D4318)

JOB NAME:	Pine Hill Rd Bridge	JOB #:	012163	LAB SAMPLE #:	12-833
SAMPLE ID:	B1 @ 41'	PERFORMED BY:	JMA	DATE:	11/12/2012
PROJECT MANGER:	JHD	CHECKED BY:	DL	DATE:	12/30/12

LINE NO.		TRIAL NO. 1	TRIAL NO. 2	TRIAL NO. 1	TRIAL NO. 2	TRIAL NO. 3
A	PAN #	13	14	7	8	9
B	PAN WT. (g)	22.180	19.960	29.010	29.180	28.720
C	WT. WET SOIL & PAN (g)	28.250	27.350	36.340	36.640	36.120
D	WT. DRY SOIL & PAN (g)	26.890	25.670	33.870	34.030	33.480
E	WT. WATER (C-D)	1.360	1.680	2.470	2.610	2.640
F	WT. DRY SOIL (D-B)	4.710	5.710	4.860	4.850	4.760
G	BLOW COUNT	--	--	35	23	17
H	MOISTURE CONTENT (E/F*100	28.9	29.4	50.8	53.8	55.5

LIQUID LIMIT	PLASTIC INDEX	PLASTIC LIMIT
53	**24**	29





Revised 1/03

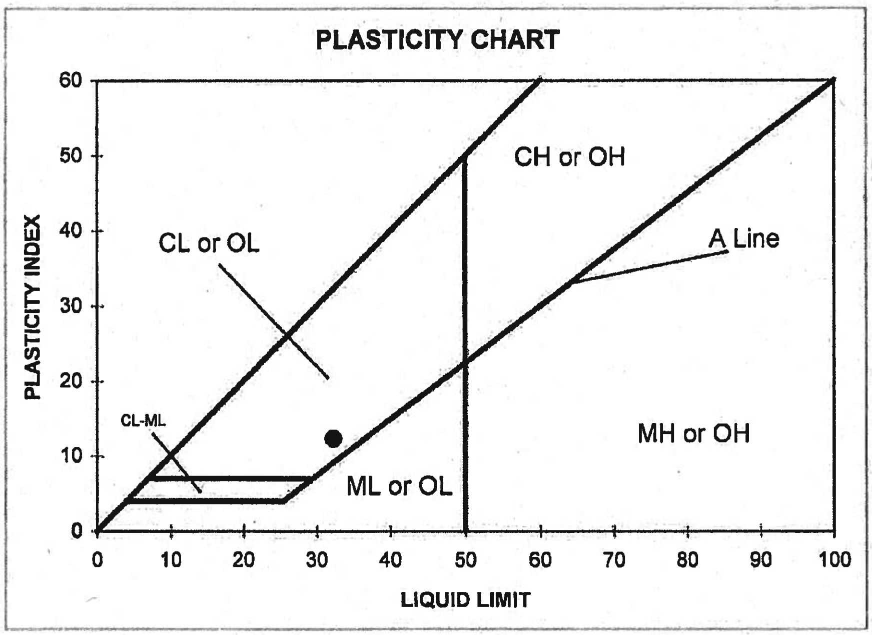
SHN
CONSULTING ENGINEERS & GEOLOGISTS, INC.
812 W. Wabash Eureka, CA 95501-2138 Tel: 707/441-8855 FAX: 707/441-8877 E-mail: shninfo@shn-engr.com

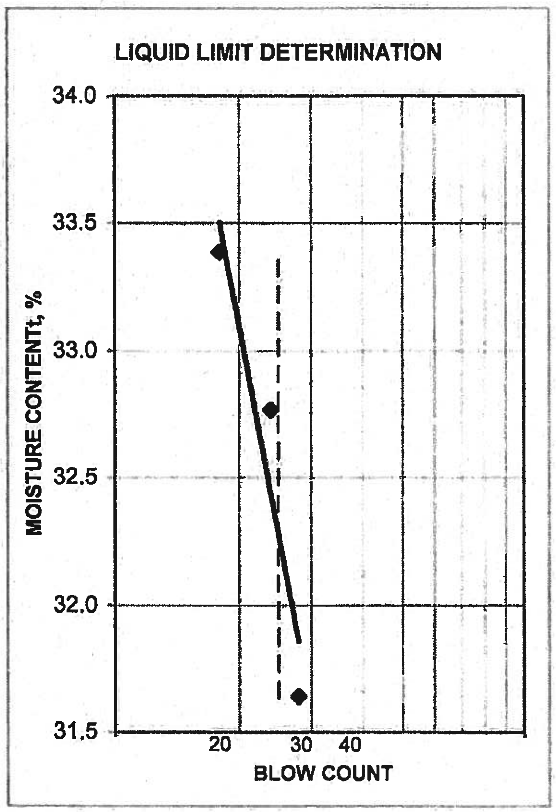
LIQUID LIMIT, PLASTIC LIMIT, and PLASTICITY INDEX (ASTM-D4318)

JOB NAME:	Pine Hill Rd Bridge	JOB #:	012163	LAB SAMPLE #:	12-831
SAMPLE ID:	B1 @ 21'	PERFORMED BY:	JMA	DATE:	11/12/2012
PROJECT MANGER:	JHD	CHECKED BY:	[signature]	DATE:	11/5/12

LINE NO.		TRIAL NO. 1	TRIAL NO. 2	TRIAL NO. 1	TRIAL NO. 2	TRIAL NO. 3
A	PAN #	15	16	4	5	6
B	PAN WT. (g)	20.640	21.030	29.390	28.860	29.690
C	WT. WET SOIL & PAN (g)	27.300	28.200	38.710	37.410	38.440
D	WT. DRY SOIL & PAN (g)	26.180	27.010	36.470	35.300	36.250
E	WT. WATER (C-D)	1.120	1.190	2.240	2.110	2.190
F	WT. DRY SOIL (D-B)	5.540	5.980	7.080	6.440	6.560
G	BLOW COUNT	--	--	28	24	18
H	MOISTURE CONTENT (E/F*100)	20.2	19.9	31.6	32.8	33.4

LIQUID LIMIT	PLASTIC INDEX	PLASTIC LIMIT
32	12	20





SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
335 S.Main St. Willits, CA 95490 Tel. (707)459-4518 Fax (707)459188

PERCENT PASSING # 200 SIEVE (ASTM - D1140)

Project Name:	Pine Hill Rd. Bridge	**Project Number:**	012163
Performed By:	SJ	**Date:**	10-Dec
Checked By:		**Date:**	
Project Manager:			

Lab Sample Number	12-091				
Boring Label	B-1				
Sample Depth (ft)	81'				
Pan Number	777				
Dry Weight of Soil & Pan	552.3				
Pan Weight	235.0				
Weight of Dry Soil	317.3				
Soil Weight Retained on #200&Pan	464.0				
Soil Weight Passing #200	88.3				
Percent Passing #200	**27.8**				

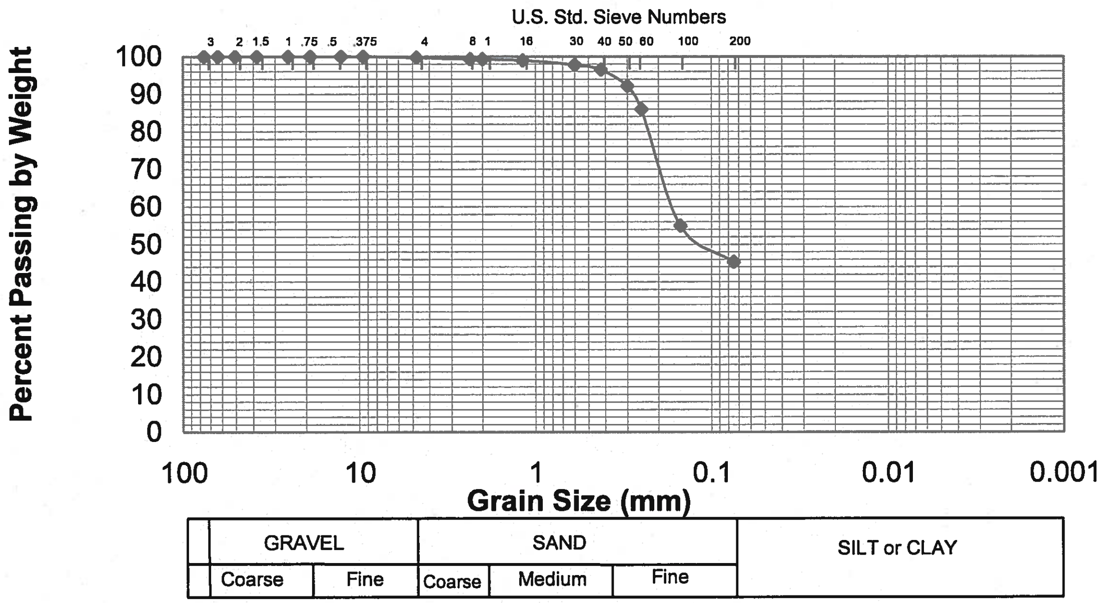
Lab Sample Number					
Boring Label					
Sample Depth (ft)					
Pan Number					
Dry Weight of Soil & Pan					
Pan Weight					
Weight of Dry Soil					
Soil Weight Retained on #200&Pan					
Soil Weight Passing #200					
Percent Passing #200					

SHN
CONSULTING ENGINEERS & GEOLOGISTS, INC.
812 W. Wabash Eureka, CA 95501-2138 Tel: 707/441-8855 FAX: 707/441-8877 E-mail: shninfo@shn-engr.com

PROJECT NAME:	Pine Hill Rd. Bridge	PROJECT NUMBER:	012163
SAMPLE ID:	B-1, 70' depth	Lab Sample#:	12-090
DATE TESTED:	**12/10/12**		

SIEVE	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#8	#10	#16	#30	#40	#50	#60	#100	#200
SIEVE SIZE (mm)	76.2	63.5	50.8	38.1	25.4	19.1	12.7	9.53	4.75	2.36	2.00	1.18	0.600	0.425	0.300	0.250	0.150	0.075
PERCENT PASSING	100	100	100	100	100	100	100	100	99.7	99.3	99.3	99.0	97.8	96.5	92.2	86.0	55.0	45.4
SPEC REQUIRED																		

Gradation Test Results



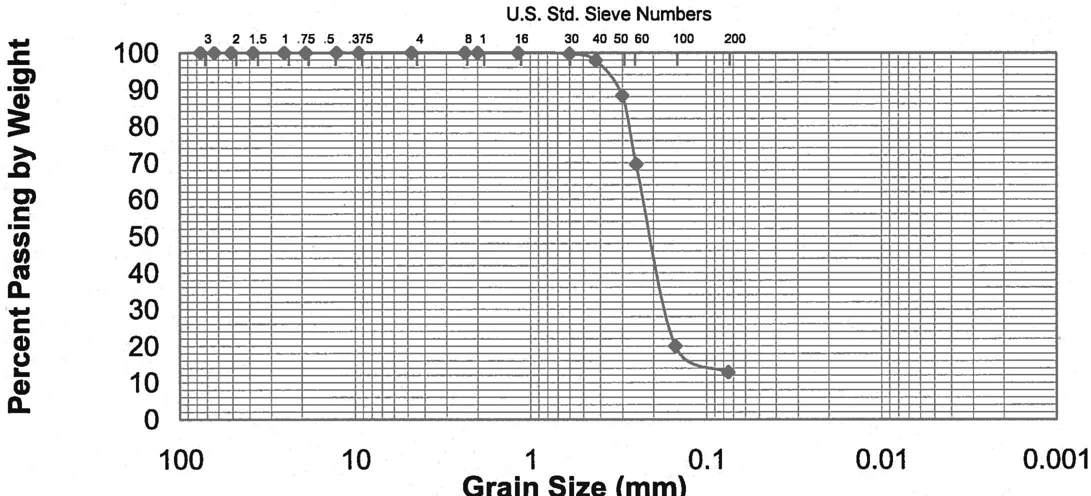
Revised 1/03

CONSULTING ENGINEERS & GEOLOGISTS, INC.
335 S. Main St. Willits, CA 95490 Tel: 707/459-4518 FAX: 707/459-1884 E-mail: shninfo@shn-engr.com

PROJECT NAME:	Pine Hill Rd. Bridge	PROJECT NUMBER: 012163	
SAMPLE ID:	B-1, 90' depth	Lab Sample#:	12-092
DATE TESTED:	12/10/12		

SIEVE	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#8	#10	#16	#30	#40	#50	#60	#100	#200
SIEVE SIZE (mm)	76.2	63.5	50.8	38.1	25.4	19.1	12.7	9.53	4.75	2.36	2.00	1.18	0.600	0.425	0.300	0.250	0.150	0.075
PERCENT PASSING	100	100	100	100	100	100	100	100	100	100.0	100.0	100.0	99.7	97.9	88.3	69.6	20.1	12.9
SPEC REQUIRED																		

Gradation Test Results



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Revised 1/03

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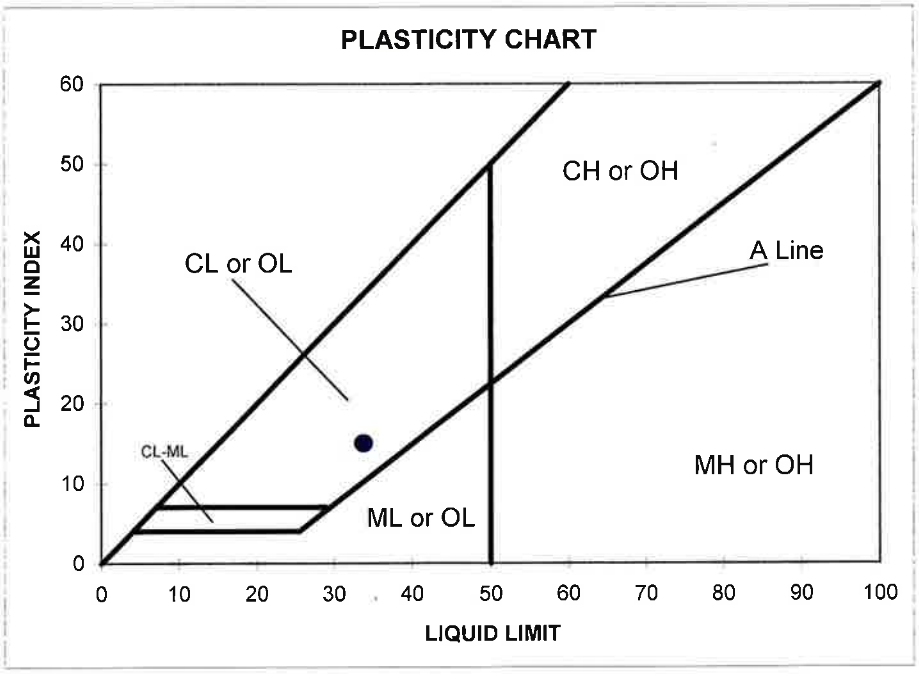
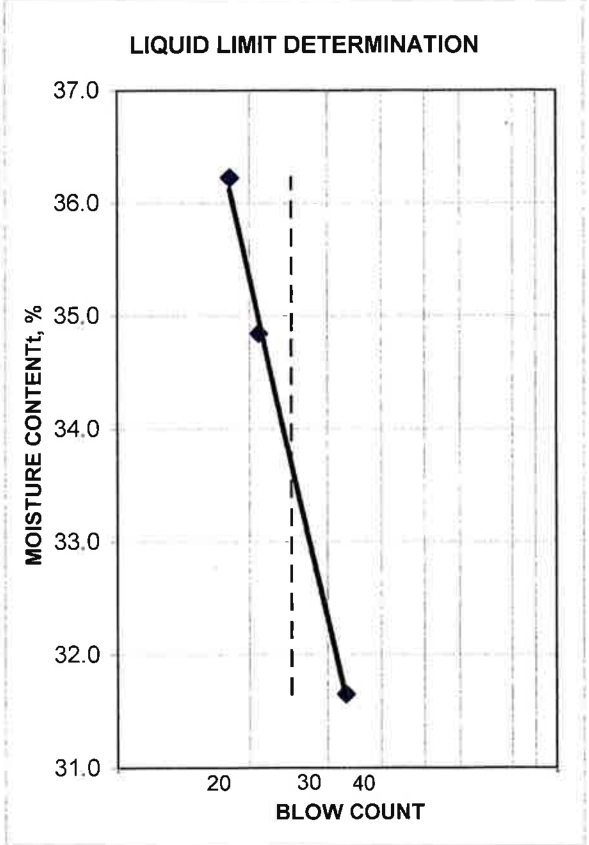
LIQUID LIMIT, PLASTIC LIMIT, and PLASTICITY INDEX (ASTM-D4318)

JOB NAME:	Pine Hill Bridge	JOB #:	012163	LAB SAMPLE #:	15-488
SAMPLE ID:	B2@110.5-111.0	PERFORMED BY:	JMA/LWP	DATE:	10/7/2015
PROJECT MANGER:	GDS	CHECKED BY:	DG	DATE:	10/8/15

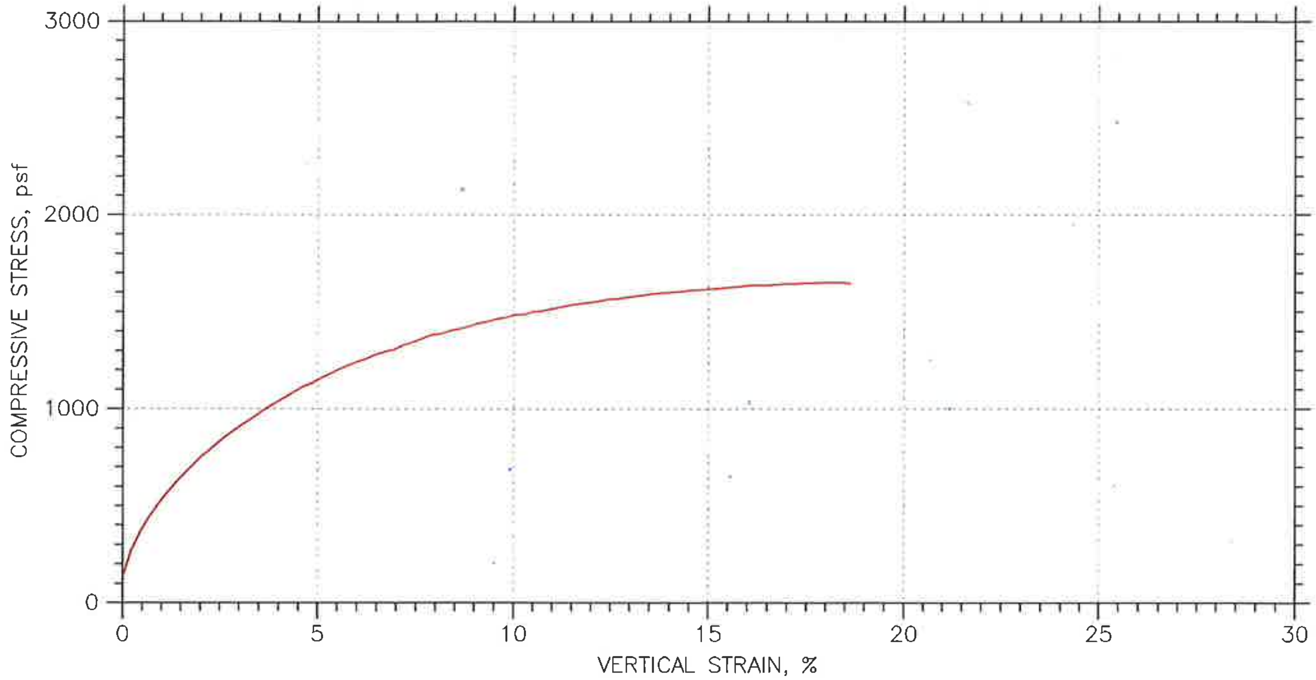
LINE NO.		TRIAL NO. 1	TRIAL NO. 2	TRIAL NO. 1	TRIAL NO. 2	TRIAL NO. 3
A	PAN #	15	16	4	5	6
B	PAN WT. (g)	20.590	21.000	29.330	28.820	29.650
C	WT. WET SOIL & PAN (g)	26.940	28.010	37.940	37.450	38.750
D	WT. DRY SOIL & PAN (g)	25.950	26.850	35.870	35.220	36.330
E	WT. WATER (C-D)	0.990	1.160	2.070	2.230	2.420
F	WT. DRY SOIL (D-B)	5.360	5.850	6.540	6.400	6.680
G	BLOW COUNT	--	--	33	21	18
H	MOISTURE CONTENT (E/F*100)	18.5	19.8	31.7	34.8	36.2

LIQUID LIMIT	**PLASTIC INDEX**	PLASTIC LIMIT
34	**15**	19





UNCONFINED COMPRESSION TEST REPORT

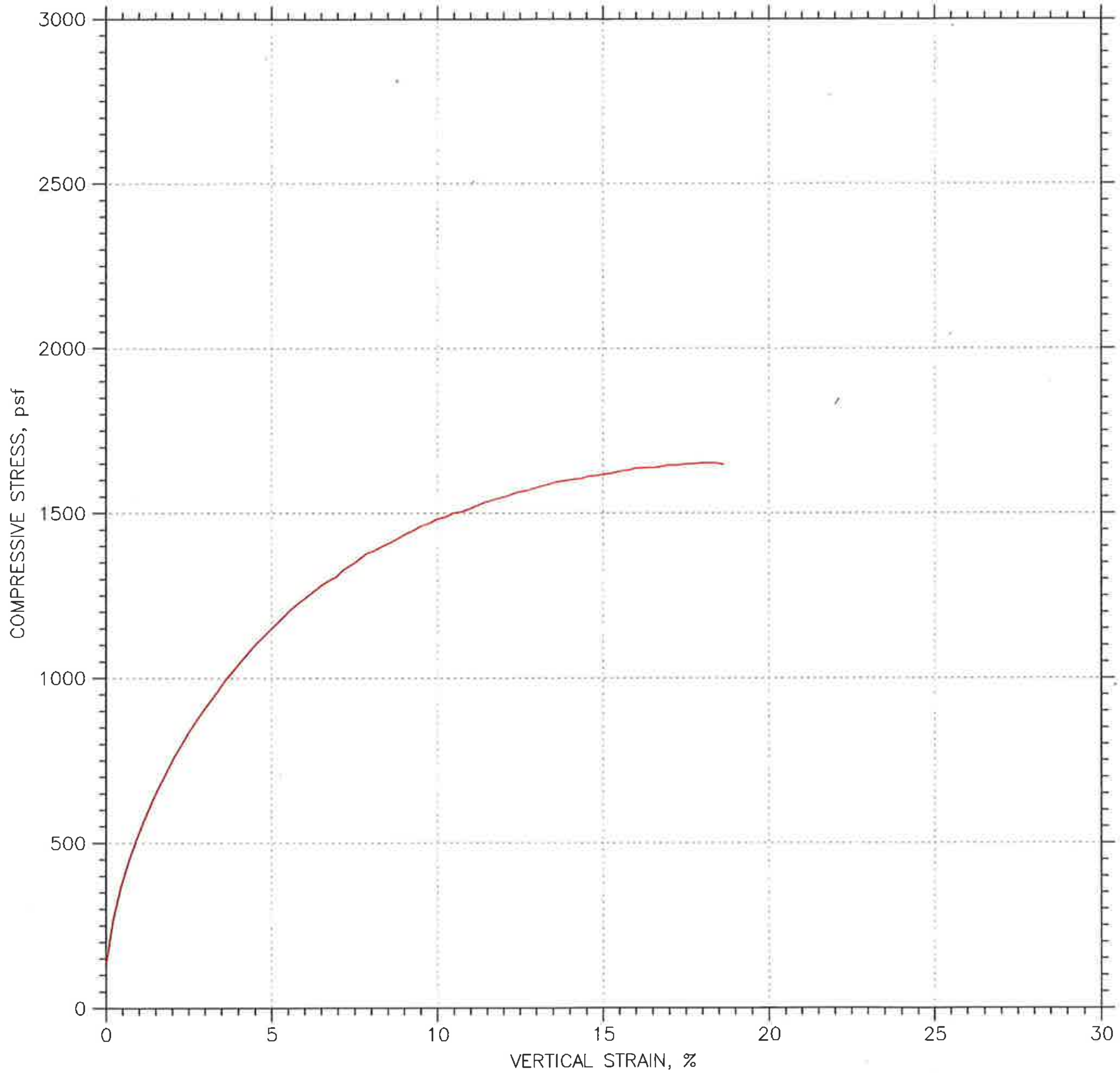


Symbol						
Test No.		15-488				
Initial	Diameter, in	2.35				
	Height, in	4.9				
	Water Content, %	25.68				
	Dry Density, pcf	101.77				
	Saturation, %	107.52				
	Void Ratio	0.6378				
Unconfined Compressive Strength, psf		1652.1				
Undrained Shear Strength, psf		826.07				
Time to Failure, min		19.504				
Strain Rate, %/min		1				
Specific Gravity		2.67				
Liquid Limit		34				
Plastic Limit		19				
Plasticity Index		15				
Failure Sketch						

Project: Pine Hill Bridge
Location: Eureka
Project No.: 012163
Boring No.: B2 @ 110.5
Sample Type: 2.5" CalBrl
Description: Gray SILT
Remarks: Catcher used on specimen reduced sample diameter

Thu, 08-OCT-2015 10:16:20

UNCONFINED COMPRESSION TEST REPORT



Project: Pine Hill Bridge	Location: Eureka	Project No.: 012163
Boring No.: B2 @ 110.5	Tested By: JMA	Checked By: DL 10/9/15
Sample No.: 15-488	Test Date: 10/5/15	Depth: 110.5-111
Test No.: 15-488	Sample Type: 2.5" CalBrl	Elevation:
Description: Gray SILT		
Remarks: Catcher used on specimen reduced sample diameter		

Thu, 08-OCT-2015 10:16:20

C

Site-Specific Response Spectrum

22 July 2014

Mr. John H. Dailey
SHN Consulting Engineers & Geologist, Inc.
335 S. Main Street
Willits, California 95490

**Subject: Development of Site-Specific Response Spectrum
Pine Hill Road Replacement Bridge
Eureka, California
Langan Project No.: 731630801**

Dear Mr. Dailey:

This letter-report presents the results of our ground motion study to develop site-specific response spectrum for the proposed Pine Hill Road replacement bridge in Eureka, California. We understand the existing 63-foot long, 65 years old, three span timber bridge is structurally deficient and is proposed to be replaced by an approximately 70-foot long reinforced concrete bridge. Figure 1 presents the site location map. The design of the new bridge will follow the California Department of Transportation (Caltrans) Seismic Design Criteria Version 1.7, April 2013. In general, the subsurface conditions consist of soft clay to a depth of approximately 70 feet. This layer is underlain by approximately 30 feet of potentially liquefiable medium dense to dense sand. Medium stiff to stiff clay underlies the sand. Considering these conditions, Caltrans design criteria requires development of site-specific response spectrum.

1.0 SCOPE OF SERVICES

Our study was performed in accordance with the scope of services presented in our revised proposal dated 6 February 2014. We used the subsurface information developed by SHN Consulting Engineers & Geologist, Inc. (SHN). Our scope of services did not include any site visits or performing supplemental field investigation. We developed site-specific response spectrum in accordance with the guidelines presented in Appendix B of 2013 Caltrans Seismic Design Criteria (Caltrans 2013). Specifically, we performed the following:

- Probabilistic seismic hazard analysis (PSHA) for a 5 percent probability of exceedance in 50 years (975 year return period)
- Deterministic seismic hazard analysis for the median spectrum of the governing scenario earthquake
- Developed site-specific design response spectrum for stiff soil for input into the nonlinear ground response analysis based on the envelope of the PSHA and deterministic spectra
- Spectrally matched five time series to the site-specific stiff soil spectrum
- Nonlinear ground response analysis
- Developed site-specific response spectrum for the project

2.0 SUBSURFACE CONDITIONS

The subsurface information provided by you included one boring drilled to a depth of 90.5 feet below existing ground surface (bgs) and four Cone Penetrometer Tests (CPTs) advance to depths ranging from approximately 73 to 103 feet bgs. In addition, shear wave velocities were measured in two of the CPT soundings. We also received laboratory test results on selected samples from the boring. In general, the subsurface conditions consist of soft clay to a depth of approximately 70 feet. This layer is underlain by approximately 30 feet of medium dense to dense sand that is potentially liquefiable. Medium stiff to stiff clay underlies the sand.

On the basis of the shear wave velocity measurements, the average shear wave velocity in the top 30 meters (100 feet) is approximately 145 m/s (477 ft/sec). Considering these conditions, Caltrans design criteria requires development of site-specific response spectrum. Because the site is underlain by deposits of soft clay and potentially liquefiable sand, we performed nonlinear ground response analysis. To perform this type of an analysis, time series are needed as input at the base of the model. On the basis of our discussions with HSN, we understand bedrock is on the order of about 1,400 feet (500 m) below the ground surface. Furthermore, the site-specific data suggest that the shear wave velocity at a depth of approximately 100 feet is about 1,000 ft/sec. Consequently, we developed stiff soil response spectrum as the basis for the development of the input motions for the ground response analysis. Details of this development are presented in the following sections of the report.

3.0 PROBABILISTIC SEISMIC HAZARD ANALYSIS

Because the location, recurrence interval, and magnitude of future earthquakes are uncertain, we performed a PSHA, which systematically accounts for these uncertainties. The results of a PSHA define a uniform hazard for a site in terms of a probability that a particular level of shaking will be exceeded during the given life of the structure.

To perform a PSHA, information regarding the seismicity, location, and geometry of each source, along with empirical relationships that describe the rate of attenuation of strong ground motion with increasing distance from the source, are needed. The assumptions necessary to perform the PSHA are that:

- the geology and seismic tectonic history of the region are sufficiently known, such that the rate of occurrence of earthquakes can be modeled by historic or geologic data
- the level of ground motion at a particular site can be expressed by an attenuation relationship that is primarily dependent upon earthquake magnitude and distance from the source of the earthquake
- the earthquake occurrence can be modeled as a Poisson process with a constant mean occurrence rate.

As part of the development of the site-specific spectrum at the base of the soil column for the nonlinear ground response analysis, we performed a PSHA to develop site-specific response spectra for 5 percent probability of exceedance in 50 years. The ground surface spectra were developed using the computer code EZFRISK 7.62 (Risk Engineering 2012). The approach used in EZFRISK is based on the probabilistic seismic hazard model developed by Cornell (1968) and McGuire (1976). Our analysis modeled the faults in area as linear and areal sources, and earthquake activities were assigned to the faults based on historical and geologic data. The levels of shaking were estimated using Next Generation Attenuation (NGA) relationships that are primarily dependent upon the magnitude of the earthquake and the distance from the site to the fault.

3.1 Probabilistic Model

In probabilistic models, the occurrence of earthquake epicenters on a given fault is assumed to be uniformly distributed along the fault. This model considers ground motions arising from the portion of the fault rupture closest to the site rather than from the epicenter. Fault rupture lengths were modeled using fault rupture length-magnitude relationships given by Wells and Coppersmith (1994).

The probability of exceedance, $P_e(Z)$, at a given ground-motion, Z, at the site within a specified time period, T, is given as:

$$P_e(Z) = 1 - e^{-V(z)T}$$

where V(z) is the mean annual rate of exceedance of ground motion level Z. V(z) can be calculated using the total-probability theorem.

$$V(z) = \sum_i v_i \iint P[Z > z \mid m,r] f_{M_i}(m) f_{R_i|M_i}(r;m)\,dr\,dm$$

where:

v_i = the annual rate of earthquakes with magnitudes greater than a threshold M_{oi} in source i

P [Z > z | m,r] = probability that an earthquake of magnitude m at distance r produces ground motion amplitude Z higher than z

f_{Mi} (m) and $f_{Ri|Mi}$ (r;m) = probability density functions for magnitude and distance

Z represents peak ground acceleration, or spectral acceleration values for a given frequency of vibration. The peak accelerations are assumed to be log-normally distributed about the mean with a standard error that is dependent upon the magnitude and attenuation relationship used.

3.2 Source Modeling and Characterization

The segmentation of faults, mean characteristic magnitudes, and recurrence rates were modeled using the data presented in the WGCEP (2008) and Cao et al. (2003) reports. We also included the combination of fault segments and their associated magnitudes and recurrence rates as described in the WGCEP (2008) in our seismic hazard model. Table 1 presents the distance and direction from the site to the fault, mean characteristic magnitude, mean slip rate, and fault length for individual fault segments. We used the 2008 California, Oregon, and Cascadia fault databases identified in EZFRISK 7.62. We understand EZFRISK obtained this database directly from USGS and models the faults with multiple segments. Each segment is characterized with multiple magnitudes, occurrence or slip rates and weights. This approach takes into account the epistemic uncertainty associated with the various seismic sources in our model.

TABLE 1
Source Zone Parameters

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude	Mean Slip Rate (mm/yr)	Approx. Fault Length (km)
Little Salmon (Onshore)	1.7	West	7.10	5	34
Little Salmon Connected	1.7	West	7.50	2.7	80
Little Salmon (Offshore)	4.2	West	7.30	1	46
Table Bluff	6.7	Southwest	7.20	0.6	49
Mendocino	7.3	East	7.3	35	260
Cascadia	14	West	9.0	35	1,300
Fickle Hill	16	East	7.10	0.6	32
Mad River	18	Northeast	7.20	0.7	42
McKinleyville	20	Northeast	7.20	0.6	47
Trinidad	24	Northeast	7.50	0.7	88
Big Lagoon-Bald Mtn	38	Northeast	7.50	0.5	90
Maacama-Garberville	56	South	7.40	9	221
N. San Andreas; SAO	60	Southwest	7.37	24	136
N. San Andreas; SAO+SAN	60	Southwest	8.00	24	326
N. San Andreas; SAO+SAN+SAP	60	Southwest	7.95	22	410
N. San Andreas; SAO+SAN+SAP+SAS	60	Southwest	8.05	22	472
Bartlett Springs	79	Southeast	7.30	6	174
Whaleshead	153	Northeast	7.01	2.6	46
Battle Creek	173	East	6.70	0.5	29
N. San Andreas; SAN	179	South	7.51	24	189
N. San Andreas; SAN+SAP	179	South	7.73	22	274
N. San Andreas; SAN+SAP+SAS	179	South	7.87	21	336
Great Valley 1	193	Southeast	6.80	0.1	44

3.3 Attenuation Relationships

On the basis of the measured shear wave velocity, we assumed a shear wave velocity of 1,000 ft/sec for the development of stiff soil response spectrum used for developing the input motions for the nonlinear ground response analysis.

Consistent with the requirements of Appendix B of Caltrans Seismic Design Criteria (2013), we used Campbell and Bozorgnia (2008) and Chiou and Youngs (2008) attenuation relationships for shallow crustal faults and Youngs et al. (1997) relationships for subduction zone.

3.4 PSHA Results

Figure 2 presents the results of the PSHA for 5 percent probability of exceedance in 50 years. The average of the four attenuation relationships is also shown on these figures. Because of the close proximity of the Little Salmon fault we considered near-source directivity using Abrahamson (2000) model.

Figure 3 presents the deaggregation plots of the PSHA results for the 5 percent probability of exceedance in 50 years hazard level. From the examination of these results, it can be seen that the Little Salmon connected fault (M_w = 7.5 at 1.7 km) dominate the hazard at the project site at different periods of interest.

4.0 DETERMINISTIC

We performed a deterministic analysis to develop the design spectrum at the site. In a deterministic analysis, a given magnitude earthquake occurring at a certain distance from the source is considered as input into an appropriate ground motion attenuation relationship. The scenario earthquake was defined as an event having a Moment Magnitude of 7.5 consistent with the mean magnitude assigned by WGCEP (2008) for the Little Salmon connected fault at a distance of approximately 1.7 kilometers from the site.

The same attenuation relationships used in the PSHA for shallow crustal faults were used in our deterministic analysis. We also included near-source directivity as discussed in Section 3.4. Figure 4 presents the median deterministic results for the attenuation relationships used in the analysis and the average of these relationships.

5.0 RECOMMENDED STIFF SOIL SPECTRUM

The Design Earthquake spectrum as defined in in Appendix B of the 2013 Caltrans code is the envelope of the 975 year return PSHA and the median deterministic on the governing fault. Figure 5 presents the PSHA and determinisitic median spectra for the site. Also, shown on this figure is the envelope of these spectra. For periods shorter than 1.0 second the PSHA spectrum governs and periods longer than or equal to 1.0 second the deterministic spectrum governs the stiff soil design spectrum. Table 2 presents the site-specific stiff soil spectrum.

TABLE 2
Site-Specific Stiff Soil Spectrum
S_a (g) for 5 percent damping

Period (seconds)	S_a (g)
0.01	0.967
0.10	1.455
0.20	1.862
0.30	1.938
0.40	1.886
0.50	1.817
0.60	1.687
0.75	1.516
1.00	1.345
1.50	1.031
2.00	0.738
3.00	0.404
4.00	0.264
5.00	0.208

6.0 MATCHED TIME SERIES

The selection of a recorded time series is an important step in developing the ground motion. The intent in this selection process is to choose time series that in general have a similar magnitude and distance as that of the design ground motion. The suite of time series recommended for this project are from recordings from large events, similar to the seismic regime of the northern part of the state of California. In addition, the use of different earthquakes captures the unique and different character of each particular earthquake. Table 3 presents the time series used for matching to the recommended spectra.

TABLE 3
Earthquake Time Series Used
for Matching to Recommended Stiff Soil Spectrum

EQ., Year	NGA Seq. No.	Rupture Mechanism	Mag.	Time History	Vs30[1] (m/s), Site Class	Epi. Dist. (km)	Closest Dist. to Rupture[1] (km)	Comp.	PGA (g)	PGV (cm/s)	PGD (cm)
Loma Prieta, 1989	779	Reverse, oblique	6.9	Los Gatos PC	478, C	23	6	0	0.966	108.5	65.8
Cape Mendocino, 1992	501	Subduction	7.0	Cape Mendocino	514, C	10	7	0	1.497	125.1	39.7
Duzce, 1999	1605	Strike-slip	7.1	Duzce	276, D	2	7	270	0.535	83.4	51.6
Tabas, 1979	143	Thrust	7.4	Tabas	767, B	55	2	L	0.836	97.8	38.7
ChiChi, 2002	1503	Reverse	7.4	TCU067	433, C	29	0.6	E	0.503	79.6	93.1

Figures 6 through 10 present the acceleration, velocity, and displacement of the matched time series and comparison between the initial, recommended matched spectrum for the stiff soil.

7.0 NONLINEAR GROUND RESPONSE ANALYSIS

Because the site is underlain by soft clay and potentially liquefiable layers, the response spectra at the ground surface were developed using the computer program DEEPSOIL Version 5.1 (Hashash et al. 2012). DEEPSOIL is a one-dimensional site response analysis program that performs non-linear time domain wave propagation analysis based on vertically propagating, horizontal shear waves. The program mathematically transmits input base motions vertically through an idealized soil column to the ground surface. DEEPSOIL incorporates the pressure-dependent hyperbolic model which was modified by Matasovic (1993) and adjusts the hyperbolic model by Konder and Zelasko (1963) by introducing two additional parameters Beta and s that adjust the shape of the back bone curve β. The stress strain equation is:

$$\tau = \frac{G_{mo}\gamma}{1 + Beta\left(\frac{G_{mo}\gamma}{\tau_{mo}}\right)^{s}} = \frac{G_{mo}\gamma}{1 + Beta\left(\frac{\gamma}{\gamma_{r}}\right)^{s}}$$

where: G_{mo} = initial shear modulus, τ_{mo} = shear strength, γ = shear strain. Beta, s, and γ_r are model parameters.

1 From NGA flatfile

We performed both total stress and effective stress (with generation and dissipation of pore pressures) nonlinear one dimensional analyses and used the strain dependent shear modulus reduction and damping curves developed by Seed and Idriss (1970) and Vucetic and Dobry (1991) for the sand and clay layers at the site, respectively. The model parameters were internally developed by curve fitting to Seed and Idriss (1970) and Vucetic and Dobry (1991) curves. The effective stress analyses were performed to account for pore pressure generation and dissipation and its effect on the computed response spectra. The modeling of for pore pressure generation and dissipation was performed using the model parameter developed by Matasovic (1992) for sand and Matasovic and Vucetic (1995) for clay as part of the effective stress analysis option in DEEPSOIL.

To develop the idealized model at the site we used subsurface information developed by SHN. We assigned the input motion (matched time series from Section 6.0) at an assumed depth of 150 feet below the ground surface and performed the analyses using the lower bound and upper bound shear wave velocities measured at the site. The lower and upper shear wave velocities used in idealized profiles in our analyses are summarized in Tables 4 and 5, respectively.

TABLE 4
Lower Bound V_s Idealized Profile Used in DEEPSOIL Analyses

Layer	Depth Range (feet)	Assigned Lower Bound Shear Wave Velocity (ft/sec)
Clay	0 – 19	315
Clay	19 – 30	364
Clay	30 – 40	381
Clay	40 – 50	486
Clay	50 – 60	479
Clay	60 – 70	502
Sand	70 – 80	630
Sand	80 – 90	850
Sand	90 – 100	870
Clay	100 - 150	1,000 (assumed)

TABLE 5
Upper Bound V_s Idealized Profile Used in DEEPSOIL Analyses

Layer	Depth Range (feet)	Assigned Upper Bound Shear Wave Velocity (ft/sec)
Clay	0 – 30	380
Clay	30 – 35	404
Clay	35 – 40	590
Clay	40 – 50	530
Clay	50 – 60	615
Clay	60 – 70	655
Sand	70 – 90	850
Sand	90 – 100	870
Clay	100 - 150	1,000 (assumed)

The matched time series were used as outcrop input motion applied at a depth of 150 feet.

7.1 Results of Nonlinear Ground Response Analysis

The results of the DEEPSOIL nonlinear analysis for the five input motions are presented on Figures 11 and 12 present for the nonlinear total stress and effective stress analysis, respectively using the upper bound shear wave velocities. These figures present the results for each of the five input motions along with average of the results and the envelope of the results. Figures 13 and 14 present similar results using the lower bound shear wave velocities. Figure 15 presents the average results for the four sets of analyses. The envelope of the results is used as the basis for the development of the recommended site-specific response.

7.2 Recommended Spectrum

Figure 16 presents a comparison of the spectrum for the envelope of the results and the ARS curves from the ATC-35 report for site class E for M = 7.25 ± 0.25 and the ARS from the Caltrans web tool for V_{s30} =150 m/s. The recommended smooth spectrum is presented as red triangles on the figure. Digitized values of the recommended spectrum are presented in Table 6.

TABLE 6
Recommended Ground Surface Spectrum
for Damping Ratio of 5 percent

Period (seconds)	S_a (g)
0.00	0.300
0.10	0.500
0.20	0.680
0.30	0.800
0.40	0.850
0.50	0.875
0.60	0.900
0.70	0.950
0.80	1.000
0.90	1.140
1.00	1.145
1.10	1.150
1.20	1.155
1.30	1.155
1.40	1.150
1.50	1.150
1.60	1.150
1.70	1.175
1.80	1.175
1.90	1.175
2.00	1.150
2.10	1.050
2.20	0.950
2.30	0.900
2.40	0.850
2.50	0.811
2.60	0.775
2.70	0.743
2.80	0.710
2.90	0.690
3.00	0.675
3.50	0.578
4.00	0.487
5.00	0.411

We appreciate the opportunity to assist you on this project. If you have any questions, please call.

Sincerely,
Langan Treadwell Rollo

John Gouchon, G.E.
Principal/Vice President

Ramin Golesorkhi, Ph.D., G.E.
Principal/Vice President

731630801.01_RG_Pine Hill Road Report

Attachments: Figures 1 through 16

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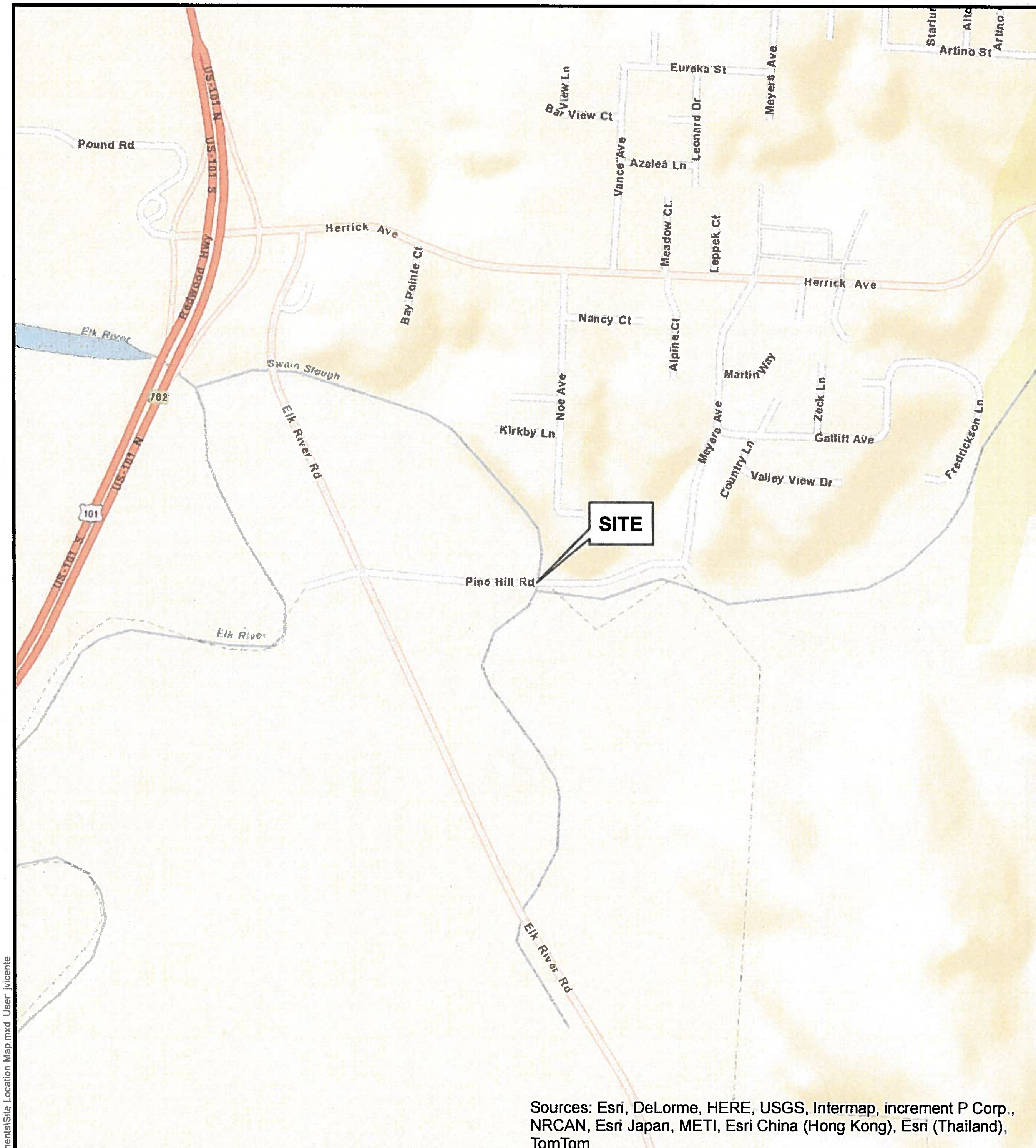


Notes:

World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

0 200 400 800
Feet

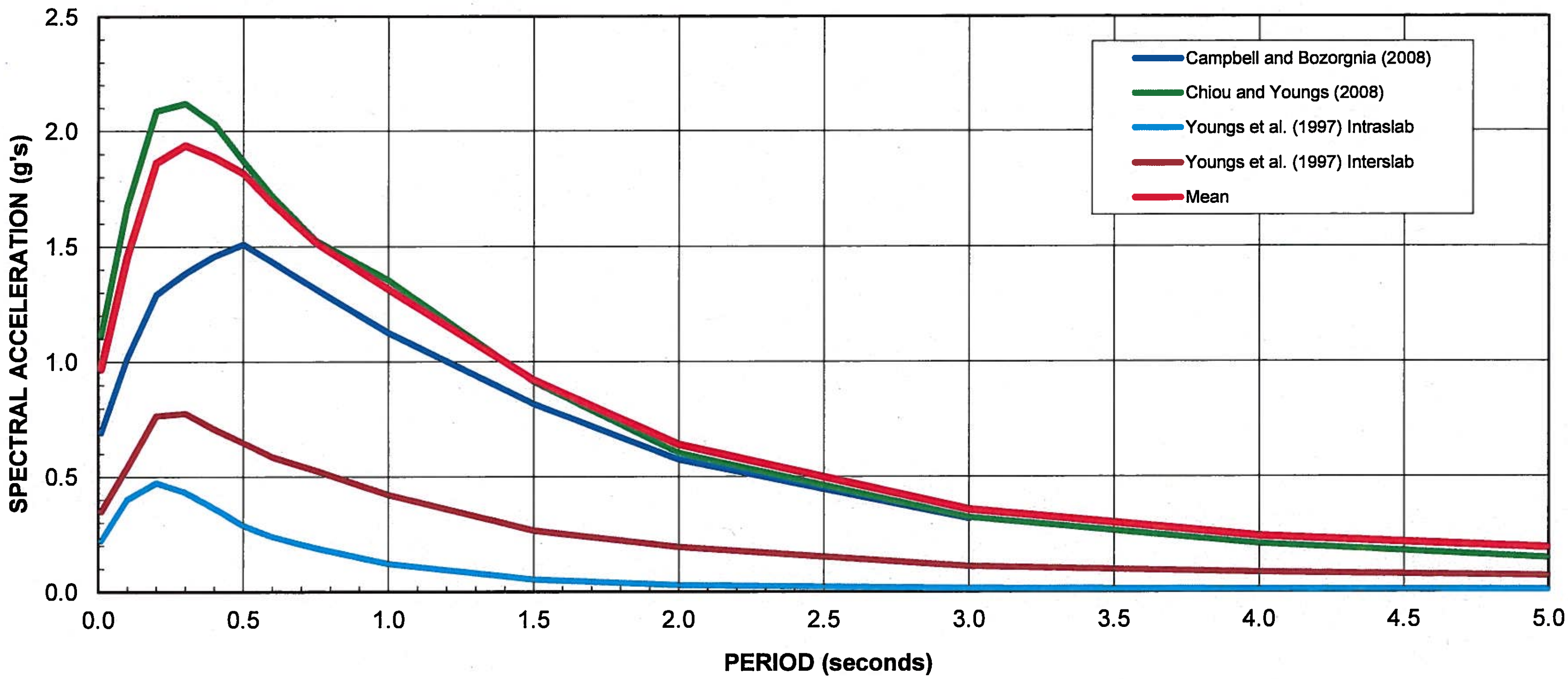
N

PINE HILL ROAD REPLACEMENT BRIDGE
Eureka, California

SITE LOCATION MAP

LANGAN TREADWELL ROLLO

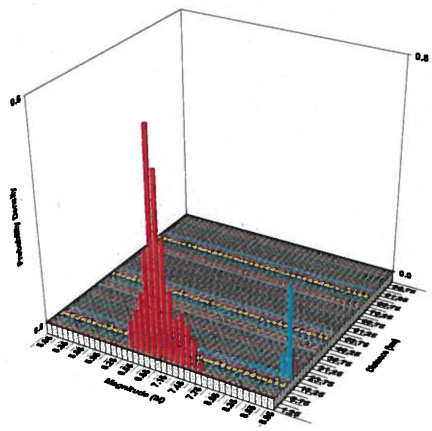
Date 7/18/2014	Project No. 731630801	Figure 1



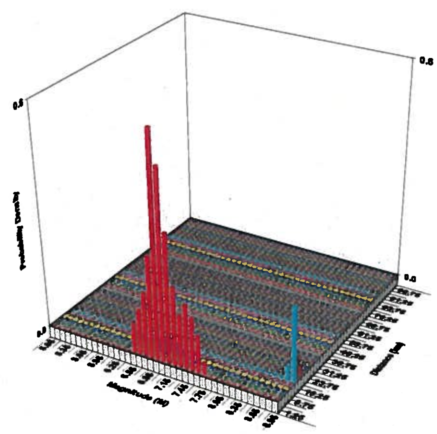
Damping Ratio = 5%

Notes:
1. Estimated V_{s30} = 300 m/s
2. Include average directivity (Abrahamson 2000)

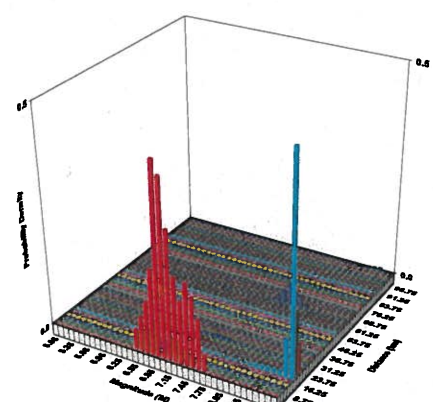
PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF PSHA FOR STIFF SOIL 5 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS		
Date 07/18/14	Project No. 731630801	Figure 2
LANGAN TREADWELL ROLLO		



(a) PGA



(b) S_a, T = 1.0 seconds



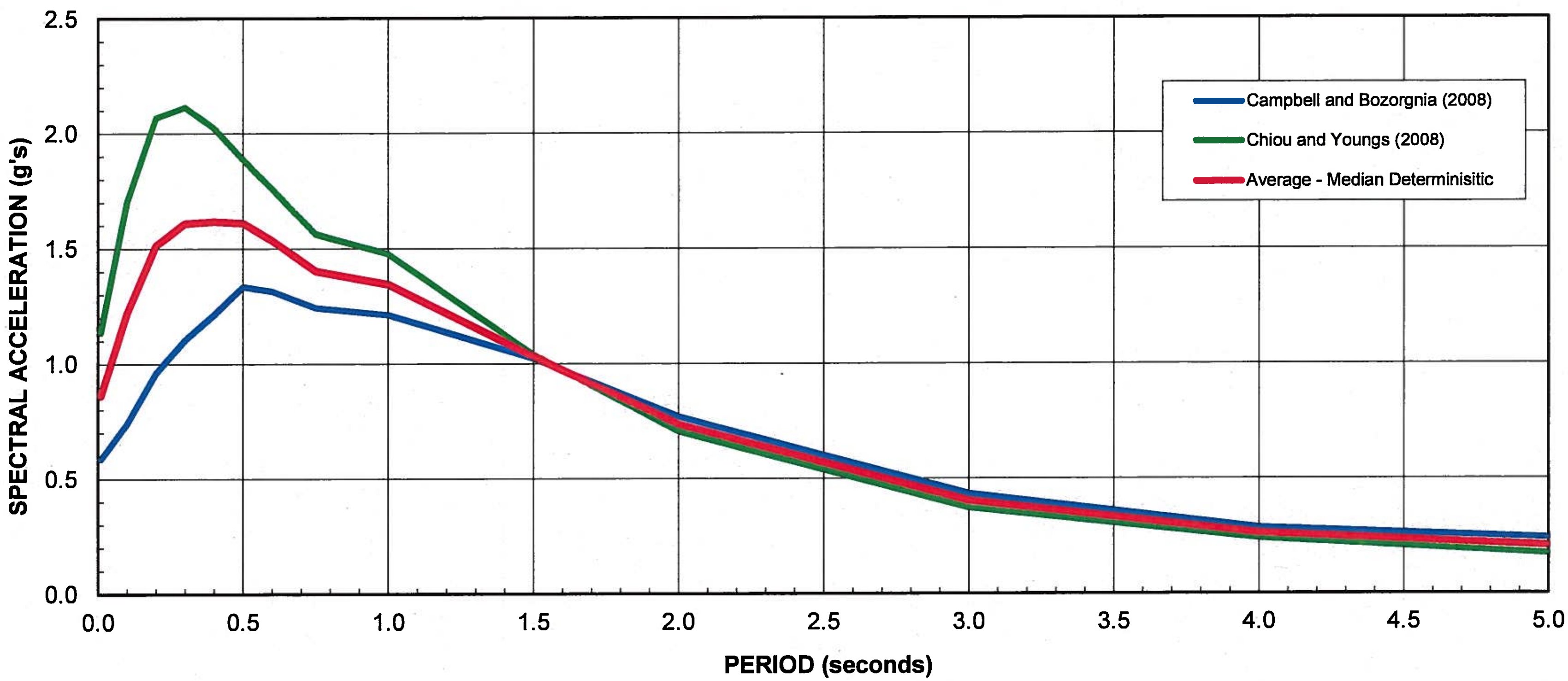
(c) S_a, T = 4.0 seconds

PINE HILL ROAD
REPLACEMENT BRIDGE
Eureka, California

5% PROBABILITY OF EXCEEDANCE IN 50 YEARS FOR STIFF SOIL - MAGNITUDE DISTANCE DEAGGREGATION PLOTS

Date 07/18/14	Project No. 731630801	Figure 3

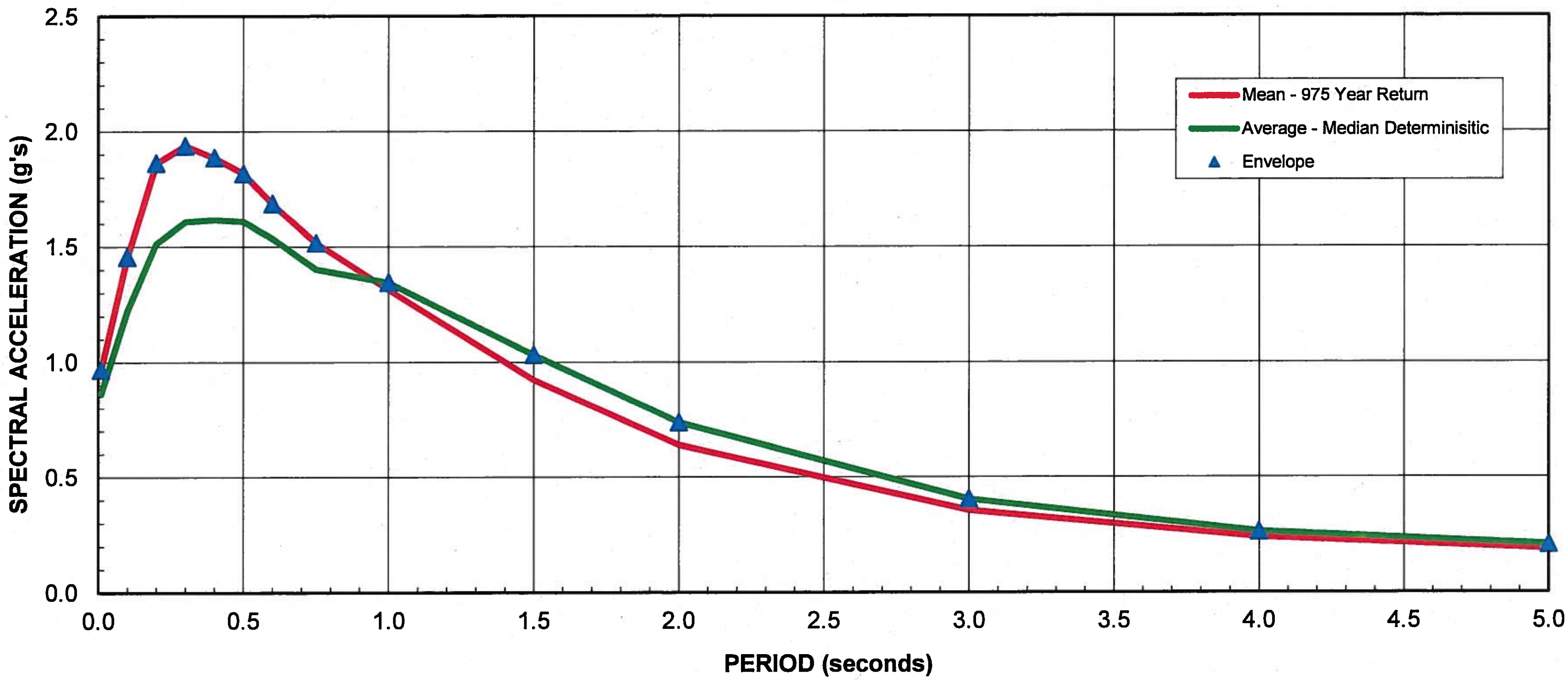
LANGAN TREADWELL ROLLO



Damping Ratio = 5%

Notes:
1. Estimated V_{s30} = 300 m/s
2. Include average directivity (Abrahamson 2000)

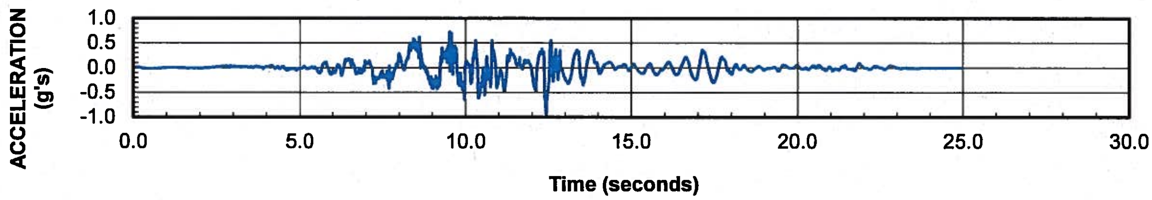
PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF MEDIAN DETERMINISTIC STIFF SOIL ANALYSIS FOR M_w = 7.5, Dist. = 1.7 km		
Date 07/18/14	Project No. 731630801	Figure 4
LANGAN TREADWELL ROLLO		

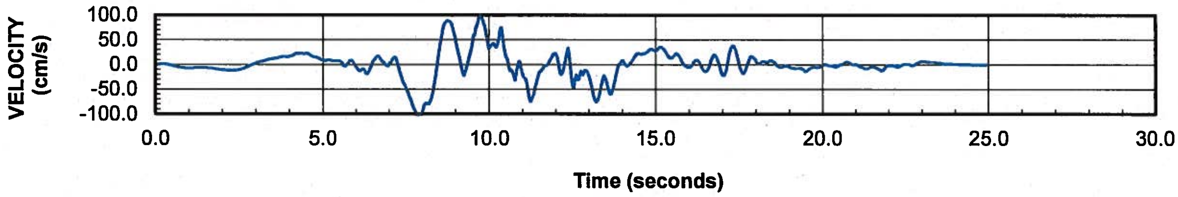


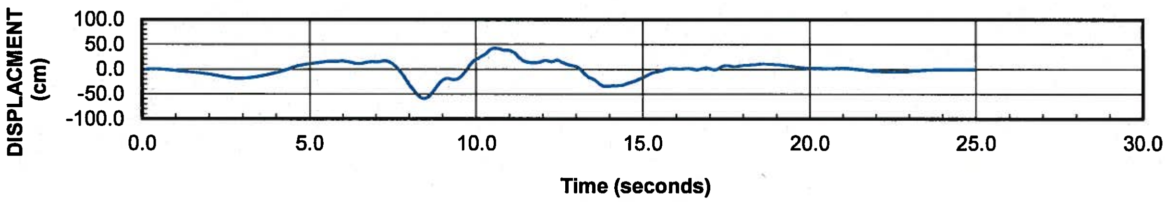
Damping Ratio = 5%

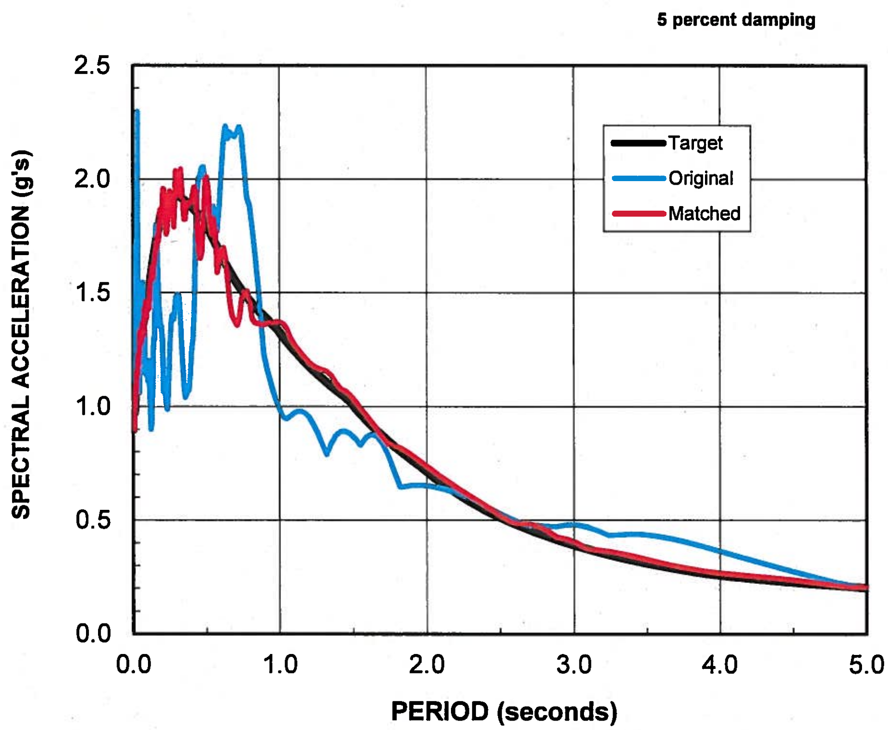
Notes:
1. Estimated V_{s30} = 300 m/s
2. Include average directivity (Abrahamson 2000)

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
COMPARISON OF DETERMINISTIC AND PROBABILISTIC SPECTRA		
Date 07/18/14	Project No. 731630801	Figure 5
LANGAN TREADWELL ROLLO		

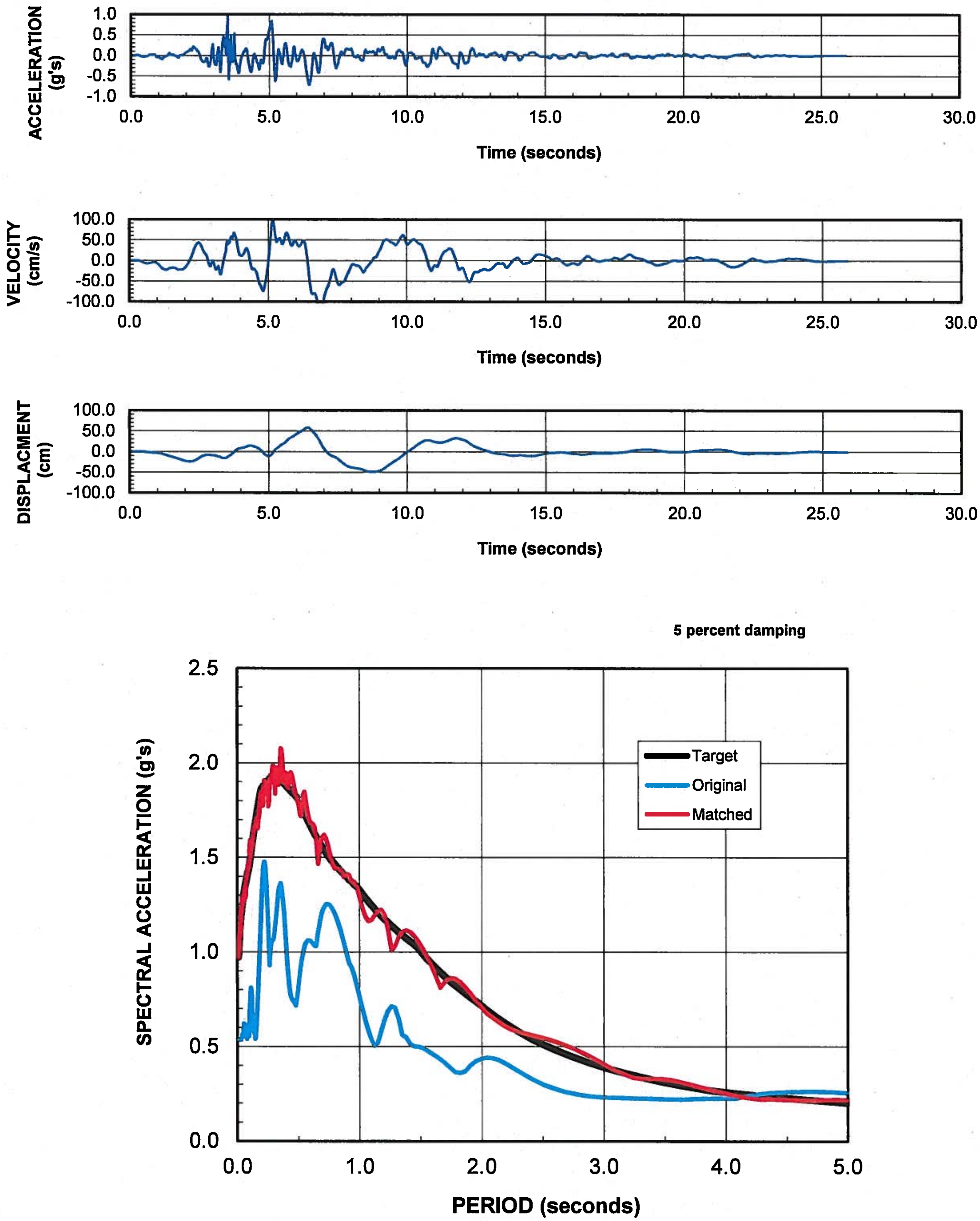




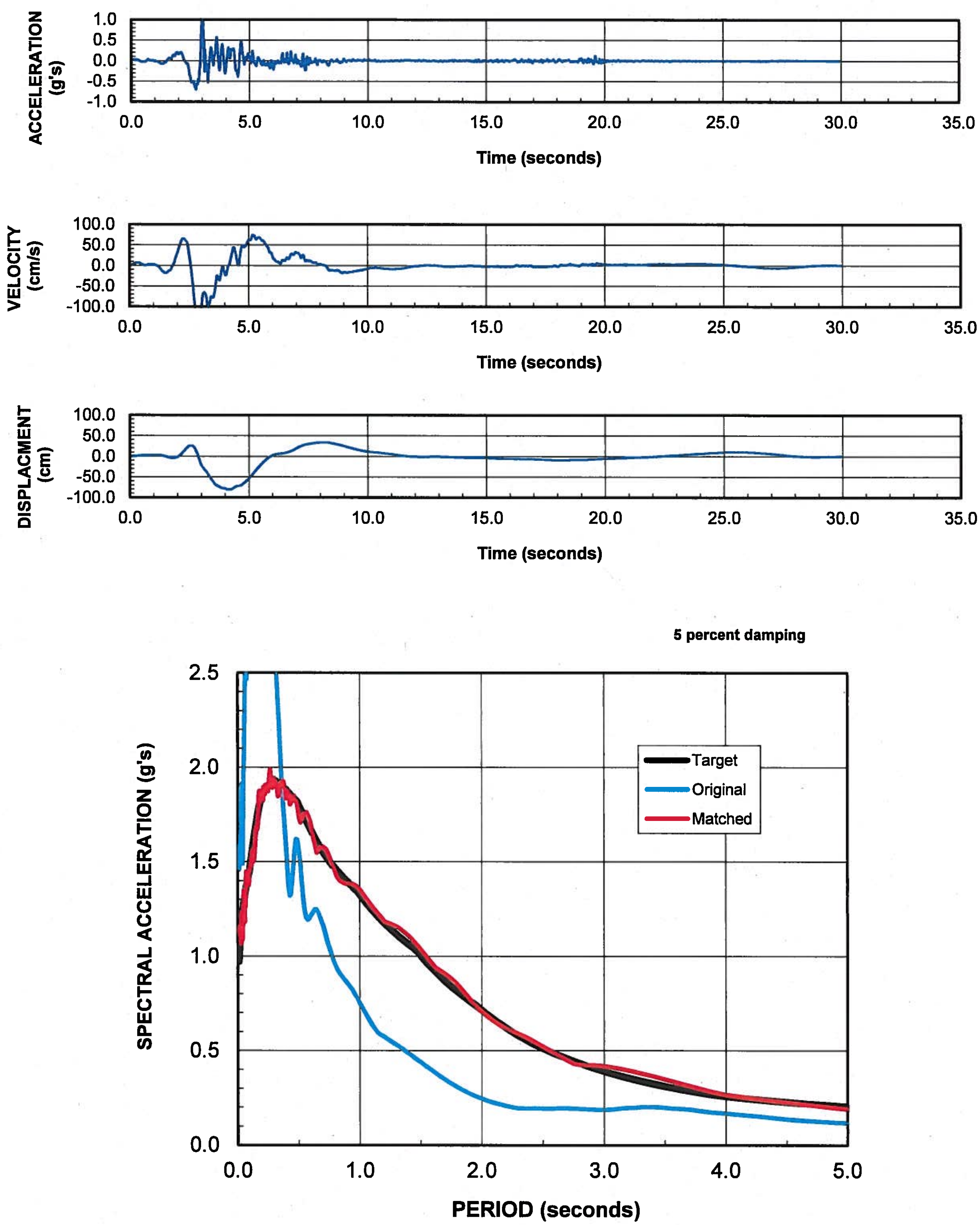




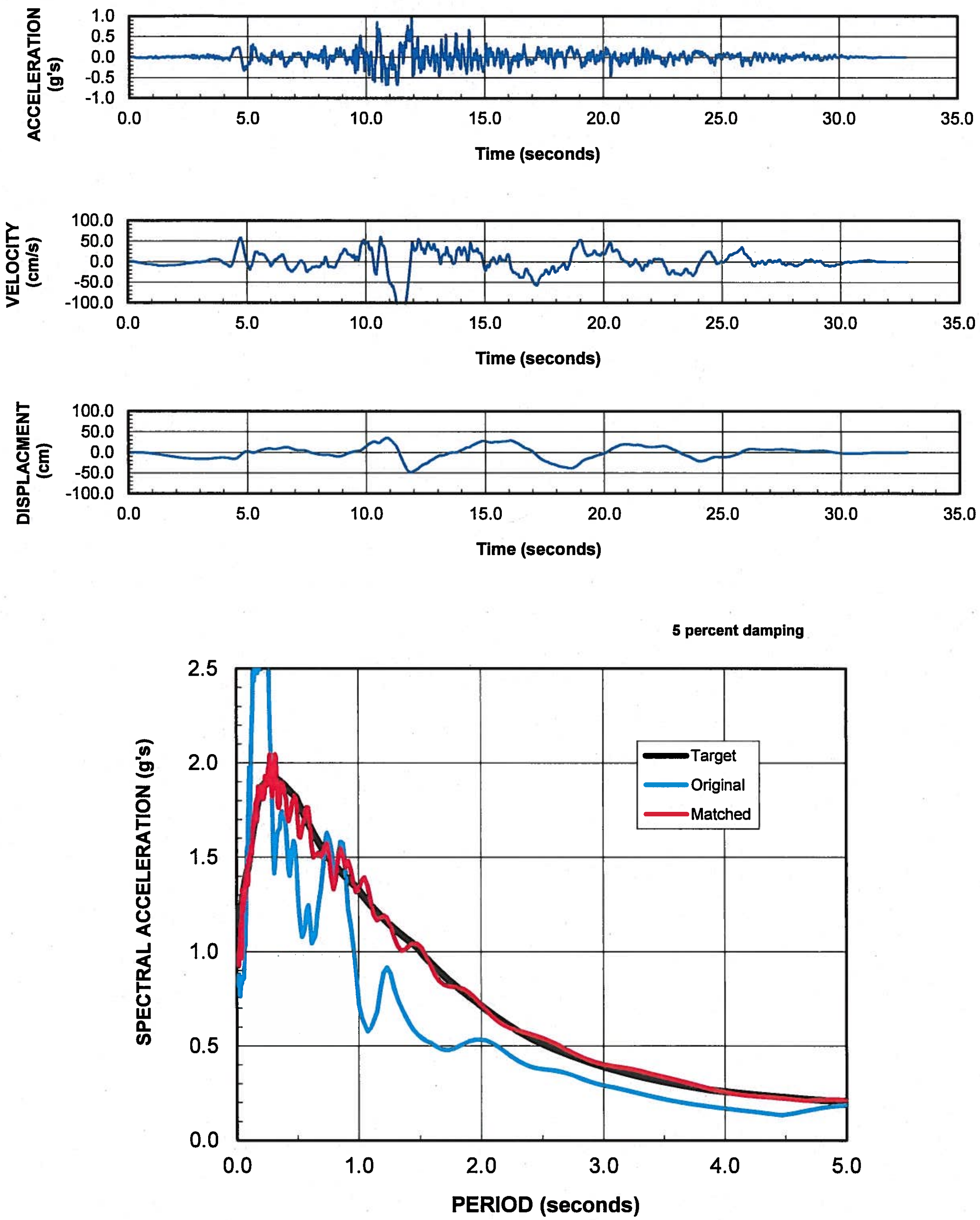
PINE HILL ROAD **REPLACEMENT BRIDGE** Eureka, California	**MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1989 LOMA PRIETA EARTHQUAKE LGPC 0 Deg.**
LANGAN TREADWELL ROLLO	Date 07/16/14 | Project No. 731630801 | Figure 6



PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California	MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1999 DUZCE EARTHQUAKE DUZCE 270 Degs.
LANGAN TREADWELL ROLLO	Date 07/16/14 | Project No. 731630801 | Figure 7



PINE HILL ROAD **REPLACEMENT BRIDGE** Eureka, California	**MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1992 CAPE MENDOCINO EARTHQUAKE MENDOCINO 0 Degs.**
LANGAN TREADWELL ROLLO	Date 07/16/14 | Project No. 731630801 | Figure 8

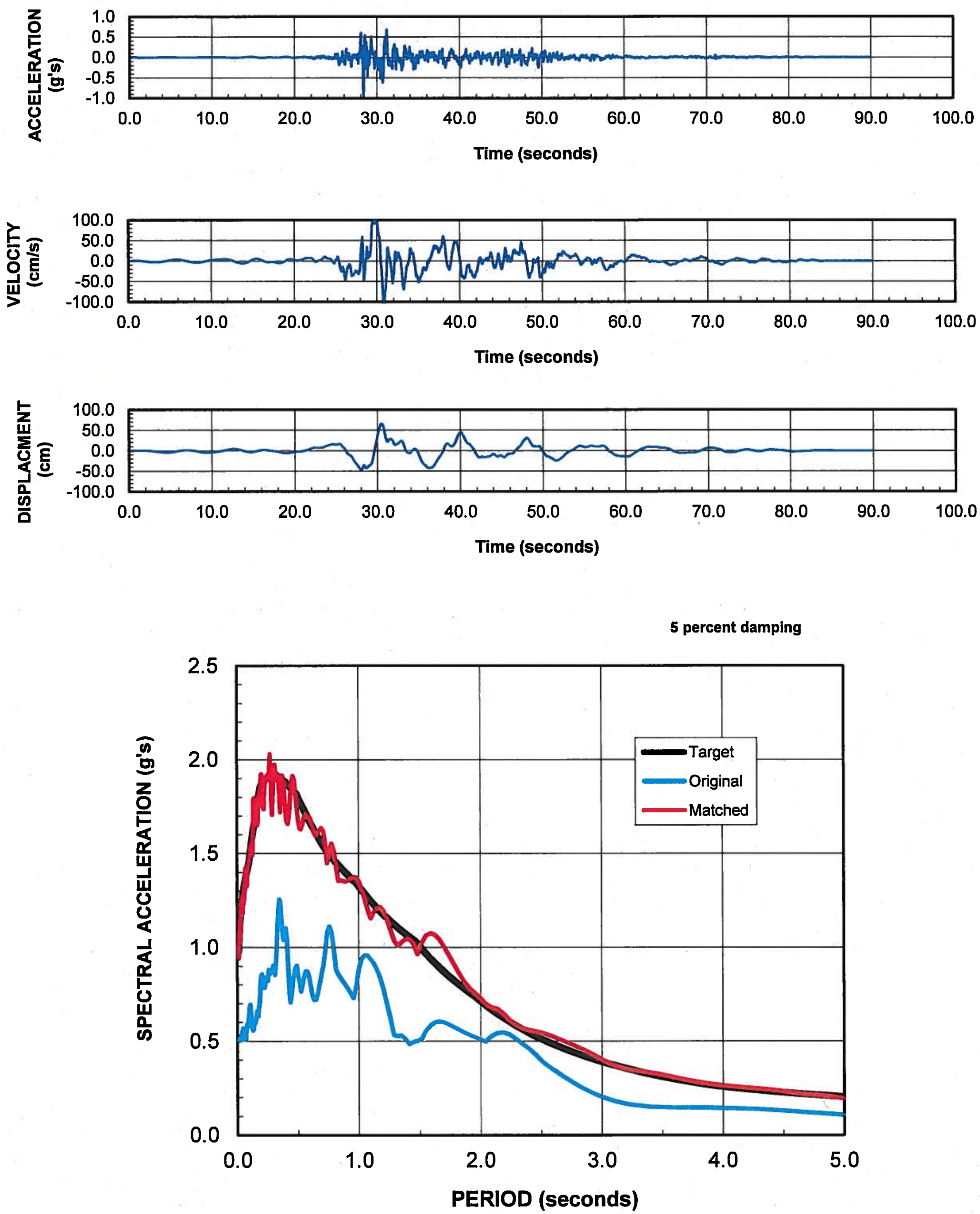


PINE HILL ROAD
REPLACEMENT BRIDGE
Eureka, California

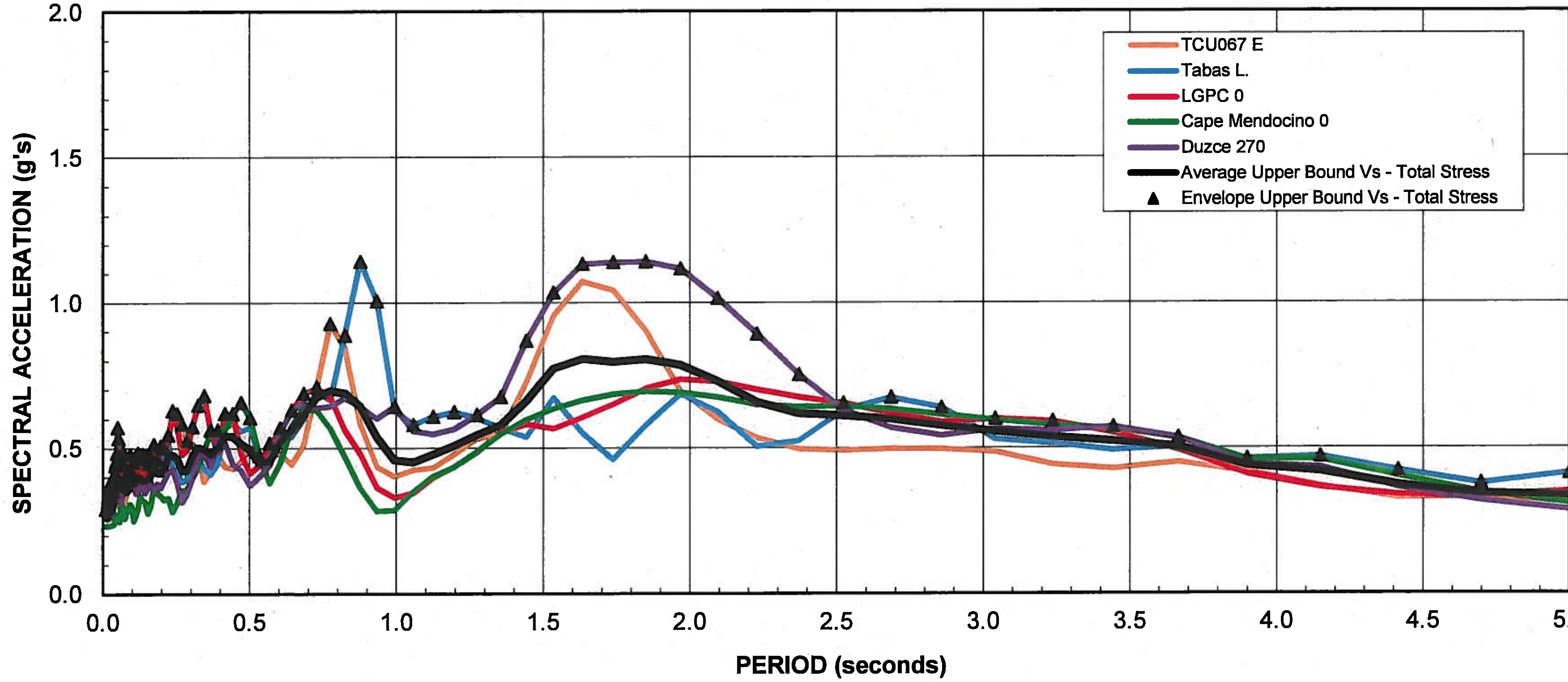
LANGAN TREADWELL ROLLO

MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1979 TABAS EARTHQUAKE TABAS L

Date 07/16/14	Project No. 731630801	Figure 9

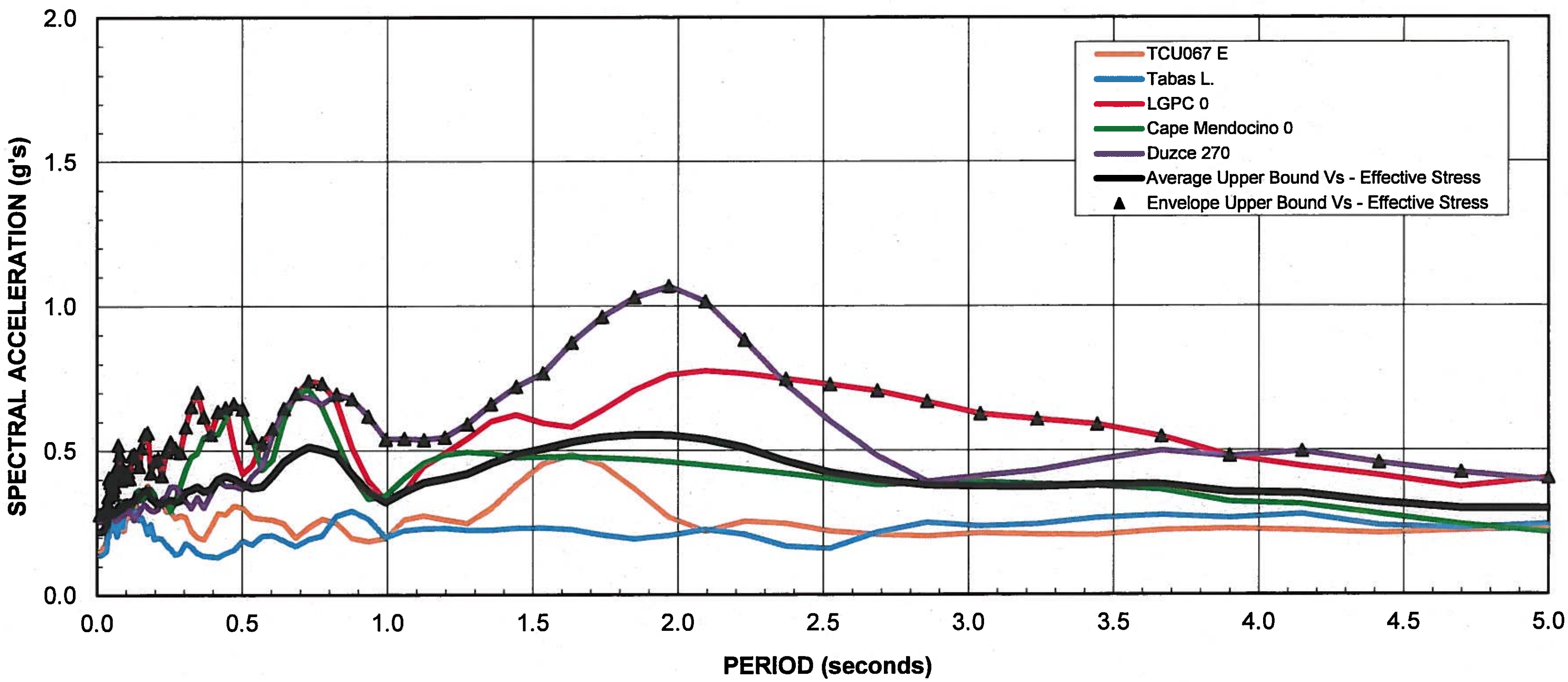


PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California	MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1999 CHI CHI EARTHQUAKE TCU 067 E		
LANGAN TREADWELL ROLLO	Date 07/16/14	Project No. 731630801	Figure 10



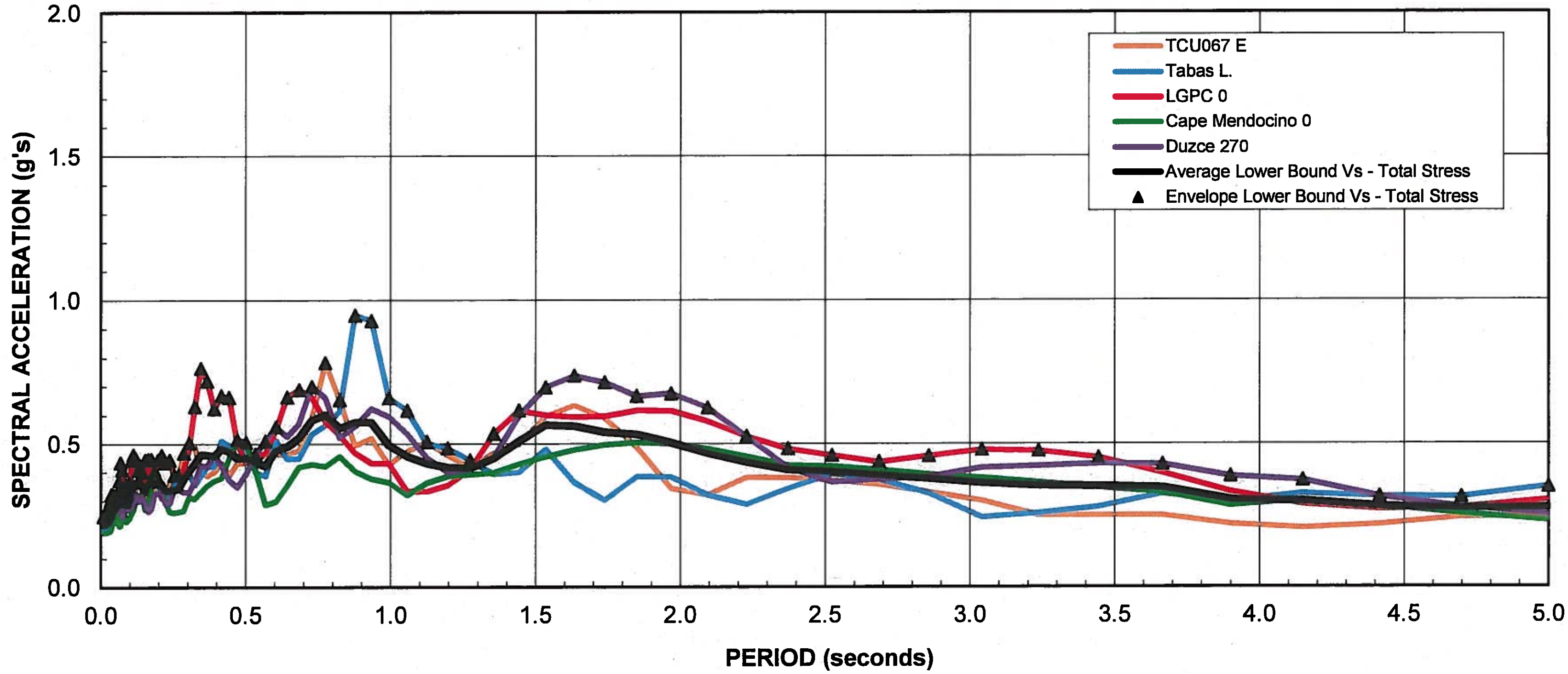
Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF TOTAL STRESS NONLINEAR GROUND RESPONSE ANALYSIS UPPER BOUND V_s PROFILE		
Date 07/18/14	Project No. 731630801	Figure 11
LANGAN TREADWELL ROLLO		



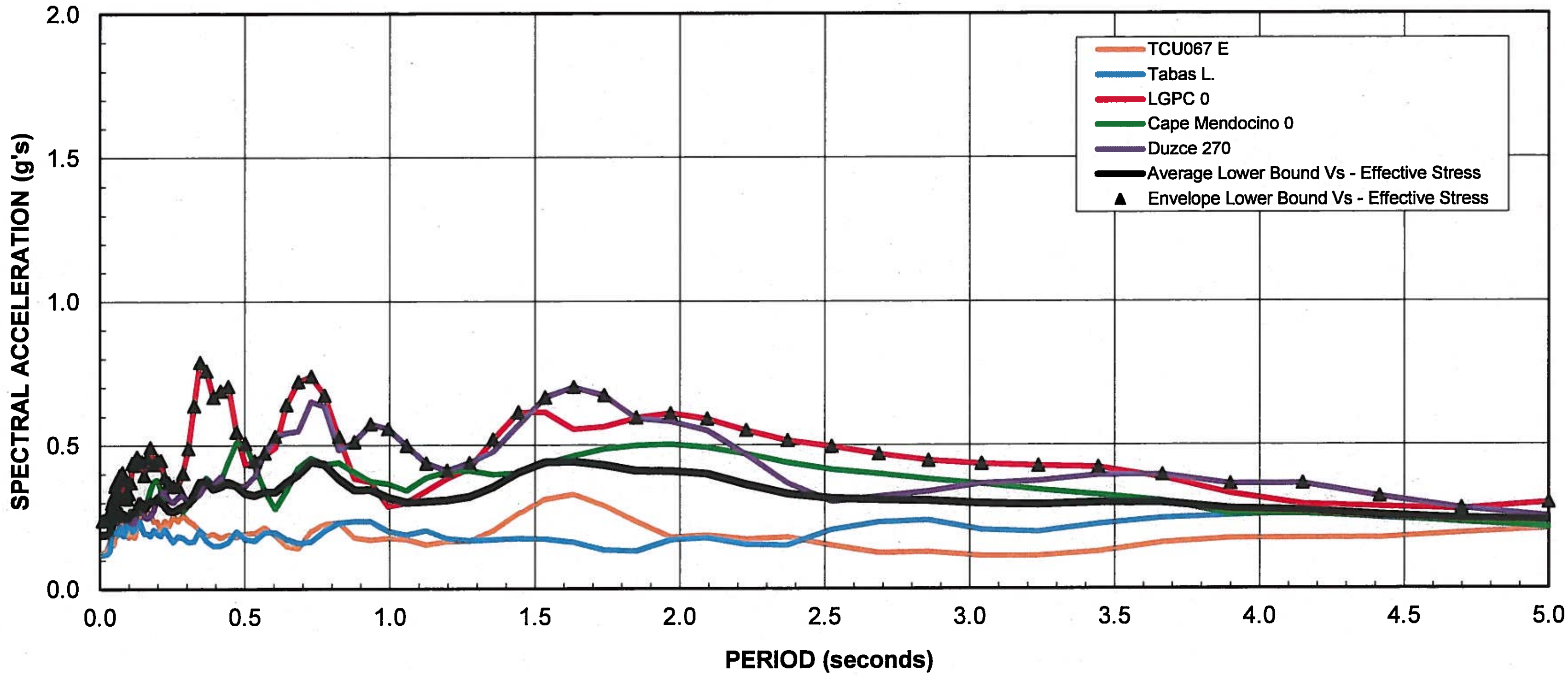
Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF EFFECTIVE STRESS WITH PORE PRESSURE GENERATION AND DISSIPATION NONLINEAR GROUND RESPONSE ANALYSIS UPPER BOUND Vs PROFILE		
Date 07/18/14	Project No. 731630801	Figure 12
LANGAN TREADWELL ROLLO		



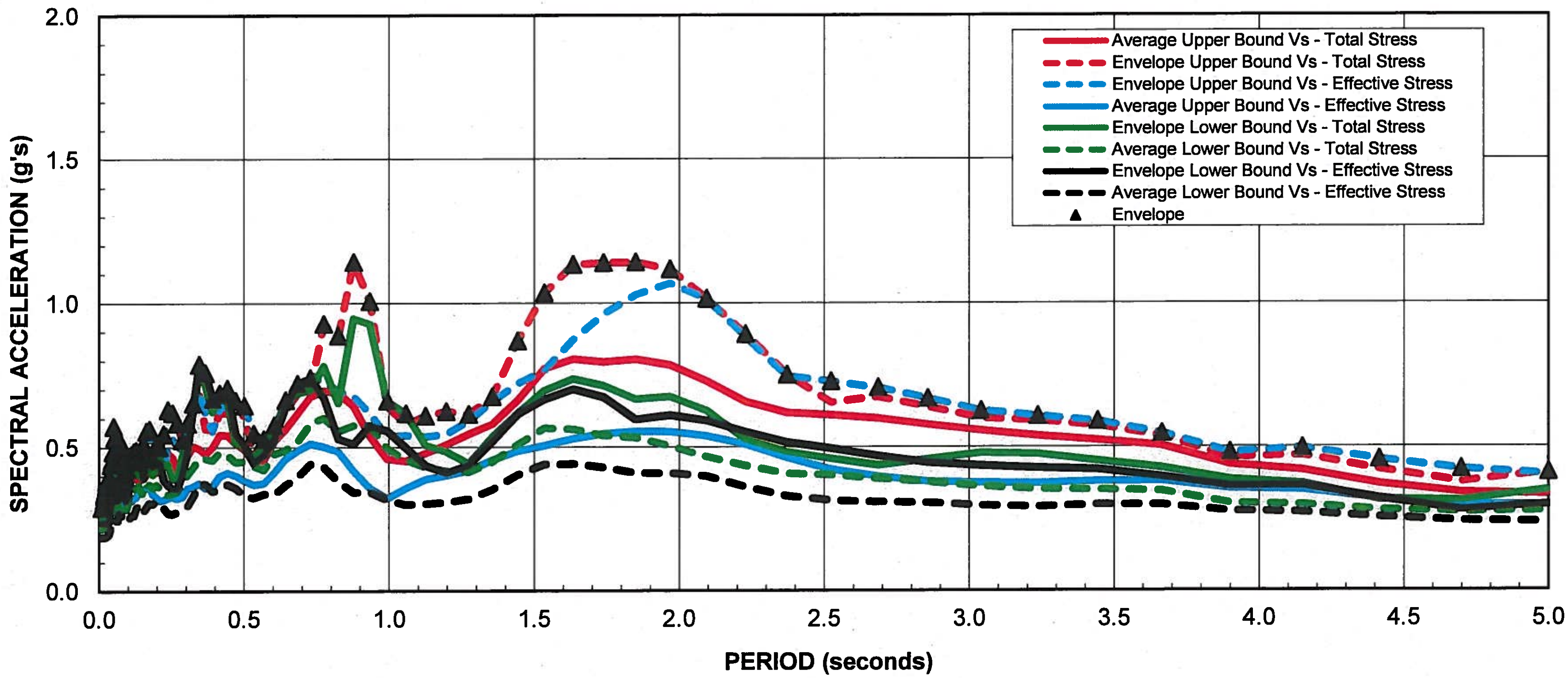
Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF TOTAL STRESS NONLINEAR GROUND RESPONSE ANALYSIS LOWER BOUND V_s PROFILE		
Date 07/18/14	Project No. 731630801	Figure 13
LANGAN TREADWELL ROLLO		



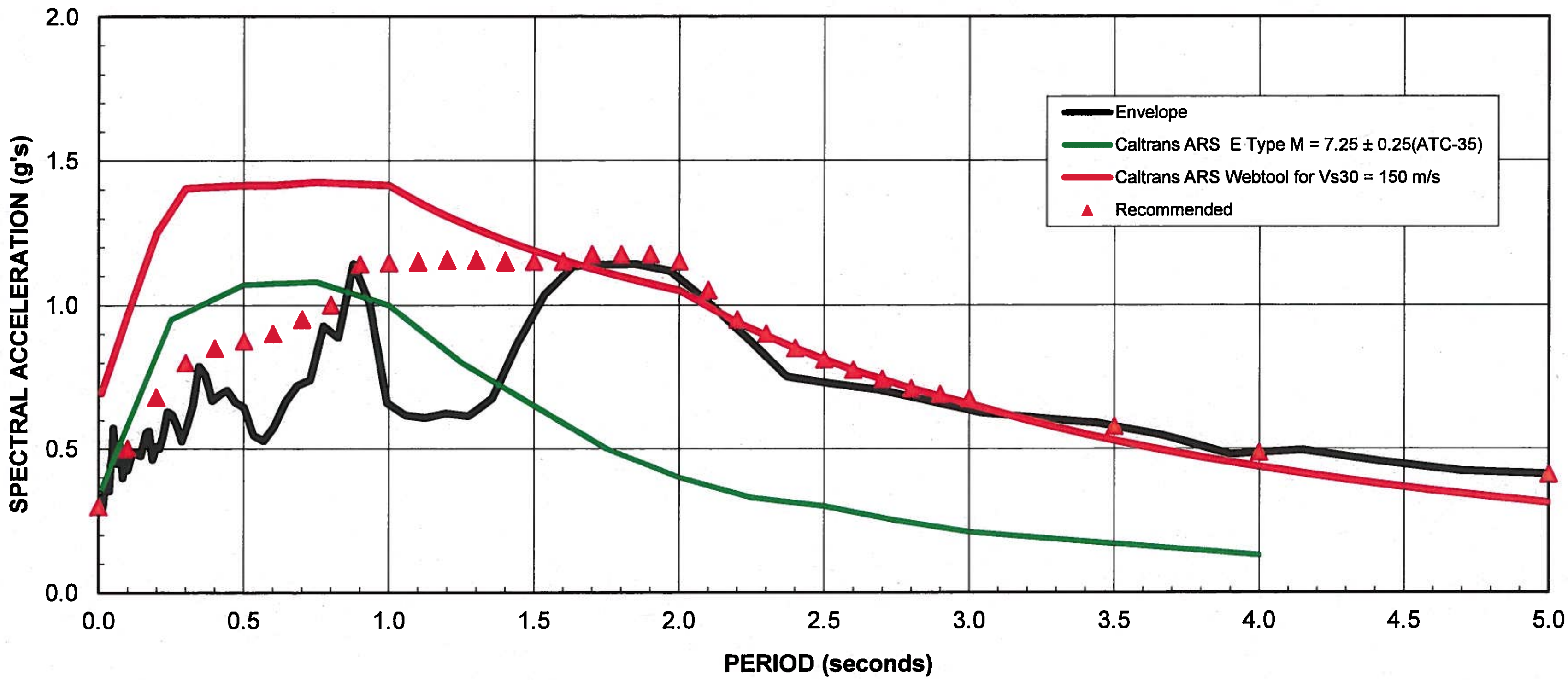
Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF EFFECTIVE STRESS WITH PORE PRESSURE GENERATION AND DISSIPATION NONLINEAR GROUND RESPONSE ANALYSIS LOWER BOUND Vs PROFILE		
Date 07/18/14	Project No. 731630801	Figure 14
LANGAN TREADWELL ROLLO		



Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
COMARISON OF RESULTS OF TOTAL AND EFFECTIVE STRESS NONLINEAR GROUND RESPONSE ANALYSES		
Date 07/18/14	Project No. 731630801	Figure 15
LANGAN TREADWELL ROLLO		



Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
COMARISON OF RESULTS OF NONLINEAR GROUND RESPONSE ANALYSIS WITH CALTRANS ARS SPECTRA		
Date 07/03/14	Project No. 731630801	Figure 16
LANGAN TREADWELL ROLLO		

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Liquefaction Analysis Reports

GeoLogismiki
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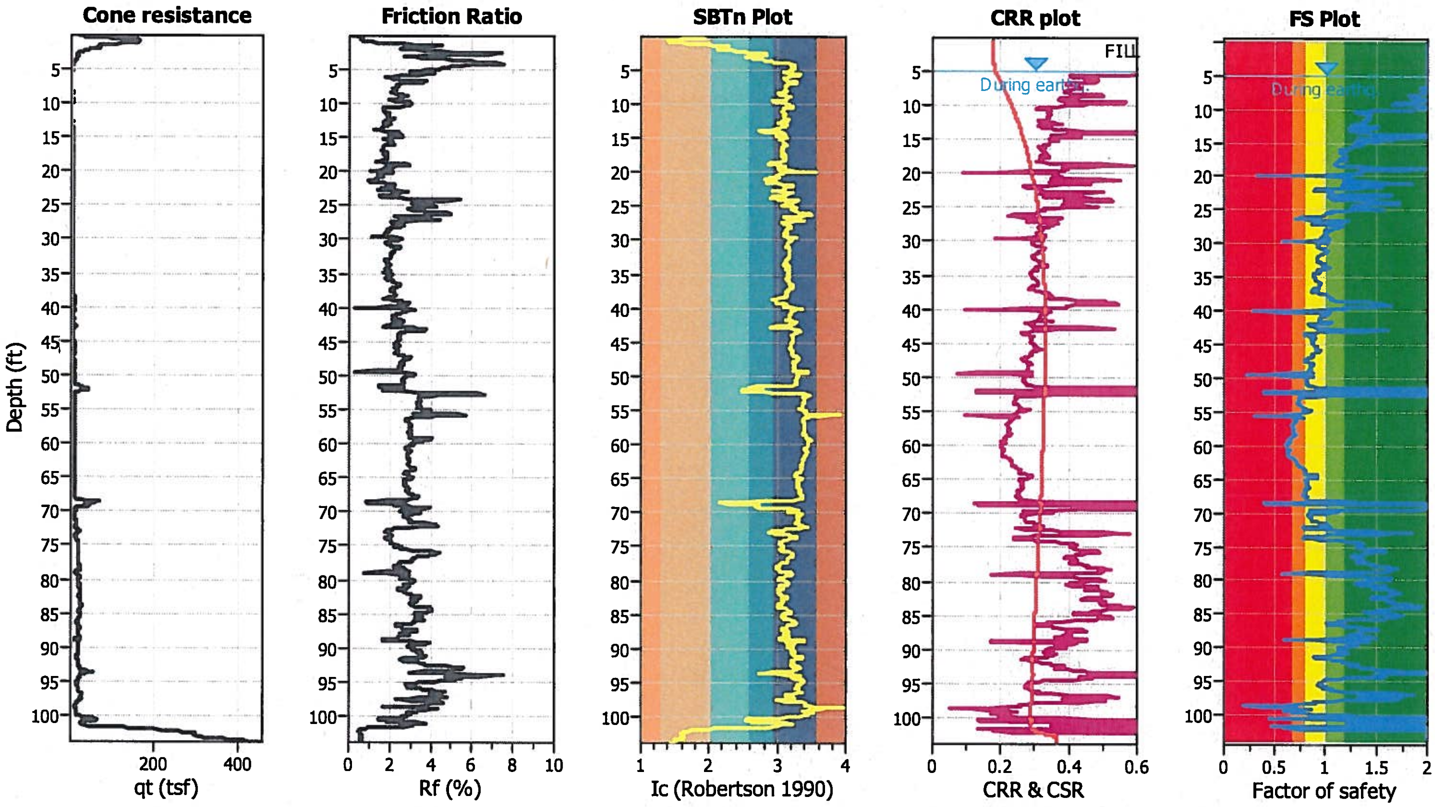
LIQUEFACTION ANALYSIS REPORT

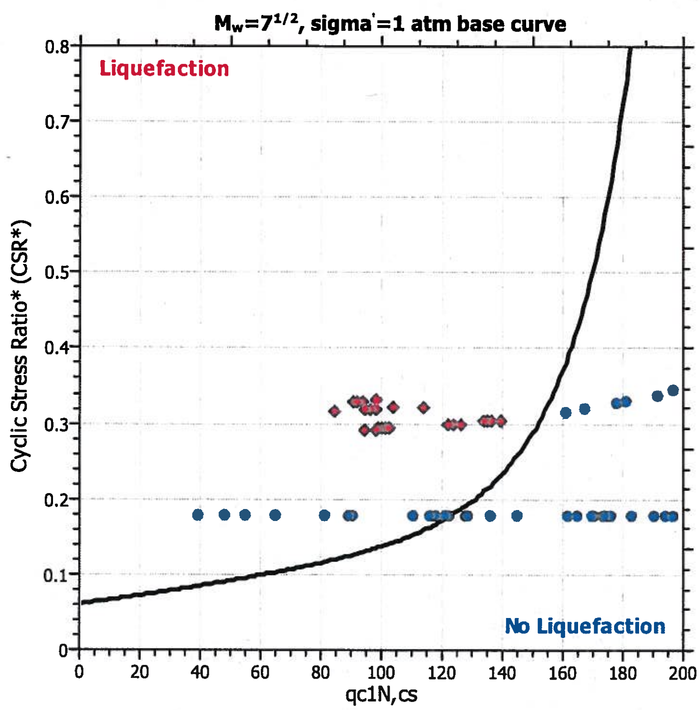
Project title : Pine Hill Road Bridge **Location : Eureka, CA**

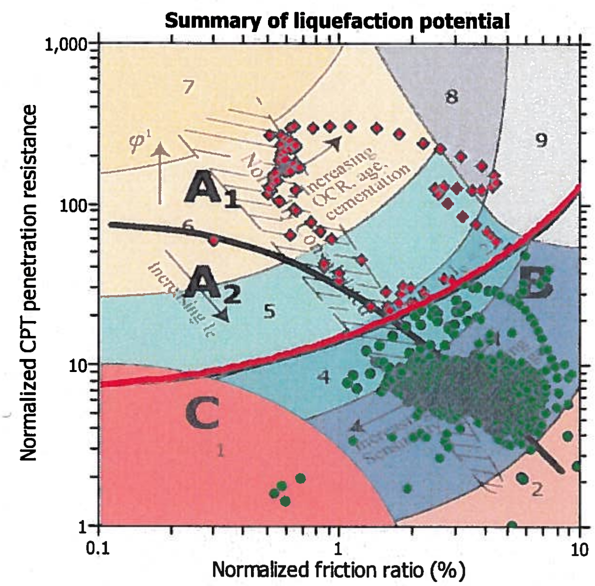
CPT file : shn pine hill1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 ft	Use fill:	Yes	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 ft	Fill height:	3.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	125.00 lb/ft³	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	I&B, 2008
Peak ground acceleration:	0.30	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

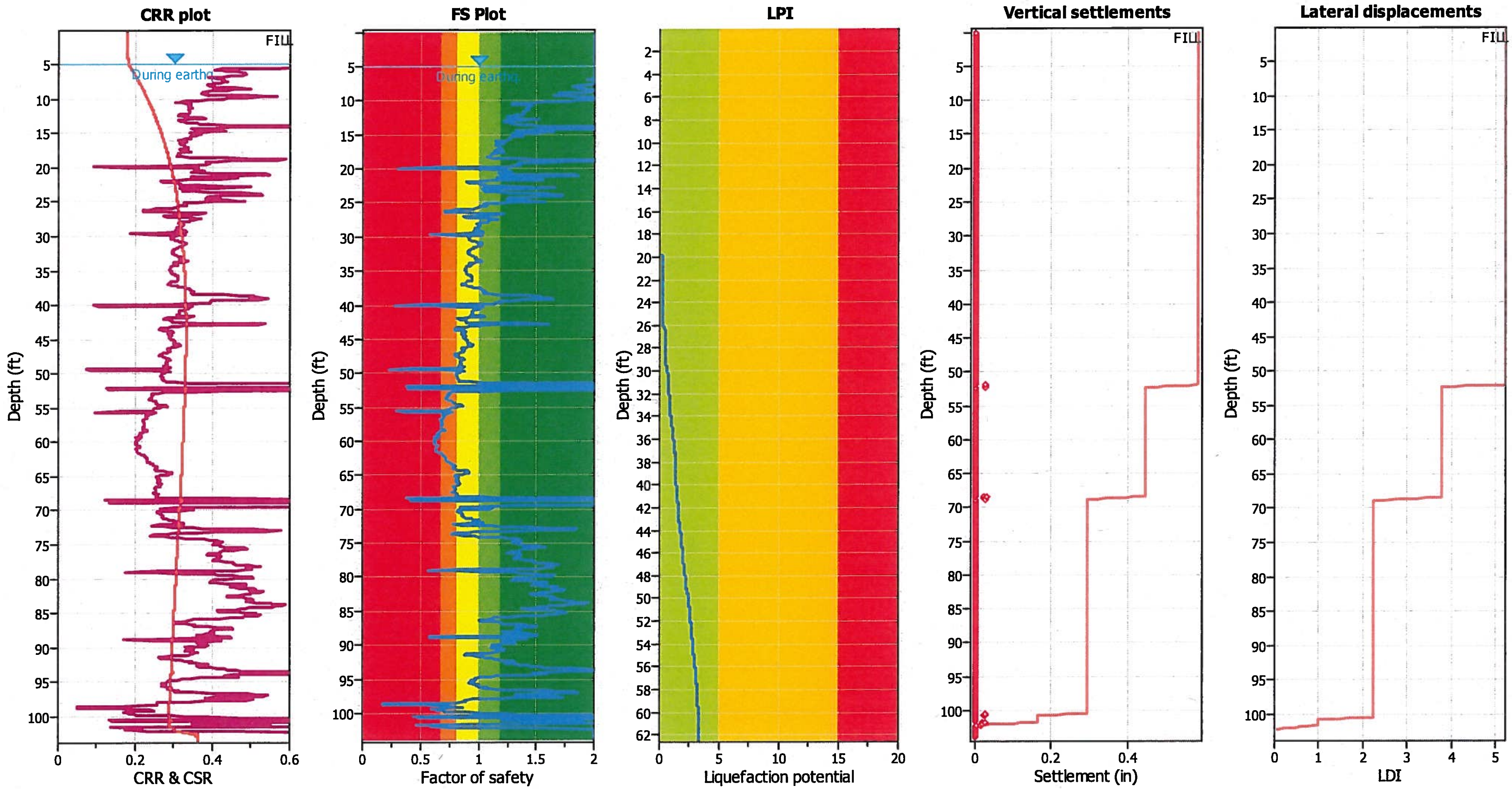






Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	8.00 ft	Fill weight:	125.00 lb/ft³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.30	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	3.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

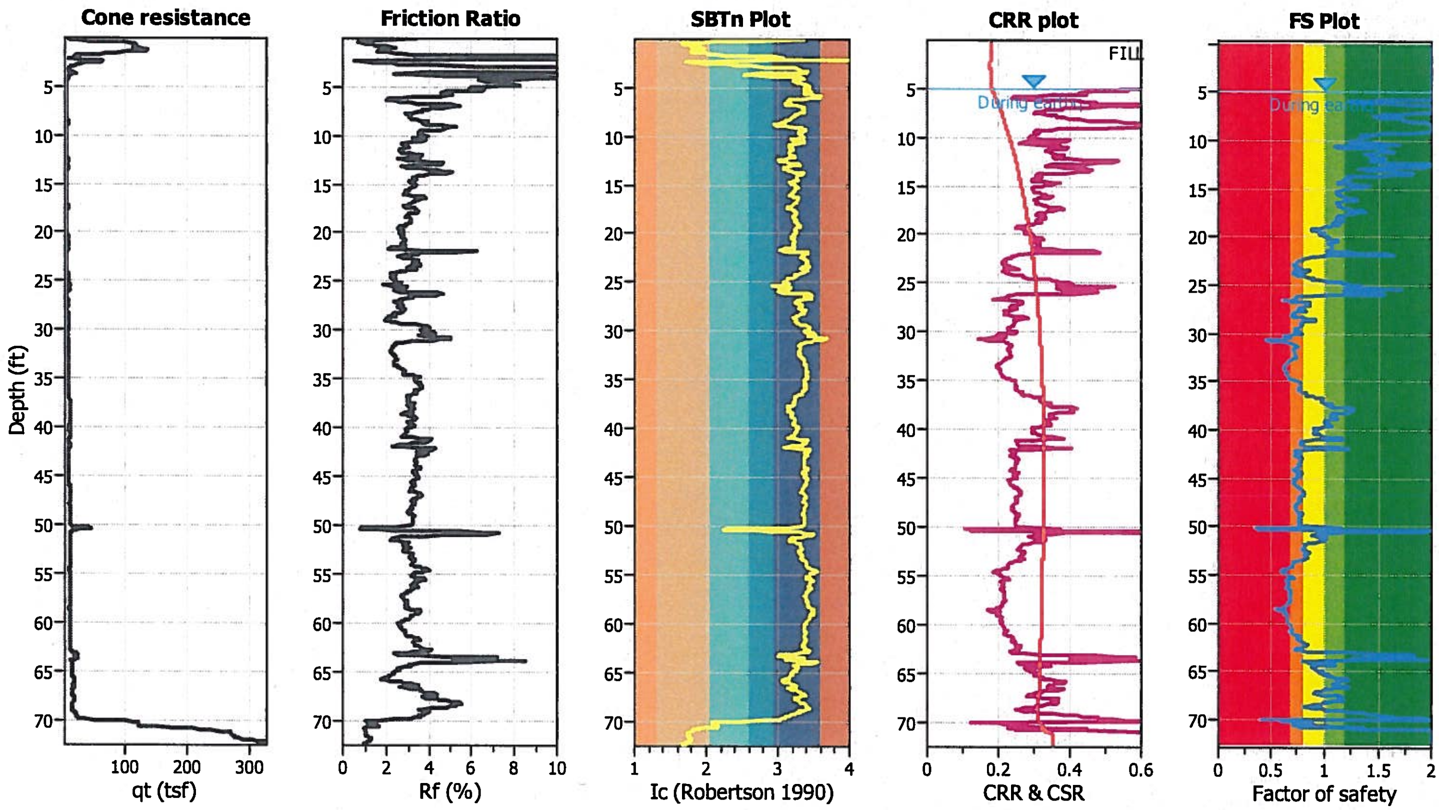
LIQUEFACTION ANALYSIS REPORT

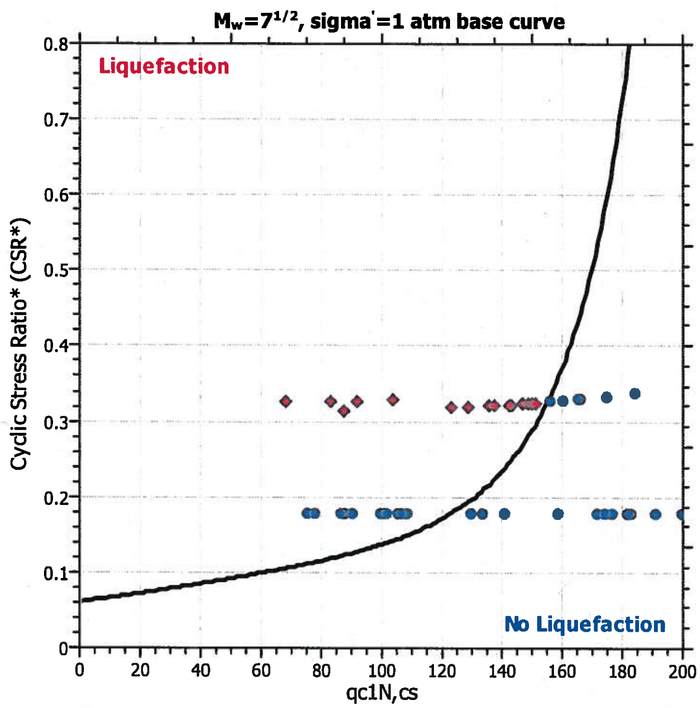
Project title : Pine Hill Road Bridge **Location : Eureka, CA**

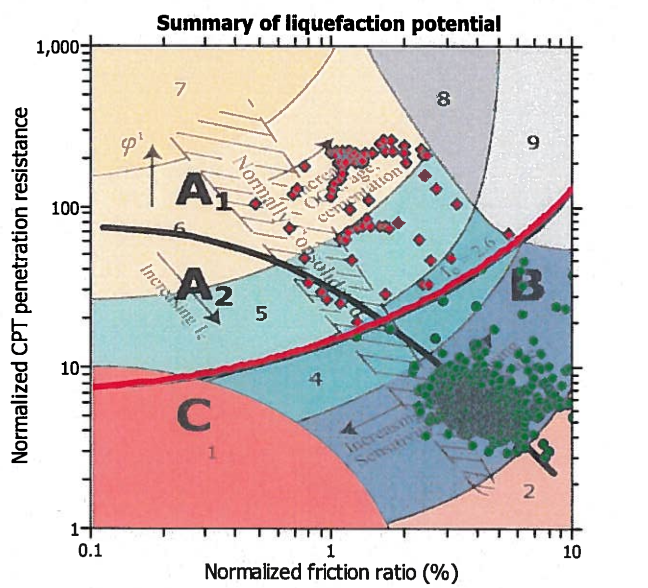
CPT file : shn pine hill2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 ft	Use fill:	Yes	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 ft	Fill height:	3.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	125.00 lb/ft³	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	I&B, 2008
Peak ground acceleration:	0.30	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

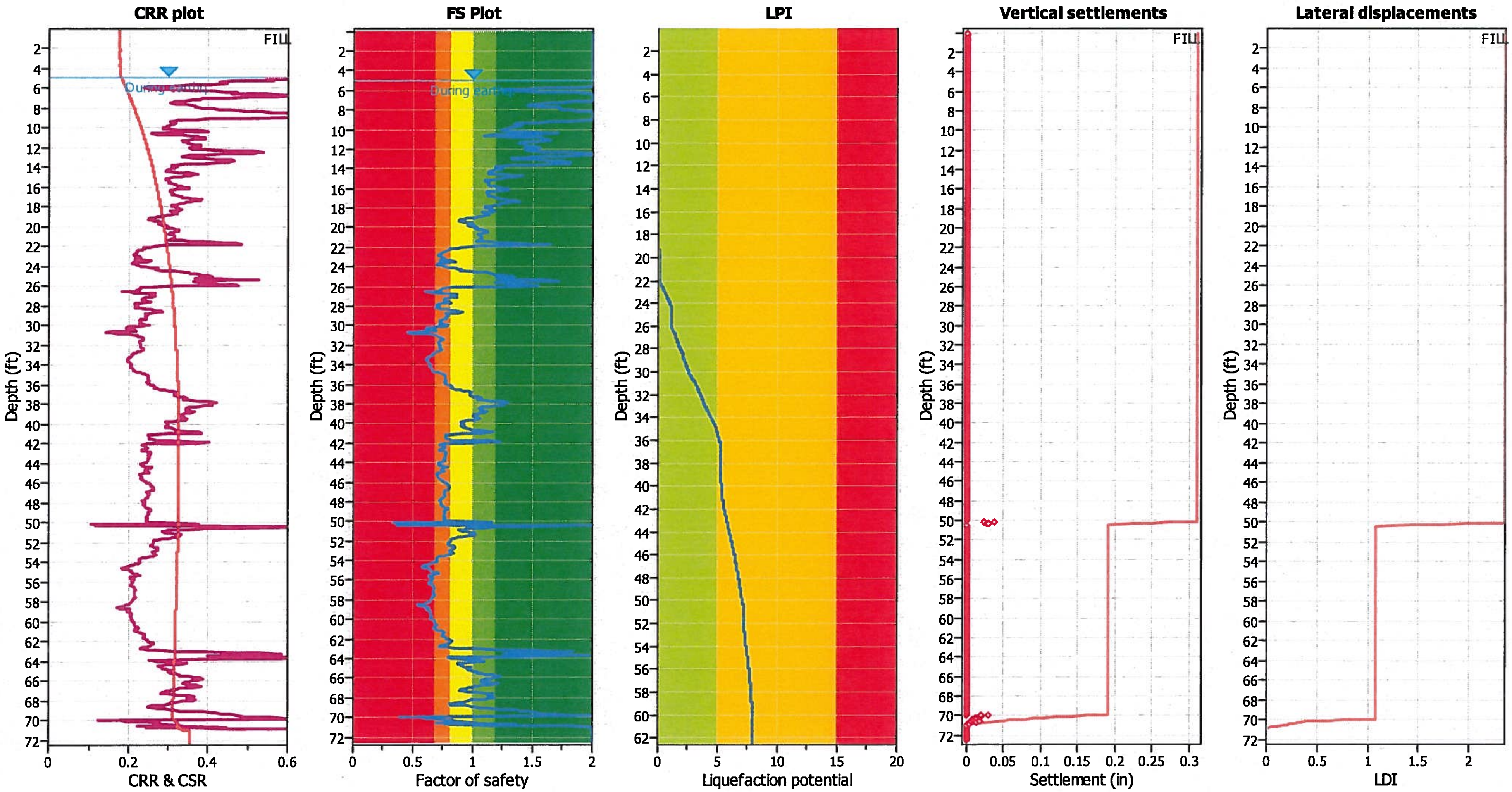






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	8.00 ft	Fill weight:	125.00 lb/ft³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.30	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	3.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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http://www.geologismiki.gr

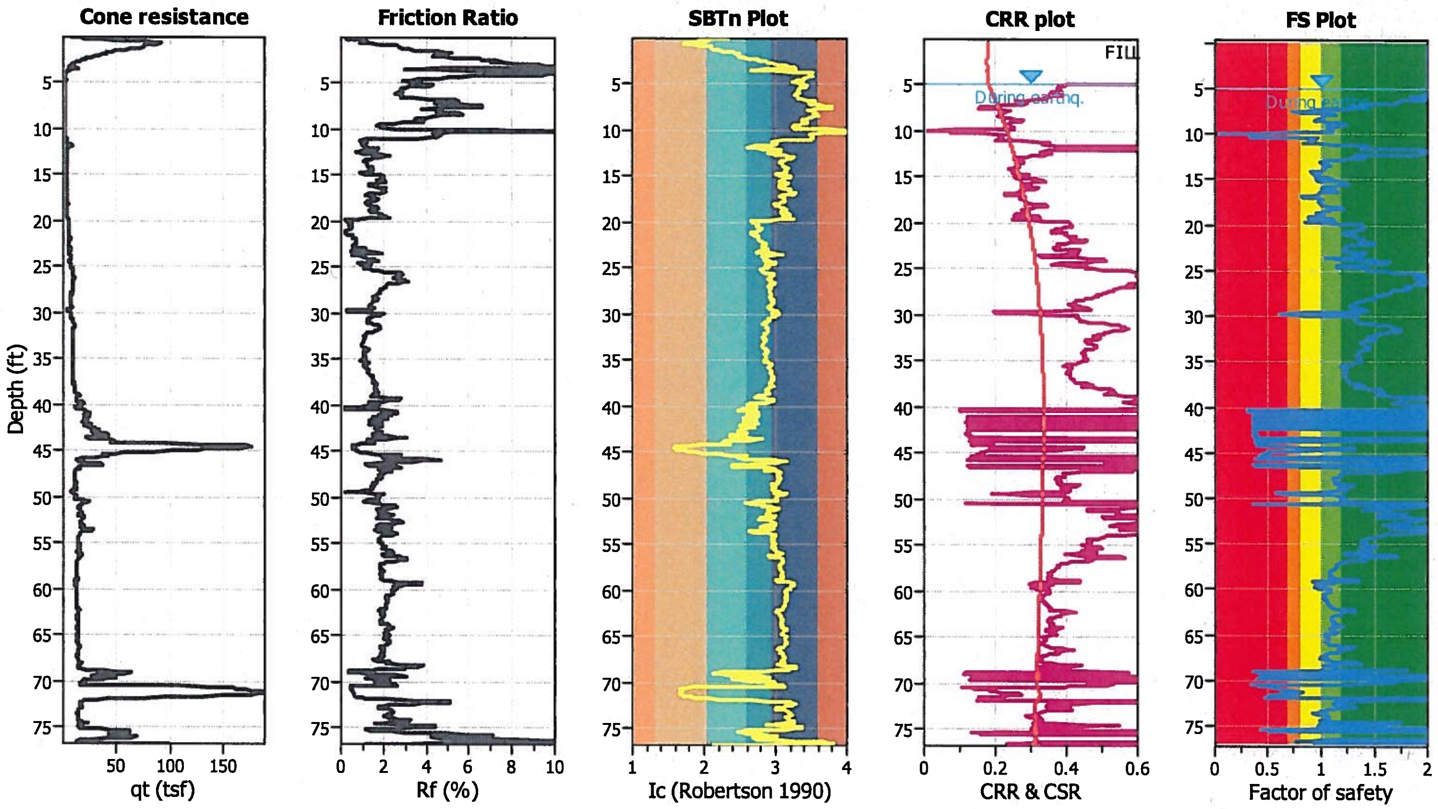
LIQUEFACTION ANALYSIS REPORT

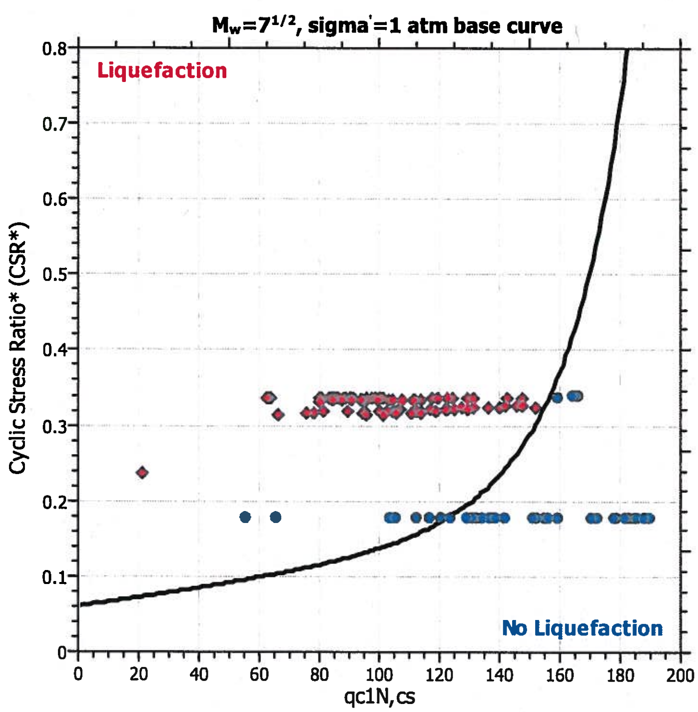
Project title : Pine Hill Road Bridge **Location : Eureka, CA**

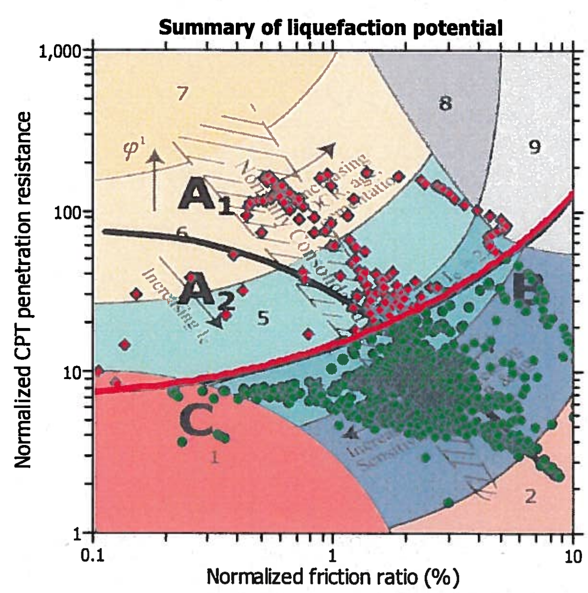
CPT file : shn pine hill3

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 ft	Use fill:	Yes	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 ft	Fill height:	3.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	125.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	I&B, 2008
Peak ground acceleration:	0.30	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

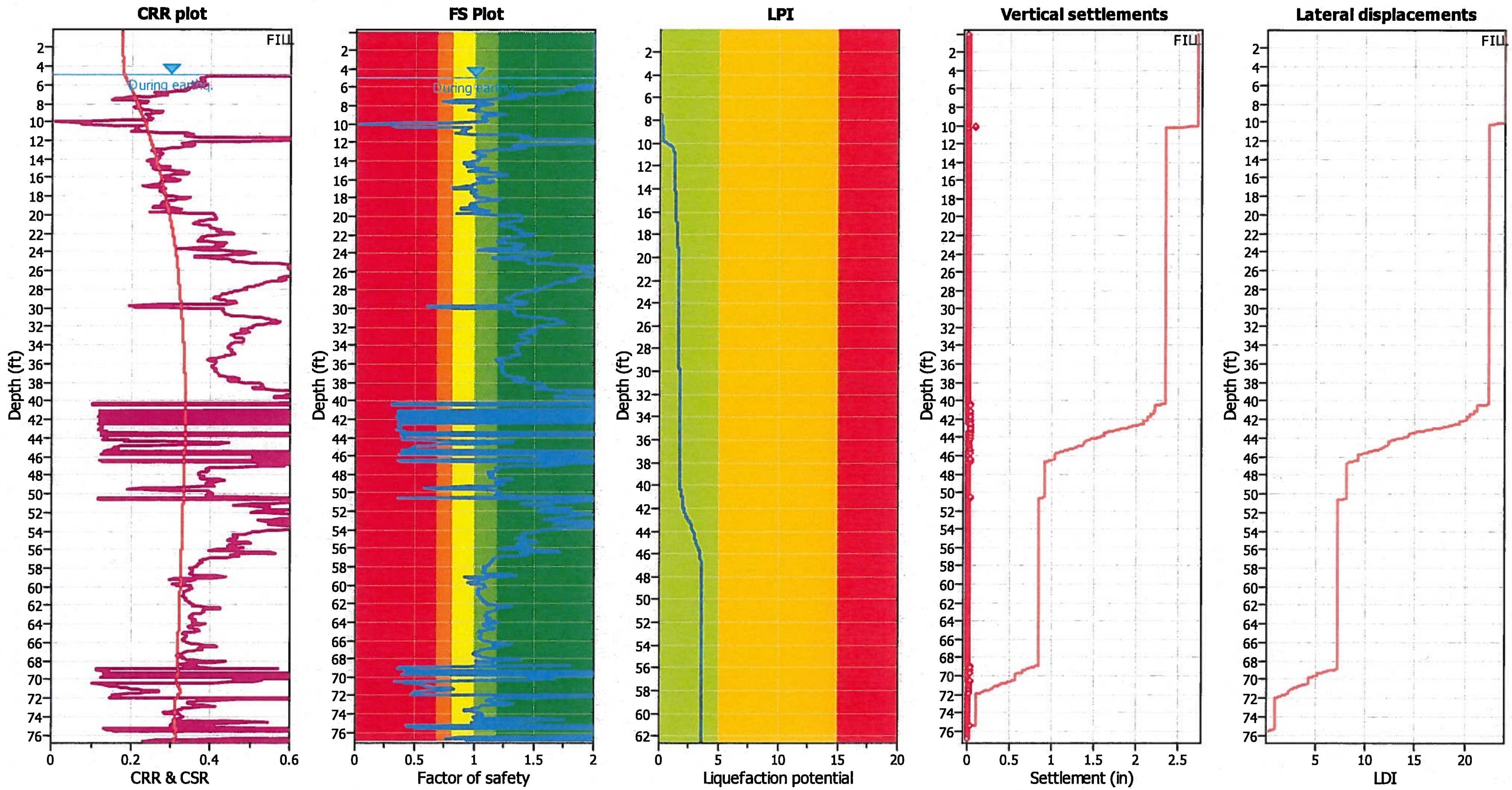






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	8.00 ft	Fill weight:	125.00 lb/ft³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.30	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	3.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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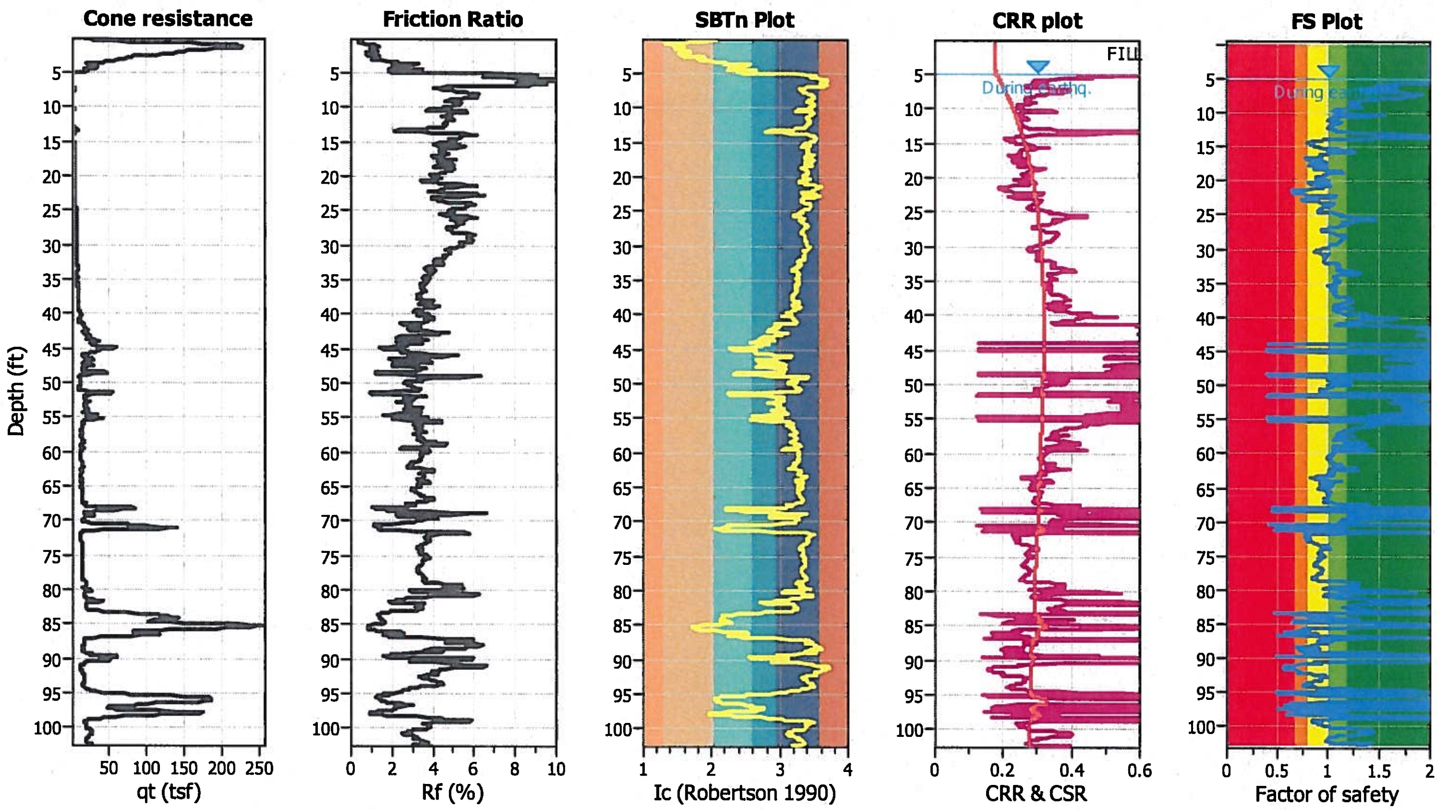
LIQUEFACTION ANALYSIS REPORT

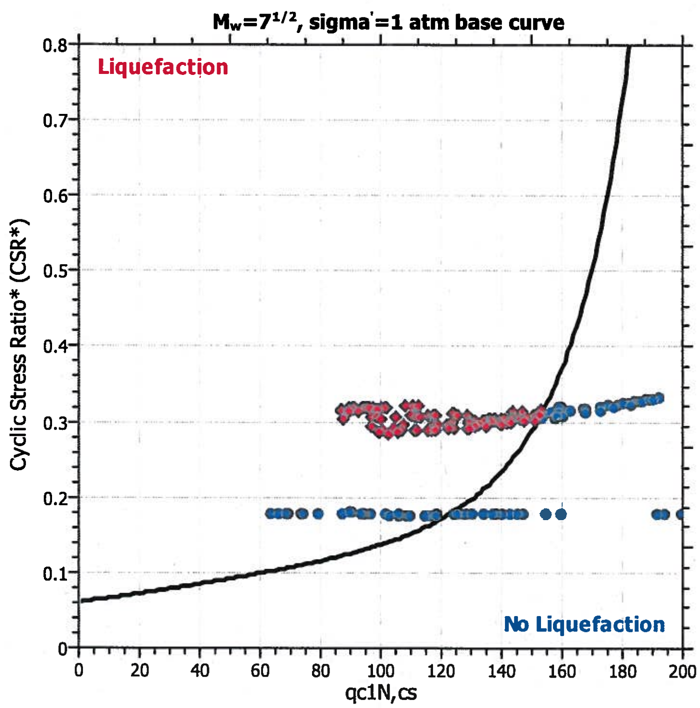
Project title : Pine Hill Road Bridge **Location : Eureka, CA**

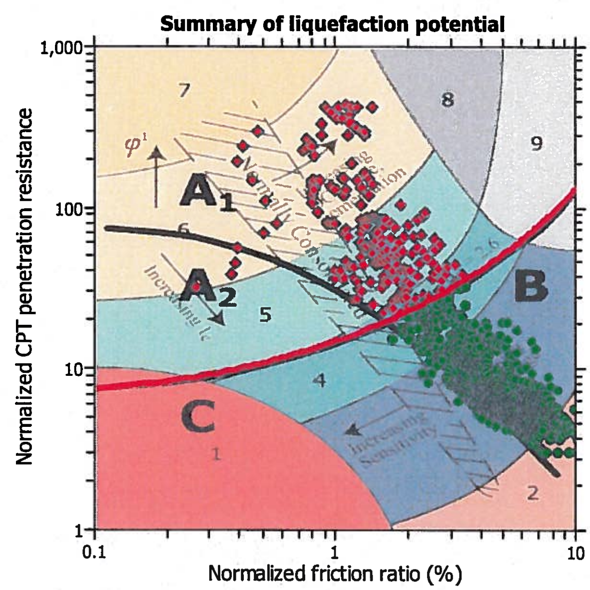
CPT file : shn pine hill4

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 ft	Use fill:	Yes	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 ft	Fill height:	3.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	125.00 lb/ft³	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	I&B, 2008
Peak ground acceleration:	0.30	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

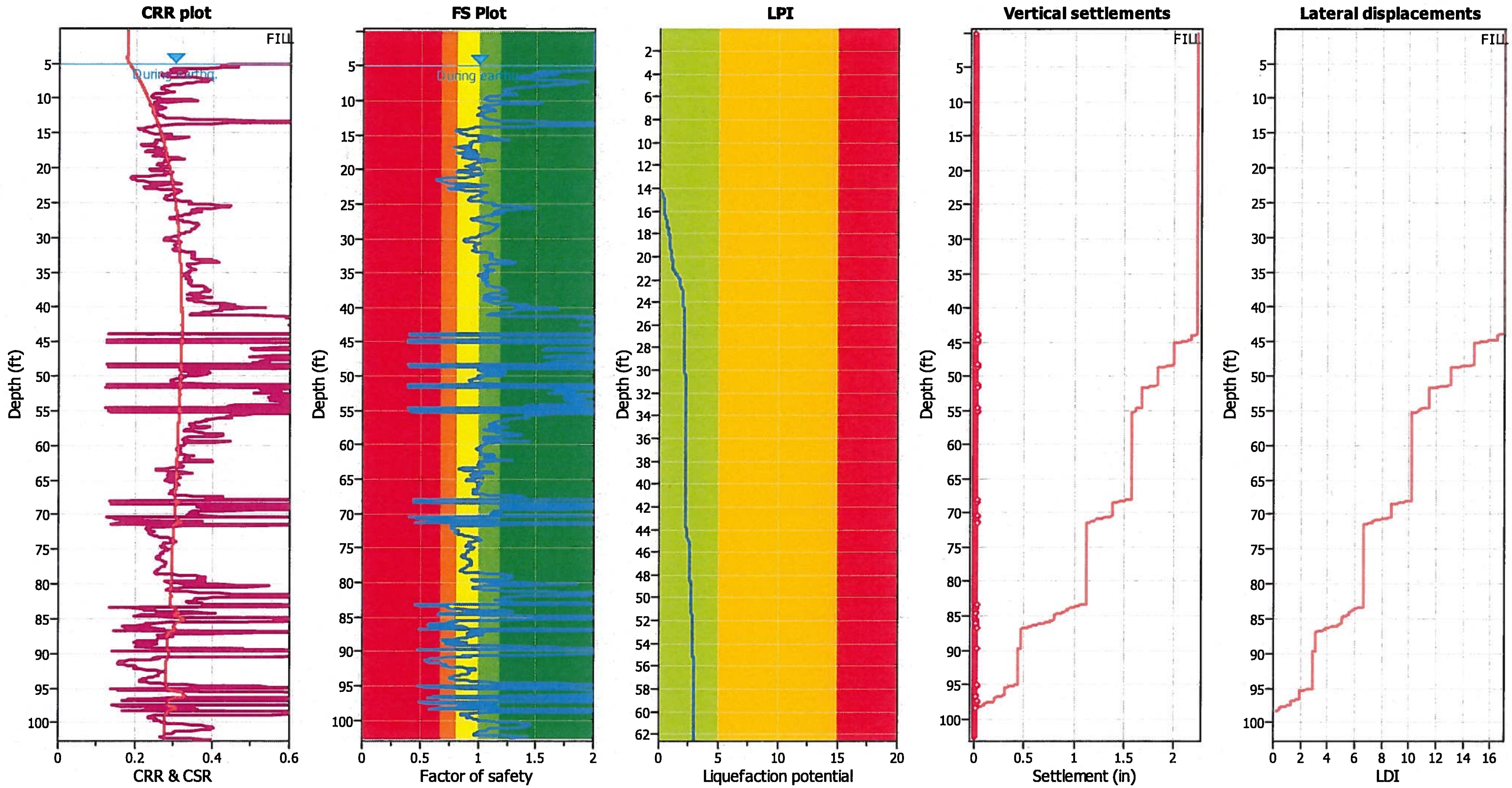






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	8.00 ft	Fill weight:	125.00 lb/ft³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.30	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	3.00 ft	Limit depth:	N/A

F.S. color scheme

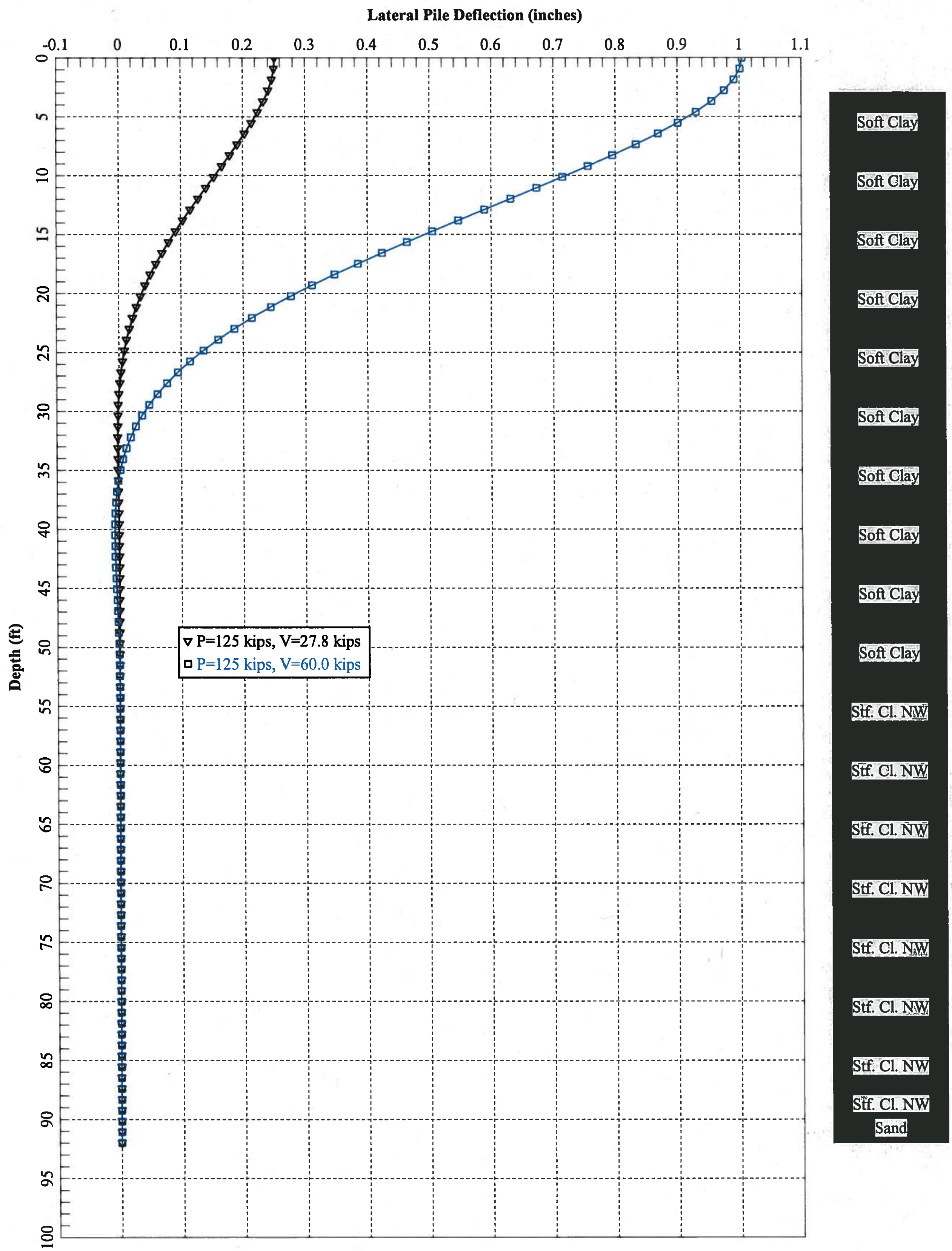
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

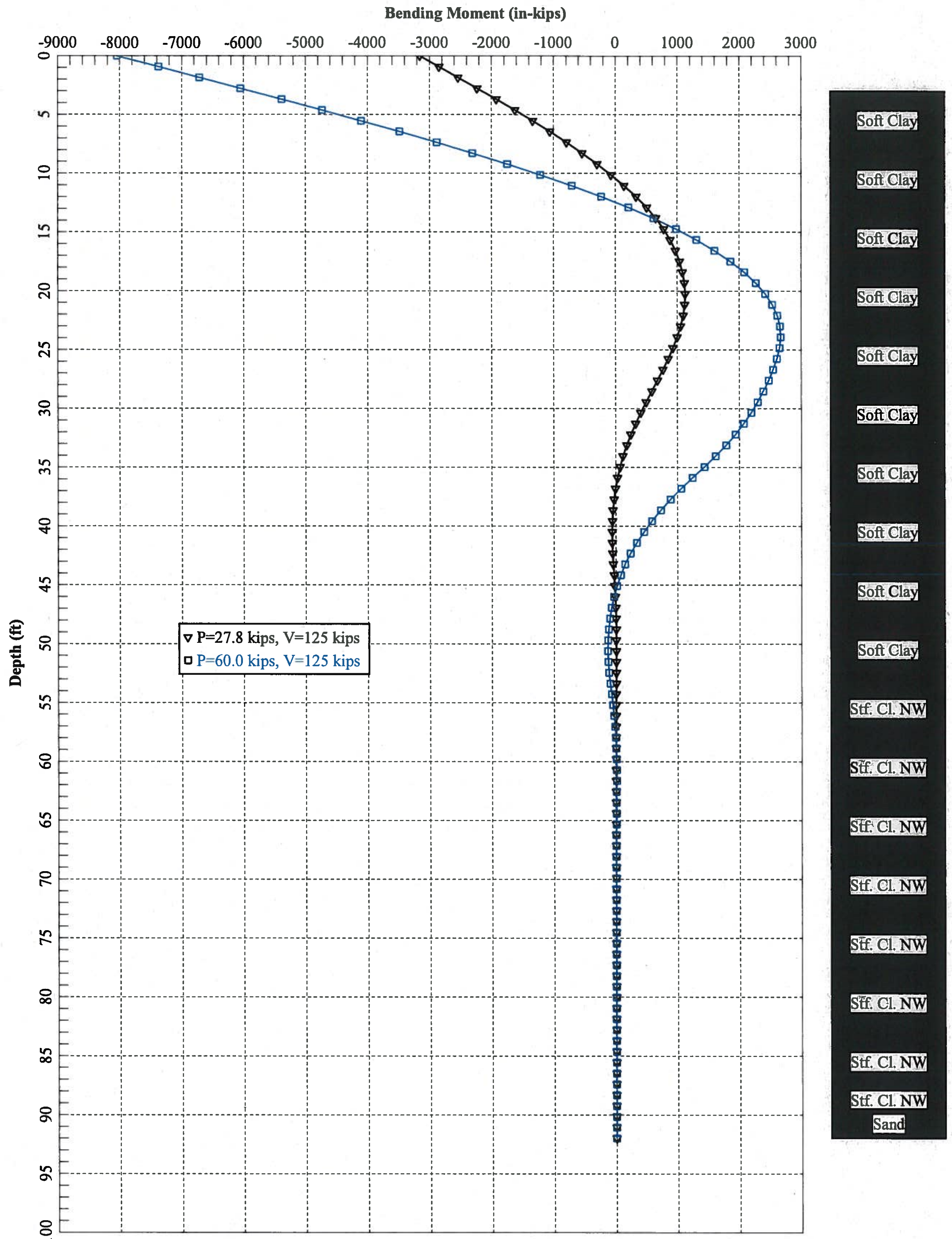
- Very high risk
- High risk
- Low risk

E

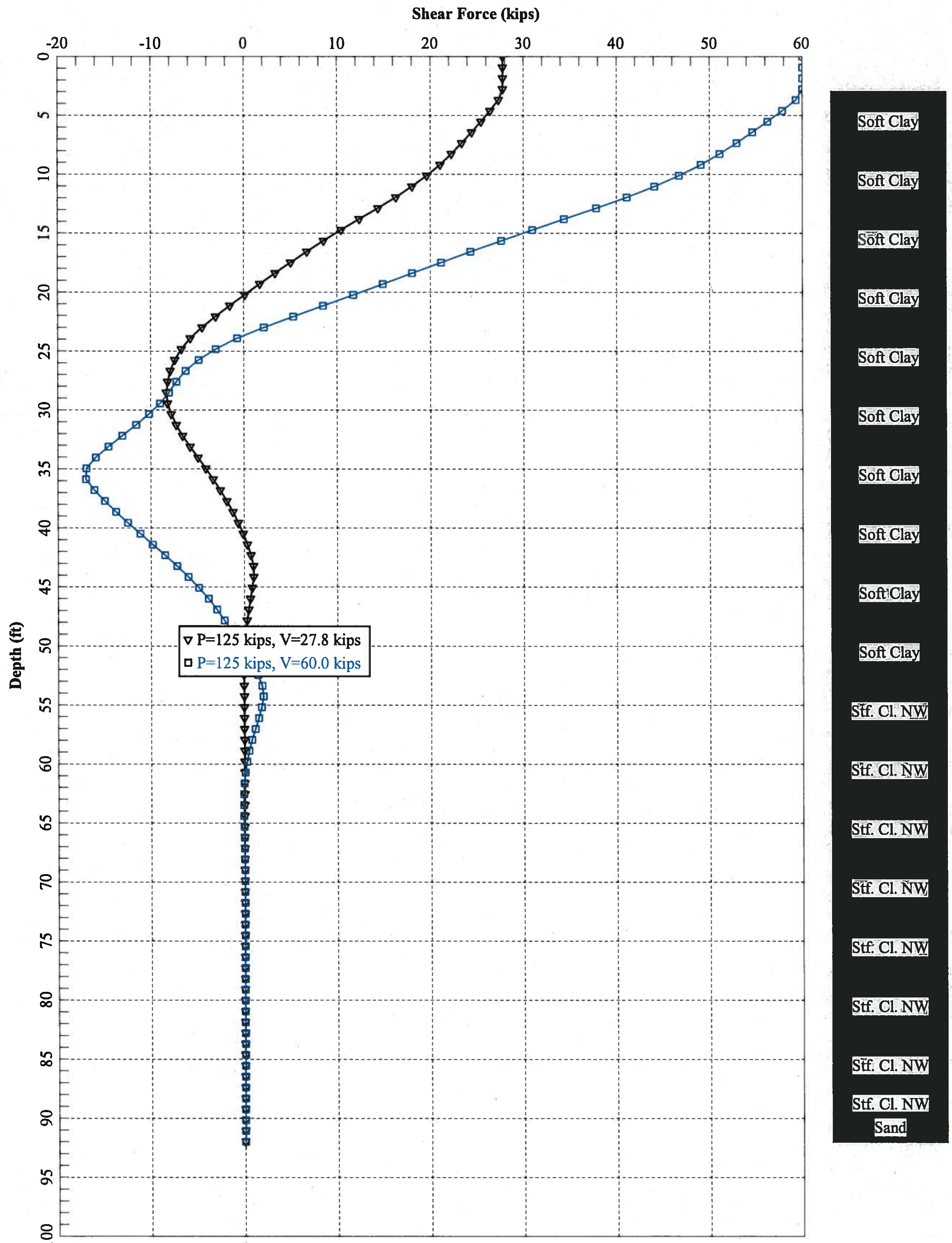
Lateral Pile Analyses



PP24X0.75 CISS Pile - Fixed Head Condition



PP24X0.75 CISS Pile - Fixed Head Condition



PP24X0.75 CISS Pile - Fixed Head Condition

F

Corrosion Test Results

Corrosivity Tests Summary

CTL #: 054-158 **Date:** 3/25/2013 **Tested By:** PJ **Checked:** PJ
Client: SHN **Project:** Pine Hill Rd. Bridge **Proj. No:** 12163
Remarks:

Sample Location or ID			Resistivity @ 15.5 oC (Ohm-cm)			Chloride	Sulfate		pH	ORP		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		(Redox)		Qualitative	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		E_H (mv)	At Test	by Lead	%	
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
B-1	-	11	-	-	172	2,889	1,709	0.1709	7.2	476	20	-	31.7	Very Dark Greenish Gray Sandy CLAY (Silty)

Corrosivity Tests

COOPER TESTING LABORATORY

CTL Job No:	054-158	**Project No.:**	12163	IC Ions to test for:	Both
Client:	SHN	**Date:**	3/12/2013		
Project Name:	Pine Hill Rd. Bridge	**By:**	PJ		

Boring:	B-1					
Sample:						
Depth, ft:	11					
Soil Description:	Very Dark Greenish Gray Sandy CLAY (Silty)					
EXTRACTION						
Extraction Flask No.						
Wt. of wet soil (g)	105.91					
Vol of water (ml)	300	300	300	300	300	300
% H_2O of Extracted Sample:						
Pan No.						
Pan wt. (g)	19.78					
Total wet wt. (g)	140.96					
Total dry wt (g)	111.77					
ORP / SULFIDE TESTS						
Beaker No.						
ORP, E_H (NHE) (Rmv)	475.7					
ORP Test Temp, ^oC	20.2					
Sulfide						
ASTM RESISTIVITY - **As Received**						
Small Dial Reading						
Large Dial Reading						
Temp. ^oC						
ASTM RESISTIVITY - **100% Saturation**						
Bowl No.						
Small Dial Reading	100					
Large Dial Reading	1.49					
Temp. ^oC	21.6					
pH TEST						
pH measurement #1	7.17					
pH measurement #2	7.16					
pH measurement #3	7.15					
CHLORIDE AND SULFATE TESTING						
IC Ions to test for:	Both	Both	Both	Both	Both	Both
Vial No.						
CHLORIDE						
Meas. conc(mg **Cl^-**/L)	713.6					
SULFATE						
Meas. conc(mg **SO_4^{-2}**/L)	422.2					
Comments:						

22 July 2014

Mr. John H. Dailey
SHN Consulting Engineers & Geologist, Inc.
335 S. Main Street
Willits, California 95490

Subject: Development of Site-Specific Response Spectrum
Pine Hill Road Replacement Bridge
Eureka, California
Langan Project No.: 731630801

Dear Mr. Dailey:

This letter-report presents the results of our ground motion study to develop site-specific response spectrum for the proposed Pine Hill Road replacement bridge in Eureka, California. We understand the existing 63-foot long, 65 years old, three span timber bridge is structurally deficient and is proposed to be replaced by an approximately 70-foot long reinforced concrete bridge. Figure 1 presents the site location map. The design of the new bridge will follow the California Department of Transportation (Caltrans) Seismic Design Criteria Version 1.7, April 2013. In general, the subsurface conditions consist of soft clay to a depth of approximately 70 feet. This layer is underlain by approximately 30 feet of potentially liquefiable medium dense to dense sand. Medium stiff to stiff clay underlies the sand. Considering these conditions, Caltrans design criteria requires development of site-specific response spectrum.

1.0 SCOPE OF SERVICES

Our study was performed in accordance with the scope of services presented in our revised proposal dated 6 February 2014. We used the subsurface information developed by SHN Consulting Engineers & Geologist, Inc. (SHN). Our scope of services did not include any site visits or performing supplemental field investigation. We developed site-specific response spectrum in accordance with the guidelines presented in Appendix B of 2013 Caltrans Seismic Design Criteria (Caltrans 2013). Specifically, we performed the following:

- Probabilistic seismic hazard analysis (PSHA) for a 5 percent probability of exceedance in 50 years (975 year return period)
- Deterministic seismic hazard analysis for the median spectrum of the governing scenario earthquake
- Developed site-specific design response spectrum for stiff soil for input into the nonlinear ground response analysis based on the envelope of the PSHA and deterministic spectra
- Spectrally matched five time series to the site-specific stiff soil spectrum
- Nonlinear ground response analysis
- Developed site-specific response spectrum for the project

2.0 SUBSURFACE CONDITIONS

The subsurface information provided by you included one boring drilled to a depth of 90.5 feet below existing ground surface (bgs) and four Cone Penetrometer Tests (CPTs) advance to depths ranging from approximately 73 to 103 feet bgs. In addition, shear wave velocities were measured in two of the CPT soundings. We also received laboratory test results on selected samples from the boring. In general, the subsurface conditions consist of soft clay to a depth of approximately 70 feet. This layer is underlain by approximately 30 feet of medium dense to dense sand that is potentially liquefiable. Medium stiff to stiff clay underlies the sand.

On the basis of the shear wave velocity measurements, the average shear wave velocity in the top 30 meters (100 feet) is approximately 145 m/s (477 ft/sec). Considering these conditions, Caltrans design criteria requires development of site-specific response spectrum. Because the site is underlain by deposits of soft clay and potentially liquefiable sand, we performed nonlinear ground response analysis. To perform this type of an analysis, time series are needed as input at the base of the model. On the basis of our discussions with HSN, we understand bedrock is on the order of about 1,400 feet (500 m) below the ground surface. Furthermore, the site-specific data suggest that the shear wave velocity at a depth of approximately 100 feet is about 1,000 ft/sec. Consequently, we developed stiff soil response spectrum as the basis for the development of the input motions for the ground response analysis. Details of this development are presented in the following sections of the report.

3.0 PROBABILISTIC SEISMIC HAZARD ANALYSIS

Because the location, recurrence interval, and magnitude of future earthquakes are uncertain, we performed a PSHA, which systematically accounts for these uncertainties. The results of a PSHA define a uniform hazard for a site in terms of a probability that a particular level of shaking will be exceeded during the given life of the structure.

To perform a PSHA, information regarding the seismicity, location, and geometry of each source, along with empirical relationships that describe the rate of attenuation of strong ground motion with increasing distance from the source, are needed. The assumptions necessary to perform the PSHA are that:

- the geology and seismic tectonic history of the region are sufficiently known, such that the rate of occurrence of earthquakes can be modeled by historic or geologic data
- the level of ground motion at a particular site can be expressed by an attenuation relationship that is primarily dependent upon earthquake magnitude and distance from the source of the earthquake
- the earthquake occurrence can be modeled as a Poisson process with a constant mean occurrence rate.

As part of the development of the site-specific spectrum at the base of the soil column for the nonlinear ground response analysis, we performed a PSHA to develop site-specific response spectra for 5 percent probability of exceedance in 50 years. The ground surface spectra were developed using the computer code EZFRISK 7.62 (Risk Engineering 2012). The approach used in EZFRISK is based on the probabilistic seismic hazard model developed by Cornell (1968) and McGuire (1976). Our analysis modeled the faults in area as linear and areal sources, and earthquake activities were assigned to the faults based on historical and geologic data. The levels of shaking were estimated using Next Generation Attenuation (NGA) relationships that are primarily dependent upon the magnitude of the earthquake and the distance from the site to the fault.

3.1 Probabilistic Model

In probabilistic models, the occurrence of earthquake epicenters on a given fault is assumed to be uniformly distributed along the fault. This model considers ground motions arising from the portion of the fault rupture closest to the site rather than from the epicenter. Fault rupture lengths were modeled using fault rupture length-magnitude relationships given by Wells and Coppersmith (1994).

The probability of exceedance, $P_e(Z)$, at a given ground-motion, Z, at the site within a specified time period, T, is given as:

$$P_e(Z) = 1 - e^{-V(z)T}$$

where V(z) is the mean annual rate of exceedance of ground motion level Z. V(z) can be calculated using the total-probability theorem.

$$V(z) = \sum_i v_i \iint P[Z > z \mid m,r] f_{M_i}(m) f_{R_i|M_i}(r;m)\,dr\,dm$$

where:

v_i = the annual rate of earthquakes with magnitudes greater than a threshold M_{oi} in source i

P [Z > z | m,r] = probability that an earthquake of magnitude m at distance r produces ground motion amplitude Z higher than z

f_{Mi} (m) and $f_{Ri|Mi}$ (r;m) = probability density functions for magnitude and distance

Z represents peak ground acceleration, or spectral acceleration values for a given frequency of vibration. The peak accelerations are assumed to be log-normally distributed about the mean with a standard error that is dependent upon the magnitude and attenuation relationship used.

3.2 Source Modeling and Characterization

The segmentation of faults, mean characteristic magnitudes, and recurrence rates were modeled using the data presented in the WGCEP (2008) and Cao et al. (2003) reports. We also included the combination of fault segments and their associated magnitudes and recurrence rates as described in the WGCEP (2008) in our seismic hazard model. Table 1 presents the distance and direction from the site to the fault, mean characteristic magnitude, mean slip rate, and fault length for individual fault segments. We used the 2008 California, Oregon, and Cascadia fault databases identified in EZFRISK 7.62. We understand EZFRISK obtained this database directly from USGS and models the faults with multiple segments. Each segment is characterized with multiple magnitudes, occurrence or slip rates and weights. This approach takes into account the epistemic uncertainty associated with the various seismic sources in our model.

TABLE 1
Source Zone Parameters

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude	Mean Slip Rate (mm/yr)	Approx. Fault Length (km)
Little Salmon (Onshore)	1.7	West	7.10	5	34
Little Salmon Connected	1.7	West	7.50	2.7	80
Little Salmon (Offshore)	4.2	West	7.30	1	46
Table Bluff	6.7	Southwest	7.20	0.6	49
Mendocino	7.3	East	7.3	35	260
Cascadia	14	West	9.0	35	1,300
Fickle Hill	16	East	7.10	0.6	32
Mad River	18	Northeast	7.20	0.7	42
McKinleyville	20	Northeast	7.20	0.6	47
Trinidad	24	Northeast	7.50	0.7	88
Big Lagoon-Bald Mtn	38	Northeast	7.50	0.5	90
Maacama-Garberville	56	South	7.40	9	221
N. San Andreas; SAO	60	Southwest	7.37	24	136
N. San Andreas; SAO+SAN	60	Southwest	8.00	24	326
N. San Andreas; SAO+SAN+SAP	60	Southwest	7.95	22	410
N. San Andreas; SAO+SAN+SAP+SAS	60	Southwest	8.05	22	472
Bartlett Springs	79	Southeast	7.30	6	174
Whaleshead	153	Northeast	7.01	2.6	46
Battle Creek	173	East	6.70	0.5	29
N. San Andreas; SAN	179	South	7.51	24	189
N. San Andreas; SAN+SAP	179	South	7.73	22	274
N. San Andreas; SAN+SAP+SAS	179	South	7.87	21	336
Great Valley 1	193	Southeast	6.80	0.1	44

3.3 Attenuation Relationships

On the basis of the measured shear wave velocity, we assumed a shear wave velocity of 1,000 ft/sec for the development of stiff soil response spectrum used for developing the input motions for the nonlinear ground response analysis.

Consistent with the requirements of Appendix B of Caltrans Seismic Design Criteria (2013), we used Campbell and Bozorgnia (2008) and Chiou and Youngs (2008) attenuation relationships for shallow crustal faults and Youngs et al. (1997) relationships for subduction zone.

3.4 PSHA Results

Figure 2 presents the results of the PSHA for 5 percent probability of exceedance in 50 years. The average of the four attenuation relationships is also shown on these figures. Because of the close proximity of the Little Salmon fault we considered near-source directivity using Abrahamson (2000) model.

Figure 3 presents the deaggregation plots of the PSHA results for the 5 percent probability of exceedance in 50 years hazard level. From the examination of these results, it can be seen that the Little Salmon connected fault (M_w = 7.5 at 1.7 km) dominate the hazard at the project site at different periods of interest.

4.0 DETERMINISTIC

We performed a deterministic analysis to develop the design spectrum at the site. In a deterministic analysis, a given magnitude earthquake occurring at a certain distance from the source is considered as input into an appropriate ground motion attenuation relationship. The scenario earthquake was defined as an event having a Moment Magnitude of 7.5 consistent with the mean magnitude assigned by WGCEP (2008) for the Little Salmon connected fault at a distance of approximately 1.7 kilometers from the site.

The same attenuation relationships used in the PSHA for shallow crustal faults were used in our deterministic analysis. We also included near-source directivity as discussed in Section 3.4. Figure 4 presents the median deterministic results for the attenuation relationships used in the analysis and the average of these relationships.

5.0 RECOMMENDED STIFF SOIL SPECTRUM

The Design Earthquake spectrum as defined in in Appendix B of the 2013 Caltrans code is the envelope of the 975 year return PSHA and the median deterministic on the governing fault. Figure 5 presents the PSHA and determinisitic median spectra for the site. Also, shown on this figure is the envelope of these spectra. For periods shorter than 1.0 second the PSHA spectrum governs and periods longer than or equal to 1.0 second the deterministic spectrum governs the stiff soil design spectrum. Table 2 presents the site-specific stiff soil spectrum.

TABLE 2
Site-Specific Stiff Soil Spectrum
S_a (g) for 5 percent damping

Period (seconds)	S_a (g)
0.01	0.967
0.10	1.455
0.20	1.862
0.30	1.938
0.40	1.886
0.50	1.817
0.60	1.687
0.75	1.516
1.00	1.345
1.50	1.031
2.00	0.738
3.00	0.404
4.00	0.264
5.00	0.208

6.0 MATCHED TIME SERIES

The selection of a recorded time series is an important step in developing the ground motion. The intent in this selection process is to choose time series that in general have a similar magnitude and distance as that of the design ground motion. The suite of time series recommended for this project are from recordings from large events, similar to the seismic regime of the northern part of the state of California. In addition, the use of different earthquakes captures the unique and different character of each particular earthquake. Table 3 presents the time series used for matching to the recommended spectra.

TABLE 3

Earthquake Time Series Used for Matching to Recommended Stiff Soil Spectrum

EQ., Year	NGA Seq. No.	Rupture Mechanism	Mag.	Time History	Vs30[1] (m/s), Site Class	Epi. Dist. (km)	Closest Dist. to Rupture[1] (km)	Comp.	PGA (g)	PGV (cm/s)	PGD (cm)
Loma Prieta, 1989	779	Reverse, oblique	6.9	Los Gatos PC	478, C	23	6	0	0.966	108.5	65.8
Cape Mendocino, 1992	501	Subduction	7.0	Cape Mendocino	514, C	10	7	0	1.497	125.1	39.7
Duzce, 1999	1605	Strike-slip	7.1	Duzce	276, D	2	7	270	0.535	83.4	51.6
Tabas, 1979	143	Thrust	7.4	Tabas	767, B	55	2	L	0.836	97.8	38.7
ChiChi, 2002	1503	Reverse	7.4	TCU067	433, C	29	0.6	E	0.503	79.6	93.1

Figures 6 through 10 present the acceleration, velocity, and displacement of the matched time series and comparison between the initial, recommended matched spectrum for the stiff soil.

7.0 NONLINEAR GROUND RESPONSE ANALYSIS

Because the site is underlain by soft clay and potentially liquefiable layers, the response spectra at the ground surface were developed using the computer program DEEPSOIL Version 5.1 (Hashash et al. 2012). DEEPSOIL is a one-dimensional site response analysis program that performs non-linear time domain wave propagation analysis based on vertically propagating, horizontal shear waves. The program mathematically transmits input base motions vertically through an idealized soil column to the ground surface. DEEPSOIL incorporates the pressure-dependent hyperbolic model which was modified by Matasovic (1993) and adjusts the hyperbolic model by Konder and Zelasko (1963) by introducing two additional parameters Beta and s that adjust the shape of the back bone curve β. The stress strain equation is:

$$\tau = \frac{G_{mo}\gamma}{1 + Beta\left(\frac{G_{mo}\gamma}{\tau_{mo}}\right)^s} = \frac{G_{mo}\gamma}{1 + Beta\left(\frac{\gamma}{\gamma_r}\right)^s}$$

where: G_{mo} = initial shear modulus, τ_{mo} = shear strength, γ = shear strain. Beta, s, and γ_r are model parameters.

1 From NGA flatfile

We performed both total stress and effective stress (with generation and dissipation of pore pressures) nonlinear one dimensional analyses and used the strain dependent shear modulus reduction and damping curves developed by Seed and Idriss (1970) and Vucetic and Dobry (1991) for the sand and clay layers at the site, respectively. The model parameters were internally developed by curve fitting to Seed and Idriss (1970) and Vucetic and Dobry (1991) curves. The effective stress analyses were performed to account for pore pressure generation and dissipation and its effect on the computed response spectra. The modeling of for pore pressure generation and dissipation was performed using the model parameter developed by Matasovic (1992) for sand and Matasovic and Vucetic (1995) for clay as part of the effective stress analysis option in DEEPSOIL.

To develop the idealized model at the site we used subsurface information developed by SHN. We assigned the input motion (matched time series from Section 6.0) at an assumed depth of 150 feet below the ground surface and performed the analyses using the lower bound and upper bound shear wave velocities measured at the site. The lower and upper shear wave velocities used in idealized profiles in our analyses are summarized in Tables 4 and 5, respectively.

TABLE 4

Lower Bound V_s Idealized Profile Used in DEEPSOIL Analyses

Layer	Depth Range (feet)	Assigned Lower Bound Shear Wave Velocity (ft/sec)
Clay	0 – 19	315
Clay	19 – 30	364
Clay	30 – 40	381
Clay	40 – 50	486
Clay	50 – 60	479
Clay	60 – 70	502
Sand	70 – 80	630
Sand	80 – 90	850
Sand	90 – 100	870
Clay	100 - 150	1,000 (assumed)

TABLE 5

Upper Bound V_s Idealized Profile Used in DEEPSOIL Analyses

Layer	Depth Range (feet)	Assigned Upper Bound Shear Wave Velocity (ft/sec)
Clay	0 – 30	380
Clay	30 – 35	404
Clay	35 – 40	590
Clay	40 – 50	530
Clay	50 – 60	615
Clay	60 – 70	655
Sand	70 – 90	850
Sand	90 – 100	870
Clay	100 - 150	1,000 (assumed)

The matched time series were used as outcrop input motion applied at a depth of 150 feet.

7.1 Results of Nonlinear Ground Response Analysis

The results of the DEEPSOIL nonlinear analysis for the five input motions are presented on Figures 11 and 12 present for the nonlinear total stress and effective stress analysis, respectively using the upper bound shear wave velocities. These figures present the results for each of the five input motions along with average of the results and the envelope of the results. Figures 13 and 14 present similar results using the lower bound shear wave velocities. Figure 15 presents the average results for the four sets of analyses. The envelope of the results is used as the basis for the development of the recommended site-specific response.

7.2 Recommended Spectrum

Figure 16 presents a comparison of the spectrum for the envelope of the results and the ARS curves from the ATC-35 report for site class E for M = 7.25 ± 0.25 and the ARS from the Caltrans web tool for V_{s30} =150 m/s. The recommended smooth spectrum is presented as red triangles on the figure. Digitized values of the recommended spectrum are presented in Table 6.

TABLE 6
Recommended Ground Surface Spectrum
for Damping Ratio of 5 percent

Period (seconds)	S_a (g)
0.00	0.300
0.10	0.500
0.20	0.680
0.30	0.800
0.40	0.850
0.50	0.875
0.60	0.900
0.70	0.950
0.80	1.000
0.90	1.140
1.00	1.145
1.10	1.150
1.20	1.155
1.30	1.155
1.40	1.150
1.50	1.150
1.60	1.150
1.70	1.175
1.80	1.175
1.90	1.175
2.00	1.150
2.10	1.050
2.20	0.950
2.30	0.900
2.40	0.850
2.50	0.811
2.60	0.775
2.70	0.743
2.80	0.710
2.90	0.690
3.00	0.675
3.50	0.578
4.00	0.487
5.00	0.411

We appreciate the opportunity to assist you on this project. If you have any questions, please call.

Sincerely,
Langan Treadwell Rollo

John Gouchon, G.E.
Principal/Vice President

Ramin Golesorkhi, Ph.D., G.E.
Principal/Vice President

731630801.01_RG_Pine Hill Road Report

Attachments: Figures 1 through 16

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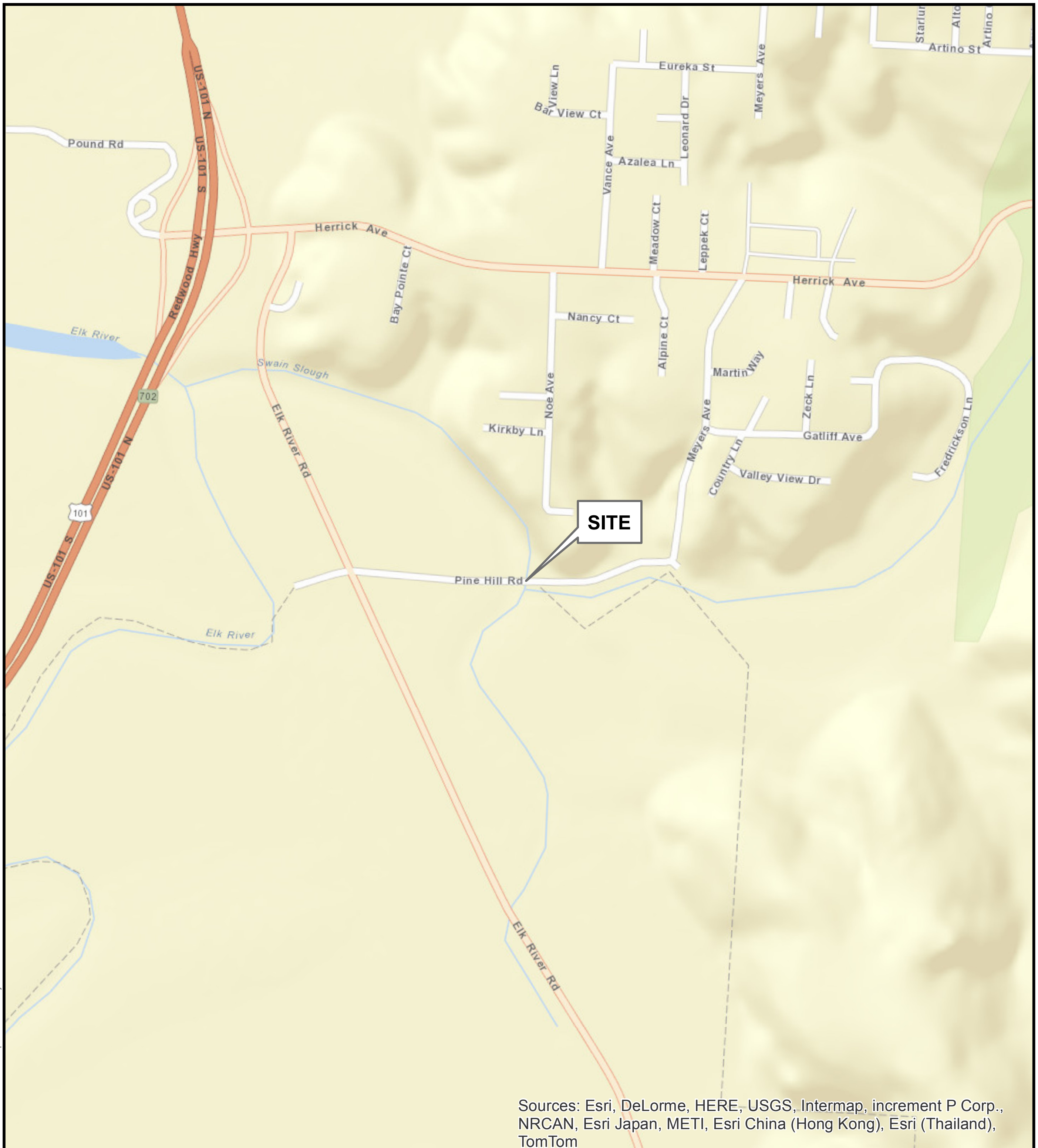

Notes:

World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

0 200 400 800
Feet

PINE HILL ROAD REPLACEMENT BRIDGE
Eureka, California

LANGAN TREADWELL ROLLO

SITE LOCATION MAP

Date 7/18/2014 | Project No. 731630801 | Figure 1

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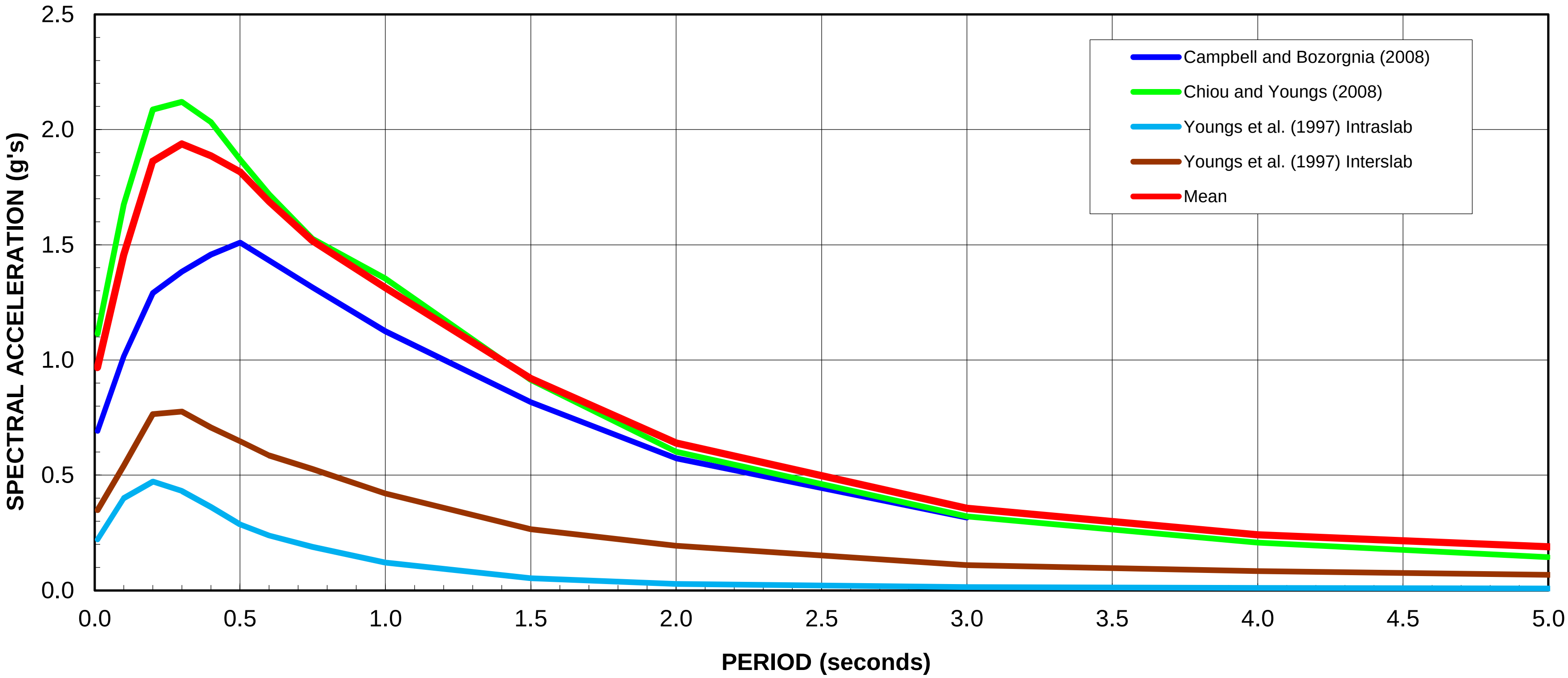
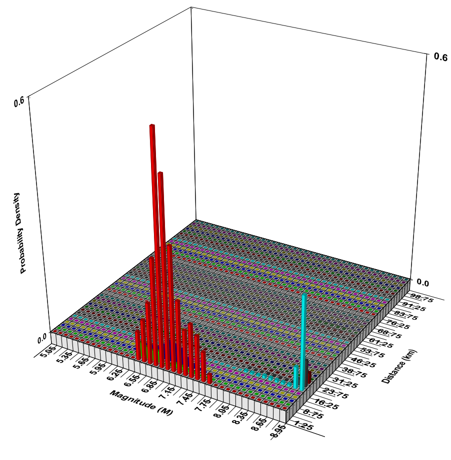


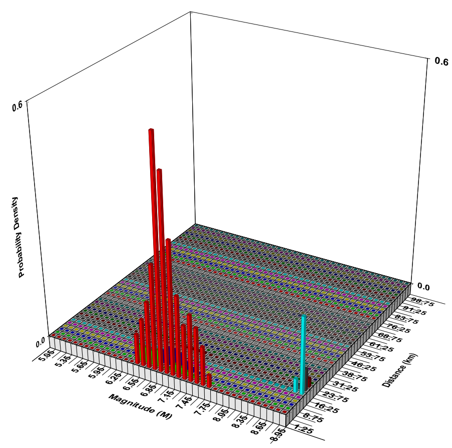
Damping Ratio = 5%

Notes:
1. Estimated V_{s30} = 300 m/s
2. Include average directivity (Abrahamson 2000)

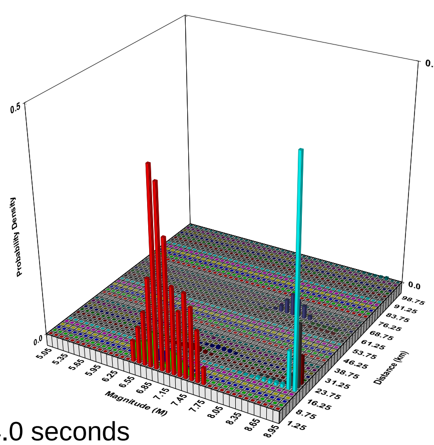
PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF PSHA FOR STIFF SOIL 5 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS		
Date 07/18/14	Project No. 731630801	Figure 2
LANGAN TREADWELL ROLLO		



(a) PGA



(b) S_a, T = 1.0 seconds



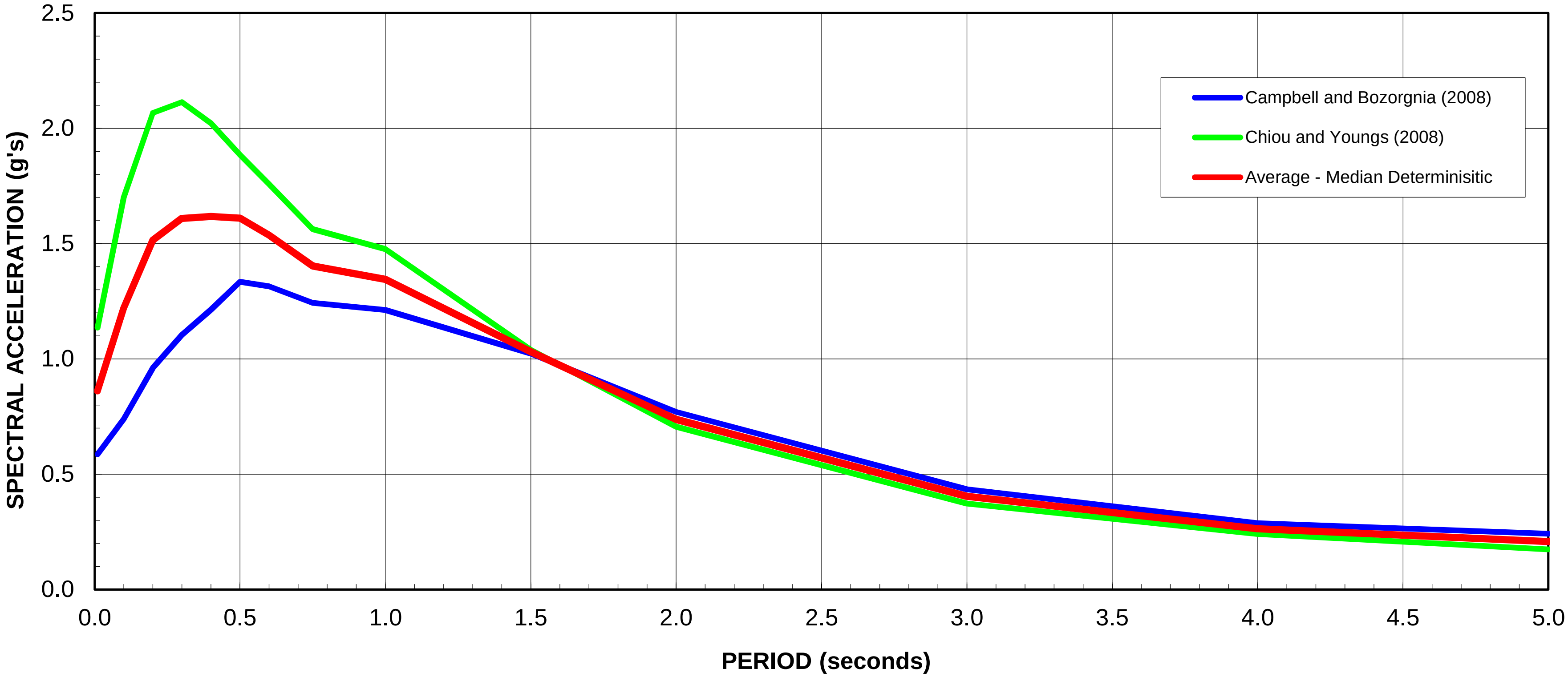
(c) S_a, T = 4.0 seconds

PINE HILL ROAD
REPLACEMENT BRIDGE
Eureka, California

5% PROBABILITY OF EXCEEDANCE IN 50 YEARS FOR STIFF SOIL - MAGNITUDE DISTANCE DEAGGREGATION PLOTS

Date 07/18/14	Project No. 731630801	Figure 3

LANGAN TREADWELL ROLLO

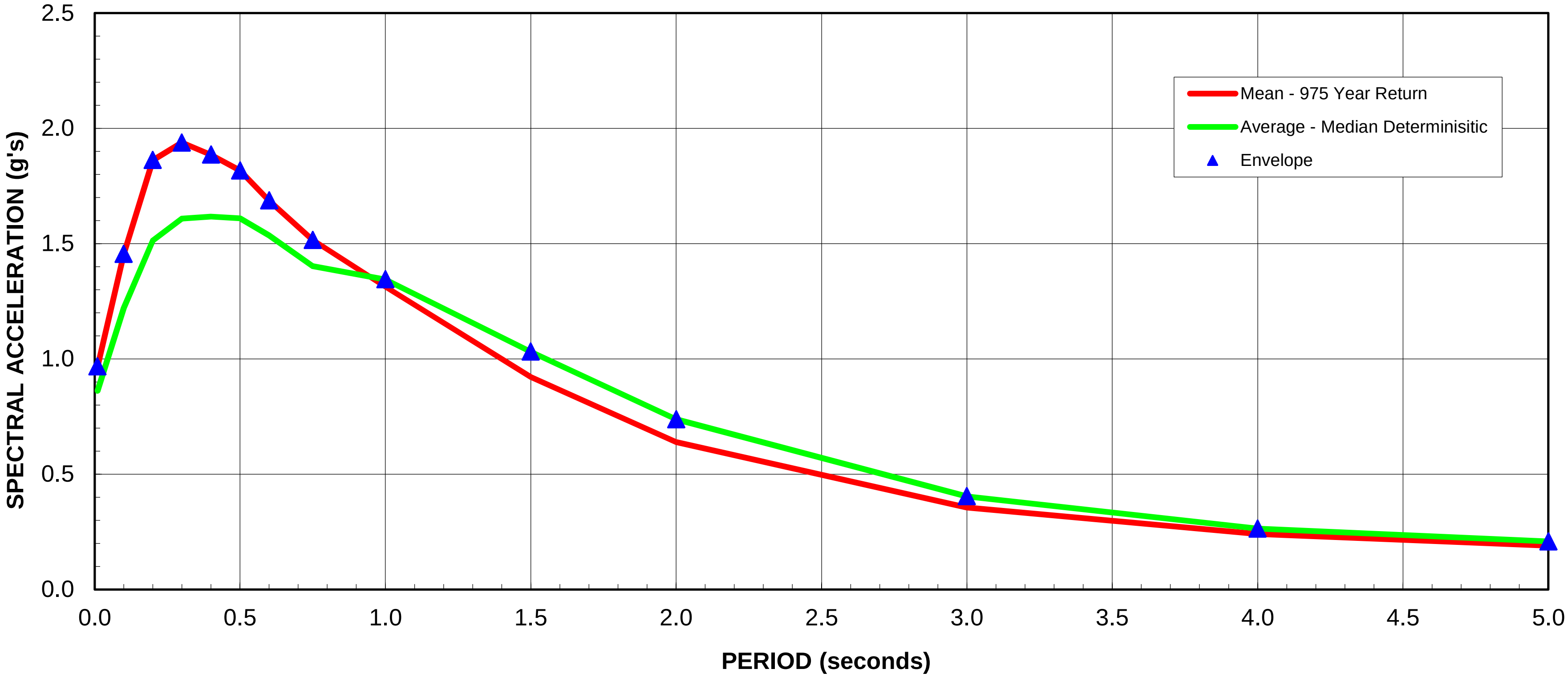


Damping Ratio = 5%

Notes:

1. Estimated V_{s30} = 300 m/s
2. Include average directivity (Abrahamson 2000)

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF MEDIAN DETERMINISTIC STIFF SOIL ANALYSIS FOR M_w = 7.5, Dist. = 1.7 km		
Date 07/18/14	Project No. 731630801	Figure 4
LANGAN TREADWELL ROLLO		

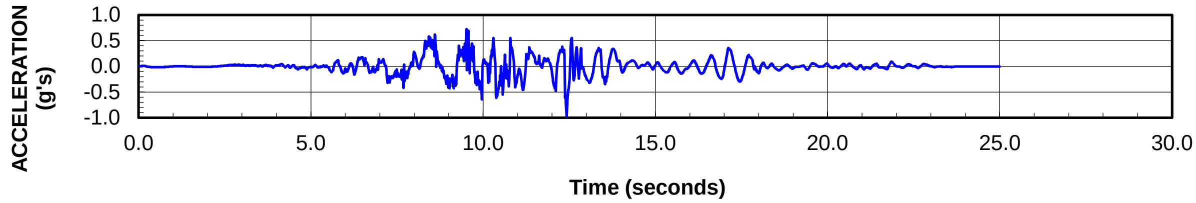


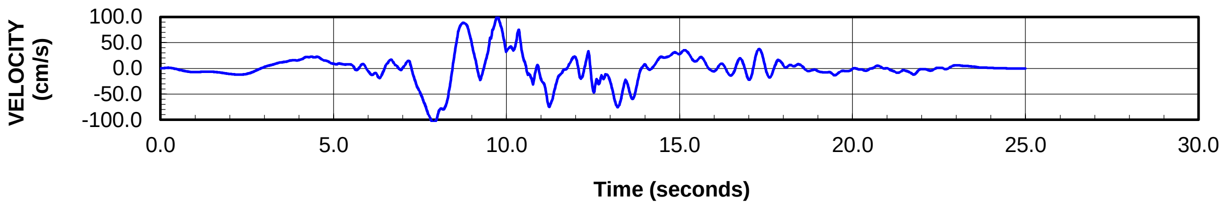
Damping Ratio = 5%

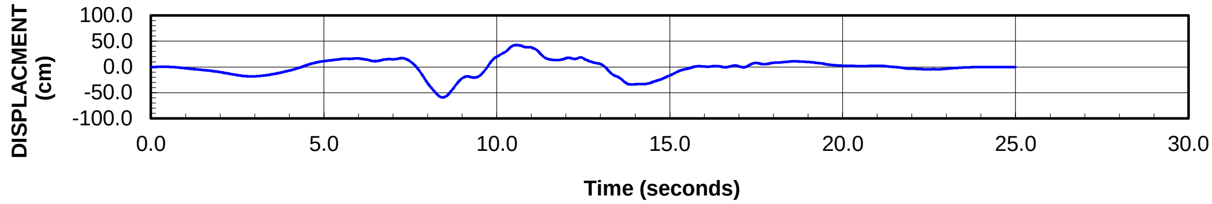
Notes:

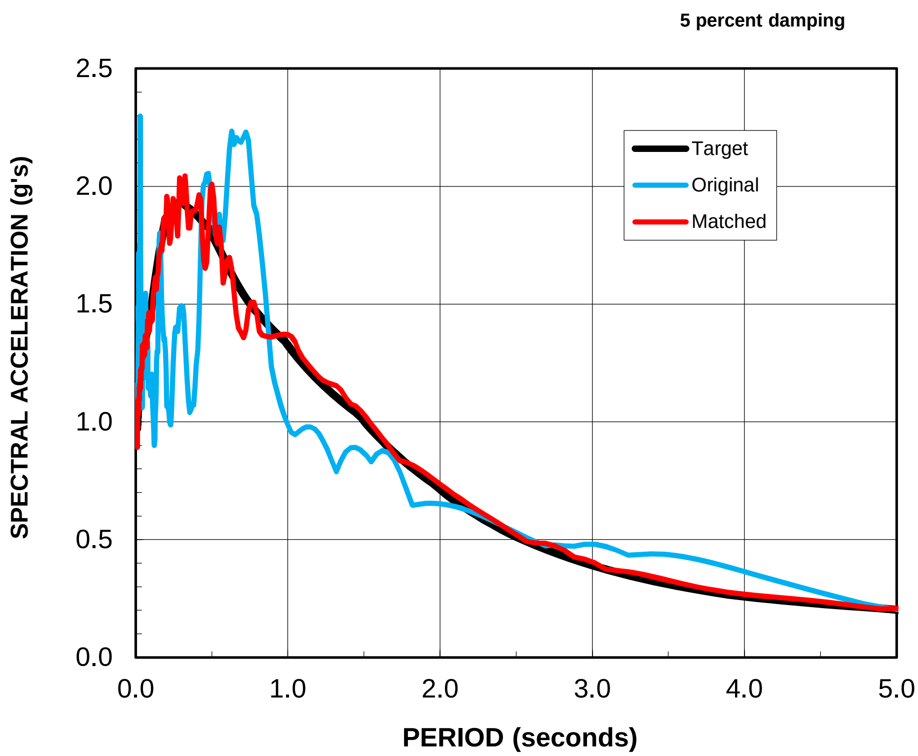
1. Estimated V_{s30} = 300 m/s
2. Include average directivity (Abrahamson 2000)

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
COMPARISON OF DETERMINISTIC AND PROBABILISTIC SPECTRA		
Date 07/18/14	Project No. 731630801	Figure 5
LANGAN TREADWELL ROLLO		

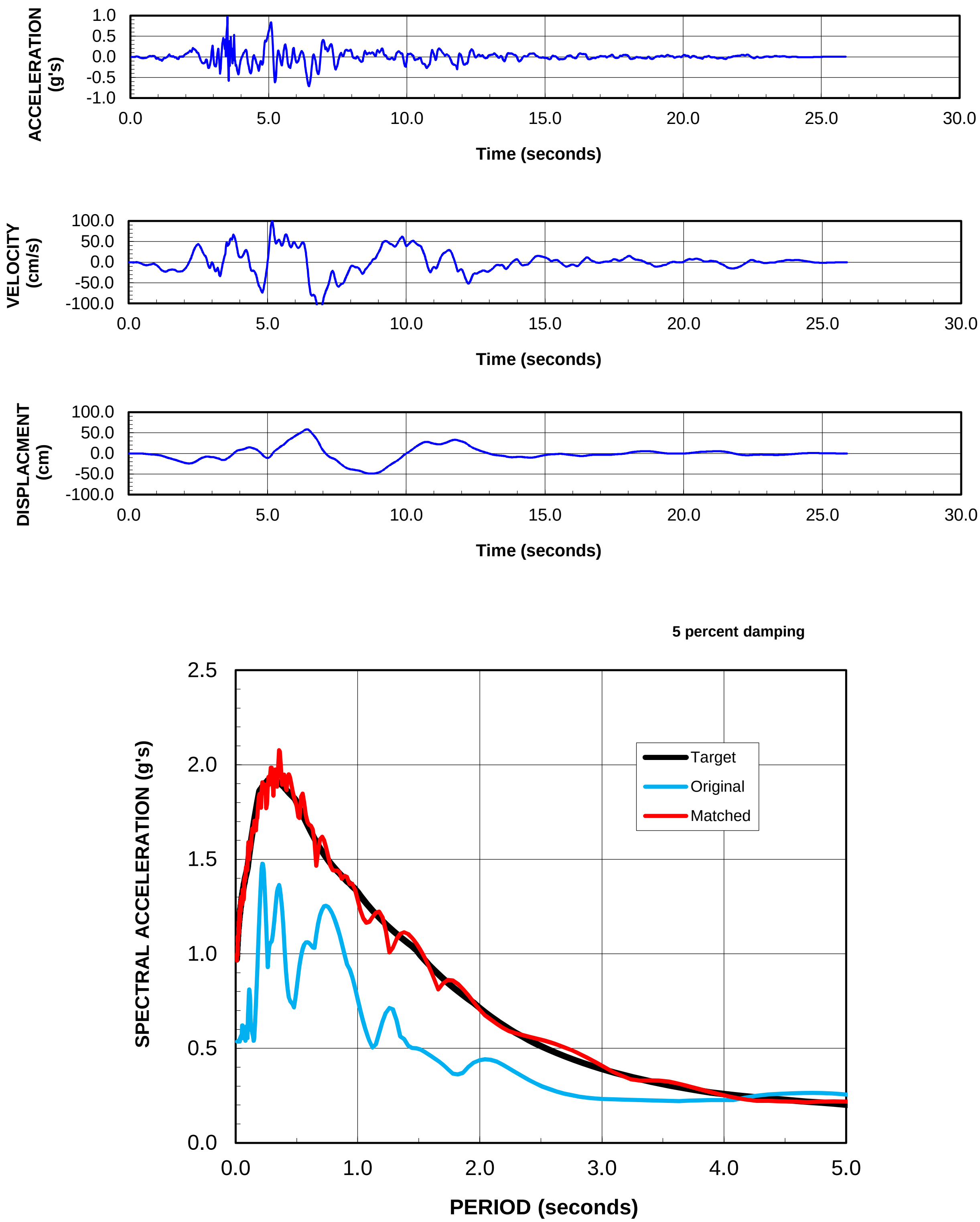








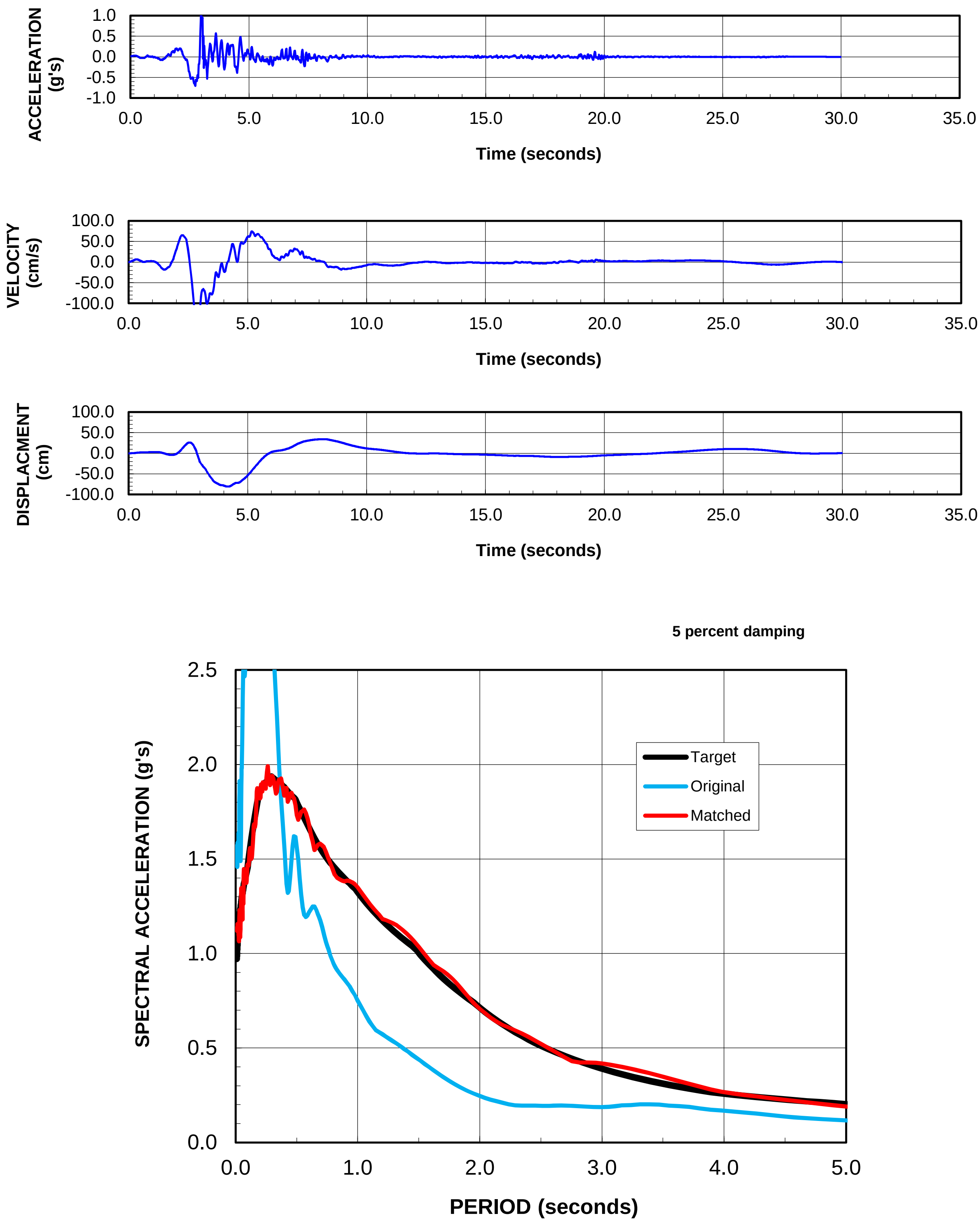
PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California	MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1989 LOMA PRIETA EARTHQUAKE LGPC 0 Deg.
LANGAN TREADWELL ROLLO	Date 07/16/14 | Project No. 731630801 | Figure 6



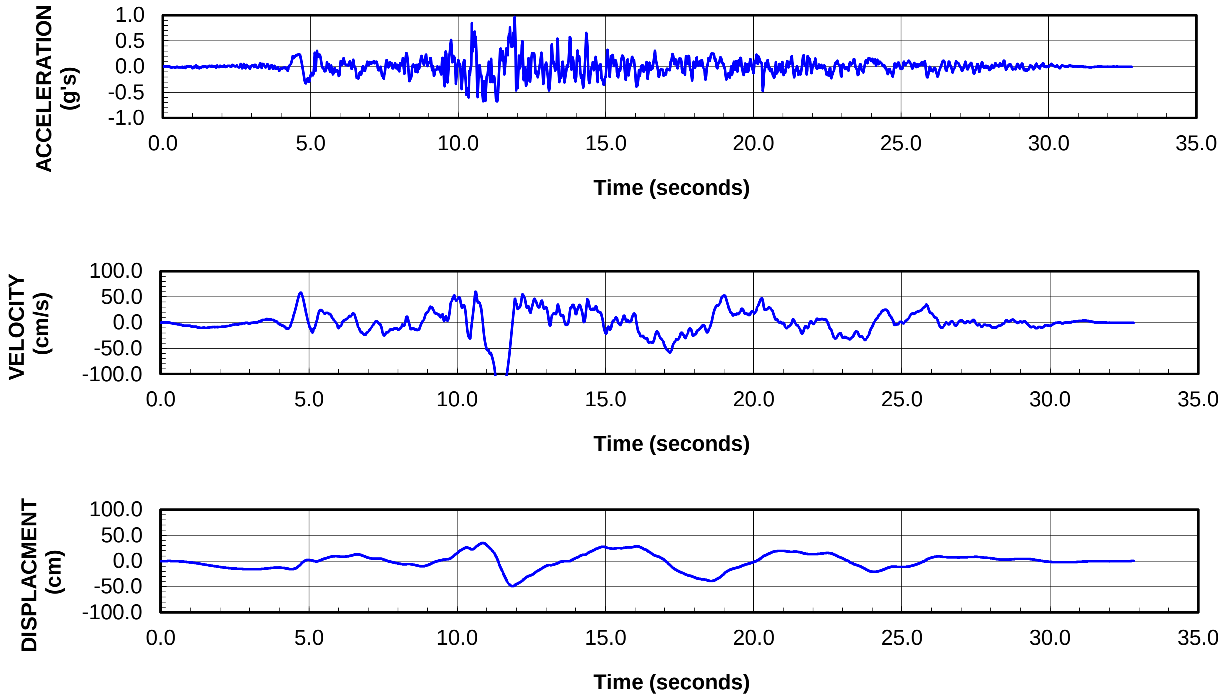
PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California	MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1999 DUZCE EARTHQUAKE DUZCE 270 Degs.

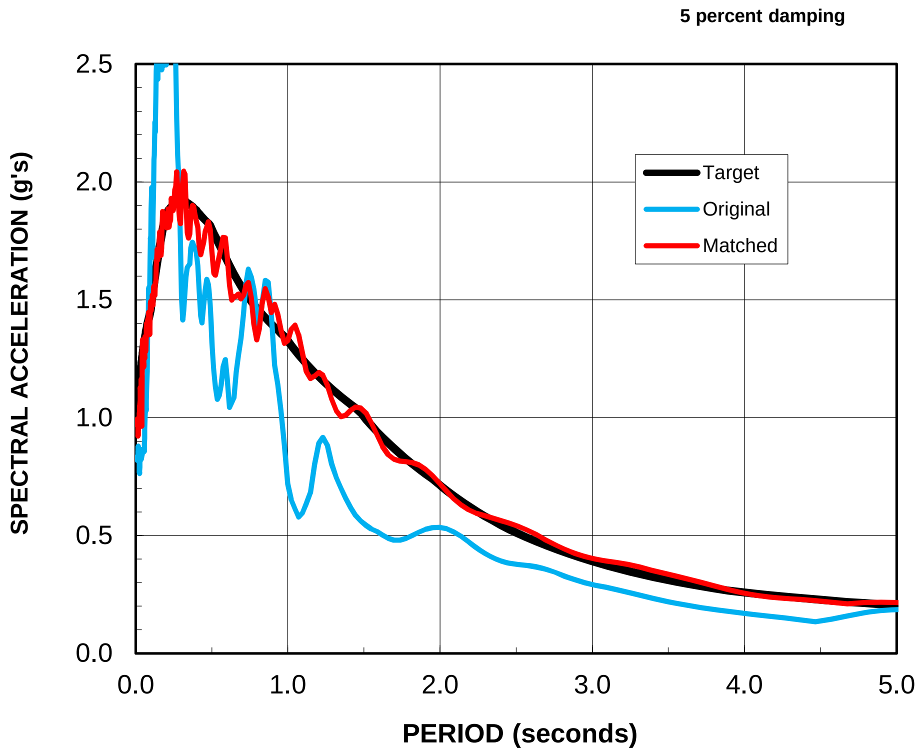
LANGAN TREADWELL ROLLO

Date 07/16/14	Project No. 731630801	Figure 7



PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California	MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1992 CAPE MENDOCINO EARTHQUAKE MENDOCINO 0 Degs.
LANGAN TREADWELL ROLLO	Date 07/16/14 | Project No. 731630801 | Figure 8



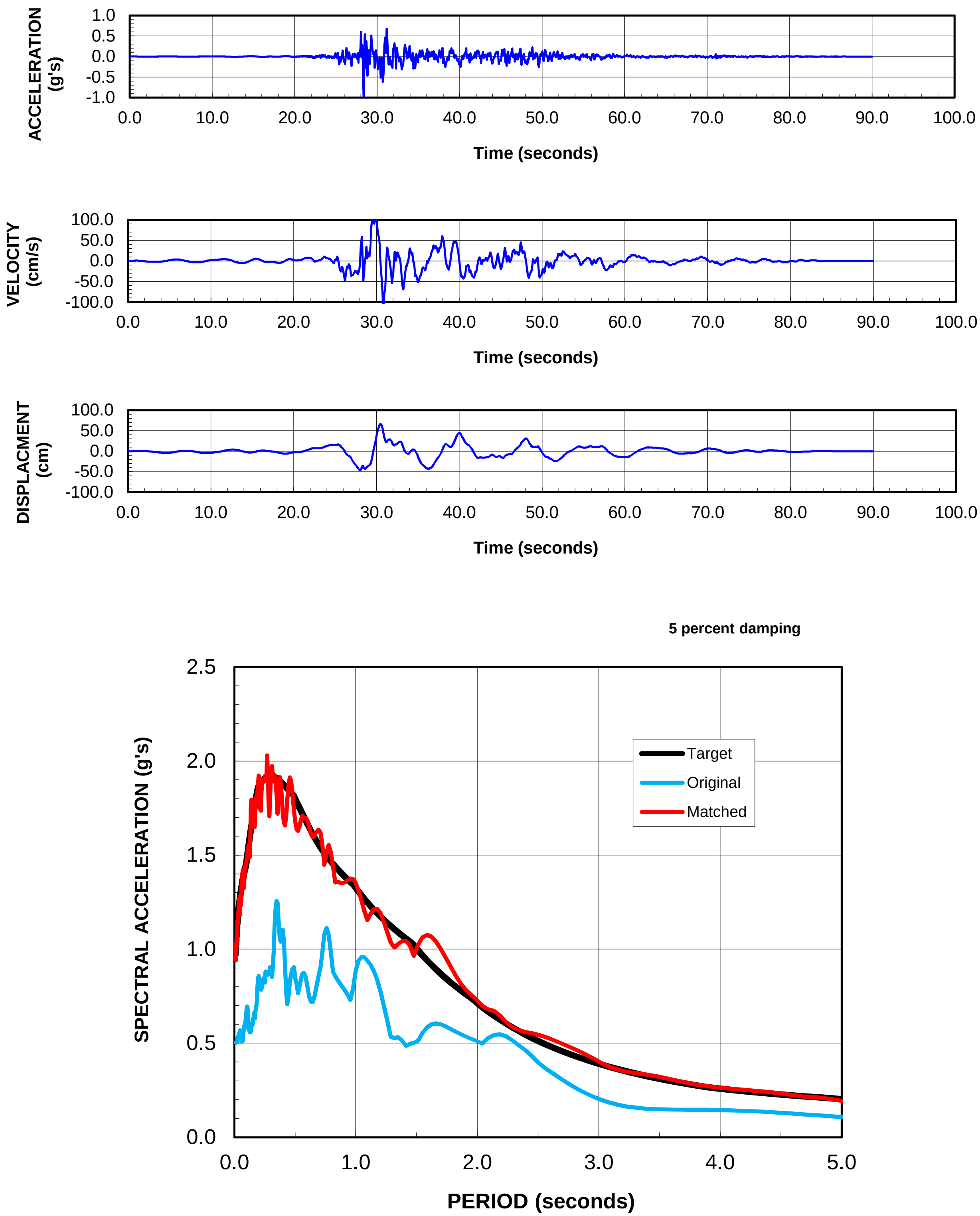


PINE HILL ROAD
REPLACEMENT BRIDGE
Eureka, California

LANGAN TREADWELL ROLLO

MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1979 TABAS EARTHQUAKE TABAS L

Date 07/16/14	Project No. 731630801	Figure 9

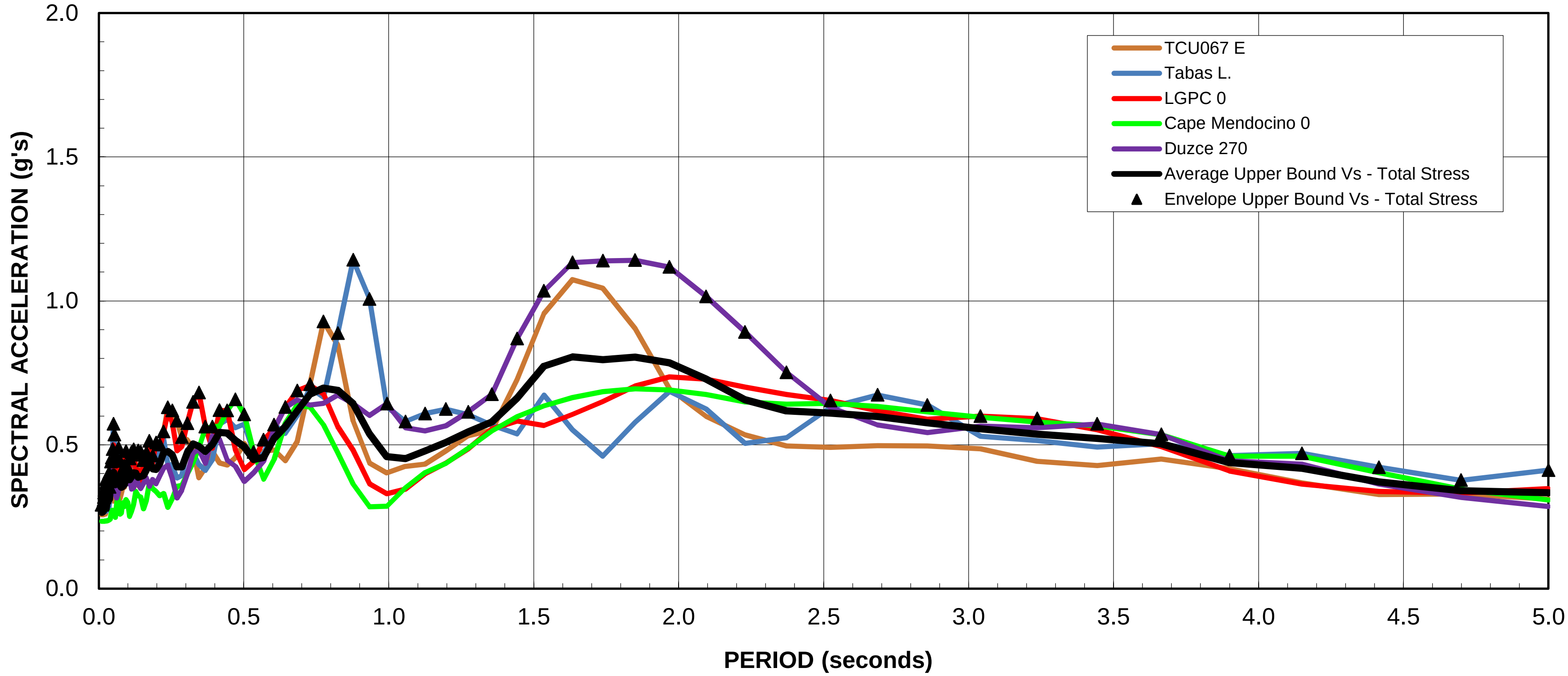


PINE HILL ROAD
REPLACEMENT BRIDGE
Eureka, California

LANGAN TREADWELL ROLLO

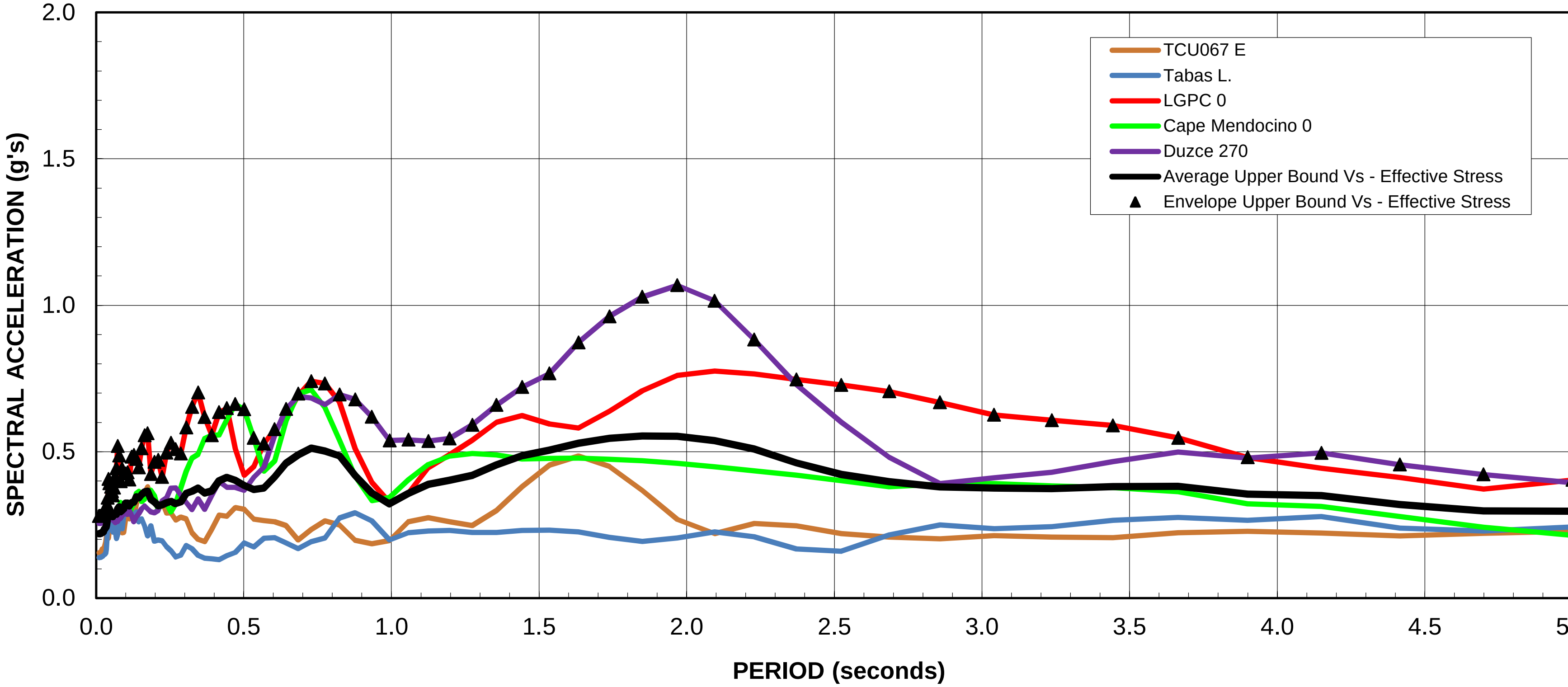
MATCHED STIFF SOIL TIME SERIES AND RESPONSE SPECTRUM 1999 CHI CHI EARTHQUAKE TCU 067 E

Date 07/16/14	Project No. 731630801	Figure 10



Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF TOTAL STRESS NONLINEAR GROUND RESPONSE ANALYSIS UPPER BOUND V_s PROFILE		
Date 07/18/14	Project No. 731630801	Figure 11
LANGAN TREADWELL ROLLO		



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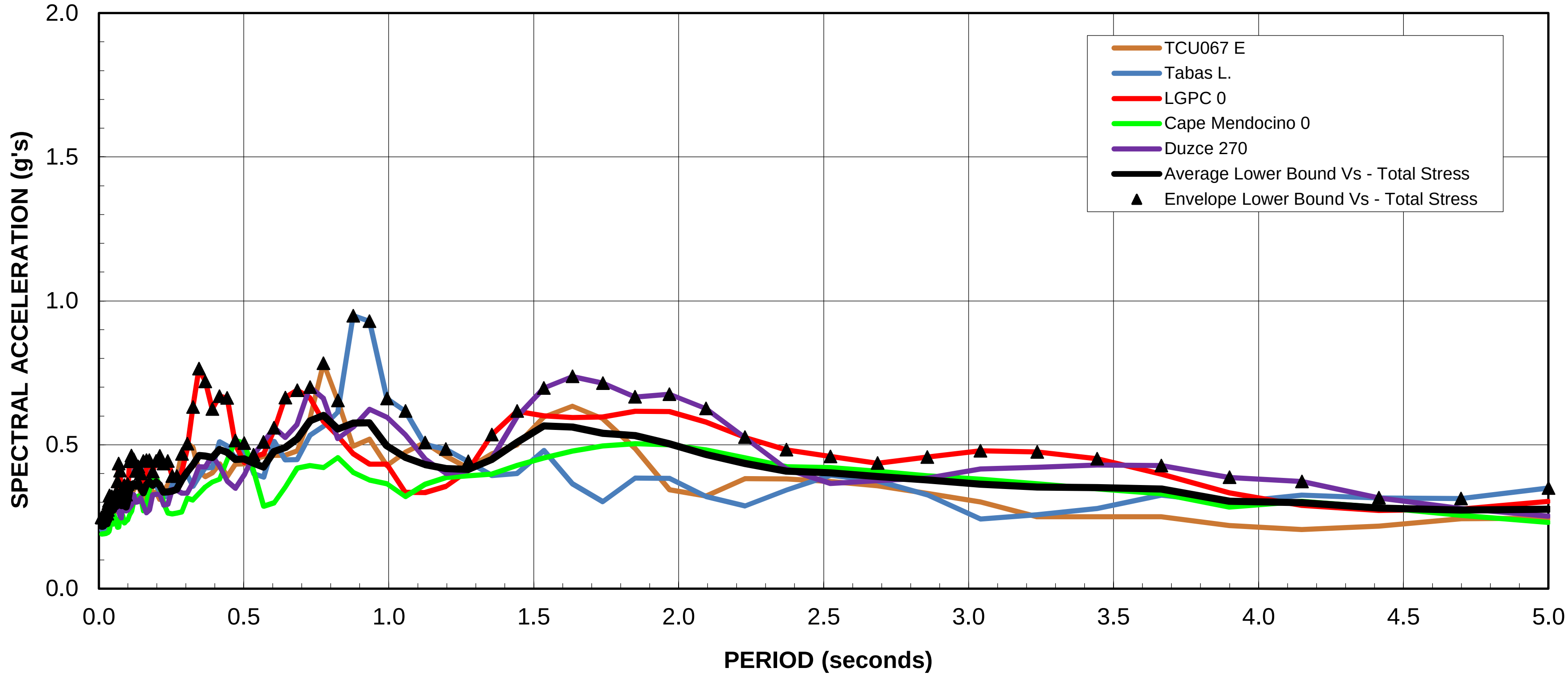
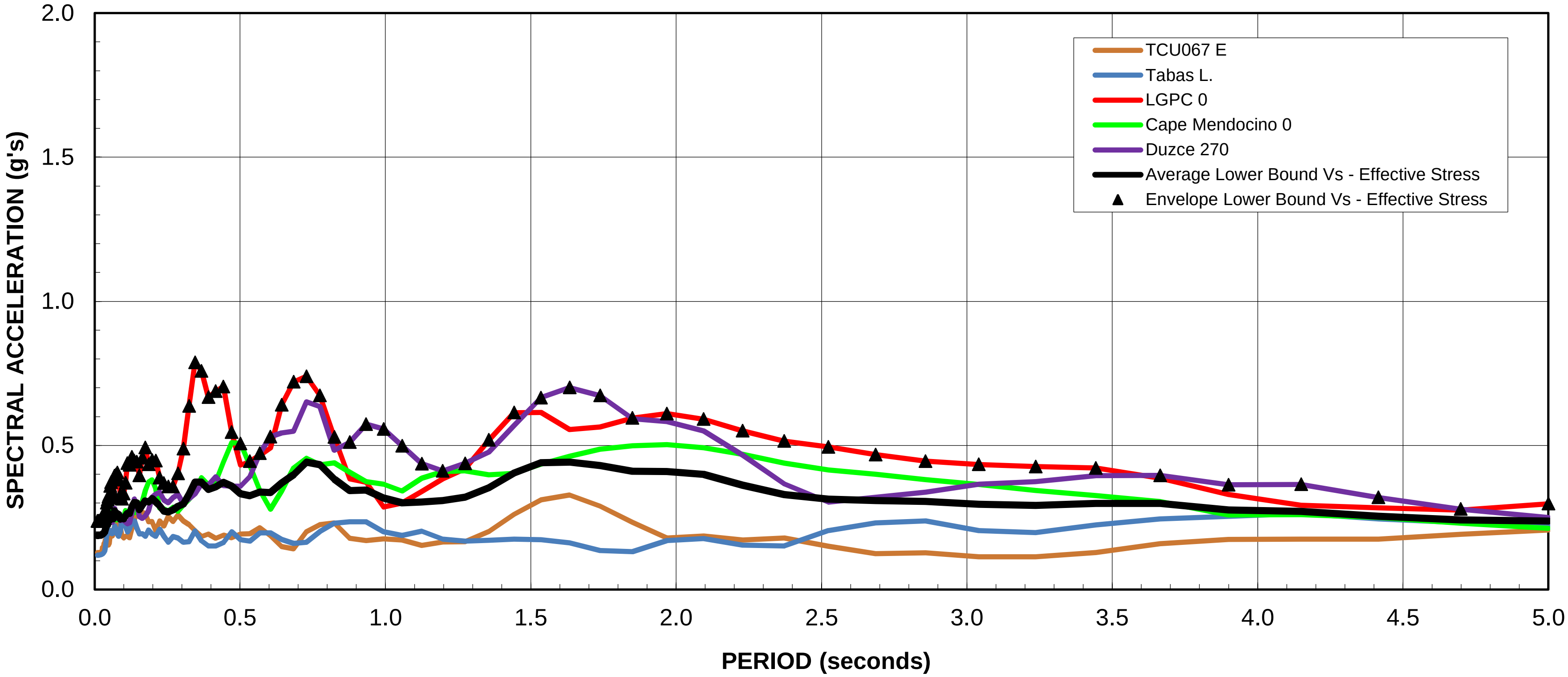
PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF EFFECTIVE STRESS WITH PORE PRESSURE GENERATION AND DISSIPATION NONLINEAR GROUND RESPONSE ANALYSIS UPPER BOUND Vs PROFILE		
Date 07/18/14	Project No. 731630801	Figure 12
LANGAN TREADWELL ROLLO		



Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
RESULTS OF TOTAL STRESS NONLINEAR GROUND RESPONSE ANALYSIS LOWER BOUND V_s PROFILE		
Date 07/18/14	Project No. 731630801	Figure 13
LANGAN TREADWELL ROLLO		



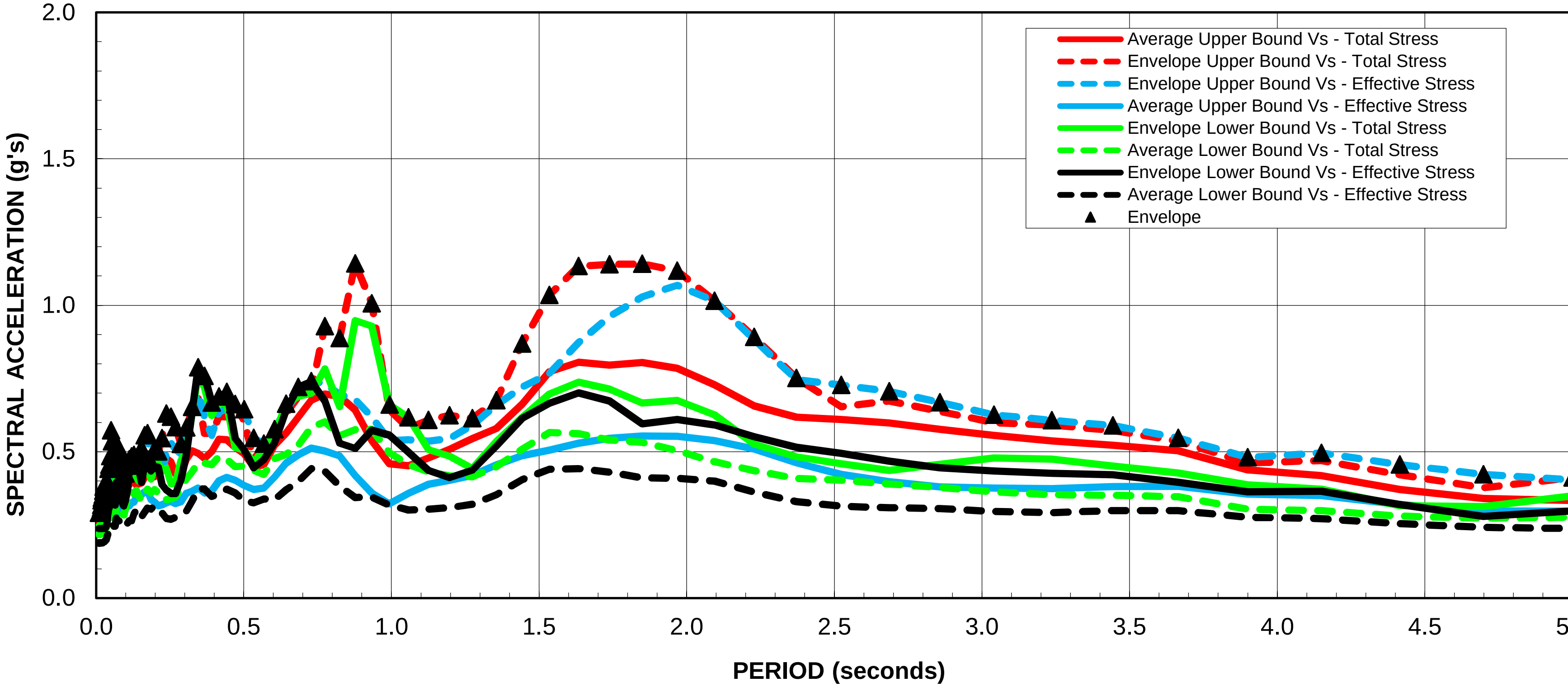
Damping Ratio = 5%

PINE HILL ROAD
REPLACEMENT BRIDGE
Eureka, California

RESULTS OF EFFECTIVE STRESS WITH PORE PRESSURE GENERATION AND DISSIPATION NONLINEAR GROUND RESPONSE ANALYSIS LOWER BOUND Vs PROFILE

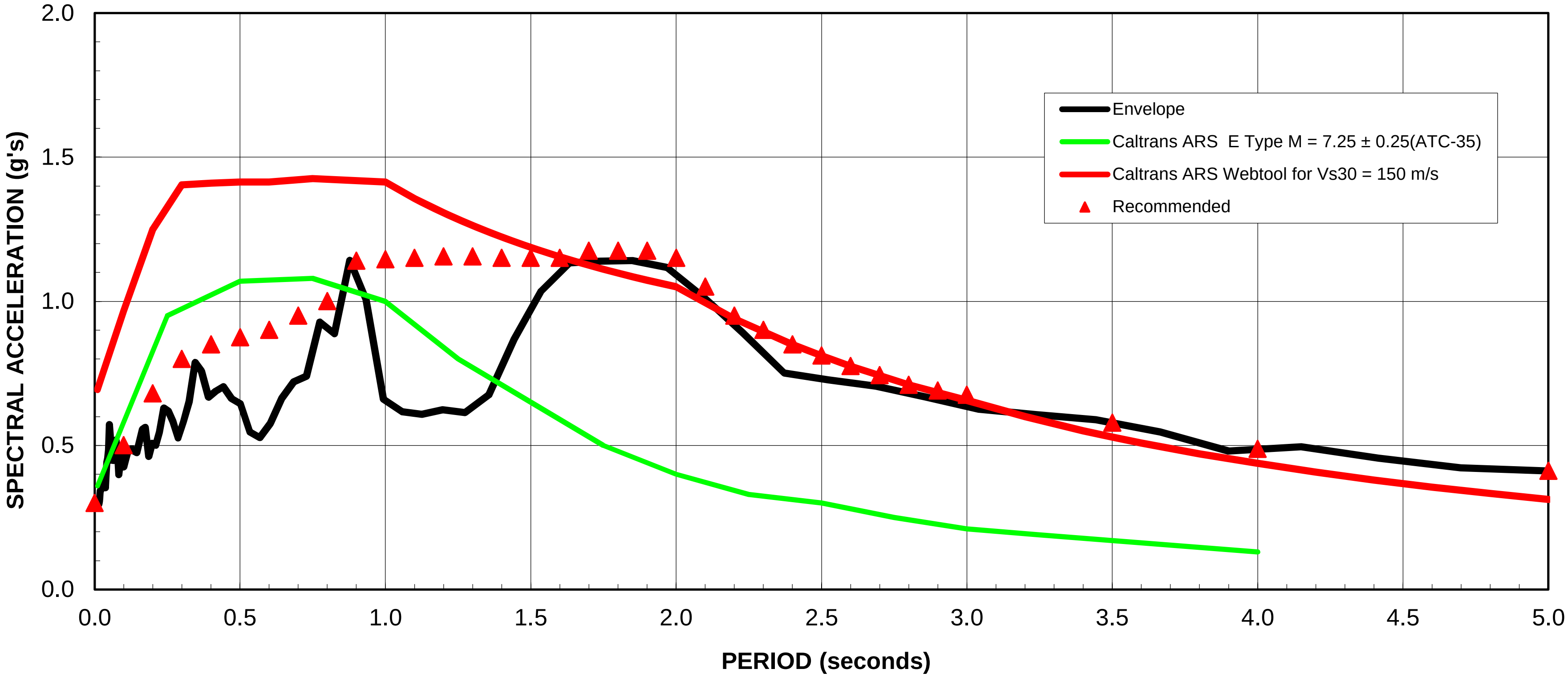
Date 07/18/14	Project No. 731630801	Figure 14

LANGAN TREADWELL ROLLO



Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
COMARISON OF RESULTS OF TOTAL AND EFFECTIVE STRESS NONLINEAR GROUND RESPONSE ANALYSES		
Date 07/18/14	Project No. 731630801	Figure 15
LANGAN TREADWELL ROLLO		



Damping Ratio = 5%

PINE HILL ROAD REPLACEMENT BRIDGE Eureka, California		
COMARISON OF RESULTS OF NONLINEAR GROUND RESPONSE ANALYSIS WITH CALTRANS ARS SPECTRA		
Date 07/03/14	Project No. 731630801	Figure 16
LANGAN TREADWELL ROLLO		

Appendix K - Hydraulics Information

Pine Hill Road Bridge Replacement Project
Humboldt County, California
Federal-Aid Project No. BRLO-5904(112)
Existing Bridge No. 04C0173

Location Hydraulic Study Report

Prepared for:

COUNTY OF HUMBOLDT — The Home of the Redwoods

QUINCY ENGINEERING

Prepared by:

WRECO

November 2015

Pine Hill Road Bridge Replacement Project
Humboldt County, California
Federal-Aid Project No. BRLO-5904(112)
Existing Bridge No. 04C0173

Location Hydraulic Study Report

Submitted to:
Humboldt County Department of Public Works

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

Han-Bin Liang, Ph.D., P.E.
Registered Civil Engineer

11/18/2015
Date

November 2015

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Appendices

Appendix A FEMA Flood Insurance Rate Map (FIRM)

Executive Summary

The Humboldt County Department of Public Works is proposing to replace the Pine Hill Road over Swain Slough (Bridge No. 04C0173). The proposed approach is to replace the existing bridge with a new bridge on the existing alignment. In accordance with Humboldt County requirements, the bridge will provide two 10-ft-wide traffic lanes and 5-ft-wide shoulders, in addition to barrier rails along both sides. In order to satisfy the 50-year event hydraulic clearance requirements, the existing bridge would need to be replaced and the existing roadway profile would have to be raised significantly. This will have major cost implications along with increased environmental and right-of-way impacts. The proposed bridge will need design exceptions to the FHWA freeboard criteria based on site conditions. The proposed bridge type is a single-span precast concrete I-girder, and will be slightly longer than the existing to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the creek channel.

The purpose of this Location Hydraulic Study is to examine and analyze the existing floodplains within the Project limits, to document any potential impacts to or encroachments upon these floodplains resulting from the proposed action, and to recommend any mitigation that may be required.

The peak discharges for Swain/Martin sloughs were estimated using a rainfall/runoff model in HEC-HMS, the U.S. Army Corps of Engineers Hydrologic Engineering Center (USACE)'s Hydrologic Modeling System. The 100-year peak discharge value for Swain/Martin sloughs was estimated to be 2,490 cubic feet per second (cfs). The hydraulic characteristics at the Project site were evaluated using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) modeling software, Version 4.1.0 developed by the USACE. The channel cross sections and proposed bridge geometry were based on data provided by Quincy Engineering, Inc.

The hydraulic characteristics for the Project site are governed by the tailwater elevations from Humboldt Bay. Tidal elevations were estimated from the Federal Emergency Management Agency (FEMA) and National Oceanic and Atmospheric Administration (NOAA) data sources. The proposed bridge will be longer and wider than the existing bridge. It will also be a single-span structure with no piers while the existing bridge is a three-span structure with two piers. However, these geometric improvements would not significantly affect the water surface elevations in the vicinity of the bridge due to the backwater effect from the bay. The roadway and approaches would still be inundated during these extreme storm events. A summary of the 100-year WSEs at the bridge is presented in the following table.

River Station	Description	100-Year WSE (ft)	
		Existing	Proposed
3118.45	Farthest upstream in the model	12.23	12.23
2868.63	Upstream of existing/proposed bridge	12.04	12.04
2686 / 2984.7	Upstream face, existing/proposed bridge	12.09	12.10
2686 / 2984.7	Downstream face, existing/proposed bridge	12.09	12.09
2616.89	Downstream of existing/proposed bridge	11.78	11.78

Note: The elevations reference the National American Vertical Datum of 1988 (NAVD 88); River Station decreases numerically travelling downstream

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRMs), dated August 5, 1986, for Humboldt County, California and Incorporated Areas show the estimated extents of the 100-year flood, Zone A, which includes the project site. No base flood elevations or depths are shown within this zone.

The Project does not propose to change the land use within the Project limits. Therefore, the Project would have insignificant impacts on the floodplain storage. The Project would not increase the WSEs upstream of the bridge. The overall potential risk associated with the proposed bridge is low.

Based on the hydraulic model results, no additional traffic interruptions are anticipated from the base flood due to the proposed improvements. The soffit elevation is designed to be higher than the adjacent banks, so the slough overtops before the soffit gets wet.

Regulatory permits and approvals are required from the USACE, the California Department of Fish and Wildlife, and the Regional Water Quality Control Board as the Project enters the final design phase. The County will coordinate with local, state, and federal water resources and floodplain management agencies as necessary during all aspects of the proposed Project.

Temporary environmental impacts resulting from construction activities for the proposed Project can be minimized with standard measures such as revegetation, best management practices, and other activities that are part of the Project's permit conditions. Long-term adverse effects to the natural and beneficial floodplain values are not anticipated as a result of the Project.

Acronyms

ACES	Automated Coastal Engineering System
ADT	Average Daily Traffic
BIR	Bridge Inspection Report
Caltrans	California Department of Transportation
CEDAS	Coastal Engineering Design and Analysis System
CFR	Code of Federal Regulations
CN	Curve Number
DWR	California Department of Water Resources
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
HBP	Highway Bridge Program
HEC-HMS	Hydrologic Engineering Centers Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HSG	hydrologic soil group
Project	Pine Hill Road over Swain Slough Bridge Replacement Project
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
SCS	Soil Conservation Service
TR-55	Technical Release 55
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
WSE	water surface elevation

LOCATION HYDRAULIC STUDY FORM

Dist. 1 Co. Humboldt Rte. Pine Hill Road P.M. N/A
EA: N/A
Federal-Aid Project Number: BRLO-5904(112)

Floodplain Description: The Project is within FEMA FIRM panel 0600600775C, effective August 5, 1986. The Special Flood Hazard Area (SFHA) classification for Swain Slough at the Pine Hill Road crossing is Zone A, which represents areas that are within a 100-year floodplain, and no base flood elevations (BFE) are determined.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)*
The Project is located approximately 0.2 mi east of Elk River Road at the existing bridge site just south of Eureka, CA. The preferred alternative is to replace the existing bridge on the existing alignment. In accordance with County requirements, the bridge will provide two 10-ft-wide traffic lanes and 5-ft-wide shoulders, in addition to barrier rails along both sides. The proposed bridge will need design exceptions to the FHWA freeboard criteria based on site conditions. The proposed bridge type is a single-span precast concrete I-girder, and will be slightly longer than the existing to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the creek channel.

2. ADT: Current (year 2010) 187 Projected (year 2030) 278

3. Hydraulic Data: Base Flood Q100= 2,490 CFS
WSE100= 12.1 ft NAVD 88 (existing and proposed) *The flood of record, if greater than Q100:*
Q=______CFS WSE= ______
Overtopping flood Q= $> Q_{100}$ CFS WSE= 12.1 ft (existing and proposed)

Are NFIP maps and studies available? NO_____ YES ✓

4. Is the highway location alternative within a regulatory floodway?
NO ✓ YES_____

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

Potential Q100 backwater damages:

A.	Residences?	NO ✓	YES___
B.	Other Bldgs?	NO ✓	YES___
C.	Crops?	NO ✓	YES___
D.	Natural and beneficial Floodplain values?	NO ✓	YES___

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO ✓	YES___
B. Emergency vehicle access?	NO ✓	YES___
C. Practicable detour available?	NO___	YES ✓

LOCATION HYDRAULIC STUDY FORM cont.

Dist. 1 Co. Humboldt Rte. Pine Hill Road P.M. N/A
Federal-Aid Project Number: BRLO-5904(112)
EA N/A Bridge No. 04C0173 (Existing)

D. School bus or mail route? NO ✓ YES __

7. Estimated duration of traffic interruption for 100-year event hours: N/A

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$ N/A
B	Property	$ N/A
	Total	$ N/A

9. Assessment of Level of Risk Low ✓
Moderate_____
High_____

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 8, and 9 of this form is accurate.

________________ *Date* ________
District Hydraulic Engineer *(capital and 'on' system projects)*

[signature] *Date* 11/18/2015
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO ✓ YES_____

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 7 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

________________ *Date* ________
District Project Engineer *(capital and 'on' system projects)*

[signature] *Date* 11/18/15
Local Agency Project Engineer *(local assistance projects)*

LOCATION HYDRAULIC STUDY FORM cont.

Dist. 1 Co. Humboldt Rte. Pine Hill Road P.M. N/A
Federal-Aid Project Number: BRLO-5904(112)
EA N/A Bridge No. 04C0173 (Existing)

CONCURRED BY:

I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

______________________________ *Date* ______________
District Project Manager *(capital and'on' system projects)*

______________________________ *Date* ______________
Local Agency Project Manager *(Local Assistance projects)*

______________________________ *Date* ______________
District Local Assistance Engineer *(or District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

______________________________ *Date* ______________
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Summary Floodplain Encroachment Report

Dist. 1 Co. Humboldt Rte. Pine Hill Road K.P. ________
Federal-Aid Project Number *(Local Assistance)* BRLO-5904(112)
Project No.: ________ Bridge No. 04C0173 (Existing)

Limits: The Project is located approximately 0.2 mi east of Elk River Road at the existing bridge site just south of Eureka, CA. The preferred alternative is to replace the existing bridge on the existing alignment. In accordance with County requirements, the bridge will provide two 10-ft-wide traffic lanes and 5-ft-wide shoulders, in addition to barrier rails along both sides. The proposed bridge will need design exceptions to the FHWA freeboard criteria based on site conditions. The proposed bridge type is a single-span precast concrete I-girder, and will be slightly longer than the existing to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as it will not require any supports in the creek channel.

Floodplain Description: The Project is within FEMA FIRM panel 0600600775C, effective August 5, 1986. The Special Flood Hazard Area (SFHA) classification for Swain Slough at the Pine Hill Road crossing is Zone A, which represents areas that are within a 100-year floodplain, and no base flood elevations (BFE) are determined.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	✓	___
2.	Are the risks associated with the implementation of the proposed action significant?	✓	___
3.	Will the proposed action support probable incompatible floodplain development?	✓	___
4.	Are there any significant impacts on natural and beneficial floodplain values?	✓	___
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	✓	___
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	✓	___
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.	___	✓

PREPARED BY:

________________________ Date ________
District Project Engineer *(capital and 'on' system projects)*

[signature] Date 11/18/2015
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

[signature] Date 11/18/15

Summary Floodplain Encroachment Report cont.

Dist.__1_____Co.___Humboldt____Rte.___Pine Hill Road______K.P.______________
Federal-Aid Project Number *(Local Assistance)*___BRLO-5904(112)______________________
Project No.:____________________________________Bridge No.04C0173 (Existing)

District Project Manager *(capital and 'on' system projects)*

____ *Date* __________________
District Local Assistance Engineer *(Local Assistance projects)*

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

____ *Date* __________________
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

1 GENERAL DESCRIPTION

The Humboldt County Department of Public Works is proposing to replace Bridge No. 04C0173 Pine Hill Road over Swain Slough. The Pine Hill Road over Swain Slough Bridge Replacement Project (Project) site is located just south of Eureka and north of Elk River. The Project is funded through the Federal Aid Highway Bridge Program (HBP) utilizing toll credits as the matching funds. The bridge was inspected by the California Department of Transportation (Caltrans) in 2011 and is classified "Structurally Deficient" with a sufficiency rating of 44.6. This bridge is eligible for replacement under the HBP guidelines.

See Figure 1 for the Project Location Map, Figure 2 for the Project Vicinity Map, and Figure 3 for the Project Aerial Map.

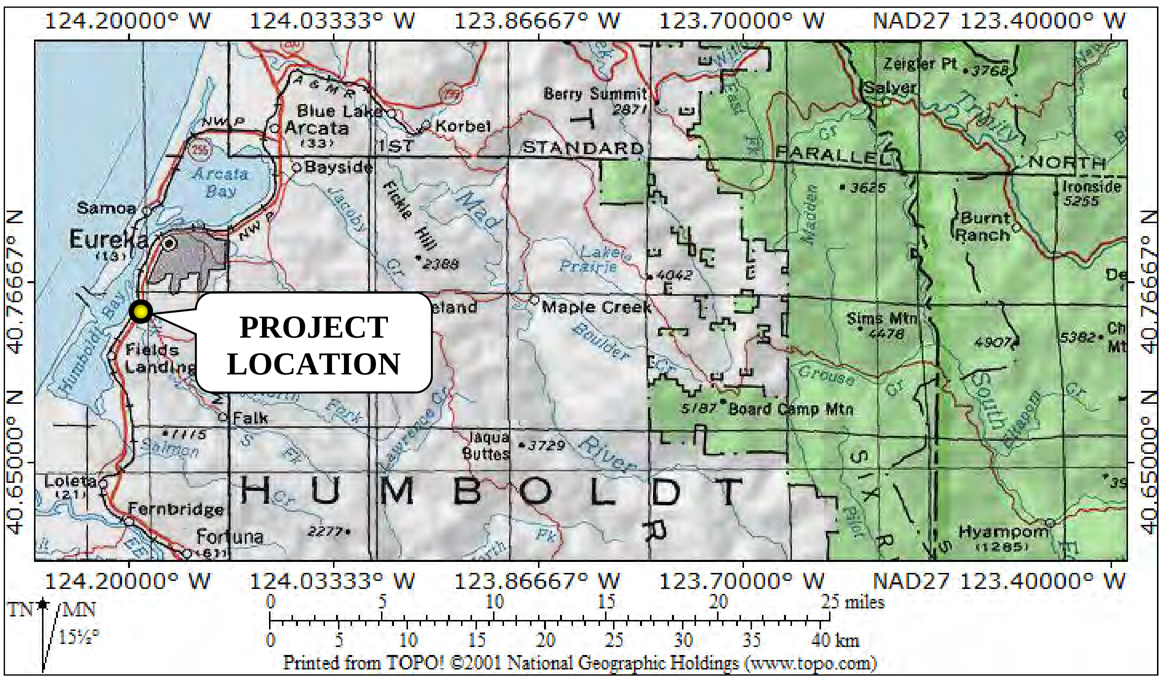

Figure 1. Project Location Map

Source: United States Geological Survey (USGS)

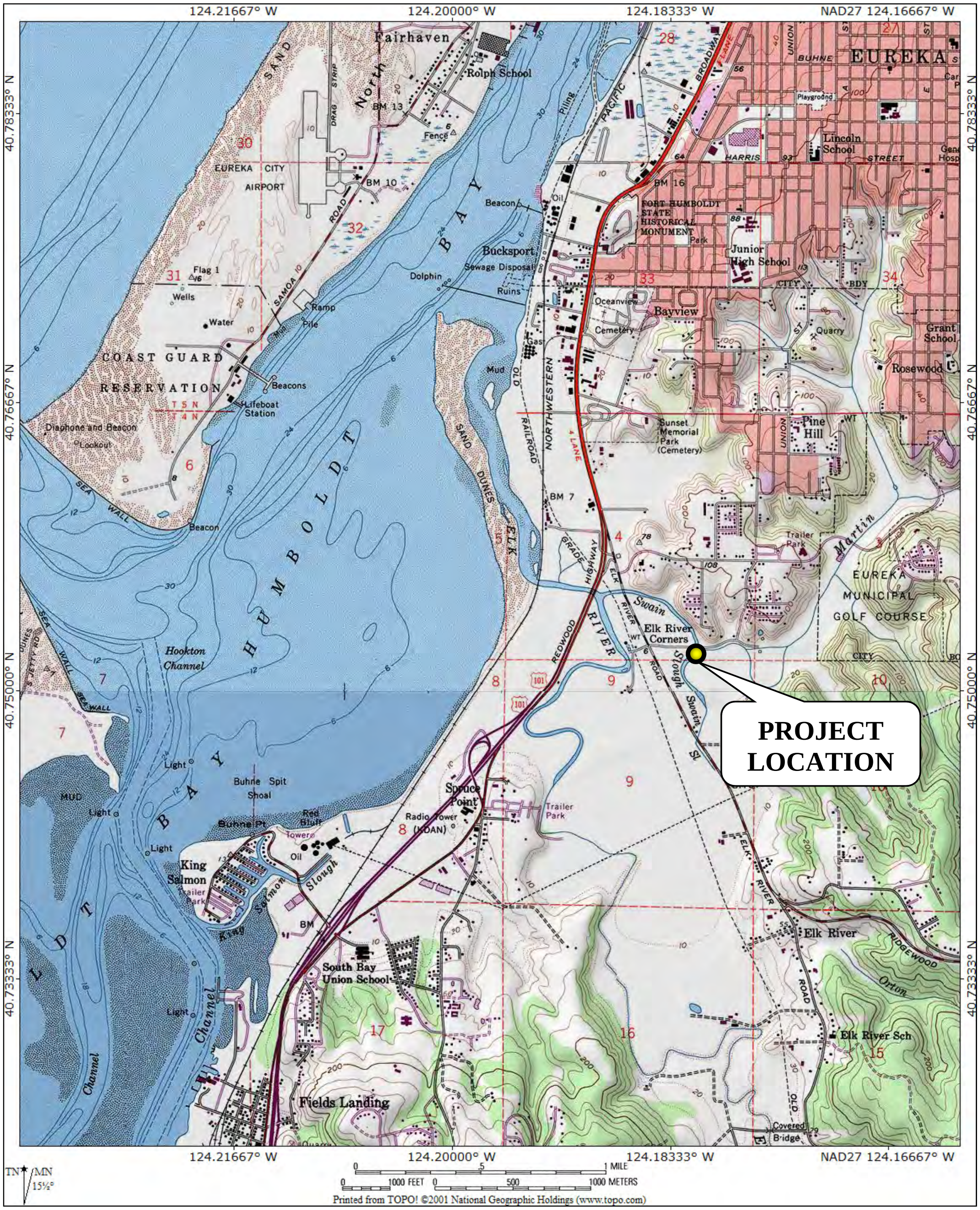

Figure 2. Project Vicinity Map

Source: USGS

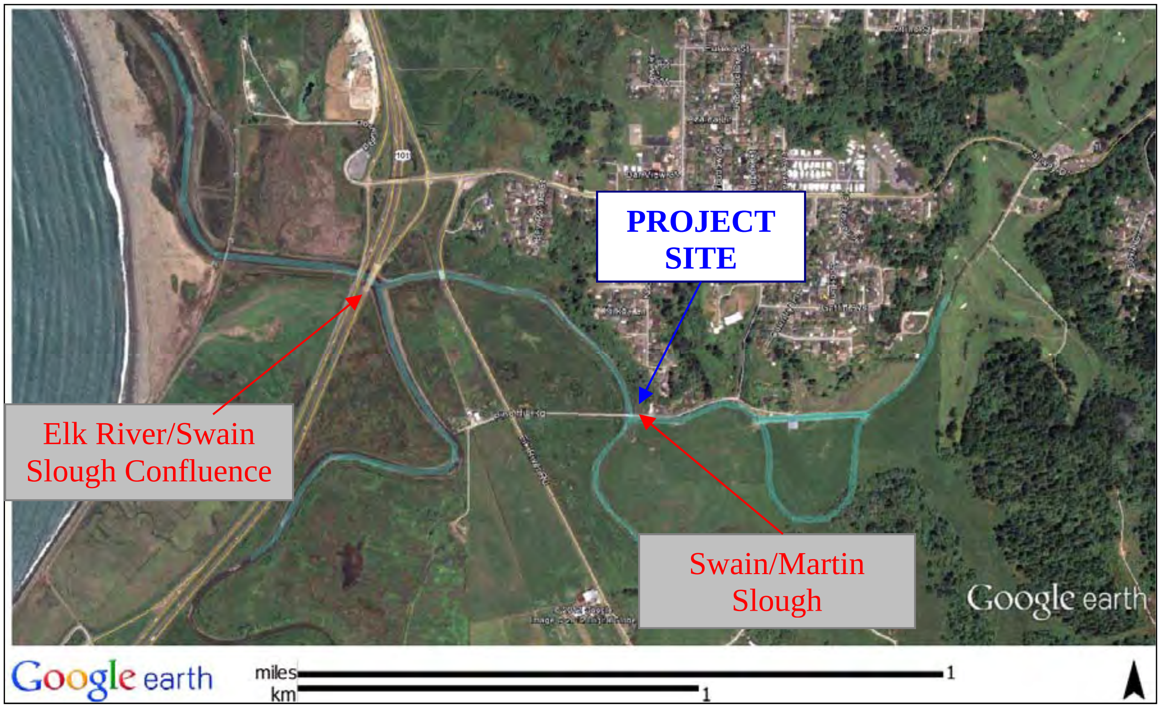

Figure 3. Project Aerial Map

Source: Google Earth

1.1 Existing Bridge

The existing bridge is a 63 ft three-span timber stringer structure with a concrete deck and concrete abutments and was built in 1955 (see Photo 1). The two bent caps are constructed of reinforced concrete on eight total reinforced concrete piles. The bridge clear width is 19ft with a 6-in. curb/rail on each side for a total bridge width of 20 ft. The railing is constructed of painted timbers and there is no end protection at the bridge corners.

The overall roadway alignment is consistent with the flat terrain of the Elk River Valley. The asphalt concrete approach roadway is approximately 19 ft in width. The bridge is located on a tangent segment of the roadway. There is a slight vertical curve both east and west of the bridge though the bridge itself is flat. The non-standard clearance condition has existed at the bridge site since it was constructed. The structure has provided reliable service in its existing condition and does not appear affected or damaged by reduced hydraulic clearance.

1.2 Proposed Bridge

The preferred alternative is to replace the existing bridge with a new bridge on the same alignment. In order to satisfy the 50-year event hydraulic clearance requirements, the existing bridge would need to be replaced and the existing roadway profile would have to be raised significantly. This will have major cost implications along with increased environmental and right-of-way impacts. In accordance with County requirements, the bridge will provide two 10-ft-wide traffic lanes and 5-ft-wide shoulders, in addition to barrier rails along both sides.

The proposed bridge will need design exceptions to the FHWA freeboard criteria based on site conditions. The channel banks are overtopped, and the surrounding area is inundated during the design event in both the existing and proposed conditions. Considering that: 1) the proposed deck elevation is set above the 100-year water surface elevations, 2) the soffit is above the bank elevations, and 3) the proposed bridge provides a significant increase in available conveyance under the bridge with no significant backwater impacts, the preferred alternative maximizes hydraulic performance while minimizing the impact on adjacent areas.

The proposed bridge type is a single-span precast concrete wide flange girder, and will be slightly longer than the existing to better fit the site conditions by reducing the encroachment into the channel. The single-span bridge option will minimize the environmental impacts to the slough as well as adjacent wetlands as it will not require any supports in the creek channel. The proposed bridge does not significantly affect the existing hydraulic clearance conditions such as water surface elevations or flow velocities. The proposed bridge general plan is shown in Figure 4.

Photo 1. Existing Bridge (Looking North/Downstream)

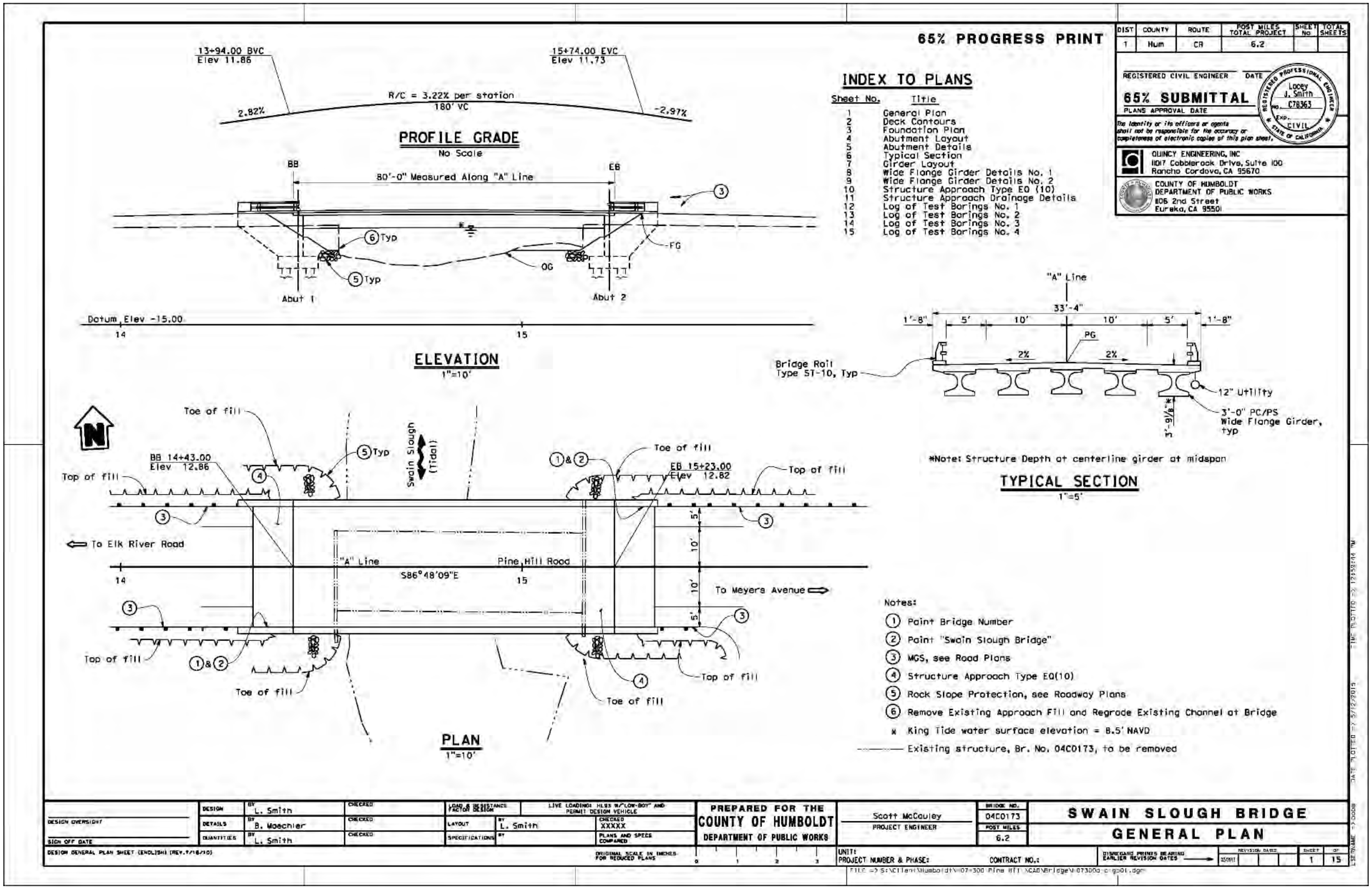

Figure 4. General Plan

Source: QEI, Inc.

1.3 Regulatory Setting

1.3.1 Executive Order 11988

Executive Order 11988 (Floodplain Management) directs all federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Requirements for compliance are outlined in Title 23, Code of Federal Regulations, Part 650, Subpart A (23 CFR 650A) titled "Location and Hydraulic Design of Encroachment on Floodplains."

If the preferred alternative involves significant encroachment onto the floodplain, the final environmental document (final environmental impact statement or finding of no significant impact) must include:

- The reasons why the proposed action must be located in the floodplain,
- The alternatives considered and why they were not practicable, and
- A statement indicating whether the action conforms to applicable State or local floodplain protection standards.

1.3.2 California's National Flood Insurance Program

The Federal Emergency Management Agency (FEMA) is the nationwide administrator of the National Flood Insurance Program (NFIP), which is a program that was established by the National Flood Insurance Act of 1968 to protect lives and property, and to reduce the financial burden of providing disaster assistance. Under the NFIP, FEMA has the lead responsibility for flood hazard assessment and mitigation, and it offers federally backed flood insurance to homeowners, renters, and business owners in communities that choose to participate in the program. FEMA has adopted the 100-year floodplain as the base flood standard for the NFIP. FEMA is also concerned with construction that would be within a 500-year floodplain for proposed projects that are considered "critical actions," which are defined as any activities where even a slight chance of flooding is too great. FEMA issues the Flood Insurance Rate Maps (FIRMs) for communities that participate in the NFIP. These FIRMs present delineations of flood hazard zones.

In California, nearly all of the State's flood-prone communities participate in the NFIP, which is locally administered by the California Department of Water Resources' (DWR) Division of Flood Management. Under California's NFIP, communities have a mutual agreement with the State and Federal government to regulate floodplain development according to certain criteria and standards, which is further detailed in the NFIP.

1.3.3 Humboldt Floodplain Data

The Project site is located within FIRM panel 775 out of 1900 for Humboldt County, California, and incorporated areas, effective August 5, 1986.

1.4 Design Standards

The following criteria were considered in the design of the proposed bridge.

1.4.1 FEMA Standards

FEMA standards are employed for design, construction, and regulation to reduce flood loss and to protect resources. Two types of standards are often employed: design criteria and performance standards.

A design criteria or specified standard dictates that a provision, practice, requirement, or limit be met; e.g., using the 1% flood and establishing floodway boundaries so as not to cause more than a 1-ft increase in flood stages.

A performance standard dictates that a goal is to be achieved, leaving it to the individual application as to how to achieve the goal; e.g., providing protection to the regulatory flood, keeping post-development stormwater runoff the same as pre-development, or maintaining the present quantity and quality of water in a wetland.

The 1% annual chance flood and floodplain have been adopted as a common design and regulatory standard in the United States. The NFIP adopted it in the early 1970s, and it was adopted as a standard for use by all federal agencies with the issuance of Executive Order 11988. States or local agencies are free to impose a more stringent standard within their jurisdiction.

1.4.2 FHWA Standards

The FHWA criterion for the hydraulic design of bridges is that they be designed to pass the 2% probability of annual exceedance flow (50-year recurrence interval design discharge) with adequate freeboard, where practicable, to account for debris and bedload.

1.4.3 Caltrans Standards

The Caltrans criteria for the hydraulic design of bridges is that they be designed to pass the 2% probability of annual exceedance flow (50-year design discharge) or the flood of record, whichever is greater, with adequate freeboard to pass anticipated drift. Two feet (2 ft) of freeboard is commonly used in bridge designs. The bridge should also be designed to convey the 1% probability of annual exceedance flow (100-year design discharge, or base flood). No freeboard is added to the base flood.

1.4.4 Design Exception

An evaluation should be performed to determine, if horizontal and vertical driftway requirements warrant a modified freeboard. The existing and proposed bridges do not meet the freeboard criteria. Although the proposed bridge would not meet freeboard criteria, the 100-year flow is still conveyed through the bridge or across the approach roadways. The soffit elevation is designed to be higher than the adjacent banks, so the slough overtops before the soffit gets wet. The bridge deck has been designed to remain dry during a 100-year flow event. The bridge would not cause objectionable backwater.

The approach roadways leading to the bridge become inundating during high flows. The existing bridge is not accessible from adjacent County roads during flood events, and the County does not plan to improve the approach roadways to meet standard flood elevation. Raising the bridge to meet all hydraulics criteria would be impractical considering the roadway approaches to the new bridge are well below the hydraulics criteria, making the bridge impossible to reach during times of flood.

Configuring the bridge to meet all hydraulics criteria including sea level rise would be very costly and would significantly increase the environmental impacts. The bridge has been designed to accommodate a future raise if needed due to sea level rise.

1.5 Traffic

In 2010, the average daily traffic (ADT) on the bridge was 109. The ADT is projected by the City to increase to 278 in 2030.

1.6 Other Projects in the Project Vicinity

The mouth of Martin Slough is separated from Swain Slough by a levee and tide gates (see Photo 2**Error! Reference source not found.**). The Martin Slough Enhancement Project was proposed and funded by the California State Water Quality Control Board Department of Water Resources and California State Coastal Conservancy. Alternatives were evaluated in the *Martin Slough Enhancement Feasibility Study* in 2006. The preferred alternative for that project consisted of removing the existing tide gates, installing new tide gates with a habitat door designed to create a muted tide cycle and facilitate fish passage, increasing the size of existing ponds, creating new ponds, and making channel modifications throughout the Project area. This structure has been built and in-place at the time this report was written (see Photo 3).

Photo 2. Tide Gates (Looking East from the Bridge)

Photo 3. New Martin Slough Tide Gates

1.7 Vertical Datum

The Project references the North American Vertical Datum of 1988 (NAVD 88). All elevations presented in this report are based on the NAVD 88 datum unless otherwise specified.

2 AFFECTED ENVIRONMENT

2.1 Geographic Location

The Project is located at 40°45' North latitude and 124°11' West longitude, just south of the city of Eureka, California. The Project site is located on Pine Hill Road and crosses over Swain Slough immediately downstream of its confluence with Martin Slough. The Project site is located approximately 0.2 mi east of Elk River Road.

2.2 Watershed Description

The Project is within the Elk River watershed. Pine Hill Road crosses over Swain Slough just downstream of Swain Slough's confluence with Martin Slough. Elk River joins the Swain Slough at a confluence approximately 1,750 feet downstream of the project site. Because of Elk River's proximity to the Project site, it was also analyzed. The watershed delineations are shown in Figure 5. The watershed that drains to the Project site was estimated to be 5.5 square mi.

Table 1. Watershed Areas

Flow Change Location	Watershed Area (sq. mi)
Swain Slough	0.2
Martin Slough	5.2
Swain Slough Downstream of its Confluence with Martin Slough	5.5
Elk River Upstream of its Confluence with Martin/Swain Slough	50.2
Elk River Downstream of its Confluence with Martin/Swain Slough	55.8

2.3 Receiving Water Bodies

The confluence of Swain Slough with Elk River is 0.5 mi downstream of the Project site. Elk River eventually drains into Humboldt Bay approximately 1.5 mi further downstream. Because of its close proximity to Humboldt Bay, the Project is tidally influenced. Flooding in the area will also be affected by sea level rise. The nearest tide gage is North Spit, Humboldt Bay (NOAA Station ID No. 9418767), which was installed in October 6, 1991.

2.4 Precipitation

The mean annual precipitation for the watershed basins described in Section 2.2 were estimated using the USGS StreamStats application, and are summarized in Table 2.

The precipitation depths were obtained from the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 website for California Precipitation Frequency Data using the longitude and latitude of the approximate centroid of the watershed. The 100-year 24-hour precipitation depth was estimated to be 6.53 in. Based on the rainfall distribution map from the NRCS, the Project is within the rainfall distribution Type IA (1986).

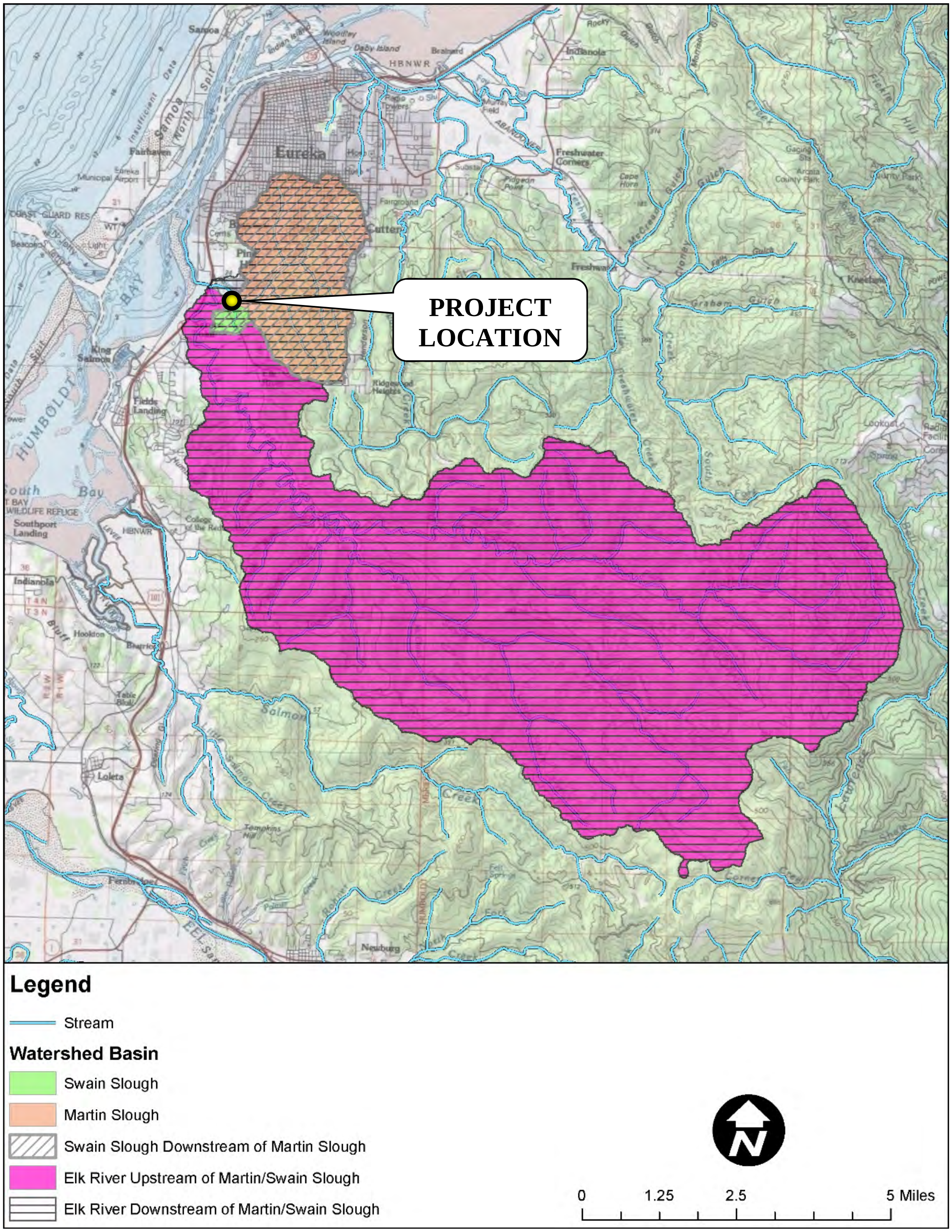

Figure 5. Project Watershed Map

Source: USGS

Table 2. Mean Annual Precipitation

Flow Change Location	Mean Annual Precipitation (in.)
Swain Slough	41.5
Martin Slough	43.1
Swain Slough Downstream of its Confluence with Martin Slough	43.0
Elk River Upstream of its Confluence with Martin/Swain Slough	54.7
Elk River Downstream of its Confluence with Martin/Swain Slough	53.5

2.5 Land Use

The Humboldt County general plan was updated in 2015. The Humboldt GIS Portal web mapping application was accessed to view the land uses for Humboldt County. The Martin/Swain Slough and Elk River watersheds are superimposed on the planned land uses from the General Plan (see Figure 6). A portion of the Martin/Swain Slough watershed is within the already developed city of Eureka. Other land uses within the Martin/Swain Slough watershed are designated in the general plan as low density residential, medium density residential, open space, public facility, coastal timberland, and agricultural exclusive. The land uses within the Elk River watershed are designated low density residential, medium density residential, rural residential, agricultural exclusive, natural resource, open space, public lands, coastal timberland, with a majority of the watershed designated as timberland. The land use element of the general plan describes these land uses and provides policies to ensure that the management of public lands within Humboldt County are consistent with the goals of the general plan. In general, the areas that are designated residential land uses are already developed. A portion of the Martin/Swain Slough watershed that is designated low density residential is currently undeveloped.

2.6 FEMA Floodplains

The Project site is located in Special Flood Hazard Area (SFHA) Zone A, which represents areas subject to flooding by the 100-year flood event determined by approximate methods where BFEs are not shown. At the Project site, the 100-year flood elevation is approximately 12.1 ft NAVD 88, 2.8 ft over the bridge deck.

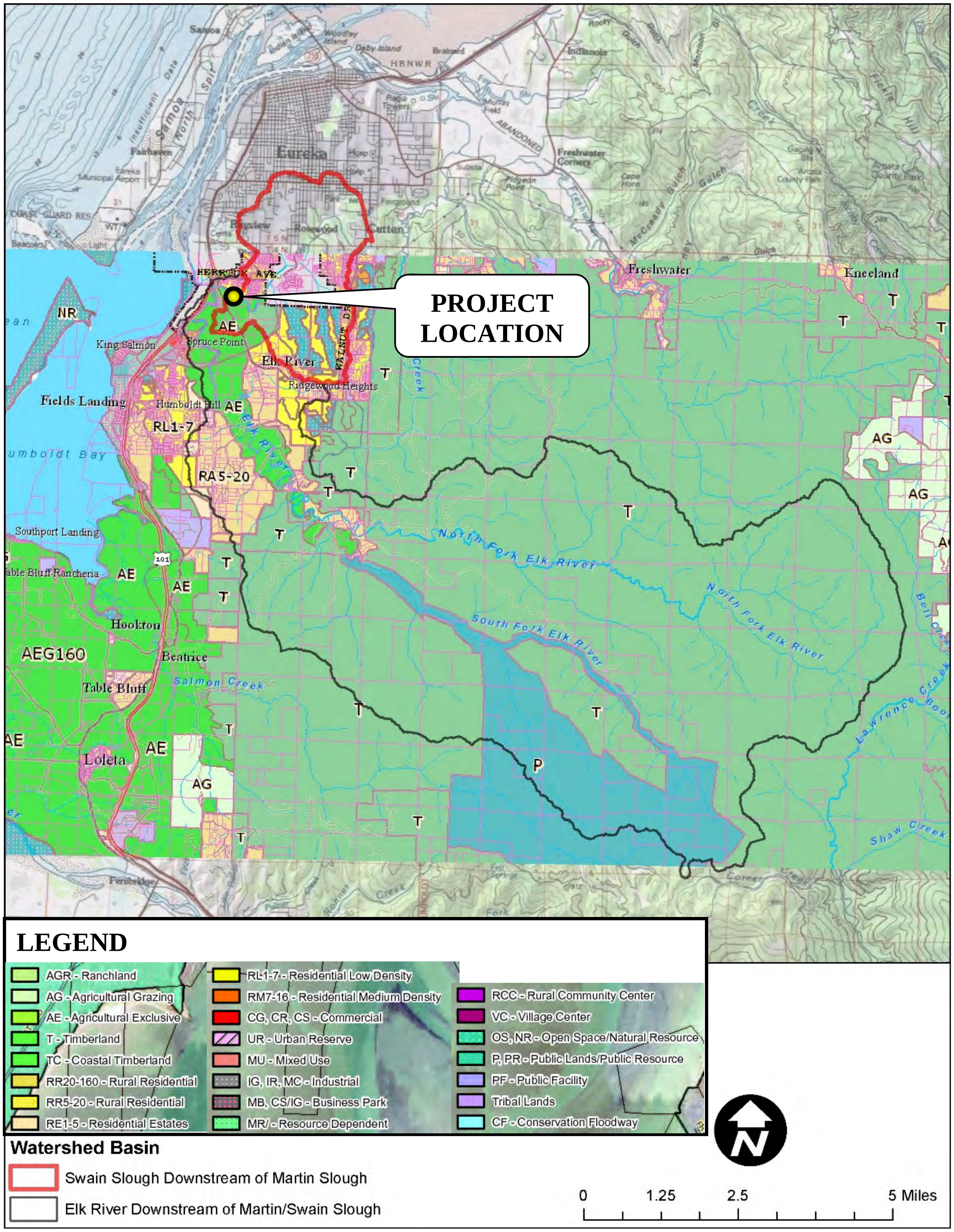

Figure 6. Land Use Map for Project Watershed

Source: USGS

3 HYDROLOGY AND HYDRAULICS

3.1 Hydrologic Assessment

The following sub-sections describe the hydrologic data sources that were used to estimate the flows for the Project site.

3.1.1 Hydrologic Design Methods

WRECO evaluated the hydrology for Martin/Swain Sloughs at the Project site using the following hydrologic methods:

1. USGS Regional Regression Equations
2. Rainfall/Runoff Model using Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) Software

WRECO evaluated the hydrology for Elk River using the United States Geological Survey Regional Regression Equations.

3.1.2 United States Geological Survey Regional Regression Equations

Flood-frequency equations were developed by the USGS based on analysis of gage station data. California is divided into six regions; the Project site is within the North Coast region. These flood-frequency equations are generally used to estimate stream flow for ungaged sites that are not affected by substantial urban development and that are natural (unregulated) streams.

On July 18, 2012, the USGS issued *Methods for Determining Magnitude and Frequency of Floods in California, Based on Data through Water Year 2006* (Gotvald et. al. 2012), which contains regional flood-frequency equations, and includes boundaries of the six regions within California. These equations are based on annual peak-flow data through water year 2006 for 771 streamflow-gaging stations in California having 10 or more years of data.

The flood-frequency equation is as follows (Gotvald et. al., 2012):

$$Q_{100} = 48.5(DRNAREA)^{0.866}(PRECIP)^{0.556}$$

Where:

Q_x = peak discharge for a storm event with a return period of x years, cubic feet per second (cfs)
$DRNAREA$ = drainage area, square mi
$PRECIP$ = mean annual precipitation, in.

The drainage areas for the watersheds in the vicinity of the Project site are presented in Section 2.2 and the mean annual precipitation values for the corresponding watersheds are presented in Section 3.1.3. The design discharges for Martin and Swain Sloughs were estimated based on a combined watershed area because Pine Hill Road crosses over Swain Slough immediately downstream of its confluence with Martin Slough. The calculated design discharges are summarized in Table 3.

Table 3. Regional Regression Design Discharges for the Project

Stream and Location	100 Year Peak Discharge (cfs)
Swain Slough (downstream of confluence with Martin Slough)	1,710
Elk River (upstream of confluence with Swain Slough)	13,340
Elk River (downstream of confluence with Swain Slough)	14,430

3.1.3 Rainfall/Runoff Model

WRECO developed a rainfall/runoff model to estimate the 100-year recurrence interval design discharge for Swain/Martin sloughs using HEC-HMS software, and following the Soil Conservation Service's (SCS) Unit Hydrograph Method. The input parameters were estimated following the procedures in Technical Release 55 (TR-55), the *Urban Hydrology for Small Watersheds* manual (Natural Resources Conservation Service [NRCS] 1986) and *A Guide to Hydrologic Analysis Using SCS Methods* (McCuen 1982).

The Project site drains a watershed area of 5.5 square mi. The watersheds were modeled using the SCS Curve Number (CN) loss method and the SCS Unit Hydrograph transform method. The SCS CN is based on the cover type, hydrologic condition of that cover, and the hydrologic soil group (HSG). Cover types are typically selected based on aerial photographs and land use maps. The hydrologic condition indicates the effects of cover type and treatment on infiltration and runoff.

Infiltration rates and runoff potential are indicated by the soil's HSG. Soils may be assigned to one of four groups (A, B, C, or D). Group A has high infiltration rates (low runoff potential) and consists mainly of deep, well-drained to excessively drained sands or gravelly sands. On the other end of the spectrum, Group D has very slow infiltration rates (high runoff potential) and consists chiefly of clays that have a high shrink-swell potential or soils with a clay or nearly impervious layer near the surface. The HSGs were not available from the NRCS online *Web Soil Survey* (2015), and the soils underlying the Project's watershed were assumed to be HSG D, as the major soil type onsite is observed to be clay.

Based on the land uses from the county general plan and the HSG, a composite CN was estimated to represent the watershed basin. In the hydrologic model, the rainfall is converted to runoff by using a CN. The composite CN was estimated to be 91 and the corresponding initial abstraction value was estimated to be 0.198 inches. The initial abstraction is the part of rainfall that occurs before direct stormwater runoff begins, and consists of interception, initial infiltration, surface depression storage, evapotranspiration, and other factors.

The lag time was estimated using the lag time presented in *A Guide to Hydrologic Analysis Using SCS Methods* (McCuen 1982). The lag time is calculated using the following equation:

$$L = \frac{\ell^{0.8}(S+1)^{0.7}}{1900Y^{0.5}}$$

Where:

L = lag time, which is the time from the center of mass of rainfall excess to the peak discharge, hours

ℓ = hydraulic length, feet

S = maximum retention, unitless

$$S = \frac{1000}{CN} - 10$$

Where:

CN = runoff curve number

Y = slope, percent

The lag time was calculated to be 1.6 hours.

The peak discharge at the Project site during the 100-year event was estimated to be 2,490 cfs.

3.1.4 Design Discharge Summary and Selected Design Discharges

Because the majority of the watershed area for Elk River is rural where flows are generally unaffected by urban development, the peak discharges calculated using the regional regression equations were used for the hydraulic analysis.

A large portion of the watershed area for Swain/Martin sloughs is encompassed by the city of Eureka as well as other residential areas within unincorporated Humboldt County. Because of the urban nature of the watershed, the regional regression equations for Swain/Martin sloughs were only used as a basis of comparison. Therefore, the peak discharges calculated using the rainfall/runoff method were selected for use in the hydraulic analysis.

The peak discharges selected for the hydraulic analysis are presented in Table 4, and the confluence points are identified in the aerial map image in Figure 3.

Table 4. Swain/Martin Sloughs and Elk River Peak Discharge Values

Stream and Location	100-Year Peak Discharge (cfs)
Swain Slough (downstream of confluence with Martin Slough)	2,490
Elk River (River Station 1407.91: upstream of confluence with Swain Slough)	13,340
Elk River (River Station 62.62: downstream of confluence with Swain Slough)	14,430

3.1.5 Hydrologic Stability

Based on a review of aerial imagery and land use maps from the Humboldt County general plan, a portion of the Martin/Swain Slough watershed is within the already developed city of Eureka. A portion of the Martin/Swain Slough watershed that is designated low density residential is currently undeveloped. In general, the areas that are designated residential land uses are already developed. Flows from these area are expected to be larger than undeveloped flows. Future development in the watershed may result in changes to the hydrograph.

3.2 Hydraulic Assessment

The following subsections discuss the development of the hydraulic models and summarize the results for the existing and proposed conditions. The water surface profile plots, hydraulic summary tables, and channel cross sections are included in Section 3.3 for the existing and proposed bridges.

3.2.1 Design Tools

The hydraulic analyses were performed for the existing and proposed conditions using the U.S. Army Corps of Engineers Hydrologic Engineering Center's (USACE) Hydrologic Engineering Centers River Analysis System (HEC-RAS) modeling software, Version 4.1.0.

3.2.2 Cross Section Data

Survey data was provided by Quincy Engineering, Inc., which included stream survey of Swain Slough, Martin Slough, and Elk River. The survey data referenced the NAVD 88 datum.

3.2.3 Modeled Hydraulic Structures

The geometry of the existing bridge in the hydraulic model is based on information from the Caltrans Bridge Inspection Report (BIR) and survey data provided by Quincy Engineering, Inc. The bridge deck elevations were based on the survey data. The proposed structural design and roadway profiles for the proposed bridge replacement were based on General Plan documents provided by Quincy Engineering, Inc.

3.2.4 Model Boundary Condition

Because of the Project site's proximity to Humboldt Bay, the downstream model boundary condition used tidal elevations from Humboldt Bay for the hydraulic design of the bridge. Information from FEMA and NOAA was obtained to develop the model's downstream boundary condition. The proposed bridge is designed based on the tidal elevations at Humboldt Bay. Although there are various studies investigation sea level rise, the downstream tidal elevations used for the model boundary conditions are based on current information.

For the purposes of scour, two other downstream boundary conditions were considered: a normal depth slope of 0.1% and mean lower-low water (MLLW). Mean lower low water from the tide gage at North Spit, Humboldt Bay, California (Station ID Number 9418767) for the 1983 to 2001 tidal epoch (tidal datum analysis period between January 1, 1983 and December 31, 2001) is -0.34 ft NAVD 88. The tidal elevations for the North Spit tide gage are graphically depicted in Figure 7.

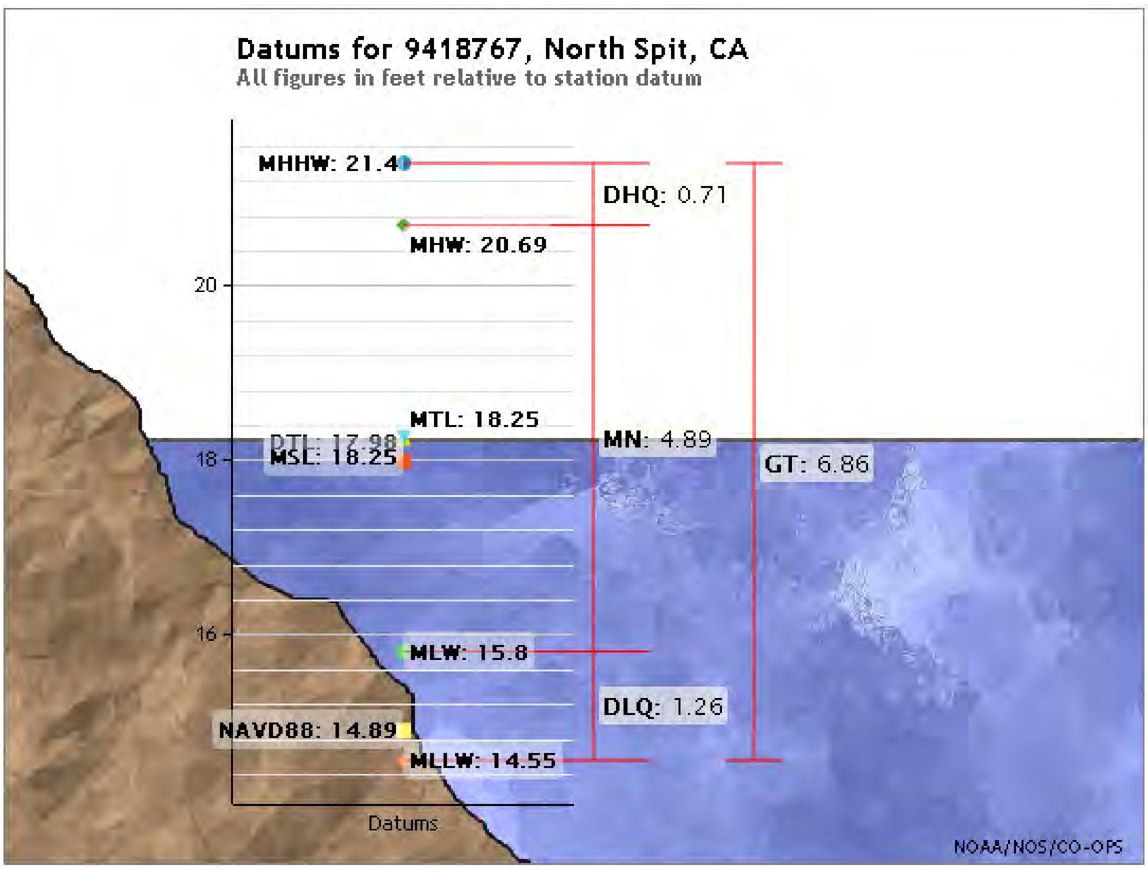

Figure 7. Tidal Elevations at North Spit Tide Gage

Source: NOAA

3.2.5 National Oceanic and Atmospheric Administration Data for Humboldt Bay

The calculation of extreme water surface events was performed using the Automated Coastal Engineering System (ACES), a program developed by the USACE and included as part of the Coastal Engineering Design and Analysis System (CEDAS). Historical tide data was obtained from NOAA's website for the tide gage at North Spit. The monthly highest water levels from 1979 through 2011 were retrieved from NOAA's database. This data was used to determine the historical yearly maximum water surface elevation, which was then used in the Extremal Significant Wave Height Analysis module of ACES to calculate 100-year and 50-year water surface elevations. The Weibull distribution with k equal to 2.0 was the best fit for the data, with a correlation of 0.99. The extreme tidal water surface elevations were calculated to be 8.04 ft for the 100-year event and 7.92 ft for the 50-year event.

3.2.6 Federal Emergency Management Agency Data for Humboldt Bay

The effective Flood Insurance Study (FIS) for Humboldt County (FEMA 1999) included stillwater elevations for Humboldt Bay at the city of Eureka. The reported elevations reference the National Geodetic Vertical Datum of 1929 (NGVD 29) vertical datum. A height conversion of 3.31 ft from NOAA's VERTCON was used to convert the elevations from NGVD 29 to NAVD 88 to match the vertical datum referenced for the Project. A preliminary FIS for Humboldt County (FEMA 2015) includes stillwater elevations for Humboldt Bay that already reference the NAVD 88 datum.

Table 5. Humboldt Bay Stillwater Elevations

Source	50-Year Stillwater Elevation
Effective FIS 1999	6.1 ft NGVD 29 (9.41 ft NAVD 88)
Preliminary FIS 2015	9.67 ft NAVD 88

3.2.7 Selected Downstream Boundary Condition

The stillwater elevation for Humboldt Bay from the preliminary FIS was selected as the downstream boundary condition for the hydraulic design. Although the FIS is preliminary, it provides the best available data and is a more conservative estimate than the effective data.

3.2.8 Sea Level Rise

The proposed bridge is designed based on the tidal elevations at Humboldt Bay and there are provisions to raise the bridge in the future to address sea level rise, but the currently proposed bridge is not designed to account for sea level rise. The following discussions are included based on currently available information and should be verified if the bridge is raised in the future. The bridge foundations are designed for the superstructure to be able to be raised in the future to accommodate sea level rise.

Sea level rise at the Project site was estimated using information from *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present and Future (National Academy of Science 2012).* The sea level rise in the year 2100 is projected to be 91.9 +/- 25.5 cm in San Francisco and its surrounding regions.

3.3 Water Surface Elevations

The water surface elevations at the upstream side of the bridge for the existing and proposed conditions are summarized in Table 6. The water surface profiles along the studied stream reach are presented in Figure 8 for the existing and proposed bridges. The cross sections at the upstream sides of the existing and proposed bridges are shown in Figure 9.

Table 6. Water Surface Elevations at Upstream Side of Pine Hill Road Bridge with Stillwater Elevations of Humboldt Bay from Preliminary FIS

Bridge Condition	100-Year Water Surface Elevation (ft)
Existing	12.1
Proposed	12.1

The proposed bridge will be longer and wider than the existing bridge. It will also be a single-span structure with no piers while the existing bridge is a three-span structure with two piers. However, these geometric improvements would not significantly affect the water surface elevations in the vicinity of the bridge. The tidal water surface elevations from Humboldt Bay govern the water surface elevations at the Project site. The bridge approaches would still be inundated during these extreme storm events.

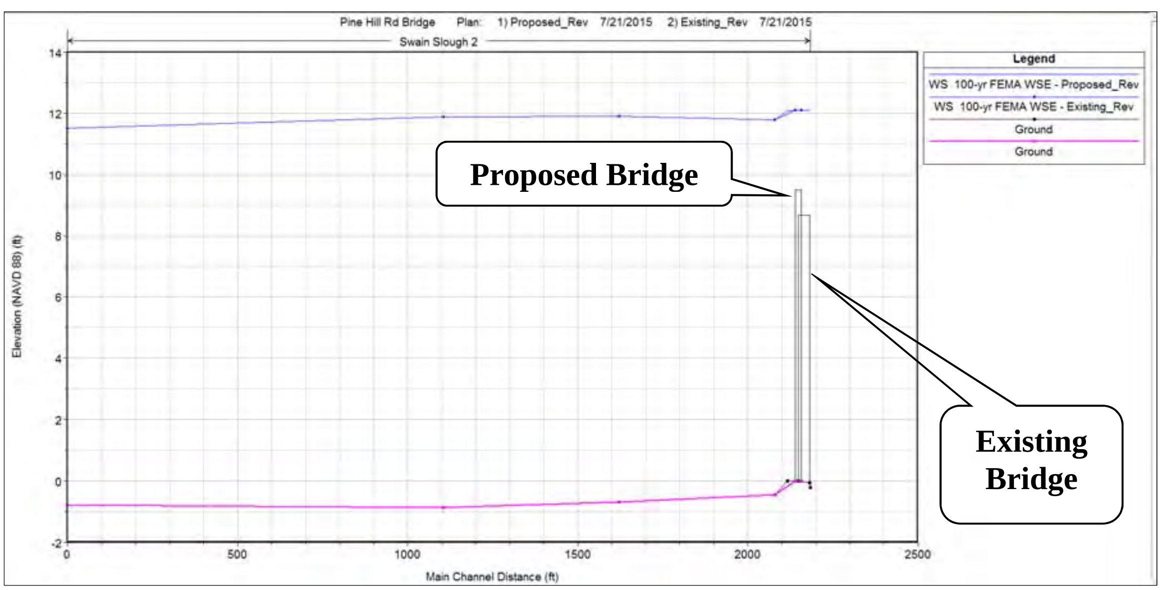

Figure 8. Swain Slough 100-Year Water Surface Profile at Pine Hill Road

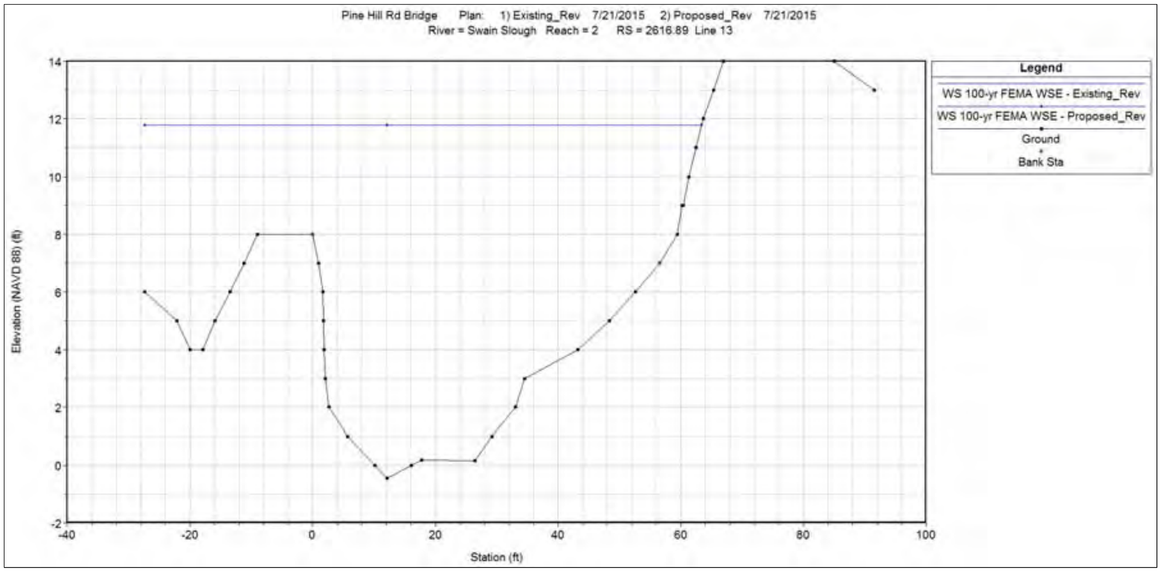

Figure 9. Upstream Face of Existing and Proposed Bridge, Looking Downstream (North)

4 PROJECT EVALUATION

Executive Order 11988 requires federal agencies to avoid to the maximum extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. This section analyzes the impacts associated with this Project.

4.1 Risk Associated with the Proposed Action

As defined by the FHWA, risk shall mean the consequences associated with the probability of flooding attributable to an encroachment. It shall include the potential for property loss and hazard to life during the service life of the bridge and roadway.

The potential risk associated with the implementation of the proposed action includes but is not limited to: 1) change in land use, 2) change in impervious surface area, 3) fill inside the floodplain, or 4) change in the 100-year water surface elevation. Change in Land Use The Project does not propose to change the land use within the Project limits.

4.1.1 Change in Land Use

The project will not change the land use. Therefore, there is no risk due to this factor.

4.1.2 Change in Impervious Surface Area

The proposed bridge will not result in significant change in the impervious surface area, so there is no risk due to this factor.

4.1.3 Fill Inside the Floodplain

The proposed bridge will not cause increase in fill inside the floodplain, so there is no risk due to this criterion.

4.1.4 Change in the 100-Year Water Surface Elevation

The hydraulic model indicated that the proposed bridge would result in no significant change of WSE upstream of the bridge, as discussed in Section 3.3. The tidal water surface elevations from Humboldt Bay govern the water surface elevations at the Project site. The bridge and approaches would still be inundated during these extreme storm events. Therefore, the risk due to this factor is low.

4.2 Summary of Potential Encroachments

The FHWA defines a significant encroachment as a highway encroachment, and any direct support of likely base floodplain development, that would involve one or more of the following construction or flood-related impacts: 1) significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route, 2) a significant risk, or 3) a significant adverse impact on the natural and beneficial floodplain values (FHWA 1994).

The following sections discuss the potential impacts to the floodplain that may result from the proposed action. The risk associated with implementation of the action is discussed in Section 4.1.

4.2.1 Potential Traffic Interruptions for the Base Flood

Under existing conditions, the FEMA FIRM shows the bridge and roadway approaches are within Zone A, which represents areas that are within the 100-year floodplains. Based on the hydraulic model that was prepared for this Project, the proposed bridge will not cause significant change in WSE during storm events. Therefore, additional traffic interruptions due to the base flood are not anticipated at the Project location.

4.2.2 Potential Impacts on Natural and Beneficial Floodplain Values

Natural and beneficial floodplain values include, but are not limited to: fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and ground water recharge.

The proposed bridge replacement project will not adversely impact any natural or beneficial floodplain value in the project vicinity.

4.2.3 Support of Probable Incompatible Floodplain Development

As defined by the FHWA, the support of incompatible base floodplain development will encourage, allow, serve, or otherwise facilitate incompatible base floodplain development, such as commercial development or urban growth.

As the project site is in not in an urban or industrial setting, the support of probable incompatible floodplain development is not of concern due to the project.

4.2.4 Longitudinal Encroachments

As defined by the FHWA, a longitudinal encroachment is an action within the limits of the base floodplain that is longitudinal to the normal direction of the floodplain.

A longitudinal encroachment is “[a]n encroachment that is parallel to the direction of flow. Example: A highway that runs along the edge of a river is usually considered a longitudinal encroachment.” The requirement for consideration of avoidance alternatives must be included in a Location Hydraulic Study by including an evaluation and a discussion of the practicability of alternatives to any significant encroachment or any support of incompatible floodplain development.

Although the improvements would longitudinally encroach onto the base floodplain, the existing road and bridge already encroaches longitudinally onto the base floodplain. The improvements would not significantly impact the WSEs.

5 AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

5.1 Minimize Floodplain Impacts

Based on the hydraulic modeling, the proposed bridge would not result in changes in land use. The Project would have minimal effects to the floodplains within the Project limits. The potential negative impacts of the proposed bridge to the existing floodplain would be minimal. No special minimization or mitigation measures are required.

5.2 Restore and Preserve Natural and Beneficial Floodplain Values

Environmental impacts due to temporary construction activities can be mitigated with standard best management practice measures. The USACE Individual Permit and Clean Water Act Section 404 permits, the California Department of Fish and Wildlife 1600 Streambed Alteration agreement, and the Regional Water Quality Control Board 401 Water Quality Certification are in place for the Project

5.3 Alternatives to Significant Encroachments

5.4 The Project would not impact the elevation of the 100-year flood within the Project vicinity. There would be no floodplain encroachments. Because this Project is not considered a significant encroachment, other alternatives were not evaluated.Alternatives to Longitudinal Encroachments

Although the improvements would longitudinally encroach onto the base floodplain, the existing road and bridge already encroaches longitudinally onto the base floodplain. The improvements would not significantly impact the WSEs. Therefore, avoidance alternatives were not considered.

5.5 Coordination with Local, State, and Federal Water Resources and Floodplain Management Agencies

The City will coordinate with local, state, and federal water resources and floodplain management agencies as necessary during all aspects of the proposed Project. Regulatory permits and approvals, as mentioned in Section 5.2, would be required as the Project enters the final design phase.

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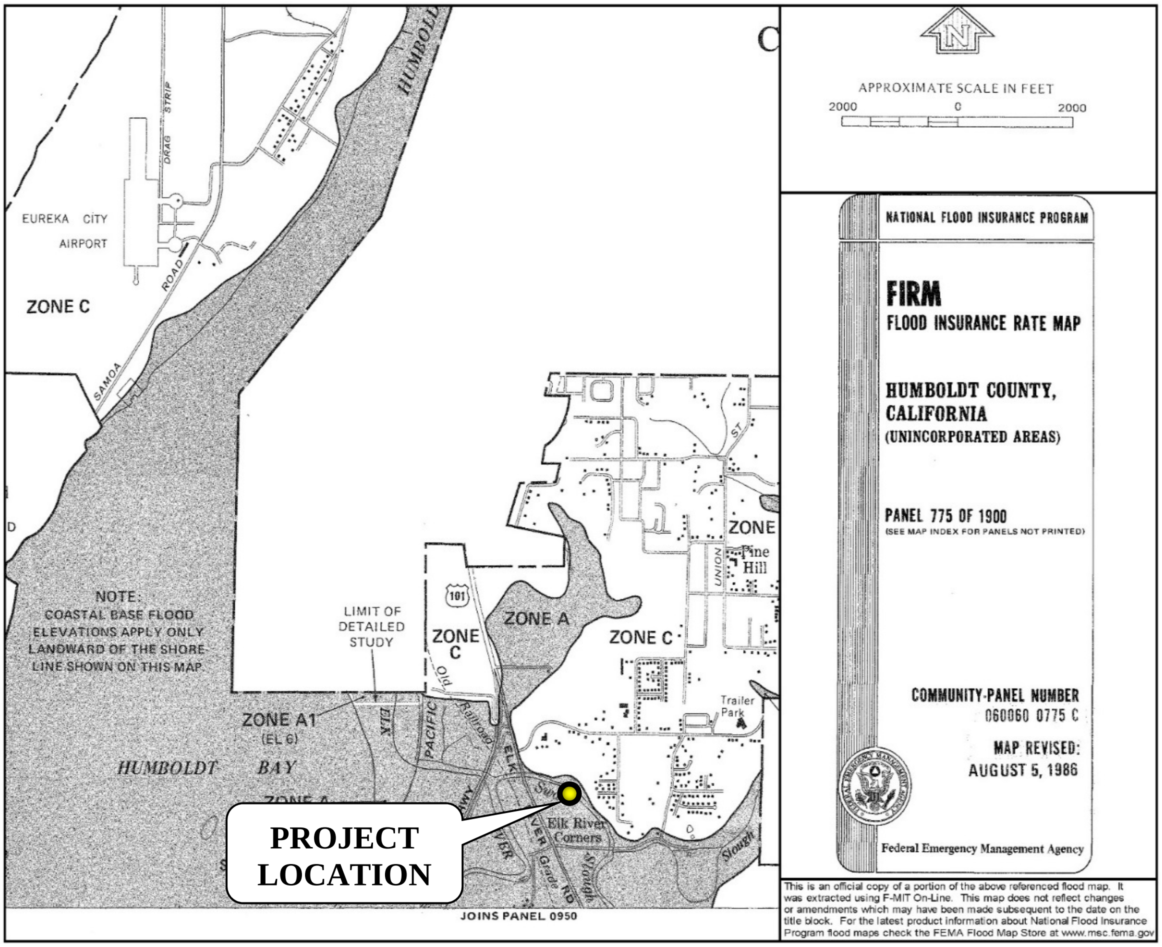
Appendix A Federal Emergency Management Agency Flood Insurance Rate Map (FIRM)


APPROXIMATE SCALE IN FEET
2000
0
2000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
HUMBOLDT COUNTY, CALIFORNIA
(UNINCORPORATED AREAS)
PANEL 775 OF 1900
(SEE MAP INDEX FOR PANELS NOT PRINTED)
COMMUNITY-PANEL NUMBER
060060 0775 C
MAP REVISED:
AUGUST 5, 1986
Federal Emergency Management Agency
EUREKA CITY AIRPORT
ZONE C
NOTE: COASTAL BASE FLOOD ELEVATIONS APPLY ONLY LANDWARD OF THE SHORE-LINE SHOWN ON THIS MAP.
LIMIT OF DETAILED STUDY
ZONE A
ZONE C
ZONE A1 (EL 6)
HUMBOLDT BAY
Pine Hill
Trailer Park
Elk River Corners
PROJECT LOCATION
JOINS PANEL 0950
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Source: FEMA

Pine Hill Road over Swain Slough Bridge Replacement
Humboldt County, California
Federal-Aid Project No. BRLO-5904(112)
Existing Bridge No. 04C0173

Bridge Design Hydraulic Study Report

Prepared for:

Prepared by:

November 2015

Pine Hill Road over Swain Slough Bridge Replacement
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Bridge Design Hydraulic Study Report

Submitted to:
Humboldt County Department of Public Works

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

Han-Bin Liang, Ph.D., P.E.
Registered Civil Engineer

11/18/2015
Date

November 2015

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Executive Summary

The Humboldt County Department of Public Works is proposing to replace Bridge No. 04C0173 Pine Hill Road over Swain Slough. The Pine Hill Road over Swain Slough Bridge Replacement Project (Project) site crosses over Swain Slough immediately downstream of its confluence with Martin Slough. The mouth of Martin Slough is separated from Swain Slough by a levee and tide gates. The confluence of Swain Slough with Elk River is 0.5 mi downstream of the Project site. Elk River eventually drains into Humboldt Bay approximately 1.5 mi further downstream. Because of its close proximity to Humboldt Bay, the Project is tidally influenced, and Elk River was also analyzed. Quincy Engineering, Inc. has provided the engineering design plans for the bridge design for the Project.

The purpose of this Bridge Design Hydraulic Study report is to present the hydrologic and hydraulic characteristics for the Project site, present the estimated scour depths at the proposed bridge, and provide recommendations for scour countermeasures for the proposed bridge.

The peak discharges for Swain/Martin sloughs were estimated using a rainfall/runoff model. The 100-year and 50-year peak discharge values for Swain/Martin sloughs were estimated to be 2,490 cubic feet per second (cfs) and 2,200 cfs, respectively. The hydraulic characteristics at the Project site were evaluated using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) modeling software, Version 4.1.0 developed by the U.S. Army Corps of Engineers (USACE).

The hydraulic characteristics for the Project site are governed by the tailwater elevations from Humboldt Bay. Tidal elevations were estimated from the Federal Emergency Management Agency (FEMA) and National Oceanic and Atmospheric Administration (NOAA) data sources. The proposed bridge will be longer and wider than the existing bridge. It will also be a single-span structure with no piers while the existing bridge is a three-span structure with two piers. However, these geometric improvements would not significantly affect the water surface elevations in the vicinity of the bridge. The tidal water surface elevations from Humboldt Bay govern the water surface elevations at the Project site. The roadway approaches would still be inundated during these extreme storm events.

The Federal Highway Administration (FHWA) criteria indicates that the bridge should be designed to pass the 50-year storm event with adequate freeboard to account for debris and bedload. The California Department of Transportation (Caltrans) also recommends that the bridge be designed to pass the 50-year storm event with adequate freeboard to account for debris and bedload (Caltrans recommends 2 ft of freeboard), or the 100-year storm event with no freeboard. The existing and proposed bridges do not meet the freeboard criteria. The water surface elevations and freeboard for the existing and proposed bridges are presented in the tables below for the 100-year and 50-year storm

events. Although the bridge would not meet freeboard requirements, the 100- and 50-year flows are still conveyed through the bridge or across the approach roadways.

The proposed bridge will need design exceptions to the FHWA freeboard criteria based on site conditions. The channel banks are overtopped, and the surrounding area is inundated during the design event in both the existing and proposed conditions. Considering that: 1) the proposed deck elevation is set above the 100-year water surface elevations, 2) the soffit is above the bank elevations, and 3) the proposed bridge provides a significant increase in available conveyance under the bridge with no significant backwater impacts, the preferred alternative maximizes hydraulic performance while minimizing the impact on adjacent areas.

100-Year Water Surface Elevations and Freeboard at Upstream Face of Bridges

Alternative	Lowest Bridge Soffit Elevation (ft*)	Water Surface Elevation (ft*)	Available Freeboard (ft)
Existing	9.3	12.1	-2.8
Proposed	8.9	12.1	-3.2

Note: * The elevations reference the North American Vertical Datum of 1988 (NAVD 88)

50-Year Water Surface Elevations and Freeboard at Upstream Face of Bridges

Alternative	Lowest Bridge Soffit Elevation (ft*)	Water Surface Elevation (ft*)	Available Freeboard (ft)
Existing	9.3	11.5	-2.2
Proposed	8.9	11.5	-2.6

Note: * The elevations reference the NAVD 88 datum.

Scour calculations were performed for the proposed conditions based on the FHWA's *Hydraulic Engineering Circular No. 18*, "Evaluating Scour at Bridges" (HEC-18). WRECO evaluated the scour potential and scour countermeasure analysis using the hydraulic characteristics for the 100-year storm event from the hydraulic analysis for the proposed bridge. Because of the tidal nature of the Project site, scour was estimated using three downstream boundary conditions: the estimated stillwater elevation of Humboldt Bay from the preliminary Flood Insurance Study (FIS), a downstream normal depth slope, and the mean lower low water elevation from the North Spit tide gage. With the stillwater elevation from Humboldt Bay, the average channel velocities would be slow, and the water surface elevations would be high. With normal depth slope, because of the overall flat longitudinal channel slope, the average channel velocities would be slow, and the water surface elevations would be high. With the MLLW elevation from Humboldt Bay, the model also excluded the flow from Elk River. By doing so, because the water surface elevations at the Project site would not be impacted by the backwater effects from Elk River, the velocities would be faster than if modeled with the flows from Elk River.

With the stillwater elevation from Humboldt Bay and normal depth, the average channel velocities would be slow, and the water surface elevations would be high, resulting in high scour estimates. However, the probability of the stillwater elevation from Humboldt Bay and the 100-year flows from Elk River and Martin/Swain Slough all occurring concurrently is rare. The probability of these events happening simultaneously is less than 1 in 100. The scour calculations using the MLLW from Humboldt Bay as a downstream boundary condition results in more reasonable scour estimates.

The median grain size diameter used in the analysis was 0.2 mm. For the purposes of scour, a median grain size diameter that is 0.2 mm or less is the threshold for cohesive soils.

The total estimated scour depths reflect the sum of the long-term bed elevation change, contraction scour, and local scour, with the bridge supported on soil. The long-term bed elevation change was not estimated due to inconsistencies in the channel measurements included in the Bridge Inspection Reports. However, historical information from Caltrans indicated that the foundations at the existing bridge are stable. The total estimated scour depth was qualitatively estimated using the local abutment sour depth and contraction scour depths. The minimum elevations for the proposed foundations are referenced to the thalweg of the channel. For the proposed bridge, the thalweg is 0 ft. The calculated scour depths and elevations are presented in the following table.

Per the FHWA HEC-18, for footings (with a designed countermeasure, such as RSP, to prevent local scour from forming at the base of the abutment), the top of the footing should reference the thalweg and be below the estimated long-term degradation and contraction scour depth. For footings (without a designed countermeasure), the top of the footing should reference the thalweg and be below the total scour depth.

Proposed Bridge Total Scour Elevation (Mean Lower Low Water)

Bridge Component	Thalweg Elevation (ft)	Total Scour (ft)	Total Scour Elevation (ft)
Abutment 1 (west)	0	9.3	-9.3
Abutment 2 (east)	0	9.7	-9.7

Based on both the *California Bank and Shore RSP Design* and the FHWA's HEC-23 RSP design criteria, as well as engineering judgment, a minimum size of Light class RSP is recommended to be used to protect the abutments of the proposed bridge. Per the *California Bank and Shore RSP Design* manual, Light class RSP should include RSP fabric type A. The RSP fabric should be placed on the bank as the initial filter separator material between the RSP and the bank. The minimum layer thickness is 2.5 ft per the Caltrans *California Bank and Shore RSP Design* manual. The abutment fill slopes should be protected with RSP to an elevation of 2 ft above the 100-year flood. The slope protection should extend from the face of the abutment to the toe of slope. The RSP should be keyed in vertically 5 ft, or to the anticipated scour elevation in the stream bed.

Acronyms

ACES	Automated Coastal Engineering System
BIR	Bridge Inspection Report
Caltrans	California Department of Transportation
CEDAS	Coastal Engineering Design and Analysis System
CN	Curve Number
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIS	Flood Insurance Study
HBP	Highway Bridge Program
HEC-18	Hydraulic Engineering Circular No. 18
HEC-23	Hydraulic Engineering Circular No. 23
HEC-HMS	Hydrologic Engineering Centers Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HSG	hydrologic soil group
Project	Pine Hill Road over Swain Slough Bridge Replacement Project
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
RSP	rock slope protection
SCS	Soil Conservation Service
TR-55	Technical Release 55
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
WSE	water surface elevation

1 GENERAL DESCRIPTION

The Humboldt County Department of Public Works is proposing to replace Bridge No. 04C0173 Pine Hill Road over Swain Slough. The Pine Hill Road over Swain Slough Bridge Replacement Project (Project) site is located just south of Eureka and north of Elk River. The Project is funded through the Federal Aid Highway Bridge Program (HBP) utilizing Toll Credits as the match. The bridge was inspected by Caltrans in 2011 and is classified 'Structurally Deficient' with a sufficiency rating of 44.6. This bridge is eligible for replacement under the HBP guidelines.

See Figure 1 for the Project Location Map, Figure 2 for the Project Vicinity Map, and Figure 3 for the Project Aerial Map.

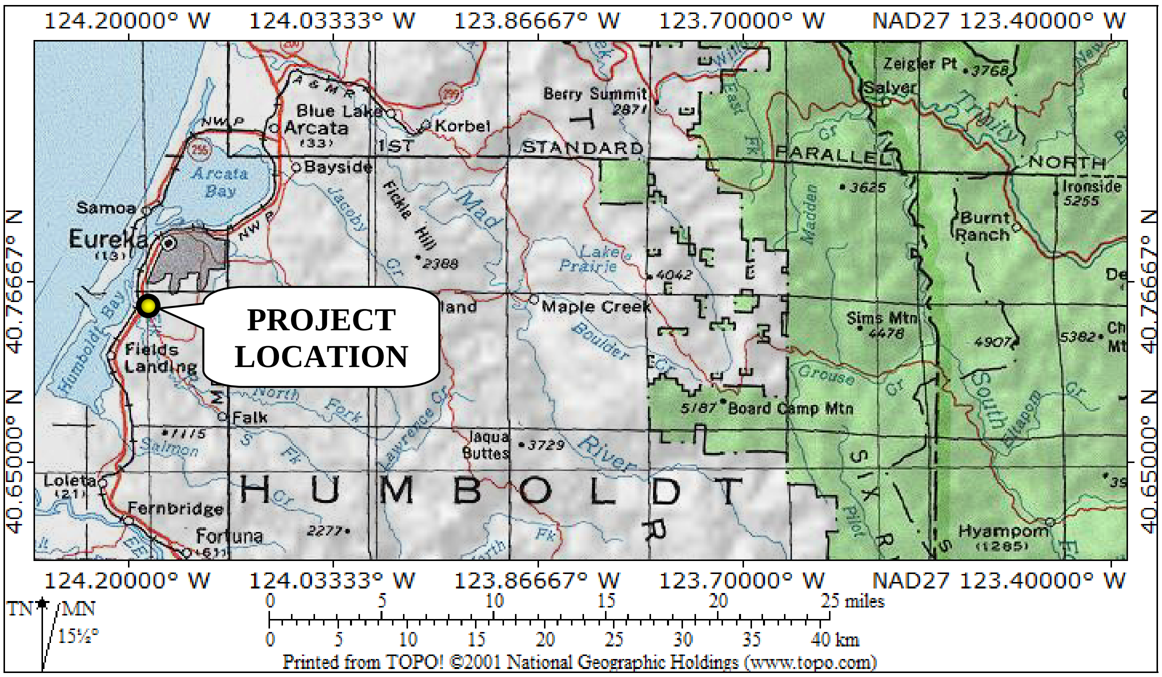

Figure 1. Project Location Map

Source: United States Geological Survey (USGS)

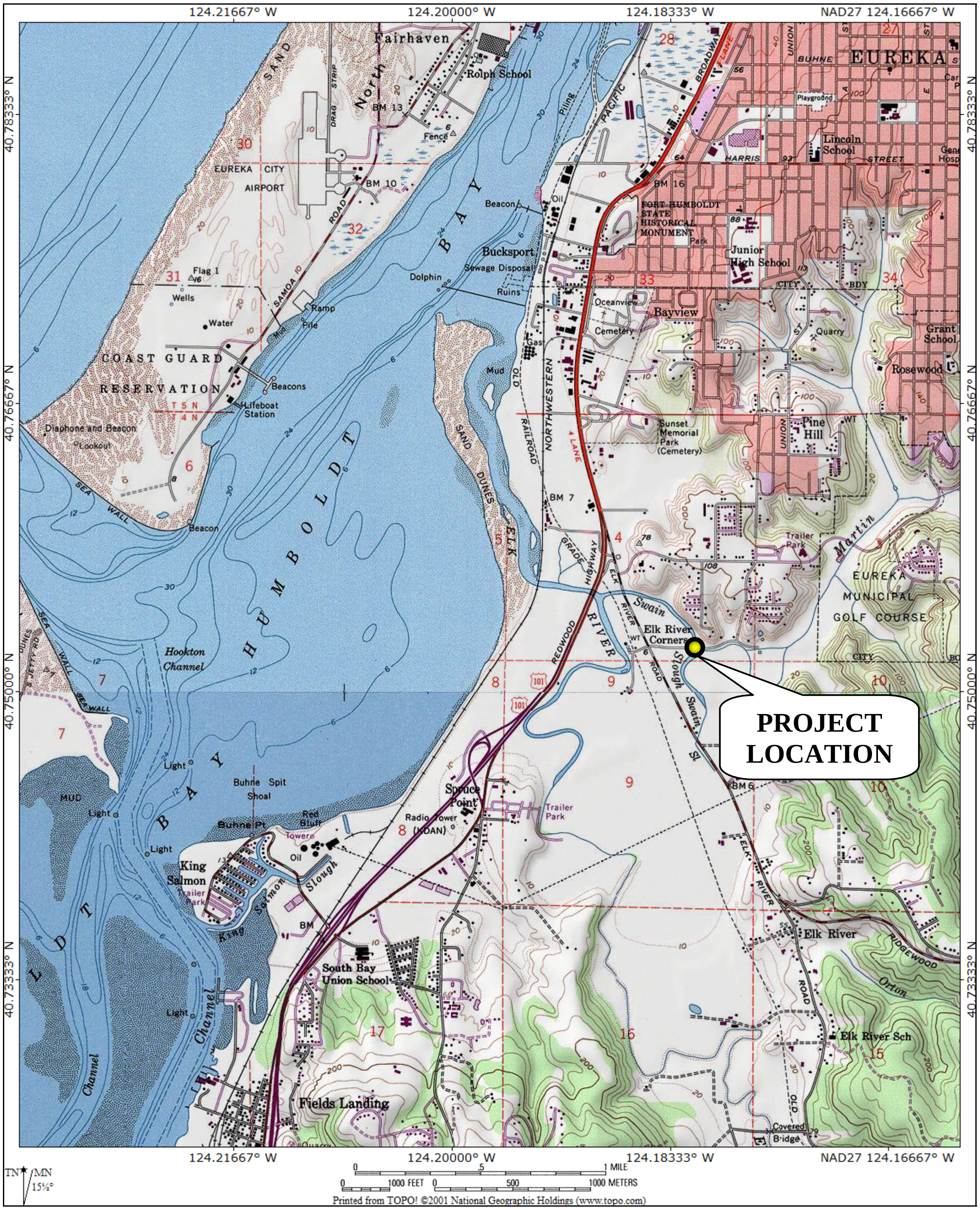

Figure 2. Project Vicinity Map

Source: USGS

Figure 3. Project Aerial Map

Source: Google Earth

1.1 Existing Bridge

The existing bridge is a 63 ft three-span timber stringer structure with a concrete deck and concrete abutments and was built in 1955 (see Photo 1). The two bent caps are constructed of reinforced concrete on 8 reinforced concrete piles. The bridge clear width is 19 ft with a 6 in. curb/rail on each side for a total bridge width of 20 ft. The railing is constructed of painted timbers and there is no end protection at the bridge corners.

The overall roadway alignment is consistent with the flat terrain of the Elk River Valley. The asphalt concrete approach roadway is approximately 19 ft in width. The bridge is located on a tangent segment of the roadway. There is a slight vertical curve both east and west of the bridge though the bridge itself is flat. The non-standard clearance condition has existed at the bridge site since it was constructed. The structure has provided reliable service in its existing condition and does not appear affected or damaged by reduced hydraulic clearance.

Photo 1. Existing Bridge (Looking North/Downstream)

1.2 Proposed Bridge

The preferred alternative is to replace the existing bridge on the existing alignment. In order to satisfy the 50-year event hydraulic clearance requirements, the existing bridge would need to be replaced and the existing roadway profile would have to be raised significantly. This will have major cost implications along with increased environmental and right-of-way impacts. In accordance with County requirements, the bridge will provide two 10-ft-wide traffic lanes and 5-ft-wide shoulders, in addition to barrier rails along both sides.

The proposed bridge will need design exceptions to the FHWA freeboard criteria based on site conditions. The channel banks are overtopped, and the surrounding area is inundated during the design event in both the existing and proposed conditions. Considering that: 1) the proposed deck elevation is set above the 100-year water surface elevations, 2) the soffit is above the bank elevations, and 3) the proposed bridge provides a significant increase in available conveyance under the bridge with no significant backwater impacts, the preferred alternative maximizes hydraulic performance while minimizing the impact on adjacent areas.

The proposed bridge type is a single-span precast concrete wide flange girder, and will be slightly longer than the existing to better fit the site conditions. The single-span bridge option will minimize the environmental impacts to the slough as well as adjacent wetlands as it will not require any supports in the creek channel. The proposed bridge does not significantly affect the existing hydraulic clearance conditions such as water surface elevations or flow velocities. The proposed bridge general plan is shown in Figure 4.

1.3 Purpose

The purpose of this Bridge Design Hydraulic Study is to present the design flow characteristics for the existing bridge and the proposed replacement bridge. This report provides the calculated scour potential and recommendations on the need for scour countermeasures for the proposed bridge. This report presents the hydraulic characteristics and scour potential and recommendations for the proposed bridge.

1.4 Key Tasks

Key tasks performed in this study included: 1) a review of available hydrologic data, 2) a hydrologic study, 3) a hydraulic analysis to determine design water surface elevations (WSEs) and flow velocities for the existing and proposed bridges, 4) a scour analysis to estimate potential scour depths for the proposed bridge, and 5) scour countermeasure analyses and recommendations for the proposed bridge.

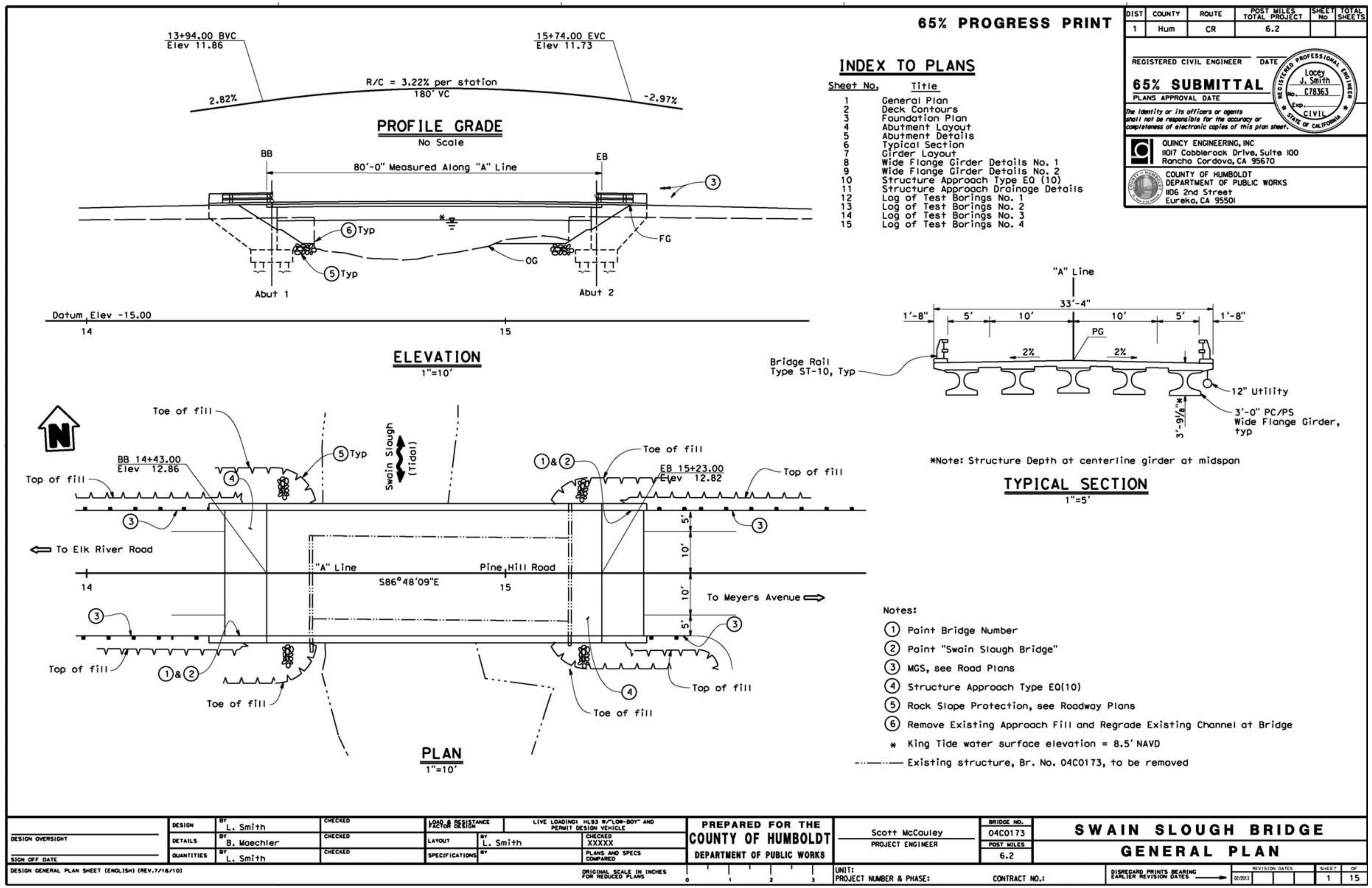

Figure 4. Proposed Bridge General Plan

Source: Quincy Engineering, Inc.

1.5 Design Criteria

The following criteria were considered in the design of the proposed bridge.

1.5.1 Hydraulic Design Criteria

1.5.1.1 FHWA Standards

The Federal Highway Administration (FHWA) criterion for the hydraulic design of bridges is that they be designed to pass the 2% probability of annual exceedance flow (50-year recurrence interval design discharge) with adequate freeboard, where practicable, to account for debris and bedload.

1.5.1.2 Caltrans Standards

The California Department of Transportation (Caltrans) criteria for the hydraulic design of bridges is that they be designed to pass the 2% probability of annual exceedance flow (50-year design discharge) or the flood of record, whichever is greater, with adequate freeboard to pass anticipated drift. Two feet (2 ft) of freeboard is commonly used in bridge designs. The bridge should also be designed to convey the 1% probability of annual exceedance flow (100-year design discharge, or base flood). No freeboard is added to the base flood.

1.5.1.3 Design Exception

An evaluation should be performed to determine, if horizontal and vertical driftway requirements warrant a modified freeboard. The existing and proposed bridges do not meet the freeboard criteria. Although the proposed bridge would not meet freeboard criteria, the 100-year flow is still conveyed through the bridge or across the approach roadways. The soffit elevation is designed to be higher than the adjacent banks, so the slough overtops before the soffit gets wet. The bridge deck has been designed to remain dry during a 100-year flow event. The bridge would not cause objectionable backwater.

The approach roadways leading to the bridge become inundating during high flows. The existing bridge is not accessible from adjacent County roads during flood events, and the County does not plan to improve the approach roadways to meet standard flood elevation. Raising the bridge to meet all hydraulics criteria would be impractical considering the roadway approaches to the new bridge are well below the hydraulics criteria, making the bridge impossible to reach during times of flood.

Configuring the bridge to meet all hydraulics criteria including sea level rise would be very costly and would significantly increase the environmental impacts. The bridge has been designed to accommodate a future raise if needed due to sea level rise.

1.5.2 Scour Design Criteria

The evaluation of potential scour at the proposed bridge followed the criteria described in the FHWA's Hydraulic Engineering Circular No. 18 (HEC-18), *Evaluating Scour at Bridges* (2012). The evaluation of potential scour was based on hydraulic characteristics of the 100-year design discharge. The total scour was estimated based upon the cumulative effects of the long-term bed elevation change, general (contraction) scour, and local scour. The life expectancy of the bridge was considered in determining the long-term bed elevation change of the waterway; it was based on an assumed 75-year design life for a new replacement bridge.

1.5.3 Rock Slope Protection Design Criteria

Two procedures for determining rock slope protection (RSP) design were considered: 1) the FHWA's Hydraulic Engineering Circular No. 23 (HEC-23), *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance* (Third Edition) (September 2009); and 2) Caltrans' *California Bank and Shore Rock Slope Protection Design* (Third Edition) (October 2000). The RSP design was based on the hydraulic characteristics of the 100-year design discharge for the proposed bridge.

1.6 Vertical Datum

The Project references the North American Vertical Datum of 1988 (NAVD 88). All elevations presented in this report are based on the NAVD 88 datum unless otherwise specified.

2 GEOGRAPHIC SETTING

2.1 Geographic Location

The Project is located at 40°45’ North latitude and 124°11’ West longitude just south of the city of Eureka, California. The Project site is located on Pine Hill Road and crosses over Swain Slough immediately downstream of its confluence with Martin Slough. The Project site is located approximately 0.2 mi east of Elk River Road. Pine Hill Road provides access across Swain Slough to residential neighborhoods, and connects to Herrick Street, which is a major arterial road that leads out of southern Eureka.

The mouth of Martin Slough is separated from Swain Slough by a levee and tide gates (see Photo 2). The Martin Slough Enhancement Project was proposed and funded by the California State Water Quality Control Board Department of Water Resources and California State Coastal Conservancy. Alternatives were evaluated in the *Martin Slough Enhancement Feasibility Study* in 2006. The preferred alternative for that project consisted of removing the existing tide gates, installing new tide gates with a habitat door designed to create a muted tide cycle and facilitate fish passage, increasing the size of existing ponds, creating new ponds, and making channel modifications throughout the project area. This structure has been built and in-place at the time this report was written (see Photo 3).

Photo 2. Existing Tide Gates (Looking East from the Bridge)

Photo 3. New Martin Slough Tide Gates

2.2 Watershed Description

The Project is within the Elk River watershed. Pine Hill Road crosses over Swain Slough just downstream of its confluence with Martin Slough. Because of its proximity to the Project site, Elk River was also analyzed. The watershed delineations are shown in Figure 5. The watershed that drains to the Project site was estimated to be 5.5 square mi.

Table 1. Watershed Areas

Flow Change Location	Watershed Area (sq mi)
Swain Slough	0.2
Martin Slough	5.2
Swain Slough Downstream of its Confluence with Martin Slough	5.5
Elk River Upstream of its Confluence with Martin/Swain Slough	50.2
Elk River Downstream of its Confluence with Martin/Swain Slough	55.8

2.3 Receiving Water Bodies

The confluence of Swain Slough with Elk River is 0.5 mi downstream of the Project site. Elk River eventually drains into Humboldt Bay approximately 1.5 mi further downstream. Because of its close proximity to Humboldt Bay, the Project is tidally influenced. Flooding in the area will also be affected by sea level rise. The nearest tide gage is North Spit, Humboldt Bay (NOAA Station ID No. 9418767), which was installed in October 6, 1991.

2.4 Precipitation

The mean annual precipitation for the watershed basins described in Section 2.2 were estimated using the USGS StreamStats application, and are summarized in Table 2.

Table 2. Mean Annual Precipitation

Flow Change Location	Mean Annual Precipitation (in.)
Swain Slough	41.5
Martin Slough	43.1
Swain Slough Downstream of its Confluence with Martin Slough	43.0
Elk River Upstream of its Confluence with Martin/Swain Slough	54.7
Elk River Downstream of its Confluence with Martin/Swain Slough	53.5

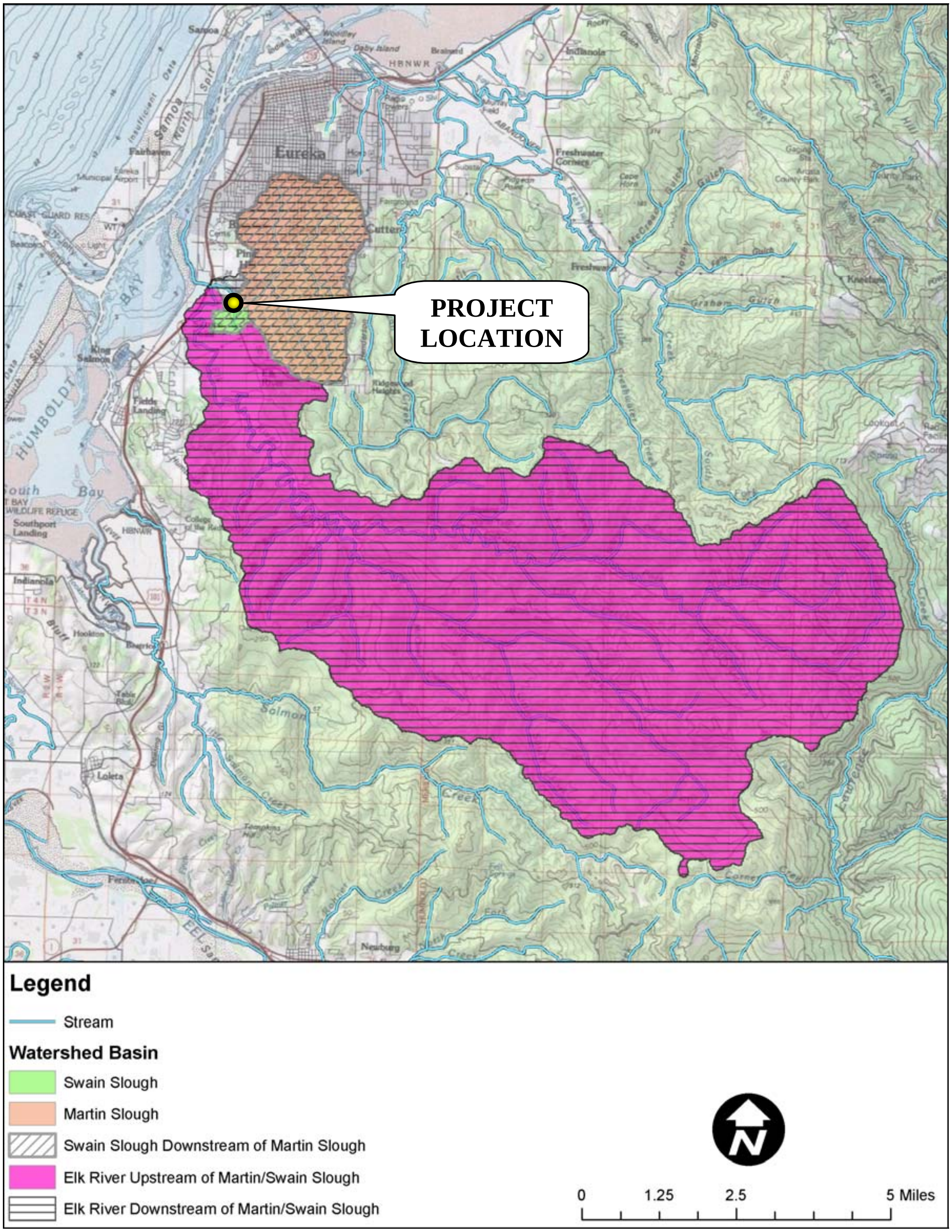

Figure 5. Project Watershed Map

2.5 Land Use

The Humboldt County general plan was updated in 2015. The Humboldt GIS Portal web mapping application was accessed to view the land uses for Humboldt County. The Martin/Swain Slough and Elk River watersheds are superimposed on the planned land uses from the General Plan (see Figure 6). A portion of the Martin/Swain Slough watershed is within the already developed city of Eureka. Other land uses within the Martin/Swain Slough watershed are designated in the general plan as low density residential, medium density residential, open space, public facility, coastal timberland, and agricultural exclusive. The land uses within the Elk River watershed are designated low density residential, medium density residential, rural residential, agricultural exclusive, natural resource, open space, public lands, coastal timberland, with a majority of the watershed designated as timberland. The land use element of the general plan describes these land uses and provides policies to ensure that the management of public lands within Humboldt County are consistent with the goals of the general plan. In general, the areas that are designated residential land uses are already developed. A portion of the Martin/Swain Slough watershed that is designated low density residential is currently undeveloped.

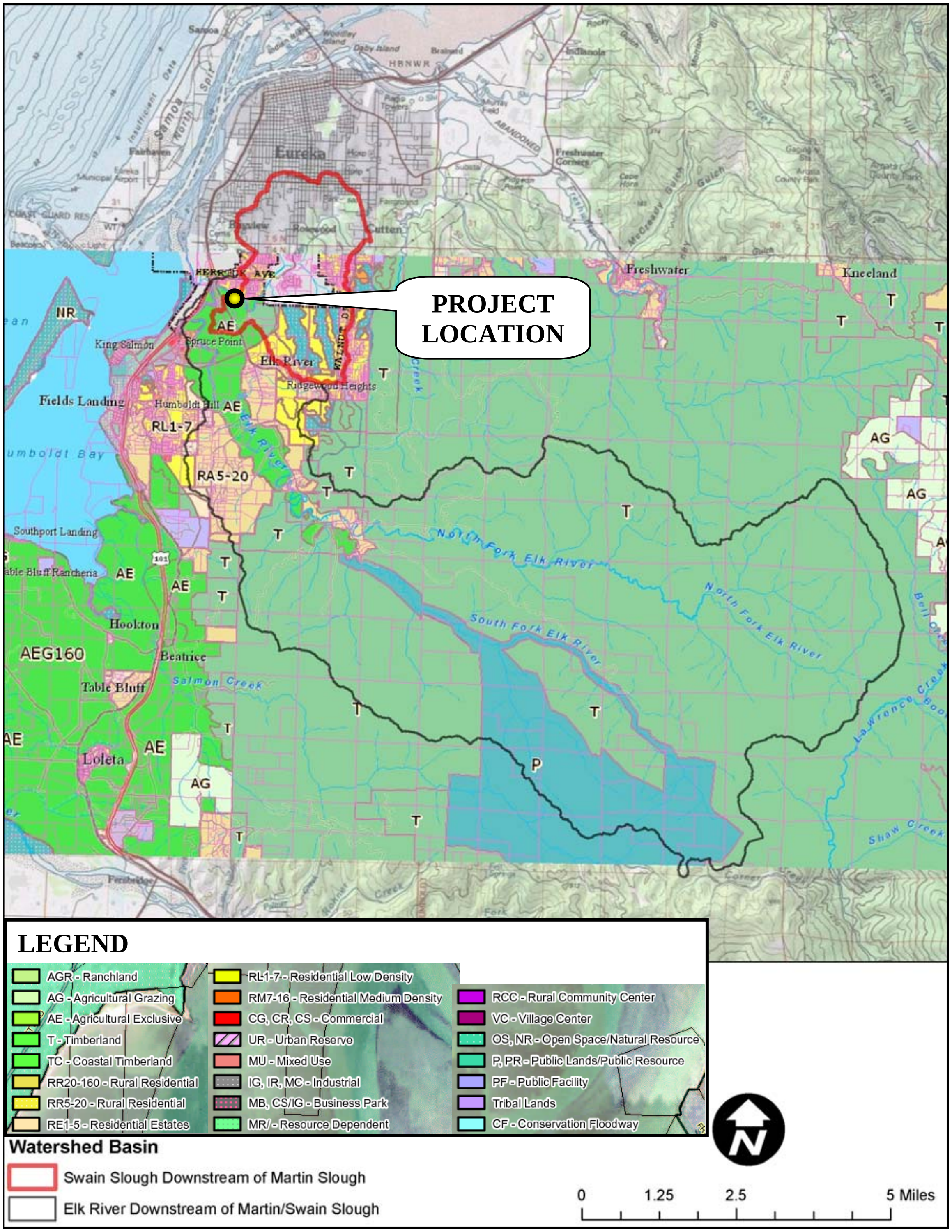

Figure 6. Land Use Map for Project Watershed

3 HYDROLOGIC ANALYSIS

The following sub-sections describe the hydrologic data sources that were used to estimate the flows for the Project site.

3.1 Hydrologic Design Methods

WRECO evaluated the hydrology for Martin/Swain sloughs at the Project site using the following hydrologic design methods:

1. United States Geological Survey Regional Regression Equations
2. Rainfall/Runoff Model using Hydrologic Engineering Centers Hydrologic Modeling System (HEC-HMS) Software

WRECO evaluated the hydrology for Elk River using the United States Geological Survey Regional Regression Equations.

3.1.1 United States Geological Survey Regional Regression Equations

Flood-frequency equations were developed by the USGS and based on analysis of data from gage stations. California is divided into six regions; the Project site is within the North Coast region. These flood-frequency equations are generally used to estimate stream flow for ungaged sites that are not affected by substantial urban development and that are natural (unregulated) streams.

On July 18, 2012, the USGS issued *Methods for Determining Magnitude and Frequency of Floods in California, Based on Data through Water Year 2006* (Gotvald et. al. 2012), which contains updated regional flood-frequency equations, and revised the boundaries of the six unique regions within California. These equations are based on annual peak-flow data through water year 2006 for 771 streamflow-gaging stations in California having 10 or more years of data. The updated equations were used in support of the Project's hydrologic analysis.

The flood-frequency equations are as follows (Gotvald et. al., 2012):

$$Q_{100} = 48.5(DRNAREA)^{0.866}(PRECIP)^{0.556}$$
$$Q_{50} = 36.3(DRNAREA)^{0.87}(PRECIP)^{0.589}$$

Where:

Q_x =	peak discharge for a storm event with a return period of x years, cubic feet per second (cfs)
DRNAREA =	drainage area, square mi
PRECIP =	mean annual precipitation, in.

The drainage areas for the watersheds in the vicinity of the Project site are presented in Section 2.2 and the mean annual precipitation values for the corresponding watersheds are presented in Section 2.4. The design discharges for Martin and Swain Sloughs were estimated based on a combined watershed area because Pine Hill Road crosses over Swain Slough immediately downstream of its confluence with Martin Slough. The calculated design discharges are summarized in Table 3.

Table 3. Regional Regression Design Discharges for the Project

Stream and Location	Peak Discharge (cfs)	
	100-year	50-year
Swain Slough (downstream of confluence with Martin Slough)	1,710	1,460
Elk River (upstream of confluence with Swain Slough)	13,340	11,570
Elk River (downstream of confluence with Swain Slough)	14,430	12,520

3.1.2 Rainfall/Runoff Model

WRECO developed a rainfall/runoff model to estimate the 100- and 50-year recurrence interval design discharges for Swain/Martin sloughs using HEC-HMS software, and following the Soil Conservation Service's (SCS) Unit Hydrograph Method. The input parameters were estimated following the procedures in Technical Release 55 (TR-55), the *Urban Hydrology for Small Watersheds* manual (Natural Resources Conservation Service [NRCS] 1986) and *A Guide to Hydrologic Analysis Using SCS Methods* (McCuen 1982).

The Project site drains a watershed area of 5.5 square mi. The watersheds were modeled using the SCS Curve Number (CN) loss method and the SCS Unit Hydrograph transform method. The SCS CN is based on the cover type, hydrologic condition of that cover, and the hydrologic soil group (HSG). Cover types are typically selected based on aerial photographs and land use maps. The hydrologic condition indicates the effects of cover type and treatment on infiltration and runoff. The Project considered the future land uses for the watershed, as described in Section 2.5.

The HSGs were not available from the NRCS online *Web Soil Survey* (2015), and the soils underlying the Project's watershed were assumed to be HSG D. Infiltration rates and runoff potential are indicated by the soil's HSG. Soils may be assigned to one of four groups (A, B, C, or D). Group A has high infiltration rates (low runoff potential) and consists mainly of deep, well-drained to excessively drained sands or gravelly sands. On the other end of the spectrum, Group D has very slow infiltration rates (high runoff potential) and consists chiefly of clays that have a high shrink-swell potential or soils with a clay or nearly impervious layer near the surface.

Based on the land uses from the general plan and the HSG, a composite CN was estimated to represent the watershed basin. In the hydrologic model, the rainfall is converted to runoff by using a CN, which is based on the watershed's soils, plant cover type and treatment, amount of impervious areas, interception, and surface storage. The composite CN was estimated to be 91 and the corresponding initial abstraction value was estimated to be 0.198. The initial abstraction is the part of rainfall that occurs before direct stormwater runoff begins, and consists of interception, initial infiltration, surface depression storage, evapotranspiration, and other factors.

The lag time was estimated using the lag method presented in *A Guide to Hydrologic Analysis Using SCS Methods* (McCuen 1982). The lag method is calculated using the following equation:

$$L = \frac{\ell^{0.8}(S+1)^{0.7}}{1900Y^{0.5}}$$

Where:

L = time lag, which is the time from the center of mass of rainfall excess to the peak discharge, hours

ℓ = hydraulic length, feet

S = maximum retention, unitless

$$S = \frac{1000}{CN} - 10$$

Where:

CN = runoff curve number

Y = slope, percent

The lag time was calculated to be 1.6 hours.

The precipitation depths were obtained from the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 website for California Precipitation Frequency Data using the longitude and latitude of the approximate centroid of the watershed. The 100-year 24-hour precipitation depth was estimated to be 6.53 in. and the 50-year 24-hour precipitation depth was estimated to be 5.86 in. Based on the rainfall distribution map from the NRCS, the Project is within the rainfall distribution Type IA (1986).

The peak discharges were estimated for the Project site as summarized in Table 4.

Table 4. Unit Hydrograph Design Discharges for Swain/Martin Sloughs at Project Site

Peak Discharge (cfs)	
100-Year	**50-Year**
2,490	2,200

3.2 Design Discharge Summary and Selected Design Discharges

Because the majority of the watershed area for Elk River is rural where flows are generally unaffected by urban development, the peak discharges calculated using the regional regression equations were used for the hydraulic analysis.

A large portion of the watershed area for Swain/Martin sloughs is encompassed by the city of Eureka as well as other residential areas within unincorporated Humboldt County. Because of the urban nature of the watershed, the regional regression equations for Swain/Martin sloughs were only used as a basis of comparison. Therefore, the peak discharges calculated using the rainfall/runoff method were selected for use in the hydraulic analysis.

The peak discharges selected for the hydraulic analysis are presented in Table 5, and the confluence points are identified in the aerial map image in Figure 3.

Table 5. Swain/Martin Sloughs and Elk River Peak Discharge Values

Stream and Location	Peak Discharge (cfs)	
	100-year	50-year
Swain Slough (downstream of confluence with Martin Slough)	2,490	2,200
Elk River (River Station 1407.91: upstream of confluence with Swain Slough)	13,340	11,570
Elk River (River Station 62.62: downstream of confluence with Swain Slough)	14,430	12,520

3.3 Hydrologic Stability

Based on a review of aerial imagery and land use maps from the Humboldt County general plan, a portion of the Martin/Swain Slough watershed is within the already developed city of Eureka. A portion of the Martin/Swain Slough watershed that is designated low density residential is currently undeveloped. In general, the areas that are designated residential land uses are already developed. The land use element of the general plan describes these land uses and provides policies to ensure that the management of public lands within Humboldt County are consistent with the goals of the general plan. Based on the 2015 general plan, no significant changes to the hydrology of Martin/Swain sloughs are expected. Future development in the watershed would result in changes to the hydrograph.

4 HYDRAULIC ANALYSIS

The following sections discuss the development of the hydraulic models and summarize the results for the existing and proposed conditions. The water surface profile plots, hydraulic summary tables, and channel cross sections are included in Appendix A for the existing bridge and Appendix B for the proposed bridge.

4.1 Design Tools

The hydraulic analyses were performed for the existing and proposed conditions using the U.S. Army Corps of Engineers' (USACE) Hydrologic Engineering Centers River Analysis System (HEC-RAS) modeling software, Version 4.1.0.

4.2 Cross Section Data

Survey data was provided by Quincy Engineering, Inc., which included stream survey of Swain Slough, Martin Slough, and Elk River. The survey data referenced the NAVD 88 datum.

4.3 Modeled Hydraulic Structures

The geometry of the existing bridge in the hydraulic model is based on information from the Caltrans BIR and survey data provided by Quincy Engineering, Inc. The bridge deck elevations were based on the survey data. The bridge soffit was modeled to be 0.5 ft below the bridge deck. The minimum soffit elevation is 9.3 ft. The proposed structural design and roadway profiles for the proposed bridge replacement were based on General Plan documents provided by Quincy Engineering, Inc. The proposed bridge is designed with a minimum bridge deck elevation of 12.82 ft along the centerline of Pine Hill Road. The minimum bridge deck elevation at the upstream and downstream faces of the bridge would be 12.49 ft with a minimum soffit elevation of 8.89 ft. There are provisions to raise the bridge in the future.

4.4 Model Boundary Condition

Because of the Project site's proximity to Humboldt Bay, the downstream model boundary condition used tidal elevations from Humboldt Bay for the hydraulic design of the bridge. Information from the Federal Emergency Management Agency (FEMA) and NOAA were obtained to develop the model's downstream boundary condition. The proposed bridge is designed based on the tidal elevations at Humboldt Bay. There are provisions to raise the bridge in the future to address sea level rise, which are not addressed with the currently proposed bridge.

For the purposes of scour, two other downstream boundary conditions were considered: a normal depth slope of 0.1% and mean lower low water. Mean lower low water from the tide gage at North Spit, Humboldt Bay, California (Station ID Number 9418767) for the 1983 to 2001 tidal epoch (tidal datum analysis period between January 1, 1983 and December 31, 2001) is -0.34 ft NAVD 88. The tidal elevations for the North Spit tide gage are graphically depicted in Figure 7.

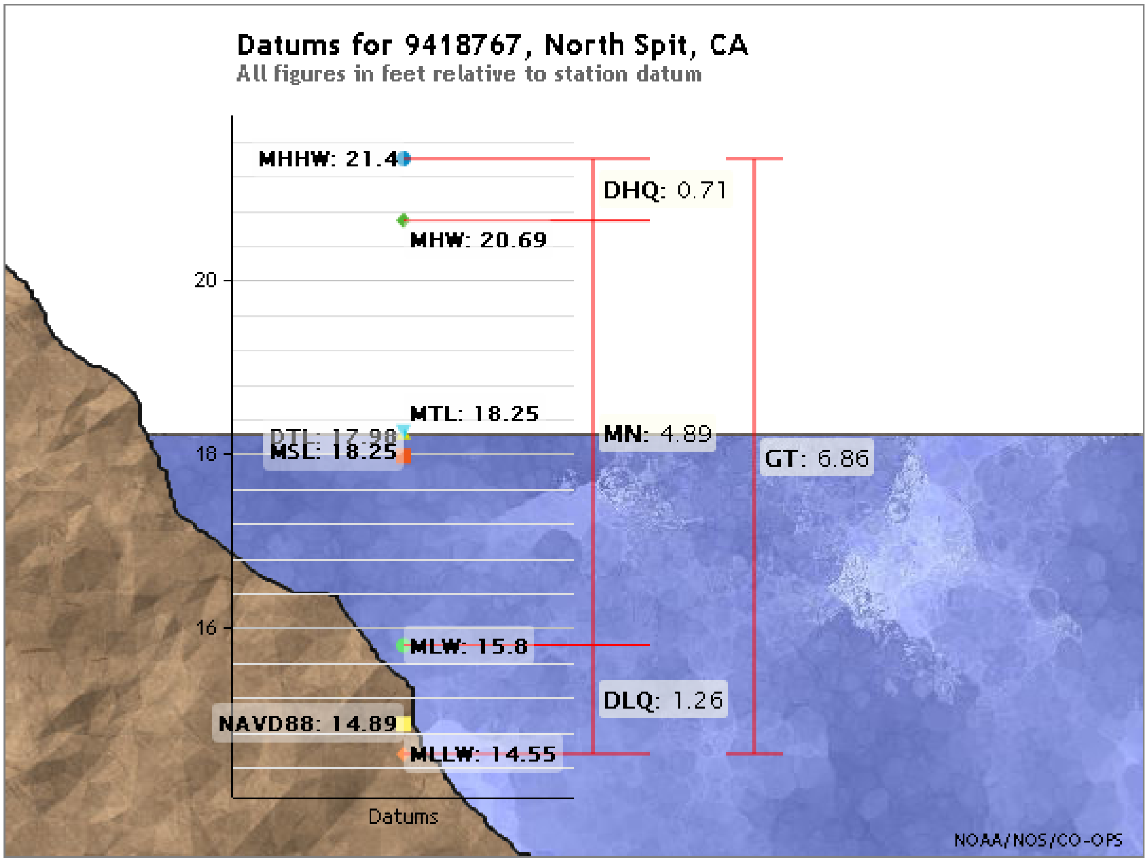

Figure 7. Tidal Elevations at North Spit Tide Gage

Source: NOAA

4.4.1 National Oceanic and Atmospheric Administration Data for Humboldt Bay

The calculation of extreme water surface events was performed using the Automated Coastal Engineering System (ACES), a program developed by the USACE and included as part of the Coastal Engineering Design and Analysis System (CEDAS). Historical tide data was obtained from NOAA's website for the tide gage at North Spit, Humboldt Bay, California (Station ID Number 9418767). The monthly highest water levels from 1979 through 2011 were retrieved from NOAA's database. This data was used to determine the historical yearly maximum water surface elevation, which was then used in the Extremal Significant Wave Height Analysis module of ACES to calculate 100-year and 50-year water surface elevations. The Weibull distribution with k equal to 2.0 was the best fit for the data, with a correlation of 0.99. The extreme tidal water surface elevation was calculated to be 8.04 ft for the 100-year event and 7.92 ft for the 50-year event.

4.4.2 Federal Emergency Management Agency Data for Humboldt Bay

The effective Flood Insurance Study (FIS) for Humboldt County (FEMA 1999) included stillwater elevations for Humboldt Bay at the city of Eureka. The reported elevations reference the National Geodetic Vertical Datum of 1929 (NGVD 29) vertical datum. A height conversion of 3.31 ft from NOAA's VERTCON was used to convert the elevations from NGVD 29 to NAVD 88 to match the vertical datum referenced for the Project. A preliminary FIS for Humboldt County (FEMA 2015) includes stillwater elevations for Humboldt Bay that already reference the NAVD 88 datum.

Table 6. Humboldt Bay Stillwater Elevations

Source	Stillwater Elevation	
	100-Year	50-Year
Effective FIS 1999	6.1 ft NGVD 29 (9.41 ft NAVD 88)	6.0 ft NGVD 29 (9.31 ft NAVD 88)
Preliminary FIS 2015	9.67 ft NAVD 88	9.37 ft NAVD 88

4.4.3 Selected Downstream Boundary Condition

The stillwater elevation for Humboldt Bay from the preliminary FIS was selected as the downstream boundary condition for the hydraulic design. Although the FIS is preliminary, it provides the best available data and is a more conservative estimate than the effective data.

4.4.4 Sea Level Rise

The proposed bridge is designed based on the tidal elevations at Humboldt Bay and there are provisions to raise the bridge in the future to address sea level rise, but the currently proposed bridge is not designed to account for sea level rise. The following discussions are included based on currently available information and should be verified if the bridge is raised in the future. The bridge foundations are designed for the superstructure to be able to be raised in the future to accommodate sea level rise.

Sea level rise estimates for the Project site were estimated using information from the following three studies:

- *The Probability of Sea Level Rise* (Environmental Protection Agency [EPA] 1995)
- *Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment* (Cayan 2009), and
- *The Proceedings of National Academy of Science* (PNAS) (Vermeer and Rahmstorf 2009)

A range of values (low and high) for the sea level rise projected to the year 2100 are presented in Table 7. The highest high and lowest positive low sea level rise estimates were derived from the PNAS study.

Table 7. Sea Level Rise Estimates for the Year 2100 near Humboldt Bay, California

Method/Source	Sea Level Rise (ft)	
	High	Low
EPA	3.0	-0.8
Cayan	4.6	3.3
PNAS	4.9	1.3

4.5 Manning's Roughness Coefficients

Manning's roughness coefficients were used in the hydraulic model to estimate energy losses in the flow due to friction. A roughness coefficient of 0.045 was used to describe the channel, and a roughness coefficient of 0.06 was used to describe the overbank areas. These values were selected based on visual observations of the Project vicinity.

4.6 Expansion and Contraction Coefficients

Expansion and contraction coefficients were used in the hydraulic model to represent energy losses in the channel. An expansion coefficient of 0.3 and a contraction coefficient of 0.1 were used to represent the channel. These values represent a channel with gradual transitions between cross sections. The expansion and contraction coefficients used in the vicinity of the bridge were 0.5 and 0.3, respectively. These values represent the flow interference caused by the bridge.

4.7 Water Surface Elevations

The water surface elevations at the upstream side of the bridge for the existing and proposed conditions are summarized in Table 8. The cross sections at the upstream sides of the existing and proposed bridges are shown in Figure 8 and Figure 9. The water surface profiles along the studied stream reach are presented in Figure 10 for the existing bridge and Figure 11 for the proposed bridge.

Table 8. Water Surface Elevations at Upstream Side of Pine Hill Road Bridge with Stillwater Elevations of Humboldt Bay from Preliminary FIS

Bridge Condition	Water Surface Elevation (ft)	
	100-Year	50-Year
Existing	12.1	11.5
Proposed	12.1	11.5

The proposed bridge will be longer and wider than the existing bridge. It will also be a single-span structure with no piers while the existing bridge is a three-span structure with two piers. However, these geometric improvements would not significantly affect the water surface elevations in the vicinity of the bridge. The tidal water surface elevations from Humboldt Bay govern the water surface elevations at the Project site. The roadway approaches would still be inundated during these extreme storm events.

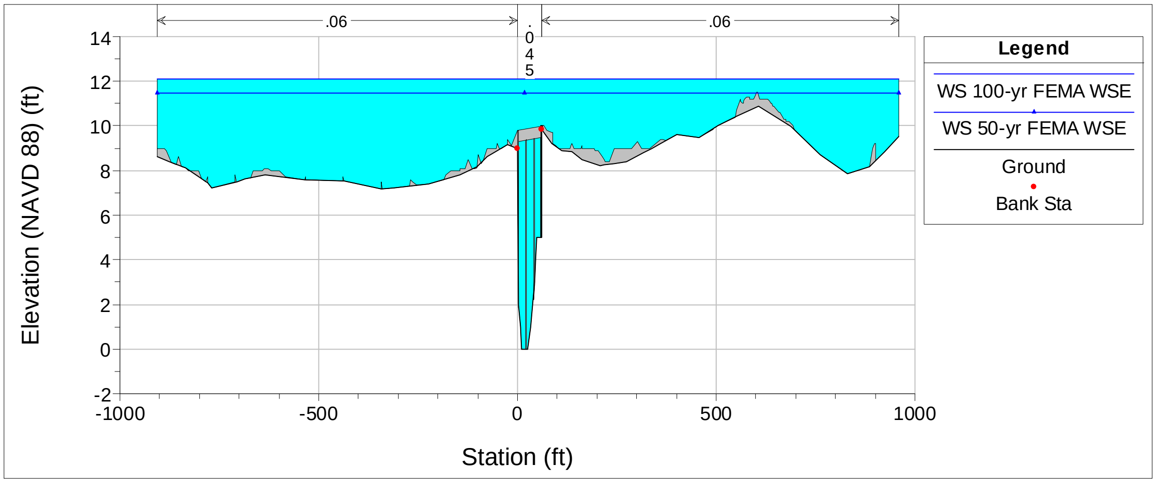

Figure 8. Upstream Face of Existing Bridge, Looking Downstream (North) with Stillwater Elevations of Humboldt Bay from Preliminary FIS

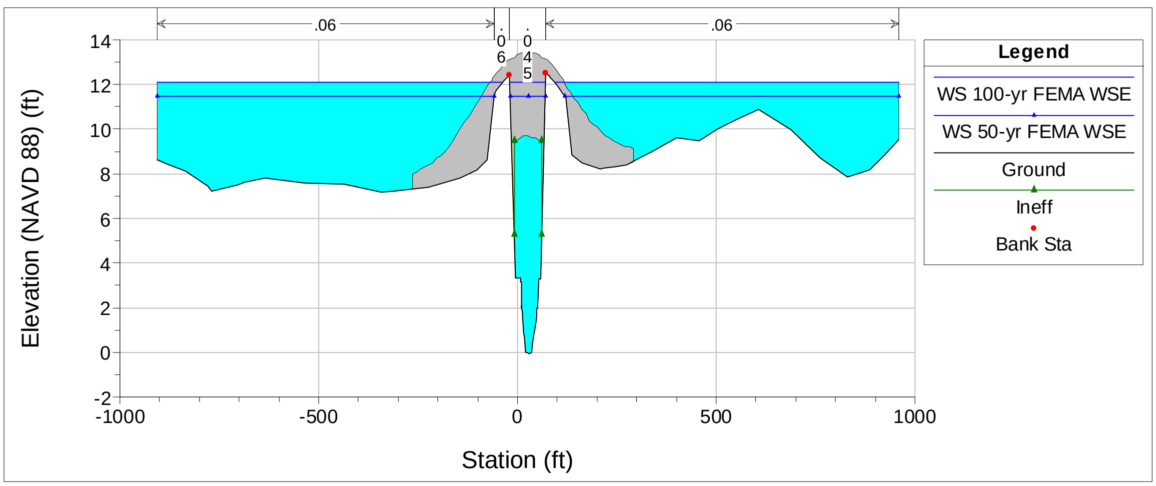

Figure 9. Upstream Face of Proposed Bridge, Looking Downstream (North) with Stillwater Elevations of Humboldt Bay from Preliminary FIS

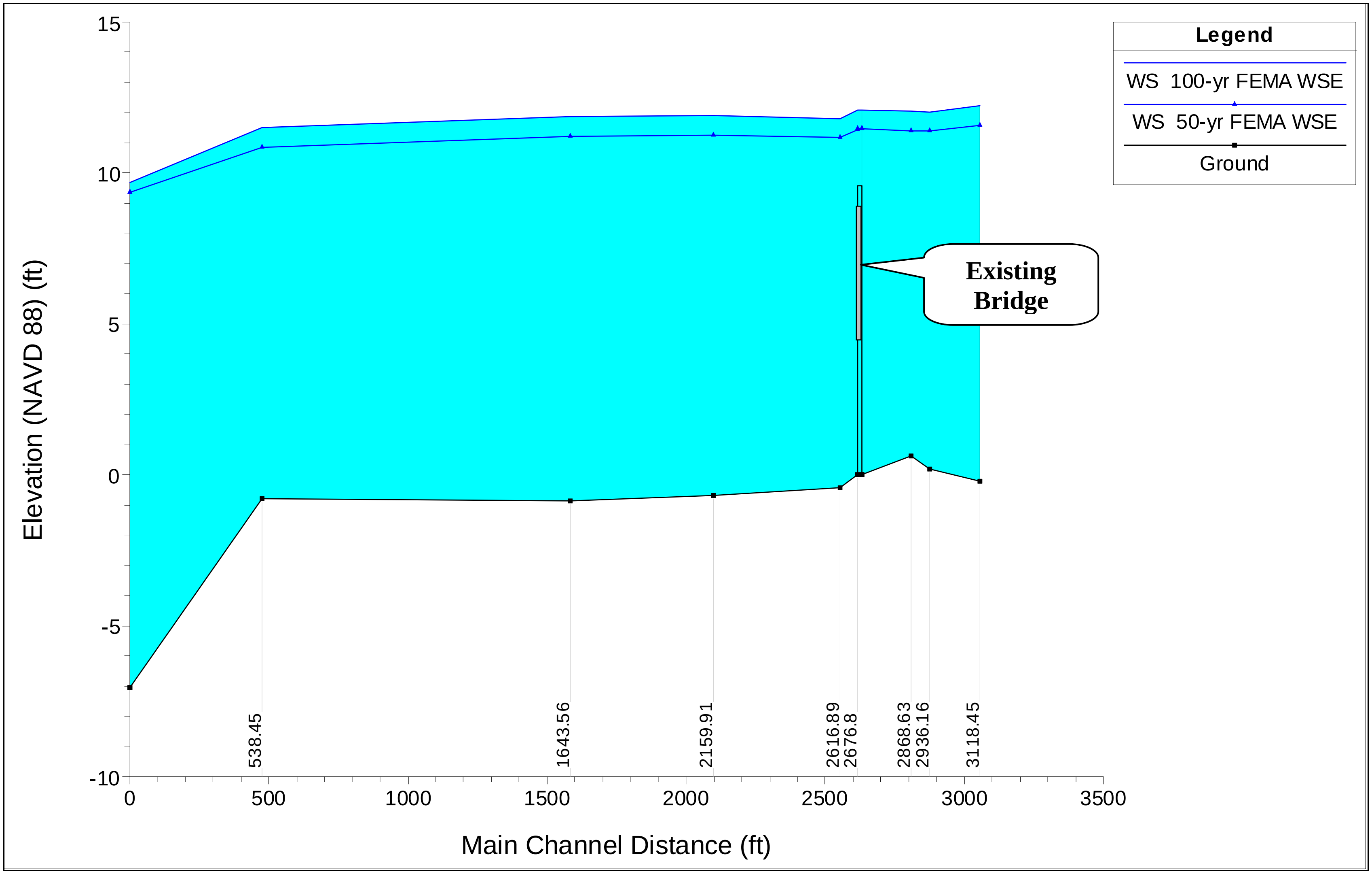

Figure 10. Existing Bridge 100-Year and 50-Year Water Surface Profiles with Stillwater Elevations of Humboldt Bay from Preliminary FIS

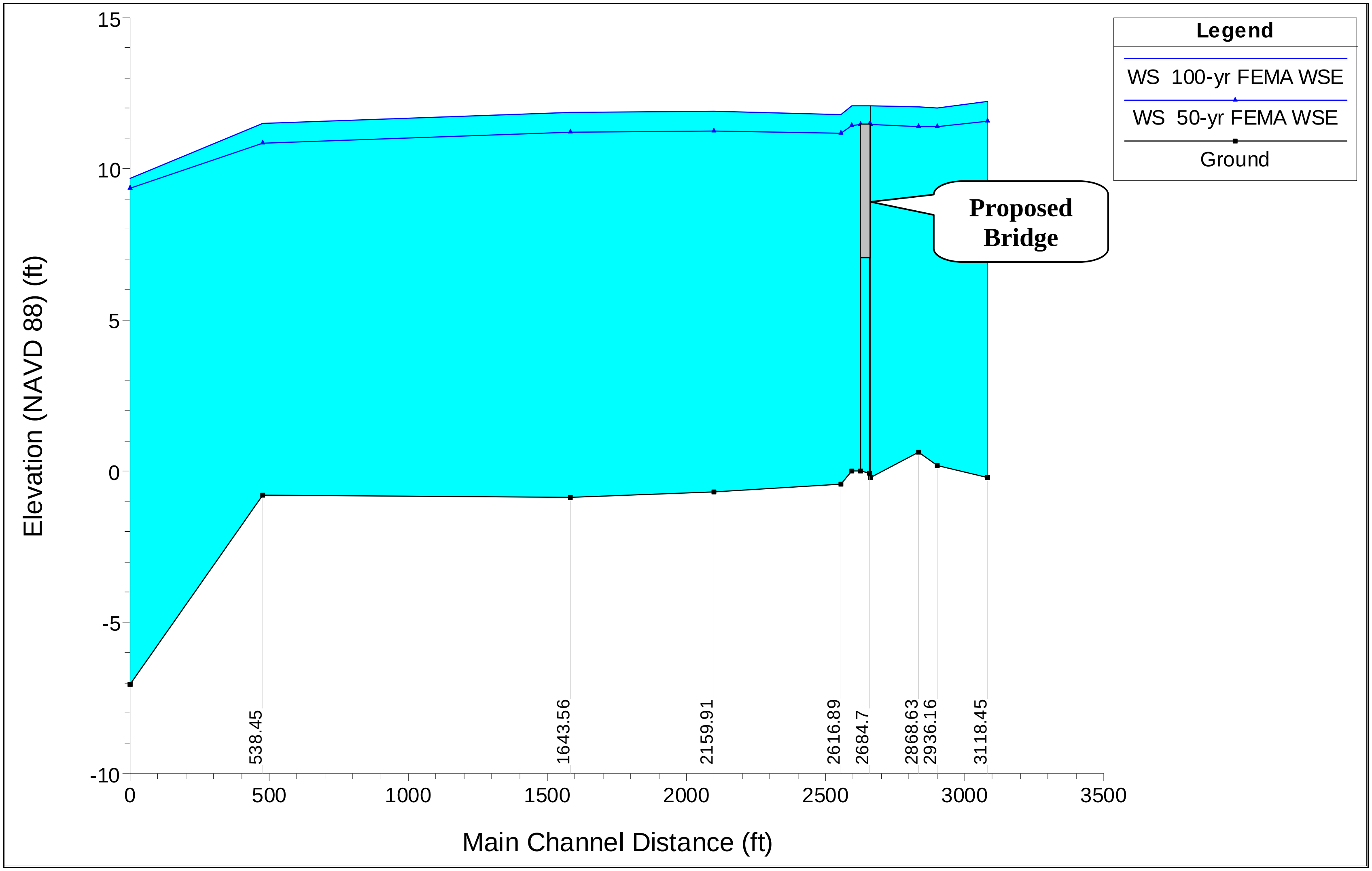

Figure 11. Proposed Bridge 100-Year and 50-Year Water Surface Profiles with Stillwater Elevations of Humboldt Bay from Preliminary FIS

4.8 Freeboard

The freeboard guidelines applicable to the Project are discussed in Section 1.5.1. To summarize, FHWA guidelines indicate that the bridge should be designed to pass the 50-year storm event with adequate freeboard to account for debris and bedload. Caltrans criteria is that the bridge should be designed to pass the 50-year storm event with adequate freeboard to account for debris and bedload (Caltrans recommends 2 ft of freeboard), or the 100-year storm event with no freeboard.

The available freeboard distances for the existing and proposed bridges are summarized in Table 9 and Table 10. The existing and proposed bridges do not meet the freeboard criteria. Although the proposed bridge would not meet freeboard criteria, the 100- and 50-year flows are still conveyed through the bridge or across the approach roadways. The soffit elevation is designed to be higher than the adjacent banks, so the slough overtops before the soffit gets wet. The bridge deck has been designed to remain dry during a 100- and 50-year flow events. The bridge would not cause objectionable backwater. The approach roadways leading to the bridge become inundating during high flows. The existing bridge is not accessible from adjacent County roads during flood events, and the County does not plan to improve the approach roadways to meet standard flood elevation. Raising the bridge to meet all hydraulics criteria would be impractical considering the roadway approaches to the new bridge are well below the hydraulics criteria, making the bridge impossible to reach during times of flood.

Table 9. 100-Year Water Surface Elevations and Freeboard Based on Stillwater Elevations of Humboldt Bay from Preliminary FIS

Alternative	Lowest Bridge Soffit Elevation (ft)	Water Surface Elevation (ft)	Available Freeboard (ft)
Existing	9.3	12.1	-2.8
Proposed	8.9	12.1	-3.2

Table 10. 50-Year Water Surface Elevations and Freeboard Based on Stillwater Elevations of Humboldt Bay from Preliminary FIS

Alternative	Lowest Bridge Soffit Elevation (ft)	Water Surface Elevation (ft)	Available Freeboard (ft)
Existing	9.3	11.5	-2.2
Proposed	8.9	11.5	-2.6

4.9 Flow Velocities

The average channel flow velocities were estimated for the existing and proposed conditions from the developed hydraulic models, which are summarized in Table 11 Table 11through Table 13 for the locations in the vicinity of the bridges. The proposed bridge would result in increases in average channel velocities in the vicinity of the bridge. The proposed bridge will be longer and wider than the existing bridge, it will have a soffit higher than the existing bridge, and it would have no piers while the existing bridge has two piers. The geometric improvements associated with the proposed bridge would result in an increase in channel area, and improved velocities just upstream of the bridge.

Table 11. Average Channel Velocities – 100-Year Flow with Stillwater Elevations of Humboldt Bay from Preliminary FIS

Description	Velocity (ft/s)	
	Existing	Proposed
Just upstream of bridge	0.7	0.5
Upstream face of bridge	0.4	0.5
Downstream face of bridge	0.4	0.5
Just downstream of bridge	0.7	1.2

Table 12. Average Channel Velocities – 100-Year Flow with Normal Depth

Description	Velocity (ft/s)	
	Existing	Proposed
Just upstream of bridge	0.4	0.4
Upstream face of bridge	0.2	0.2
Downstream face of bridge	0.2	0.2
Just downstream of bridge	0.4	0.7

Table 13. Average Channel Velocities – 100-Year Flow with MLLW from Humboldt Bay

Description	Velocity (ft/s)	
	Existing	Proposed
Just upstream of bridge	1.7	0.8
Upstream face of bridge	1.0	1.4
Downstream face of bridge	1.0	1.4
Just downstream of bridge	1.8	2.1

5 SCOUR ANALYSIS

WRECO evaluated bridge scour per the criteria described in HEC-18 (FHWA 2012). The minimum design criterion for bridge scour is the 100-year design storm. WRECO evaluated the scour potential and scour countermeasure analysis using the results of the steady-state flow analysis from HEC-RAS for the proposed bridge. Because of the tidal nature of the Project site, a range of scour values were estimated using three downstream boundary conditions: the estimated stillwater elevation of Humboldt Bay from the preliminary FIS, a downstream normal depth slope, and the mean lower low water elevation from the North Spit tide gage.

With the stillwater elevation from Humboldt Bay, the average channel velocities would be slow, and the water surface elevations would be high. With normal depth slope, because of the overall flat longitudinal channel slope, the average channel velocities would be slow, and the water surface elevations would be high. With the MLLW elevation from Humboldt Bay, the model also excluded the flow from Elk River. By doing so, because the water surface elevations at the Project site would not be impacted by the backwater effects from Elk River, the velocities would be faster than if modeled with the flows from Elk River.

The following sub-sections summarize the results of the analysis. The detailed scour calculations are included in Appendix C.

5.1 Caltrans Bridge Inspection Reports

Based on historic bridge inspections, it was observed that Abutment 1 was undermined 1 m (3.3 ft) vertically and 1.2 m (3.9 ft) horizontally along the entire length of the abutment. The right wingwall at Abutment 1 was undermined approximately 200 mm (0.7 ft) vertically and 300 mm (1 ft) horizontally along the entire length of the wingwall. No footing exposure or undermining of the back wall was noted during the inspection of Abutment 4. The abutment appeared to be in good condition.

The 2008 hydraulic bridge inspection noted that the bridge was not scour critical. The tidal influence did not appear to have significant scour effect on the structure.

Based on the 2013 Bridge Inspection Report (BIR), the Item 113, vulnerability to scour, is rated 5: Bridge foundations determined to be stable for assessed or calculated scour condition. Scour is determined to be within the limits of footing or piles by assessment (i.e., bridge foundations are on rock formations that have been determined to resist scour within the service life of the bridge), by calculations or by installation of properly designed countermeasures.

5.2 Existing Channel Bed

SHN Consulting Engineers and Geologists, Inc., the geotechnical engineering consultants for the Project, have indicated that the material in the banks are lean clays and high plasticity silts that are typically at least 60 ft thick in depth in the area of Swain Slough. Two boring samples at a depth of 70 ft and 90 ft were collected at the Project site. Based on gradation test results provided by SHN Consulting Engineers and Geologists, Inc., the median grain size diameter for the bed material is approximately 0.2 mm. Scour equations are available in HEC-18 to estimate ultimate (contraction) and pier scour depths for channel bed materials that are cohesive. In general, the threshold for cohesive bed materials is a median grain size diameter that is 0.2 mm or less.

5.3 Long-Term Bed Elevation Change

Aggradation at the bridge site is a result of the deposition of material eroded from the channel. Degradation at the bridge site is a result of scouring of the channel due to sediment deficit. Only degradation is accounted for in scour calculations. The long-term bed elevation changes can be estimated based on historical data at the bridge site.

Two channel measurements were included in the BIRs: May 9, 2007 and June 2, 2008. Both measurements were made relative to the top of curb and both measurements were provided in meters. However, the width of the bridge in the 2007 BIR was 18.3 meters while the width of the bridge in the 2008 BIR was 70.41 meters. No other channel measurements were provided. Due to the inconsistencies in the measurements and the limited data, the long-term bed elevation change was not quantified. However, based on the 2013 BIR, the existing bridge foundations have been determined to be stable for the scour condition, and therefore, long-term scour is negligible. The channel bed at the bridge location should continue to be monitored for signs of scour or lateral channel migration.

5.4 Contraction Scour

Contraction scour occurs when the flow area of a stream is reduced by: 1) the natural contraction of the stream channel; 2) by a bridge structure; or 3) the overbank flow forced back to the channel by roadway embankments at the roadway approach to a bridge. From the continuity equation, a decrease in flow area results in an increase in average velocity and bed shear stress through the contraction. Hence, there is an increase in erosive forces in the contraction section, and more bed material is removed from the contracted reach than is transported into the reach. This increase in transport of bed material from the reach lowers the natural bed elevation. As the bed elevation is lowered, the flow area increases. Thus, the velocity and shear stress decrease until relative equilibrium is reached; i.e., the quantity of bed material that is transported into the reach is equal to that removed from the reach, or the bed shear stress is decreased to a value such that no sediment is transported out of the reach. Contraction scour, in a natural channel or at a bridge crossing, involves removal of material from the bed across all or most of the channel width (FHWA).

Equations are available to estimate ultimate (contraction) and pier scour depths for channel bed materials that are cohesive. In general, the threshold for cohesive bed materials is a median grain size diameter that is 0.2 mm or less. Based on gradation test results from SHN Consulting Engineers and Geologists, Inc., the median grain size diameter for the bed material is approximately 0.2 mm, and the bed material in the channel banks are described as being lean organic clays and high plasticity clayey silts.

The equation for estimating ultimate scour, as presented in HEC-18, is as follows:

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n y_1^{1/3}} \right)$$

Where:

y_{s-ult} = scour depth for cohesive soils, ft
y_1 = average depth in the upstream main channel, ft
V_2 = average flow velocity in the contracted section, ft/s
g = gravitational acceleration, 32.2 ft/s^2
K_u = 1.486 for U.S. Customary units, and 1.0 for S.I. units
τ_c = critical shear stress, lbs/ft^2
ρ = density of sediment, slugs/ft^3
n = Manning's roughness coefficient, unitless

The ultimate (contraction) scour estimates are presented in Table 14.

Table 14. Ultimate (Contraction) Scour

Downstream Boundary Condition	Ultimate Contraction Scour (ft)
Stillwater Elevation from Humboldt Bay from Preliminary FIS	0.3
Normal Depth Slope	0.1
MLLW Elevation from Humboldt Bay	1.1

5.5 Local Abutment Scour

Abutment scour occurs when the bridge abutments block approaching flow. Abutment scour is commonly evaluated using either the Froehlich or HIRE live-bed scour equation. The HIRE equation is applicable when the ratio of the projected abutment length (the L parameter) to the flow depth (the y_1 parameter) is greater than 25. The HIRE equation was used for this scour analysis when the ratio of the projected abutment length to the flow depth was greater than 25. The Froehlich equation was used for the scour analysis when the ratio of the projected abutment length to the flow depth at each of the abutments was less than 25.

The HIRE abutment scour equation is given below:

$$\frac{y_s}{y_1} = 4Fr^{0.33}\frac{K_1}{0.55}K_2$$

Where:

y_s = Scour depth, ft
y_1 = Depth of flow at the abutment on the overbank or in the main channel, ft
y_1 = Froude Number based on the velocity and depth adjacent to and upstream of the abutment
K_1 = Abutment shape coefficient (from Table 8.1 of HEC-18)
K_2 = Coefficient for skew angle of abutment to flow

The Froehlich equation is given below:

$$y_s = y_a\left[2.27K_1K_2\left(\frac{L'}{y_a}\right)^{0.43}Fr^{0.61}+1\right]$$

Where:

$y_s =$ scour depth, ft
$K_1 =$ abutment shape coefficient (from Table 7.1 of HEC-18)
$K_2 =$ coefficient for skew angle of abutment to flow
$L' =$ length of active flow obstructed by the embankment, ft
$Fr =$ Froude number, based on the velocity and depth adjacent to and upstream of the abutment
$y_a =$ average depth of flow at the abutment = A_e/L , ft
$L =$ length of embankment projected normal to the flow, ft
$A_e =$ flow area of the approach cross section obstructed by the embankment, sq ft

The local abutment scour estimates are presented in Table 15.

Table 15. Local Abutment Scour

Downstream Boundary Condition	Local Abutment Scour (ft)	
	Abutment 1 (Western)	Abutment 2 (Eastern)
Stillwater Elevation from Humboldt Bay from Preliminary FIS	11.1	11.3
Normal Depth Slope	12.5	17.4
MLLW Elevation from Humboldt Bay	8.2	8.6

5.6 Total Scour and Scour Countermeasures

With the stillwater elevation from Humboldt Bay and normal depth, the average channel velocities would be slow, and the water surface elevations would be high, resulting in high scour estimates. However, the probability of the stillwater elevation from Humboldt Bay and the 100-year flows from Elk River and Martin/Swain Slough all occurring concurrently is rare. The probability of these events happening simultaneously is less than 1 in 100. The scour calculations using the MLLW from Humboldt Bay as a downstream boundary condition results in more reasonable scour estimates.

5.6.1 Total Scour

According to the *Caltrans Bridge Memo to Designers*, bridge footings supported on soil or degradable rock should be embedded below the maximum computed scour depth (2003). It also states that "footings on piles may be located above the lowest anticipated scour level provided the piles are designed for this condition." The total estimated scour depths reflect the sum of the long-term bed elevation change, contraction scour, and local scour, with the bridge supported on soil. The long-term bed elevation change was not quantified. However, the historical information provided in the Caltrans BIRs has indicated that the foundations at the existing bridge are stable, and therefore, was determined to be negligible. The total estimated scour depth was qualitatively estimated using the local abutment scour depth and contraction scour depths.

The minimum elevations for the proposed foundations are referenced to the thalweg of the channel. For the proposed bridge, the thalweg is 0 ft. The calculated scour depths and elevations are presented in Table 16.

Table 16. Proposed Bridge Total Scour Elevation

Bridge Component	Thalweg Elevation (ft)	Contraction Scour (ft)	Local Scour (ft)	Total Scour (ft)	Total Scour Elevation (ft)
Abutment 1 (west)	0	1.1	8.2	9.3	-9.3
Abutment 2 (east)	0	1.1	8.6	9.7	-9.7

Per FHWA's HEC-18, for footings (with a designed countermeasure, such as RSP, to prevent local scour from forming at the base of the abutment), the top of the footing should reference the thalweg and be below the estimated long-term degradation and contraction scour depth. For footings (without a designed countermeasure), the top of the footing should reference the thalweg and be below the total scour depth. The bridge abutment footings are placed above the lowest estimated total scour depth, and the piles are designed for this condition.

5.6.2 Scour Countermeasures

RSP generally consists of rocks on channel and structure boundaries to limit the effects of scour. It is the most common type of scour countermeasure due to its general availability, ease of installation, and relatively low cost. RSP sizing was calculated following Caltrans' *California Bank and Shore RSP Design* manual (Caltrans 2000) and the FHWA's HEC-23 (2009). The detailed RSP calculations are included in Appendix D.

The D_{50} of the RSP for the bridge abutments was calculated using the Isbash relationship or Equation 14.2 from HEC-23, Design Guideline 14, depending on the Froude number from the hydraulic analysis for the proposed bridge. The median stone diameter is a function of velocity and depth. The average channel flow velocities and flow depths for the 100-year storm event from the hydraulic analysis were used to calculate the minimum required median stone diameter of the RSP to protect the embankments in the vicinity of the bridge.

Based on both the *California Bank and Shore RSP Design* and the FHWA's HEC-23 RSP design criteria, as well as engineering judgment, a minimum size of Light class RSP is recommended to be used to protect the abutments of the proposed bridge. Per the *California Bank and Shore RSP Design* manual, Light class RSP should include RSP fabric type A. The RSP fabric should be placed on the bank as the initial filter separator material between the RSP and the bank. The minimum layer thickness is 2.5 ft per the Caltrans *California Bank and Shore RSP Design* manual. The abutment fill slopes should be protected with RSP to an elevation of 2 ft above the 100-year flood. The slope protection should extend from the face of the abutment to the toe of slope. The RSP should be keyed in vertically 5 ft, or to the anticipated scour elevation in the stream bed.

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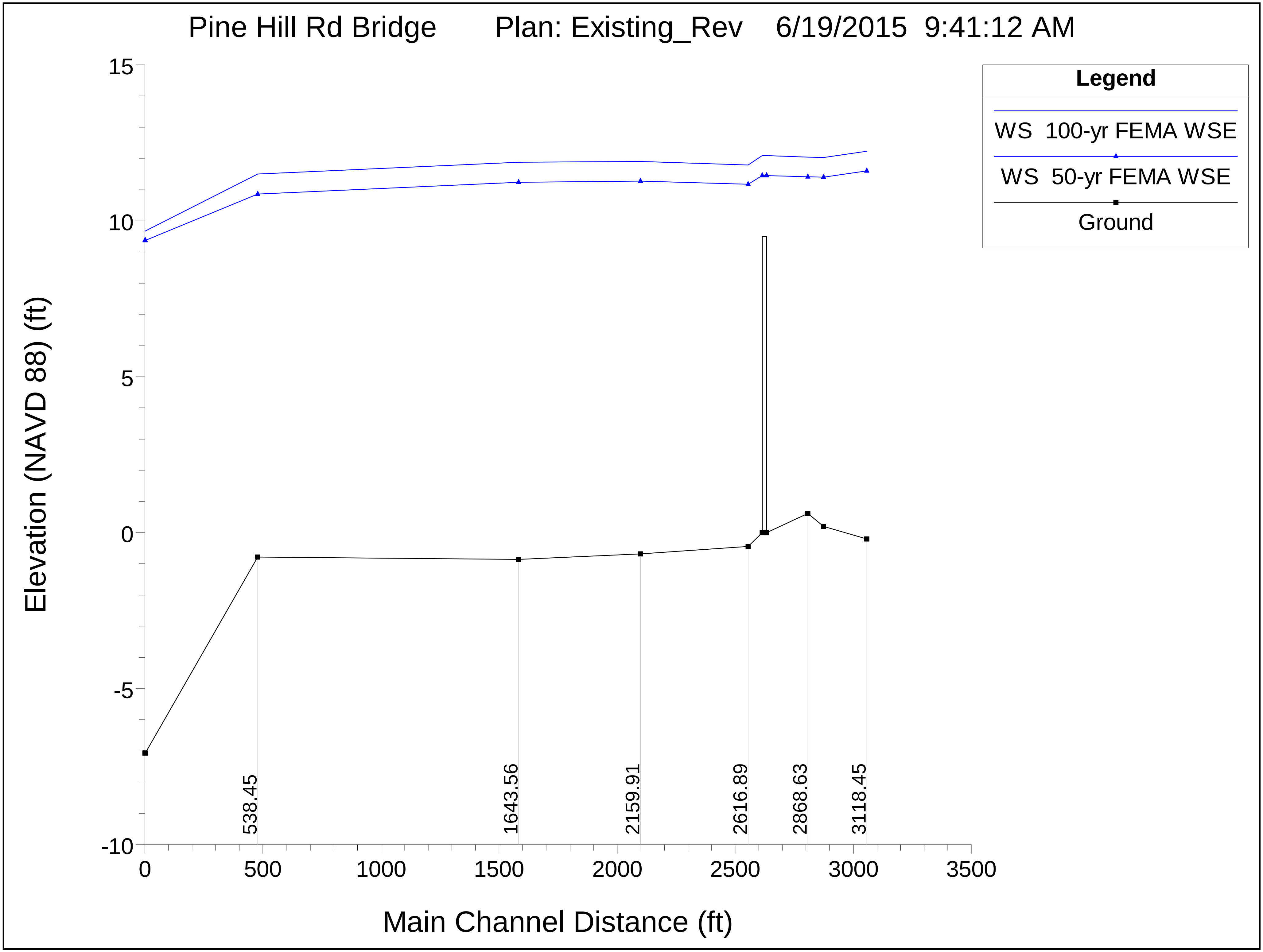
Appendix A HEC-RAS Existing Condition


Pine Hill Rd Bridge Plan: Existing_Rev 6/19/2015 9:41:12 AM
Legend
WS 100-yr FEMA WSE
WS 50-yr FEMA WSE
Ground
Elevation (NAVD 88) (ft)
15
10
5
0
-5
-10
538.45
1643.56
2159.91
2616.89
2868.63
3118.45
0
500
1000
1500
2000
2500
3000
3500
Main Channel Distance (ft)

HEC-RAS Plan: Existing_Rev

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Swain Slough	1	3118.45	100-yr FEMA WSE	2490.00	-0.20	12.23		12.26	0.000229	1.96	1845.70	314.70	0.12
Swain Slough	1	3118.45	50-yr FEMA WSE	2200.00	-0.20	11.60		11.63	0.000253	1.96	1646.92	314.70	0.12
Swain Slough	1	2936.16	100-yr FEMA WSE	2490.00	0.20	12.03		12.19	0.000656	3.59	882.39	120.31	0.21
Swain Slough	1	2936.16	50-yr FEMA WSE	2200.00	0.20	11.40		11.55	0.000671	3.46	807.15	120.31	0.21
Swain Slough	1	2868.63	100-yr FEMA WSE	2490.00	0.62	12.04		12.13	0.000396	2.68	1165.69	175.79	0.16
Swain Slough	1	2868.63	50-yr FEMA WSE	2200.00	0.62	11.41		11.50	0.000417	2.61	1054.75	175.79	0.17
Swain Slough	2	2695.15	100-yr FEMA WSE	2490.00	0.00	12.09	5.80	12.09	0.000028	0.72	7148.31	1863.49	0.04
Swain Slough	2	2695.15	50-yr FEMA WSE	2200.00	0.00	11.45	5.51	11.46	0.000037	0.80	5960.57	1863.49	0.05
Swain Slough	2	2686		Bridge									
Swain Slough	2	2676.8	100-yr FEMA WSE	2490.00	0.00	12.09		12.09	0.000030	0.73	6966.73	1840.64	0.04
Swain Slough	2	2676.8	50-yr FEMA WSE	2200.00	0.00	11.45		11.46	0.000039	0.81	5799.09	1795.17	0.05
Swain Slough	2	2616.89	100-yr FEMA WSE	2490.00	-0.44	11.78		12.02	0.000876	4.09	700.42	90.79	0.24
Swain Slough	2	2616.89	50-yr FEMA WSE	2200.00	-0.44	11.17		11.39	0.000874	3.90	644.96	90.03	0.23
Swain Slough	2	2159.91	100-yr FEMA WSE	2490.00	-0.68	11.90		11.90	0.000036	0.81	5294.00	1008.61	0.05
Swain Slough	2	2159.91	50-yr FEMA WSE	2200.00	-0.68	11.27		11.27	0.000042	0.84	4655.40	1007.54	0.05
Swain Slough	2	1643.56	100-yr FEMA WSE	2490.00	-0.86	11.87		11.88	0.000063	1.13	3961.64	824.36	0.06
Swain Slough	2	1643.56	50-yr FEMA WSE	2200.00	-0.86	11.23		11.24	0.000075	1.18	3435.88	821.62	0.07
Swain Slough	2	538.45	100-yr FEMA WSE	2490.00	-0.78	11.50		11.69	0.000797	3.50	740.52	123.17	0.22
Swain Slough	2	538.45	50-yr FEMA WSE	2200.00	-0.78	10.85		11.03	0.000797	3.40	665.15	109.40	0.22
Elk River	2	62.62	100-yr FEMA WSE	14430.00	-7.07	9.67		10.64	0.002567	7.88	1832.08	172.67	0.43
Elk River	2	62.62	50-yr FEMA WSE	12520.00	-7.07	9.37		10.14	0.002087	7.03	1780.50	170.30	0.38
Elk River	2	61.62	100-yr FEMA WSE	14430.00	-7.07	9.67	4.47	10.63	0.002569	7.88	1831.57	172.64	0.43
Elk River	2	61.62	50-yr FEMA WSE	12520.00	-7.07	9.37	3.77	10.14	0.002088	7.03	1780.13	170.28	0.38

Plan: Existing_Rev Swain Slough 2 RS: 2686 Profile: 100-yr FEMA WSE

E.G. US. (ft)	12.09	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	12.09	E.G. Elev (ft)	12.09	12.09
Q Total (cfs)	2490.00	W.S. Elev (ft)	12.09	12.09
Q Bridge (cfs)	146.43	Crit W.S. (ft)	6.20	6.24
Q Weir (cfs)		Max Chl Dpth (ft)	12.09	12.09
Weir Sta Lft (ft)		Vel Total (ft/s)	0.37	0.37
Weir Sta Rgt (ft)		Flow Area (sq ft)	6790.55	6724.86
Weir Submerg		Froude # Chl	0.02	0.02
Weir Max Depth (ft)		Specif Force (cu ft)	14649.38	14550.28
Min El Weir Flow (ft)	7.19	Hydr Depth (ft)	3.64	3.65
Min El Prs (ft)	9.49	W.P. Total (ft)	2018.35	1996.12
Delta EG (ft)	0.00	Conv. Total (cfs)	396821.4	392993.6
Delta WS (ft)	0.00	Top Width (ft)	1863.49	1840.64
BR Open Area (sq ft)	377.61	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	0.39	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.01	0.01
Br Sel Method	Energy only	Power Total (lb/ft s)	-905.19	-907.26

Plan: Existing_Rev Swain Slough 2 RS: 2686 Profile: 50-yr FEMA WSE

E.G. US. (ft)	11.46	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	11.45	E.G. Elev (ft)	11.46	11.46
Q Total (cfs)	2200.00	W.S. Elev (ft)	11.45	11.45
Q Bridge (cfs)	175.26	Crit W.S. (ft)	5.86	5.92
Q Weir (cfs)		Max Chl Dpth (ft)	11.45	11.45
Weir Sta Lft (ft)		Vel Total (ft/s)	0.39	0.40
Weir Sta Rgt (ft)		Flow Area (sq ft)	5603.24	5557.98
Weir Submerg		Froude # Chl	0.02	0.02
Weir Max Depth (ft)		Specif Force (cu ft)	10699.31	10635.27
Min El Weir Flow (ft)	7.19	Hydr Depth (ft)	3.01	3.10
Min El Prs (ft)	9.49	W.P. Total (ft)	2013.33	1949.50
Delta EG (ft)	0.00	Conv. Total (cfs)	292355.6	292573.3
Delta WS (ft)	0.00	Top Width (ft)	1859.75	1795.30
BR Open Area (sq ft)	377.61	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	0.46	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.01	0.01
Br Sel Method	Energy only	Power Total (lb/ft s)	-905.19	-907.26

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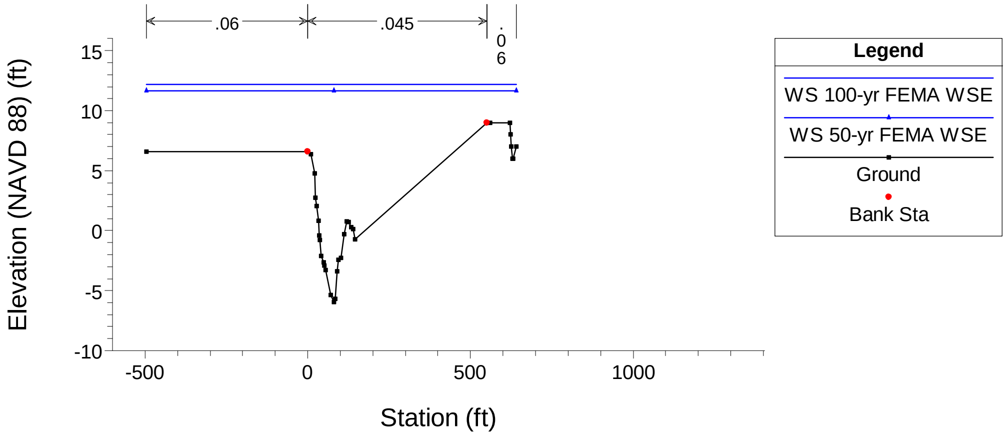

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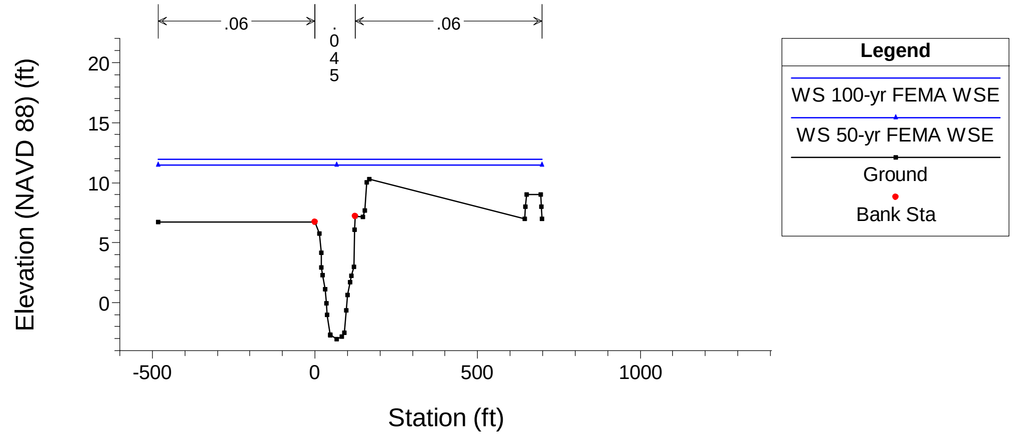

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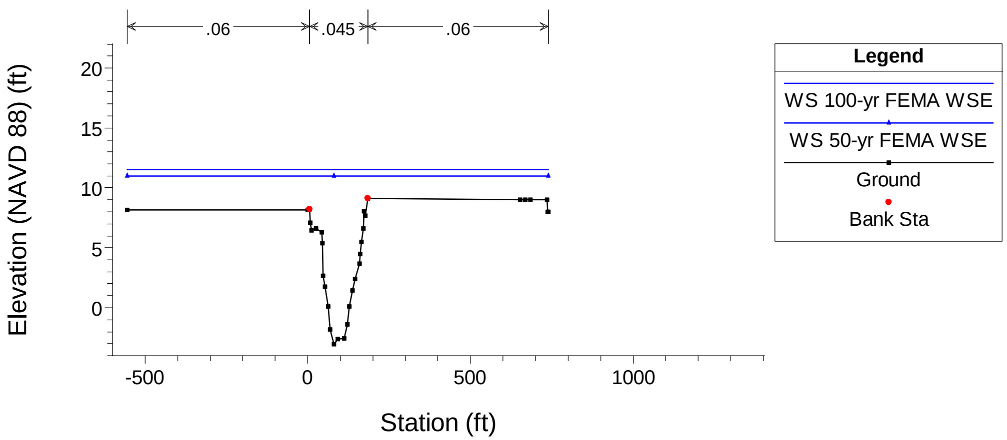
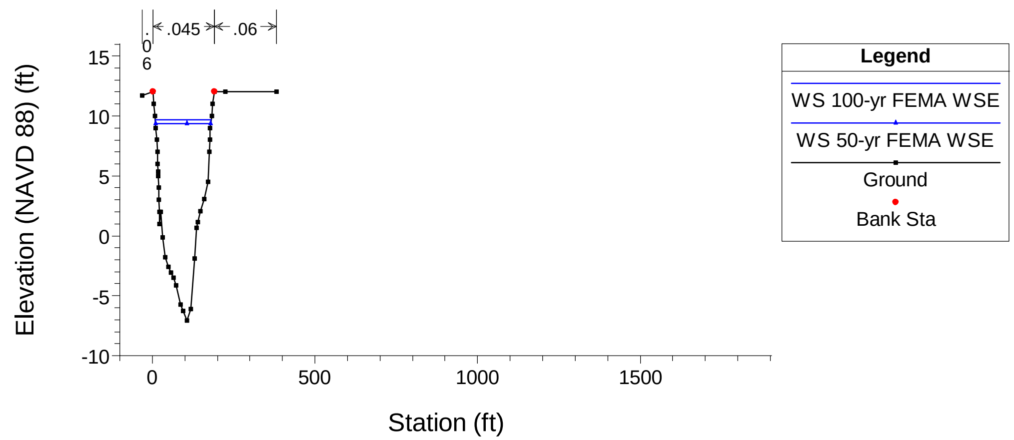
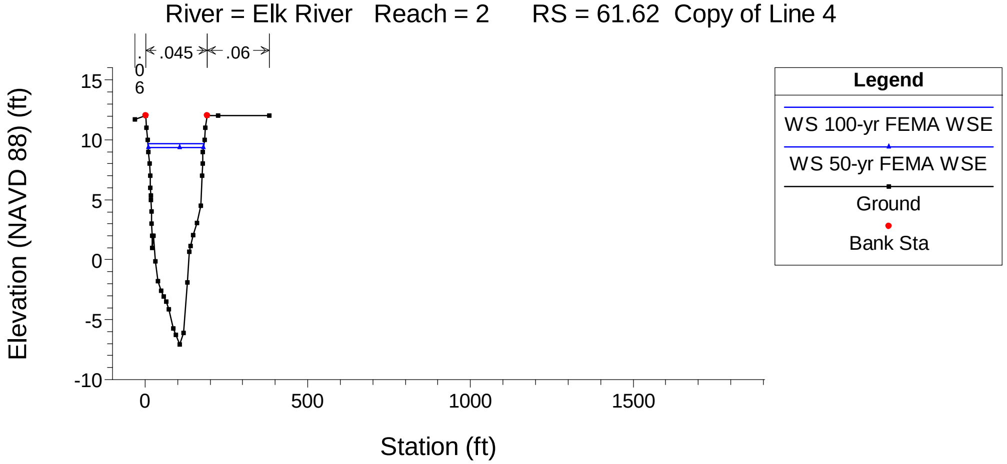


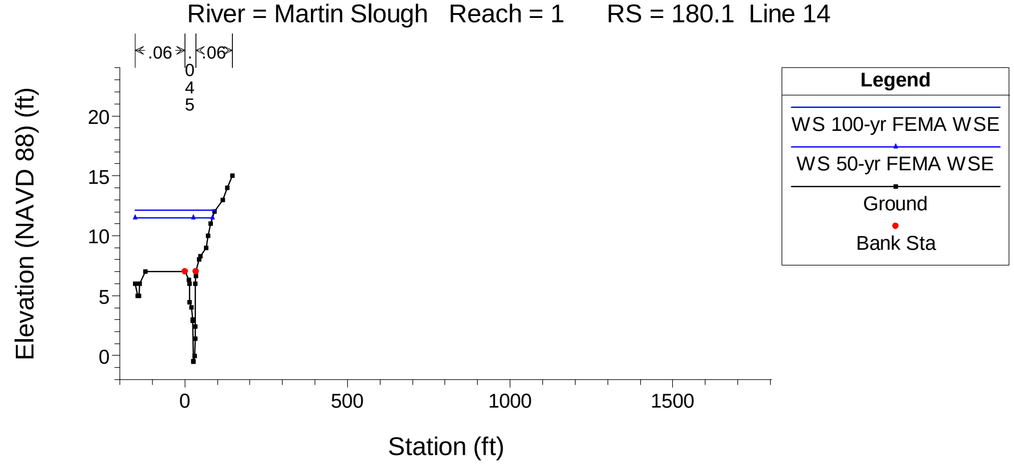
Pine Hill Rd Bridge Plan: Existing_Rev 6/19/2015 9:41:12 AM
River = Elk River Reach = 2 RS = 62.62 Line 4



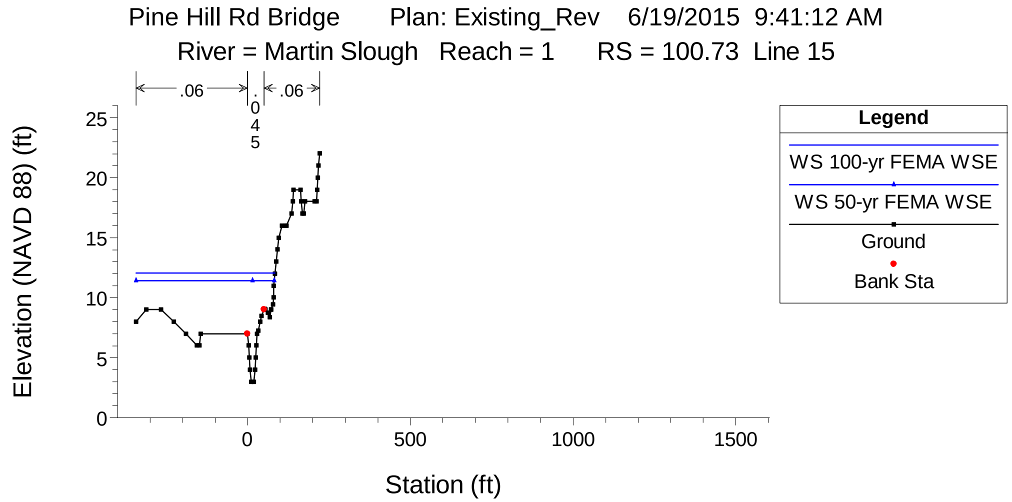
Pine Hill Rd Bridge Plan: Existing_Rev 6/19/2015 9:41:12 AM
River = Elk River Reach = 2 RS = 61.62 Copy of Line 4

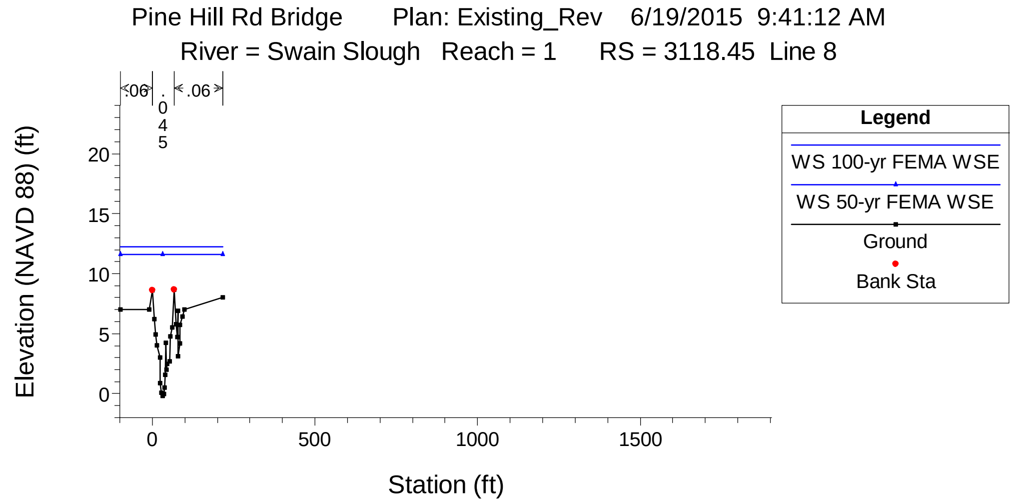


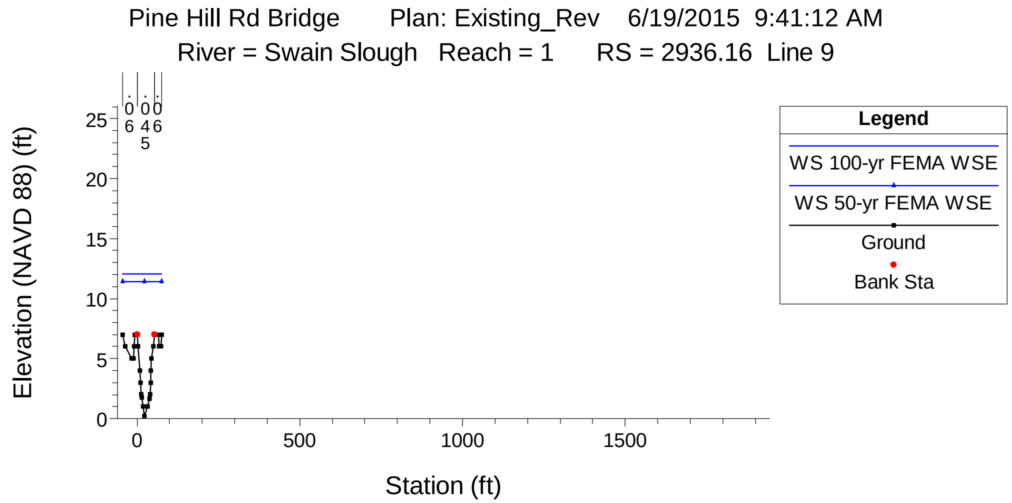
Pine Hill Rd Bridge Plan: Existing_Rev 6/19/2015 9:41:12 AM
River = Martin Slough Reach = 1 RS = 180.1 Line 14

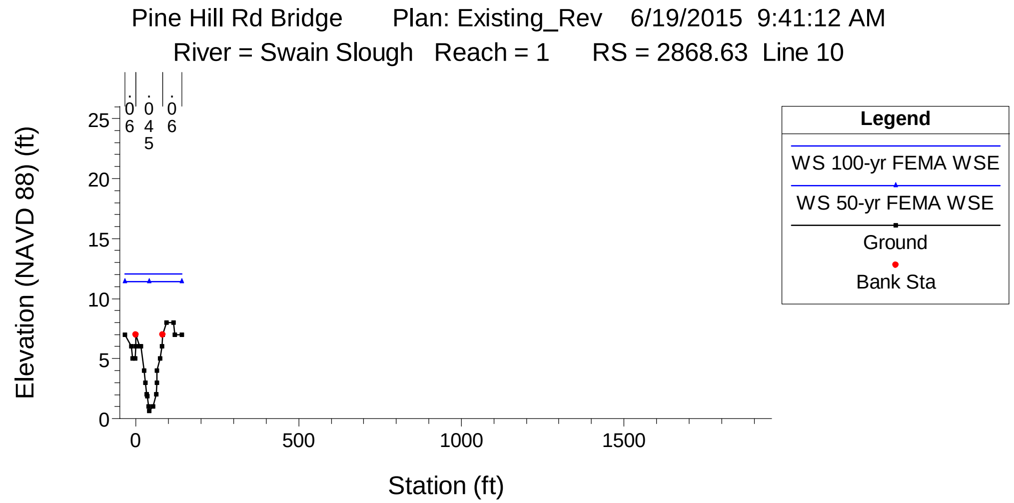


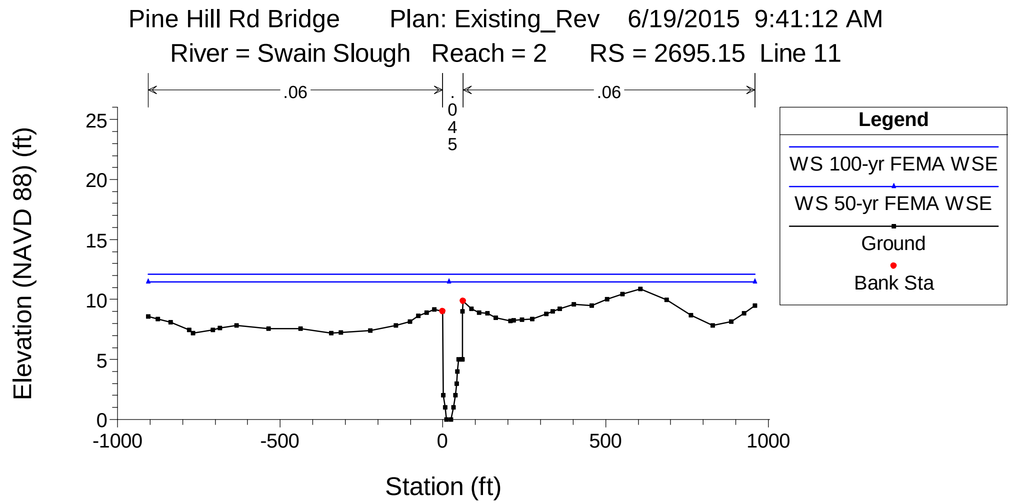
1 in Horiz. = 590 ft 1 in Vert. = 16 ft

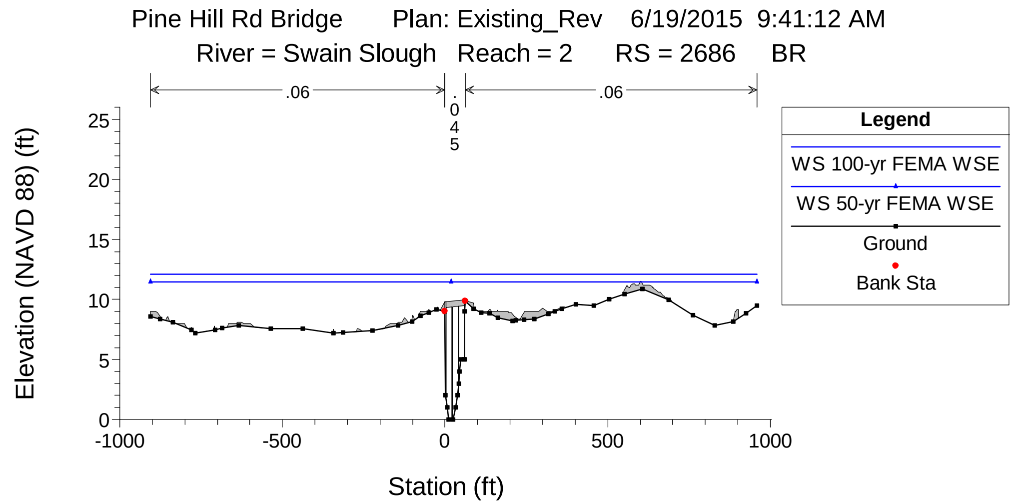




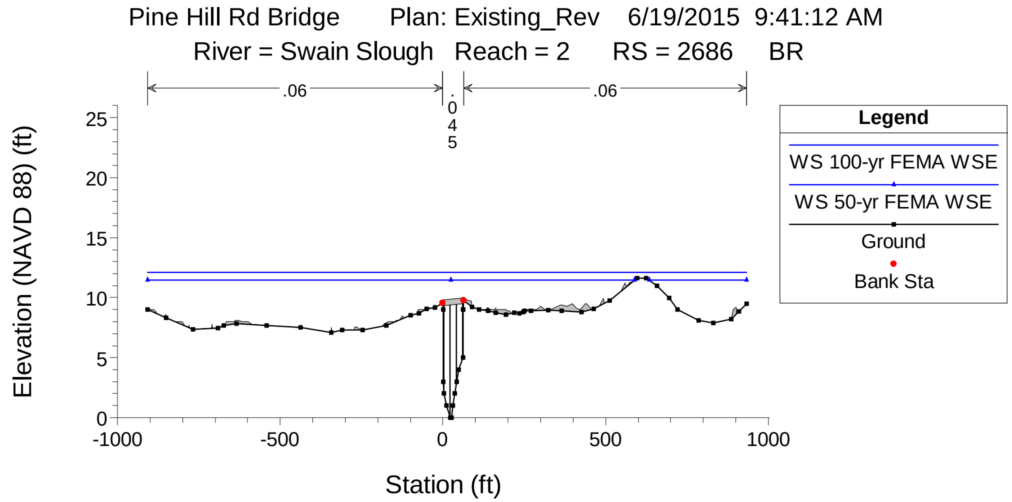


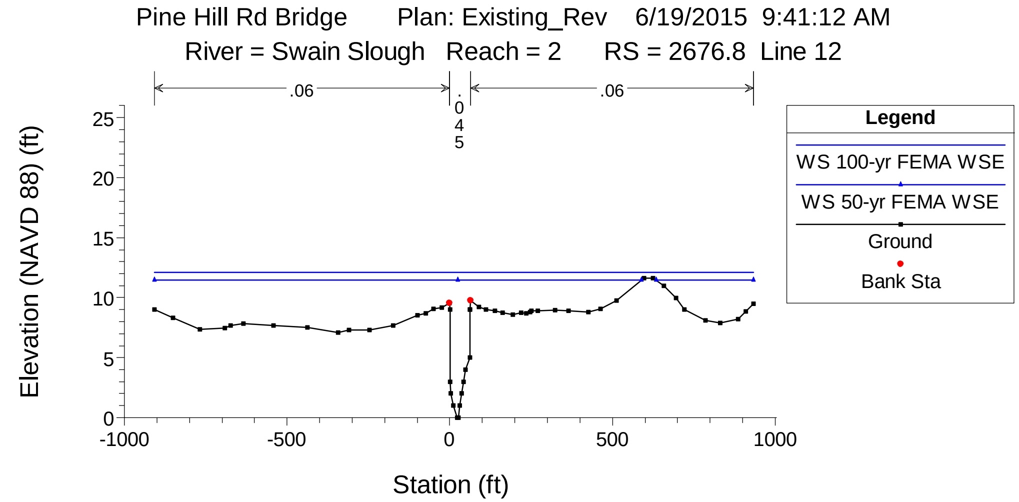


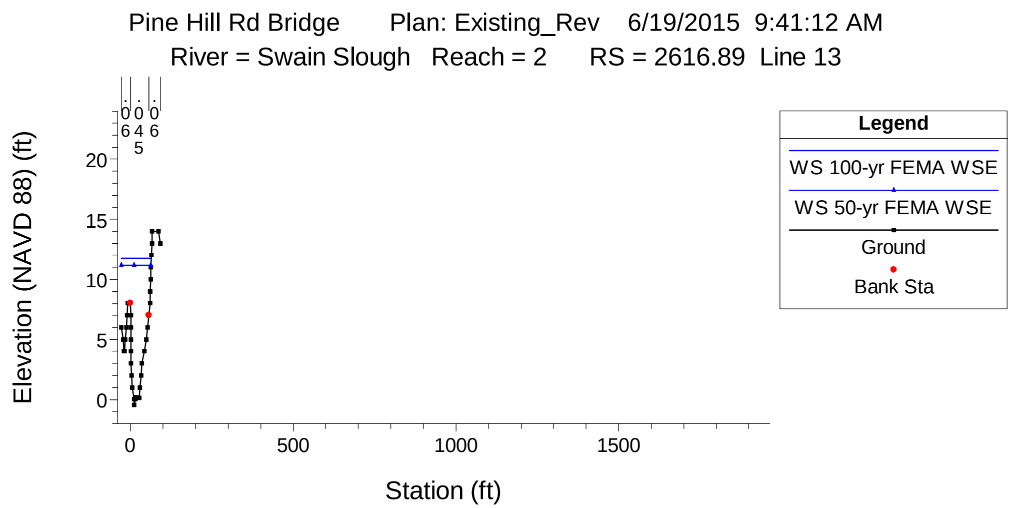


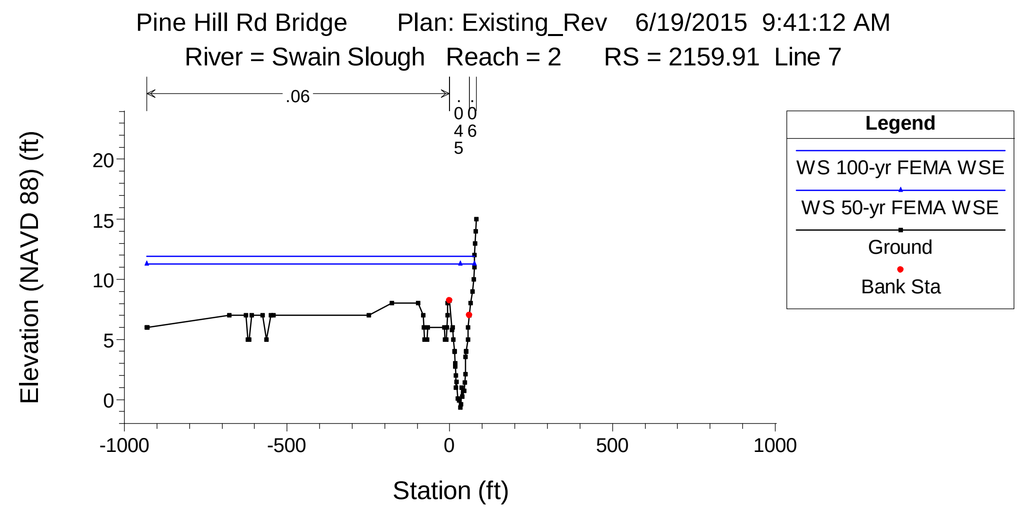


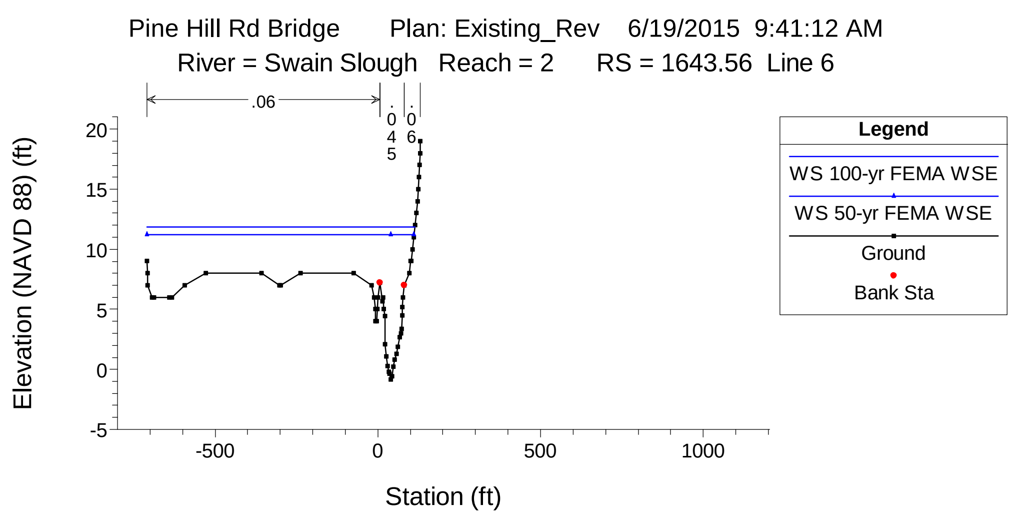
1 in Horiz. = 590 ft 1 in Vert. = 16 ft

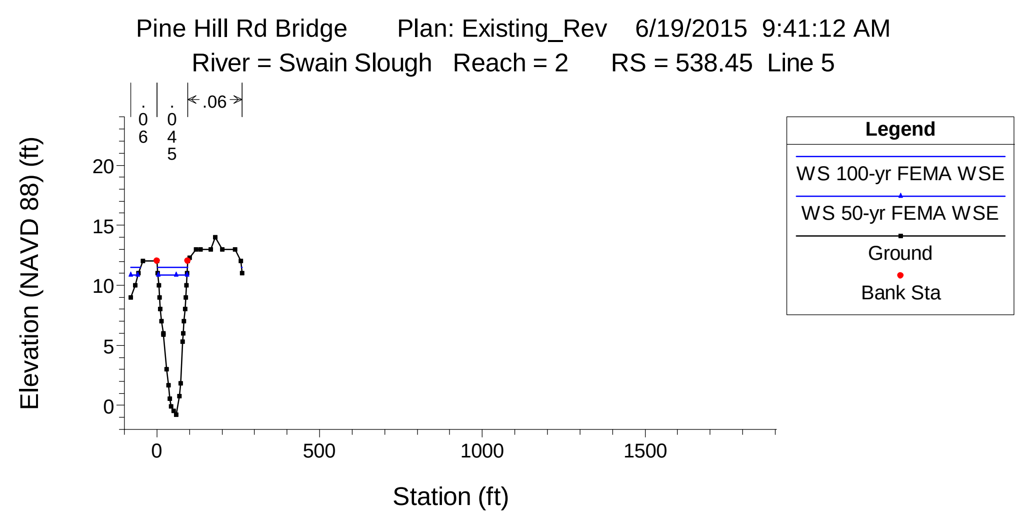












1 in Horiz. = 590 ft 1 in Vert. = 16 ft

```
                         HEC-RAS Version 4.1.0 Jan 2010
                          U.S. Army Corps of Engineers
                         Hydrologic Engineering Center
                               609 Second Street
                               Davis, California


            X     X  XXXXXX    XXXX        XXXX       XX      XXXX
            X     X  X        X    X       X   X     X  X    X
            X     X  X        X            X   X    X    X   X
            XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
            X     X  X        X            X  X     X    X        X
            X     X  X        X    X       X   X    X    X        X
            X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

```
PROJECT DATA
Project Title: Pine Hill Rd Bridge
Project File : PineHillRoadBrid.prj
Run Date and Time: 11/18/2015 2:55:54 PM

Project in English units



PLAN DATA

Plan Title: Existing_Rev
Plan File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS
Model\PineHillRoadBrid.p02

           Geometry Title: Existing_Rev
           Geometry File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18
           RAS Model\PineHillRoadBrid.g03

           Flow Title    : Swain/Martin/Elk
           Flow File     : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18
           RAS Model\PineHillRoadBrid.f06

Plan Summary Information:
Number of:  Cross Sections =   16    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    1    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001
```

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Swain/Martin/Elk
Flow File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS Model\PineHillRoadBrid.f06

Flow Data (cfs)

River	Reach	RS	100-yr FEMA WSE	50-yr FEMA WSE	100-yr ND	100-yr MLLW
Elk River	1	1407.91	13340	11570	13340	.01
Elk River	2	62.62	14430	12520	14430	.01
Martin Slough	1	180.1	2490	2200	2490	2490
Swain Slough	1	3118.45	2490	2200	2490	2490
Swain Slough	2	2695.15	2490	2200	2490	2490

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Elk River	2	100-yr FEMA WSE		Known WS = 9.67
Elk River	2	50-yr FEMA WSE		Known WS = 9.37
Elk River	2	100-yr ND		Normal S = 0.001
Elk River	2	100-yr MLLW		Known WS = -0.34

GEOMETRY DATA

Geometry Title: Existing_Rev
Geometry File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS Model\PineHillRoadBrid.g03

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
Elk River	1		Swain-Elk
Elk River	2	Swain-Elk	
Martin Slough	1		Pine Hill Rd
Swain Slough	1		Pine Hill Rd
Swain Slough	2	Pine Hill Rd	Swain-Elk

JUNCTION INFORMATION

Name: Pine Hill Rd
Description:
Energy computation Method

Length across Junction River	Reach	Tributary River	Reach	Length	Angle
Swain Slough	1	to Swain Slough	2	173.48	
Martin Slough	1	to Swain Slough	2	5	

Name: Swain-Elk
Description:
Energy computation Method

Length across Junction River	Reach	Tributary River	Reach	Length	Angle
Swain Slough	2	to Elk River	2	475.83	
Elk River	1	to Elk River	2	657.7	

CROSS SECTION

RIVER: Elk River
REACH: 1 RS: 1407.91

INPUT
Description: Line 1
Station Elevation Data num= 33

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-495.656     6.6   .4983     6.6  9.8966    6.36 20.6811    4.76 22.7645    2.76
 28.2917    2.03 33.1512     .82 35.9649    -.38 37.5126    -.78 41.1892   -2.09
 49.0949   -2.62 51.3937   -2.91 53.9924   -3.27 70.1936   -5.36  79.709   -5.96
 83.7181   -5.68 90.0982   -3.37 95.0206   -2.45101.6848   -2.24 111.091    -.31
119.8141     .76 125.488     .71132.7298      .3139.2829     .15145.4747    -.73
550.1818       9559.5398       9620.5295       9622.8073       8625.2212       7
628.3207       6631.9674       6 641.629       7
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-495.656     .06   .4983    .045550.1818     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         .4983550.1818           329.47  329.47  329.47              .1       .3

CROSS SECTION


RIVER: Elk River
REACH: 1                  RS: 1078.44

INPUT
Description: Line 2
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-482.133    6.74       0    6.74 13.9084    5.77 18.5737    4.16 19.3555    2.91
 24.2443    2.28 30.3345    1.12 35.0071    -.06  37.318   -1.01 46.0715   -2.74
 46.4556   -2.68 66.6613   -3.03 82.0238   -2.81 90.5396   -2.48 96.9076    -.66
100.8131     .64107.5066     1.7111.4751    2.23119.6734    2.97120.8081    6.06
 123.145    7.18147.3569    7.14152.8555    7.67159.5722   10.04167.7746   10.29
 645.293       7647.7288       8 649.908       9694.6366       9 696.101       8
697.2163       7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-482.133     .06       0    .045 123.145     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 123.145           420.74  420.74  420.74              .1       .3

CROSS SECTION


RIVER: Elk River
REACH: 1                  RS: 657.7

INPUT
Description: Line 3
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-555.487    8.15       0    8.15  5.1318    8.23   7.662    7.11 10.9105    6.43
 24.7099     6.6 43.8952    6.31 45.7699    5.41 46.8227    2.68 53.4299    1.77
  63.584     .08 69.1987   -1.79 79.6939   -3.03  91.547   -2.62111.1688   -2.55
121.4236   -1.39127.5531     .12  136.55    1.43145.5573    2.42159.8011    3.66
160.4782    4.49164.8015     5.5170.1038     6.6172.4629    8.08176.7684    7.68
184.2836    9.13653.1684       9669.4502       9684.5269       9734.8904       9
736.7045       8739.7709       8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-555.487     .06  5.1318    .045184.2836     .06
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        5.1318184.2836                0       0       0              .1       .3

CROSS SECTION



RIVER: Elk River
REACH: 2                  RS: 62.62

INPUT
Description: Line 4
Station Elevation Data    num=      39
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
-30.6735    11.69   1.7051       12    5.112       11   8.3018       10  10.6871        9
  13.206        8  15.5476        7  16.7659        6  17.7209     5.36  18.0539        5
 19.2578        4  20.3652        3  21.4603        2  22.4528        1  25.1102     1.98
  32.412     -.16  39.8847    -1.77  48.5214    -2.57  56.9498    -3.08  64.6987    -3.51
 73.3526    -4.13  85.8668    -5.73  94.8034    -6.29105.5397    -7.07117.8966    -6.09
129.1598    -1.9135.9209      .67138.9949     1.14147.2467     2.07  159.587     3.09
171.4851     4.48175.2133     6.99177.2178        8178.0591        9183.5394       10
185.5446       11191.1513       12223.5299       12381.2216       12

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
-30.6735      .06   1.7051     .045191.1513      .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1.7051191.1513                1       1       1              .1       .3

CROSS SECTION



RIVER: Elk River
REACH: 2                  RS: 61.62

INPUT
Description: Copy of Line 4
Station Elevation Data    num=      39
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
-30.6735    11.69   1.7051       12    5.112       11   8.3018       10  10.6871        9
  13.206        8  15.5476        7  16.7659        6  17.7209     5.36  18.0539        5
 19.2578        4  20.3652        3  21.4603        2  22.4528        1  25.1102     1.98
  32.412     -.16  39.8847    -1.77  48.5214    -2.57  56.9498    -3.08  64.6987    -3.51
 73.3526    -4.13  85.8668    -5.73  94.8034    -6.29105.5397    -7.07117.8966    -6.09
129.1598    -1.9135.9209      .67138.9949     1.14147.2467     2.07  159.587     3.09
171.4851     4.48175.2133     6.99177.2178        8178.0591        9183.5394       10
185.5446       11191.1513       12223.5299       12381.2216       12

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
-30.6735      .06   1.7051     .045191.1513      .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1.7051191.1513                1       1       1              .1       .3
```

CROSS SECTION

RIVER: Martin Slough
REACH: 1 RS: 180.1

INPUT
Description: Line 14
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-153.133	6	-145.237	5	-140.862	5	-139.829	6	-121.388	7
0	7	11.9859	6.3	13.5256	6	14.643	4.46	20.5059	4
23.2613	3	23.5276	2.93	25.5578	-.47	27.1053	-.5	29.3718	-.05
31.6165	1.43	31.7153	2.4	32.3762	6	33.2223	7	34.0014	6.63
34.8132	7.06	44.3037	8	47.3797	8.3	65.7553	9	71.7228	10
79.4184	11	90.838	12	116.1651	13	129.5451	14	145.5885	15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-153.133	.06	0	.045	33.2223	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	33.2223	180.1	180.1	180.1	.1	.3

CROSS SECTION

RIVER: Martin Slough
REACH: 1 RS: 100.73

INPUT
Description: Line 15
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-342.841	8	-311.098	9	-265.531	9	-226.435	8	-188.784	7
-156.117	6	-148.601	6	-143.833	7	0	7	4.1243	6
5.1721	5	7.9804	4	11.0274	3	19.334	3	23.1117	4
25.7662	5	27.3436	6	28.9803	7	32.1684	7.26	37.9916	8
41.8027	8.47	50.8164	9	52.1745	9.07	54.7401	9	54.7902	9
63.0434	8.76	67.5874	8.4	72.6961	9	72.7176	9	78.024	9.45
79.6654	10	80.6923	11	83.7436	12	86.8428	13	92.4978	14
96.1042	15	106.2177	16	115.1048	16	119.6858	16	134.6643	17
138.0456	18	140.7584	19	161.9231	19	164.9896	18	167.9579	17
172.1182	17	176.487	18	206.1302	18	212.3356	18	214.2315	19
216.2697	20	218.4128	21	221.1067	22				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-342.841	.06	0	.045	50.8164	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	50.8164	0	0	0	.1	.3

```
CROSS SECTION


RIVER: Swain Slough
REACH: 1                    RS: 3118.45

INPUT
Description: Line 8
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-97.9254       7 -9.6099       7       0    8.63  6.5839    6.23 10.5031    4.91
 13.7673       4 23.5333    3.01 23.7593     .86 27.8821     .09 32.3231     -.2
 34.8832    -.02 37.7423     .53 40.3977    1.59 42.4233    4.24 42.7578    1.98
 46.1172    2.49 54.0575    2.71 55.9147    4.77 60.5714    5.54  67.144    8.69
  73.758    5.77 76.2974    4.72 78.2433    6.91 79.7778    3.12 84.5895    4.18
 85.7079    5.75 93.1683    6.43 98.9451       7 216.774       8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-97.9254     .06       0    .045  67.144     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0  67.144           182.29  182.29  182.29             .1       .3

CROSS SECTION


RIVER: Swain Slough
REACH: 1                    RS: 2936.16

INPUT
Description: Line 9
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-43.8533       7-36.2473       6-17.6671       5-10.2326       5  -9.006       6
 -7.5551       7       0       7  2.6584       6  7.9783       4 10.6401       3
 13.3467       2 13.9407    1.77 18.2706       1  22.747      .2 31.4931       1
 38.9011    1.67 40.3033       2 42.0707       3 42.8974       4 44.0699       5
 50.9562       6 53.1115       7 65.9823       7 67.7883       6 74.0239       6
 76.4603       7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-43.8533     .06       0    .045 53.1115     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 53.1115            67.53   67.53   67.53             .1       .3

CROSS SECTION


RIVER: Swain Slough
REACH: 1                    RS: 2868.63
```

```
INPUT
Description: Line 10
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-34.3974       7-13.8813       6-11.3092       5 -2.2697       5 -1.2206       6
       0       7 10.7265       6 15.2428       6 24.2409       4  28.751       3
 33.2421       2 33.8764    1.86 38.7846       1 40.7294     .62 51.9939       1
  61.863       2 63.5125       3 64.7918       4 73.1363       5 79.6641       6
 81.9044       7 93.6721       8115.4074       8118.6834       7141.3972       7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-34.3974     .06       0    .045 81.9044     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 81.9044           270.09  270.09  270.09              .1       .3

CROSS SECTION


RIVER: Swain Slough
REACH: 2                  RS: 2695.15

INPUT
Description: Line 11
Station Elevation Data    num=      54
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-905.194    8.61-876.298     8.4-836.233    8.11-779.831    7.45-768.408    7.22
-706.668    7.49-684.968    7.63-634.669    7.82-536.259    7.58 -437.15    7.55
-343.411    7.18-313.251    7.23-224.143    7.39-144.427    7.82-100.496    8.15
-75.2063    8.63-50.1786     8.9-26.0294    9.18       0       9  1.9662       2
  7.3509       1 11.2434       0 25.5344       0 32.5629       1 39.0786       2
 42.7122       3 45.0992       4 47.4638       5 58.9415       5  60.762       5
 60.8709       9 62.0607    9.85 87.5355    9.23112.0104    8.89137.6754    8.87
161.8089    8.47207.3775     8.2217.7859    8.27243.4937     8.3274.4125    8.38
318.5187    8.78337.0036       9359.5423    9.23 401.738    9.61457.9224    9.49
504.0239      10552.0157   10.44606.4791   10.86688.3458    9.96761.2707    8.69
829.5144    7.86886.1743    8.17924.6126    8.83958.2914    9.51

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-905.194     .06       0    .045 62.0607     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 62.0607            18.35   18.35   18.35              .3       .5

BRIDGE


RIVER: Swain Slough
REACH: 2                  RS: 2686

INPUT
Description:
```

Distance from Upstream XS = .1
Deck/Roadway Width = 18
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 468

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-935.3	9.8		-920.3	9		-914.6	9	
-909.5	9.1		-908.6	9.2		-905.5	9	
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-813	8		-802.5	8		-802.1	8	
-793.2	7.6		-786.3	7.3		-786.3	7.3	
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-276	7		-275.6	7		-274.5	7.1	
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-238	7	-234.5	7		-233.6	7	
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-204.2	7	-204	7		-203.5	7	
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-181.4	7.8	-167.6	8		-167.6	8	
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-145.8	8	-145.5	8		-144.1	8.1	
-142.1	8.1	-134.4	8.1		-133.2	8.1	
-125.4	8.5	-124.6	8.5		-121.7	8.4	
-113.1	8.1	-103.4	8.1		-102.9	8.1	
-102.5	8.2	-99.4	8.7		-90.7	8.2	
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88.1	9.7	89.3	9.1		96.9	9.1	
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108.9	9	112.5	9		112.6	9	
116.1	9	116.4	9		118.5	9	
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135.1	9.1	137.1	9.2		137.8	9.2	
138	9.2	138.2	9.2		143.4	9	
149.4	9	150.8	9		160	9	
161.7	9.1	162.9	9		176.2	9	
182	9	183.1	9		183.2	9	
183.3	9	192.9	9		193	9	
196.7	8.9	204.1	8.9		204.1	8.9	
204.2	8.9	213.1	8.6		218.6	8.5	
221.4	8.4	230.5	8.4		235.2	8.6	
244.2	9	244.4	9		245.4	9	
245.7	9	250.4	9		251.1	9	
252.8	9	252.8	9		254	9	
255.7	9	282.8	9		286	9	
288	9	300.8	9.3		300.8	9.3	
313.3	9	315.8	9		327.3	9	
331.8	9	331.9	9		360.4	9.4	
365.8	9.4	366.5	9.4		381.3	9.3	
397.6	9.5	397.7	9.5		408.7	9.2	
418.1	9	421.4	9		436.9	9.5	
438	9.5	438.4	9.5		438.9	9.5	
439.5	9.5	439.7	9.5		441.4	9.5	
453.2	9.1	453.2	9		455.4	8.9	
465.8	8.7	465.9	8.7		469.5	8.8	
492	9.9	494	9.8		494.9	9.8	

495.8	9.3	496	9	504.4	9.6
507.7	9.6	514	9.5	516.6	9.5
516.7	9.5	521.9	9.6	524	9.7
524.2	9.7	527.8	9.7	531.4	9.8
535.4	9.8	539.7	10	540.4	10.2
545	10.1	550.6	10.7	560.1	11.2
560.3	11.1	566.9	11	568.2	11
569.1	11.1	570.8	11.2	577.1	11.3
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583.1	11.3	585	11.2	585.5	11.2
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590.6	11.2	590.9	11.2	593.7	11.2
594.1	11.2	599.4	11.4	601.7	11.5
602.7	11.5	603.5	11.5	603.7	11.5
608.2	11.2	612.6	11.2	615	11.2
616.5	11.2	616.6	11.2	618.4	11.2
622	11.2	625.1	11.2	627.3	11.2
628.3	11.2	635.3	11.1	637.9	11
638.1	11	639.5	11	642.3	10.9
642.7	10.9	642.9	10.9	643.2	10.9
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680.1	10.2	681.7	10.2	687.2	10.1
687.3	10.1	687.4	10.1	692.4	10
693	10	693	10	693.1	10
693.2	10	693.2	10	693.2	10
693.3	10	693.4	10	693.8	10
695.3	9.9	719.8	9	719.9	9
721.5	9	726	8.7	726.2	8.7
729.9	8.5	731.5	8.5	733.2	8.5
734.6	8.4	745.8	8.1	746.6	8.1
747.4	8.1	750	8.1	751.1	8.1
753.4	8.4	755.9	8.4	759.3	8.4
762	8	763.9	8	767.1	8
767.9	8	773.7	7.4	781.4	7.5
781.8	7.5	783.1	7.5	784.5	7.5
785.9	7.5	788.4	7.5	790.6	7.5
791.1	7.5	791.7	7.5	792.3	7.5
794	7.5	795.6	7.5	796.1	7.5
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806.9	7.3	809.3	7.3	823.7	7.9
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852	7.6	852.3	7.6	853.1	7.7
854	7.7	854.3	7.7	854.6	7.7
855.7	7.7	860.5	8	866.6	8
869.3	8	870.7	8	875.8	8
879.4	8	880.5	8	881.1	8.1
883.3	8.1	884.8	8.1	888.3	8.5
892.6	9	894	9	895.5	9.1
895.6	9.1	896.5	9.1	896.5	9.1
898.6	9.2	899.9	9.2	901.7	9.2

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Upstream Bridge Cross Section Data
Station Elevation Data    num=      54
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
-905.194    8.61-876.298     8.4-836.233    8.11-779.831    7.45-768.408    7.22
-706.668    7.49-684.968    7.63-634.669    7.82-536.259    7.58 -437.15    7.55
-343.411    7.18-313.251    7.23-224.143    7.39-144.427    7.82-100.496    8.15
-75.2063    8.63-50.1786     8.9-26.0294    9.18       0       9  1.9662       2
  7.3509       1 11.2434       0 25.5344       0 32.5629       1 39.0786       2
 42.7122       3 45.0992       4 47.4638       5 58.9415       5  60.762       5
 60.8709       9 62.0607    9.85 87.5355    9.23112.0104    8.89137.6754    8.87
161.8089    8.47207.3775     8.2217.7859    8.27243.4937     8.3274.4125    8.38
318.5187    8.78337.0036       9359.5423    9.23 401.738    9.61457.9224    9.49
504.0239      10552.0157   10.44606.4791   10.86688.3458    9.96761.2707    8.69
829.5144    7.86886.1743    8.17924.6126    8.83958.2914    9.51

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
-905.194     .06        0    .045 62.0607     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
             0 62.0607             .3       .5

Downstream  Deck/Roadway Coordinates
    num=     468
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
  -935.3     9.8           -920.3       9           -914.6       9
  -909.5     9.1           -908.6     9.2           -905.5       9
  -894.9       9           -891.5       9           -891.4       9
  -891.4       9             -889       9           -883.6     8.9
  -883.5     8.9           -883.5     8.9           -861.1       8
    -856     8.5           -855.1     8.5           -853.1     8.6
  -843.1       8           -843.1       8             -842       8
  -841.9       8           -836.2       8           -828.7       8
  -827.7       8           -824.5       8           -824.3       8
  -823.2       8           -817.2       8           -814.1       8
    -813       8           -802.5       8           -802.1       8
  -793.2     7.6           -786.3     7.3           -786.3     7.3
  -779.8     7.7             -779     7.6           -778.6       7
  -775.3       7             -774       7           -772.2       7
  -772.1       7           -771.8       7           -767.5       7
  -761.4       7           -755.7       7           -754.6       7
  -738.8       7           -730.4       7           -715.1       7
  -713.5       7           -711.7     7.4           -709.5     7.8
  -708.2     7.6           -704.8       7           -700.3       7
  -699.2       7           -697.2       7           -696.5     7.1
  -688.6     7.1           -687.2       7           -686.7       7
  -681.9       7             -677     7.2           -676.8     7.3
  -669.4     7.7           -664.7       8           -664.6       8
  -664.3       8           -663.1       8           -641.6       8
  -638.2     8.1           -637.9     8.1           -636.9     8.1
  -634.5     8.1             -634     8.1           -633.9     8.1
  -633.4     8.1             -631     8.1           -627.1     8.1
    -619       8             -606       8           -601.6       8
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-601.6	8	-601.4	8		-599.6	8	
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-538.5	7	-538.1	7		-538.1	7	
-535.2	7.4	-534	7.7		-531.1	7.1	
-531	7	-530.8	7		-486.6	7	
-447.3	7	-447.2	7		-444.2	7	
-444.2	7	-444.2	7		-440.9	7	
-440.8	7	-438.4	7.7		-431.3	7.1	
-430.5	7	-428.1	7		-424.7	7	
-386.7	7	-386.2	7		-344.4	7	
-344.3	7	-343.9	7		-342.5	7.4	
-342.2	7.5	-340	7		-328.2	7	
-326.1	7	-317.7	7		-317.6	7	
-315.9	7	-312.1	7		-312.1	7	
-309.9	7	-309.9	7		-309.7	7	
-304.1	7	-303.7	7		-302.1	7	
-289.9	7	-289.7	7		-276.6	7	
-276	7	-275.6	7		-274.5	7.1	
-272	7.3	-269.6	7.6		-268.5	7.6	
-262.8	7.5	-238.4	7		-238.2	7	
-238	7	-234.5	7		-233.6	7	
-231.7	7	-219.7	7		-212.1	7	
-211.8	7	-207	7		-206.9	7	
-204.2	7	-204	7		-203.5	7	
-195.3	7.2	-194.5	7.2		-181.4	7.8	
-181.4	7.8	-167.6	8		-167.6	8	
-167.2	8	-150.6	8		-147.7	8	
-145.8	8	-145.5	8		-144.1	8.1	
-142.1	8.1	-134.4	8.1		-133.2	8.1	
-125.4	8.5	-124.6	8.5		-121.7	8.4	
-113.1	8.1	-103.4	8.1		-102.9	8.1	
-102.5	8.2	-99.4	8.7		-90.7	8.2	
-90.4	8.2	-74.9	9		-74.4	9	
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138	9.2	138.2	9.2		143.4	9	
149.4	9	150.8	9		160	9	
161.7	9.1	162.9	9		176.2	9	

182	9	183.1	9	183.2	9
183.3	9	192.9	9	193	9
196.7	8.9	204.1	8.9	204.1	8.9
204.2	8.9	213.1	8.6	218.6	8.5
221.4	8.4	230.5	8.4	235.2	8.6
244.2	9	244.4	9	245.4	9
245.7	9	250.4	9	251.1	9
252.8	9	252.8	9	254	9
255.7	9	282.8	9	286	9
288	9	300.8	9.3	300.8	9.3
313.3	9	315.8	9	327.3	9
331.8	9	331.9	9	360.4	9.4
365.8	9.4	366.5	9.4	381.3	9.3
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438	9.5	438.4	9.5	438.9	9.5
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453.2	9.1	453.2	9	455.4	8.9
465.8	8.7	465.9	8.7	469.5	8.8
492	9.9	494	9.8	494.9	9.8
495.8	9.3	496	9	504.4	9.6
507.7	9.6	514	9.5	516.6	9.5
516.7	9.5	521.9	9.6	524	9.7
524.2	9.7	527.8	9.7	531.4	9.8
535.4	9.8	539.7	10	540.4	10.2
545	10.1	550.6	10.7	560.1	11.2
560.3	11.1	566.9	11	568.2	11
569.1	11.1	570.8	11.2	577.1	11.3
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589.4	11.2	589.9	11.2	590.4	11.2
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594.1	11.2	599.4	11.4	601.7	11.5
602.7	11.5	603.5	11.5	603.7	11.5
608.2	11.2	612.6	11.2	615	11.2
616.5	11.2	616.6	11.2	618.4	11.2
622	11.2	625.1	11.2	627.3	11.2
628.3	11.2	635.3	11.1	637.9	11
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643.9	10.9	656.8	10.6	660.9	10.6
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680.1	10.2	681.7	10.2	687.2	10.1
687.3	10.1	687.4	10.1	692.4	10
693	10	693	10	693.1	10
693.2	10	693.2	10	693.2	10
693.3	10	693.4	10	693.8	10
695.3	9.9	719.8	9	719.9	9
721.5	9	726	8.7	726.2	8.7
729.9	8.5	731.5	8.5	733.2	8.5
734.6	8.4	745.8	8.1	746.6	8.1
747.4	8.1	750	8.1	751.1	8.1

753.4	8.4	755.9	8.4	759.3	8.4
762	8	763.9	8	767.1	8
767.9	8	773.7	7.4	781.4	7.5
781.8	7.5	783.1	7.5	784.5	7.5
785.9	7.5	788.4	7.5	790.6	7.5
791.1	7.5	791.7	7.5	792.3	7.5
794	7.5	795.6	7.5	796.1	7.5
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854	7.7	854.3	7.7	854.6	7.7
855.7	7.7	860.5	8	866.6	8
869.3	8	870.7	8	875.8	8
879.4	8	880.5	8	881.1	8.1
883.3	8.1	884.8	8.1	888.3	8.5
892.6	9	894	9	895.5	9.1
895.6	9.1	896.5	9.1	896.5	9.1
898.6	9.2	899.9	9.2	901.7	9.2

```
Downstream Bridge Cross Section Data
Station Elevation Data    num=      56
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
-907.259    9.02-851.064    8.33-767.859    7.34-690.752    7.48-674.312    7.68
-634.012    7.86-542.575    7.67-436.989    7.53-342.677     7.1-310.625     7.3
-246.582    7.31-174.339    7.68-99.0834    8.54-73.8754    8.69-49.7054    9.09
-24.1212    9.18        0    9.56    .9522       9  1.0641       3  2.3107       2
 10.4984       1 21.7144       0 26.4557       0 30.8535       1 36.2293       2
 41.5189       3 48.3547       4 61.6524       5 61.7237       9 61.9538       9
 63.1937    9.76  88.821    9.25112.0223    9.04137.7226    8.89  162.82    8.76
 192.847    8.59219.0203    8.72235.4593    8.67246.9746    8.82251.7447    8.89
270.7995    8.89323.3417    8.96364.6551    8.88426.4643    8.79463.3697    9.09
511.5541    9.76596.7125   11.63624.7191   11.63657.2901   11.01694.9018    9.98
720.0103       9785.5819    8.09830.9925     7.9886.8119    8.22909.9197    8.86
933.3759    9.47

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-907.259     .06       0    .045 63.1937     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
             0 63.1937             .3       .5

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Abutments =  2
```

```
Abutment Data
Upstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
       0     9.8     2.9     9.8     2.9       0
Downstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
       0     9.8     2.9     9.8     2.9       0

Abutment Data
Upstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
   59.16       0   59.16      10   62.06      10
Downstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
  60.297       0  60.297      10  63.194      10

Number of Piers =  2

Pier Data
Pier Station     Upstream=   21.07    Downstream=   21.45
Upstream     num=       2
    Width   Elev    Width   Elev
     2.9       0     2.9     9.9
Downstream     num=       2
    Width   Elev    Width   Elev
     2.9       0     2.9     9.9

Pier Data
Pier Station     Upstream=   40.99    Downstream=   41.75
Upstream     num=       2
    Width   Elev    Width   Elev
     2.3       0     2.3     9.9
Downstream     num=       2
    Width   Elev    Width   Elev
     2.3       0     2.3     9.9

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =      .8
           Max Low Cord                =

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line
```

```
CROSS SECTION



RIVER: Swain Slough
REACH: 2                    RS: 2676.8

INPUT
Description: Line 12
Station Elevation Data    num=      56
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-907.259    9.02-851.064    8.33-767.859    7.34-690.752    7.48-674.312    7.68
-634.012    7.86-542.575    7.67-436.989    7.53-342.677     7.1-310.625     7.3
-246.582    7.31-174.339    7.68-99.0834    8.54-73.8754    8.69-49.7054    9.09
-24.1212    9.18       0    9.56   .9522       9  1.0641       3  2.3107       2
 10.4984       1 21.7144       0 26.4557       0 30.8535       1 36.2293       2
 41.5189       3 48.3547       4 61.6524       5 61.7237       9 61.9538       9
 63.1937    9.76  88.821    9.25112.0223    9.04137.7226    8.89  162.82    8.76
 192.847    8.59219.0203    8.72235.4593    8.67246.9746    8.82251.7447    8.89
270.7995    8.89323.3417    8.96364.6551    8.88426.4643    8.79463.3697    9.09
511.5541    9.76596.7125   11.63624.7191   11.63657.2901   11.01694.9018    9.98
720.0103       9785.5819    8.09830.9925     7.9886.8119    8.22909.9197    8.86
933.3759    9.47

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-907.259     .06       0    .045 63.1937     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 63.1937             59.91   59.91   59.91             .3       .5

CROSS SECTION



RIVER: Swain Slough
REACH: 2                    RS: 2616.89

INPUT
Description: Line 13
Station Elevation Data    num=      38
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-27.3757       6-22.1495       5-19.9356       4-17.8932       4 -15.931       5
-13.3997       6-11.1732       7 -8.9807       8       0       8   .9838       7
  1.6616       6  1.7626       5  1.8252       4   2.066       3  2.6226       2
  5.6743       1 10.1634       0 12.0819    -.44  16.038       0 17.7542     .19
 26.4716     .16 29.1834       1   33.08       2 34.5866       3 43.2425       4
 48.3719       5 52.6332       6 56.5626       7 59.3739       8 60.1734       9
 60.3837       9 61.3326      10 62.4476      11 63.6826      12 65.3311      13
 66.9443      14 85.0371      14 91.4984      13

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-27.3757     .06       0    .045 56.5626     .06
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 56.5626            456.98  456.98  456.98              .1       .3

CROSS SECTION



RIVER: Swain Slough
REACH: 2                  RS: 2159.91

INPUT
Description: Line 7
Station Elevation Data    num=      59
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-932.044       6-928.635       6-678.153       7-627.295       7-620.888       5
-617.421       5-608.184       7 -575.81       7-563.561       5-548.692       7
-541.909       7-249.517       7-177.238       8-98.2575       8-81.4958       7
-80.4089       6-77.8185       5-70.5183       5-67.9728       6-17.4905       6
 -14.492       5-10.8819       5 -9.4783       6 -7.5669       7 -5.9211       8
       0    8.26  7.4735    5.76  8.6559       6 11.0678       5 14.5481       4
 15.4111    3.99 15.8366    2.77 16.8743       3 17.9266       2 18.8202       1
 20.7052    1.47 23.7215     .09 28.8796    -.08 31.9546    -.68 34.5284     -.4
 36.8228       1 39.1446     .26 43.3862     .73 46.2956    1.42  47.835    2.11
 48.3773    3.54 49.9196    3.96 50.7688       4 55.6249       5   56.75       6
 59.8795       7 64.5946       8 69.9105       9 73.5128      10 75.0509      11
 76.7312      12  78.511      13 79.5533      14 80.9687      15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-932.044     .06       0    .045 59.8795     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 59.8795            516.35  516.35  516.35              .1       .3

CROSS SECTION



RIVER: Swain Slough
REACH: 2                  RS: 1643.56

INPUT
Description: Line 6
Station Elevation Data    num=      57
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-710.374       9-708.413       8-707.115       7 -694.17       6-688.701       6
-639.727       6-633.578       6-594.227       7-528.989       8-357.205       8
-302.066       7-297.611       7-237.213       8-75.2052       8 -19.324       7
-10.4289       6 -8.1435       5 -6.7674       4 -2.6025       4 -1.2379       5
       0       6  7.0881    7.19  13.766    5.66 15.5131       6 17.2383       5
 21.8452    4.45 22.9149    2.11 26.1704    1.07 29.7266     .27  33.307     -.2
 36.0272    -.34 39.3065    -.86 43.9098    -.57 47.6934     .24 52.4435     .81
  57.129    1.29 61.9194    1.88 67.5585    2.66 72.1268    2.99  73.816    3.35
 74.2399     4.5 75.9708     5.2 76.3462       6 81.7265       7 97.2145       8
101.5241       9101.7502       9105.8639      10110.2544      11114.5372      12
118.6876      13122.2418      14124.4174      15126.6126      16128.2847      17
```

```
129.3414      18130.6335      19

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-710.374     .06  7.0881    .045 81.7265     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        7.0881 81.7265          1105.11 1105.11 1105.11              .1       .3

CROSS SECTION


RIVER: Swain Slough
REACH: 2                  RS: 538.45

INPUT
Description: Line 5
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-79.4539       9-65.9481      10-57.4296      11-43.5131      12       0      12
  3.1876      11  6.2022      10   8.761       9 11.0114       8 14.8865       7
 19.0982       6 20.8771    5.89 29.5715       3 35.9918    1.69  39.464     .57
 43.3499     -.1 51.3697    -.44 59.9064    -.78 68.3274     .76 73.3072    1.82
 79.8672    5.28 81.0018       6 83.0465       7 86.4117       8 88.2612       9
 90.7158      10 92.5183      11 95.1668      12100.8006   12.32119.3853      13
 134.648      13164.5775      13 180.048      14200.9811      13240.2796      13
258.7743      12262.4423      11

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-79.4539     .06       0    .045 95.1668     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 95.1668           538.45  538.45  538.45              .1       .3



SUMMARY OF MANNING'S N VALUES

River:Elk River

      Reach          River Sta.       n1        n2        n3

 1                     1407.91            .06      .045       .06
 1                     1078.44            .06      .045       .06
 1                     657.7              .06      .045       .06
 2                     62.62              .06      .045       .06
 2                     61.62              .06      .045       .06


River:Martin Slough

      Reach          River Sta.       n1        n2        n3
```

1	180.1	.06	.045	.06
1	100.73	.06	.045	.06

River:Swain Slough

Reach	River Sta.	n1	n2	n3
1	3118.45	.06	.045	.06
1	2936.16	.06	.045	.06
1	2868.63	.06	.045	.06
2	2695.15	.06	.045	.06
2	2686	Bridge		
2	2676.8	.06	.045	.06
2	2616.89	.06	.045	.06
2	2159.91	.06	.045	.06
2	1643.56	.06	.045	.06
2	538.45	.06	.045	.06

SUMMARY OF REACH LENGTHS

River: Elk River

Reach	River Sta.	Left	Channel	Right
1	1407.91	329.47	329.47	329.47
1	1078.44	420.74	420.74	420.74
1	657.7	0	0	0
2	62.62	1	1	1
2	61.62	1	1	1

River: Martin Slough

Reach	River Sta.	Left	Channel	Right
1	180.1	180.1	180.1	180.1
1	100.73	0	0	0

River: Swain Slough

Reach	River Sta.	Left	Channel	Right
1	3118.45	182.29	182.29	182.29
1	2936.16	67.53	67.53	67.53
1	2868.63	270.09	270.09	270.09
2	2695.15	18.35	18.35	18.35
2	2686	Bridge		
2	2676.8	59.91	59.91	59.91
2	2616.89	456.98	456.98	456.98

2	2159.91	516.35	516.35	516.35
2	1643.56	1105.11	1105.11	1105.11
2	538.45	538.45	538.45	538.45

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Elk River

Reach	River Sta.	Contr.	Expan.
1	1407.91	.1	.3
1	1078.44	.1	.3
1	657.7	.1	.3
2	62.62	.1	.3
2	61.62	.1	.3

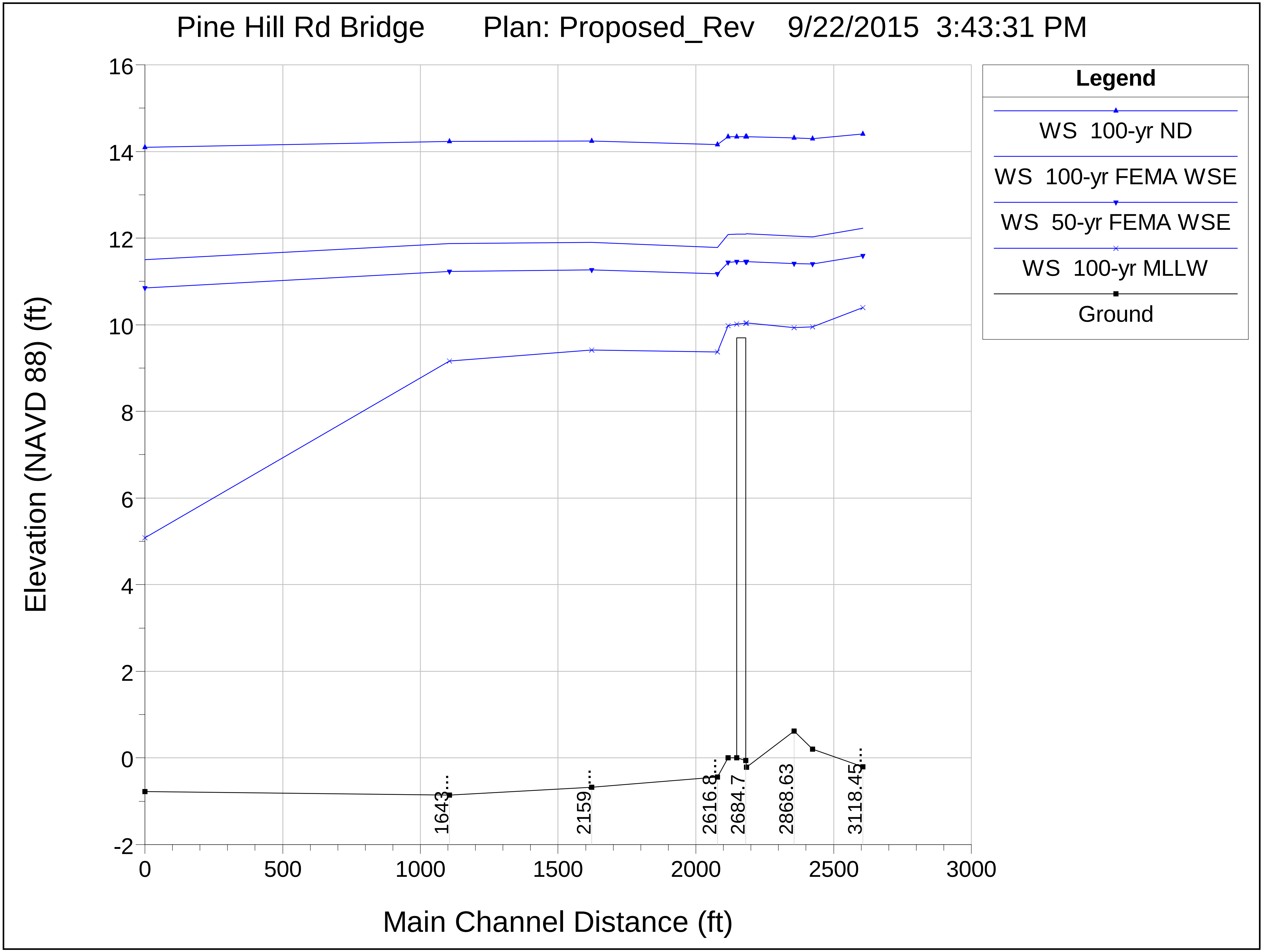
River: Martin Slough

Reach	River Sta.	Contr.	Expan.
1	180.1	.1	.3
1	100.73	.1	.3

River: Swain Slough

Reach	River Sta.	Contr.	Expan.
1	3118.45	.1	.3
1	2936.16	.1	.3
1	2868.63	.1	.3
2	2695.15	.3	.5
2	2686 Bridge		
2	2676.8	.3	.5
2	2616.89	.1	.3
2	2159.91	.1	.3
2	1643.56	.1	.3
2	538.45	.1	.3

Appendix B HEC-RAS Proposed Condition



Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
Legend
WS 100-yr ND
WS 100-yr FEMA WSE
WS 50-yr FEMA WSE
WS 100-yr MLLW
Ground
Elevation (NAVD 88) (ft)
16
14
12
10
8
6
4
2
0
-2
1643....
2159....
2616.8...
2684.7
2868.63
3118.45...
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)

HEC-RAS Plan: Proposed_Rev

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Swain Slough	1	3118.45	100-yr FEMA WSE	2490.00	-0.20	12.23		12.26	0.000229	1.96	1845.62	314.70	0.12
Swain Slough	1	3118.45	100-yr ND	2490.00	-0.20	14.40		14.42	0.000086	1.39	2530.05	314.70	0.07
Swain Slough	1	3118.45	50-yr FEMA WSE	2200.00	-0.20	11.59		11.63	0.000254	1.96	1646.17	314.70	0.12
Swain Slough	1	3118.45	100-yr MLLW	2490.00	-0.20	10.39		10.48	0.000708	2.94	1268.17	314.70	0.20
Swain Slough	1	2936.16	100-yr FEMA WSE	2490.00	0.20	12.03		12.19	0.000656	3.59	882.36	120.31	0.21
Swain Slough	1	2936.16	100-yr ND	2490.00	0.20	14.30		14.39	0.000288	2.76	1155.13	120.31	0.14
Swain Slough	1	2936.16	50-yr FEMA WSE	2200.00	0.20	11.40		11.55	0.000672	3.46	806.84	120.31	0.21
Swain Slough	1	2936.16	100-yr MLLW	2490.00	0.20	9.95		10.26	0.001782	4.98	632.14	120.31	0.33
Swain Slough	1	2868.63	100-yr FEMA WSE	2490.00	0.62	12.04		12.13	0.000396	2.68	1165.64	175.79	0.16
Swain Slough	1	2868.63	100-yr ND	2490.00	0.62	14.31		14.36	0.000161	2.00	1564.53	175.79	0.11
Swain Slough	1	2868.63	50-yr FEMA WSE	2200.00	0.62	11.41		11.49	0.000418	2.61	1054.27	175.79	0.17
Swain Slough	1	2868.63	100-yr MLLW	2490.00	0.62	9.93		10.13	0.001227	3.88	794.59	175.79	0.27
Swain Slough	2	2702.55	100-yr FEMA WSE	2490.00	-0.21	12.10	4.48	12.10	0.000013	0.53	7485.24	1148.30	0.03
Swain Slough	2	2702.55	100-yr ND	2490.00	-0.21	14.34	4.48	14.34	0.000005	0.38	10063.36	1148.30	0.02
Swain Slough	2	2702.55	50-yr FEMA WSE	2200.00	-0.21	11.46	4.16	11.46	0.000014	0.53	6754.42	1148.30	0.03
Swain Slough	2	2702.55	100-yr MLLW	2490.00	-0.21	10.05	4.48	10.05	0.000042	0.81	5129.69	1148.30	0.05
Swain Slough	2	2684.7		Bridge									
Swain Slough	2	2666.8	100-yr FEMA WSE	2490.00	0.00	12.08	6.30	12.09	0.000082	1.17	3403.93	800.01	0.07
Swain Slough	2	2666.8	100-yr ND	2490.00	0.00	14.34	6.30	14.34	0.000025	0.73	5381.29	951.56	0.04
Swain Slough	2	2666.8	50-yr FEMA WSE	2200.00	0.00	11.44	5.94	11.45	0.000094	1.20	2937.20	696.81	0.08
Swain Slough	2	2666.8	100-yr MLLW	2490.00	0.00	9.98	6.30	10.02	0.000352	2.07	1990.16	587.61	0.14
Swain Slough	2	2616.89	100-yr FEMA WSE	2490.00	-0.44	11.78		12.02	0.000876	4.09	700.42	90.79	0.24
Swain Slough	2	2616.89	100-yr ND	2490.00	-0.44	14.16		14.30	0.000394	3.19	927.47	118.87	0.16
Swain Slough	2	2616.89	50-yr FEMA WSE	2200.00	-0.44	11.17		11.39	0.000874	3.90	644.96	90.03	0.23
Swain Slough	2	2616.89	100-yr MLLW	2490.00	-0.44	9.37		9.85	0.002596	5.77	484.84	88.11	0.39
Swain Slough	2	2159.91	100-yr FEMA WSE	2490.00	-0.68	11.90		11.90	0.000036	0.81	5294.00	1008.61	0.05
Swain Slough	2	2159.91	100-yr ND	2490.00	-0.68	14.24		14.24	0.000011	0.52	7658.79	1011.94	0.03
Swain Slough	2	2159.91	50-yr FEMA WSE	2200.00	-0.68	11.27		11.27	0.000042	0.84	4655.40	1007.54	0.05
Swain Slough	2	2159.91	100-yr MLLW	2490.00	-0.68	9.42		9.44	0.000262	1.77	2797.53	1003.47	0.12
Swain Slough	2	1643.56	100-yr FEMA WSE	2490.00	-0.86	11.87		11.88	0.000063	1.13	3961.64	824.36	0.06
Swain Slough	2	1643.56	100-yr ND	2490.00	-0.86	14.23		14.24	0.000018	0.70	5918.92	833.12	0.04
Swain Slough	2	1643.56	50-yr FEMA WSE	2200.00	-0.86	11.23		11.24	0.000075	1.18	3435.88	821.62	0.07
Swain Slough	2	1643.56	100-yr MLLW	2490.00	-0.86	9.16		9.24	0.000616	2.82	1743.16	812.78	0.19
Swain Slough	2	538.45	100-yr FEMA WSE	2490.00	-0.78	11.50		11.69	0.000797	3.50	740.52	123.17	0.22
Swain Slough	2	538.45	100-yr ND	2490.00	-0.78	14.10		14.18	0.000254	2.37	1360.41	341.90	0.13
Swain Slough	2	538.45	50-yr FEMA WSE	2200.00	-0.78	10.85		11.03	0.000797	3.40	665.15	109.40	0.22

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Swain Slough	2	538.45	100-yr MLLW	2490.00	-0.78	5.08	5.08	7.07	0.019820	11.31	220.09	56.19	1.01
Martin Slough	1	180.1	100-yr FEMA WSE	2490.00	-0.50	12.12		12.20	0.000654	2.90	1240.87	247.10	0.18
Martin Slough	1	180.1	100-yr ND	2490.00	-0.50	14.34		14.38	0.000213	1.95	1840.74	288.16	0.11
Martin Slough	1	180.1	50-yr FEMA WSE	2200.00	-0.50	11.50		11.58	0.000746	2.93	1090.52	238.29	0.19
Martin Slough	1	180.1	100-yr MLLW	2490.00	-0.50	10.31		10.50	0.002278	4.55	814.66	227.28	0.33
Martin Slough	1	100.73	100-yr FEMA WSE	2490.00	3.00	12.08		12.11	0.000306	1.89	1956.40	426.83	0.13
Martin Slough	1	100.73	100-yr ND	2490.00	3.00	14.33		14.35	0.000084	1.22	2929.33	436.54	0.07
Martin Slough	1	100.73	50-yr FEMA WSE	2200.00	3.00	11.44		11.47	0.000385	1.97	1684.74	424.88	0.15
Martin Slough	1	100.73	100-yr MLLW	2490.00	3.00	9.97		10.08	0.002108	3.74	1063.16	422.42	0.33
Elk River	1	1407.91	100-yr FEMA WSE	13340.00	-5.96	12.17		12.22	0.000186	1.99	8217.31	1137.29	0.11
Elk River	1	1407.91	100-yr ND	13340.00	-5.96	14.24		14.27	0.000086	1.54	10572.28	1137.29	0.08
Elk River	1	1407.91	50-yr FEMA WSE	11570.00	-5.96	11.65		11.70	0.000176	1.86	7625.79	1137.29	0.11
Elk River	1	1407.91	100-yr MLLW	0.01	-5.96	-0.34		-0.34	0.000000	0.00	235.25	94.04	0.00
Elk River	1	1078.44	100-yr FEMA WSE	13340.00	-3.03	11.96		12.11	0.000637	4.17	5872.30	1179.35	0.22
Elk River	1	1078.44	100-yr ND	13340.00	-3.03	14.17		14.23	0.000222	2.76	8471.68	1179.35	0.13
Elk River	1	1078.44	50-yr FEMA WSE	11570.00	-3.03	11.44		11.59	0.000645	4.07	5256.78	1179.35	0.22
Elk River	1	1078.44	100-yr MLLW	0.01	-3.03	-0.34		-0.34	0.000000	0.00	132.96	62.18	0.00
Elk River	1	657.7	100-yr FEMA WSE	13340.00	-3.03	11.54		11.76	0.001060	4.69	4961.47	1295.26	0.27
Elk River	1	657.7	100-yr ND	13340.00	-3.03	14.06		14.12	0.000261	2.73	8222.89	1295.26	0.14
Elk River	1	657.7	50-yr FEMA WSE	11570.00	-3.03	10.98		11.22	0.001184	4.75	4228.63	1295.26	0.28
Elk River	1	657.7	100-yr MLLW	0.01	-3.03	-0.34		-0.34	0.000000	0.00	117.34	60.84	0.00
Elk River	2	62.62	100-yr FEMA WSE	14430.00	-7.07	9.67		10.64	0.002567	7.88	1832.08	172.67	0.43
Elk River	2	62.62	100-yr ND	14430.00	-7.07	13.28		13.77	0.001000	5.68	2784.81	411.90	0.28
Elk River	2	62.62	50-yr FEMA WSE	12520.00	-7.07	9.37		10.14	0.002087	7.03	1780.50	170.30	0.38
Elk River	2	62.62	100-yr MLLW	0.01	-7.07	-0.34		-0.34	0.000000	0.00	392.16	100.02	0.00
Elk River	2	61.62	100-yr FEMA WSE	14430.00	-7.07	9.67	4.47	10.63	0.002569	7.88	1831.57	172.64	0.43
Elk River	2	61.62	100-yr ND	14430.00	-7.07	13.28	4.45	13.77	0.001001	5.68	2784.38	411.90	0.28
Elk River	2	61.62	50-yr FEMA WSE	12520.00	-7.07	9.37	3.77	10.14	0.002088	7.03	1780.13	170.28	0.38
Elk River	2	61.62	100-yr MLLW	0.01	-7.07	-0.34	-7.04	-0.34	0.000000	0.00	392.16	100.02	0.00

Plan: Proposed_Rev Swain Slough 2 RS: 2684.7 Profile: 100-yr FEMA WSE

E.G. US. (ft)	12.10	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	12.10	E.G. Elev (ft)	12.10	12.10
Q Total (cfs)	2490.00	W.S. Elev (ft)	12.10	12.09
Q Bridge (cfs)	300.42	Crit W.S. (ft)	5.22	5.51
Q Weir (cfs)		Max Chl Dpth (ft)	12.16	12.09
Weir Sta Lft (ft)		Vel Total (ft/s)	0.41	0.42
Weir Sta Rgt (ft)		Flow Area (sq ft)	6048.34	5940.70
Weir Submerg		Froude # Chl	0.02	0.02
Weir Max Depth (ft)		Specif Force (cu ft)	13920.43	13668.79
Min El Weir Flow (ft)	9.51	Hydr Depth (ft)	3.61	3.59
Min El Prs (ft)	9.70	W.P. Total (ft)	1835.54	1810.26
Delta EG (ft)	0.01	Conv. Total (cfs)	350575.5	342500.5
Delta WS (ft)	0.02	Top Width (ft)	1677.15	1652.58
BR Open Area (sq ft)	523.79	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	0.57	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.01	0.01
Br Sel Method	Energy only	Power Total (lb/ft s)	-905.19	-907.26

Plan: Proposed_Rev Swain Slough 2 RS: 2684.7 Profile: 100-yr ND

E.G. US. (ft)	14.34	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	14.34	E.G. Elev (ft)	14.34	14.34
Q Total (cfs)	2490.00	W.S. Elev (ft)	14.34	14.34
Q Bridge (cfs)	137.31	Crit W.S. (ft)	5.22	5.51
Q Weir (cfs)		Max Chl Dpth (ft)	14.40	14.34
Weir Sta Lft (ft)		Vel Total (ft/s)	0.25	0.25
Weir Sta Rgt (ft)		Flow Area (sq ft)	10065.34	9908.50
Weir Submerg		Froude # Chl	0.01	0.01
Weir Max Depth (ft)		Specif Force (cu ft)	31905.89	31367.44
Min El Weir Flow (ft)	9.51	Hydr Depth (ft)	5.40	5.38
Min El Prs (ft)	9.70	W.P. Total (ft)	2026.41	2002.85
Delta EG (ft)	0.00	Conv. Total (cfs)	761724.5	748435.4
Delta WS (ft)	0.01	Top Width (ft)	1863.49	1840.64
BR Open Area (sq ft)	523.79	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	0.26	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.00	0.00
Br Sel Method	Energy only	Power Total (lb/ft s)	-905.19	-907.26

Plan: Proposed_Rev Swain Slough 2 RS: 2684.7 Profile: 50-yr FEMA WSE

E.G. US. (ft)	11.46	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	11.46	E.G. Elev (ft)	11.46	11.46
Q Total (cfs)	2200.00	W.S. Elev (ft)	11.46	11.46
Q Bridge (cfs)	350.10	Crit W.S. (ft)	4.93	5.24
Q Weir (cfs)		Max Chl Dpth (ft)	11.52	11.46
Weir Sta Lft (ft)		Vel Total (ft/s)	0.44	0.45
Weir Sta Rgt (ft)		Flow Area (sq ft)	4994.18	4906.83
Weir Submerg		Froude # Chl	0.02	0.02
Weir Max Depth (ft)		Specif Force (cu ft)	10402.12	10211.08

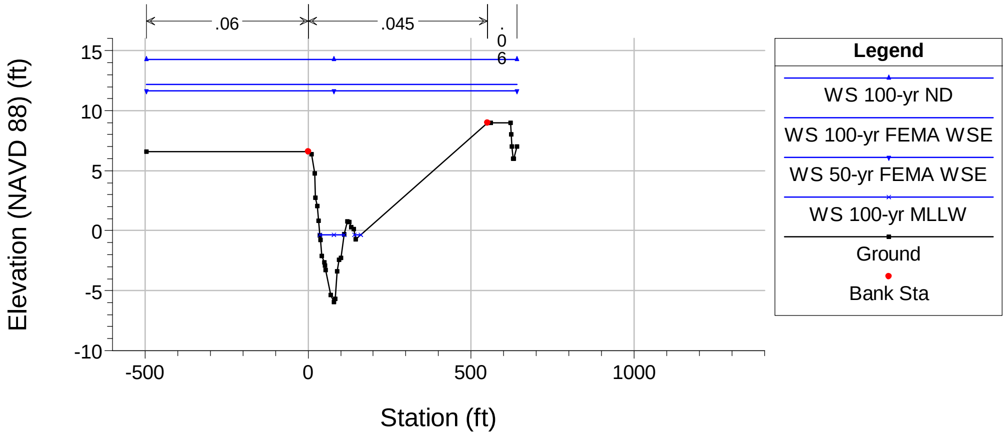
Plan: Proposed_Rev Swain Slough 2 RS: 2684.7 Profile: 50-yr FEMA WSE (Continued)

Min El Weir Flow (ft)	9.51	Hydr Depth (ft)	3.06	3.14
Min El Prs (ft)	9.70	W.P. Total (ft)	1789.50	1720.74
Delta EG (ft)	0.01	Conv. Total (cfs)	265789.8	262611.3
Delta WS (ft)	0.02	Top Width (ft)	1632.40	1564.35
BR Open Area (sq ft)	523.79	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	0.67	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.01	0.01
Br Sel Method	Energy only	Power Total (lb/ft s)	-905.19	-907.26

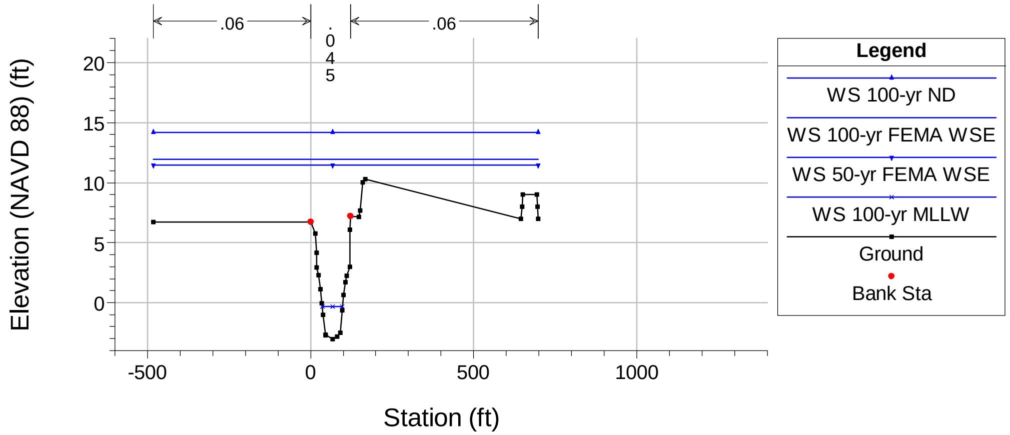
Plan: Proposed_Rev Swain Slough 2 RS: 2684.7 Profile: 100-yr MLLW

E.G. US. (ft)	10.05	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	10.05	E.G. Elev (ft)	10.05	10.03
Q Total (cfs)	2490.00	W.S. Elev (ft)	10.03	10.02
Q Bridge (cfs)	816.73	Crit W.S. (ft)	5.22	5.51
Q Weir (cfs)		Max Chl Dpth (ft)	10.09	10.02
Weir Sta Lft (ft)		Vel Total (ft/s)	0.89	0.88
Weir Sta Rgt (ft)		Flow Area (sq ft)	2812.59	2829.51
Weir Submerg		Froude # Chl	0.06	0.06
Weir Max Depth (ft)		Specif Force (cu ft)	4918.61	4728.21
Min El Weir Flow (ft)	9.51	Hydr Depth (ft)	2.10	2.14
Min El Prs (ft)	9.70	W.P. Total (ft)	1495.17	1475.13
Delta EG (ft)	0.03	Conv. Total (cfs)	128953.6	127237.3
Delta WS (ft)	0.07	Top Width (ft)	1340.97	1321.69
BR Open Area (sq ft)	523.79	Frctn Loss (ft)	0.01	0.01
BR Open Vel (ft/s)	1.56	C & E Loss (ft)	0.00	0.01
Coef of Q		Shear Total (lb/sq ft)	0.04	0.05
Br Sel Method	Energy only	Power Total (lb/ft s)	-905.19	-907.26

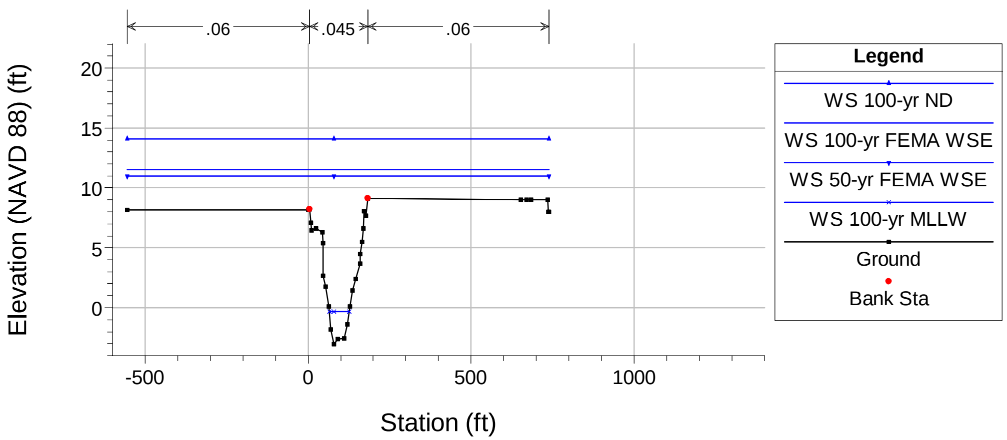
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Elk River Reach = 1 RS = 1407.91 Line 1



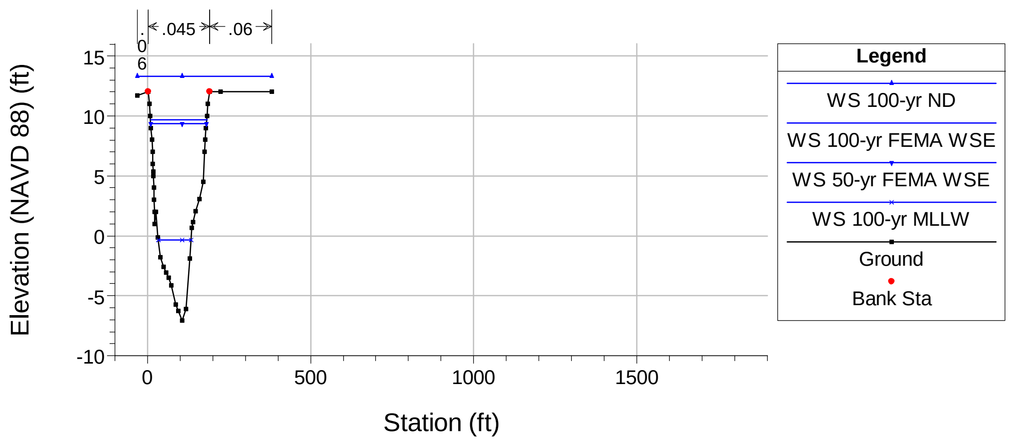
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Elk River Reach = 1 RS = 1078.44 Line 2



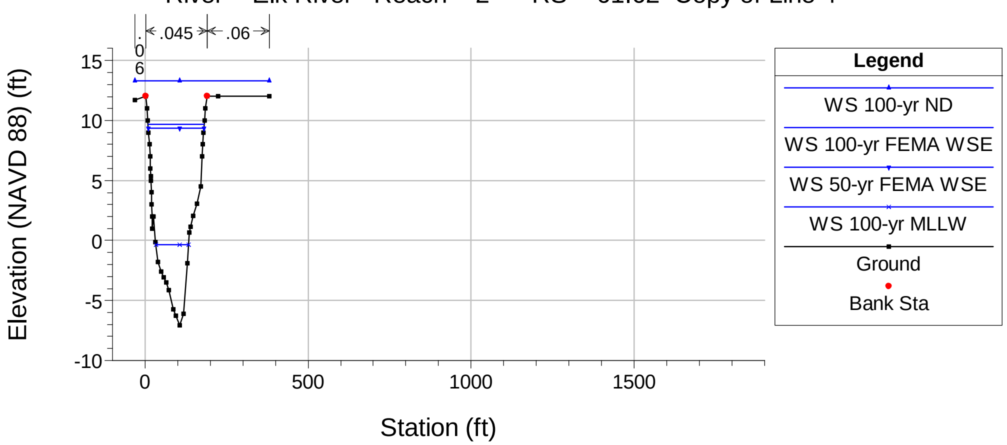
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Elk River Reach = 1 RS = 657.7 Line 3



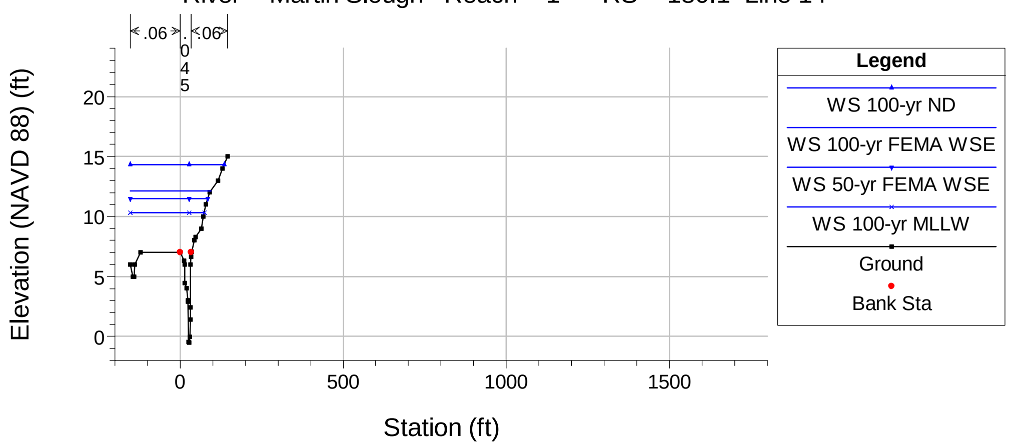
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Elk River Reach = 2 RS = 62.62 Line 4



Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Elk River Reach = 2 RS = 61.62 Copy of Line 4

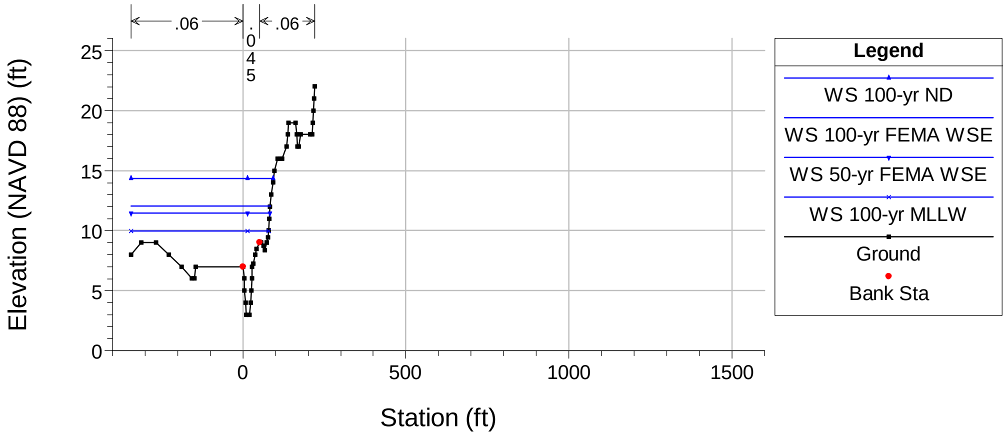


Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Martin Slough Reach = 1 RS = 180.1 Line 14

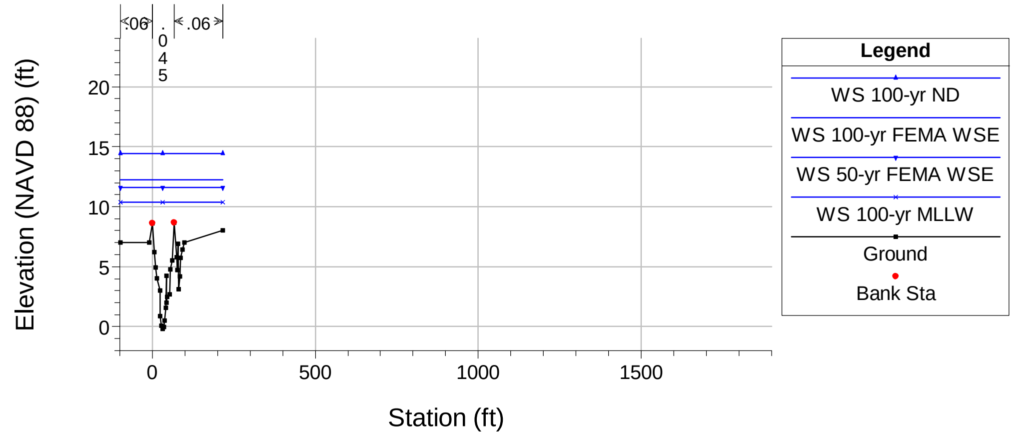


1 in Horiz. = 589 ft 1 in Vert. = 16 ft

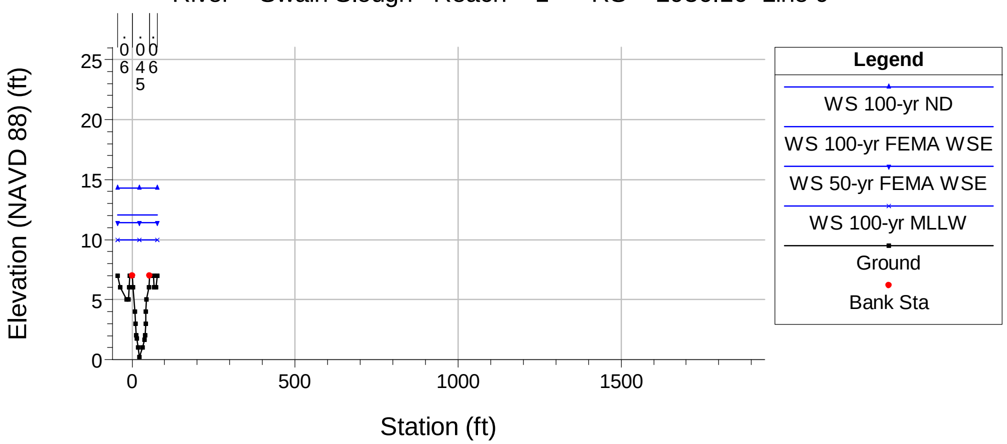
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Martin Slough Reach = 1 RS = 100.73 Line 15



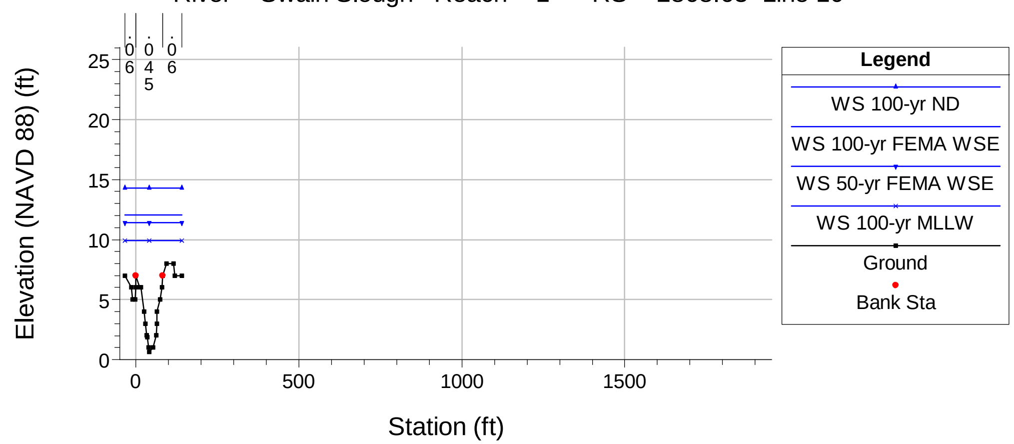
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 1 RS = 3118.45 Line 8



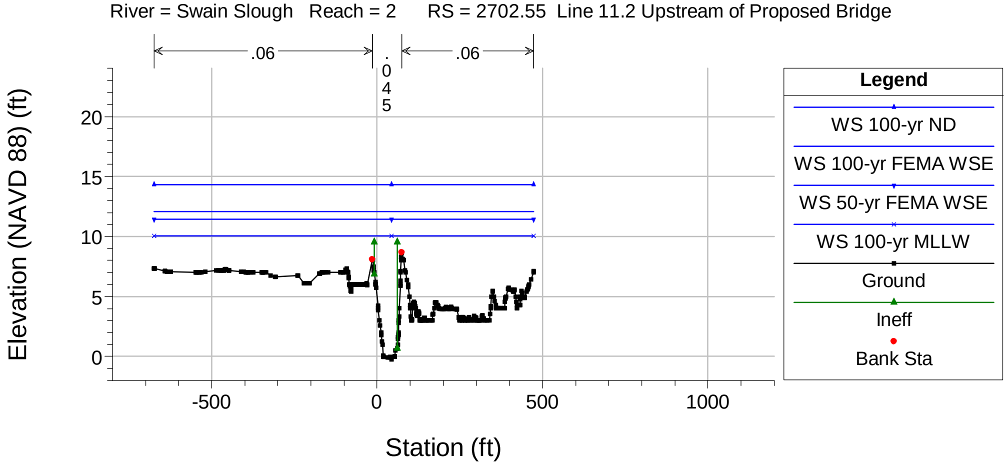
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 1 RS = 2936.16 Line 9



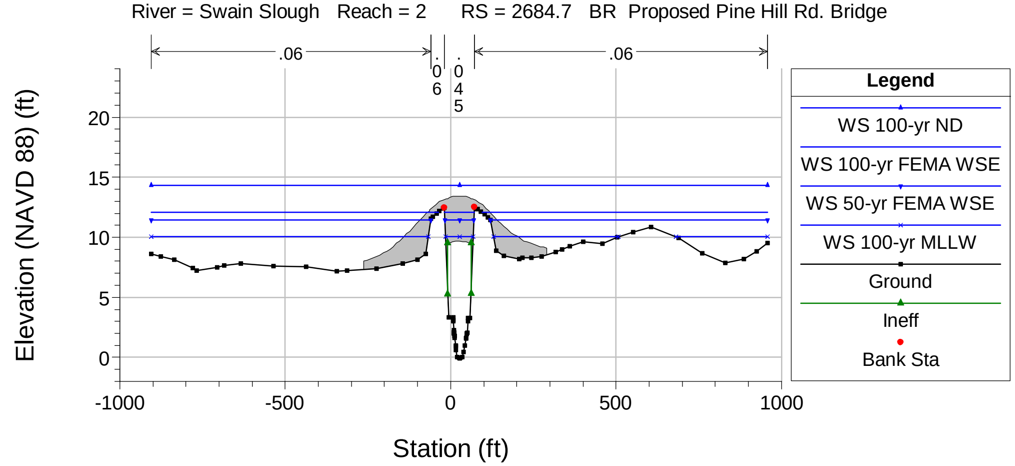
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 1 RS = 2868.63 Line 10



Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 2702.55 Line 11.2 Upstream of Proposed Bridge

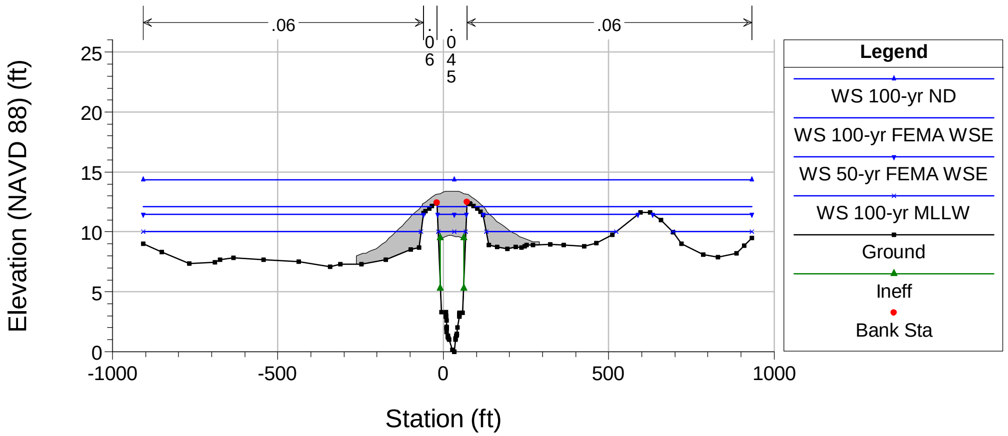


Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 2684.7 BR Proposed Pine Hill Rd. Bridge

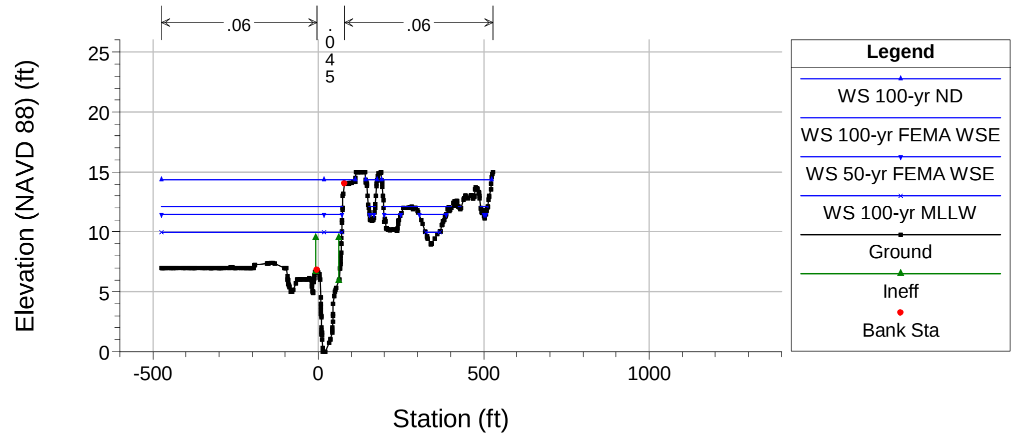


1 in Horiz. = 589 ft 1 in Vert. = 16 ft

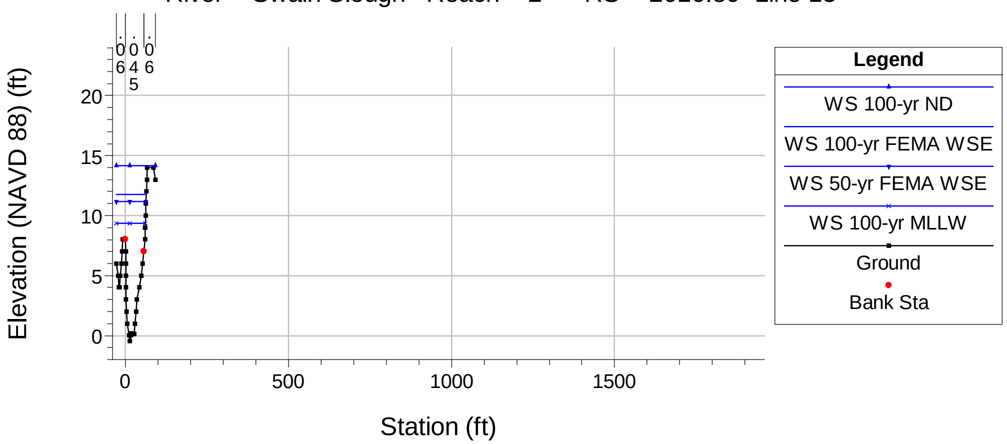
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 2684.7 BR Proposed Pine Hill Rd. Bridge



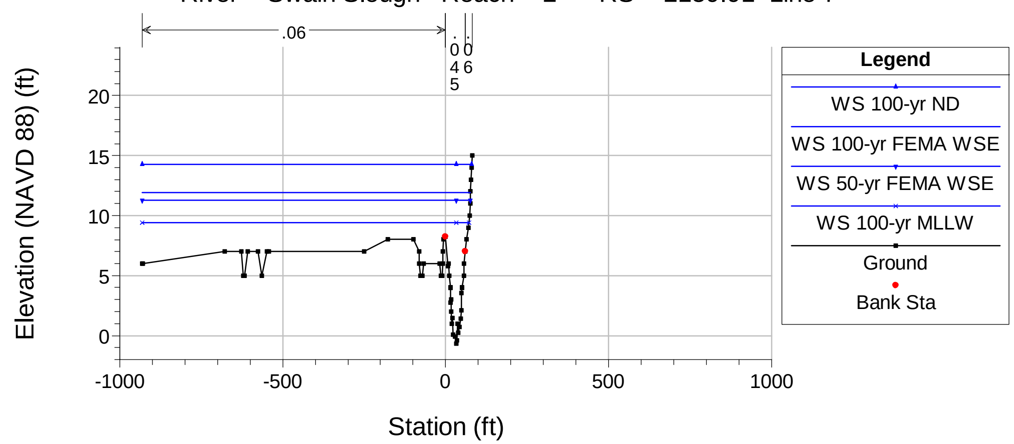
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 2666.8 12.1 Downstream of Proposed Bridge



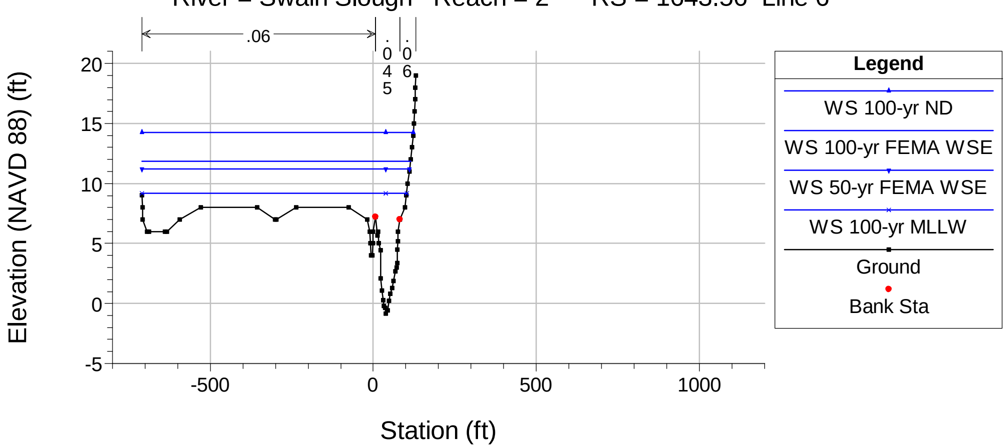
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 2616.89 Line 13



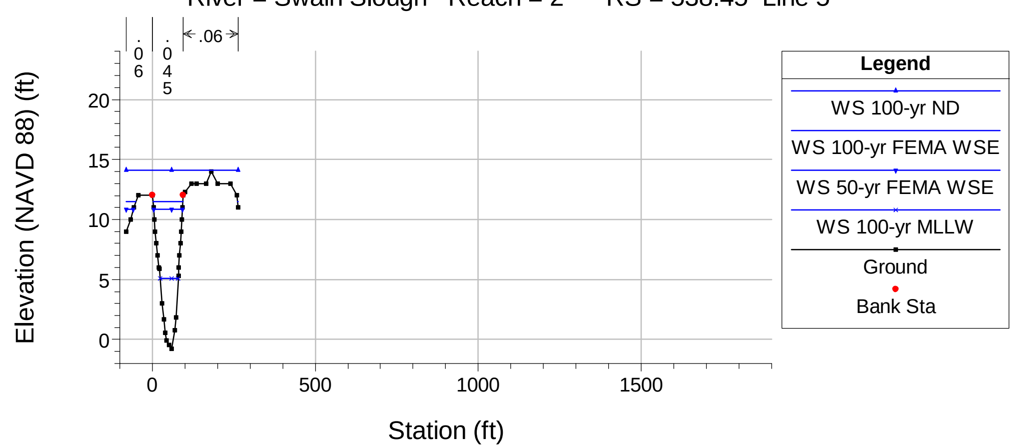
Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 2159.91 Line 7



Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 1643.56 Line 6



Pine Hill Rd Bridge Plan: Proposed_Rev 9/22/2015 3:43:31 PM
River = Swain Slough Reach = 2 RS = 538.45 Line 5



1 in Horiz. = 589 ft 1 in Vert. = 16 ft

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                         HEC-RAS Version 4.1.0 Jan 2010
                          U.S. Army Corps of Engineers
                         Hydrologic Engineering Center
                               609 Second Street
                               Davis, California

            X     X  XXXXXX    XXXX        XXXX       XX      XXXX
            X     X  X        X    X       X   X     X  X    X
            X     X  X        X            X   X    X    X   X
            XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
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PROJECT DATA
Project Title: Pine Hill Rd Bridge
Project File : PineHillRoadBrid.prj
Run Date and Time: 11/18/2015 2:55:57 PM

Project in English units

PLAN DATA

Plan Title: Proposed_Rev
Plan File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS Model\PineHillRoadBrid.p03

Geometry Title: Proposed_Rev
Geometry File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS Model\PineHillRoadBrid.g04

Flow Title : Swain/Martin/Elk_
Flow File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS Model\PineHillRoadBrid.f01

Plan Summary Information:

Number of:	Cross Sections =	16	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	1	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method: Average Conveyance
    Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Swain/Martin/Elk_
Flow File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS Model\PineHillRoadBrid.f01

Flow Data (cfs)

River	Reach	RS	100-yr FEMA WSE	50-yr FEMA WSE	100-yr ND	100-yr MLLW
Elk River	1	1407.91	13340	11570	13340	.01
Elk River	2	62.62	14430	12520	14430	.01
Martin Slough	1	180.1	2490	2200	2490	2490
Swain Slough	1	3118.45	2490	2200	2490	2490
Swain Slough	2	2702.55	2490	2200	2490	2490

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Elk River	2	100-yr FEMA WSE		Known WS = 9.67
Elk River	2	50-yr FEMA WSE		Known WS = 9.37
Elk River	2	100-yr ND		Normal S = 0.001
Elk River	2	100-yr MLLW		Known WS = -0.34

GEOMETRY DATA

Geometry Title: Proposed_Rev
Geometry File : g:\Projects\Y2012\P1225 Pine Hill Rd Bridge\Submittals\2015-11-18 RAS Model\PineHillRoadBrid.g04

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
Elk River	1		Swain-Elk
Elk River	2	Swain-Elk	
Martin Slough	1		Pine Hill Rd
Swain Slough	1		Pine Hill Rd
Swain Slough	2	Pine Hill Rd	Swain-Elk

JUNCTION INFORMATION

Name: Pine Hill Rd
Description:
Energy computation Method

Length across Junction		Tributary			
River	Reach	River	Reach	Length	Angle
Swain Slough	1	to Swain Slough	2	173.48	
Martin Slough	1	to Swain Slough	2	5	

Name: Swain-Elk
Description:
Energy computation Method

Length across Junction		Tributary			
River	Reach	River	Reach	Length	Angle
Swain Slough	2	to Elk River	2	475.83	
Elk River	1	to Elk River	2	657.7	

CROSS SECTION

RIVER: Elk River
REACH: 1 RS: 1407.91

INPUT
Description: Line 1
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-495.656	6.6	.4983	6.6	9.8966	6.36	20.6811	4.76	22.7645	2.76
28.2917	2.03	33.1512	.82	35.9649	-.38	37.5126	-.78	41.1892	-2.09
49.0949	-2.62	51.3937	-2.91	53.9924	-3.27	70.1936	-5.36	79.709	-5.96
83.7181	-5.68	90.0982	-3.37	95.0206	-2.45	101.6848	-2.24	111.091	-.31
119.8141	.76	125.488	.71	132.7298	.3	139.2829	.15	145.4747	-.73
550.1818	9	559.5398	9	620.5295	9	622.8073	8	625.2212	7
628.3207	6	631.9674	6	641.629	7				

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-495.656     .06   .4983    .045550.1818     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         .4983550.1818           329.47  329.47  329.47              .1       .3

CROSS SECTION


RIVER: Elk River
REACH: 1                   RS: 1078.44

INPUT
Description: Line 2
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-482.133    6.74       0    6.74 13.9084    5.77 18.5737    4.16 19.3555    2.91
 24.2443    2.28 30.3345    1.12 35.0071    -.06  37.318   -1.01 46.0715   -2.74
 46.4556   -2.68 66.6613   -3.03 82.0238   -2.81 90.5396   -2.48 96.9076    -.66
100.8131     .64107.5066     1.7111.4751    2.23119.6734    2.97120.8081    6.06
 123.145    7.18147.3569    7.14152.8555    7.67159.5722   10.04167.7746   10.29
 645.293       7647.7288       8 649.908       9694.6366       9 696.101       8
697.2163       7

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-482.133     .06       0    .045 123.145     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 123.145           420.74  420.74  420.74              .1       .3

CROSS SECTION


RIVER: Elk River
REACH: 1                   RS: 657.7

INPUT
Description: Line 3
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-555.487    8.15       0    8.15  5.1318    8.23   7.662    7.11 10.9105    6.43
 24.7099     6.6 43.8952    6.31 45.7699    5.41 46.8227    2.68 53.4299    1.77
  63.584     .08 69.1987   -1.79 79.6939   -3.03  91.547   -2.62111.1688   -2.55
121.4236   -1.39127.5531     .12  136.55    1.43145.5573    2.42159.8011    3.66
160.4782    4.49164.8015     5.5170.1038     6.6172.4629    8.08176.7684    7.68
184.2836    9.13653.1684       9669.4502       9684.5269       9734.8904       9
736.7045       8739.7709       8

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-555.487     .06  5.1318    .045184.2836     .06
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        5.1318184.2836                0       0       0              .1       .3

CROSS SECTION



RIVER: Elk River
REACH: 2                  RS: 62.62

INPUT
Description: Line 4
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-30.6735   11.69  1.7051      12   5.112      11  8.3018      10 10.6871       9
  13.206       8 15.5476       7 16.7659       6 17.7209    5.36 18.0539       5
 19.2578       4 20.3652       3 21.4603       2 22.4528       1 25.1102    1.98
  32.412    -.16 39.8847   -1.77 48.5214   -2.57 56.9498   -3.08 64.6987   -3.51
 73.3526   -4.13 85.8668   -5.73 94.8034   -6.29105.5397   -7.07117.8966   -6.09
129.1598    -1.9135.9209     .67138.9949    1.14147.2467    2.07 159.587    3.09
171.4851    4.48175.2133    6.99177.2178       8178.0591       9183.5394      10
185.5446      11191.1513      12223.5299      12381.2216      12

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-30.6735     .06  1.7051    .045191.1513     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1.7051191.1513                1       1       1              .1       .3

CROSS SECTION



RIVER: Elk River
REACH: 2                  RS: 61.62

INPUT
Description: Copy of Line 4
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-30.6735   11.69  1.7051      12   5.112      11  8.3018      10 10.6871       9
  13.206       8 15.5476       7 16.7659       6 17.7209    5.36 18.0539       5
 19.2578       4 20.3652       3 21.4603       2 22.4528       1 25.1102    1.98
  32.412    -.16 39.8847   -1.77 48.5214   -2.57 56.9498   -3.08 64.6987   -3.51
 73.3526   -4.13 85.8668   -5.73 94.8034   -6.29105.5397   -7.07117.8966   -6.09
129.1598    -1.9135.9209     .67138.9949    1.14147.2467    2.07 159.587    3.09
171.4851    4.48175.2133    6.99177.2178       8178.0591       9183.5394      10
185.5446      11191.1513      12223.5299      12381.2216      12

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-30.6735     .06  1.7051    .045191.1513     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1.7051191.1513                1       1       1              .1       .3
```

```
CROSS SECTION


RIVER: Martin Slough
REACH: 1                  RS: 180.1

INPUT
Description: Line 14
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-153.133       6-145.237       5-140.862       5-139.829       6-121.388       7
       0       7 11.9859     6.3 13.5256       6  14.643    4.46 20.5059       4
 23.2613       3 23.5276    2.93 25.5578    -.47 27.1053     -.5 29.3718    -.05
 31.6165    1.43 31.7153     2.4 32.3762       6 33.2223       7 34.0014    6.63
 34.8132    7.06 44.3037       8 47.3797     8.3 65.7553       9 71.7228      10
 79.4184      11  90.838      12116.1651      13129.5451      14145.5885      15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-153.133     .06       0    .045 33.2223     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 33.2223            180.1   180.1   180.1              .1       .3

CROSS SECTION


RIVER: Martin Slough
REACH: 1                  RS: 100.73

INPUT
Description: Line 15
Station Elevation Data    num=      53
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-342.841       8-311.098       9-265.531       9-226.435       8-188.784       7
-156.117       6-148.601       6-143.833       7       0       7  4.1243       6
  5.1721       5  7.9804       4 11.0274       3  19.334       3 23.1117       4
 25.7662       5 27.3436       6 28.9803       7 32.1684    7.26 37.9916       8
 41.8027    8.47 50.8164       9 52.1745    9.07 54.7401       9 54.7902       9
 63.0434    8.76 67.5874     8.4 72.6961       9 72.7176       9  78.024    9.45
 79.6654      10 80.6923      11 83.7436      12 86.8428      13 92.4978      14
 96.1042      15106.2177      16115.1048      16119.6858      16134.6643      17
138.0456      18140.7584      19161.9231      19164.9896      18167.9579      17
172.1182      17 176.487      18206.1302      18212.3356      18214.2315      19
216.2697      20218.4128      21221.1067      22

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-342.841     .06       0    .045 50.8164     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 50.8164                0       0       0              .1       .3
```

```
CROSS SECTION



RIVER: Swain Slough
REACH: 1                 RS: 3118.45

INPUT
Description: Line 8
Station Elevation Data    num=      29
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
-97.9254        7 -9.6099        7        0     8.63  6.5839     6.23 10.5031     4.91
 13.7673        4 23.5333     3.01 23.7593      .86 27.8821      .09 32.3231      -.2
 34.8832     -.02 37.7423      .53 40.3977     1.59 42.4233     4.24 42.7578     1.98
 46.1172     2.49 54.0575     2.71 55.9147     4.77 60.5714     5.54  67.144     8.69
  73.758     5.77 76.2974     4.72 78.2433     6.91 79.7778     3.12 84.5895     4.18
 85.7079     5.75 93.1683     6.43 98.9451        7 216.774        8

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
-97.9254      .06        0    .045  67.144      .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0  67.144          182.29  182.29  182.29             .1       .3

CROSS SECTION



RIVER: Swain Slough
REACH: 1                 RS: 2936.16

INPUT
Description: Line 9
Station Elevation Data    num=      26
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
-43.8533        7-36.2473        6-17.6671        5-10.2326        5  -9.006        6
 -7.5551        7        0        7  2.6584        6  7.9783        4 10.6401        3
 13.3467        2 13.9407     1.77 18.2706        1  22.747       .2 31.4931        1
 38.9011     1.67 40.3033        2 42.0707        3 42.8974        4 44.0699        5
 50.9562        6 53.1115        7 65.9823        7 67.7883        6 74.0239        6
 76.4603        7

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
-43.8533      .06        0    .045 53.1115      .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 53.1115           67.53   67.53   67.53             .1       .3

CROSS SECTION



RIVER: Swain Slough
REACH: 1                 RS: 2868.63
```

INPUT
Description: Line 10
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-34.3974	7	-13.8813	6	-11.3092	5	-2.2697	5	-1.2206	6
0	7	10.7265	6	15.2428	6	24.2409	4	28.751	3
33.2421	2	33.8764	1.86	38.7846	1	40.7294	.62	51.9939	1
61.863	2	63.5125	3	64.7918	4	73.1363	5	79.6641	6
81.9044	7	93.6721	8	115.4074	8	118.6834	7	141.3972	7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-34.3974	.06	0	.045	81.9044	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	81.9044	270.09	270.09	270.09	.1	.3

CROSS SECTION

RIVER: Swain Slough
REACH: 2 RS: 2702.55

INPUT
Description: Line 11.2 Upstream of Proposed Bridge
Station Elevation Data num= 476

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-674.57	7.337	-674.25	7.338	-673.96	7.339	-673.84	7.339	-673.73	7.339
-673.39	7.339	-673.04	7.339	-641.76	7.119	-641.63	7.119	-641.53	7.119
-641.17	7.118	-640.78	7.117	-635.88	7.083	-631.86	7.081	-623.91	7.076
-623.78	7.075	-548.66	7.036	-548.64	7.036	-548.62	7.036	-547.46	7.036
-546.14	7.036	-544.65	7	-543.83	6.999	-538.79	7	-537.68	7.003
-537.49	7.003	-537.27	7.004	-534.76	7.005	-531.12	7.007	-518.55	7.056
-485.61	7.177	-481.33	7.181	-477.24	7.185	-474.35	7.182	-471.18	7.17
-470.3	7.149	-466.24	7.182	-463.15	7.195	-462.77	7.19	-462.5	7.191
-461.16	7.246	-459.94	7.262	-457.74	7.26	-455.27	7.253	-448.18	7.195
-447.7	7.192	-447.44	7.19	-447.3	7.19	-410.81	7.092	-410.37	7.092
-407.62	7.09	-404.27	7.078	-396.65	7.031	-396.38	7.009	-395.66	7.009
-392.73	7.017	-390.71	7.021	-390.55	7.022	-390.3	7.024	-389.76	7.019
-388.46	7.017	-382.72	7.017	-377.06	7.017	-374.77	7.016	-349.23	7.005
-347.29	7.004	-347.01	7.004	-346.98	7.004	-346.19	7.003	-346.15	7.003
-345.92	7.003	-343.91	7.002	-339.94	7	-336	6.989	-322.15	6.771
-308.43	6.624	-307.43	6.616	-241.34	6.756	-239.22	6.771	-220.92	6.096
-220.5	6.098	-216.77	6.091	-215.99	6.089	-215.58	6.09	-210.84	6.089
-210.58	6.09	-206.86	6.096	-205.62	6.099	-205.06	6.096	-204.67	6.098
-174.42	6.902	-174.14	6.902	-173.34	6.902	-172.64	6.907	-167.68	6.994
-166.04	6.996	-164.47	6.996	-163.4	7	-162.35	7.002	-158.75	7.003
-155.3	7.002	-148.42	7.004	-110.47	7.005	-110.07	7.004	-103.8	7.007
-102.92	7.01	-101.43	7.016	-100.99	7.018	-96.27	7.218	-92.68	7.356
-91.64	7.277	-91.23	7.235	-90.34	7.047	-90.32	7.047	-90.07	7.038
-88.89	7.025	-87.44	7	-86.28	6.655	-85.88	6.51	-84.3	6
-83.85	5.999	-82.96	5.998	-82.04	5.854	-80.19	5.455	-78.78	5.413
-77.52	5.75	-74.86	6	-74.34	6	-72.53	6	-70.33	6
-69.44	6	-68.97	6	-68.34	6.001	-67.75	6.001	-67.6	6.001

-65.07	6.001	-61.48	6.001	-57.51	6.001	-56.81	6.001	-51.85	6.001
-51.75	6.001	-51.26	6.001	-50.77	6.001	-50.19	6.001	-47.09	6.004
-42.66	6.015	-39.92	6.016	-39.39	6.015	-35.6	6.008	-31.81	6.091
-30.54	6	-30.05	5.925	-14.06	8.088	-13.27	8	-11.19	7.48
-10.1	7.147	-9.26	7	-5.69	6.193	-5.22	6.077	-4.64	6
-4.63	6	-2.78	5.755	2	4.263	3.18	4	3.79	3.864
7.66	3	9.45	2.601	12.15	2	12.88	1.837	13.16	1.775
14.79	1.28	15.71	1	18.83	.054	19.01	0	19.1	-.001
20.66	-.011	32.4	-.09	37.76	-.056	39.85	-.049	43.77	-.214
52.95	-.024	53.71	0	55.8	.509	61.36	.669	61.61	.676
62.1	1	62.81	1.483	63.3	1.619	64.51	1.797	64.55	1.857
64.57	1.891	64.65	2	65.21	2.774	65.57	3	66.07	3.309
67.19	4	70.23	5.89	70.41	6	70.94	6.331	71.43	7
71.53	7.134	72.16	8	72.39	8.305	72.44	8.308	74.14	8.671
74.16	8.671	74.4	8.663	77.45	8.123	78.55	8.092	79.65	8
84.99	7.2	86.33	7	90.41	6.39	93.01	6	94.24	5.816
94.54	5.771	96.83	5	98.88	4.305	100.44	4.011	100.83	4.011
101.57	4	102.6	3.36	103.19	3	103.61	3	103.8	3
105.37	3	105.63	3.131	107.48	4	108.51	4.269	109.31	4.412
109.64	4.43	110.78	4.542	112.79	4.467	113.53	4.455	115.3	4.18
115.47	4.162	115.59	4.146	116.82	4	118.93	3.713	119.27	3.596
119.38	3.57	119.72	3.515	120.4	3.408	121.4	3.611	125.18	3.769
126.51	3.648	127.36	3.564	128.35	3.107	128.48	3.071	128.7	3
128.85	3	129.07	3	129.97	3	133.44	3	133.5	3
133.73	3	135.68	3	136.04	3	138.77	3	138.78	3
138.86	3	140.72	3.141	141.66	3.145	142.86	3.213	143.89	3.213
146.22	3	148.39	3	149.1	3	150.25	3	151.08	3
152.76	3	153.81	3	161.22	3	162.37	3	164.62	3
166.23	3	166.89	3	168.28	3.471	169.26	3.549	170.04	3.573
173.26	4	174.5	4.446	175.81	4.51	178.04	4.53	178.5	4.511
183.08	4.296	184.81	4.166	184.86	4.163	184.91	4.162	187.16	4
189.6	3.999	190.3	3.999	193.24	3.996	194.56	3.995	195.79	3.994
196.14	3.994	197.21	3.993	197.5	3.993	199.92	3.991	199.93	3.991
201.05	3.99	202.17	3.989	202.18	3.989	202.19	3.989	203.76	3.991
204.6	3.99	206.69	3.999	206.77	4	207.21	4.151	209.5	4.104
209.65	4.101	209.93	4.078	210.45	4	214.63	3.989	215.56	3.989
216.53	3.985	216.96	3.984	217.83	3.983	217.99	3.982	218.77	3.978
219.58	3.983	221.36	4	223.84	4.141	223.89	4.143	223.95	4.145
226.18	4	229.91	3.978	230.92	3.972	231.78	3.973	233.45	3.973
234.37	3.972	236.36	3.972	236.98	3.97	237.22	3.969	238.27	3.958
239.71	3.953	240.72	3.951	241.44	3.944	241.66	3.942	246.7	3.304
247.48	3.251	247.85	3.237	248.45	3.232	249.53	3	249.85	3
250.15	3	255.51	3	256.58	3	256.88	3	257.04	3
257.16	3.062	257.33	3.1	258.24	3.263	258.76	3.269	263.09	3.228
263.77	3.198	265.04	3	265.7	3	266.48	3	266.69	3
269.2	3	270.86	3.13	271.02	3.125	273.01	3.064	273.32	3
274.12	3	274.85	3	276.7	3	277.88	3.255	280.54	3.097
280.74	3.085	280.9	3	286.03	3	288.35	3	288.92	3
292.67	3	293.21	3.184	294.05	3.406	297.34	3.278	298.13	3.247
298.33	3.233	299.5	3.148	300.23	3.016	300.24	3.015	300.27	3.005
300.28	3	304.93	3	306.06	3	307.83	3	309.44	3
309.79	3	310.14	3	311.21	3	314.93	3	316.25	3.337
317.8	3.39	318.97	3.453	322.86	3.191	323.66	3	323.92	3
326.4	3	331.95	3	333.54	3	333.82	3	340.53	3

342.24	3.55	343.55	4	344.13	4.169	346.29	5	348.75	5.392
349.57	5.475	352.41	5	356.06	4.618	358.89	4.267	359.32	4.136
359.61	4	360.06	4	361.18	4	361.88	4	363.48	4
363.9	4	366.98	4	368.01	4	368.87	4	369.41	4
373.56	4	375.01	4	376.93	4	379.34	4	379.62	4
381.97	4	383.76	4	385.7	4	386.56	4.574	387.48	4.834
387.68	4.878	388.1	4.925	389.15	5	396.18	5.615	397.55	5.665
397.62	5.667	398.48	5.727	401.02	5.599	407.78	5.56	408.42	5.53
410.66	5.498	412.03	5.427	412.9	5.402	414.31	5.546	415.33	5.59
415.99	5.554	418.71	5	420.48	4.54	421.92	4.314	423.49	4.036
423.67	4.025	431.43	4.272	431.71	4.286	432.05	4.316	432.84	4.798
433.04	4.86	433.32	5	436.01	5.463	438.81	5.324	444.16	5
445.38	4.889	446.7	5	452.41	5.418	453.7	5.55	455.35	5.641
457.45	5.778	458.53	5.875	460.02	6	465.2	6.435	472.48	7
473.73	7.1								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-674.57	.06	-14.06	.045	74.14	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-14.06	74.14	66.78	66.78	66.78	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-674.57	-8.6	9.5	F
61.4	473.73	9.5	F

BRIDGE

RIVER: Swain Slough
REACH: 2 RS: 2684.7

INPUT
Description: Proposed Pine Hill Rd. Bridge
Distance from Upstream XS = 1.9
Deck/Roadway Width = 33.3
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 61

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-263.6	8		-253.6	8.1		-243.6	8.2	
-233.6	8.3		-223.6	8.4		-213.6	8.5	
-203.6	8.7		-193.6	8.8		-183.6	9	
-173.6	9.2		-163.6	9.5		-153.6	9.7	
-143.6	10		-133.6	10.3		-123.6	10.5	
-113.6	10.8		-103.6	11.1		-93.6	11.4	
-83.6	11.7		-73.6	12		-63.6	12.2	
-62.6	12.3		-53.6	12.5		-43.6	12.7	
-33.6	13		-23.6	13.1		-13.6	13.2	
-8.6	13.2	9.5	-3.6	13.3	9.5	6.4	13.4	9.6
16.4	13.4	9.7	26.4	13.4	9.7	36.4	13.4	9.6
46.4	13.4	9.6	56.4	13.3	9.5	61.4	13.2	9.5
66.4	13.2		76.4	13.1		86.4	12.9	

96.4	12.7		106.4	12.4		116.4	12.2	
117.4	12.1		127.4	11.8		131.4	11.7	
141.4	11.4		151.4	11.2		161.4	10.9	
171.4	10.7		181.4	10.4		191.4	10.2	
201.4	10.1		211.4	9.9		221.4	9.7	
231.4	9.6		241.4	9.5		251.4	9.4	
261.4	9.3		271.4	9.2		281.4	9.2	
291.4	9.1							

Upstream Bridge Cross Section Data

Station Elevation Data num= 85

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-905.194	8.61	-876.298	8.4	-836.233	8.11	-779.831	7.45	-768.408	7.22
-706.668	7.49	-684.968	7.63	-634.669	7.82	-536.259	7.58	-437.15	7.55
-343.411	7.18	-313.251	7.23	-224.143	7.39	-144.427	7.82	-100.496	8.15
-75.206	8.63	-59.08	11.56	-53.08	11.723	-43.08	11.97	-33.68	12.173
-22.58	12.375	-19.34	12.427	-5.68	3.319	8.77	3.319	8.77	3.136
8.93	3.137	8.97	3	10.39	2.287	10.94	2.024	10.94	2.047
10.94	2.057	10.94	2.084	10.95	2.055	10.95	2.034	10.95	2.023
10.96	2	11.44	1.813	11.51	1.784	11.53	1.782	12.52	1.653
15.11	1	15.43	.919	16.7	.6	20.14	0	24.66	-.032
27.9	-.061	29.47	-.049	35.01	0	38.48	.451	42.72	1
46.98	1.552	47.7	1.645	49.37	1.961	49.58	2	49.96	2.073
52.18	3	52.82	3.269	58.38	3.269	72.21	12.49	80.23	12.367
82.21	12.334	92.21	12.145	102.21	11.924	112.21	11.671	120.92	11.425
137.675	8.87	161.809	8.47	207.378	8.2	217.786	8.27	243.494	8.3
274.413	8.38	318.519	8.78	337.004	9	359.542	9.23	401.738	9.61
457.922	9.49	504.024	10	552.016	10.44	606.479	10.86	688.346	9.96
761.271	8.69	829.514	7.86	886.174	8.17	924.613	8.83	958.291	9.51

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-905.194	.06	-59.08	.06	-19.34	.045	72.21	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
-19.34	72.21	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-905.194	-8.6	9.5	F
61.4	958.291	9.5	F

Downstream Deck/Roadway Coordinates

num= 61

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-263.6	8		-253.6	8.1		-243.6	8.2	
-233.6	8.2		-223.6	8.4		-213.6	8.5	
-203.6	8.6		-193.6	8.8		-183.6	9	
-173.6	9.2		-163.6	9.5		-153.6	9.7	
-143.6	10		-133.6	10.3		-123.6	10.5	
-113.6	10.8		-103.6	11.1		-93.6	11.4	
-83.6	11.7		-73.6	11.9		-63.6	12.2	
-62.6	12.3		-53.6	12.5		-43.6	12.7	
-33.6	12.9		-23.6	13.1		-13.6	13.2	
-8.6	13.2	9.5	-3.6	13.3	9.5	6.4	13.4	9.6

16.4	13.4	9.7	26.4	13.4	9.7	36.4	13.4	9.6
46.4	13.4	9.6	56.4	13.3	9.5	61.4	13.2	9.5
66.4	13.2		76.4	13.1		86.4	12.9	
96.4	12.7		106.4	12.5		116.4	12.2	
117.4	12.2		127.4	11.9		131.4	11.7	
141.4	11.4		151.4	11.2		161.4	10.9	
171.4	10.7		181.4	10.5		191.4	10.3	
201.4	10.1		211.4	9.9		221.4	9.8	
231.4	9.6		241.4	9.5		251.4	9.4	
261.4	9.3		271.4	9.2		281.4	9.2	
291.4	9.2							

Downstream Bridge Cross Section Data

Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-907.259	9.02	-851.064	8.33	-767.859	7.34	-690.752	7.48	-674.312	7.68
-634.012	7.86	-542.575	7.67	-436.989	7.53	-342.677	7.1	-310.625	7.3
-246.582	7.31	-174.339	7.68	-99.083	8.54	-73.875	8.69	-59.08	11.56
-53.08	11.723	-43.08	11.97	-33.68	12.173	-22.58	12.375	-19.34	12.427
-5.68	3.319	8.073	3.319	8.45	3.065	8.49	3	8.53	2.943
8.76	2.929	8.98	2.916	9.19	2.589	9.5	2.089	9.62	2
9.75	1.964	9.91	1.964	10	1.908	10.59	1.675	13.03	1.359
13.7	1.31	13.92	1.222	14.56	1.21	15.98	1.097	17.74	1
27.85	.175	32.85	0	32.92	0	32.95	0	33	.011
37.31	1	37.88	1.13	39.63	1.312	40.43	1.395	40.95	1.494
43.63	2	48.6	2.939	48.63	3	49.04	3.161	49.387	3.269
58.38	3.269	72.21	12.49	80.23	12.367	82.21	12.334	92.21	12.145
102.21	11.924	112.21	11.671	120.92	11.425	137.723	8.89	162.82	8.76
192.847	8.59	219.02	8.72	235.459	8.67	246.975	8.82	251.745	8.89
270.8	8.89	323.342	8.96	364.655	8.88	426.464	8.79	463.37	9.09
511.554	9.76	596.713	11.63	624.719	11.63	657.29	11.01	694.902	9.98
720.01	9	785.582	8.09	830.993	7.9	886.812	8.22	909.92	8.86
933.376	9.47								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-907.259	.06	-59.08	.06	-19.34	.045	72.21	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
-19.34	72.21	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-907.259	-8.6	9.5	F
61.4	933.376	9.5	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Swain Slough
REACH: 2 RS: 2666.8

INPUT
Description: 12.1 Downstream of Proposed Bridge
Station Elevation Data num= 492

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-474.08	7	-472.87	7	-471.66	7	-471.49	7	-468.88	7
-468.69	7	-464.73	6.999	-460.82	7	-460.18	7	-453.86	6.999
-447.61	7	-446.49	7	-442.6	7	-438.7	7	-438	7
-436.94	7	-430.38	7	-429.97	7	-418.95	7	-407.77	7
-406.57	7	-402.58	7	-402.39	7	-391.67	7	-391.24	7
-390.01	7	-384.77	7	-379.45	7	-379.26	7	-376.42	7
-373.94	7	-373.91	7	-373.77	7	-362.18	7	-350.67	7
-350.33	7	-345.55	7	-340.72	7	-340.62	7	-332.31	7
-326.28	7	-325.48	7	-324.6	7	-324.29	7.002	-323.28	7.002
-322.5	7.002	-321.73	7	-318.27	7	-313.16	7	-307.94	7
-302.05	7	-301.46	7	-300.29	7	-299.58	7	-297.12	7
-296.62	7	-294.81	7.005	-292.26	7.005	-290.82	7.009	-285.27	7.007
-279.18	7.003	-270.03	7.002	-267.92	7.009	-264.58	7.016	-261.36	7.017
-258.81	7.018	-256.19	7.01	-253.14	7.005	-252.32	7	-250	7
-249.98	7	-241.81	7	-234.08	7	-233.51	7	-227.68	7
-222.38	7	-221.41	7	-219.43	7	-217.3	7	-217.06	7
-211.91	7	-207.08	7	-206.56	7	-206.06	7.003	-205.86	7
-204.25	7	-201	7	-196.43	7	-195.68	7	-193.16	7.202
-193.01	7.209	-190.93	7.255	-154.48	7.343	-152.44	7.365	-150.98	7.379
-150.75	7.383	-143.38	7.418	-139.73	7.427	-137.65	7.41	-132.28	7.359
-102.2	7.006	-101.86	7.006	-101.42	7.006	-100.55	7.005	-98.05	7.002
-98.01	7.002	-96.6	7	-96.4	6.962	-96.38	6.961	-93.87	6.285
-92.83	6.045	-92.61	6.018	-92.39	6	-91.98	5.954	-91.59	5.932
-91.45	5.926	-90.3	5.655	-89.16	5.623	-88.34	5.536	-87.42	5.444
-86.86	5.395	-84.1	5.048	-83.77	5.007	-83.57	5.008	-83.38	5.008
-83.18	5.008	-81.87	5.011	-79.47	5.011	-79.29	5.011	-76.51	5.192

-67.68	5.693	-64.5	6	-62.5	6	-56.23	6	-55.32	6
-55.27	6	-55.04	6	-54.12	6	-52.1	6	-50.04	6
-48.93	6	-38.46	6	-38.14	6	-37.89	6	-35.56	6
-34.23	6	-33.96	6	-26.74	6.112	-26.58	6.104	-22.59	6
-20.76	5.949	-20.1	5.708	-19.34	5.484	-19.22	5.449	-18.46	5.084
-17.8	5	-16.55	4.925	-16.33	4.913	-16.18	4.921	-15.79	4.958
-15.41	5	-13.49	5.794	-13.11	6	-12.82	6.1	-12.66	6.112
-11.73	6.404	-10.98	6.381	-9.22	6.65	-8.79	6.689	-4.94	6.773
-4.58	6.802	-1.43	6.759	-.12	6.604	2.96	6.429	3.78	6.161
5.39	6	7.02	4.527	7.5	4	7.72	3.805	8.12	3.464
8.45	3.144	8.59	3	8.82	2.871	9.86	2	10.11	1.789
10.34	1.477	10.34	1.444	10.35	1.627	10.47	1.576	10.87	1.41
11.85	1	13.53	.301	14.26	0	19.67	0	22.03	0
31.91	.737	35.65	1	36.43	1.081	41.65	1.623	42.26	1.686
43.11	1.846	43.19	2	43.47	2.506	43.74	3	44.16	3.163
44.94	4	48.03	4.625	50.53	4.994	51.99	5.195	54.76	5.352
60.87	5.939	61.96	5.917	63.32	5.972	64.02	6	65.75	6.907
65.94	7	66.76	7.304	67.29	7.521	68.14	7.835	68.39	8
68.63	8.261	69.52	9	69.55	8.998	69.57	8.996	69.63	8.993
69.68	8.996	69.74	9	70.16	9.491	70.55	10	71.44	10.791
71.75	11	72.72	11.836	72.89	11.982	72.92	12	72.94	12.016
74.16	13	74.72	13.156	74.84	13.184	78.17	14	80.89	14.018
85.75	14.042	90.94	14.048	91.43	14.05	91.95	14.051	94.42	14.087
94.46	14.086	94.47	14.086	94.5	14.086	96.4	14.089	97.15	14.085
97.54	14.08	97.72	14.079	98.83	14.074	100.83	14.086	100.89	14.086
100.97	14.085	105.3	14.174	105.45	14.173	105.52	14.174	105.67	14.17
106.51	14.183	109.9	14.188	111.51	14.174	112.55	14.504	114.55	15
116.29	15	117.44	15	117.88	15	118.8	15	119.84	15
121.49	15	126.64	15	128.11	15	128.55	15	128.73	15
128.86	15	136.73	15	138.69	15	141.39	15	141.86	15
143.22	14.33	143.91	14.152	144.55	14.162	144.7	14.109	146.09	14
147.37	13.879	149.04	13	151.15	12.273	152.34	12	153.65	11.642
154.87	11.488	156.08	11.078	156.37	11.058	156.65	11	159.42	10.96
161.63	10.928	163.02	10.946	166.74	11	167.39	11.171	169.28	11.607
171.1	12	171.95	12.339	173.75	13	175.67	13.791	176.18	14
176.9	14.296	180.06	14.677	181.81	14.891	189.73	14.985	189.83	14.985
189.86	14.98	189.97	14.949	192.16	14.317	192.48	14.161	192.91	14
193.58	13.758	195.46	13	196.42	12.616	198.12	12	199.62	10.837
200.85	11.098	201.17	11	202.12	10.863	202.14	10.862	204.89	10.302
207.56	10.3	210.5	10.228	211.6	10.181	212.38	10.161	217.2	10.152
219.71	10.173	226.05	10.189	226.15	10.187	227.68	10.2	237.9	10.06
238.01	10.062	238.14	10.069	238.74	10.228	239.41	10.312	241.2	10.681
242.07	10.859	242.44	10.908	243.06	11	247.92	11.35	251.19	11.55
251.28	11.551	256.52	12	256.88	12.008	256.93	12.009	270	12.008
270.07	12.009	270.18	12.013	271.41	12	272.03	11.978	272.57	12
276.95	12.025	277.1	12.036	277.8	12.033	277.89	12.038	283.11	12.085
285.76	12	286.97	11.867	292.92	12	293.72	12.01	293.73	12.011
294.26	12.012	294.53	12	299.48	11.777	302.22	11.644	310.63	11
314.68	10.691	323.71	10	328.38	9.646	329.36	9.572	330.87	9.453
340.07	9	340.09	9.002	340.1	9.003	340.11	9.001	340.13	9
340.78	8.968	341.49	9	341.52	9.001	341.53	9.002	341.54	9.002
341.56	9	351.21	9.432	359.36	9.797	367.79	10	369.22	10.034
369.42	10.039	369.61	10.061	374.08	10.579	374.58	10.59	377.4	10.885
377.76	10.886	381.01	11	383.21	11.23	384.2	11.305	384.89	11.376

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  386.19  11.452  391.43  11.891  392.41  11.943  393.11      12  393.61  12.032
  394.78  12.054  394.84  12.051  395.28      12  397.23   11.74  398.77  11.832
  401.58      12  407.31  12.402  411.08  12.535   411.4  12.507  413.61  12.338
   414.3  12.229  414.66  12.184  414.84  12.191  415.71   12.32  418.06   12.58
   418.5   12.61  419.07  12.579  420.29  12.425  423.09  12.091  423.44  12.089
  426.51      12   428.8  11.944  429.44  11.906  430.69      12  439.33  12.716
   440.6  12.785  444.59      13  444.95  13.019  445.08  13.017  445.76      13
  451.84  12.857  453.07  12.819   460.9      13  462.91  13.044  462.91  13.045
  463.44      13  463.96  13.005  464.03      13  467.21  12.796  468.38   12.81
  471.18  12.932  471.49      13  474.24  13.554   475.3   13.66  476.03   13.69
  479.29  13.652  480.46   13.65   481.4  13.532  484.63  13.343  485.47  13.221
  485.57  13.215  486.16  13.217  487.43      13  488.17  12.823  490.47      12
  490.51  11.986  490.65   11.97  493.03  11.672   494.2    11.6   494.3  11.595
  495.84  11.576  497.33  11.655  498.41  11.788  498.63  11.792  499.59  11.769
  499.71  11.759  500.33  11.646  501.32  11.295   502.7  11.175  502.84   11.15
   503.1  11.132  503.55  11.147  506.42  11.492  508.98  11.762  509.16  11.793
  510.91      12  511.59  12.088   511.7  12.081  515.34  12.713  516.57  12.922
  517.04      13  521.35  13.547  522.63      14  524.04  14.536  525.23  14.808
  525.46  14.824  527.14      15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 -474.08     .06   -4.58    .045   78.17     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -4.58   78.17             38.16   38.16   38.16              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 -474.08    -8.6     9.5       F
    61.4  527.14     9.5       F

CROSS SECTION



RIVER: Swain Slough
REACH: 2                  RS: 2616.89

INPUT
Description: Line 13
Station Elevation Data    num=      38
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-27.3757       6-22.1495       5-19.9356       4-17.8932       4 -15.931       5
-13.3997       6-11.1732       7 -8.9807       8       0       8   .9838       7
  1.6616       6  1.7626       5  1.8252       4   2.066       3  2.6226       2
  5.6743       1 10.1634       0 12.0819    -.44  16.038       0 17.7542     .19
 26.4716     .16 29.1834       1   33.08       2 34.5866       3 43.2425       4
 48.3719       5 52.6332       6 56.5626       7 59.3739       8 60.1734       9
 60.3837       9 61.3326      10 62.4476      11 63.6826      12 65.3311      13
 66.9443      14 85.0371      14 91.4984      13

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-27.3757     .06       0    .045 56.5626     .06
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Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 56.5626           456.98  456.98  456.98              .1       .3

CROSS SECTION



RIVER: Swain Slough
REACH: 2                  RS: 2159.91

INPUT
Description: Line 7
Station Elevation Data    num=      59
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
-932.044       6-928.635       6-678.153       7-627.295       7-620.888       5
-617.421       5-608.184       7 -575.81       7-563.561       5-548.692       7
-541.909       7-249.517       7-177.238       8-98.2575       8-81.4958       7
-80.4089       6-77.8185       5-70.5183       5-67.9728       6-17.4905       6
 -14.492       5-10.8819       5 -9.4783       6 -7.5669       7 -5.9211       8
       0    8.26  7.4735    5.76  8.6559       6 11.0678       5 14.5481       4
 15.4111    3.99 15.8366    2.77 16.8743       3 17.9266       2 18.8202       1
 20.7052    1.47 23.7215     .09 28.8796    -.08 31.9546    -.68 34.5284     -.4
 36.8228       1 39.1446     .26 43.3862     .73 46.2956    1.42  47.835    2.11
 48.3773    3.54 49.9196    3.96 50.7688       4 55.6249       5   56.75       6
 59.8795       7 64.5946       8 69.9105       9 73.5128      10 75.0509      11
 76.7312      12  78.511      13 79.5533      14 80.9687      15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-932.044     .06       0    .045 59.8795     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 59.8795           516.35  516.35  516.35              .1       .3

CROSS SECTION



RIVER: Swain Slough
REACH: 2                  RS: 1643.56

INPUT
Description: Line 6
Station Elevation Data    num=      57
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
-710.374       9-708.413       8-707.115       7 -694.17       6-688.701       6
-639.727       6-633.578       6-594.227       7-528.989       8-357.205       8
-302.066       7-297.611       7-237.213       8-75.2052       8 -19.324       7
-10.4289       6 -8.1435       5 -6.7674       4 -2.6025       4 -1.2379       5
       0       6  7.0881    7.19  13.766    5.66 15.5131       6 17.2383       5
 21.8452    4.45 22.9149    2.11 26.1704    1.07 29.7266     .27  33.307     -.2
 36.0272    -.34 39.3065    -.86 43.9098    -.57 47.6934     .24 52.4435     .81
  57.129    1.29 61.9194    1.88 67.5585    2.66 72.1268    2.99  73.816    3.35
 74.2399     4.5 75.9708     5.2 76.3462       6 81.7265       7 97.2145       8
101.5241       9101.7502       9105.8639      10110.2544      11114.5372      12
118.6876      13122.2418      14124.4174      15126.6126      16128.2847      17
```

```
129.3414      18130.6335      19

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-710.374     .06  7.0881    .045 81.7265     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        7.0881 81.7265          1105.11 1105.11 1105.11              .1       .3

CROSS SECTION



RIVER: Swain Slough
REACH: 2                  RS: 538.45

INPUT
Description: Line 5
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-79.4539       9-65.9481      10-57.4296      11-43.5131      12       0      12
  3.1876      11  6.2022      10   8.761       9 11.0114       8 14.8865       7
 19.0982       6 20.8771    5.89 29.5715       3 35.9918    1.69  39.464     .57
 43.3499     -.1 51.3697    -.44 59.9064    -.78 68.3274     .76 73.3072    1.82
 79.8672    5.28 81.0018       6 83.0465       7 86.4117       8 88.2612       9
 90.7158      10 92.5183      11 95.1668      12100.8006   12.32119.3853      13
 134.648      13164.5775      13 180.048      14200.9811      13240.2796      13
258.7743      12262.4423      11

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-79.4539     .06       0    .045 95.1668     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0 95.1668           538.45  538.45  538.45              .1       .3



SUMMARY OF MANNING'S N VALUES

River:Elk River

      Reach          River Sta.       n1        n2        n3

 1                    1407.91            .06      .045       .06
 1                    1078.44            .06      .045       .06
 1                    657.7              .06      .045       .06
 2                    62.62              .06      .045       .06
 2                    61.62              .06      .045       .06


River:Martin Slough

      Reach          River Sta.       n1        n2        n3
```

1	180.1	.06	.045	.06
1	100.73	.06	.045	.06

River:Swain Slough

Reach	River Sta.	n1	n2	n3
1	3118.45	.06	.045	.06
1	2936.16	.06	.045	.06
1	2868.63	.06	.045	.06
2	2702.55	.06	.045	.06
2	2684.7	Bridge		
2	2666.8	.06	.045	.06
2	2616.89	.06	.045	.06
2	2159.91	.06	.045	.06
2	1643.56	.06	.045	.06
2	538.45	.06	.045	.06

SUMMARY OF REACH LENGTHS

River: Elk River

Reach	River Sta.	Left	Channel	Right
1	1407.91	329.47	329.47	329.47
1	1078.44	420.74	420.74	420.74
1	657.7	0	0	0
2	62.62	1	1	1
2	61.62	1	1	1

River: Martin Slough

Reach	River Sta.	Left	Channel	Right
1	180.1	180.1	180.1	180.1
1	100.73	0	0	0

River: Swain Slough

Reach	River Sta.	Left	Channel	Right
1	3118.45	182.29	182.29	182.29
1	2936.16	67.53	67.53	67.53
1	2868.63	270.09	270.09	270.09
2	2702.55	66.78	66.78	66.78
2	2684.7	Bridge		
2	2666.8	38.16	38.16	38.16
2	2616.89	456.98	456.98	456.98

2	2159.91	516.35	516.35	516.35
2	1643.56	1105.11	1105.11	1105.11
2	538.45	538.45	538.45	538.45

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Elk River

Reach	River Sta.	Contr.	Expan.
1	1407.91	.1	.3
1	1078.44	.1	.3
1	657.7	.1	.3
2	62.62	.1	.3
2	61.62	.1	.3

River: Martin Slough

Reach	River Sta.	Contr.	Expan.
1	180.1	.1	.3
1	100.73	.1	.3

River: Swain Slough

Reach	River Sta.	Contr.	Expan.
1	3118.45	.1	.3
1	2936.16	.1	.3
1	2868.63	.1	.3
2	2702.55	.3	.5
2	2684.7 Bridge		
2	2666.8	.3	.5
2	2616.89	.1	.3
2	2159.91	.1	.3
2	1643.56	.1	.3
2	538.45	.1	.3

Appendix C Scour Calculations

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed Bridge (100-yr FEMA WSE)

Equation 6.6:

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n {y_1}^{1/3}} \right)$$

Input

Variable	English Units	Metric Units	Description
y1	9.9 ft	3.0 m	Upstream depth
V2	0.5 ft/s	0.1 m/s	Average velocity in contracted section
n	0.045	0.045	Manning's roughness coefficient
Ku	1.486	1	1.486 for U.S. Customary, and 1.0 for S.I.
r	slugs/ft^3		Density 1,000 kg/m^3 = 1.94 slugs/ft^3
g	32.2 ft/s^2	9.81 m/s^2	acceleration due to gravity
D50		0.15 mm	grain size for which 50% of bed material is finer

Density, rho

Material	Density	
	Metric Units	English Units
Clay	1,250 kg/m^3	2.43 slugs/ft^3
Clay loam	1,500 kg/m^3	2.91 slugs/ft^3
Water, sea	1,026 kg/m^3	1.99 slugs/ft^3
Water, pure	1,000 kg/m^3	1.94 slugs/ft^3

Critical Shear Stress Tc	Tc (N/m^2)
Tc=0.05(D50)^-0.4	0.1
Tc=0.006(D50)^-2	0.3

Scour Depths, ys

With Density for Clay and Critical Shear Stress Equation Tc=0.05(D50)^-0.4			With Density for Clay loam and Critical Shear Stress Equation Tc=0.05(D50)^-0.4		
ys =	0.10 m	0.3 ft	ys =	0.10 m	0.3 ft

Local Scour at Abutments - Froehlich or HIRE

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed Bridge (100-yr FEMA WSE)

Units = (SI or English)	English	
g = acceleration due to gravity =	32.2	ft/s^2

Left Overbank = Abutment 1 (West)

y1 = depth of flow at abutment on the overbank or in the main channel =	5.5	ft
L = length of embankment projected normal to flow =	180	ft
Ratio of projected embankment length to flow depth = L/y1 =	3.277E+01	
Abutment scour equation to be used =	HIRE	

HIRE Live Bed Abutment Scour Equation

V = velocity of flow at upstream face of abutment =	0.3	ft/s
Fr = Froude Number = V/((g*y1)^.5) =	0.02	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = (Θ/90)^0.13 =	1	
Ys = abutment scour = y1*(4*(Fr^0.33)*(K1/0.55)*K2) =	**11.1**	**ft**

Right Overbank = Abutment 2 (East)

y1 = depth of flow at abutment on the overbank or in the main channel =	5.4	ft
L = length of embankment projected normal to flow =	170	ft
Ratio of projected embankment length to flow depth =	3.145E+01	
Abutment scour equation to be used =	HIRE	

HIRE Live Bed Abutment Scour Equation

V = velocity of flow at upstream face of abutment =	0.3	ft/s
Fr = Froude Number = V/((g*y1)^.5) =	0.02	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = (Θ/90)^0.13 =	1	
Ys = abutment scour = y1*(4*(Fr^0.33)*(K1/0.55)*K2) =	**11.3**	**ft**

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed Bridge (100-yr ND)

Equation 6.6:

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n {y_1}^{1/3}} \right)$$

Input

Variable	English Units		Metric Units		Description
y1	12.1	ft	3.7	m	Upstream depth
V2	0.2	ft/s	0.1	m/s	Average velocity in contracted section
n	0.045		0.045		Manning's roughness coefficient
Ku	1.486		1		1.486 for U.S. Customary, and 1.0 for S.I.
r		slugs/ft^3			Density 1,000 kg/m^3 = 1.94 slugs/ft^3
g	32.2	ft/s^2	9.81	m/s^2	acceleration due to gravity
D50			0.15	mm	grain size for which 50% of bed material is finer

Density, rho

Material	Density			
	Metric Units		English Units	
Clay	1,250	kg/m^3	2.43	slugs/ft^3
Clay loam	1,500	kg/m^3	2.91	slugs/ft^3
Water, sea	1,026	kg/m^3	1.99	slugs/ft^3
Water, pure	1,000	kg/m^3	1.94	slugs/ft^3

Critical Shear Stress Tc	Tc (N/m^2)
Tc=0.05(D50)^-0.4	0.1
Tc=0.006(D50)^-2	0.3

Scour Depths, ys

With Density for Clay and Critical Shear Stress Equation Tc=0.05(D50)^-0.4					With Density for Clay loam and Critical Shear Stress Equation Tc=0.05(D50)^-0.4				
ys =	0.02	m	0.1	ft	ys =	0.02	m	0.1	ft

Local Scour at Abutments - Froehlich or HIRE

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed Bridge (100-yr ND)

Units = (SI or English)	English	
g = acceleration due to gravity =	32.2	ft/s^2

Left Overbank = Abutment 1 (West)

y1 = depth of flow at abutment on the overbank or in the main channel =	7.7	ft
L = length of embankment projected normal to flow =	180	ft
Ratio of projected embankment length to flow depth = L/y1 =	2.326E+01	
Abutment scour equation to be used =	Froehlich	

Froehlich's Live Bed Abutment Scour Equation

L' = length of active flow obstructed by the embankment =	173	ft
Ae = flow area of the approach cross section obstructed by the embankment =	1376	ft^2
ya = average depth of flow on the flood plain = Ae/L'	7.7	ft
Qe = flow obstructed by the abutment and approach embankment =	298	ft^3/s
Ve = flow velocity = Qe/Ae =	0.2	ft/s
Fr = Froude Number of approach flow upstream of the abutment	0.01	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = (Θ/90)^0.13 =	1	
Ys = abutment scour = ya*(2.27*k1*k2*((L'/ya)^0.43)*(Fr^0.61)+1) =	**12.5**	**ft**

Right Overbank = Abutment 2 (East)

y1 = depth of flow at abutment on the overbank or in the main channel =	7.7	ft
L = length of embankment projected normal to flow =	170	ft
Ratio of projected embankment length to flow depth =	2.226E+01	
Abutment scour equation to be used =	Froehlich	

Froehlich's Live Bed Abutment Scour Equation

L' = length of active flow obstructed by the embankment =	176	ft
Ae = flow area of the approach cross section obstructed by the embankment =	2010	ft^2
ya = average depth of flow on the flood plain = ae/L	11.8	ft
Qe = flow obstructed by the abutment and approach embankment =	446	ft^3/s
Ve = flow velocity = Qe/Ae =	0.2	ft/s
Fr = Froude Number of approach flow upstream of the abutment	0.01	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = (Θ/90)^0.13 =	1	
Ys = abutment scour = ya*(2.27*k1*k2*((L'/ya)^0.43)*(Fr^0.61)+1) =	**17.4**	**ft**

Ultimate (Contraction) Scour

100-year Flow

Calculation guideline from HEC-18 5th Edition

Input from HEC-RAS for Proposed Bridge (100-yr MLLW)

Equation 6.6:

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n {y_1}^{1/3}} \right)$$

Input

Variable	English Units		Metric Units		Description
y1	7.8	ft	2.4	m	Upstream depth
V2	1.4	ft/s	0.4	m/s	Average velocity in contracted section
n	0.045		0.045		Manning's roughness coefficient
Ku	1.486		1		1.486 for U.S. Customary, and 1.0 for S.I.
r		slugs/ft^3			Density 1,000 kg/m^3 = 1.94 slugs/ft^3
g	32.2	ft/s^2	9.81	m/s^2	acceleration due to gravity
D50			0.15	mm	grain size for which 50% of bed material is finer

Density, rho

Material	Density			
	Metric Units		English Units	
Clay	1,250	kg/m^3	2.43	slugs/ft^3
Clay loam	1,500	kg/m^3	2.91	slugs/ft^3
Water, sea	1,026	kg/m^3	1.99	slugs/ft^3
Water, pure	1,000	kg/m^3	1.94	slugs/ft^3

Critical Shear Stress Tc	Tc (N/m^2)
Tc=0.05(D50)^-0.4	0.1
Tc=0.006(D50)^-2	0.3

Scour Depths, ys

With Density for Clay and Critical Shear Stress Equation Tc=0.05(D50)^-0.4					With Density for Clay loam and Critical Shear Stress Equation Tc=0.05(D50)^-0.4				
ys =	0.32	m	1.0	ft	ys =	0.32	m	1.1	ft

Local Scour at Abutments - Froehlich or HIRE

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed Bridge (100-yr MLLW)

Units = (SI or English)	English	
g = acceleration due to gravity =	32.2	ft/s^2

Left Overbank = Abutment 1 (West)

y1 = depth of flow at abutment on the overbank or in the main channel =	3.4	ft
L = length of embankment projected normal to flow =	180	ft
Ratio of projected embankment length to flow depth = L/y1 =	5.266E+01	
Abutment scour equation to be used =	HIRE	

HIRE Live Bed Abutment Scour Equation

V = velocity of flow at upstream face of abutment =	0.4	ft/s
Fr = Froude Number = V/((g*y1)^.5) =	0.03	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = (Θ/90)^0.13 =	1	
Ys = abutment scour = y1*(4*(Fr^0.33)*(K1/0.55)*K2) =	**8.2**	**ft**

Right Overbank = Abutment 2 (East)

y1 = depth of flow at abutment on the overbank or in the main channel =	3.4	ft
L = length of embankment projected normal to flow =	170	ft
Ratio of projected embankment length to flow depth =	5.089E+01	
Abutment scour equation to be used =	HIRE	

HIRE Live Bed Abutment Scour Equation

V = velocity of flow at upstream face of abutment =	0.4	ft/s
Fr = Froude Number = V/((g*y1)^.5) =	0.04	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = (Θ/90)^0.13 =	1	
Ys = abutment scour = y1*(4*(Fr^0.33)*(K1/0.55)*K2) =	**8.6**	**ft**

Appendix D Rock Slope Protection Calculations

Rock Slope Protection Calculations for Banks

Calculation guideline from California Bank and Shore Rock Slope Protection Design

Input from HEC-RAS for Proposed Bridge (100-yr MLLW)

100-year Flow

$$W = \frac{0.00002V^6 SG}{(SG-1)^3 SIN^3(r-a)}$$

Location		Upstream	Upstream Face	Downstream Face	Downstream
Storm Event		100-year	100-year	100-year	100-year
VM	(ft/s)	0.8	1.4	1.4	2.1
Flow Condition					
SG		2.7	2.7	2.7	2.7
r	(degrees)	70	70	70	70
a	(degrees)	34	34	34	34

Impinging Flow Condition

V	(ft/s)	1.1	1.8	1.8	2.8
W	(lb)	0.0	0.0	0.0	0.0
RSP Class		Backing No. 3	Backing No. 3	Backing No. 3	Backing No. 3

Parallel Flow Condition

V	(ft/s)	0.5	0.9	0.9	1.4
W	(lb)	0.0	0.0	0.0	0.0
RSP Class		Backing No. 3	Backing No. 3	Backing No. 3	Backing No. 3

Rock Slope Protection Calculations for Abutments
Calculation guideline from HEC-23 3rd Edition

Input from HEC-RAS for Proposed Bridge (100-yr MLLW)

100-year Flow

Location	Upstream	Upstream Face	Downstream Face	Downstream	
V	0.8	1.4	1.4	2.1	ft/s
g	32.2	32.2	32.2	32.2	ft/s^2
y	7.8	2.1	2.1	6.5	ft
Fr	0.05	0.17	0.17	0.14	
	Isbash	**Isbash**	**Isbash**	**Isbash**	**from HEC-23**

For Froude Numbers $(V/(gy)^{1/2})<=0.80$, Isbash relationship

y	7.8	2.1	2.1	6.5	depth of flow in the contracted bridge opening, ft
K	1.0	1.0	1.0	1.0	(1.02 for vertical wall abutment, 0.89 or for spill-through abutment)
S_s	2.7	2.7	2.7	2.7	specific gravity of rock
V	0.8	1.4	1.4	2.1	average velocity in contracted section, ft/s
g	32.2	32.2	32.2	32.2	gravitational acceleration, ft/s^2
D_{50}	0.0	0.0	0.0	0.1	median stone diameter, ft
D_{50}	0.2	0.4	0.4	1.0	median stone diameter, inches
	Backing No. 2	Backing No. 2	Backing No. 2	Backing No. 2	rock class

Appendix L - Bridge Inspection Records Information System Report

DEC 2 2 2017

PUBLIC WORKS
DIR
AV
BUS
ENG
MAINT
RD
EM
FM
BLDG
NR
PK
RP
LU
SEC
FILE
TIC

DEPARTMENT OF TRANSPORTATION
Structure Maintenance & Investigations

Caltrans

Bridge Number : 04C0173
Facility Carried: PINE HILL RD
Location : 0.2 MI E/O ELK RIVER RD
City :
Inspection Date : 06/21/2017

Bridge Inspection Report

Inspection Type

Routine	FC	Underwater	Special	Other
X				

STRUCTURE NAME: MARTIN SLOUGH

CONSTRUCTION INFORMATION

Year Built : 1955
Year Modified: N/A
Length (m) : 19.2

Skew (degrees): 0
No. of Joints : 0
No. of Hinges : 0

Structure Description: Simply supported timber girder (17) with a concrete deck with timber rails on reinforced concrete bent caps on reinforced concrete piles (8) and reinforced concrete pile abutments with concrete lagging and reinforced concrete caps.

Span Configuration : 3 @ 20 ft

SAFE LOAD CAPACITY AND RATINGS

Design Live Load: UNKNOWN
Inventory Rating: RF=0.73 =>23.7 metric tons Calculation Method: ALLOWABLE STRESS
Operating Rating: RF=1.22 =>39.5 metric tons Calculation Method: ALLOWABLE STRESS
Permit Rating : PPPPP
Posting Load : Type 3: Legal Type 3S2: Legal Type 3-3: Legal

DESCRIPTION ON STRUCTURE

Deck X-Section: 0.2 ft br - 0.3 ft cu - 19 ft - 0.3 ft cu - 0.2 ft br
Total Width: 6.2 m Net Width: 5.8 m No. of Lanes: 2 Speed: 55 mph
Min. Vertical Clearance: Unimpaired Overlay Thickness: 0.0 inches

Rail Code: 0000

Rail Type	Location	Length (ft)	Rail Modifications
Timber Rail	Right/Left	124	

DESCRIPTION UNDER STRUCTURE

Channel Description: Mud with heavy vegetation growth along the banks. The channel appears to have a good alignment with the bridge opening. The channel appears to have a flat slope with no hydraulic skew. Tidal flow.

NOTICE

The bridge inspection condition assessment used for this inspection is based on the American Association of State Highway and Transportation Officials (AASHTO) Bridge Element Inspection Manual 2013 as defined in Moving Ahead for Progress in the 21st Century (MAP-21) federal law. The new element inspection methodology may result in changes to related condition and appraisal ratings on the bridge without significant physical changes at the bridge.

The element condition information contained in this report represents the current condition of the bridge based on the most recent routine and special inspections. Some of the notes presented below may be from an inspection that occurred prior to the date noted in this report. Refer to the Scope and Access section of this inspection report for a description of which portions of the bridge were inspected on this date.

INSPECTION COMMENTARY

SCOPE AND ACCESS

At the time of this inspection the water depth was 2 feet in Span 1. Pier 3 and Abutment

INSPECTION COMMENTARY

4 were outside of the water level. A complete inspection of this bridge was performed by wading and probing.

SAFE LOAD CAPACITY

A Load Rating Summary Sheet dated October 19, 2009 is on file for this structure. While this report does not include a check of that analysis, it does verify that the structural conditions observed during this inspection are consistent with those assumed in that analysis.

The current rating is based on hand calculations dated January 02, 1981 and October 7, 2009.

WATERWAY

A channel cross section was spot checked at the supports during this inspection and compared to the measurements taken on June 23, 2015. The results of that comparison indicate that the channel has remained relatively stable since 2007 with no significant degradation or aggradation. However, scour and erosion are affecting the stability of the approach roadway at Abutment 1. See text under the Abutment Scour defect for more details.

ELEMENT INSPECTION RATINGS AND COMMENTARY

Elem No.	Defect /Prot	Defect	Element Description	Env	Total Qty	Units	Qty in each Condition State St. 1	St. 2	St. 3	St. 4
12			Deck-RC	2	110	sq.m	29	30	51	0
	1080		Delamination/Spall/Patched Area	2	1		0	0	1	0
	1130		Cracking (RC and Other)	2	80		0	30	50	0

(12-1080)
There is a 12 inch diameter spall in the deck at Bent 3. The spall is less than 1 inch deep. See photo 2 included with this report.

(12-1130)
Longitudinal deck cracks are present in the deck surface. The deck cracks are predominately present near the centerline of the bridge and extend the full length of the structure. The cracks are up to 0.25 inches wide with edge spalls and are spaced 2 to 3 feet apart. See photo 1 included with this report.

Elem No.	Defect /Prot	Defect	Element Description	Env	Total Qty	Units	St. 1	St. 2	St. 3	St. 4
111			Girder/Beam-Timber	2	290	m	0	254	0	36
	1140		Decay/Section Loss (Timber)	2	36		0	0	0	36
	1150		Check/Shake (Timber)	2	254		0	254	0	0

(111-1140)
The left and right exterior timber girders and timber sill plates are in an advanced state of decay at the abutments and piers where the girders bear on the sill plates. Up to 1.5 inches of the bottom of the girders and up to 12 inches in length from the ends of the girders are affected by decay. See photos 2 through 8 included with this report.

Because of the concrete deck's ability to distributes live loads to adjacent and sound girders and the reduced tributary area of live load influence at exterior girders (half of the tributary area of interior girders), this condition does not severely impact the serviceability of this structure. However, during future biennial inspection, the first interior girders in each span shall be closely

ELEMENT INSPECTION RATINGS AND COMMENTARY

Elem No.	Defect /Prot	Defect	Element Description	Env	Total Qty	Units	Qty in each Condition State St. 1	St. 2	St. 3	St. 4

monitored for load induced stresses. Up to 12 inches of the ends of the timber sill plates are also affected by decay at the abutments and piers. The sill plates are crushing and bulging beneath the exterior girders. Decay of the exterior girders and timber sills continues to advance. No broken girders were observed.

Mold is present on the surface of the most of the timber girders.

See photos archived with the July 17, 2014 Bridge Inspection Report.

(111-1150)
Checks and shakes are present in all the timber. The checks and shakes penetrate approximately 5 to 10 percent of the member thicknesses.

Elem No.	Defect /Prot	Element Description	Env	Total Qty	Units	St. 1	St. 2	St. 3	St. 4
205		**Column-RC**	4	16	each	0	6	10	0
	1130	**Cracking (RC and Other)**	4	16		0	6	10	0

(205-1130)
There are vertical cracks in most of the columns. The cracks are up to 0.06 inches wide. The cover concrete is delaminating from the reinforcing steel at the corners of the square concrete columns below the high water mark. This condition does not appear to have changed significantly. See photos archived with the July 17, 2014 Bridge Inspection Report.

Elem No.	Defect /Prot	Element Description	Env	Total Qty	Units	St. 1	St. 2	St. 3	St. 4
215		**Abutment-RC**	4	24	m	18	6	0	0
	6000	**Scour**	4	6		0	6	0	0

(215-6000)
The Abutment 1 reinforced concrete lagging is undermined approximately 3 feet vertically and 4 feet longitudinally from the face of the abutment. This condition affects the entire width of the abutment. Twelve to 18 inch diameter rock is in place behind the concrete lagging at Abutment 1. The right wingwall at Abutment 1 is undermined approximately 1 foot vertically and 1.5 feet transversely along the entire length of the wingwall. The rock slope protection for the left wingwall at Abutment 1 is no longer effective. This condition continues to affect the stability of the asphaltic concrete approach roadway to Abutment 1 and results in roadway settlement. At the time of this inspection settlement at Abutment 1 was not present and there was a smooth transition from the approach roadway to the structure.

Elem No.	Defect /Prot	Element Description	Env	Total Qty	Units	St. 1	St. 2	St. 3	St. 4
227		**Pile-RC**	2	1	ea.	1	0	0	0

(227)
The pile element is included to indicate the presence of piles on this structure. The piles were not exposed for visual inspection. No indication of pile distress was noted in any substructure element.

Elem No.	Defect /Prot	Element Description	Env	Total Qty	Units	St. 1	St. 2	St. 3	St. 4
234		**Pier Cap-RC**	2	24	m	24	0	0	0

(234)
There were no significant defects noted.

Elem No.	Defect /Prot	Element Description	Env	Total Qty	Units	St. 1	St. 2	St. 3	St. 4
332		**Railing-Timber**	2	38	m	38	0	0	0

(332)
There were no significant defects noted.

WORK RECOMMENDATIONS

WORK RECOMMENDATIONS

RecDate: 07/17/2013 Action : Deck-Methacrylate Work By: LOCAL AGENCY Status : PROPOSED	EstCost: StrTarget: 2 YEARS DistTarget: EA:	Patch all deck spalls, repair all unsound areas of the deck, and treat deck cracks with methacrylate.
RecDate: 05/09/2007 Action : Sub-Scour Mitigate Work By: LOCAL AGENCY Status : PROPOSED	EstCost: StrTarget: 2 YEARS DistTarget: EA:	Provide scour countermeasures at Abutment 1.
RecDate: 12/03/2004 Action : Super-Rehab Work By: LOCAL AGENCY Status : PROPOSED	EstCost: StrTarget: 1 YEAR DistTarget: EA:	Replace all of the exterior timber stringers. Replace decayed sill plates at both abutments and Piers 2 and 3.
RecDate: 01/13/1999 Action : Sub-Rehab Work By: LOCAL AGENCY Status : PROPOSED	EstCost: StrTarget: 2 YEARS DistTarget: EA:	Provide protection for the steel reinforcement in the RC columns. Remove unsound concrete and patch RC columns.

Team Leader : Rohit Nand

Report Author : Rohit Nand

Inspected By : R.Nand/W.Baker

Rohit Nand 12/18/2017

Rohit Nand (Registered Civil Engineer) (Date)

REGISTERED PROFESSIONAL ENGINEER
Rohit Nand
No. 84722
03/31/2018
CIVIL
STATE OF CALIFORNIA

STRUCTURE INVENTORY AND APPRAISAL REPORT

**************** IDENTIFICATION ***************

(1) STATE NAME- CALIFORNIA 069
(8) STRUCTURE NUMBER **04C0173**
(5) INVENTORY ROUTE(ON/UNDER)- ON 140000000
(2) HIGHWAY AGENCY DISTRICT 01
(3) COUNTY CODE 023 (4) PLACE CODE 00000
(6) FEATURE INTERSECTED- MARTIN SLOUGH
(7) FACILITY CARRIED- PINE HILL RD
(9) LOCATION- 0.2 MI E/O ELK RIVER RD
(11) MILEPOINT/KILOMETERPOINT 0
(12) BASE HIGHWAY NETWORK- NOT ON NET 0
(13) LRS INVENTORY ROUTE & SUBROUTE
(16) LATITUDE 40 DEG 45 MIN 09.06 SEC
(17) LONGITUDE 124 DEG 10 MIN 57.76 SEC
(98) BORDER BRIDGE STATE CODE % SHARE %
(99) BORDER BRIDGE STRUCTURE NUMBER

******** STRUCTURE TYPE AND MATERIAL *********

(43) STRUCTURE TYPE MAIN:MATERIAL- WOOD OR TIMBER
TYPE- STRINGER/MULTI-BEAM OR GDR CODE 702
(44) STRUCTURE TYPE APPR:MATERIAL- OTHER/NA
TYPE- OTHER/NA CODE 000
(45) NUMBER OF SPANS IN MAIN UNIT 3
(46) NUMBER OF APPROACH SPANS 0
(107) DECK STRUCTURE TYPE- CIP CONCRETE CODE 1
(108) WEARING SURFACE / PROTECTIVE SYSTEM:
A) TYPE OF WEARING SURFACE- NONE CODE 0
B) TYPE OF MEMBRANE- NONE CODE 0
C) TYPE OF DECK PROTECTION- NONE CODE 0

*************** AGE AND SERVICE ***************

(27) YEAR BUILT 1955
(106) YEAR RECONSTRUCTED 0000
(42) TYPE OF SERVICE: ON- HIGHWAY 1
UNDER- WATERWAY 5
(28) LANES:ON STRUCTURE 02 UNDER STRUCTURE 00
(29) AVERAGE DAILY TRAFFIC 187
(30) YEAR OF ADT 2010 (109) TRUCK ADT 3 %
(19) BYPASS, DETOUR LENGTH 2 KM

*************** GEOMETRIC DATA ****************

(48) LENGTH OF MAXIMUM SPAN 6.1 M
(49) STRUCTURE LENGTH 19.2 M
(50) CURB OR SIDEWALK: LEFT 0.2 M RIGHT 0.2 M
(51) BRIDGE ROADWAY WIDTH CURB TO CURB 5.8 M
(52) DECK WIDTH OUT TO OUT 6.2 M
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS) 6.2 M
(33) BRIDGE MEDIAN- NO MEDIAN 0
(34) SKEW 0 DEG (35) STRUCTURE FLARED NO
(10) INVENTORY ROUTE MIN VERT CLEAR 99.99 M
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR 5.8 M
(53) MIN VERT CLEAR OVER BRIDGE RDWY 99.99 M
(54) MIN VERT UNDERCLEAR REF- NOT H/RR 0.00 M
(55) MIN LAT UNDERCLEAR RT REF- NOT H/RR 0.0 M
(56) MIN LAT UNDERCLEAR LT 0.0 M

*************** NAVIGATION DATA ***************

(38) NAVIGATION CONTROL- NO CONTROL CODE 0
(111) PIER PROTECTION- CODE
(39) NAVIGATION VERTICAL CLEARANCE 0.0 M
(116) VERT-LIFT BRIDGE NAV MIN VERT CLEAR M
(40) NAVIGATION HORIZONTAL CLEARANCE 0.0 M

****

SUFFICIENCY RATING = 42.6
STATUS STRUCTURALLY DEFICIENT
HEALTH INDEX 63.4
PAINT CONDITION INDEX = N/A

************* CLASSIFICATION ************* CODE

(112) NBIS BRIDGE LENGTH- YES Y
(104) HIGHWAY SYSTEM- NOT ON NHS 0
(26) FUNCTIONAL CLASS- LOCAL RURAL 09
(100) DEFENSE HIGHWAY- NOT STRAHNET 0
(101) PARALLEL STRUCTURE- NONE EXISTS N
(102) DIRECTION OF TRAFFIC- 2 WAY 2
(103) TEMPORARY STRUCTURE-
(105) FED.LANDS HWY- NOT APPLICABLE 0
(110) DESIGNATED NATIONAL NETWORK - NOT ON NET 0
(20) TOLL- ON FREE ROAD 3
(21) MAINTAIN- COUNTY HIGHWAY AGENCY 02
(22) OWNER- COUNTY HIGHWAY AGENCY 02
(37) HISTORICAL SIGNIFICANCE- NOT ELIGIBLE 5

**************** CONDITION **************** CODE

(58) DECK 4
(59) SUPERSTRUCTURE 4
(60) SUBSTRUCTURE 4
(61) CHANNEL & CHANNEL PROTECTION 5
(62) CULVERTS N

********* LOAD RATING AND POSTING ********* CODE

(31) DESIGN LOAD- UNKNOWN 0
(63) OPERATING RATING METHOD- ALLOWABLE STRESS 2
(64) OPERATING RATING- 39.5
(65) INVENTORY RATING METHOD- ALLOWABLE STRESS 2
(66) INVENTORY RATING- 23.7
(70) BRIDGE POSTING- EQUAL TO OR ABOVE LEGAL LOADS 5
(41) STRUCTURE OPEN, POSTED OR CLOSED- A
DESCRIPTION- OPEN, NO RESTRICTION

**************** APPRAISAL **************** CODE

(67) STRUCTURAL EVALUATION 4
(68) DECK GEOMETRY 3
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL N
(71) WATER ADEQUACY 8
(72) APPROACH ROADWAY ALIGNMENT 8
(36) TRAFFIC SAFETY FEATURES 0000
(113) SCOUR CRITICAL BRIDGES 5

********** PROPOSED IMPROVEMENTS **********

(75) TYPE OF WORK- SUP/SUB REHAB CODE 35
(76) LENGTH OF STRUCTURE IMPROVEMENT 19.2 M
(94) BRIDGE IMPROVEMENT COST $117,000
(95) ROADWAY IMPROVEMENT COST $53,820
(96) TOTAL PROJECT COST $452,088
(97) YEAR OF IMPROVEMENT COST ESTIMATE 2017
(114) FUTURE ADT 284
(115) YEAR OF FUTURE ADT 2036

*************** INSPECTIONS ***************

(90) INSPECTION DATE 06/17 (91) FREQUENCY 24 MO
(92) CRITICAL FEATURE INSPECTION: (93) CFI DATE
A) FRACTURE CRIT DETAIL- NO MO A)
B) UNDERWATER INSP- NO MO B)
C) OTHER SPECIAL INSP- NO MO C)

MARTIN SLOUGH

0.2 MI E/O ELK RIVER RD — 06/21/2017 [AAAK] — 04C0173

102 - PHOTO-Deck-Damage/Deterioration

Photo No. 1
Longitudinal deck cracks.

102 - PHOTO-Deck-Damage/Deterioration

Photo No. 2
Deck spall at Bent 3.

113 - PHOTO-Sub-Damage/Deterioration

Photo No. 3
Advanced decay at the ends of the timber sill at Bent 3 (right).

113 - PHOTO-Sub-Damage/Deterioration

Photo No. 4
Advanced decay at the ends of the timber sill at Bent 3 (right).

113 - PHOTO-Sub-Damage/Deterioration

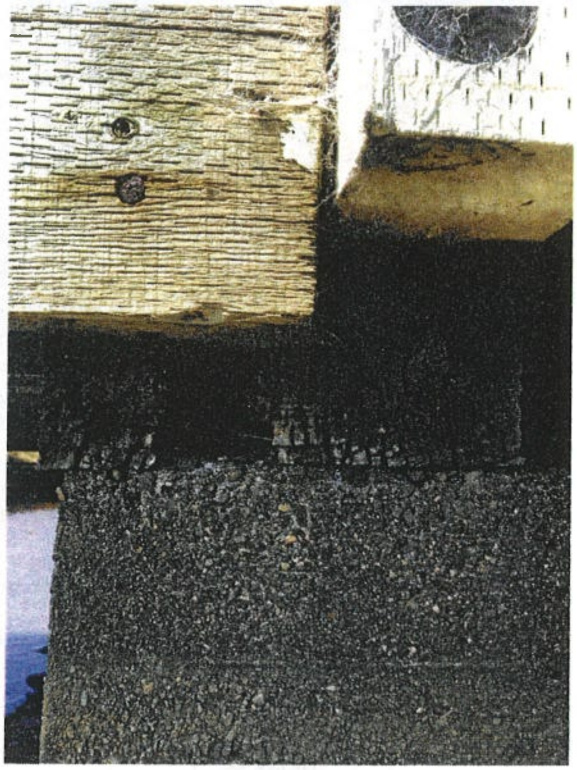

Photo No. 5

Advanced decay at the ends of the timber sill at Bent 3 (right).

113 - PHOTO-Sub-Damage/Deterioration

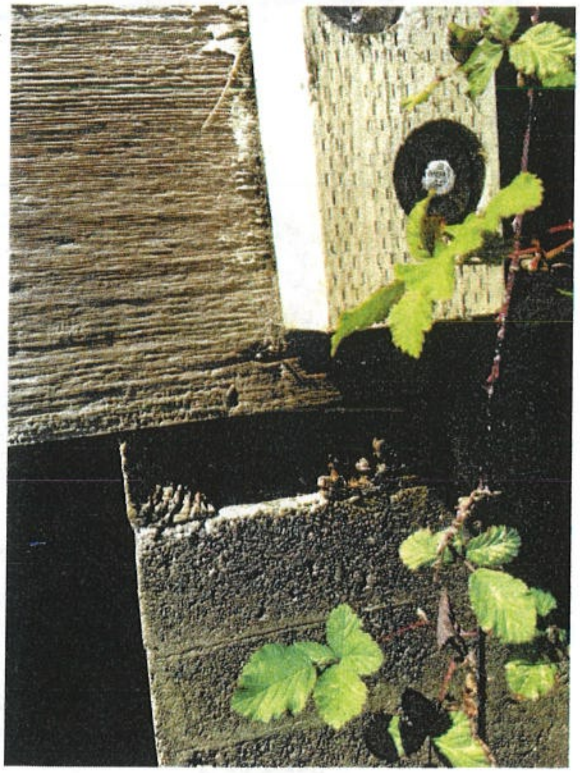

Photo No. 6

Advanced decay at the ends of the timber sill at Abutment 4 (right).

113 - PHOTO-Sub-Damage/Deterioration

Photo No. 7

Advanced decay at the ends of the timber sill at Abutment 4 (left).

113 - PHOTO-Sub-Damage/Deterioration

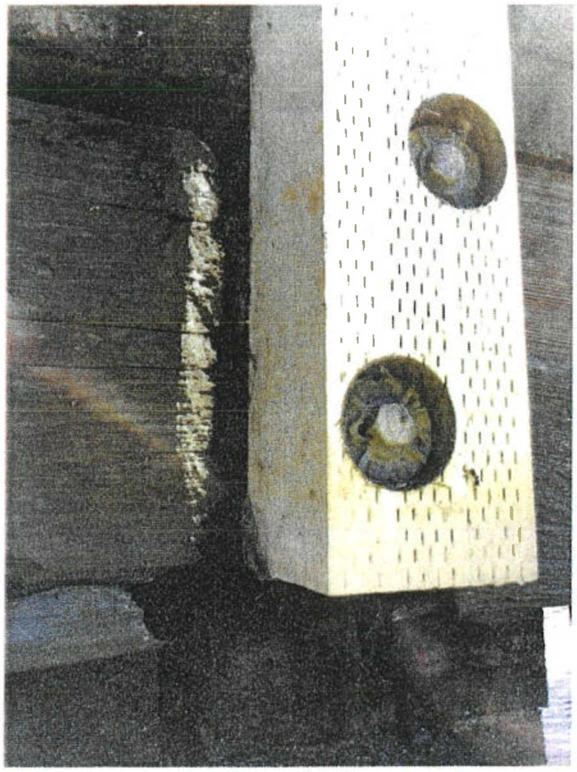

Photo No. 8

Advanced decay at the ends of the timber sill at Abutment 4 (left).