Appendix A.
Notice of Preparation and Response Letters

SAN LUIS OBISPO COUNTY
DEPARTMENT OF PUBLIC WORKS
County Government Center, Room 207 • San Luis Obispo, CA 93408 • (805)781-5252

Fax (805) 781-1229 *email address: pwd@co.slo.ca.us*

DATE: June 5, 2009

TO: Interested Parties

FROM: County of San Luis Obispo Department of Public Works

SUBJECT: **NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT**

PROJECT TITLE: **Arroyo Grande Creek Channel Waterway Management Program**

PROJECT APPLICANT: **San Luis Obispo County Flood Control and Water Conservation District (District)**

RESPONSES DUE BY: **July 10, 2009**

The County of San Luis Obispo is the lead agency for the full development of the Waterway Management Program (WMP) projects and will prepare an Environmental Impact Report (EIR) for the project described in the attached project description. We would like to know your views as to the scope and content of the environmental information proposed for the WMP and EIR.

PLEASE provide us the following information at your earliest convenience, but not later than the 30-day comment period which will begin with your agency's receipt of the NOP.

1. **NAME OF CONTACT PERSON**. (Address and telephone number)

2. **PERMIT(S) or APPROVAL(S) AUTHORITY**. Please provide a summary description of these and send a copy of the relevant sections of legislation, regulatory guidance, etc.

3. **ENVIRONMENTAL INFORMATION**. What environmental information must be addressed in the EIR to enable your agency to use this documentation as a basis for your permit issuance or approval?

4. **ALTERNATIVES**. What alternatives does your agency recommend be analyzed in equivalent level of detail with those listed below?

5. **RELEVANT INFORMATION**. Please provide references for any available, appropriate documentation you believe may be useful to the county in preparing the EIR.

6. **FURTHER COMMENTS**. Please provide any further comments or information that will help the county to scope the document and determine the appropriate level of environmental assessment.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date, but not later than **30 days** after receipt of this notice.

The project description, location, and the probable environmental effects are contained in the attached materials and are available online at SLOCountyWater.org.

Please send your response to the attention of Mr. John Farhar, Project Manager, at the following address:

John Farhar
County of San Luis Obispo
Department of Public Works
c/o Mary B. Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, CA 93401-2954

We will need the name of a contact person in your agency. If you have any questions regarding the NOP or the proposed project, please contact Ms. Mary Reents at (805) 543-7095, extension 103.

In addition, an EIR scoping meeting will be held on June 25, 2009 at 6:00 pm at the Oceano Community Services District Meeting Room, located at 1655 Front Street, Oceano, San Luis Obispo County, California. The EIR scoping meeting will be open to all interested parties and provide an opportunity for input relating to the scope and content of the EIR.

Reviewed by:

Signature Ellen Carroll

Ellen Carroll
County of San Luis Obispo
Environmental Coordinator

Reference: *California Administrative Code, Title 14, Section 15082*

NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT FOR THE ARROYO GRANDE CREEK CHANNEL WATERWAY MANAGEMENT PROGRAM

PROJECT DESCRIPTION AND LOCATION

Refer to Attachment A, Project Description.

SCOPE OF THE EIR

The following discussion outlines the issues that will be addressed in the EIR, based on the probable environmental effects associated with the proposed project, as identified by the District. **Please indicate any additions or corrections to the proposed scope of work as part of your response to this Notice of Preparation**. The EIR will address the following project components:

1. *Summary*. The summary section will include a summary of the project alternatives, as well as a summary of impacts and mitigation measures in tabular form.
2. *Project Description*. The project description will include a description of the project site location and a legal description; a detailed description of the actions comprising the long-term vegetation and sediment maintenance proposed; the project objectives and project phasing; and a recent history of flood management within the District.
3. *Environmental Setting*. This will include a discussion of the general setting; a detailed description of flood management facilities; and an analysis of the consistency of the project with applicable County plans and policies that pertain to the project site.
4. *Environmental Impacts and Mitigation Measures.* This will include a discussion of the anticipated significant and potential effects of the proposed project. Mitigation measures will be recommended to reduce potential impacts. This section will also include a description of any impacts that cannot be avoided or reduced to a level of insignificance. The environmental impact topics to be included will be an inclusive list (refer to Attachment B, Initial Study Checklist), as follows:

    - Agricultural Resources
    - Air Quality
    - Biological Resources
    - Cultural Resources
    - Geology and Soils
    - Hazards / Hazardous Materials
    - Flooding / Hydrology / Water Quality
    - Transportation and Traffic

5. *Cumulative Impacts*. This will include the cumulative impacts associated with the proposed project when viewed in connection with the effects of past, current, and probable future projects.
6. *Project Alternatives*. The alternatives section of the EIR will be prepared in accordance Section 15126(d) of the CEQA Guidelines, and will include as required the "No-Project" alternative. The discussion will include reasonable alternatives capable of eliminating or

reducing significant adverse environmental effects. The environmentally superior alternative will be identified, and if it is identified as the "No-Project" alternative then a preferred or environmentally superior alternative among the other alternatives will be included. Secondary impacts of the alternatives will be discussed, but in less detail than the significant effects of the project as per CEQA section 15126(d)(4).

7. *Significant Irreversible Environmental Changes*. This will include irreversible changes associated with the projects.
8. *Growth-inducing Impacts*. This section will analyze the proposed project in terms of its potential to substantially induce growth in the surrounding area.
9. *Impacts Not Found to be Significant*. Impacts that are determined in the analysis not to have significant impacts will be identified and discussed. Based on preliminary review of the proposed projects (refer to Attachment B, Initial Study Checklist), the following resource areas are expected to have less than significant impacts and will not be addressed in individual sections:

- Land Use / Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Recreation
- Visual Resources

ATTACHMENT A

- **Project Description**

ATTACHMENT A
PROJECT DESCRIPTION

PROJECT SUMMARY

The Arroyo Grande Creek Channel Waterway Management Program (WMP, proposed project) is being developed through a cooperative effort between the community, the Coastal San Luis Resource Conservation District (RCD) and the San Luis Obispo County Flood Control and Water Conservation District (District). The project is located along the lower reaches of Arroyo Grande Creek, from near the intersection of Los Berros Creek to the Arroyo Grande lagoon, and along Los Berros Creek from Century Lane to the confluence with Arroyo Grande Creek. This area is within Flood Control District "Zones 1 and 1A" (Zone 1/1A).

The County of San Luis Obispo Public Works Department (County) is developing the WMP and preparing California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documentation, including an Environmental Impact Report (EIR), to obtain the necessary federal and state permits for implementation. The WMP includes the following components:

1. Manage riparian vegetation annually to maintain a composite roughness of 0.040 within the flood control reach, fill existing gaps in the riparian corridor vegetation and encourage species diversity by planting riparian tree species;

2. Remove sediment to create secondary channels that could be self-maintaining, and monitor annually to evaluate future sediment deposition and the need for annual maintenance of accumulated sediments;

3. Raise levees throughout the flood control channel to achieve channel capacity for up to 10-year flood flows; and

4. Raise levees throughout the flood control channel to achieve channel capacity for up to 20-year flood flows.

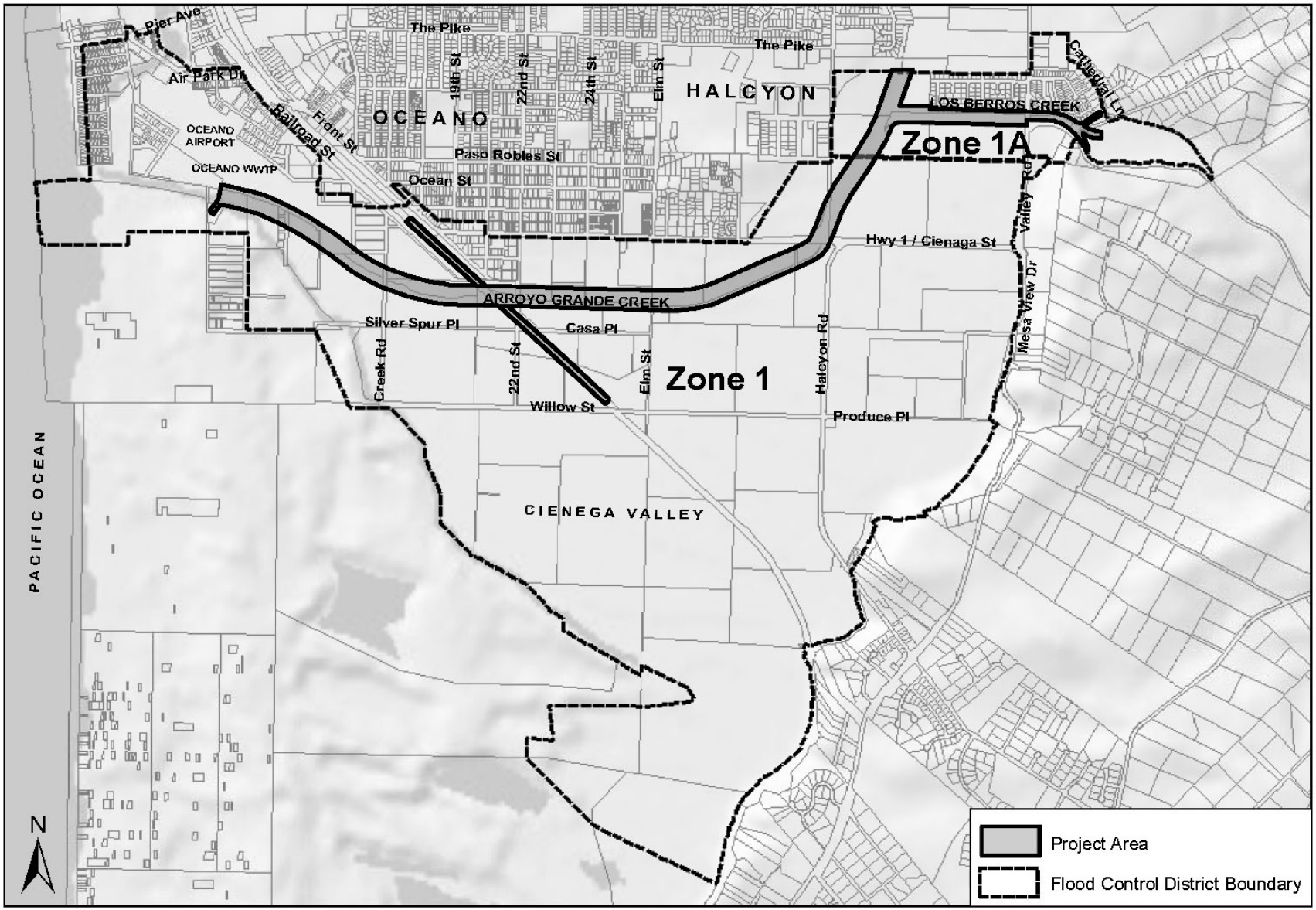
PROJECT LOCATION

The proposed project is located within San Luis Obispo County, California, near the City of Arroyo Grande and the community of Oceano (refer to Figure 1). The project area is located entirely within the unincorporated areas of San Luis Obispo County. The project area is a linear corridor with two segments: (1) beginning on Arroyo Grande Creek 0.14 mile upstream of the confluence of Los Berros Creek and continuing downstream to the upper edge of the Arroyo Grande lagoon at the Pacific Ocean, and (2) beginning at the Century Lane Bridge on Los Berros Creek and continuing downstream to the confluence with Arroyo Grande Creek (refer to Figure 2). This area is within Zone 1/1A. The total length of the flood control channels addressed in the WMP is approximately 3.5 miles.

Source: ESRI Resources Center.

NORTH
Not to Scale

Project Vicinity Map
FIGURE 1



Source: ESRI Resource Center

Project Location Map
FIGURE 2

PROJECT BACKGROUND

The lower Arroyo Grande Valley has a long history of flooding and severe damage to agricultural and residential lands. Levees were built along lower Arroyo Grande Creek, and the lower portion of Los Berros Creek was diverted in 1961 to provide flood control for the adjacent Cienega Valley. Lopez Lake is a water supply reservoir that also provides the added benefit of some flood storage for the uppermost portion of Arroyo Grande Creek.

In February 2005, the Department of Water Resources (DWR) issued a Statement of Necessary Work with the goal of initiating maintenance work on the channel in July 2005. As mandated by State Water Code, the intended Work Plan was the existing plan developed as part of the 1955 Arroyo Grande Creek Flood Control Project which requires maintaining the channel by restoring it to its original 1958 design. Without Water Code provisions to study or implement alternative flood control designs, DWR was faced with a difficult and expensive regulatory permitting process which would likely result in costly mitigation requirements related to habitat loss for federally-listed species. These costs would have been paid locally through a Zone 1/1A property assessment process.

In response to impending assessments estimated by DWR, the Zone 1/1A Advisory Committee comprised of agriculturalists and other local residents and various stakeholders, actively lobbied the County Board of Supervisors to restore funding for a study of flood control alternatives, which had been dropped with the decision to relinquish responsibility to DWR in 2003. In June 2004, the District approved release of funding to Coastal San Luis RCD to conduct the "Arroyo Grande Creek Erosion, Sedimentation and Flooding Alternatives Study" (Alternatives Study). It was prepared in 2006 by Swanson Hydrology + Geomorphology. The Alternatives Study focuses in-depth on erosion sources, sedimentation, and hydrology as they relate to recurring flooding in the lower reaches of the creek.

Following completion of the Alternatives Study the Zone 1/1A Advisory Committee selected a preliminary preferred project alternative which was considered feasible within anticipated funding limits. The selected approach was to pursue vegetation and sediment management within the channel, and a phased implementation of Alternative 3a, at a minimum, as funding within the local flood control district became available. Alternative 3a would provide flood protection up to the 10-year return period and would most likely be implemented in several phases. Alternative 3c would also be pursued as funding allows. Alternative 3c includes all elements of Alternative 3a, and additionally raises the levees and Union Pacific Railroad (UPRR) Bridge to provide flood protection up to the 20-year return period.

PROJECT OBJECTIVE

The primary objective of the WMP is to develop a comprehensive set of actions designed to restore the capacity of the leveed lower three miles of Arroyo Grande Creek Channel and the Los Berros Creek Diversion Channel to provide flood protection from up to a 20-year storm event while simultaneously enhancing water quality and sensitive species habitat within the managed channel.

PROPOSED PROJECT

The WMP is currently being prepared, and the information below reflects the most recent information available at the time this Notice of Preparation (NOP) was published. The project description may be refined somewhat for use in the CEQA and NEPA analyses; however, no significant changes are anticipated. Implementation of the WMP would include three distinctive components:

1. Vegetation Management
2. Sediment Management
3. Levee Raising (Alternatives 3a and 3c)

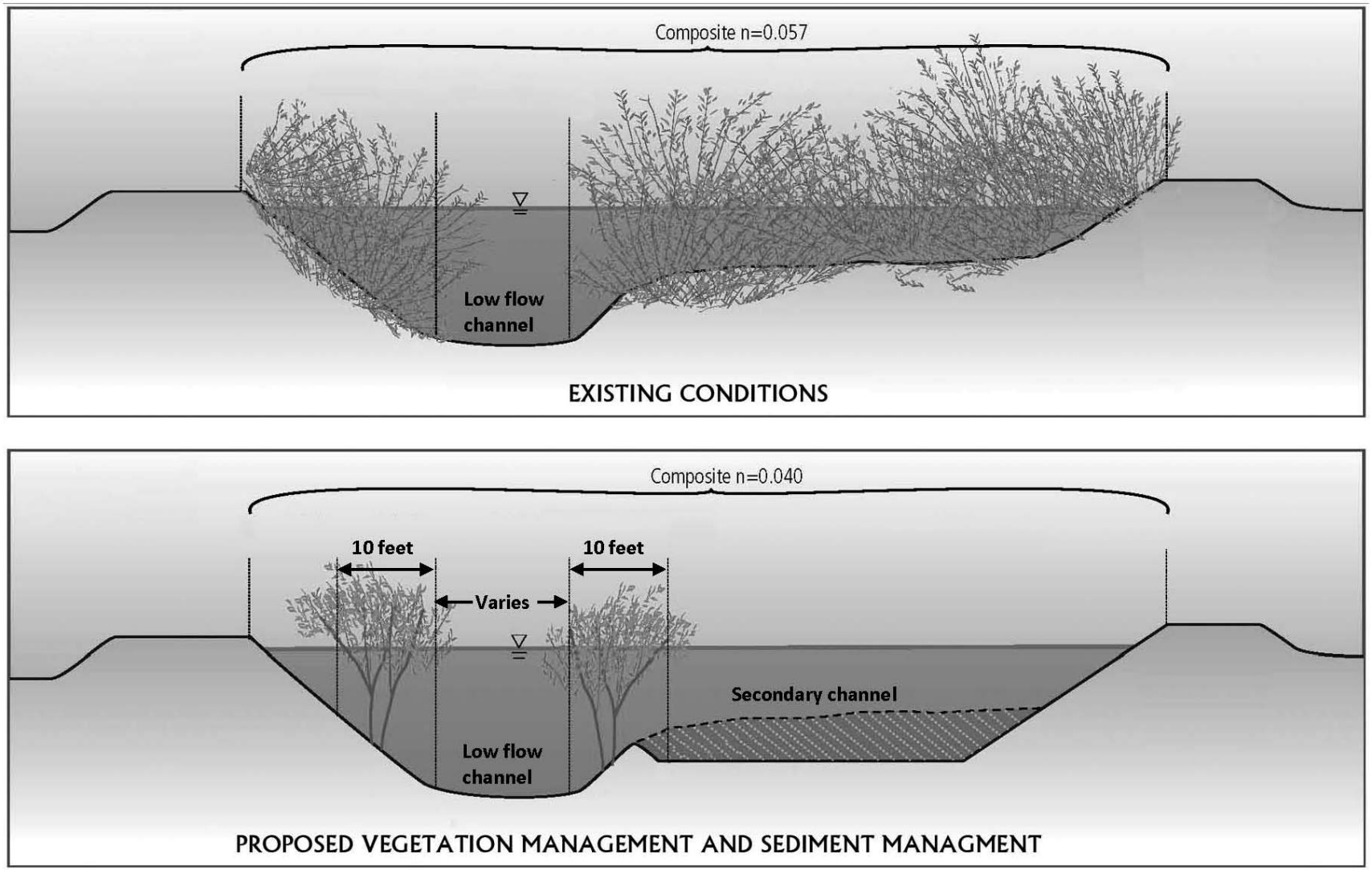
In addition there are a number of known secondary components resulting from implementation of the levee raising components of the project. These include raising of the railroad bridge, raising and/or relocating a portion of Halcyon Road, making improvements to the 22nd Street Bridge, and potentially the relocation of structures located within the Arroyo Grande Channel maintenance easement that encroach on proposed improvements.

A. VEGETATION MANAGEMENT

The vegetation management program would consist of maintaining a 10-foot riparian buffer on both sides of the low-flow channel to provide riparian habitat and streamside cover to protect aquatic habitat. The management would result in an approximate 40-foot riparian corridor, not including canopy width, although this width could vary depending upon the width of the channel and the location of the low-flow channel in relation to the levees. The corridor would also act to maintain a bankfull channel that has developed over the last several years by providing root strength along the low flow channel margins. All vegetation outside of the buffer would be removed completely to allow for high flows to access secondary channels and provide for increased conveyance and flood capacity (refer to Figure 3).

Willows present within the buffer would be limbed up to reduce cross-sectional roughness but still provide adequate stream shading and riparian habitat. Root balls within the riparian buffer would be left intact to encourage spring/summer growth along the bankfull channel edge. Gaps in the riparian buffer would be revegetated with native riparian species including cottonwood, sycamore, and willow. Cottonwood and sycamore would be planted at random along the length of the flood control channel within the buffer to encourage long-term diversity in the riparian canopy.

Vegetation management would be conducted as often as necessary to maintain a roughness coefficient of 0.04 (current roughness is approximately 0.057 on average) through an adaptive management approach that would include reconnaissance surveys and site visits with regulatory agency staff. Based on past experience, vegetation management would be repeated approximately every one to three years, depending on the amount of regrowth. Vegetation management would occur as late as possible in the summer and fall of each year to maximize stream shading during the warmer summer months while avoiding impacts to steelhead. Regrowth of willow is expected in late winter and spring providing low, overhanging vegetation during critical months for steelhead rearing.



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Proposed Vegetation & Sediment Management
FIGURE 3

B. SEDIMENT MANAGEMENT

1. Short Term Removal

The Arroyo Grande Creek flood control channel currently lacks the secondary channels that are found in more natural, low gradient stream environments. Therefore secondary, or overflow channels, would be excavated into areas in the channel that have accumulated excess sediment in bars and terraces resulting in reduced flood capacity (refer to Figure 3). At strategic locations, the excavated secondary channels would be connected with the primary channels to allow for complex flow conditions that would encourage scour and sediment transport, and reduce the need for future sediment removal. No sediment in the primary channel would be excavated.

Large wood structures would be placed at the confluence of each active and secondary channel connection to enhance aquatic habitat. Approximately 35 large wood structures are proposed for the project, to promote pool scour, encourage sediment sorting, and provide deep pools and cover habitat for steelhead and red-legged frog. It is currently estimated that this project component would require the removal of approximately 21,000 cubic yards of sediment from the Arroyo Grande Creek and Los Berros channels. Sediment would be hauled by truck to an approved disposal site. The site had not been identified at the time the NOP was published. Heavy machinery would need to operate in the channel during initial sediment removal and during construction of the log structures.

2. Long-term Sediment Removal

Some maintenance (sediment removal) of the secondary channels would be required over the long-term because of the likelihood that significant quantities of fine material would be deposited in the channels. Annual cross-section monitoring would assess the performance of the channel in moving supplied sediment. Cross-sections would be prepared each year following the rainy season. The hydraulic model would also be rerun annually with updated cross-sections and roughness information to assess channel capacity.

The volume of sediment to be removed would vary from year to year, would be considerably less than the initial removal, and in some years may not be required at all. Maintenance of the secondary channel would consist of removal of excess sediment by an excavator located on the top of the levee, and a long-reach bucket would be used to scoop up sediment from designated areas and deposit it in a dump truck to take the sediment off-site to a County approved disposal area. Heavy machinery would most likely not need to access the channel during the annual sediment removal.

C. LEVEE RAISING

The originally constructed flood control channel was believed to provide flood protection from a 50-year storm, but due to challenges in maintaining the channel, such as inadequate funding and regulatory requirements, and changes in the hydrology of the watershed associated with significant changes in land use, the level of flood protection has been reduced. It is estimated that the channels can currently provide flood protection from only a 4.6 year storm. This means that the channel has the probability to overtop once every 4.6 years.

The proposed project includes raising the levees in two stages along portions of the Los Berros Creek Diversion Channel and along Arroyo Grande Creek Channel from the Los Berros confluence to the lagoon. Levee raising would most likely be conducted in phases as funding is available. The levees would ultimately be raised up to 2.5 feet above the 20-year storm flows (i.e., "freeboard"). Although overtopping of the levees is not desired at all, it is more desirable to overtop to the south where flood waters would inundate agricultural fields, rather than housing, the airport and a wastewater treatment plant, and reduce the risk of loss of life. To that end, the north levee is currently approximately 4-6 inches higher than the south levee, and would remain so as a result of the proposed project.

In general, levee slopes would be constructed at a ratio of 2:1 (horizontal:vertical) on the channel side of the levees and 1.5:1 on the outside of the levees due to the limited levee easement area and number of existing structures encroaching on the levees. Retaining walls may also be necessary in some places to minimize the levee footprint due to the proximity of existing structures to the base of the levee. Retaining walls would not be located within the channel. The levees would maintain a minimum top width of 15 feet. Refer to Figures 4a and 4b for the approximate area of disturbance associated with the proposed project.

1. Short-term Levee Raise (Alternative 3a)

The first phase of the levee raising (Alternative 3a) would raise the levees to an elevation that would, along with the vegetation and sediment management discussed above, provide up to 10-year flood protection with freeboard. This raise would focus on "low spots" along the existing levee. The levees would need to be raised in various locations from approximately six inches to as much as two feet. This component would require approximately 14,350 cubic yards of fill material and would be implemented over a period of one or more years, depending on available funding.

2. Longer-term Levee Raise (Alternative 3c)

The longer term levee raise (Alternative 3c) would achieve 20-year flood protection with up to 2.5-feet of freeboard for those parcels included within the special maintenance assessment district. The average levee raise required to implement this component would be approximately 2.8 feet from existing grade, with a maximum raise necessary in some places of approximately 5 feet. These heights would be reduced accordingly if Alternative 3a is implemented first. It is currently estimated that this component would require a total of approximately 67,000 cubic yards of fill, less if Alternative 3a is implemented first. Refer to Figures 4a and 4b for more information regarding the approximate location and extent of the proposed levee improvements.

3. Secondary Components

In some cases, achieving the goals of levee raise Alternatives 3a (10 year protection) and 3c (20 year protection) would require improvements other than vegetation management, sedimentation management, and the levee raise. These are discussed below.

a. Union Pacific Railroad Bridge Replacement

The existing railroad bridge, located downstream of the 22nd Street bridge, hangs low in elevation in the Creek and creates a hydraulic constriction in levee raise Alternative 3c. The bridge would need to be raised or replaced at a higher elevation (approximately 5 feet) to relieve the constriction. Raising the bridge also necessitates raising the railroad tracks approaching the bridge. The raise of the approaching railroad bed would have to begin approximately 1,700 feet north and 2,400 feet south of the bridge, according to conceptual plans prepared by UPRR in 2006 (refer to Figure 4a). The area of disturbance would be approximately three acres (4,100 feet by 30 feet). So that railroad service is not disrupted, a parallel but temporary track would need to be installed. This track is known as a "shoefly" and would allow for uninterrupted railroad service during the bridge raising. The area of disturbance for the shoefly may be approximately the same as that necessary for the bridge raising and immediately west of the current tracks. It would occur mostly within the existing railroad right-of-way. This component of the project may result in earthwork totaling approximately 135,000 cubic yards (90,000 to construct and remove the shoefly, and 45,000 to construct the permanent raise). These construction improvements may require work within the creek channel.

b. Halcyon Road

Halcyon Road was built at an elevation roughly equal to the top of the bank of Arroyo Grande Creek. North of Highway 1, the northwest levee visually disappears becoming part of Halcyon Road. The levee raise for alternative 3c would encroach into a portion of Halcyon Road north of Highway 1 for approximately 600 feet (refer to Figure 4b). Either the road would need to be shifted to the west, or the ground would need to be elevated to achieve the flood protection goal under levee raise alternative 3c. The road would need to be raised along this length approximately 5.5 feet or flood walls could be installed in the channel to an equivalent height.

The Department of Public Works is currently working on plans to improve the Halcyon Road/Highway 1 intersection, and it is expected that the improvements would be coordinated with the implementation of the WMP to minimize the work required and disturbance of the flood control channel. The Halcyon Road project may result in shifting Halcyon Road to the west, and if this project occurs first, it will provide space for the levee improvements to occur.

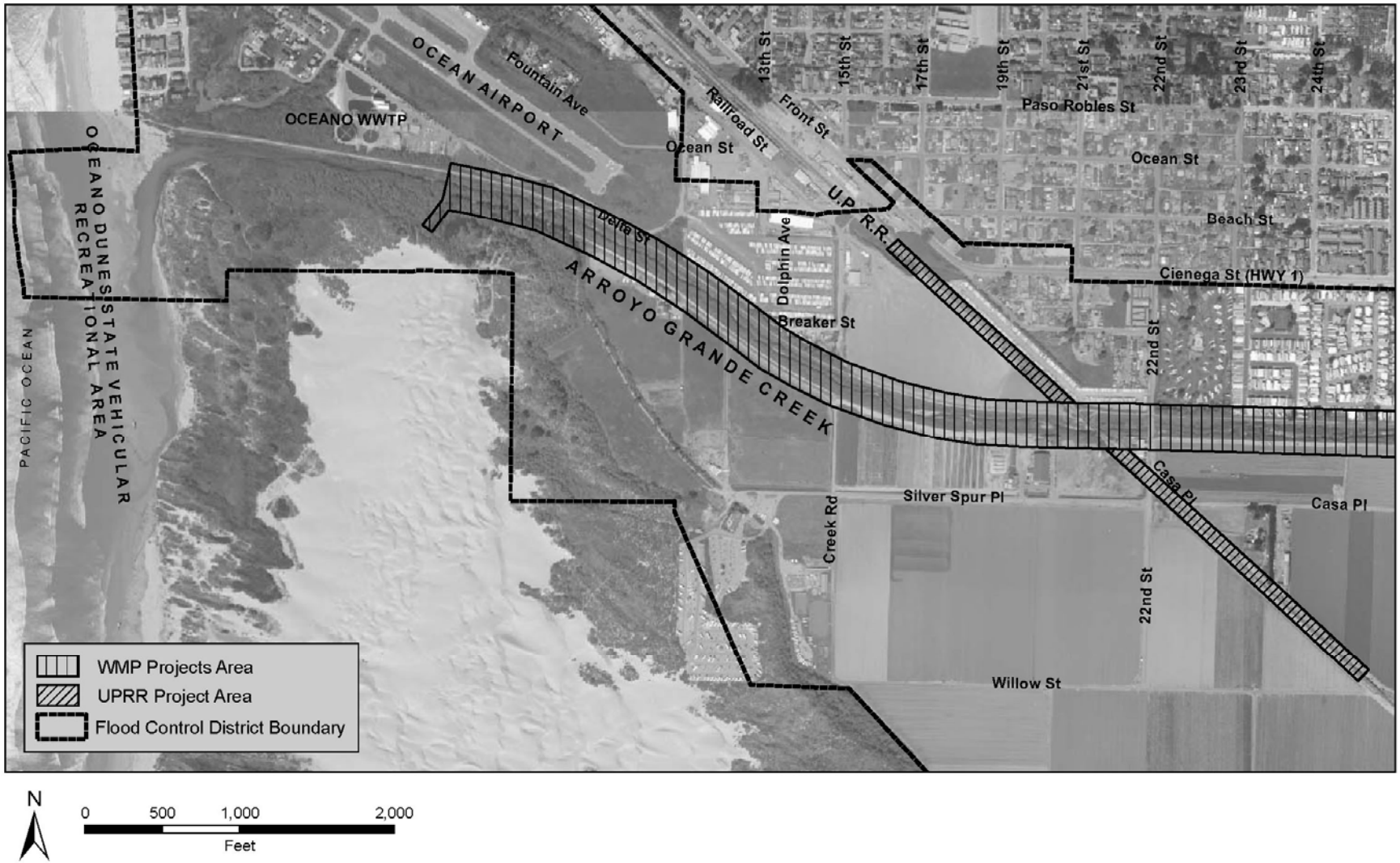
c. Structure Encroachment

There are a number of locations along Arroyo Grande Creek Channel where structures have been constructed within the right-of-way. Many of these structures would be impacted by the construction of Levee Raise Alternative 3a and/or 3c. These structures include water tanks, stalls, a barn, propane tanks, and a mobile home, among others. The degree to which they encroach varies. Some would only be affected by work on alternative 3c, for example. The actual encroachment issues will not be known until the construction plans have been further

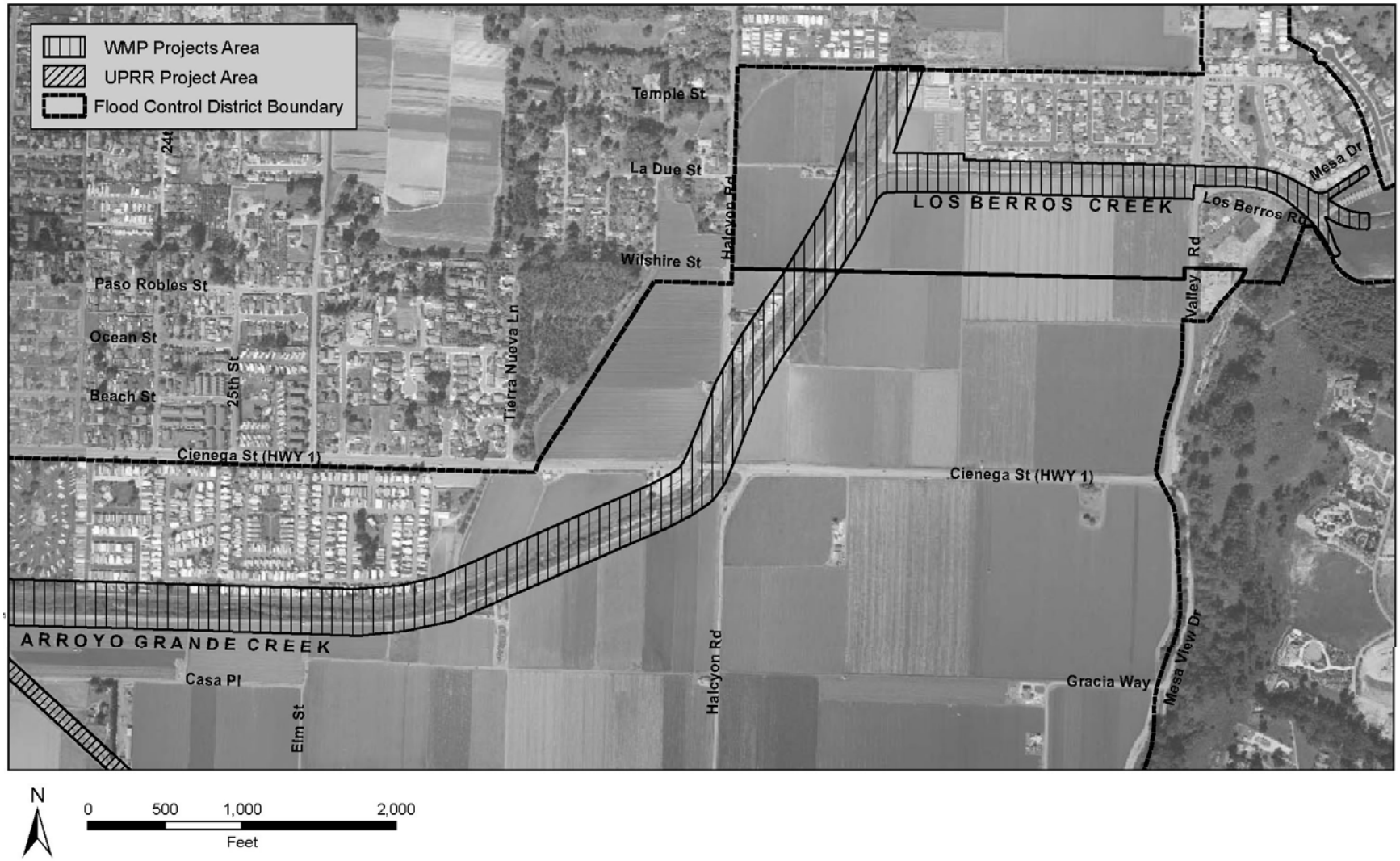
refined. It may be possible to design around these structures through the use of retaining walls or other alternate design techniques.

d. 22nd Street Bridge Modification

The 22nd Street Bridge is considered a "perched" bridge. This means that if water is allowed to flow over the bridge it will not continue to flow perpendicular to the bridge deck but would turn and flow parallel, potentially creating flooding to adjacent properties. Alternative 3a would only require the installation of a short length of concrete floodwall along the north side of the upstream levee. As part of alternative 3c, the project would include replacing the open bridge railing with a solid concrete barrier on the upstream side of the bridge. It would also require construction of concrete floodwalls on both the north and south levees, to keep floodwaters in the channel. It should be noted that the 22nd bridge, unlike the railroad bridge does not create a hydraulic constriction.



Project Area
FIGURE 4a



Project Area
FIGURE 4b

ATTACHMENT B

- **Initial Study Checklist**

COUNTY OF SAN LUIS OBISPO
INITIAL STUDY SUMMARY - ENVIRONMENTAL CHECKLIST
(ver 2.1)

Project Title & No. Arroyo Grande Creek Channel Waterway Management Program ED 07-243

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED: The proposed project could have a "Potentially Significant Impact" for at least one of the environmental factors checked below. Please refer to the attached pages for discussion on mitigation measures or project revisions to either reduce these impacts to less than significant levels or require further study.

☐ Aesthetics	☒ Geology and Soils	☐ Recreation
☒ Agricultural Resources	☒ Hazards/Hazardous Materials	☒ Transportation/Circulation
☒ Air Quality	☐ Noise	☐ Wastewater
☒ Biological Resources	☐ Population/Housing	☒ Water
☒ Cultural Resources	☐ Public Services/Utilities	☒ Land Use

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation, the Environmental Coordinator finds that:

☐ The proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ Although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ The proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

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

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

Keith Miller, Morro Group/SWCA — May 26, 2009
Prepared by (Print) — Signature — Date

Ellen Carroll,
Environmental Coordinator
Reviewed by (Print) — Signature (for) — Date

Project Environmental Analysis

The County's environmental review process incorporates all of the requirements for completing the Initial Study as required by the California Environmental Quality Act (CEQA) and the CEQA Guidelines. The Initial Study includes staff's on-site inspection of the project site and surroundings and a detailed review of the information in the file for the project. In addition, available background information is reviewed for each project. Relevant information regarding soil types and characteristics, geologic information, significant vegetation and/or wildlife resources, water availability, wastewater disposal services, existing land uses and surrounding land use categories and other information relevant to the environmental review process are evaluated for each project. Exhibit A includes the references used, as well as the agencies or groups that were contacted as a part of the Initial Study. The Environmental Division uses the checklist to summarize the results of the research accomplished during the initial environmental review of the project.

Persons, agencies or organizations interested in obtaining more information regarding the environmental review process for a project should contact the County of San Luis Obispo Environmental Division, Rm. 200, County Government Center, San Luis Obispo, CA, 93408-2040 or call (805) 781-5600.

A. PROJECT

DESCRIPTION: See attached.

ASSESSOR PARCEL NUMBER(S): multiple SUPERVISORIAL DISTRICT # 4

B. EXISTING SETTING

PLANNING AREA: South County (Coastal), South County (Inland)

LAND USE CATEGORY: Agriculture

COMBINING DESIGNATION(S): Flood Hazard , Streams Riparian Vegetation , Coastal Appealable Zone

EXISTING USES: Leveed flood control channel

TOPOGRAPHY: Nearly level

VEGETATION: Riparian , ruderal

PARCEL SIZE: Not applicable

SURROUNDING LAND USE CATEGORIES AND USES:

North: Residential Single Family; various residential uses Public Facilities; WWTP, Oceano airport	*East:* Agriculture; intensive agriculture, row crops single family residences
South: Agriculture; intensive agriculture, row crops	*West:* Recreation; Oceano Dunes SRVA

C. ENVIRONMENTAL ANALYSIS

During the Initial Study process, several issues were identified as having potentially significant environmental effects (see following Initial Study). Those potentially significant items associated with the proposed uses can be minimized to less than significant levels.

COUNTY OF SAN LUIS OBISPO
INITIAL STUDY CHECKLIST

1. **AESTHETICS** - ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Create an aesthetically incompatible site open to public view?	☐	☐	☒	☐
b) Introduce a use within a scenic view open to public view?	☐	☐	☒	☐
c) Change the visual character of an area?	☐	☐	☒	☐
d) Create glare or night lighting, which may affect surrounding areas?	☐	☐	☒	☐
e) Impact unique geological or physical features?	☐	☐	☒	☐
f) Other:_____	☐	☐	☐	☐

Setting. The project would be visible from Halcyon Road, Los Berros Road, Valley Road, Highway 1 and 22nd Street, among others. Much of the routine vegetation and sediment management maintenance work would occur within the levees and only periodically. Levee construction would be visible from public roads. The proposed improvements would result in a maximum levee raise of approximately 5 feet in some places, although this would not be necessary along the entire levee. The railroad bridge would be raised approximately 5 feet as well.

The proposed project would not result in glare or night lighting, change the visual character of an area, or block any ridgelines or scenic views. The levee raising would occur over an extended period of time and result in levees that are a maximum of approximately five feet higher than they are currently. The raised levees would not be tall enough to block any scenic views or unique visual features. The project is not in the vicinity of unique geologic features.

Impact. No significant visual impacts are expected to occur.

Mitigation/Conclusion. No mitigation measures are necessary.

2. AGRICULTURAL RESOURCES - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Convert prime agricultural land to non-agricultural use?	☒	☐	☐	☐
b) Impair agricultural use of other property or result in conversion to other uses?	☐	☒	☐	☐
c) Conflict with existing zoning or Williamson Act program?	☐	☒	☐	☐
d) Other: _____	☐	☐	☐	☐

Setting. The proposed project is located within the Cienega Valley, a productive agricultural region. Row crops are common in the area, and a wide variety of crops are grown. Significant agricultural improvements have been made as well, including irrigation systems, barns, stalls, and other agricultural accessory structures. In some cases, landowners utilize access points along the levee, facilitating movement of machinery while avoiding public roads. Based on a preliminary evaluation, four large parcels located adjacent to the levee may be under an agricultural land conservation contract.

Impact. Proposed levee improvements, particularly Alternative 3c the long term levee raise, would require disturbance beyond the existing levee footprint. Temporary and permanent easements may be required to accommodate proposed improvements. Construction staging areas may also temporarily reduce the amount of land available for agricultural production. Agricultural structures currently encroach on the levee easement, and in some cases those structures may need to be relocated to facilitate construction of the levee raises.

The proposed project may result in prime soils being converted to a non-agricultural use. Improvements could impair or conflict with the use of existing agricultural improvements. Construction and maintenance activities could conflict with agricultural activities. The proposed project would reduce flooding frequency and intensity, potentially improving agricultural productivity.

Mitigation/Conclusion. The County of San Luis Obispo has not developed any standard mitigation for the permanent loss of prime soils. However, it should be noted that the loss of the soils may result from a project that improves the agricultural viability of the area by decreasing flood risk. This issue would be evaluated in the EIR. Mitigation measures may include minimizing the size of staging and construction areas, preservation/relocation of topsoil, and inclusion of a WMP component that addresses conflicts between construction and maintenance activities, and agricultural activities. It does not appear that the proposed project would conflict with existing Williamson Act contracts, but this issue would be evaluated in the EIR.

3. AIR QUALITY - *Will the project:*		Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a)	***Violate any state or federal ambient air quality standard, or exceed air quality emission thresholds as established by County Air Pollution Control District?***	☐	☒	☐	☐
b)	***Expose any sensitive receptor to substantial air pollutant concentrations?***	☐	☐	☒	☐
c)	***Create or subject individuals to objectionable odors?***	☐	☐	☒	☐
d)	***Be inconsistent with the District's Clean Air Plan?***	☐	☐	☒	☐
e)	***Other:*** _____	☐	☐	☐	☐

Setting. The Air Pollution Control District (APCD) has developed the 2003 CEQA Air Quality Handbook to evaluate project specific impacts and help determine if air quality mitigation measures are needed, or if potentially significant impacts could result. To evaluate long-term emissions, cumulative effects, and establish countywide programs to reach acceptable air quality levels, a Clean Air Plan has been adopted (prepared by APCD).

Impact. As proposed, the project will result in the disturbance along much of approximately 3.5 miles of the existing levee system. The initial sediment removal from the channel would occur in one year and require the "cut" of approximately 22,000 cubic yards of material. Levee improvements 3a and 3c, which would be constructed over multiple years, require approximately 14,350 and 67,000 cubic yards of fill, respectively. These construction activities would result in the creation of construction dust, as well as short- term vehicle construction emissions. Raising the railroad bridge would require approximately 90,000 yards of cut and fill (shoefly construction and removal) and 45,000 cubic yards of fill for the permanent raise of the bridge.

Mitigation/Conclusion. The URBEMIS air emissions modeling program would be used to estimate specific emission production in the EIR. That program would model emissions, including carbon dioxide, a greenhouse gas that may result from construction of the project. Mitigation measures would be developed subsequently and in accordance with the SLOAPCD CEQA Handbook.

4. BIOLOGICAL RESOURCES - *Will the project:*		Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a)	***Result in a loss of unique or special status species or their habitats?***	☐	☒	☐	☐
b)	***Reduce the extent, diversity or quality of native or other important vegetation?***	☐	☒	☐	☐

4. BIOLOGICAL RESOURCES - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
c) Impact wetland or riparian habitat?	☐	☒	☐	☐
d) Introduce barriers to movement of resident or migratory fish or wildlife species, or factors, which could hinder the normal activities of wildlife?	☐	☒	☐	☐
e) Other: _____	☐	☐	☐	☐

Setting. As part of the Analysis prepared for the Alternatives Study prepared by Swanson G+H, a Biotic Assessment was conducted. This assessment habitat mapping within the channel reach identified impacts to sensitive habitats and species. It was used by the CDFG to issue a Streambed Alteration Agreement which expires in 2009. According to a preliminary search of the California Natural Diversity Database (CNDDB, January 2008), a review of the Biotic Assessment, and familiarity with the project area, federally-listed plant and animal species protected under the Federal Endangered Species Act (FESA) have the potential for occurrence in or near the project site and could be affected by the proposed project. These include marsh sandwort (Arenaria paludicola), Gambel's water cress (Nasturtium gambelii), tidewater goby (Eucyclogobius newberryi), south-central California coast steelhead evolutionarily significant unit (ESU) (Oncorhynchus mykiss irideus), and California red-legged frog (Rana aurora draytonii). Several other sensitive species protected under the California Endangered Species Act (CESA) and/or CEQA may also have the potential for occurrence. The proposed project area also includes riparian habitat and wetlands. The mouth of Arroyo Grande Creek includes a lagoon.

The WMP would include measures intended to preserve and improve habitat within the levees. These measures include constructing channels such that they provide shade and pools for fish, providing habitat in the form of log structures, reducing willow growth, and replacing willows with more permanent species such as sycamore and cottonwoods.

Impact. The project site supports significant sensitive native vegetation, significant wildlife habitats, and special status species. Construction of the secondary channel, log structures, and 22nd Street Bridge floodwalls would involve heavy machinery working directly in the channel. Annual sediment management and levee improvements would involve heavy machinery operated from the top of the levee. Vegetation management would be performed by hand, similar to existing practices. Other activities may include temporary diversion and/or dewatering of the creek in some locations to facilitate construction. Impacts to sensitive species and habitats could occur during construction activities.

Mitigation/Conclusion. The WMP is expected to be "self-mitigating". In other words, policies and procedures would be incorporated into the program to mitigate potential significant impacts identified in the EIR to a less than significant level. As such, it would include policies addressing sensitive species, such as performing pre-construction red-legged frog surveys, nesting bird surveys, minimizing activities during the rainy season, and maintaining a 10-foot riparian buffer on either side of the active channel. The WMP would also promote adaptive management of the channel to address changes due to flows, channel morphology, vegetation growth, and agency requirements.

5. CULTURAL RESOURCES - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Disturb pre-historic resources?	☐	☒	☐	☐
b) Disturb historic resources?	☐	☒	☐	☐
c) Disturb paleontological resources?	☐	☐	☒	☐
d) Other:_____	☐	☐	☐	☐

Setting. The project is located in an area historically occupied by the Obispeno Chumash. Historic structures associated with the community of Halcyon are known to exist in the vicinity of the proposed project. Other structures, including the levee and the railroad bridge may also qualify as historic. The proposed project would modify the levees, and in some cases expand their footprint. The channel and adjacent areas are largely previously disturbed due to original levee construction and existing agricultural activities. No paleontological resources are known to exist in the area.

Impact. The project is an area that would be considered culturally sensitive due to its proximity to Arroyo Grande Creek, the Pacific Ocean, and known resources. Construction would occur almost entirely within previously disturbed areas, and therefore impacts may be avoidable.

Mitigation/Conclusion. A cultural resources surface survey and an assessment of potentially historic architectural resources are currently being prepared for the project and their conclusions would be incorporated into the EIR. Mitigation measures would vary considerably depending on the resources discovered. Typical mitigation measures may include pre-construction documentation of historic structures, and monitoring during excavation of native soils. The measures would focus on avoidance of the resources to the extent feasible.

6. GEOLOGY AND SOILS - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Result in exposure to or production of unstable earth conditions, such as landslides, earthquakes, liquefaction, ground failure, land subsidence or other similar hazards?	☐	☒	☐	☐
b) Be within a California Geological Survey "Alquist-Priolo Earthquake Fault Zone"?	☐	☐	☐	☒
c) Result in soil erosion, topographic changes, loss of topsoil or unstable soil conditions from project-related improvements, such as vegetation removal, grading, excavation, or fill?	☐	☒	☐	☐

6. GEOLOGY AND SOILS - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
d) Change rates of soil absorption, or amount or direction of surface runoff?	☐	☒	☐	☐
e) Include structures located on expansive soils?	☐	☒	☐	☐
f) Change the drainage patterns where substantial on- or off-site sedimentation/ erosion or flooding may occur?	☐	☒	☐	☐
g) Involve activities within the 100-year flood zone?	☐	☒	☐	☐
h*) Be inconsistent with the goals and policies of the County's Safety Element relating to Geologic and Seismic Hazards?*	☐	☒	☐	☐
i) Preclude the future extraction of valuable mineral resources?	☐	☐	☐	☒
j) Other:_____	☐	☐	☐	☐

Setting. GEOLOGY - The topography of the project is nearly level. The area proposed for development is outside of the Geologic Study Area designation. A geotechnical evaluation has been prepared by Fugro West for the proposed project. The evaluation considers existing levee stability and the feasibility of the proposed project. It identifies hazards, such as expansive soils and the saturated soils associated with the channel. The evaluation recommends slopes that would remain stable and provided specific measures that should be taken during construction to ensure the long-term competence of the levees. The landslide risk potential is considered negligible. The liquefaction potential during a ground-shaking event is considered high. No active faulting is known to exist on or near the subject property. The project is not within a known area containing serpentine or ultramafic rock or soils.

DRAINAGE – The flood control channel is at the downstream, lower gradient terminus of the Arroyo Grande Creek Watershed and has already received the majority of the runoff from the watershed. Its capacity to accommodate the flows has decreased over time. Drainage patterns beyond the levee would only change in that flooding severity and frequency would be reduced in the Cienaga Valley.

SEDIMENTATION AND EROSION – When highly erosive conditions exist, a sedimentation and erosion control plan is required (LUO Sec. 22.52.090) to minimize these impacts. When required, the plan is prepared by a civil engineer to address both temporary and long-term sedimentation and erosion impacts. Projects involving more than one acre, such of disturbance are subject to the preparation of a Storm Water Pollution Prevention Plan (SWPPP), which focuses on controlling storm water runoff. The Regional Water Quality Control Board is the local extension who monitors this program.

Impact. As proposed, the project will result in the disturbance of portions of the north and south levees and the channel, within the lower 3.5 miles of Arroyo Grande Creek Channel and the Los Berros Creek Diversion channel. The proposed project is expected to reduce flooding frequency and

severity for properties in Flood Control Zone 1/1A by providing increased capacity within the flood control facility. Construction activities associated with the levee improvements have the potential to result in temporary erosion and sedimentation of the flood control channel. The project would result in a northern levee that is higher than the southern levee. As discussed in the Project Description, the northern levee is currently maintained at a higher elevation so that initially floodwaters would overtop the southern levee prior to the northern one, reducing the potential for floodwaters to impact public facilities and residential structures. This design feature would remain with the proposed project. This built-in preference to overtop the southern levee first may result in greater flood-related disturbance of the southern levee.

Mitigation/Conclusion. A preliminary geotechnical evaluation of the proposed project has been prepared. Based on that report, it appears that the proposed project is feasible and standard engineering and construction methods would be adequate to construct and maintain the levee improvements. There is no evidence that measures above what is identified in the report and those that are already required by ordinance or codes are needed. The conclusions of that report and associated local, state and federal requirements will be summarized in the EIR.

7. HAZARDS & HAZARDOUS MATERIALS - ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Result in a risk of explosion or release of hazardous substances (e.g. oil, pesticides, chemicals, radiation) or exposure of people to hazardous substances?	☐	☒	☐	☐
b) Interfere with an emergency response or evacuation plan?	☐	☒	☐	☐
c) Expose people to safety risk associated with airport flight pattern?	☐	☐	☒	☐
d) Increase fire hazard risk or expose people or structures to high fire hazard conditions?	☐	☐	☒	☐
e) Create any other health hazard or potential hazard?	☐	☒	☐	☐
f) Other: _____	☐	☐	☐	☐

Setting. The project is not located in an area of known hazardous material contamination. The project is not within a high severity risk area for fire. The project is within the Airport Review area for the Oceano Airport. A Phase I Environmental Site Assessment (ESA) is currently being prepared for the proposed project. This assessment would identify potentially hazardous materials that may be located in the projects area of disturbance.

Impact. The project does not propose the use of hazardous materials. The project does not present a significant fire safety risk. The project is not expected to conflict with any regional evacuation plan. The project would require disturbance of the existing railroad grade. Railroad right-of-ways may have elevated levels of heavy metals and/ or other contaminates, which could become airborne during

construction.

The proposed project would reduce flooding frequency and severity, and as a result would also reduce the possibility that flood waters could transport hazardous substances which could affect residents or property. Due to the southern levee being 4 to 6 inches lower than the northern one, areas south of the channel are currently more likely to flood than areas to the north. This situation would remain under the proposed project. This is discussed in the Geology and Soils section.

Mitigation/Conclusion. Mitigation to address possible railroad contamination would require site specific testing prior to construction. Depending on the level of contamination, specific handling of the soil may be required. The EIR will summarize the results of the ESA.

8. NOISE - ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Expose people to noise levels that exceed the County Noise Element thresholds?	☐	☐	☒	☐
b) Generate increases in the ambient noise levels for adjoining areas?	☐	☐	☒	☐
c) Expose people to severe noise or vibration?	☐	☐	☒	☐
d) Other: _____	☐	☐	☐	☐

Setting. The project is not within close proximity of loud noise sources. Based on the Noise Element's projected future noise generation from known stationary and vehicle-generated noise sources, the project is within an acceptable threshold area. The levee improvements may require construction in close proximity to residences. The preliminary sediment removal would require significant truck activity in proximity to residences.

Impact. The project is not expected to generate loud noises for extended periods. Construction would be limited to daytime hours, as required by local ordinance.

Mitigation/Conclusion. No significant noise impacts are anticipated, and no mitigation measures are necessary.

9. POPULATION/HOUSING - ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Induce substantial growth in an area either directly or indirectly (e.g., through projects in an undeveloped area or extension of major infrastructure)?	☐	☐	☒	☐

9. POPULATION/HOUSING - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
b) Displace existing housing or people, requiring construction of replacement housing elsewhere?	☐	☐	☒	☐
c) Create the need for substantial new housing in the area?	☐	☐	☒	☐
d) Use substantial amount of fuel or energy?	☐	☐	☒	☐
e) Other: _____	☐	☐	☐	☐

Setting. The proposed project include construction of levee improvements, sedimentation and vegetation management.

Impact. The project will not result in a need for a significant amount of new housing, and will not displace existing housing.

Mitigation/Conclusion. No significant population and housing impacts are anticipated, and no mitigation measures are necessary.

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10. PUBLIC SERVICES/UTILITIES - *Will the project have an effect upon, or result in the need for new or altered public services in any of the following areas:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Fire protection?	☐	☐	☒	☐
b) Police protection (e.g., Sheriff, CHP)?	☐	☐	☒	☐
c) Schools?	☐	☐	☒	☐
d) Roads?	☐	☐	☒	☐
e) Solid Wastes?	☐	☐	☒	☐
f) Other public facilities?	☐	☐	☒	☐
g) Other: _____	☐	☐	☐	☐

Setting. The project area is served by the County Sheriff's Department and CDF/County Fire as the primary emergency responders.

Impact. No significant project-specific impacts to utilities or public services were identified.

Mitigation/Conclusion. No impacts would result and no mitigation measures are required.

11. RECREATION - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Increase the use or demand for parks or other recreation opportunities?	☐	☐	☒	☐
b) Affect the access to trails, parks or other recreation opportunities?	☐	☐	☒	☐
c) Other _____	☐	☐	☐	☐

Setting. The County Trails Plan does not show that a potential trail goes through the proposed project. The levees are located on private property and are not considered a recreational facility, but they are used by some residents for horseback riding and walking as they provide an off-road connection between the Cienega Valley and the Pacific Ocean.

Impact. The existing recreational use, while not encouraged or allowed by the County of San Luis Obispo, would most likely remain due to the infeasibility of monitoring use of the levee by local residents.

The proposed project will not create a significant need for additional park or recreational resources.

Mitigation/Conclusion. No significant recreation impacts are anticipated, and no mitigation measures are necessary.

12. TRANSPORTATION/ CIRCULATION - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Increase vehicle trips to local or areawide circulation system?	☐	☒	☐	☐
b) Reduce existing "Levels of Service" on public roadway(s)?	☐	☐	☒	☐
c) Create unsafe conditions on public roadways (e.g., limited access, design features, sight distance, slow vehicles)?	☐	☒	☐	☐
d) Provide for adequate emergency access?	☐	☐	☒	☐
e) Result in inadequate parking capacity?	☐	☐	☒	☐
f) Result in inadequate internal traffic circulation?	☐	☐	☒	☐

12. TRANSPORTATION/ CIRCULATION - *Will the project:*		Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
g)	***Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., pedestrian access, bus turnouts, bicycle racks, etc.)?***	☐	☐	☒	☐
h)	***Result in a change in air traffic patterns that may result in substantial safety risks?***	☐	☐	☒	☐
i)	***Other:*** _____	☐	☐	☐	☐

Setting. Future development will access onto the following public road(s): Highway 1, Halcyon Road, Los Berros Road, 22nd Street, and Valley Road. The identified roadways are operating at acceptable levels. The proposed project would occur in the same location as the proposed Halcyon Road improvements.

Impact. The proposed project would generate significant construction-related traffic during the initial sediment removal and during levee improvements. Specific daily truck trips which may be generated by the project are unknown at this time. Large trucks pulling out onto public roads could affect local traffic safety. The levee improvements would require moving Halcyon Road. This may conflict with other plans to improve the Halcyon Road and Highway 1 intersection.

Mitigation/Conclusion. It appears that a construction traffic management plan may be necessary to address construction traffic during high activity periods. The EIR will evaluate the potential of the proposed project to conflict with the proposed Halcyon Road/Highway1 intersection improvements

13. WASTEWATER - *Will the project:*		Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a)	***Violate waste discharge requirements or Central Coast Basin Plan criteria for wastewater systems?***	☐	☐	☒	☐
b)	***Change the quality of surface or ground water (e.g., nitrogen-loading, daylighting)?***	☐	☐	☒	☐
c)	***Adversely affect community wastewater service provider?***	☐	☐	☒	☐
d)	***Other:*** _____	☐	☐	☐	☐

Setting. The proposed project would not generate wastewater.

Impact. No impacts would result of the project.

Mitigation/Conclusion. No mitigation measures are necessary.

14. WATER - ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Violate any water quality standards?	☐	☒	☐	☐
b) Discharge into surface waters or otherwise alter surface water quality (e.g., turbidity, temperature, dissolved oxygen, etc.)?	☐	☒	☐	☐
c) Change the quality of groundwater (e.g., saltwater intrusion, nitrogen-loading, etc.)?	☐	☐	☒	☐
d) Change the quantity or movement of available surface or ground water?	☐	☐	☒	☐
e) Adversely affect community water service provider?	☐	☐	☒	☐
f) Other: _____	☐	☐	☐	☐

Setting. The proposed project would only require water for dust control during construction activities. This would be trucked in or potentially come from neighboring wells.

Projects involving more than one acre of disturbance are subject to preparation of a Storm Water Pollution Prevention Plan (SWPPP) to minimize on-site sedimentation and erosion.

Impact. Regarding surface water quality, as proposed, the project will result in the disturbance of large sections of the Arroyo Grande Creek Channel and Los Berros Creek Diversion Channel levee system. These activities have the potential to introduce additional sediment to the channel. Construction may also require channel dewatering or diversion in some cases. Implementation of the full WMP would result in a channel and levee system capable of accommodating up to a 20-year flood. It would reduce the frequency and intensity of flooding events in the Cienega valley. It is unclear at this time how this may affect local groundwater conditions.

Mitigation/Conclusion. The WMP would include BMPs to address stormwater quality during construction. The project would require a SWPPP. The Biological Resources section and Geology and Soils section would also include measures intended to reduce water quality impacts as they relate to construction and biological resources. Standard drainage and erosion control measures will be required for the proposed project and will provide sufficient measures to adequately protect surface water quality.

15. LAND USE - *Will the project:*	Inconsistent	Potentially Inconsistent	Consistent	Not Applicable
a) Be potentially inconsistent with land use, policy/regulation (e.g., general plan [county land use element and ordinance], local coastal plan, specific plan, Clean Air Plan, etc.) adopted to avoid or mitigate for environmental effects?	☐	☒	☐	☐
b) Be potentially inconsistent with any habitat or community conservation plan?	☐	☐	☒	☐
c) Be potentially inconsistent with adopted agency environmental plans or policies with jurisdiction over the project?	☐	☐	☒	☐
d) Be potentially incompatible with surrounding land uses?	☐	☐	☒	☐
e) Other: _____	☐	☐	☐	☐

Setting/Impact. Surrounding uses are identified on Page 2 of the Initial Study. The proposed project will be reviewed for consistency with policy and/or regulatory documents relating to the environment and appropriate land use (e.g., County Land Use Ordinance, Local Coastal Plan, etc.). The NOP will be sent to outside agencies to review for policy consistencies (e.g., CDF for Fire Code, APCD for Clean Air Plan, etc.).

Mitigation/Conclusion. Land use inconsistencies would be discussed in the applicable section of the EIR, and/or in the Environmental Setting section.

16. MANDATORY FINDINGS OF SIGNIFICANCE - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)	☐	☒	☐	☐
c) Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

For further information on CEQA or the county's environmental review process, please visit the County's web site at "www.sloplanning.org" under "Environmental Review", or the California Environmental Resources Evaluation System at: "http://ceres.ca.gov/topic/env_law/ceqa/guidelines/" for information about the California Environmental Quality Act.

Exhibit A - Initial Study References and Agency Contacts

The County Planning or Environmental Division have contacted various agencies for their comments on the proposed project. With respect to the subject application, the following have been contacted (marked with an ☒) and when a response was made, it is either attached or in the application file:

Contacted	Agency	Response
☐	County Public Works Department	**Project proponent**
☒	County Environmental Health Division	**Will receive NOP**
☒	County Agricultural Commissioner's Office	**Will receive NOP**
☒	County Airport Manager	**Will receive NOP**
☒	Airport Land Use Commission	**Will receive NOP**
☒	Air Pollution Control District	**Will receive NOP**
☒	County Sheriff's Department	**Will receive NOP**
☒	Regional Water Quality Control Board	**Will receive NOP - has expressed concerns over alternatives in the past**
☒	CA Coastal Commission	**Will receive NOP**
☒	CA Department of Fish and Game	**Will receive NOP**
☒	CA Department of Forestry	**Will receive NOP**
☒	CA Department of Transportation	**Will receive NOP**
☒	OceanoCommunity Service District	**Will receive NOP**
☒	Other Army Corp of Engineers	**Will receive NOP**
☒	Other USFWS	**Will receive NOP**

*** "No comment" or "No concerns"-type responses are usually not attached*

The following checked ("☒") reference materials have been used in the environmental review for the proposed project and are hereby incorporated by reference into the Initial Study. The following information is available at the County Planning and Building Department.

☐ Project File for the Subject Application

County documents

☐ Airport Land Use Plans
☐ Annual Resource Summary Report
☒ Building and Construction Ordinance
☐ Coastal Policies
☒ Framework for Planning (Coastal & Inland)
☒ General Plan (Inland & Coastal), including all maps & elements; more pertinent elements considered include:
  - ☒ Agriculture & Open Space Element
  - ☐ Energy Element
  - ☐ Environment Plan (Conservation, Historic and Esthetic Elements)
  - ☐ Housing Element
  - ☒ Noise Element
  - ☒ Parks & Recreation Element
  - ☒ Safety Element

☒ Land Use Ordinance
☐ Real Property Division Ordinance
☐ Trails Plan

Other documents

☐ Archaeological Resources Map
☐ Area of Critical Concerns Map
☒ Areas of Special Biological Importance Map
☒ California Natural Species Diversity Database
☒ Clean Air Plan
☒ Fire Hazard Severity Map
☒ Flood Hazard Maps
☒ Natural Resources Conservation Service Soil Survey for SLO County
☐ Regional Transportation Plan
☐ Uniform Fire Code
☒ Water Quality Control Plan (Central Coast Basin – Region 3)
☒ GIS mapping layers (e.g., habitat, streams, contours, etc.)

In addition, the following project specific information and/or reference materials have been considered as a part of the Initial Study:

Fugro West, Inc. *Preliminary Geotechnical Report Arroyo Grande Creek*, April 22, 2009.

Morro Group, *Halcyon Road Master Environmental Impact Report*, 2007.

Swanson H+G, *Arroyo Grande Creek Erosion, Sedimentation, and Flooding Alternatives Study*, 2006.

Swanson H+G, *Tech Memos prepared for the Department of Public Works (various)*, 2007-2009

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

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IN REPLY REFER TO:
81440-2009-FA-0100

JUL 2 2009

July 1, 2009

John Farhar
Department of Public Works
County of San Luis Obispo
c/o Mary B. Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, California 93401-2954

Subject: Comments on the Draft Environmental Impact Report for the Proposed Arroyo Grande Creek Channel Waterway Management Program, Arroyo Grande, San Luis Obispo County, California

Dear Mr. Farhar,

We are responding to your request, dated June 5, 2009, and received in our office on June 8, 2009, for comments on the draft environmental impact report (DEIR) for the subject project. The proposed project is a cooperative effort between the community of Arroyo Grande, the Coastal San Luis Resource Conservation District (RCD), and the San Luis Obispo County Flood Control and Water Conservation District (District). The proposed project is located within city of Arroyo Grande, San Luis Obispo County, along the lower reaches of Arroyo Grande Creek, near the intersection of Los Berros Creek to the Arroyo Grande Lagoon, and along Los Berros Creek from Century Lane to the confluence with Arroyo Grande Creek. This area is within the District zones 1 and 1A. The proposed Arroyo Grande Creek Channel Waterway Management Program (WMP) includes management of the riparian vegetation annually to maintain a composite roughness (determined from the values of the factors that affect the roughness of channels and flood plains; in densely vegetated flood plains, the major roughness is caused by trees, vines, and brush) of 0.040 within the flood control reach; filling existing gaps in the riparian corridor vegetation; encouraging species diversity by planting riparian tree species; removing sediment to create secondary channels that could be self-maintaining; monitoring the area annually to evaluate future sediment deposition and the need for annual maintenance of accumulated sediments; raising the levees throughout the flood control channel to achieve channel capacity for up to 10-year flow events; and eventually raising the levees throughout the flood control channel to achieve channel capacity for up to 20-year flow events. Additionally, there are some secondary components of the proposed project that would be required in order to accomplish raising the levees to the 10- and 20-year flow events, including replacing the Union Pacific Railroad Bridge, elevation of or relocation of Halcyon Road for 600 feet of the road, which adjoins Arroyo Grande Creek, potential movement of several small structures located in

the right-of-way along the Arroyo Grande Creek Channel, and the modification of the 22nd Street Bridge. The total length of the flood control channels addressed in the WMP is approximately 3.5 miles.

Specifically, the vegetation management program would consist of maintaining a 10-foot riparian buffer on either side of the low-flow channel. All vegetation directly outside of the buffer area would be removed completely. Willows (*Salix* spp.) present within the buffer zone would be limbed to reduce the cross-sectional roughness and gaps within the buffer zone would be revegetated with native vegetation including cottonwood (*Populus* spp.), sycamore (*Platanus racemosa* spp.), and willow. The sediment management consists of excavating some secondary channels along the Arroyo Grande Creek, to provide an area for overflow. No sediment in the primary channel would be excavated. Approximately 21,000 cubic yards of sediment would be removed from the Arroyo Grande Creek and Los Berros channels initially and there would be smaller-scale sediment removal and maintenance that would occur annually. Thirty-five large wooden structures would be placed at the confluence of the connections between the active and secondary channels to enhance the available aquatic habitat for federally threatened steelhead (*Oncorhynchus mykiss*) and California red-legged frog (*Rana aurora draytonii*). The levee raising portion of the proposed project, consisting of a short-term levee raise to the 10-year storm level, would require raising the banks of the creek anywhere from 6 inches to 2 feet and placement of 14,350 cubic yards of fill over several years. The longer-term levee raise to the 20-year storm level would require raising the banks of the channel approximately 2.8 to 5 feet from existing grade and placement of approximately 67,000 cubic yards of fill (including the 14,350 cubic yards of fill from the short-term levee raise). The first component required for completion of the levee raising for the proposed project is the replacement of the Union Pacific Railroad Bridge. This bridge would have to be raised approximately 5 feet, by creating a gentle slope that starts 1,700 feet north and 2,400 feet south of the bridge and requiring the movement of approximately 135,000 cubic yards of dirt. The second component necessary to accomplish the proposed levee raising is shifting the 600 feet of Halcyon Road that adjoins the creek channel to the west or elevating that portion of the road approximately 5.5 feet. Additionally, some of the small structures that are within the creek channel right-of-way would need to be either relocated or designed around. Lastly, the proposed levee-raising would include replacing the open bridge railing of the 22nd Street Bridge with a solid concrete barrier on the upstream side of the bridge, in addition to the construction of concrete floodwalls on the levees on both the north and south side of the bridge.

The U.S. Fish and Wildlife Service's (Service) responsibilities include administering the Endangered Species Act of 1973, as amended (Act), including sections 7, 9, and 10. Section 9 of the Act prohibits the taking of any federally listed endangered or threatened species. Section 3(18) of the Act defines take to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Service regulations (50 CFR 17.3) define harm to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly

disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Exemptions to the prohibitions against take may be obtained through the Service in two ways: through interagency consultation for projects with Federal involvement pursuant to section 7, or through the issuance of an incidental take permit under section 10(a)(1)(B) of the Act.

We are concerned about the potential adverse impacts of the proposed project on the federally endangered least Bell's vireo (*Vireo bellii pusillas*), southwestern willow flycatcher (*Empidonax traillii extimus*), marsh sandwort (*Arenaria paludicola*), Gambel's watercress (*Nasturtium gambelii*), and tidewater goby (*Eucyclogobius newberryi*), and threatened California red-legged frog. The DEIR indicates that the sources of information used in developing the biological resources section included a search of rare, sensitive, threatened, and endangered species in the California Natural Diversity Database in 2008; a review of the biotic assessment for the proposed project; and the consultant's personal knowledge of the area. We have not been provided with a copy of the biological assessment that was conducted for the proposed project.

There are historic records of marsh sandwort, Gambel's watercress, and tidewater goby, and California red-legged frog occurrence within the vicinity of the subject project; however, we are unaware of whether recent pre-construction or protocol level surveys have been conducted for these species in the area. We recommend that pre-construction surveys are conducted for the marsh sandwort, Gambel's watercress, and California red-legged frog to determine whether these species occur within the subject project area. There is suitable California red-legged frog dispersal and breeding habitat on-site within the subject project area and it is reasonable to expect that individual California red-legged frogs make overland excursions between the drainages in this region and therefore may be adversely impacted by the subject project activities, as proposed in the Initial Study. Additionally, we recommend that the appropriate level of surveys are conducted for the tidewater goby, according to the guidelines in Appendix F of the recovery plan for the tidewater goby (Service 2005). If tidewater gobies occur within or downstream of the proposed project area, they could be adversely impacted by the proposed alteration of the existing creek channel, as well as stormwater runoff, erosion, or actions directly related to the construction activities within the proposed project site. Fine sediment could degrade tidewater goby habitat and smother tidewater goby eggs; therefore, best management practices and erosion control measures should be implemented on-site to reduce impacts to the tidewater goby. We recommend that you conduct surveys according Service protocol for the least Bell's vireo and southwestern willow flycatcher prior to commencement of the proposed activities in habitat suitable for these species.

We are also concerned about the project's potential impacts to migratory birds. The Service has conservation responsibilities and management authority for migratory birds under the Migratory Bird Treaty Act of 1918, as amended (MBTA) (16 U.S.C. 703 et. seq.). Any land clearing or other surface disturbance associated with proposed actions should be timed to avoid potential destruction of bird nests or young of birds that breed in the area, as such destruction may be in violation of the MBTA. Under the MBTA, nests with eggs or young of migratory birds may not

be damaged, nor may migratory birds be killed. If this seasonal restriction is not possible, we recommend that a qualified biologist survey the area for nests or evidence of nesting (e.g., mated pairs, territorial defense, carrying of nesting material, transporting food) prior to the commencement of land clearing activities. If nests or other evidence of nesting are observed, a protective buffer should be delineated and the entire area should be avoided to prevent destruction or disturbance to nests until they are no longer active.

Based on our review of the proposed project and its associated supplemental information, we are unable to determine the extent of impacts of the proposed project on the California red-legged frog and other federally listed species that may occur in the project vicinity. To make a determination on the potential impacts of the proposed project on federally listed species, we would require the following information:

1. Specific information regarding the timeframe for implementing the proposed project.

2. Detailed information regarding the results from the proposed surveys that will be performed and any previous surveys that have been conducted for California red-legged frogs in the project area.

3. Detailed results from the biological assessment that was performed for the proposed project and from any other focused surveys that have been or will be performed for the following federally listed species that have the potential to occur within the project area: marsh sandwort, Gambel's watercress, tidewater goby, least Bell's vireo, and southwestern willow flycatcher. The DEIR does not indicate whether biological reconnaissance surveys were performed for all of these species.

4. More detailed information regarding the specific minimization measures for the proposed project that will reduce impacts to federally listed species within the proposed project area.

Only listed species receive protection under the Act. However, sensitive species should be considered in the planning process in the event they become listed or proposed for listing prior to project completion. We recommend that you review information in the California Department of Fish and Game's Natural Diversity Data Base. You can contact the California Department of Fish and Game at (916) 324-3812 for information on other sensitive species that may occur in this area.

This letter does not reflect a comprehensive review of the DEIR document on our part; however, we are concerned that the subject project, as proposed, could result in take of and/or adverse impacts to the least Bell's vireo, southwestern willow flycatcher, marsh sandwort, Gambel's watercress, tidewater goby, and California red-legged frog. Therefore, we recommend that you address these potential effects in the final EIR and if any federally listed species are found within the proposed project area during the surveys, we recommend that you initiate formal consultation with the Service through either Section 7 or Section 10 of the Act prior to the onset of any proposed project activities. Please note that despite the incorporation of any mitigation measures

developed pursuant to the California Environmental Quality Act, any take of listed species that could result from the proposed project would require exemption pursuant to section 7 or authorization pursuant to section 10 of the Act.

We appreciate the opportunity to provide comments on the proposed project and look forward to working with the County in the future. If you have any questions regarding these comments, please contact Heather Abbey of my staff at (805) 644-1766, extension 290.

Sincerely,

Chris Dellith
Senior Biologist

cc:
Anthony Spina, National Marine Fisheries Service
Bob Stafford, California Department of Fish and Game

REFERENCES

Bulger, J.B., N.J. Scott, and R.B. Seymour. 2003. Terrestrial activity and conservation of adult California red-legged frogs (*Rana aurora draytonii*) in coastal forests and grasslands. Biological Conservation 110(2003):85-95.

Hayes, M.P. and M.R. Jennings. 1985. Pre-1900 over harvest of California red-legged frogs (*Rana aurora draytonii*): the inducement for bullfrog (*Rana catesbeiana*) introduction. Herpetologica 31:94-103.

Hayes, M.P. and M.R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): implications for management. Pages 144-158. In Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. R. Sarzo, K.E. Severson, and D.R. Patton (technical coordinators). U.S.D.A. Forest Service General Technical Report RM-166.

U.S. Fish and Wildlife Service. 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

U.S. Fish and Wildlife Service. 2005. Recovery plan for the tidewater goby (*Eucyclogobius newberryi*). U.S. Fish and Wildlife Service, Portland, Oregon. vi + 199 pp.

Mary Reents

From: James Kilmer [james_kilmer@dot.ca.gov]
Sent: Sunday, July 26, 2009 10:23 PM
To: Mary Reents
Cc: Gary Ruggerone; Jim Mills
Subject: RE: Arroyo Grande Creek Channel Watreway Managment Program NOP

Hi Mary,
I received responses back from District 5 Hydraulics and Non-Capital Environmental - they don't have any comments. HQ structures hasn't sent any comments so we'll take that as a No Comment from them. It appears that Caltrans doesn't have any issues with your project.

Thanks Mary.

-James

James Kilmer
Associate Transportation Planner
District 5
Development Review

Phone # (805) 549-3683
Fax # (805) 549-3077

"Mary Reents" <mreents@swca.com> 07/10/2009 09:33 AM

To: "James Kilmer" <james_kilmer@dot.ca.gov>
cc: "Keith Miller" <klmiller@swca.com>, <jfarhar@co.slo.ca.us>
Subject: RE: Arroyo Grande Creek Channel Watreway Managment Program NOP

Hi James- Yes, you can have a time extension. We need your comments! Please get them in as soon as you can.

Mary B. Reents
Senior Consultant
SWCA Environmental Consultants
1422 Monterey Street, Suite C200
San Luis Obispo, CA 93401
*805) 543-7095X103
(805) 543-2367 (FAX)
mreents@SWCA.com
www.swca.com

-----Original Message-----
From: James Kilmer [mailto:james_kilmer@dot.ca.gov]

Sent: Thursday, July 09, 2009 3:00 PM
To: mreents@morrogroup.com
Subject: Arroyo Grande Creek Channel Watreway Managment Program NOP

Hi Mary,
The comments for the NOP are due tomorrow the10th. Is it possible to get a time extension on those comments?
-James

James Kilmer
Associate Transportation Planner
District 5
Development Review

Phone # (805) 549-3683
Fax # (805) 549-3077

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

In reply refer to:
SWR/2009/03881:MRM

AUG 19 2009

John Farhar
County of San Luis Obispo
Department of Public Works
c/o Mary B. Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, California 93401

Dear Mr. Farhar:

NOAA's National Marine Fisheries Service (NMFS) reviewed the June 5, 2009, Notice of Preparation (NOP) of a Draft Environmental Impact Report (EIR) for the Arroyo Grande Creek Channel Waterway Management Program (Program) near Arroyo Grande, California. As requested in the NOP, NMFS provides the following information to assist the County of San Luis Obispo (County) in formulating the EIR.

The Program is of concern because threatened steelhead (*Oncorhynchus mykiss*) and critical habitat for this species are present within the action area of Arroyo Grande Creek. Accordingly, the EIR should clearly identify and describe the Program including interrelated and interdependent actions to the extent that NMFS may develop an understanding of the potential effects (offsite, onsite, direct, indirect, temporary, permanent) of the Program on steelhead and critical habitat. The EIR should include a list of measures for avoiding and minimizing potential negative effects of the Program on steelhead and their habitat. Unavoidable effects should be fully described according to life stage (i.e., spawning, rearing and migration) and features of this species' habitat. The manner in which the preferred alternative would be implemented (e.g., construction schedule, level of manpower, equipment types, access roads) should be clearly described. The potential benefits of the Program for steelhead, including any compensatory mitigation measures, should be described. Engineered design drawings and results of topographic surveys and creek-hydraulic analyses should be included in the EIR.

Because the County included a brief project description with the June 5, 2009 NOP, NMFS provides the following additional specific comments on the Program. These comments are related to the general comments above and should be addressed in the EIR.

- Evidence provided in the ecological literature indicates that floodplains can impart an elevated level of biotic diversity, fish and invertebrate production, and habitat area and diversity. The Program specifies an increase in the elevation of the existing levees which is expected to continue to confine the creek within an artificially defined corridor and perpetuate the existing disconnect between the

creek and the historical floodplain, particularly those historical floodplain areas that are not developed with hard structures. Precluding Arroyo Grande Creek from entering the available historical floodplain during the wet season is expected to be unfavorable for the aquatic environment in general and the local population of steelhead in particular. The County should provide an analysis in the EIR on the effects to steelhead and critical habitat that will occur as a result of continuing to confine the creek within an artificially defined corridor rather than a more natural approach to promote stream connectivity with the historical floodplain.

- The EIR should provide an analysis to determine the degree that development of secondary overflow channels are expected to increase the potential that steelhead will become trapped or stranded in residual wetted areas outside the active creek channel as streamflow declines.

- Any channel modification to improve flood conveyance will likely result in a reduction in the complexity of instream and riparian habitat, which is expected to translate into a decreased ability to conserve threatened steelhead. The EIR should provide an analysis of the likelihood and extent of potential impacts that the Program will have as a result of reducing habitat complexity.

- The basis for the proposed width of the vegetated buffer (10ft) as part of the vegetation removal should be provided in the EIR. Currently, whether the proposed width is ecologically meaningful, is unknown. In addition, the terminology "limbed up" is not defined, but is presumed to imply that most tree limbs will be removed. Removing limbs from trees is not expected to favor over-summering juvenile steelhead, and may appreciably reduce the function and value of streamside vegetation as an essential feature of critical habitat for the species.

- The EIR should provide an analysis of the potential effects of long term and short term sediment removal activities on steelhead and critical habitat.

- Finally, the EIR should describe the relationship of the Program to Section 7 of the U. S. Endangered Species Act (ESA). In this regard, the EIR should disclose whether consultation with NMFS is necessary prior to undertaking the project, in accordance with Section 7 of the ESA.

NMFS appreciates the opportunity to provide information that would assist the County to develop the EIR for the subject Program. Matt McGoogan is NMFS' representative for this specific project. Please call him at (562) 980-4026 if you have any questions concerning this letter or if you require additional information.

Sincerely,

Rodney R. McInnis
Regional Administrator

cc: Margaret Roper, CDFG, San Luis Obispo, California
Roger Root, USFWS, Ventura, California
Copy to Administrative File: 151422SWR2009PR00360

STATE OF CALIFORNIA Arnold Schwarzenegger, *Govemor*

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-4082
(916) 657-5390 - Fax

JUN 16 2009

June 12, 2009

John Farhar
San Luis Obispo County Department of Public Works
C/O Mary B. Reents
Morro Group/SWCA, Suite C200
1422 Monterey St.
San Luis Obispo, CA 93401-2954

RE: SCH#2009061030 Arroyo Grande Creek Channel Waterway Management Program; San Luis Obispo County.

Dear Mr. Farhar:

The Native American Heritage Commission (NAHC) has reviewed the Notice of Preparation (NOP) referenced above. The California Environmental Quality Act (CEQA) states that any project that causes a substantial adverse change in the significance of an historical resource, which includes archeological resources, is a significant effect requiring the preparation of an EIR (CEQA Guidelines 15064(b)). To comply with this provision the lead agency is required to assess whether the project will have an adverse impact on historical resources within the area of project effect (APE), and if so to mitigate that effect. To adequately assess and mitigate project-related impacts to archaeological resources, the NAHC recommends the following actions:

- ✓ Contact the appropriate regional archaeological Information Center for a record search. The record search will determine:
  - If a part or all of the area of project effect (APE) has been previously surveyed for cultural resources.
  - If any known cultural resources have already been recorded on or adjacent to the APE.
  - If the probability is low, moderate, or high that cultural resources are located in the APE.
  - If a survey is required to determine whether previously unrecorded cultural resources are present.
- ✓ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  - The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for public disclosure.
  - The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.
- ✓ Contact the Native American Heritage Commission for:
  - A Sacred Lands File Check. **USGS 7.5 minute quadrangle name, township, range and section required.**
  - A list of appropriate Native American contacts for consultation concerning the project site and to assist in the mitigation measures. **Native American Contacts List attached.**
- ✓ Lack of surface evidence of archeological resources does not preclude their subsurface existence.
  - Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) §15064.5(f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.
  - Lead agencies should include in their mitigation plan provisions for the disposition of recovered artifacts, in consultation with culturally affiliated Native Americans.
  - Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, CEQA §15064.5(e), and Public Resources Code §5097.98 mandates the process to be followed in the event of an accidental discovery of any human remains in a location other than a dedicated cemetery.

Sincerely,

Katy Sanchez

Katy Sanchez
Program Analyst
(916) 653-4040

CC: State Clearinghouse

Native American Contact
San Luis Obispo County
June 10, 2009

Beverly Salazar Folkes
1931 Shadybrook Drive
Thousand Oaks , CA 91362
805 492-7255
(805) 558-1154 - cell
folkes9@msn.com
Chumash
Tataviam
Fe†rnandeño

Judith Bomar Grindstaff
63161 Argyle Road
King City , CA 93930
(831) 385-3759-home
Salinan

Santa Ynez Band of Mission Indians
Vincent Armenta, Chairperson
P.O. Box 517
Santa Ynez , CA 93460
varmenta@santaynezchumash.org
(805) 688-7997
(805) 686-9578 Fax
Chumash

San Luis Obispo County Chumash Council
Chief Mark Steven Vigil
1030 Ritchie Road
Grover Beach , CA 93433
cheifmvigil@fix.net
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(805) 474-4729 - Fax
Chumash

Julie Lynn Tumamait
365 North Poli Ave
Ojai , CA 93023
jtumamait@sbcglobal.net
(805) 646-6214
Chumash

Diane Napoleone and Associates
Diane Napoleone
1433 Camino Trillado
Carpinteria , CA 93013
805-684-4213
Chumash

Lei Lynn Odom
1339 24th Street
Oceano , CA 93445
(805) 489-5390
Chumash

Salinan Tribe of Monterey, San Luis Obispo and San Benito Counties
John W. Burch, Traditional Chairperson
8315 Morro Rd, #202
Atascadero , CA 93422
salinantribe@aol.com
805-460-9202
805 235-2730 Cell
805-460-9204
Salinan

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 SCH# 2009061030 Arroyo Grande Creek Channel Waterway Management Program: San Luis Obispo County.

Native American Contact
San Luis Obispo County
June 10, 2009

Santa Ynez Tribal Elders Council
Adelina Alva-Padilla, Chair Woman
P.O. Box 365
Santa Ynez , CA 93460
elders@santaynezchumash.org
(805) 688-8446
(805) 693-1768 FAX

Chumash

Salinan Nation Cultural Preservation Association
Robert Duckworth, Environmental Coordinator
Drawer 2447
Greenfield , CA 93927
dirobduck@thegrid.net
831-578-1852

Salinan

Randy Guzman - Folkes
4577 Alamo Street, Unit C
Simi Valley , CA 93063
ndnrandy@hotmail.com
(805) 905-1675 - cell

Chumash
Fernandeño
Tataviam
Shoshone Paiute
Yaqui

Salinan Nation Cultural Preservation Association
Jose Freeman, President
15200 County Road, 96B
Woodland , CA 95695
josefree@ccio1.com
(530) 662-5316

Salinan

Xolon Salinan Tribe
Donna Haro
110 Jefferson Street
Bay Point , CA 94565

Salinan

Coastal Band of the Chumash Nation
Janet Garcia,Chairperson
P.O. Box 4464
Santa Barbara , CA 93140
805-964-3447

Chumash

Salinan Nation Cultural Preservation Association
Doug Alger, Cultural Resources Coordinator
PO Box 56
Lockwood , CA 93932
fabbq2000@earthlink.net
(831) 262-9829 - cell
(831) 385-3450

Salinan

Mona Olivas Tucker
660 Camino Del Rey
Arroyo Grande , CA 93420
(805) 489-1052 Home
(805) 748-2121 Cell

Chumash

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Native American Contact
San Luis Obispo County
June 10, 2009

Matthew Darian Goldman
495 Mentone
Grover Beach , CA 93433
805-748-6913

Chumash

Northern Chumash Tribal Council
Fred Collins, Spokesperson
67 South Street
San Luis Obispo , CA 93401
(805) 801-0347 (Cell)

Chumash

Santa Ynez Band of Mission Indians
Sam Cohen, Tribal Administrator
P.O. Box 517
Santa Ynez , CA 93460
(805) 688-7997
(805) 686-9578 Fax

Chumash

Frank Arredondo
PO Box 161
Santa Barbara , Ca 93102
805-617-6884
ksen_sku_mu@yahoo.com

Chumash

Salinan Nation Cultural Preservation Association
Gregg Castro, Administrator
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glcastro@pacbell.net
(408) 864-4115

Salinan

Salinan-Chumash Nation
Xielolixii
3901 Q Street, Suite 31B
Bakersfield , CA 93301
xielolixii@yahoo.com

408-966-8807 - cell

Salinan
Chumash

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This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed SCH# 2009061030 Arroyo Grande Creek Channel Waterway Management Program: San Luis Obispo County.

COUNTY OF SAN LUIS OBISPO
Department of Agriculture/Weights and Measures
2156 SIERRA WAY, SUITE A • SAN LUIS OBISPO, CALIFORNIA 93401-4556
(805) 781-5910
ROBERT F. LILLEY
AGRICULTURAL COMMISIONER/SEALER
FAX (805) 781-1035
www.slocounty.ca.gov/agcomm
AgCommSLO@co.slo.ca.us

JUL 2009
RECEIVED

DATE: June 26, 2009

TO: John Farhar, County of San Luis Obispo Department of Public Works c/o Mary B. Reents, Morro Group, Inc

FROM: Michael Isensee, Agriculture Department

SUBJECT: Arroyo Grande Creek Waterway Management Program Notice of Preparation (Ag #1445)

Thank you for requesting the County Agriculture Department's input into the preparation of a Draft Environmental Impact Report (DEIR) for flood control enhancement along the lower portion of Arroyo Grande and Los Berros Creek. The proposed project appears to have the potential for direct and indirect, temporary and permanent impacts to agricultural resources. The proposed project also appears to include secondary components which may also have impacts to agricultural resources and operations.

JUL - 6 2009

Answers to basic scoping questions follow:

Contact Person:
Michael Isensee
Agricultural Resource Specialist
San Luis Obispo County Agriculture Department
2156 Sierra Way, Suite A
San Luis Obispo, CA 93401
805-781-5753

Approval Authority:
None. Advisory on issues relating to CEQA and agricultural resource impacts

Environmental Information:
-Amount of agricultural soils permanently and temporarily impacted by the project and secondary components of the project
-Options that reduce the amount of impact to agricultural resources and operations

Permit Stipulations
-Measures that reduce construction impacts to growers
-Measures that avoid or reduce impacts to productive soils
-Measures that avoid impacts to adjoining agricultural operations

Alternatives
-Alternatives that avoid temporary impacts to the maximum extent feasible and that minimize permanent loss of farmland associated with levee improvements

Relevant Information & Further Comments

The Agriculture Department recommends the DEIR:

- details the quantities of agricultural land that may be impacted by the project and specifies which project component the impact relates to. Information about secondary project components should be incorporated if necessary to achieve the goals of the proposed project. The conversion of agricultural soils in the Cienega Valley contributes to the irreversible loss of a very limited resource: productive soils with sufficient groundwater resources located in a mild coastal climate allowing for the year-round utilization of these soils for the production of food crops.
- addresses construction related impacts such as dust.
- analyzes the ultimate disposal of spoils generated by the project.
- addresses potential impacts to agricultural infrastructure including power lines, wells/pumps, access roads, and irrigation water lines.
- details farm field access routes, any possible disruption to field access, and ensures the incorporation of measures which ensure growers' timely and ongoing access necessary for row crop production.
- addresses potential impacts to properties encumbered with Williamson Act contracts that abut the creek or secondary project components.
- considers alternatives which locate temporary construction areas, stockpiles, and other project components off of capable agricultural land.
- evaluates mitigation options. Mitigation should focus on avoiding impacts including temporary impacts whenever possible. While the county does not have specific implementation procedures for mitigating farmland soil conversion, several current projects include farmland conversion mitigation recommendations. The County's draft Conservation Element soils chapter includes policy language regarding such mitigation for the loss of productive agricultural soils.

These comments and recommendations are based on policies in the San Luis Obispo County Agriculture and Open Space Element, the Land Use Ordinance, the California Environmental Quality Act (CEQA), and on current departmental policy to conserve agricultural resources and to provide for public health, safety and welfare while mitigating negative impacts of development to agriculture.

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN LUIS OBISPO

July 10, 2009

JUL 14 2009

John Farhar, Project Manager
County of San Luis Obispo
Department of Public Works
c/o Mary B. Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, CA 93401-2954

SUBJECT: APCD Comments on the Notice of Preparation (NOP) for the Arroyo Grande Creek Channel Waterway Management Program (ED 07-243)

Dear Mr. Farhar and Ms. Reents,

Thank you for including the San Luis Obispo County Air Pollution Control District (APCD) in the environmental review process. We have completed our review of the proposed Arroyo Grande Creek Channel Waterway Management Program (WMP) that would implement a comprehensive set of actions designed to restore the capacity of the leveed lower three miles of the Arroyo Grande Creek Channel and the Los Berros Creek Diversion Channel. This would provide flood protection from up to a 20-year storm event while simultaneously enhancing water quality and sensitive species habitat within the managed channel. The WMP would include vegetative management, 2) sediment management, including the dredging/excavation of approximately 21,000 cubic yards of material that would be trucked to an approved disposal site, and 3) potential levee raising that would also result in raising sections of road and rail road and some structure relocations. Annually; thereafter, a long-term sediment management program would occur with assessment of sediment loading, removal of excess sediment with excavation, and trucking of the material to an approved disposal site.

The following are APCD comments that are pertinent to this project.

1. Contact Person:

   Andy Mutziger
   Air Pollution Control District
   3433 Roberto Court
   San Luis Obispo, CA 93401
   (805) 781-5912

2. Permit(s) or Approval(s) Authority:

   Hydrocarbon Contaminated Soil
   Should hydrocarbon contaminated soil be encountered during construction activities, the APCD must be notified as soon as possible and no later than 48 hours after affected material is discovered to determine if an APCD Permit will be required. In addition,

the following measures shall be implemented immediately after contaminated soil is discovered:

- Covers on storage piles shall be maintained in place at all times in areas not actively involved in soil addition or removal;
- Contaminated soil shall be covered with at least six inches of packed uncontaminated soil or other TPH –non-permeable barrier such as plastic tarp. No headspace shall be allowed where vapors could accumulate;
- Covered piles shall be designed in such a way to eliminate erosion due to wind or water. No openings in the covers are permitted;
- During soil excavation, odors shall not be evident to such a degree as to cause a public nuisance; and,
- Clean soil must be segregated from contaminated soil.

The notification and permitting determination requirements shall be directed to the APCD Compliance Division at 781-5912.

Construction Permit Requirements

Based on the information provided, we are unsure of the types of equipment that may be present during the project's construction phase. Portable equipment, 50 horsepower (hp) or greater, used during construction activities will require California statewide portable equipment registration (issued by the California Air Resources Board) or an APCD permit. The following list is provided as a guide to equipment and operations that may have permitting requirements, but should not be viewed as exclusive. For a more detailed listing, refer to page A-5 in the District's CEQA Handbook.

- Power screens, conveyors, diesel engines, and/or crushers;
- Portable generators and equipment with engines that are 50 hp or greater;
- IC engines;
- Unconfined abrasive blasting operations;
- Concrete batch plants;
- Rock and pavement crushing;
- Tub grinders; and
- Trommel screens.

To minimize potential delays, prior to the start of the project, please contact the APCD Engineering Division at (805) 781-5912 for specific information regarding permitting requirements.

Demolition Activities

The project referral indicated that there are existing structures on the proposed site that will be demolished, moved, or renovated. These activities can have potential negative air quality impacts, including issues surrounding proper handling, demolition, and disposal of asbestos containing material (ACM). Asbestos containing materials could be encountered during demolition or remodeling of existing buildings. Asbestos can also be found in utility pipes/pipelines (transite pipes or insulation on pipes). **If utility pipelines are scheduled for removal or relocation; or building(s) are removed or renovated this project may be subject to various regulatory jurisdictions, including the requirements stipulated in the National Emission Standard for Hazardous Air Pollutants (40CFR61, Subpart M - asbestos NESHAP).** These requirements include but are not limited to: 1) notification

requirements to the District, 2) asbestos survey conducted by a Certified Asbestos Inspector, and, 3) applicable removal and disposal requirements of identified ACM. Please contact the APCD Compliance Division at 781-5912 for further information.

3. Environmental Information:

The potential air quality impacts from construction and operational phases of the project should be assessed in the EIR. The project under development has the potential for significant impacts to local air emissions, ambient air quality, sensitive receptors, and the implementation of the Clean Air Plan (CAP). A complete air quality analysis should be included in the DEIR to adequately evaluate the overall air quality impacts associated with implementation of the proposed project. This analysis should address both short-term (construction) and long-term (operational) emissions impacts (including traditional air pollutants and greenhouse gas emissions). The following is an outline of items that should be included in the analysis:

a) A description of existing air quality and emissions in the impact area, including the attainment status of the APCD relative to State and Federal air quality standards and any existing regulatory restrictions to development. The most recent CAP should be consulted for applicable information and the APCD should be consulted to determine if there is more up to date information available.

b) A detailed quantitative air emissions analysis at the project scale needs to be estimated as part of the DEIR.

c) A qualitative analysis of the air quality impacts should be conducted. A consistency analysis with the CAP will determine if the emissions resulting from development under the project will be consistent with the emissions projected in the CAP, as described in item 6 of this letter. The qualitative analysis should be based upon criteria such as prevention of urban sprawl and reduced dependence on automobiles. A finding of Class I impacts could be determined qualitatively. The DEIR author should contact the APCD if additional information and guidance is required. All assumptions used should be fully documented in an appendix to the DEIR.

4. Alternatives:

The DEIR should include a range of alternatives that could effectively minimize air quality impacts. A consistency analysis should be performed for each of the proposed alternatives identified, as described above. A qualitative analysis of the air quality impacts should be generated for each of the proposed alternatives. Examples include but are not limited to:

- Flexible zoning to promote mixed use and design standards that protect mixed use.
- Increase the amount of neighborhood scale mixed use.
- Additional density beyond proposed zoning allowances.

- Design standards that require narrow streets and minimum front setbacks on structures.
- Limiting the size of each arterial through the development. This reduces the need for noise barriers such as cinder block walls along roadways, decreases roadway widths, and slows the speed of traffic, creating an atmosphere that encourages walking and bicycling.

d) Mitigation measures to reduce air quality impacts from construction and operational phases to a level of insignificance should be specified. Any alternatives described in the DEIR should involve the same level of air quality analysis as described in bullet items 3.c and 3.d listed above.

If you would like to receive a copy of an example of a recommended format for the qualitative analysis section on air emissions impacts, contact the APCD Planning Division at 781-5912.

5. Relevant Information:

It is recommended that you refer to the "CEQA Air Quality Handbook" (the Handbook). If you do not have a copy, it can be accessed on the APCD web page (www.slocleanair.org) in the Business Assistance section, listed under Regulations, or a hardcopy can be requested by contacting the APCD. The Handbook provides information on mitigating emissions from development (Section 5) which should be referenced in the DEIR.

6. Further Comments:

The following are additional air quality issues that the EIR shall need to address:

Naturally Occurring Asbestos
The project site is located in a candidate area for Naturally Occurring Asbestos (NOA), which has been identified as a toxic air contaminant by the California Air Resources Board (ARB). Under the ARB Air Toxics Control Measure (ATCM) for Construction, Grading, Quarrying, and Surface Mining Operations, **prior to any grading activities at the site, the project proponent shall ensure that a geologic evaluation is conducted to determine if NOA is present within the area that will be disturbed. If NOA is not present, an exemption request must be filed with the District (see Attachment 1). If NOA is found at the site, the applicant must comply with all requirements outlined in the Asbestos ATCM.** This may include development of an Asbestos Dust Mitigation Plan and an Asbestos Health and Safety Program for approval by the APCD. Please refer to the APCD web page at *http://www.slocleanair.org/business/asbestos.asp* for more information or contact the APCD Enforcement Division at 781-5912.

Developmental Burning
Effective February 25, 2000, **the APCD prohibited developmental burning of vegetative material within San Luis Obispo County.** Under certain circumstances where no technically feasible alternatives are available, limited developmental burning under restrictions may be allowed. This requires prior application, payment of fee based on the size of the project, APCD

approval, and issuance of a burn permit by the APCD and the local fire department authority. The applicant is required to furnish the APCD with the study of technical feasibility (which includes costs and other constraints) at the time of application. If you have any questions regarding these requirements, contact the APCD Enforcement Division at 781-5912.

Dust Control Measures

Construction activities can generate fugitive dust, which could be a nuisance to local residents and businesses in close proximity to the proposed construction site. Dust complaints could result in a violation of the APCD's 402 "Nuisance" Rule. Any project with a grading area greater than 4.0 acres exceeds the APCD's PM10 quarterly threshold. **This project has areas that are near potentially sensitive receptors and shall be conditioned to comply with all applicable Air Pollution Control District regulations pertaining to the control of fugitive dust (PM10) as contained in section 6.5 of the Air Quality Handbook. All site grading and demolition plans noted shall list the following regulations:**

a. Reduce the amount of the disturbed area where possible,
b. Use of water trucks or sprinkler systems in sufficient quantities to prevent airborne dust from leaving the site. Increased watering frequency would be required whenever wind speeds exceed 15 mph. Reclaimed (non-potable) water should be used whenever possible,
c. All dirt stock pile areas should be sprayed daily as needed,
d. Permanent dust control measures identified in the approved project revegetation and landscape plans should be implemented as soon as possible following completion of any soil disturbing activities,
e. Exposed ground areas that are planned to be reworked at dates greater than one month after initial grading should be sown with a fast germinating native grass seed and watered until vegetation is established,
f. All disturbed soil areas not subject to revegetation should be stabilized using approved chemical soil binders, jute netting, or other methods approved in advance by the APCD,
g. All roadways, driveways, sidewalks, etc. to be paved should be completed as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used,
h. Vehicle speed for all construction vehicles shall not exceed 15 mph on any unpaved surface at the construction site,
i. All trucks hauling dirt, sand, soil, or other loose materials are to be covered or should maintain at least two feet of freeboard (minimum vertical distance between top of load and top of trailer) in accordance with CVC Section 23114,
j. Install wheel washers where vehicles enter and exit unpaved roads onto streets, or wash off trucks and equipment leaving the site, and
k. Sweep streets at the end of each day if visible soil material is carried onto adjacent paved roads. Water sweepers with reclaimed water should be used where feasible.

All PM10 mitigation measures required should be shown on grading and building plans. In addition, the contractor or builder should designate a person or persons to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust offsite. Their duties shall include holidays and weekend periods when work may not be in

progress. **The name and telephone number of such persons shall be provided to the APCD prior to land use clearance for map recordation and finished grading of the area.**

Truck Routing
Where feasible, proposed truck routes need to be evaluated to identify routing patterns with the least impact to residential communities and sensitive receptors, such as schools, daycare facilities, hospitals, and senior centers.

Material Removal
The APCD will need the EIR to evaluate the construction and operational phase emissions associated with the equipment needed to excavate materials from these waterways and determine whether emissions thresholds (daily and quarterly for the construction phase and daily for the operational phase) may be exceeded. Mitigation needs to be proposed to address any potential threshold exceedences and to ensure that impacts, particularly diesel impacts, to sensitive receptors are minimized. Staging areas shall not be placed within 1,000 feet of sensitive receptors. Sensitive receptors include: Schools, parks and playgrounds, day care centers, nursing homes, hospitals, and residential communities. The EIR should identify the sensitive receptors that may be impacted by the work on this project. In addition, work within 1,000 feet of sensitive receptors should be minimized as practically as possible and measures to minimize diesel emissions identified for implementation during all project phases.

Again, thank you for the opportunity to comment on this proposal. If you have any questions or comments, feel free to contact me at 781-5912.

Sincerely,

Andy Mutziger
Air Quality Specialist

AJM/AAG/lmg

cc: John Farhar, SLO County Public Works
Karen Brooks, Enforcement Division, APCD
Tim Fuhs, Enforcement Division, APCD
Gary Willey, Engineering Division, APCD

Attachment: Naturally Occurring Asbestos – Construction & Grading Project Exemption Request Form, Construction & Grading Project Form

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN LUIS OBISPO

3433 Roberto Court, San Luis Obispo, CA 93401
805-781-5912 – FAX: 805-781-1002

Naturally Occurring Asbestos Construction and Grading Project Form

Applicant Information/Property Owner		Project Name	
Address		Project Address and/or Assessors Parcel Number	
City, State, Zip		City, State, Zip	
Email		Email	
Phone Number	Date Submitted	Agent	Phone Number

Check Applicable	DESCRIPTION (attach applicable required information)	APCD REQUIREMENT 1	APCD REQUIREMENT 2
	Project is subject to NOA requirements but NOT disturbing NOA	Geological Evaluation	Exemption Request Form
	Project is subject to NOA requirements and project is disturbing NOA – more than one acre	Geological Evaluation	Dust Control Measure Plan
	Project is subject to NOA requirements and project is disturbing NOA – one acre or less	Geological Evaluation	Mini Dust Control Measure Plan

Please note that the applicant will be invoiced for any associated fees

REQUIRED APPLICANT SIGNATURE:

Legal Declaration/Authorized Signature _____ Date _____

APCD OFFICE USE ONLY				
Geological Evaluation	**Exemption Request Form**	**Dust Control Measure Plan**		**Monitoring, Health and Safety Plan**
Approved Yes ☐ No ☐	Approved: Yes ☐ No ☐	Approved: Yes ☐ No ☐		Approved: Yes ☐ No ☐
Comments:	Comments:	Comments:		
APCD Staff:	Intake Date:	Date Reviewed	OIS Site #	OIS Proj #
Invoice No.	Basic Fee	Additional Fees	Billable Hrs	Total Fees

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN LUIS OBISPO

3433 Roberto Court, San Luis Obispo, CA 93401
805-781-5912 – FAX: 805-781-1002

Naturally Occurring Asbestos
Construction & Grading Project Exemption Request Form

Applicant Information/ Property Owner		Project Name	
Address		Project Address and /or Assessors Parcel Number	
City, State, Zip		City, State, Zip	
Email Address		Email Address	
Phone Number	Date Submitted	Agent	Phone Number

The District may provide an exemption from Section 93105 of the California Code of Regulations - Asbestos Airborne Toxic Control Measure For Construction, Grading, Quarrying, And Surface Mining Operations for any property that has any portion of the area to be disturbed located in a geographic ultramafic rock unit; if a registered geologist has conducted a geologic evaluation of the property and determined that no serpentine or ultramafic rock is likely to be found in the area to be disturbed. Before an exemption can be granted, the owner/operator must provide a copy of a report detailing the geologic evaluation to the District for consideration. The District will approve or deny the exemption within 90 days. An outline of the required geological evaluation is provided in the District handout **"ASBESTOS AIRBORNE TOXIC CONTROL MEASURES FOR CONSTRUCTION, GRADING, QUARRYING, AND SURFACE MINING OPERATIONS – Geological Evaluation Requirements."**

NOTE: A basic exemption evaluation fee of $150.00 will be charged.

APPLICANT MUST SIGN BELOW:

I request the San Luis Obispo County Air Pollution Control District grant this project exemption from the requirements of the ATCM based on the attached geological evaluation.

Legal Declaration/Authorized Signature _____ Date: _____

OFFICE USE ONLY - APCD Required Element – Geological Evaluation			
Intake Date:	APCD Staff:	OIS Site #:	OIS Project #:
Date Reviewed:	APCD Staff:	Approved	Not Approved
Comments:			

Central Coast Salmon Enhancement, Inc.
229 Stanley Ave.
Arroyo Grande, CA 93420
805/473-8221 Office * 805/473-8167 Fax

FAX

To: Mary Reents **Fax:** 543-2367

From: Steph Wald **Date:** July 7, 2009

Re: Comments on AG WMP **Pages:** 2 including cover

CC:

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Notes:

CENTRAL COAST SALMON ENHANCEMENT, INC.

Fish for Everyone

July 7, 2009

John Farhar
c/o Mary Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, CA 93401

RE: Comments on NOP-IS for AGWMP

Hello:

Please accept the following comments for the Arroyo Grande Creek Waterways Management Plan Notice of Preparation and Initial Study.

For the Biological Resources section, I would suggest that taking beaver management into consideration would strengthen the management program. As was discussed at the NOP meeting on June 25th, the ability to manage beaver will influence the success of revegetating the area with canopy trees. Perhaps the EIR could take a close look at how other management programs deal with beaver and what the best strategies are to manage for steelhead and RLF habitat where beaver are not removed. This might involve looking at the following issues:

1. Do beaver dams pose a migration barrier threat for Steelhead/rainbow trout (SHT)?
2. Do beaver dams create pools that attract SHT allowing them to remain in the levee area?
3. Do the artificial pools increase liability for SHT fish kills when pumping occurs in drought years and in unseasonably warm temperatures in the flood control channel as occurred in June 2008?
4. Might beaver exclusion fencing be part of mitigation or management program to protect planted canopy trees?

While these issues are indirect impacts of the proposed project, I believe addressing them within the context of the EIR process may be prudent in the long run. Thank you for your consideration.

Sincerely,

Stephnie Wald

Stephnie Wald
Watershed Projects Manager

PO Box 277, Avila Beach, CA 93424

Phone: 805-473-8221 Fax: 805-473-8167 www.centralcoastsalmon.com

Cienaga Seabreeze Park Inc.
2300 Cienaga
Oceano, CA. 93445

JUN 16 2009

June 15, 2009

Mr John Farhar
County of San Luis Obispo
Department of Public Works
c/o Mary B. Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, CA 93401-2954

Dear Mr Farhar,

Thank you very much for your "NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT" and in response we are happy to submitt The Information you have requested.

The primary person to contact at the Cienaga Seabreeze Senior Mobil Home Park is:

Mr Bill Edmonson
8273 E. Church
Sanger, CA 93657
Phone; 559-907-3777

The secondary person to contact would be the following person:

Thomas H. Bowman
2300 Cienage SP-51
Oceano, CA 93445-8925
Phone; 805-481-9757

We have no information at this time for your questions number 2, 3, 4, and 5. If we can be of further help please let us know.

Sincerely,

Thomas H. Bowman
Cienage Seabreeze Senior Mobil Home Park

817 Valley Rd.
Arroyo Grande, CA
July 10, 2009

JUL 14 2009

Dept. of Public Works -
Mrs. Mary Reante.

I was unable to attend the meeting in Oceano because of eye surgery so please consider my comments.

Project A. Vegetation management.

Gaps in the riparian buffer should not be revegitated in the channel — especial the willows. Cottonwood would be a bad choice because of the fuzz from the blossome — bad for pollen alergies & messy on house screens, etc.

The channel should be clean and clear of all weeds and vegitation that drops seeds.

I don't think its is a good plan to construct large wood structures in the flood control channel to provide

habitat for steelhead or red legged frogs. The channel is dry most of the year except during a heavy rain. The resulting water is usually very fast flowing (roaring) during heavy rains. It destroys any habitat.

Since I am paying the assessment charge annually - $4.20, besides in addition to the $7.00 Los Berros assessment for 1-1A, I cannot afford more taxes or assessments for any further work done on the Los Berros channel.

Thank you -

Marjorie Gilliam

Charlie Lackie
2828 Biddle Ranch Road
San Luis Obispo, CA 93401

July 8, 2009

Attn: John Farhar
County of San Luis Obispo
Department of Public Works
c/o Mary B. Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, CA 93401-2954

Dear John Farhar;

I am responding to your June 5, 2000 letter regarding the preparation of a draft environmental impact report pertaining to the Arroyo Grande Creek Channel. My concerns are: 1) the quality of the dirt brought in to use as fill for any project related to the levee, 2) maintaining the integrity of my existing well as it relates to any levee project, 3) the protection of my parcel's agricultural viability.

1) My concerns regarding any fill materials are related to how soil born diseases could deleteriously affect my existing organic avocado orchard and future agricultural projects intended for my parcel. Avocados are particularly sensitive to a number of soil born diseases. My existing avocado orchard is immediately adjacent to the area of the levee. I do not want to have any diseases introduced to my property and would like the environmental impact report to consider this issue.

2) I would like for your report to address the location of my existing well and how to best protect it during any levee improvement/maintenance projects.

3) My parcel consists of 4.37 acres, small by agricultural standards. It is my hope your report will consider that any reduction of my agricultural land will jeopardize its agricultural use.

It is my hope that your report will seriously consider how any reduction of my agricultural land would negatively impact the viability of continuing agricultural use.

I greatly appreciate your consideration of my concerns.

Yours truly,

Charlie Lackie

Charlie Lackie
(805) 235-8695

JUN 2 2 2009

6. **FURTHER COMMENTS.** Please provide any further comments or information that will help the county to scope the document and determine the appropriate level of environmental assessment.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date, but not later than **30 days** after receipt of this notice.

The project description, location, and the probable environmental effects are contained in the attached materials and are available online at SLOCountyWater.org.

Please send your response to the attention of Mr. John Farhar, Project Manager, at the following address:

John Farhar
County of San Luis Obispo
Department of Public Works
c/o Mary B. Reents
Morro Group/SWCA
1422 Monterey Street, Suite C200
San Luis Obispo, CA 93401-2954

We will need the name of a contact person in your agency. If you have any questions regarding the NOP or the proposed project, please contact Ms. Mary Reents at (805) 543-7095, extension 103.

In addition, an EIR scoping meeting will be held on June 25, 2009 at 6:00 pm at the Oceano Community Services District Meeting Room, located at 1655 Front Street, Oceano, San Luis Obispo County, California. The EIR scoping meeting will be open to all interested parties and provide an opportunity for input relating to the scope and content of the EIR.

Reviewed by:

Signature Ellen Carroll

Ellen Carroll
County of San Luis Obispo
Environmental Coordinator

THE CONTACT PERSON FOR THE FOLLOWING PARCELS IS: SOREN STEJER
528 WATER ST
W. SACRAMENTO CA 95605

075.011.020
052.011

Reference: *California Administrative Code, Title 14, Section 15082*

Appendix B.
Waterway Management Plan

ARROYO GRANDE CREEK CHANNEL WATERWAY MANAGEMENT PROGRAM

FINAL REPORT

prepared for

for San Luis Obispo County Flood Control and Water Conservation District Zones 1 and 1A Flood Control District

prepared by

John Dvorsky, Principal Scientist

WATERWAYS CONSULTING, INC.

October 2010

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LIST OF FIGURES, TABLES, AND PHOTOS

Appendices

1.0 PURPOSE, CONTEXT, AND GOALS

1.1 Purpose of the Arroyo Grande Creek Channel Waterway Management Program

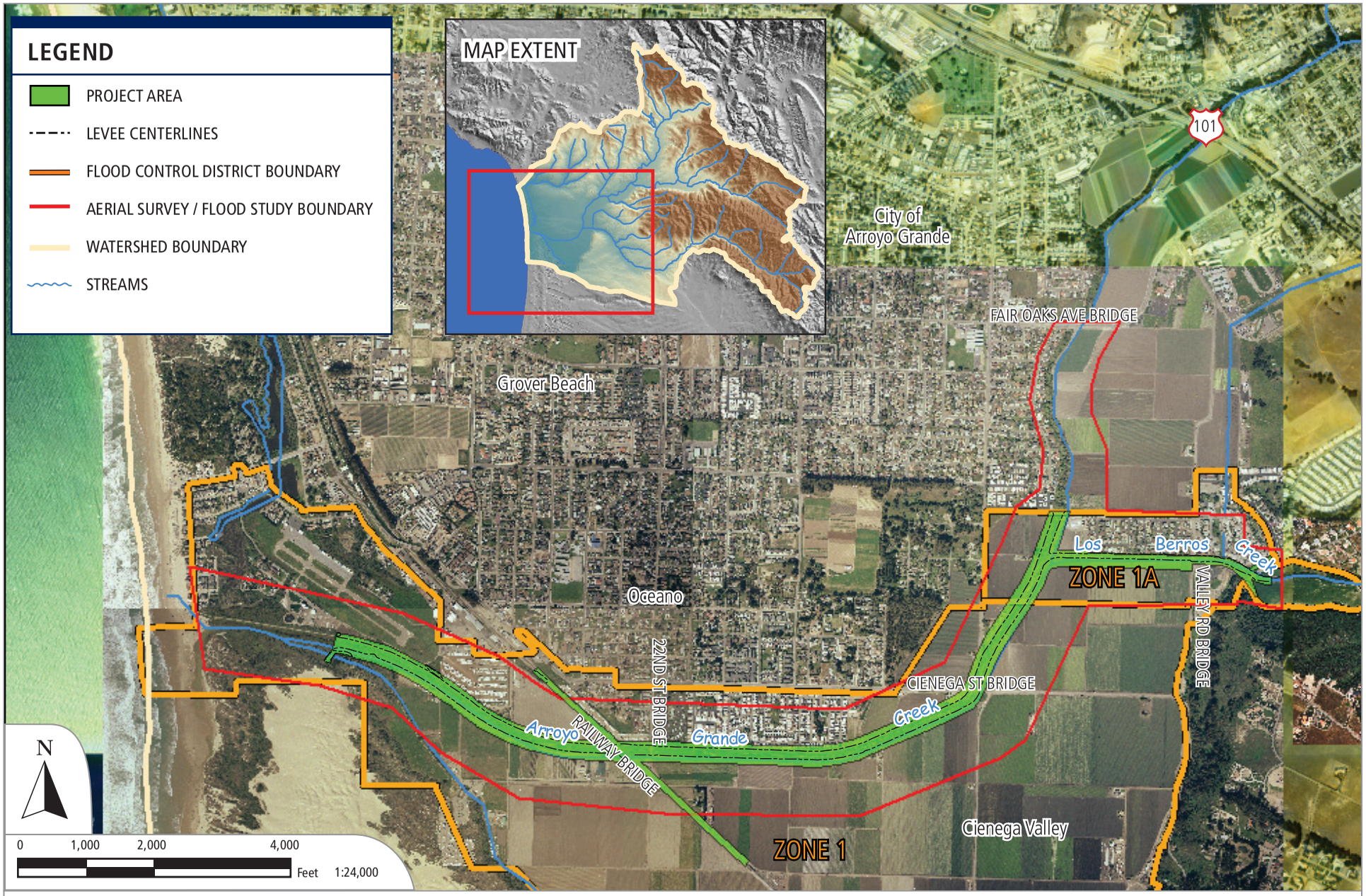
The Arroyo Grande Creek Channel Waterway Management Program (WMP) is a comprehensive set of actions designed to restore the capacity of the levied lower three miles of Arroyo Grande Creek Channel and the Los Berros Creek Diversion Channel (Figure 1) to provide flood protection up to a 20-year storm event while simultaneously enhancing water quality and sensitive species habitat within the managed channel. The WMP establishes a framework for how the lower portion of Arroyo Grande and Los Berros Creeks will be managed, long-term, to meet the goals established by Zones 1 and 1A (Zone 1/1A) of the San Luis Obispo County Flood Control and Water Conservation District (District) (Figure 1).

Management, within the context of the WMP, includes a combination of capital improvement projects, long-term maintenance activities, active restoration and enhancement projects, mitigation measures, performance monitoring, monitoring of implemented projects, programmatic elements, and adaptive management that responds to the performance monitoring activities. A description of each of these management activities are included in the WMP with enough detail so that the WMP will act as a guiding document on how to implement the project or program, how the project or program's success will be monitored, and what mitigation or protection measures will be required as part of project or program implementation.

1.2 Waterway Management Program Project Elements

The WMP was developed subsequent to an alternatives analysis that evaluated options to reduce flooding, manage sediment, and improve habitat conditions in the Arroyo Grande Creek Channel. The program alternatives were developed in cooperation with the community, the Coastal San Luis Resource Conservation District (RCD) and the District and are described in detail in the Arroyo Grande Creek Erosion, Sedimentation, and Flooding Alternatives Study (Alternatives Study) completed in January 2006 by Swanson Hydrology and Geomorphology. Alternatives 3a and 3c are the preferred alternatives and are the basis of the proposed Waterway Management Program. Alternative 3 includes the following key project elements:

- ***Vegetation Management:*** Manage riparian vegetation annually to improve flood capacity. Within the riparian corridor support a continuous canopy cover of mature trees and fill existing gaps while encouraging species diversity.



WATERWAYS CONSULTING, INC.
Santa Cruz, CA | watways.com | Portland, OR

FIGURE 1: General location map for the project and study areas on Arroyo Grande Creek. The hydrology and sediment loads are dominated by tributaries such as Los Berros

- ***Sediment Management***: Conduct sediment management in a way that will improve flood capacity and enhance geomorphic function so as to minimize future sediment accumulations that require intensive management;
- ***Levee Raise:*** Raise levees throughout the flood control channel to ultimately achieve a channel capacity that will protect the adjacent community and farmland up to a 20-year flood event; and
- ***Raise UPRR Bridge:*** Raise the Union Pacific Railroad Bridge above the 20-year water surface elevation to increase the flood capacity of the channel.

1.3 Project Background

Arroyo Grande Creek has a long history of flood impacts to agriculture and human habitation that dates back to the time of the early settlements in the mid-19th century. Historical accounts and a geomorphic analysis of the lower watershed and Cienega Valley suggest that much of the valley floor was at grade with the Creek and consisted of a broad thicket of willows and other riparian trees (Dvorsky, 2004). From the time of the earliest settlements, use of the valley for homesteading, agricultural production, dairies, and cattle ranching required clearing of vegetation and active management of the channel and floodplain (Figure 2). Management, in those days, consisting primarily of ditching the channel to provide a predictable flow path, building levees, removing willow thickets, and leveling the land. Much of these activities were carried out by individual landowners with little to no coordinated efforts between adjacent property owners.

In the 1950's, severe flooding from Arroyo Grande Creek resulted in inundation of prime farmland in the Cienega Valley and significant impacts to existing infrastructure. At the time, Arroyo Grande and adjacent communities were primarily rural with a combined population of less than 5,000 residents. To reduce future economic impacts to the agricultural economy and the growing urban and rural residential population, the community organized the Arroyo Grande Creek Flood Control Project (Project). The Project, led jointly by the USDA-Soil Conservation Service/Arroyo Grande Resource Conservation District, was completed in 1961 to protect homes and farmland in La Cienega Valley. (These organizations are now known as the USDA-Natural Resources Conservation Service and the Coastal San Luis RCD, respectively.)

The main feature of the Project was a levee system and trapezoidal channel that confined Arroyo Grande Creek from its confluence with Los Berros Creek downstream to the Pacific Ocean (Photo 1). In addition, the lower portion of Los Berros Creek from the Valley Rd Bridge to the confluence with Arroyo

A: Remnant riparian area evident in 1939 aerial photo, (highlighted in red), no longer exists in 2002 aerial photo.

B: Wide floodplain / riparian area evident in 1939 aerial photo, in 2002 aerial photo riparian area is confined by agricultural fields.

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Santa Cruz, CA | watways.com | Portland, OR

FIGURE 2: A) 1939 and 2003 comparison of aerial photos showing remnant floodplain and channel features. B) 1939 and 2002 comparison of aerial photos showing changes to riparian width.

Grande Creek was diverted from its pre-1960 channel, which ran along the southern edge of La Cienega Valley, to its current confluence upstream of the Highway 1 Bridge. Runoff from the Meadow Creek watershed, which runs though Pismo Lake, was designed to enter Arroyo Grande Creek through a pair of flap gates, known as the Sand Canyon Flap Gates, near the Pismo State Beach. Maintenance of the Project, following construction was the responsibility of the District (Zone 1/1A), RCD, and NRCS per a maintenance agreement. Landowners within the zone are assessed an annual fee to support management and maintenance of the flood control reach.

Photo 1. Constructed trapezoidal channel at UPRR bridge in 1958.

The original flood control channel was built in 1959 and was designed to carry a discharge of 10,120 cubic feet per second (cfs), which, at the time of the analysis, was determined to have a recurrence of once every 100 years. Maintenance of the flood control channel as required by the 1959 Operation and Maintenance Agreement between the District, NRCS, and the CSLRCD (1959 Agreement), consisted primarily of vegetation and sediment removal to maintain the design geometry and capacity of the channel and routine maintenance of the levee system and associated infrastructure. Maintenance activities in recent years were restricted by a combination of lack of funding (Zone 1/1A maintenance funds had not risen appreciably since the creation of the special district) and environmental concerns about the impacts of vegetation and sediment removal on aquatic and riparian habitat in the flood control reach.

Environmental concerns and restrictions increased following the listing of the California red-legged frog (*Rana aurora draytonii*), in 1996, and steelhead (*Oncorhynchus mykiss*), in 1997. Protection of critical habitat for these two species meant that past maintenance activities, required under the 1959 Agreement with the NRCS and RCD, were no longer feasible. Limited sediment management did occur in November 1999 and October 2001 but pursuit of subsequent sediment management projects ended when the District pursued a permit in 2002 and it was determined that a Coastal Development Permit (CDP) was required. Although the Coastal Commission issued a CDP, they required preparation of a comprehensive analysis of the alternatives available for long-term flood protection, to be completed in three years. The District felt that development of a comprehensive plan would require more time and the 2002 CDP was withdrawn.

The requirements put forth by the Coastal Commission led the U.S. Fish and Wildlife Service, NOAA Fisheries, and the California Department of Fish and Game to also request that a more comprehensive strategy be prepared to manage the flood control reach through a maintenance program that specifically protects aquatic habitat. The 1959 Agreement was terminated by all parties on December 1, 2009. The termination of the agreement recognizes that the original project has reached its design life (50 years) and achieved its intended purpose. Parties to the agreement concur that major changes in watershed regulations, hydrology and objectives for the watershed require a new watershed plan not consistent with the 1959 maintenance agreement.

In 1999, the US Army Corps of Engineers developed a study to assess the existing capacity of the flood control reach. The results suggested that the system currently has a reduced capacity of 1,700 cfs which equates to a recurrence interval of approximately 2-year to 5-years (USACE, 2001). The capacity of the as-built channel (the channel as built in 1961), according to the USACE model, was determined to be 6,500 cfs with an associated level of protection between the 10-year and 20-year runoff event. These results showed that even with 1961 geometry, where sediment has been removed, the capacity of the channel has been reduced by approximately 1,000 cfs, most likely due to changes in the levee geometry from settlement and erosion. The USACE study pointed to the need for a more detailed alternative assessment to define project opportunities and costs associated with improving overall capacity and flood protection.

On March 5, 2001, during a high intensity rain event, the levee was breached on the south side between the mouth and the Union Pacific railroad bridge (Photos 2 and 3). It was estimated by observers in the field at the time of the levee breach that the levee would have overtopped upstream of the 22nd Street bridge had the levee not breached and lowered the overall water surface. Hundreds of acres of

farmland and several residences were flooded in La Cienega Valley. Impacts from the flooding persisted beyond the winter season as many of the lower lying areas with clay soils located in the southern portion of the valley remained saturated. The northern levee remained intact, thereby protecting several residential developments, the Oceano Aiport, and the regional wastewater treatment plant that services the communities of Arroyo Grande, Oceano and Grover Beach.

Photo 2. Oblique photo of flooding in the Cienega Valley following the levee breach of March 2001 (looking south).

Photo 3. Close-up view of the levee breach and flooding of farmland in March 2001 (looking at south levee from north levee).

As a result and subsequent to the 2001 flooding, the RCD, on behalf of the District, contracted with the consulting firm of Swanson Hydrology and Geomorphology (SH+G) to develop a range of flood protection alternatives, known as the Alternatives Study, which was completed in January 2006. The Alternatives Study focused in-depth on erosion sources, sedimentation and hydrology as they relate to recurring flooding in the lower reaches of the creek. The final study described six different

"Alternatives", or sets of feasible projects and management actions, that could be implemented to manage flooding in Zone 1/1A, and provides estimates of the degree of flood protection afforded by each Alternative. The Zone 1/1A Task Force, a technical subcommittee of the Zone 1/1A Advisory Committee, met with SH+G staff twice during 2005 to provide feedback and recommendations regarding which options to consider for analysis in the Alternatives Study, and to review preliminary results. The Zone 1/1A Task Force consisted of representatives from U.S. Fish and Wildlife, California Department of Fish and Game, the Coastal Conservancy, NOAA/NMFS, Regional Water Quality Control Board, San Luis Obispo County Public Works and Environmental Planning Departments, City of Arroyo Grande, Oceano Community Services District, Central Coast Salmon Enhancement, Zone 1/1A Advisory Committee, and U.S. Army Corps of Engineers.

The completion of the Alternatives Study provided Zone 1/1A with a range of viable solutions to improve flood capacity in the channel(s). The Zone 1/1A Advisory Committee endorsed Alternative 3 as the preferred alternative and in 2006 the property owners in Zone 1/1A approved additional property tax assessments to substantially enhance maintenance and operation efforts to the Arroyo Grande and Los Berros Creek Channels. Funding was now available to develop and carry out a long-term management plan for the flood control channel. In fall 2007, SLO County Public Works drafted a Notice of Preparation and a Request for Qualifications for preparation of an environmental impact report/environmental assessment and assistance with regulatory permitting. Representatives of the Zone 1/1A Advisory Committee Task Force joined SLO County Public Works staff in reviewing applications, conducting interviews, and selecting a consulting firm to recommend to the SLO County Board of Supervisors for contract. The firm selected was the Morro Group, now SWCA, Inc., partnering with SH+G (now Waterways Consulting) to prepare a Waterway Management Program (WMP) that includes project actions described under Alternative 3 of the Alternatives Study combined with enhancement actions that improve habitat conditions in the flood control reach for steelhead, California red-legged frog, and other species that rely on the aquatic environment.

In addition to activities specifically addressed in the WMP relating to the Arroyo Grande Creek channel, a Memorandum of Understanding (MOU) is in place that is designed to improve watershed conditions and limit sediment delivery from upslope areas to impacted reaches Arroyo Grande Creek such as the flood control reach. The County of San Luis Obispo and the County Flood Control and Water Conservation District became a signatory to the Arroyo Grande Creek Watershed MOU on April 22, 2008. The purpose of the MOU is to enhance an overall understanding of watershed issues and promote consensus between the parties in order to better protect, manage and enhance the Arroyo Grande Creek watershed.

The MOU recognizes that some of the agencies have existing responsibilities within the watershed and that those autonomous responsibilities will continue. The intent of the MOU involves educating each other on those efforts and identifying how collaborative efforts in the watershed management can be implemented in the future more efficiently and effectively. Future implementation of collaborative efforts will require development of cost sharing agreements and action plans, which will need separate approval by participating agencies.

By signing the MOU, the County showed its support for collaborative watershed management. Other signatories of the MOU include: the City of Arroyo Grande, RCD, and the Central Coast Salmon Enhancement. The RCD and the Central Coast Salmon Enhancement have become key advocates for the MOU and are working with other resource agencies to become signatories, including: US Fish and Wildlife Service, Natural Resource Conservation Service, CA Department of Fish and Game, and CA Department of Parks and Recreation. The CA Regional Water Quality Control Board was solicited for signature, but was unable to sign and instead endorsed the MOU.

1.4 Project Need

The proposed project is needed to provide the residents of Zone 1/1A with improved flood protection. Prior to the termination of the 1959 maintenance agreement, the District, RCD, and NRCS were responsible for operation and maintenance of the leveed lower three miles of Arroyo Grande Creek. As concerns for environmental protection have increased, the District has been limited in its ability to conduct periodic maintenance to reduce flood risks to adjacent landowners and sustain the channel's design capacity. Consequently, the existing channel has a severely reduced capacity and can only provide protection up to the 4.6 year flow recurrence event. This level of flood protection is inadequate and severely limits the ability of Zone 1/1A to meet its obligations to residents in the District. This was evidenced during the 2001 levee system breach on the south side which inundated hundreds of acres of farmland and several residences. It could have been much worse if the system breached on the north side. However, the northern levee remained intact, thereby protecting several residential developments, the Oceano Airport, and the South County Sanitation District Wastewater Treatment Plant that services the communities of Arroyo Grande, Oceano, and Grover Beach.

2.0 EXISTING CONDITIONS

2.1 Project area

Arroyo Grande Creek is a 157 square mile coastal watershed located in west-central San Luis Obispo County (Figure 3). The mainstem of Arroyo Grande Creek flows through the cities of Arroyo Grande and Oceano and is an important regional waterway, providing agricultural and municipal water to the communities of Arroyo Grande, Grover Beach, Oceano, Pismo Beach, and Avila Beach by way of Lopez Reservoir located in the upper portion of the watershed. An expanding urban population and a desire to maintain the region's agricultural roots has resulted in an increasing demand on the natural and biological resources of the Arroyo Grande Creek watershed.

The Waterway Management Program project area is located along the lower portion of mainstem Arroyo Grande and Los Berros Creeks within San Luis Obispo County, California. The project area is a linear corridor with two segments: (1) beginning on Arroyo Grande Creek 0.14 mile upstream of the confluence of Los Berros Creek and continuing downstream to the upper edge of the Arroyo Grande Creek lagoon at the Pacific Ocean, and (2) beginning at the Century Lane Bridge on Los Berros Creek and continuing downstream to the confluence with Arroyo Grande Creek (Figure 1). The total project length is approximately 3.5 miles.

The project area ends just upstream of a euryhaline coastal lagoon that occurs at the mouth of Arroyo Grande Creek (Figure 4). Portions of the lagoon lie within the Pismo Dunes State Reserve and the lagoon bisects Pismo State Beach. Similar to other coastal lagoons in central California, the mouth of the creek is seasonally obstructed by a sand bar that forms in spring and persists until winter rains are sufficient to hydraulically force the sand bar to open. During drought or periods of prolonged dry weather the sand bar may not open at all. When the sand bar is in place depths in the lagoon can increase causing the lagoon to backwater a significant distance up into the flood control channel.

2.2 Larger watershed context

Though it is difficult to definitively describe what Arroyo Grande Creek may have historically looked like, historical accounts from early settlers and an understanding of the physical setting provides a glimpse into the past and a picture of how the channel functioned. A key feature in the existing landscape of Arroyo Grande is Lopez Dam. Lopez Dam is located at a point in the watershed where there is a

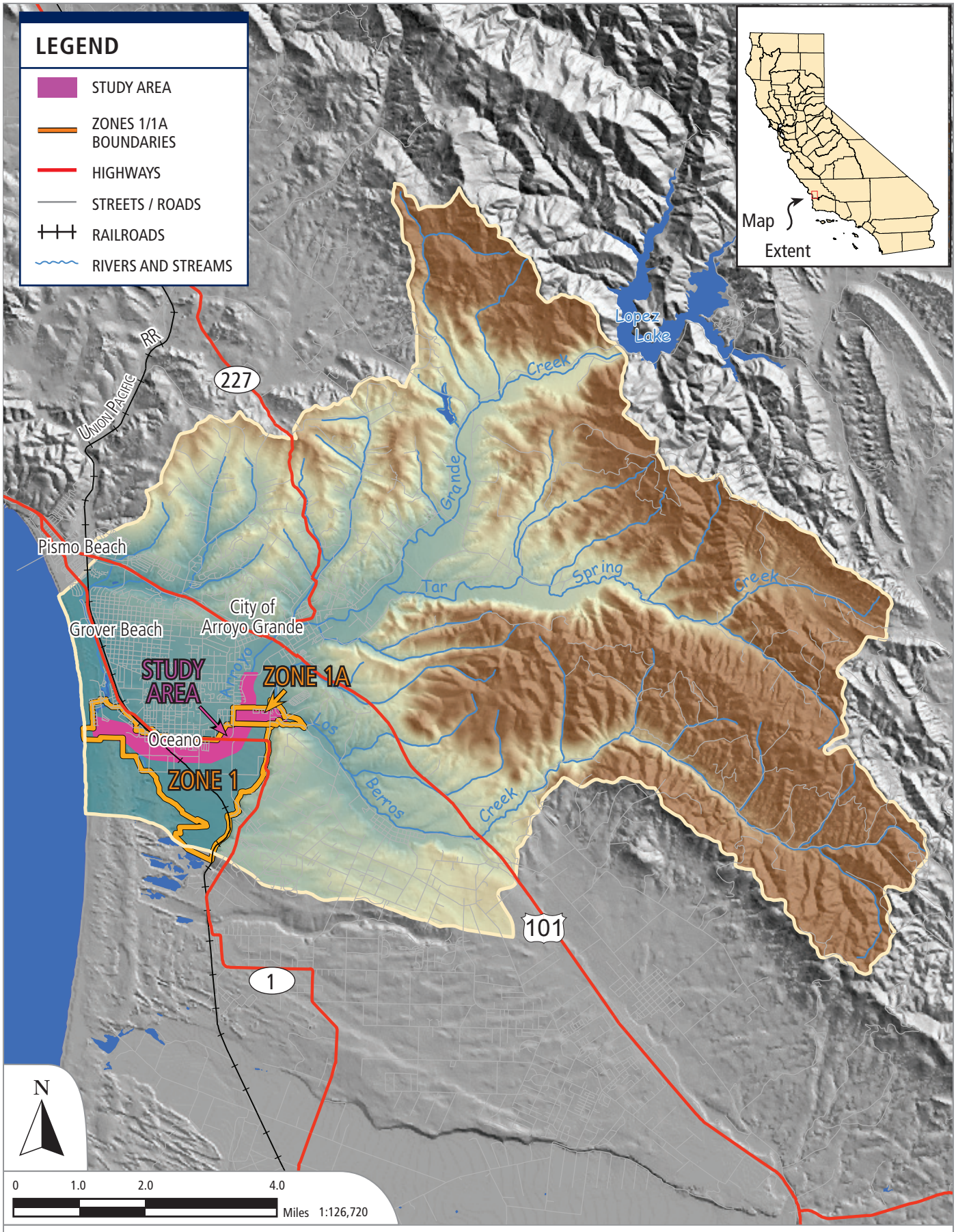

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FIGURE 3: Study area for the WMP. The WMP includes the levees, channel and riparian areas on lower Arroyo Grande Creek and lower Los Berros Creek within the Zone 1/1A Flood Control District.

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FIGURE 4: Lagoon and flapgate locations.

transition from confined mountain valley to an unconfined coastal plain. Dams are often sited in such a location because they provide a convenient constriction point for a dam, thereby minimizing the amount of earthen material required to impound a relatively large area upstream. Downstream of Lopez Dam the channel is much flatter, the valley much wider and historic floodplain deposits occur across the entire valley bottom (Figure 5). This area represents a depositional zone within the watershed where large quantities of water and sediment transported from the upper watershed historically spread across the valley floor, creating the large alluvial valley that exists today. Channels in steep, higher gradient valleys can transport more sediment than channels in lower gradient, wide valleys because the energy required to move sediment is a function of an energy gradient that is related to surface water slope and depth. This is often referred to as the sediment transport competence of the flow. In the lower portions of the mainstem, near the Community of Oceano, the floodplain deposits are extensive. Combined with the potential for a sand berm to form at the mouth, high tides and storm surges during peak flow events, and the constricting presence of the sand dunes, this portion of the system can be classified as deltaic in nature. The lower portion of the channel historically supported a large lagoon that extended into the Meadow Creek wetlands to the north of the existing levee.

2.3 Biological conditions

2.3.1 Botanical resources

Six plant community types occur within the Project Area including willow riparian woodland, riparian scrub, coyote brush scrub, ruderal (weedy) grassland, in-stream wetlands, and landscape tree groves. The willow riparian woodland habitat type comprises the majority of the proposed flood control area. In addition to the main plant community types, four special status species have been identified as having the potential to occur in the project area including sand marshwort, La Graciosa thistle, Gambels watercress, and San Bernardino aster. The potential for these species to occur is based on a records search of the California Native Plant Society (CNPS) and California Natural Diversity Database (CNDDB) inventories and the presence of suitable habitat on site.

When the flood control channel was constructed in 1959 all riparian vegetation was removed from the channel, resulting in a flat-bottom trapezoidal channel devoid of all vegetation. This condition was maintained for many decades with periodic dredging of the channel to maintain overall capacity. Due to concerns associated with the presence of threatened species, past management activities that maintained flood conveyance were restricted. Since 2006 vegetation is annually managed as part of a program conducted by the District with assistance from the RCD. The current program acquires annual permits from California Department of Fish and Game and the California Coastal Commission.

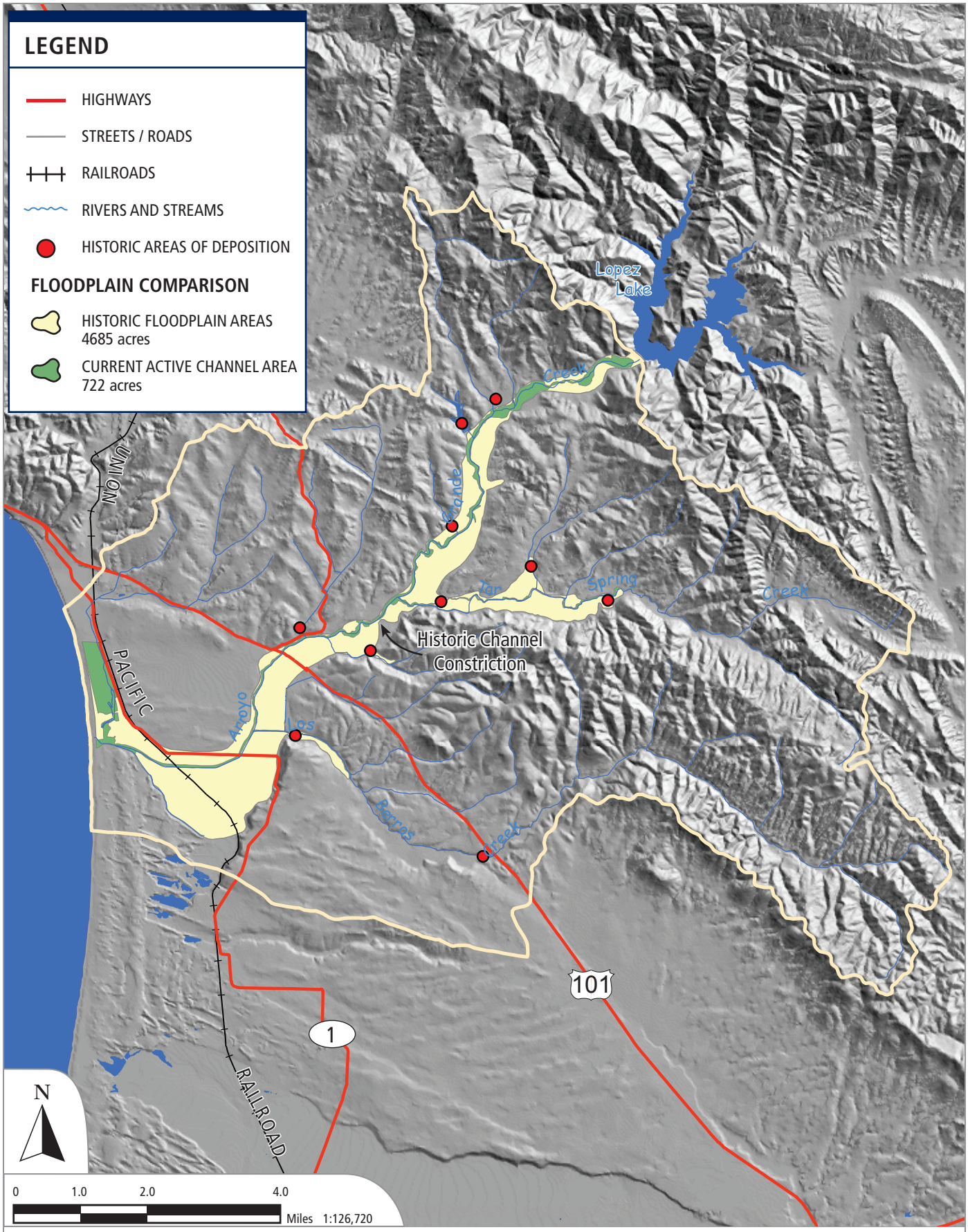

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FIGURE 5: Historic versus existing active channel areas on Arroyo Grande Creek and tributary channels downstream of Lopez Reservoir. Mapped surfaces represent areas of active deposition and storage of sediment delivered from the upper watershed. Loss of potential sediment storage in the lower valley results in transport and delivery of supplied sediment to the flood control reach.

2.3.2 Fisheries resources

Historically, Arroyo Grande Creek supported a large native population of steelhead (*Oncorhynchus mykiss*). Land use impacts in the watershed and construction of Lopez Dam and Reservoir has greatly reduced their numbers to a point where only a small run of adult steelhead occur today. Access to historic spawning habitat upstream of Lopez Reservoir was completely cut off due to construction of the dam in the late 1960's. The remaining habitat consists of the mainstem of Arroyo Grande Creek downstream of the dam and short reaches of year-round flow on tributaries such as Los Berros and Tar Springs. Unfortunately, the mainstem of Arroyo Grande Creek downstream of Lopez Reservoir, Los Berros Creek, and Tar Spring Creek do not provide the prime spawning and rearing habitat that historically occurred upstream of Lopez Reservoir. The accessible reaches of the mainstem of Arroyo Grande Creek consist of approximately 14 miles of channel along the mainstem, 14 miles of channel along Los Berros and an equal amount along Tar Springs.

In 1997, steelhead (*Oncorhynchus mykiss*) runs along the Central Coast of California were listed as threatened under the Endangered Species Act. Due to their declining numbers and federal protection, awareness has been raised about the fate of the steelhead run in Arroyo Grande Creek and a strategy is being pursued to restore this population through habitat enhancement measures downstream of Lopez Reservoir.

The most recent habitat assessment and steelhead abundance surveys were conducted in 2004 and 2006, respectively. Habitat assessments of the entire mainstem of Arroyo Grande Creek below Lopez Reservoir were conducted in the summer of 2004 by the California Conservation Corps (Close and Smith, 2004). Those data were then used to develop a random sample of discreet habitat units for a fish abundance survey conducted in the fall of 2006 (Dvorsky and Hagar, 2008). Within the Project Area a total of five discreet habitat units were sampled representing approximately 840 feet of channel. All of the habitat units were sampled via snorkeling and one of the habitat units was sampled via both snorkeling and electrofishing. The number of steelhead observed via snorkeling in all five habitat units sampled as part of the study was five. No steelhead were captured via electrofishing in the single habitat unit.

In the 2006 study, steelhead were markedly more abundant upstream of the flood control channel than within the flood control reach and then declined within the vicinity of Lopez Dam. In general low numbers of steelhead visually observed and sampled during the 2006 survey are consistent with previous studies on Arroyo Grande Creek which have suggested low steelhead adult returns, poor

quality habitat, and impacts from loss of historic, high quality habitat present above Lopez Reservoir. The observations summarized in the 2008 report suggest that the best habitat present in the system occurs in the upper portions of Reach 2, Reach 3, and the lower portion of Reach 4 (Figure 6; Tables 1 and 2). Habitat conditions in the upper portions of Reaches 4, 5, 6, and 7 appear to be significantly influenced by a lack of high flows due to regulation by Lopez Reservoir. The lack of channel flushing flows has resulted in a narrow low-flow channel that lacks complexity (Close and Smith, 2004). In addition, much of the bed of the channel consists primarily of silt that likely limits spawning. The presence of excessive fine sediment loads in streams has been shown to limit macroinvertebrate production, reduce the amount of cover habitat available to juvenile salmonids, and limit successful spawning (Terhune, 1958; McNeil and Ahnell, 1964; Vaux, 1962; Cooper, 1965; Daykin, 1965). Portions of Reaches 2, 3, and 4 probably exhibit higher steelhead abundance because unregulated flows from Los Berros, Tar Springs, and Corbett/Carpenter Creeks allow for introduction of coarse material for spawning and flushing of fine sediment from pools and riffles.

In addition to steelhead a number of other species of fish occur in the system including Sacramento sucker, California roach, and threespine stickleback. Non-native fish species include bullhead, centrarchids, and mosquitofish.

Fisheries resources were evaluated in the lagoon from 2003 through 2006 (Rischbieter 2004; Rischbieter 2006; Rischbieter 2007). The purpose of the lagoon study was to understand fish use of the lagoon and evaluate the impacts that off-highway vehicles have on habitat quality and use. Off-highway vehicles are currently permitted to cross the mouth of Arroyo Grande Creek to gain access to the State Vehicular Recreation Area. In the 2006 study a total of 13 species of fish were collected from the lagoon including steelhead and tidewater goby. The highest densities of steelhead occurred in February 2006 with a decline in relative abundance through the summer and into fall of 2006.

2.3.3 Other Threatened & Endangered species

The California red-legged frog is a State Species of Special Concern and is Federally listed as threatened. This species is found in quiet pools along streams, in marshes, and ponds. Red-legged frogs are closely tied to aquatic environments, and favor intermittent streams which include some areas with water at least 0.7 meters deep, a largely intact emergent or shoreline vegetation, and a lack of introduced bullfrogs and non-native fishes. This species' breeding season spans January to April (Stebbins 1985). Females deposit large egg masses on submerged vegetation at or near the surface. Embryonic stages require a salinity of $\leq$4.5 parts per thousand (Jennings and Hayes 1994). They are generally found on

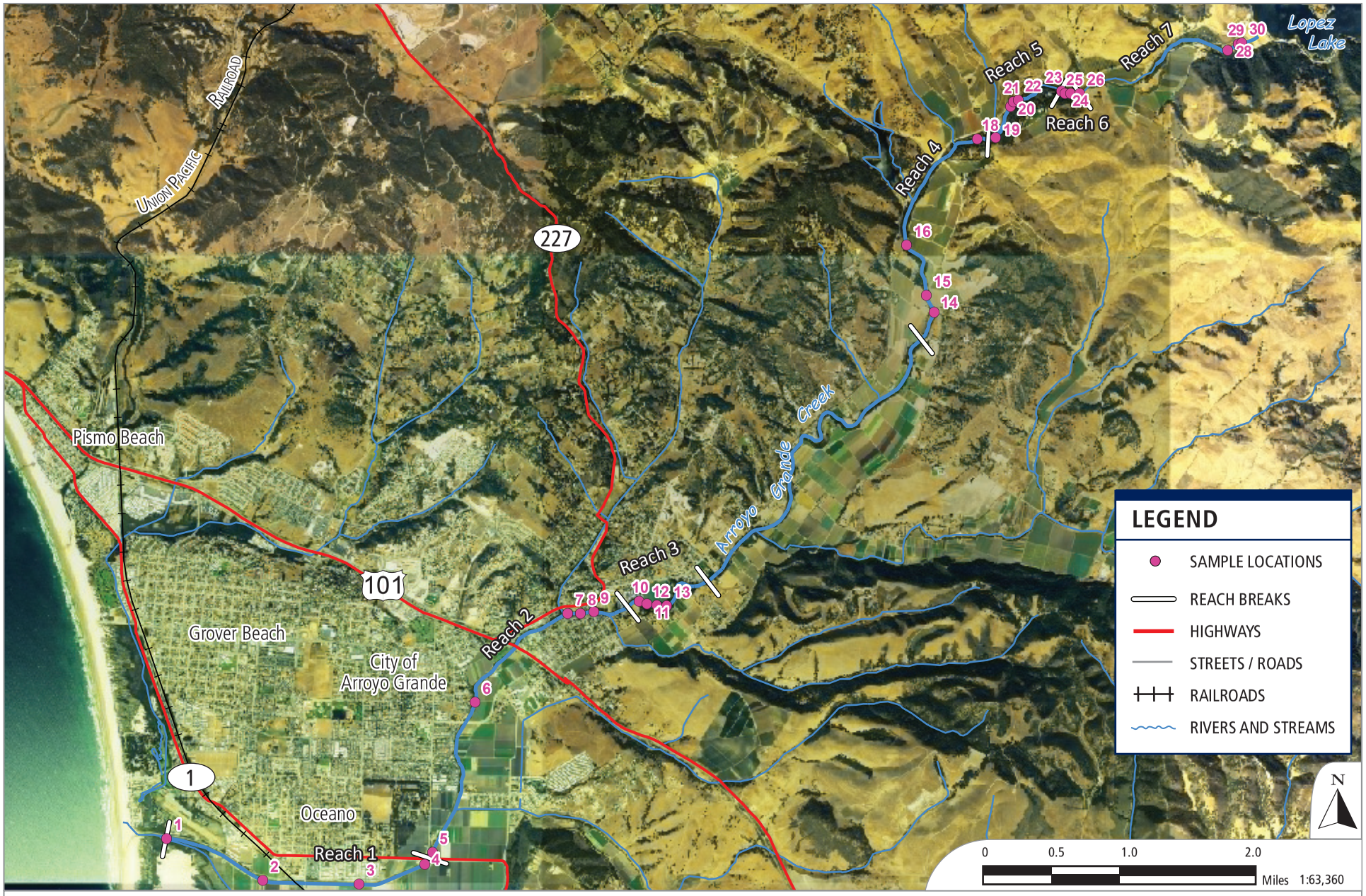

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FIGURE 6: Map indicating sample locations for the 2006 relative fish abundance study and geomorphic reaches along Arroyo Grande Creek.

Table 1

Reach	Sample Unit #	Steelhead	Sacramento Sucker	California Roach	Threespine Stickleback	Speckled Dace	Sculpin	Bullhead Catfish
1	3		19	15	12	1		
2	8	6	58	22		1	7	1
3	13	8	31	25	2	10		
4	14	3	10		1			
5	22	6	5		1			
6	23	4	12					1
7	28		13					

Table 2

Reach	Unit #	Electrofishing Total Catch	Snorkel Total Count
1	1		1
	2		1
	3	0	1
	4		2
2	5		0
	6		0
	7		21
	8	6	14
	9		15
3	10		28
	11		7
	12		12
	13	8	22
4	14	3	20
	15		6
	16		16
	18		3
5	19		1
	20		10
	21		2
	22	6	3
6	23	4	3
	24		1
	25		5
	26		0
7	28	0	4
	29		0
	30		9
	Grand Total	**27**	**207**

Note: Gray highlights denote habitat units that were electrofished and visually sampled.

TABLES 1 & 2: Table 1 - Fish species abundance as determined from electrofishing surveys in Arroyo Grande Creek, October 2006; Table 2 - Steelhead abundance in Arroyo Grande Creek based on electrofishing and visual surveys, October 2006.

streams having a small drainage area and low gradient (Hayes and Jennings 1988). Recent studies have shown that although only a small percentage of red-legged frogs from a pond population disperse, they are capable of moving distances of up to 2 miles (Bulger 1999). The red-legged frog occurs west of the Sierra Nevada-Cascade crest and in the Coast Ranges along the entire length of the state. Much of its habitat has undergone significant alterations in recent years, leading to extirpation of many populations. Other factors contributing to its decline include its former exploitation as food, water pollution, and predation and competition by the introduced bullfrog and green sunfish (Moyle 1973, Hayes and Jennings 1988).

California red-legged frogs have been observed within the flood control reach of Arroyo Grande Creek (Essex Environmental 2002; CSLRCD 2005). The flood control reach is expected to provide summer foraging habitat for the frog; however, due to swift winter flows through the study area, it is not likely to provide suitable frog breeding habitat. The lack of vegetation and dry summer conditions in the Los Berros Creek portion of the study area make it unsuitable for California red-legged frogs. The study area is not within the currently designated critical habitat for California red-legged frog (USFWS 2005).

2.4 Hydrologic and hydraulic conditions

Winter peak flow events on Arroyo Grande Creek can be characterized as flashy and are tied closely to the duration and magnitude of winter rainfall and antecedent soil moisture conditions. In most years, the rainy season begins in October, but the soil moisture demand of the surrounding areas is not met until a significant amount of precipitation has occurred. Once the ground is saturated, a greater percentage of the precipitation is converted to stream flow during storm runoff and the continual contribution of groundwater and subsurface flow to stream channels increases the winter baseflows. Precipitation is typically much lower during April, but the stream flows remain elevated as groundwater and subsurface flow continues to contribute water to the streams. By May, the water levels in the streams are typically low and relatively unresponsive to small spring thundershowers.

Historically, in lower Arroyo Grande Creek, summer baseflow was primarily maintained by releases from Lopez Reservoir. Summer releases from Lopez Reservoir were conducted to recharge the aquifer and meet the municipal water needs and those of the farming community. Currently, downstream releases are conducted on a daily basis throughout the year to ensure that environmental and agricultural needs are being met. This downstream release flow regimen is expected to change once the flood control district completes an on-going Habitat Conservation Plan (HCP). It is anticipated that the HCP will be completed within the next 2-3 years. Although it is rare due to the moderate coastal climate in the area

and the presence of a summer marine layer, off-shore winds can result in unusually warm temperatures on the coastal plain. When these conditions occur, heavy pumping of the local aquifer for agricultural uses can result in temporary dewatering of portions of lower Arroyo Grande Creek.

In the 1950's, the AG Creek flood control channel was designed to handle a 100-year storm, then calculated to be 10,120 cubic feet per second (cfs). However, since construction of the flood control channel, additional data has been collected that better describes less frequent peak discharge events such as the 50-year and 100-year recurrence events. In addition, urbanization of the watershed has likely altered the timing, magnitude, and frequency of high flow events. Both the 1999 Army Corps of Engineers report and 2006 Alternatives Study now calculate the 100-year flood at more than 19,200 cfs, almost twice the 1950's estimate of 10,120 cfs (USACE 1999; SH+G 2006). More frequent events also have a higher discharge than what was calculated when the flood control channel was constructed. The modeling has also been improved allowing for more precise estimates of channel roughness and the influence of debris and sediment on the ability of a channel to convey water. Consequently, even if regulatory constraints were not present and the original cross-sectional area of the flood control channel was restored, the Project could not protect adjacent property owners during a 100-year event.

Most recent estimates of peak flow hydrology for the Arroyo Grande Creek channel were conducted in 1998-99 by the U.S. Army Corps of Engineers, Los Angeles District. These data show the effect of the dam on peak flow in lower Arroyo Grande Creek. Downstream of Lopez Dam, a 2-year event is only 25% of what it would be if the dam were not present. During a 100 year event it is approximately half. The opposite is true for summer baseflow conditions. Winter peak flows are stored in Lopez Reservoir for release in the dry summer months for groundwater recharge for municipal and agricultural uses. Historically, those releases have been managed to maximize recharge and minimize the amount of water that reaches the Pacific Ocean. Currently, additional releases are being made for environmental considerations as well. Therefore, higher base flows occur along lower Arroyo Grande Creek than under pre-dam conditions. The hydrologic record suggests that median summer baseflow conditions prior to construction of Lopez ranged between 1.5 to 2.5 cubic feet per second (cfs), as opposed to 3 to 4 cfs post-dam. During dry and drought years, the data suggest that the Creek would periodically dry up between July and October pre-dam but maintain flows between 0.5 and 2 cfs post-dam (Stetson, 2004).

3.0 PROJECT ELEMENTS

Following completion of the Alternatives Study, the Task Force that was directed to oversee completion of the study met to discuss the proposed project alternatives and to make a decision on how to move forward. The approach selected by the Task Force was to pursue a phased implementation of Alternative 3 as funding within the local flood control district became available and/or opportunities arose to pursue grant funding or long-term loans. Alternative 3, once completely implemented, would provide flood protection up to the modeled 20-year return period. Given limited funding on an annual basis, the need to fund the environmental review and regulatory permitting, and the ongoing vegetation management program, Alternative 3 would most likely be implemented in several phases to eventually provide the expected level of flood protection (Figure 7).

Alternative 3 includes the following components:

- Annual vegetation management;
- An initial phase of sediment removal with maintenance in subsequent years;
- Raising existing levees in two stages representing protection from 10-year and 20-year floods; and,
- Raising and/or retrofitting the Union Pacific Railroad Bridge that crosses Arroyo Grande Creek to improve conveyance and reduce flood risk.

3.1 Current Efforts

Currently, the District conducts annual vegetation management, but has not conducted any sediment removal since 2001. No sediment removal has been authorized due to environmental restrictions and requirements put forth by regulatory agencies that a more comprehensive strategy be prepared to manage the flood control reach (see section 1.3).

In 2006 the RCD received a permit on behalf of the District, from California Department of Fish and Game to begin a vegetation management program through the flood control reach from approximately the Union Pacific Bridge upstream to Los Berros Creek. The vegetation maintenance program generally followed the approach laid out in the Alternative Study, limbing up existing vegetation to encourage formation of a riparian canopy, removal of smaller stems and trunks to reduce cross-sectional

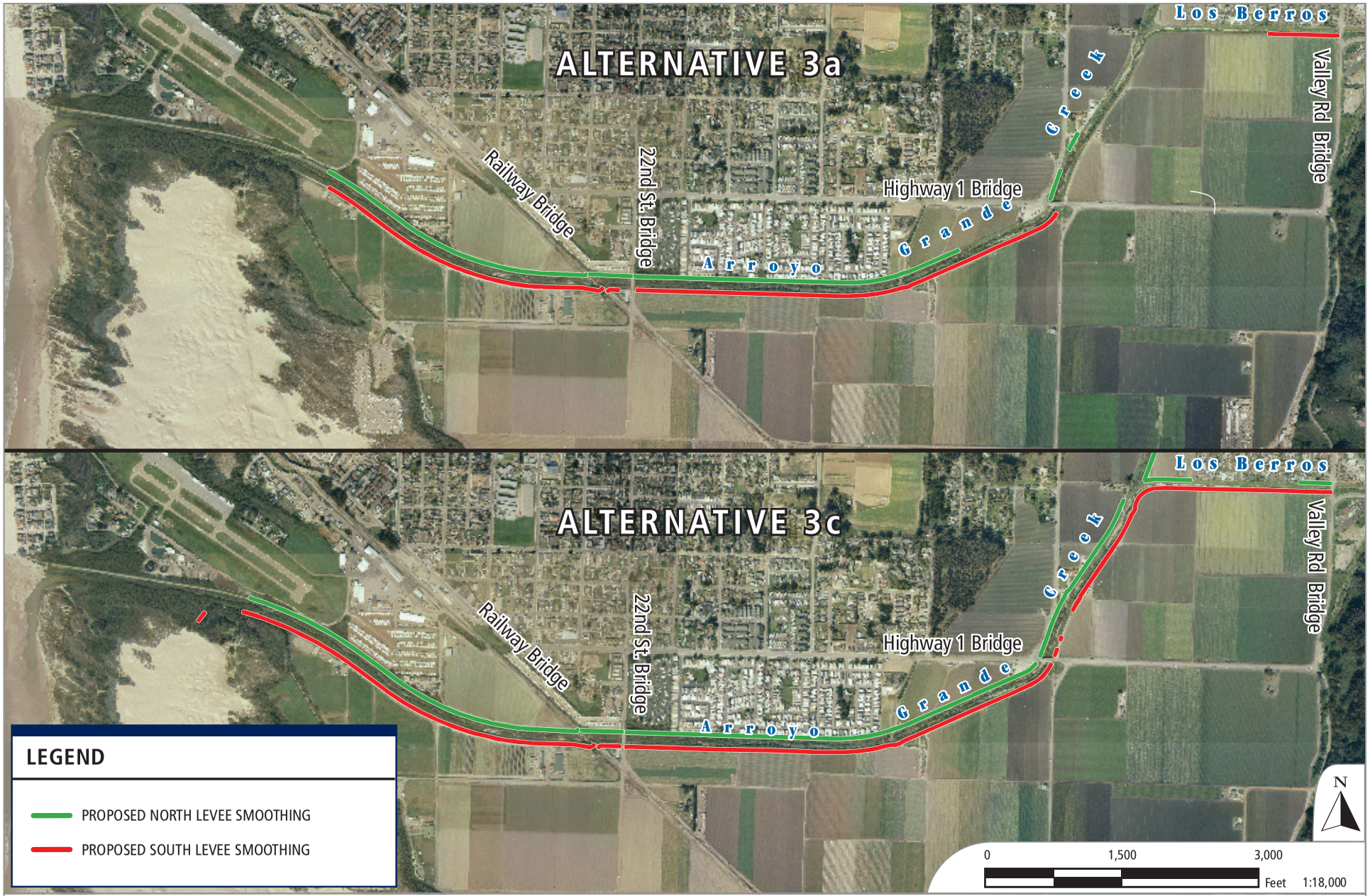

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FIGURE 7: Plan views of levee raise locations for Alternative 3a - Levee Smoothing (10-year protection), and Alternative 3c - Levee Raise (20-year protection). Under Alternative 3a, the north levee is raised approximately 4-inches above the south levee to provide additional protection to residential areas as compared to the south levee which is dominated by agricultural land uses. Under Alternative 3c, levee raising would occur along most of the flood control reach including the Los Berros channel.

roughness, and invasive removal. In 2007 the RCD received a permit, on behalf of the District, from the Coastal Commission to extend the vegetation management program within the Coastal Zone from the Union Pacific Railroad Bridge to just downstream of Guitton's Crossing. Vegetation management activities utilizing these principles has greatly improved the riparian canopy and complexity throughout the Arroyo Grande Creek Channel while at the same time providing increased flood protection. Improvements in the riparian canopy conditions are illustrated in Photos 4-9.

The long-term effectiveness of the existing vegetation management program, conducted by the District with assistance from the RCD, to reduce the potential for flooding on lower Arroyo Grande Creek is limited by the following factors:

1. The current vegetation management program is only permitted by short-term agreements with the California Department of Fish and Game and the California Coastal Commission. The program does not require a U.S. Army Corps of Engineers permit and therefore does not have incidental take statements issued by U.S. Fish and Wildlife and National Marine Fisheries Service that would protect the District from an enforcement action if ESA listed species were "taken" during annual maintenance activities. The current permits only allow for biological monitors to be present during maintenance activities and avoid areas where species, mainly California red-legged frog, are found. This has resulted in a lack of vegetation management along portions of the channel, creating segments where channel roughness is high relative to upstream and downstream segments and flood conveyance is low. Because overall flood conveyance is generally limited by the segment with the least conveyance, discontinuities in the vegetation management program have reduced flood conveyance along the entire flood control reach.
2. The current permit does not allow for complete removal of all woody vegetation outside the 10 foot buffer or any long-term program to manage sediment. The program proposed in the Alternatives Study was developed to protect the primary low flow channel and maintain a functional riparian corridor while providing improved flood protection by increasing conveyance. Outside the designated riparian corridor, secondary channels would be created and maintained for flood conveyance. Meeting the competing objectives of improving flood capacity and protecting aquatic and riparian resources required this compromise.

The need to address the reduced flood protection of the levee system due to sediment accumulation, the obstruction at the UPRR Bridge, and the limitations in the annual vegetation management program prompted the preparation of the WMP. The intent of the WMP is to define how lower Arroyo Grande and Los Berros Creek Channels will be managed to provide long-term reductions in flood risk and improved aquatic habitat conditions for key species of interest. The key components of the WMP

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PHOTOS 4,5,6: Times series of photographs looking upstream of 22nd St. Photos show recovery and improvement of the riparian corridor along the Arroyo Grande Creek Channel following sediment removal in 1999 and annual vegetation management activities after 2006.

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PHOTOS 7,8,9: Times series of photographs at UPRR bridge. Photos show recovery and improvement of the riparian corridor along the Arroyo Grande Creek Channel following sediment removal in 1999 and annual vegetation management activities after 2006.

include vegetation management, sediment management, two phases of levee raise, and replacement or modification of the Union Pacific Railroad Bridge.

3.2 Vegetation Management

For vegetation management activities, a differentiation is made between the Arroyo Grande Creek Channel and Los Berros Creek Channel. Because the relative size of these channels are completely different and the flood control channel reach of Los Berros lacks any appreciable flow in the summertime, vegetation management activities need to be different to reflect site conditions, opportunities, and constraints.

The vegetation management program for the Arroyo Grande Creek Channel will consist of maintaining a 10-foot buffer on both sides of the low-flow channel to provide riparian habitat and streamside cover to protect aquatic habitat (Figure 8). Where riparian vegetation exists on the Los Berros Creek Channel, a 5-foot buffer on each side of the active low flow channel will be maintained. Each buffer would be measured at breast height (i.e. - similar to the technique of measuring tree trunk diameters at breast height) and does not necessarily represent the width of the riparian canopy. Depending upon the maturity of the trees, the upper portion of the tree canopy would likely extend well beyond the buffer width although the exact future width of the canopy would be unknown and would vary (Figure 9).

The buffer would also act to maintain a primary low-flow channel that has developed over the last several years by providing root strength along the low flow channel margins. Woody vegetation outside of the buffer would be removed completely to allow for high flows to access secondary channels (see sediment management program) and provide for increased conveyance and flood capacity. Non-woody herbaceous vegetation would not be removed as they are expected to lay down during a large flow event. Willows present within the buffer would be limbed up to reduce cross-sectional roughness but still provide adequate stream shading and riparian habitat.

Management activities within the buffer will consist of the following:

- Trees greater than 4” in diameter on the banks of the active channel, from the toe of the active stream channel uphill to a distance of 10 feet from the channel (5 feet for Los Berros), will have horizontal branches trimmed to a height of not more than six feet from ground level. If creek shade is provided by adjacent larger trees, willow sprouts less than 4” in diameter will be cut to within 6” of the ground. Trimming the trees on the banks in this manner will encourage growth

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FIGURE 8: Conceptual cross-section view.

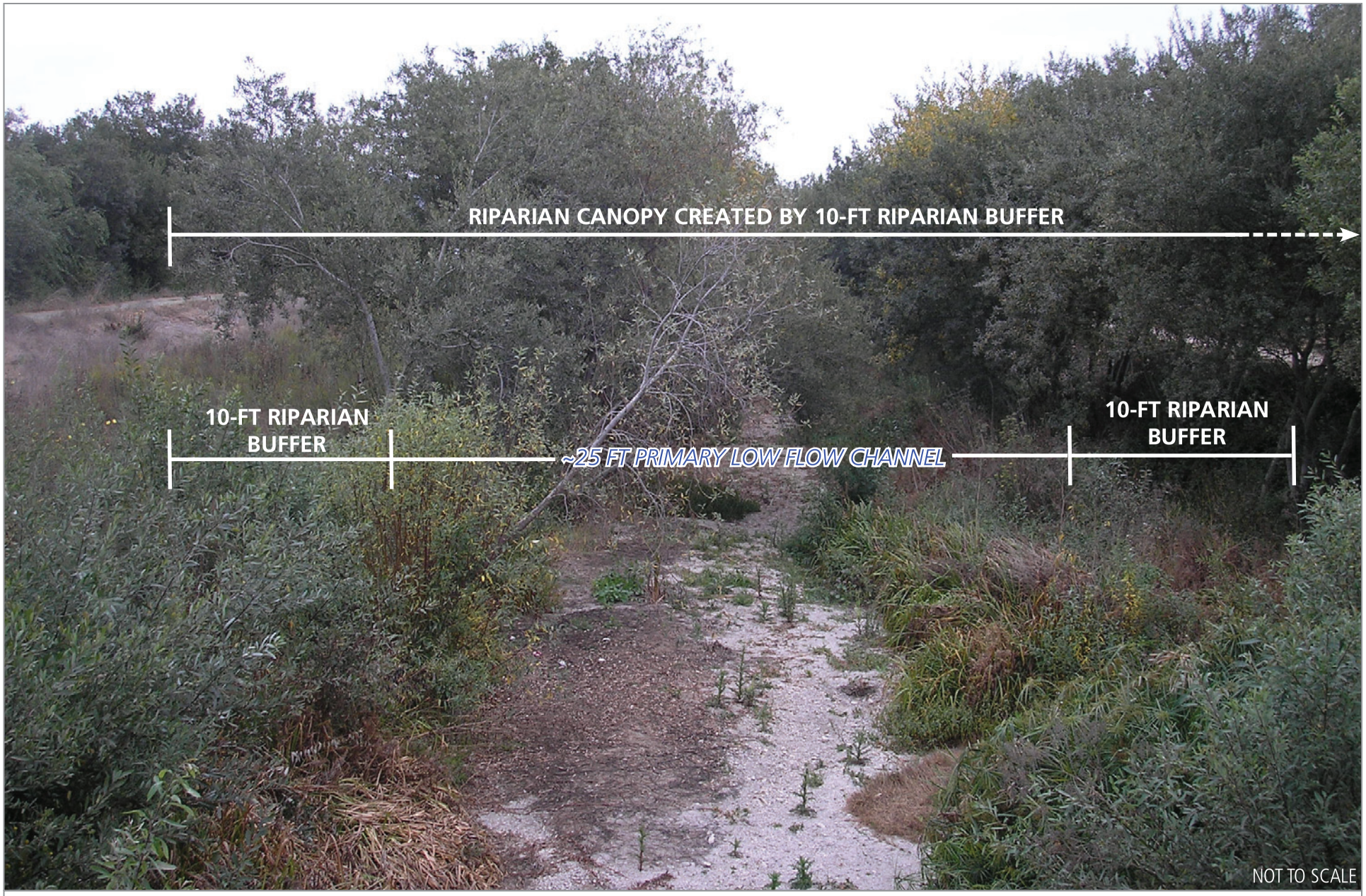

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FIGURE 9: Typical view of vegetation maintenance activities.

in the upper canopy of the trees, improving their ability over time to shade the creek, while also improving channel capacity to handle high flows by lowering the roughness coefficient.

- No trees will be removed within the buffer area with the exception of trees that have fallen over and are a risk to the integrity of the levee (e.g. – lodged against levee or bridge) or have the potential to increase the risk of flooding (e.g. – have fallen across the channel and are obstructing flow). All root balls will be left intact to enable resprouting and to help stabilize soils.

All woody vegetation within the buffer occurring 50 feet upstream and 30 feet downstream of existing bridges will be removed completely.

- Vegetation management activities will be conducted by hand crews and will include the use of mechanized and non-mechanized hand equipment such as chainsaws, loppers, etc. No debris will be allowed to enter the stream channel and debris from invasive species will be separated, bagged and disposed of at a designated landfill. Native vegetation cut from the channel will be mulched on site and either used as mulch on the back side of the levees or removed to a designated off-site area.

To improve riparian habitat through the project area, existing gaps in the riparian buffer would be revegetated with native riparian species including cottonwood, sycamore, and willow, with the exception of the Los Berros portion of the project area. Los Berros Creek differs from Arroyo Grande Creek in that it is not a perennial channel therefore vegetation characteristics are different and it lacks a mature riparian corridor. Cottonwood, sycamore, and alder will be planted at random along the length of the Arroyo Grande Creek Channel to encourage long-term diversity in the riparian corridor. Vegetation management activities will be combined with an active program to remove non-native vegetation from the flood control channel. Non-native species to be actively removed include Himalayan blackberry, English ivy, fennel, weeping willow, giant reed, castor bean, poison hemlock, and geranium. Non-native species management activities could include use of goats, application of herbicides, or removal by hand of plant and rootball. Non-native vegetation removed from the channel will be bagged and disposed of accordingly to limit their spread.

Vegetation management would be conducted as often as necessary to maintain a composite roughness of 0.04 through an adaptive management approach that would include reconnaissance surveys and site visits with regulatory agency staff. Vegetation management activities would likely occur annually depending on the amount of re-growth and funding. Based on vegetation management activities that

have occurred over the last four years, regrowth of managed vegetation during the spring and summer is heavy, requiring annual maintenance.

Vegetation management involving tree trimming would occur as late as possible in the summer and fall of each year to maximize stream shading during the warmer summer months and would only occur between July 1 and October 15 of any given year. If tree trimming activities occur prior to August 15 protocols to avoid impacts to nesting birds will be followed. Vigorous regrowth of willow is expected in late winter and spring providing low, overhanging vegetation during critical months for steelhead and red-legged frog rearing (Photo 10). In the Los Berros Creek Channel, since there are few trees but an overgrowth of non-native species, vegetation management to remove the invasive species would occur in early spring to prevent the vegetation from going to seed. If activities occur prior to July 1, protocols to avoid impacts to the low flow channel will be followed. These will include a start date no earlier than April 15 in the Los Berros Channel and activities will occur when the channel is dry and with agency authorization. Removing the invasive species prior to them going to seed will reduce vigorous regrowth during the following winter/spring and promote the growth of native species.

Photo 10. Spring/early summer regrowth of vegetation in the flood control channel just upstream of the 22nd St Bridge.

3.3 Sediment Management

The need for constant dredging of the flood control channel to maintain design capacity is primarily rooted in two geomorphic principles that dictate sediment delivery and transport in the flood control reach. They include:

1. Much of lower Arroyo Grande Creek downstream of Lopez Dam historically consisted of a broad floodplain characterized by an ephemeral active channel that migrated across the floodplain in response to sediment deposition and debris jams. The loss of that function has resulted in delivery of high sediment loads to the lower reaches of the watershed resulting in excessive sediment deposition in the flood control reach.
2. The original flood control channel design did not consider the concept of a "bankfull" channel when sizing bed dimensions. Bankfull can be defined as the stage that corresponds to the discharge at which channel maintenance is the most effective. It is at the bankfull discharge where, over time, the largest volume of sediment is moved and in-stream morphologic features, such as pools and riffles, are created.

Field observations in the flood control reach, following an extended period with no appreciable dredging, suggests that a bankfull or primary low-flow channel width of approximately 20-25 feet has developed along the Arroyo Grande Creek channel (bankfull was difficult to evaluate in areas backwatered by beaver dams). The flood control channel design created a bottom width of 60-70 feet, resulting in excessive sediment deposition because flow was spread out, resulting in shallower water depths and less energy to move sediment (shear stress, a measure of the water's ability to do work, is a function of flow depth). Consequently, the geomorphic setting and design geometry are an important reason why there is a need to constantly remove sediment from the channel. Maintenance of a primary low-flow channel, enforced by the presence of a stable riparian corridor, will improve sediment transport conditions through the flood control reach.

To enhance geomorphic function, improve flood conveyance, and "set" the flood control channel to an initial condition that will enhance sediment transport, a two step process has been proposed for sediment management within the project area. The two step process consists of an initial phase of sediment removal that will be completed the first year, followed by a long-term sediment management program that will rely on periodic monitoring of sediment conditions in the channel and consultation with permitting agencies to "reset" conditions back to the first year condition.

The first year sediment removal program will include removal of sediment on the levee side of the riparian buffers (Figure 9). Where excessive sediment has built up in the designated off-channel areas, sediment would be removed to a depth of 1.5-foot above the thalweg elevation of the Arroyo Grande Creek Channel and 1-foot above the Los Berros Creek Channel, as measured at a riffle. These depths were estimated as the appropriate bankfull depth for these channels based on field indicators. Sediment that has accumulated as a bar feature along the buffers will not be removed, thereby encouraging higher velocity flows along the primary and secondary channels and enhancing sediment transport conditions.

Overflow or secondary channels will be excavated in designated off-channel areas to create overflow paths during high flow events. In natural systems, the primary channel contains low flows, whereas secondary channels become activated during higher flows that, on average, occur once a year (Figure 10). The Arroyo Grande Creek flood control channel currently lacks the secondary channels that are found in more natural, low gradient stream environments. Based on the current configuration of the primary (low flow) channel, secondary channels will crisscross the primary channel as the primary channel meanders between the levee side slopes (see Appendix B - Preliminary Engineering Design Plans).

During high flow events, the intersection of the primary and secondary channels are expected to be areas of complex flow conditions that will create localized eddies, backwaters, and scour. To take advantage of these high energy areas and encourage development of complex cover habitat for steelhead and red-legged frog, two types of large woody structures will be constructed at these locations (see Appendix B for details on the proposed log structures). One type of large wood structure will be placed at the downstream end of each secondary channel as it conflues with the primary channel. The structure will provide protection from any headcutting into the secondary channel and therefore enforce the location of the primary channel. The structure has also been designed to encourage pool scour at the confluence and mimic an undercut bank (similar to lunker structures traditionally used to enhance fish habitat). Because pool habitat and escape cover is lacking through the flood control reach, improvements to these physical habitat characteristics are expected to greatly improve aquatic habitat. In addition, these structures will provide escape cover for adults migrating through the reach to preferred spawning and rearing habitat areas that occur upstream of the flood control reach.

The second type of large wood structure would protect the head of bar that would exist at the downstream side of the confluence. This structure would also enforce maintenance of the primary and

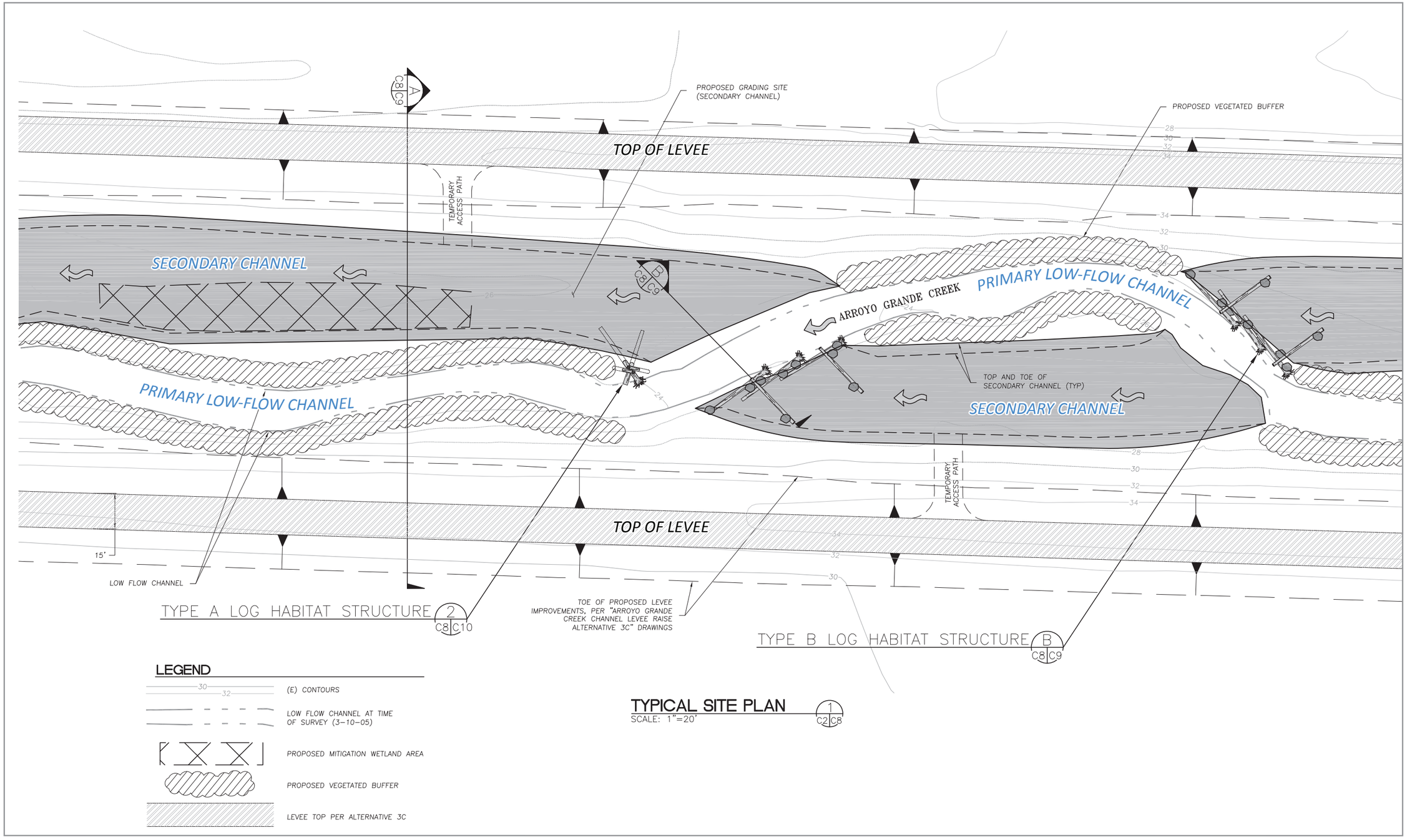

FIGURE 10
Conceptual sediment and vegetation management plans for the Arroyo Grande Creek Channel.

secondary channel locations and create a hard point that would encourage turbulence and creation of a pool at the confluence of the channels. Although both types of structures are designed to meet different habitat and channel stability objectives, they will promote pool scour, encourage variability in substrate and flow field conditions, and provide deep pools and cover habitat for steelhead and red-legged frog.

Some maintenance of the secondary channels is expected over the long-term. Post first-year sediment management activities will likely consists of an excavator, located on the top of the levee, scooping and removing built up sediment. Removed sediment will be placed in a dump truck, also located at the top of the levee, to take the sediment off-site to a County approved area. Long-term sediment management activities are not expected to involve removal of vegetation or use of equipment within areas with flowing water.

Cross-sections will be monitored periodically to assess the performance of the channel in moving supplied sediment. Modeling presented in Chapter 4 of the Alternatives Study (SH+G, 2006) suggests that increased sediment transport conditions through the flood control reach will not negatively impact the Arroyo Grande Creek lagoon. To ensure that the depth of the lagoon is not impacted, additional cross-sections will be established at the lagoon and monitored following significant runoff events. Cross-sections will also be established along the flood control reach to provide information on the need to do spot removal of accumulated sediment to ensure that the project passes target flood flows. Annual maintenance will also be a component of the overall vegetation and sediment management program. A similar program has been successful on the San Lorenzo River in Santa Cruz County despite concerns about steelhead and Coho salmon (SH+G et al, 2002). In the case of the San Lorenzo River, secondary channels have developed a gravel/cobble surface due to scouring action and lack of fine sediment deposition. The objective of the annual maintenance program is to keep the secondary channels open for flood flows.

3.4 Raise Existing Levees

A key component of the Waterway Management Program involves raising the existing levees to improve flood protection along lower Arroyo Grande Creek. The levees would likely be raised in two phases to ultimately achieve flood protection up to a 20-year flood event. The first phase would raise the levees to an elevation that would provide 10-year flood protection. The second phase would achieve the desired 20-year flood protection. Both phases would incorporate sediment and vegetation management activities to achieve the desired level of flood protection. The levees would be raised along most of

lower Los Berros Creek Channel and along Arroyo Grande Creek Channel from the Los Berros confluence to the upstream end of the lagoon (Figure 8). The existing levees will be raised with the inside slope of the levee at 2:1, the outside levee at a slope of 1.5:1 and top of levee width not less than 15 feet (see Appendix B - Engineering Design Plans for details on the proposed levee raise). All levee raising work would take place on the outside of the existing levee, where feasible, and not impinge upon the existing Ordinary High Water (OHW).

3.5 Union Pacific Railroad Bridge

The Union Pacific Railroad (UPRR) Bridge, located near the downstream end of the flood control reach, presents an obstruction to flow under current conditions (Photo 11). In addition, the bridge does not cross at a 90 degree angle to the flood control channel and the abutments do not run parallel to the flow path of Arroyo Grande Creek. Under the proposal to raise the adjacent levees to provide 20-year flood protection, the UPRR Bridge would need to be modified, raised, or replaced to enable the levee raise. The UPRR Bridge does not need to be modified for the smaller (10-year protection) levee raise project. Given funding issues, it is unclear when the bridge would be modified, raised, or replaced in relation to the proposed levee raise.

Photo 11. Union Pacific Railroad (UPRR) bridge during the 2001 flood.

Any plan to modify, raise, or replace the UPRR Bridge would require work within OHW and within the low flow active channel. A temporary shoo fly track would be constructed adjacent to the existing bridge to provide uninterrupted service along the UPRR line during construction activities. The project

may require temporary dewatering activities during certain phases of the construction which would be accompanied by standard water quality and aquatic habitat protection measures. It is also likely that a small amount of riparian vegetation would need to be removed in the riparian buffer area (beyond the already proposed vegetation removal 50 feet upstream and 30 feet downstream of the bridge), necessitating revegetation efforts following construction.

4.0 MONITORING AND ADAPTIVE MANAGEMENT PLAN

4.1 Goals and objectives

Two key elements of the WMP, namely the vegetation and sediment management programs, will require activity within Arroyo Grande Creek over the long-term and in some cases on an annual basis. To maximize the benefit of these activities, reduce the costs to Zone 1/1A, and protect vital biological resources, long-term management will need to be adaptive to the conditions on site in any given year and will require a regulatory approach that is flexible within the objectives defined by the management program. An integral element of the management program is a well-defined monitoring program that provides the data necessary, in a timely manner, to effectively manage the system. This section outlines the proposed Mitigation and Monitoring Plan that will guide long-term vegetation and sediment management within the flood control reach.

4.2 Vegetation management

4.2.1 Goal

The goal of the vegetation management program is to maintain a balance between flood protection along lower Arroyo Grande Creek and protection of natural resources that rely on a healthy riparian corridor to protect important aquatic habitat. The vegetation management program, as outlined in Section 3.1 accomplishes these objectives in two ways:

1. Management of riparian vegetation to maintain a cross-sectional roughness of 0.04, and
2. Maintenance of a continuous corridor of riparian vegetation along the established primary (low flow) channel.

It is expected that vegetation management activities will occur on an annual basis, requiring a large crew working in the channel between April 15 and October 15. To ensure that vegetation management activities are carried out in a consistent manner, all workers will need to be properly trained and abide to the protection measures proposed in the WMP.

4.2.2 Monitoring and Performance Measures

Management of vegetation for flood control through the project reach has been conducted annually for the last three years and is expected to continue indefinitely on an annual basis. Because some of the work related to vegetation management is subjective and the level of effort may vary from year to year depending on growth rates, high flow conditions the previous year, and an inherent variability in year to year effort, annual monitoring will be required to direct management activities. The annual monitoring of vegetation conditions is meant to be a key component of an adaptive management strategy that seeks to respond to changing conditions, both from a flood control and natural resource perspective, based on defined performance measures. A summary of the performance measures and monitoring efforts associated with each is provided in Table 3 and are as follows:

- **PM VEG-1:** Finalize the annual vegetation management work plan by July 1. The draft work plan should be submitted for review and comment by the regulatory agencies by May 1 with comments provided by the regulatory agencies by June 1. The final work plan should be in place by July 1 for implementation. If invasive removal is needed, a final work plan just for invasive removal shall be in place by May 1. The work plan will address Performance Measures 2 through 4.
    - **MON VEG-1:** Each year in late spring, a report will be prepared defining the proposed vegetation management work plan to be conducted in the summer and early fall. The work plan will incorporate field notes and maps to define the management actions that will be carried out each year. Issues addressed in the work plan will include proposed areas of revegetation based on mapped gaps in riparian vegetation, locations and densities for focused plantings of non-willow species, areas and species type of non-native removal efforts, and depictions of areas where woody vegetation needs to be removed outside the riparian buffers. The work plan should be detailed and specific enough to provide a year-to-year road map to the group tasked with conducting the proposed activities. Where feasible, woody vegetation outside of the buffer recommended for removal should be flagged to allow independent review by regulatory agency staff.
- **PM VEG-2:** Increase riparian canopy cover. The primary objective of maintaining a riparian buffer is to create a continuous riparian canopy through the project area that provides benefit to terrestrial and aquatic species that rely on cover habitat, cool water temperatures, and other functions provided by a continuous and diverse riparian corridor. The objective of this performance measure would be to maintain or increase riparian canopy cover through the project area.

Activity	Performance Measure	Monitoring Element	Current Status of Parameter	Performance Target	Frequency
Vegetation Management	**PM VEG-1**: Finalize Work Plan	**MON VEG-1**: Prepare vegetation management work plan	Not Applicable	Annual work plan finalized by July 1[1]. Work plan will address PM VEG 2-4.	Annually following adoption of the WMP
	PM VEG-2: Increase riparian canopy cover	**MON VEG-2**: Measure canopy cover through project reach	To be measured following adoption of the WMP and Year 1 vegetation management to establish a baseline	Maintain or increase % canopy cover above baseline conditions.	Every three years following adoption of the WMP
	PM VEG-3: Increase riparian species diversity	**MON VEG-3**: Measure canopy species diversity through project reach	To be estimated following adoption of the WMP and Year 1 vegetation management to establish a baseline	County will consult with agency staff to determine targets based on success of diversity efforts over first 10 years of management	Every three years following adoption of the WMP
	PM VEG-4: Eliminate invasive species	**MON VEG-4**: Map invasive vegetation that occurs within project reach	Invasive species populations not currently mapped. Would be mapped prior to initial vegetation management activities.	1. Provide map of invasive species populations prior to Year 1 vegetation management	Update invasive species map every three years following adoption of the WMP
				2. No net increase of invasive species populations after Year 2015.	
Sediment Management	**PM SED-1**: Finalize Work Plan	**MON SED-1**: Prepare sediment management work plan	Not Applicable	Work plan finalized by September 1 of year prior to sediment management activities. Work plan will address PM SED 2-5.	As needed according to cross-section and hydraulic modeling results
	PM SED-2: Aggradation does not cause loss of 2-foot levee freeboard	**MON SED-2**: Cross-section monitoring through project reach	Not Applicable	Modeling results show that freeboard still exists above expected level of protection.	As needed according to reconnaissance assessment of sedimentation through flood control reach
	PM SED-3: Project does not result in long-term aggradation of lagoon	**MON SED-3**: Cross-section monitoring of lagoon	Baseline will be surveyed prior to first-year sediment management activities	Lagoon sedimentation patterns are within the range of natural variation.	Every three years following adoption of the WMP
	PM SED-4: Improve cover habitat for salmonids	**MON SED-4**: Evaluate habitat conditions in the project reach (Flosi et al)	Baseline to be established from CCC survey conducted in 2004.	Maintain or increase the cover rating for the project area as compared to baseline.	Every three years following adoption of the WMP
	PM SED-5: Improve maximum pool depth		Baseline to be established from CCC survey conducted in 2004.	Maintain or increase the average maximum pool depth in project area as compared to baseline.	Every three years following adoption of the WMP

1 - If invasive removal is proposed on Los Berros prior to June 15, that portion of the annual Work Plan will need to be finalized by May 1.

TABLE 3
Summary of the performance measures and monitoring efforts.

- **MON VEG-2:** Measure canopy cover every three years and report the percent cover in the annual Vegetation Management Workplan. The area of measurement shall include that between the centerlines of the north and south levees and the east and west project boundaries, as shown in Figure 1.

- **PM VEG-3:** Increase riparian species richness and density in the project area. Candidate species include but are not limited to sycamore, alder, and cottonwood. A performance target will be adapted as necessary during annual consultation with regulatory agencies.
  - **MON VEG-3:** Preparation of the first Vegetation Management Workplan shall include (1) a description of the number and approximate diameter at breast height (DBH) of the existing candidate species within the project area and (2) a planting plan for candidate species. Each subsequent annual workplan shall include an update of the number of individual candidate species, the DBH, and a planting/maintenance plan, as applicable.

- **PM VEG-4:** Achieve a riparian corridor that is free of invasive non-native species. Non-native invasive species are prevalent throughout the project reach although they have not been mapped. Consequently, a baseline will need to be established in the summer of 2010 and an eradication strategy will need to be developed and discussed in the annual work plan. The performance target would be to conduct most of the eradication efforts prior to 2015 with no net increase in infected areas beyond 2015. Key species to eradicate would be Arundo, ivy, Himalayan blackberry, and castor bean. Removal techniques may include application of herbicide, removal by hand of plant and rootballs, or the use of goats.
  - **MON VEG-4:** Map the presence of significant areas of non-native invasive species within the project area.

4.3 Sediment management

4.3.1 Goal

The goal of sediment management activities is to increase and maintain flood capacity through the project reach while at the same time improving instream aquatic habitat and reducing the need for maintenance dredging in the future. These goals will be achieved through an initial dredging of previously built up sediment to create secondary channels and integration of habitat enhancement structures consisting of large wood. Sediment management activities, including Year 1 and future activities, incorporate Best Management practices, monitoring activities, and performance measures that are well tested and have proven to be important as part of an overall strategy to adaptively manage channel conditions.

4.3.2 Monitoring and Performance measures

Monitoring of the sediment management portion of the project is directly related to the performance of the elements of the sediment management plan. Secondary channels are being proposed to enhance sediment transport through the reach and reduce the frequency of dredging activities. Concerns were also raised about the impact sediment management activities in the flood control reach will have on sediment transport into and through the lagoon.

Performance measures for the sediment management portion of the project are focused on preparation of the work plan and assessing the quality of instream aquatic habitat and how aquatic habitat function changes over time in response to sediment management activities. Aquatic habitat conditions were last surveyed in 2004 and relative fish abundance sampled in 2006. These studies would act as a baseline to evaluate the benefits of the proposed sediment management activities moving forward. The results from these studies suggest that the Arroyo Grande Creek Channel is primarily used by steelhead adults as a migratory corridor and marginally as rearing habitat for juveniles. Monitoring and performance measures summarized in Table 3 and included below address these concerns through a monitoring program that directly responds to management actions that address sediment reduction and habitat enhancement activities.

- **PM SED-1:** Finalize a work plan for sediment management activities by September 1 of year prior to when activities are expected to occur. The work plan should be submitted for review and comment by the regulatory agencies by August 1 with comments provided by the regulatory agencies by August 15. The work plan will address Performance Measures 2 through 5.
    - **MON SED-1:** Prepare, review and finalize work plan for sediment management.
- **PM SED-2:** Sedimentation in the project area does not reduce capacity in any one location beyond the defined freeboard.
    - **MON SED-2:** Cross-section monitoring will be conducted periodically in the flood control reach to determine if sediment accumulation in the secondary channels has reduced conveyance to the extent where additional sediment management is required. Cross-section monitoring data will be used in conjunction with the hydraulic model to determine if the levee freeboard has been compromised. Freeboard has been defined as 2-feet under all modeled alternatives in the Alternatives Study. For example, under the action that only includes vegetation and sediment management, the flood control channel is expected to provide protection up to the 4.6 year event with 2 feet of freeboard. In any given year, if the cross-section data and modeling results show that a

4.6 year event cannot be contained without the freeboard, Zone 1/1A would prepare a sediment management plan, based on the cross-section monitoring data, to remove sediment from the secondary channels to achieve 4.6 year flood protection with 2 feet of freeboard. Cross-section monitoring and preparation of a sediment management work plan would consist of the following:

1. Permanent cross-section locations will be established and monumented along the project reach following Year 1 sediment management activities. Cross-sections will be established every 500 feet along the channel and at the upstream and downstream sides of each of the bridges.
2. All of the established cross-sections will be measured Year 1 and roughness will be estimated for each to establish a baseline. A report will be produced and a database established.
3. Periodically, at the discretion of the District, Zone 1/1A, a portion of the cross-sections will be re-surveyed to evaluate the degree of sedimentation. The cross-sections surveyed in any given year will be incorporated into the hydraulic model along with the roughness estimates and a determination will be made regarding the need for dredging of any secondary channels.
4. Re-surveying of established cross-sections should occur as early as possible following the cessation of winter rains (i.e. – April/May). A report cataloging the results of the survey will be used to determine if a sediment management plan is necessary.
5. If sediment management is required, a sediment management plan will be prepared outlining where sediment management is needed, what quantity of sediment will be removed, when the activity will occur, and what equipment and approach will be used. The sediment management plan will be submitted to the agencies for review and comment.
6. If a sediment management plan is prepared, it should be submitted for comment to the agencies by August 1 of the year prior to any proposed dredging activities. Agency comments shall be received by August 15 following submittal of the sediment management plan.

- **PM SED-3:** Sediment management activities in the project area do not result in long-term aggradation in the lagoon and loss of lagoon volume. Evaluation of this performance measure will require a survey of the lagoon prior to the first year of sediment management activities to establish a baseline condition. The performance goal will be to not reduce the lagoon volume

by more than 25% from the baseline based on a six year moving average of measured conditions.

- **MON SED-3:** To evaluate potential long-term sediment impacts on the lagoon from sediment management activities in the flood control reach, cross-sections will be established in the lagoon.
    1. A total of four cross-sections will be established, approximately equally spaced throughout the lagoon. The cross-sections will be established in 2010 to develop a baseline and to understand year-to-year natural variability in lagoon morphology prior to initiation of long-term sediment management activities.
    2. The four cross-sections will be monitored every 3 years following the first year sediment management activities and a report will be prepared.
    3. If after 9 years sediment management shows no effect on the lagoon, then cross-sections monitoring will be reduced, following discussions with regulatory agencies.

- **PM SED-4:** Increase or maintain the cover rating through the project reach. Cover habitat is important for rearing juvenile steelhead, especially with the known presence of non-native predatory species, as well as providing refuge areas for adult steelhead during high flow conditions. A baseline of the cover rating will need to be established for the project area. The last comprehensive habitat survey of the project area was in 2004 by the CCC's. Depending upon the timing of first year sediment management activities additional surveys may be required to establish baseline conditions.
    - **MON SED-4:** To evaluate changes in aquatic habitat conditions along the Arroyo Grande Creek Channel, habitat assessments will be conducted through the project reach every three years using protocols established in the California Salmonid Stream Habitat Restoration Manual (Flosi et al, 1998). The habitat assessment will repeat the work conducted by the California Conservation Corps in 2004 or a later survey if it is determined to represent a better baseline condition. The assessment work will be conducted in late summer/early fall of each monitoring year with a report prepared and submitted by December 1. The report should also include recommendations for adaptive management.
- **PM SED-5:** Increase or maintain average maximum pool depth through the project reach. Deep pool habitat is important for steelhead and is currently lacking in the project reach. Most of the pools are shallow, bordering on glide habitat with little to no complexity. A long-term goal of the project would be to improve local scour to enhance pool formation. A baseline of average maximum pool depth will need to be established for the project area. The last comprehensive

habitat survey of the project area was in 2004 by the CCC's. Depending upon the timing of first year sediment management activities additional surveys may be required to establish baseline conditions.

- **MON SED-5:** Same as MON SED-4.

4.4 Protection measures

The following measures have been proposed to protect natural resources within the project area during all proposed activities included within the WMP:

- **PM-1:** RLF are assumed to occur throughout the AG Creek flood control channel during the season that vegetation management activities are likely to happen. To protect RLF, the following protection measures must be adhered to:

  1. To allow for the potential disturbance of habitat or the necessary temporary relocation of RLF during maintenance and/or construction activities, take protection for RLF must be obtained as part of the 404 process with U.S. Army Corps of Engineers. This process will require consultation with U.S. Fish and Wildlife Service who will issue a Biological Opinion for the project. The Biological Opinion may contain protection measures in addition to those outlined in this section that must be adhered to.
  2. A Service-approved biologist will survey the project site no more than 48 hours before the onset of work activities. Given the length of time that vegetation management activities are likely to occur, daily surveys may need to occur that precede work in any particular section of the channel. If any life stage of the California red-legged frog is found and these individuals are likely to be killed or injured by work activities, the approved biologist will be allowed sufficient time to move them from the site before work activities begin. The Service-approved biologist will relocate the California red-legged frogs the shortest distance possible to a location that contains suitable habitat and will not be affected by activities associated with the proposed project. The Service-approved biologist will maintain detailed records of any individuals that are moved (e.g., size, coloration, any distinguishing features, photographs (digital preferred) to assist him or her in determining whether translocated animals are returning to the original point of capture.
  3. Before any management or construction activities begin, a Service-approved biologist will conduct a "worker awareness" training session for all personnel involved in the

activity. At a minimum, the training will include a description of the ecology of the California red-legged frog and its habitat, its protected status, and the specific measures being implemented for this project to avoid harm to and conserve the California red-legged frog for the current project, and the boundaries within which the project may be accomplished. Brochures, books and briefings may be used in the training session, provided that a qualified person is on hand to answer any questions.

4. During maintenance or construction activities, if a RLF is observed within an area where activities are occurring, all activities will cease and qualified biologist will be contacted. Activities can not resume until the qualified biologist has either temporarily relocated the RLF or the amphibian has been identified as another species.
5. Weed whackers will NOT be used by maintenance crews so as to reduce the risk of harming RLF.
6. A monitoring report and completion form will be prepared by the qualified biologist and sent to the Ventura Fish and Wildlife Office following completion of the activity.

- **PM-2:** For any work performed between February 15 and August 15, a qualified biologist will conduct the necessary surveys for nesting birds. If active nests are identified, work in those particular areas will be delayed until after August 15 or the biologist has determined the young have fledged.
- **PM-3:** When feasible, all work activity occurring within the active low flow channel shall be conducted when the channel is dry or at its lowest flow condition (late summer).
- **PM-4:** If management or construction activities require the temporary dewatering and relocation of fish, these activities will utilize gravity flow and will be constructed, operated, and removed according to the following conservation measures:
    - Where diversions are appropriate, they will be constructed independently for each project element, or group of project elements, so as to minimize the duration that any particular segment of stream channel is dewatered.

- **PM-5:** Dewatering activities may require the temporary relocation of fish. To protect fish resources the following measures will be adhered to in order to minimize potential steelhead mortality during relocation activities:
    1. Block nets will be placed at the upper and lower extent of the diversions or coffer dams to ensure that salmonids upstream and downstream do not enter the areas proposed

for dewatering. Block nets will not be removed until installation of all cofferdams, bypass pipes or channels, diversion dams or other facilities designed to dewater or divert flow, are completed.

2. If electrofishing techniques are utilized during fish relocation activities, at least one member of the field crew will be familiar with NMFS electrofishing guidelines and have a minimum of 100 hours of field experience with electrofishing techniques.
3. Electrofishing may not be performed if water temperatures exceed 18^{o} Celsius, or could reasonably be expected to rise above this temperature during the activities.
4. Electrofishing shall not be utilized in areas where water conductivity is greater than 350 uS/cm. Only direct current (DC) shall be used. At least one assistant shall aid the biologist during electrofishing by netting stunned fish and other aquatic vertebrates.
5. Each electrofishing session must start with all equipment settings (voltage, pulse width, and pulse rate) set to the minimums needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized and captured, and not allowed to exceed the specified maxima: Voltage = 100V (Initial) – 400V (Max); Pulse width= 500 uS (Initial) – 5 uS (Max); Pulse rate = 30 Hz (Initial) – 70 Hz (Max).
6. A minimum of three passes with the electrofisher will be utilized to ensure maximum capture probability of salmonids within the area proposed for dewatering, unless the number of fish captured in the second pass is less than 10 percent of the first pass. In that case, two passes are adequate. If steelhead are present on any pass, a minimum of 20 minutes will separate the beginning of each pass through the Project reach to allow time for fish that are not captured to become susceptible to electrofishing again.
7. All captured fish will be held in water with temperatures not greater than ambient in-stream temperatures. If cooling is used, water temperatures will be maintained not more than three degrees Celsius less than ambient in-stream temperatures. All captured fish will be held in well oxygenated water, with a dissolved oxygen level of not less than seven parts per million. Prior to release, the following information shall be recorded: 1) Enumerate fish by species, 2) Visual determination of age of steelhead, 3) Enumerate steelhead injuries and fatalities by age class, 4) Enumerate successfully relocated steelhead by age class for each relocation site, and 5) Date and time of release of steelhead to each relocation site. Steelhead shall be subject to the minimum handling and holding times required. All captured fish will be allowed to recover from electrofishing and other capture gear before being returned to the stream. All captured fish will be processed and released prior to any subsequent electrofishing pass or netting effort.

8. All captured fish will be released upstream of the block nets to facilitate redistribution into dewatered areas following construction activities.

- **PM-6:** During all management or construction activities, Best Management Practices, consistent with those recommended by the Regional Water Quality Control Board and the California Department of Fish and Game, should be adhered to. They include the following:

    1. The contractor shall only use the approved access routes shown on the plans. No persons, equipment, or material shall be allowed outside the designated limits of disturbance.
    2. The stockpile areas for removed sediment that are adjacent to the levee and have potential for entering the active channel shall be fully enclosed with silt fence and boundary fence.
    3. All equipment shall be stored, maintained and refueled in a designated portion of the stockpile area. The contractor shall adhere to a spill prevention plan, to be prepared by the contractor and submitted for review by the engineer.
    4. Contractor shall immediately stop all operations and devote all on-site personnel to the containment and clean up of any fuel, fluid or oil spill, to the satisfaction of the engineer.
    5. The contractor shall be responsible for continuous dust control in accordance with the conditions of the permits. The contractor shall be responsible for the regular cleaning of all mud, dirt, debris, etc., from any and all adjacent roads and sidewalks.
    6. All excess soil shall be disposed of off-site or at locations to be designated in the permit documents.
    7. No debris, rubbish, creosote-treated wood, soil, silt, sand, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products or other organic material or earthen material shall be allowed to enter into, or be placed where it may be washed by rainfall or runoff into the creek. Any of these materials placed within or where they may enter the creek shall be removed immediately. When construction is complete, any excess material shall be removed from the work area so that such materials do not wash into the creek.
    8. Adequate erosion control measures shall be constructed and maintained to prevent the discharge of earthen materials to the creek from disturbed areas under construction and from completed construction areas. All disturbed areas of bed and bank shall be

stabilized, winterized, and vegetated with appropriate native vegetation prior to the end of the work window.

9. No equipment shall be operated in areas of flowing or standing water. No fueling, cleaning or maintenance of vehicles or equipment shall take place within any areas where an accidental discharge to the creek may occur; construction material and heavy equipment must be stored outside of the ordinary high water mark. All work done within the creek shall be completed in a manner so as to minimize impacts to beneficial uses and habitat; measures shall be employed to minimize disturbances along the channel that will adversely impact the water quality of the creek.

4.5 Beaver management

The beaver is an important mammal to California, as well as to North America, from a historical and aesthetic perspective. Beaver can be beneficial elements of the ecosystem by creating wetland habitat for a variety of wildlife species including fish, birds, amphibians, reptiles, and other mammals. This variety of wildlife is in turn valued for recreational, scientific, educational and aesthetic purposes. This increase in biodiversity of wildlife is a great asset to open space areas and is often highly valued by trail users and residents. In some areas beaver activity is also helpful in retaining storm water runoff and improving water quality by trapping sediment, nutrients, and pollutants. The dams act as natural check dams during floods and high water, reducing erosion and slowing the water enough to encourage sediment deposition. Water behind beaver dams also create additional shoreline and enable water-loving plants and trees to grow and thrive.

Beaver activity can also have detrimental effects. Their actions can sometimes lead to flooding of roads and trails, the loss of trees and shrubs, and the destruction of both public and private property. Their impacts often occur suddenly and dramatically. Beavers are usually not noticed in an area until valuable trees have been felled or flooding occurs. When beavers and their dams are deemed a nuisance, the initial response is to breach the dam. Although this can be a quick fix solution, the dams are usually rebuilt fairly quickly.

In the case of the flood control channel, the presence of beaver dams causes sediment to accumulate in the channel, especially in overbank areas that may not be scoured if the dams are breached. The accumulation of sediment results in less conveyance during a flood event and an increased need to periodically remove sediment.

With regard to aquatic habitat, anecdotal evidence suggests that the beaver dams may enhance rearing habitat for juvenile steelhead by creating deeper pools with complex cover habitat around flooded willows. The downside of the beaver ponds are that they tend to not persist through the entire low flow summer season and they may inhibit outmigration of adult steelhead in the spring, as was the case in the summer of 2008.

The impacts the beaver dams have on flood control in the Arroyo Grande Creek Channel is dramatic. Not only do the dams directly reduce flood conveyance due to the impoundment of water, they result in significant deposition of coarse bed material that builds up in the channel and reduces flood conveyance long term. Because of the confined nature of the constructed flood control channel, loss of conveyance in one area dramatically impacts conveyance upstream for a considerable distance as the zone of sediment deposition propagates upstream. Beaver also may threaten the efficacy of achieving a diverse, continuous, riparian corridor along the Arroyo Grande Creek Channel as they cut down larger trees and create gaps in the canopy.

Although the numbers of beavers currently using the Arroyo Grande Creek Channel and their distribution in the Arroyo Grande system are unknown, their existing and expected future impact is significant enough to warrant active management of the beaver. The District and Zone 1/1A, have, and will, be making a considerable investment in flood management and habitat enhancement measures. Consequently, it has been recommended during preparation of the WMP that active beaver management be included as a tool to ensure that flood control is maintained and that future sediment management activities are not compromised by beaver activity.

Beaver management activities allowed under the WMP would include capture and relocation, removal of existing dams, and where necessary capture and euthanization of individual beavers. If euthanization is used as an alternative to capture and relocation, a depredation permit would be necessary from the California Department of Fish and Game. Beaver management activities will be conducted in a way as to be sensitive to the local community. Beaver management activities in any given year, where feasible, will be specified in the annual work plan prepared for vegetation management activities. Removal of beaver dams will require the same environmental protection measures as vegetation management activities including use of non-mechanized equipment and RLF surveys prior to conducting work. A biological monitor, with a federal permit to handle steelhead, should also be present during dam removal activities in case fish are stranded as a result of the action.

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Appendix A

Historical Summary of lower Arroyo Grande Creek

Arroyo Grande Creek has a long history of flood impacts to agriculture and human habitation that dates back to the time of the early settlements in the mid-19th century. Historical accounts and a geomorphic analysis of the lower watershed and Cienega Valley suggest that much of the valley floor was at grade with the Creek and consisted of a broad thicket of willows and other riparian trees (Dvorsky, 2004). From the time of the earliest settlements, use of the valley for homesteading, agricultural production, dairies, and cattle ranching required clearing of vegetation and active management of the channel and floodplain. Management, in those days, consisting primarily of ditching the channel to provide a predictable flow path, building levees, removing willow thickets, and leveling the land. Much of these activities were carried out by individual landowners with little to no coordinated efforts between adjacent property owners.

The historic channel likely had a much wider active floodplain, as compared to the incised condition it is in today. The entire valley bottom most likely consisted of a series of active channels, flood channels, and abandoned channels with backwater wetlands that all occurred at, or near, the elevation of the current valley floor. The active channel was likely to be an ephemeral feature, shifting from one location to another based on sediment deposition, debris jams, or other obstructions. In some areas the channel was likely braided, where the floodplain was wide, and a single thread channel where constrictions such as bedrock outcrops narrowed the floodplain.

Several lines of evidence suggest that the channel exhibited these characteristics including remnant channel and floodplain areas observed on historic aerial photos and historic accounts from early settlers (Figure 2). Historic accounts from early settlers, presented below, are taken from a book by Robert Brown, a local historian, entitled, “Story of the Arroyo Grande Creek”, published in 2002:

> “..When Francisco and Manuela Branch came here in 1837 to establish their home, the valley was described as a ‘thicket of swamp and willow and cottonwood, a monte, as it was called by the Spanish…”

> “…The great adobe, built by Branch, was midway up the valley on a hill just below the present day Branch School. From that point on to the ocean the creek had no channel; it just spread out in the monte, creating bogs and ponds as it made its way to the sea.”

> “W. H. Findley, who came here in 1875 said in a speech delivered in 1911:’A large part of this beautiful valley was still covered with primeval forests through which the flood waters of the

> Arroyo Grande had been spreading for untold ages…we helped make the channel and reclaim the land. We felled the forests and built our homes…'"

> "As far as the creek is concerned, the early settler, Branch, did some clearing of the monte when he first arrived, but it wasn't until 1863-64 that nature extended a hand and lent assistance by sending the Central Coast a devastating drought. A lot of wetlands dried up and it was easier to channel the creek."

The historic accounts, along with an analysis of historic photos dating back to 1939 (Dvorsky, 2004) point to Arroyo Grande Creek being a completely different channel than it is today. Much of the existing channel has been straightened, confined, constricted, and deepened. Floodplain areas have been converted to agricultural fields and the associated riparian forests have been removed. Many of these changes occurred in the late 1800's and early 1900's as evidenced in these historic accounts (Brown, 2002):

> "…The Arroyo Grande Creek became used as a boundary line and it kept shifting, it made good business sense to get a fixed line somewhere. The way the creek shifted around and tore up the land when it flooded, it was necessary to create a definite channel on the south side of the valley."

> "The channel formed by Francis Branch and others basically flowed along the south side of the valley…A second ditch brought the creek water down to a farm….This ditch had been extended down the north side of the valley to lands…To divert water into their ditch, Beckett and Young had put up a temporary dam across the main creek. The heavy rainfall in 1883-84 was early and was followed by additional rains in October and November, which coming before the temporary dam had been removed for the winter, resulting in a strong flow of water down the ditch on the north side of the valley. So heavy was the flow that the main channel of the creek swung to the north side of town, where it had remained ever since."

> "…The farmers all up and down the creek were working to straighten the creek and prevent further damage should another such flood ever come."

> "While the amount of damage done is great, including the loss of practically all bridges and the washing out of roads, it has some compensation. The channel of the Arroyo Grande Creek was

> never in better condition to carry future floods than it is now. The channel has been widened, many bad corners cut off and the creek bed is four to six feet deeper than it was…"
>
> "…In the winter of 1969, before the dam, it became furious and frothy to the belly of the Harris Bridge, 30 feet above the gorge that Mr. Harris and some engineers had dynamited in the early part of the century, for the creek had a lethal history."

Despite the best intentions and well-laid plans of land owners to control Arroyo Grande Creek and reduce impacts to adjacent farmlands and infrastructure, the history of the creek from settlement to present has been a series of devastating floods that have greatly impacted the residents of the area. Severe flood damage has been documented in the Arroyo Grande valley in 1883-84, 1893, 1895, 1907, 1909, 1911, 1914, 1936-37, 1943, 1952, and 2001. The valley avoided the significant flood events that occurred elsewhere on the central and south coast in 1969, 1983, and 1997, most likely due to flood storage in Lopez Reservoir.

The lower Arroyo Grande Creek, or Cienega Valley, is especially vulnerable to flooding because it lies at the downstream, lower gradient terminus of a highly erosive watershed. Much of the erosion occurring in the upper watershed is transported and delivered to the floodplains that make up the lower valley. Historically, much of the transported sediment was deposited onto broad floodplains of the lower alluvial valleys of Arroyo Grande Creek, Tar Springs Creek, and Los Berros Creek (Figure 3). Due to conversion of floodplain areas to agricultural and residential uses, much of the sediment that historically was deposited on the floodplain ends up being deposited in backwater areas behind bridges, beaver dams, or in lower gradient areas, such as the lower Arroyo Grande Creek Channel.

In the 1950's, severe flooding from Arroyo Grande Creek resulted in inundation of prime farmland in the Cienega Valley and significant impacts to existing infrastructure. At the time, Arroyo Grande and adjacent communities were primarily rural with a combined population of less than 5,000 residents. To reduce future economic impacts to the agricultural economy and the growing urban and rural residential population, the community organized the Arroyo Grande Creek Flood Control Project (Project). The Project, led jointly by the USDA-Soil Conservation Service/Arroyo Grande Resource Conservation District, was completed in 1961 to protect homes and farmland in La Ciénega Valley. (These organizations are now known as the USDA-Natural Resources Conservation Service and the Coastal San Luis RCD, respectively.)

The main feature of the Project was a levee system and trapezoidal channel that confined Arroyo Grande Creek from its confluence with Los Berros Creek downstream to the Pacific Ocean (Photo 1). In addition, the lower portion of Los Berros Creek from the Valley View Bridge to the confluence with Arroyo Grande Creek was diverted from its pre-1960 channel, which ran along the southern edge of La Cienega Valley, to its current confluence upstream of the Highway 1 Bridge. Runoff from the Meadow Creek watershed, which runs though Pismo Lake, was designed to enter Arroyo Grande Creek through a pair of flap gates near the Pismo Dunes State Vehicular Recreation Area. Maintenance of the Project, following construction, was the responsibility of Zone 1/lA, under the purview of the County Public Works Department. Landowners within the zone are assessed an annual fee to support management and maintenance of the flood control reach.

Photo 1. Constructed trapezoidal channel at UPRR bridge in 1958.

The original flood control channel was built in 1959 and was designed to carry a discharge of 7,500 cubic feet per second, which, at the time of the analysis, was determined to have a recurrence of once every 50 years. Maintenance of the flood control channel by the District, RCD, and NRCS since completion of the project in 1961 consisted primarily of vegetation and sediment removal to maintain the design geometry and capacity of the channel and routine maintenance of the levee system and associated infrastructure. The frequency of maintenance varied depending on rainfall and runoff conditions that preceded maintenance. Maintenance activities in recent years was restricted by a combination of lack of funding (Zone 1/1A maintenance funds had not risen appreciably since the creation of the special

district) and environmental concerns about the impacts of vegetation and sediment removal on aquatic and riparian habitat in the flood control reach.

Environmental concerns and restrictions increased following the listing of the California red-legged frog (*Rana aurora draytonii*), in 1996, and steelhead (*Oncorhynchus mykiss*), in 1997. Protection of critical habitat for these two species meant that past maintenance activities, authorized under the 1959 Operation and Maintenance Agreement with the NRCS and RCD, was no longer feasible. The agencies overseeing protection of sensitive species, including the U.S. Fish and Wildlife Service, NOAA Fisheries, and the California Department of Fish and Game, requested that a more comprehensive strategy be prepared to manage the flood control reach through a maintenance program that specifically protects aquatic habitat.

In the interim, Arroyo Grande was experiencing a development boom. During the late 1990's, 625 new home sites were approved in the City of Arroyo Grande in a period of 5 years. This number represents an increase of almost 10% in a city with only 6,750 housing units (US Census, 2000.). Much of the development, both proposed and existing, provides little in the way of stormwater management or Best Management Practices (BMP's) that limit runoff and reduce impacts to the hydrology of the watershed. Consequently, an increase in impervious surfaces within the watershed contributed to increased runoff to the flood control reach with increased risk of flooding. A flood estimated to occur once every 50 years in 1955 is now estimated to have a recurrence interval of 15-20 years due to changes in the hydrology of the lower watershed (defined as the watershed below Lopez Dam). In addition, much of the development occurred on steep, highly erodible soils. Sediment eroded from disturbed lands are eventually transported to the flood control reach, resulting in impacts to low lying agricultural land through increased flooding and flood risk.

In 1999, the US Army Corps of Engineers developed a study to assess the existing capacity of the flood control reach. The results suggested that the system currently has a reduced capacity of 1,700 cfs which equates to a recurrence interval of approximately 2-year to 5-years (USACE, 2001). The capacity of the as-built channel (the channel as built in 1961), according to the USACE model, was determined to be 6,500 cfs with an associated level of protection between the 10-year and 20-year runoff event. These results showed that even with 1961 geometry, where sediment has been removed, the capacity of the channel has been reduced by approximately 1,000 cfs, most likely due to changes in the levee geometry from settlement and erosion. The USACE study pointed to the need for a more detailed alternative assessment to define project opportunities and costs associated with improving overall capacity and flood protection.

On March 5, 2001, during a high intensity rain event, the levee was breached on the south side between the mouth and the Union Pacific railroad bridge (Photos 2 and 3). It was estimated by observers in the field at the time of the levee breach that the levee would have overtopped upstream of the 22nd Street bridge had the levee not breached and lowered the overall water surface. Hundreds of acres of farmland and several residences were flooded in the La Cienega Valley. Impacts from the flooding persisted beyond the winter season as many of the lower lying areas with clay soils located in the southern portion of the valley remained saturated. The northern levee remained intact, thereby protecting several residential developments, the Oceano Aiport, and the regional wastewater treatment plant that services the communities of Arroyo Grande, Oceano and Grover Beach.

Photo 2. Oblique photo of flooding in the Cienega Valley following the levee breach of March 2001 (looking south).

Photo 3. Close-up view of the levee breach and flooding of farmland in March 2001 (looking at south levee from north levee).

In April of 2003, the County Board of Supervisors passed a "Resolution to Relinquish the Arroyo Grande and Los Berros Diversion Flood Control Channels and Appurtenant Structures to the State of California". County Public Works Department staff recommended that maintenance responsibilities be turned over

to the State Department of Water Resources (DWR) because the County had not been able to maintain the channel due to regulatory requirements, inadequate funding from the Zone 1/1A assessments, and the cost of liability insurance. The State is mandated to accept this responsibility under Water Code Section 12878. In fall 2004, the responsible entity, the Division of Flood Management at DWR, initiated the process of establishing a new Maintenance Area for flood control along lower Arroyo Grande Creek.

In February of 2005, DWR issued a Statement of Necessary work with the goal of initiating maintenance work on the channel in July 2005. Because the State Water Code mandates that DWR maintain the channel by restoring it to its original 1958 design, DWR was faced with a difficult and expensive regulatory process in order to obtain the necessary environmental permits. Due to the presence of two federally listed species, restoring the original design would likely result in requirements to develop and implement costly mitigation measures to compensate for habitat loss that would be paid locally through the Zone 1/1A assessment process. There are no provisions in the Water Code which allows DWR to study or implement other acceptable flood control designs or alternatives that would also be more environmentally acceptable.

During late 2002 the SLOCFCWCD allocated money for a Program Evaluation and Engineering Alternatives Analysis Study of the lower Arroyo Grande Creek flood control channel. This study was intended to evaluate a wide range of flood control alternative projects and provide a plan to manage flooding at the most downstream section of the creek. When the SLOCFCWCD began the process of relinquishing maintenance of the channel over to the State, it also withdrew the funding for this study. The Zone 1/1A Advisory Committee, comprised of agriculturalists and other local residents, and various stakeholders, actively lobbied the County Board of Supervisors to restore this funding so that the plan could be developed. In June 2004, the SLOCFCWCD approved to the RCD to conduct "The Erosion, Sedimentation, and Flooding Alternatives Study" (Alternatives Study). The County grant was matched by the State Coastal Conservancy, and augmented from the State Dept of Parks and Recreation Off-Highway Vehicles Division.

The County and the Zone 1/1A Task Force, consisting of Zone 1/1A property owners and stakeholder organizations, worked together over the ensuing months to organize a Proposition 218 election to raise sufficient funds to provide a basic level of flood channel maintenance without putting an oppressive financial burden on Zone 1/1A property owners. When the returned ballots were counted on June 8, 2006, the Prop 218 measure passed with more than 89% of the votes cast. As a result of the overwhelming passage of the Prop 218 measure for Zone 1/1A, on June 27, 2006, the County Board of Supervisors, acting as the SLOCFCWCD, rescinded their 2003 resolution to relinquish the flood channel

to DWR. By keeping the maintenance responsibility local, channel maintenance can be conducted both in a more flexible and environmentally sensitive manner than would have been possible under DWR.

The consulting firm of Swanson Hydrology and Geomorphology (SH+G) was contracted by the RCD to conduct the Alternatives Study, and began work in February 2005. A Technical Advisory Team met with SH+G staff twice during 2005 to provide feedback and recommendations regarding which options to consider for analysis in the Alternatives Study, and to review preliminary results. The Technical Advisory Team consisted of representatives from U.S. Fish and Wildlife, California Department of Fish and Game, the Coastal Conservancy, NOAA/NMFS, Regional Water Quality Control Board, San Luis Obispo County Public Works and Environmental Planning Departments, City of Arroyo Grande, Oceano Community Services District, Central Coast Salmon Enhancement, Zone 1/1A Advisory Committee, and U.S. Army Corps of Engineers.

The Alternatives Study was completed in January 2006. The Alternatives Study focused in-depth on erosion sources, sedimentation and hydrology as they relate to recurring flooding in the lower reaches of the creek. The final study described six different "Alternatives", or sets of feasible projects and management actions, that could be implemented to manage flooding in Zone 1/1A, and provided estimates of the degree of flood protection afforded by each Alternative. The Study also discussed and analyzed the projected benefits of necessary watershed-wide management activities, such as floodplain restoration, stream restoration, and sediment control, to diminish flood risk and reduce the frequency of dredging through the flood control reach.

With the 2006 passage of the Proposition 218 measure, funding was now available to develop and carry out a long-term management plan for the flood control channel. In fall 2007, SLO County Public Works drafted a Notice of Preparation and a Request for Qualifications for preparation of an environmental impact report/environmental assessment and assistance with regulatory permitting. Representatives of the Zone 1/1A Advisory Committee Task Force joined SLO County Public Works staff in reviewing applications, conducting interviews, and selecting a consulting firm to recommend to the SLO County Board of Supervisors for contract. The firm selected was the Morro Group, now SWCA, Inc., partnering with SH+G (now Waterways Consulting) to prepare a Waterway Management Program (WMP) that includes project actions described under Alternative 3c of the Alternatives Study combined with enhancement actions that improve habitat conditions in the flood control reach for steelhead, California red-legged frog, and other species that rely on the aquatic environment.

Appendix B

Preliminary Engineering Design Plans

ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN

CONCEPTUAL PLANS

PROJECT DESCRIPTION

THESE PLANS PROVIDE DETAILS FOR THE REMOVAL OF SEDIMENT FROM ARROYO GRANDE AND LOS BERROS CREEK CHANNELS IN THE COUNTY OF SAN LUIS OBISPO. CONSTRUCTION ACTIVITIES WILL CONSIST OF EXCAVATION AND DISPOSAL OF SEDIMENT FROM THE CHANNEL FLOODPLAINS AND INSTALLATION OF LOG HABITAT STRUCTURES.

GRADING SUMMARY

TOTAL CUT VOLUME =	21,332 CY
TOTAL FILL VOLUME =	0 CY
NET CUT =	21,332 CY

THE ABOVE QUANTITIES ARE APPROXIMATE IN-PLACE VOLUMES CALCULATED AS THE DIFFERENCE BETWEEN EXISTING GROUND, AS MAPPED IN 2006, AND THE PROPOSED FINISH GRADE. EXISTING GROUND IS DEFINED BY THE TOPOGRAPHIC CONTOURS AND/OR SPOT ELEVATIONS ON THE PLAN. PROPOSED FINISH GRADE IS DEFINED AS THE DESIGN SURFACE ELEVATION OF EARTH TO BE CONSTRUCTED.

THE ABOVE QUANTITIES HAVE BEEN CALCULATED FOR PERMITING PURPOSES ONLY AND HAVE NOT BEEN FACTORED TO INCLUDE ALLOWANCES FOR BULKING, CLEARING AND GRUBBING, SUBSIDENCE, SHRINKAGE, OVER EXCAVATION, AND RECOMPACTION, UNDERGROUND UTILITY AND SUBSTRUCTURE SPOILS AND CONSTRUCTION METHODS.

THE CONTRACTOR SHALL PERFORM AN INDEPENDENT EARTHWORK ESTIMATE FOR THE PURPOSE OF PREPARING BID PRICES FOR EARTHWORK. THE BID PRICE SHALL INCLUDE COSTS FOR ANY NECESSARY IMPORT AND PLACEMENT OF EARTH MATERIALS OR THE EXPORT AND PROPER DISPOSAL OF EXCESS EARTH MATERIALS.

PRIOR TO COMMENCEMENT OF CONSTRUCTION, CONTRACTOR SHALL PERFORM AN UPDATED CROSS SECTION SURVEY TO DETERMINE ACTUAL CONDITIONS.

GENERAL NOTES

1) PREPARED AT THE REQUEST OF:
SAN LUIS OBISPO COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT

2) AERIAL MAPPING OF THE PROJECT AREA WAS PERFORMED BY:
CENTRAL COAST AERIAL MAPPING, INC.
710 FIERO LN #24
SAN LUIS OBISPO, CALIFORNIA 93401
(805)543-4307
JOB# 2005-841
PHOTOGRAPHY DATE: 3/10/2005

3) ELEVATION DATUM: NAVD 88, BASED ON NGS BENCHMARK X 532, PID "FV0421", ELEVATION= 13.5'

4) HORIZONTAL DATUM: HORIZONTAL COORDINATES CONSTRAINED TO NGS MONUMENT HPGN CA 05 05, PID "FV2048", NAD83, CALIFORNIA STATE PLAN ZONE 5

5) APN'S: T.B.D.

6) ELEVATIONS AND DISTANCES SHOWN ARE IN FEET AND DECIMALS THEREOF. CONTOUR INTERVAL IS 2 FEET.

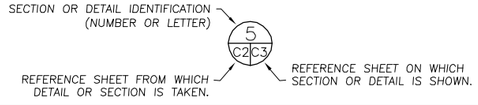
7) PROPERTY LINES ARE NOT SHOWN HEREON.

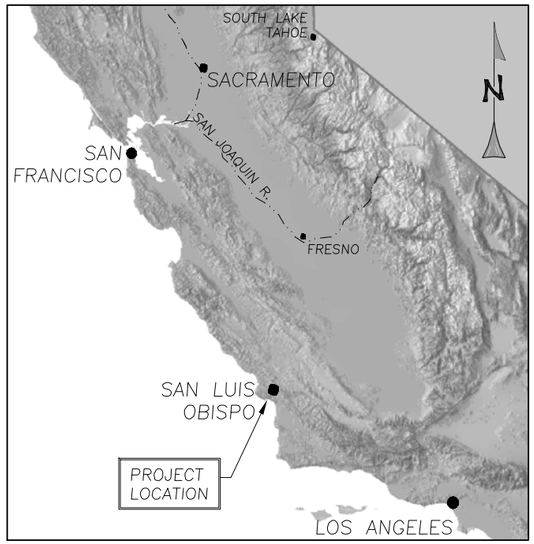
8) ALL CONSTRUCTION AND MATERIALS SHALL CONFORM TO THE CURRENT EDITION OF THE STATE OF CALIFORNIA STANDARD SPECIFICATIONS FOR CONSTRUCTION OF LOCAL STREETS AND ROADS (HEREAFTER REFERRED TO AS "STANDARD SPECIFICATIONS", AND SHALL BE SUBJECT TO APPROVAL OF THE OWNER.

9) THE COUNTY PUBLIC WORKS DEPARTMENT SHALL BE NOTIFIED AT LEAST 48 HOURS PRIOR TO CONSTRUCTION. A QUALIFIED CIVIL ENGINEER WITH EXPERIENCE IN THE INSTALLATION OF FEATURES OF THE TYPE SHOWN ON THESE PLANS, SHALL PROVIDE INSPECTION SERVICES DURING THE CONSTRUCTION PROCESS.

10) CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTION LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL. NEITHER THE PROFESSIONAL ACTIVITIES OF CONSULTANT NOR THE PRESENCE OF CONSULTANT OR HIS OR HER EMPLOYEES OR SUB-CONSULTANTS AT A CONSTRUCTION SITE SHALL RELIEVE THE CONTRACTOR AND ITS SUBCONTRACTORS OF THEIR RESPONSIBILITIES INCLUDING, NOT LIMITED TO, CONSTRUCTION MEANS, METHODS, SEQUENCE, TECHNIQUES OR PROCEDURES NECESSARY FOR PERFORMING, SUPERINTENDING OR COORDINATING ALL PORTIONS OF THE WORK OF CONSTRUCTION IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND APPLICABLE HEALTH OR SAFETY REQUIREMENTS OF ANY REGULATORY AGENCY OR OF STATE LAW.

SECTION AND DETAIL CONVENTION





REGIONAL MAP
N.T.S.

VICINITY MAP
N.T.S.

SHEET INDEX

GENERAL NOTES CONT'D

11) EXISTING UNDERGROUND UTILITY LOCATIONS:

LOCATIONS SHOWN ARE COMPILED FROM INFORMATION SUPPLIED BY THE APPROPRIATE UTILITY AGENCIES OR FROM FIELD MEASUREMENTS TO ABOVE GROUND FEATURES READILY VISIBLE AT THE TIME OF SURVEY. LOCATIONS SHOWN ARE APPROXIMATE. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE DIMENSIONS, SIZES, MATERIALS, LOCATIONS, AND DEPTH OF UNDERGROUND UTILITIES.

THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE LOCATION AND/OR PROTECTION OF ALL EXISTING AND PROPOSED PIPING, UTILITIES, TRAFFIC SIGNAL EQUIPMENT (BOTH ABOVE GROUND AND BELOW GROUND), STRUCTURES, AND ALL OTHER EXISTING IMPROVEMENTS THROUGHOUT CONSTRUCTION.

PRIOR TO COMMENCING FABRICATION OR CONSTRUCTION, CONTRACTOR SHALL DISCOVER OR VERIFY THE ACTUAL DIMENSIONS, SIZES, MATERIALS, LOCATIONS, AND ELEVATIONS OF ALL EXISTING UTILITIES AND POTHOLE THOSE AREAS WHERE POTENTIAL CONFLICTS ARE LIKELY OR DATA IS OTHERWISE INCOMPLETE.

CONTRACTOR SHALL TAKE APPROPRIATE MEASURES TO PROTECT EXISTING UTILITIES DURING CONSTRUCTION OPERATIONS, AND SHALL BE SOLELY RESPONSIBLE FOR THE COST OF REPAIR/REPLACEMENT OF ANY EXISTING UTILITIES DAMAGED DURING CONSTRUCTION. CONTRACTOR TO CALL UNDERGROUND SERVICE ALERT (1-800-642-2444) TO LOCATE ALL UNDERGROUND UTILITY LINES PRIOR TO COMMENCING CONSTRUCTION.

UPON LEARNING OF THE EXISTENCE AND/OR LOCATIONS OF ANY UNDERGROUND FACILITIES NOT SHOWN OR SHOWN INACCURATELY ON THE PLANS OR NOT PROPERLY MARKED BY THE UTILITY OWNER, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE UTILITY OWNER AND THE CITY BY TELEPHONE AND IN WRITING.

UTILITY RELOCATIONS REQUIRED FOR THE CONSTRUCTION OF THE PROJECT FACILITIES WILL BE PERFORMED BY THE UTILITY COMPANY, UNLESS OTHERWISE NOTED.

PRIOR TO BEGINNING WORK, THE CONTRACTOR SHALL CONTACT ALL UTILITIES COMPANIES WITH REGARD TO WORKING OVER, UNDER, OR AROUND EXISTING FACILITIES AND TO OBTAIN INFORMATION REGARDING RESTRICTIONS THAT ARE REQUIRED TO PREVENT DAMAGE TO THE FACILITIES.

12) SHOULD THE CONTRACTOR DISCOVER ANY DISCREPANCIES BETWEEN THE CONDITIONS EXISTING IN THE FIELD AND THE INFORMATION SHOWN ON THESE DRAWINGS, HE SHALL NOTIFY THE ENGINEER PRIOR TO PROCEEDING WITH CONSTRUCTION.

13) THE CONTRACTOR SHALL BE RESPONSIBLE FOR DESIGN, PERMITTING, INSTALLATION, AND MAINTENANCE OF ANY AND ALL TRAFFIC CONTROL MEASURES DEEMED NECESSARY.

14) THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE GENERAL SAFETY DURING CONSTRUCTION. ALL WORK SHALL CONFORM TO PERTINENT SAFETY REGULATIONS AND CODES. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR FURNISHING, INSTALLING, AND MAINTAINING ALL WARNING SIGNS AND DEVICES NECESSARY TO SAFEGUARD THE GENERAL PUBLIC AND THE WORK, AND PROVIDE FOR THE PROPER AND SAFE ROUTING OF VEHICULAR AND PEDESTRIAN TRAFFIC DURING THE PERFORMANCE OF THE WORK. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR COMPLIANCE WITH ALL APPLICABLE PROVISIONS OF OSHA IN THE CONSTRUCTION PRACTICES FOR ALL EMPLOYEES DIRECTLY ENGAGED IN THE CONSTRUCTION OF THIS PROJECT.

15) THE CONTRACTOR SHALL PURSUE WORK IN A CONTINUOUS AND DILIGENT MANNER TO ENSURE A TIMELY COMPLETION OF THE PROJECT.

16) ALL CONSTRUCTION SHALL BE CLOSELY COORDINATED WITH THE ENGINEER SO THAT THE QUALITY OF WORK CAN BE CHECKED FOR APPROVAL.

17) THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE SITE IN A NEAT AND ORDERLY MANNER THROUGHOUT THE CONSTRUCTION PROCESS. ALL MATERIALS SHALL BE STORED WITHIN APPROVED CONSTRUCTION AREAS.

18) THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AT HIS EXPENSE, ALL PERMITS AS REQUIRED BY THE LOCAL AGENCIES, INCLUDING BUT NOT LIMITED TO; ENCROACHMENT, GRADING AND LANE CLOSURES NOT PREVIOUSLY OBTAINED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS, LABOR AND EQUIPMENT REQUIRED TO COMPLY WITH ALL APPLICABLE PERMIT CONDITIONS AND REQUIREMENTS.

19) CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CONSTRUCTION STAKING AND LAYOUT, UNLESS OTHERWISE SPECIFIED IN THE PLANS.

20) NO CONSTRUCTION SHALL BE STARTED WITHOUT PLANS APPROVED BY THE COUNTY DEPARTMENT OF PUBLIC WORKS. THE DEPARMENT OF PUBLIC WORKS SHALL BE NOTIFIED AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION AND OF THE TIME AND LOCATION OF THE PRE-CONSTRUCTION CONFERENCE. ANY CONSTRUCTION PERFORMED WITHOUT PRIOR NOTIFICATION TO THE DEPARTMENT OF PUBLIC WORKS WILL BE REJECTED AND WILL BE AT THE CONTRACTOR'S RISK.

21) THE CONTRACTOR SHALL NOT BEGIN ANY CONSTRUCTION WORK UNTIL THE PROJECT SCHEDULE AND WORK PLAN IS APPROVED BY THE ENGINEER.

WATERWAYS CONSULTING
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SAN LUIS OBISPO COUNTY
FLOOD CONTROL AND
WATER WCONSERVATION DISTRICT

COVER SHEET

ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN CONCEPTUAL PLANS

DESIGNED BY:	B.M.S.
DRAWN BY:	B.M.S.
CHECKED BY:	M.W.W.
DATE:	9/21/09
JOB NO.:	08-707

BAR IS ONE INCH ON ORIGINAL DRAWING, ADJUST SCALES FOR REDUCED PLOTS
0 1"

C1 | 1 OF 10

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EROSION CONTROL AND ACCESS NOTES

1. PRIOR TO COMMENCEMENT OF WORK, CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A DETAILED CONSTRUCTION SCHEDULE, INCLUDING DETAILS OF SITE B.M.P.S AND INTENDED WORKING HOURS.

2. ACCESS TO LEVEES SHALL BE FROM EXISTING ESTABLISHED ACCESS POINTS.

3. ACCESS TO ALL GRADING SITES SHALL BE ALONG THE EXISTING LEVEES TOP ACCESS ROADS. WE ANTICIPATE THAT AN EXCAVATOR WILL ACCESS THE CHANNEL AT EACH GRADING SITE BY WALKING DOWN THE LEVEE SLOPE. THE EXCAVATOR SHALL ACCESS EACH GRADING SITE ALONG A SINGLE ACCESS PATH, AS SHOWN ON SHT. C8. ACCESS PATHS SHALL BE ESTABLISHED AT THE DIRECTION OF THE ENGINEER.

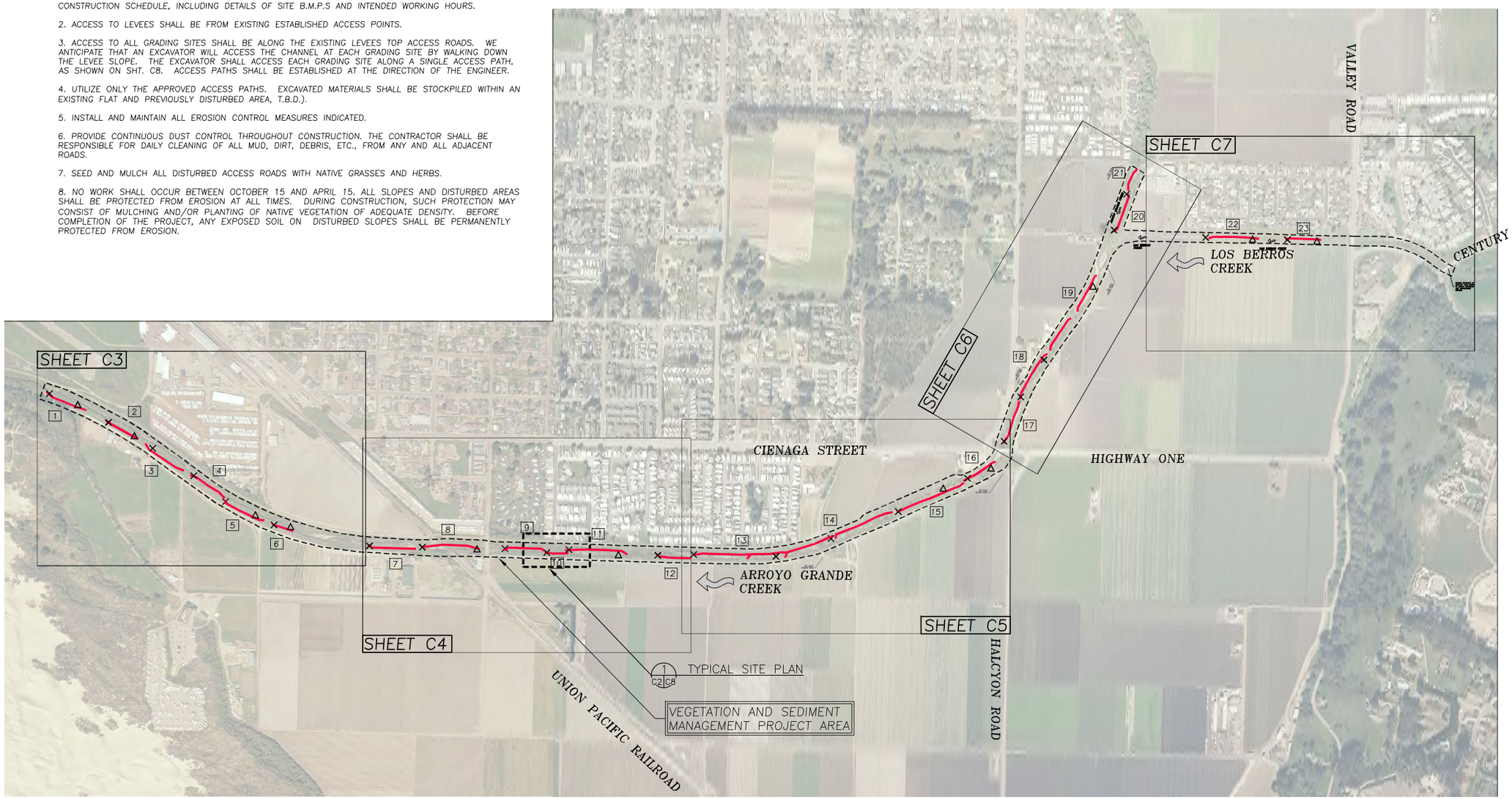
4. UTILIZE ONLY THE APPROVED ACCESS PATHS. EXCAVATED MATERIALS SHALL BE STOCKPILED WITHIN AN EXISTING FLAT AND PREVIOUSLY DISTURBED AREA, T.B.D.).

5. INSTALL AND MAINTAIN ALL EROSION CONTROL MEASURES INDICATED.

6. PROVIDE CONTINUOUS DUST CONTROL THROUGHOUT CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DAILY CLEANING OF ALL MUD, DIRT, DEBRIS, ETC., FROM ANY AND ALL ADJACENT ROADS.

7. SEED AND MULCH ALL DISTURBED ACCESS ROADS WITH NATIVE GRASSES AND HERBS.

8. NO WORK SHALL OCCUR BETWEEN OCTOBER 15 AND APRIL 15. ALL SLOPES AND DISTURBED AREAS SHALL BE PROTECTED FROM EROSION AT ALL TIMES. DURING CONSTRUCTION, SUCH PROTECTION MAY CONSIST OF MULCHING AND/OR PLANTING OF NATIVE VEGETATION OF ADEQUATE DENSITY. BEFORE COMPLETION OF THE PROJECT, ANY EXPOSED SOIL ON DISTURBED SLOPES SHALL BE PERMANENTLY PROTECTED FROM EROSION.



PROJECT AREA OVERVIEW
SCALE: 1"=500'

LEGEND

- △ TYPE "A" LOG HABITAT STRUCTURE (11 TOTAL)
- × TYPE "B" LOG HABITAT STRUCTURE (24 TOTAL)
- [9] GRADING SITE IDENTIFICATION NUMBER
- PROPOSED GRADING SITE (SECONDARY CHANNEL)

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SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER WCONSERVATION DISTRICT

PROJECT AREA OVERVIEW

ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN CONCEPTUAL PLANS

DESIGNED BY: B.M.S.
DRAWN BY: B.M.S.
CHECKED BY: M.W.W.
DATE: 9/21/09
JOB NO.: 08-707

BAR IS ONE INCH ON ORIGINAL DRAWING, ADJUST SCALES FOR REDUCED PLOTS
0 1"

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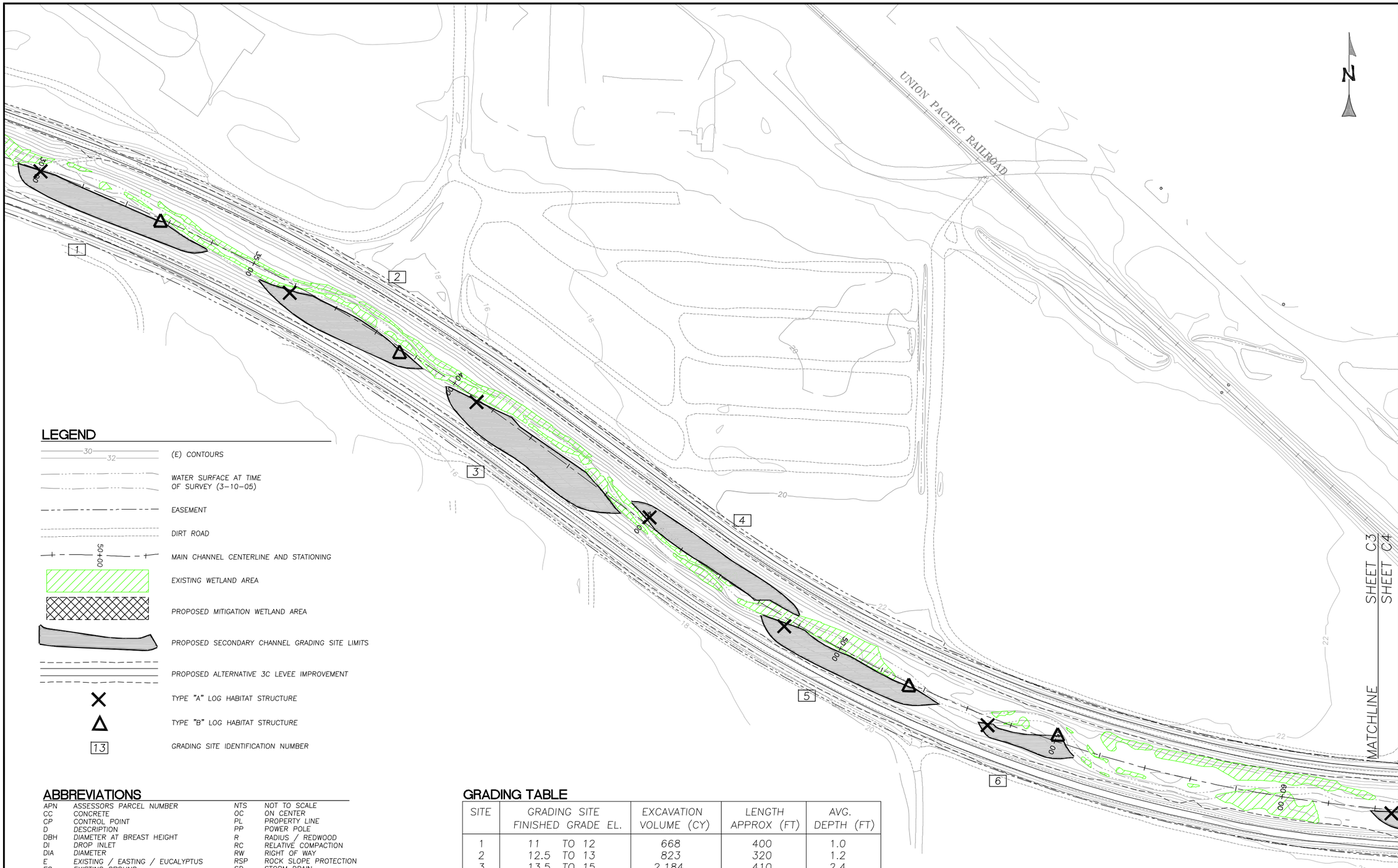

LEGEND

- (E) CONTOURS
- WATER SURFACE AT TIME OF SURVEY (3-10-05)
- EASEMENT
- DIRT ROAD
- MAIN CHANNEL CENTERLINE AND STATIONING
- EXISTING WETLAND AREA
- PROPOSED MITIGATION WETLAND AREA
- PROPOSED SECONDARY CHANNEL GRADING SITE LIMITS
- PROPOSED ALTERNATIVE 3C LEVEE IMPROVEMENT
- TYPE "A" LOG HABITAT STRUCTURE
- TYPE "B" LOG HABITAT STRUCTURE
- 13 GRADING SITE IDENTIFICATION NUMBER

ABBREVIATIONS

APN	ASSESSORS PARCEL NUMBER	NTS	NOT TO SCALE
CC	CONCRETE	OC	ON CENTER
CP	CONTROL POINT	PL	PROPERTY LINE
D	DESCRIPTION	PP	POWER POLE
DBH	DIAMETER AT BREAST HEIGHT	R	RADIUS / REDWOOD
DI	DROP INLET	RC	RELATIVE COMPACTION
DIA	DIAMETER	RW	RIGHT OF WAY
E	EXISTING / EASTING / EUCALYPTUS	RSP	ROCK SLOPE PROTECTION
EG	EXISTING GROUND	SD	STORM DRAIN
EL	ELEVATION	SF	SQUARE FEET
FG	FINISH GRADE	SHT.	SHEET
FL	FLOW LINE	STA	STATION
INV	INVERT	TBD	TO BE DETERMINED
LF	LINEAR FEET	TW	TOP OF WALL
N	NEW / NORTHING	TYP	TYPICAL
		Z	ELEVATION

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
1	11 TO 12	668	400	1.0
2	12.5 TO 13	823	320	1.2
3	13.5 TO 15	2,184	410	2.4
4	15 TO 16	358	370	0.7
5	16.5 TO 17.5	787	360	1.5
6	18 TO 18.5	378	170	2.0

SITE PLAN

SCALE: 1"=100'

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SITE PLAN 1 OF 5

ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN CONCEPTUAL PLANS

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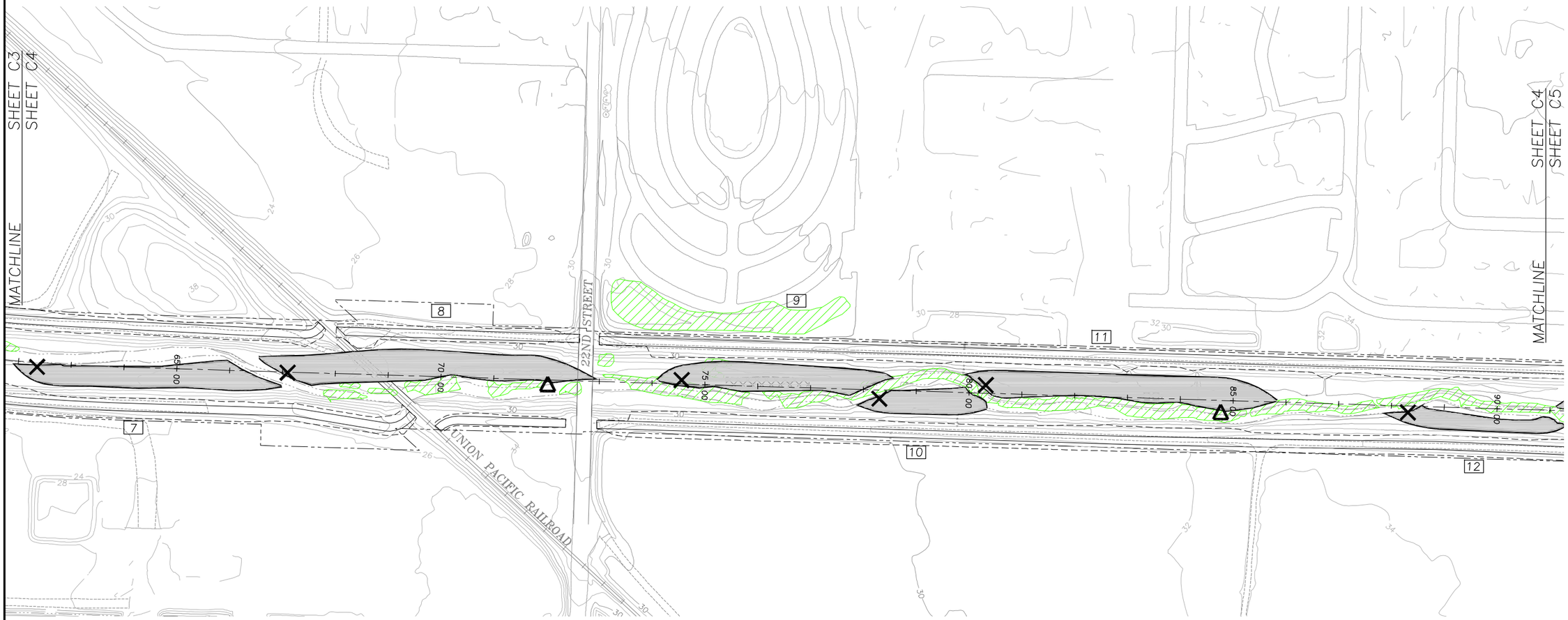

SITE PLAN
SCALE: 1"=100'

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
7	21 TO 22	193	450	0.3
8	22 TO 24	1,121	560	1.1
9	24.5 TO 25.8	738	400	1.0
10	25.8 TO 26.1	498	210	1.4
11	26.2 TO 28.5	1,262	530	1.3
12	29 TO 29.2	243	300	0.6

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SITE PLAN
2 OF 5

ARROYO GRANDE CREEK
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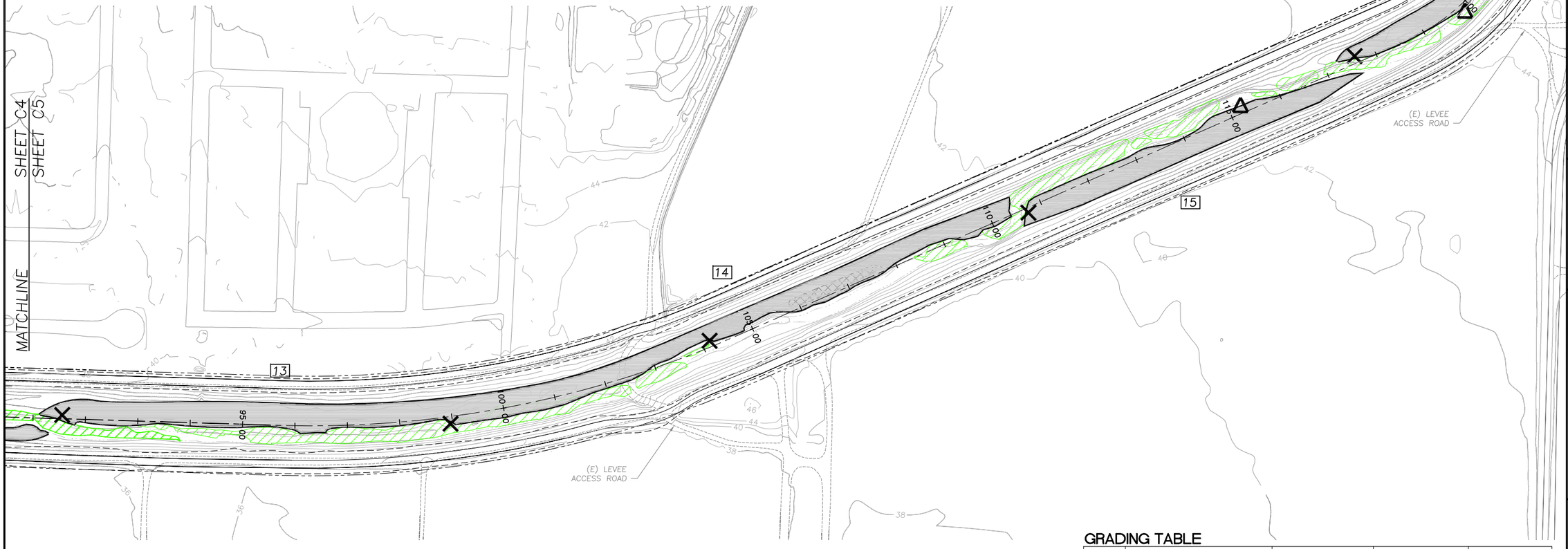

SITE PLAN
SCALE: 1"=100'

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
13	29.5 TO 31.5	2,700	830	1.8
14	31.5 TO 35	3,110	1,030	2.0
15	35.5 TO 37	1,309	660	1.2
16	37.5 TO 38.5	516	310	1.1

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SITE PLAN
3 OF 5

ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN CONCEPTUAL PLANS

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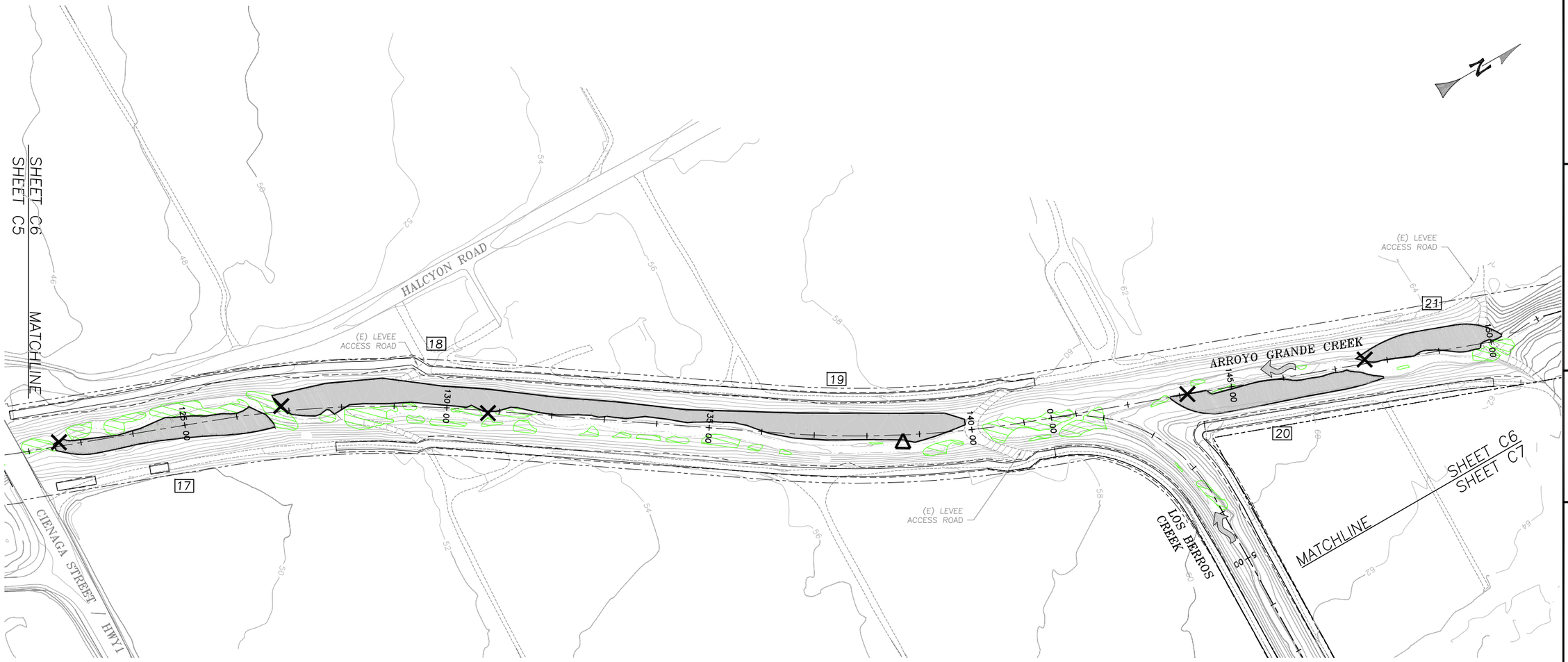

SITE PLAN
SCALE: 1"=100'

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
17	38.5 TO 40.5	605	400	1.2
18	40.5 TO 44	615	490	0.8
19	44 TO 46	504	800	0.5
20	47 TO 48	767	350	1.3
21	48.5 TO 49	532	250	1.3

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SITE PLAN
4 FO 5

ARROYO GRANDE CREEK
CHANNEL SEDIMENT
AND VEGETATION
MANAGEMENT PLAN
CONCEPTUAL PLANS

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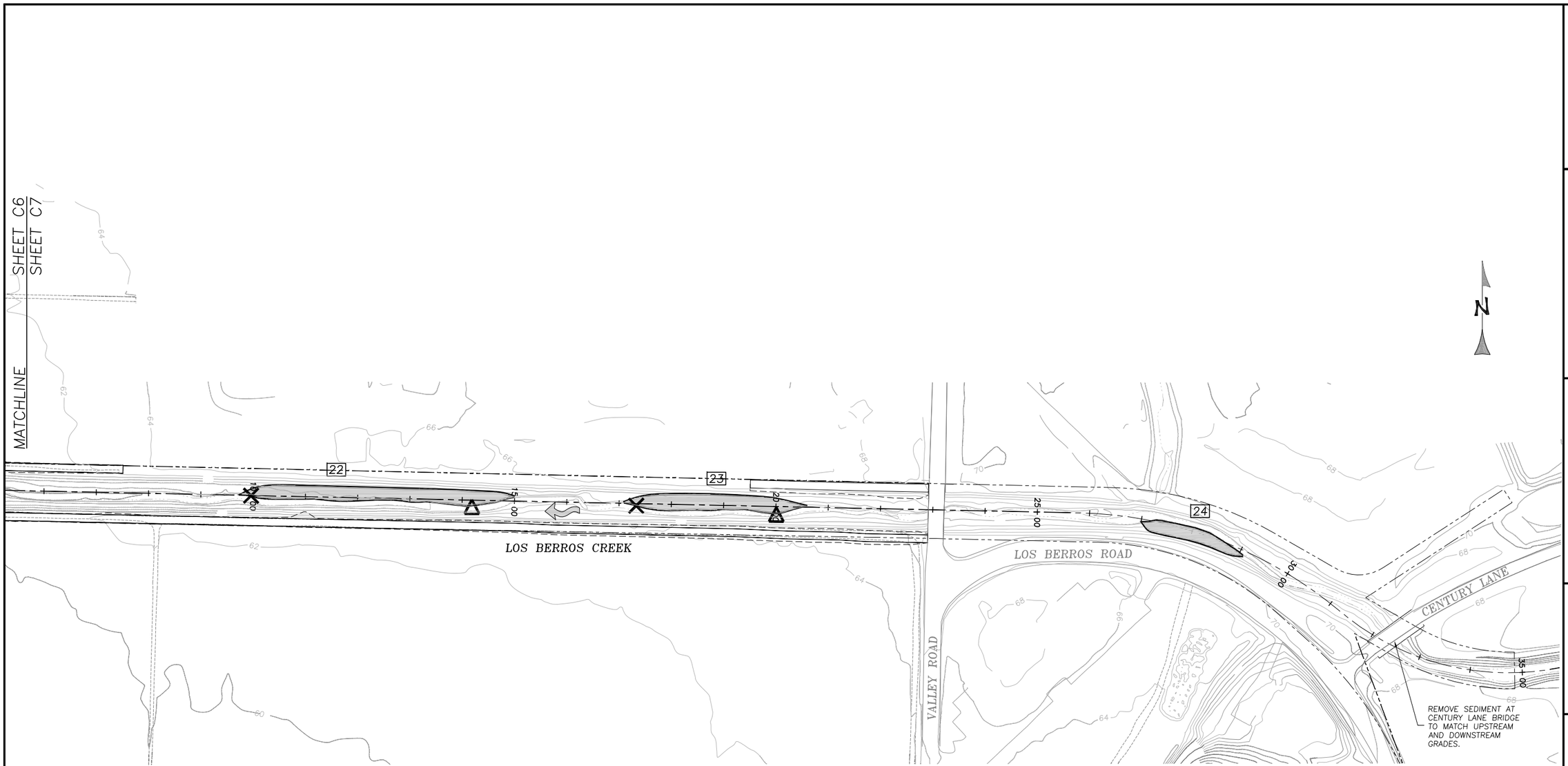

SITE PLAN
SCALE: 1"=100'

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
22	52.5 TO 54.5	825	480	1.5
23	55.5 TO 56	592	320	1.7
24	60.2 TO 60.6	106	140	0.7

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PREPARED AT THE REQUEST OF:
SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER WCONSERVATION DISTRICT

SITE PLAN
5 OF 5

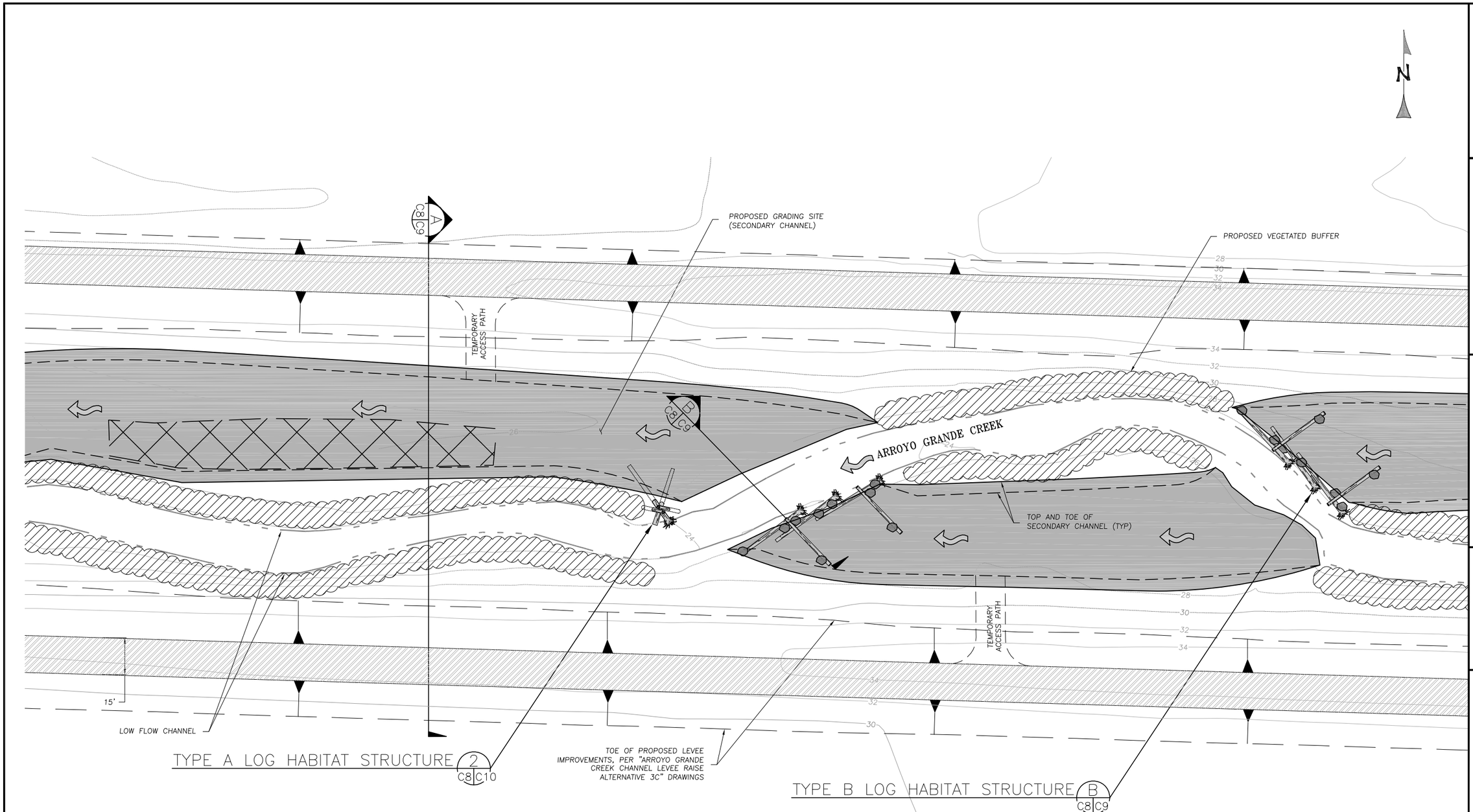
ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN
CONCEPTUAL PLANS

DESIGNED BY: B.M.S.
DRAWN BY: B.M.S.
CHECKED BY: M.W.W.
DATE: 9/21/09
JOB NO.: 08-707

BAR IS ONE INCH ON ORIGINAL DRAWING, ADJUST SCALES FOR REDUCED PLOTS
0 1"

C7
7 OF 10

R:\LAND PROJECTS\04-436_ARROYO GRANDE FLOOD CONTROL\dwg\Sediment-Management_Plans\30% Sediment Management_9-21-09.dwg 9/22/2009 9:21:56 AM PDT



LEGEND

- (E) CONTOURS
- LOW FLOW CHANNEL AT TIME OF SURVEY (3-10-05)
- PROPOSED MITIGATION WETLAND AREA
- PROPOSED VEGETATED BUFFER
- LEVEE TOP PER ALTERNATIVE 3C

TYPICAL SITE PLAN

SCALE: 1"=20'

1
C2|C8

WATERWAYS CONSULTING
4038 SWIFT ST.
SANTA CRUZ, CA 95060
PH:(831)421-0941 FAX:(888)819-6847
WWW.WATWAYS.COM

CONCEPTUAL

NOT FOR CONSTRUCTION

PREPARED AT THE REQUEST OF:
SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER WCONSERVATION DISTRICT

TYPICAL SITE PLAN

ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN CONCEPTUAL PLANS

DESIGNED BY:	B.M.S.
DRAWN BY:	B.M.S.
CHECKED BY:	M.W.W.
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JOB NO.:	08-707

BAR IS ONE INCH ON ORIGINAL DRAWING. ADJUST SCALES FOR REDUCED PLOTS
0 1"

C8 | 8 OF 10

R:\LAND PROJECTS\04-436_ARROYO GRANDE FLOOD CONTROL\dwg\Sediment-Management_Plans\30% Sediment Management_9-21-09.dwg 9/22/2009 9:40:24 AM PDT

Appendix C.
URBEMIS Data Sheets

7/16/2009 9:52:38 AM

Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: C:\Documents and Settings\klmiller\Desktop\Projects\AG Creek\EIR sections\Air Quality\sediment management.urb924

Project Name: AG Creek WMP Sediment Management

Project Location: San Luis Obispo County APCD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	4.23	55.57	100.50	2.22	102.73	21.01	2.05	23.06	7,133.92

7/16/2009 9:44:11 AM

Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: C:\Documents and Settings\klmiller\Desktop\Projects\AG Creek\EIR sections\Air Quality\alt 3a.urb924

Project Name: AG Creek WMP Alternative 3a

Project Location: San Luis Obispo County APCD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	4.32	50.47	338.82	2.26	341.08	70.78	2.07	72.85	6,296.76

7/16/2009 9:46:29 AM

Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: C:\Documents and Settings\klmiller\Desktop\Projects\AG Creek\EIR sections\Air Quality\alt 3c.urb924

Project Name: AG Creek WMP Alternative 3c

Project Location: San Luis Obispo County APCD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2013 TOTALS (lbs/day unmitigated)	3.53	38.51	79.24	1.67	80.91	16.57	1.54	18.11	6,802.01

7/16/2009 9:41:49 AM

Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: C:\Documents and Settings\klmiller\Desktop\Projects\AG Creek\EIR sections\Air Quality\UPRR Bridge Raise.urb924

Project Name: AG Creek WMP UPRR Bridge Raise

Project Location: San Luis Obispo County APCD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2014 TOTALS (lbs/day unmitigated)	4.61	53.29	265.83	2.11	267.94	55.55	1.94	57.49	11,104.47

Appendix D.
Biological Resources Background Information

Appendix D. Biological Resources Background Information

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Hoover's bent grass	*Agrostis hooveri*	-- / -- / 1B.2	Stoloniferous herb. Occurs in chaparral, cismontane woodland, valley and foothill grassland; usually sandy soils (6 – 610 meters).	April - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Arroyo de la Cruz manzanita	*Arctostaphylos cruzensis*	-- / -- / 1B.2	Shrub. Occurs in broad-leafed upland forest, coastal bluff scrub, closed-cone coniferous forest, chaparral, coastal scrub, and valley and foothill grassland habitats; usually on sandy soil (30 – 310 meters).	December - March	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Santa Lucia manzanita	*Arctostaphylos luciana*	-- / -- / 1B.2	Shrub. Occurs in chaparral and cismontane woodland; usually on shale soils (35 – 850 meters).	February - March	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Morro manzanita	*Arctostaphylos morroensis*	FT / -- / 1B.1	Shrub. Occurs in maritime chaparral, cismontane woodland, coastal dunes (pre-Flandrian), and coastal scrub; usually on sandy loam soils (5 – 205 meters).	December - March	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Pecho manzanita	*Arctostaphylos pechoensis*	-- / -- / 1B.2	Shrub. Occurs in closed coniferous forest, chaparral, and coastal scrub; usually on siliceous shale (125 – 850 meters).	November - March	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Santa Margarita manzanita	*Arctostaphylos pilosula*	-- / -- / 1B.2	Shrub. Occurs in closed coniferous forest, chaparral, and cismontane woodland; usually on shale soils (170 – 1100 meters).	December - March	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
sand mesa manzanita	*Arctostaphylos rudis*	-- / -- / 1B.2	Shrub. Occurs in chaparral and coastal scrub in Lompoc and Nipomo area; usually on sandy soils. (25 - 230 meters).	November - February	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Well's manzanita	*Arctostaphylos wellsii*	-- / -- / 1B.1	Shrub. Occurs in closed cone coniferous forests and chaparral; usually on sandstone (30 – 400 meters).	December - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
marsh sandwort	*Arenaria paludicola*	FE / SE / 1B.1	Perennial herb. Occurs in freshwater marshes; usually with saturated acidic bog soils (3 – 170 meters).	May - August	• Not observed during appropriately timed floristic surveys. • Potential habitat (freshwater marsh) occurs in the project corridor; however, this habitat is considered marginal at best, as no acidic bog occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Miles' milk vetch	*Astragalus didymocarpus* var. *milesianus*	-- / -- / 1B.2	Annual herb. Occurs in coastal scrub habitat (20 - 90 meters).	March - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
San Luis mariposa lily	*Calochortus obispoensis*	-- / -- / 1B.2	Perennial herb. Occurs in chaparral, coastal scrub, and grassland communities on serpentine soils (75 – 730 meters).	May - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine soils) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
La Panza mariposa lily	*Calochortus simulans*	--/--/1.B.3	Bulbiferous herb. Occurs in cismontane woodland, lower montane coniferous forest, valley and foothill grassland/sandy; usually on granitic sometimes serpentinite (395 – 1100 meters).	April - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine soils) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Cambria morning-glory	*Calystegia subacaulis* ssp. *episcopalis*	-- / -- / 1B.2	Rhizomatous herb. Occurs in chaparral, cismontane woodland, coastal prairie (60 – 500 meters).	April - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
San Luis Obispo sedge	*Carex obispoensis*	-- / -- / 1B.2	Rhizomatous herb. Occurs in closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, and valley and foothill grassland habitats; usually with serpentine seeps (10 - 790 meters).	April - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine seeps) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
San Luis Obispo owl's clover	*Castilleja densiflora* ssp. *obispoensis*	-- / -- / 1B.2	Annual herb. Occurs in valley and foothill grasslands (10 – 400 meters).	March - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Congdon's tarplant	*Centromadia parryi* ssp. *congdonii*	-- / -- / 1B.2	Annual herb. Occurs in valley and foothill grasslands; usually on alkaline soils (1 – 230 meters).	May - October	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
dwarf soaproot	*Chlorogalum pomeridianum* var. *minus*	-- / -- / 1B.2	Bulbiferous herb. Occurs in chaparral habitat; usually on serpentine soil (45 - 800 meters).	May - August	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine soils) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Brewer's spineflower	*Chorizanthe breweri*	-- / -- / 1B.3	Annual herb. Occurs in closed coniferous forest, chaparral, cismontane woodland, coastal scrub; usually on gravelly or rocky serpentinite soils (45 – 800 meters).	April - August	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine soils) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
straight awned spineflower	*Chorizanthe rectispina*	-- / -- / 1B.3	Annual herb. Occurs in chaparral, cismontane woodland, and coastal scrub habitats (85 - 1,035 meters)	May - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
San Luis Obispo fountain thistle	*Cirsium fontinale* var. *obispoense*	FE / SE / 1B.2	Perennial herb. Occurs in chaparral, cismontane woodland, in association with serpentine seeps (35 – 380 meters).	February - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine seeps) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
La Graciosa thistle	*Cirsium loncholepis*	FE / ST / 1B.1	Perennial herb. Occurs in coastal wetlands with dunes (4 – 220 meters).	May - August	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal wetlands with dunes) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
surf thistle	*Cirsium rhothophilum*	-- / ST / 1B.2	Perennial herb. Occurs in coastal bluff scrub and coastal dune habitats (3 – 60 meters).	April - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal bluff/dunes) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
California saw-grass	*Cladium californicum*	-- / -- / 2.2	Rhizomatous herb. Occurs in meadows and seeps, and marshes and swamps; usually alkaline or freshwater (60 - 600 meters).	June - September	• Not observed during appropriately timed floristic surveys. • Marginal habitat (Freshwater marsh/wetland) occurs within the project corridor area; however, project corridor is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Pismo clarkia	*Clarkia speciosa* ssp. *immaculata*	FE / SR / 1B.1	Annual herb. Occurs in cismontane woodland, valley foothill grasslands, and in openings along the margins of chaparral habitats (25 – 185 meters).	May - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
branching beach aster	*Corethrogyne leucophylla*	-- / -- / 3.2	Perennial herb. Closed-cone coniferous forest, coastal dunes (3 - 60 meters).	May - December	• Not observed during appropriately timed floristic surveys. • No suitable habitat (closed coned coniferous forest/dunes) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
leafy tarplant	*Deinandra increscens* ssp. *foliosa*	-- / -- / 1B.2	Annual herb. Occurs in valley and foothill grasslands (300 - 500 meters).	June - September	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.
dune larkspur	*Delphinium parryi* ssp. *blochmaniae*	-- / -- / 1B.2	Perennial herb. Occurs in chaparral and coastal dune habitats (maritime) (0 – 200 meters).	April - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal dunes/maritime chaparral) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
umbrella larkspur	*Delphinium umbraculorum*	-- / -- / 1B.3	Perennial herb. Occurs in cismontane woodland. (400 – 1600 meters).	April - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (cismontane woodland) occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.
beach spectaclepod	*Dithyrea maritima*	-- / ST / 1B.1	Rhizomatous herb. Occurs in coastal dune and coastal scrub habitats with sandy substrate (3 – 50 meters).	March - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal dune/scrub) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Betty's dudleya	*Dudleya abramsii* ssp*. bettinae*	-- / -- / 1B.2	Perennial herb. Occurs in chaparral, coastal scrub, valley and foothill grassland in serpentinite, rocky soils (20 – 180 meters).	May - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
mouse grey dudleya	*Dudleya abramsii* ssp*. murina*	-- / -- / 1B.3	Perennial herb. Occurs in chaparral, cismontane woodland valley, and foothill grassland (serpentinite) (90 – 440 meters).	May - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Blochman's dudleya	*Dudleya blochmaniae* ssp. *blochmaniae*	-- / -- / 1B.1	Perennial herb. Occurs in coastal bluff scrub, chaparral, coastal scrub, and valley and foothill grassland on rocky soils, often serpentine (5 – 450 meters).	April - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine/rocky) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
yellow-flowered eriastrum	*Eriastrum luteum*	-- / -- / 1B.2	Annual herb. Occurs in broadleafed upland forest, chaparral, cismontane woodland (290 – 1000 meters).	May - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Blochman's leafy daisy	*Erigeron blochmaniae*	-- / -- / 1B.2	Perennial rhizomatous herb. Occurs in coastal dune habitats with sandy substrate (3 – 45 meters).	July - August	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal dunes) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Indian Knob mountainbalm	*Eriodictyon altissimum*	FE / SE / 1B.1	Evergreen shrub. Occurs in maritime chaparral, cismontane woodland, coastal scrub, on sandstone (80 – 270 meters).	March - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (sandstone) occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Hoover's button-celery	*Eryngium aristulatum* var. *hooveri*	-- / -- / 1B.1	Annual/perennial herb. Occurs in vernal pools (3 – 45 meters).	July	• Not observed during appropriately timed floristic surveys. • No suitable habitat (vernal pools) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Ojai fritillary	*Fritillaria ojaiensis*	-- / -- / 1B.2	Bulbiferous herb. Occurs in broadleafed upland forest (mesic), chaparral and lower montane coniferous forest (rocky) (300 - 998 meters).	March - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (vernal pools) occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.
San Benito fritillary	*Fritillaria viridea*	-- / -- / 1B.2	Bulbiferous herb. Occurs in chaparral on serpentine soil (200 - 1,525 meters).	March - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal bluff/dunes) occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
San Francisco gumplant	*Grindelia hirsutula* var. *maritima*	-- / -- / 1B.2	Perennial herb. Occurs in coastal bluff scrub, coastal scrub, valley and foothill grassland; usually sandy or serpentinite soils (15 - 400 meters).	June - September	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal bluff scrub) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
mesa horkelia	*Horkelia cuneata* ssp. *puberula*	-- / -- / 1B.1	Perennial herb. Occurs in chaparral, cismontane woodland, coastal scrub/sandy, or gravelly (70 - 810 meters).	February - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal scrub/sandy gravelly) occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.
Kellogg's horkelia	*Horkelia cuneata* ssp. *sericea*	-- / -- / 1B.1	Perennial herb. Occurs in closed-cone coniferous forest, chaparral (maritime), and coastal scrub with sandy or gravelly openings (10 - 200 meters).	April - September	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Jones's layia	*Layia jonesii*	-- / -- / 1B.2	Annual herb. Occurs in chaparral and valley and foothill grassland on clay or serpentinite soils (5 – 500 meters).	March - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
San Luis Obispo County lupine	*Lupinus ludovicianus*	-- / -- / 1B.2	Perennial herb. Occurs in chaparral and cismontane woodland on sandstone or sandy soils (50 – 525 meters).	April - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat (sandstone/sandy soil) occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.
Nipomo Mesa lupine	*Lupinus nipomensis*	-- / -- / 1B.1	Annual herb. Occurs in coastal dunes (10 - 50 meters).	December – May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal dunes) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Camel Valley bush-mallow	*Malacothamnus palmeri* var. *involucratus*	-- / -- / 1B.2	Deciduous herb. Occurs in chaparral, cismontane woodland, coastal scrub (30 – 1100 meters).	May - August	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal dunes/maritime chaparral) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Santa Lucia bush-mallow	*Malacothamnus palmeri var. palmeri*	-- / -- / 1B.2	Deciduous shrub. Chaparral; usually in rocky soils (60 – 360 meters).	May - July	• Not observed during appropriately timed floristic surveys. • No suitable habitat (chaparral) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
crisp monardella	*Monardella crispa*	-- / -- / 1B.2	Rhizomatous herb. Occurs in coastal dunes and coastal scrub with sandy soils (10 - 120 meters).	April - August	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal dunes and coastal scrub) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
San Luis Obispo monardella	*Monardella frutescens*	-- / -- / 1B.2	Rhizomatous herb. Occurs in coastal dunes and coastal scrub with sandy soils (10 - 200 meters).	May - September	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal dunes and coastal scrub) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
Palmers monardella	*Monardella palmeri*	-- / -- / 1B.2	Rhizomatous herb. Occurs in chaparral and cismontane woodland habitats on serpentine soil (200 - 800 meters).	June - August	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the project corridor, which is outside the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Gambel's watercress	*Nasturtium gambellii*	FE / ST / 1B.1	Rhizomatous herb. Occurs in freshwater and brackish marshes, swamps and the borders of lakes (5 - 451 meters).	April - September	• Not observed during appropriately timed floristic surveys. • Potential suitable habitat (brackish waters) occurs within the project corridor; however, this species was not observed during appropriately timed floristic surveys; rather, the common water cress (*Rorippa nasturtium-aquaticum*) was observed to be prevalent in the channel. • Not expected to occur within the project corridor. • No further studies recommended.
short-lobed broomrape	*Orobanche parishii* ssp*. brachyloba*	-- / -- / 4.2	Perennial herb parasitic. Occurs in coastal bluff scrub, coastal dunes, and coastal scrub (sandy) (3 – 305 meters).	April - October	• Not observed during appropriately timed floristic surveys. • No suitable habitat (coastal bluff scrub, coastal dunes) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
white rabbit-tobacco	*Pseudognaphalium leucocephalum*	-- / -- / 2.2	Perennial herb. Occurs in chaparral, cismontane woodland, and coastal scrub, riparian woodland, usually in sandy or gravelly soils (0 - 2100 meters).	August - November	• Not observed during appropriately timed floristic surveys. • Marginal suitable habitat (riparian woodland) occurs within the project corridor; however, species was not observed during field surveys. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
adobe sanicle	*Sanicula maritima*	-- / SR / 1B.1	Perennial herb. Occurs in chaparral, coastal prairie, meadows and seeps, and valley and foothill grassland habitats on clay and serpentine soil (30 - 240 meters).	February - May	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
black-flowered figwort	*Scrophularia atrata*	-- / -- / 1B.2	Perennial herb. Occurs in closed cone conifer forest, chaparral, coastal dune, coastal scrub, and riparian scrub habitats. Diatomaceous shales (10 - 500 meters).	March - July	• Not observed during appropriately timed floristic surveys. • Potential habitat occurs within the project corridor; however, species was not observed during field surveys. • Not expected to occur within the project corridor. • No further studies recommended.
chaparral ragwort	*Senecio aphanactis*	-- / -- / 2.2	Annual herb. Occurs in chaparral, cismontane woodland, and coastal scrub habitats on alkaline soil (15 - 1800 meters).	January - April	• Not observed during appropriately timed floristic surveys. • No suitable habitat (alkaline) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
Cuesta Pass checkerbloom	*Sidalcea hickmanii* ssp*. anomala*	-- / SR / 1B.2	Perennial herb. Occurs in closed-cone coniferous forest on serpentine soil (600 - 800 meters).	May - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the BS, which is outside of the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.
most beautiful jewel flower	*Streptanthus albidus* ssp*. peramoenus*	-- / -- / 1B.2	Annual herb. Occurs in chaparral, cismontane woodland, and valley and foothill grassland habitats on serpentinite soil (94 - 1,000 meters).	April - September	• Not observed during appropriately timed floristic surveys. • No suitable habitat (serpentine) occurs within the BS, which is outside of the known elevation range. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence
San Bernardino aster	*Symphyotrichum defoliatum*	-- / -- / 1B.2	Rhizomatous herb. Occurs in cismontane woodland, coastal scrub, and foothill grassland near ditches and springs (2 - 2,040 meters).	July - November	• Not observed during appropriately timed floristic surveys. • Suitable habitat occurs within the project corridor; however, species was not observed during field surveys. • A similar species (*Aster chilensis*) was identified throughout the project corridor. Specimens were collected and Dr. David Keil of Cal Poly verified the species as *Aster chilensis*. • Not expected to occur within the project corridor. • No further studies recommended.
saline clover	*Trifolium depauperatum* var. *hydrophilum*	-- / -- / 1B.2	Annual herb. Occurs in marshes and swamps, valley and foothill grassland (mesic, alkaline), and vernal pools (0 - 300 meters).	April - June	• Not observed during appropriately timed floristic surveys. • No suitable habitat (alkaline/vernal pools) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.
caper fruited tripdocarpum	*Tropidocarpum capparideum*	-- / -- / 1B.1	Annual herb. Occurs in valley and foothill grassland habitats on alkaline hills (1 - 455 meters).	March - April	• Not observed during appropriately timed floristic surveys. • No suitable habitat (alkaline) occurs within the project corridor. • Not expected to occur within the project corridor. • No further studies recommended.

Table D-1. Special-status Plant Species Evaluated for Potential for Occurrence within the Project Corridor

Common Name	Scientific Name	Status Federal/ State/CNPS Status & Threat Code	General Habitat Description	Blooming Period	Potential for Occurrence

Status Codes:

Federal:

FE = Federally Endangered

FT = Federally Threatened

State:

SE = State Endangered

ST=State Threatened

SR = State Rare

California Native Plant Society (CNPS):

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

List 2 = rare, threatened, or endangered in California, but more common elsewhere.

List 4 = A watch list. Species are of limited distribution or infrequent.

***Threat Code*:**

.1 = Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat)

.2 = Fairly endangered in California (20-80% occurrences threatened)

.3 = Not very endangered in California (<20% of occurrences threatened or no current threats known)

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence
Invertebrates			
vernal pool fairy shrimp *Branchinecta lynchi*	Occur in vernal pool habitats including depressions in sandstone, to small swale, earth slump, or basalt-flow depressions with a grassy or, occasionally, muddy bottom in grassland (Eriksen and Belk, 1999).	FT/-- /--	**Habitat Absent / Occurrence Unlikely:** Vernal pool habitat has not been documented within the project corridor.
California linderiella *Linderiella occidentalis*	Seasonal ponds in grasslands, sandstone depressions, and alluvial flats with hardpan beneath.	--/SA/--	**Habitat Absent / Occurrence Unlikely:** Seasonal pond habitat has not been documented within the project corridor.
mimic tryonia *Tryonia imitator*	Coastal lagoons, estuaries, and salt marshes; found only in permanently submerged areas.	--/SA/--	**Habitat Absent / Occurrence Unlikely:** Known habitat associations for this species occur west of the project corridor. Species last documented at the mouth of the Oceano lagoon in 1970 (CNDDB 2009).
Fish			
tidewater goby *Eucyclogobius newberryi*	Occurs in brackish shallow lagoons and lower stream reaches where water is fairly still, but not stagnant.	FE/--/SSC	**Habitat Present / Occurrence Known**: Suitable aquatic habitat is present within the project site. Species is known to occur within Arroyo Grande Creek.
south-central California coast steelhead ESU *Oncorhynchus mykiss irideus*	Clear, cool water with abundant in-stream cover, well-vegetated stream margins, relatively stable water flow, and a 1:1 pool-to-riffle ratio.	FT, CH /-- /SSC	**Habitat Present / Occurrence Known**: Suitable aquatic habitat is present within the project corridor. Arroyo Grande Creek occurs within Critical Habitat Estero Bay Hydrologic Unit 3310, Oceano Hydrologic Sub- area 331031.

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence
Amphibians			
California red-legged frog *Rana draytonii*	Aquatic habitats with little or no flow and surface water depths to at least 2.3 feet. Presence of fairly sturdy underwater supports such as cattails.	FT/--/SSC	**Habitat Present / Occurrence Known**: Suitable aquatic habitat is present within the project corridor. Species observed within the project corridor during surveys and known to occur throughout Arroyo Grande Creek.
California tiger salamander *Ambystoma californiense*	Vernal pools within grassland or oak woodlands; require seasonal water, ground squirrel burrows, or other underground refuges.	FT/ST/SSC	**Habitat Absent/ Occurrence Unlikely:** Species is not expected to occur within the project corridor due to the lack of uncultivated grasslands with temporary rain pools. Species has not been documented within the lower reaches of Arroyo Grande Creek.
western spadefoot *Spea hammondii*	Inhabits vernal pools primarily in grassland, but also in valley and foothill hardwood woodlands. Requires seasonal pools for breeding and egg-laying.	--/--/SSC	**Habitat Absent / Occurrence Unlikely:** No vernal pools for breeding have been identified within the project corridor. Species not observed during surveys.
Coast Range newt *Taricha torosa torosa*	Coastal drainages from Mendocino County to San Diego County. Resides in terrestrial habitats and migrates up to 1 km to breed in slow moving streams, ponds, and reservoirs. Frequents terrestrial habitats such as oak woodlands.	--/--/SSC	**Habitat Present / Potential for Occurrence but Unlikely:** Species is known to occur in Arroyo Grande Creek in the vicinity of Lopez Lake. Habitat within the project corridor is marginal. Species not observed during surveys.
Reptiles			
southwestern pond turtle *Actinemys marmorata pallida*	Quiet waters of ponds, lakes, streams, and marshes. Typically in the deepest parts with an abundance of basking sites.	-- /--/SSC	**Habitat Present / Occurrence Known:** Suitable aquatic habitat was observed with the project corridor. This species was observed during surveys.

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence
silvery legless lizard *Anniella pulchra pulchra*	Sandy or loose loamy soils with high moisture content under sparse vegetation.	--/--/SSC	**Habitat Absent / Occurrence Unlikely:** Sandy loam occurs within the project corridor but Arroyo Grande Creek is likely too moist and well-vegetated to support the species. Species not observed during surveys.
coast horned lizard *Phrynosoma coronatum frontale*	Coastal sage, chaparral, annual grasslands, oak woodland, riparian woodland, and coniferous forest. Typically in loose, fine soils, with a high sand fraction.	--/--/SSC	**Habitat Present / Potential for Occurrence but Unlikely**: Riparian habitat and sandy soils were observed within the project corridor. Species not observed during surveys.
two-striped garter snake *Thamnophis hammondii*	Inhabits perennial and intermittent streams with rocky beds bordered by dense vegetation. May also utilize stock ponds and other artificially-created aquatic habitats	--/--/SSC	**Habitat Present / Moderate Potential for Occurrence**: Suitable riparian and aquatic habitat is present within the project corridor. Nearest occurrence Guadalupe/Nipomo dunes area (CNDDB 2009). Species not observed during surveys.
Birds			
Cooper's hawk *Accipiter cooperii*	Deciduous riparian woodland habitat throughout California. Nests in deciduous trees and conifers**.**	MBTA/--/--	**Habitat Present / Occurrence Likely:** The project corridor contains suitable nesting and foraging habitat for Cooper's hawk. This species was observed during surveys by SWCA biologists.
sharp-shinned hawk *Accipiter striatus*	Occurs in ponderosa pine, black oak, deciduous riparian areas, mixed conifer, and Jeffrey pine habitats. North facing slopes with plucking perches and close proximity to water (within 275 feet).	MBTA/--/--	**Habitat Present / Potential for Occurrence but Unlikely:** Species has been observed at the Woodlands Development 5.5 miles southeast of Oceano (CNDDB 2009). Although riparian habitat within project corridor may provide suitable habitat for this species, the likelihood of occurrence is considered low.

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence
tricolored blackbird *Agelaius tricolor*	(Nesting colony); requires open water, protected nesting substrate (*Juncus* and *Scirpus*), and foraging area with insect prey.	--/--/SSC	**Habitat Absent / Occurrence Unlikely**: Known habitat associations (e.g., open water and nesting substrate) occur within the project corridor, but are considered marginal due to relative amount of nesting substrate. Species not observed during field surveys.
burrowing owl *Athene cunicularia*	Open, dry grasslands, deserts, and scrublands. Subterranean nester, dependent upon burrowing mammals.	MBTA/--/SSC	**Habitat Absent / Occurrence Unlikely:** Known habitat associations are not present within the project corridor. Species not observed during surveys.
ferruginous hawk *Buteo regalis*	(Wintering) open grasslands, sagebrush flats, desert scrub, low foothills, and fringes of pinyon-juniper habitats; eats lagomorphs, ground squirrels, and mice; population trends may follow lagomorph population cycles.	MBTA/--/--	**Habitat Absent / Occurrence Unlikely:** project corridor does not contain habitat suitable for wintering ferruginous hawks. Species not observed during surveys of the project corridor.
western snowy plover *Charadrius alexandrinus nivosus*	Occurs on sandy beaches, salt pond levees, and shores of large alkali lakes. Needs sandy, gravelly, or friable soils for nesting.	MBTA, FT/ --/SSC	**Habitat Absent / Occurrence Unlikely:** Known habitat associations are not present within the project corridor. Species not observed during surveys.
western yellow-billed cuckoo *Coccyzus americanus*	Nest in riparian forests along broad, lower flood zones of larger river systems. Often found in willow thickets mixed with cottonwoods, sycamores, and presence of a thick under story including blackberry and other sub-shrubs.	FC, MBTA/SE/ --	**Habitat Present / Potential for Occurrence but Unlikely:** The project corridor contains riparian habitat for western yellow-billed cuckoo. The most recent nearby CNDDB occurrence record for the species is a 1932 egg set collection by Santa Barbara Natural History Museum from an unspecified location in San Luis Obispo County (CNDDB 2009). The likelihood of this species occurring within the project corridor is very low.
yellow warbler *Dendroica petechia brewsteri*	Riparian associations, prefers willows, cottonwoods, aspens, sycamores, and alders for nesting and foraging.	MBTA/--/--	**Habitat Present / Occurrence Likely:** Suitable nesting and foraging habitat was observed within the project corridor. .

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence
white-tailed kite *Elanus leucurus*	Open grasslands, meadows, or marshlands for foraging close to isolated trees for nesting and perching.	MBTA/--/FP	**Habitat Present / Occurrence Likely:** Suitable foraging and nesting habitat occurs throughout the project corridor. Species not observed during surveys; however, pre-construction nesting bird surveys are recommended. .
California horned lark *Eremophila alpestris actia*	Occurs in short grass prairies, coastal plains, fallow grain fields and alkali flats. Found in coastal regions from Sonoma to San Diego county, and west to the San Joaquin Valley. .	MBTA/--/--	**Habitat Absent / Occurrence Unlikely**: Known habitat associations are not present within the project corridor. Species not observed during surveys.
merlin *Falco columbarius*	Coastal areas, tidal estuaries, open woodlands, savannahs, edges of grasslands and deserts and agricultural areas. Requires clumps of trees or windbreaks for roosting in open country.	MBTA/--/--	**Habitat Absent / Occurrence Unlikely:** Known habitat associations for this species are not present within the project corridor. Nearest documented occurrence Santa Margarita Ranch (CNDDB 2009). Species not observed during surveys.
prairie falcon *Falco mexicanus*	Occurs in dry, open terrain that is level or hilly and breeds on cliffs.	MBTA/--/--	**Habitat Absent / Occurrence Unlikely:** project corridor does not contain dry open habitat for foraging or suitable cliff habitat for nesting. Species not observed during surveys.
California condor *Gymnogyps californianus*	Occurs in open savannahs, grasslands, and foothill chaparral, in mountain ranges with moderate altitudes. Nest in deep canyons on rock walls with clefts.	FE/SE/--	**Habitat Absent / Occurrence Unlikely:** Known habitat associations for this species are not present within the project corridor. Species not observed during surveys.
California black rail *Laterallus jamaicensis coturnniculus*	California black rail are shore birds known to frequent tidal salt marshes. These birds utilize densely vegetated mud flats and the high tide line in salt water marsh systems.	--/ST/--	**Habitat Absent / Occurrence Unlikely:** Suitable salt marsh habitat was not observed within the project corridor. Species not observed during surveys.

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence
purple martin *Progne subis*	Occupies valley foothill and montane hardwood forests, conifer forests, and riparian habitats. May nest in old woodpecker cavities or in human-made structures such as bridges and culverts. Feeds on insects.	--/--/SSC	**Habitat Present / Occurrence Likely:** project corridor contains suitable riparian and nesting habitat for this species. Species not observed during surveys.
California least tern *Sternula antillarum browni*	Largely a coastal species that feed on fish and nest on sandy dunes or beaches. Once a common species in California; currently nesting colonies are isolated to Southern California and scattered Bay Area beaches.	FE/SE/--	**Habitat Absent / Occurrence Unlikely:** Known habitat associations are not present within the project corridor. Species not observed during surveys.
least Bell's vireo *Vireo bellii pusillus*	Summer resident of southern California. This species occurs in low riparian areas or in dry river bottoms (below 2000 feet). Nests along the margins of willows, *Baccharis* sp. or mesquite.	MBTA,FE/SE/--	**Habitat Present / Potential for Occurrence but Unlikely:** Riparian habitat is present within the project corridor but is considered marginal for least Bell's vireo as the area lacks dense foliage due to maintenance activities and historical disturbances. The nearest known occurrence of this species is a recent observation in Los Osos, CA (San Luis Obispo County Birding Digest 2873).
southwestern willow flycatcher	Breeds in relatively dense riparian tree and shrub communities associated with rivers, swamps, and other wetlands, including lakes (e.g., reservoirs); mostly forested wetlands or scrub-shrub wetlands. Wintering habitat includes include brushy savanna edges, second growth, shrubby clearings and pastures, and woodlands near water.	MBTA,FE/SE/--	**Habitat Present / Potential for Occurrence but Unlikely:** Riparian habitat is present within the project corridor but is considered marginal for southwestern willow flycatcher due to the disturbed nature of the habitat and general lack of dense understory. There are no documented occurrences of this species breeding within San Luis Obispo County (Edell 2001).
Other migratory bird species (nesting) Class Aves	Annual grasslands, riparian areas, coastal scrub, chaparral, and oak woodlands may provide nesting habitat.	MBTA/--/--	**Habitat Present / Occurrence Likely:** Nesting habitat occurs throughout the project corridor. No active nests observed during surveys.

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence
Mammals			
American badger *Taxidea taxus*	Occurs in open stages of shrub, forest, and herbaceous habitats; needs uncultivated ground with friable soils.	--/--/SSC	**Habitat Absent / Occurrence Unlikely:** Known habitat associations for this species were not observed within the project corridor. Species not observed during surveys.
pallid bat *Antrozous pallidus*	Prefers rocky outcrops, cliffs, and crevices with access to open habitats for foraging. Day roosts are in caves, crevices, mines, and occasionally in hollow trees and buildings. Night roosts may be in more open sites, such as porches and buildings.	--/--/SSC	**Habitat Present / Potential for Occurrence but Unlikely.** Potential habitat occurs under bridges within the project corridor, but roosting would be unlikely. Species not observed during surveys.
Townsend's big-eared bat *Corynorhinus townsendii*	Occurs in a wide variety of habitats; most common in mesic (wet) sites. May use trees for day and night roosts; however, requires caves, mines, rock faces, bridges or buildings for maternity roosts. Maternity roosts are in relatively warm sites.	--/--/SSC	**Habitat Present / Potential for Occurrence but Unlikely.** Potential habitat occurs under bridges within the project corridor, but roosting would be unlikely. Species not observed during surveys.
western mastiff bat *Eumops perotis*	Found in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral, etc.; roosts in crevices in cliff faces, high buildings, trees, and tunnels.	--/--/SSC	**Habitat Absent / Occurrence Unlikely:** project corridor is in a coastal setting and located outside of semi-arid to arid habitats. Species not observed during surveys.
Other roosting bats Class Chiroptera	Potential for roosting in several natural and artificial habitats.	--/CEQA/--	**Habitat Present / Potential for Occurrence but Unlikely.** Potential habitat occurs under bridges within the project corridor, but roosting would be unlikely. No active bat roosts observed during surveys.

Table D-2. Special-status Wildlife Evaluated for Potential for Occurrence within the Project Corridor

Species Name	Habitat and Distribution	Legal Status Federal/State/CDFG	Rationale for Expecting Presence or Absence

Status Codes

-- = No status

Federal:

FE = Federal Endangered

FT = Federal Threatened

FC = Federal Candidate

CH = Federal Critical Habitat

PCH = Proposed Federal Critical Habitat

MBTA = Protected by Federal Migratory Bird Treaty Act

State:

SE = State Endangered

ST = State Threatened

CEQA = considered sensitive under CEQA

California Department of Fish and Game:

SSC = Special of Special Concern

FP = Fully Protected Species

SA = Not formally listed but included in CDFG “Special Animal” List.

Appendix E.
Geology and Soils Background Information

FUGRO WEST, INC.

PRELIMINARY GEOTECHNICAL REPORT
ARROYO GRANDE CREEK WATERWAYS MANAGEMENT PLAN
LOS BERROS CREEK TO NEAR OCEANO AIRPORT
SAN LUIS OBISPO COUNTY, CALIFORNIA

Prepared for:
County of San Luis Obispo
Department of Public Works

April 22, 2009

FUGRO WEST, INC.

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April 22, 2009
Project No. 3014.029

County of San Luis Obispo
Public Works Department, Utilities Administration
County Government Center, Room 107
San Luis Obispo, California 93401

Attention: Ms. Jill Ogren

Subject: Preliminary Geotechnical Report, Arroyo Grande Creek Waterways Management Plan, Los Berros Creek to near Oceano Airport, San Luis Obispo County, California

Dear Ms. Ogren:

Fugro is pleased to submit this Preliminary Geotechnical Report for the Arroyo Grande Creek Waterways Management Plan in San Luis Obispo County, California. This report was prepared in accordance with our proposal dated April 3, 2008. The proposal was authorized under County Purchase Order No. 25004312, dated April 29, 2008.

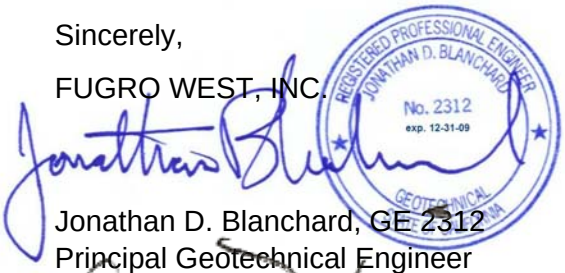
This report presents the results of a preliminary geotechnical evaluation of alternatives to raise the levees along a portion of Arroyo Grande Creek. Site-specific exploration, previous geotechnical studies, published geologic information, and project information provided by the County of San Luis Obispo, Swanson Hydrology + Geomorphology, Cannon Associates, and the Morro Group were used as a basis for preparing this report.

The purpose of this report is twofold: to provide input to the Environmental Impact Report and study being prepared by the Morro Group; and to provide geotechnical alternatives for improving the levee along Arroyo Grande Creek. Preliminary design of the improvements is being prepared by Swanson Hydrology + Geomorphology (SH +G). This report summarizes geologic hazards and geotechnical considerations that are likely to impact the design and construction of the project, and discusses mitigation measures that may be needed to address these items.

We appreciate the opportunity to provide our services on this project. Please contact the undersigned if you have questions regarding this report, or require additional information.

Sincerely,

FUGRO WEST, INC.



Jonathan D. Blanchard, GE 2312
Principal Geotechnical Engineer

Gresham D. Eckrich
Staff Engineer/Geologist

Reviewed by:

Lori E. Prentice, C.E.G. 2312
Principal Engineering Geologist

Copies: 4 – Addressee (1 – pdf on CD ROM)

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1. SITE AND PROJECT DESCRIPTION

The project will generally consist of raising an existing levee from the city limits of Arroyo Grande and the confluence with Los Berros Creek to approximately 2,500 feet downstream of Creek Road, near the Oceano Airport. The location of the site and project limits is shown on Plate 1 - Site Map. The proposed levee improvements will extend along the lower approximately 3½ miles of Arroyo Grande Creek and the lower approximately 1,700 feet of Los Berros Creek (a total of about 7 miles of levee). Arroyo Grande Creek is mainly confined by levees west of Highway 1, and intermittently confined by levees east of Highway 1.

1.1 EXISTING SITE

Los Berros Creek flows west into Arroyo Grande Creek at the eastern terminus of the project. Arroyo Grande Creek then flows westerly to the Pacific Ocean, about 3½ miles downstream of Los Berros Creek. Based on site observations, concrete weirs and check dams are located within the Los Berros Creek channel, and rip-rap boulders associated with construction and maintenance of existing levees were observed along sections of variable length within the Arroyo Grande Creek channel. Bridges span Arroyo Grande Creek at Highway 1/Cienega Street, 22nd Street, and the Union Pacific Railroad (UPRR).

Existing site grades range from approximately elevation 11 feet (SH+G, 2008), at the west end of the project reach, to approximately elevation 63 feet, near the city limits of Arroyo Grande. The existing channel bottom consists mostly of gravel with vegetated banks and levee slopes. Sand and gravel bars have built up within the channel between the slopes of the levees. The existing land use adjacent to the southern levee is predominantly agricultural land planted in irrigated row crops. There is also the Cardoza (horse) Ranch west of Creek Road. The existing land use adjacent to the northern levee is a combination of the Oceano airport, and residential and agricultural plots. Beyond the down stream limits of the project, the south levee is bordered by active sand dunes within the Oceano Vehicle Recreation Area operated by State Parks.

The levees and channelized Arroyo Grande Creek were constructed in the late 1950s as a U.S. Department of Agriculture, Soil Conservation Service project (USDA 1956). Portions of the creek were relocated as part of the construction of the levee system. Downstream of Highway 1, the levees consist of earthen berms. Review of the USDA (1956) plans show the levee embankments designed with 15-foot wide crests, with 1½h :1v to 2h:1v exterior slope inclinations, and 3h:1v interior slope inclinations. As-built plans provided by the County, and cross sections developed from recent topo, show that the interior slopes were constructed as steep as about 2h:1v. The interior height of the channel slopes indicated on the plans ranges from about 11 to 14 feet. The exterior slope height appears to have been designed about 5 to 12 feet above the adjacent grades downstream of Highway 1. However, upstream of Highway 1, the existing levee is less pronounced and more intermittent, with a design height generally less than about 3 feet above adjacent grades. The existing stream channel upstream of Highway 1 is increasingly incised to the east, with localized areas of near vertical creek banks, likely from bank erosion.

As part of the levee construction (USDA 1956), the alignment of Los Berros Creek was altered. Prior to 1956, Los Berros Creek appears to have merged with Arroyo Grande Creek downstream of their current confluence, closer to the western limits of the project and along the southwestern edge of Cienega Valley. The approximate pre-1956 Los Berros Creek alignment is shown on Plate 2. This channel appears to serve as a seasonal drainage path.

The levee was damaged by the 2003 San Simeon Earthquake. Damage to the southern levee, as evidenced by cracking and settlement of the berm, was observed by the County near Creek Road following the earthquake. Based on reports discussed by the U.S. Geologic Survey (Holzer et al. 2004), the damage was likely related to liquefaction and settlement of the foundation support soil in response to the earthquake. The County subsequently repaired the levee by regrading areas where the cracking was observed. We understand that the County performs periodic tree trimming and vegetation management of the channel as part of the maintenance of the levee system. Levee maintenance was being performed at the time of our field work in the summer of 2008.

1.2 FLOOD CONTROL IMPROVEMENTS

In the project area, Arroyo Grande Creek receives storm water runoff from the Arroyo Grande Flood Control Channel, referred to as Zones 1 and 1A of the San Luis Obispo County Flood Control and Water Conservation District (Morro Group, 2008). The project will involve flood control improvements along the northern and southern banks of the Arroyo Grande and Los Berros Creeks. The project is intended to provide increased flood control benefits and riparian enhancement through vegetation management and sediment control within Arroyo Grande Creek channel. The preliminary designs under consideration for the project are described as Alternatives 3a, 3b and 3c in a memorandum prepared by Swanson Hydrology + Geomorphology (SH+G, 2008).

Alternative 3c is the main alternative evaluated for this study. The geotechnical aspects of the proposed flood control improvements for Alternative 3c include raising the height of the levees by approximately 3 to 6 feet along roughly 3 miles of the creek. Raising the levees will increase the channel capacity and elevate the levees above the 20-year water surface with 2 feet of freeboard. Alternative 3c involves placement of the greatest quantity and lineal extent of imported or native fill relative to Alternatives 3a and 3b.

2. WORK PERFORMED

2.1 PURPOSE

The purpose of this report is to provide a preliminary engineering evaluation regarding the geotechnical feasibility of raising the levee along Arroyo Grande Creek for the preliminary design and as input to the Environmental Impact Report. The main geotechnical considerations that we have evaluated for this project are:

- Potential for the levee to be impacted by geologic hazards;

- Characterization of the soil and groundwater conditions along the alignment of the levee relative to foundation design, constructability, and seismic vulnerability; and
- A preliminary evaluation of the stability of planned levee improvements relative to slope stability, erosion, seepage, and feasibility for design.

2.2 SCOPE

To evaluate the geotechnical considerations for the project, we have executed the following scope of work:

- Meeting and consulting with members of the design team regarding our approach to providing geotechnical services for the project, and to review the project objectives;
- Reviewing selected published geologic maps and reports, previous geotechnical studies performed along the levee and for bridges that span the creek channel, and as-built plans for the existing levee;
- Performing site visits to observe the general site conditions, coordinate the field exploration program, and collect near-surface samples of selected stream channel materials;
- Laboratory testing of selected samples obtained from the site to assist in characterizing the material properties of the streambed and bank sediments encountered;
- Performing field exploration consisting of advancing six (6) cone penetration test soundings to depths of approximately 43 to 50 feet; and
- Preparing this Preliminary Geotechnical Report for the project that provides our opinions and recommendations regarding:
  - Geologic and seismic setting;
  - Soil and groundwater conditions encountered;
  - Predominant soil and formational units in the project area;
  - Historical seismicity including the impact that the 2003 San Simeon Earthquake had on the site;
  - Potential for the site to be impacted by geologic hazards (such as strong ground motion, fault rupture, liquefaction, seismic settlement, landsliding, flooding, tsunami or seiche, or dam inundation);
  - Potential for erosion, hydrocollapse, subsidence, expansive or collapsible soil conditions;
  - Potential to encounter naturally occurring asbestos or radon gases;
  - Areas that pose geologic hazards;

- Potential for geologic conditions to cause site alterations (such as grading) to adversely impact the project;
- Construction or geotechnical considerations that could impact the project, such as the need for dewatering, excavation characteristics of the geologic materials, and anticipated grading;
- A discussion of the existing levees, and alternatives to dredge the creek, and raise the levees;
- Anticipated site preparation, grading, and slope inclinations that can be used for preliminary design and planning (and subject to change based on design-level studies); and
- Mitigation measures for project development and preliminary design as necessary to address potentially significant impacts.

2.3 FIELD EXPLORATION

Field exploration activities consisted of performing six (6) electric cone penetration test (CPT) soundings, collecting hand samples from the creek, and performing a hand auger boring adjacent to the levee. The logs of the CPT soundings and hand auger boring are presented in Appendix A. The approximate locations of the CPT soundings, hand samples and hand auger boring are shown on Plate 2 – Field Exploration Plan.

2.3.1 Cone Penetration Testing

Fugro Geosciences of Santa Fe Springs, California performed the CPT work for this project on July 22, 2008. CPT soundings were advanced to depths of approximately 43 to 50 feet below the ground surface. The CPT soundings were performed using an electronic piezocone penetrometer. The penetrometer was advanced into the ground using a hydraulic ram mounted within a truck having a weight of at least 20 tons. The piezocone has a diameter of approximately 1.7 inches. Cone tip resistance (q_c), sleeve friction (f_s), and penetration pore pressures measured behind the tip (u_2) were recorded during penetration using an on-board computer. Data were collected from the penetrometer at approximately 2 centimeter intervals to provide a nearly continuous profile of the subsurface conditions encountered during penetration. The friction ratio (FR) was computed for each value of q_c and f_s recorded. The data was retrieved electronically for use in subsequent geotechnical analyses. CPT data and soil behavior type classifications were used in conjunction with historical boring information to evaluate soil boundaries encountered at the site.

2.3.2 Hand Samples

Fugro personnel collected thirteen (13) bulk samples from within the Arroyo Grande Creek channel on July 14 and 22, 2008. Samples of the sediments were collected from the active streambed and from bars and bank materials above the water surface in the creek. Descriptions of the samples obtained are included with the laboratory test results in Appendix B.

2.3.3 Hand Auger Boring

One hand auger boring was advanced adjacent to the southern levee by Fugro on August 14, 2008. The hand auger had a diameter of 4 inches, and was excavated in the agricultural field east adjacent to the southern levee just north of Creek Road. The hand auger boring was drilled to a depth of approximately 4½ feet. Samples were obtained at selected intervals from the boring using a hand-driven modified California sampler and from excavated cuttings. The hand driven sampler had an outside diameter of approximately 3 inches, and contained six (6) 1-inch high brass rings. The sampler was driven using a 5-pound slide hammer.

2.4 LABORATORY TESTING

Laboratory tests for grain size distribution and direct shear strength were performed on selected samples recovered from the field exploration program. The tests were performed in general accordance with the applicable standards of ASTM. The results of the tests are presented in Appendix B.

2.5 PREVIOUS STUDIES

The U.S. Geological Survey (Holzer et al., 2004) previously performed a geotechnical study in the project vicinity. The study focused on liquefaction and liquefaction-induced lateral spreading that occurred in Oceano in response to the 2003 San Simeon Earthquake. As part of that study, the USGS performed three CPT soundings (SOC 036, 035 and 037) on the Arroyo Grande Creek Levee within the project limits. The soundings were performed in this area of the levee because the USGS observed evidence of instability of the levee and liquefaction within the field adjacent to the levee. The data from those CPT soundings were used to assist in our characterization of the subsurface conditions for this report. The logs of those CPT soundings performed by the USGS are included with the Fugro CPT logs in Appendix A. The approximate locations of the CPT soundings performed by the USGS are also shown on Plate 2.

We reviewed logs of test borings from Caltrans (1956, 1984) and San Luis Obispo County (1984) as part of geotechnical investigations for the State Route 1 Bridge and 22nd Street Bridge, respectively. This boring information was used to help characterize the subsurface profile for the site. The approximate locations of the bridge borings are shown on Plate 2.

2.6 GENERAL CONDITIONS

Fugro prepared the conclusions and professional opinions presented in this report in accordance with generally accepted geotechnical engineering principals and practices at the time and location this report was prepared. This statement is in lieu of all warranties, expressed or implied.

This report has been prepared for San Luis Obispo County and their authorized agents only. It may not contain sufficient information for the purposes of other parties or other uses. If any changes are made in the project as described in this report, the conclusions and

recommendations contained in this report should not be considered valid unless Fugro reviews the changes and modifies and approves, in writing, the conclusions and recommendations of this report. The report and drawings contained in this report are preliminary, intended for design-input purposes; they are not intended to act as construction drawings or specifications.

Soil and rock deposits will vary in type, strength, and other geotechnical properties between points of observation and exploration. Additionally, groundwater and soil moisture conditions can also vary seasonally or for other reasons. Therefore, we do not and cannot have complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, and interpolation and extrapolation of information between and beyond the points of observation, and are subject to confirmation based on the conditions revealed during construction.

The scope of services did not include any environmental assessments for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere. Any statements or absence of statements, in this report or data presented herein regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous/toxic assessment. Site conditions

3. SITE CONDITIONS

3.1 GEOLOGIC SETTING

The project is located in the Arroyo Grande and Cienega Valleys and within the Coast Ranges geologic and geomorphic province. That province consists of north-northwest-trending sedimentary, volcanic, and igneous rocks extending from the Transverse ranges to the south into northern California. Rocks of the Coast Ranges province are predominantly of Jurassic and Cretaceous age; however, some pre-Jurassic, along with Paleocene-age to Recent rocks are present. The surficial geology in the project vicinity, as mapped by Hall et al. (1973), is shown on Plate 3 – Regional Geologic Map.

The Arroyo Grande and Cienega Valleys and adjacent eolian (windblown) dune sand deposits are the dominant geomorphic features within the project vicinity. The valleys were formed during a period of low sea level (the Wisconsin glacial stage), as coastal streams adjusted to the drop in sea level by carving into the landscape. A subsequent rise in sea level produced a dynamic depositional environment reflected in the discontinuous and variable subsurface stratigraphy. Approximately 800 feet of interlayered and unconsolidated sediments have been deposited within the valleys, dip gently to the west, and are underlain by bedrock consisting of Pismo Sandstone or similar sedimentary rocks.

As shown on Plates 2 and 3, the predominant geologic units mapped in the study area are surficial sediments comprised of dune sand deposits (Qs), older-stabilized dune sand deposits (Qos), and alluvium (Qal). The dune sands (Qs and Qos) mapped by Hall et al. (1973) are referred to as eolian deposits (Qe) by Hanson et al. (1994) on Plate 6. Hall identified older

dune sands as eolian deposits that have been stabilized and subsequently covered by vegetation. The alluvium is associated with sediment that has been deposited along Arroyo Grande Creek and Los Berros Creek, and the floor of the Arroyo Grande and Cienega Valleys. Surficial sediments are primarily underlain by weakly consolidated units of the age-equivalent of Paso Robles Formation and Careaga Sandstone.

Also depicted on Plate 2, a portion of the site along the creek was previously occupied by dune sand and an extensive pre-settlement Estero, according to an 1873-1874 map produced by the U.S. Coast Survey (Holzer et al., 2004). According to the USGS (2004) report, this area was subsequently "subdivided and turned into developable lots by leveling dunes and filling in swamp areas with dune sand in March 1927." Presumably, the creek alignment was altered as a consequence of this development. The approximate limits of the Pre-Existing Estero reported by Holzer et al. are noted on Plate 2.

3.2 SUBSURFACE CONDITIONS

The subsurface conditions encountered generally consisted of artificial fill (Af) materials overlying alluvium deposits (Qal). Logs for this and previous explorations are presented in Appendix A. The locations of the explorations are shown on Plate 2. Subsurface profiles summarizing our interpretation of the soil conditions encountered along the alignment of Arroyo Grande Creek within the project limits are shown on Plates 4a and 4b. A discussion of the geologic units encountered is provided below. Our interpretation of subsurface conditions is based on the CPT correlations developed by Robertson and Campanella (1986) and our hand auger boring log, and is generally supplemented by logs of previous explorations (USGS, 2004; Caltrans, 1956, 1984; San Luis Obispo County, 1984).

Artificial Fill (Af). Artificial fill materials were encountered in each of the CPT soundings advanced through the existing levee. Fill materials were encountered from the ground surface to approximately 2½ to 10½ feet below the ground surface. The artificial fill generally consisted of the earth materials placed during the construction of the existing levee, except in C-2 advanced within an adjacent parking lot (near the intersection of Halcyon Road and Highway 1). The artificial fill materials encountered in the CPT soundings consisted predominantly of medium dense to very dense sand (SP or SW) and silty sand (SM).

Alluvium Deposits (Qal). The alluvium encountered likely contained undifferentiated units of floodplain, fluvial, and estuarine sediments deposited along Los Berros Creek and Arroyo Grande Creek. The alluvium was encountered below the artificial fill materials to the maximum depth explored, approximately 43 to 50 feet below the existing ground surface. The alluvium encountered has been characterized as two predominant units of sandy alluvium (Qal1, Qal2), and three predominant units of fine-grained alluvium that were encountered at various depths within and below the sandy alluvium (Qal3, Qal4 and Qal5). Our interpretation of the subsurface conditions is shown on Plates 4a and 4b - Subsurface Profile.

Qal1. This unit consisted predominantly of loose to medium dense sandy material encountered below the levee fill and/or surficial clay units. The sandy alluvium was interbedded with various units of the fine grained alluvium as shown on Plates 4a and 4b. The unit was

encountered from at or near the creekbed elevation to depths of approximately 10 to 15 feet below the creek bed where penetrated. This upper sand unit consists of mostly silty sand (SM) to sandy silt (ML) and sand (SP or SW). This unit would also include the gravel and gravelly sand (SP or SW) streambed material.

Qal2. This unit consisted predominantly of dense to very dense sandy alluvium encountered below the upper Qal1 sand unit at a depth of approximately 10 to 15 feet below the streambed elevation. This lower sand unit consists mostly of sand (SP/SW), silty sand (SM) and gravelly sand or gravel (GP/GW). The layer is interbedded at various depths with finer grained alluvial units (Qal4), as shown on Plates 4a and 4b. The USGS soundings (SOC 035, 036 and 037) encountered materials classified as very dense cemented or overconsolidated sand (SP/SW) or clayey sand (SC). Where penetrated near and downstream of Highway 1, this unit was underlain by a deeper fine grained alluvium (Qal5) at depths of approximately 30 to 55 feet below the creek bed. The unit was encountered to the maximum depth explored, approximately 40 feet below the creek bed in C-1.

Qal3. This unit consisted of a shallow layer of predominantly stiff to very stiff clay and silt that was encountered near or just below the levee fill in most of the explorations (see Plates 4a and 4b). The thickness of this unit ranged from approximately 2 to 15 feet. The unit is generally thin (less than 4 feet thick) downstream of Highway 1, and increases in thickness upstream of Highway 1. This unit consisted of mostly clay (CL/CH), silty clay (CL-ML), sandy silt (ML) and clayey silt (ML), and hard cemented or overconsolidated fine grained material.

The hand auger boring (H-1) was drilled near the Creek Road adjacent to the southern levee to obtain a sample of this material for direct shear testing (used in our slope stability analyses). Based on the test results, the sample of the clayey sand had a friction angle of approximately 38 degrees and a cohesion of approximately 100 pounds per square foot.

Qal4. This unit consisted of 2- to 10-foot-thick layers and lenses of stiff to very stiff fine grained alluvium that was interbedded at various depths throughout the sandy Qal1 and Qal2 units (Plates 4a and 4b). A zone of about 15 feet of soft to medium stiff clay was encountered in the USGS CPT sounding 37. The soft clay is likely estuarine deposits associated with the pre-settlement Estero noted on Plate 2.

Qal5. This unit consisted of a deeper, very stiff to hard fine grained alluvium encountered at depths ranging from approximately 30 to 50 feet below the creekbed in USGS CPT soundings 35 and 36, and Fugro's CPT sounding C-3. This unit is inferred to underlie all other units within the alluvium, to the maximum depth explored, approximately 95 feet below the creekbed in USGS Sounding 35. This unit consists mostly of sediment classified as clay (CL/CH), silty clay (CL-ML), sandy silt (ML), and clayey silt (ML).

3.3 GROUNDWATER CONDITIONS

Groundwater was encountered in C-3 during our July 2008 field exploration program at a depth of approximately 14 feet below the ground surface. The sounding holes created by C-1, C-2, C-4, C-5, and C-6 caved following removal of the CPT probe at approximate depths of 9, 9,

11, 11, and 9½ feet, respectively. Groundwater levels and caved surfaces were typically encountered at approximately the same elevation as the water elevation in Arroyo Grande Creek. Groundwater was encountered at a depth of approximately 3 feet (elevation +17 feet) in the hand auger boring. During our field exploration program, the water in Arroyo Grande Creek was observed to be approximately ½ to 2½ feet deep. Variations in groundwater levels and soil moisture conditions will occur depending on changes in precipitation, runoff, tidal fluctuations, irrigation schedules, and other factors.

3.4 SEISMIC CONDITIONS

3.4.1 Faulting

The locations of the main faults mapped in the Central Coast area are shown on Plate 5 – Regional Fault Map. The majority of the faults within the Coast Ranges province and the Sierra de Salinas belt generally trend north-northwest. The California Geological Survey (CGS 1996, formerly the California Division of Mines and Geology) considers major faulting within the project vicinity to be related to the San Luis Range fault zone (a compilation of several named fault strands), the Los Osos fault, the offshore Hosgri fault, and the San Andreas fault. The CGS fault database consists of active and potentially active faults that are considered by the CGS to be capable of affecting regional seismicity in California.

Fugro utilized the fault search routine in FRISKSP (Blake, 2000) to identify active and potentially active mapped faults and fault segments within a 62-mile radius of the project vicinity. The site coordinates (latitude and longitude) for the Arroyo Grande Creek Waterways Management Plan vicinity were estimated to be 35.0952° latitude and -120.6030° longitude. Summarized below are nine (9) faults and fault segments that were considered to be the most capable of producing high ground motion within the project vicinity. Additional information is presented in the California Geological Survey (CGS, 2002) fault database.

Summary of Fault Characteristics

Fault	Approximate Distance From Site (mile)	Maximum Moment Magnitude (M_w)	Fault or Fault Segment Length (km)	Slip Rate (mm/yr)
San Luis Range (S. Margin)	1.8	7.2	64 ± 6	0.2 ± 0.1
Los Osos	6.2	7.0	44 ± 4	0.5 ± 0.4
Casmalia (Orcutt Frontal Fault)	11	6.5	29 ± 3	0.3 ± 0.2
Hosgri	14	7.5	169 ± 17	2.5 ± 1.0
Rinconada	16	7.5	190 ± 19	1.0 ± 1.0
Lions Head	16	6.6	41 ± 4	0.02 ± 0.02
Los Alamos – Baseline	28	6.9	28 ± 3	0.7 ± 0.7
San Juan	31	7.1	68 ± 7	1.0 ± 1.0
San Andreas (Cholame)	42	7.3	63 ± 6	34 ± 5

San Luis Range Fault System. The San Luis Range fault system is the closest mapped fault to the site. The California Geologic Survey (CGS, 2002) groups the Oceano, Wilmar Avenue and several other faults as the San Luis Range fault system, which they consider to be potentially active. The Wilmar Avenue and Oceano faults, shown on Plate 6 – Local Fault Map, are interpreted by CGS to be a part of the San Luis Range fault system. No known active faults cross the site and the site is not located within a designated Alquist-Priolo Earthquake Fault Zone.

The mapped locations of the Wilmar Avenue and Oceano faults shown on Plate 6 are inferred offsets in well logs and steps in the Franciscan bedrock from geophysical data. Within the Cienega Valley, the inferred locations of the faults are concealed by relatively deep alluvium. It is our opinion that the presence of the faults does not pose a significant fault rupture hazard to the project. However, significant ground motion could impact the site if an earthquake were to occur on the San Luis Range fault system within the life of the project.

3.4.2 Historical Seismicity

The project is located within a seismically active region of Central California. Historical records indicate that the area has been subject to various seismic events over the last 183 years (PG&E, 1988). A summary of Magnitude 2 and greater seismic events recorded from 1933 through March 2008 by the Council of the National Seismic System (CNSS 2008) are presented on Plate 7 - Historical Seismicity Map. Examples of relatively strong ground motion that has reportedly been experienced near the project area are the seismic events of 1830, 1857, 1913, 1916, 1917, 1952, 1966, 1980, and 2003.

The 1830 event is estimated to be an approximately M5.0 earthquake that occurred from a poorly located source near San Luis Obispo. The effects of the 1830 event were generally observed between the Los Osos and Rinconada faults. The 1857 event (the Fort Tejon earthquake) occurred on the Mojave segment of the San Andreas fault, and reportedly resulted in damage in central and southern California. The 1913 event is estimated to be an approximately M5 earthquake that occurred along the southwestern margin of the San Luis/Pismo block near Arroyo Grande. The 1916 event is estimated to be an approximately M5.0 earthquake that occurred near Avila, possibly along the Los Osos fault or faults along the southwestern margin of the San Luis/Pismo block. The 1917 event is estimated to be an approximately M5.0 earthquake that occurred near Lopez Canyon between the Rinconada and West Huasna faults. The 1952 earthquake is estimated to be a M6.0 earthquake occurring within the Nacimiento Fault Zone. The 1966 event (the Parkfield earthquake) is estimated to be an approximately M6.0 earthquake that occurred on the San Andreas fault. The 1980 event is estimated to be an approximately M5.0 earthquake that occurred offshore near Point Sal along the Casmalia fault zone, and near its intersection with the Hosgri fault.

The 2003 event (the San Simeon Earthquake) is estimated to have been a M6.5 earthquake resulting in a ground acceleration of about 0.29 ± 0.04g in the project vicinity (Holzer et al., 2004). The epicenter of the 2003 earthquake was located approximately 51 miles northwest of the site, near the Nacimiento fault zone, and near the previous M6.0 1952 Bryson Earthquake. According to Holzer et al. both the Bryson and San Simeon Earthquakes caused

damage in Oceano. Evidence of liquefaction in the fields along Cardoza Ranch (Plate 2) and displacement of the Arroyo Grande Creek levee were both documented by the Holzer et al. team following the 2003 earthquake.

4. GEOTECHNICAL ANALYSIS

4.1 SEISMIC HAZARD ANALYSIS

A preliminary probabilistic seismic hazard evaluation for the site was performed using the computer program FRISKSP (Blake, 2000) and the USGS Hazard Calculator program based on the 2007 California Building Code (CBC). The current CBC was adopted by the County in January 2008, and was used to define the seismic hazard exposure for this preliminary evaluation. The CBC seismic design code is referenced to the American Society of Civil Engineers ASCE 7-05 report. The program FRISKSP is based on FRISK (McGuire, 1978) and has been modified for the probabilistic estimations of seismic hazards using three-dimensional earthquake sources. The results of our preliminary evaluation are tabulated below.

Our evaluation was used to estimate earthquake effects corresponding to the Maximum Considered Earthquake (MCE). The MCE is defined by the code as an earthquake having a 2 percent chance of being exceeded in 50 years (Statistical Return Period of approximately once every 2,475 years). Design earthquake ground motions for liquefaction and other geotechnical analyses are defined as two-thirds ($^2/_3$) of the corresponding MCE ground motions.

Based on velocity data estimated in the USGS (Holzer et al., 2004) study and subsurface conditions encountered at the site, the Soil Profile Type selected for our evaluations was Site Class D, "S_D". This soil profile type corresponds to a stiff soil profile with an average shear wave velocity ranging between 600 and 1,200 feet per second (180 and 360 meters per second), according to the CBC (2007). The average velocity for the upper 100 feet was estimated at approximately 224 meters per second (m/s) for explorations SOC035, SOC036 and SOC037. Although liquefaction can be a basis for modifying the site class, only portions of the site were estimated to have a potential for liquefaction and associated loss in strength under the MCE (discussed in Section 4.2 of this report).

FRISKSP was used to estimate the peak horizontal acceleration using the attenuation relationship proposed by Boore et al. (1997) and assuming an average shear wave velocity of 250 m/s in the upper 100 feet. The MCE was estimated to result in an approximately peak horizontal ground acceleration of 0.7g, and is assumed to occur from an M7.0 event on the San Luis Range Fault System for the purposes of our evaluation. The ground motion was reduced by two-thirds to 0.46g as input to our seismic hazards evaluation.

4.2 LIQUEFACTION AND SEISMIC SETTLEMENT

Liquefaction is defined as the loss of soil strength due to an increase in soil pore water pressures that results from seismic ground shaking. In order for liquefaction to occur, three general geotechnical conditions need to occur: 1) groundwater is present within the potentially liquefiable material; 2) the soil is granular and meets a specific range of grain sizes; and 3) the soil is in a loose state of low relative density. If those conditions are present and strong ground

motion occurs, portions of the soil column could liquefy, depending upon the intensity and duration of the strong ground motion. Seismic settlement can occur in relatively loose sands, similar to soil types that are vulnerable to liquefaction, but can also occur in soils that are unsaturated and above the groundwater table.

The manifestation and damage that can be associated with liquefaction is strongly dependent on the duration of the ground motion. Liquefaction and seismic settlement hazards were evaluated using NCEER guidelines (Youd and Idriss, 2001) for the design M7.0 earthquake having a ground acceleration of 0.46g. Earthquakes that occur closer to a site generally result in higher ground motions than a similar magnitude earthquake that could occur away from the site. The design earthquake ground motion (0.46g) is higher than the San Simeon Earthquake ground motion (0.25g, adjusted for site-specific amplification effects). The stronger ground motion from the design earthquake would likely result from a near-field earthquake occurring within only 1 to 6 miles of the site, much closer than the San Simeon Earthquake. For purposes of comparison, we also conducted liquefaction analyses using data from the San Simeon Earthquake effects (M6.5 and 0.25g). The USGS (2004) study reports that liquefaction resulting from the San Simeon Earthquake significantly impacted the south levee within the western limits of the project.

Field data from the CPT soundings were used to estimate liquefaction and seismic settlement for the analysis. These data were then imported into a geographic information system (GIS) to spatially orient the digital information. Liquefaction analyses were subsequently performed using a programmed algorithm. The results of the analyses are presented with the subsurface profiles presented on Plates 4a and 4b, and on logs of the individual CPT soundings in Appendix C. The red lines on these plates are the estimated CPT tip resistance needed to resist liquefaction for the seismic conditions considered. A blue zone between the red line and the CPT tip resistance indicates a zone of potentially liquefiable soil.

Various soil layers within the sandy alluvium units (Qal1 and Qal2 on Plates 4a and 4b) are potentially liquefiable under the design earthquake. The fine-grained units of the alluvium (Qal3, Qal4 and Qal5 on Plates 4a and 4b) consist mostly of clay and are not considered susceptible to liquefaction. The existing levee fill (Af on Plates 4a and 4b), though underlain by the potentially liquefiable foundation support soil, appears to be relatively compact and has a low potential for liquefaction.

The potentially liquefiable soil was encountered within two zones of the sandy alluvium: an approximately 13-foot thickness of sand encountered just below the levee within the Qal1 unit at the west end of the project, and relatively thin, interbedded loose to medium dense sand layers within the Qal1 and Qal2 units encountered at various depths and locations over the site. The first area (near Cordova Ranch) has the greatest potential for liquefaction, and is within the Pre-settlement Estero area where liquefaction resulted in damage to the south levee following the San Simeon Earthquake. Our analysis suggests that the interbedded sandy units identified outside the Pre-settlement Estero area are generally denser and likely did not experience significant liquefaction in response to the San Simeon Earthquake.

Manifestation of liquefaction could impact the existing or proposed levee as settlement, instability, or cracking of the levee. We estimate that approximately 2 to 9 inches of seismic settlement could occur along the levee due to liquefaction under the design earthquake. Seismic settlement is estimated to be approximately 2 to 4 inches upstream of about Creek Road and approximately 3 to 9 inches within the Pre-settlement Estero Area downstream of about Creek Road. An evaluation of potential instability of the levee associated with liquefaction is discussed in the following section. The estimated higher settlement downstream of Creek Road is the same area where instability and settlement of the levee was reported following the December 2003 San Simeon Earthquake.

4.3 SLOPE STABILITY

The purpose of the slope stability analysis was to provide a basis for recommending slope inclinations for the preliminary design of the proposed levee improvements, and to evaluate the stability of the proposed embankments relative to the geotechnical feasibility of raising the levees. Slope stability analyses were evaluated for static loading conditions, pseudostatic (earthquake) loading, and post-liquefaction static loading conditions. The loading conditions analyzed as well as the results of our slope stability analyses are presented in Appendix D.

Slope stability analyses were performed for typical cross sections estimated at a location on the north levee embankment in the vicinity of Sta. 72, and at a location on the south levee embankment near Sta. 30 on the Cardoza Ranch that was destabilized by the 2003 San Simeon Earthquake. For both sections, slope stability was evaluated for the interior (creek side) and exterior (land side) levee slopes. The surface profiles at the cross section locations were selected based on cross sections provided by SH+G (2008b). The stability of the existing levees at these two locations was estimated under the existing static slope conditions, and considering liquefaction of the foundation support soil that reportedly occurred during the 2003 San Simeon Earthquake. The estimated stability of the existing slope levee provides a basis for evaluating the impact raising the levee will have on slope stability.

Two proposed embankment configurations were evaluated, each with six (6) feet of artificial fill placed above the existing embankment crest elevation. The first proposed configuration was evaluated with the raised levee centered on the centerline of the existing levee, and with the exterior and interior slope graded to an inclination of 2h:1v. The second proposed configuration was evaluated with the crest of the raised levee moved landward with a flatter interior slope that would match the existing approximately 3.5h:1v slope inclination. The exterior slope was evaluated using a 2h:1v inclination, the same as the first configuration.

4.3.1 Slope Stability Criteria

For the purpose of evaluating analytical results, the San Luis Obispo County (2005) Guidelines for Engineering Geology Reports considers slopes stable when the estimated factor of safety from slope stability analyses is at least 1.5 under static loading conditions, and at least 1.1 under pseudostatic (earthquake) loading conditions when using a horizontal pseudostatic coefficient of 0.15. These values are consistent with local practice and CDMG (1997) guidelines

for slope stability evaluations. A factor of safety of 1.0 represents the theoretical boundary below which a slope is no longer stable and experiences failure. Factors of safety greater than 1.0, such as those stated above, are typically used to define stable slope conditions in practice to help account for uncertainties in characterizing subsurface conditions and limitations of analyses used to evaluate slope stability. We considered the potential for liquefaction to impact the levee slopes in the analysis. Ground motions and liquefaction generated by the 2003 San Simeon earthquake are reported to have resulted in damage to a portion of the southern levee and sand boils near the Cardoza Ranch (USGS, 2004).

4.3.2 Analysis Methods

The slope stability analyses were performed using the computer program GSTABL7 (Gregory, 2001). GSTABL7 was used with STEDwin (Van Aller 2002) to estimate factors of safety for slope stability under static and pseudostatic loading conditions. GSTABL7 requires the user to input the ground surface profile; subsurface profile; soil properties including unit weight (γ), friction angle (ϕ), and cohesion (c); groundwater levels; and the analysis method to be used. Plots of the output, soil properties, and conditions used for the analyses are presented in Appendix C. Slope stability analyses were performed using the modified Bishop method to estimate factors of safety for circular failure surfaces. A key to the results of our slope stability analyses is presented on Plate C-1 in Appendix C.

4.3.3 Selection of Shear Strength Parameters

For our static load stability analyses, “static” shear strength parameters were assigned to selected subsurface units based on correlations with CPT data. The shear strength of sand units were modeled as cohesionless, based on a phi-only (ϕ) analysis estimated from the CPT data. The shear strength of fine-grained units was modeled as solely cohesive, based on the undrained shear strength estimated from the CPT data (S_u, noted as the cohesion intercept, c). Direct shear strength testing was performed on a relatively thin unit of clayey sand (SC) encountered at the base of levee embankments, because the strength of this unit was found to significantly influence the stability results. The layer was modeled as having both friction (ϕ) and cohesion (c) based on the additional direct shear test.

For our post-liquefaction stability analyses, “static” strength parameters were assigned to compacted fill, alluvium encountered above the groundwater table, medium dense “liquefiable” sand, and fine-grained soil layers because these units were considered as having limited or low potential for strength loss due to liquefaction. Post-liquefaction undrained residual shear strength values ($S_{u,r}$) were assigned to liquefiable soil units using correlations to CPT data and methods recommended by Seed and Harder (1990), which were mainly the loose sand units below the groundwater table (Qal1 on Plates 4a and 4b). The post-liquefaction undrained residual shear strength value was assigned as an equivalent value of cohesion (c) with a frictional angle (ϕ) equal to zero.

4.3.4 Groundwater Conditions

The groundwater levels used in our slope stability analyses were based on our field observations discussed in Section 3.3 of this report. The groundwater level was modeled near or above the existing water level in the creek. Rapid drawdown can occur in poorly drained soil as flood water recedes, typically resulting in surficial instability or slumping of the slope face. Specific analysis for rapid drawdown conditions was not performed, because the existing embankment soil is relatively well-drained sandy material and in our opinion should experience drainage to draw water away from the slope face as the flood water recedes. Additionally, the interior slopes of the existing channel are heavily stabilized by vegetation, except in local areas upstream of Highway 1, where some scouring of the slope has occurred.

4.3.5 Summary of Slope Stability Results

Preliminary plans (SH+G 2008a,b) show that the proposed levees will be raised approximately 3 to 6 feet above the existing top of levee. We estimated factors of safety for the existing and two proposed slope configurations described above. Each configuration was evaluated for two locations: one in the vicinity of Sta. 72 that is upstream of the 22nd Street Bridge, and one in the vicinity of Sta. 30 on the Cardoza Ranch. The estimated factors of safety for the existing and proposed levee slope conditions are generally considered stable under static loads. However, the estimated factors of safety for the existing and proposed embankment conditions are considered unstable when considering post-liquefaction of the underlying foundation support soils (mainly within the Qal1 unit shown on Plates 4a and 4b) in the vicinity of the Cardoza Ranch. Instability of the levee associated with liquefaction mainly occurs because the excess porewater pressure generated by the design earthquake is sufficient to essentially force loosely packed sand particles apart causing the soil to lose strength.

Sta. 72 Vicinity, North Levee Upstream of 22nd Street. The estimated factors of safety for this vicinity exceed those needed for slope stability for the existing and proposed conditions. The estimated factors of safety were greater than 1.7 for static loading conditions, and greater than 1.2 for pseudostatic (earthquake) loading conditions. The soils encountered in this area, although prone to liquefaction and moderate seismic settlement under the design earthquake, do not appear to be prone to significant loss in strength in response to liquefaction that would cause the estimated factor of safety of the slope to be considered unstable. For preliminary design, this evaluation generally suggests that the existing and proposed levee slope configurations considered in our evaluations are relatively stable under static and earthquake loading conditions upstream of about Creek Road (outside the limits of the Pre-settlement Estero noted on Plate 2). A summary of the slope stability results for this vicinity is provided in the following table.

Summary of Slope Stability Results for Sta. 72 Vicinity on North Levee upstream of 22nd Street Bridge

Condition		Estimated Factor of Safety		
		Static Loading	Pseudostatic (earthquake) Loading	Post-Liquefaction
Existing	Interior 3.5h:1v Slope	2.5	1.5	2.5
	Exterior 2h:1v Slope	1.7	1.2	1.7
Proposed Configuration 1: 6-foot levee raise centered on existing levee	Interior 2h:1v Slope	1.9	1.3	1.8
	Exterior 2h:1v Slope	1.7	1.2	1.7
Proposed Configuration 2: 6-foot levee centered outside existing channel and levee)	Interior 3.5h:1v Slope	2.5	1.5	2.2
	Exterior 2h:1v Slope	1.7	1.2	1.7

Sta. 30 Vicinity, South Levee on Cardoza Ranch. The estimated factors of safety for this vicinity exceed those needed for slope stability for the existing and proposed conditions when considering static loads, but are potentially unstable when considering post-liquefaction conditions associated with the design earthquake. This is essentially the same areas where instability of the levee was reported by the USGS (Holzer et al. 2003) following the December 2003 San Simeon Earthquake. The estimated factors of safety for the existing levee when considering post-liquefaction conditions were approximately 0.8 to 1.1, and generally below the minimum factor of safety of 1.1 considered to be stable by the County guidelines when considering earthquake loading conditions. The estimated factor of safety for post-liquefaction conditions falls to 0.5 to 0.8 when considering the proposed levee configurations. For preliminary design, this evaluation generally suggests that the existing and proposed levee slopes are relatively stable under static loads, and potentially unstable when considering earthquake (post-liquefaction) conditions downstream of about Creek Road (within the limits of the Pre-settlement Estero noted on Plate 2). A summary of the slope results for this vicinity is provided in the following table.

Slope Stability Results for Sta. 30 Vicinity on South Levee on Cardoza Ranch

Condition		Estimated Factor of Safety		
		Static Loading	Pseudostatic (earthquake) Loading	Post-Liquefaction
Existing	Interior 3.5h:1v Slope	2.6	1.5	0.8
	Exterior 1.5-2h:1v Slope	1.9	1.3	1.1
Proposed Configuration 1: 6-foot levee raise centered on existing levee	Interior 2h:1v Slope	1.9	1.3	0.5
	Exterior 2h:1v Slope	1.9	1.3	0.8
Proposed Configuration 2: 6-foot levee centered outside existing channel and levee)	Interior 3.5h:1v Slope	2.6	1.5	0.7
	Exterior 2h:1v Slope	1.9	1.3	0.8

5. GEOLOGIC HAZARDS AND GEOTECHNICAL CONSIDERATIONS

The following sections present a summary of geologic hazards that were evaluated for the project, our opinion regarding the potential for the hazards to impact the project, and preliminary recommendations for mitigation of the hazard, if needed.

5.1 APPROACH

The County has provided input regarding how potential impacts to the levee that may be related to earthquake/seismic related hazards should be evaluated. Earthquake related hazards and their associated impacts have been evaluated and discussed specific to the project. However, the County has stated that the project will not include potentially costly mitigations for seismic hazards that may damage the levee. We understand that the County's approach to mitigating seismic hazards will generally be to repair damages in response to earthquakes, should they occur. The County feels that given economic constraints, the most beneficial use of the available funds would be to provide increased flood protection. A factor in this decision is the unlikeliness that there would be full flows in Arroyo Grande Creek at the same time as a damaging earthquake. It is anticipated that if an earthquake occurs and damage is realized, that the County would have the opportunity to make repairs to the levee system before high flows would inundate the channel. The County will consider alternatives to mitigate or partially-mitigate seismic hazards if they can be relatively easily accomplished within the economic constraints of project.

The assessment of hazards is therefore discussed relative to potential impacts to the project, relative to the existing levee conditions, the general type of mitigation that may be needed to address seismic related hazards, and whether or not we recommend that potential impacts of the hazard be considered in the County operation, maintenance and emergency response planning for the levee.

5.2 FAULT RUPTURE

Fault rupture is the displacement of the ground surface created by movement along a fault plane during an earthquake. The project vicinity is not located within a designated Alquist-Priolo Earthquake Fault Hazard Zone. The Alquist-Priolo Earthquake Fault Zoning Act identifies areas of known active faults, and the main purpose of the act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. While habitable structures can be sited away from known active faults, uninhabited infrastructure, such as the levees proposed for this project, may not be able to be sited away from faults and therefore would have to cross any fault that were present.

A fault rupture hazard would exist where the levee would cross directly on an active fault, and rupture of that fault could displace the ground surface upon which the levee is located. The closest mapped active fault to the project vicinity is the Oceano fault. The Oceano fault is considered potentially active, and to be a part of the San Luis Range fault system. The Oceano fault is mapped approximately 1,000 feet southwest of the western terminus of the project, as shown on Plate 6. The potential for fault rupture to impact the project site is considered low and no mitigation for fault rupture is recommended.

Mitigation: None anticipated.

5.3 STRONG GROUND MOTION

The potential exists for strong ground motion to affect the project during the design lifetime. Strong ground motion (shaking) can occur in response to local or regional earthquakes. The project site is located within a seismically active area, and has been impacted by historic earthquakes in the recent past (such as the 2003 San Simeon Earthquake). The recency of the San Simeon Earthquake however does not suggest that the project area is more prone to earthquakes, or has a greater frequency of earthquakes, than it did prior to 2003. In general, the primary effects will be those phenomena associated with shaking and/or ground acceleration. Those effects are discussed in subsequent sections of this report regarding liquefaction, seismic settlement, ground lurching, and slope instability.

As discussed in Section 4.1 of this report, the design earthquake for this project is estimated to be a M7.0 event with a corresponding peak ground acceleration of approximately 0.46g. Design earthquake ground motions for liquefaction and other geotechnical analyses are defined as two-thirds ($^2/_3$) of the corresponding MCE ground motions. The MCE was defined based on the CBC as an earthquake having a 2 percent chance of being exceeded in 50 years (Statistical Return Period of approximately once every 2,475 years).

Mitigation: Seismic data and site classification for the design of levees should be reviewed and updated in the design-level Geotechnical Report in accordance with applicable County codes, ordinances, and guidelines. The report should provide ground motion parameters (magnitude and peak ground acceleration) for use in geotechnical analyses, such as for evaluating slope stability, liquefaction, and seismic settlement.

5.4 LIQUEFACTION AND SEISMIC SETTLEMENT

As discussed in Section 4.2, the existing levee is underlain by geologic units that may contain sediments susceptible to liquefaction. The potentially liquefiable soil was encountered within two zones of the sandy alluvium: 1) an approximately 13-foot thickness of sand encountered just below the levee within the Qal1 unit (see Plate 4a) at the west end of the project, and 2) relatively thin, interbedded loose to medium dense sand layers within the Qal1 and Qal2 units encountered at various depths and locations over the site. The first area (near Cordova Ranch) has the greatest potential for liquefaction, and is within the Pre-settlement Estero area where liquefaction and seismic settlement damaged the southern levee following the San Simeon Earthquake in 2003. Our analysis suggests that the interbedded sandy units identified outside the Pre-settlement Estero area are generally denser and likely did not experience significant liquefaction in response to the San Simeon Earthquake.

Manifestation of liquefaction could impact the existing or proposed levees as settlement, instability, or cracking of the levees. We estimate that approximately 2 to 9 inches of seismic settlement could occur along the levees due to liquefaction under the design earthquake. Seismic settlement is estimated to be approximately 2 to 4 inches upstream of about Creek Road and approximately 3 to 9 inches within the Pre-settlement Estero Area downstream of about Creek Road. An evaluation of potential instability of the levees associated with liquefaction is discussed in the following section. The estimated higher settlement downstream of Creek Road is within the area where instability and settlement of the levees was reported following the December 2003 San Simeon Earthquake.

Mitigation of liquefaction potential can be relatively costly. Mitigation methods for this project could consist of either removal and replacement of potentially liquefiable soils with properly compacted fill (estimated to be at least 13 feet below the existing streambed near Cardoza Ranch), or in-situ ground improvement to deeply compact the soil and thereby reduce the potential for liquefaction and seismic settlement to impact the levees, or widening the crest width and designing the levee with flatter slopes to help limit slope movement associated with liquefaction and slope instability (however, right-of-way and channel constraints may limit the feasibility and practicality of this mitigation method).

Alternatively, liquefaction and seismic hazards can be addressed in an Emergency Response Plan (ERP) for the levee improvements. The ERP should recognize the potential for liquefaction and seismic hazards to impact the levee, and delineate specific high hazard areas that should be inspected for damage following an earthquake.

Mitigation: A design-level geotechnical report should be prepared to evaluate potential mitigation methods for liquefaction and seismic settlement, and/or address geotechnical issues

that should be considered in the ERP. An ERP should be prepared as part of the design to identify high seismic hazard areas along the levees and protocols for responding and inspecting the levee following a damaging earthquake.

5.5 GROUND LURCHING

Ground lurching occurs as the ground is accelerated during a seismic event. As evidenced by the Loma Prieta, Landers, Northridge, and San Simeon Earthquakes, the effects of ground lurching can damage earthen fills. Ground lurching occurs due to detachment of underlying stratigraphic units, allowing near-surface soil to move differentially from underlying soil. The site is within a seismically active region of Central California that is prone to moderate to large earthquakes. It is therefore our opinion that there is a potential for ground lurching to impact the site. Ground lurching is generally not a geologic hazard that can be prevented, and therefore is mitigated by implementing preparedness measures.

Mitigation: Address in ERP with other seismic hazards.

5.6 LANDSLIDING AND SLOPE INSTABILITY

5.6.1 Landslides

The project site is generally on relatively flat terrain and not in areas that would be subject to large-scale landslides. The site is not within an area of mapped landslides, unstable formations, or known instability that would impact the levees or creek.

Mitigation: None anticipated.

5.6.2 Static Slope Stability

Destabilization of a slope occurs when the driving mechanisms associated with the slope exceed the resistance capacity of the soils comprising the slope. We performed preliminary slope stability analyses of selected portions of the slopes to evaluate slope stability and the geotechnical feasibility of raising the levee. The slope stability evaluation is discussed in Section 4.3 of this report. Failure surfaces may be surficial or deep-seated, with varying degrees of soil displacement as a consequence. The estimated factors of safety for the existing slopes and proposed embankment configurations are considered stable under static loading conditions. Design and construction of slopes should be further evaluated in subsequent design-level geotechnical reports. The destabilization of the embankment slopes could also be triggered by bank erosion/scour, undercutting the toe of slopes, grading, animal burrows, or other factors that should be periodically reviewed and maintained following construction.

Mitigation: The design-level geotechnical report should be prepared to recommend final slope inclinations for design of the levee improvements. Periodic review and maintenance of the improved channel and levee should be provided to help maintain vegetation, remove debris, and repair areas of scour, erosion, burrowing, or other changes to the channel slopes (see Scour and Erosion, Section 5.8).

5.6.3 Seismic Slope Stability and Lateral Spreads

We evaluated the stability of existing and proposed levee embankments under pseudo-static (earthquake) load conditions and post-liquefaction conditions, as discussed in Section 4.3 of this report). The destabilization of a slope can be triggered by forces (ground accelerations) associated with seismic activity. Additionally, a reduction in strength (resistance capacity) of constituent soils may be a consequence of seismically-induced liquefaction, potentially resulting in slope instability of the levee slopes and/or stream banks (a type of lateral spreading). Lateral spreading typically develops on sloping ground underlain by liquefiable soils or where free-face conditions can develop in a liquefiable soil, such as along a river bank or drainage. According to the USGS report (Holzer et al. 2004), lateral spreading was observed in areas along the perimeter of the Oceano Lagoon (north of the project site) following the December 2003 San Simeon Earthquake.

For preliminary design, the slope stability evaluation suggests that the existing and proposed levee embankments are generally stable under earthquake loading and post-liquefaction conditions upstream of about Creek Road. However, the existing and proposed embankments for the levee are potentially unstable within the Pre-settlement Estero area downstream of Creek Road (see Plate 2). Our evaluation also suggests that there is a potential for liquefaction and instability to impact the levee within the Pre-settlement Estero area whether the levee is raised or not. Mitigation of liquefaction hazards, as discussed in Section 5.4 of this report, would also help improve the stability of the levee slopes, but likely would be costly.

Mitigation: Address in ERP with other seismic hazards. The main mitigation for slope instability associated with seismic hazards in the ERP will be for the County to respond to earthquakes, and repair areas that may be damaged by these hazards. The design-level geotechnical report should address the potential for slope instability to occur in association with liquefaction, the extent to which the hazard could impact the design of improvements, and whether the hazard can be mitigated by modifying the geometry of the raised levee within the scope, right-of-way, and economic constraints of the project.

5.7 SUBSIDENCE AND COLLAPSE

The project site is not in an area where the withdrawal of subsurface fluids is known to have caused ground subsidence. The greatest potential for subsidence would be if potentially compressible soils were impacted by lowering of the groundwater table during construction dewatering. The buoyancy of the soil above a specific depth decreases as groundwater levels are lowered. Lowering of the groundwater level therefore increases the effective weight of the soil above that depth, which can cause the soil to subside (settle) under the increased weight of the ground above it.

Our subsurface exploration and geologic maps indicate the project area is underlain by heterogeneous alluvium deposits. The alluvium is currently saturated from near the creekbed elevation downward. We do not anticipate that dewatering will be necessary for construction purposes. However, if dewatering is planned, the potential for subsidence in association with lowering of the groundwater table should be evaluated.

Mitigation: None anticipated.

5.8 SCOUR AND EROSION

SH+G is performing the hydraulic analysis and estimating scour depths along Arroyo Grande Creek and Los Berros Creek for this project. As input to their analysis, Fugro obtained samples of selected streambed and stream channel materials within the project extent and performed grain size analysis. The stream channel deposits observed along the streambed consist predominantly of gravel and sand. The bank materials generally consist of interbedded layers of erodable granular and fine-grained soils. Erosion of the channel slopes has occurred in localized areas of scour observed during our July 2008 site visits, particularly in areas upstream of Highway 1.

Graded fill slopes associated with the levee improvements will be subject to sheet and rill erosion. Erosion of soils can be accelerated where soils are exposed directly to runoff and/or areas of concentrated storm runoff, such as at culvert outlets. Site drainage and landscape improvements can be designed to reduce the potential for soil erosion. We observed abundant vegetation along the interior levee slopes and within the creek channel, which likely decreases the susceptibility of surficial soils to erosion.

The stream channel is a dynamic environment that will likely change and respond to changes in flow and rainfall seasonally. The existing levee slopes within the channel of Arroyo Grande are mostly stabilized by vegetation with graded slope inclinations of about 3:1 or flatter. Maintaining vegetation within the channel and maintaining the channel slopes can be used to mitigate the affects of scour and erosion.

Mitigation: On-going maintenance or other measures should be provided to reduce the potential for scour of the levee slopes. Erosion control measures, such as hydro-seeding, erosion control matting, and maintenance, should be provided to reduce the potential for erosion while vegetation is being established on new slopes. On-going maintenance of the slopes should be provided, as-needed, to assist in establishing appropriate vegetation, to repair areas where localized scour and erosion may impact slopes, and to remove debris from the channel that may dam or adversely channel the flow of water within the channel. Energy dissipation and erosion control devices should be provided at outlets of drainage pipes and in areas where there are concentrated flows of runoff to reduce the potential for erosion.

5.9 EXPANSIVE SOILS

Expansive soil generally consists of fine-grained soil of high plasticity (clay) that can damage near-surface improvements in response to shrinking and swelling associated with changes in soil moisture content. The expansion potential of the soil used to construct a levee can influence the strength and permeability of the levee. While clay material near the core of an embankment can help to limit seepage through the embankment, shrinking and swelling of the clay soil can also influence the stability and maintenance of the slope face. The existing levees appear to be constructed of predominantly sandy sediment having a low potential for expansion,

therefore, surficial soils having a high potential for expansion are not anticipated to impact the levee improvements.

Mitigation: The design-level geotechnical report should provide recommendations for fill material that can be used in raising the levee. The recommendations should consider the expansion potential and other geotechnical properties of the soil relative to controlling the seepage and slope stability conditions for the new levees.

5.10 HYDROCOLLAPSE POTENTIAL

Hydrocollapse or hydroconsolidation describes soils that are prone to settling when subjected to wetting or saturation. Hydroconsolidation can result in differential settlement and possible cracking of the levee, particularly if the soils vulnerable to collapse are left in-place below the levee fill. The levee fill itself will be constructed of compacted fill that should not be prone to excessive settlement or collapse due to wetting. Shallow near surface soils, such as expansive clay soil and loose dune sand may be vulnerable to collapse. Near surface soils that may be vulnerable to collapse are typically removed during site preparation and grading and replaced with compacted (engineered) fill. Soils below the groundwater (creekbed) level are not prone to post-construction settlement associated with hydrocollapse.

Mitigation: The design-level geotechnical report should provide recommendations for site preparation and grading to reduce the potential for settlement associated with hydrocollapse to impact the levee.

5.11 TSUNAMIS AND INUNDATION

Tsunamis are long-period sea waves created due to seismic events or submarine landslides and have historically occurred in the project region. Tsunamis can range in height from a few feet to greater than 50 feet, and can result in run-ups, or bores, extending great distances up streams, rivers, and creeks. As evidenced by recent events around the world, tsunamis can have devastating impacts on coastal areas. The project vicinity is located at elevations ranging from approximately el. +11 feet above mean sea level (MSL) to approximately el. +63 feet MSL near the city limits of Arroyo Grande. The County of San Luis Obispo has prepared web-based tsunami inundation maps (http://www.sloplanning-maps.org/ed.asp?bhcp=1) that show coastal areas that may be vulnerable to inundation from tsunami below about el. +40 feet MSL. The inundation zones are generally the coastal areas along San Luis Bay, and low lying areas along Arroyo Grande Creek. Nearly the entire project site is located below the estimated tsunami run-up elevation shown on the County website. As a result, tsunami run-ups may be considered a potential hazard to the existing levee and surrounding area. The presence of the levees would not increase the susceptibility of the project vicinity, and may provide moderate protection from smaller events should they occur.

According to Kilbourne and Mualchin (1980), the following historical tsunamis have occurred in the project region:

Historical Tsunami Run-up

Year	Estimated Tsunami Generation Location	Estimated Impact Location	Estimated Tsunami Run-up (feet)
1868[1]	Unknown	Morro Bay	Unknown
1878[2]	Unknown	Morro Bay	Unknown
1927	Local	Pismo Beach	6 feet
1946	Aleutian Trench	San Luis Obispo Bay	4-5 feet
1960	Chile-Peru Trench	Central Coast	>3 feet
1964	Gulf of Alaska	Central Coast	>3 feet

[1] Speculative

[2] Reportedly overtopped the sand spit that separates the bay from the ocean (SLO County 1999).

Mitigation: None anticipated. Tsunami hazards are typically addressed by developing warning systems and evacuation plans for coastal areas. The San Luis Obispo County Office of Emergency Services is responsible for the emergency response plan.

5.12 DAM INUNDATION

The project site is located downstream of Lopez Lake and two dams: the Lopez Canyon Dam and the Lopez Terminal Dam. According to the County of San Luis Obispo Safety Element (1999), the entire project extent is subject to inundation due to dam failure.

Mitigation: None anticipated. Dam inundation hazards are typically addressed by developing warning systems and evacuation plans for vulnerable areas. The San Luis Obispo County Office of Emergency Services is responsible for the emergency response plan.

5.13 NATURALLY OCCURRING ASBESTOS

Naturally occurring asbestos (NOA) is common in serpentine rock throughout San Luis Obispo County. The California Air Resources Board has identified serpentine rock as having the potential to contain asbestos. Serpentine rock is typically a constituent of Franciscan Formation mélange, which has not been mapped or encountered within the project limits. The grading for the project should therefore not encounter areas containing serpentine rock. Therefore, it is our opinion that there is a low potential for NOA to impact the project. If encountered, mitigation for NOA typically consists of dust control during earthwork operations to reduce the potential for asbestos dust from being an inhalation hazard.

Mitigation: The County will likely require a letter prepared by a geotechnical professional for the project that specifically identifies whether or not NOA is considered to be a potential hazard for the project.

5.14 RADON GASES

Radon gases are generally associated with Mesozoic granitic rocks and derivative Tertiary sedimentary rocks, and Tertiary marine sedimentary rocks. Radon hazards are generally related to an accumulation of radon gases within homes and housing structures and do not apply to the proposed levee project. The San Luis Obispo County Safety Element (1999) has identified these geologic formations as having high equivalent uranium (eU) concentrations. These formations have not been mapped or encountered within the project site. We do not anticipate components of the project will be planned for areas potentially containing rocks with high eU concentrations, nor would the raising of the levee have any impact on this hazard. Therefore, it is our opinion that there is a low potential for this hazard to impact the project.

Mitigation: None anticipated.

5.15 EMBANKMENT SEEPAGE AND PIPING

During sustained high-flow events, water permeating through the levee embankments may daylight on the exterior levee slopes, resulting in localized erosion of embankment material. Continued seepage and erosion can lead to piping, which generally consists of a tunnel-like void in the embankment that results from erosion of the embankment fill caused by uncontrolled seepage daylighting on the face of the exterior slope of the levee. The existing levee appears to be constructed of compacted sandy material that could be vulnerable to piping in the event that sustained flows at flood levels within the creek occurred.

Steady state seepage refers to the stabilized water level and zone of seepage through the levee at a sustained water level within the flow channel. The potential for steady state seepage to develop within the embankment is generally expected to be relatively low because the storm events for the project are likely to have a short duration (typically only a few hours in duration). We anticipate the typical duration of high-flow events may be short enough that a hydraulic gradient capable of daylighting on the exterior slope is unlikely to develop. We did not observe visual evidence of seepage or erosion of the existing embankment material that would indicate that piping or seepage through the levee has occurred in the past.

Mitigation for seepage and piping can consist of providing low permeability fill materials within the levee embankment to slow the rate of seepage through the embankment and/or providing drainage on the outer slopes of the levee to collect and control seepage. Drainage materials, if used, are designed with graded-granular filters that will help to retain the levee fill where the seepage exits the embankment and prevent piping. The design-level geotechnical study should include a detailed seepage analysis of the levee considering the flood levels and storm durations. It is likely that the design of the new levees can include provisions for using a layer of low-permeability materials within the embankment to control seepage. The near-surface alluvium encountered adjacent to the levees appears suitable for use as low-permeability material but would need to be evaluated for the project.

Mitigation: The design-level geotechnical report should address and evaluate seepage conditions through the embankment for the design storm events and water levels, and address

the need for control of seepage and drainage to avoid piping and seepage from daylighting on the exterior slopes of the levee.

5.16 FOUNDATION SEEPAGE

Foundation seepage refers to underflow beneath the levee that results when the higher water level (high gradient) in the creeks infiltrates the creekbed, and then flows beneath the levee to the lower water level outside the levee (low gradient). Similar to embankment seepage discussed above, uncontrolled seepage daylighting beyond the exterior slope of the levee can result in boils, piping, and instability of the foundation soils where the seepage exits the ground. Piping of the subsurface can erode foundation materials and potentially destabilize the embankment.

A hand auger boring drilled adjacent to the exterior slope of the levee near Creek Road encountered groundwater at a depth of about 3 feet below the ground surface. Water was flowing in Arroyo Grande Creek at the time of the exploration. The water level suggests that the foundation soils beneath the levee embankments are saturated to some extent by the normal dry-season water flow within the creek. As a result, it is possible that rising water levels within the channel may increase the rate of seepage beneath the embankment relatively quickly.

The exit gradient refers to the hydraulic gradient where the foundation seepage will daylight on the outside of the levee slopes. The critical gradient refers to when seepage force exceeds the effective weight of the soil, heaves the soil, and typically causes a boil to form beyond the exterior slope of the levee. For design, exit gradients should be subcritical and are preferred to be 5 to 6 times below critical. We preliminarily evaluated seepage forces beneath the embankment near Creek Road considering the 20-year water surface elevation as defined by SH+G (2008b). The exit gradients were estimated to be subcritical for the raised levee condition, but by a factor of about 2, less than the optimal factor of 5 to 6.

The design-level geotechnical study should include a detailed seepage analysis of the levee foundation considering the flood levels and storm durations. Mitigation for foundation seepage can consist of cutoff walls, impervious blankets, or relief wells or drainage systems to control or reduce exit gradients.

Mitigation: The design-level geotechnical report should address and evaluate seepage conditions through the embankment foundation for the design storm events and water levels, and address the need for control of seepage and drainage to avoid piping and seepage from daylighting beyond the exterior slopes of the levees.

5.17 VEGETATION MANAGEMENT

Vegetation growing within the channel can block flows and reduce flood protection. The existing channel is relatively heavily vegetated with brush and small trees. Management of vegetation can impact seepage conditions if the root systems of dying or cut trees are left in-place to decay within the embankment. The County was performing a vegetation management program with the California Conservation Corps at the time of our field work. The program generally consisted of trimming low limbs from trees within the channel, and cutting smaller

brush and vegetation on the channel slopes. Root holes and voids left from the decayed or pulled roots can shorten seepage paths through the embankment increasing the potential for seepage or piping to extend through the embankment.

Mitigation: Management of the vegetation within the Arroyo Grande Creek channel should include removal of dead trees, and repair of voids left from pulled or decaying roots by filling the voids with properly compacted soil.

5.18 SEDIMENT REMOVAL - DREDGING

Accumulation of sediment within the channel of Arroyo Grande Creek can reduce flood protection by blocking flow within the channel. Sediment will be removed from the existing channel as part of the project. Disposal of sediment will require that the sediments within the channel be characterized to evaluate whether or not the sediments are compatible with the disposal area in accordance with U.S. Army Corps requirements. Characterization typically includes laboratory tests for grain size and chemical compatibility. The properties of the sediment are then compared to potential disposal sites being considered to identify a suitable site for disposal. Typical disposal sites can include beach replenishment with sandy material, agricultural fields to replace lost fine-grained sediment, stockpiles to provide construction material resources, or as on-site fill material for the levee construction.

The sediment observed within the channel appears to be comprised of sand and gravel bars that have formed within the channel. Based on review of the project plans and water level observed during our field observations, most of the sediment that likely will be removed appears to be near or above the water level in the creek. If so, the sediment therefore likely would be removed by mechanical methods (such as by an excavator or other earth moving equipment).

Mitigation: The design-level geotechnical report should include characterization of the channel sediment that will be removed, and evaluate the suitability of the material for on-site use during the levee construction. The report should also discuss anticipated excavation conditions (above or below water) and appropriate excavation methods.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY OF FINDINGS

- The soils encountered along the project extent consisted of the existing levee fill material founded on alluvial deposits. The levee fill consisted of mostly medium dense to very dense sandy materials. The alluvium was encountered to the maximum depths explored, approximately 100 feet below the ground surface, and consisted of interbedded loose to very dense sandy soils and medium stiff to hard clay materials (see Plates 4a and 4b). Water was observed flowing in the creek at the time of our July 2008 field exploration program. Groundwater was encountered as shallow as approximately 9 feet below the existing top of levee and about 3 feet below the exterior toe of the levee, in explorations advanced for this study.

- The levees and channel along Arroyo Grande Creek were constructed in the late 1950's as a U.S. Department of Agriculture, Soil Conservation Service project (USDA 1956). The location of the creek is controlled by channels and levees, and portions of the creek were relocated as part of the construction of the levee system. The existing earthen levee is about 3 to 12 feet above adjacent grades. The USDA (1956) plans show the levees were designed with a 15-foot wide crest and side slopes graded to inclinations of 1½ h:1v to 2h:1v on the exterior slopes and 3h:1v on the interior channel slopes. The existing levees are less pronounced and more intermittent upstream of Highway 1, where the design height of the levee is generally less than about 3 feet above adjacent grades as shown on the plans. The existing stream channel upstream of Highway 1 is increasingly incised to the east, with local areas of near vertical creek bank and erosion.

- Geologic hazards relating to fault rupture, landsliding, subsidence, hydrocollapse, naturally occurring asbestos, and radon gases are unlikely to impact the project. The site is located within the inundation area identified by the County for failure of Lopez Canyon Dam or tsunami. The site is located within a seismically active area, and could be impacted by seismic hazards related to liquefaction, seismic settlement and slope instability. The County stated that their approach to mitigating seismic hazards will be to repair damages in response to earthquakes should they occur, and to focus the project on improving flood protection.

- Geotechnical considerations relating to scour, erosion, and seepage should be considered in the design, construction, and maintenance of the project. A detailed seepage analysis of the proposed raised levee configuration and design flood conditions should be provided to evaluate whether or not specific measures, such as provisions for drainage, low permeability materials, or flatter slopes will need to be included in the project design.

- The western limits of the project are located within an area underlain by a Pre-settlement Estero that has subsequently been filled in as a result of development and realignment of the channel. This area was documented by the County and USGS (Holzer et al. 2003) as an area where relatively extensive liquefaction and lateral spreading occurred (including damage to a portion of the southern levee) in response to the 2003 San Simeon Earthquake. The existing and proposed levees in this area have the potential to be impacted by liquefaction of the ground beneath the embankment, incur estimated seismic settlements of up to approximately 9 inches, and result in slope instability for the design earthquake. Upstream of Creek Road, the proposed and existing levees were estimated to be stable under the design earthquake but could experience seismic settlements of approximately 2 to 4 inches. Mitigation for these hazards should be considered in the emergency response and maintenance plan for the project.

- Slope stability analyses of the preliminary levee configurations suggest that the levee can be raised to the conceptual design height and should be stable under static loading and the anticipated flood levels. However, the stability of the levees likely would be compromised by liquefaction of the foundation soil within the Pre-

Settlement Estero area west of about Creek Road. Because it is unlikely that there would be full flows in Arroyo Grande Creek at the same time as a damaging earthquake, the County anticipates that if an earthquake were to occur and damage is realized, they would have the opportunity to make repairs to the levee system before high flows would inundate the channel. The existing levee is vulnerable to this potential hazard whether the height of the levee is raised to improve flood protection or not.

- The existing channel is relatively heavily vegetated with brush and small trees. Management of vegetation can impact seepage conditions if the root systems of dying or cut trees are left in-place to decay within the embankment. The County was performing a vegetation management program with the California Conservation Corps at the time of our field work. The program generally consisted of trimming low limbs from trees within the channel, and cutting smaller brush and vegetation on the channel slopes. Root holes and voids left from decayed or pulled roots can shorten seepage paths through the embankment increasing the potential for seepage or piping to extend through the embankment. Management of the vegetation should include removal of dead trees, and repair of voids left from pulled or decaying roots by filling the voids with properly compacted soil.
- Sediment will be removed from the existing channel as part of the project. The sediment that we observed within the channel is mostly comprised of sand and gravel bars that have formed within the channel. Based on review of the project plans and water level observed during our field observations, most of the sediment that likely will be removed appears to be near or above the water level in the creek. If so, the sediment would likely be removed using mechanical methods (such by an excavator or other earth-moving equipment). If excavation depths are lower, and/or the water levels higher, hydraulic dredging equipment may be used to clear saturated sediment from channels that are below the water level.

6.2 GEOTECHNICAL CONSIDERATIONS FOR CONSTRUCTION

6.2.1 Site Preparation and Grading

Grading for the improvements is likely to consist of placing fill material to raise and widen the existing levees. Prior to grading, the site should be cleared and grubbed. Where relatively small (less than approximately 1 foot) increases in the levee height may occur, the grading will likely be performed within the footprint of the existing levee. Prior to placing fill over the existing levee material, the surface of the existing fill should be scarified and compacted in-place to provide a suitable surface for placing additional fill. Voids or depressions left from clearing and grubbing, or possible rodent holes, should be filled with compacted material. Compacted fill can then be placed to finished grade.

Where higher grade raises are proposed and new fill will be placed beyond the footprint of the existing levee, additional site preparation could be needed prior to placing fill. The near-surface soil within the agricultural fields adjacent to the existing levees is likely loose, and should be removed prior to placing fill material. Site preparation in these areas will likely consist

of removing the existing soil from areas to receive fill to a depth of about 2 to 3 feet below the existing ground surface. The new fill can then be placed on the undisturbed subgrade. Soft or yielding subgrade conditions should be stabilized by placing a mat of dry, compacted fill over the undisturbed subgrade. Where fill is placed over the existing fill, the new fill should be keyed and benched several feet into the existing levee slope to provide a uniform transition with the existing levee fill. The final grading and depth of removal should be evaluated during the design-level geotechnical evaluation.

6.2.2 Use of On-site Soil

Excavated on-site soil that is free or organics and deleterious materials should generally be suitable for use in levee construction. Dredged or wet soil removed from excavations will need to be dried to a moisture content suitable for compaction prior to being placed as compacted fill. Fine-grained soil that appears to be present to a depth of several feet within the agricultural fields may be suitable to provide a blanket of impervious fill within the new levees. The quality of and need for this material should be considered in the design-level geotechnical study.

6.2.3 Groundwater

Groundwater was encountered at approximately 3 feet below the existing ground surface near Creek Road. Groundwater levels will vary depending on the time of construction, and should be considered in the excavation plans for the project. Dewatering and control of groundwater will likely be needed for excavations performed within the existing channel, or extending more than about 2 to 3 feet below the existing ground surface.

6.2.4 Excavation

The existing soil encountered along the levee can likely be excavated using conventional earth-moving equipment. Excavations extending below the levee or within the channel will need to consider the potential for encountering wet and yielding ground. Wet soils within the channel, or below the adjacent grade within the agricultural fields, will likely not support heavy construction traffic, such as self-loading scrapers or haul trucks, without stabilization. Subgrade stabilization and maintenance of haul roads will likely be needed to provide suitable access for construction traffic.

6.3 GEOTECHNICAL CONSIDERATIONS FOR DESIGN

The design of the levee will be geotechnically intensive. This preliminary evaluation identified geotechnical considerations relating to slope stability, seepage, and grading that should be considered in the design of the project. The design-level geotechnical study will likely involve additional slope stability and seepage analyses to provide specific recommendations for design, and to confirm the preliminary slope inclinations provided in this report. The report will also provide material requirements for compacted fill, low-permeability materials, and drainage as needed for the improvements based on the results of the additional analyses.

6.4 COMPARISON OF EXISTING AND PROPOSED CONDITIONS

Because the existing and proposed levees are vulnerable to various geologic hazards, our assessment of hazards is discussed relative to potential impacts to the project and relative to the existing levee conditions. The following table provides a comparison of the existing and proposed raised-levee conditions relative to the geologic hazards and geotechnical considerations that were evaluated for the project.

The following is the ranking of hazards that we used in the comparison.

Low: There is a low potential for the hazard to impact the project, because either review of the hazard suggests there is no potential for it to occur, the hazard has not been documented to be present at the site, the hazard has already been mitigated by the existing levee, or it will be mitigated as part of normal design and construction practice.

Moderate. There is a potential for the hazard to impact the project, the hazard can either only be partially mitigated or mitigation of the hazard reduces the risk of damage but it cannot be completely mitigated, or the site could be impacted by a hazard that has a low or uncertain rate of recurrence.

High. The hazard is likely to impact the project within the design life of the project, or the hazard is present and requires mitigation by applicable design standards and codes.

Comparison of Geologic Impacts to Existing Condition

Hazard	Description of Hazard	Potential to Impact the Existing Levee	Change due to Raising Levee	Comments
Fault Rupture	Rupture of a fault beneath a site or structure that can cause upheaval, cracking, and displacement of ground surface.	Low	Same	There are no known active faults that cross the project.
Seismic Shaking	Ground motion that results from nearby or regional earthquakes. The design earthquake is a M7.0 event resulting in a peak horizontal ground acceleration of about 46% of gravity that should be considered in geotechnical analyses for slope stability and liquefaction.	High	Nearly the same	See liquefaction and slope stability hazards.
Liquefaction and Seismic Settlement	Loss of strength and displacement of ground surface that normally occurs in loose sandy soil below the groundwater table. Portions of the soil column beneath Arroyo Grande Creek are prone to liquefaction and seismic settlement under the design earthquake effects, particularly downstream of about Creek Road.	High	Same	Hazard likely to be addressed by emergency response planning (ERP).
Slope Instability – static loading	The stability of the levee embankment under normal static (not earthquake) loads that may occur at existing or flood level conditions.	Low	Same	Factors of safety above minimums for stability for existing and proposed levee.

Hazard	Description of Hazard	Potential to Impact the Existing Levee	Change due to Raising Levee	Comments
Slope Instability – seismic loading including lateral spreads **downstream of Creek Road**	The reduced stability of the levee embankment when considering horizontal forces, liquefaction of the foundation support soil, and potential lateral displacement that could occur in response to the design earthquake.	High	Nearly the same	Hazard likely to be addressed by ERP.
Slope Instability – seismic loading including lateral spreads **upstream of Creek Road**	Same as above.	Low to Moderate	Nearly the same	Factors of safety above minimums for stability for existing and proposed levee. Address in ERP.
Ground Lurching	Detachment of underlying stratigraphic units within the ground, allowing near-surface soil to move differentially from underlying soil, as a result of inertial forces associated with an earthquake.	Moderate	Same	Address in ERP.
Landslides	The potential for a site to be unstable as a result of the location being underlain by existing landslides. The area along Arroyo Grande Creek is flat and not prone to landslides.	Low	Same	No existing landslides.
Subsidence	Settlement of the ground surface due to extraction of fluids, such as may occur due to pumping from an oil field or water well. Subsidence is common where there are highly compressible soils in areas where the groundwater table is artificially lowered causing the effective weight of the soil to increase.	Low	Same	Lowering of the groundwater table is not anticipated.
Scour and Erosion	Removal of sediment within the creek, along its banks, or the surface of the levees due to stream flow. Scour and erosion can cause degradation of the streambed or bank erosion that can cause slopes to be unstable. Vegetation within the existing channel and on the levee slope is the primary protection of the slopes within the existing channel.	Moderate	Same	Scour conditions to be addressed in the design of levees. Maintenance of channel should include debris removal that may cause localized scour.
Expansive Soils	Shrinking and swelling of a soil in response to changes in soil moisture. Shrinking and swelling of soil within a levee could result in fissures or cracks that can lead to seepage.	Low	Same	Levee materials encountered predominantly consisted of granular soils having low expansion potential.
Hydrocollapse	Settlement that occurs within a soil with relatively high porosity in response to wetting of the soil, typically due to irrigation, flooding, or rainfall.	Low	Same	Soils are either not susceptible or will be removed and replaced with compacted fill during normal site preparation and grading.
Tsunami	Long-period sea waves created due to seismic events or submarine landslides, that can bore up coastal rivers and streams causing flooding and destruction due to fast moving water and severe erosion. The project site is located within the coastal inundation zones shown on the County website.	Moderate	Reduced	Some increased flood protection will be provided by higher levees, but final levee height is below the County estimated depth of inundation.

Hazard	Description of Hazard	Potential to Impact the Existing Levee	Change due to Raising Levee	Comments
Dam Inundation	Flooding due to failure or breach of an upstream dam or impoundment. The site is downstream and within the inundation zone for Lopez Dam.	High	Reduced	Some increased flood protection will be provided by higher levees, but the levees will not be designed to retain flooding due to a dam failure.
Naturally Occurring Asbestos	Potential for air-born dust particles to cause an inhalation hazard, particularly to construction workers performing earthwork or causing dust.	Low	Same	Serpentinitic rocks in San Luis Obispo County are known to contain asbestos, but have not been mapped or encountered within project vicinity.
Radon Gases	Potential for geologic formations containing equivalent uranium concentrations to cause inhalation hazards within homes.	Low	Same	Hazard not applicable to levee project, and is not known to be present within the project limits.
Embankment Seepage and Piping	Erosion and potential instability of the levee resulting from uncontrolled seepage through the levee embankment, and subsequent erosion of the levee embankment due to seepage forces daylighting on the outside slope of the levee. Raising the levee can increase the potential hydraulic gradient through the levee, and the severity of this potential hazard.	Low	Increased	The anticipated short duration for anticipated high-flow events may not have sufficient duration to cause steady-state seepage that would impact the levee. Because the impacts of seepage are important to the stability of hydraulic earth structures, seepage and any necessary mitigation should be addressed in the design of the levees. The existing levee does not appear to have been impacted by uncontrolled seepage or piping.
Foundation Seepage	Erosion and potential instability of the levee resulting from uncontrolled seepage beneath the levee embankment, and subsequent piping of the foundation support soil due to seepage forces daylighting outside of the levee footprint. Raising the levee can increase the potential hydraulic gradient through the levee, and the severity of this potential hazard.	Low to moderate	Increased	The anticipated short duration anticipated for high-flow events may not have sufficient duration to cause steady-state seepage that would impact the levee. However, because the impacts of seepage are important to the stability of hydraulic earth structures, seepage and any necessary mitigation should be addressed in the design of levee. The existing levee does not appear to have been impacted by uncontrolled seepage or piping beneath the levee.

Hazard	Description of Hazard	Potential to Impact the Existing Levee	Change due to Raising Levee	Comments
Vegetation Management	Vegetation growing within the channel can block flows and reduce flood protection. The existing channel is relatively heavily vegetated with brush and small trees. Management of vegetation can impact seepage conditions if the root systems of dying or cut trees are left in-place to decay within the embankment. Root holes and voids left from the decayed or pulled roots can shorten seepage paths through the embankment increasing the potential for seepage or piping to extend through the embankment.	High	Same	Management of the vegetation should include removal of dead trees, and repair of voids left from pulled or decaying roots by filling the voids with properly compacted soil for either the existing or proposed levee condition.
Sediment Removal – Dredging	Accumulation of sediment within the channel of Arroyo Grande Creek and reduction of flood protection by blocking flow within the channel. Existing sediment within Arroyo Grande Creek will be removed as part of the project, and will need to be disposed of or re-used onsite.	High	Same	Ongoing maintenance of the channel should include periodic removal of sediment for either the existing or proposed conditions.

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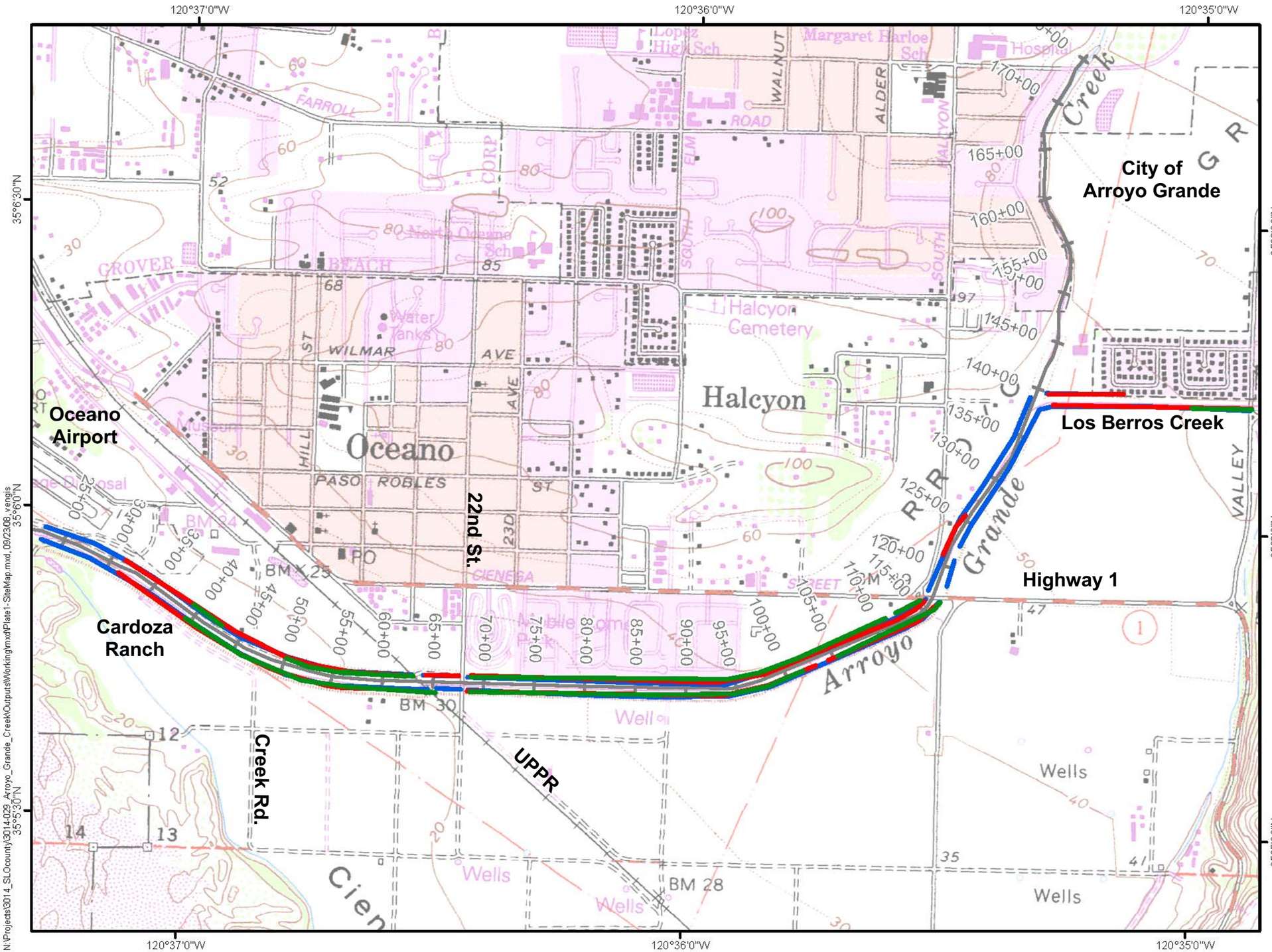
PLATES



SITE MAP
Arroyo Grande Creek
Waterways Management Plan
San Luis Obispo County, California

PLATE 1

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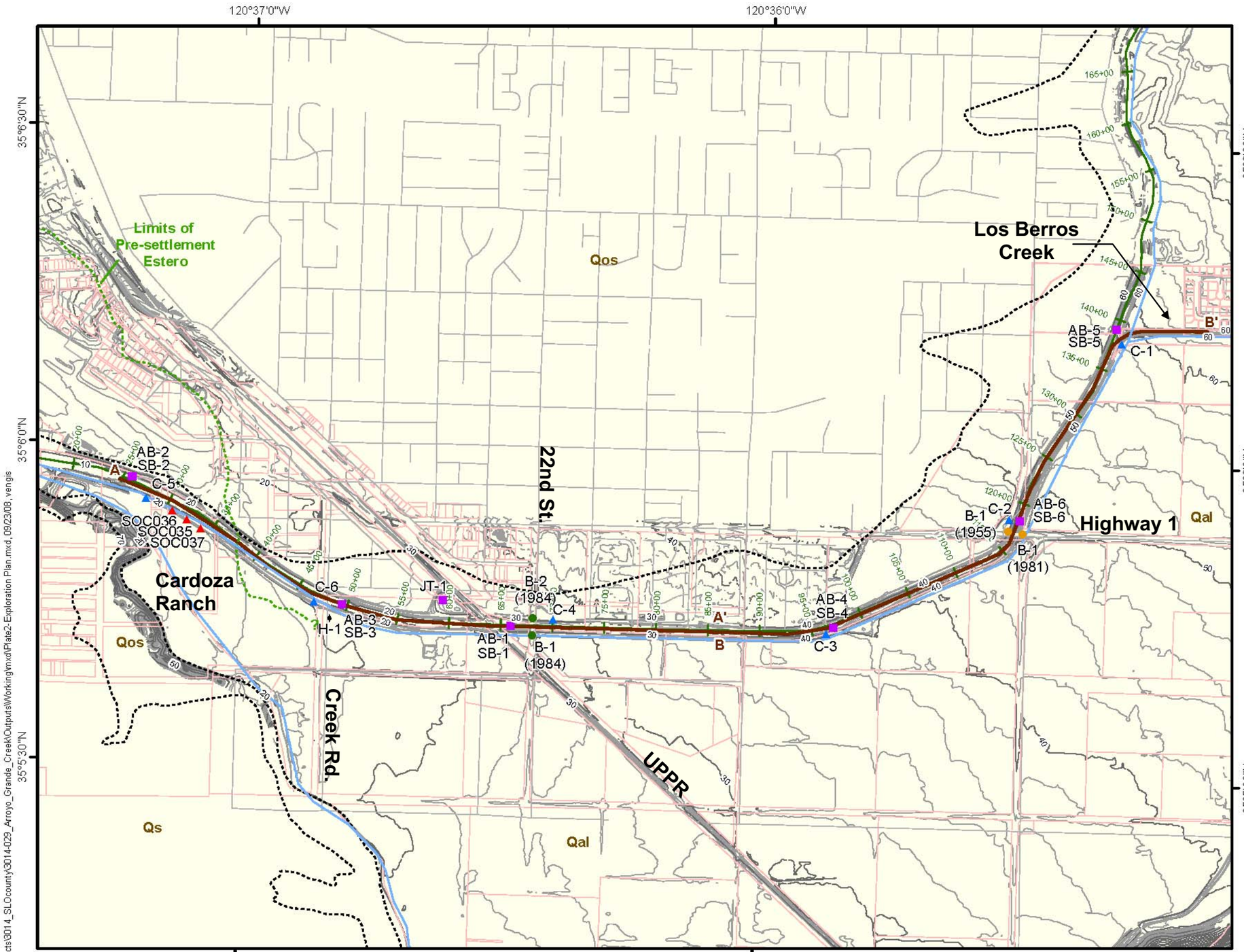

Legend

Approximate Exploration Locations

- Fugro CPT
- USGS SCPT
- Caltrans Boring (Year of Study)
- SLO County Boring (Year of Study)
- Hand Auger Boring
- Hand Samples
  - SB Collected from Streambed
  - AB Collected Above Water Surface
  - JT Collected from J.Taylor's Property
- Profile Line
- Centerline Along Levee with Stationing
- Roads
- 10 foot contour
- 2 foot contour
- Parcels within Zones 1 and 1a

Geology

- Contact
- Limits of Pre-settlement Estero
- Qal Alluvial Deposits
- Qs Sand Dune Deposits
- Qos Older Sand Dune Deposits

N

Horizontal Scale: 1:12,000

1,000 500 0 1,000 Feet

FIELD EXPLORATION PLAN
Arroyo Grande Creek
Waterways Management Plan
San Luis Obispo County, California

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MAP UNITS

Qal	Alluvial deposits
Qs	Sand Dune deposits
Qos	Older Sand Dune deposits
Qpr	Paso Robles Formation
Tmot	Obispo Formation, white or crystalline tuff
Tmor	Obispo Formation, silicified or zeolitized tuff
Jfcg	Franciscan Rocks, conglomerate
Jfch	Franciscan Rocks, green, white and red chert
Jfcly	Franciscan Rocks, claystone
Jfv	Franciscan Rocks, basalt, pillow basalt
s	Serpentinite

PROJECT LIMITS

BASE MAP SOURCE: Geology of the Arroyo Grande 15' Quadrangle, San Luis Obispo County (Hall, 1973).

LEGEND

- Contact - Dashed where approximately located or inferred; queried where doubtful; dotted where concealed
- High-angle fault - Dashed where approximately located or inferred; dotted where concealed and inferred; queried where uncertain. Arrows show relative direction of movement on cross sections when known; queried where uncertain.
- Thrust or reverse fault - Dashed where approximately located or inferred, dotted where concealed and inferred; queried where concealed or doubtful. Sawteeth on upper plate. Dip of fault plane between 30° and 80°
- Photo lineament - Queried where uncertain
- Synform - Trace of axis at surface. Dashed where approximately located. Flanks coverate downward in folds and in rocks whose stratigraphic sequence is unknown.
- Antiform - Trace of axis at surface. Dashed where approximately located. Flanks diverge downward in folds and in rocks whose stratigraphic sequence is unknown.
- Strike and dip of beds uncertain

Marker beds

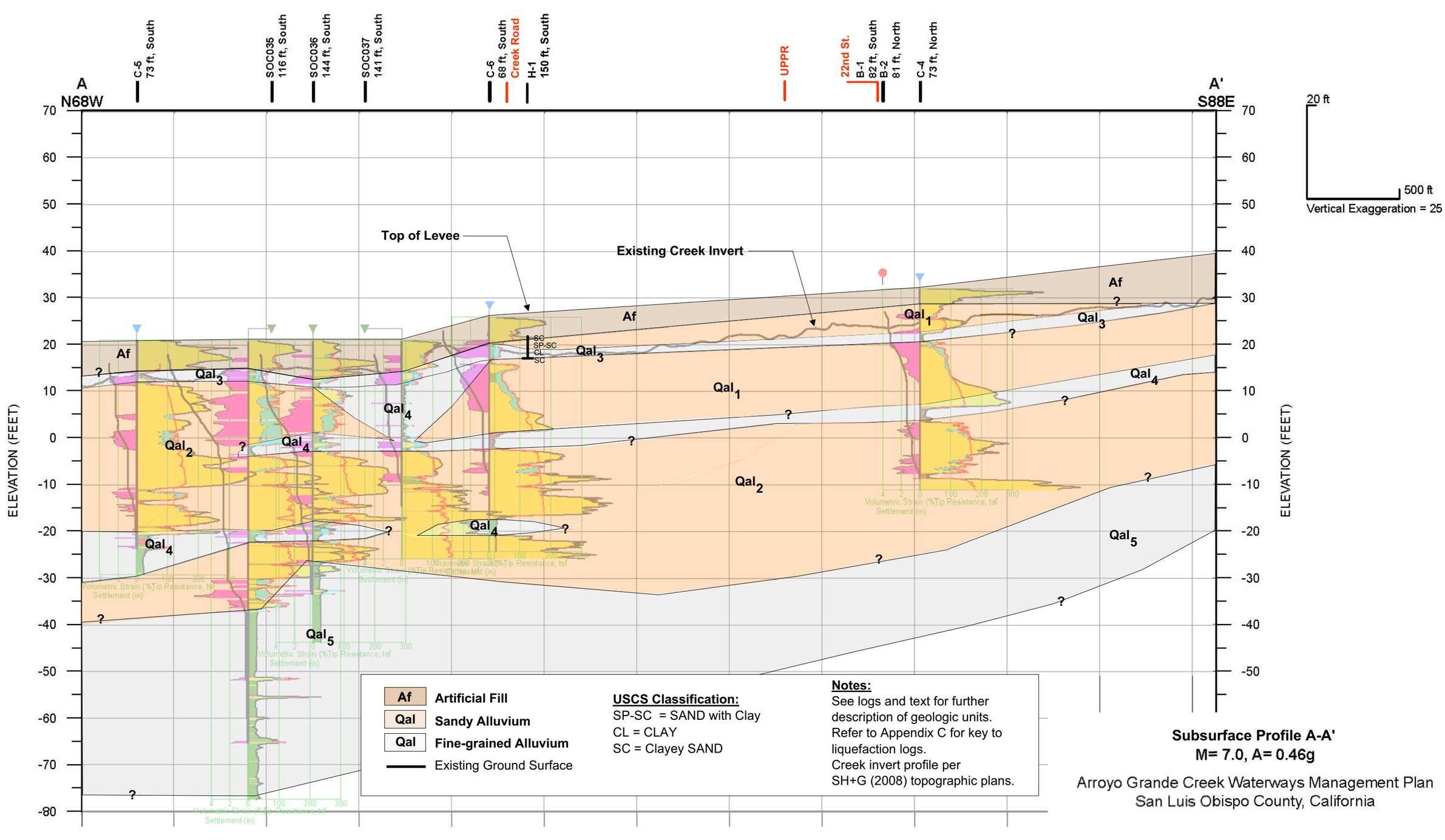
- Conglomerate or gravel bed
- Sandstone
- Siltstone or diatomaceous siltstone
- Tuff
- Breccia

- 30 — Strike and dip of flow banding
- x6193 — Megafossil locality - U.C.L.A. locality number
- Vollmer — Ranch name/property owner

NORTH
0 1000 2000
FEET

REGIONAL GEOLOGIC MAP
Arroyo Grande Creek
Waterways Management Plan
San Luis Obispo County, California

PLATE 3



Subsurface Profile A-A'
M= 7.0, A= 0.46g

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE 4a

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B
N88W

B'
E

C-3
50 ft, Sout

Highway 1
B-1
89 ft, East
B-1
56 ft, West
C-2
84 ft, West

C-1
45 ft, Sout

Existing Creek Invert

Af
Qal$_1$
Qal$_2$
Qal$_3$
Qal$_4$
Qal$_5$

ELEVATION (FEET)

20 ft
500 ft
Vertical Exaggeration = 25

Af	Artificial Fill
Qal	Sandy Alluvium
Qal	Fine-grained Alluvium
	Existing Ground Surface

USCS Classification:
SP-SC = SAND with Clay
CL = CLAY
SC = Clayey SAND

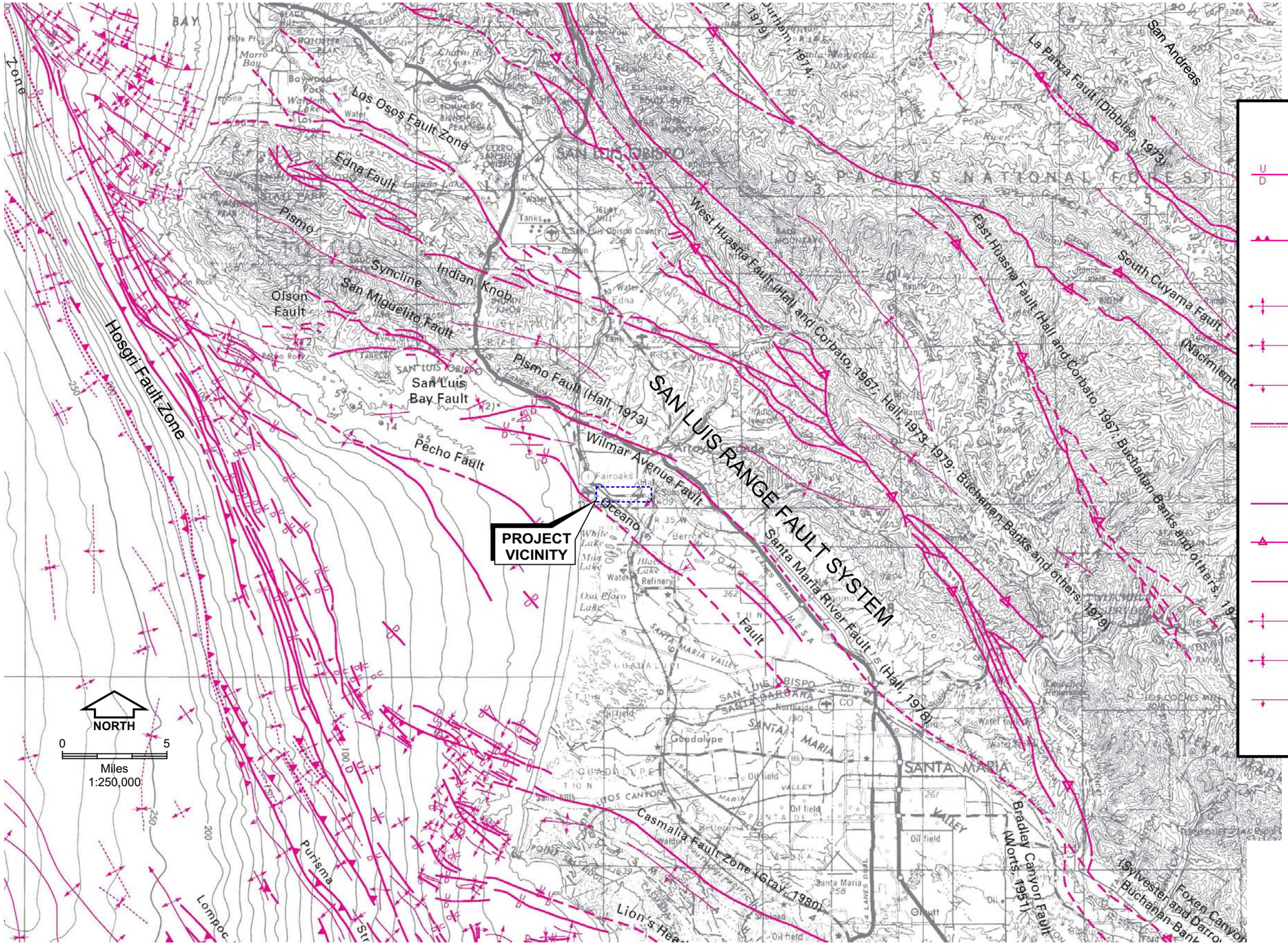
Notes:
See logs and text for further description of geologic units.
Refer to Appendix C for key to liquefaction logs.
Creek invert profile per SH+G (2008) topographic plans.

Subsurface Profile B - B'
M=7.0, A=0.46g

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE 4b

N:\Projects\3014_SLOcounty\30114-029_Arroyo_Grande_Creek\GIS\Data\XSectX\sect_2008_JulyMX\DVProfileB.mxd, 08/11/08, CDean



EXPLANATION

OFFSHORE REGION*

U/D — Active or potentially active high angle fault (sea-floor projection of fault tip where blind or buried)—Deforms early/late Pliocene (2.8–3.4 Ma) unconformity or younger deposits or surfaces; U/D (Up/Down) indicates relative sense of displacement, bar indicates dip direction; dashed where approximately located

Active or potentially active low angle fault (sea-floor projection of fault tip or leading edge of ramp where blind or buried)—Deforms early/late Pliocene (2.8–3.4 Ma) unconformity or younger deposits or surfaces; teeth indicate dip direction; dashed where approximately locate

Active or potentially active anticline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located

Active or potentially active *syncline* axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located

Active or potentially active monocline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located

Inactive fault (bold) or fold (light)—Does not deform early/late Pliocene (2.8–3.4 Ma) unconformity; where this unconformity and (or) younger sediments are absent as a result of erosion, structures are mapped as potentially active

ONSHORE REGION*

Active fault trace—Deforms deposits or surfaces ≤500,000 ka; dashed where approximately located

Potentially active fault trace—May deform deposits or surfaces ≤500,000 ka; dashed where approximately located

Inactive active fault trace—Does not deform deposits or surfaces ≤500,000 ka; dashed where approximately located

Anticline axial trace—Arrow indicates direction of plunge; solid where active or potentially active; dotted where inactive

Syncline axial trace—Arrow indicates direction of plunge; solid where active or potentially active; dotted where inactive

Monocline axial trace—Solid where active or potentially active; dotted where inactive

*Note: See text for discussion of mapping techniques and age criteria used to identify fault activity.

REGIONAL FAULT MAP
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

BASE MAP: Lettis et al. (2004), Faults and Folds in Onshore and Offsore Regions of South-Central California.

Madonna Construction
"Oceano" I
11 to -294 Q & Tc
-294 to -1297 Tf, Tm?, Tsq
-1297 to -1698 T or KJf?
-1698 to -2030 KJf

PROJECT LIMITS

vss (KJf ≥ 61 m)

vss (KJf 60 m)

vss (KJf 187 to 210 m)

vss (KJf > 76 m)

MAP UNITS

Qb	Beach deposit
Qes	Estuarine deposit
Qe	Eolian deposit
Qeo	Older Eolian deposit
Qf	Fluvial and alluvial deposits
Qc	Colluvial deposit
Qm	Marine terrace deposit
Qoa	Older alluvial deposit
Tca	Cereaga sandstone
Tmpm	Miguelito member of Pismo Formation
KJf	Franciscan Complex
KJfmv	Metavolcanics
KJfch	Red, white or green cherts
KJfg	Graywacke
S	Serpentinite

BASE MAP SOURCE: Quaternary Geologic Map of the Southern Margin of the San Luis Range from Shell Beach to the Santa Maria Valley, South-Central California, Plate 3 (Hanson et al., 1994).

LEGEND

Fault - Dashed where approximately located; dotted where concealed; U = up/D = down indicates relative sense of displacement; small arrow and number indicate strike and dip of fault exposed in outcrop; sawteeth on upper plate of thrust fault

Aerial photo lineament - Or fault-related feature; dashed where less distinct; queried where uncertain; hachures indicate topographic scarp and show direction; ld = linear drainage, tc = tonal contrast, v = vegetation lineament, dd = deflected drainage, bis = break in slope, s = saddle, shb = side hill bench

Marine terrace strandline - Solid where well constrained; double dot dash where concealed; dotted where eroded; altitude shown in meters

Contact - Dashed where approximately located or inferred; queried where uncertain

Strike and dip of bedding

Syncline - Showing trace of axial surfaces and direction of plunge

Anticline - Showing trace of axial surface and direction of plunge

Borehole - GS-1 - U.S. Geological Survey (unpublished data, G. Yates, Water Resource Division); MBO-2 - California Department of Water Resources (1972); altitude of subsurface of formations shown in meters

Borehole - Completed as part of Long-Term Seismic Program (PG&E, 1988)

Exploratory oil well - Producer, name of well, and depth (meters) are indicated

Closed depression

Spring

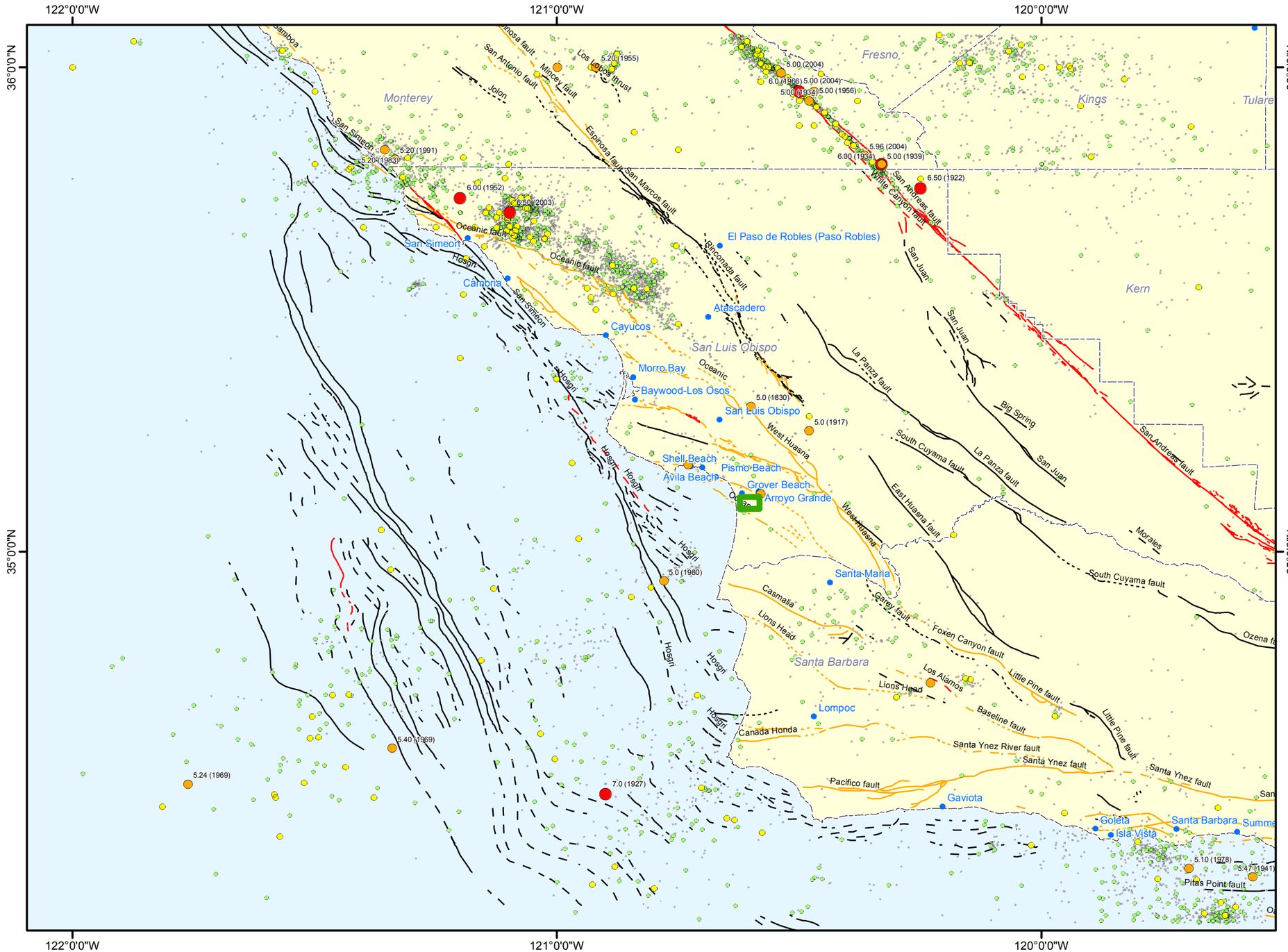
Bedrock exposure

Limit of mapping

NORTH
0 1000 2000
FEET

LOCAL FAULT MAP
Arroyo Grande Creek
Waterways Management Plan
San Luis Obispo County, California

PLATE 6



Legend

Project Area

Earthquake Magnitude
Magnitudes equal to and greater than 5 are labeled.

- 2.0 - 2.9
- 3.0 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9
- >6.0

Faults (dashed where inferred, dotted where concealed)

- Active Fault
- Potentially Active Fault
- Inactive Fault

Source:

1) Earthquake Data:
Earthquake epicenters from:
a) ANSS Composite
Catalog Search, 1933 to 2008,
<www.ncedc.org/anss/> (downloaded March 2008)
b) "Seismotectonic framework, coastal central California", Seismotectonics of the Central California Coast Range, Special Paper 292, Geological Society of America, 1994.

2) Faults:
a) Bryant, 2005
b) Jennings, 1994

N

0 7.5 15 30
Miles

HISTORICAL SEISMICITY MAP
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE 7

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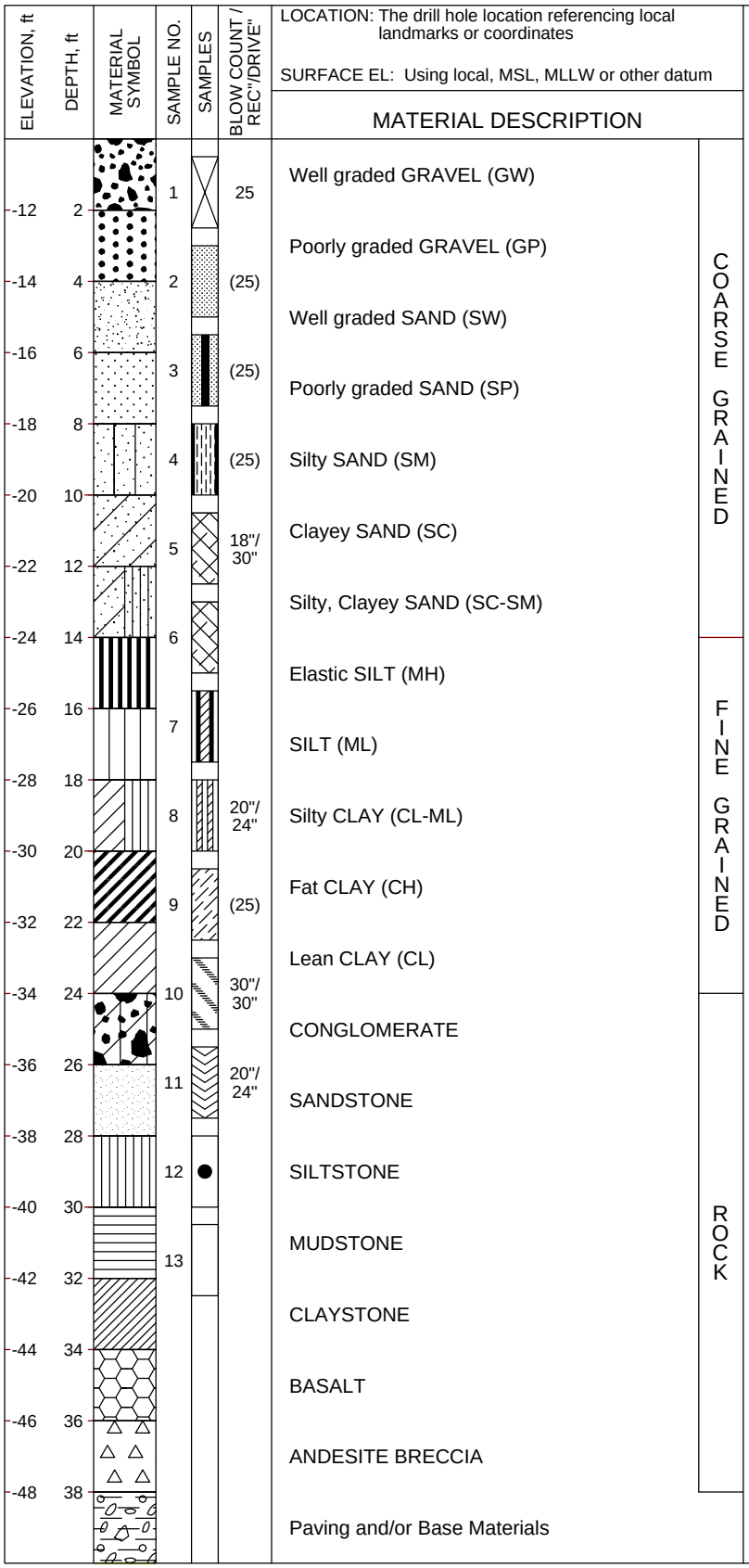
APPENDIX A



General Notes

Soil Texture Symbol

Sloped line in symbol column indicates transitional boundary

Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

Symbol for:

1	SPT Sampler, driven 1-3/8" ID, 2" OD
2	CA Liner Sampler, driven 2-3/8" ID, 3" OD
3	CA Liner Sampler, disturbed 2-3/8" ID, 3" OD
4	Thin-walled Tube, pushed 2-7/8" ID, 3" OD
5	Bulk Bag Sample (from cuttings)
6	CA Liner Sampler, Bagged
7	Hand Auger Sample
8	CME Core Sample
9	Pitcher Sample
10	Lexan Sample
11	Vibracore Sample
12	No Sample Recovered
13	Sonic Soil Core Sample

Sampler Driving Resistance

Number of blows with 140 lb. hammer, falling 30" to drive sampler 1 ft. after seating sampler 6"; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
86/11"	After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval
50/6"	50 blows drove sampler 6" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval

Blow counts for California Liner Sampler shown in ( )

Length of sample symbol approximates recovery length

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Strength Legend

Q = Unconfined Compression
u = Unconsolidated Undrained Triaxial
t = Torvane
p = Pocket Penetrometer
m = Miniature Vane

Water Level Symbols

- Initial or perched water level
- Final ground water level
- Seepages encountered

Rock Quality Designation (RQD) is the sum of recovered core pieces greater than 4 inches divided by the length of the cored interval.

KEY TO TERMS & SYMBOLS USED ON LOGS

PLATE A-1

LOCATION: Approximately 25' south of South Levee, and approximately 14' east of Creek Road

SURFACE EL: 20 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
			1			**ALLUVIUM (Qal)** TOPSOIL: loose, dry Clayey SAND (SC): loose to medium dense, dark brown, moist	107	92	12	48			
18	2		2			Poorly-graded SAND with clay (SP-SC): loose, light brown, moist to wet							
			3			Lean CLAY (CL): soft to medium stiff, moist to wet Clayey SAND (SC): medium dense, brown, wet							
16	4		4										
14	6												
12	8												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 4.5 ft
DEPTH TO WATER: 3.0 ft

DRILLING METHOD: 4-inch-dia. Hand Auger
DRILLED BY: C.Stoehr
LOGGED BY: C.Stoehr

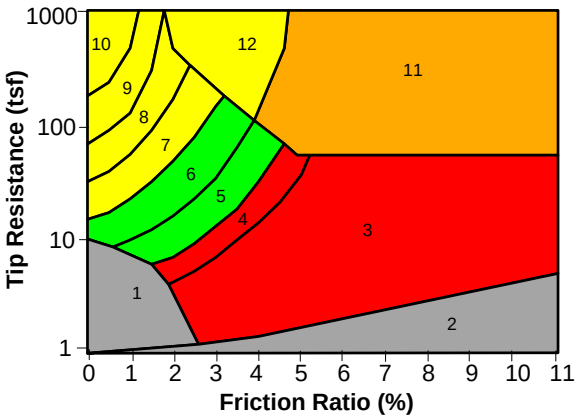
DRILLING DATE: August 14, 2008

LOG OF BORING NO. H-1

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE A-2

COLOR LEGEND FOR FRICTION RATIO TRACES



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

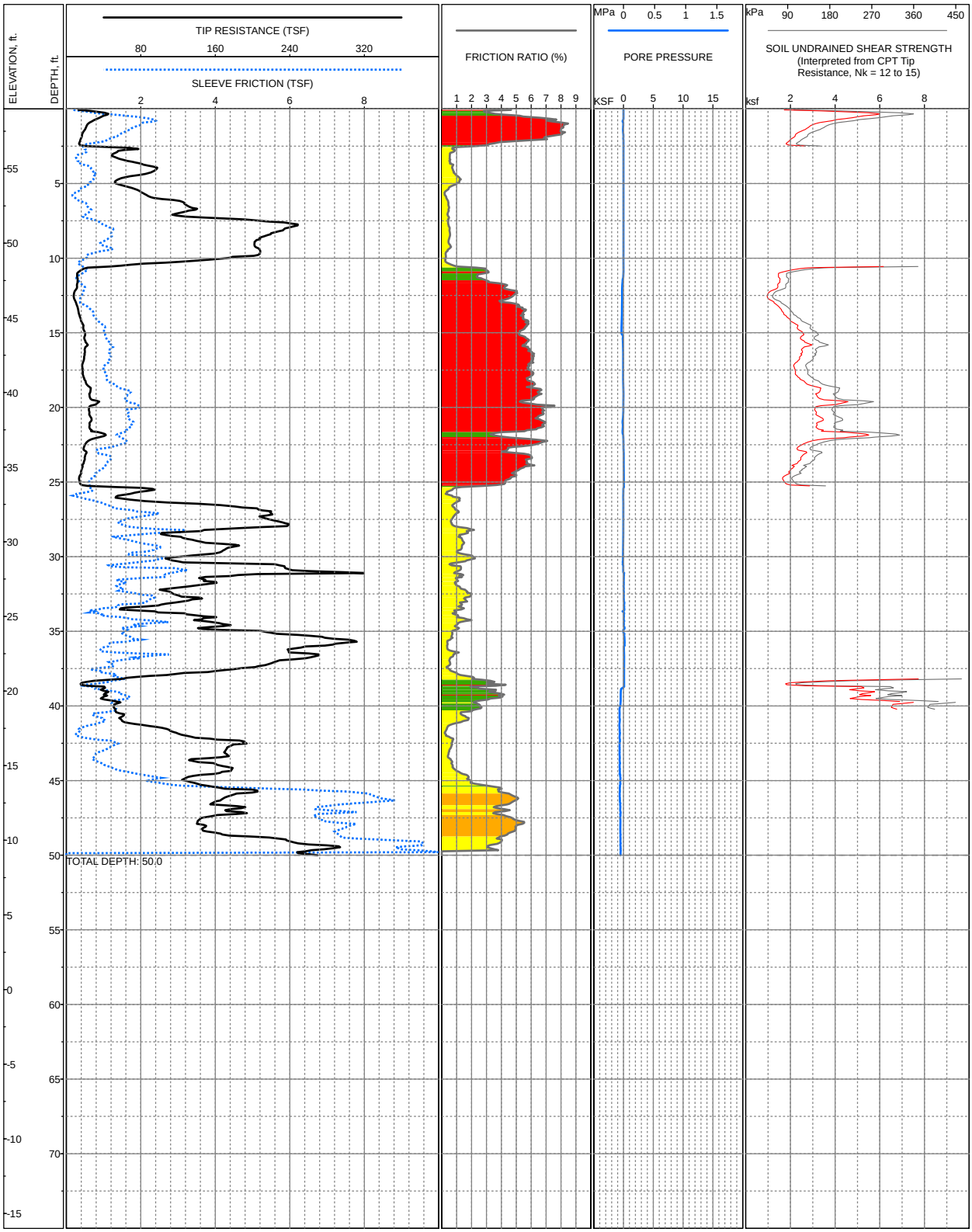
*overconsolidated or cemented

CPT CORRELATION CHART
(Robertson and Campanella, 1984)

KEY TO CPT LOGS

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Su_2008_08_13\MXD\PlateA-3_CPTKey.mxd, 08/29/08, ksheil



COORDINATES: 2,233,857.20N 5,787,490.08W
SURFACE EL: 59.0ft +/- (MSL)
COMPLETION DEPTH: 50.0ft
TESTDATE: 7/22/2008

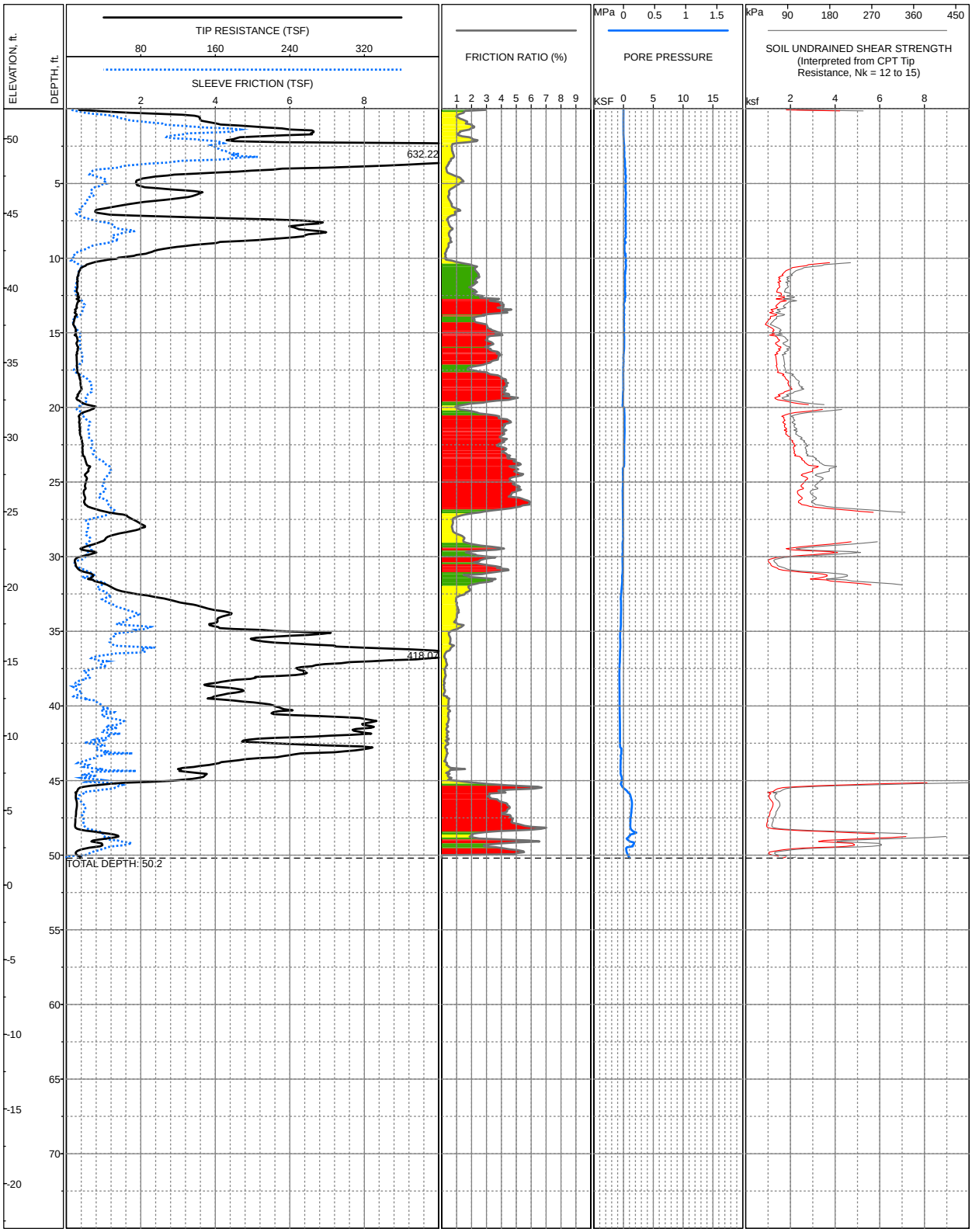
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J.Blanchard

LOG OF C-1

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-4

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Su_2008_08_13\MXD\CPTLog_Su.mxd.08/29/2008.ksheil



COORDINATES: 2,232,173.97N 5,786,405.43W
SURFACE EL: 52.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

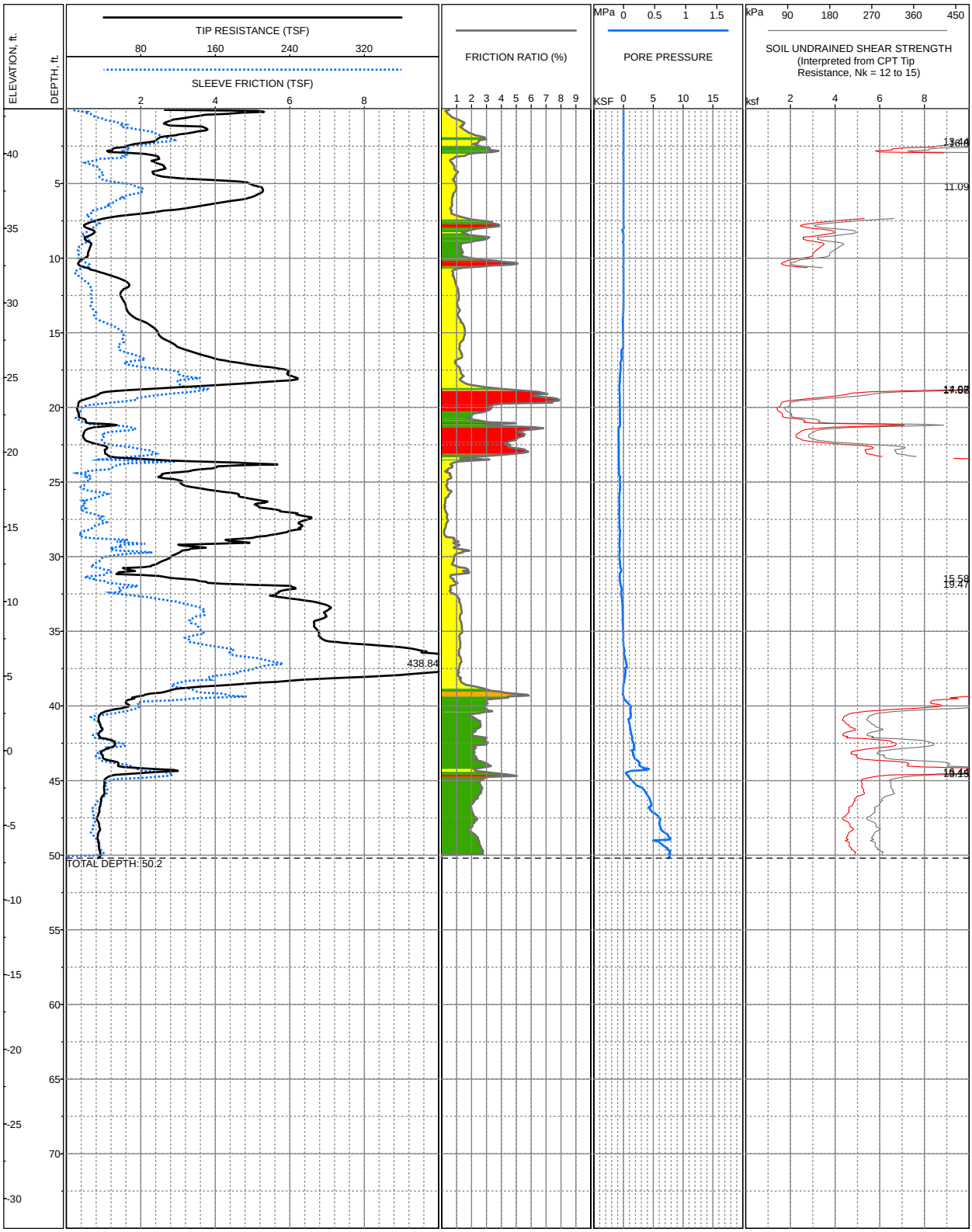
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J.Blanchard

LOG OF C-2

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-5

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Su_2008_08_13\MXD\CPTLog_Su.mxd.08/29/2008.ksheil



COORDINATES: 2,231,087.37N 5,784,635.85W
SURFACE EL: 43.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

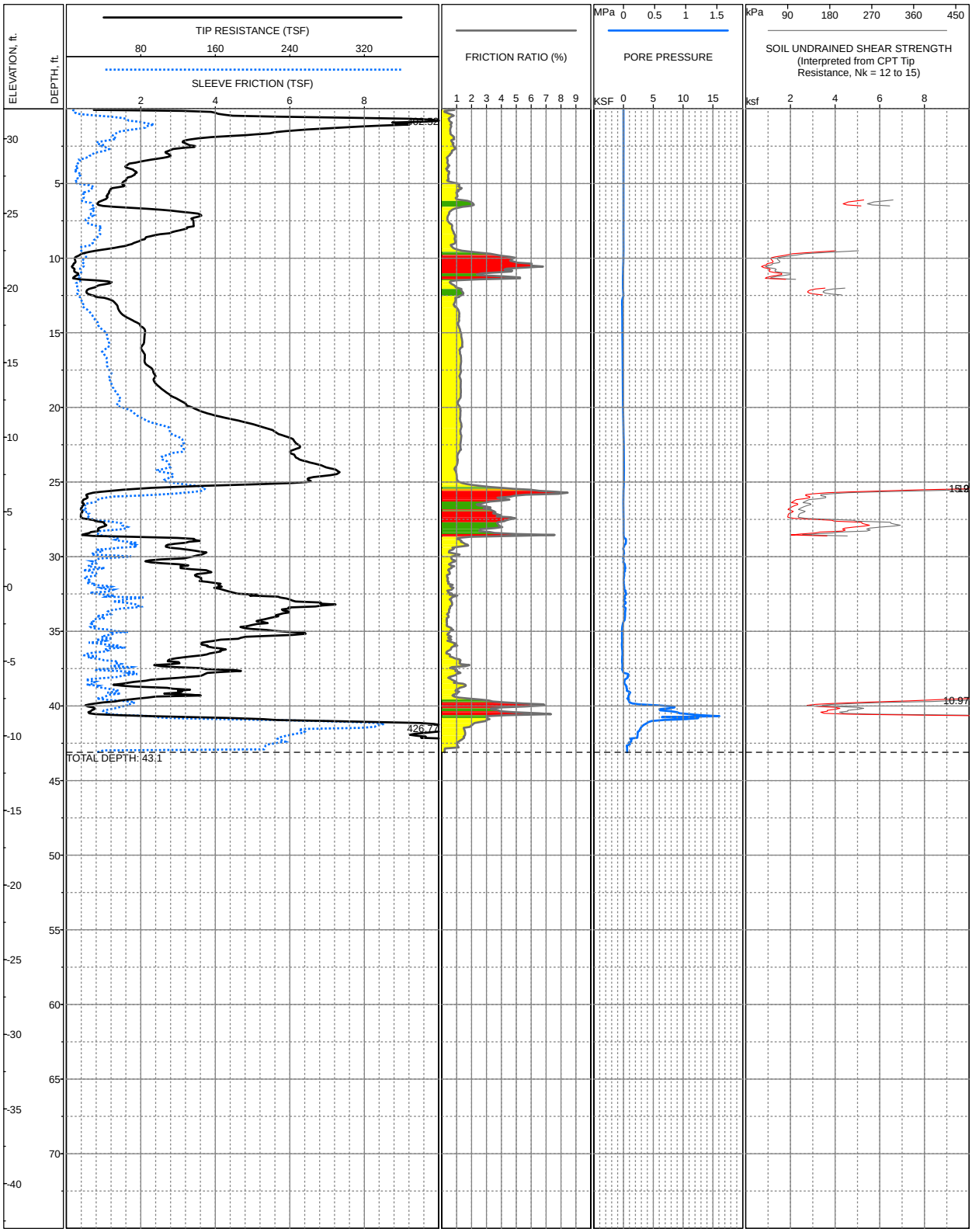
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J.Blanchard

LOG OF C-3

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-6

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Su_2008_08_13\MXD\CPTLog_Su.mxd.08/29/2008.ksheil



COORDINATES: 2,231,221.08N 5,782,003.06W
SURFACE EL: 32.0ft +/- (MSL)
COMPLETION DEPTH: 43.1ft
TESTDATE: 7/22/2008

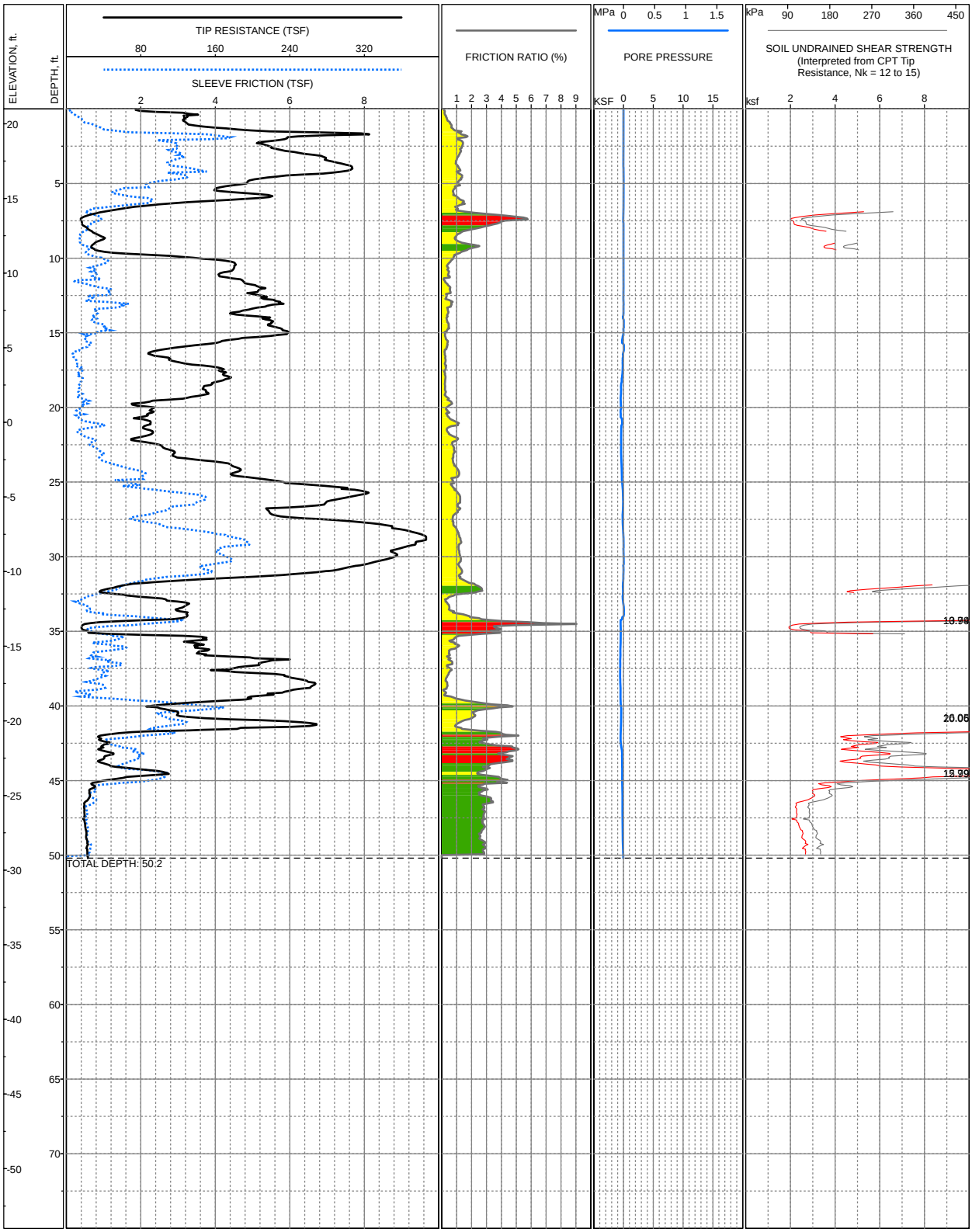
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J.Blanchard

LOG OF C-4

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-7

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Su_2008_08_13\MXD\CPTLog_Su.mxd.08/29/2008.ksheil



COORDINATES: 2,232,390.00N 5,778,074.64W
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

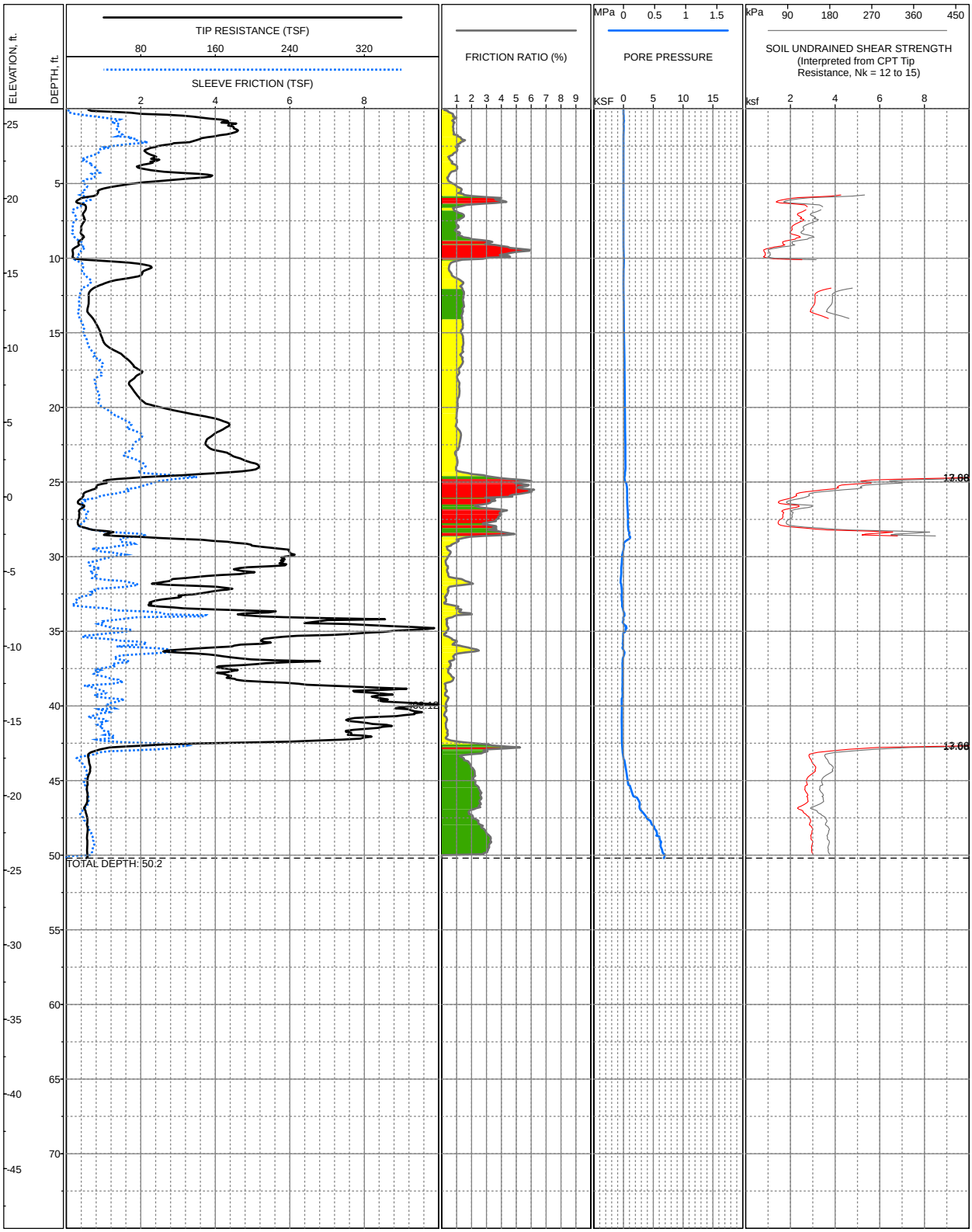
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J.Blanchard

LOG OF C-5

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-8

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Su_2008_08_13\MXD\CPTLog_Su.mxd.08/29/2008.ksheil



COORDINATES: 2,231,397.63N 5,779,691.56W
SURFACE EL: 26.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

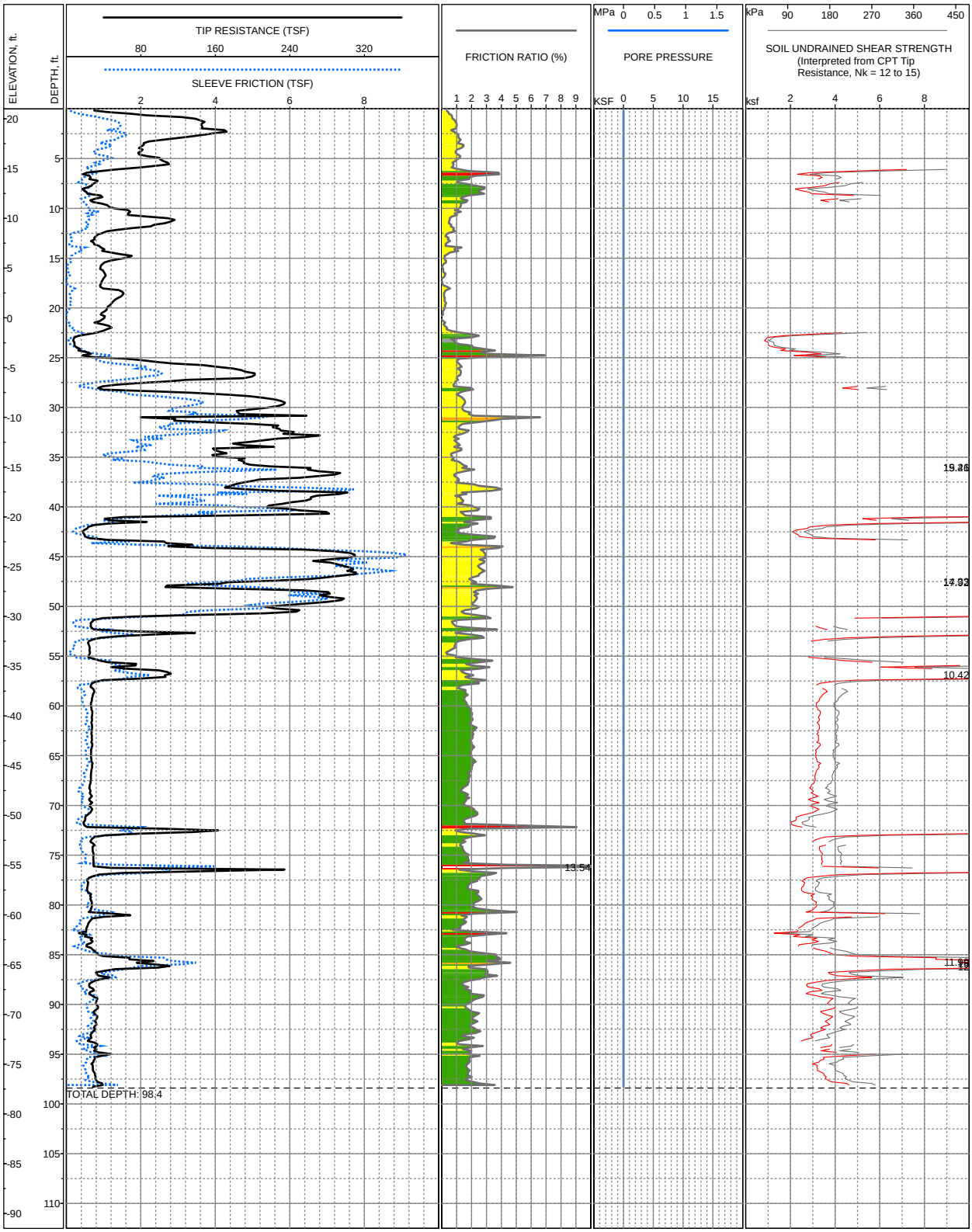
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J.Blanchard

LOG OF C-6

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-9

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Su_2008_08_13\MXD\CPTLog_Su.mxd.08/29/2008,ksheil



LOCATION: South Levee, Approx. 3350 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 98.4ft
TESTDATE: 3/5/2004

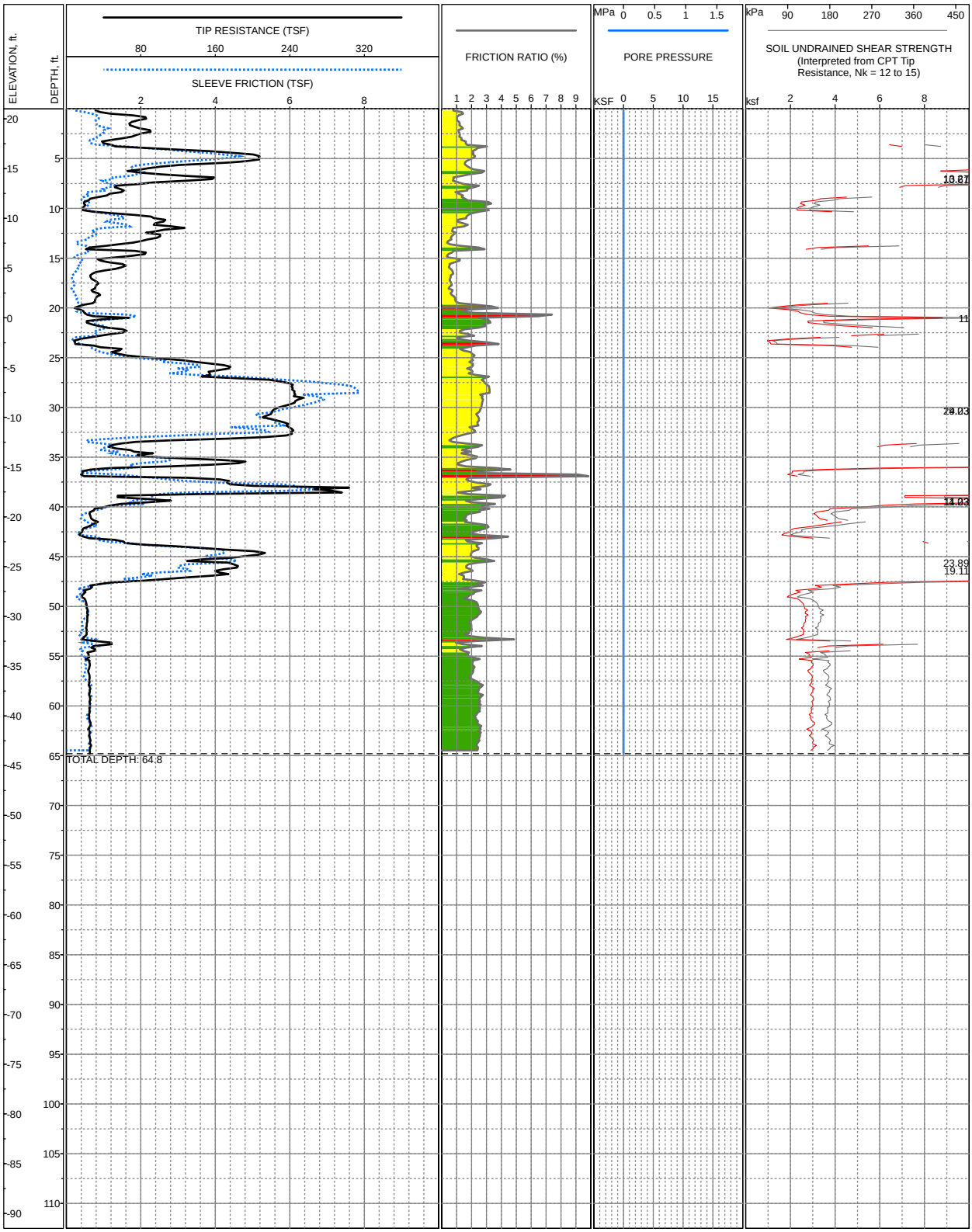
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J.Blanchard

LOG OF SOC035

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-10

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_Su_2008_Aug\MXD\CPTLog_Su.mxd.08/29/2008.ksheil



LOCATION: South Levee, Approx. 3500 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 64.8ft
TESTDATE: 3/5/2004

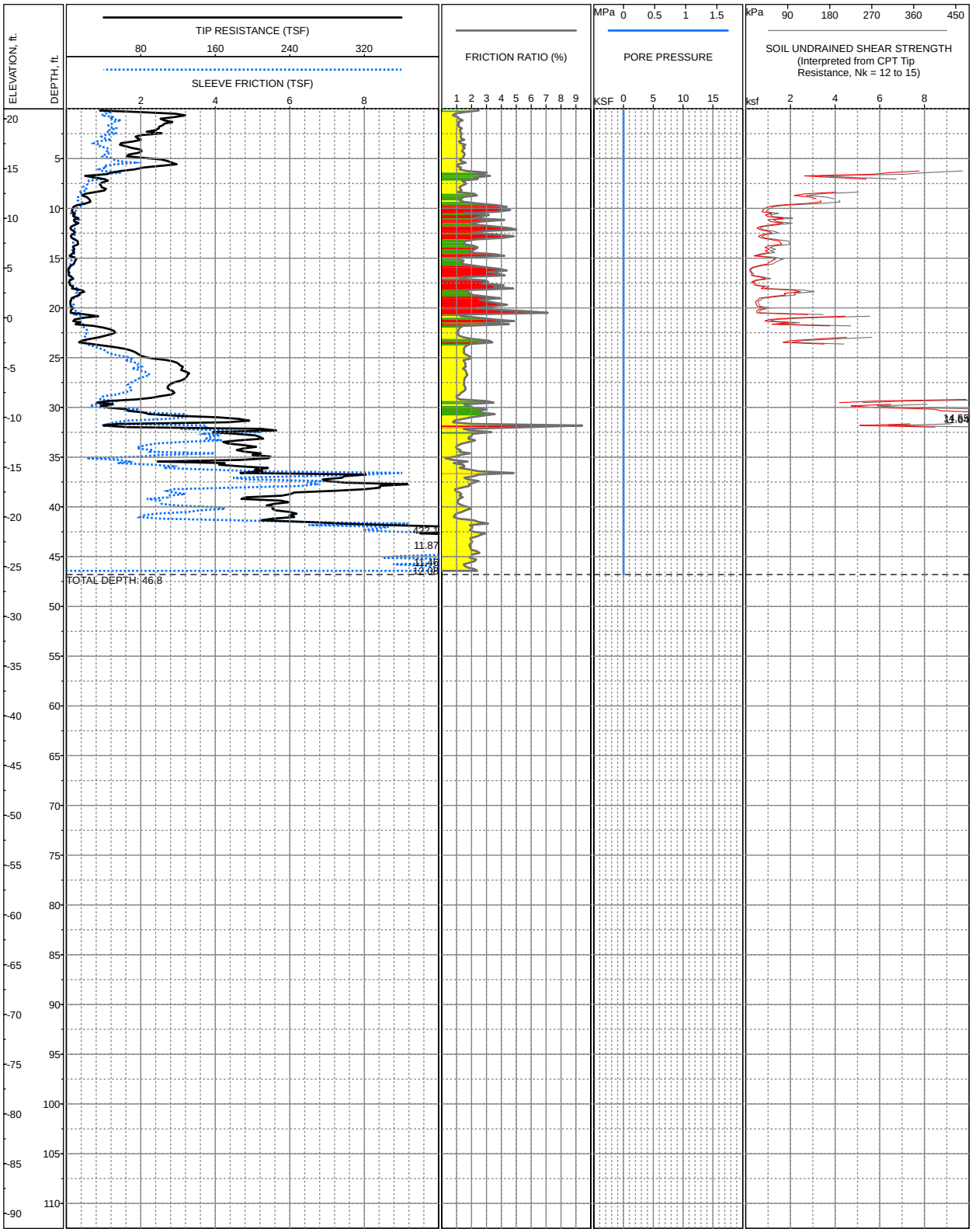
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J.Blanchard

LOG OF SOC036

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-11

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_Su_2008_Aug\MXD\CPTLog_Su.mxd.08/29/2008.ksheil



LOCATION: South Levee, Approx. 3250 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 46.8ft
TESTDATE: 3/5/2004

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J.Blanchard

LOG OF SOC037

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo, California

PLATE A-12

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_Su_2008_Aug\MXD\CPTLog_Su.mxd.08/29/2008.ksheil

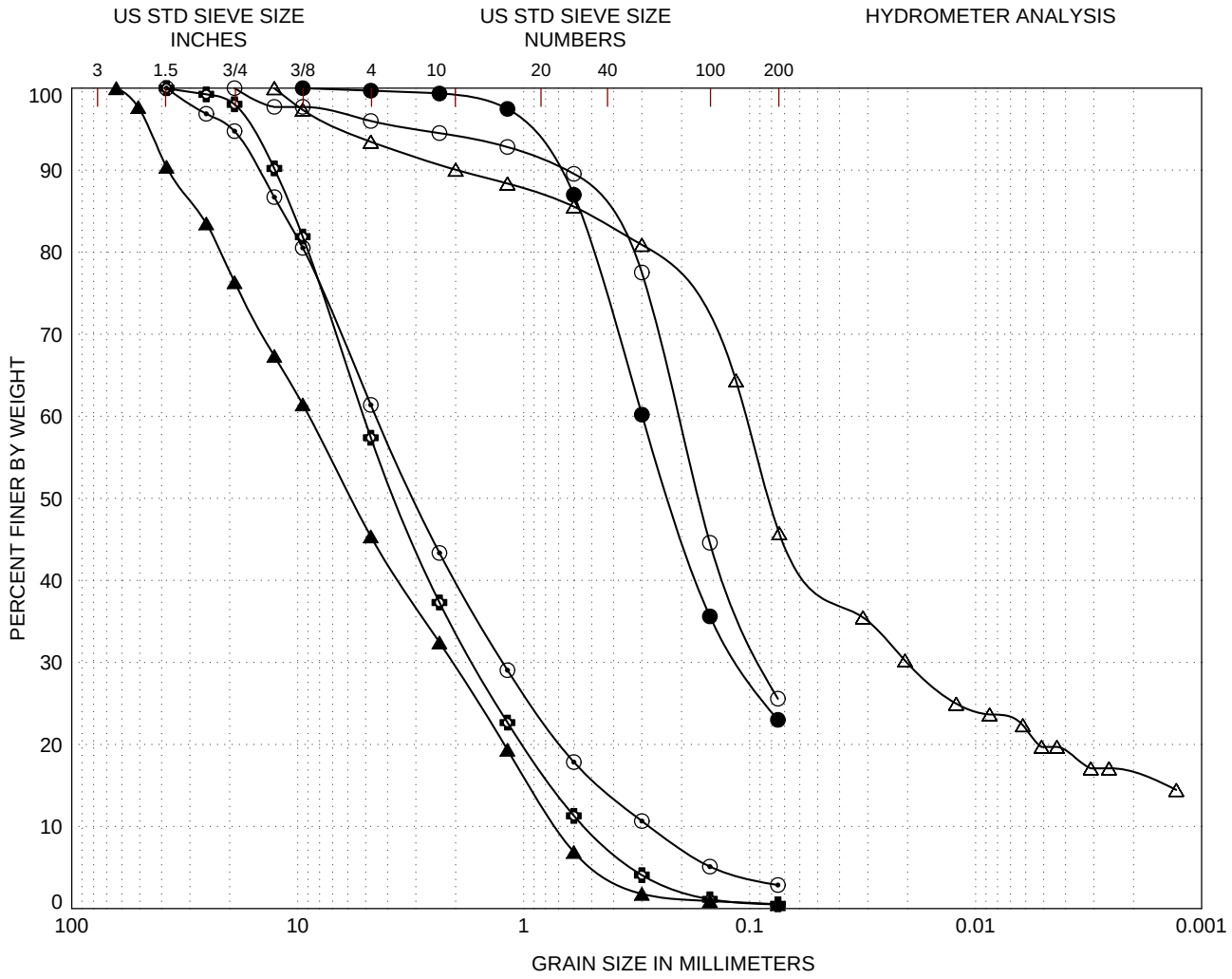
APPENDIX B

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	Permeability, cm/s
								LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_U (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
AB-1	0.0		Silty SAND (SM)				26																
AB-2	0.0		Silty SAND (SM)				23																
AB-6	0.0		Silty SAND (SM)				46																
H-1	1.0	1	Clayey SAND (SC)	107	92	12	48					0.1	38										
SB-1	0.0		Poorly-graded GRAVEL with sand (GP)				1																
SB-2	0.0		Well-graded SAND with gravel (SW)				3																
SB-6	0.0		Well-graded SAND with gravel (SW)				1																

SUMMARY OF LABORATORY TEST RESULTS

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE B-1

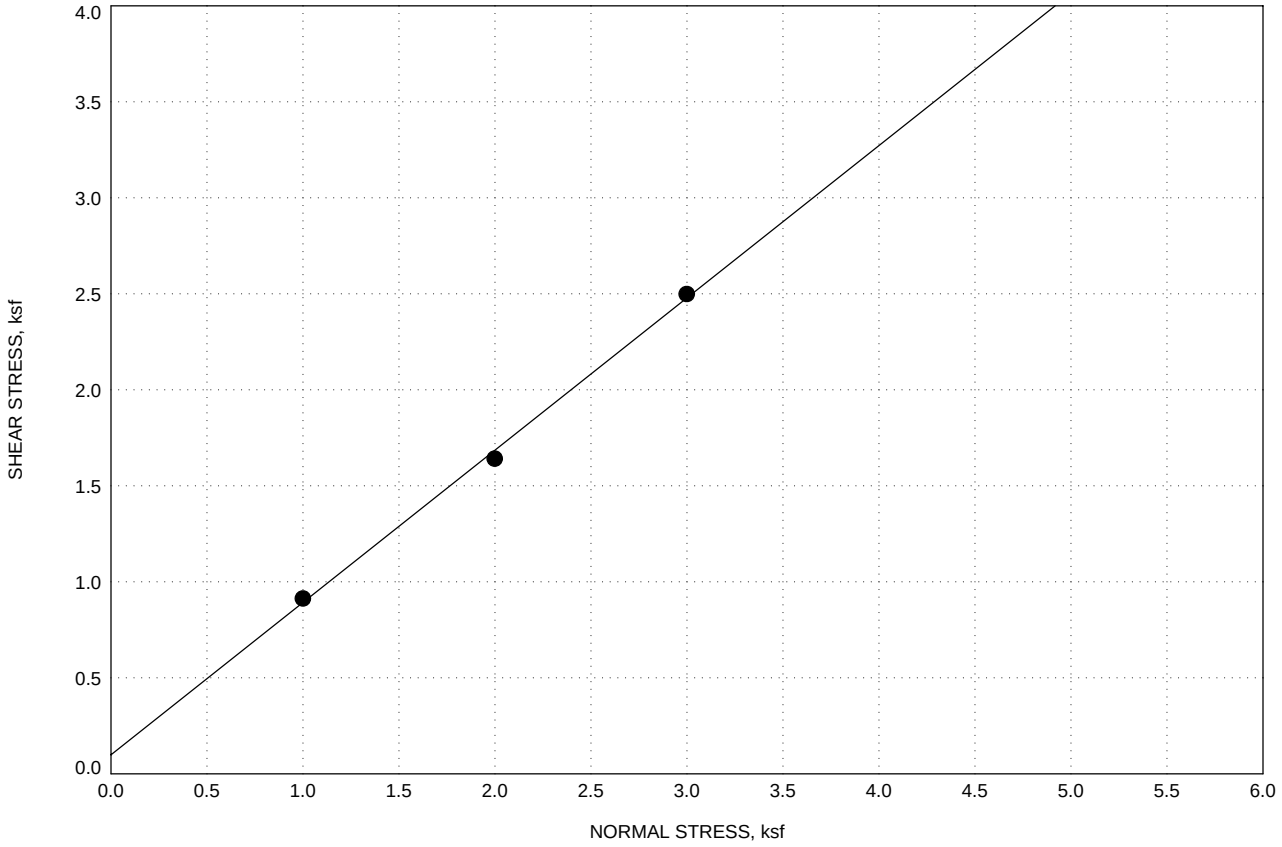


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)	CLASSIFICATION	Cc	Cu
○	AB-1	0.0	Silty SAND (SM)		
●	AB-2	0.0	Silty SAND (SM)		
△	AB-6	0.0	Silty SAND (SM)		
▲	SB-1	0.0	Poorly-graded GRAVEL with sand (GP)	0.7	12.6
⊙	SB-2	0.0	Well-graded SAND with gravel (SW)	1.2	16.3
✿	SB-6	0.0	Well-graded SAND with gravel (SW)	1.0	9.7

GRAIN SIZE CURVES
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE B-2



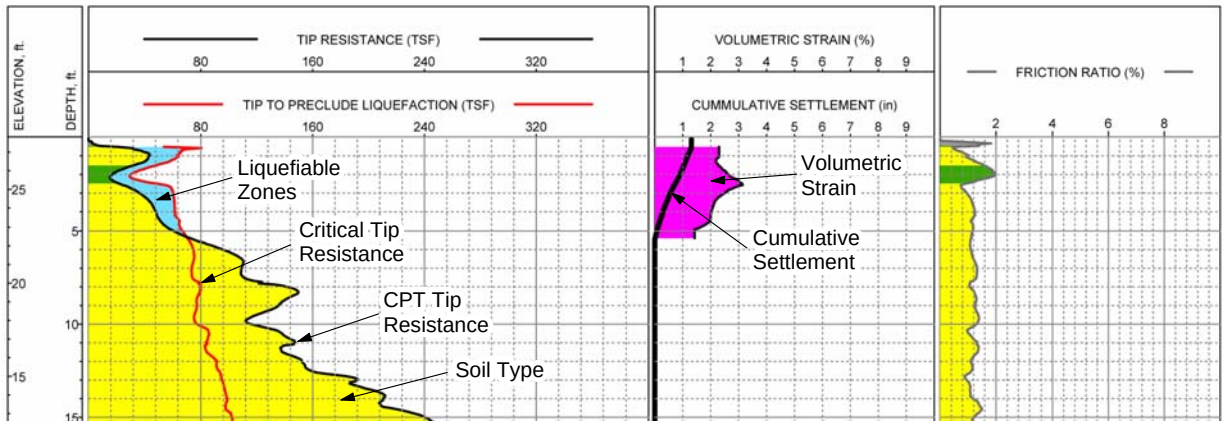
COHESION, ksf	0.1
ANGLE OF INTERNAL FRICTION, deg	38
LOCATION	H-1
DEPTH, ft	1
MOISTURE CONTENT, %	17
UNIT DRY WEIGHT, pcf	92
MATERIAL DESCRIPTION	Clayey SAND (SC)
SAMPLE CONDITION	Ring Sample

DIRECT SHEAR TEST RESULTS

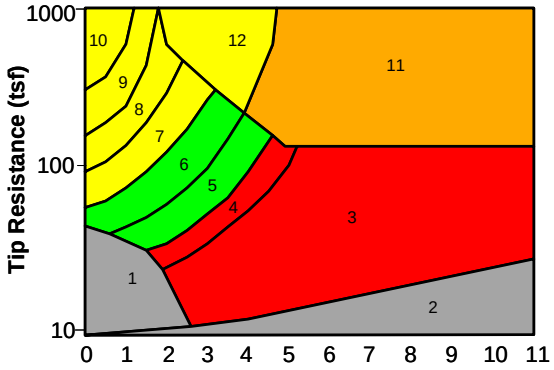
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE B-3

APPENDIX C



COLOR LEGEND FOR FRICTION RATIO TRACES



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

*overconsolidated or cemented

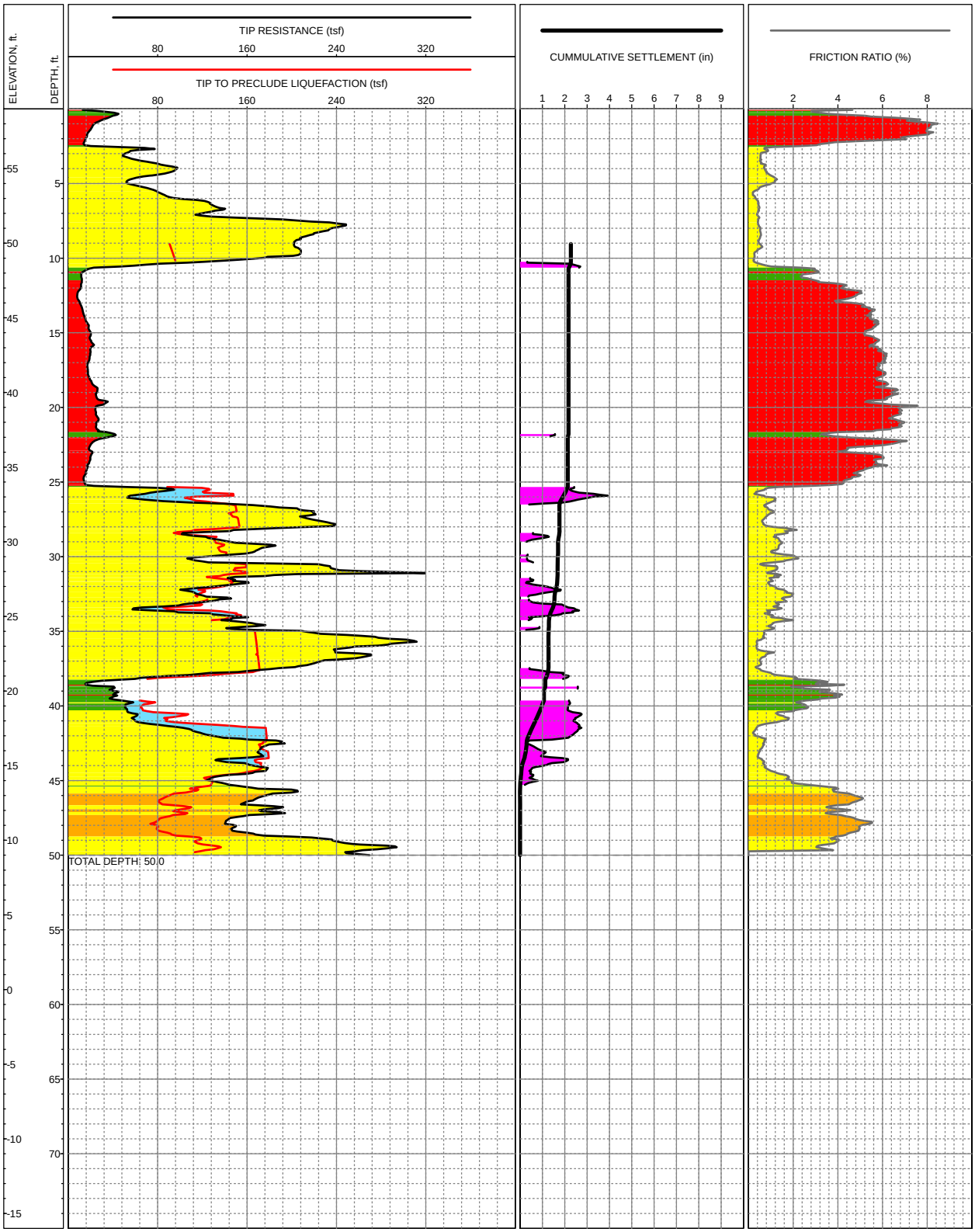
CPT CORRELATION CHART
(Robertson and Campanella, 1984)

KEY TO CPT LOGS

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-1

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\PLateC-1-KeytoCPT-Liquefaction.mxd, 08/29/08, ksheil



COORDINATES: 2,233,857.20N 5,787,490.08W
SURFACE EL: 59.0ft +/- (MSL)
COMPLETION DEPTH: 50.0ft
TESTDATE: 7/22/2008

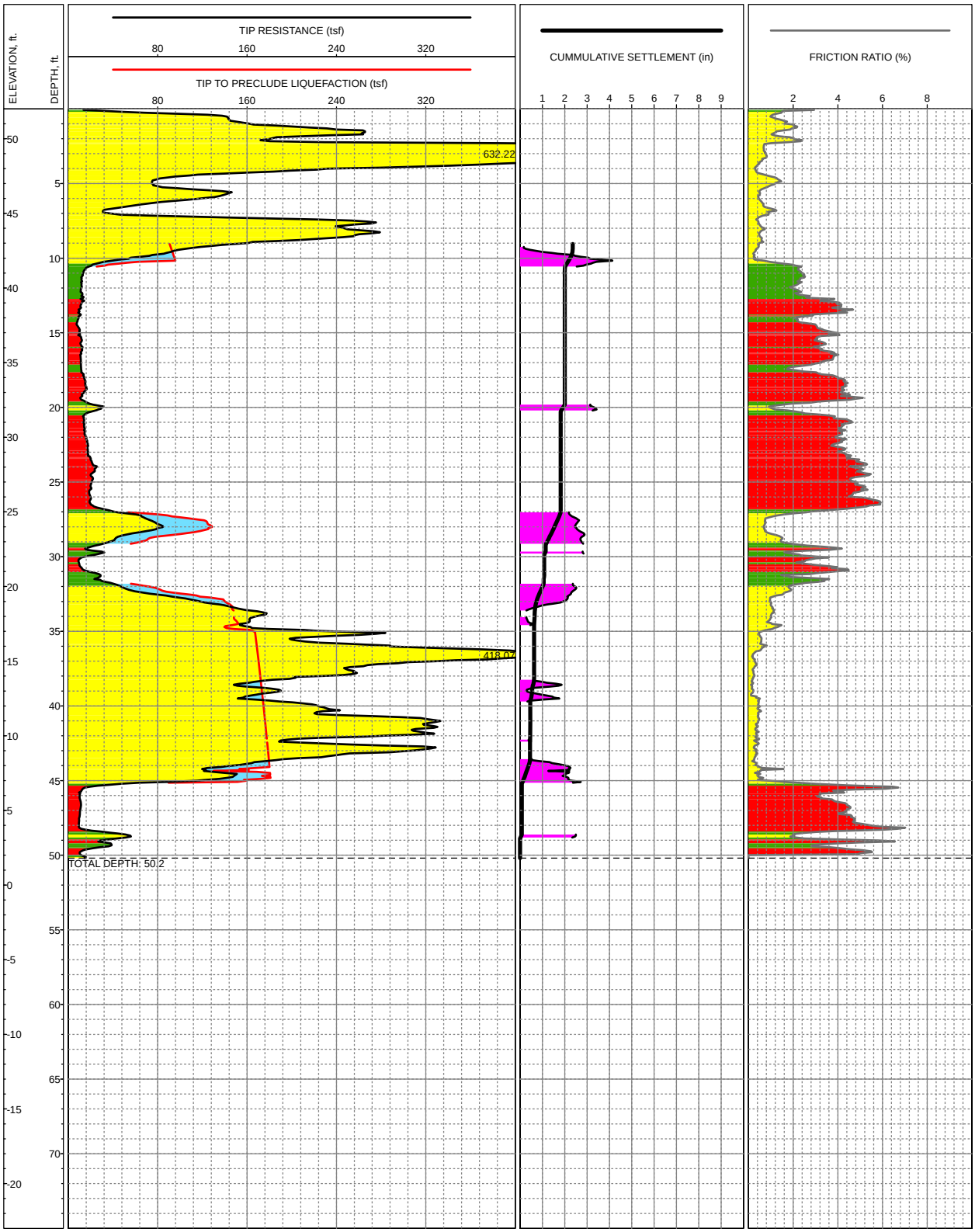
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-1, M7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-2

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,232,173.97N 5,786,405.43W
SURFACE EL: 52.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

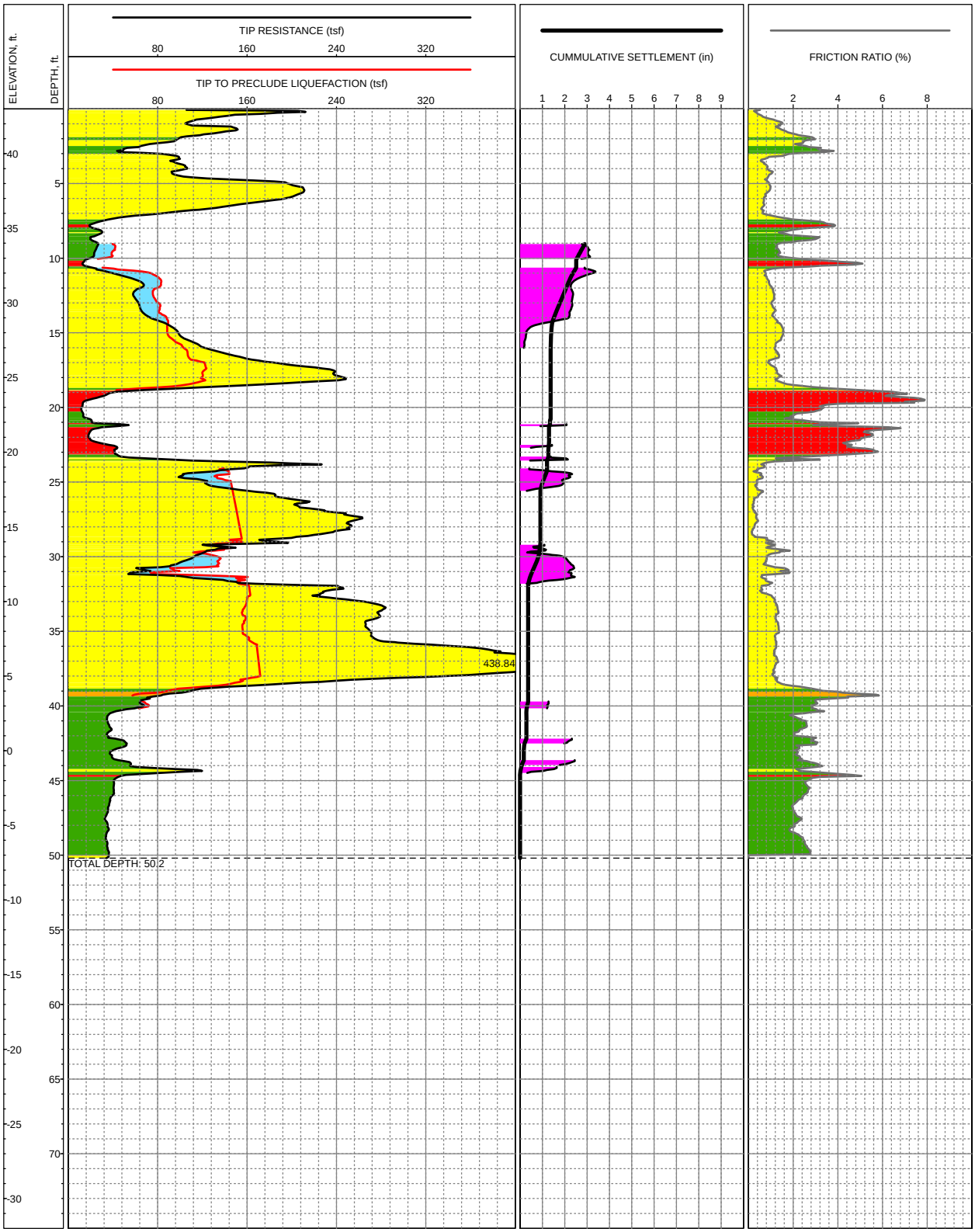
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-2, M7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-3

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,231,087.37N 5,784,635.85W
SURFACE EL: 43.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

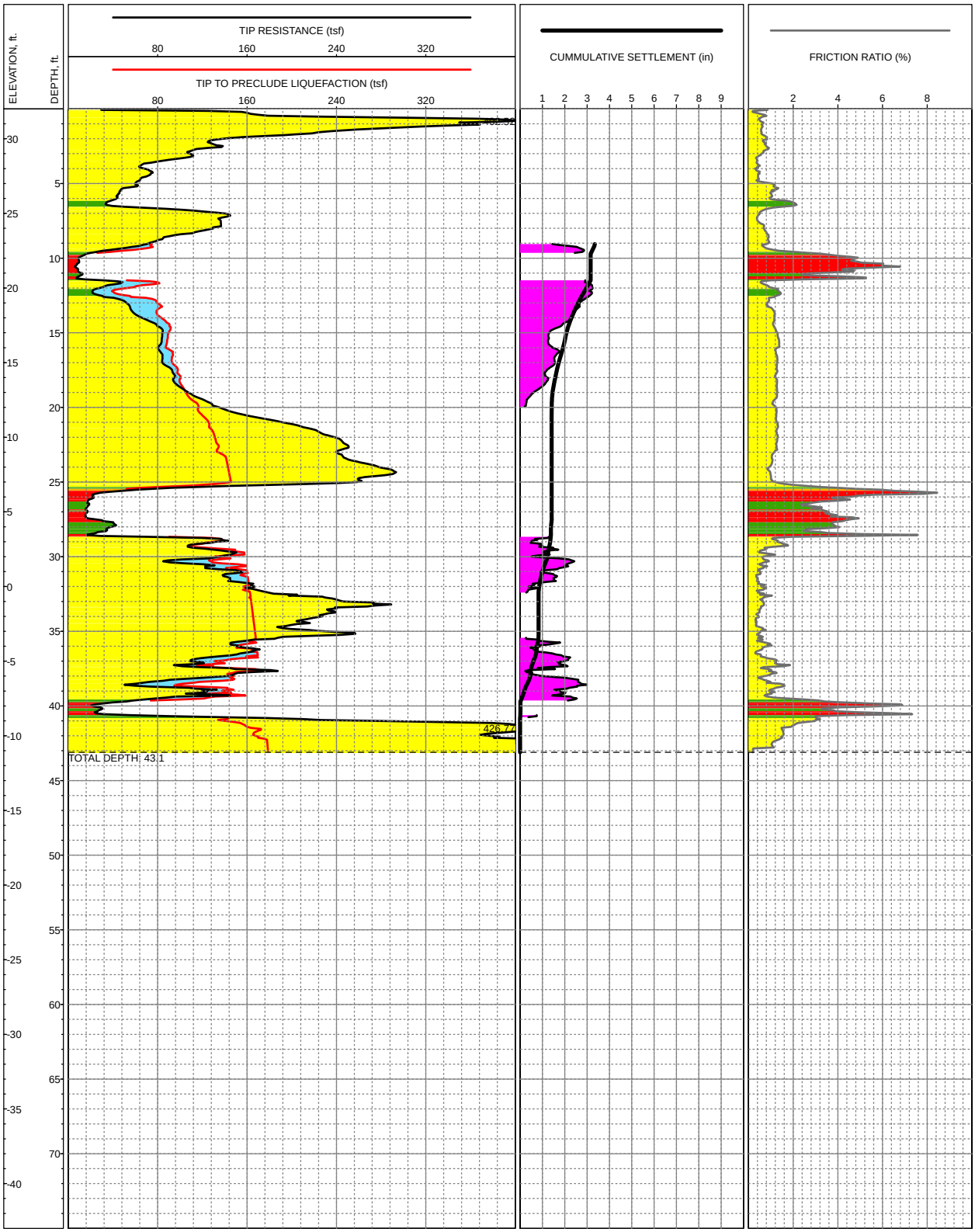
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-3, M7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-4

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,231,221.08N 5,782,003.06W
SURFACE EL: 32.0ft +/- (MSL)
COMPLETION DEPTH: 43.1ft
TESTDATE: 7/22/2008

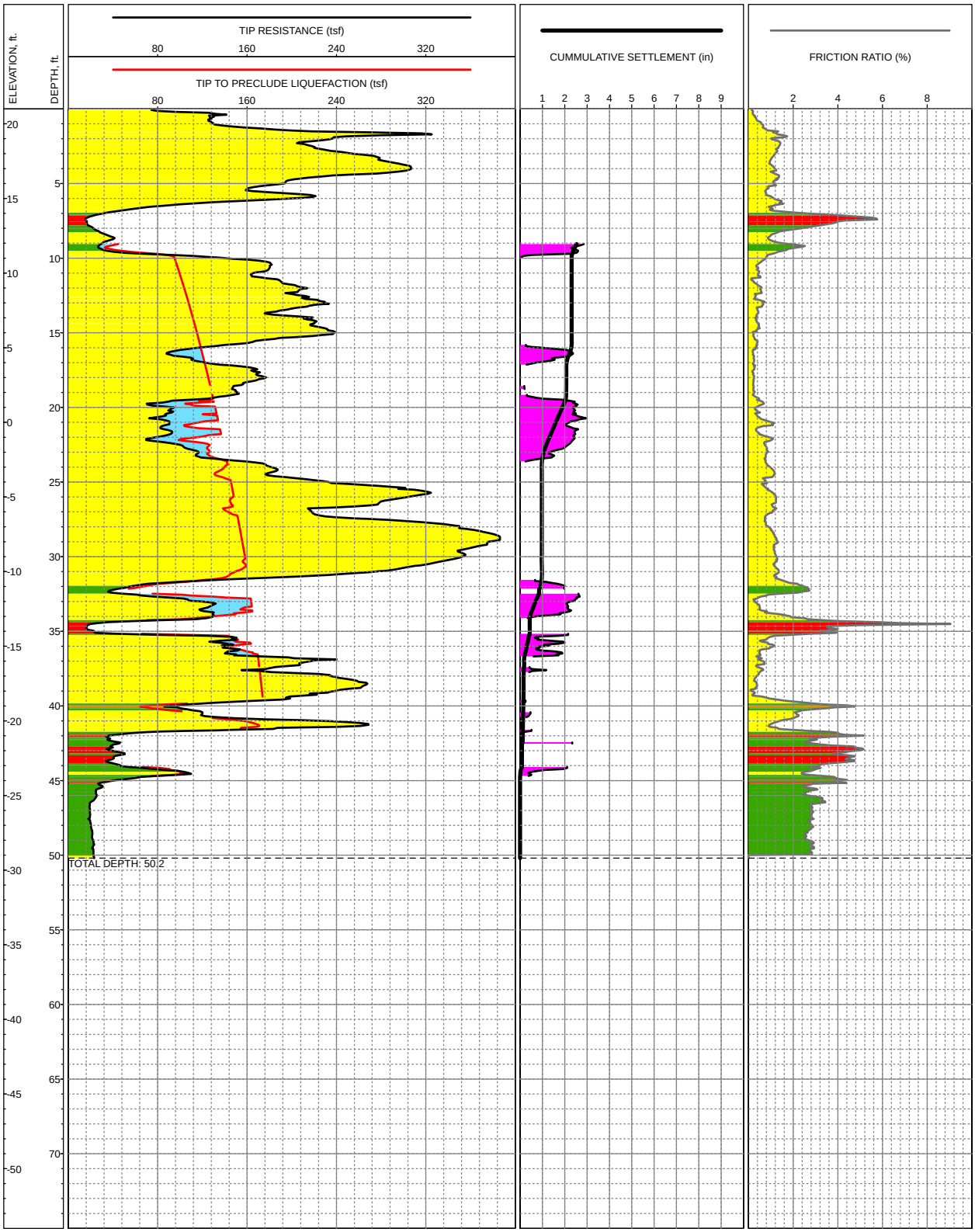
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-4, M7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-5

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,232,390.00N 5,778,074.64W
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

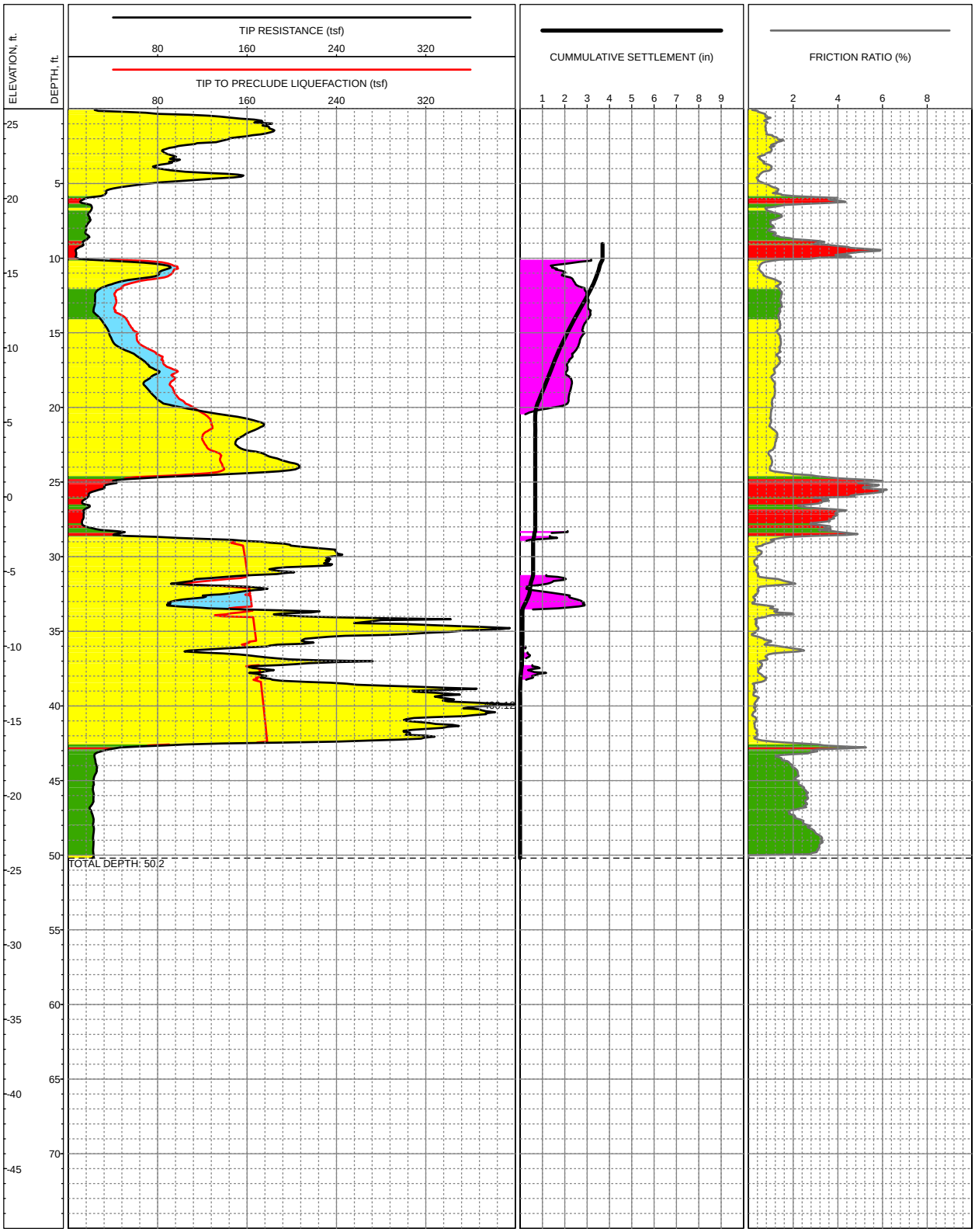
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-5, M7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-6

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,231,397.63N 5,779,691.56W
SURFACE EL: 26.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

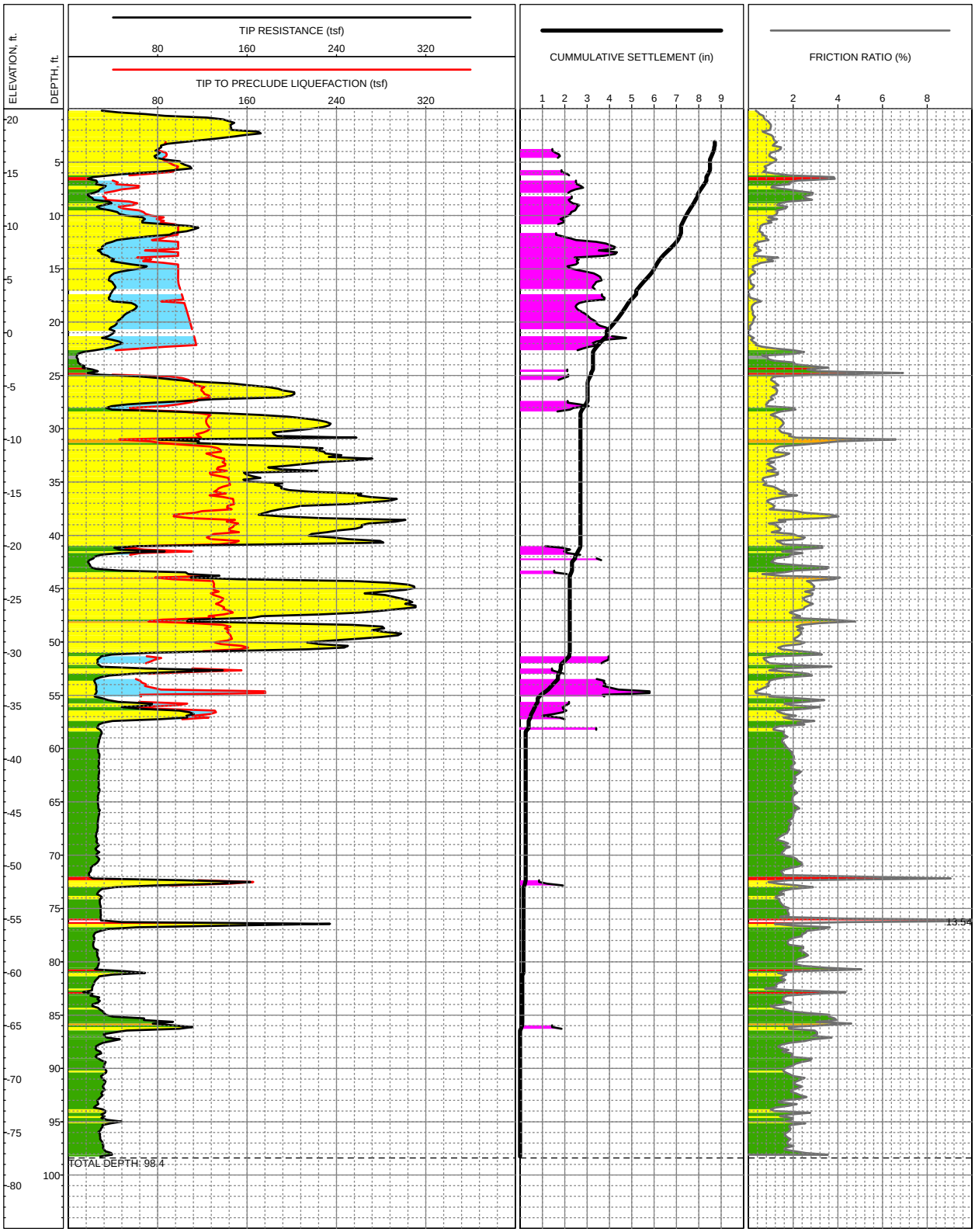
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-6, M7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-7

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd.08/29/2008.ksheil



LOCATION: South Levee, Approx. 3350 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 98.4ft
TESTDATE: 3/5/2004

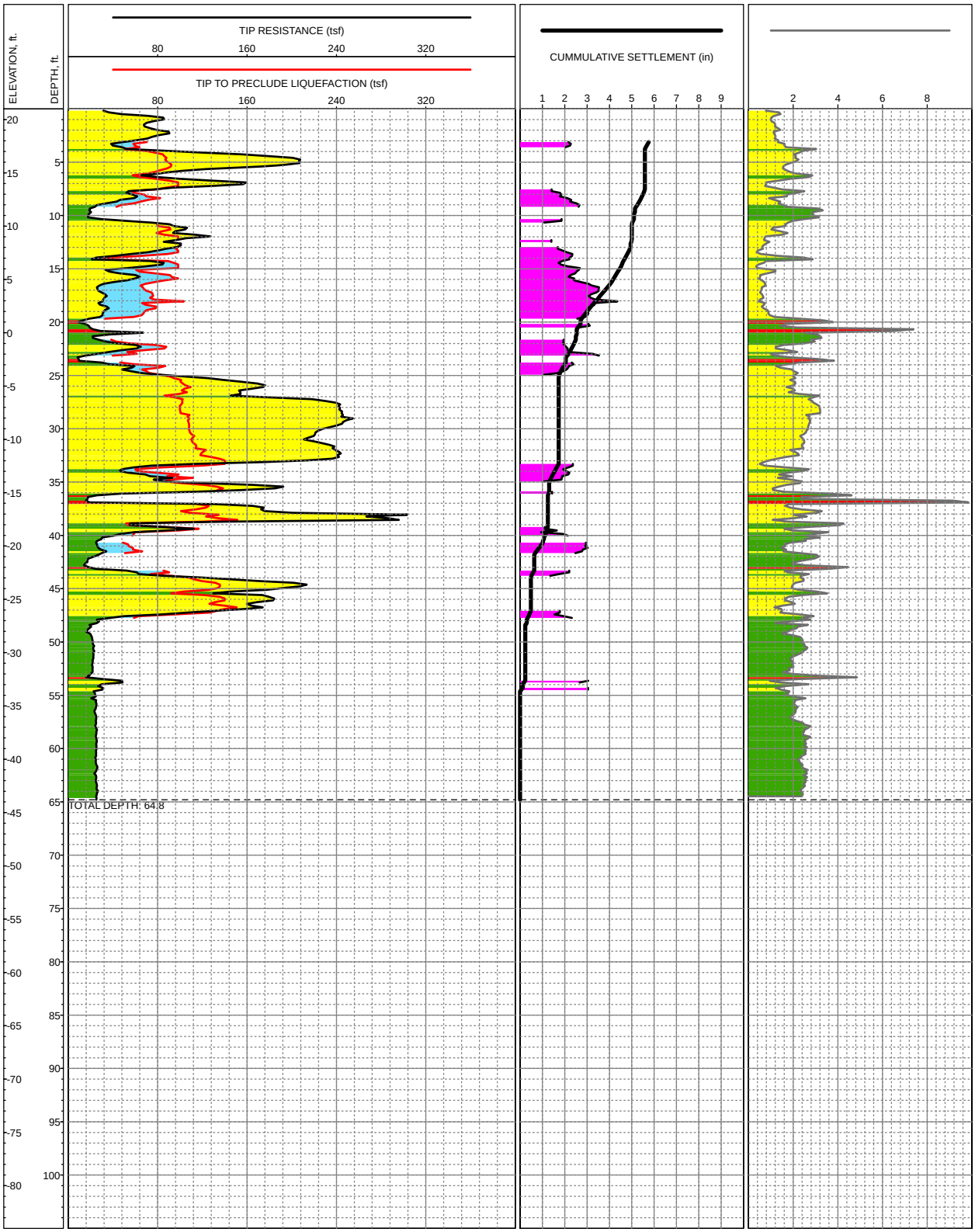
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J Blanchard

LOG OF CPT SOC035, M=7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-8

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_LiquM7.0_A0.46_2008_08_01\MXD\CPTLogs_Liq7_46.mxd.08/29/2008.ksheil



LOCATION: South Levee, Approx. 3500 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 64.8ft
TESTDATE: 3/5/2004

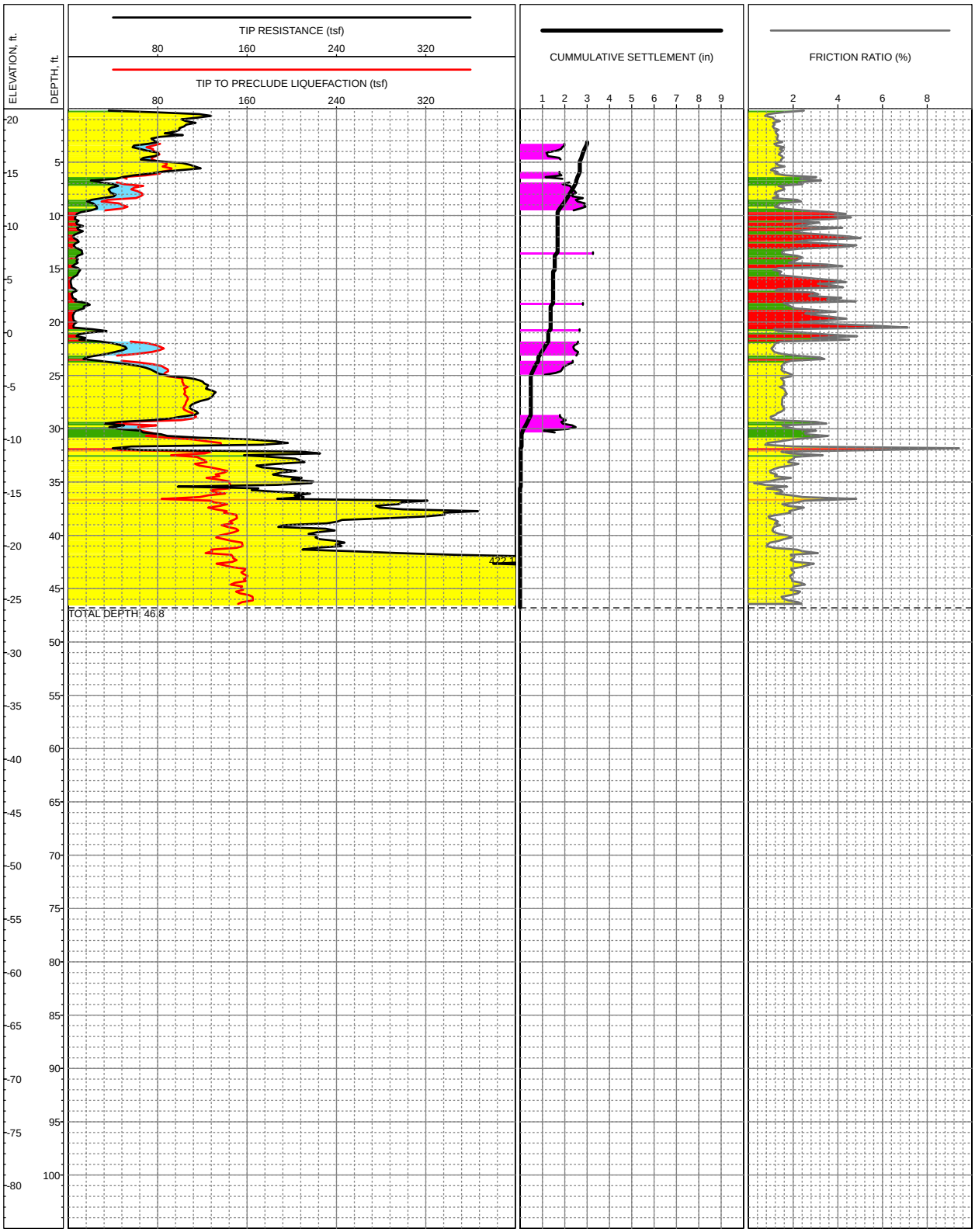
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J Blanchard

LOG OF CPT SOC036, M=7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-9

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_LiquM7.0_A0.46_2008_08_01\MXD\CPTLogs_Liq7_46.mxd.08/29/2008.ksheil



LOCATION: South Levee, Approx. 3250 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 46.8ft
TESTDATE: 3/5/2004

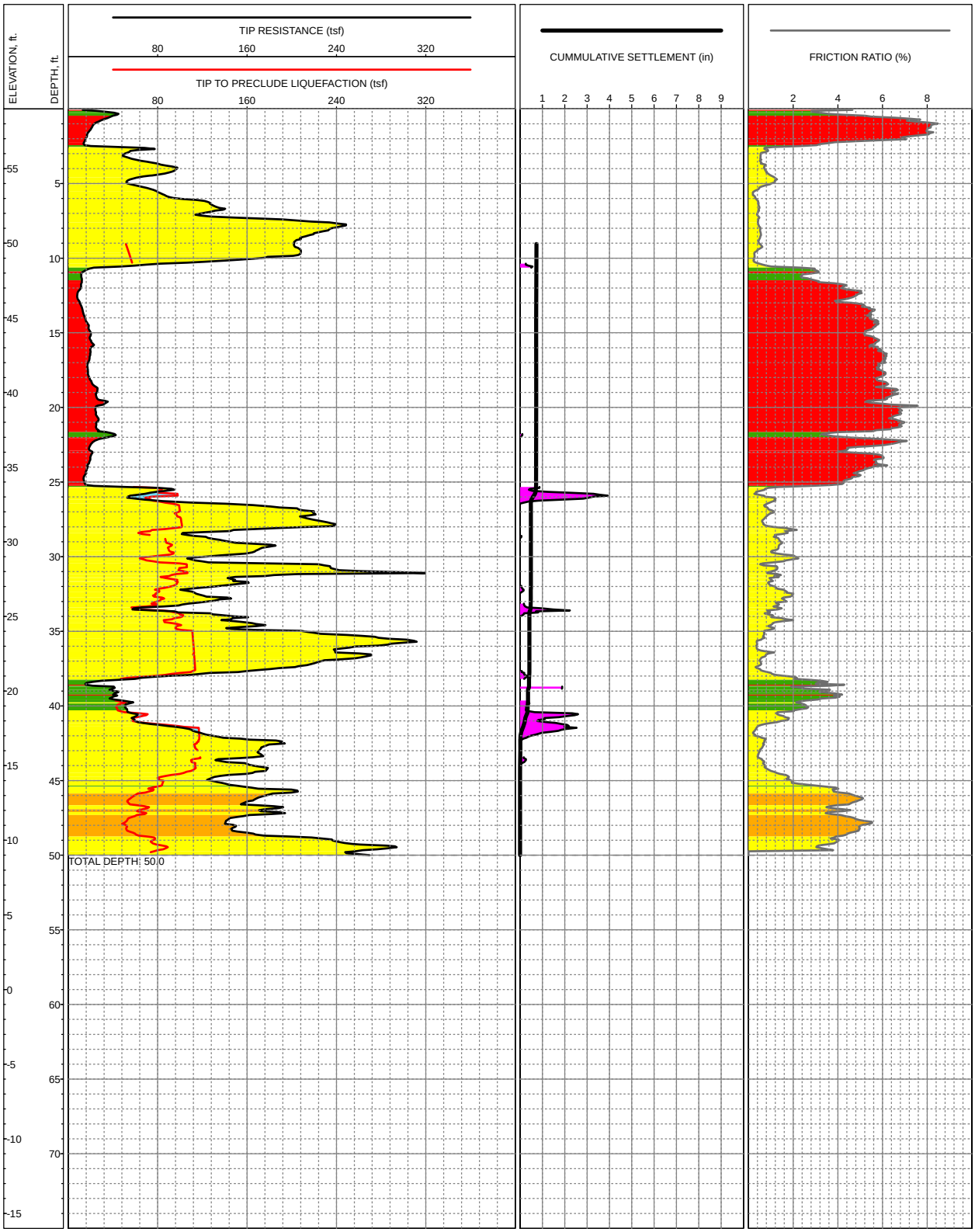
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J Blanchard

LOG OF CPT SOC037, M=7.0, a=0.46

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-10

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_LiquM7.0_A0.46_2008_08_01\MXD\CPTLogs_Liq7_46.mxd.08/29/2008.ksheil



COORDINATES: 2,233,857.20N 5,787,490.08W
SURFACE EL: 59.0ft +/- (MSL)
COMPLETION DEPTH: 50.0ft
TESTDATE: 7/22/2008

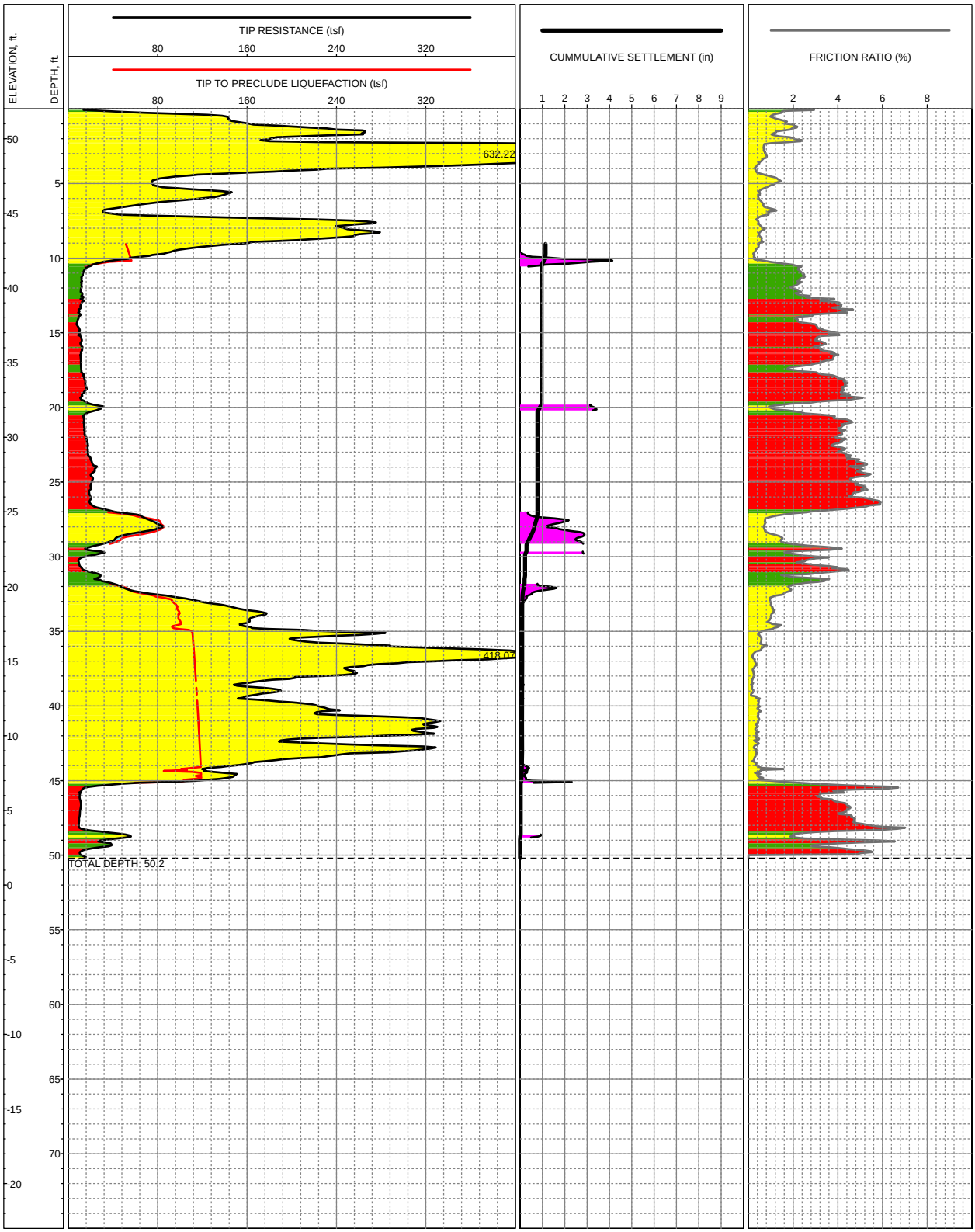
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-1, M6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-11

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,232,173.97N 5,786,405.43W
SURFACE EL: 52.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

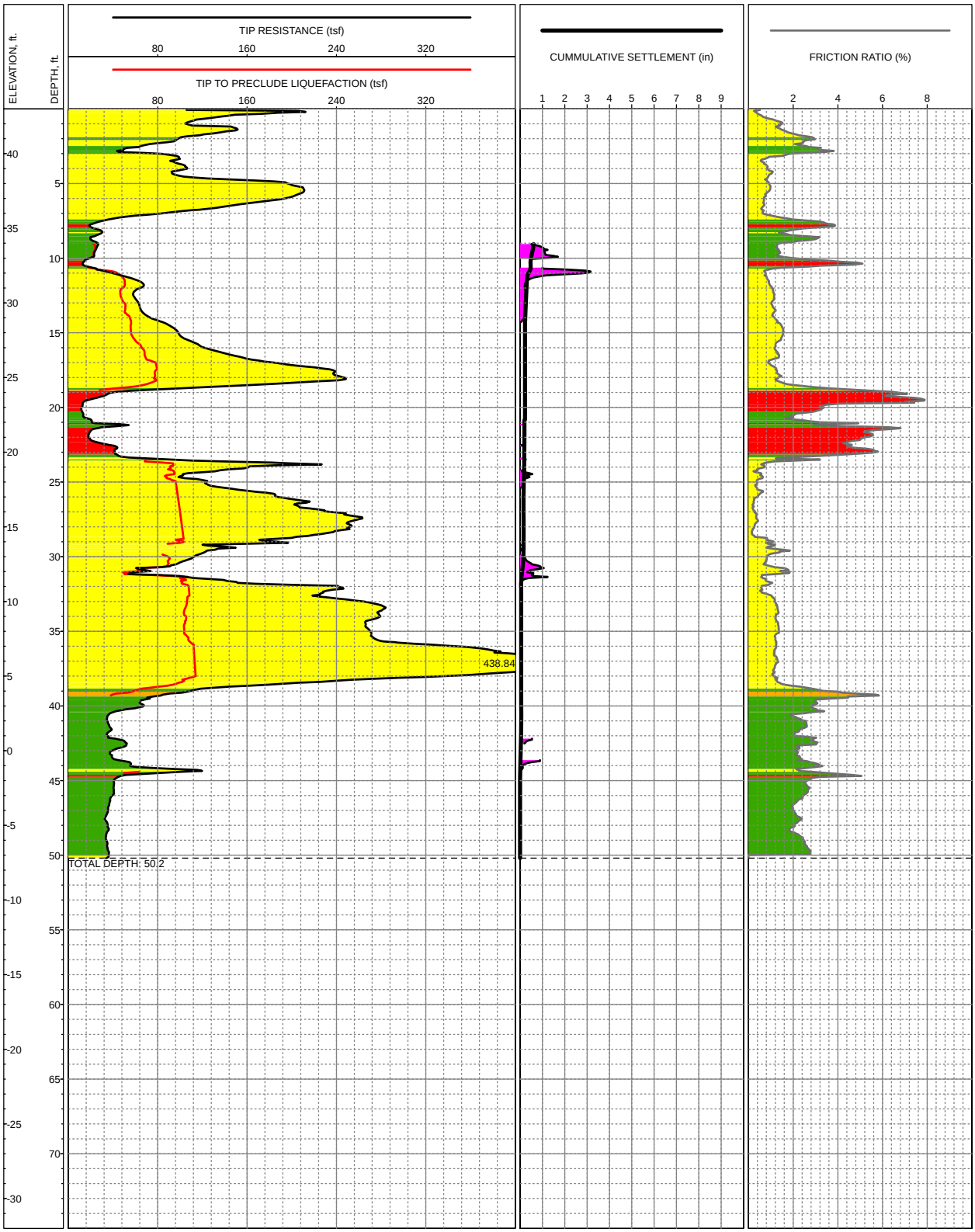
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-2, M6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-12

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,231,087.37N 5,784,635.85W
SURFACE EL: 43.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

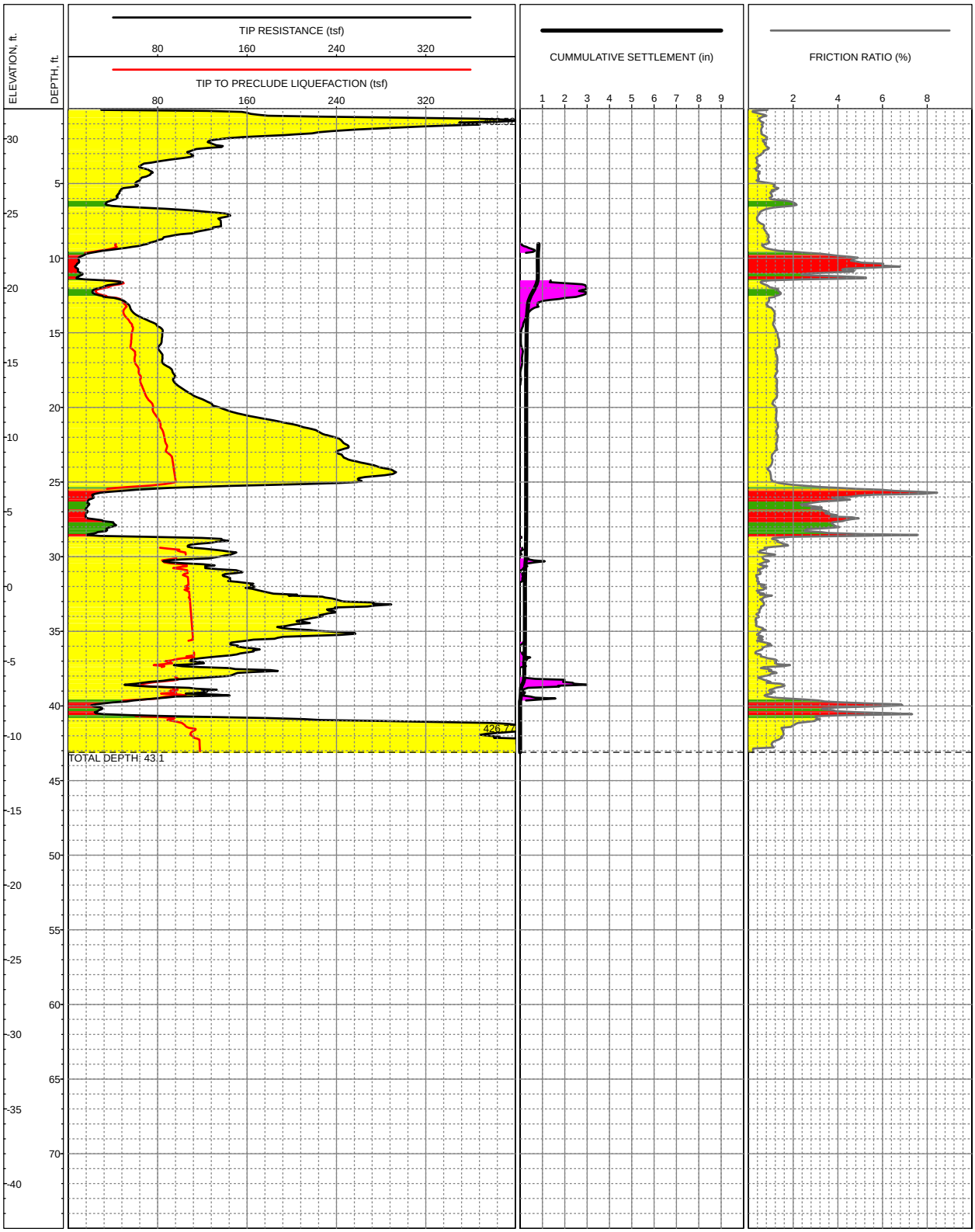
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-3, M6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-13

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,231,221.08N 5,782,003.06W
SURFACE EL: 32.0ft +/- (MSL)
COMPLETION DEPTH: 43.1ft
TESTDATE: 7/22/2008

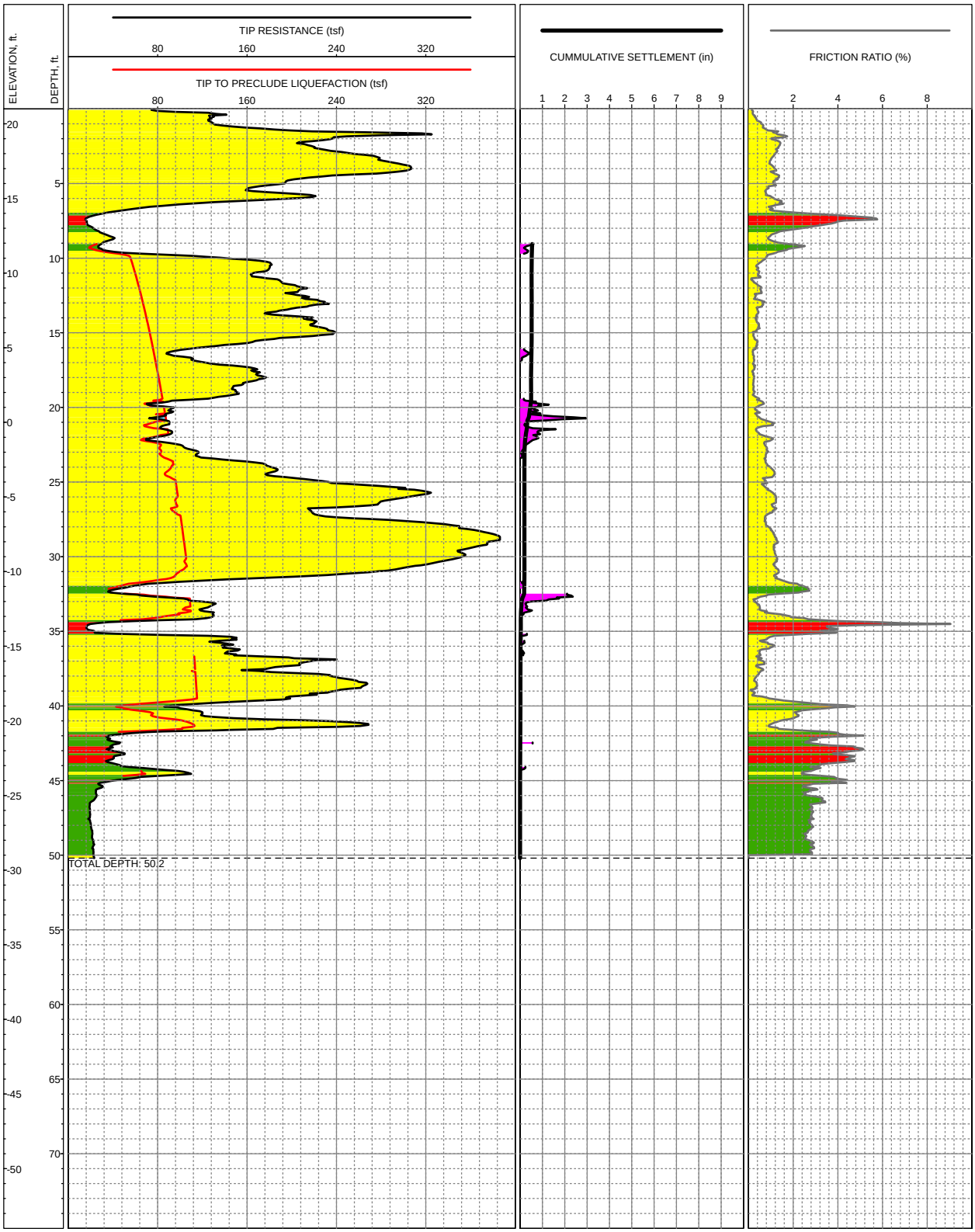
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-4, M6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-14

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,232,390.00N 5,778,074.64W
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

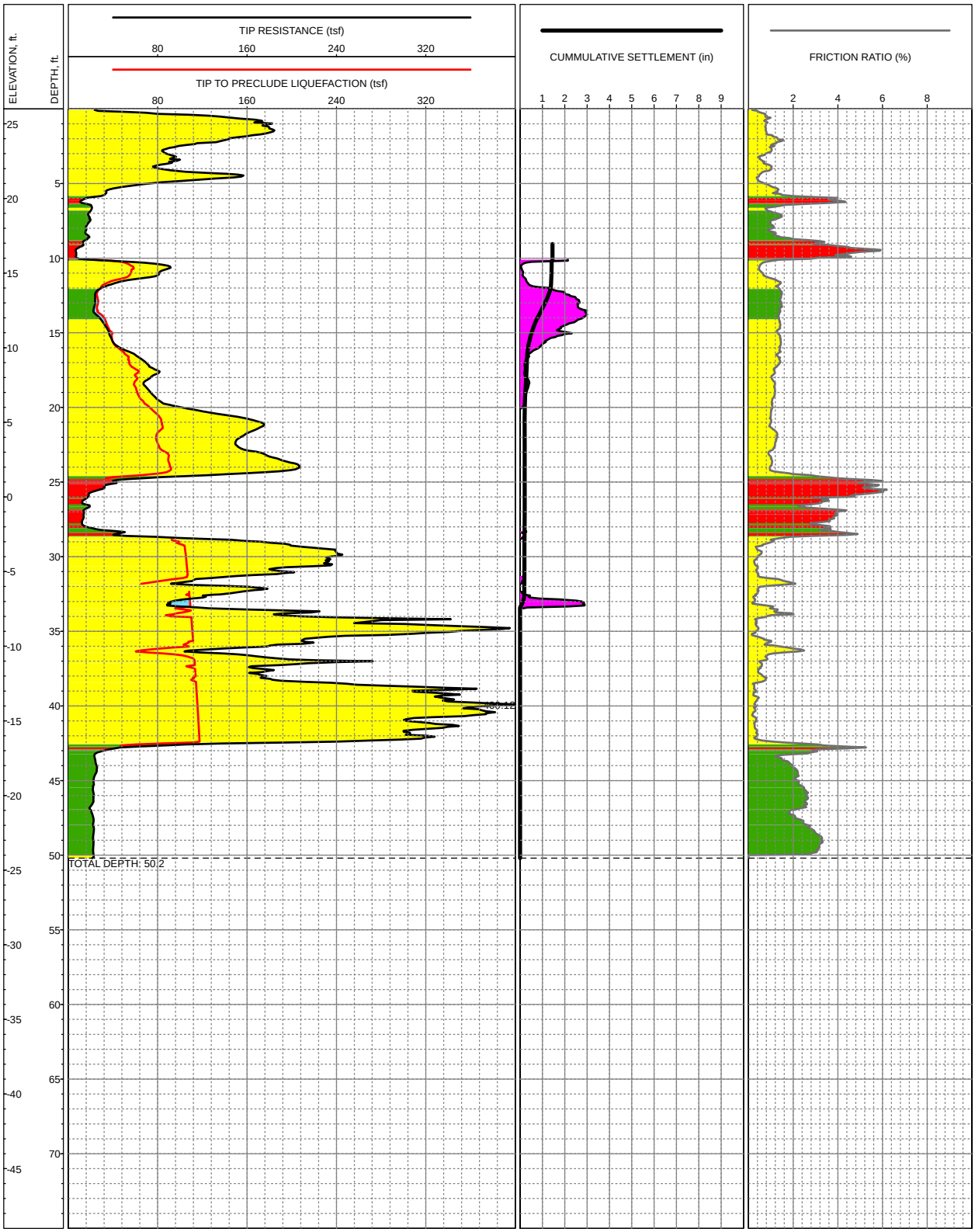
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-5, M6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-15

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



COORDINATES: 2,231,397.63N 5,779,691.56W
SURFACE EL: 26.0ft +/- (MSL)
COMPLETION DEPTH: 50.2ft
TESTDATE: 7/22/2008

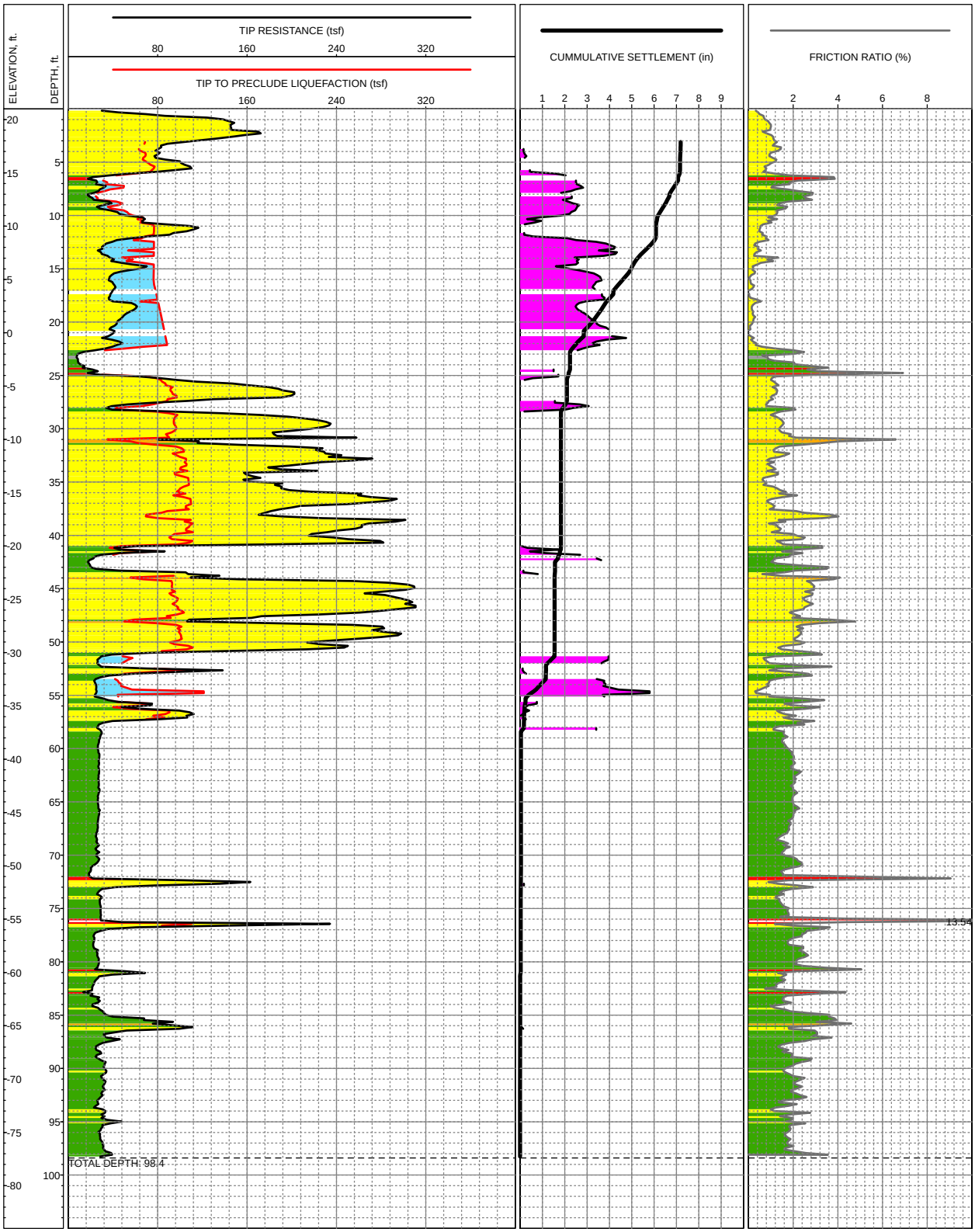
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF CPT C-6, M6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-16

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPT\2008\Logs\Logs_Liq_2008_July\MXD\CPTLogs_Liq.mxd 08/29/2008 ksheil



LOCATION: South Levee, Approx. 3350 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 98.4ft
TESTDATE: 3/5/2004

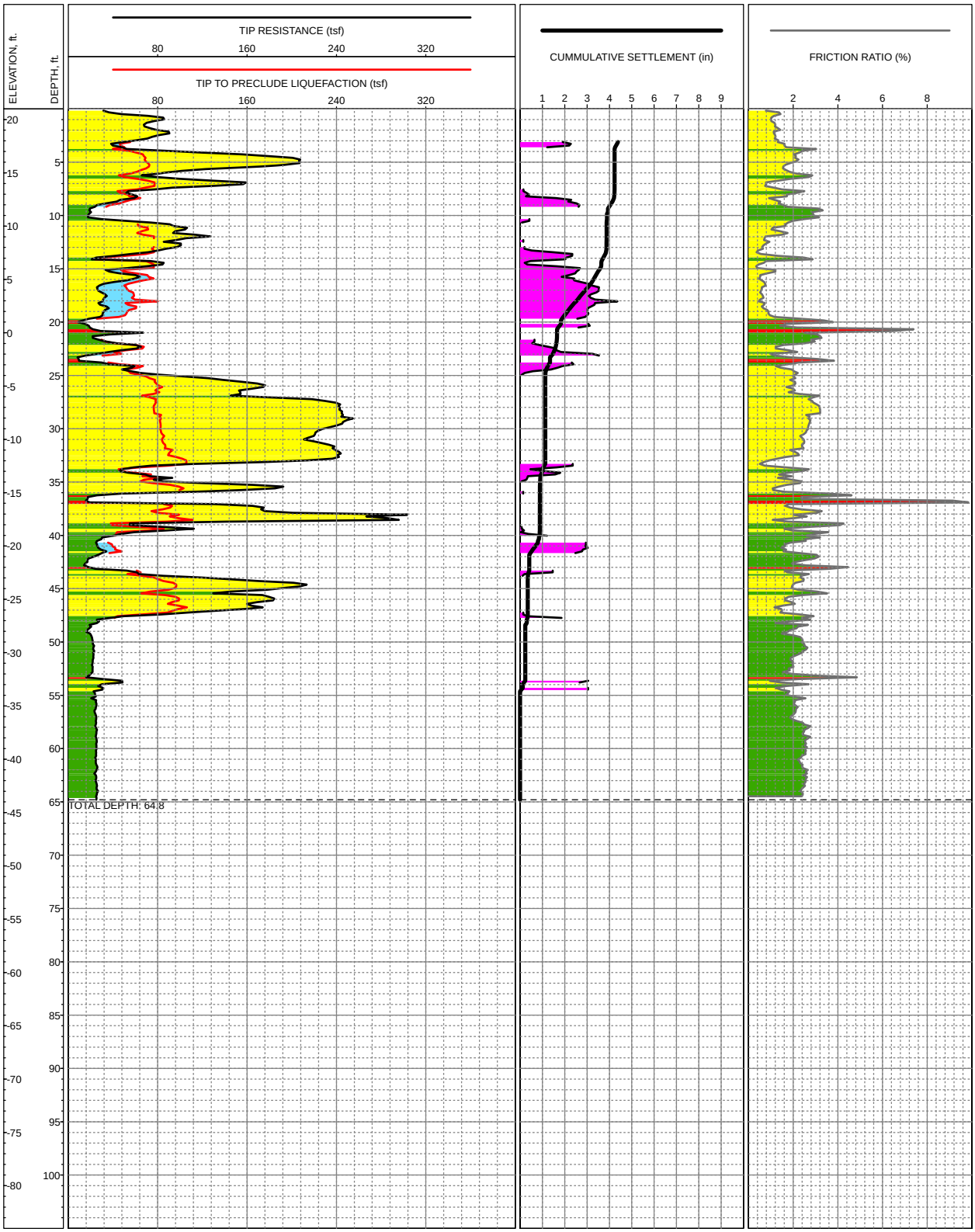
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J Blanchard

LOG OF CPT SOC035, M=6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-17

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_LiquM7.0_A0.46_2008_08_01\MXD\CPTLogs_Liq7_46.mxd.08/29/2008.ksheil



LOCATION: South Levee, Approx. 3500 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 64.8ft
TESTDATE: 3/5/2004

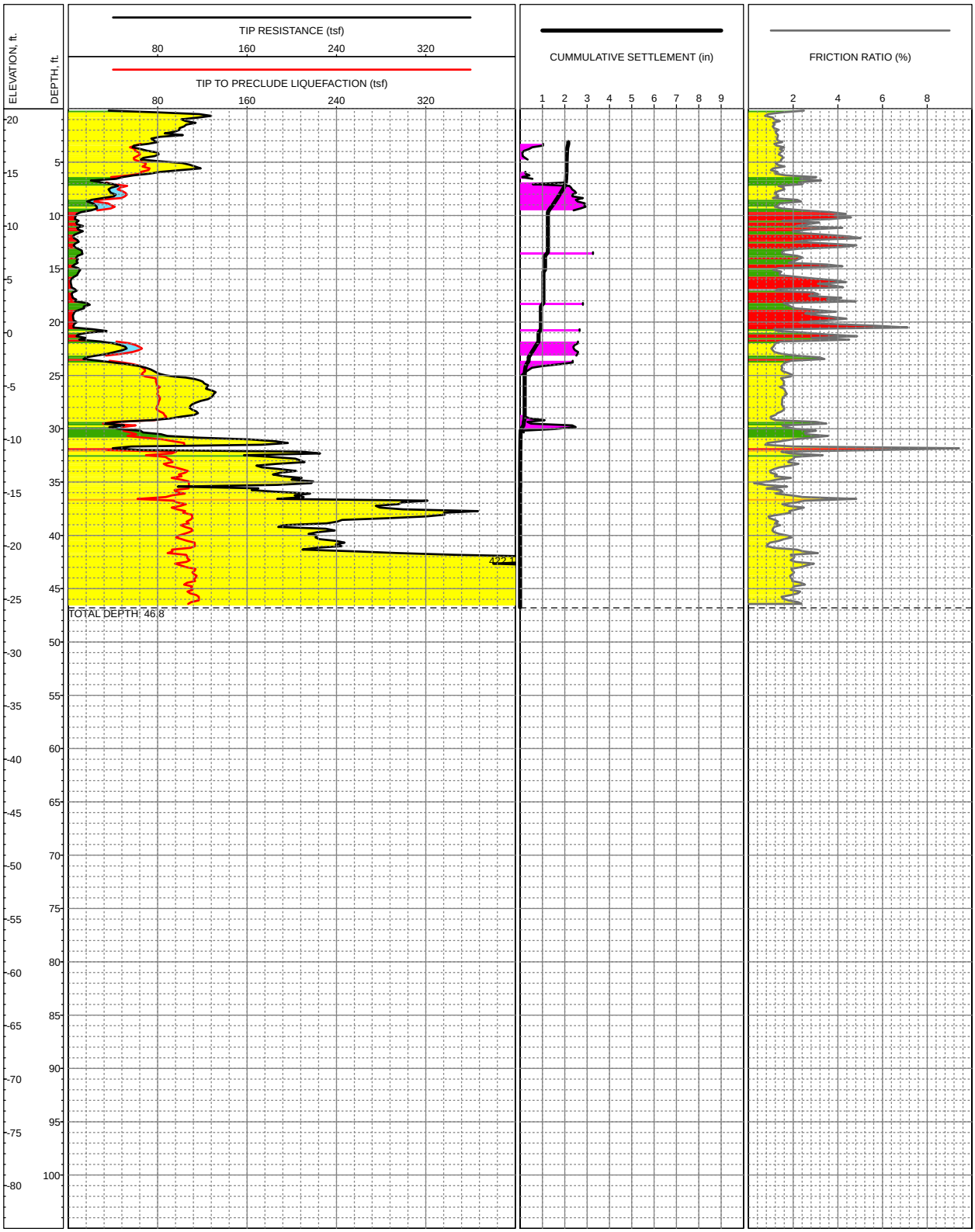
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J Blanchard

LOG OF CPT SOC036, M=6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-18

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_LiquM7.0_A0.46_2008_08_01\MXD\CPTLogs_Liq7_46.mxd.08/29/2008.ksheil



LOCATION: South Levee, Approx. 3250 ft northwest of 22nd St. Bridge
SURFACE EL: 21.0ft +/- (MSL)
COMPLETION DEPTH: 46.8ft
TESTDATE: 3/5/2004

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: USGS
REVIEWED BY: J Blanchard

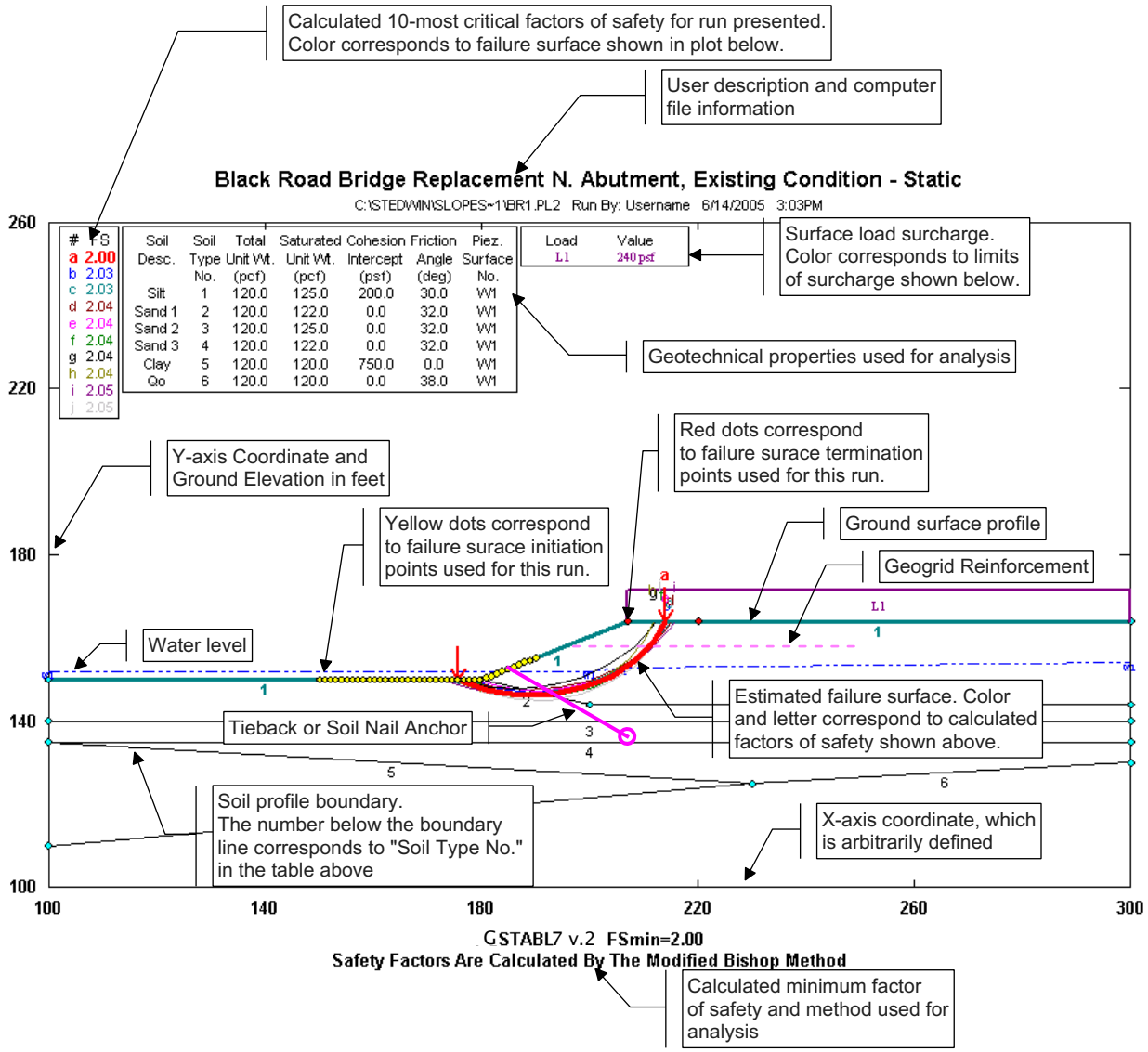
LOG OF CPT SOC037, M=6.5, a=0.25

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE C-19

N:\Projects\3014_SLOcounty\3014-029_Arroyo_Grande_Creek\Explorations\CPTUSGS_2004\Logs\Logs_LiquM7.0_A0.46_2008_08_01\MXD\CPTLogs_Liq7_46.mxd.08/29/2008.ksheil

APPENDIX D



Notes:

1. Plots are shown for run with least calculated factor of safety. Additional termination and initiation limits may have been considered. Typically over 100 surfaces are calculated for each run.

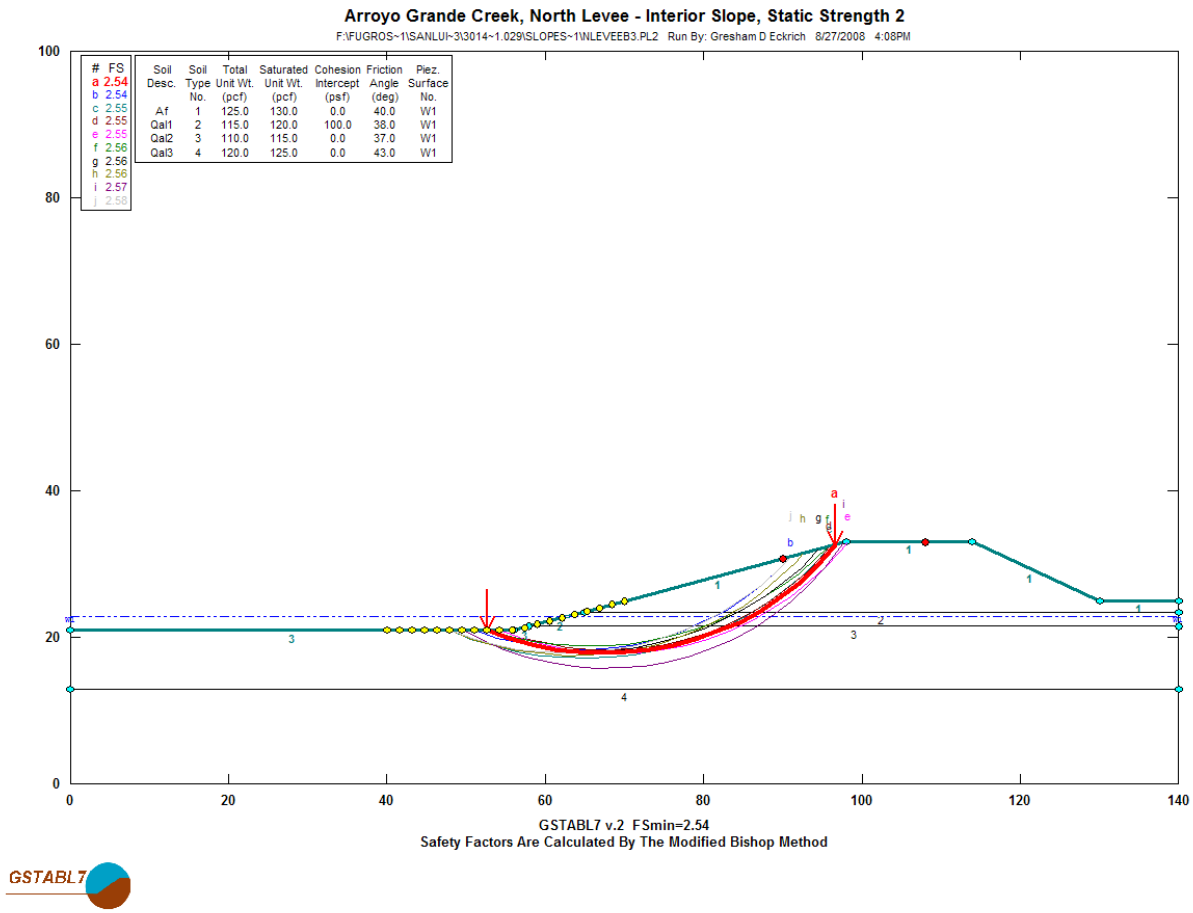
2. Discussion of the results and methodology is provided in the text of the report.

3. The surface and subsurface boundaries are approximate and represent only a generalization of interpreted and inferred subsurface conditions estimated from limited points of exploration.

KEY TO SLOPE STABILITY PLOTS

Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County,California

PLATE D-1



GSTABL7

ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **2.5**

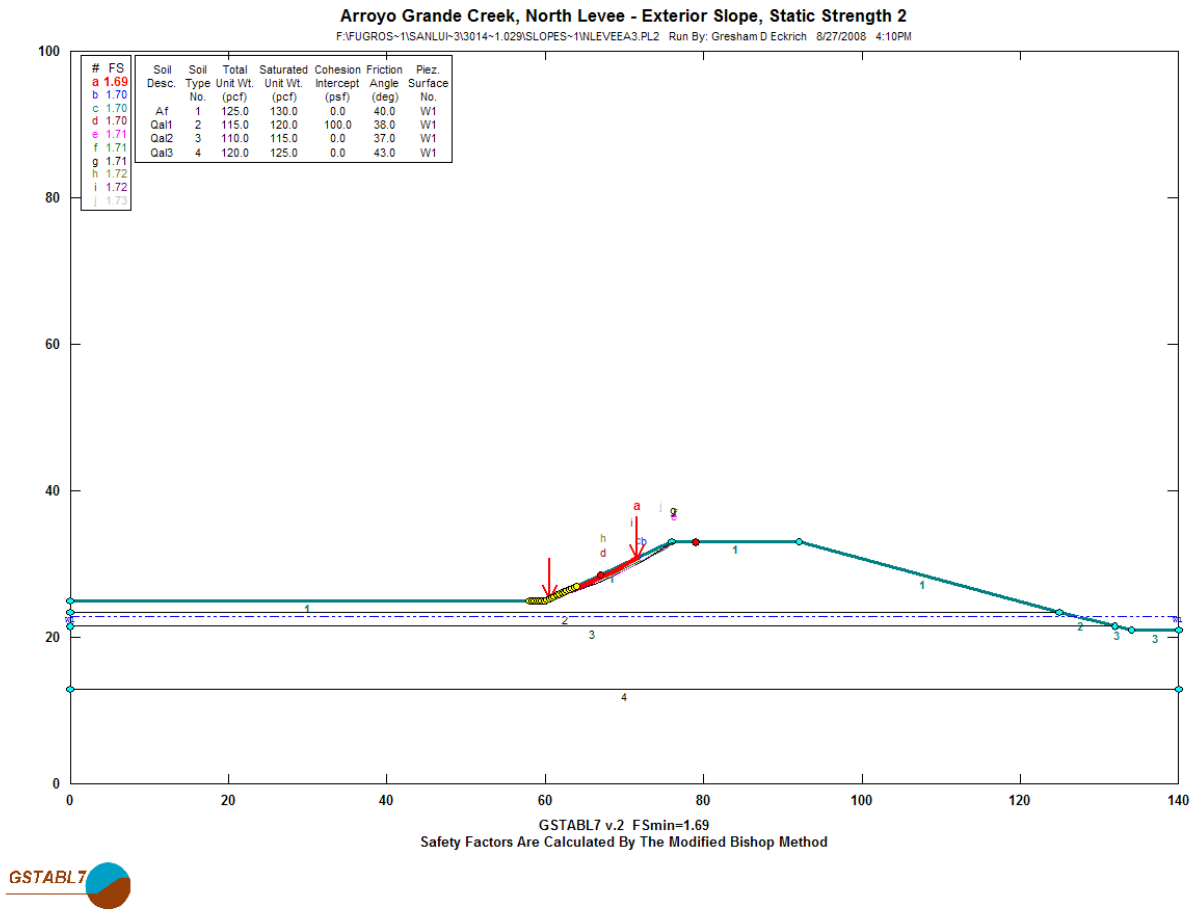
Pseudostatic Loading Condition: **1.5**

Pseudostatic Coefficient: **0.15**

Condition: **Existing Interior Slope, Static Loading**

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-2



GSTABL7

ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.7**

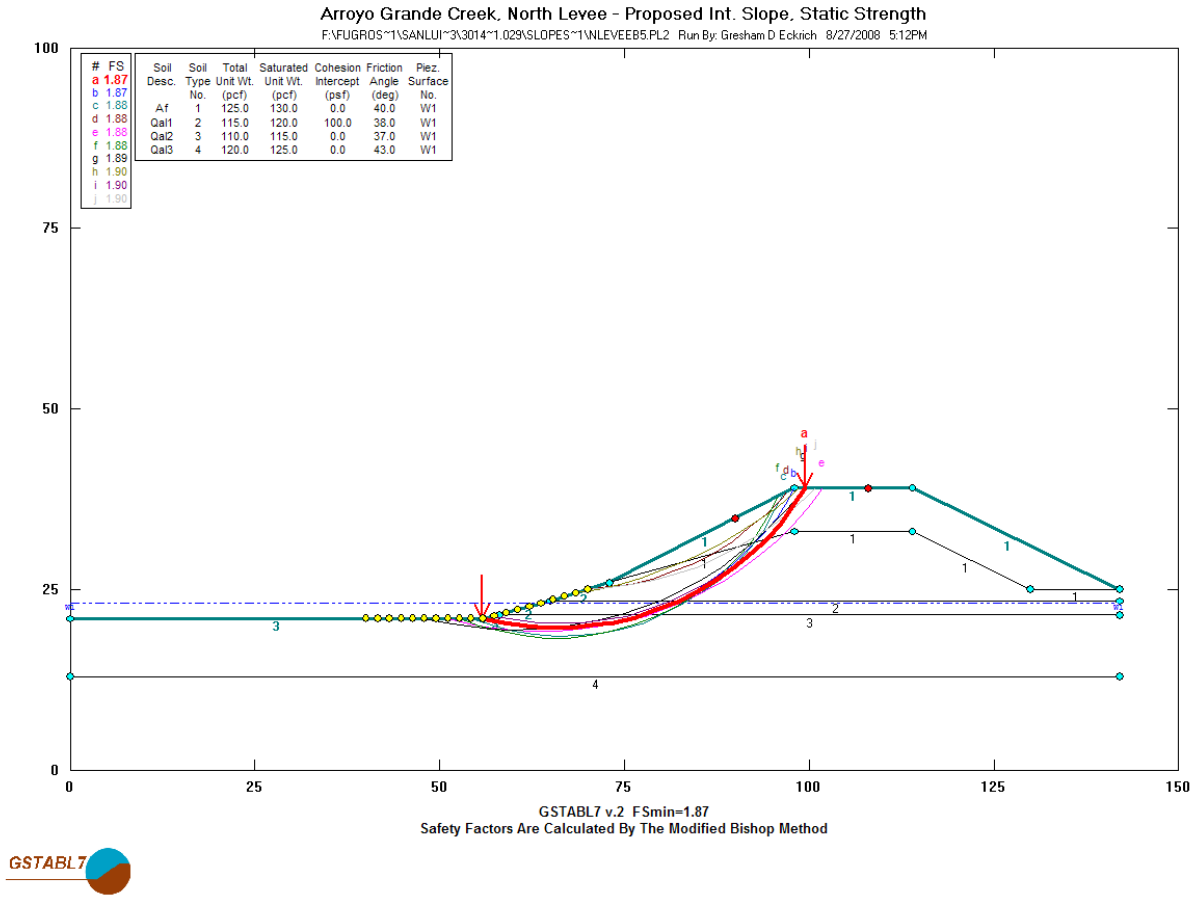
Pseudostatic Loading Condition: **1.2**

Pseudostatic Coefficient: **0.15**

Condition: **Existing Exterior Slope, Static Loading**

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-3



GSTABL7

ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.9**

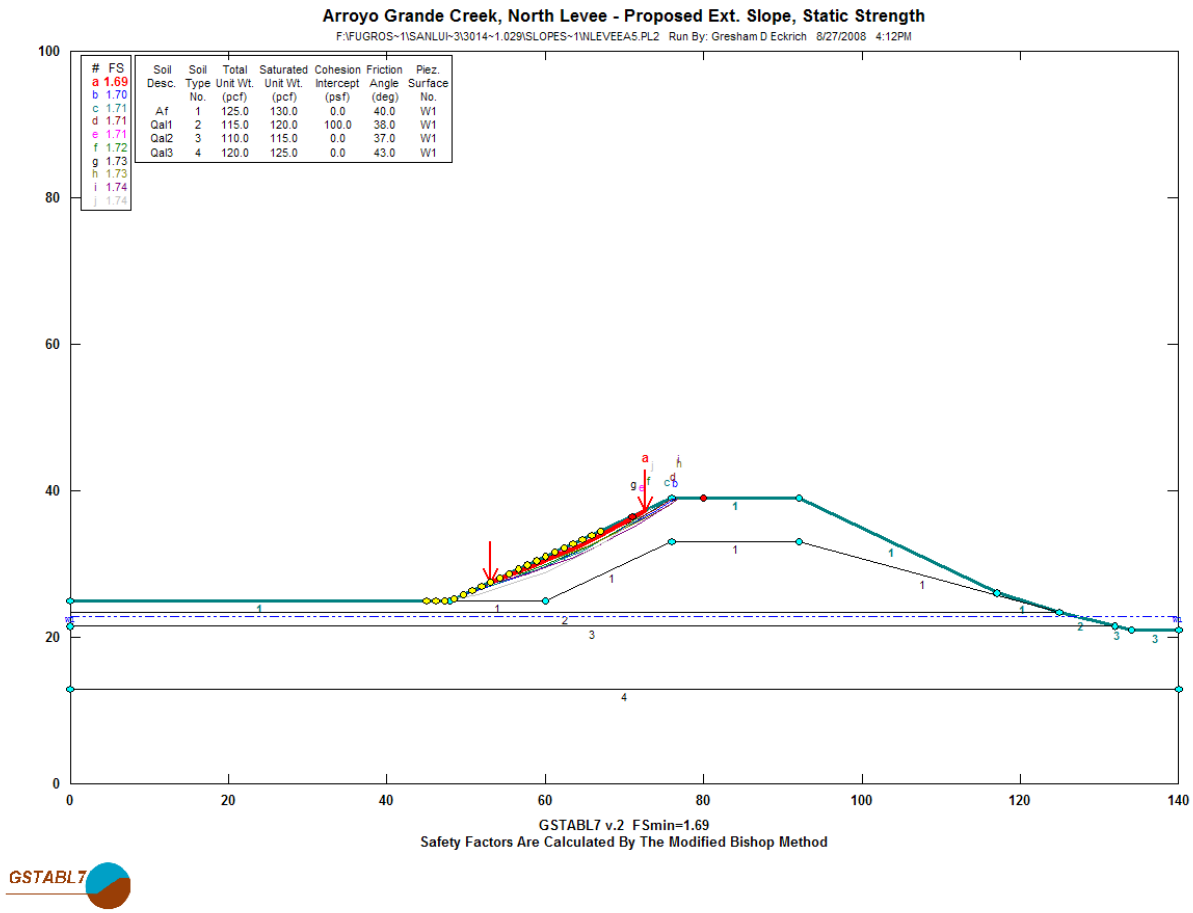
Pseudostatic Loading Condition: **1.3**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Interior Slope 1, Static Loading**

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-4



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.7**

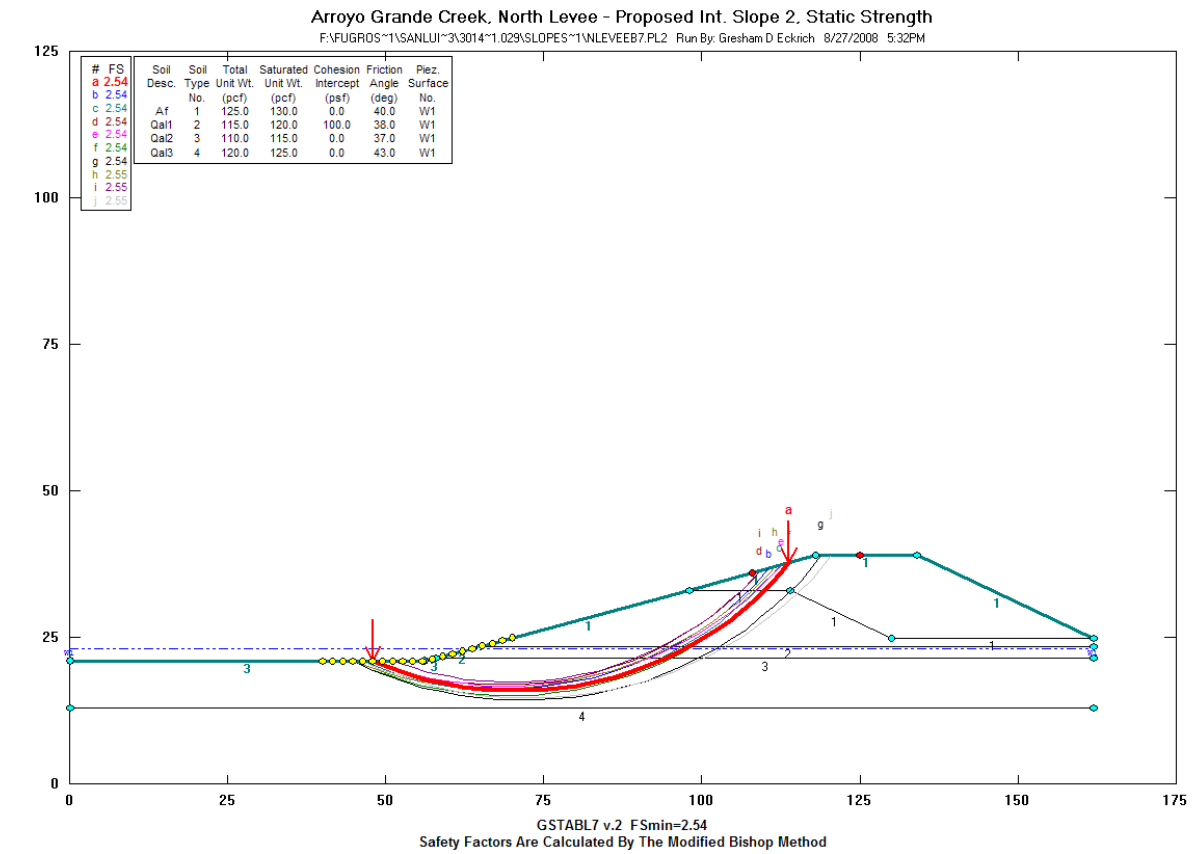
Pseudostatic Loading Condition: **1.2**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Exterior Slope 1, Static Loading**

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-5



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **2.5**

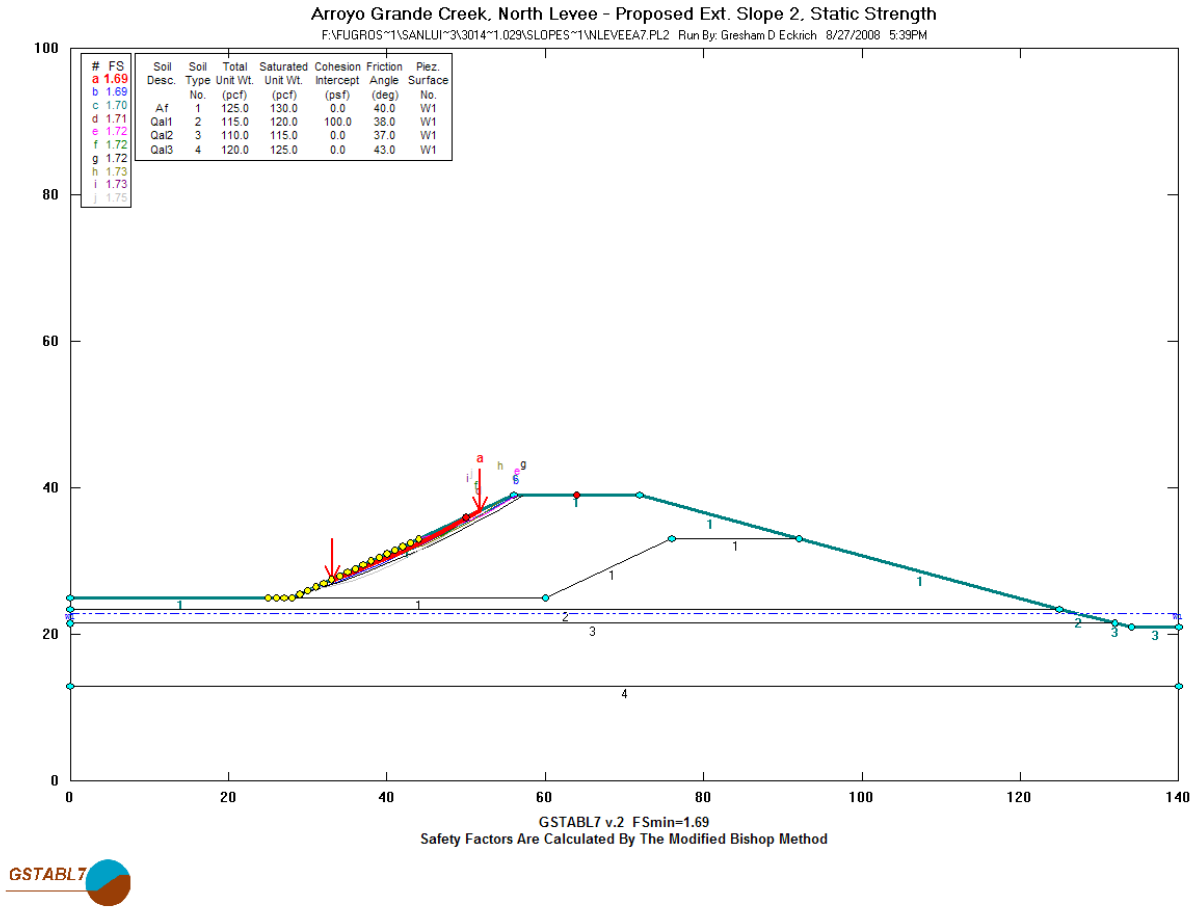
Pseudostatic Loading Condition: **1.5**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Interior Slope 2, Static Loading**

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-6



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.7**

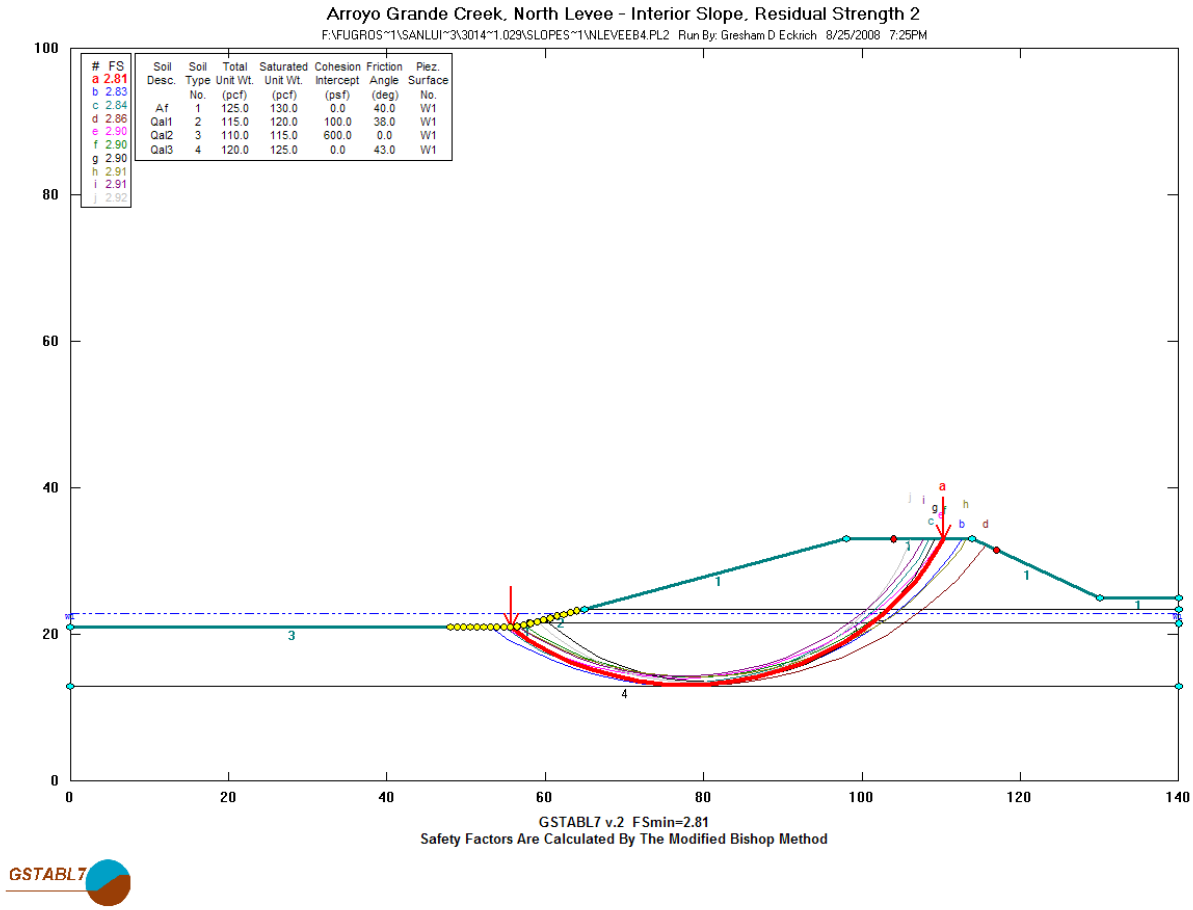
Pseudostatic Loading Condition: **1.2**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Exterior Slope 2, Static Loading**

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-7



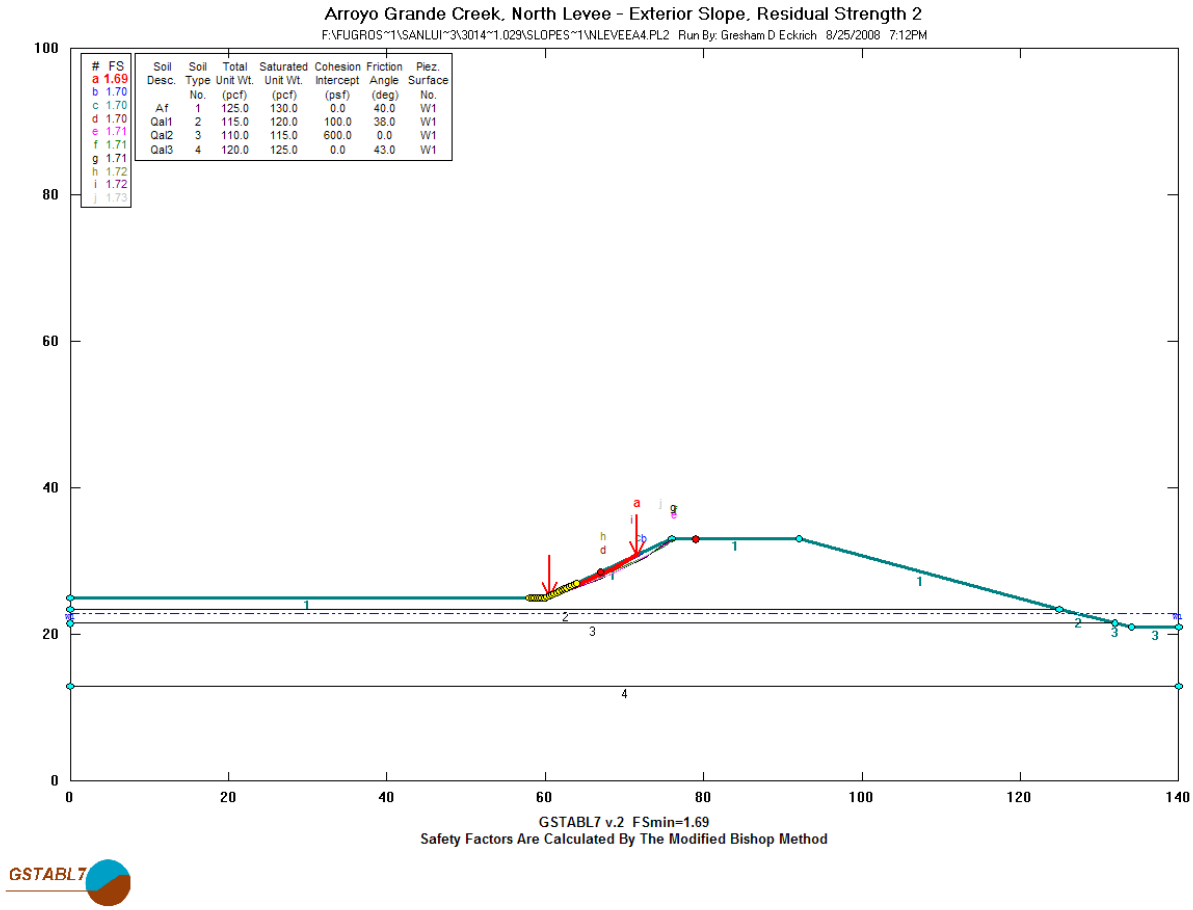
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 2.5

Condition: Existing Interior Slope

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-8



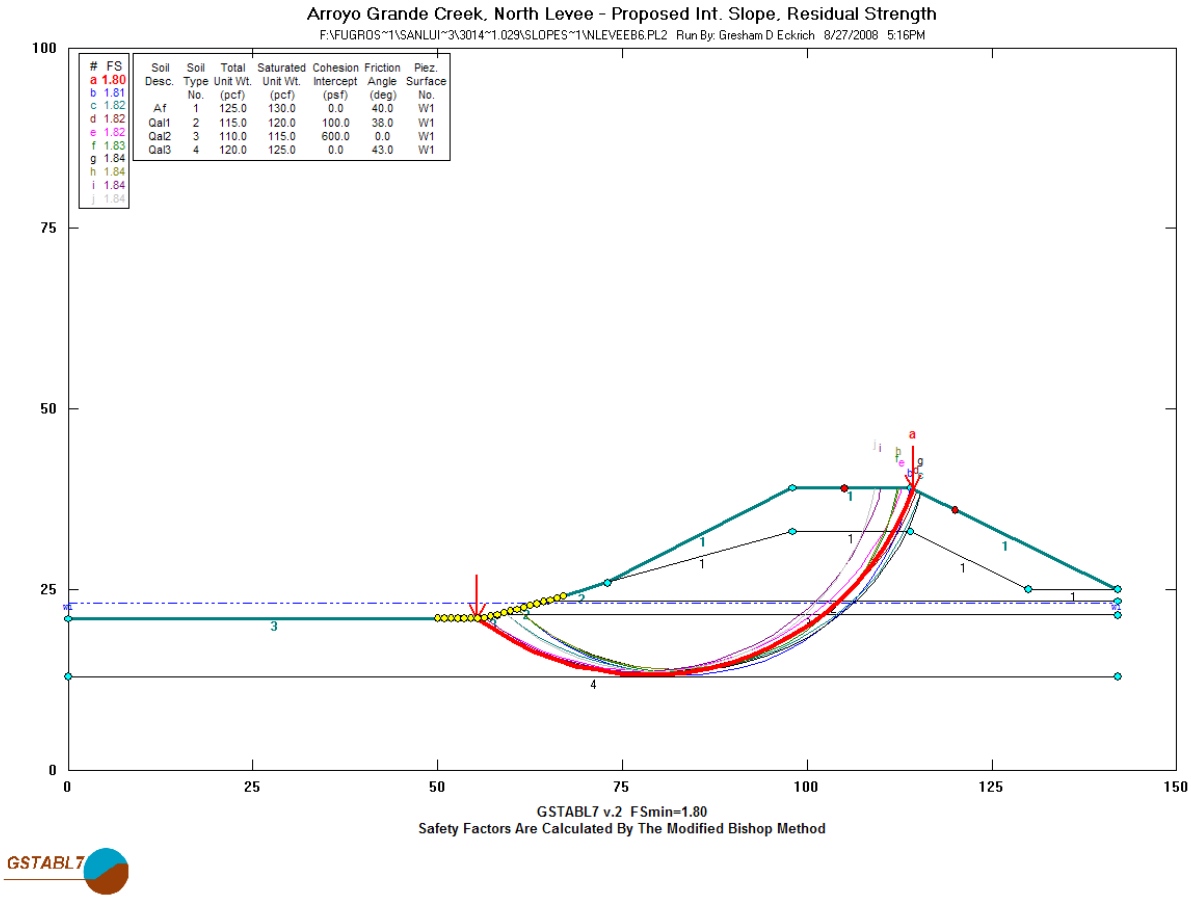
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 1.7

Condition: Existing Exterior Slope

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-9



GSTABL7

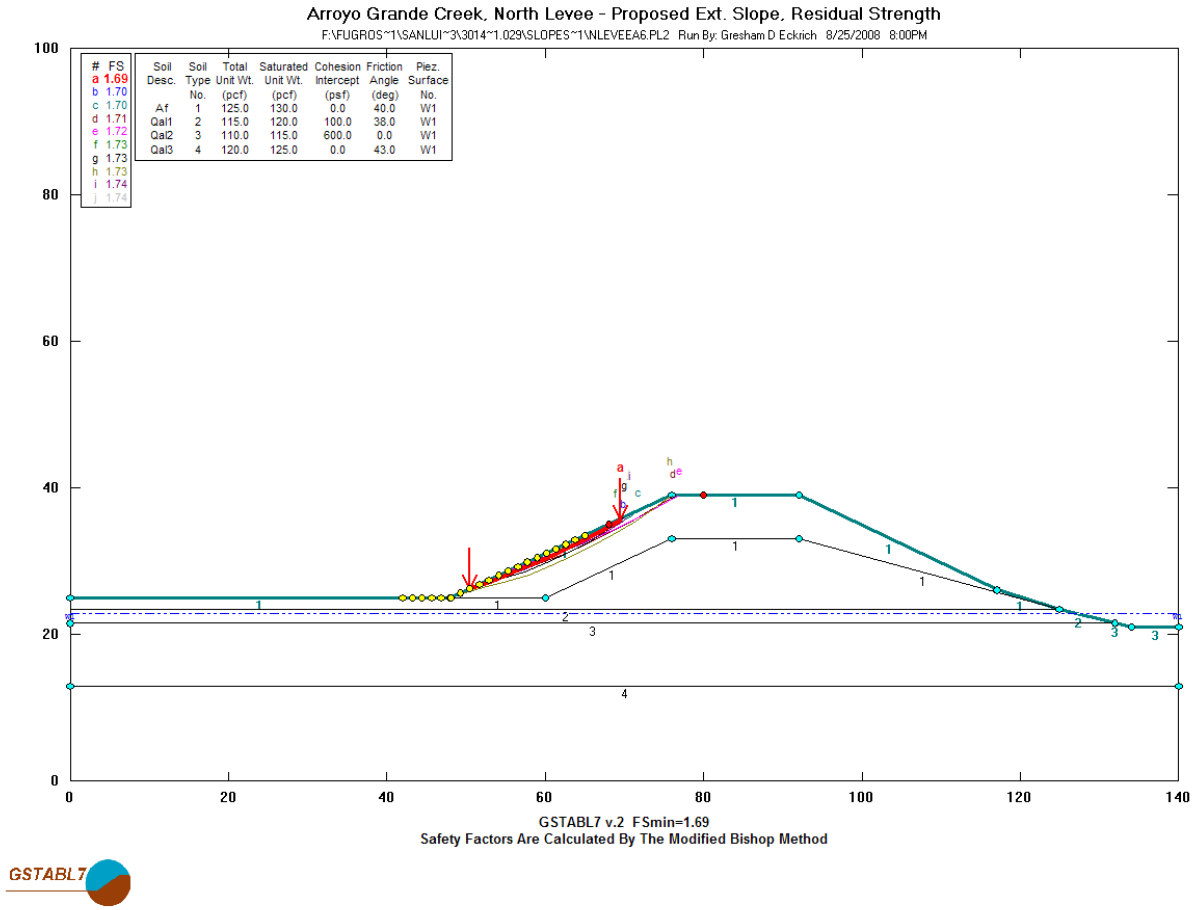
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 1.8

Condition: Proposed Interior Slope 1

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-10



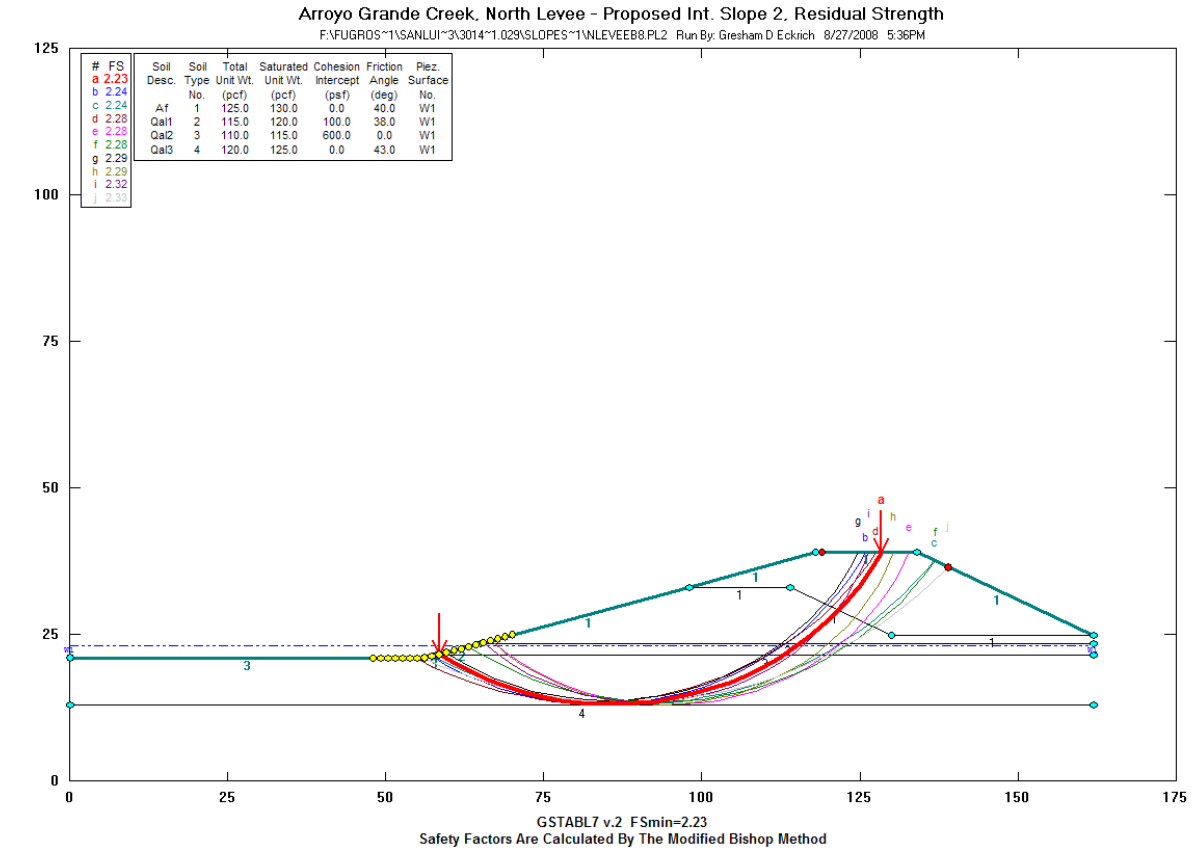
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 1.7

Condition: Proposed Exterior Slope 1

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-11



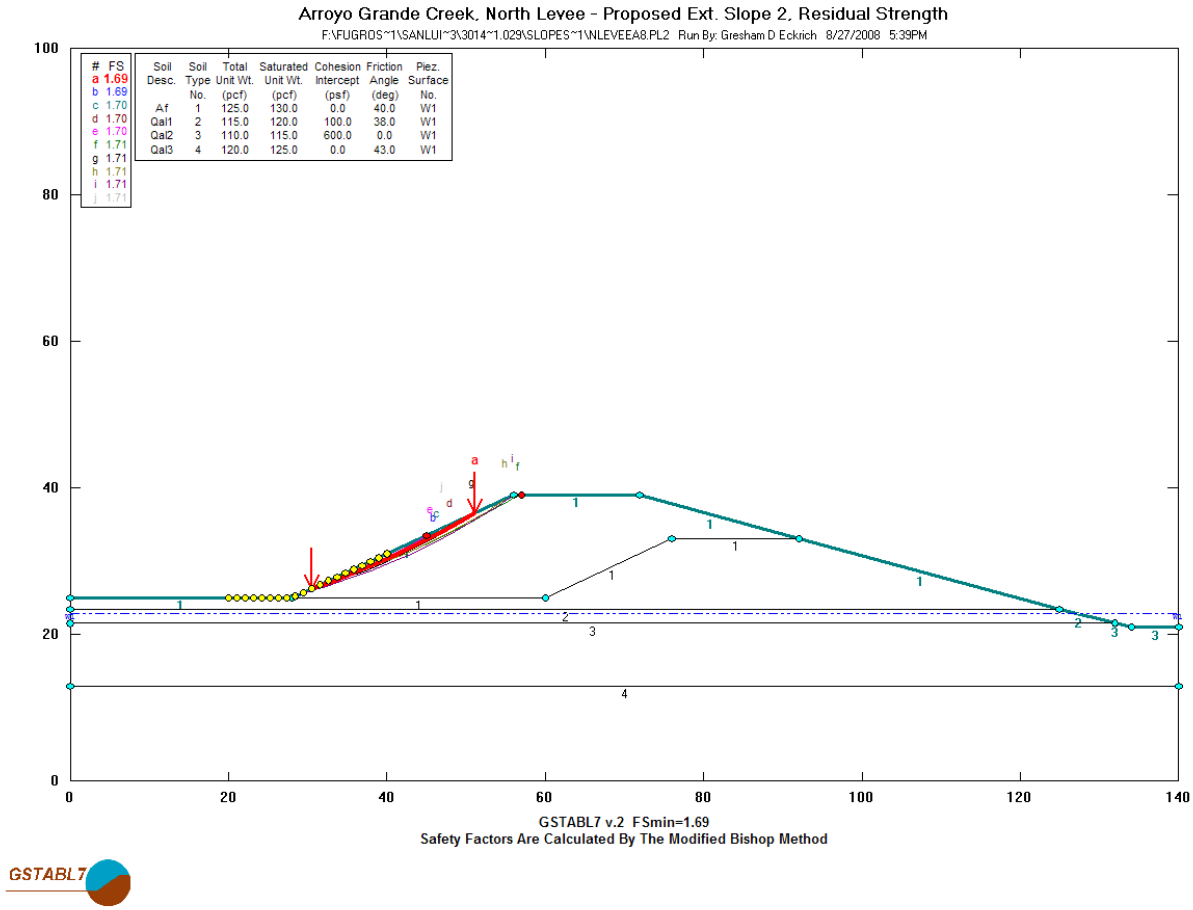
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 2.2

Condition: Proposed Interior Slope 2

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-12



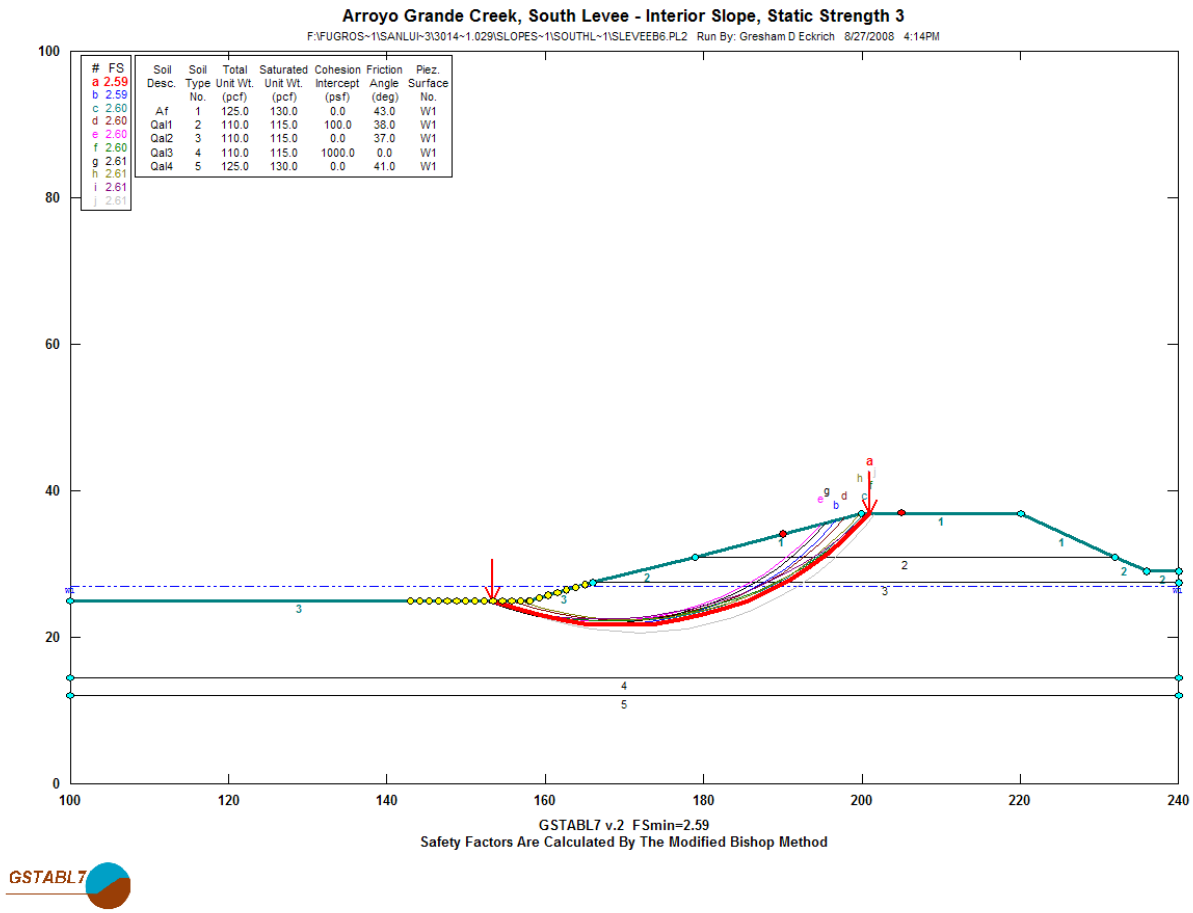
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 1.7

Condition: Proposed Exterior Slope 2

SLOPE STABILITY PLOT FOR NORTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-13



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **2.6**

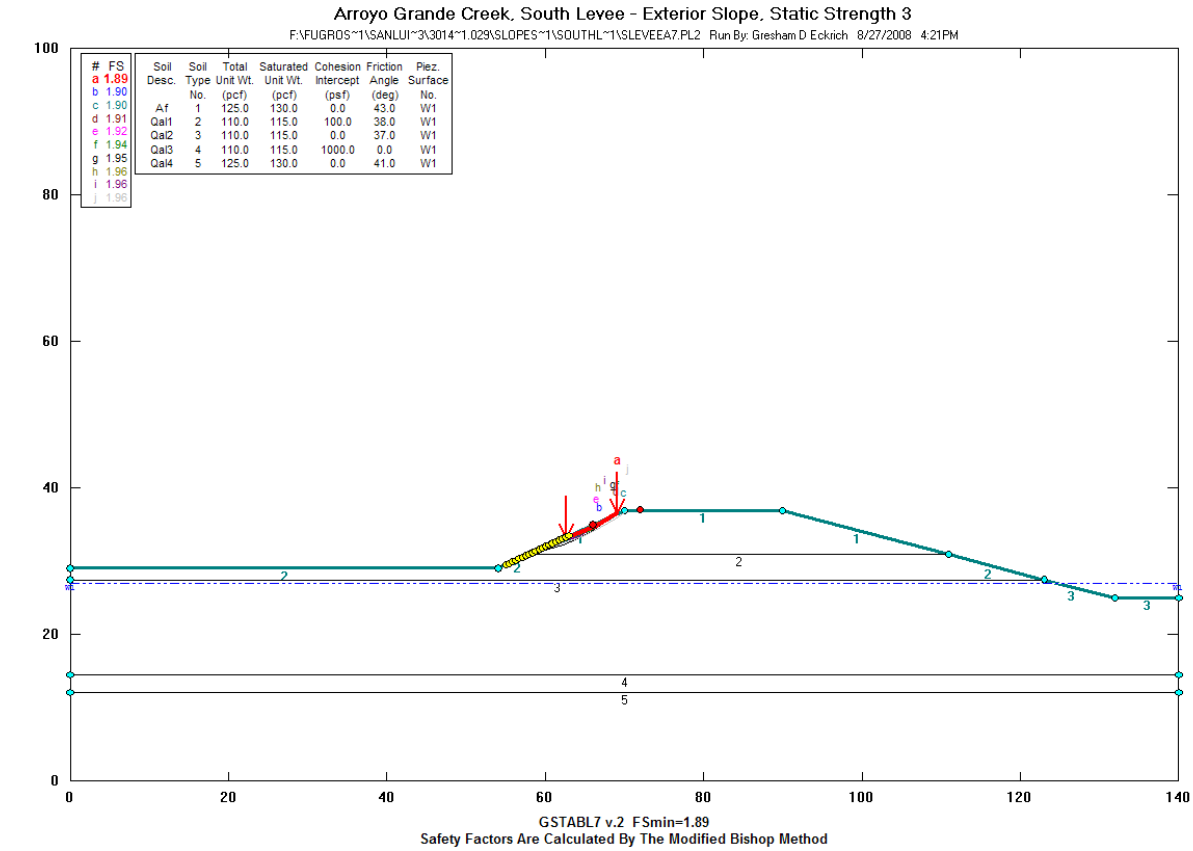
Pseudostatic Loading Condition: **1.5**

Pseudostatic Coefficient: **0.15**

Condition: **Existing Interior Slope, Static Loading**

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-14



GSTABL7

ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.9**

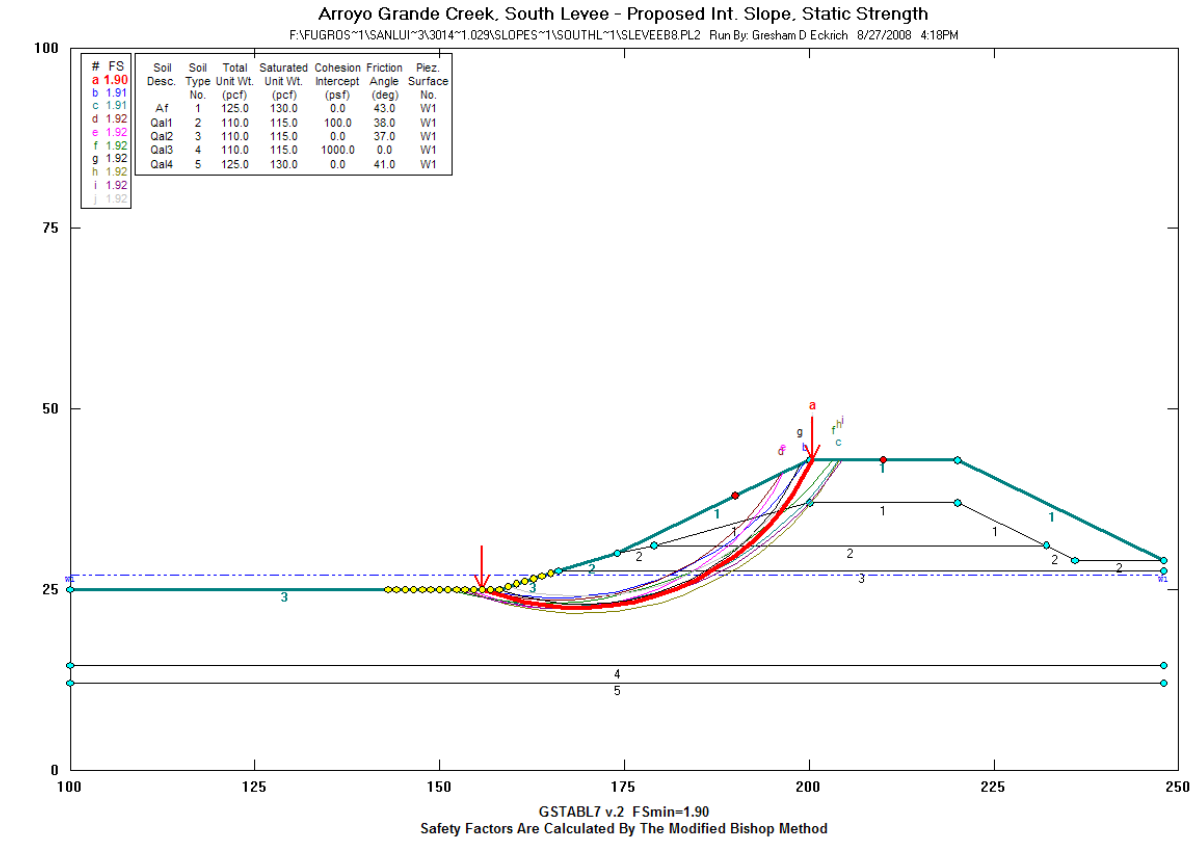
Pseudostatic Loading Condition: **1.3**

Pseudostatic Coefficient: **0.15**

Condition: **Existing Exterior Slope, Static Loading**

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-15



GSTABL7

ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.9**

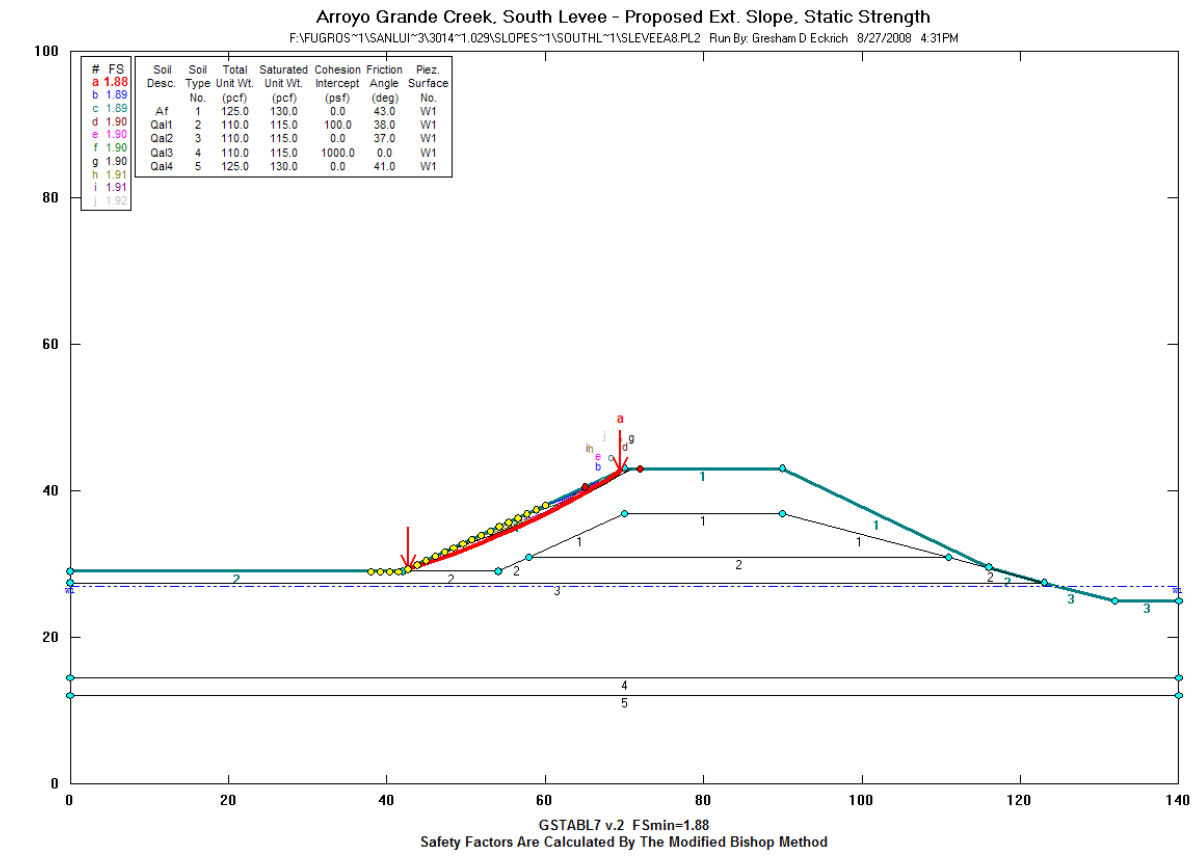
Pseudostatic Loading Condition: **1.3**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Interior Slope 1, Static Loading**

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-16



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.9**

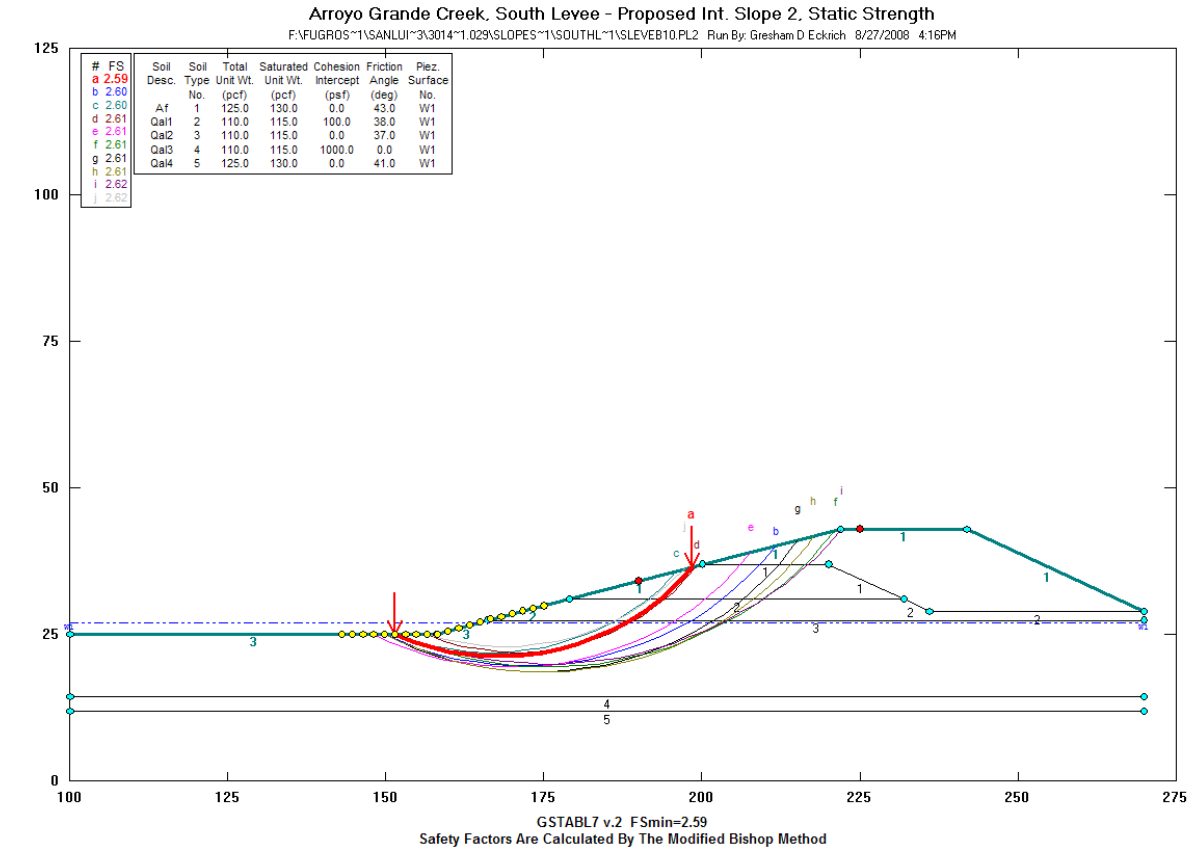
Pseudostatic Loading Condition: **1.3**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Exterior Slope 1, Static Loading**

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-17



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **2.6**

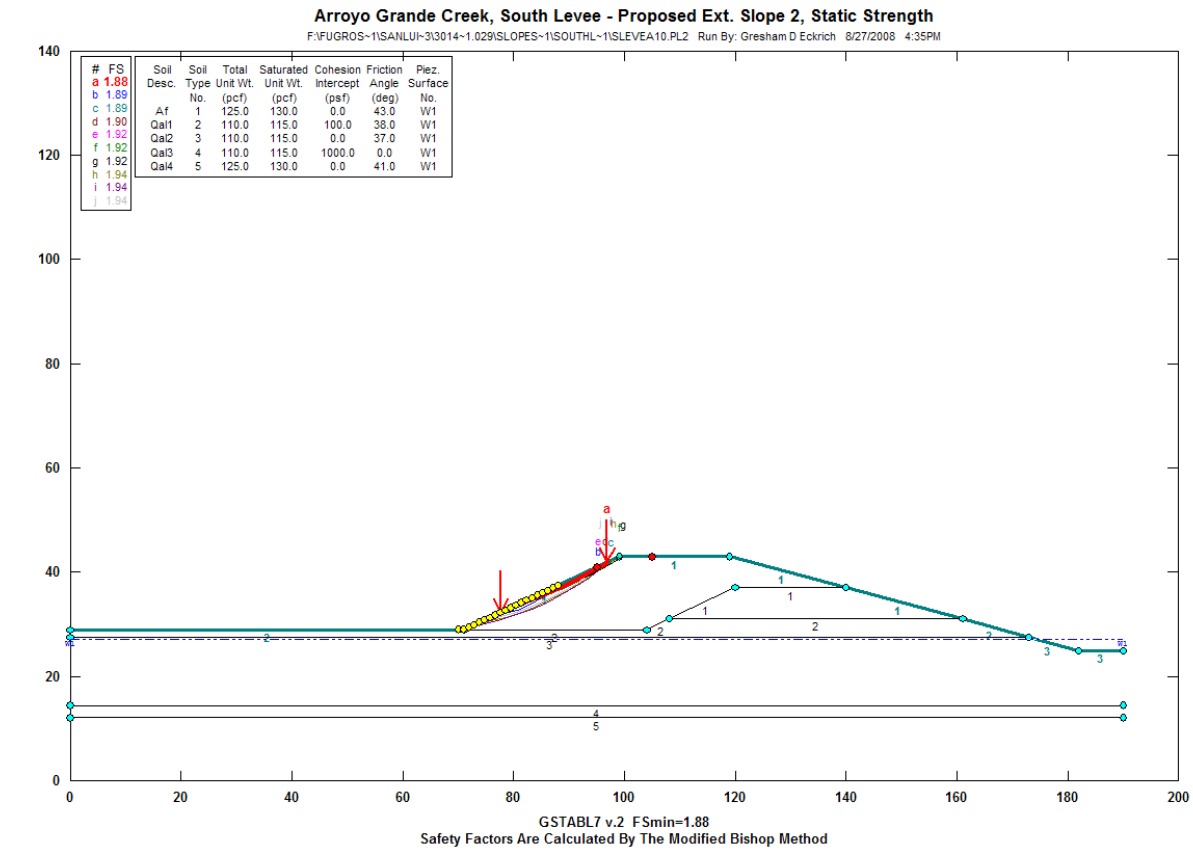
Pseudostatic Loading Condition: **1.5**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Interior Slope 2, Static Loading**

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-18



GSTABL7

ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.9**

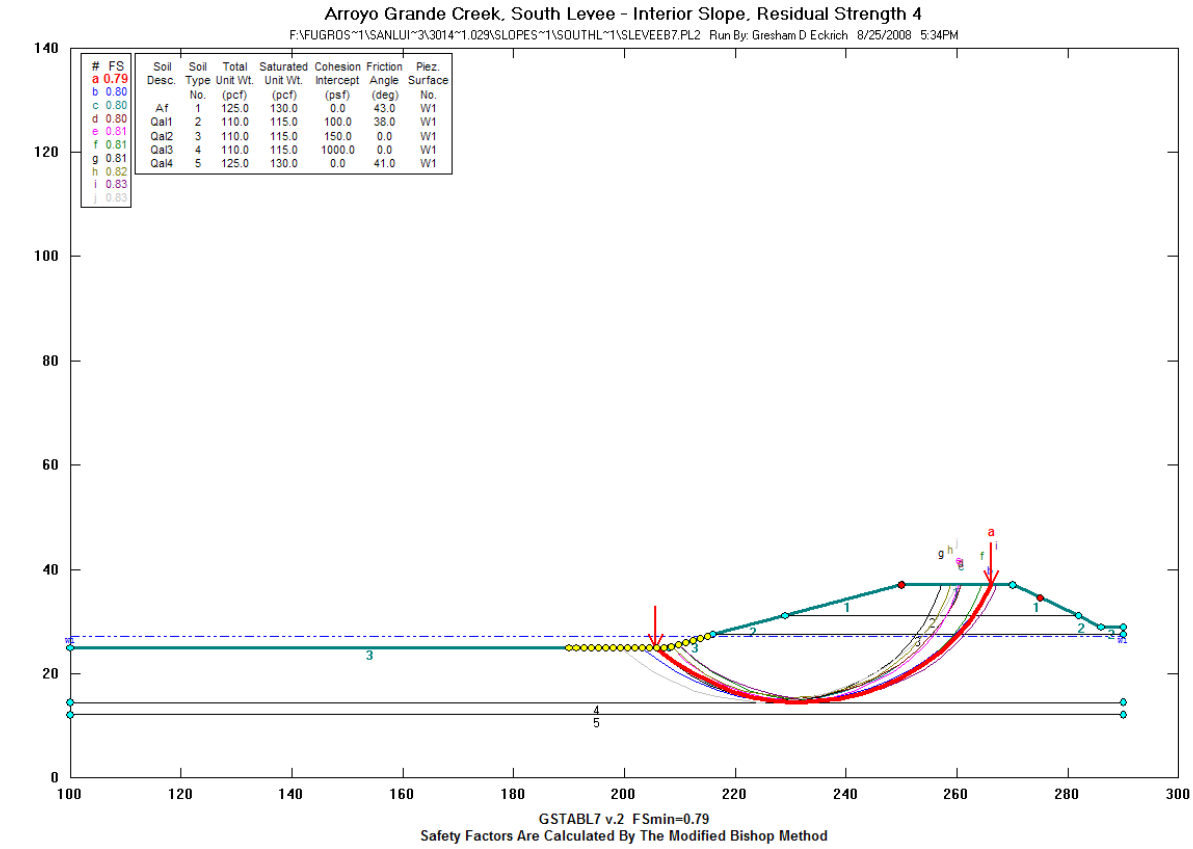
Pseudostatic Loading Condition: **1.3**

Pseudostatic Coefficient: **0.15**

Condition: **Proposed Exterior Slope 2, Static Loading**

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-19



GSTABL7

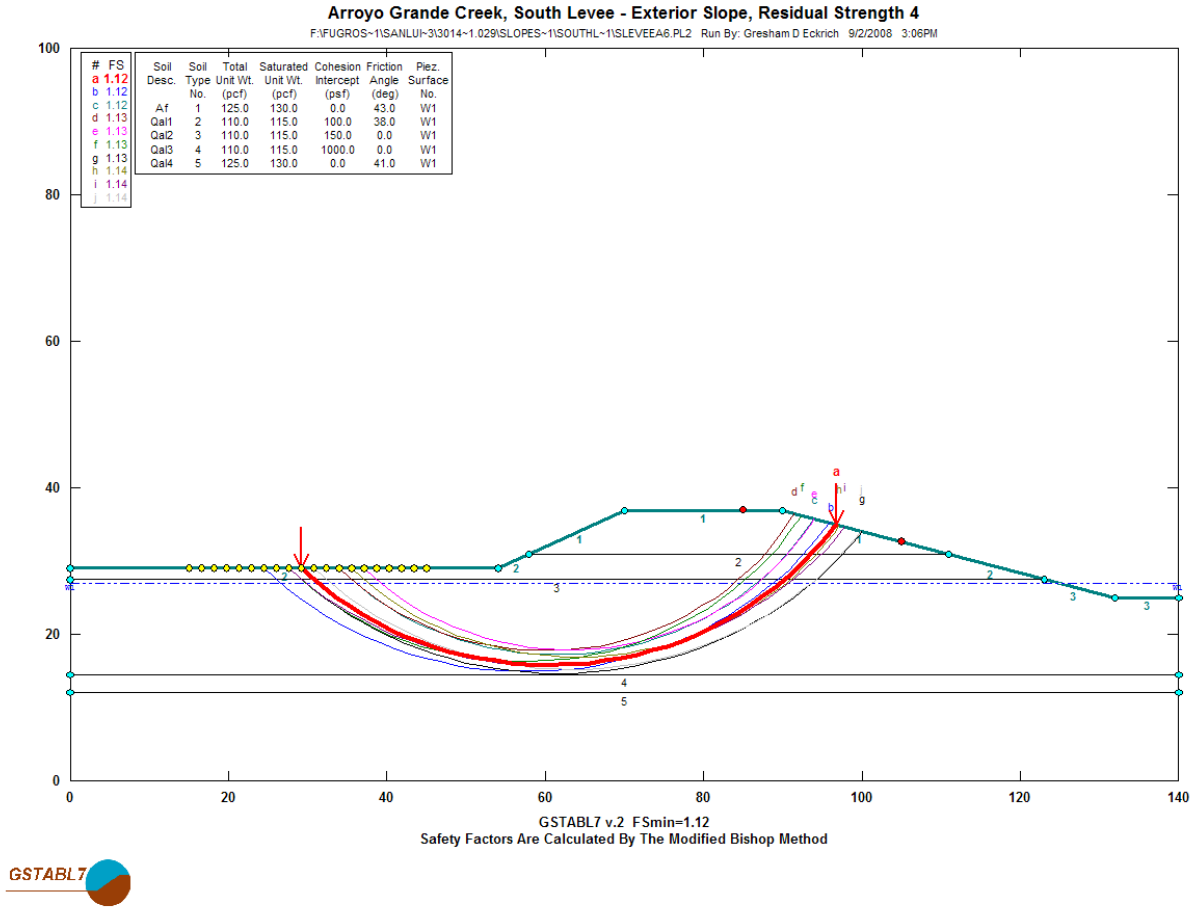
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 0.8

Condition: Existing Interior Slope

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-20



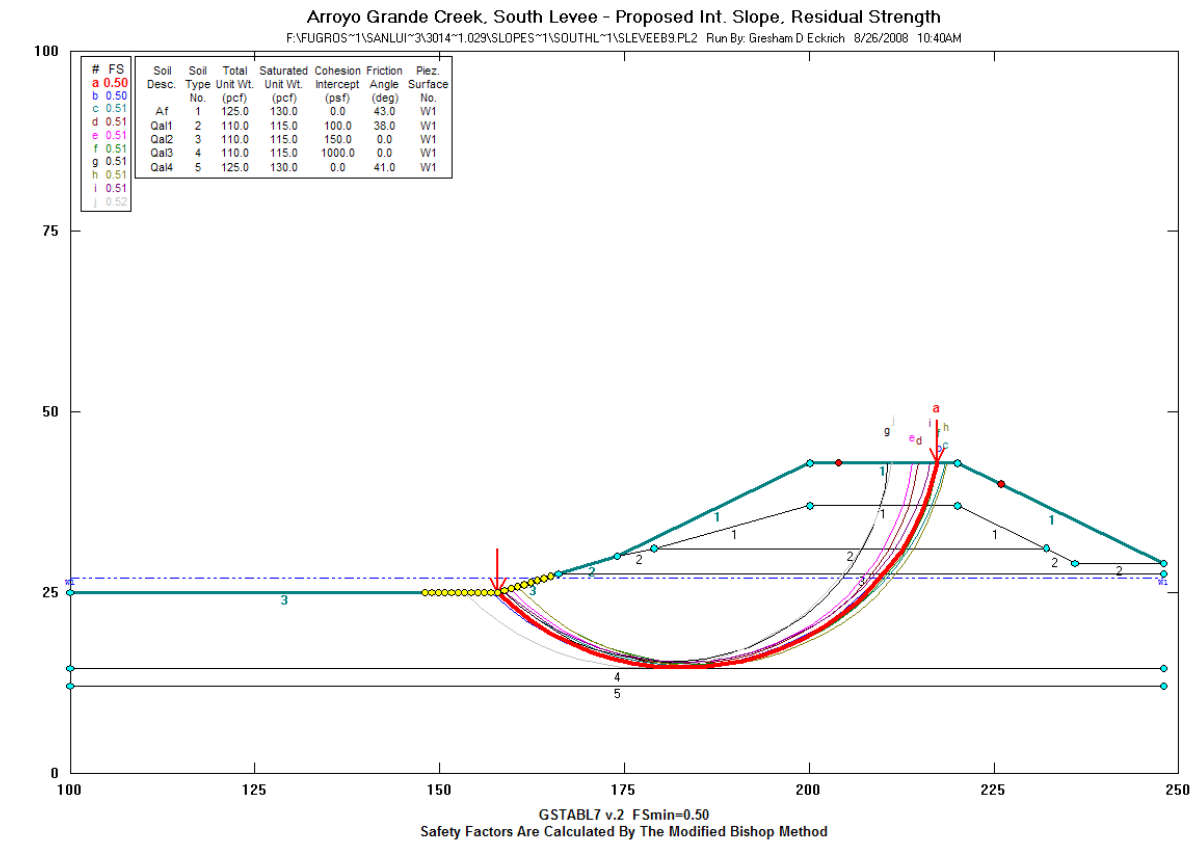
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 1.1

Condition: Existing Exterior Slope

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-21



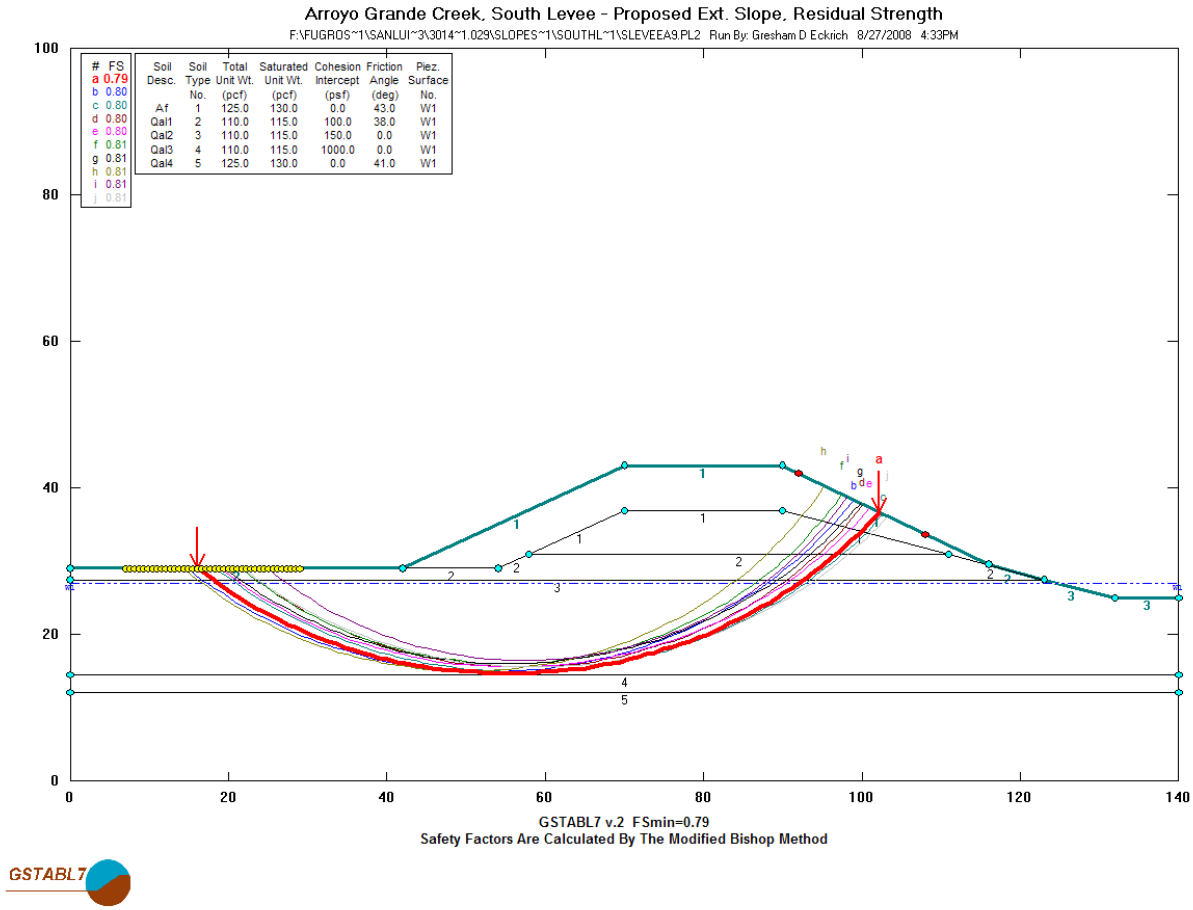
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 0.5

Condition: Proposed Interior Slope 1

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-22



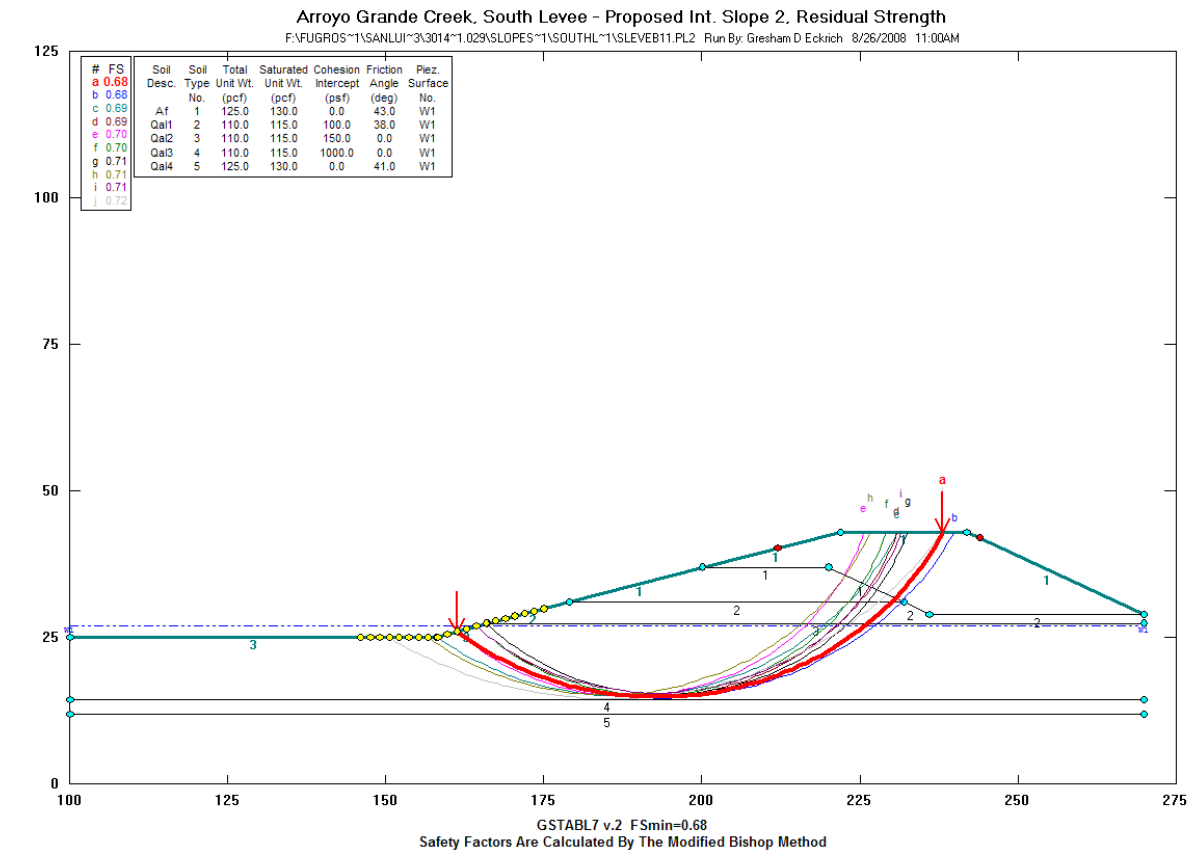
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 0.8

Condition: Proposed Exterior Slope 1

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-23



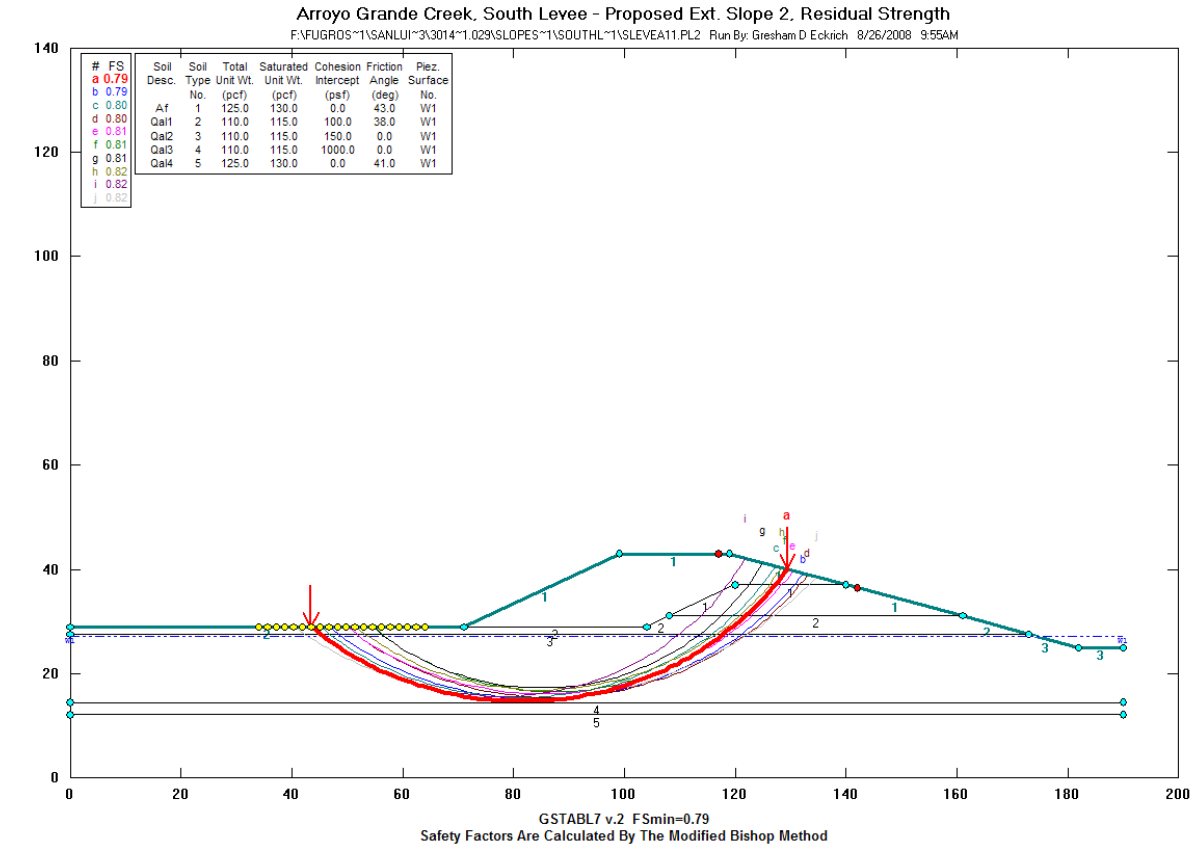
ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 0.7

Condition: Proposed Interior Slope 2

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-24



ESTIMATED FACTOR OF SAFETY

Post-Liquefaction Condition: 0.8

Condition: Proposed Exterior Slope 2

SLOPE STABILITY PLOT FOR SOUTH LEVEE EMBANKMENT
Arroyo Grande Creek Waterways Management Plan
San Luis Obispo County, California

PLATE D-25