Appendix A Public Comments and NOP

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
State Clearinghouse

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Gray Davis
GOVERNOR

Steven A. Nissen
DIRECTOR

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BY: A.D.

Notice of Preparation

October 29, 2001

To: Reviewing Agencies

Re: Berryessa Creek Project: Calaveras Boulevard to Old Piedmont Road, San Jose and Milpitas, California
SCH# 2001104013

Attached for your review and comment is the Notice of Preparation (NOP) for the Berryessa Creek Project: Calaveras Boulevard to Old Piedmont Road, San Jose and Milpitas, California draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Mr. Rene Langis
Santa Clara Valley Water District
Coyote Watershed Program Office
2471 Autumnvale Drive, Suite G
San Jose, CA 95131

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Katie Shulte Joung
Associate Planner, State Clearinghouse

Attachments
cc: Lead Agency

Document Details Report
State Clearinghouse Data Base

SCH#	**2001104013**
Project Title	Berryessa Creek Project: Calaveras Boulevard to Old Piedmont Road, San Jose and Milpitas, California
Lead Agency	U.S. Army Corps of Engineers

Type **NOP** Notice of Preparation

Description The action being taken is a General Reevaluation Report to study alternatives to increase the level of flood protection, reduce sediment load and maintenance requirements, enhance the ecosystem, and provide additional recreation opportunities in the cities of San Jose and Milpitas.

The project is intended to achieve the following objectives:

1) Improve flood protection in the cities of San Jose and Milpitas;
2) Reduce sedimentation and maintenance requirements in the creek;
3) Provide for recreational amenities;
4) Integrate ecosystem restoration into the project.

Lead Agency Contact

Name	Mr. Rene Langis		
Agency	Santa Clara Valley Water District		
Phone	408 586-0110	***Fax***	408 586-0101
email	rlangis@scvwd.dst.ca.us		
Address	Coyote Watershed Program Office 2471 Autumnvale Drive, Suite G		
City	San Jose	***State*** CA	***Zip*** 95131

Project Location

County	Santa Clara						
City							
Region							
Cross Streets	Old Piedmont Road, Calaveras Boulevard						
Parcel No.							
Township		***Range***		***Section***		***Base***	

Proximity to:

Highways	237
Airports	
Railways	
Waterways	
Schools	
Land Use	

Project Issues Flood Plain/Flooding; Vegetation; Wildlife; Aesthetic/Visual; Other Issues; Recreation/Parks; Landuse; Water Quality; Air Quality; Traffic/Circulation

Reviewing Agencies Resources Agency; Office of Historic Preservation; Department of Parks and Recreation; San Francisco Bay Conservation and Development Commission; Department of Water Resources; Department of Fish and Game, Region 3; Native American Heritage Commission; State Lands Commission; Caltrans, District 4; State Water Resources Control Board, Division of Water Rights; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 2

Date Received 10/29/2001 ***Start of Review*** 10/29/2001 ***End of Review*** 11/27/2001

Note: Blanks in data fields result from insufficient information provided by lead agency.

NOP Distribution List

County: Santa Clara **SCH#** 2001104013

Resources Agency

- [x] **Resources Agency**
  Nadell Gayou
- [ ] **Dept. of Boating & Waterways**
  Bill Curry
- [ ] **California Coastal Commission**
  Elizabeth A. Fuchs
- [ ] **Dept. of Conservation**
  Ken Trott
- [ ] **Dept. of Forestry & Fire Protection**
  Allen Robertson
- [x] **Office of Historic Preservation**
  Hans Kreutzberg
- [x] **Dept of Parks & Recreation**
  Resource Mgmt. Division
- [ ] **Reclamation Board**
  Pam Bruner
- [x] **S.F. Bay Conservation & Dev't. Comm.**
  Steve McAdam
- [x] **Resources Agency**
  Nadell Gayou
  Dept. of Water Resources

Health & Welfare

- [ ] **Health & Welfare**
  Wayne Hubbard
  Dept. of Health/Drinking Water

Food & Agriculture

- [ ] **Food & Agriculture**
  Tad Bell
  Dept. of Food and Agriculture

Fish and Game

- [ ] **Dept. of Fish & Game**
  Scott Flint
  Environmental Services Division
- [ ] **Dept. of Fish & Game 1**
  Donald Koch
  Region 1
- [ ] **Dept. of Fish & Game 2**
  Banky Curtis
  Region 2
- [x] **Dept. of Fish & Game 3**
  Robert Floerke
  Region 3
- [ ] **Dept. of Fish & Game 4**
  William Laudermilk
  Region 4
- [ ] **Dept. of Fish & Game 5**
  Don Chadwick
  Region 5, Habitat Conservation Program
- [ ] **Dept. of Fish & Game 6**
  Gabrina Gatchel
  Region 6, Habitat Conservation Program
- [ ] **Dept. of Fish & Game 6 I/M**
  Tammy Allen
  Region 6, Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Game M**
  Tom Napoli
  Marine Region

Independent Commissions

- [ ] **California Energy Commission**
  Environmental Office
- [x] **Native American Heritage Comm.**
  Debbie Treadway
- [ ] **Public Utilities Commission**
  Andrew Barnsdale
- [x] **State Lands Commission**
  Betty Silva
- [ ] **Governor's Office of Planning & Research**
  State Clearinghouse Planner

- [ ] **Colorado River Board**
  Gerald R. Zimmerman
- [ ] **Tahoe Regional Planning Agency (TRPA)**
  Lyn Barnett
- [ ] **Office of Emergency Services**
  John Rowden, Manager
- [ ] **Delta Protection Commission**
  Debby Eddy
- [ ] **Santa Monica Mountains Conservancy**
  Paul Edelman

Dept. of Transportation

- [ ] **Dept. of Transportation 1**
  IGR/Planning
  District 1
- [ ] **Dept. of Transportation 2**
  Vicki Roe
  Local, Development Review, District 2
- [ ] **Dept. of Transportation 3**
  Jeff Pulverman
  District 3
- [x] **Dept. of Transportation 4**
  Jean Finney
  District 4
- [ ] **Dept. of Transportation 5**
  Lawrence Newland
  District 5
- [ ] **Dept. of Transportation 6**
  Marc Birnbaum
  District 6
- [ ] **Dept. of Transportation 7**
  Stephen J. Buswell
  District 7
- [ ] **Dept. of Transportation 8**
  Mike Sim
  District 8
- [ ] **Dept. of Transportation 9**
  Caroline Yee for Kate Walton
  District 9
- [ ] **Dept. of Transportation 10**
  Chris Sayre
  District 10
- [ ] **Dept. of Transportation 11**
  Lou Salazar
  District 11
- [ ] **Dept. of Transportation 12**
  Aileen Kennedy
  District 12

Business, Trans & Housing

- [ ] **Housing & Community Development**
  Cathy Creswell
  Housing Policy Division
- [ ] **Caltrans - Division of Aeronautics**
  Sandy Hesnard
- [ ] **California Highway Patrol**
  Lt. Julie Page
  Office of Special Projects
- [ ] **Dept. of Transportation**
  Ron Helgeson
  Caltrans - Planning
- [ ] **Dept. of General Services**
  Robert Sleppy
  Environmental Services Section

Air Resources Board

- [ ] Airport Projects
  Jim Lerner
- [ ] Transportation Projects
  Ann Geraghty
- [ ] Industrial Projects
  Mike Tollstrup

- [ ] **California Integrated Waste Management Board**
  Sue O'Leary
- [ ] **State Water Resources Control Board**
  Diane Edwards
  Division of Clean Water Programs
- [ ] **State Water Resources Control Board**
  Greg Frantz
  Division of Water Quality
- [x] **State Water Resouces Control Board**
  Mike Falkenstein
  Division of Water Rights
- [x] **Dept. of Toxic Substances Control**
  CEQA Tracking Center

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
  Cathleen Hudson
  North Coast Region (1)
- [x] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] **RWQCB 3**
  Central Coast Region (3)
- [ ] **RWQCB 4**
  Jonathan Bishop
  Los Angeles Region (4)
- [ ] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)

25.4.5

October 27, 2001

NOTICE OF PREPARATION

For an Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) for the Berryessa Creek Project: Calaveras Boulevard to Old Piedmont Road San Jose and Milpitas, California

The U. S. Army Corps of Engineers (Corps) and the Santa Clara Valley Water District (District) are conducting a General Reevaluation Report for Berryessa Creek. The study will focus on alternatives to increase the level of flood protection, reduce sediment load, enhance the ecosystem within and along the creek, and provide for recreation opportunities. The Berryessa Creek watershed is located in Santa Clara County, south of San Francisco Bay. Berryessa Creek is a tributary to the Coyote Creek system, which flows into the southern end of San Francisco Bay. The Corps is the lead agency for environmental review under the National Environmental Policy Act (NEPA), and will be preparing a joint EIS/EIR. The District is the lead agency for environmental review under the California Environmental Quality Act (CEQA). The District wishes to know your views or those of your agency as to the scope and content of the environmental analysis that should be considered. For agencies, this information should be relevant to your agency's statutory responsibilities in connection with the proposed project. Some agencies will use the EIS/EIR when considering permit applications or other types of review and approval for this project.

The project description, location, and environmental effects that will be evaluated are discussed in the attached Project Description.

Please respond in writing or by electronic mail no later than **November 27, 2001** to indicate who the contact person at your agency will be. Send your response to the following person:

Mr. René Langis
Santa Clara Valley Water District
Coyote Watershed Program Office
2471 Autumnvale Drive, Suite G
San Jose, CA 95131
rlangis@scvwd.dst.ca.us

Additional information on this project including the Notice of Preparation will be posted soon on the District's website at www.heynoah.org.

Stanley M. Williams
Chief Executive Officer

Attachment

NOTICE OF PREPARATION
PROJECT DESCRIPTION

Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) for the Berryessa Creek Project

Introduction and Need for EIS/EIR

The Berryessa Creek Project (Project) is a joint project of the U.S. Army Corps of Engineers (Corps), Sacramento District, and the Santa Clara Valley Water District (District)). The Corps is the lead agency for compliance with the National Environmental Policy Act (NEPA), and the District is the lead agency for compliance with the California Environmental Quality Act (CEQA). These lead agencies have determined that the Berryessa Creek Project may have a significant impact on the quality of the environment, and have decided to prepare an EIS/EIR to provide ample opportunity for public disclosure and participation in the planning and decision-making process. The integrated document will include sufficient information for approval of the Project and compliance with NEPA and CEQA. The purpose of Draft EIS/EIR process is to develop and assess a recommended plan and alternatives for the Project, and to avoid and/or mitigate significant adverse effects on environmental resources. The EIS/EIR will address a reasonable range of alternatives, environmental effects of the alternatives, and compliance with related environmental laws and permits.

Project Description

The action being taken is a General Reevaluation Report to study alternatives to increase the level of flood protection, reduce sediment load and maintenance requirements, enhance the ecosystem, and provide additional recreation opportunities in the cities of San Jose and Milpitas. The Berryessa Creek watershed is located in Santa Clara County, south of San Francisco Bay. Berryessa Creek is a tributary to the Coyote Creek system, which flows into the southern end of San Francisco Bay. The watershed is about 22 square miles in area, and drains portions of the Diablo Range on the east side of the Santa Clara Valley. The reach of Berryessa Creek being studied for the General Reevaluation Report is approximately 4.5 miles in length, and extends from about 600 feet upstream of Old Piedmont Road in the City of San Jose down to Calaveras Boulevard (Highway 237) in the City of Milpitas, as shown in the attached figure.

The focus of the Berryessa Creek Project is to improve flood protection and reduce sedimentation while avoiding environment impacts and providing appropriate habitat restoration. The Project is intended to achieve the following objectives:

1) Improve flood protection in the cities of San Jose and Milpitas;
2) Reduce sedimentation and maintenance requirements in the creek;
3) Provide for recreational amenities;
4) Integrate ecosystem restoration into the project.

The Berryessa Creek Project was authorized for construction by the Water Resources Development Act (WRDA) of 1990. Prior studies on Berryessa Creek indicate that certain areas in San Jose and Milpitas continue to be at risk from a 100-year flood event. These studies also indicate that sediment deposition in the creek is a continual maintenance problem, and natural resources along the creek are degraded as a result of channeling and concrete lining of the creek. The General Reevaluation Report will address an array of project alternatives to address flooding and sedimentation issues, and provide ecosystem restoration when feasible. Alternatives to be analyzed will include a combination of one or more sediment reduction measures. These alternative measures may include levee work, off-line flood and sediment storage basins, adding vegetation along the creek, and improving or replacing culverts to improve flood conveyance and fish passage.

Possible Environmental Issues

Significant issues to be analyzed in depth in the EIS/EIR include appropriate levels of flood protection, potential adverse effects on vegetation and wildlife resources, special status species, aesthetics, cultural resources, recreation, land use, fisheries, water quality, air quality, transportation, socioeconomics, and cumulative effects of related projects in the study area. The Corps will consult with the State Historic Preservation Officer, and the U.S. Fish and Wildlife Service to provide a Wildlife Coordination Act Report as an appendix to the EIS/EIR.

Formal Scoping and Public Participation

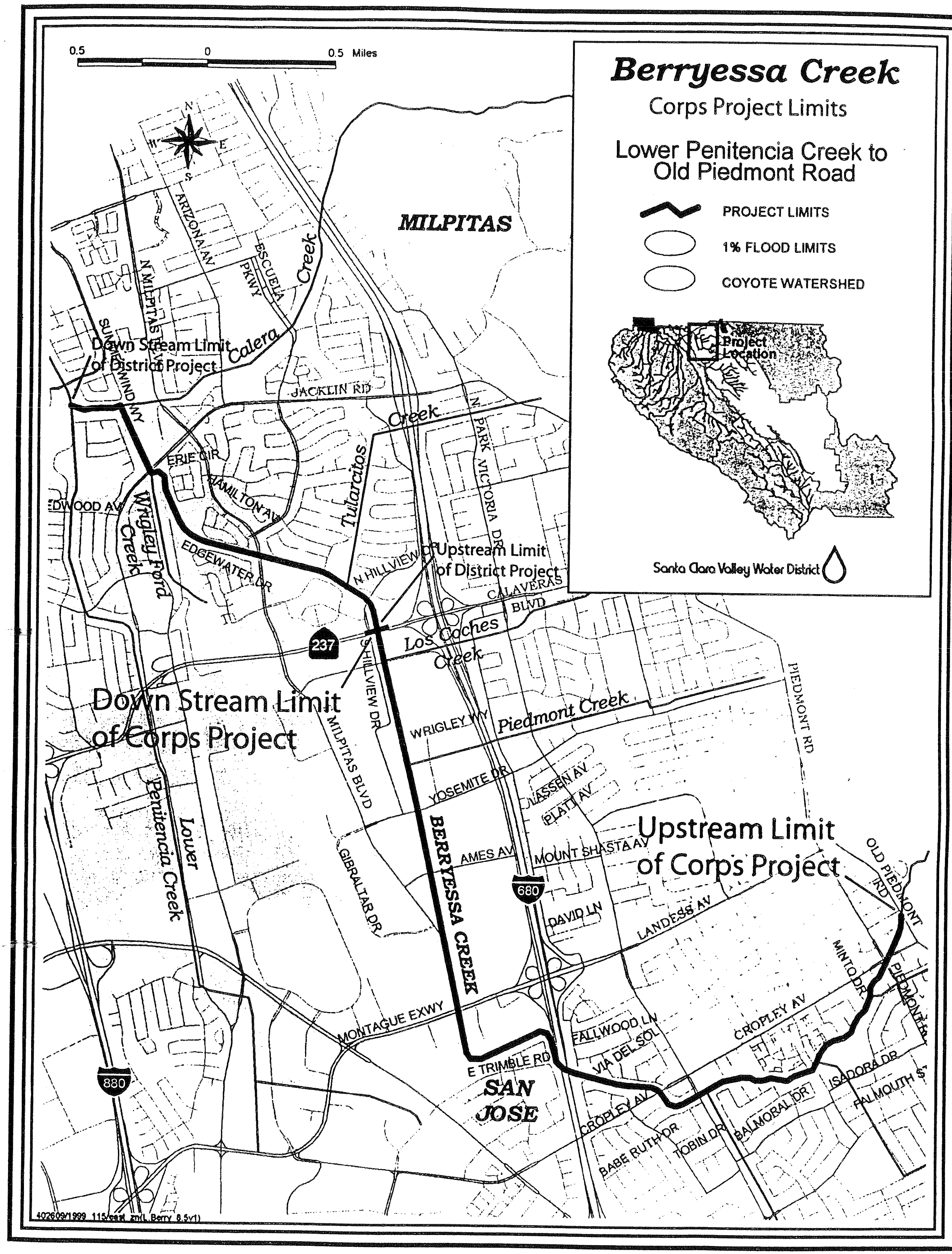
Federal, state, and local responsible and other agencies, and interested individuals, are encouraged to participate in the EIS/EIR scoping process. The Corps will file a Notice of Intent in the Federal Register, pursuant to NEPA requirements. A 30-day public scoping period under CEQA will commence on October 27, 2001, and end on November 27, 2001. Public comment is invited on the proposal to prepare the EIS/EIR, and on the scope of issues to be included in the EIS/EIR. A public scoping meeting is scheduled for November 7, 2001 at the location identified below. Concerned persons and organizations are invited to call or write to be included on the mailing list for public meetings or to receive other correspondence concerning the Berryessa Creek Project.

- The scoping meeting on November 7, 2001 will be from 7:00 to 9:00 p.m. at the City of Milpitas Police Department at 1275 North Milpitas Boulevard, Milpitas, California 95035.

All written comments should be submitted within 30 days of the published date of this notice to:

Mr. René Langis, Environmental Planner
Santa Clara Valley Water District, Coyote Watershed Program Office
2471 Autumnvale Drive, Suite G
San Jose, California, 95131

Rlangis@scvwd.dst.ca.us
Telephone: (408) 586-0110
Fax: (408) 586-0101



Berryessa Creek
Corps Project Limits
Lower Penitencia Creek to Old Piedmont Road
PROJECT LIMITS
1% FLOOD LIMITS
COYOTE WATERSHED
Project Location
Santa Clara Valley Water District
0.5
0
0.5 Miles
MILPITAS
SAN JOSE
Down Stream Limit of District Project
Upstream Limit of District Project
Down Stream Limit of Corps Project
Upstream Limit of Corps Project
Calera Creek
Creek
Tularcitos
Wrigley Ford Creek
Los Coches Creek
Piedmont Creek
Lower Penitencia Creek
BERRYESSA CREEK
ARIZONA AV
N MILPITAS BLVD
ESCUELA PKWY
SUNNYHILLS WINDY WY
JACKLIN RD
ERIE CIR
HAMILTON AV
EDWOOD AV
EDGEWATER DR
N HILLVIEW DR
N PARK VICTORIA DR
CALAVERAS BLVD
237
S HILLVIEW DR
MILPITAS BLVD
WRIGLEY WY
PIEDMONT RD
YOSEMITE DR
JASSEN AV
PLATT AV
MOUNT SHASTA AV
AMES AV
GIBRALTAR DR
680
DAVID LN
LANDESS AV
OLD PIEDMONT RD
MINTO DR
PIEDMONT RD
MONTAGUE EXWY
FALLWOOD LN
VIA DEL SOL
CROPLEY AV
E TRIMBLE RD
ISADORA DR
PALMOUTH ST
BALMORAL DR
TOBIN DR
BABE RUTH DR
CROPLEY AV
880
402609/1999 115/east zn(L.Berry 8.5v1)

SANTA CLARA COUNTY
STREAMS FOR TOMORROW
Post Office Box 1409
San Martin, California 95046

November 10, 2001

261741/4.2

G. Fowler
M. Klemencic
J. Ortiz
J. Gutierrez
Liz Holland
M. Hayden
File = 25.24

Dr. Rene Langis
Santa Clara Valley Water District
Coyote Watershed Program Office
2471 Autumnvale Drive, Suite G
San Jose, CA 95131

UPPER 4.9

Dear Dr. Langis:

Response to Notice of Preparation for an Environmental Impact Statement / Environmental Impact Report (EIS/EIR) for the Berryessa Creek Project: Calaveras Boulevard to Old Piedmont Road

We have the following comments for your consideration regarding the scope and content of the proposed draft EIS/EIR for the Berryessa Creek Project (Project).

It is difficult to provide specific comments and recommendations about the scope and content of the environmental review of the Project in the absence of a specific project description. Although the Notice of Preparation (NOP) includes the Project objectives and states that an array of project alternatives to address these objectives will be identified, no project-specific nor site-specific features are described. This circumstance limits comments at this time to a more general level of discussion.

The NOP states that studies indicate that "natural resources along the creek are degraded as a result of channeling and concrete lining of the creek." The Project should address this degradation by reducing the effects and features of channelization and eliminating existing concrete lining to the maximum extent possible. Project features should emphasize softscape approaches to bank stabilization and erosion control needs. Sediment reduction and management features should emphasize source controls and off-line sediment storage basins in addition to employing natural fluvial processes. All Project features should contribute to a substantial reduction in channel maintenance requirements.

All Project features for flood protection, bank stabilization and sediment reduction, should demonstrably contribute to ecosystem restoration.

The Preferred Project should be a channel design that uses natural fluvial processes to achieve ecosystem restoration to the maximum extent feasible, rather than a design that relies on engineered structures and regular maintenance. In this regard, if the Project requires extensive modification of the Berryessa Creek channel, the Project design should follow that of the Lower Silver Creek Project in providing, to the extent possible, "a multi-stage channel including a base flow channel formed by natural fluvial processes, a sediment transport channel sized to mobilize and transport sediment at an ecologically relevant frequency, and an effective in-channel floodplain to dissipate high flow energy and facilitate the natural formation of an appropriately sized base flow channel" (page 8, September 2001 Addendum to the IS/ND for the Lower Silver Creek Watershed Project).

An objective of the Project should be to design sediment transport features that employ natural processes so that sediment will be mobilized during flow events that are frequent enough to maintain fish and wildlife habitat diversity and complexity, while correspondingly reducing the frequency and magnitude of sediment removal maintenance in the main channel. Source controls and natural sediment transport processes are favored over in-channel sediment traps and basins that require frequent and extensive maintenance and channel disturbances.

Maintenance roads should not be located in the channel, and definitely not on the channel invert.

The EIS/EIR must describe the maintenance program for the Project and assess the environmental effects of any maintenance activity not already included in the District's Multi-Year Stream Maintenance Program (SMP). Any significant impacts from new maintenance activities must be mitigated in the EIS/EIR and incorporated into the SMP.

Since ecosystem restoration is a Project objective, the preferred project design should provide for the maximum amount of riparian and wetland vegetation along the creek as maintenance access requirements will allow. Plantings will not be limited to compensatory mitigation obligations. The Project offers an opportunity to establish extensive amounts of wetland and riparian vegetation, which will enhance local bird habitats. Recreational trails should be designed and sited to be consistent with maximizing the wildlife benefits of the riparian corridor.

Although Berryessa Creek apparently does not support nor has potential to support anadromous salmonids, such as steelhead trout, project features to provide fish passage at in-stream structures will benefit the local movements and migrations of resident fishes, thus contributing to ecosystem restoration.

The EIS/EIR will need to demonstrate in a comparative fashion that the preferred project is the least damaging alternative to wetland and riparian vegetation and the fish and wildlife resources of Berryessa Creek, and qualifies as the environmentally superior alternative under the California Environmental Quality Act.

Thank you for the opportunity to comment on the subject NOP. If you have questions about our comments, please contact me at the letterhead address or telephone number (408) 683-4330 (voice and fax).

When available, please send us a copy of the draft EIS/EIR.

Sincerely,

Keith R. Anderson

Keith R. Anderson
Environmental Advocate

STATE OF CALIFORNIA - BUSINESS, TRANSPORTATION AND HOUSING AGENCY GRAY DAVIS, *Governor*

DEPARTMENT OF TRANSPORTATION
P O BOX 23660
OAKLAND, CA 94623-0660
Tel: (510) 286-4444
Fax: (510) 286-5513
TDD (510) 286-4454

RECEIVED
NOV 29 2001
BY: AD

November 21, 2001

SCL-General
SCL000140
SCH 2001104013
261741/4.2

Mr. Rene' Langis
Santa Clara Valley Water District
Coyote Watershed Program Office
2471 Autumnvale Drive, Suite G
San Jose, CA 95131

Dear Mr. Langis:

Berryessa Creek Project: Calaveras Blvd. to Old Piedmont Rd. – Notice of Preparation (NOP)

Thank you for including the California Department of Transportation (Department) in the environmental review process for the proposed project. We have examined the NOP and have the following comment:

The Berryessa Creek Project should accommodate the Department's existing storm drainage facilities at each of the State highway bridge crossings.

We look forward to reviewing the Draft Environmental Impact Report (DEIR) and any relevant project plans or engineering reports for this project. We do expect to receive a copy of the DEIR from the State Clearinghouse, but in order to expedite our review, you may send two copies in advance to:

Maija Cottle
Office of Transportation Planning B
Department of Transportation, District 4
P.O. Box 23660
Oakland, CA 94623-0660

Should you require further information or have any questions regarding this letter, please call Maija Cottle, of my staff at (510) 286-5737.

Sincerely,

RANDELL H. IWASAKI
Acting District Director

By Jean CR Finney

JEAN C. R. FINNEY
District Branch Chief
IGR/CEQA

c: Katie Shulte Joung (State Clearinghouse)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

May 6, 2013

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

Attention: Tyler Stalker

Subject: Draft Environmental Impact Statement for the Berryessa Creek Project, Santa Clara County, California (CEQ # 2013068)

The U.S. Environmental Protection Agency (EPA) is providing comments on the Draft Environmental Impact Statement (DEIS) for the Berryessa Creek Project. Our comments are provided pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), our NEPA review authority under Section 309 of the Clean Air Act, and the provisions of the Federal Guidelines promulgated at 40 CFR 230 under Section 404(b)(1) of the Clean Water Act.

EPA provided scoping comments for this project in a letter dated January 3, 2002. We support the Corps' interest in developing an economically justified and environmentally sound flood protection project; however, we are concerned that the effect of sea-level rise on the project has not been sufficiently considered, as required by the Corps own Climate Change Adaptation Policy Statement. We are also concerned that the DEIS does not provide sufficient analysis of temperature effects and maintenance requirements for the project, nor provide sufficient assurance that the Corps is prepared for the possibility of encountering contamination during the project. Additionally, we ask the Corps to clarify whether any project alternatives preclude floodplain terracing and riparian revegetation in the Greenbelt Reach, upstream of the project area.

Based on our concerns about sea-level rise, water quality, and maintenance, we have rated the action alternatives Environmental Concerns – Insufficient Information (EC-2). The enclosed Detailed Comments elaborate on these concerns and our recommendations.

We appreciate the opportunity to review this DEIS. When the Final EIS is released for public review, please send one hard copy and one electronic copy to the address above (mail code: CED-2). If you have questions, please contact me at (415) 972-3521 or have your staff contact Tom Kelly at kelly.thomasp@epa.gov or (415) 972-3856.

Sincerely,

/s/

Kathleen Martyn Goforth, Manager
Environmental Review Office
Communities and Ecosystems Division

Enclosures: EPA's Detailed Comments
Summary of EPA's Rating Definitions

cc (via email): Dennis Cheong, Santa Clara Valley Water District
Shin-Roei Lee, Regional Water Quality Control Board, San Francisco Bay
Mark Johnson, Regional Water Quality Control Board, San Francisco Bay
Margarete Beth, Regional Water Quality Control Board, San Francisco Bay
Tami Schane, California Department of Fish and Wildlife

Sea-Level Rise

The DEIS does not appear to consider rising sea levels that will result from climate change. The Army Corps' own policy[1] states "it is the policy of USACE to integrate climate change adaptation planning and actions into our Agency's missions, operations, programs, and projects."

A San Francisco Bay Conservation Development Commission report[2] evaluated the impact of a 16-inch sea level rise by mid-century, and a 55-inch sea level rise by the end of the century to the San Francisco Bay shoreline. In regard to flood control projects, the report states:

> With higher Bay water levels and more extreme storm events, Bay water will intrude further into flood control channels making it more difficult for fresh water to drain rapidly from upland areas. This will increase flood risks in locations further upstream. More precise identification of upland areas near creeks and flood channels where this type of flooding may occur is needed for addressing future flood risks. Exploring alternative methods of flood control may be necessary.
>
> *Recommendation:*
> The FEIS should specifically consider the effects of rising sea level on the Berryessa Creek project.

Water Resources

Temperature Impacts

The DEIS notes that current temperatures, as high as 84.7^{o}F, reduce the habitat available to native fish and amphibians in Berryessa Creek, which prefer cooler temperatures (p.4-24). Water temperature is a key indicator of poor water quality in Berryessa Creek, yet the DEIS considers shading the creek as an "aesthetic feature" (p. 3-24). Only alternative 4/d appears to address high water temperatures by including more than 8 acres of trees and vegetation to shade the creek (p. 3-57). The benefits of shading proposed by this alternative are described as "less than significant," a "slightly decreased water temperature," (p. 5-20) and "minimal" (Table 5-10), but the DEIS provides no basis for these conclusions.

---

[1] USACE Climate Change Adaptation Policy Statement, effective June 3, 2011, <http://www.corpsclimate.us/docs/USACEAdaptationPolicy3June2011.pdf>

[2] Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline, San Francisco Bay Conservation and Development Commission, October 6, 2011 <http://www.bcdc.ca.gov/BPA/LivingWithRisingBayvst.pdf>

Recommendations:
The FEIS should include additional discussion, and if possible, quantification of the shading benefits of Alternative 4/d and consider the feasibility of modifying alternatives 2A/B and 2B/d to add trees to reduce the temperature of Berryessa Creek.

Cumulative Impacts

NEPA requires the evaluation of cumulative impacts that are reasonably foreseeable [40 CFR 1508.8]. The DEIS analyzed two alternatives, 2B/d and 4/d, that modeled a bypass channel upstream of Interstate 680 and the DEIS project area (p. 3-50). The bypass is a potential project of the Santa Clara Valley Water District, the local project sponsor for the Berryessa Creek Project. It would convey water around the Greenbelt Reach to alleviate flooding in the upper watershed (3-53). Given the modeling prepared to support it, the upstream bypass appears to be reasonably foreseeable project that could result in cumulative impacts that should have been described in greater detail in the DEIS.

The Santa Clara Valley Water District also investigated floodplain terrace and native riparian revegetation of the Greenbelt Reach as a way to provide flood protection and mitigation within the Greenbelt Reach. It was the focus of coordinated agency comments by EPA and the San Francisco Bay Regional Water Quality Control Board (RWQCB) in support of a terracing and revegetation approach at the Corps' Upper Berryessa F4A conference held on August 17, 2006. At that time, it was also considered a potential element of the Corps' Berryessa Creek Project. While we understand the reason that flood control measures upstream of I-680 were not considered in the DEIS (i.e., the Corps' "800 cfs rule" and the lack of economic justification, p. 3-47 and 3-48), we seek to ensure that the Corps' project will not preclude Greenbelt terracing and revegetation, which EPA and RWQCB have supported.

Recommendation:
The FEIS should discuss the cumulative impacts of the Greenbelt bypass, and clarify whether any of the project alternatives would preclude floodplain terracing and riparian revegetation of the Greenbelt Reach.

Groundwater Contamination

The DEIS acknowledges Jones Chemical Company and Great Western Chemical Company as sources of hazardous, toxic and radiologic waste. Based on discussions with the RWQCB, the Corps is likely to encounter contamination from the Jones Chemical site[3]. While the DEIS discusses the potential to encounter contamination from these sites (5-19), and mentions the preparation of Best Management Plans to minimize impacts, it provides no discussion of treatment technologies, permitting requirements, appropriate discharge limits nor reuse potential (e.g. dust control). Without adequate preparation, unexpectedly encountering contaminated groundwater during de-watering could cause project delays and

[3] Person communication between Mark Johnson, RWQCB, San Francisco Bay and Tom Kelly, U.S. EPA, on April 11, 2013.

cost increases. Additionally, dewatering wells could draw contaminated groundwater away from remediation wells designed to contain the plume.

> *Recommendations:*
> The Army Corps should coordinate closely with the Regional Water Quality Control Board, so that dewatering does not unexpectedly withdraw contaminated groundwater nor expand the plume beyond the control of wells designed to control contaminant migration.
>
> The FEIS should include Best Management Plans for the treatment and discharge of contaminated groundwater, or an outline of the plan that would be developed later.
>
> The FEIS should discuss requirements for treatment and discharge of contaminated groundwater.
>
> The FEIS should clearly describe the circumstances under which potentially contaminated soil would be sampled, and contaminated soil would be managed as hazardous waste rather than redeposited in levees or the adjacent road base.

Permanent Impacts

The DEIS included more discussion of the construction impacts than operational impacts of the project. As the DEIS frequently noted, construction impacts are temporary, so an added focus on operational impacts may be more informative for the Corp's decision-maker.

> *Recommendation:*
> The FEIS should expand the discussion of permanent impacts, such as sediment loading, nutrient loading, temperature, and stream velocities, particularly where more detailed information is available in appendices.

The Environmentally Preferred Alternative

The DEIS selects Alternative 2A/d as the environmental preferred (and environmentally superior under CEQA) alternative (p. 5-68), but includes no discussion of the relative magnitude of benefits and adverse effects (e.g. temperature, sediment loading and maintenance) of each alternative.

> *Recommendation:*
> The FEIS should explain the basis for the selection of Alternative 2A/d as the environmentally preferred alternative.

Tree Removal and Mitigation

The DEIS discusses the need for tree removal (e.g. p. 3-24). Because Berryessa Creek is a water of the state, the Regional Board may require mitigation when trees are shading the creek, which does not appear to be discussed. The DEIS does describe the Corps Levee Vegetation Management Policy on page 3-48, which requires a "15-foot vegetation-free zone outside of the proposed levee toes or floodwalls." The levee vegetation policy potentially conflicts with, or limits, opportunities to mitigate tree removals along the creek.

Recommendations :
Discuss, in the FEIS, the impact of the Levee Vegetation Management Policy on the Corps' obligations to mitigate tree removals and other impacts that increase water temperature.

Identify, in the FEIS, trees to be removed as part of the project, for which mitigation of the removal would be required by state or local regulations.

Maintenance

One of the goals of the project is reducing maintenance following project construction (p. 1-1). Current maintenance is described as "sediment removal activities designed to restore flood conveyance capacity, vegetation management in and around streams and canals, and bank protection" (p. 4-30). While Table 6-11 lists the annual maintenance costs for each alternative, the DEIS does not specify the activities associated with the maintenance costs. It does explain that Alternatives 2A/d and 2B/d include an access road built inside levees and floodwalls (p. 3-51 and 3-53), making maintenance less expensive (p. 3-57), but the DEIS does not clarify the reason maintenance of Alternative 2A/d is less than Alternative 2B/d. Additionally, Alternative 4 includes 15-foot vegetation-free zones on the outside of both floodwalls, which would allow relatively easy access for maintenance. While the road inside the levee would allow for easy access, it likely would result in additional costs, because the road could be overtopped as frequently as once every 10 years (0.1 to 0.04 exceedance probability, p. 3-53).

Recommendation:
The FEIS should include a breakdown of maintenance activities, frequency, extent and costs, as well as any assumptions used to estimate costs.

Air Quality

We acknowledge that the air quality impacts of the NED Plan, Alternative A2/d, are less than significant, and the DEIS includes a thorough list of mitigation measures addressing air quality (p. 5-9 to 5-11). The Corps could further reduce the project's emissions and possibly reduce complaints through careful planning and the use of clean diesel equipment meeting the most stringent of applicable Federal[4] or State Standards[5].

Recommendations:
Commit, in the FEIS, to:

- Request that bidding construction contractors provide information on emissions from construction equipment (e.g. Tier 3 off-road diesel engines or engines retrofitted to meet equivalent emissions) and give preference

[4] EPA's website for nonroad mobile sources is http://www.epa.gov/nonroad/.
[5] For ARB emissions standards, see: http://www.arb.ca.gov/msprog/offroad/offroad.htm.

(among other factors such as low cost) to contractors employing clean construction fleets.

- Avoid the use of portable generators where power can be practically obtained from the local power grid.

- Develop a construction traffic and parking management plan that minimizes traffic interference and maintains traffic flow.

Include, in the FEIS, a map of the sensitive receptors mentioned in the DEIS, and commit to locate operating construction equipment and staging zones away from these sensitive receptors (e.g. the opposite side of the creek), to the extent practicable.

Editorial Note

Several pages (e.g. 3-55) include a note at the top stating, "[t]he information is distributed solely for the purpose of pre-dissemination peer review under applicable information quality guidelines. It has not been formally disseminated by the Corps. It does not represent and should not be construed to represent any agency determination or policy." This note should be removed from the FEIS.

Appendix B Air Quality Model Data Sheets

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Berryessa 2A/2A+ R123				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	2.2	12.3	17.7	20.8	0.8	20.0	4.9	0.8	4.2	2,263.1
Grading/Excavation	8.9	48.1	99.2	24.5	4.5	20.0	8.2	4.0	4.2	12,526.5
Drainage/Utilities/Sub-Grade	7.3	38.7	66.8	23.6	3.6	20.0	7.4	3.3	4.2	7,614.6
Paving	3.4	19.1	26.0	1.7	1.7	-	1.6	1.6	-	3,384.1
Maximum (pounds/day)	8.9	48.1	99.2	24.5	4.5	20.0	8.2	4.0	4.2	12,526.5
Total (tons/construction project)	0.9	4.9	9.1	2.7	0.4	2.2	0.9	0.4	0.5	1,110.1

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (acres) -> 19
Maximum Area Disturbed/Day (acres) -> 2
Total Soil Imported/Exported (yd^3/day)-> 417

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Berryessa 2A/2A+ R123				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	1.0	5.6	8.0	9.5	0.4	9.1	2.2	0.3	1.9	1,028.7
Grading/Excavation	4.0	21.9	45.1	11.1	2.0	9.1	3.7	1.8	1.9	5,693.9
Drainage/Utilities/Sub-Grade	3.3	17.6	30.4	10.7	1.6	9.1	3.4	1.5	1.9	3,461.2
Paving	1.6	8.7	11.8	0.8	0.8	-	0.7	0.7	-	1,538.2
Maximum (kilograms/day)	4.0	21.9	45.1	11.1	2.0	9.1	3.7	1.8	1.9	5,693.9
Total (megagrams/construction project)	0.8	4.4	8.2	2.4	0.4	2.0	0.8	0.4	0.4	1,006.9

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (hectares) -> 8
Maximum Area Disturbed/Day (hectares) -> 1
Total Soil Imported/Exported (meters^3/day)-> 319

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Berryessa 2A/2A+ R4 Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	1.8	10.6	16.4	20.7	0.7	20.0	4.8	0.7	4.2	2,016.8
Grading/Excavation	8.2	44.3	88.2	24.2	4.2	20.0	8.0	3.8	4.2	9,814.8
Drainage/Utilities/Sub-Grade	6.9	35.8	65.3	23.5	3.5	20.0	7.3	3.2	4.2	7,052.1
Paving	3.0	16.5	24.6	1.6	1.6	-	1.5	1.5	-	2,890.8
Maximum (pounds/day)	8.2	44.3	88.2	24.2	4.2	20.0	8.0	3.8	4.2	9,814.8
Total (tons/construction project)	0.8	4.5	8.4	2.7	0.4	2.2	0.9	0.4	0.5	927.9

Notes:

Project Start Year ->	2017
Project Length (months) ->	12
Total Project Area (acres) ->	10
Maximum Area Disturbed/Day (acres) ->	2
Total Soil Imported/Exported (yd^3/day)->	105

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Berryessa 2A/2A+ R4 Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	0.8	4.8	7.4	9.4	0.3	9.1	2.2	0.3	1.9	916.7
Grading/Excavation	3.7	20.1	40.1	11.0	1.9	9.1	3.6	1.7	1.9	4,461.3
Drainage/Utilities/Sub-Grade	3.1	16.3	29.7	10.7	1.6	9.1	3.3	1.4	1.9	3,205.5
Paving	1.4	7.5	11.2	0.7	0.7	-	0.7	0.7	-	1,314.0
Maximum (kilograms/day)	3.7	20.1	40.1	11.0	1.9	9.1	3.6	1.7	1.9	4,461.3
Total (megagrams/construction project)	0.8	4.0	7.6	2.4	0.4	2.0	0.8	0.3	0.4	841.6

Notes:

Project Start Year ->	2017
Project Length (months) ->	12
Total Project Area (hectares) ->	4
Maximum Area Disturbed/Day (hectares) ->	1
Total Soil Imported/Exported ($meters^3$/day)->	80

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Berryessa 2B R123 Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	2.2	12.3	17.7	20.8	0.8	20.0	4.9	0.8	4.2	2,263.1
Grading/Excavation	8.9	48.4	102.2	24.6	4.6	20.0	8.2	4.0	4.2	13,188.5
Drainage/Utilities/Sub-Grade	7.3	38.7	66.8	23.6	3.6	20.0	7.4	3.3	4.2	7,614.6
Paving	3.4	19.1	26.0	1.7	1.7	-	1.6	1.6	-	3,384.1
Maximum (pounds/day)	8.9	48.4	102.2	24.6	4.6	20.0	8.2	4.0	4.2	13,188.5
Total (tons/construction project)	0.9	4.9	9.2	2.7	0.5	2.2	0.9	0.4	0.5	1,145.0

Notes:		
	Project Start Year ->	2017
	Project Length (months) ->	12
	Total Project Area (acres) ->	19
	Maximum Area Disturbed/Day (acres) ->	2
	Total Soil Imported/Exported (yd^3/day)->	514

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Berryessa 2B R123 Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	1.0	5.6	8.0	9.5	0.4	9.1	2.2	0.3	1.9	1,028.7
Grading/Excavation	4.1	22.0	46.4	11.2	2.1	9.1	3.7	1.8	1.9	5,994.8
Drainage/Utilities/Sub-Grade	3.3	17.6	30.4	10.7	1.6	9.1	3.4	1.5	1.9	3,461.2
Paving	1.6	8.7	11.8	0.8	0.8	-	0.7	0.7	-	1,538.2
Maximum (kilograms/day)	4.1	22.0	46.4	11.2	2.1	9.1	3.7	1.8	1.9	5,994.8
Total (megagrams/construction project)	0.8	4.4	8.4	2.4	0.4	2.0	0.8	0.4	0.4	1,038.6

Notes:		
	Project Start Year ->	2017
	Project Length (months) ->	12
	Total Project Area (hectares) ->	8
	Maximum Area Disturbed/Day (hectares) ->	1
	Total Soil Imported/Exported ($meters^3$/day)->	393

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Berryessa 2B R4				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	1.8	10.6	16.4	20.7	0.7	20.0	4.8	0.7	4.2	2,016.8
Grading/Excavation	8.2	44.4	89.3	24.2	4.2	20.0	8.0	3.8	4.2	10,067.4
Drainage/Utilities/Sub-Grade	6.9	35.8	65.3	23.5	3.5	20.0	7.3	3.2	4.2	7,052.1
Paving	3.0	16.5	24.6	1.6	1.6	-	1.5	1.5	-	2,890.8
Maximum (pounds/day)	8.2	44.4	89.3	24.2	4.2	20.0	8.0	3.8	4.2	10,067.4
Total (tons/construction project)	0.8	4.5	8.4	2.7	0.4	2.2	0.9	0.4	0.5	941.2

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (acres) -> 10
Maximum Area Disturbed/Day (acres) -> 2
Total Soil Imported/Exported (yd^3/day)-> 142

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Berryessa 2B R4				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	0.8	4.8	7.4	9.4	0.3	9.1	2.2	0.3	1.9	916.7
Grading/Excavation	3.7	20.2	40.6	11.0	1.9	9.1	3.6	1.7	1.9	4,576.1
Drainage/Utilities/Sub-Grade	3.1	16.3	29.7	10.7	1.6	9.1	3.3	1.4	1.9	3,205.5
Paving	1.4	7.5	11.2	0.7	0.7	-	0.7	0.7	-	1,314.0
Maximum (kilograms/day)	3.7	20.2	40.6	11.0	1.9	9.1	3.6	1.7	1.9	4,576.1
Total (megagrams/construction project)	0.8	4.1	7.7	2.4	0.4	2.0	0.8	0.3	0.4	853.7

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (hectares) -> 4
Maximum Area Disturbed/Day (hectares) -> 1
Total Soil Imported/Exported ($meters^3$/day)-> 109

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Berryessa 4 R123				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	2.2	12.3	17.7	20.8	0.8	20.0	4.9	0.8	4.2	2,263.1
Grading/Excavation	9.0	48.9	107.9	24.7	4.7	20.0	8.3	4.1	4.2	14,471.6
Drainage/Utilities/Sub-Grade	7.3	38.7	66.8	23.6	3.6	20.0	7.4	3.3	4.2	7,614.6
Paving	3.4	19.1	26.0	1.7	1.7	-	1.6	1.6	-	3,384.1
Maximum (pounds/day)	9.0	48.9	107.9	24.7	4.7	20.0	8.3	4.1	4.2	14,471.6
Total (tons/construction project)	0.9	4.9	9.5	2.7	0.5	2.2	0.9	0.4	0.5	1,212.8

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (acres) -> 19
Maximum Area Disturbed/Day (acres) -> 2
Total Soil Imported/Exported (yd^3/day)-> 702

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Berryessa 4 R123				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	1.0	5.6	8.0	9.5	0.4	9.1	2.2	0.3	1.9	1,028.7
Grading/Excavation	4.1	22.2	49.1	11.2	2.1	9.1	3.8	1.9	1.9	6,578.0
Drainage/Utilities/Sub-Grade	3.3	17.6	30.4	10.7	1.6	9.1	3.4	1.5	1.9	3,461.2
Paving	1.6	8.7	11.8	0.8	0.8	-	0.7	0.7	-	1,538.2
Maximum (kilograms/day)	4.1	22.2	49.1	11.2	2.1	9.1	3.8	1.9	1.9	6,578.0
Total (megagrams/construction project)	0.8	4.5	8.6	2.5	0.4	2.0	0.8	0.4	0.4	1,100.0

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (hectares) -> 8
Maximum Area Disturbed/Day (hectares) -> 1
Total Soil Imported/Exported ($meters^3$/day)-> 537

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for -> Berryessa 4 R4 Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	1.8	10.6	16.4	20.7	0.7	20.0	4.8	0.7	4.2	2,016.8
Grading/Excavation	8.3	44.5	90.0	24.2	4.2	20.0	8.0	3.8	4.2	10,217.5
Drainage/Utilities/Sub-Grade	6.9	35.8	65.3	23.5	3.5	20.0	7.3	3.2	4.2	7,052.1
Paving	3.0	16.5	24.6	1.6	1.6	-	1.5	1.5	-	2,890.8
Maximum (pounds/day)	8.3	44.5	90.0	24.2	4.2	20.0	8.0	3.8	4.2	10,217.5
Total (tons/construction project)	0.8	4.5	8.5	2.7	0.4	2.2	0.9	0.4	0.5	949.2

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (acres) -> 10
Maximum Area Disturbed/Day (acres) -> 2
Total Soil Imported/Exported (yd^3/day)-> 164

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Berryessa 4 R4 Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	0.8	4.8	7.4	9.4	0.3	9.1	2.2	0.3	1.9	916.7
Grading/Excavation	3.8	20.2	40.9	11.0	1.9	9.1	3.6	1.7	1.9	4,644.3
Drainage/Utilities/Sub-Grade	3.1	16.3	29.7	10.7	1.6	9.1	3.3	1.4	1.9	3,205.5
Paving	1.4	7.5	11.2	0.7	0.7	-	0.7	0.7	-	1,314.0
Maximum (kilograms/day)	3.8	20.2	40.9	11.0	1.9	9.1	3.6	1.7	1.9	4,644.3
Total (megagrams/construction project)	0.8	4.1	7.7	2.4	0.4	2.0	0.8	0.4	0.4	860.9

Notes: Project Start Year -> 2017
Project Length (months) -> 12
Total Project Area (hectares) -> 4
Maximum Area Disturbed/Day (hectares) -> 1
Total Soil Imported/Exported ($meters^3$/day)-> 125

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Appendix C Wetlands/Other Waters of the U.S./Waters of the State Delineation Report

UPPER BERRYESSA CREEK
FLOOD RISK MANAGEMENT PROJECT
SANTA CLARA COUNTY, CALIFORNIA

WETLANDS/OTHER WATERS OF THE U.S./WATERS OF THE STATE
DELINEATION REPORT

PREPARED FOR:

Santa Clara Valley Water District

Prepared by:

TETRA TECH

In compliance with Subtask 2.2 of Agreement A3740G dated July 1, 2014

April 2015

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A. PROJECT BACKGROUND AND OBJECTIVES

The Upper Berryessa Creek Flood Control Project, sponsored by the U.S. Army Corps of Engineers and the Santa Clara Valley Water District (SCVWD), would provide improved flood protection along a 2.1-mile stretch of Berryessa Creek between Interstate 680 and Calaveras Blvd (Appendix A, Figure 1). Improvements would include a larger channel with greater capacity, increased flow capacity through culverts, and raised floodwalls in place of levees in certain locations. Construction would occur over two years, with in-channel construction occurring during the dry season of April through October. Because components of the proposed project will occur within the Berryessa Creek stream channel, there is potential for impacts on Wetlands and Other Waters of the U.S. and stream components under the jurisdiction of the California Department of Fish and Wildlife (CDFW).

The goal of this Wetlands/Waters of the U.S./Waters of the State delineation is to update the Wetlands Delineation Report for the larger Berryessa Creek Project prepared by the U.S. Army Corps of Engineers in April 2005 (USACE 2005a) and document resources in the survey area that may fall under the jurisdiction of the U.S. Army Corps of Engineers (USACE), the Regional Water Quality Control Board (RWQCB), or the California Department of Fish and Wildlife (CDFW). The 2005 delineation identified two relatively small patches of wetlands and reported the balance of the area as being Waters of the United States (WoUS). One of the key differences between the 2005 delineation report and this report is that the 2005 delineation report was prepared before the Regional Supplement (Arid West Region) (USACE 2008) was published, whereas the current report reflects guidance in the Regional Supplement. Therefore, methods for gathering and reporting wetlands/waters data are different between the two reports. Also, the original delineation report included a much longer stretch of stream than the current report, and assessed the stretch of stream from Old Piedmont Road to about 50’ downstream of Calaveras Blvd. The survey area includes the stream bed and banks, extending laterally to the upland edge of riparian vegetation supported by the stream. Key outcomes of this survey and report include the delineation of all wetlands present, and establishing classification and rating based on functions and values. Other Waters of the U.S. are also identified by establishing ordinary high water marks (OHWM), and classified according to their characteristics, function, and value. Stream waters falling under the jurisdiction of RWQCB and CDFW are established using similar parameters but may extend beyond the limits of federal jurisdiction.

B. SITE DESCRIPTION AND LANDSCAPE SETTING

Upper Berryessa Creek is located in the South San Francisco Bay area of California, in Santa Clara County, California, and is a tributary to Lower Berryessa Creek, Lower Penitencia Creek, and Coyote Creek, which ultimately flow into the southern end of San Francisco Bay. The Berryessa Creek watershed is about 22 square miles, draining the east side of Santa Clara Valley. Appendix A, Figure 1, provides the project vicinity and location. It includes Los Coches Creek and Piedmont Creek, which enter Upper Berryessa Creek approximately 800 feet and 2400 feet upstream of Calaveras Boulevard, which marks the downstream end of the project area. The lowermost 400 feet of Los Coches Creek and the lowermost 80 feet of Piedmont Creek are included in the project area and are assessed in this report.

The headwaters of Berryessa Creek are located in the Los Buellis Hills of the Diablo Range. Once the creek leaves the foothills of the Diablo Range, it flows through the Cities of San Jose and Milpitas, eventually making its way to San Francisco Bay. Previous flood control efforts and adjacent development have significantly altered Upper Berryessa Creek. Levees and concrete-lined portions of the stream channel have resulted in significant modification and channelization (Appendix C, Photos 1 and 2, please note that photos are presented in the Appendix in the order referenced herein). The creek flows through numerous culverts at road crossings and the gradient is controlled by several engineered drop structures. Upper Berryessa Creek is identified as an intermittent blue-line water by the U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2014) Upper Berryessa Creek flows throughout its length during the rainy season, especially after heavy rainfalls. Portions of the creek may retain water throughout the year as a result of summer runoff from urban areas. Upper Berryessa Creek is not tidally influenced, nor does it generally contain common wetland characteristics. Rather, it functions more as a riverine system, therefore characteristics of jurisdictional waters within the stream are more typical of a riverine system than an emergent wetland system.

The project area is surrounded by residential and commercial development and encompasses a 2.1 mile length of Upper Berryessa Creek (Appendix C, Photo 3), beginning on the west side of Interstate Highway 680, and ending about 50 feet downstream of Calaveras Boulevard. Two tributaries merge with Berryessa Creek within the project area: Arroyo De Los Coches and Piedmont Creek (USGS 2014). The Section, Township, and Range for the project area is Mount Diablo Meridian T6S, R1E, Sections 5, 8, and 17.

For the purposes of the proposed project, the project area has been divided into four reaches (Appendix A, Figure 1). From downstream to upstream, Reach 1 extends from 50 feet downstream of Calaveras Boulevard to Los Coches Creek, Reach 2 is from Los Coches Creek to Piedmont Creek, Reach 3 is from Piedmont Creek to Montague Expressway, and Reach 4 is from Montague Expressway to Interstate Highway 680.

C. EXISTING CONDITIONS

Vegetation

Vegetation in the proposed project area is highly disturbed, and species composition varies by location relative to the active channel, but retains a relatively uniform composition throughout the length of the system. Three plant community types are present in the survey area, including (1) open water/aquatic, (2) fringing wetland, and (3) herb-dominated upland. All plant communities are dominated by exotic species, are highly disturbed, and are of low quality (Appendix C, Photo 4). The SCVWD actively maintains the vegetation within the project area to ensure sufficient hydrologic conveyance. Maintenance practices include mechanical removal of vegetation and sediment from the bottom of the channel and the use of herbicides on the creek banks. Frequent spraying or mowing of creek bank vegetation prevents the establishment of woody riparian species as well as succession of vegetation types. Flashy winter flows move through the channelized system and scour vegetation from the active stream channel. Tree species are occasionally present within the survey area, primarily along levee roads and within 25 feet from top of bank, but have higher densities in adjacent areas outside of the proposed project footprint. Vegetation is much denser in Reaches 1 and 2, downstream of Piedmont Creek. The vegetation present in each reach is discussed below.

Reach 1 (Downstream of Calaveras Boulevard)

Reach 1, where it extends 50 feet downstream of Calaveras Boulevard, has the least-disturbed vegetation despite being in a highly managed area (Appendix C, Photos 5 and 6). This is likely due to the presence of flowing water and a wider, split channel morphology. In-channel vegetation is dominated by wetland grasses and forbs including tall flatsedge (*Cyperus eragrostis*), spotted lady's thumb (*Polygonum persicaria*), willow smartweed (*P. lapathifolium*), American brooklime (*Veronica americana*), barnyard grass (*Echinochloa* sp.), and common cattail (*Typha latifolia*). Aquatic species include Gila River water hyssop (*Bacopa eisenii*) and watercress (*Rorippa nasturtium-aquaticum*). Upslope of the OHWM, common species include wild radish (*Raphanus sativus*), and giant horsetail (*Equisetum telmateia*). The surrounding upland community is maintained and consists of weedy non-woody species such as black mustard (*Brassica nigra*), cheeseweed mallow (*Malva parviflora*), wild oat (*Avena fatua*), ripgut brome (*Bromus diandrus*), rescue grass (*Bromus catharticus*), and tumbleweed (*Amaranthus albus*). The only tree in this portion of Reach 1 is a single Peruvian peppertree (*Schinus molle*).

Reach 1 (Upstream of Calaveras Boulevard)

Reach 1, upstream of Calaveras Boulevard, is very similar to the adjoining downstream portion of the reach, with the exception that it is generally more channelized, narrow, and subsequently hosts only a thin fringing wetland along the creek channel (Appendix C, Photo 7). Species assemblages are also similar but the fringing wetland is dominated by the more weedy species such as spotted lady's thumb, American brooklime, barnyard grass, and rough cocklebur (*Xanthium strumarium*). Other vegetation communities are the same between the two portions of Reach 1.

Reach 2

Reach 2 is very similar to Reach 1 except that it has an even narrower channel, steeper stream banks, and a narrower fringing wetland along the creek channel (Appendix C, Photo 8). Although the species assemblage in the fringing wetland here is similar to Reach 1, plant densities are lower. One patch of red willow (*Salix laevigata*) saplings is present. The aquatic floating water primrose (*Ludwigia peploides*), is present in high density patches near the downstream end of Reach 2. Algae are ubiquitous in areas of open water, and likely due to slow flow through this reach. Patches of Himalayan blackberry (*Rubus armeniacus*) are present in the upland areas. Upland vegetation is the same as in Reach 1.

Reach 3

Reach 3 is located upstream of the confluence with Piedmont Creek and is mostly out of its hydrologic influence. With the exception of the downstream end and some isolated depressions, surface water was absent during the survey. The limited hydrology in Reach 3 reduces the extent of fringing wetland, and substantially reduces its distribution and density along much of its length (Appendix C, Photo 4). Where fringing wetland (and hydrology) are present, the same species assemblage and density is present as in Reach 2. Upstream, the dry open channel is very narrow and dominated by gravel and cobble with limited fringing wetland species present. Upland plants extend along the steep, highly incised channel slopes into the active stream channel in some areas.

Reach 4

Reach 4 is similar to the dry, upstream portion of Reach 3, and hosts primarily weedy upland species, very few fringing wetland species, and no aquatic species (Appendix C, Photos 1 and 9). Trees are present on the edge of the channel in places and include coast live oak (*Quercus agrifolia*), holly oak (*Q. ilex*), Fremont cottonwood (*Populus fremontii*), and elm (*Ulmus* sp.). The majority of the plants present are the same non-woody weedy upland species observed in all other reaches. Little vegetation is present where the channel is concrete lined, and only includes weedy upland species.

Los Coches Creek

Because Los Coches Creek is an intermittent stream and generally has flow only during and shortly after rain events, conditions are similar to those in Reach 3 upstream of the Piedmont Creek confluence. An unvegetated low-flow channel approximately 2 feet wide occurs in this reach of Los Coches Creek, and the sparse vegetation found in the bed of the stream is similar to vegetation on the banks. Most of the vegetation is not hydrophytic. It is assumed that soils are similar to those in Upper Berryessa Creek and do not show hydric characteristics.

Piedmont Creek

Piedmont Creek has perennial flow and provides perennial flow to Upper Berryessa Creek downstream of Ames Avenue. Vegetation communities in Piedmont Creek are similar to those found in Reaches 1 and 2, and a short stretch of Reach 3, and include wetland plant communities found between the low-flow channel and the banks. The banks support upland plant communities starting at or below the OHWM.

Soils

The soil survey report of the survey area (NRCS 1903, 2014b) indicates that four soil types (i.e., map units) are present in the survey area; all are Urban land. The soil types are discussed below; a map and additional details of the soils within and around the survey site is provided in Appendix A, Figure 2; hydric ratings are also provided.

- ***Urban land-Flaskan complex, 0 to 2 percent slopes (140)***: The Urban land component makes up 70 percent of the map unit; the remaining 30 percent is composed of the minor components; Flaskan and similar soils (20 percent), and other minor components (10 percent). Slopes are 0 to 2 percent and the Urban land component is found on alluvial fans. The parent material consists of disturbed and human-transported material, and ranges in texture from sandy loam at the surface to gravelly sandy clay loam from 17 to 31 inches. Depth to a root restrictive layer is more than 80 inches, and the natural drainage class is well drained. Water movement in the most restrictive layer is moderately high (0.20 to 0.57 in/hr). This soil has no flooding or ponding frequency. Neither the soils major component nor minor components meet hydric criteria (NRCS 2014c). Urban land-Flaskan complex, 0 to 2 percent slopes comprises approximately 31 percent of the survey area and is mostly distributed in Reach 3.
- ***Urban land-Hangerone complex, 0 to 2 percent slopes, drained (145)***: The Urban land component makes up 70 percent of the map unit; the remaining 30 percent is composed of the minor components; Hangerone, drained, and similar soils (25 percent), and other minor components (5 percent). Characteristics of the major component; Urban land, are the same as those described above. Although Urban land does not meet hydric criteria, minor components: Hangerone, drained, Bayshore, Clear Lake, and Embarcadero are hydric (NRCS 2014c). Urban land-Hangerone complex, 0 to 2 percent slopes comprises approximately 36 percent of the survey area and is mostly distributed in Reach 1 and 2.
- ***Urban land-Campbell complex, 0 to 2 percent slopes, protected (165)***: The Urban land component makes up 65 percent of the map unit; the remaining 35 percent is composed of the minor components; Clear Lake and similar soils (25 percent), and other minor components (10 percent). Characteristics of the major component; Urban land, are the same as those described above. Although Urban land does not meet hydric criteria, the minor component Clear Lake is hydric (NRCS 2014c). Urban land-Campbell complex, 0 to 2 percent slopes, protected comprises approximately 3 percent of the survey area and is confined to a narrow zone in Reach 1.
- ***Urban land-Cropley complex, 0 to 2 percent slopes (317)***: The Urban land component makes up 75 percent of the map unit; the remaining 25 percent is composed of the minor components;

Cropley and similar soils. Characteristics of the major component; Urban land, are the same as those described above. Neither the soils major component nor minor components meet hydric criteria (NRCS 2014c). Urban land-Cropley complex, 0 to 2 percent slopes comprises approximately 30 percent of the survey area and is mostly distributed in Reach 3 and 4.

Hydrology

Water generally moves down-gradient from the south to the north, and takes the forms of groundwater and surface water when present. The existing hydrologic regime has been highly altered from the surrounding hardscaped urban environment and alterations of the stream channel designed to efficiently convey flow (Appendix C, Photos 1 and 3). These conditions result in surface water existing only as punctuated flows during the wet season or as artificial inputs from the urban environment during the dry season. Numerous storm drains empty into the system, which is surrounded by impervious and compacted surfaces.

D. PRECIPITATION DATA AND ANALYSIS

The delineation was performed on two days in late summer: 25 and 26 of August 2014. Wetland climate data (WETS), which provides normal ranges of monthly precipitation (including 30 percent average ranges) was obtained for the survey area from NRCS (2014a), as well as measured monthly totals for June through August 2014 (NOAA 2014). Because the field work occurred at the end of the month, August is considered a "preceding month" in this analysis. Preliminary daily precipitation summary data for the field survey interval was also obtained (NRCS 2014a; generated by ACIS-NOAA Regional Climate Centers). The nearest NOAA Climatological Station to the survey site was San Jose (CA293), California (NOAA 2014), located approximately five miles to the southwest.

Field work was conducted during a typical summer with dry conditions (Table 1). Of the 3 months preceding the delineation; June, July, and August, functionally no precipitation occurred, which corresponds to the normal mean values. No precipitation fell during or immediately prior to the field survey, and other weather conditions were usual for the time of year: afternoon temperatures of approximately 80^0 F, calm to light wind form the north, and morning fog burning off to clear afternoon skies.

Table 1. Precipitation summary of spatially comparable WETS data and monthly totals from the nearest NOAA Climatological Station. Data is presented for the three months preceding the field survey. WETS data includes average monthly precipitation and 30% range (in parenthesis). All units are in inches.

PRECEDING MONTHS PRECIPITATION SUMMARY					
August		July		June	
2014	Normal	2014	Normal	2014	Normal
0	0 (0-0)	0	0 (0-0)	0.01	0 (0-0.08)

Source: NRCS 2014a (generated by ACIS-NOAA Regional Climate Centers), NOAA 2014

E. METHODS

Field work for the delineation occurred on the 25th and 26th of August, 2014. Tetra Tech biologists Jeff Barna and Sara Townsend conducted all aspects of the field survey, with technical support from David Munro, PWS, and mapping support from GIS scientists, James Carney and Matt Iman (see *Section I; Authors and Qualifications* for additional information).

This delineation was conducted via field investigations following the 1987 *Corps of Engineers Wetland Delineation Manual* (USACE manual) (USACE 1987), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (regional supplement) (USACE 2008), *Regulatory Guidance Letter; Ordinary High Water Mark Identification* (USACE 2005b), and the *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (OHWM guidance) (USACE 2010). The California Rapid Assessment Method (CRAM) for Riverine Wetlands (CWMW 2013) was used to assess the functions of wetlands identified in the survey area.

Because an initial investigation indicated past and ongoing human alterations have occurred throughout the survey area to soils, vegetation, and hydrology (i.e., straightening and channelizing the streambed, and maintenance of vegetation and adjacent access roads), the methods for problematic conditions in the regional supplement (USACE 2008) were referenced during field work and the preparation of this delineation report.

National Wetland Inventory (NWI) data were reviewed to determine if wetlands or other waters had been previously identified within the site (USFWS 2014) (Appendix A, Figure 3). Other waters were also assessed by obtaining current National Hydrologic Data (NHD) maps for the survey area (USGS 2014) (Appendix A, Figure 4). Soil surveys for Santa Clara County, California (NRCS 1903, 2014b) were reviewed to determine mapped soil characteristics, and hydric soils were assessed using the current National List of Hydric Soils (NRCS 2014c) (Appendix A, Figure 2). Soil data analyses and NWI mapping data are discussed in their respective sections, above, and are discussed relative to field findings, below.

The routine methodology described in the USACE manual (USACE 1987) and regional supplement (USACE 2008) was the primary method employed for the field investigation, although the OHWM guidance was also extensively referenced (USACE 2010). Supporting resources included the following publications; *Munsell® Soil Color Charts* (2009 Edition) (Munsell 2009), *Jepson Manual: Vascular Plants of California, Second Edition* (Baldwin et al. 2012), *Weeds of the West: 5th Edition* (Parker et al. 2006), and *Aquatic and Riparian Weeds of the West* (DiTomaso and Healy 2003). Wetland plant indicator status was obtained from the U.S. Army Corps of Engineers *National Wetland Plant List* (Lichvar et al. 2014).

Before the initiation of data collection, a representative portion of the survey area was walked to plan how the Wetlands/Waters of the U.S./Waters of the State delineation would proceed. During the formal delineation, likely upland and wetland plots were selected and sampled to characterize community distinctions and to facilitate wetland boundary determinations. Sample plots were located within line-of-sight of one another at locations with clear breaks of topography, vegetation, and/or hydrologic features. At each sample plot, indicators of vegetation, hydrology, and soils were documented. Because topographic breaks were discrete and narrow, causing vegetation communities to change abruptly, vegetation strata were surveyed using relatively small diameter circular plots; 3 meter diameter plots for tree, shrub/sapling, and woody vine stratum, and 2 meter diameter plots for herbaceous strata.

According to USACE (2005b) (33 CFR Sections 328.3[e] and 329.11[a][1]), an ordinary high water mark (OHWM) is a; "…line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas." The USACE determines, on a case-by-case basis, the extent of geographic jurisdiction for the purpose of administering its regulatory program. For purposes of Section 404 of the Clean Water Act (CWA), the lateral limits of jurisdiction over non-tidal water bodies extend to the OHWM in the absence of adjacent wetlands. When adjacent wetlands are present, CWA jurisdiction extends beyond the OHWM to the limits of the adjacent wetlands. For purposes of Sections 9 and 10 of the Rivers and Harbors Act of 1899, the lateral extent of Federal jurisdiction, which is limited to the traditional navigable waters of the U.S., extends to the OHWM whether or not adjacent wetlands extend landward of the OHWM. Any features of Other Waters of the U.S. were documented in the field in intervals that were within line-of-site of adjacent survey points. The methods and field datasheet provided in the OHWM guidance (USACE 2010) were used to establish OHWM and any physical changes in stream structure and their locations along the survey area.

The method described above was also generally used to identify Waters of the State and those components of the stream that fall under the jurisdiction of the CDFW. Although riparian areas supported by moisture in the stream would also normally be included in CDFW jurisdictional areas, no such areas were identified. CDFW jurisdiction also includes areas from bank to bank; however, in this instance, since Berryessa Creek is a constructed trapezoidal channel and is extremely incised, the top of bank was identified as the internal top of bank; that is, the stream typically has an internal bank that ends at the edge of a steepened dirt wall, which extends vertically above the internal top of bank by up to 6 feet; therefore the Waters of the U.S. and Waters of the State were determined to be the same.

Mapping Methods

Field data was collected with a Trimble GeoExplorer 6000 Series GeoXH hand-held GPS, which collects data to sub-meter accuracy. Data was post-processed and transferred to GIS shapefiles, which were then overlain onto topographic base maps. Figures created with this data appear in Appendix A (Figures 5-9).

F. FINDINGS AND RESULTS

One wetland as well as Other Waters of the U.S./State were delineated in the survey area. The locations of these potentially jurisdictional features are presented as maps in Appendix A. Spatial dimensions of these features are presented in Table 2, below. Some areas of Other Waters also hosted small patches of fringing wetland. These wetlands were not delineated separately from WoUS, however, due to their small size and patchy distribution, being located below OHWM, and only providing small ecological influence on the primarily riverine system. It is estimated that less than 0.5 acre of patchy fringe wetland is present within the area of Other Waters of the U.S./Waters of the State, and is present in Upper Berryessa Creek mostly north of Ames Avenue (around the upstream extent of surface water) and in the lower part of Piedmont Creek. The previous delineation (USACE 2005a) identified approximately 0.38 acres of wetland in the same area, with the balance being WoUS.

Table 2. Summary of Wetlands and Other Waters of the U.S./State delineated within the survey area.

RESULTS SUMMARY		
Location	**HGM Class [1] or Other Waters Description [2]**	**Area (acres)**
Other Waters of the U.S./Waters of the State		
Mainstem of Upper Berryessa Creek, upstream of Calaveras Blvd.	Intermittent and Perennial Stream	4.05
Los Coches Creek	Intermittent Stream	0.10
Piedmont Creek	Perennial Stream	0.03
Wetland		
50' downstream of Calaveras Blvd.	RIVERINE: Occasionally Flooded, Floodplain, herb-dominated	0.02
Grand Total		**4.20**

[1] NRCS 2008
[2] Cowardin 1979

Other Waters of the U.S./Waters of the State

Identifying the OHWM is a method for determining the lateral limits of Waters of the U.S. and is indicated by shelving, changes in sediment texture, and changes in vegetation as described above (USACE 2005b). The OHWM is; "established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas." Effective discharge events capable of moving the greatest proportion of sediment over time establish the OHWM. In the Arid West region, these ordinary high flows are low- to moderate-discharge events.

Despite being highly engineered and altered, as a tributary to navigable water (San Francisco Bay), the area of Upper Berryessa Creek at or below the OHWM has been delineated as Other Waters of the U.S./Waters of the State. The survey area contains a total of 4.18 acres of Other Waters of the U.S./Waters of the State and 0.02 acre of wetland. Several areas of Berryessa Creek have been concrete-lined including areas of reinforcement under bridges and two prominent sections of high-angle stream bends in Reach 4.

Two of the most common features found throughout the survey area were: 1) consistent indicators of OHWM (Appendix C, Photos 11 to 14) and, 2) patchy vegetation typically consisting of a narrow fringe of hydrophytic species growing between unvegetated areas in the low-flow channel and the steep upland slopes (Appendix C, Photo 4). Most patches of hydrophytic vegetation averaged less than three feet wide due to being within the extremely incised channel. Because wetland hydrology was lacking in most areas, hydrophytic vegetation was patchy, and the sandy/gravelly soil texture did not indicate hydric conditions, the majority of the survey area was determined to not be wetland (i.e., it consistently failed the three-factor wetland test, as described by the regional supplement in *Section 5; Difficult Wetland Situations in the Arid West* [USACE 2010]). However, because indicators of OHWM were common and typically located higher in elevation than patches of hydrophytic vegetation, most areas were determined to be within the lateral limits of Other Waters of the U.S./Waters of the State (USACE 2005b, 2010), and to fall under the jurisdiction of CDFW.

The engineered and consistent channel profile, and lack of riparian vegetation present throughout the survey area, combined with presence of vertical banks in many locations, results in the Other Waters of the U.S./Waters of the State having consistent dimensions. Universal indicators of OHWM included the following (taken from the OHWM guidance) and are presented in ranked order of frequency of occurrence (field datasheets are provided in Appendix B):

1. Change in vegetation species,
2. Break in bank slope,
3. Change in vegetation cover, and
4. Change in average sediment texture (present in most areas) (Appendix C, Photo 15).

Indicators of floodplains, present throughout the survey area, included the following, which are presented in ranked order of frequency of occurrence:

1. Drift and/or debris,
2. Presence of bed and bank,
3. Benches,
4. Surface relief, and
5. Soil development (not observed in all areas).

Overall, the presence of drift deposits was the most obvious and consistent indicator of OHWM in the survey area, and was used as one of the primary indicators to delineate the boundary, although other indicators were also present.

Upper Berryessa Creek is mapped as an intermittent water by USGS NHD (USGS 2014) (Appendix A, Figure 3), however, some evidence suggests that it is perennial downstream of Piedmont Creek in Reaches 1 and 2. Flowing water was found in and downstream of Piedmont Creek (water source) during the dry season, when it would normally not be expected (Appendix C, Photo 16). The flows, however, appear to be from urban runoff of unknown duration and frequency. Historic aerial photography suggests flow downstream of Piedmont Creek is inconsistent during the dry season, but has generally been absent. Under natural conditions, both Upper Berryessa Creek (in its entirety) and Piedmont Creek were likely intermittent streams, with flowing water only in the wet season. Upstream of Piedmont Creek in Reaches 3 and 4 (Appendix C), Upper Berryessa Creek was dry and displayed evidence of flashy flows, indicating it to be an intermittent stream. The USACE definition of a *perennial stream* is a stream that has flowing water year-round during a typical year, the water table is located above the stream bed for most of the year, and groundwater is the primary source of water for stream flow (2012). Because water does not flow year-round except where flow is provided by Piedmont Creek, the water table is located below the stream bed for most of the year (as evident from wetland test pits discussed below), and urban discharges are likely the primary source of water, it is determined that Berryessa Creek, is in fact an intermittent stream.

Wetland 1

The single wetland identified in the survey area is described below, and is shown on the overview map (Appendix A, Figure 5) as well as on the individual map for Reach 1 (Appendix A, Figure 6). Additional details of the wetland, including size and HGM classification, are presented in Table 2. Because no wetlands were identified by NWI in the survey area, locating and delineating wetlands during the survey was not anticipated.

Wetland 1 is located along the far northern end of the survey area in Reach 1, north of Calaveras Boulevard. In this area, the stream channel is relatively wide and slopes are shallow compared to upstream reaches, allowing the streambed to be relatively complex. The landform of Wetland 1 includes an island in the center of the stream channel, as well as the edge of the active channel (Appendix C, Photo 17). Wetland 1 is well-established relative to other areas within Berryessa Creek system, but is likely to have only been present for a less than 10 years, based on stream maintenance schedules and historic aerials. All vegetation is herbaceous, hydrophytic, and weedy. Hydrology is present in the form of surface flow, saturated soil, and water table (all being located below OHWM), and soils are mineral-based, recently deposited, and have no redoximorphic characteristics. The entire wetland is located below OHWM and within the delineated polygon for Other Waters of the U.S./State, but its relatively significant contribution to its surrounding ecology warranted its delineation. Wetland 1 is considered a *RIVERINE: Occasionally Flooded, Floodplain, herb-dominated wetland* (NRCS 2008). The majority of wetland plants identified in Wetland 1 are those listed for fringing wetland in Table 3, below.

Vegetation

Vegetation patterns associated with Other Waters of the U.S./State and Wetland 1 were distinct and corresponded to topographic breaks. Despite the highly managed vegetation in the survey area, most areas located below the OHWM had not been mowed at the time of the survey, but at least some portions had been sprayed with herbicide. Although soil type varied by elevation, as evident in the cut banks found throughout the incised survey area (Appendix C, Photo 18), elevation of hydrology is likely the most influential factor in determining the distribution of plant species. For example, there were clear differences in vegetation composition above and below Piedmont Creek at comparable elevations and soil types (see NRCS 2014b).

Vegetation patterns described in *Section C; Existing Conditions* were identified during the survey. Summary data corresponding to these patterns is presented in Table 3, below, and includes vegetation type, species, average cover, general distribution, wetland indicator status, and location relative to hydrology.

Table 3. Summary of vegetation conditions in the survey area.

VEGETATION CONDITIONS						
Vegetation Type	**Scientific Name**	**Common Name**	**Average Cover (%)**	**Distribution**	**Indicator Status [1]**	**Location Relative to Hydrology**
Herb-dominated Upland	*Avena fatua*	Wild Oat	70	Throughout	UPL	Above
	Bromus diandrus	Ripgut brome	70	Throughout	NL	Above
	Amaranthus albus	Tumbleweed	30	Patchy	FACU	Above
	Brassica nigra	Black mustard	25	Throughout	NL	Above

VEGETATION CONDITIONS						
Vegetation Type	**Scientific Name**	**Common Name**	**Average Cover (%)**	**Distribution**	**Indicator Status [1]**	**Location Relative to Hydrology**
	Lactuca serriola	Prickly Wild Lettuce	25	Throughout	FACU	Above
	Bromus catharticus	Rescue grass	25	Throughout	NL	Above
	Lolium multiflorum	Italian rye grass	10	Throughout	FAC	Above
	Malva parviflora	Cheeseweed mallow	5	Throughout	NL	Above
	Malva nicaeensis	Bull mallow	5	Throughout	NL	Above
	Conyza canadensis	Horseweed	5	Patchy	NL	Above
	Leymus cinereus	Giant wild rye	5	Patchy	FAC	Above
	Sonchus asper	Prickly sow thistle	5	Throughout	FAC	Above
	Tragopogon porrifolius	Purple salsify	5	Patchy	NL	Above
	Convolvulus arvense	Field bindweed	5	Patchy	NL	Above
Fringing wetland	*Cyperus eragrostis*	Tall flatsedge	70	Throughout	FACW	Above
	Echinochloa sp.	Barnyard grass	30	Throughout	FACW	Above
	Veronica americana	American brooklime	30	Throughout	OBL	Above
	Polygonum persicaria	Spotted lady's thumb	20	Throughout	FACW	Above
	Veronica anagallis-aquatica	Water speedwell	20	Throughout	OBL	Above
	Typha latifolia	Common cattail	10	Patchy	OBL	Above
	Xanthium strumarium	Rough cockleburr	10	Throughout	FAC	Above
	Lythrum hyssopifolia	Hyssop loosestrife	10	Patchy	NL	Above
	Foeniculum vulgare	Sweet fennel	5	Patchy	NL	Above
	Polypogon monspeliensis	Rabbit's foot grass	5	Throughout	FACW	Above
	Polygonum lapathifolium	Willow smartweed	5	Throughout	FACW	Above
	Juncus xiphioides	Iris leaf rush	5	Patchy	OBL	Above
	Salix laevigata	Red willow	5	Patchy	FACW	Above
Aquatic	*Ludwigia peploides*	Floating water primrose	20	High density patches	FACW	At/Below
	Rorippa nasturtium-aquaticum	Watercress	15	Throughout	OBL	At/Below

VEGETATION CONDITIONS						
Vegetation Type	**Scientific Name**	**Common Name**	**Average Cover (%)**	**Distribution**	**Indicator Status [1]**	**Location Relative to Hydrology**
	Bacopa eisenii	Gila River water hyssop	10	Throughout	OBL	At/Below
Wetland/Upland Transition	*Equisetum telmateia*	Giant horsetail	40	Throughout	FACW	At
	Paspalum distichum	Knot grass	40	Throughout	FACW	At
	Raphanus sativus	Wild radish	20	Throughout	NL	At
	Epilobium ciliatum	Fringed willowherb	20	Throughout	FACW	At
	Urtica dioica	Hoary nettle	10	Patchy	FAC	At
	Phalaris aquatica	Harding grass	10	Patchy	FACU	At
	Lepidium latifolium	Perennial pepperweed	10	Throughout	FAC	At
	Rumex conglomeratus	Green dock	10	Patchy	FACW	At
	Populus fremontii	Fremont cottonwood	10	Patchy	FAC	At
	Oenothera elata	Evening primrose	5	Patchy	FACW	At
	Ricinus communis	Castor bean	5	Patchy	FACU	At
	Conium maculatum	Poison hemlock	5	Patchy	FACW	At
	Rubus armeniacus	Himalayan blackberry	5	Patchy	FACU	At
	Schinus molle	Peruvian peppertree	5	Patchy	FACU	At
	Quercus agrifolia	Coast live oak	5	Patchy	NL	At
	Ulmus sp.	Elm (exotic)	5	Patchy	NL	At
Other Plants Adjacent to Survey Area	*Pinus radiata*	Monterey Pine	NA	Patchy	NL	Above
	Juglan hindsii	Black walnut	NA	Patchy	NL	Above
	Quercus ilex	Holly oak	NA	Patchy	NL	Above
	Salix babylonica	Weeping willow	NA	Patchy	FAC	Above
	Sambucus mexicana	Blue elderberry	NA	Patchy	FAC	Above

[1] Lichvar et al. 2014

Soils

Soils require long periods, in some cases hundreds of years, for development of wetland soil characteristics. Substantial alterations to Upper Berryessa Creek's natural channel, through its human-induced channelization and subsequent maintenance, have prevented natural wetland soils development. Because the likelihood of hydric soil characteristics being present within the constructed channel was expected to be low, standard soil profile test pits were only placed in areas with clear characteristics of a relatively well-established wetland. Only one such place in Reach 1 was identified during the survey. No hydric soil characteristics were observed during the survey, including in areas delineated as wetland.

Two test pits were sampled at Wetland 1 – one within the wetland (W1) and the other in the adjacent upland (U1) (datasheets are presented in Appendix B). The soils in both test pits appeared to be recently deposited and likely composed of recent alluvium. Soil color in test pit W1 was 10YR2/1 in the first 6 inches, and 10YR2/2 between 6 and 20 inches. Texture was sandy in the surface, and a combination of sand, gravel, and cobble was found below. No redoximorphic features were observed. Although the likely young age of the soils was not expected to convey hydric features, the dark matrix color may mask the expression of redoximorphic features that are present (see: *Section 5; Difficult Wetland Situations in the Arid West* [USACE 2010]). Soil color of the paired upland plot (U1) was 10YR5/2 from the surface to a depth of 20 inches, and had a sandy texture. No redoximorphic features were present. It is assumed that Wetland 1 had only been present for a relatively short period due to frequent channel maintenance and the dynamic nature of the system.

In the remainder of the survey area, soils appeared to be a mix of sand, cobble, rock, and human-made hard surfaces. Several areas of Upper Berryessa Creek have been concrete-lined, including areas of reinforcement under bridges and two prominent sections of high-angle bends in the stream located upstream of Montague Expressway (Appendix A, Sheet 4). All areas appeared engineered and recently disturbed by maintenance activities and/or high velocity flows resulting from the channelized nature of the streambed.

Hydrology

The confluence with Piedmont Creek, a relatively large tributary of Upper Berryessa Creek, defines the transition between Reach 2 and Reach 3. Piedmont Creek also provided the only flowing surface water into the system. Piedmont Creek has three to four forks beginning at private ranch properties located upslope in the eastern foothills in Milpitas. At Piedmont Road, the two primary forks join and flow into a piped underground stream that passes under residences and daylights 0.8 miles upstream of the confluence. Like Berryessa Creek, the open channel of Piedmont Creek is embedded within a highly altered residential and industrial zone. Piedmont Creek is designated as an intermittent water by USGS NHD (USGS 2014). Because the field survey occurred in late summer and Upper Berryessa Creek was mostly dry above Reach 2, it is presumed hydrology observed in Piedmont Creek was from urban sources. It is unclear what the flow duration is for Piedmont Creek, or when it began to contribute to Upper Berryessa Creek during the dry season. No other tributary of Upper Berryessa Creek within the survey area had surface flows, or evidence of recent flows at the time of the field survey.

Some low depressions in Upper Berryessa Creek, likely caused by scouring during periods of high flows, had ponded water at the time of the survey. Ponding in these scour holes was likely due to the depressions being recessed below the water table, allowing water to surface. Most ponded scour holes were shallow, relatively small, hosted abundant algae growth, and were located between Piedmont Creek and Ames Avenue.

G. CONCLUSIONS

According to the USACE manual and implementing guidance, there must be positive indicators of each parameter (hydrophytic vegetation, hydrology, and hydric soils) present to make a wetland determination. Additionally, the CDFW takes jurisdiction over riparian areas that may not otherwise qualify as wetlands, but also includes; "…lands which contain habitat which grows close to and which depends on soil moisture from a nearby freshwater source" (CA Fish and Wildlife Code 2785(e)). However, because most areas lacked at least two of three indicators, but instead exhibited clear indicators of OHWM, the majority of Upper Berryessa Creek was delineated as Other Waters of the U.S./State, and one wetland within OHWM was delineated. Functionally, the survey area exhibited distinct elements of a riverine system, and the fringing wetland present was small, patchy, and located within the boundaries of the OHWM. Evidence suggests the system is highly dynamic due to the flashy flows it receives during the wet season, and because of maintenance activities, which combine to alter vegetation and soils (when maintenance requires erosion control or other earthwork) on a regular basis. The engineered structure of the channel further prevents the development of wetland features, due to the system being designed to efficiently move storm flows. The distinct wetland identified in the survey area below Calaveras Blvd. was located in an area where the stream channel is wider and banks maintain a relatively more gradual angle, allowing the low-flow channel to be somewhat meandering. Wetland hydrology and hydrophytic vegetation were present in the wetland area, and the landscape position is such that hydric soil conditions would form under normal conditions. Fringing wetlands identified upstream of Calaveras Boulevard were not considered as being distinct from WoUS in that area due to their location below the OHWM, lack of distinct functional characteristics, and lack of characteristics that would lead to formation of hydric soils.

In general, all natural aspects of Upper Berryessa Creek in the survey area have been disturbed and altered by human activities. There was no evidence of habitat that would support protected aquatic or terrestrial species in the survey area.

Because a wetland was determined to be present in the survey area, a CRAM assessment was completed for this feature and is included in Appendix B. A summary of CRAM assessment scores are presented in Table 4, below. Overall, the wetland was of poor quality and degraded by the altered system and maintenance that occurs in the survey area.

Table 4. CRAM attributes and scores for the wetland identified in the survey area.

Attribute	Score
Attribute 1: Buffer and Landscape Context	25
Attribute 2: Hydrology	58
Attribute 3: Physical Structure	50
Attribute 4: Biotic Structure	36
Overall AA Score	**42**

H. DISCLAIMER

This report documents the investigation, best professional judgment, and conclusions of the investigators. It should be considered a Preliminary Jurisdictional Determination and used at your own risk until it has been approved in writing by the reviewing agency/agencies.

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J. LITERATURE CITED

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken (editors). 2012. The Jepson Manual: Vascular Plants of California, Second Edition. University of California Press, Berkeley.

Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. (Version 04DEC98). http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm.

CWMW (Level 2 Committee of the California Wetland Monitoring Workgroup). 2013. California Rapid Assessment Method for Wetlands – Riverine Wetlands Field Book; Ver. 6.1. January 2013. Available: http://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM%20Field%20Book%20Riverine%206.1_0.pdf.

DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources. Publicaiton 3421.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. The National Wetland Plant List: 2014 Update of Wetland Ratings. Phytoneuron 2014-41: 1-42.

Munsell (Munsell® Soil Color Charts). 2009. Year 2009 Revised Edition. Gretag/Macbeth Publishing, NY.

NOAA (National Oceanic and Atmospheric Administration). 2014. Climatological Report (Monthly) (Preliminary). National Climatic Data Center (NCDC). Accessed 2 September 2014. Available: http://www.ncdc.noaa.gov.

NRCS (U.S. Department of Agriculture Soil Conservation Service; National Resources Conservation Service). 1903. Soil Survey of the San Jose Area, California. Author: M.H. Lapham.

NRCS. 2008. Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better to Meet the Needs of the Natural Resources Conservation Service. Technical Note No. 190-8-76. February 2008.

NRCS. 2014a. USDA Field Office Climate Data. San Jose, CA, CA293. Creation date: 5 September 2014. Available: http://efotg.sc.egov.usda.gov/treemenuFS.aspx.

NRCS. 2014b. Custom Soil Resource Report for Santa Clara Area, California, Western Part. Created: 19 November 2014.

NRCS. 2014c. National List Hydric Soils; All States. 29 August 2014. Available: ftp://ftp-fc.sc.egov.usda.gov/NSSC/Hydric_Soils/Lists/hydric_soils.xlsx.

Parker, R., S.A. Dewey, L.C. Burrill, D.W. Cudney, and T.D. Whitson. 2006. Weeds of the West: 5th (fifth) Edition. June 1, 2006. Publisher: Cooperative Extension Service.

USACE (U.S. Army Corps of Engineers). 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. Vicksburg, MI.

USACE. 2005a. Wetland Delineation Report for Santa Clara Valley Water District and U.S. Army Corps of Engineers; General Re-evaluation of Flood Control Needs along Berryessa Creek (Draft). In: USACE (2013). Berryessa Creek Project Santa Clara County, California Draft Report for Public Review Draft General Reevaluation Report and Environmental Impact Statement. Appendix A, Part 1.

USACE. 2005b. Regulatory Guidance Letter; Ordinary High Water Mark Identification. No. 05-05. 7 December 2005. Available: http://www.usace.army.mil/Portals/2/docs/civilworks/RGLS/rgl05-05.pdf.

USACE. 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0); J.S. Wakeley, R.W. Lichvar, and C.V. Noble (Eds). ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

USACE. 2010. Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. K.E. Curtis and R.W. Lichvar. ERDC/ERREL TN-10-1. July 2010. Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center, Hanover, NH.

USACE. 2012. Nationwide Permits, Conditions, District Engineer's Decision, Further Information, and Definitions (with corrections). Available: http://www.usace.army.mil/Portals/2/docs/civilworks/nwp/2012/NWP2012_corrections_21-sep-2012.pdf.

USFWS (U.S. Fish and Wildlife Service). 2014. National Wetlands Inventory Web Page. Accessed: 29 August 2014. Available: http://www.fws.gov/wetlands/Wetlands-Mapper.html.

USGS (U.S. Geological Survey, National Geospatial Program). 2014. The National Map; Hydrology (NHD) Viewer – Berryessa Creek Project Area. Accessed: 3 September 2014. Available: http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd&b=base1&q=piedmont%20creek%2C%20ca&x=-13568011.165311167&y=4498070.235580203&l=15&v=vectorSelectablePolygons%3A10.

APPENDIX A: FIGURES

Figure 1: Project Location and Reaches

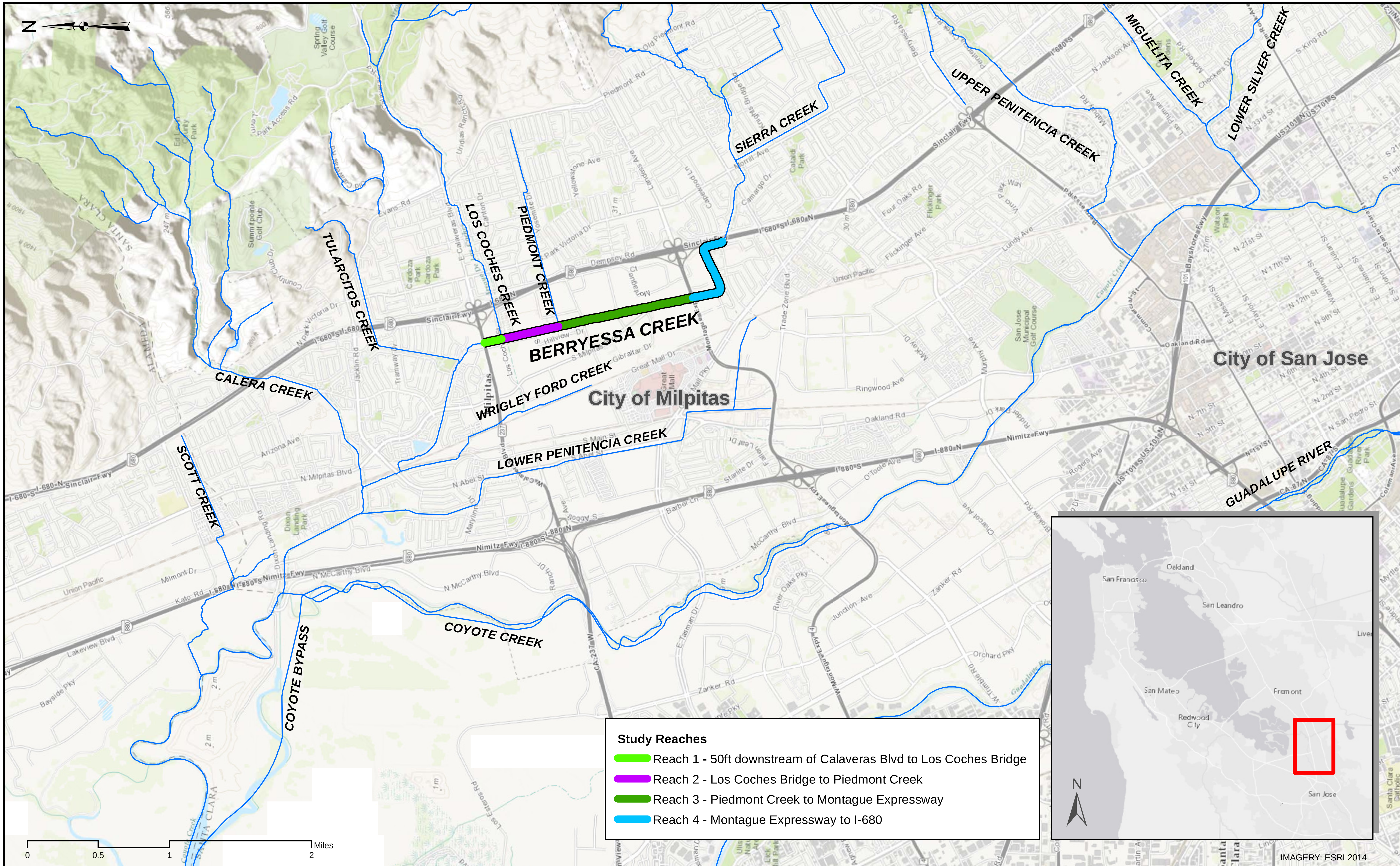
Figure 2: NRCS Soil Surveys and Hydric Ratings

Figure 3: NWI Map

Figure 4: NHD Map

Figures 5-10: Wetlands/Waters of the U.S./Waters of the State, by Reach

Figure 1: Project Location and Reaches



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Santa Clara Valley Water District

County of Santa Clara, California

UPPER BERRYESSA CREEK
FLOOD RISK MANAGEMENT PROJECT
Wetlands/Waters of the U.S./Waters of the State

Figure 2: NRCS Soil Surveys and Hydric Ratings

United States Department of Agriculture

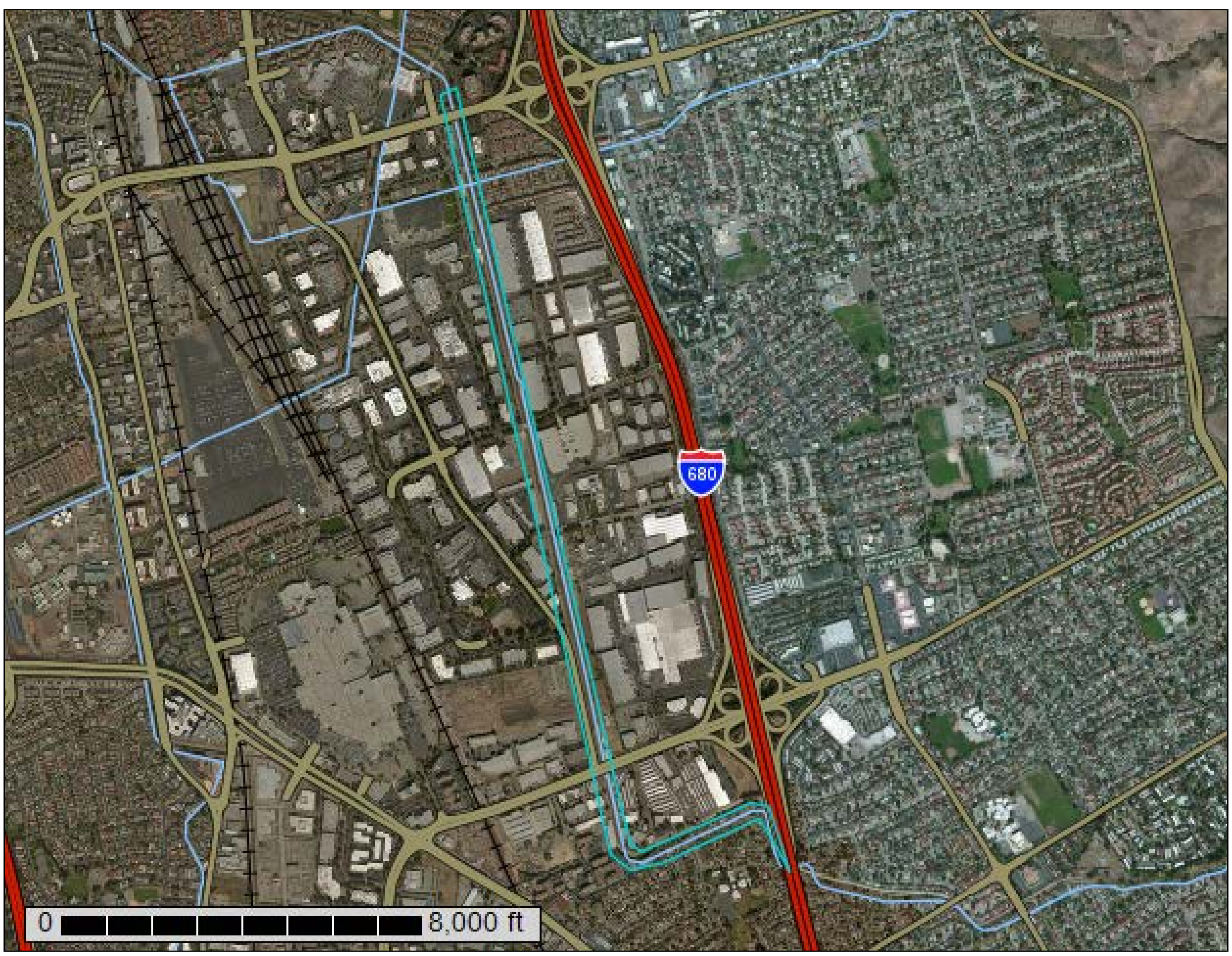
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Santa Clara Area, California, Western Part



November 19, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

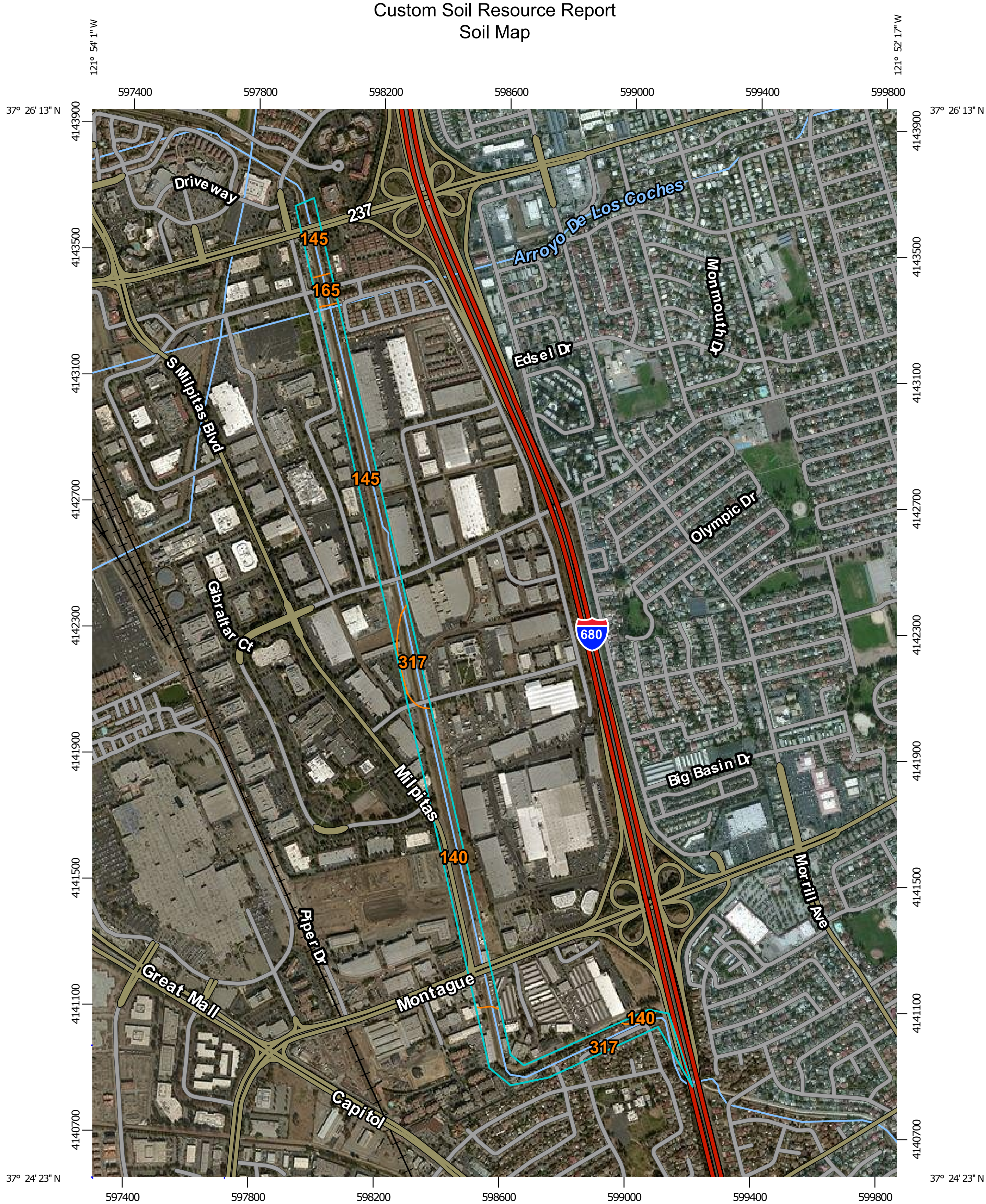
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:16,500 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 200, 400, 800, 1200

Feet: 0, 500, 1000, 2000, 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Santa Clara Area, California, Western Part
Survey Area Data: Version 3, Sep 18, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 12, 2010—Nov 3, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Santa Clara Area, California, Western Part (CA641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
140	Urban land-Flaskan complex, 0 to 2 percent slopes	18.4	31.3%
145	Urbanland-Hangerone complex, 0 to 2 percent slopes, drained	21.2	36.1%
165	Urbanland-Campbell complex, 0 to 2 percent slopes, protected	1.5	2.6%
317	Urbanland-Cropley complex, 0 to 2 percent slopes	17.5	29.9%
Totals for Area of Interest		**58.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Santa Clara Area, California, Western Part

140—Urban land-Flaskan complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1nszx
Elevation: 20 to 660 feet
Mean annual precipitation: 14 to 24 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 275 to 325 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 70 percent
Flaskan and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Disturbed and human transported material

Description of Flaskan

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from metamorphic and sedimentary rock and/or alluvium derived from metavolcanics

Typical profile

Ap - 0 to 2 inches: sandy loam
ABt - 2 to 7 inches: sandy clay loam
Bt1 - 7 to 17 inches: gravelly sandy clay loam
Bt2 - 17 to 31 inches: gravelly sandy clay loam
C - 31 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C

Minor Components

Pachic haploxerolls, loamy-skeletal

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Landelspark

Percent of map unit: 2 percent
Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Botella

Percent of map unit: 2 percent
Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Stevenscreek

Percent of map unit: 1 percent
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

145—Urbanland-Hangerone complex, 0 to 2 percent slopes, drained

Map Unit Setting

National map unit symbol: 1nszw
Elevation: 0 to 220 feet
Mean annual precipitation: 14 to 24 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 275 to 325 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 70 percent
Hangerone, drained, and similar soils: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Disturbed and human-transported material

Description of Hangerone, Drained

Setting

Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Alluvium derived from metamorphic and sedimentary rock and/or alluvium derived from metavolcanics

Typical profile

A1 - 0 to 9 inches: clay
A2 - 9 to 17 inches: clay
Bw - 17 to 27 inches: clay
Bk - 27 to 35 inches: clay
Ck - 35 to 45 inches: clay loam
C - 45 to 72 inches: gravelly loam
2Ab - 72 to 89 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.2 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C

Minor Components

Bayshore

Percent of map unit: 2 percent
Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Clear lake

Percent of map unit: 2 percent
Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Embarcadero

Percent of map unit: 1 percent
Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

165—Urbanland-Campbell complex, 0 to 2 percent slopes, protected

Map Unit Setting

National map unit symbol: 1qsvl
Elevation: 0 to 240 feet
Mean annual precipitation: 14 to 24 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 275 to 325 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 70 percent
Campbell, protected, and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Disturbed and human-transported material

Description of Campbell, Protected

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from metamorphic and sedimentary rock and/or alluvium derived from metavolcanics

Typical profile

Ap - 0 to 10 inches: silt loam
A1 - 10 to 24 inches: silt loam
A2 - 24 to 31 inches: silty clay loam
A3 - 31 to 38 inches: silty clay loam
2A - 38 to 51 inches: silty clay loam
2Bw1 - 51 to 71 inches: silty clay
2Bw2 - 71 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (1.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C

Minor Components

Newpark

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Clear lake

Percent of map unit: 5 percent
Landform: Basin floors
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

317—Urbanland-Cropley complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 261rq
Elevation: 10 to 530 feet
Mean annual precipitation: 14 to 24 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 275 to 325 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 75 percent
Cropley and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Disturbed and human-transported material

Description of Cropley

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous shale

Typical profile

A1 - 0 to 4 inches: clay
A2 - 4 to 11 inches: clay
Bss1 - 11 to 24 inches: clay
Bss2 - 24 to 33 inches: clay
Bss3 - 33 to 51 inches: clay
BCk1 - 51 to 57 inches: sandy clay loam
BCk2 - 57 to 63 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (1.0 to 3.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

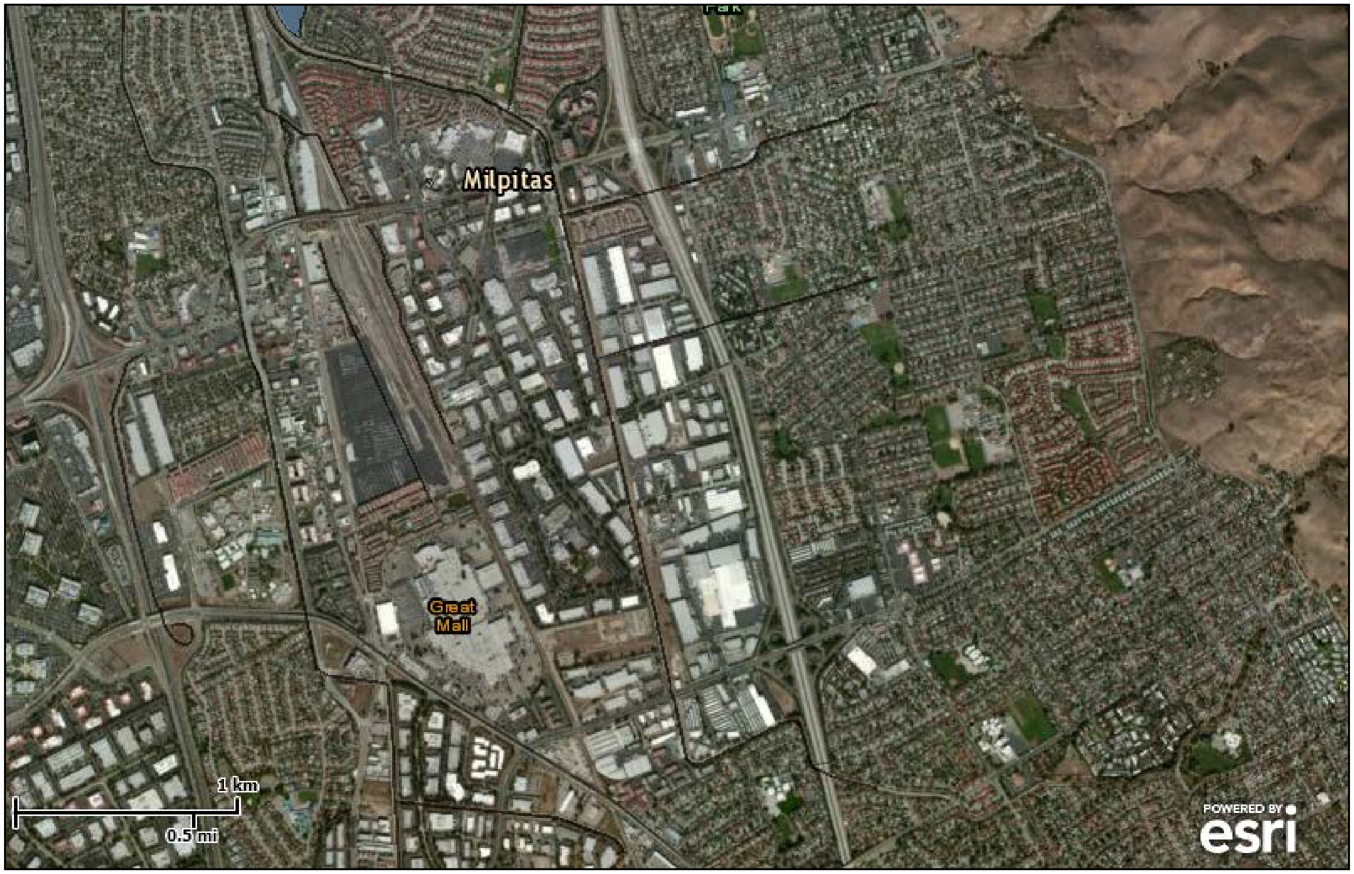
Figure 3: NWI Map

U.S. Fish and Wildlife Service

National Wetlands Inventory

Berryessa Crk

Sep 19, 2014



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

Riparian Status

- Digital Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

Figure 4: NHD Map

The National Map

NOTES: Data available from U.S. Geological Survey, National Geospatial Program.

Open in The National Map Viewer

9/3/14 11:44 AM

Figures 5-10: Wetlands/Waters of the U.S./Waters of the State, by Reach

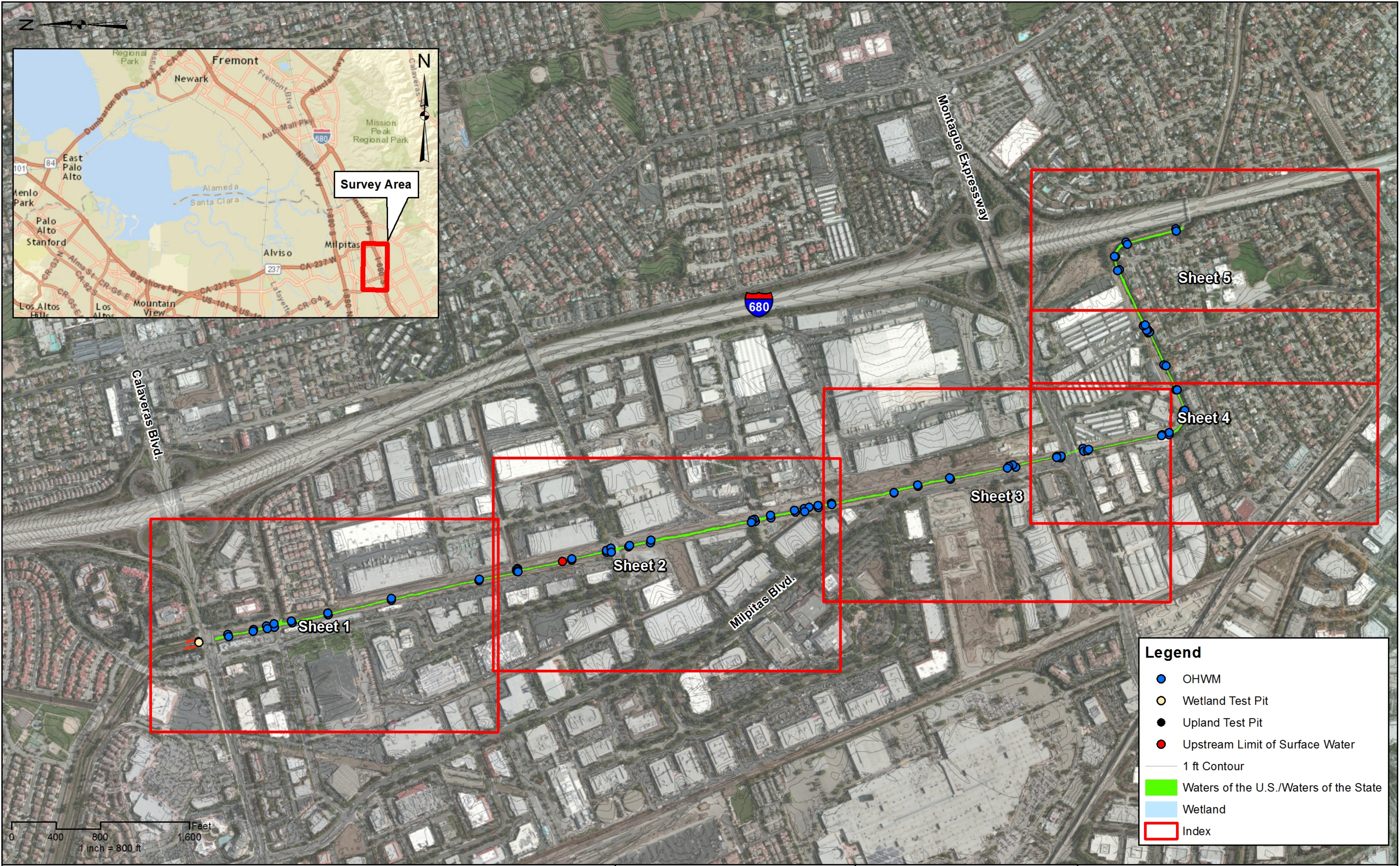


Figure 5: Survey Area
Orthophotography: ESRI World Imagery, 11/02/2010.
Prepared by: Matthew Iman. Date: 09/26/2014.

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Santa Clara Valley Water District

County of Santa Clara, California

UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT: WETLANDS, WATERS OF THE U.S., AND WATERS OF THE STATE

Figure 6: Calaveras Blvd. to 1000' Downstream of Yosemite Drive
Orthophotography: ESRI World Imagery, 11/02/2010.
Prepared by: Matthew Iman. Date: 09/26/2014. Revised 04/01/2015

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UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT: WETLANDS, WATERS OF THE U.S., AND WATERS OF THE STATE

Figure 7: 1100' Downstream of Yosemite Drive to 250' Downstream of Gibralter Drive
Orthophotography: ESRI World Imagery, 11/02/2010.
Prepared by: Matthew Iman. Date: 09/26/2014. Revised 04/01/2015

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County of Santa Clara, California

UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT: WETLANDS, WATERS OF THE U.S., AND WATERS OF THE STATE

Figure 8: 375' Downstream of Gibralter Drive to 870' Upstream of Montague Expwy.
Orthophotography: ESRI World Imagery, 11/02/2010.
Prepared by: Matthew Iman. Date: 09/26/2014.

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County of Santa Clara, California

UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT: WETLANDS, WATERS OF THE U.S., AND WATERS OF THE STATE

Figure 9: 315' Downstream of Montague Expwy. to 315' Upstream of Lakewood Drive.
Orthophotography: ESRI World Imagery, 11/02/2010.
Prepared by: Matthew Iman. Date: 09/26/2014.

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County of Santa Clara, California

UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT: WETLANDS, WATERS OF THE U.S., AND WATERS OF THE STATE

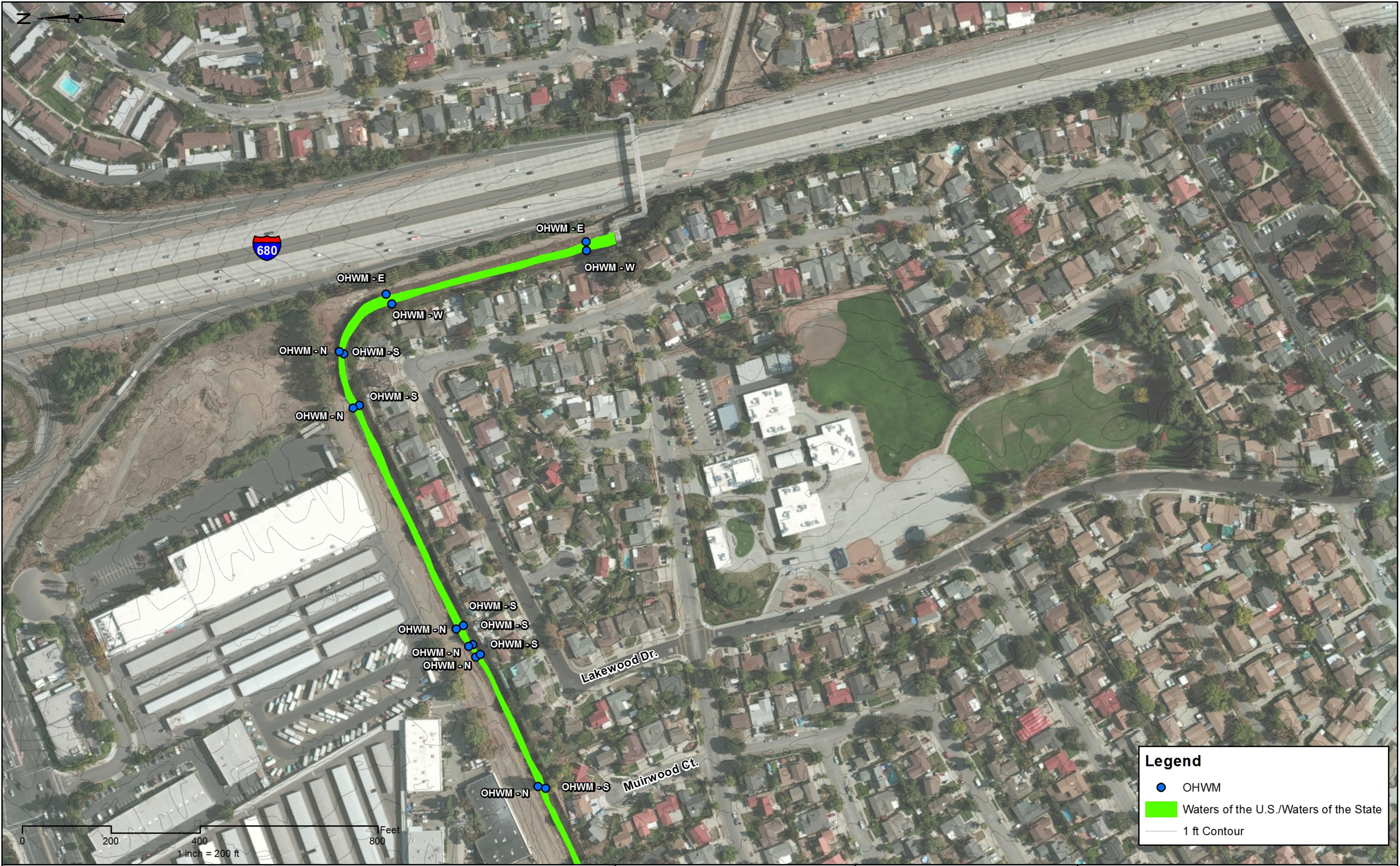

Figure 10: Interstate 680 to100' Downstream of Muirwood Ct.
Orthophotography: ESRI World Imagery, 11/02/2010.
Prepared by: Matthew Iman. Date: 09/26/2014.

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Santa Clara Valley Water District

County of Santa Clara, California

UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT: WETLANDS, WATERS OF THE U.S., AND WATERS OF THE STATE

APPENDIX B: DATA FORMS

and

WETLAND RATING FORMS

Wetland 1 Data Forms

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Berryessa Crk   City/County: Milpitas   Sampling Date: 25 Aug '14

Applicant/Owner: SCV water DIST.   State: CA   Sampling Point: W1

Investigator(s): J. Barnes   Section, Township, Range: Mt. Diablo T6S, R1E, Sec 9

Landform (hillslope, terrace, etc.): Stream bed   Local relief (concave, convex, none): Convex   Slope (%): 1

Subregion (LRR): ______   Lat: 37.433950°   Long: -121.892825°   Datum: NAD 84

Soil Map Unit Name: Urban land-Hangerone complex, 0-2% slopes, drained.   NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed?   Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic?   (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: Entire System has been engineered - Channelized & maintained, Area in Reach 1A has widest profile
New Soils = Not enough Time to develope Hydric Characteristics.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 2)			
1. Polygonum sp. (Lady thumb)	80	X	FACW
2. Typha	25		OBL
3. Echinocloa sp.	30	X	FACW
4. Cyperus eragrostis	15		FACW
5. Foeniculum sp.	3		NL
6.			
7.			
8.			
= Total Cover	153		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum Ø   % Cover of Biotic Crust Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: W1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Fine Sand	
7-20	10YR 2/2	100					Sand, Gravel, Cobble	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- X Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ____ Depth (inches): 10"

Water Table Present? Yes X No ____ Depth (inches): Surf

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): Surf

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Hydrology from urban sources.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Berryessa Crk City/County: Milpitas Sampling Date: 25 Aug '14

Applicant/Owner: SCV Water Dist. State: CA Sampling Point: U1

Investigator(s): J. Barna Section, Township, Range: Mt. Diablo T6S, R1E, Sec 9

Landform (hillslope, terrace, etc.): Stream bed Local relief (concave, convex, none): Convex Slope (%): 1

Subregion (LRR): ______ Lat: 37.433950° Long: -121.892825° Datum: NAD 84

Soil Map Unit Name: Urbanland-Hangerone complex, 0-2% Slopes, drained NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks: Entire System has been engineered - Channelized & maintained, Area in Reach 1A has widest profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 2)			
1. Brassica nigra	60	X	NL
2. Malva sp.	5		NL
3. Bromus catharticus	60	X	NL
4.			
5.			
6.			
7.			
8.			
= Total Cover	125		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum Ø % Cover of Biotic Crust Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: Ø (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: Ø (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

SOIL

Sampling Point: 41

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR 5/2	100					Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
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- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland Rating Forms

CRAM Assessment

Basic Information Sheet: Riverine Wetlands

Assessment Area Name: Berryessa (Reach 1A) - Below Calaveras Blvd	
Project Name: Berryessa Creek	
Assessment Area ID #: Reach 1A	
Project ID #:	**Date:** 25 Aug 2014 / 1135 hrs.
Assessment Team Members for This AA: JB / ST	
Average Bankfull Width: 30'	
Approximate Length of AA (10 times bankfull width, min 100 m, max 200 m): 40'	
X **Upstream Point Latitude:** 37.433905	**Longitude:** -121.892795
X **Downstream Point Latitude:** 37.433994	**Longitude:** -121.892861

Wetland Sub-type:

☐ Confined ☒ Non-confined

AA Category:

☒ Restoration ☐ Mitigation ☒ Impacted ☐ Ambient ☐ Reference ☐ Training

☐ Other:

Did the river/stream have flowing water at the time of the assessment? ☒ yes ☐ no

What is the apparent hydrologic flow regime of the reach you are assessing?

The hydrologic flow regime of a stream describes the frequency with which the channel conducts water. *Perennial* streams conduct water all year long, whereas *ephemeral* streams conduct water only during and immediately following precipitation events. *Intermittent* streams are dry for part of the year, but conduct water for periods longer than ephemeral streams, as a function of watershed size and water source.

Artificial (Likely) - Flow from urban sources.

No ☒ perennial ☒ intermittent ☐ ephemeral

BFH = 3'

↑ Possibly as well

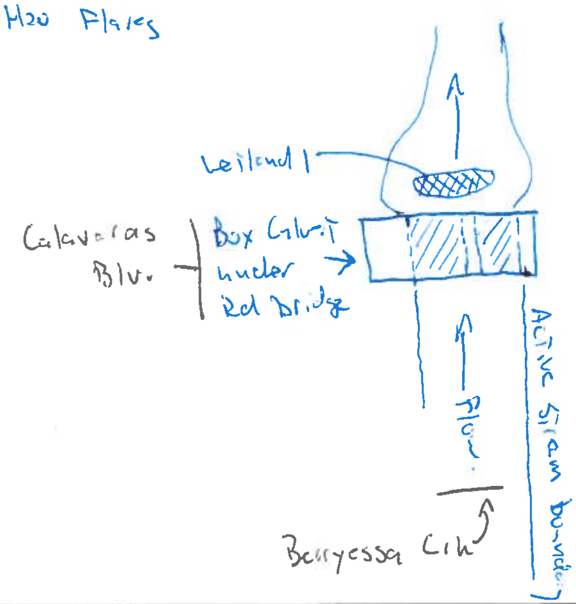
Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		Upstream			
2		Middle Left			
3		Middle Right			
4		Downstream			
5					
6					
7					
8					
9					
10					

Site Location Description:

Site heavily altered / Disturbed - urban Creek Sys, Channelized with concrete lining in places, steep banks w/ erosional problems, wetland @ downstream toe of box culvert where flowing H2O flares

Comments:



Scoring Sheet: Riverine Wetlands

AA Name: Wetland 1 (Berryessa Creek, Reach 1A)			Date: 25 Aug 2014	
Attribute 1: Buffer and Landscape Context (pp. 11-19)			**Comments**	
	Alpha.	Numeric		
Stream Corridor Continuity (D)	D	3	Highly Altered & maintained	
Buffer:			• urban setting	
Buffer submetric A: Percent of AA with Buffer	D	3	• very little similar to Native-Type condition	
Buffer submetric B: Average Buffer Width	D	3	• Novel env - Perennial flows	
Buffer submetric C: Buffer Condition	D	3	• Flows from urban sources	
Raw Attribute Score = $D+[C \times (A \times B)^{1/2}]^{1/2}$		6	**Final Attribute Score = (Raw Score/24) x 100**	25 ✓
Attribute 2: Hydrology (pp. 20-26)				
	Alpha.	Numeric		
Water Source	D	3	unnatural Hydrology	
Channel Stability	C	6		
Hydrologic Connectivity	A	12		
Raw Attribute Score = sum of numeric scores		21	**Final Attribute Score = (Raw Score/36) x 100**	58 ✓
Attribute 3: Physical Structure (pp. 27-33)				
	Alpha.	Numeric		
Structural Patch Richness	C	6		
Topographic Complexity	C	6		
Raw Attribute Score = sum of numeric scores		12	**Final Attribute Score = (Raw Score/24) x 100**	50 ✓
Attribute 4: Biotic Structure (pp. 34-41)				
Plant Community Composition (based on sub-metrics A-C)				
	Alpha.	Numeric		
Plant Community submetric A: Number of plant layers	C	6		
Plant Community submetric B: Number of Co-dominant species	D	3		
Plant Community submetric C: Percent Invasion	A	12		
Plant Community Composition Metric (*numeric average of submetrics A-C*)		7		
Horizontal Interspersion	D	3		
Vertical Biotic Structure	D	3		
Raw Attribute Score = sum of numeric scores		13	**Final Attribute Score = (Raw Score/36) x 100**	36 ✓
Overall AA Score (average of four final Attribute Scores)			42 ✓	

Ordinary High Water Mark Identification Forms

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Berryessa (Reach 1A), below Calaveras Blvd
Date: 25 Aug '14
Time: 1135 hrs
Project Number:
Town: Milpitas
State: CA
Stream: Berryessa Crk
Photo begin file#:
Photo end file#:
Investigator(s): AB/ST

Y [x] / N [ ] Do normal circumstances exist on the site?

Y [x] / N [ ] Is the site significantly disturbed?

Location Details: Berryessa (Reach 1A) Down stream of Calaveras Blvd.

Projection:
Datum:
Coordinates:

Potential anthropogenic influences on the channel system:
• Channelized, maintained, concreted, straightened, sprayed for weeds (Roundup), mowed in upland areas.

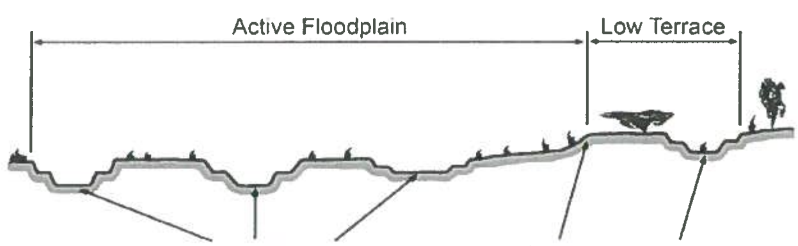
Brief site description:
silt, weedy veg, heavily managed. Perennial system, heavily urbanized throughout.

Checklist of resources (if available):

- [x] Aerial photography
  Dates:
- [x] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [x] Soils maps
- [ ] Rainfall/precipitation maps
- [x] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies

- [x] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [x] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

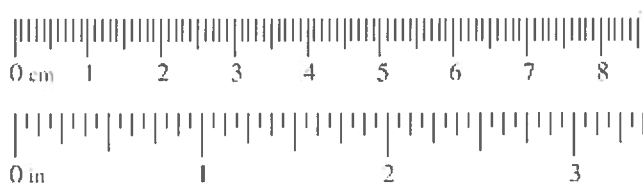


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [x] Mapping on aerial photograph
   - [x] GPS
   - [ ] Digitized on computer
   - [ ] Other:

Wentworth Size Classes

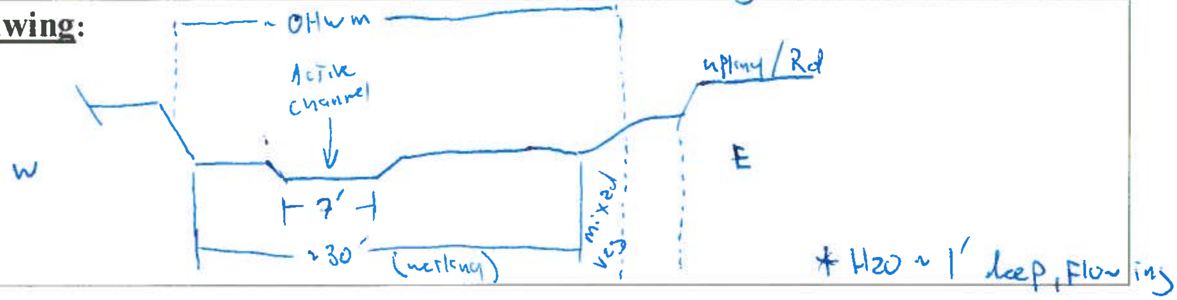
Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	
	2.56	64		
			Pebble	
	0.157	4		
			Granule	
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0.50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0.125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud



Berryessa Crk

Project ID: Reach 1A **Cross section ID:** 1 **Date:** 25 Aug '14 **Time:** 1135 hrs.

Cross section drawing:



OHWM

GPS point: OHW-EB-1, OHW-WB-2

Indicators:

- [ ] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: ____________
- [ ] Other: ____________

Comments: Clear Topographic break ~ ↑ of 1-2' in elevation, matches w/ lossy wetland hydrology + hydrophytic plants, plants above break are weedy ruderal upland sp.

• Sediment is Sandy Fine w/ limited gravel throughout cx

Floodplain unit:

- [x] Low-Flow Channel
- [x] Active Floodplain
- [ ] Low Terrace

GPS point: OHW-EB-1 OHW-WB-2

Characteristics of the floodplain unit:

Average sediment texture: Fine - Med Sand

Total veg cover: 100 % Tree: 0 % Shrub: 0 % Herb: 100 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

* maintained + disturbed veg - altered + Not able to succeed.

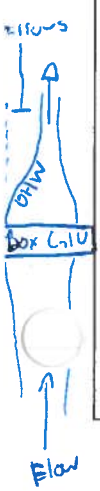
Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris - shore + in Pepper Tree
- [x] Presence of bed and bank
- [x] Benches - very Clear.
- [ ] Soil development
- [x] Surface relief
- [x] Other: Water Mark in Box Culvert under Rd ~2' above substrate & 36 in below ceiling of Box Culvert. Where the Cob lehs stop)
- [ ] Other: ____________
- [ ] Other: ____________

Comments:

• Hydrology Constrained by Concrete revetment + Box Culvert just upstream of reach = likely prevents more variable system - OHW is consistent & similar to in OHW + Normal Flows, Sandy soil prevent Cracks from being produced
• OHWM wider on downstream end of Box Culvert due to eddies + scour

* OHWM likely higher in box culvert than out of due to constriction & Ease of Flow.



Because wetland was w/in OHWM, it was delineated independently (see associated data)
↳ Alternatives = wetland being outside OHW - would be delineated, wetland = OHW - considered a stream - Not delineated.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: ______________________________

Characteristics of the floodplain unit:

Average sediment texture: ____________________

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [ ] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: ____________________
- [ ] Other: ____________________
- [ ] Other: ____________________

Comments:

Floodplain unit: [ ] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: ______________________________

Characteristics of the floodplain unit:

Average sediment texture: ____________________

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
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Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [ ] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: ____________________
- [ ] Other: ____________________
- [ ] Other: ____________________

Comments:

Same as Prior.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Berryessa (Reach 1)
Project Number:
Stream: Berryessa Crk
Investigator(s): JB / ST

Date: 25 Aug '14
Town: Milpitas
Photo begin file#:

Time: 1458
State: CA
Photo end file#:

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [X] / N [ ] Is the site significantly disturbed?

Location Details: Berryessa (Reach 1) Reach between Calaveras & Los Coches.

Projection:
Datum:
Coordinates:

Potential anthropogenic influences on the channel system:

Entire System altered - urbanized & maintained.

Brief site description:

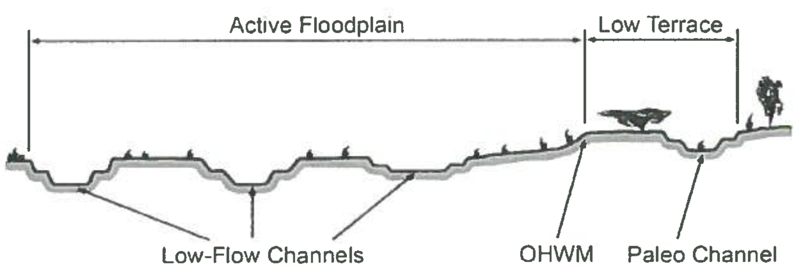
Engineered & Channelized, veg maintained, Flows are artificial

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [X] Soils maps
- [ ] Rainfall/precipitation maps
- [X] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies

- [X] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [X] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



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1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
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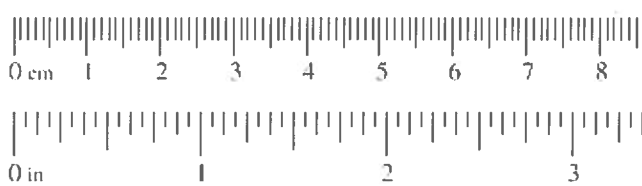
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

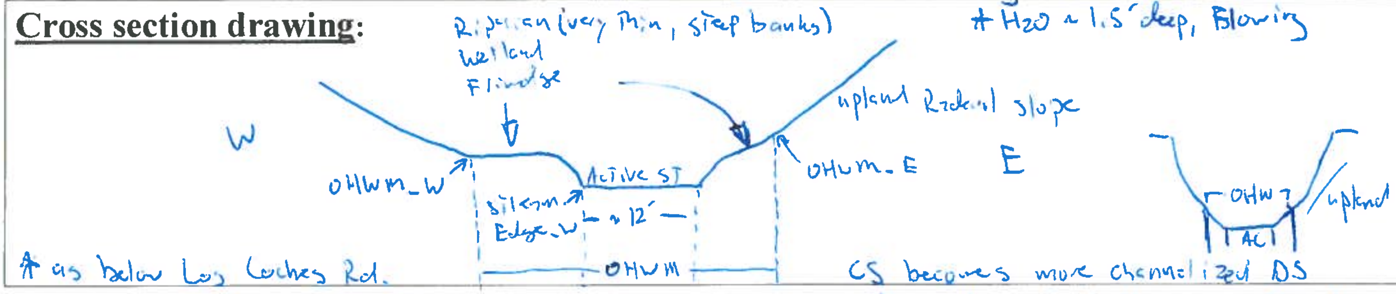
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	
	2.56	64		
			Pebble	
	0.157	4		
			Granule	
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0.50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0.125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud



Project ID: **Cross section ID:** **Date:** 25 Aug '14 **Time:** 1458

Cross section drawing:



CS becomes more channelized DS above Calaveras Blvd, CS becomes slightly wider + Riprap is present w/ in active channel - diversity is it but not the XS.

OHWM

GPS point: Several

Indicators:

- [X] Change in average sediment texture
- [X] Change in vegetation species
- [X] Change in vegetation cover
- [X] Break in bank slope
- [ ] Other: ______
- [ ] Other: ______

Comments:

• Below OHWM, sediment is Gravel/Sand - Active stream is Sand/Gravel
• Reach is very channelized for ~ 85% of length (uniform on both banks), 15% has somewhat less channelized structure w/ slight bench on west side.

Floodplain unit: [X] Low-Flow Channel [X] Active Floodplain [ ] Low Terrace

GPS point: Several

Characteristics of the floodplain unit:

Average sediment texture: Pebble (Ranging from Sand - Cobble)

Total veg cover: 100 % Tree: Ø % Shrub: Ø % Herb: 100 %

Community successional stage:

- [X] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

See prior form.

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [X] Drift and/or debris
- [X] Presence of bed and bank
- [X] Benches
- [X] Soil development - Sorted Soil (Lg on upper bench) (sm on lower bench)
- [ ] Surface relief
- [ ] Other: ______
- [ ] Other: ______
- [ ] Other: ______

Comments: Same plant sp as Reach 1A.

wetland Fringe present but same bounds as OHWM - Did not sample wetland independently (~x1' wide)
→ very thin → - " " " " "

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ___________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ___________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Same as Prior

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Berryessa Creek (Reach 2) **Project Number:** **Stream:** Berryessa Crk. **Investigator(s):** JB/ST	**Date:** 25 Aug '14 **Time:** 1600 hrs **Town:** Milpitas **State:** CA **Photo begin file#:** **Photo end file#:**
Y [X] / N [ ] Do normal circumstances exist on the site? Y [X] / N [ ] Is the site significantly disturbed?	**Location Details:** Berryessa (Reach 2) Los Coches - (Piedmont Crk) **Projection:** **Datum:** **Coordinates:**

Potential anthropogenic influences on the channel system:

Entire System altered - Urbanized + maintained

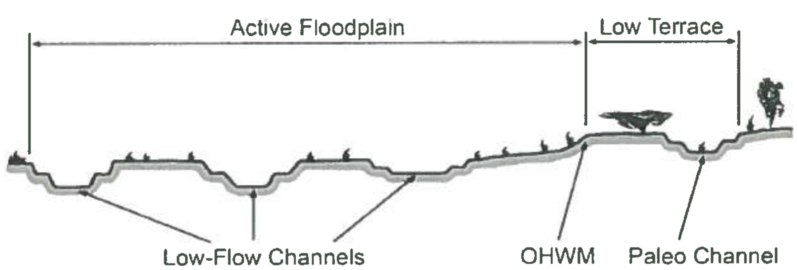
Brief site description:

Engineered + Channelized, Veg maintained, Flows are artificial

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [X] Soils maps
- [ ] Rainfall/precipitation maps
- [X] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [X] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [X] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

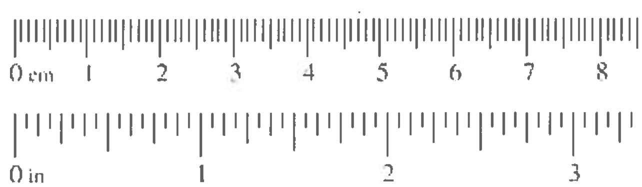


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [X] GPS
   - [ ] Digitized on computer
   - [ ] Other:

Wentworth Size Classes

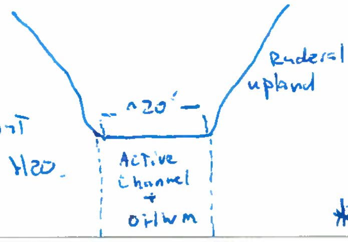
Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	
	2.56	64		
			Pebble	
	0.157	4		
			Granule	
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0.50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0.125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud



Project ID: **Cross section ID:** **Date:** 25 Aug '14 **Time:** 1600 hrs.

Cross section drawing:

* upstream of Piedmont Crk; Little surface H2O, Downstream To No surface H2O from Piedmont Crk.
↳ Channel the same; however, but has more emergents than open H2O.



* H2O ~ 1.5' deep, flowing

OHWM

GPS point: Several

Indicators:

- [ ] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [ ] Break in bank slope
- [ ] Other: ______
- [ ] Other: ______

Comments:

OHWM = Stream Edge = wetland boundary

Floodplain unit:

- [ ] Low-Flow Channel
- [x] Active Floodplain
- [ ] Low Terrace

GPS point: Several

Characteristics of the floodplain unit:

Average sediment texture: Pebble (Ranging from Sand-Cobble)

Total veg cover: 100 % Tree: Ø % Shrub: Ø % Herb: 100 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Same as prior

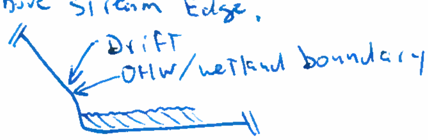
Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [x] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: ______
- [ ] Other: ______
- [ ] Other: ______

Comments:

• very incised channel - very narrow/ none wetland fringe - just transition from open water to upland
• Drift present vertically above stream edge.

wetland ≈ 1' wide



Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ____________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ____________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Same as prior

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Berryessa Crk (Reach 2/3)
Project Number:
Stream: Berryessa Crk
Investigator(s): JB/ST

Date: 25 Aug '14
Town: Milpitas
Photo begin file#:

Time: 1658
State: CA
Photo end file#:

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [X] / N [ ] Is the site significantly disturbed?

Location Details: Berryessa (Reach 2 ~~X~~ 3) Piedmont Creek

Projection:
Datum:
Coordinates:

Potential anthropogenic influences on the channel system:

Entire System altered - Urbanized + maintained.

Brief site description:

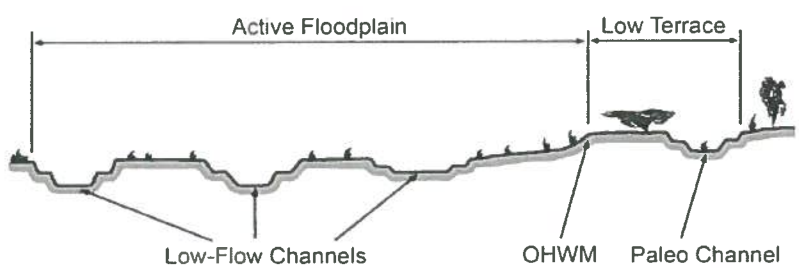
Engineered + Channelized, Veg maintained, Flows are artificial

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [X] Soils maps
- [ ] Rainfall/precipitation maps
- [X] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies

- [X] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [X] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

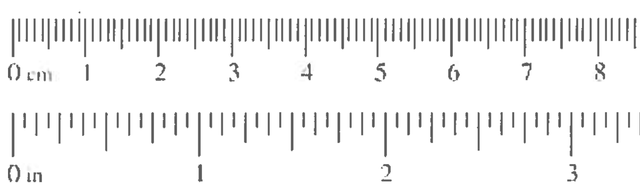


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

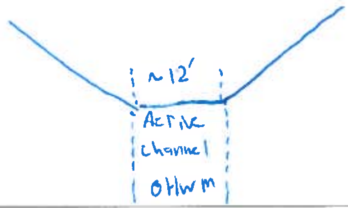
Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	
	2.56	64		
			Pebble	
	0.157	4		
			Granule	
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0.50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0.125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud



Project ID: **Cross section ID:** **Date:** 25 Aug '14 **Time:** 1658

Cross section drawing:

Same basic structure & conditions as Berryessa downstream of confluence.



* H_2O ~1.0' deep, flowing

OHWM

GPS point: Several (N & S points)

Indicators:

- ☐ Change in average sediment texture
- ☒ Change in vegetation species
- ☒ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: ______
- ☐ Other: ______

Comments: Same as for downstream section of Berryessa.

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: (N & S pts) Several

Characteristics of the floodplain unit:

Average sediment texture: med sand

Total veg cover: 100 % Tree: Ø % Shrub: Ø % Herb: 100 %

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

* Same as prior.

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: ______
- ☐ Other: ______
- ☐ Other: ______

Comments:

- Appears to be 1° source of surface H_2O downstream on Berryessa.
- Same physical features as adjacent portion of Berryessa.
- wetland $\bar{x}$ = 1' wide

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ___________________

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ___________________

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Same as prior.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Berryessa Crk	**Date:** 25 Aug 2014	**Time:** 1715
Project Number:	**Town:** Milpitas	**State:** CA
Stream: Berryessa Crk	**Photo begin file#:**	**Photo end file#:**
Investigator(s): JB/ST		

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [X] / N [ ] Is the site significantly disturbed?

Location Details: Berryessa (Reach 3) Piedmont Crk - Yosemite Bridge (Rd)

Projection: **Datum:**

Coordinates:

Potential anthropogenic influences on the channel system:

Same as previous

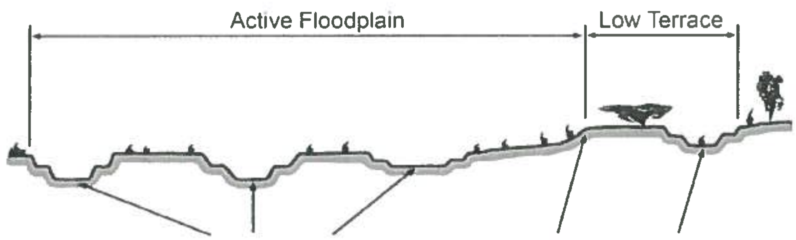
Brief site description:

Same as previous.

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [X] Soils maps
- [ ] Rainfall/precipitation maps
- [X] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [X] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [X] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
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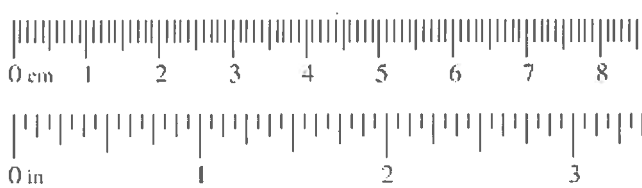
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

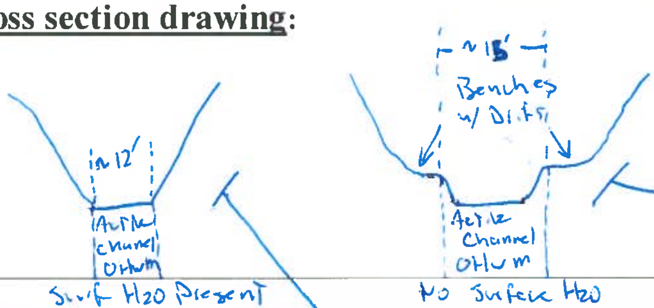
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	
	2.56	64		
			Pebble	
	0.157	4		
			Granule	
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0.50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0.125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud

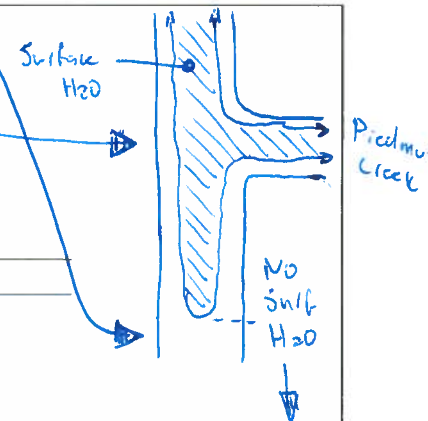


Project ID: **Cross section ID:** **Date:** 25 Aug 2014 **Time:** 1715.

Cross section drawing:



* Surf. water ~1.5' deep / Flowing where Present



OHWM

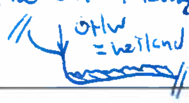
GPS point: Several

Indicators:

- [ ] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: ______
- [ ] Other: ______

Comments:

- XS w/ No/Little benches - Same as downstream portions of Berryessa.
- XS w/ Benches - No surf H2O present, channel dry w/ hydrophytic sp - bench slope very steep causing Active Channel Edge = "wetland" boundary - No delin performed, = OHWM.



Floodplain unit:

- [x] Low-Flow Channel
- [x] Active Floodplain
- [ ] Low Terrace

GPS point: Several

Characteristics of the floodplain unit:

Average sediment texture: Pebble (Ranging From Sand - Cobble)

Total veg cover: 100 % Tree: Ø % Shrub: Ø % Herb: 100 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

See Prior

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [x] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: ______
- [ ] Other: ______
- [ ] Other: ______

Comments:

Same plants in prior reach, benches partially mowed - mostly upland sp. wetland $\bar{x}$ = 1' wide.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ___________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

☐ NA
☐ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☐ Late (herbaceous, shrubs, mature trees)

Indicators:

☐ Mudcracks
☐ Ripples
☐ Drift and/or debris
☐ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☐ Other: ____________________
☐ Other: ____________________
☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: ___________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

☐ NA
☐ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☐ Late (herbaceous, shrubs, mature trees)

Indicators:

☐ Mudcracks
☐ Ripples
☐ Drift and/or debris
☐ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☐ Other: ____________________
☐ Other: ____________________
☐ Other: ____________________

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Berryessa Crk
Project Number:
Stream: Berryessa Crk
Investigator(s): DB/ST

Date: 26 Aug '14
Town: Milpitas
Photo begin file#:

Time: 0904 hrs
State: CA
Photo end file#:

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☒ / N ☐ Is the site significantly disturbed?

Location Details: Berryessa (Reach 3) above Yosemite Rd - Montague Exp way

Projection:
Datum:
Coordinates:

Potential anthropogenic influences on the channel system:

Same as prior, Numerous armored Culvert inlets - All/most heavily eroded & perched.

Brief site description:

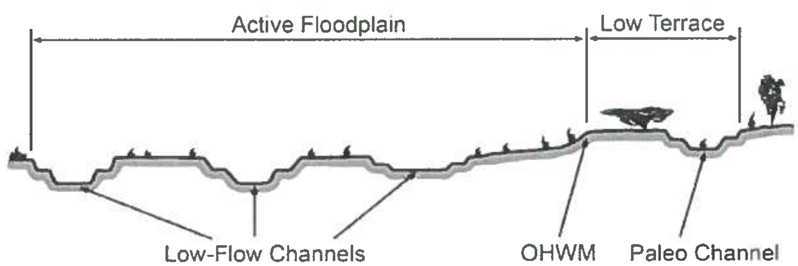
" " "

Checklist of resources (if available):

☒ Aerial photography
Dates:
☒ Topographic maps
☐ Geologic maps
☐ Vegetation maps
☒ Soils maps
☒ Rainfall/precipitation maps
☒ Existing delineation(s) for site
☐ Global positioning system (GPS)
☐ Other studies

☒ Stream gage data
Gage number:
Period of record:
☐ History of recent effective discharges
☐ Results of flood frequency analysis
☐ Most recent shift-adjusted rating
☒ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

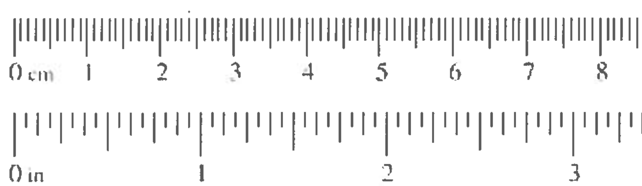
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:

☒ Mapping on aerial photograph
☐ Digitized on computer

☒ GPS
☐ Other:

Wentworth Size Classes

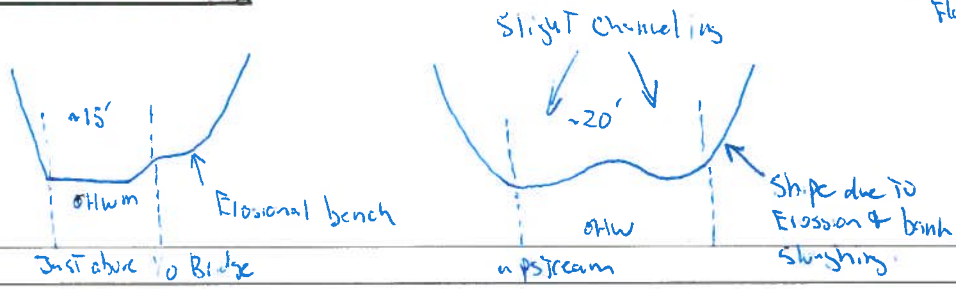
Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	
	2.56	64		
			Pebble	
	0.157	4		
			Granule	
	0 079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0 50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0 125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud



Project ID: **Cross section ID:** **Date:** 26 Aug '14 **Time:** 0904 hrs.

Cross section drawing:

+ H2O - Pockets of Standing - Last Flood in Late spring



OHWM

GPS point: Several

Indicators:

- [ ] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: ____________
- [ ] Other: ____________

Comments: Similar To previous

Floodplain unit:

- [ ] Low-Flow Channel
- [x] Active Floodplain
- [ ] Low Terrace

GPS point: Several

Characteristics of the floodplain unit:

Average sediment texture: Gravel - Pebble (Riprap + Cobble also present)

Total veg cover: 70 % Tree: Ø % Shrub: Ø % Herb: 100 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

• Disturbed sys - Not Successional

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris - 1° indicator
- [x] Presence of bed and bank
- [x] Benches - captures drift.
- [x] Soil development
- [x] Surface relief
- [ ] Other: ____________
- [ ] Other: ____________
- [ ] Other: ____________

Comments:

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:
Average sediment texture: ____________________
Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:
Average sediment texture: ____________________
Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____________________
- ☐ Other: ____________________
- ☐ Other: ____________________

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Berryessa Crk
Project Number:
Stream: Berryessa Crk
Investigator(s): JB/ST

Date: 26 Aug '14
Town: Milpitas
Photo begin file#:

Time: 1112
State: CA
Photo end file#:

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [X] / N [ ] Is the site significantly disturbed?

Location Details: Berryessa Crk Reach 4) Montague Exp Bridge - End Proj

Projection: **Datum:**

Coordinates:

Potential anthropogenic influences on the channel system:

Same as Prior Reaches, 2 Prominant Concreted Sections Forming 90° bends in This Reach.

Brief site description:

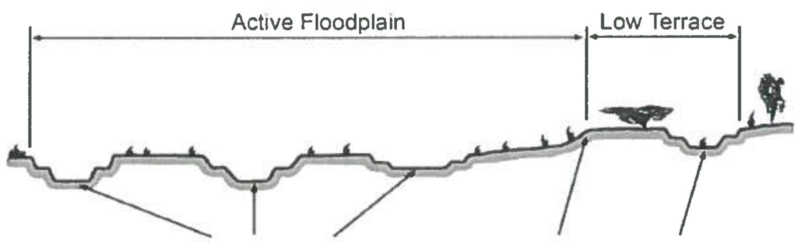
" " ", heavily altered/engineered, almost entirely dry (surface)

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [X] Soils maps
- [ ] Rainfall/precipitation maps
- [X] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies

- [X] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [X] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

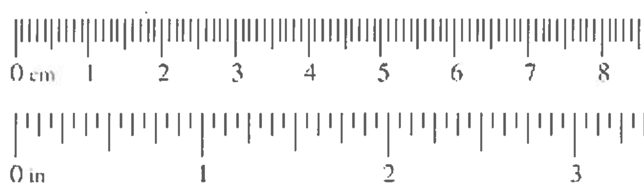


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

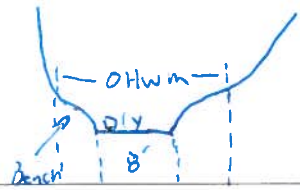
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	
	2.56	64		
			Pebble	
	0.157	4		
			Granule	
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0.50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0.125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud



Project ID: **Cross section ID:** **Date:** 26 Aug 2014 **Time:** 1112

Cross section drawing:



XS varies slightly in width (Due To Concrete Sections) & prominence of benches
Benches are never prominent but are present in some places.

OHWM

GPS point: Several (Note: Stream Extends both N-S & E-W in Reach 4)

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover - 1° indicator although more hydrophitic sp Tend To be present in stream rather Than out
- [x] Break in bank slope
- [ ] Other: ____________
- [ ] Other: ____________

Comments:

-Sediment varies - Typically larger & more sorted in active channel.

Floodplain unit:

- [ ] Low-Flow Channel
- [x] Active Floodplain
- [ ] Low Terrace

GPS point: Several (N-S, E-W Sections)

Characteristics of the floodplain unit:

Average sediment texture: gravel-Pebble w/ some cobble

Total veg cover: 60 % Tree: Ø % Shrub: Ø % Herb: 100 %

* Some riparian Trees are present in areas (Populus, Quercus, Sambucus,) but all are well outside of OHWM.

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Disturbed - No Succession occuring.

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris - 1° indicator
- [x] Presence of bed and bank
- [x] Benches - Active Channel insized below OHW Bench
- [ ] Soil development
- [x] Surface relief
- [ ] Other: ____________
- [ ] Other: ____________
- [ ] Other: ____________

Comments:

- Channel uniform From Montague Exp - Concrete-lined bend.
- " relatively wider above Concrete-lined bend - still insized & weedy - First bend
- " is maintained until Toe of Second Concrete-lined bend, as well as above bend.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: __________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

☐ NA
☐ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☐ Late (herbaceous, shrubs, mature trees)

Indicators:

☐ Mudcracks
☐ Ripples
☐ Drift and/or debris
☐ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☐ Other: ____________________
☐ Other: ____________________
☐ Other: ____________________

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: ____________________________

Characteristics of the floodplain unit:

Average sediment texture: __________________

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

☐ NA
☐ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☐ Late (herbaceous, shrubs, mature trees)

Indicators:

☐ Mudcracks
☐ Ripples
☐ Drift and/or debris
☐ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☐ Other: ____________________
☐ Other: ____________________
☐ Other: ____________________

Comments:

APPENDIX C: GROUND LEVEL COLOR PHOTOGRAPHS

Photo: 1	Looking: Downstream	Notes: Reach 4

Photo: 2	Looking: Downstream from active channel	Notes: Reach 3

Photo: 3	Looking: Upstream at urban environment	Notes: Reach 1A

Photo: 4	Looking: Upstream across disturbed channel	Notes: Reach 3

Photo: 5	Looking: Upstream at wetland veg (Wetland 1)	Notes: Reach 1A

Photo: 6	Looking: Downstream at wetland/upland boundary	Notes: Reach 1A

Photo: 7	Looking: Upstream, overview	Notes: Reach 1

Photo: 8	Looking: Upstream, overview	Notes: Reach 2

Photo: 9	Looking: Upstream, overview	Notes: Reach 4
		
Photo: 10	**Observation: Drift at base of gage**	**Notes: Reach 4**
		

Photo: 11	Observation: Drift deposit	Notes: Reach 4

Photo: 12	Observation: Drift deposit at base of gage	Notes: Reach 4

Photo: 13	Observation: Drift deposit	Notes: Reach 1A

Photo: 14	Observation: Drift deposit on left of channel	Notes: Reach 3

Photo: 15	Observation: Change in sediment – scour line	Notes: Reach 3
		
Photo: 16	**Looking: Upstream, Piedmont Creek**	**Notes: Between Reach 2 and 3**
		

Photo: 17	Looking: Downstream at Wetland 1	Notes: Reach 1A

Photo: 18	Observation: Head cutting	Notes: Reach 3

APPENDIX D: LITERATURE CITATIONS

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken (editors). 2012. The Jepson Manual: Vascular Plants of California, Second Edition. University of California Press, Berkeley.

Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. (Version 04DEC98). http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm.

CWMW (Level 2 Committee of the California Wetland Monitoring Workgroup). 2013. California Rapid Assessment Method for Wetlands – Riverine Wetlands Field Book; Ver. 6.1. January 2013. Available: http://www.cramwetlands.org/sites/default/files/2013.03.19_CRAM%20Field%20Book%20Riverine%206.1_0.pdf.

DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources. Publicaiton 3421.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. The National Wetland Plant List: 2014 Update of Wetland Ratings. Phytoneuron 2014-41: 1-42.

Munsell (Munsell® Soil Color Charts). 2009. Year 2009 Revised Edition. Gretag/Macbeth Publishing, NY.

NOAA (National Oceanic and Atmospheric Administration). 2014. Climatological Report (Monthly) (Preliminary). National Climatic Data Center (NCDC). Accessed 2 September 2014. Available: http://www.ncdc.noaa.gov.

NRCS (U.S. Department of Agriculture Soil Conservation Service; National Resources Conservation Service). 1903. Soil Survey of the San Jose Area, California. Author: M.H. Lapham.

NRCS. 2008. Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better to Meet the Needs of the Natural Resources Conservation Service. Technical Note No. 190-8-76. February 2008.

NRCS. 2014a. USDA Field Office Climate Data. San Jose, CA, CA293. Creation date: 5 September 2014. Available: http://efotg.sc.egov.usda.gov/treemenuFS.aspx.

NRCS. 2014b. Custom Soil Resource Report for Santa Clara Area, California, Western Part. Created: 29 August 2014.

NRCS. 2014c. National List Hydric Soils; All States. 29 August 2014. Available: ftp://ftp-fc.sc.egov.usda.gov/NSSC/Hydric_Soils/Lists/hydric_soils.xlsx.

Parker, R., S.A. Dewey, L.C. Burrill, D.W. Cudney, and T.D. Whitson. 2006. Weeds of the West: 5th (fifth) Edition. June 1, 2006. Publisher: Cooperative Extension Service.

USACE (U.S. Army Corps of Engineers). 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. Vicksburg, MI.

USACE. 2005. Regulatory Guidance Letter; Ordinary High Water Mark Identification. No. 05-05. 7 December 2005. Available: http://www.usace.army.mil/Portals/2/docs/civilworks/RGLS/rgl05-05.pdf.

USACE. 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0); J.S. Wakeley, R.W. Lichvar, and C.V. Noble (Eds). ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

USACE. 2010. Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. K.E. Curtis and R.W. Lichvar. ERDC/ERREL TN-10-1. July 2010. Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center, Hanover, NH.

USACE. 2012. Nationwide Permits, Conditions, District Engineer's Decision, Further Information, and Definitions (with corrections). Available: http://www.usace.army.mil/Portals/2/docs/civilworks/nwp/2012/NWP2012_corrections_21-sep-2012.pdf.

USFWS (U.S. Fish and Wildlife Service). 2014. National Wetlands Inventory Web Page. Accessed: 29 August 2014. Available: http://www.fws.gov/wetlands/Wetlands-Mapper.html.

USGS (U.S. Geological Survey, National Geospatial Program). 2014. The National Map; Hydrology (NHD) Viewer – Berryessa Creek Project Area. Accessed: 3 September 2014. Available: http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd&b=base1&q=piedmont%20creek%2C%20ca&x=-13568011.165311167&y=4498070.235580203&l=15&v=vectorSelectablePolygons%3A10.

Appendix D Geotechnical Report

Geotechnical Appendix
Upper Berryessa Creek Flood Risk Management Project
I-680 to Calaveras Boulevard
Santa Clara County
Milpitas, California

Prepared for:

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686

Prepared by:

Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614-6213

Final

April 3, 2015

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TABLES

FIGURES

ATTACHMENTS

GEOTECHNICAL APPENDIX
UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT
SANTA CLARA COUNTY
MILPITAS, CALIFORNIA

1. INTRODUCTION

This Appendix presents the results of the geotechnical explorations and analyses for the Berryessa Creek Flood Risk Management Project (Project). The project consists of improvements to the existing channel to increase the hydraulic capacity of the channel. The improvements consist of widening the base of the channel, adding a short floodwall in one area, scour protection, grade control structures, a low-height levee, and a new culvert for the Union Pacific Railroad (UPRR) over the creek. A location map of the Project is presented on **Figure 1**.

The explorations were performed in a phased approach based on a review of the available and existing subsurface information, borings, and test results. The initial exploration phase of the subsurface exploration (Phase I) for this project was performed using Cone Penetrometer Testing (CPT) borings at representative and critical locations, or in areas with limited existing, subsurface information. Phase II of the exploration was performed to supplement the results of the Phase I exploration, and was performed with Standard Penetration Testing (SPT) borings to refine the findings from the Phase I exploration and to obtain samples for index and shear strength testing.

The geotechnical analyses and evaluations performed for the improvements included stability analyses of the proposed channel configuration, foundation recommendations for the new UPRR culvert and the short floodwall, settlement evaluations for the short floodwall and low-height levee, and construction recommendations for the proposed improvements.

It should be noted that the Project lies within an area of known environmental contamination and several environmental explorations and evaluations have been performed in the area over the years. There are environmental issues that need to be addressed as part of the design and construction of this project. However, this appendix presents only the geotechnical considerations for the Project. The environmental aspects of this project will be considered and addressed in a separate document.

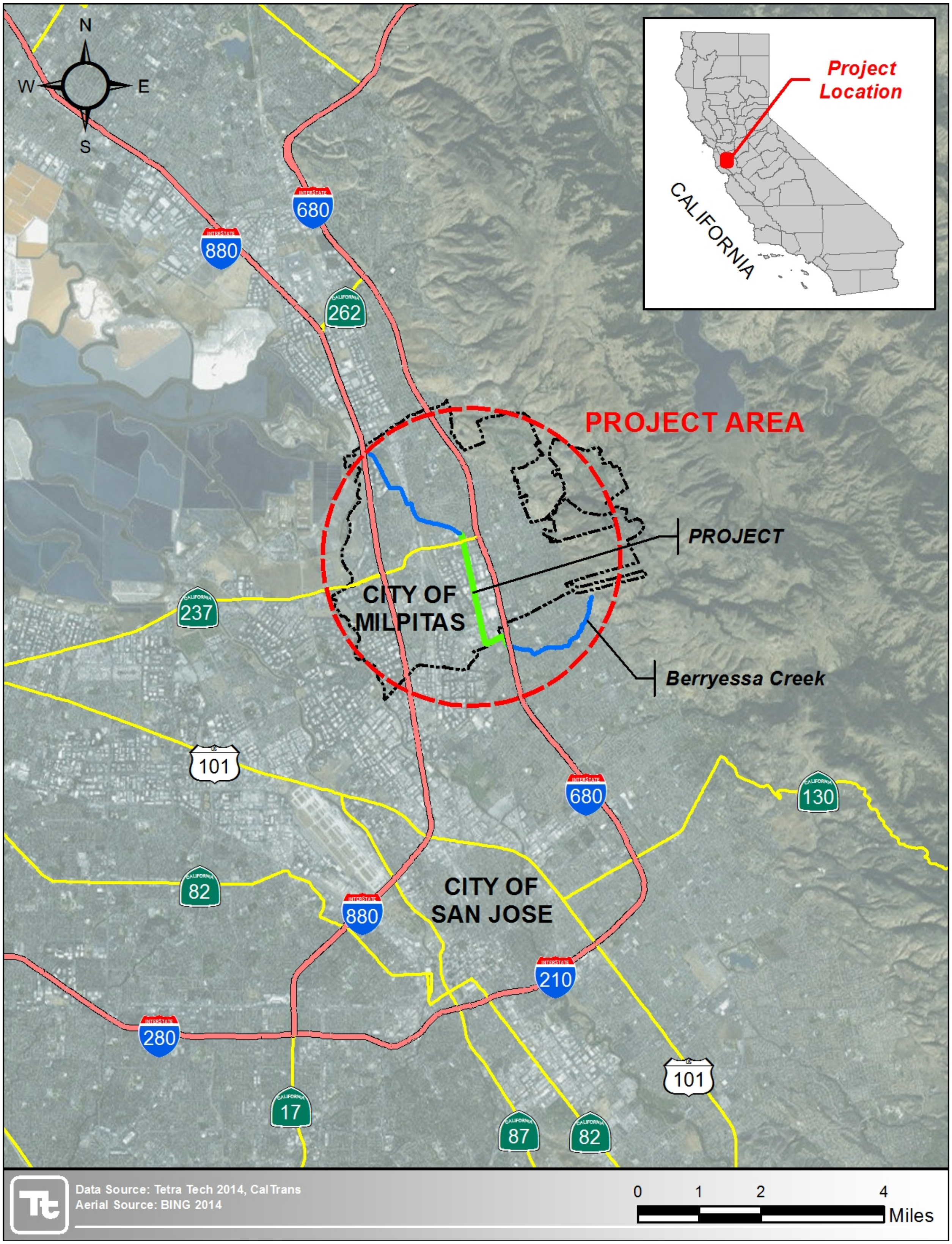

Figure 1. Project Location Map

2. PROJECT DESCRIPTION

2.1. Channel Improvements

The project consists of the improvements to the Berryessa Creek Channel between Calaveras Boulevard (Station 86+00) and I-680 (Station 193+00). In general, the channel improvements will consist of widening the existing channel, installing slope protection on the channel slopes, and using a short floodwall in on the left bank between Stations 103+50 and 115+23 and Stations 171+00 and 175+50 to maintain flows in the channel.

At the time this geotechnical appendix was prepared, the designs of the various elements of the channel improvements were at a 60% design level. The channel will be widened, deepened slightly, and the slopes will be graded to a consistent 2H:1V slope. The bottom of the channel will vary in width between 15 and 40 feet. Erosion protection will be placed on the channel slopes. This erosion protection will consist of rip rap on the lower portion of the slope and geocells filled with aggregate or concrete on the upper portion of the slope.

2.2. UPRR Trestle

The current plans call for the demolition of the existing UPRR timber trestle bridge over Berryessa Creek near station 160+85 and replacing it with a two-cell, reinforced-concrete box culvert. The 60% design plans indicate that each of the two cells on the proposed culvert will be 10 feet wide and 9 feet high. The invert of the culvert is approximately one foot below the lowest current elevation in the existing creek.

3. REGIONAL GEOLOGY

The subject site is located within the northeastern portion of the Santa Clara Valley approximately 5 miles southeast of the San Francisco Bay. The Santa Clara Valley lies within the Coast Ranges Geomorphic Province. The Santa Clara Valley is part of a long, northwest-southeast-trending structural down-block depression known as the as Alum Rock Block which is located between the right lateral strike-slip San Andreas fault to the southwest and the right lateral strike-slip Hayward and Calaveras faults to the northeast and is concealed and overlain by thick Quaternary alluvial sediments. The Alum Rock Block is bound by the Mt. Hamilton Block in the northeast, separated by the right lateral strike-slip Calaveras Fault and the concealed Silver Creek Block in the southwest which extends northwest under the San Francisco Bay. The Alum Rock Block consists of a stack of Mesozoic to Cenozoic strata that was originally deposited on Jurassic Coast Range ophiolite and associated intermediate silicic volcanic rocks. The Quaternary materials consists of Pleistocene and Holocene alluvial Fan Deposits which are overlain by Holocene Basin Deposits associated with the San Francisco Bay.

Based on the United States Geologic Survey (USGS) Geologic Map, of the San Jose 30 X 50-Minute Quadrangle Map, the subject site is mostly covered by Holocene Basin Deposits (Qhb), Upper Pleistocene Alluvial Fan Deposits (Qpf) and Holocene Young Alluvial Fan Deposits (Qhfl). A geologic map of the general project area is shown on Figure 2. Description of the main geologic units are:

Qhb - Basin Deposits (Holocene) - dark-colored clay and very fine silty clay, rich in organic material;

Qhf1 - Young Alluvial Fan Deposits (Holocene) - (Younger) brown gravelly sand and sandy and clayey gravel, grading upward to sandy and silty clay, moderately dense to dense, coarser near the fan heads and upstream, deposited by flooding streams where they emerge from constrained channels of the uplands;

Qhf2 - Older Alluvial Fan Deposits (Holocene) - (Older) brown gravelly sand and sandy and clayey gravel, grading upward to sandy and silty clay, moderately dense to dense, coarser near the fan heads and upstream, deposited by flooding streams where they emerge from constrained channels of the uplands;

Qpf - Alluvial Fan Deposits (Upper Pleistocene) - light gray/tan to reddish brown gravel, clast supported, clasts typically cobble sized, clayey and sandy matrix, crudely bedded.

4. SUBSURFACE EXPLORATIONS

4.1. General

As mentioned above, the subsurface exploration for the Project was performed in phases. Historic borings along the channel were initially reviewed. The findings from that review were used to develop the Phase I exploration, which consisted of 13 CPT borings drilled at critical and representative locations along the channel. The results of the CPT borings, combined with the historic boring results, were then used to develop the Phase II exploration. The Phase II exploration consisted of 10 SPT borings drilled in areas with no borings and in representative areas to collect samples for laboratory testing.

Borings designated SPT-12 and SPT-13 were drilled specifically for the proposed box culvert. They were located on the left and right bank of the existing Berryessa Creek as close to the existing UPRR timber trestle as was safely feasible. Exploration within the channel bottom for the proposed culvert could not be performed because of permit requirements and project schedule limitations.

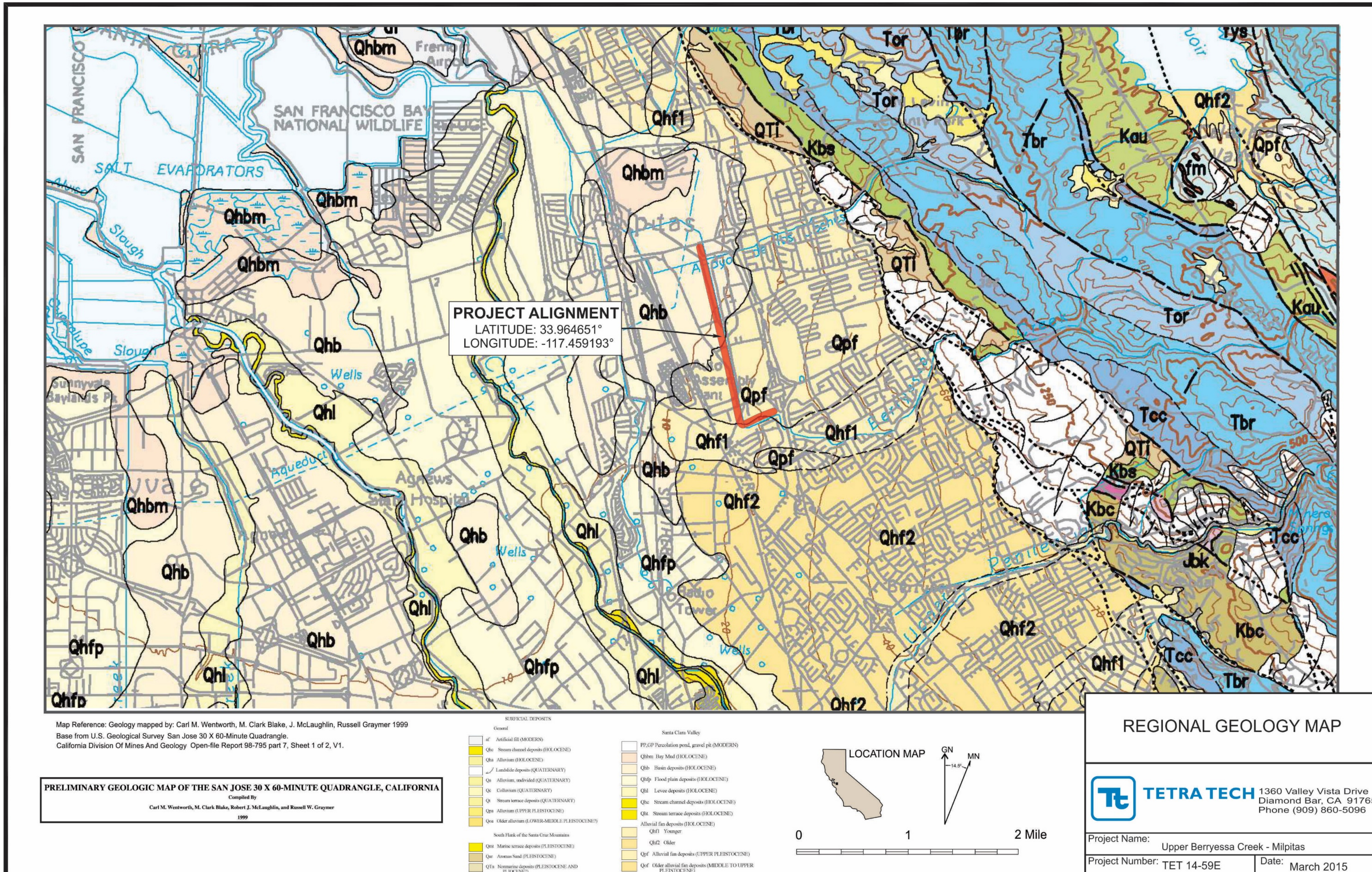

Figure 2. Regional Geology Map

4.2. Historic Borings

To evaluate the existing subsurface conditions along the creek alignment, several previous geotechnical reports were reviewed. However, much of the geologic and geotechnical conditions along the Upper Berryessa Creek Project alignment between Calaveras Boulevard and I-680 were summarized in the Geotechnical Report prepared in 2004 by Parikh Consultants, Inc. (Parikh 2004). The report included data from several geotechnical and environmental studies performed along or adjacent to the creek alignment.

Based on the existing boring information review, the subsurface conditions along the creek alignment below depths of 30 to 40 feet appear to be fairly consistent. Below these depths, the existing borings indicated stiff to hard, overconsolidated silty and sandy clays to the depths of the borings.

However, the upper soils from the ground surface to depths of 30 to 40 feet were more variable. The upper soils were typically overconsolidated silty clays and sandy clays but their consistency was softer and more variable than the lower soils, generally ranging from medium stiff to very stiff. One boring near Montague Expressway encountered upper soils that were very soft to soft to a depth of about 10 feet. These very soft to soft soils may be normally consolidated but they were located in a boring nearly 600 feet east of the channel.

In addition, the upper soils contained seams of granular soil, ranging from clayey sands and gravels to fine sands. These sand seams were not encountered consistently and were encountered at various depths and their thickness varied.

4.3. Groundwater Conditions – Historical Borings

Groundwater was encountered in many of the historical borings within the Project limits at depths varying from approximately 7 to 16 feet below existing grade. Further south along the alignment, near I-680, groundwater was encountered at a depth of 30 feet or more below existing grade.

A plan showing the locations of the historical borings is presented on **Figure 3**. A summary of the historic borings that were considered for the Project and used to develop the Phase I CPT program is shown on **Table 1** on the following pages.

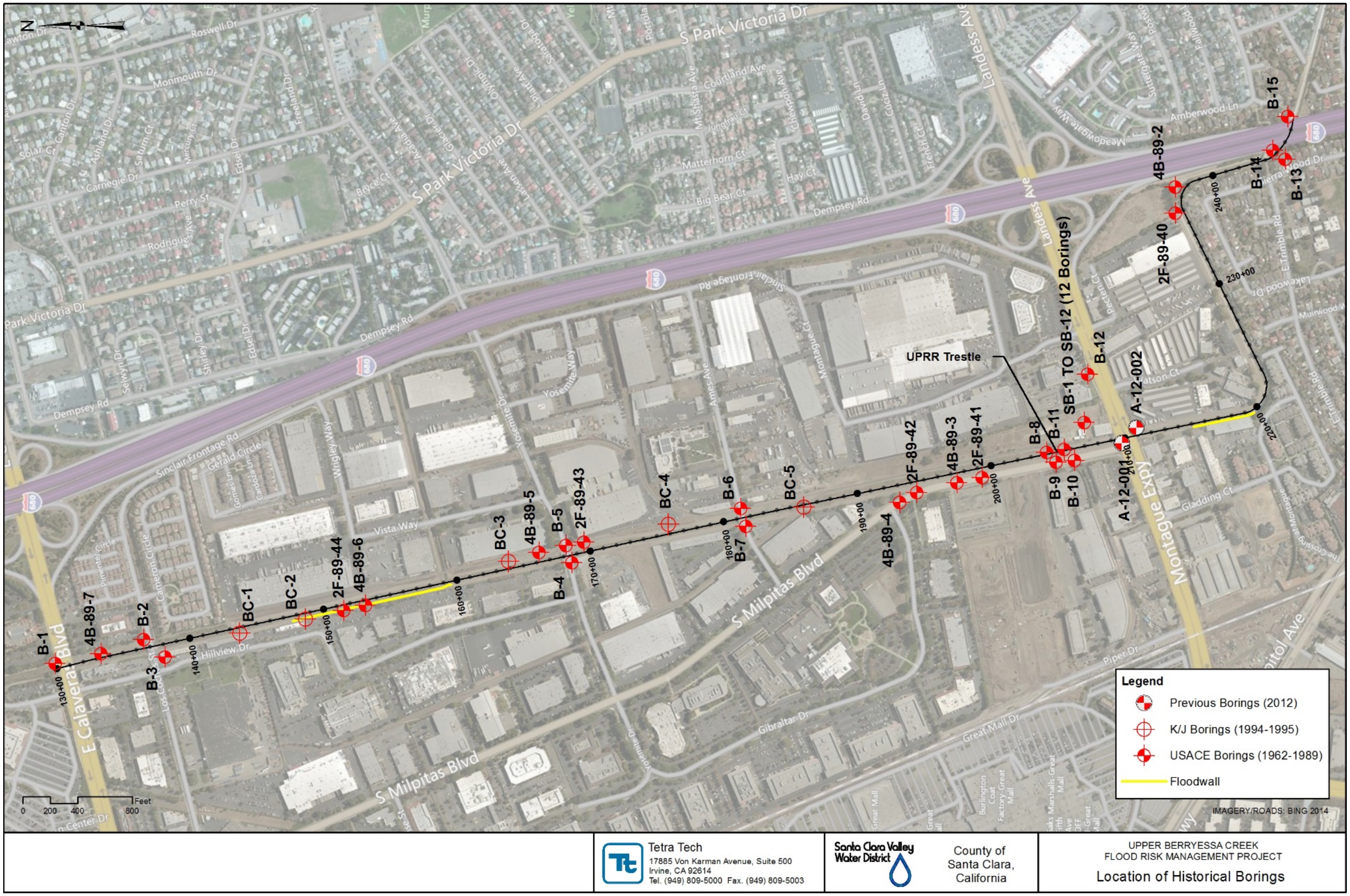

Figure 3. Historic Boring Locations

Table 1. Summary of Historical Boring Information

Boring/Trench Nos. (Date Drilled)	Top Elevation (ft)	Depth (ft)	Bottom Elevation (ft)	Approximate Depth of Groundwater (ft)	N-values (Y/N)	Triaxial Strength Testing (Y/N)	Drilled by	Available Geotechnical Information
B-1 (5/68)	26.0	51.0	-25.0	13.0	Y	N	SCVWD	Moisture content, density, and consolidation testing performed
B-2 (7/66)	29.5	62.0	-32.5	-	Y	N	Caltrans	Moisture content, density, and consolidation testing performed
B-3 (7/66)	29.7	72.0	-42.3	12.0	Y	N		
B-4 (1/72)	40.0	80.0	-40.0	-	Y	N	Geolabs, Inc	Moisture content, density, consolidation, CBR, and direct shear testing performed
B-5 (1/72)	40.5	80.0	-39.5	-	Y	N		
B-6 (1/72)	46.7	85.0	-38.3	-	Y	N		
B-7 (1/72)	46.5	80.0	-33.5	-	Y	N		
B-8 (4/82)	61.0	20.0	41.0	10.0	N	N	J.H. Kleinfelder and Associates	No laboratory testing available
B-9 (4/82)	60.0	20.0	40.0	10.0	N	N		
B-10 (4/82)	60.0	20.0	40.0	10.0	N	N		
B-11 (4/82)	61.0	20.0	41.0	10.0	N	N		
B-12 (4/82)	61.0	20.0	41.0	16.0	N	N		
B-13 (3/66)	77.0	66.5	10.5	32.7	Y	N	Caltrans	No laboratory testing available
B-14 (6/66)	79.0	44.0	35.0	34.7	Y	N		
B-15 (6/66)	79.2	75.0	4.2	34.4	Y	N		

Table 1 (cont.). Summary of Historical Boring Information

Boring/Trench Nos. (Date Drilled)	Top Elevation (ft.)	Depth (ft.)	Bottom Elevation (ft.)	Approximate Depth of Groundwater (ft)	N-values (Y/N)	Triaxial Strength Testing (Y/N)	Drilled by	Available Geotechnical Information
2F-89-40 (4/89)	74.0	20.0	54.0	-	Y	N	USACE	Moisture content, specific gravity, sieve, and Atterberg limit testing performed
2F-89-41 (4/89)	58.0	20.0	38.0	15.6	Y	N		
2F-89-42 (4/89)	53.5	20.0	33.5	-	Y	N		
2F-89-43 (4/89)	41.0	20.0	21.0	12.8	Y	N		
2F-89-44 (4/89)	30.0	20.0	10.0	9.8	Y	N		
BC-1 (2/95)	30.1	17.0	13.1	8.5	Y	N	Kennedy/ Jenks Consultants	No testing available
BC-2 (2/95)	29.0	16.0	13.0	8.4	Y	N		
BC-3 (2/95)	35.9	16.5	19.4	7.5	Y	N		
BC-4 (2/95)	43.2	16.5	26.7	9.0	Y	N		
BC-5 (2/95)	49.7	16.5	33.2	11.0	Y	N		
SB-1 (12/94)	27.6	18.0	9.6	-	N	N		No testing available
SB-2 (12/94)	29.2	19.0	10.2	-	N	N		
SB-3 (12/94)	29.2	20.0	9.2	-	N	N		
SB-4 (12/94)	29.7	18.0	11.7	-	N	N		

Table 1 (cont.). Summary of Historical Boring Information

Boring/Trench Nos. (Date Drilled)	Top Elevation (ft.)	Depth (ft.)	Bottom Elevation (ft.)	Approximate Depth of Groundwater (ft)	N-values (Y/N)	Triaxial Strength Testing (Y/N)	Drilled by	Available Geotechnical Information
SB-5 (12/94)	29.9	20.0	9.9	-	N	N	Kennedy/ Jenks Consultants	No testing available
SB-6 (12/94)	29.1	19.0	10.1	-	N	N		
SB-7 (12/94)	34.6	13.0	21.6	-	N	N		
SB-8 (12/94)	36.9	10.0	26.9	-	N	N		
SB-9 (12/94)	37.8	15.0	22.8	-	N	N		
SB-10 (12/94)	41.4	17.0	24.4	-	N	N		
SB-11 (12/94)	41.5	15.0	26.5	-	N	N		
SB-12 (12/94)	43.1	15.0	28.1	-	N	N		
4B-89-2	74.0	11.0	63.0	-	N	N	USACE	No testing available
4B-89-3	58.3	11.5	46.8	-	N	N		
4B-89-4	53.0	11.5	41.5	-	N	N		
4B-89-5	40.5	10.0	30.5	10.0	N	N		
4B-89-6	30.0	10.3	19.7	9.4	N	N		
4B-89-7	27.5	10.4	17.1	9.7	N	N		
A-12-001	63.0	81.5	-18.5	10.0	Y	N	Parikh	Moisture content, density, Atterberg limits, consolidation, and unconfined strength testing performed
A-12-002	64.0	81.5	-17.5	10.0	Y	N		

4.4. Phase I Subsurface Exploration – CPT Borings

Many of the historical borings available for review were shallow borings (less than 20 feet deep) for environmental purposes or sampling. Consequently, there was little geotechnical testing available. In addition, it was anticipated that the undrained slope stability evaluations for the channel improvements could result in failure surfaces that extended to depths of 30 feet or more, deeper than many of the historical borings. Therefore, while there was existing subsurface data to review and evaluate, there were also significant gaps in the existing data that needed to be explored.

Consequently, the purpose of the Phase I CPT exploration program was to provide additional subsurface information below the bottoms of the historical borings, develop undrained shear strengths that would be used in the geotechnical evaluations for the channel improvements, and to estimate groundwater levels at the time of drilling. This Phase I exploration program consisted of 13 CPT borings drilled at critical or representative locations, or at locations where there was no historical information or the historical information was not deep enough. The CPT borings were drilled between the dates of December 6 and December 7, 2014. All of the CPT borings were advanced to a depth of 40 feet.

A plan showing the locations of the CPT borings is shown on **Figure 4**. Logs of the CPT borings are presented in Attachment A.

4.5. Phase II Subsurface Exploration – SPT Borings

The Phase II Subsurface Exploration consisted of 10 SPT borings drilled to collect samples and to fill in any subsurface data gaps remaining from the CPT boring program. The SPT borings were drilled between the dates of December 10 and December 12, 2014 using 8-inch diameter hollow stem augers and a track-mounted drill rig. The locations of the SPT borings are shown on **Figure 5**. The SPT borings were drilled to depths of 13.5 to 61.5 feet. Both driven ring-type and bulk samples were retrieved at selected depths during drilling. The driven samples were collected utilizing a California-type sampler driven by a 140 pound hammer with a drop of 30 inches. Standard Penetration Testing was also performed using the same auto-trip hammer and drop as for the ring-type samples in general accordance with ASTM D 1586.

After completion of the drilling, groundwater depths were measured and the borings were backfilled with bentonite/cement grout. Details of the field exploration are presented in Attachment A. Logs of the SPT borings are also presented in Attachment A.

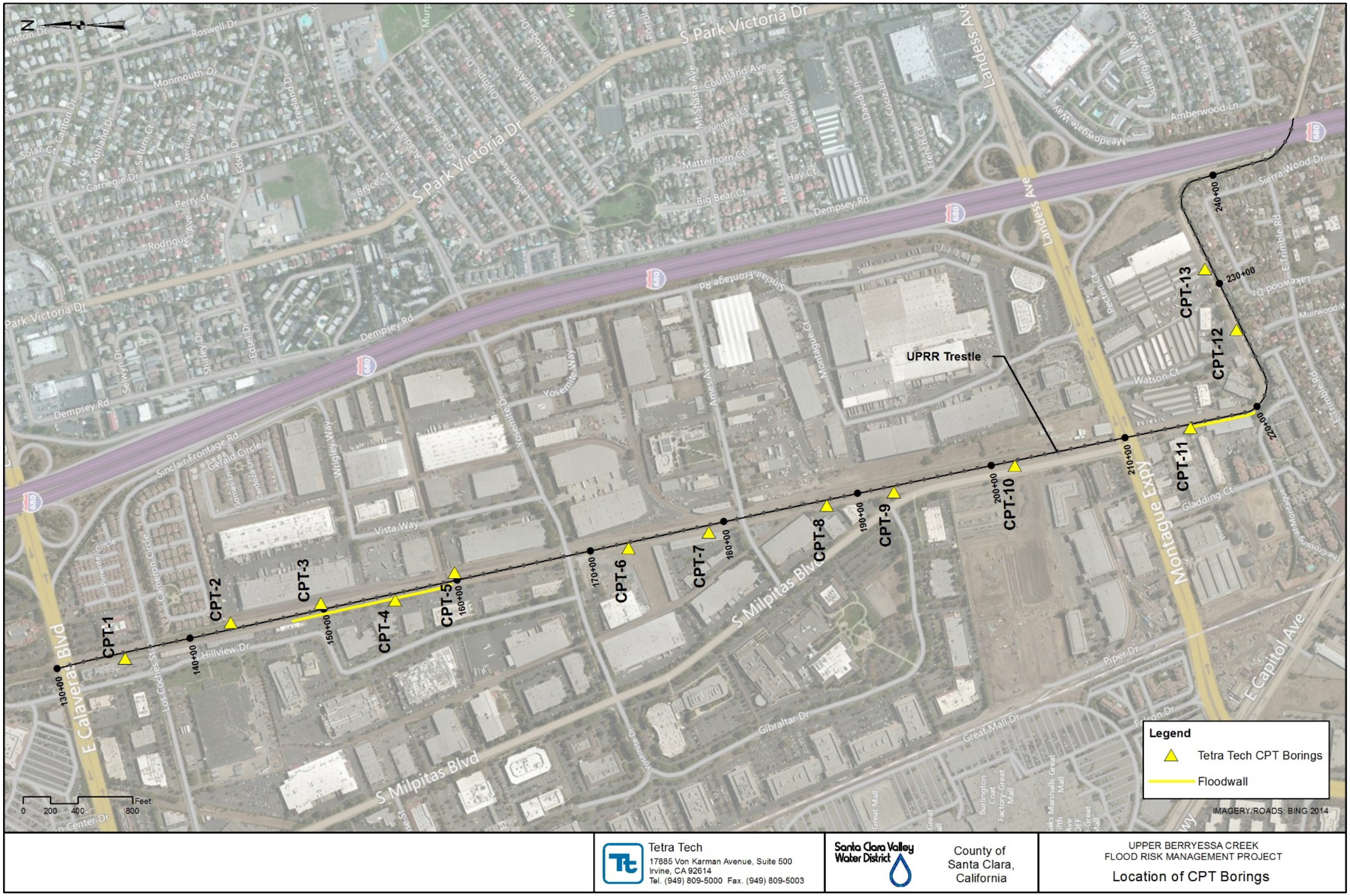

Figure 4. CPT Boring Locations

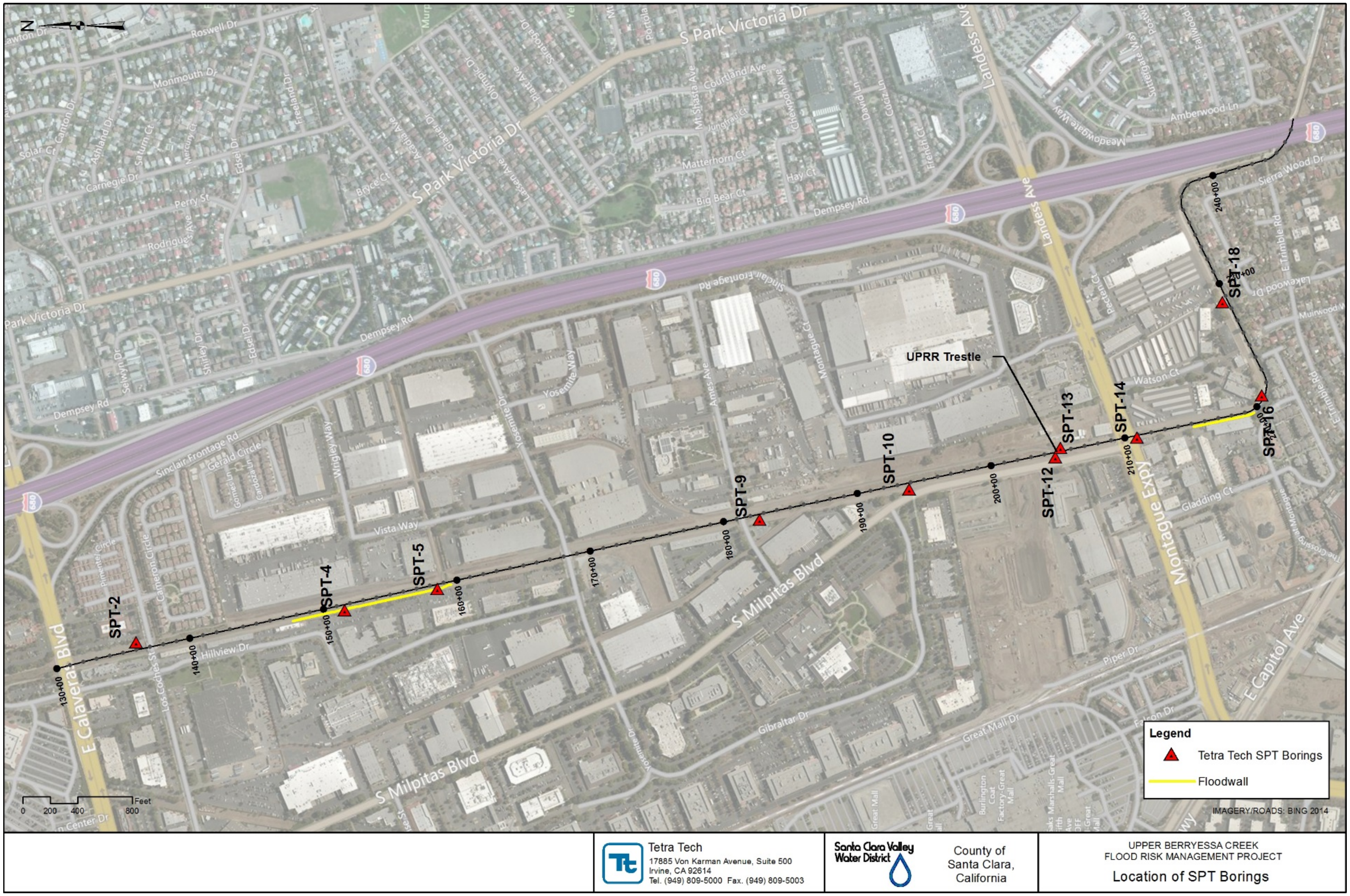

Figure 5. SPT Boring Locations

5. LABORATORY TESTING

Laboratory tests were performed on selected samples obtained from the borings in order to aid in the soil classification and to evaluate pertinent engineering properties of the foundation soils. The testing program was also developed to obtain the shear strengths required for the stability analyses and other geotechnical evaluations for the Project. Specifically, consolidated-undrained triaxial tests with pore pressure measurements were performed to determine "R" and "S" strengths required for the stability analyses in the Corps' engineering manual EM 1110-2-1902, Slope Stability. The following tests were performed for the Project:

- In-situ Moisture Content and Dry Density
- Grain Size Distribution
- Percent Passing #200 (silt and/or clay fraction)
- Atterberg Limits
- Unconfined Compression
- Direct Shear
- Consolidated-Undrained Triaxial with Pore Pressure Measurements
- Consolidation
- Expansion Index
- Water Soluble Sulfate Content

Testing was performed in general accordance with applicable ASTM Standards and California Test Methods. Results of all laboratory tests are presented in Attachment B. Selected laboratory results are also presented on the logs of the borings drilled for this exploration that are presented in Attachment A.

6. SUBSURFACE CONDITIONS

6.1. General

Based on the results of the historical borings, it was anticipated that the subsurface conditions were relatively consistent, with the soils generally being firm clays that contained irregular and discontinuous sand layers at various depths.

The CPT and SPT borings drilled for this project were located along the top of the existing bank. The top of the bank is relatively flat and roughly 8 to 10 feet above the channel bottom. The channel slopes are typically 2H:1V or flatter but some localized areas exhibits slopes steeper than 2H:1V.

Profiles of the subsurface conditions encountered by the historic CPT and SPT borings are shown on **Figure 6 and Figure 7**. The following sections present the significant results from each of the Phase I - CPT and Phase II - SPT explorations.

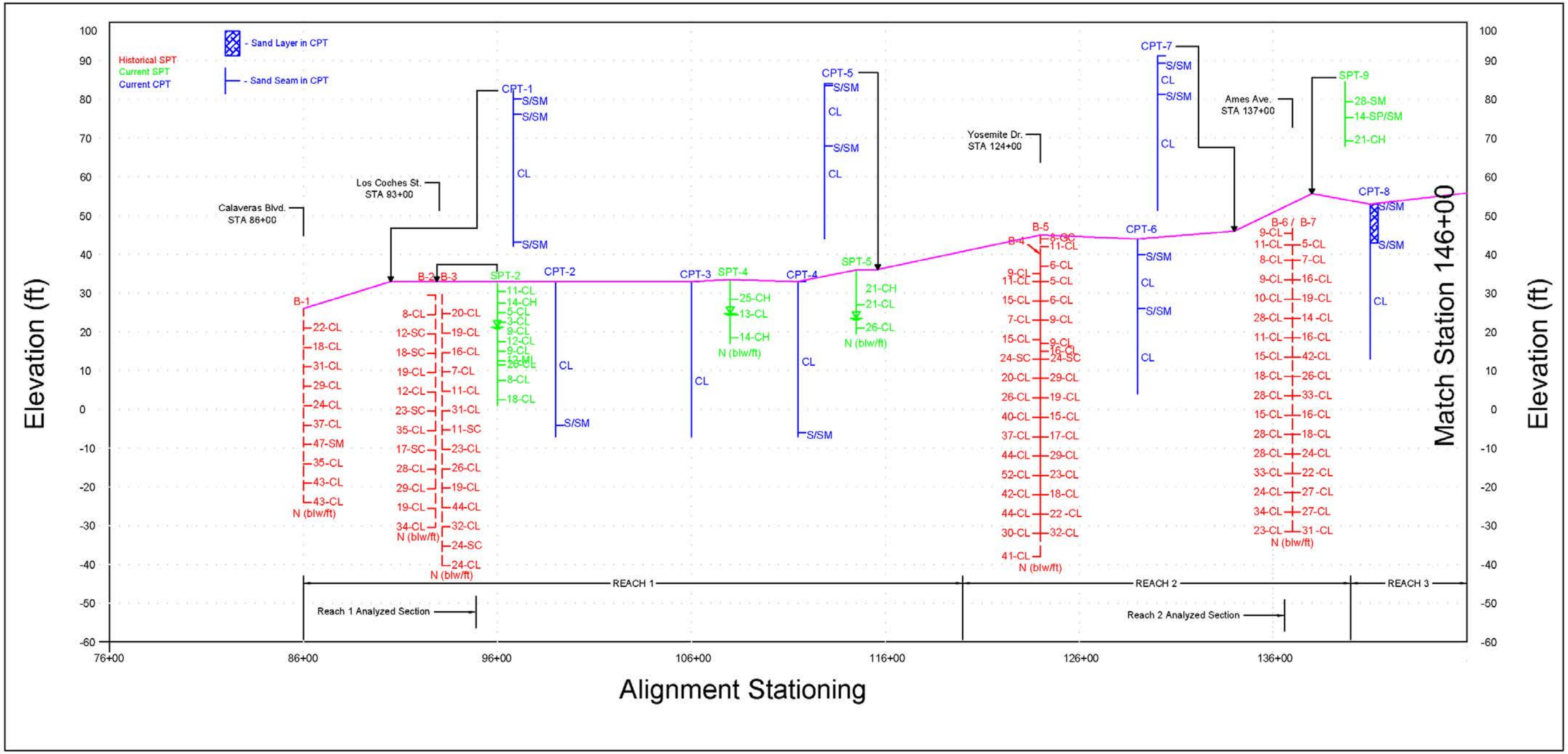

Figure 6. Soil Profile Along Alignment - Downstream

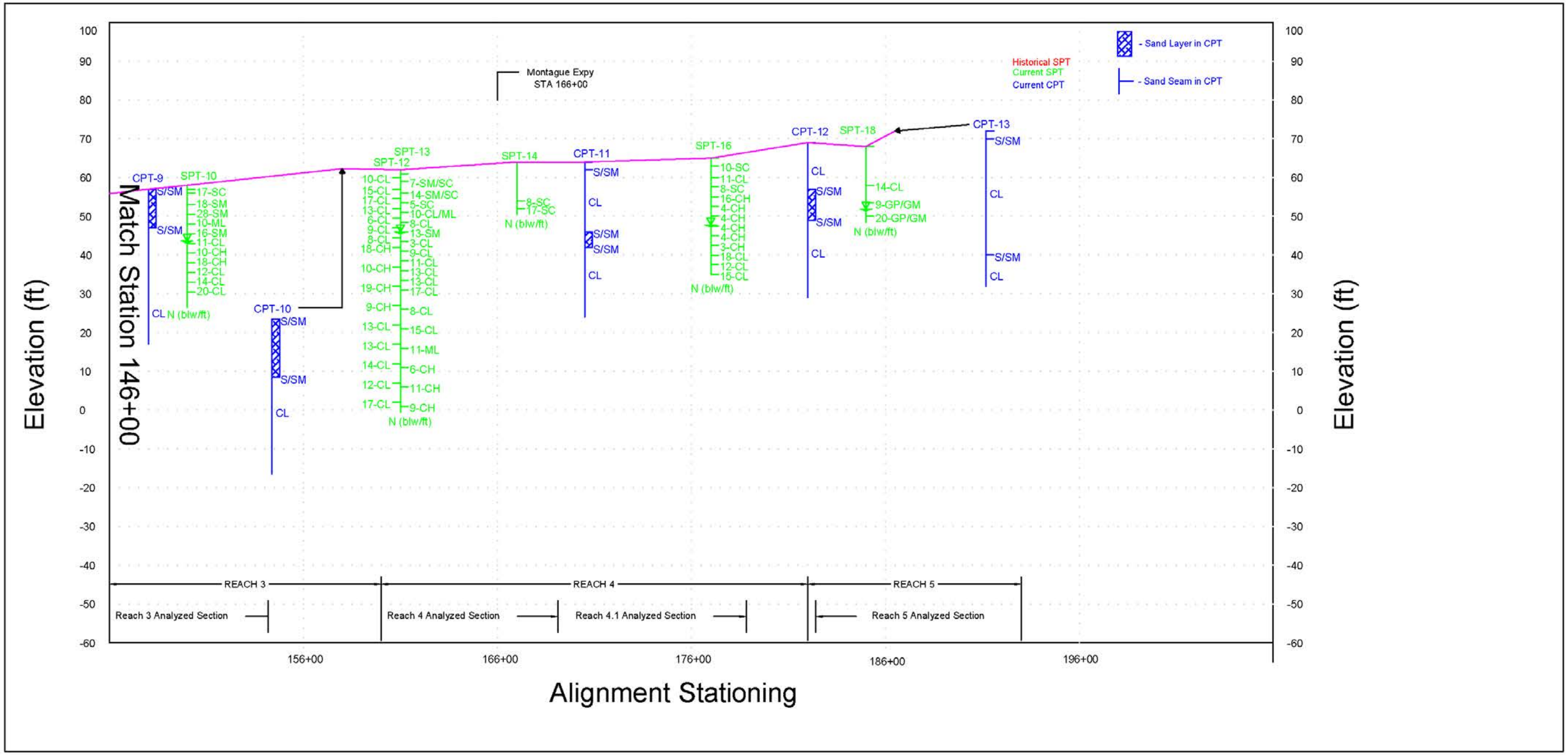

Figure 7. Soil Profile Along Alignment - Upstream

6.2. Phase I – CPT Exploration

As mentioned above, a total of 13 CPT borings were drilled for the Phase I exploration. The CPT borings were located at representative or critical locations to determine the subsurface conditions in the locations and depths where no historical data existed. All of the CPT borings were drilled to a depth of 40 feet.

The results of the CPT were essentially consistent with the results of the historical borings in that mostly cohesive soils were encountered. However, the total cone resistance (q_t) was very high in many of the clays, possibly indicating a significant amount of sand content.

Also, the Soil Behavior Types (SBT) for the CPT borings were also plotted. SBT charts use the basic CPT parameters of total cone resistance, q_t and friction ratio, R_f. The chart is global in nature and can provide reasonable predictions of soil behavior type for CPT soundings up to about 60 feet in depth. The SBT plots for the subsurface materials are presented on the CPT boring logs in Attachment A.

Because the CPT boring provides essentially a continuous profile of the subsurface conditions, the variability of the subsurface materials with depth are easily observed. As can be seen on the CPT boring logs, even the clays are variable with depth, ranging from sandy silts and clayey silts to clays and silty clays that alternate over short vertical distances. Zones of sand are readily apparent on the SBT plots on the CPT logs.

6.3. Phase II – SPT Exploration

While the CPT borings provided substantial information about the subsurface materials and conditions, no sampling was performed in the CPT borings. Therefore, 10 SPT borings were used to collect samples for laboratory testing, measure groundwater levels, and fill in any remaining data gaps in the subsurface information. The logs for the SPT borings are presented in Attachment A.

The subsurface conditions encountered in the exploratory borings generally consisted of shallow fills soils (af) overlying alluvial soils. The alluvium encountered in the borings were divided into two basic groups, younger alluvial deposits (Qa) associated with basin and younger alluvial fan deposits and older alluvial deposits (Qoa) associated with older alluvial fan deposits of the Upper Pleistocene and Holocene. Field classification between older and younger geologic units was primarily based on color and consistency of the soils observed.

Uncontrolled fill was encountered in all of the SPT borings at the ground surface to depths of 2 to 7 feet overlying natural soils. The uncontrolled fill consisted of silty sand or clayey sand in eight of the borings but consisted of clay soils in two of the borings. No documentation or records are available for this existing fill.

The natural soils beneath the uncontrolled fill typically consisted of firm cohesive soils with interbedded layers of sand to the depths of the borings. The cohesive soils were somewhat variable, ranging from clayey silts (CL-ML) to silty clays (CL) to high-plasticity clays (CH) that generally became stiffer with depth. The interbedded sands were generally silty sands and clayey sands.

The sand content of the cohesive soils also varied along the alignment. Some of the higher plasticity clays had 10 to 20 percent sand content while many of the silty clays had 35 to nearly 50 percent sand content. While the sand content in the silty clays was high, it is believed that there is sufficient fines contents in these deposits such that their behavior will be more cohesive in nature rather than granular.

Softer zones of clays were encountered in several of the borings although these layers were not thick and did not appear to be continuous. Many of these layers were encountered near the bottom of the existing channel invert elevation.

However, boring SPT-16 encountered 4 feet of clayey sand fill at the ground surface overlying stiff clay to a depth of 12 feet. Below the stiff clay, 13 feet of soft to medium stiff clay was encountered to a depth of 25 feet, where stiff clays were encountered to the depth of the boring. The N-values for the SPT samples in the soft to medium stiff layer were 4, although one sample exhibited an N-value of 3.

6.4. Groundwater Conditions

Historical high groundwater at the site was mapped by CDMG at depths between 7 and 12 feet (Figure 4, CDMG, 2001). Groundwater was encountered in many of the historical borings within the Project limits at depths varying from approximately 7 to 16 feet below existing grade. Further south along the alignment, near I-680, groundwater was encountered at a depth of 30 feet or more below existing grade (see **Table 1**).

In the 10 SPT borings drilled for the Phase II exploration, groundwater levels were encountered at depths of 8.8 to 17.2 feet, which is similar to the findings in the historic borings. **Table 2** presents the ground water measurements from the SPT borings.

Table 2. Groundwater Measurements in the SPT Borings

Boring	Depth to Groundwater During Drilling (ft.)	Depth to Groundwater At Completion of Drilling (ft.)
SPT-2	9.0	11.3 (15 min. AD[1])
SPT-4	10.2	8.8 (30 min. AD)
SPT-5	15.1	12.5 (30 min. AD)
SPT-9	None encountered	None encountered
SPT-10	18.0	14.4
SPT-12	17.5	14.8 (30 min. AD) 16.0 (60 min. AD)
SPT-13	20.0	16.7 (30 min. AD) 17.2 (60 min. AD)
SPT-14	None encountered	None encountered
SPT-16	15.5	17.2 (60 min. AD)
SPT-18	13.0	16.1

(1) AD – After Drilling complete.

This water was often contained in sand seams or other more permeable zones. However, as can be seen in the table, in two of the borings (SPT-9 and SPT-14) no water was encountered in the borings at the completion of drilling. In boring SPT-18, a wet gravel layer was encountered at a depth of 13.0 feet that extended to the depth of the boring at 19.5 feet.

Caving was noted only in the deep SPT borings drilled for the culvert and it occurred in these two borings at depths greater than 50 feet. In the remaining borings, no caving of the bore hole was reported, indicating the relatively cohesive nature of the subsurface materials and relatively high fines content of the sands on the Project. Even the gravel encountered in boring SPT-18 had sufficient fines and cohesion to stay open after the augers were removed the bore hole.

A comparison of the currently measured depths to groundwater and levels measured during previous exploration indicates that significant fluctuations in local groundwater can occur over time and across relatively short distances. For instance, the 1982 groundwater measurements from borings near the proposed UPRR culvert location were made in April and likely reflect typical water levels at the end of the winter season. The current groundwater measurements in that area were made in December, at the beginning of the winter rainy season. It must be noted as well that all the borings were located within the top of the channel bank, and likely a horizontal distance of at least 25 feet away from invert of the channel. Construction work for the proposed culvert will require excavation within and beneath the existing channel bottom. It should be anticipated that this work will encounter groundwater.

7. ENGINEERING SEISMOLOGY

7.1. General Seismic Setting

The Northern California region is known to be seismically active. Earthquakes occurring within approximately 60 miles of the site are generally capable of generating ground shaking of engineering significance to the proposed construction. The project area is located in the general proximity of several active and potentially active faults, as shown on **Figure 8**. Active faults are defined as those that have experienced surface displacement within the Holocene period (approximately the last 11,000 years). The closest active faults to the site are the Hayward Fault, located approximately 1.1 mile to the northeast, and the Calaveras-Pacines-San Benito Fault (Hayward Fault), is located approximately 4.2 miles to the east. The Calveras and Hayward Fault splay apart south of the Project site and become two distinct fault features. Other nearby faults include the Monte Vista/East Fault and San Andreas Fault, located approximately 11 miles and 15.5 miles to the southwest, respectively.

Figure 9 – Regional Historical Seismicity Map, shows the location of significant faults along with the locations of historic earthquakes with magnitudes of 5 or greater. Of these, notable historic earthquakes in Southern California of significance to the Project are included in **Table 3**.

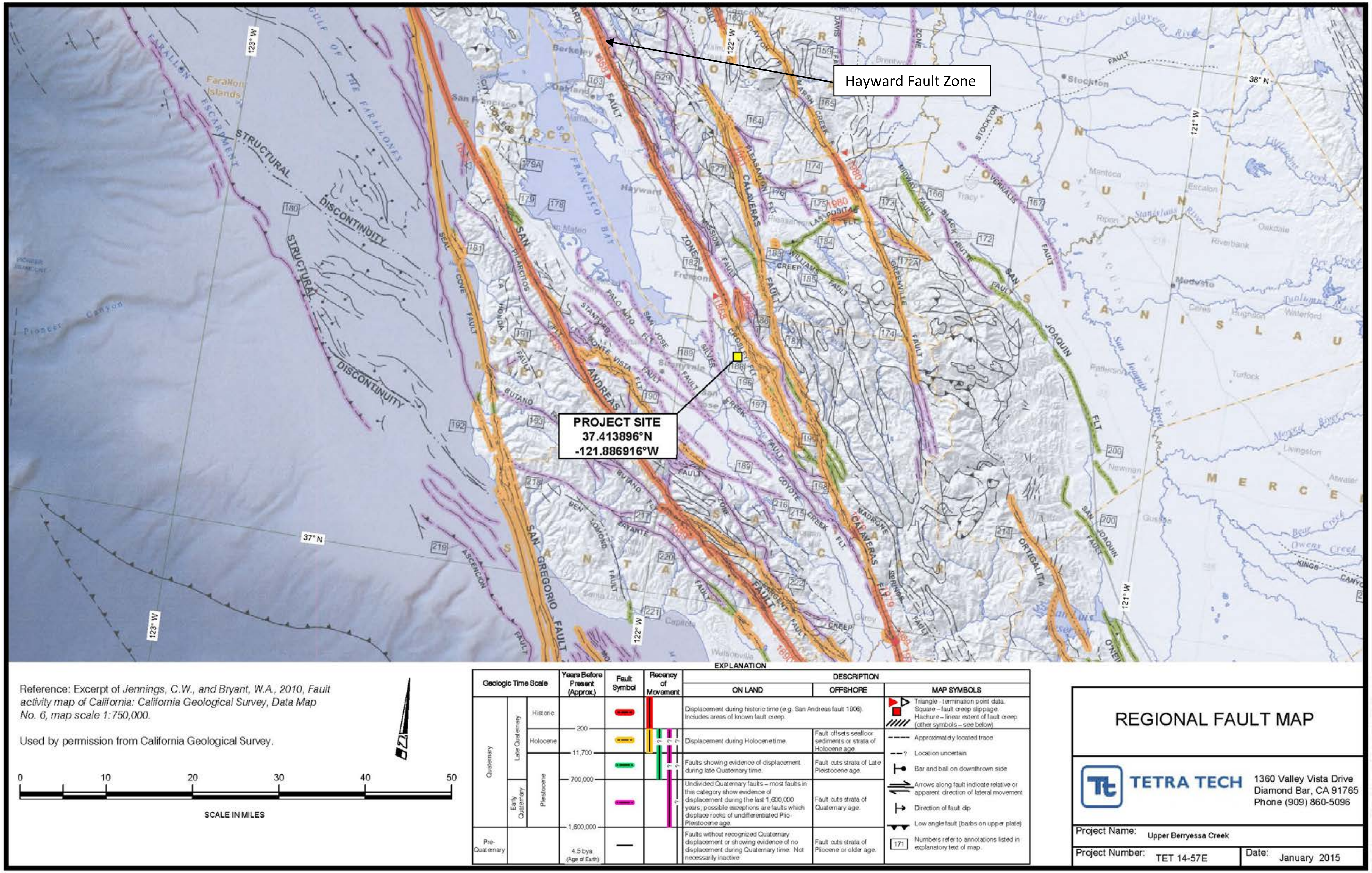

Figure 8. Regional Fault Map

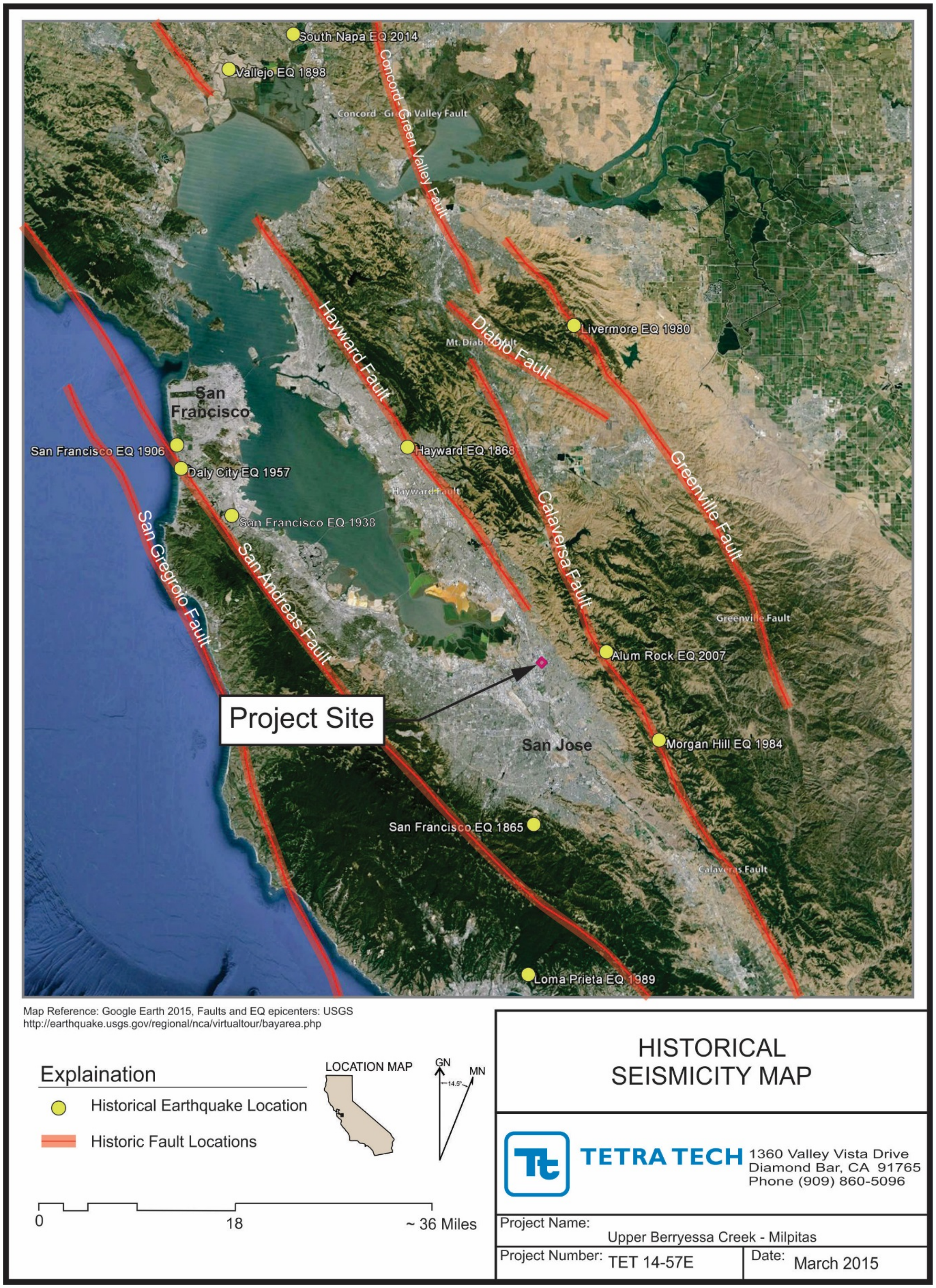

Figure 9. Historical Seismicity Map

Table 3. Significant Historical Earthquakes

Year	Date	Location	Mag.	Approximate Epicenter Location	Fault Name	Distance from Site (miles)
2014	24-Aug	American Canyon	6.0	38.21°N, -122.32°W	2014 South Napa earthquake	59.9 N
2007	30-Oct	Alum Rock	5.6	37.43°N, -121.77°W	2007 Alum Rock earthquake	6.5 S
1989	17-Oct	Santa Cruz Mountains	6.9	37.00°N, -121.90°W	**1989 Loma Prieta earthquake**	28.8 S
1984	24-Apr	Morgan Hill	6.2	37.31°N -121.68°W	1984 Morgan Hill earthquake	13.5 SE
1980	24-Jan	Livermore	5.8	37.86°N, -121.82°W	1980 Livermore earthquake	30.9 N
1957	22-Mar	Daly City	5.3	37.67°N, -122.48°W	1957 Daly City earthquake	36.9 NW
1911	1-Jul	Coyote	6.6	37.25°N, -121.75°W	1911 Calaveras earthquake	13.9 S
1906	18-Apr	San Francisco	7.8	37.70°N, -122.51°W	**1906 San Francisco earthquake**	39.1 NW
1898	31-Mar	Mare Island	6.2	38.20°N, -122.41°W	1898 Vallejo	59.7 N
1868	21-Oct	Hayward	6.8	37.70°N, -122.10°W	1868 Hayward earthquake	22.6 N
1865	8-Oct	Santa Cruz Mountains	6.3	37.20°N, -121.92°W	1865 San Francisco earthquake	15.3 S
1838	June	San Francisco Peninsula	7.0	37.60°N, -122.40°W	1838 San Francisco earthquake	30.6 NW

Based on the data above, the most notable historic earthquakes occurred in 1906 (San Francisco earthquake) and 1989 (Loma Prieta earthquake).

7.2. Seismic Hazards

The engineering seismology study for the site included reviewing local and regional fault maps and the review of historical earthquake data. Specifically, the following engineering seismology issues were addressed:

<u>Seismic Hazard Zones</u>: Maps of seismic hazard zones are issued by the California Geological Survey (CGS, formerly California Department of Conservation, Division of Mines and Geology (CDMG)) in accordance with the Seismic Hazards Mapping Act enacted in April 1997. The intent of the Seismic Hazards Mapping Act is to provide for a statewide seismic hazard mapping and technical advisory program to assist cities and counties in developing compliance requirements to protect the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes.

Based on the review of the Milpitas Quadrangle Official Map of Seismic Hazard Zones issued October 19, 2004 (**Figure 10**), the Project is located within an area identified by the State of California as subject to the hazard of liquefaction but is not located in an area subject to earthquake-induced landslides.

Surface Fault Rupture: Official Maps of Earthquake Fault Zones were reviewed to evaluate the location of the Project relative to active fault zones. Earthquake Fault Zones (known as Special Studies Zones prior to 1994) have been established in accordance with the Alquist-Priolo Special Studies Zones Act enacted in 1972. The Act directs the State Geologist to delineate the regulatory zones that encompass surface traces of active faults that have a potential for future surface fault rupture. The purpose of the Alquist-Priolo Act is to regulate development near active faults in order to mitigate the hazard of surface fault rupture.

The site is not located within a designated Alquist-Priolo Earthquake Fault Zone for fault surface rupture hazard. No surface traces of any active or potentially active faults are known to pass directly through or project towards the site. Neither our field exploration nor literature review disclosed an active fault trace in the Project area. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. Based on a review of State of California Earthquake Fault Zone maps, the closest fault is located approximately 2 km (CDMG, 1991) to the northeast of the Project.

7.3. Seismic Demand

The seismic demand at the site was evaluated based upon a probabilistic seismic hazard analyses approach. The evaluation utilized the USGS Probabilistic Seismic Hazard Deaggregation website https://geohazards.usgs.gov/deaggint/2008/ as a tool to calculate probabilistic peak ground acceleration. The attenuation relationships used for ground motion prediction include the Next Generation Attenuation (NGA) relationships of Boore and Atkinson (2008), Campbell and Bozorgnia (2008), and Chiou and Youngs (2008). An assumed average shear wave velocity in the top 30 meters (Vs_{30}) of 270 meters per second was used in the model. The peak ground accelerations for various year return periods were estimated from the USGS website. USACE criteria for design of structures require various return period values for Operating Basis Earthquake (OBE) and Maximum Design Earthquake (MDE). A summary of the estimated peak ground acceleration values for various return periods are presented in **Table 4**. A printout of the seismic demand analysis is included in this report as Attachment C.

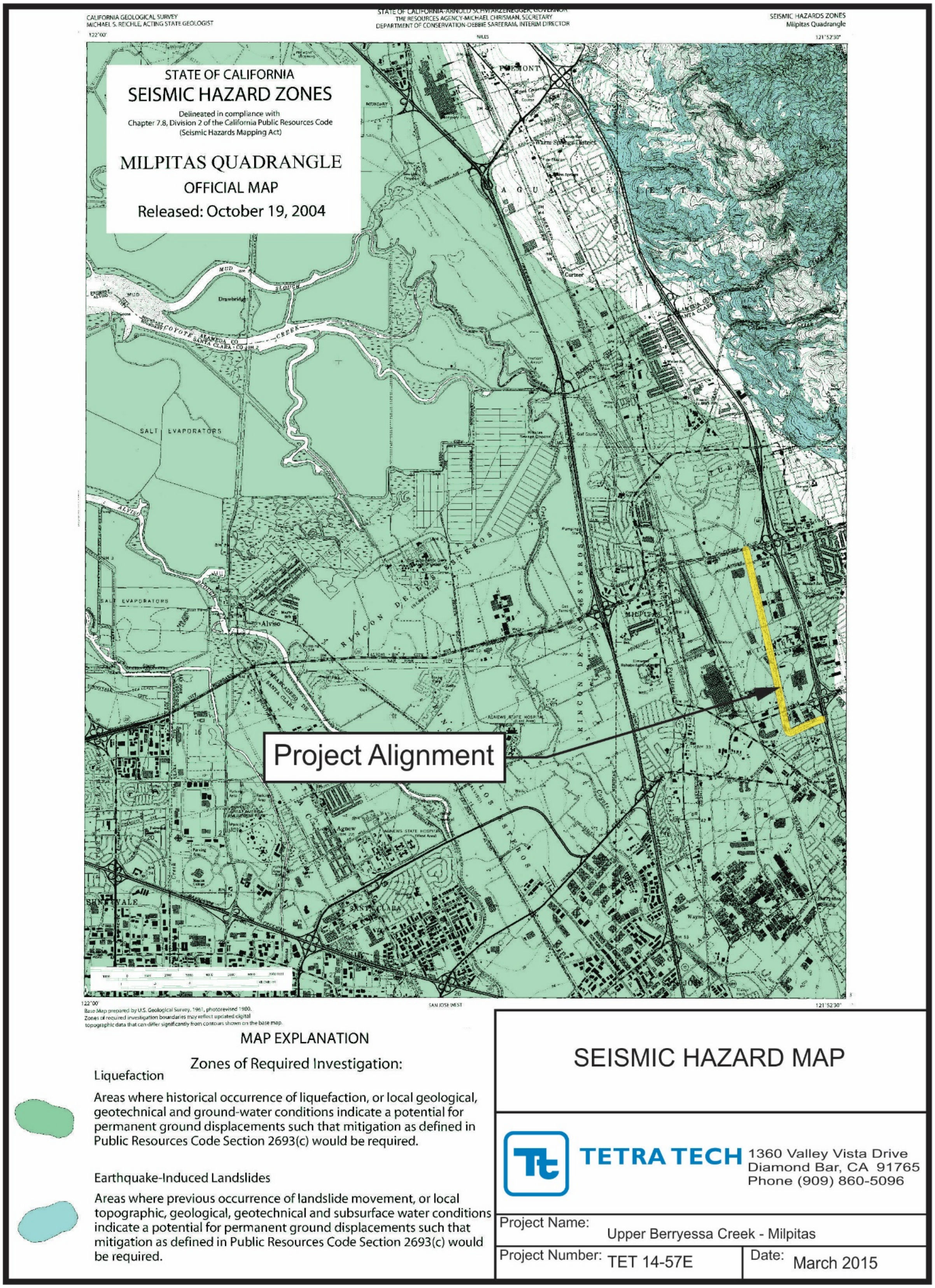

Figure 10. Seismic Hazard Map

Table 4. Estimated Peak Ground and Spectral Accelerations

Return Period	Peak Ground Acceleration	Spectral Acceleration		
		0.2 second	0.3 second	1 second
108 years	0.36g	0.77g	0.75g	0.43g
144 years	0.41g	0.87g	0.86g	0.50g
475 years	0.63g	1.35g	1.35g	0.82g
949 years	0.76g	1.64g	1.66g	1.04g

Seismic parameters for the Maximum Considered Earthquake (MCE) were estimated using the USGS website (**http://earthquake.usgs.gov/designmaps/us/application.php**). The MCE values estimated by this website are the lesser of values based on a probabilistic analysis utilizing a 2,475 year return period (2% probability of exceedance in 50 years) and maximum values based on a deterministic analysis of nearby characteristic faults. This procedure yielded design spectral acceleration values of 1.24g for 0.2 and 0.3 second, and 0.75g for 1.0 second. A printout of the MCE analysis is included in Attachment C.

7.4. Liquefaction Potential and Dynamic Settlement

Liquefaction of soils can be caused by ground shaking during earthquakes. Research and historical data indicate that loose, relatively clean granular soils are susceptible to liquefaction and dynamic settlement. Liquefaction is generally known to occur in saturated or near-saturated, cohesionless soils at depths shallower than about 50 feet. Most clayey silts, silty clays and clays are not typically adversely affected by ground shaking, however, fine-grained soils with high sensitivity (low remolded strength versus peak strength) can be susceptible to liquefaction.

7.5. Potential Liquefiable Soils

Evaluation of liquefaction potential for the sandy soils was performed based on the soil stratigraphy encountered in Boring SPT-12, and CPT sounding CPT-5, CPT-6, and CPT-8 through CPT-12. Potentially liquefiable soils consisted of relatively thin layers of loose to medium dense sandy soils encountered at various depths shown in the boring and CPT logs. In addition, fine-grained soils were evaluated with regard to strength sensitivity and susceptibility to liquefaction.

7.6. Groundwater Level

Historical high groundwater at the site was mapped by CDMG (**Figure 11**) at depths of about 7 to 12 feet (CDMG, 2001). Parikh (2004) reported groundwater depths as shallow as 7.5 below the existing channel bank. For the current field exploration, groundwater shortly after the completion of drilling was encountered at depths of approximately 9 to 17 feet below the channel bank. In this study, a groundwater depth of 7 to 10 feet was assumed for evaluation of liquefaction potential of the on-site materials, depending on the boring/CPT location.

7.7. Evaluation of Liquefaction Potential

The liquefaction potential of cohesionless (sandy) soils was evaluated based on the field exploration and laboratory test results utilizing procedure published in Youd and Idriss (2001) consensus publication on liquefaction evaluation, and as recommended in the CDMG Special Publication 117 (CDMG, 2008).

The analyses based on standard penetration test (SPT) blow-counts (N) considered the energy ratio correction factor C_E of 1.3 to estimate corrected blow-count values (N_{60}). This ratio is based on Table 5.2 of the Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California (SCEC, 1999). For an automatic trip hammer the table suggests the energy ratio correction factor range from 0.9 to 1.6 (modified from Youd and Idriss, 1997). Consequently, the selected design energy ratio correction factor of 1.3 is an average and reflects a hammer efficiency of approximately 78 percent, which is consistent with our experience with similar equipment. The blowcounts recorded for soils driven with the 3-inch O.D. California Sampler with brass rings were converted to an equivalent SPT blowcounts using a reduction factor of 0.65 to account for the larger sampler diameter size. Borehole diameter correction factor C_B of 1 based on the internal diameter of the hollow stem auger system used for the drilling was utilized in our liquefaction evaluation. Where CPT data was utilized, equivalent N_{60} values were estimated based on Lunne et al (1997).

Results of liquefaction analyses of granular soils are summarized in **Tables 5 and 6** in the next section and presented in Attachment D. The analyses indicated that the loose to medium silty fine sands encountered at various depths are susceptible to liquefaction.

Liquefaction and cyclic softening potential of fine-grained soils were evaluated based on moisture content and other index properties of the soils. The fine-grained soils are classified in the following three categories:

1. Soils with Plasticity Index < 12 and moisture content greater than 85 percent of the liquid limit are classified as fine-grained soils susceptible to liquefaction (typically silts).

2. Soils with Plasticity Index > 18 are classified as fine-grained soils potentially susceptible to significant loss of strength during seismic shaking and require additional evaluation. The sensitivity of the on-site fine-grained soils was then evaluated based on the water content, Atterberg limits, and effective vertical stresses using the procedures suggested by Holtz and Kovacs (1981) and Mitchell and Soga (2005).

3. Fine-grained soils falling outside the two categories above are considered to behave like clays and are not considered susceptible to liquefaction.

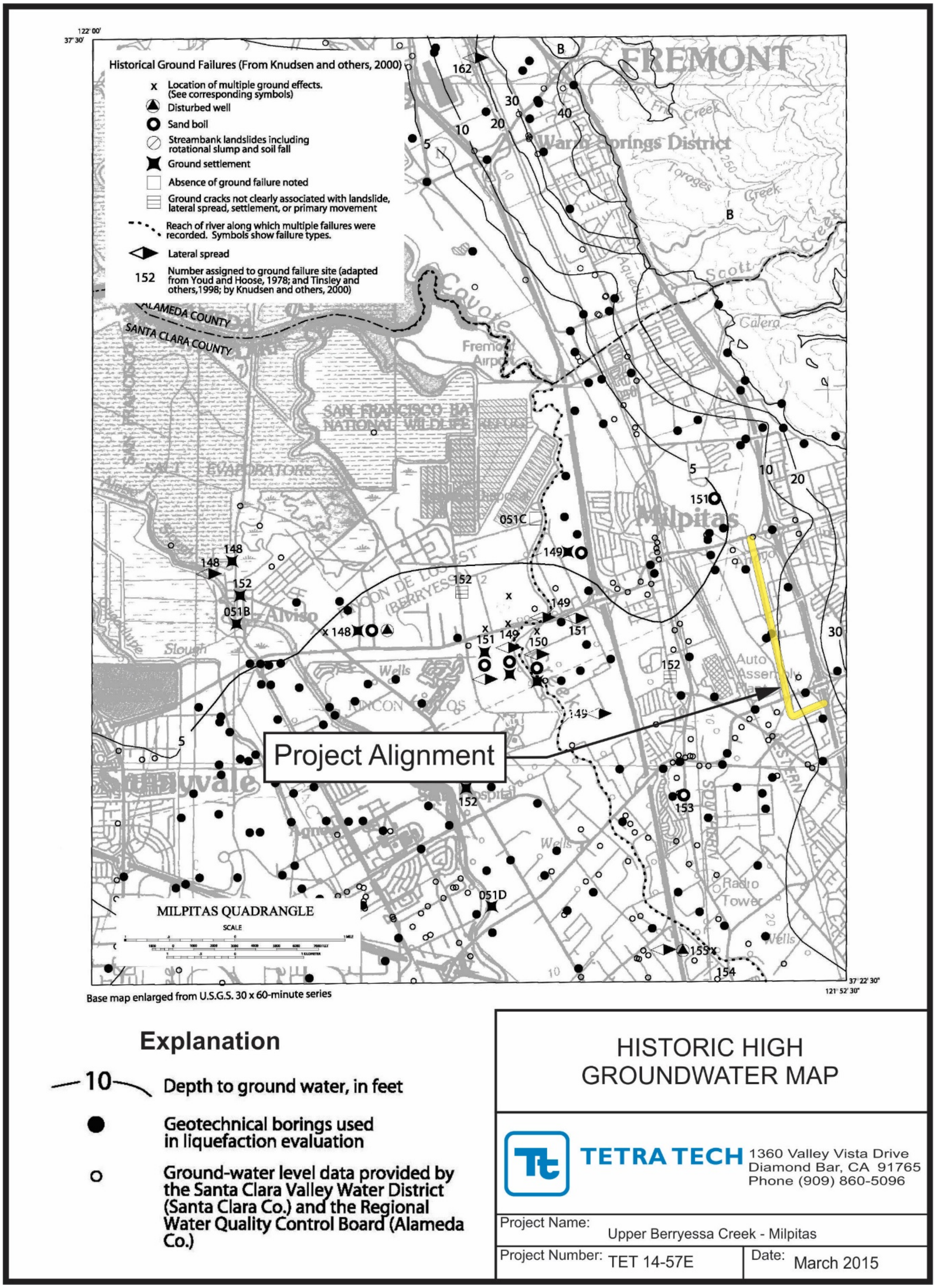

Figure 11. Historic High Groundwater Map

The plasticity index of the on-site clayey soils generally ranges from 15 to 52. Sensitivity analyses were performed for the on-site fine-grained soils with a plasticity index greater 18. Analyses of the sensitivity of the on-site clayey soils indicated low sensitivity with an estimated sensitivity index generally ranging from 1 to 4. Consequently, the potential for significant loss of strength of the on-site clayey soils and ensuing seismic deformation during seismic shaking is considered low. Results of sensitivity analyses for the on-site clayey soils are included in Attachment D.

7.8. Dynamic Settlement

Seismic settlement can occur in both dry and saturated sands when loose to medium-dense granular soils undergo volumetric changes during ground shaking. Seismic settlement can occur in saturated sands due to liquefaction or in dry sands due to densification of the soil matrix. The potential for seismic settlement due to liquefaction was calculated according to the procedures presented by Tokimatsu and Seed (1987). The potential for dry seismic settlement was calculated according to the procedures presented by Pradel (1998). **Tables 5 and 6** present the results of liquefaction analyses and dynamic settlement:

Table 5. Results of Liquefaction Analyses (108-year return period earthquake)

Boring No.	Assumed Groundwater Depth	Liquefiable Zone Depth	FS_{liq}	Liquefaction Settlement	Settlement of Dry Sands	Combined Dynamic Settlement
	(ft)	(ft)	–	(inch)	(inch)	(in)
SPT-12	10	14 to 16	0.9	0.5	0.1	0.6
CPT-5	7	Non - liquefiable	>1.3	--	--	--
CPT-6	7	Non - liquefiable	>1.3	--	--	--
CPT-8	10	Non - liquefiable	>1.3	--	--	--
CPT-9	10	Non - liquefiable	>1.3	--	--	--
CPT-10	10	Non - liquefiable	>1.3	--	--	--
CPT-11	10	Non - liquefiable	>1.3	--	--	--
CPT-12	10	Non - liquefiable	>1.3	--	--	--

Table 6. Results of Liquefaction Analyses (475-year return period earthquake)

Boring No.	Assumed Groundwater Depth	Liquefiable Zone Depth	FS_{liq}	Liquefaction Settlement	Settlement of Dry Sands	Combined Dynamic Settlement
	(ft)	(ft)	–	(inch)	(inch)	(in)
SPT-12	10	14 - 16	0.5	0.5	0.4	0.9
CPT-5	7	14 - 16	0.6 – 1.0	0.3	0.1	0.4
CPT-6	7	18 - 19	0.5 – 1.2	0.2	0.1	0.3
CPT-8	10	13 – 14, 27.5 - 29	0.5 – 1.0	0.6	0.1	0.7
CPT-9	10	10 - 11	0.5 – 0.6	0.5	0.1	0.6
CPT-10	10	10 - 14	0.9 – 1.3	0.4	0.0	0.4
CPT-11	10	17 – 20, 36 - 38	0.3 – 1.0	0.5	0.1	0.6
CPT-12	10	19 – 20.5	0.4 – 1.1	0.2	0.1	0.3

As shown in **Tables 5 and 6** above, the combined dynamic settlement was estimated to be less than 1 inch. Given the magnitude of the dynamic settlement and the thinness of the potentially liquefiable layers encountered in the exploration borings and CPTs, it is our opinion that liquefaction is not a geotechnical concern, and potential dynamic settlement at the site will not adversely impact the proposed improvements. The results of dynamic settlement analyses are presented in Attachment D.

8. ANALYSES OF CHANNEL IMPROVEMENTS

8.1. General

As mentioned previously, the channel improvements will be designed to provide protection against a 100-year level flood event. The improvements consist of regrading and widening the existing channel, installing slope protection on the channel slopes, and using short floodwalls less than 2 feet high in two areas (see Figure 3 for the location of the floodwalls). The following sections present the results of the analyses and evaluations for the proposed channel cross-sections.

8.2. Hydrologic and Hydraulic Evaluations

To determine the 100-year flood levels, the latest Hydrologic and Hydraulic model was used. The 100-year water surface profile from this model was used to determine at the 100-year flood level at the individual analyses locations. Based on a review of the hydrograph for the 100-year event, it appears that the duration of the higher water levels is relatively brief, only remaining high for less than four hours. It is understood that the hydrologic and hydraulic model and results have been submitted separately.

8.3. Channel Geometry

The channel will be deepened slightly and the slopes will be graded to a consistent 2H:1V slope and a constant 20-foot bottom width. Erosion protection will be placed on the channel slopes. It is anticipated that the erosion protection will consist of geocells filled with aggregate or concrete and stabilized with stakes installed into the subgrade. Details of the erosion protection can be found in the 60% design drawings. A typical cross-section of the proposed channel from the 60% design drawings is shown in **Figure 12**.

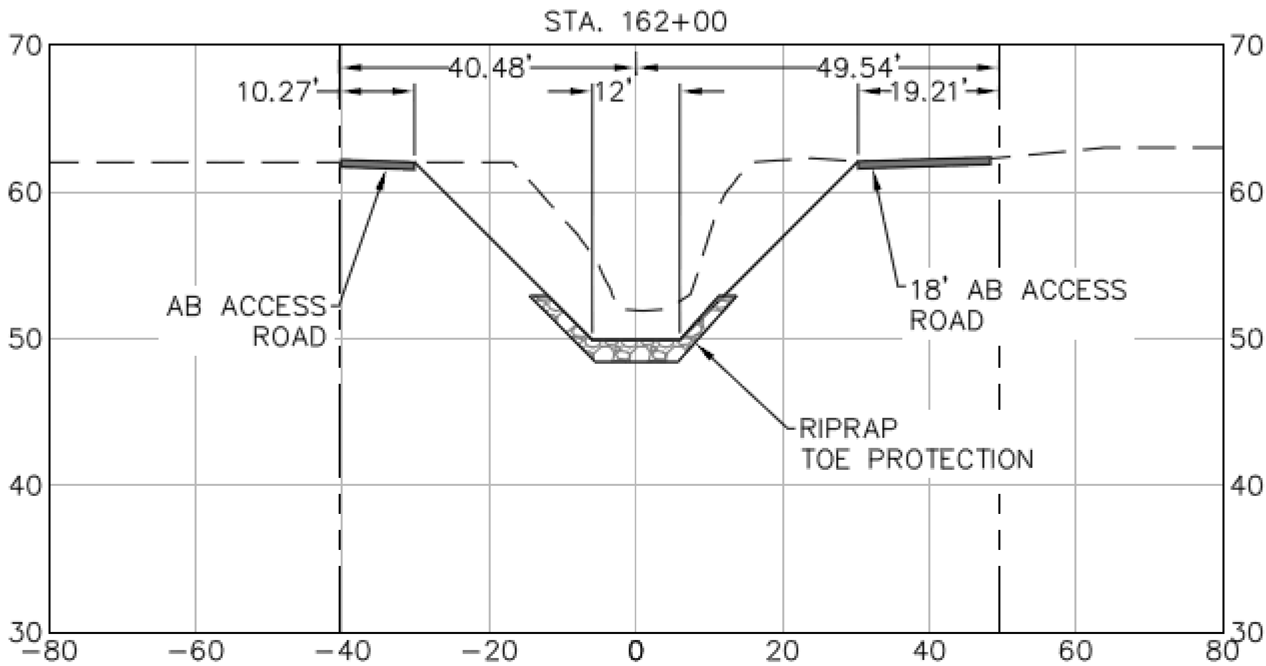

Figure 12. Typical Proposed Channel Cross-Section

8.4. Geotechnical Analyses

8.4.1. General

The geotechnical evaluations for the channel improvements consisted of slope stability analyses of the proposed side slopes using the results of the subsurface explorations and laboratory testing. The initial step in the evaluations was to review the results of the borings and laboratory testing and to divide the Project into reaches. A single cross-section was then analyzed for stability that would be representative for the entire reach. The most critical subsurface conditions encountered in the reach were used in the evaluations. Discussion of the reach determinations, shear strength determinations, and stability analyses are presented in the following sections.

8.4.2. Reach Determinations

Based on a review of the historic borings and the results of the Phase I CPT and Phase II SPT explorations, the channel was divided into reaches such that the conditions within each reach were relatively consistent and could be modeled using a single cross-section.

A total of six reaches were determined. The locations of the reaches and the analyzed cross-sections within each reach are shown on **Figures 6 and 7**. The floodwalls in Reaches 1 and 4 were not included in the stability analyses of the channel slopes but are discussed separately later in this report.

The individual reaches and the CPT and SPT borings considered for the reaches are shown in **Table 7** and discussed in more detail in the following paragraphs.

Table 7. Reach CPT/SPT and Station Limits

Reach No.	Station Limits	CPT/SPT
Reach 1	86+00 - 120+00	CPT-1, CPT-2, CPT-3, CPT-4, CPT-5, SPT-2, SPT-4, SPT-5
Reach 2	120+00 - 140+00	CPT-6, CPT-7, SPT-9
Reach 3	140+00 - 160+00	CPT-8, CPT-9, CPT-10, SPT-10, SPT-12, SPT-13
Reach 4	160+00 - 182+00	CPT-11, CPT-12, CPT-13, SPT-14
Reach 4.1	177+00	SPT-16
Reach 5	182+00 - 193+00	SPT-18

Reach 1 lies between Stations 86+00 and 120+00. Top of bank elevations in Reach 1 vary between approximately 33.0 and 40.0 feet. A sandy silt to silty clay layer tends to be present within the first 10.0 to 15.0 feet of Reach 1 soil profile. This initial layer is typically followed by a clay layer roughly 15.0 feet thick, which is then underlain by a slightly stronger clay layer to a depth of 40.0 feet.

Reach 2 lies between Stations 120+00 and 140+00, and the top of bank elevations range from elevation 40.0 to 53.0 feet. Typically, the soil profile in Reach 2 begins with a silty clay layer to approximately elevation 35.0 feet. A second layer of weaker clay is then encountered that ranged from 15.0 to 17.0 feet thick overlying a slightly stronger layer of clay and silty clay.

Reach 3 extends from station 140+00 to station 160+00, and the top of bank elevation ranges from elevation 53.0 to 61.0 feet. Reach 3 is distinguished due to a thick silty sand and sandy silt layer that typically extends to depths of 10 to 15 feet below the top of the bank. The initial layer is followed by a clay layer to elevation 21.0 feet. The final layer is a thin silty clay layer extending to elevation 13.0 feet.

Reach 4 extend from station 160+00 to station 182+00, and straddles the Montague Expressway. The top of bank elevation ranges from 61.0 to 65.0 feet. A stiff silty clay layer is usually encountered first, down to elevation 55.0 feet. This first layer is typically followed by a sandy clay layer that extends to elevation 33.0 feet, and is followed by a significantly stronger silty clay to sandy clay layer down to elevation 25.0 feet.

However, boring SPT-16 was within Reach 4 at the outside bend of the channel (Station 177+00) and this boring encountered much different conditions than the closest upstream and downstream borings. Boring SPT-16 encountered 4 feet of clayey sand fill at the ground surface overlying stiff clay to a depth of 12 feet. Below the stiff clay, 13 feet of soft to medium stiff clay were encountered to a depth of 25 feet. Because these soft to medium stiff clays could adversely impact the stability of the proposed slopes and because of its critical location at the outside bend of the channel, it was decided to analyze this section location. This analyzed section was designated as Reach 4.1.

Reach 5 extend from station 182+00 to station 193+00, and the top of bank elevation ranges from elevations 65.0 to 75.0 feet. An increasingly stiff clay and silty clay layer follows the first sand layer and extend to elevation 47.0 feet. The final layer is moderately stiff clay that typically extend down to elevation 30.0 feet.

8.4.3. Shear Strength Selections

8.4.3.1 Undrained Shear Strengths. To determine the undrained strengths of the cohesive soils on the Project, SPT N-values, CPT relationships, and the results of the laboratory tests were all considered. However because the CPT testing provides a nearly continuous determination of the undrained strength of the soil with depth, the CPT data was evaluated first, then compared with the SPT and testing information.

For the CPT boring results, the undrained shear strength, s_u (Q-strength) is estimated with the following relationship:

$$s_u = \frac{q_t - \sigma}{N_{kt}}$$

where:
s_u = undrained shear strength (psf)
q_t = total cone resistance (psf)
σ = overburden pressure (psf)

N_{kt} = dimensionless factor (10 to 18 but often 14 to 16)

Initially, the undrained shear strengths from the CPT borings were calculated using an N_{kt} value of 16. The results of the undrained shear strength determinations were then compared to the unconfined compression test results performed on two samples of the clays at the Project. However, these two unconfined compression tests indicated undrained shear strengths of 623 and 721 psf which were significantly less than the undrained strengths calculated for the CPT borings near these test locations. As a result, the undrained shear strengths from the CPT borings were recalculated using an N_{kt} value of 18.

For each reach, the undrained shear strengths from each CPT boring within that reach were plotted. The selected undrained strength was then conservatively selected based on an inspection of the plots for each reach. These plots of the undrained shear strengths from the CPT borings, unconfined compression tests, and our selected undrained strengths (Q-strengths) for the various clay layers in the five reaches are shown in **Figures 13 through 17**.

For the cohesionless sands on the Project, the undrained strengths were assumed to be equal to the drained strengths. The drained strength determinations for the cohesionless sands are discussed in detail in the next section of the report.

The clayey sands on the Project generally contained an appreciable amount of fines. It is believed that these cohesive sands will behave more similarly to cohesive soils rather than cohesionless soils. Therefore, to be conservative, the undrained strengths for the clays on the Project were also assigned to the clayey sands.

For boring SPT-16, the undrained shear strengths for the clays were determined using the SPT N-values in accordance with the procedures outlined in Bowles (Bowles, 1997). The upper clay was assigned a cohesion value of 1,164 psf, the soft to medium stiff clays a cohesion value of 380 psf and a cohesion value of 1,430 psf was determined for the underlying stiff clays. These calculations are presented in Attachment E. We would note that a shear strength test was assigned to a sample of the soft to medium stiff clay in this boring but the result of the test was very questionable and could not be used.

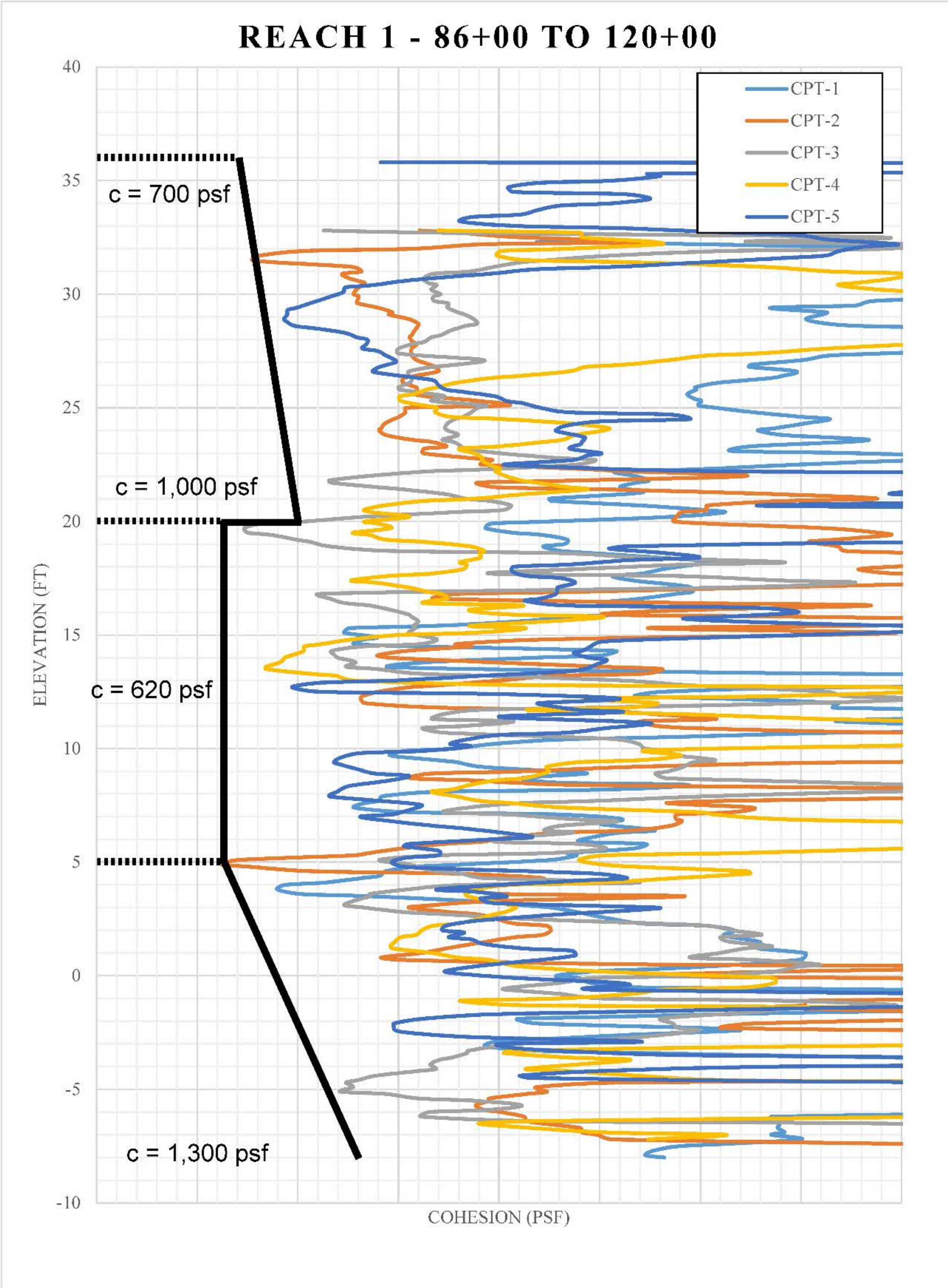

Figure 13. Reach 1 CPT Results and Selected Undrained Strengths

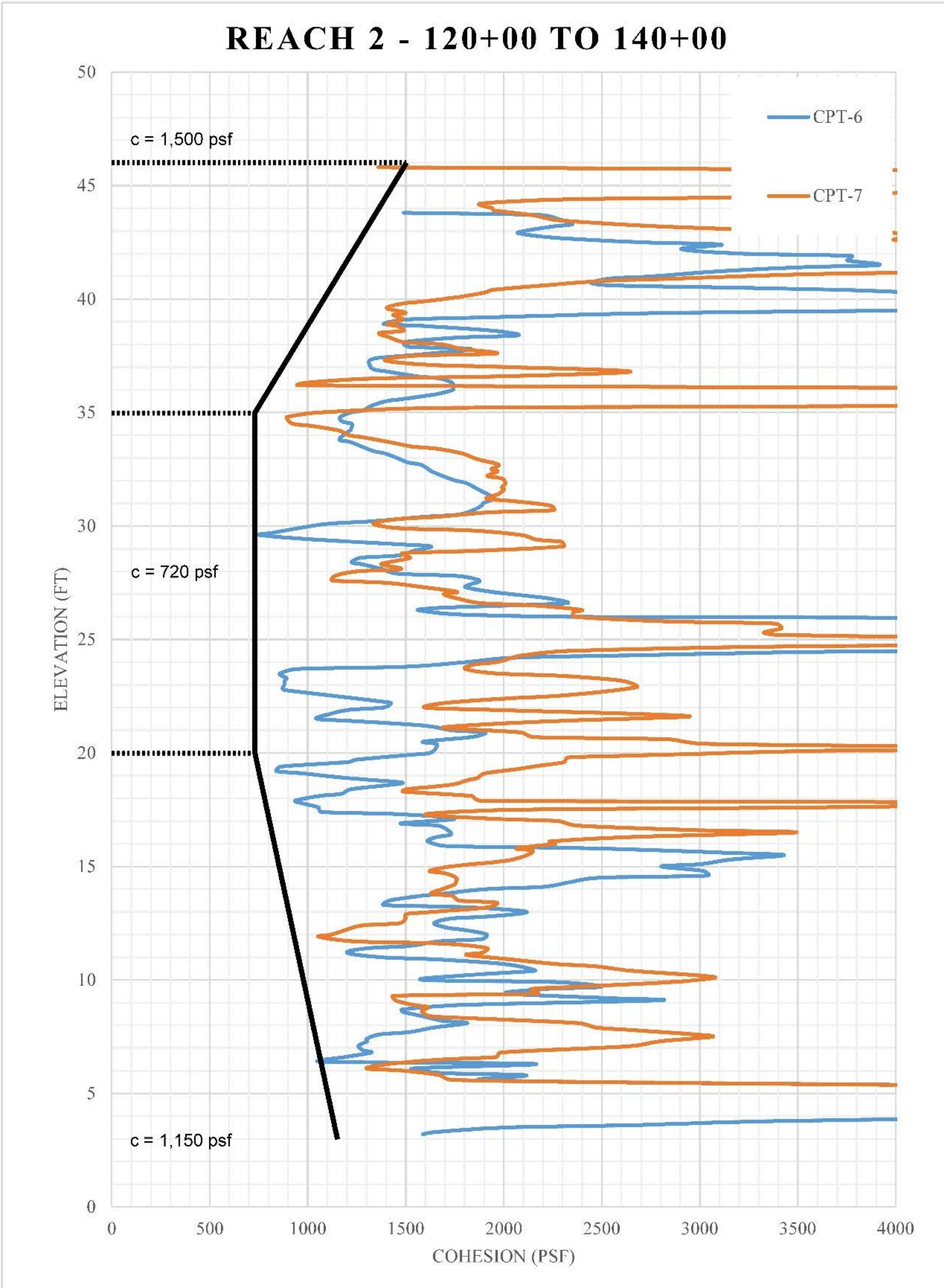

Figure 14. Reach 2 CPT Results and Selected Undrained Strengths

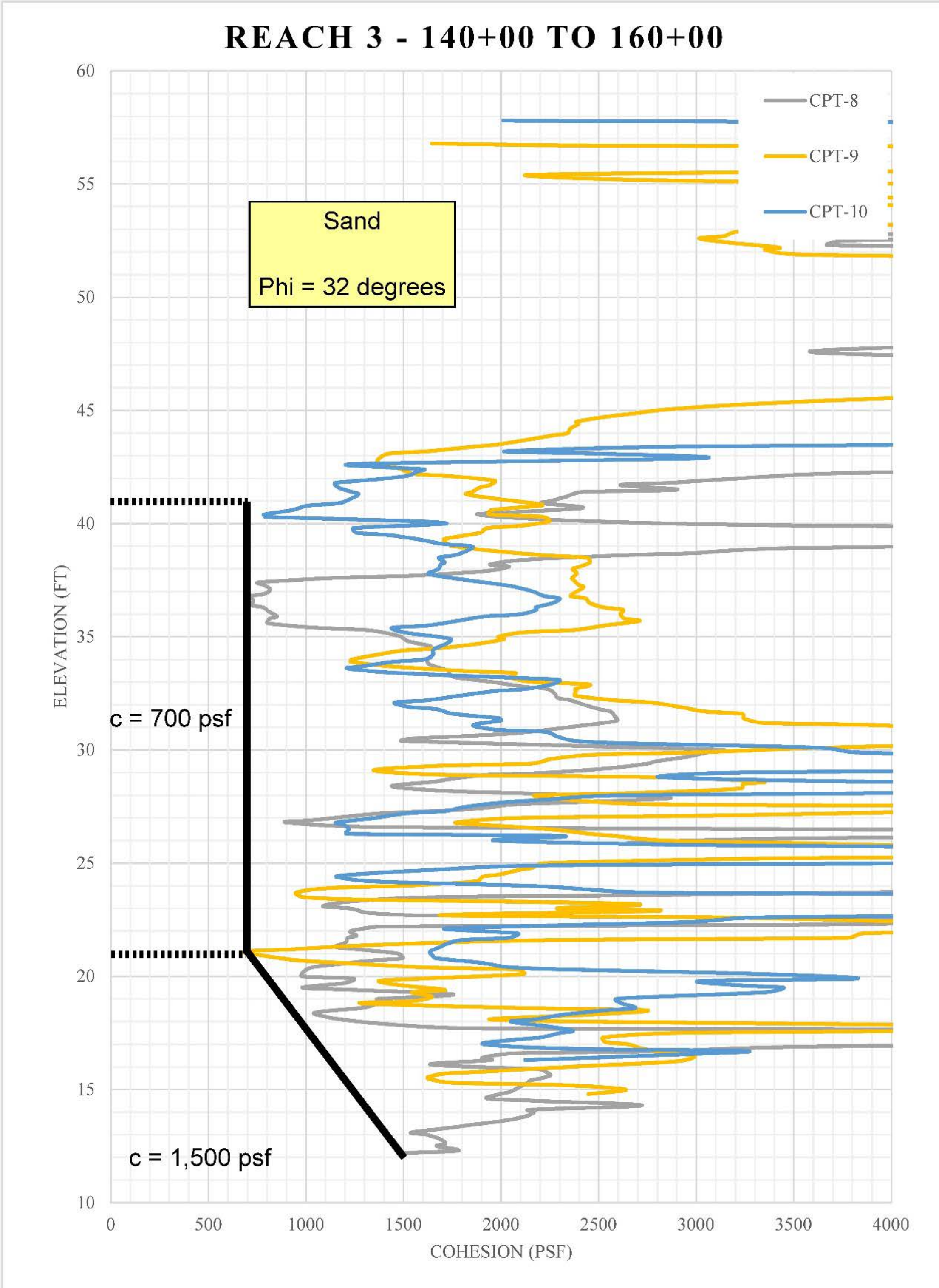

Figure 15. Reach 3 CPT Results and Selected Undrained Strengths

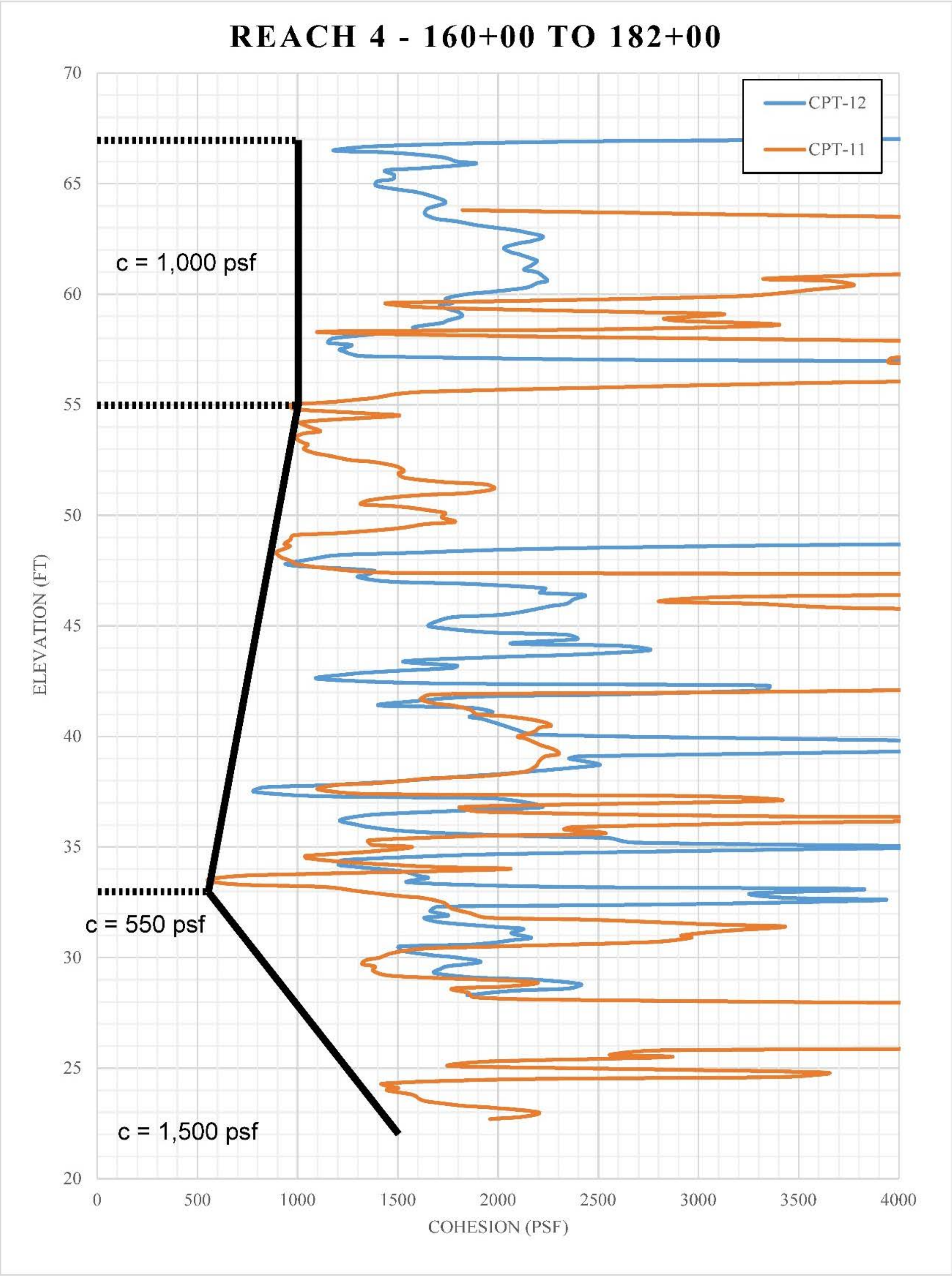

Figure 16. Reach 4 CPT Results and Selected Undrained Strengths

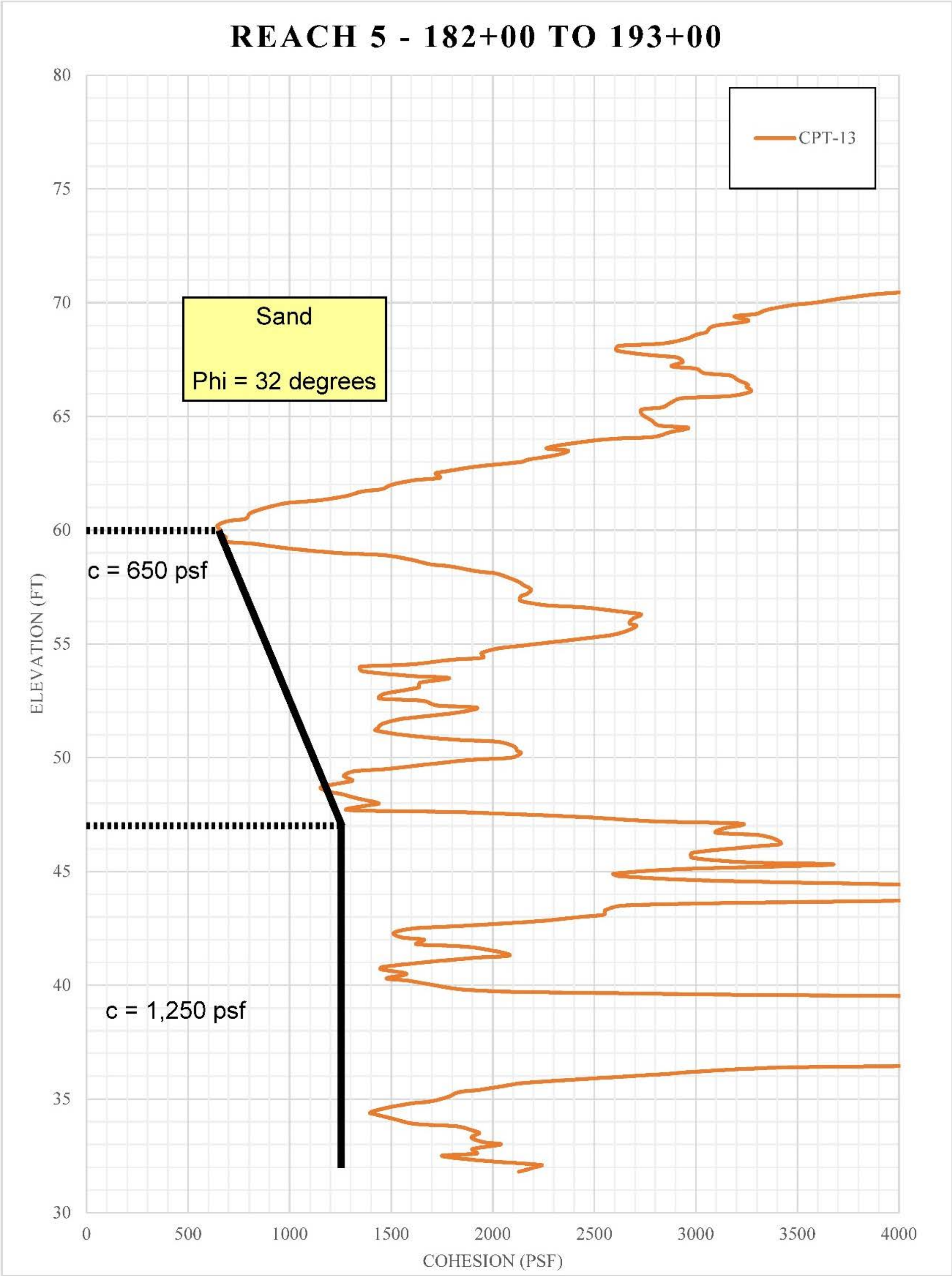

Figure 17. Reach 5 CPT Results and Selected Undrained Strengths

8.4.3.2 Drained Shear Strengths. The drained shear strengths (S-strengths) for the clays and sands in the channel slopes were selected based on the results of the classification of the soils, the SPT N-values, and two consolidated-undrained triaxial tests and the SPT results, respectively. For the clays, one of the triaxial tests was performed on a high-plastic clay with about 15% sand while the other was performed on a silty clay with about 45% sand. The drained strengths from the triaxial tests are listed below:

Silty clay (45% sand)	c' = 0 psf	ϕ' = 34.5°
High-plastic clay (15% sand)	c' = 180 psf	ϕ' = 30°

Based on these two results, the lower drained strengths (S-Strengths) of c' = 180 psf and ϕ' = 30° were selected for all of the clays on the Project to be conservative. Based on our review of all of the borings and the laboratory test results, we believe these strengths are appropriate for all of the clays on the Project, even the soft soils encountered in boring SPT-16.

The consolidated-undrained strengths (R-strengths) from these two tests varied significantly, likely due to the difference in sand content. The result for the silty clay (45% sand) was a c = 90 psf and a ϕ' = 18°. For the high-plastic clay (15% sand), the result was a c = 450 psf and a ϕ' = 12.5°. The lower of these two values is very low for clays and using the lower value was considered to be overly conservative. Therefore, these two strengths were averaged and the average value was assigned to all of the clays resulting. Consequently, R-strengths of c = 270 psf and ϕ' = 15° were used for all of the clays on the Project.

For the cohesionless, silty sands encountered on the Project, the drained strengths were determined using the results of the SPT N-values obtained in the sands during the drilling operations. A review of the uncorrected N-values indicated a minimum value of 5 and an average value of 16.5. Using the relationship in Bowles (Bowles, 1997) that correlates uncorrected N-values to angles of internal friction in sands, friction angles of 32.5° and 35.8° were determined for the minimum N-value and average N-value, respectively. To be conservative, a friction angle of 32° was selected for all of the cohesionless sands on the Project. These calculations are presented in Attachment E.

As mentioned in the discussion on the selection of undrained strengths, it is believed that the clayey sands will behave more similarly to cohesive soils rather than cohesionless soils. Therefore, to be conservative, the drained strengths for the clays on the Project were also assigned to the clayey sands.

8.4.4. Stability Analyses

8.4.4.1 Method of Analyses. Slope stability analyses were performed using the slope stability analysis software Slide v.6.0. All analyses were performed using Spencer's method. Stability analyses were performed for the end-of-construction cases using Q-strength data and for the long-term cases using S-strength data. The drawdown cases were performed using the multi-stage, drawdown evaluations with composite S-strength and R-strength data in accordance with the procedures outlined in EM 1110-2-1902, Slope Stability (USACE, 2003).

Circular failure surfaces searches were performed for each analyzed cross-section and stability case. Based on our experience, non-circular failure surfaces are not as critical with the types of stratigraphies modeled at this project. However, this conclusion was confirmed by performing a non-circular failure surface search on the most critical cross-section and loading case determined by the results of the circular failure surface searches.

Cross-sections of the channel were based on the 60% design drawings. The proposed channel will be about 10 feet high with bottom widths of 15 to 40 feet. Side slopes of 2H:1V were used but the rip rap and geocell slope protection were neglected to be conservative. Since the proposed slopes are 2H:1V for the entire project, the critical cross-section locations were based on the height of the proposed banks. For Reaches 1 through 3, because they are relatively long reaches, two cross-sections were initially evaluated and the more critical selected for further analyses. In Reaches 4 and 5, because of their relatively short length, only a single, critical cross-section was selected. However, two cross-sections were analyzed in Reach 4 due to the conditions encountered in boring SPT-16, as described in previous sections. These cross-sections were used with the results of the borings and the shear strength selections to develop the analyzed sections. At each analyzed section, both banks were analyzed for stability. However, only the more critical of the banks is presented and discussed. The analyzed sections, along with the results of the stability analyses, are shown in Attachment F.

8.4.4.2 Load Cases Analyzed. As mentioned above, the stability of the channel slopes was performed in accordance with EM 1110-2-1902, Slope Stability (USACE, 2003). The load cases considered for the stability analyses are discussed below.

Case 1: End of Construction. This case was evaluated for all of the analyzed sections. In this case, unconsolidated undrained (Q) strength parameters were used for this evaluation. The water level in the channel was assumed to be below the bottom of the proposed invert level. For this end-of-construction condition, this assumed water level is the most critical assumption since the water is a stabilizing load for the slope.

Case 2: Steady State Seepage. The stability analyses for the case of steady seepage were performed assuming the 100-year flood event is at that level for a long period sufficient to saturate the bank soils. This is a conservative assumption since it is anticipated that the 100-year event will not remain high enough for a sufficient period to saturate the bank soils. S-strengths were used for these analyses.

Case 3: Sudden Drawdown. For the sudden drawdown analysis, it was assumed that the water level within the channel dropped from the 100-year level to near the bottom of the proposed channel. This is a very conservative assumption since it assumes the 100-year flood level will remain high enough in the channel to completely saturate the bank soils. In these analyses, the drained (S) strength parameters were used for the sand layers and the lower of the drained (S) and undrained (R) shear-strength envelopes was used for the clays. The staged drawdown feature of Slide v.6.0 was utilized and the program's documentation indicates that the procedure incorporated in the software matches the procedures outlined in EM 1110-2-1902, Slope Stability (USACE, 2003).

Case 4: Critical Flood Level. Finally, a critical flood analysis was performed on the reach cross-section that exhibited the lowest safety factor for the Case 2, steady seepage at the 100-year flood level. For Case 4, steady seepage conditions and S-strengths were used. The critical flood level was found by varying the water level within the channel and determining which flood level resulted in the minimum safety factor. Since the other cross-sections exhibited higher safety factors for Case 2, if this case were run on the other cross-sections they would exhibit safety factors greater than those determined for the critical cross-section.

8.4.4.3 Minimum Required Safety Factors. The required minimum safety factors used for each of the load cases was developed using the criteria in EM 1110-2-1902, Slope Stability (USACE, 2003). Table 3-1 in the EM presents the required minimum safety factors for new embankment dam slopes. However, in Section 3-4 of the EM, there is discussion of the minimum required safety factors to use in the stability analyses of other slopes. Within paragraph 3-4, the EM states:

> *…Typical minimum acceptable values of factor of safety are about 1.3 for end of construction and multistage loading, 1.5 for normal long-term loading conditions, and 1.1 to 1.3 for rapid drawdown in cases where rapid drawdown represents an infrequent loading condition. In cases where rapid drawdown represents a frequent loading condition, as in pumped storage projects, the factor of safety should be higher.*

Based on this guidance, required minimum safety factors of 1.3, 1.5, and 1.3 were selected for the end of construction case, the long-term 100-year flood level steady seepage and critical flood steady seepage cases, and the rapid drawdown case, respectively. We believe the rapid drawdown case may be a relatively frequent loading condition in the channel so a higher required minimum safety factor should be considered for this case.

8.4.4.4 Analyses Results. The results of the stability analyses are summarized in **Table 8** and presented in Attachment F. As can be seen in the table, the calculated critical safety factors were all above the required minimum safety factors.

Table 8. Summary of Stability Analyses Results

Reach (see Figures 6 and 7)	Case Analyzed	Critical F.S. (Req'd min.)
Reach 1 (86+00 to 120+00)	End of Construction (Q)	2.44 (1.3)
	Steady Seepage (S)	3.05 (1.5)
	Sudden Drawdown (R,S)	1.61 (1.3)
Reach 2 (120+00 to 140+00)	End of Construction (Q)	2.68 (1.3)
	Steady Seepage (S)	2.61 (1.5)
	Sudden Drawdown (R,S)	1.62 (1.3)
Reach 3 (140+00 to 160+00)	End of Construction (Q)	2.26 (1.3)
	Steady Seepage (S)	2.19 (1.5)
	Sudden Drawdown (R,S)	1.40 (1.3)
Reach 4 (160+00 to 182+00)	End of Construction (Q)	2.69 (1.3)
	Steady Seepage (S)	2.69 (1.5)
	Sudden Drawdown (R,S)	1.73 (1.3)
Reach 4.1 (SPT-16 at 177+00)	End of Construction (Q)	2.41 (1.3)
	Steady Seepage (S)	3.07 (1.5)
	Sudden Drawdown (R,S)	1.93 (1.3)
Reach 5 (182+00 to 193+00)	End of Construction (Q)	1.44 (1.3)
	Steady Seepage (S)	1.69 (1.5)
	Sudden Drawdown (R,S)	1.42 (1.3)
Critical Drained Section	Critical Flood	1.65 (1.5)
Critical Undrained Section	End of Construction (Q)	4.50 (non-circular) (1.3)

For Reaches 3 and 5, where sand was present in the proposed channel slope, the critical safety factors were infinite-slope type failures with safety factors of 1.2 or greater. Infinite-slope type failures represent a theoretical minimum safety factor but the failure surfaces are very shallow, raveling-type of surfaces that are maintenance issues and do not impact the integrity of the slope. Typically, a safety factor greater than 1.0 for an infinite-slope type failure is considered acceptable.

Therefore, for cases where an infinite-slope type surface was the critical failure surface and the safety factor was greater than 1.0, deeper surfaces were analyzed to determine a more appropriate safety factor to confirm that more realistic failure surfaces had safety factors greater than the required minimum.

8.4.5. 1.5H:1V Slopes

It is understood that steeper slopes of up to 1.5H:1V may be required in isolated areas to maintain the channel capacities, such as at bridges or other channel constrictions. If 1.5H:1V slopes must be used in an area, we recommend that these slopes be constructed with rip rap or channel protection stone. If an encroachment into the channel is prohibitive, this may require overexcavating the soil into the bank then rebuilding the slope with the rip rap or channel protection stone. The toe of this rock zone should be keyed into the channel bottom to provide stability. Stability analyses would be needed to determine the proper configuration and amount of rip rap or channel protection stone to use, but it is anticipated that a slope 10 feet high would require a rock zone that was a few to several feet thick for adequate stability.

An evaluation of these isolated areas should be performed after the design progresses and these locations are known. Using the results of the borings and the laboratory testing, stability analyses can be performed to properly design the configuration of these rock fill slopes.

9. UPRR TRESTLE AND OTHER CULVERT DESIGNS

9.1. General

As mentioned earlier in this report, current plans call for the demolition of the existing UPRR timber trestle bridge over Berryessa Creek and replacement with a two cell reinforced concrete culvert. The UPRR culvert project extends from channel station 160+44 to 161+46. In addition, new culverts are planned for lateral drainage features entering the channel at Los Coches Avenue and Piedmont Avenue.

Preliminary plans indicate that the proposed UPRR culvert will be a double, 10-foot wide (W) and 9-foot high (H) reinforced concrete box (RCB) structure. The culvert invert elevation is anticipated to range from elevation 49.25 to 49.67 feet, which is approximately one foot below the lowest current invert elevation in the existing creek.

The proposed culvert at Los Coches is a 15-foot wide (W) and 7-foot high (H) reinforced concrete box (RCB) structure. The culvert invert elevation is anticipated to range from elevation 19.92 to 33.23 feet.

The proposed culvert at Piedmont is a 14-foot wide (W) and 7-foot high (H) reinforced concrete box (RCB) structure. The culvert invert elevation is anticipated to range from elevation 26.21 to 30.71 feet.

9.2. Foundation Preparation

Based on subsurface conditions encountered in the exploratory borings and on potential high groundwater conditions it is anticipated that saturated, clayey soils could be encountered at the proposed base of culvert elevations. It is expected that these conditions will produce a relatively soft bearing surface and difficult working conditions. Therefore, it is recommended that an engineered fill mat be constructed within the area below the proposed culverts and any appurtenant wing wall footings. The engineered fill should be constructed as follows:

- Over-excavate at least 2 feet below the base of the culvert slab or wall footing elevation.
- At the UPRR culvert location, cut and remove all existing pile foundations for the exiting trestle at a depth of at least 6 inches below the excavated surface.
- If necessary, stabilize the soft subgrade by working open-graded aggregate material (typically ¾-inch or 1.5-inch crushed rock, coarser for softer subgrade) at least 4 to 6 inches into the soil.
- Place non-woven geotextile, Mirafi 180N or approved equivalent, over the stabilized subgrade.
- Place and compact well-graded select fill. The fill can be either Crushed Aggregate Base (Green Book Section 200-2.2) or Crushed Miscellaneous Base (Green Book Section 200-2.4) to specified compaction over the geotextile.

9.3. Culvert and Retaining Wall Backfill

It is expected that due to the clayey nature of most of the on-site material, it will not be suitable as a backfill immediately behind site retaining walls. Free draining material should be used for backfill behind retaining walls. Consequently, an approved import material should be used for the backfill within at least 2 feet behind the back side of the wall. Suitable material should have a Sand Equivalent of about 30, an Expansion Index of less than 20, and fines content (passing #200 sieve) of less than 15 percent. The suitability of the import material for retaining wall backfill should be verified at the time of construction.

The backfill should be moisture-conditioned to at least optimum moisture content and compacted in loose horizontal lifts not more than 8 inches in uncompacted thickness to at least 90 percent of the maximum dry density as evaluated by the latest version of ASTM D 1557. Where bare ground is present behind the top of the wall, the backfill should be capped with a concrete swale or with at least 12 inches of relatively impervious clayey material (USCS Classification CL) and sloped to prevent ponding of water.

9.4. Subdrainage

Retaining walls should be constructed to limit potential for hydrostatic pressure built-up behind the wall by installing subdrains near the base of the wall. The drain pipe should consist of a minimum 4 inch diameter perforated PVC pipe surrounded by 2 cubic foot per foot of the Class II Permeable Material (Caltrans Standard Specifications - Section 68), or by ¾ inch crushed rock (Standard Specification for Public Works Construction ("Greenbook") - Section 200-1.2) wrapped in suitable non-woven filter fabric, e.g., Mirafi 140NL or approved equivalent. Perforations in the drain pipe should have a maximum diameter of 1/4 inches or 3/8 inches for Class 2 Permeable or ¾-inch crushed rock drain material, respectively, spaced 3 inches on center, and be arranged in 2 rows at a radial spacing of approximately 120 degrees. The axis of the included angle between the perforation rows should be positioned downward to form a flowline. The drain pipe should discharge through a solid pipe to appropriate outlets, such as the storm drain system or through the wall. The maximum length of the drain pipe between discharge outlets should not exceed 200 feet.

Unless the culvert designs include lateral and uplift pressures for hydrostatic forces, continuous subdrains should also be installed behind the base of the culvert walls. If the UPRR, Los Coches, and Piedmont culverts are being designed to resist uplift pressures, a groundwater elevation of +55, +30, and +35 feet, respectively, should be utilized.

9.5. Settlement

Based on the consolidation testing of the saturated clayey foundation soil underlying the UPRR culvert it is expected that some long term settlement of the culvert will occur. The total settlement at the midpoint of the culvert is estimated to be approximately 1.5 inches. This amount of settlement is not expected to be problematic to the structure or rail subgrade, however, it is recommended that a camber in the UPRR culvert invert incorporate this amount of potential differential settlement from the ends to the midpoint of the culvert. Grading provisions above the UPRR culvert should incorporate this amount of potential settlement at the centerline of the channel.

Settlements of the other two culverts, wing walls or retaining structures placed on foundation soils prepared in accordance with Section 9.2 ''Foundation Preparation'' are estimated to be less than one inch.

9.6. Design Parameters

The culverts and appurtenant retaining walls may be designed using the following parameters. These design values are based on foundation preparation and grading recommendations presented in this report.

9.7. Vertical Loading

Vertical loads on the UPRR culvert should be assessed by the design chart presented in Figure 5.2 of USACE EM 1110-2-2902 ''Engineering and Design, Conduits, Culverts and Pipes'' for railroad loading and Figure 8-16-1 in the AREMA Manual for Railway Engineering Chapter 8. Both charts should be consulted for this culvert because total loading varies between the two charts depending on embedment depth. Based on maximum density testing of on-site soils, the dead load curve for both design charts should be adjusted to reflect a total unit weight of 130 pcf. Vertical loads on the Los Coches and Piedmont culverts should be assessed by the design chart presented in Figure 5.2 of USACE EM 1110-2-2902 ''Engineering and Design, Conduits, Culverts and Pipes.''

If the UPRR, Los Coches, and Piedmont culverts are being designed to resist uplift pressures, a groundwater elevation of + 55, + 30, and + 35 feet, respectively, should be utilized.

9.8. Lateral Loading

9.8.1. Retaining Walls

Retaining walls should be designed for the appropriate lateral earth pressure based on the following design parameters and equivalent fluid pressures (**Tables 9 and 10**):

Table 9. Retaining Wall Design Parameters

Active Earth Pressure Coefficient	0.39
At-Rest Earth Pressure Coefficient	0.56
Allowable Passive Pressure Coefficient	1.7
Allowable Friction Coefficient	0.30
Total Unit Weight	130 pcf
Buoyant Unit Weight (below groundwater)	67.6 pcf

Note: Assumes level backfill behind the wall

Table 10. Equivalent Fluid Pressures[1]

Description	Above Water Table (pcf)	Below Water Table (pcf)[2]
Active Equivalent Earth Pressure	51	26
At-Rest Equivalent Earth Pressure	73	38

Passive Equivalent Earth Pressure	221	115

Note: (1) Assumes level backfill behind the wall
(2) Soil pressure only

Determination of whether the active or at-rest condition is appropriate for design will depend on the flexibility of the walls. In clayey soils walls that are free to rotate at least 0.01 radians (deflection at the top of the wall of at least 0.01 x H) may be designed for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead or live load) located within a 1(H):1(V) plane drawn upward from the heel of the wall footing should be added to the lateral earth pressures by multiplying the surcharge pressure by the appropriate earth pressure coefficient.

Where design requires that seismic earth forces be considered the following appropriate seismic earth forces should be utilized (**Table 11**).

Table 10. Summary of Seismic Earth Forces

Seismic Earth Force (100 year return period)	$17.6H^2$ lbs/foot of wall
Seismic Earth Force (144 year return period)	$20.0H^2$ lbs/foot of wall
Seismic Earth Force (475 year return period)	$30.7H^2$ lbs/foot of wall
Seismic Earth Force (949 year return period)	$37.1H^2$ lbs/foot of wall
Seismic Earth Force (MCE or 2475 year return period)	$24.4H^2$ lbs/foot of wall

Seismic earth force should be applied at a distance of 2/3H up from the base of the wall.
H = Height of Wall (feet)

9.8.2. Culverts

For culvert design, the AREMA manual requires that minimum and maximum earth pressure coefficients of 0.33 and 1.0, respectively, be used to evaluate lateral pressure on the structure. We recommend that the Los Coches and Piedmont culverts be designed using the same earth pressure coefficients. Vertical pressures used in the calculations should be those calculated by the design charts discussed in Section 9.7, Vertical Loading. If the UPRR, Los Coches, and Piedmont culverts are being designed to resist uplift pressures, a groundwater elevation of +55, +30, and +35 feet, respectively, should be utilized.

9.9. Bearing Capacity

Design of the invert slabs of the culverts and footing foundations for retaining walls should be designed based on an allowable bearing capacity defined by the following equation:

q_{all} = 1120 + 260D + 60B (psf) (3,000 maximum)

q_{all} = allowable bearing pressure

D = minimum footing embedment (feet)

B = footing width (feet)

The allowable bearing pressure may be increased by one-third when considering live loads and seismic loads.

The modulus of subgrade reaction for the design of the culvert slabs can be calculated as:

$$K_s = \frac{280}{B} \ \ in\, pci$$

where B is the governing width of the element in feet, but no more than 14 times the thickness of the element.

9.10. Cutoffs

The upstream and downstream edges of the culvert slab/apron should include a full width cutoff wall extending at least 3 feet below the base of the slab or at least 6 inches below the potential scour depth, whichever is deeper.

10. FLOODWALLS

10.1. General

Based on the 60% design drawings, it appears that a short floodwall is needed on the left bank to contain the channel flows and an adequate freeboard between Stations 103+50 and 115+23 and Stations 171+00 and 175+50. The floodwall will only be a few feet high at the most per the 60% drawings.

The two SPT borings in the area of the floodwall between Stations 103+50 and 115+43 (SPT-4 and SPT-5) encountered 3 feet of uncontrolled clay fill at the ground surface. This uncontrolled fill is not considered suitable to support the proposed floodwall. Therefore, it is recommended that this fill be overexcavated, replaced, and recompacted beneath the floodwall or the floodwall should be founded in the natural clays below the fill. If overexcavation and replacement is performed, it is possible that the existing material can be reused as fill, based on the classifications of the material encountered in the borings; however, this will have to be confirmed in the field during construction. Any fill placed to support the floodwall should be placed in 8-inch thick loose lifts and compacted to at least 95% of the material's maximum dry density as determined by ASTM D 1557.

The floodwall between Stations 171+00 and 175+50 lies between an existing building and the top of the channel bank. To construct the floodwall, the existing material behind the building will be overexcavated about 5 feet to construct the floodwall. Following the floodwalls construction, the overexcavated material will be replaced to the original grade. Because the floodwall is essentially buried within the soil, the net load on the foundation soils beneath the floodwall will be very low.

The floodwalls should be designed in accordance with the following Corps' Engineering Regulations and Engineering Manuals:

ER 1110-2-1150 Engineering and Design for Civil Works Projects
ER 1110-2-1806 Earthquake Design and Evaluation for Civil Works Projects
EM 1110-2-2100 Stability Analysis of Concrete Structures
EM 1110-2-2104 Strength Design for Reinforced-Concrete Hydraulic Structures
EM 1110-2-2502 Retaining and Flood Walls

10.2. Earth Pressures and Uplift

Most of the load on the floodwalls will be from the hydrostatic loads from the channel flows. If earth pressures are needed for the structural design, the values listed in **Tables 9 and 10** should be used.

Cohesive soils should be assumed for the backfill around the floodwalls. Granular material should not be used for backfill unless needed for seepage control at the landside toe of the floodwall. However, any seepage relief needs to be analyzed and designed for appropriate exit gradients.

The floodwall design should also account for uplift on the base of the foundation. The uplift should vary linearly from the heel to the toe of the wall. The uplift pressure value at the heel should be equal to the full hydrostatic pressure from the flood level while the uplift pressure value at the toe should be equal to the full hydrostatic pressure from the tailwater level.

10.3. Sliding

Based on the results of the borings, the proposed floodwalls should bear on clay soils. For concrete on clay soils, it is recommended that a friction factor of 0.30 be used to determine the sliding factor of safety along the base of the walls.

10.4. Bearing Capacity

The allowable bearing capacities of the floodwall foundations were determined using the procedures in EM 1110-1-1905, Bearing Capacity of Soils. The undrained strengths from the borings along the floodwall were used and Meyerhof's equation was considered. The calculations indicate an allowable undrained bearing capacity of the soils beneath the floodwall equal to 1,250 psf. It was assumed the floodwall alignment in relation to the slope was as shown in the 60% design drawings. The undrained bearing capacity calculations for the floodwall are presented in Attachment G.

The allowable bearing capacity of the soils should be calculated based on both undrained and drained strengths. However, the bearing capacity calculation using drained strengths requires the dimensions of the floodwall foundation, which are not known at this time. However, we estimated a minimum floodwall foundation width assuming a head differential of 2 feet and an embedment of 2 feet. Using the line of creep analysis presented in EM 1110-2-2502, the calculations indicate that a minimum floodwall foundation width of 4.5 feet should be considered.

Once the floodwall design is complete for the 90% design and the foundation dimensions are known, the allowable bearing capacity of the soils using drained strengths should be checked. In addition, the line of creep analysis should be reviewed to determine that the foundation width and embedment are sufficient to provide an adequate safety factor against piping.

10.5. Settlement

If the floodwalls are designed for the allowable bearing capacity recommended in the previous section, we estimate that the floodwall total settlements will be less than one inch. Differential settlement between floodwall monoliths should be less than 0.5 inches. However, once the floodwall is completed to the 90% level, this should be confirmed by checking the settlement based on the final dimensions and actual bearing pressures of the foundation.

11. TRANSITION STRUCTURES

Transition structures will be constructed at several locations along the channel. In the 60% design drawings, transition structures are located at each of the bridge crossings except for Yosemite Drive and Ames Avenue. Based on our review of the 60% design and the boring results, we see no significant geotechnical impacts on the design or construction of the transition structures with the exception of the transition structure beneath the Los Coches Avenue bridge.

The Los Coches Avenue bridge was constructed in the mid-1960s and is currently the responsibility of the City of Milpitas. The structure is a two-span bridge with the abutments and pier supported on driven, pre-cast concrete piles. Based on as-built drawings of the bridge, the piles were roughly 50 feet long and designed for an axial capacity of 45 tons.

The excavation for the transition structure beneath Los Coches Avenue will remove soil from in front of the abutment piles, reducing the axial and lateral capacity of the abutment piles. Since this nearly 50-year old bridge likely doesn't meet current design standards, this excavation makes the situation worse.

In addition, with the soil in front of the abutment piles removed, deflections of the abutment piles will increase. The magnitude of this deflection cannot be accurately determined without a very detailed structural study of the bridge. However, the abutment deflection could impact the transition structure and possibly damage or crack the transition structure. Therefore, it is recommended that the transition structure beneath Los Coches be designed to accommodate some movement from the bridge abutment piles.

The modulus of subgrade reaction for the design of the transition slabs can be calculated as:

$$K_s = \frac{240}{B} \ \ in\, pci$$

where B is the governing width of the element in feet, but no more than 14 times the thickness of the element. This K_s value is less than that used for the culvert slabs since the transition slabs do not exert a significant load on the subgrade and soft soils beneath the transition slabs may not be removed during construction.

Due to the potential for the presence of granular layers near the channel invert, it is recommended that the cut off walls at the upstream and downstream ends of the transition structures be extended to a depth of 4 feet below the channel invert. Due to the corrosive nature of the soils on the Project, it is recommended that concrete cut off walls be used rather than sheet pile walls.

12. SCOUR AND EROSION PROTECTION

It is understood that rip rap will be used for scour protection near the base of the slopes along the channel. Rip rap is also being used for the channel invert between approximately Stations 115+00 and 164+00. The rip rap material size and toe-down depth should be designed in accordance with EM 1110-2-1601 and ETL 1110-2-120.

It is anticipated that the rip rap will be imported to the site from commercial sources. The construction documents should require the contractor to provide rip rap from only qualified and approved sources that meet the requirements of the Corps and CalDOT. The commercial source used to prepare the construction cost estimate was the Lake Herman Quarry in Vallejo, California. The phone number for this quarry is 707-643-3261.

Based on the 60% design drawings, geocells, filled with aggregate or concrete, will be used for erosion protection on the upper portions of the channel slope, above the rip rap. Based on our review of the 60% design and the results of the borings, we see no geotechnical issues with using the geocells, provided they are designed and installed per the supplier's recommendations. The one caveat to this is the corrosivity of the soils. Based on the 60% design, it appears that the geocells are staked into the slope with metal rods. Any anchorage system or other metals that are part of the geocell system will need to be resistant to this corrosion.

13. SOIL CORROSIVITY

Laboratory testing was performed on representative soil samples to evaluate soil corrosivity to buried steel and concrete. **Table 12** presents the results of the corrosivity testing.

Table 11. Corrosivity Test Results

Location	**Sample ID**	**Depth (feet)**	**pH**	**Minimum Resistivity (ohm-cm)** CTM 643	**Chloride Content** CTM 422	**Soluble Sulfate Content** CTM 417
SPT-4	SK-1	0 – 5	7.7	1,160	0.0025%	0.0092 %
SPT-5	SK-1	0 – 5	7.8	1,274	0.0023%	0.0270 %
SPT-12	SK-1	0 – 5	7.3	488	0.0084%	0.0566 %
SPT-12	SPT-8	17.5 – 19	7.7	1,908	0.0022%	0.0032 %
SPT-13	SK-1	0 – 5	7.7	910	0.0036%	0.0124 %
SPT-13	SPT-6	12.5 – 14	8.0	3,116	0.0006%	0.0019 %
SPT-16	SPT-1	2 – 3.5	7.6	2,388	0.0004%	0.0057 %
SPT-18	SK-1	0 – 5	7.9	2,228	0.0004%	0.0057 %

Per CBC 2013/ IBC 2012, Section 1904.3, concrete subject to exposure to sulphates shall comply with the requirements set forth in ACI 318, Section 4.3. Based on the measured water soluble sulphate results the exposure of buried concrete to sulphate attack should be considered ''not applicable'', i.e., exposure class S0 per ACI 318, Table 4.2.1. Consequently, injurious sulfate attack is not a concern for concrete with a minimum 28-day compressive strength of 2,500 psi.

Per CBC 2013, Section 1904.4, concrete reinforcement should be protected from corrosion and exposure to chlorides in accordance with ACI 318, Section 4.4.

The minimum soil resistivity values indicate that the on-site soils have a high to very high metallic corrosion potential. A corrosion specialist should be consulted regarding suitable types of piping and necessary protection for underground metal conduits for this project.

14. PAVEMENT DESIGN PARAMETERS

14.1. General

Access roads are planned along both sides of the proposed channel for inspection and maintenance purposes. However, the type of roadway surface has not been determined at this time. General recommendations for the construction and design of the proposed access roads are presented below.

14.2. Subgrade Design

Based on the results of the laboratory testing, it is recommended that the proposed access road pavements be designed based on an R-value of 8. This recommendation assumes that the pavement subgrades are prepared and constructed as recommended in the following section.

14.3. Subgrade Construction Recommendations

The subgrade for the proposed access roads should be stripped of all topsoil or organic soils to a point 5 feet outside of the roadway limits. Once the subgrade is cut to grade, it should be proofrolled with heavy construction equipment and any areas that pump or deflect excessively should be overexcavated. After proofrolling, the subgrade should be compacted then scarified to ensure a good bond with the initial fill lift.

The fill beneath roadways should be spread in 8-inch thick loose lifts and uniformly compacted with a sheepsfoot-type roller to 95% of the material's maximum dry density (ASTM D 1557). The moisture content of the fill should be within 3±% of the material's optimum moisture content.

15. OTHER CONSTRUCTION RECOMMENDATIONS

15.1. Site Preparation and Fill Placement

The surface should be cleared of any topsoil, pavement, structures, vegetation, trash, and debris prior to commencement of any earthwork or foundation construction. Any subterranean installations such as pipes, utility collectors, tanks, etc. that are not to be preserved should be abandoned per the geotechnical engineer’s recommendations and in accordance with applicable regulations.

Based on the 60% design cross-sections, some areas will require small slivers of fill to be placed on existing slopes. Where new engineered fill will be placed on an existing slope, the fill should be supported by a shear key constructed at the base of the toe of slope. The key should extend to a minimum depth of 3 feet below existing grade, have a minimum bottom width of 5 feet, and side slopes of 1H:1V.

In addition, existing slopes to receive fill must be benched with 2-foot high vertical cuts prior to fill placement. In order to adequately compact the face of fill slopes, it is recommended that the fill slopes be overbuilt by a foot or so and trimmed back to the final configuration.

Fill should be placed in horizontal lifts not more than 8 inches in loose, uncompacted thickness. All fill placement associated with the replacement of the excavated soils, or fill placed to achieve finished grade or subgrade should be moisture-conditioned to within 3± percent of the optimum moisture content and compacted to at least 92 percent of the maximum dry density, as evaluated by the latest version of ASTM D 1557. However, fill placed below pavements should be compacted to at least 95 percent of the maximum dry density, as evaluated by the latest version of ASTM D 1557.

Based on the findings from the borings, it appears that most of the excavated on-site soils may be re-used as compacted fill provided they are free of organics, deleterious materials, debris and particles over 3 inches in largest dimension. Locally, particles up to 4 inches in largest dimension may be incorporated in the fill soils.

However, it should be noted that the softer, wetter soils on the Project were encountered near the existing channel invert. These soils may need to be spread, disked, and dried before they can be used for fill.

Specifically, an area of note was in the vicinity of boring SPT-16 (Station 177+00) which encountered about 13 feet of soft to medium stiff clay near the existing channel invert. It may be difficult to excavate these soft soils and special efforts or equipment may be required to remove these soils. It is anticipated that these soils will not be suitable for reuse as fill without drying significantly.

15.2. Temporary Excavation and Construction Slopes

The on-site soils are not expected to pose unusual excavation difficulties, and therefore, conventional earth-moving equipment may be used. Localized sloughing/raveling of exposed soil intervals should be anticipated. All excavations should be performed in accordance with CalOSHA regulations. The on-site soils above the groundwater level may be considered a Type B soil, as defined by the current CalOSHA soil classification system.

Unsurcharged excavations: Temporary short-term, generally less than five days, unsurcharged excavations shallower than 4 feet may be excavated with vertical sides. Sides of temporary, unsurcharged, excavation deeper than 4 feet should be sloped back at an inclination of 1H:1V or flatter. Where space for sloped sides is not available, shoring will be necessary.

Surcharge setback recommendations: Stockpiled (excavated) materials should be placed no closer to the edge of a trench excavation than a distance defined by a line drawn upward from the bottom of the trench at an inclination of 1(H):1(V), but no closer than 4 feet. A greater setback may be necessary when considering heavy vehicles, such as concrete trucks and cranes. Alternatively, a shoring system should be designed to allow reduction in the setback distance.

Excavation below groundwater: The on-site soils below the groundwater level should be considered a Type C soil. It should be anticipated that excavation at or below the current creek level will encounter groundwater. In these areas temporary control and diversion of both surface water and groundwater seepage will be necessary.

15.3. Shoring

It is estimated that the maximum depth of temporary excavation required for this project will be about 10 to 15 feet. Cantilevered or anchored steel sheet pile walls may be considered for the temporary support of excavation, depending on the required excavation depth. Cantilevered sheet pile walls are typically used for excavation depths less than 12 feet. Shoring for the UPRR culvert should be designed based on the appropriate requirements in the AREMA Manual for Railway Engineering, Chapter 8. Shoring in other areas of the alignment should be designed based on the appropriate Corps of Engineers' Engineering Manuals.

16. REFERENCES

AREMA 2007, American Railway Engineering and Maintenance-of-Way Association, Manual for Railway Engineering Chapter 8.

Boore, D.M., and Atkinson, G.M., 2008, Ground-motion prediction equations for the average horizontal component of PGA, PGV, and 5% damped PSA at spectral periods between 0.01s and 10.0s, Earthquake Spectra, Vol. 24, No.1, pp. 99-138

Bowles, Joseph, Foundation Analysis and Design, 5th Edition, 1997.

California Department of Conservation, Division of Mines and Geology, 2008, Guidelines for Evaluation and Mitigation of Seismic Hazards in California: Special Publication 117.

California Department of Conservation, Division of Mines and Geology, 2001, Seismic Hazard Zone Report for the Milpitas 7.5-Minute Quadrangle, Alameda and Santa Clara Counties, Seismic Hazards Zone Report 051.

California Department of Conservation, Division of Mines and Geology 1982, Revised official map of Alquist-Priolo Earthquake Fault Hazard Zones, Milpitas 7.5-Minute Quadrangle: California Division of Mines and Geology, scale 1:24,000.

Campbell, K.W., and Bozorgnia, Y., 2008, NGA ground motion model for the geometric mean horizontal component of PGA, PGV, PGD, and 5% damped linear elastic response spectra for periods ranging from 0.01s to 10.0s, Earthquake Spectra, Vol. 24, No.1, pp. 139-171.

Chiou, B.S.J., and Youngs, R.R., 2008, Chiou-Youngs NGA ground motion relations for the geometric mean horizontal component of peak and spectral ground motion parameters, Earthquake Spectra, Vol. 24, No.1, pp. 173-215.

Jennings, C.W. and Bryant, W.A., 2010, Fault Activity Map of California: California Geological Survey Geologic Data Map No. 6, scale: 1:750,000.

Lunne, R., Robertson, P.K., and Powell, J.J.M. 1997. Cone Penetration Testing in Geotechnical Practice. EF Spon/Blackie Academic, Routledge Publishers, London, 312p.

Parikh Consultants Inc. 2004. Geotechnical Office Report, Coyote and Berryessa Creek General Re-Evaluation Study for Proposed Project Modifications, Santa Clara County, California, Job No. 200145.10, April 2004.

Pradel, D., 1998a, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils: Journal of Geotechnical and Geoenvironmental Engineering, dated April, pp. 364-368.

Pradel, D., 1998b, Erratum to Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils: Journal of Geotechnical and Geoenvironmental Engineering, dated October, p. 1048.

Santa Clara Valley Water District 2002. Levee Safety Technical Guidance Manual. Final Report. URS Corporation.

Southern California Earthquake Center, 1999. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. Dated March.

Tokimatsu, K. and H.B. Seed, 1987. Evaluation of settlements in sands due to earthquake shaking, J. Geot. Engrg., 113 (8), 861-878.

USACE, EM 1110-1-1905, "Bearing Capacity of Soils," October 30, 1992.

USACE, EM 1110-2-1902, "Slope Stability," October 3, 2003.

USACE, EM 1110-2-2100, "Stability Analysis of Concrete Structures," December 1, 2005.

USACE, EM 1110-2-2104, "Strength Design for Reinforced-Concrete Hydraulic Structures," August 20, 2003.

USACE, EM 1110-2-2502, "Retaining and Flood Walls," September 29, 1989.

USACE, EM 1110-2-1601, "Hydraulic Design of Flood Control Channels," July 1, 1991.

USACE, ER 1110-2-1150, "Engineering and Design for Civil Works Projects," August 31, 1999.

USACE, ER 1110-2-1806, "Earthquake Design and Evaluation for Civil Works Projects," July 31, 1995.

USACE, ETL 1110-2-120, "Additional Guidance for Rip Rap Channel Protection," May 14, 1971.

USACE, EM 1110-2-2902 ‘‘Engineering and Design, Conduits, Culverts and Pipes," March 31, 1998.

U.S. Geological Survey, Preliminary Geologic Map of the San Jose 30 x 60-Minute Quadrangle, California, 1999, Carl M. Wentworth, M. Clark Blake, Robert J. McLaughlin, and Russell W. Graymer, Open File Report 98-795.

Youd, T.L., and Idriss, I.M. (eds.), 1998, Summary Report in Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils: National Center for Earthquake Engineering Research Technical Report NCEER-97-0022, pp. 1-40.

Youd, T.L. and Idriss, I.M., 2001, Liquefaction Resistance of Soils: Summary report of NCEER 1996 and 1998 NCEER/SF Workshops on Evaluation of Liquefaction Resistance of Soils: Journal of Geotechnical and Geoenvironmental Engineering, dated April, pp. 297-313.

Appendix E Hazardous Toxic, and Radioactive Waste (HTRW) Soil Sampling Report

HTRW Soil Sampling Report
including Two Groundwater Grab Samples
Upper Berryessa Creek Flood Risk Management Project
Between Montague Expressway and Yosemite Drive
Santa Clara County
Milpitas, California

April 20, 2015

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APPENDICES

1.0 INTRODUCTION AND SCOPE OF WORK

Tetra Tech, Inc. performed soil and groundwater sampling in areas within the project boundaries that are intersected by Jones Chemical, Inc. (JCI) and Great Western Chemical Company (GWCC) groundwater plumes. The volatile organic compounds (VOCs) trichloroethene (TCE), tetrachloroethene (PCE) and associated breakdown products are known to be present in soil and groundwater at each of these two sites, both of which are located hydraulically up-gradient from the Project boundaries, with a general west-northwest groundwater flow direction. Figure 1 and Figure 2 depict the approximate extent of each groundwater plume in the creek channel area.

The scope of work consisted of completing five direct-push soil borings (ST-1 through ST-5) to 20 feet below ground surface (bgs), field-monitoring soil conditions, and collecting soil samples at 5-foot depth intervals for laboratory analysis. Borings ST-1 and ST-2 were completed within the GWCC groundwater plume, and borings ST-3, ST-4 and ST-5 were completed within the JCI groundwater plume. One soil boring from each plume area was also pre-selected for grab-groundwater sampling and analysis (borings ST-2 and ST-3).

Based on 2014 (first half) groundwater monitoring data from the JCI site (*JCI Jones Chemicals, Inc., Semiannual Groundwater Monitoring Report, February 1, 2014 through July 31, 2014, Former JCI Jones Chemicals Facility, 985 Montague Expressway, Milpitas, California*, dated August 29, 2014), shallow monitoring wells B17, B19 and B59, located in the vicinity of borings ST-4 and ST-5, contained PCE concentrations ranging from 1.4 micrograms per liter (µg/L) to 1,400 µg/L, and TCE concentrations ranging from 4.2 µg/L to 96 µg/L during the first half of 2014.

Based on 2014 (first half) groundwater monitoring data for the GWCC site (*Groundwater Monitoring Report for the Semiannual Period from January 1 through June 30, 2014, Former Great Western Chemical Company Facility, Milpitas, California*, dated July 30, 2014), TCE was detected in shallow groundwater at concentrations ranging from 5.7 to 64 µg/L in onsite groundwater monitoring wells, and from 1.7 to 8.5 µg/L in offsite intermediate (40-70 feet bgs) groundwater monitoring wells that are located within the project boundaries and associated with the GWCC plume. Off-site shallow groundwater monitoring wells were not sampled during this time frame.

Tetra Tech hired a private utility clearance contractor to clear the proposed soil boring locations prior to drilling. No utility conflicts were encountered.

Results of the soil and groundwater sampling are presented in the following sections.

2.0 SOIL AND GROUNDWATER SAMPLING

2.1 DEPTH TO GROUNDWATER

A saturated zone was encountered from 15.5 feet bgs to 19 feet bgs in soil boring ST-3, returning to slightly moist soil conditions from 19 feet to 20 feet bgs. Upon removal of the drilling rods, the groundwater level rose to 13 feet below grade at boring ST-3. Similarly, groundwater entered the other four soil boings upon removal of the drill rods, rising to a depth of 11 feet bgs at location ST-2. Minimal water (< 1 foot) had accumulated at the base of the other borings (ST-1, ST-4 and ST-5) in the approximate 15 minutes they remained open before being abandoned.

Based on 2011 monitoring well network data for the GWCC site, the average depth to water in the area was 7.2 feet bgs. Based on 2004 monitoring well network data for the JCI site, the average depth to water in the area was 12.1 feet bgs.

2.2 GROUNDWATER FLOW DIRECTION

Not determined, but known to flow in a west-northwest direction, based on the GWCC and JCI monitoring well networks.

2.3 BORINGS COMPLETED

Five borings (ST-1 through ST-5), as shown on Figure 1 and Figure 2 were advanced. Boring ST-1 is located directly downgradient from the GCCW release site, while boring ST-2 is located closer to the southern edge of the GCCW plume. Likewise, boring ST-4 is located immediately adjacent to, and downgradient of, the JCI release site, and borings ST-3 and ST-5 are located nearer to the northern and southern extents of the JCI plume, respectively. These locations were chosen with the intention of sampling: (1) where contamination would potentially be the highest based on proximity to the release sites, as well as (2) closer to the boundary of the suspected plumes to help identify uniformity of any soil contamination that exists.

2.4 DATE OF WORK

December 29, 2014.

2.5 DRILLING METHOD

The soil borings were completed using a Strataprobe direct-push drill rig operated by TEG of Northern California. Each soil boring was abandoned using neat cement grout, prepared with the equipment decontamination water.

2.6 BORING PERMIT

Boring Permits are not required in Santa Clara County for soil borings completed to depths of less than 45 feet bgs.

2.7 SOIL SAMPLING METHOD

A 2.5-inch outside diameter by 48-inch long, dual-tube macro-core barrel was used for obtaining continuous core soil samples to total depth. Core samples were obtained in 48-inch long acetate liners; a new liner was used for each 48-inch drive. The acetate tube section containing the selected soil sample was cut from the tube, capped, labeled and placed on ice in a cooler. Upon completing each boring, the soil samples were hand-delivered to TEG's mobile laboratory that was stationed between borings ST-1 and ST-2.

2.8 LITHOLOGY

Continuous soil cores were collected to total depth in each boring (approximately 20 feet bgs). The lithology encountered generally consists of alternating sequences of fine-grained clayey silt and silty clay, with gravelly sands encountered between 7 and 11 feet in depth at borings ST-4 and ST-5. This gravelly sand zone can be seen outcropping on the creek bank adjacent to each of these soil borings. Soil drilling logs are presented in Appendix A.

2.9 FIELD SCREENING

A MiniRAE 3000 PID (photo-ionizing detector) was used for field screening the soil cores at 4-foot intervals. A portion of soil from each interval was placed in a Ziploc bag and allowed to sit in the sun for 5-10 minutes before screening with the PID. Positive PID readings were detected at each depth interval, but at very low concentrations (typically below 5 ppmv), with the highest reading detected at 12 feet bgs at boring ST-4 (7.7 ppmv). No field indication of soil impacts (odor and/or soil discoloration) were noted in the soil borings.

2.10 GROUNDWATER SAMPLING METHOD

New temporary 1-inch diameter PVC well casing fitted with a 5-foot section of new well screen (0.020-inch slot size) was inserted downhole upon reaching 20-feet in depth, and removing the drill rods. New ¼-inch diameter polyethylene tubing equipped with a stainless steel re-usable foot valve was inserted to total depth, and a grab groundwater sample was collected. The sample was placed in laboratory-supplied, HCl preserved, VOA vials, labeled, and placed on ice in a cooler. The groundwater samples from ST-2 and ST-3 were hand-delivered to TEG's mobile laboratory.

2.11 SOIL CUTTINGS/DECON WATER

Minimal soil cuttings were generated during the investigation activities and were placed on the ground adjacent to each boring. The drill rod and foot valves were washed in a water/liquinox solution between borings, and rinsed with clean water. The decon water was used to mix the grout to abandon each boring.

2.12 FIELD INVESTIGATION SUMMARY TABLE

Boring ID	Total Depth (feet)	Soil Sample Depth (feet)	Soil Sample Analyzed	Groundwater Sample Analyzed	PID Field Screening (ppmv)
ST-1	20	4.75-5 9.75-10 14.75-15 19.75-20	YES YES YES YES	NO	0.0 (4') 0.4 (8') 1.2 (12') 0.7 (16') 0.0 (20')
ST-2	20	4.75-5 9.75-10 14.75-15 19.75-20	YES YES YES YES	YES	2.4 (4') 3.1 (8') 1.2 (12') 0.7(16') 0.8 (20')
ST-3	20	4.75-5 9.75-10 14.75-15 19.75-20	YES YES YES YES	YES	0.1 (4') 0.0 (8') 0.4 (12') 0.5 (16') 0.5 (20')
ST-4	20	4.75-5 9.75-10 14.75-15 19.75-20	YES YES YES YES	NO	2.2 (4') 1.8 (8') 7.7 (12') 0.5 (16') 4.7 (20')
ST-5	20	4.75-5 9.75-10 14.75-15 19.75-20	YES YES YES YES	NO	0.0 (4') 0.0 (8') 0.0 (12') 0.7 (16') 0.0 (20')

PID – Photo-ionizing Detector (MiniRAE 3000).

2.13 LABORATORY ANALYSES

Soil:

- VOCs by EPA Method 8260B. Analysis performed on-site by a mobile lab operated by TEG of Northern California. Results are summarized in Table 1.

Water:

- VOCs by EPA Method 8260B. Analysis performed by TEG's mobile lab, at their office in Rancho Cordova, California. Results are summarized in Table 2.

Copies of laboratory analytical laboratory data sheets and chain-of-custody forms are presented in Appendix B. Review of the laboratory analytical data sheets indicate all samples were analyzed at a dilution factor of 1 (no dilution), no chemicals were detected in the respective instrument blanks for soil and water analyses, and the laboratory QA/AC data are within acceptable limits.

3.0 ANALYTICAL RESULTS

This Section presents the laboratory analytical results associated with the soil and groundwater samples that were collected from the GWCC and JCI Plume Areas. Comparison of these analytical results to commonly used risk screening levels is discussed in Section 3.3.

3.1 GWCC AREA

3.1.1 GWCC Plume Area Soil Analytical Results

As discussed in Section 2.0 and associated subsections, soil boreholes ST-1 and ST-2 were advanced to approximately 20 feet bgs in the GWCC Plume Area (Figure 1), and sampled at approximately 5, 10, 15, and 20 feet bgs for VOCs by EPA Method 8260 B.

The soil analytical results associated with borehole ST-1 are summarized in Table 1 and below:

- TCE was detected at concentrations ranging from 5.0 to 19 ug/Kg in the soil samples collected from 10 (duplicate sample only) to 20 feet bgs. TCE was not detected (ND) above the laboratory reporting limit of 5 ug/kg in the soil sample collected from borehole ST-1 at 5 feet bgs;

- PCE was detected in the duplicate soil sample collected from 10 feet bgs and the soil samples collected from 15 and 20 feet bgs at concentrations ranging from 5.3 to 14 ug/kg. PCE was ND in the soil samples collected from borehole ST-1 at 5 feet bgs and 10 feet bgs (primary sample only);

- Cis-1,2-DCE was detected at a concentration of 5.4 ug/kg in the soil sample collected at 15 feet bgs. Cis-1,2-DCE was ND in all other samples collected from borehole ST-1; and

- In all other cases, VOCs were ND in the soil samples collected from borehole ST-1.

As summarized in Table 1, all VOCs were ND in all soil samples collected from borehole ST-2.

3.1.2 GWCC Plume Area Groundwater Analytical Results

As discussed in Section 2.0 and associated subsections, a groundwater samples was collected from borehole ST-2 and analyzed for VOCs by EPA Method 8260B. TCE (1.3 ug/L), m,p-xylene 2.0 (ug/L), o-xylene (1.2 ug/L, and 1,2,4-trimethylbenzene (1.1 ug/L) were detected in the groundwater sample collected from borehole ST-2. All other VOCs were ND in the groundwater sample collected from borehole ST-2.

3.2 JCI AREA

3.2.1 JCI Plume Area Soil Analytical Results

As discussed in Section 2.0 and associated subsections, soil boreholes ST-3 through ST-5 were advanced to approximately 20 feet bgs in the JCI Plume Area (Figure 2), and sampled at approximately 5, 10, 15, and 20 feet bgs for VOCs by EPA Method 8260 B.
The soil analytical results associated with borehole ST-3 are summarized in Table 1 and below:

- TCE was detected at a concentration of 8.9 ug/Kg in the soil sample collected from 20 feet bgs. TCE was ND in the all other soil sample collected from borehole ST-3;

- PCE was detected at a concentration of 9.1 ug/Kg in the soil sample collected from 20 feet bgs. PCE was ND in the all other soil sample collected from borehole ST-3; and

- In all other cases, VOCs were ND in the soil samples collected from borehole ST-1.

The soil analytical results associated with borehole ST-4 are summarized in Table 1 and below:

- TCE was detected at concentrations ranging from 17 ug/Kg to 84 ug/kg in the soil samples collected from 10 to 20 feet bgs. TCE was ND in the soil sample collected from borehole ST-4 at 5 feet bgs;

- PCE was detected in the soil samples collected from 5 to 15 feet bgs at concentrations ranging from 21 to 150 ug/kg, and 1,800 ug/kg in the soil sample collected at 20 feet bgs;

- 1,1-DCE was detected at a concentration of 8.4 ug/kg in the soil sample collected at 20 feet bgs. 1,1-DCE was ND in all other samples collected from borehole ST-4; and

- In all other cases, VOCs were ND in the soil samples collected from borehole ST-4.

As summarized in Table 1, PCE was detected in was detected in the 20-foot soil sample collected from borehole ST-5 at a concentration 10 ug/kg. In all other cases, VOCs were ND in the soil samples collected from borehole ST-5.

3.2.2 JCI Plume Area Groundwater Analytical Results

As discussed in Section 2.0 and associated subsections, a groundwater sample was collected from borehole ST-3 and analyzed for VOCs by EPA Method 8260B. TCE (5.6 ug/L) and PCE (3.0 ug/L) were detected in the groundwater sample collected from borehole ST-3. All other VOCs were ND in the groundwater sample collected from borehole ST-3.

4.0 EVALUATION OF RESULTS

In anticipation of future soil moving and dewatering (if needed) associated with the upcoming implementation of the Project, Tetra Tech collected soil and ground water samples within the areas where the JCI and GWCC groundwater contaminant plumes intersect the Project Area. The purpose of this work was to assist in the evaluation of the following:

- Whether the San Francisco Regional Water Quality Control Board (SFRWQCB) would be likely to determine that the soils that will be excavated during Project implementation from the JCI and GWCC plume areas will be suitable for reuse within the Project Area;
- Whether soils that will be excavated during Project implementation from the JCI and GWCC plume areas would exceed regulatory thresholds for characteristic hazardous waste; and
- Whether contaminated groundwater that will be removed during Project dewatering would likely be required by the regulatory agencies to be treated prior to discharge.

4.1 SELECTION OF SCREENING CRITERIA

4.1.1 Soil Screening Criteria

There are no regulatory thresholds that directly apply to determining whether excavated contaminated soil is suitable for onsite reuse. In the absence of directly applicable regulatory thresholds, Tetra Tech compared the soil analytical data to SFRWQCB Environmental Screening Levels (ESLs) and USEPA Region 9 Regional Screening Levels (RSLs) to evaluate the potential of whether excavated contaminated soil will likely be suitable for onsite reuse. Based on professional experience, regulatory agencies are likely to allow the reuse of excavated soil if contaminant concentrations are below appropriate screening levels.

The RSLs and ESLs are described in further detail below. It is noted that neither of these screening levels are directly applicable to this particular project; however each provide conservative regulatory-derived risk-based values that can be used as an indication as to whether or not reusing the excavated soil would present significant health or environmental risks.

<u>USEPA Region 9 Regional Screening Levels</u>

USEPA Region 9 RSLs were developed using risk assessment guidance from the EPA Superfund program. The EPA considers SLs to be protective for humans (including sensitive groups) over a lifetime; however, SLs are not always applicable to a particular site and do not address non-human health endpoints, such as ecological impacts. The published RSLs are generic; they are calculated without site-specific information and may be re-calculated using site-specific data. RSLs address specific media and concerns, including: soil, air, tap water, and the protection of groundwater.

RSLs are used for site "screening" and as initial cleanup goals, if applicable. SLs are not de facto cleanup standards and should not be applied as such. The SL's role in site "screening" is to help identify areas, contaminants, and conditions that require further federal attention at a particular site. Generally, at sites where contaminant concentrations fall below SLs, no further action or study is warranted under the Superfund program, so long as the exposure assumptions at a site match those taken into account by the SL calculations. Chemical concentrations above the RSL would not automatically designate a site as "dirty" or trigger a response action; however, exceeding a RSL suggests that further evaluation of the potential risks by site contaminants is appropriate. SLs are also useful tools for identifying initial cleanup goals at a site. RSLs provide long-term targets to use during the analysis of different remedial alternatives.

ESLs

The ESLs, which are prepared by staff of the SFRWQCB, provide conservative screening levels for over 100 chemicals commonly found at sites with contaminated soil and groundwater. They are intended to help expedite the identification and evaluation of potential environmental concerns at contaminated sites. ESLs address a range of media (soil, groundwater, soil gas, and indoor air) and a range of concerns (e.g., impacts to drinking water, vapor intrusion, and impacts to aquatic life).

The ESLs allow dischargers and regulators in the San Francisco Bay region to quickly focus on the most significant problems at contaminated sites. The ESLs are considered to be protective for typical bay area sites. Under most circumstances, and within the limitations described, the presence of a chemical in soil, soil gas, or groundwater at concentrations below the corresponding ESL can be assumed to not pose a significant threat to human health, water resources, or the environment.

The ESLs utilized for this project pertain to shallow soils of depths less than three meters. This would include surficial (cover) and subsurface (fill) soils.

4.1.2 Groundwater Screening Criteria

Groundwater concentrations were compared to maximum contaminant levels (MCLs) and groundwater ESLs. It is expected that if groundwater is extracted during the Project, the discharged water will have to meet the MCLs and/or ESLs. Thus comparison to the MCLS and ESLs provides insight as to whether or not groundwater treatment would be required prior to discharge.

4.2 COMPARISON OF SOIL ANALYTICAL DATA TO ESLS AND RSLS

The maximum depth of excavation during Project Implementation will be approximately 15 feet below ground surface. A total of 17 soil samples (including 2 duplicates) were collected from the upper 15 feet of the soil column (ST-1-5', 10', 10'D, 15'; ST-2-5', 10', 15'; ST-3-5', 10', 15'; ST-4-5', 10', 15'; ST-4-5', 10', 15'; ST-5-5', 10', 15', and 15'D). The only VOCs detected in these soil samples were 1,1-DCE, cis-1,2-DCE, TCE, PCE. As summarized below and in Table 1, none of the VOCs exceeded screening levels in the upper 15 feet (the maximum excavation depth):

- 1,1-DCE was detected at maximum concentration of 8.4 ug/kg in the upper 15 feet (maximum excavation depth), well below the residential ESL of 1,000 ug/kg and the RSL of 23,000 ug/kg;

- Cis-1,2-DCE was detected at maximum concentration of 5.4 ug/kg in the upper 15 feet (maximum excavation depth), well below the residential ESL of 190 ug/kg and the RSL of 16,000 ug/kg; and

- TCE was detected at maximum concentration of 19 ug/kg in the upper 15 feet (maximum excavation depth), well below the residential ESL of 460ug/kg and the RSL of 8,100 ug/kg.

PCE was detected at maximum concentration of 150 ug/kg in the upper 15 feet (maximum excavation depth), well below the residential ESL of 550 ug/kg and the RSL of 550 ug/kg.

4.3 POTENTIAL WASTE CLASSIFICATION

Based on a review of the available data and comparison to the risk screening levels, the excavated soil would not be classified as a hazardous waste.

4.4 GROUNDWATER

PCE and TCE concentrations detected in groundwater samples ranged from less than 1.0 (detection limit) to 3.0 µg/L, and 1.3 to 5.6 µg/L, respectively. The TCE concentration exceeded the California and USEPA MCL of 5.0 µg/L.

5.0 CONCLUSIONS

Based on the available data, Tetra Tech concludes the following:

- The VOC concentrations detected in the upper 15 feet of soil are less than risk-based screening criteria applied by the SFRWQCB and the USEPA. Although these screening criteria are not directly applicable to reuse of excavated soil, Tetra Tech concludes that the reuse of the soils would not present an unacceptable human health or environmental risk, and therefore would be appropriate;
- Soil transported offsite for disposal would be classified as non-hazardous; and
- Dewatering, if necessary, would require treatment prior to discharge.

FIGURES

SOURCE: ***Google Earth Pro, February 23, 2014.***

ST-1 ● Soil boring location (Tetra Tech, 12/29/14)

Known VOC Groundwater Plume (approximate extent) – Great Western Chemical Company (GWCC)

N

0 feet 150

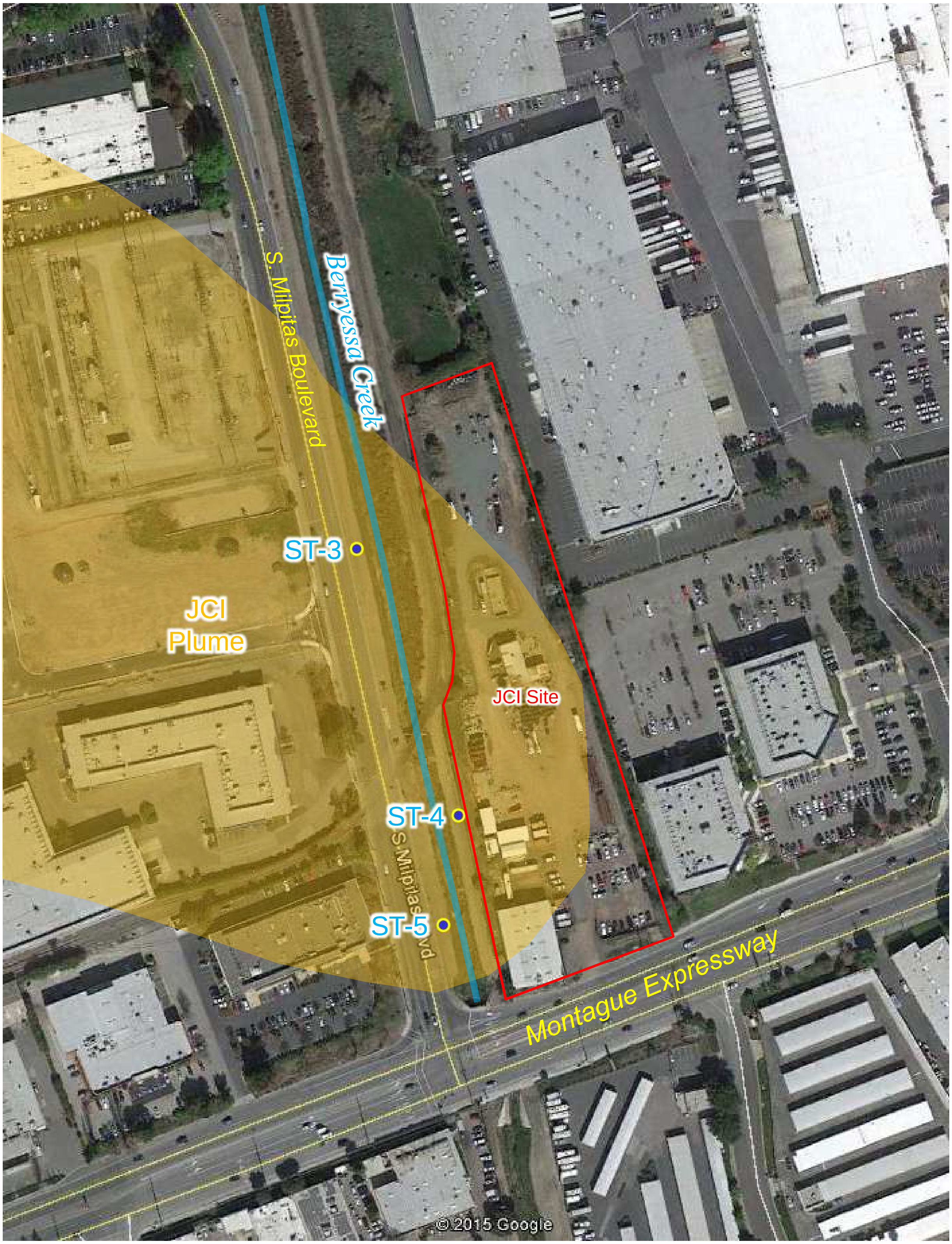
TITLE: **Soil Boring Locations**

LOCATION: **Upper Berryessa Creek FRMP**
Between Montague Expressway and Yosemite Drive
Milpitas, California

TETRA TECH

CHECKED:	IA
DRAFTED:	KDH
FILE:	100-SWW-T31331
DATE:	01-14-15

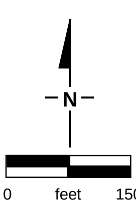
FIGURE: 1



SOURCE: ***Google Earth Pro, February 23, 2014.***

ST-3 ● Soil boring location (Tetra Tech, 12/29/14)

Known VOC Groundwater Plume (approximate extent) – Jones Chemicals, Inc. (JCI)



TITLE:

Soil Boring Locations

LOCATION:

Upper Berryessa Creek FRMP
Between Montague Expressway and Yosemite Drive
Milpitas, California

TETRA TECH

CHECKED:	IA	**FIGURE:**
DRAFTED:	KDH	**2**
FILE:	100-SWW-T31331	
DATE:	01-14-15	

TABLES

TABLE 1

Analytical Results Summary - Soil
Upper Berreyssa Creek FRMP
Between Montague Expressway and Yosemite Drive
Milpitas, California

Sample Location	Date Sampled	Depth (feet, bgs)	VOCs - EPA 8260B (µg/Kg)						
			1,1-DCE	cis-1,2-DCE	TCE	PCE	m,p-Xylene (1)	o-Xylene (1)	1,2,4-TMB (1)
ST-1-5'	12/29/2014	5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-1-10'	12/29/2014	10	< 5.0	< 5.0	**5.0**	< 5.0	< 5.0	< 5.0	< 5.0
ST-1-10'D	12/29/2014	10	< 5.0	< 5.0	**8.1**	**5.3**	< 5.0	< 5.0	< 5.0
ST-1-15'	12/29/2014	15	< 5.0	**5.4**	**17**	**11**	< 5.0	< 5.0	< 5.0
ST-1-20'	12/29/2014	20	< 5.0	< 5.0	**19**	**14**	< 5.0	< 5.0	< 5.0
ST-2-5'	12/29/2014	5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-2-10'	12/29/2014	10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-2-15'	12/29/2014	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-2-20'	12/29/2014	20	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-3-5'	12/29/2014	5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-3-10'	12/29/2014	10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-3-15'	12/29/2014	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-3-20'	12/29/2014	20	< 5.0	< 5.0	**8.9**	**9.1**	< 5.0	< 5.0	< 5.0
ST-4-5'	12/29/2014	5	< 5.0	< 5.0	< 5.0	**21**	< 5.0	< 5.0	< 5.0
ST-4-10'	12/29/2014	10	< 5.0	< 5.0	**17**	**150**	< 5.0	< 5.0	< 5.0
ST-4-15'	12/29/2014	15	< 5.0	< 5.0	**19**	**150**	< 5.0	< 5.0	< 5.0
ST-4-20'	12/29/2014	20	**8.4**	< 5.0	**84**	**1,800**	< 5.0	< 5.0	< 5.0

TABLE 1

Analytical Results Summary - Soil
Upper Berreyssa Creek FRMP
Between Montague Expressway and Yosemite Drive
Milpitas, California

Sample Location	Date Sampled	Depth (feet, bgs)	VOCs - EPA 8260B (µg/Kg)						
			1,1-DCE	cis-1,2-DCE	TCE	PCE	m,p-Xylene (1)	o-Xylene (1)	1,2,4-TMB (1)
ST-5-5'	12/29/2014	5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-5-10'	12/29/2014	10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-5-15'	12/29/2014	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-5-15'D	12/29/2014	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
ST-5-20'	12/29/2014	20	< 5.0	< 5.0	< 5.0	**10**	< 5.0	< 5.0	< 5.0
ESL - Residential (< 3m)			1,000	190	460	550	2,300	2,300	NV
RSL - Residential			23,000	16,000	410	8,100	55,000	65,000	5,800
TTLC			NV	NV	2,040,000	NV	NV	NV	NV

Notes:

VOCs	Volatile organic compounds. Analyzed by EPA Method 8260B (TEG-Northern California Mobile Lab)
µg/Kg	micrograms per kilogram or parts per billion (ppb).
D	Duplicate sample
DCE	Dichloroethene
TCE	Trichloroethene
PCE	Tetrachloroethene
TMB	Trimethylbenzene
(1)	Only detected in grab-groundwater samples.
Bold Value	Detected above the laboratory reporting limit.
	Shaded value exceeds screening level and/or regulatory action level.
ESL (<3 m)	Environmental Screening Level, Regional Water Quality Control Board, Table A, Shallow Soil Screening Levels (<3m bgs); Commerical and Residential Land Use (groundwater is current or potential drinking water source), December 2013.
ESL (>3 m)	Environmental Screening Level, Regional Water Quality Control Board, Table C, Shallow Soil Screening Levels (>3m bgs); Commerical and Residential Land Use (groundwater is current or potential drinking water source), December 2013.
Groundwater Protection ESL	Environmental Screening Level, Regional Water Quality Control Board, Table G, Soil Screening Levels for Leaching Concerns, December 2013.
RSL	United States Environmental Protection Agency, Regional Screening Level - Summary Table, January 2015.
TTLC	California Title 22, classification as a hazardous waste, if trasported off-site.
NV	No Value

TABLE 2

Analytical Results Summary - Water
Upper Berreyssa Creek FRMP
Between Montague Expressway and Yosemite Drive
Milpitas, California

			VOCs - EPA 8260B (µg/L)						
Boring	**Depth (feet, bgs)**	**Date**	**1,1-DCE**	**cis-1,2-DCE**	**TCE**	**PCE**	**m,p-Xylene**	**o-Xylene**	**1,2,4-TMB**
ST-2-W	11-20	12/29/2014	< 1.0	< 1.0	**1.3**	< 1.0	**2.0**	**1.2**	**1.1**
ST-3-W	13-20	12/29/2014	< 1.0	< 1.0	**5.6**	**3.0**	< 1.0	< 1.0	< 1.0
	ESL		6	6	5	5	20	20	NV
	MCL		6	6	5	5	1,750	1,750	330 (1)

Notes:

Groundwater samples are unfiltered, grab-groundwater samples from a direct-push borehole. Collected through temporary PVC well screen and casing.

VOCs Volatile organic compounds. Analyzed by EPA Method 8260B (TEG-Northern California Mobile Lab).

µg/L micrograms per liter or parts per billion (ppb).

DCE Dichloroethene

TCE Trichloroethene

PCE Tetrachloroethene

TMB Trimethylbenzene

Bold Value Detected above the laboratory reporting limit.

(shaded) Shaded value exceeds screening level and/or regulatory action level.

ESL RWQCB - San Francisco Environmental Screening Level. Groundwater Screening Levels, Table F-1a (groundwater is a current or potential drinking water resource), December 2013.

MCL Maximum Containment Level (California primary drinking water standard), Title 22, California Code of Regulations. On-line database, searched 1/14/15.

(1) No published MCL value. Value represents California Department of Public Heath Notification Level.

NV No Value

APPENDIX A

Soil Drilling Logs

TETRA TECH

BORING LOG

PROJECT NUMBER	100-SWW-T31331 Task 3.62	BORING/WELL NUMBER	ST-1
PROJECT NAME	Upper Berryessa Creek FRMP	DATE DRILLING BEGAN	12/29/2014
LOCATION	Milpitas, CA	DATE DRILLING ENDED	12/29/2014
DRILLING METHOD	Strataprobe Direct Push	NORTHING [CA STATE PLANE ZONE III (NAD 83)]	
SAMPLING METHOD	Continuous Core, 2" Diameter	EASTING [CA STATE PLANE ZONE III (NAD 83)]	
DEPTH TO SATURATED SOIL (ft)		GROUND SURFACE ELEVATION (ft, NAVD 88)	42'(ST-1)-63'(ST-5)
LOGGED BY	Keith Hoofard	REMARKS	

PID (ppm)	BLOW COUNTS	RECOVERY (ft)	SAMPLE ID.	SAMPLE DEPTH	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION (Percent Gravel, Sand, Silt, Clay)
0.0			ST-1-5'		5	ML		0-7' **CLAYEY SILT (ML):** (0,5,70,25); Dark gray (7.5YR 4/1); very fine sand; slight plasticity; stiff; slightly moist.
0.4 1.2			ST-1-10'		10	CL		7-14.5' **SILTY CLAY (CL):** (0,5,35,60); Dark brown (7.5YR 3/2); very fine sand; slight plasticity; soft; slightly moist. @12' - Increasing plasticity - low to medium; firm to stiff.
0.7			ST-1-15'		15	ML		14.5-17' **CLAYEY SILT w/ SAND (ML):** (0,10,60,30); Dark yellowish brown (10YR 4/4); very fine sand; slight plasticity; firm; moist.
			ST-1-20'		20	CL		17-20' **SILTY CLAY (CL):** (0,5,40,55); Dark yellowish brown (10YR 4/4); very fine sand; low plasticity; stiff; moist.
0.0								Note: Saturated soil conditions not encountered. Groundwater entered borehole after removing drill rods, reaching 19 feet bgs before abandoning borehole.

Keith Hoofard

Name of Geologist

Name of Reviewer

TETRA TECH

BORING LOG

PROJECT NUMBER	100-SWW-T31331 Task 3.62	**BORING/WELL NUMBER**	ST-2
PROJECT NAME	Upper Berryessa Creek FRMP	**DATE DRILLING BEGAN**	12/29/2014
LOCATION	Milpitas, CA	**DATE DRILLING ENDED**	12/29/2014
DRILLING METHOD	Strataprobe Direct Push	**NORTHING [CA STATE PLANE ZONE III (NAD 83)]**	
SAMPLING METHOD	Continuous Core, 2" Diameter	**EASTING [CA STATE PLANE ZONE III (NAD 83)]**	
DEPTH TO SATURATED SOIL (ft)		**GROUND SURFACE ELEVATION (ft, NAVD 88)**	42'(ST-1)-63'(ST-5)
LOGGED BY	Keith Hoofard	**REMARKS**	

PID (ppm)	BLOW COUNTS	RECOVERY (ft)	SAMPLE ID.	SAMPLE DEPTH	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION (Percent Gravel, Sand, Silt, Clay)
					0	ML		0-6' **CLAYEY SILT (ML):** (0,5,70,25); Dark gray (7.5YR 4/1); very fine sand; slight plasticity; stiff; slightly moist.
2.4			ST-2-5'		5			
3.1			ST-2-10'		10	CL		6-13' **SILTY CLAY (CL):** (0,5,35,60); Dark brown (7.5YR 3/2); very fine sand; slight plasticity; soft; slightly moist.
1.2								
0.7			ST-2-15'		15	CL		13-18' **SILTY CLAY w/ SAND (CL):** (0,15,30,55); Yellowish brown (10YR 5/4); fine sand; low plasticity; firm; slightly moist to moist.
						SM		18-20' **SILTY SAND (SM):** (0,65,35,0); Yellowish brown (10YR 5/4); fine sand; loose; moist to very moist.
0.8			ST-2-20'		20			Note: Saturated soil conditions not encountered. Groundwater entered borehole after removing drill rods, reaching 11 feet bgs before abandoning borehole.

Keith Hoofard

Name of Geologist

Name of Reviewer

TETRA TECH

BORING LOG

PROJECT NUMBER	100-SWW-T31331 Task 3.62	**BORING/WELL NUMBER**	ST-3
PROJECT NAME	Upper Berryessa Creek FRMP	**DATE DRILLING BEGAN**	12/29/2014
LOCATION	Milpitas, CA	**DATE DRILLING ENDED**	12/29/2014
DRILLING METHOD	Strataprobe Direct Push	**NORTHING [CA STATE PLANE ZONE III (NAD 83)]**	
SAMPLING METHOD	Continuous Core, 2" Diameter	**EASTING [CA STATE PLANE ZONE III (NAD 83)]**	
DEPTH TO SATURATED SOIL (ft)	15.5	**GROUND SURFACE ELEVATION (ft, NAVD 88)**	42'(ST-1)-63'(ST-5)
LOGGED BY	Keith Hoofard	**REMARKS**	

PID (ppm)	BLOW COUNTS	RECOVERY (ft)	SAMPLE ID.	SAMPLE DEPTH	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION (Percent Gravel, Sand, Silt, Clay)
0.1			ST-3-5'		5	ML		0-5' **CLAYEY SILT (ML):** (0,5,70,25); Very dark gray (10YR 3/1); no plasticity; firm to stiff; slightly moist.
0.0			ST-3-10'		10	ML		5-9.5' **SANDY SILT (ML):** (0,40,60,0); Dark yellowish brown (10YR 4/4); fine sand; soft; slightly moist.
0.4			ST-3-15'		15	CL		9.5-15.5' **SILTY CLAY (CL):** (0,5,45,50); Dark grayish brown (10YR 4/2); low plasticity; firm; slightly moist.
0.5						SC		15.5-19' **CLAYEY SAND (SC):** (0,70,5,25); Dark yellowish brown (10YR 4/4); fine to medium sand; saturated.
0.5			ST-3-20'		20	CL		19-20' **SILTY CLAY (CL):** (0,0,45,55); Dark yellowish brown (10YR 4/4); low to medium plasticity; firm; slightly moist.

Note: Groundwater level rose to 13 feet bgs after removing drill rods.

TT GEO TT-DIV - UPPER BERRYESSA CREEK FRM.GPJ LAEWNN01.GDT 1/16/15

Keith Hoofard

Name of Geologist

Name of Reviewer

TETRA TECH

BORING LOG

PROJECT NUMBER	100-SWW-T31331 Task 3.62	**BORING/WELL NUMBER**	ST-4
PROJECT NAME	Upper Berryessa Creek FRMP	**DATE DRILLING BEGAN**	12/29/2014
LOCATION	Milpitas, CA	**DATE DRILLING ENDED**	12/29/2014
DRILLING METHOD	Strataprobe Direct Push	**NORTHING [CA STATE PLANE ZONE III (NAD 83)]**	
SAMPLING METHOD	Continuous Core, 2" Diameter	**EASTING [CA STATE PLANE ZONE III (NAD 83)]**	
DEPTH TO SATURATED SOIL (ft)		**GROUND SURFACE ELEVATION (ft, NAVD 88)**	42'(ST-1)-63'(ST-5)
LOGGED BY	Keith Hoofard	**REMARKS**	

PID (ppm)	BLOW COUNTS	RECOVERY (ft)	SAMPLE ID.	SAMPLE DEPTH	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION (Percent Gravel, Sand, Silt, Clay)
					0–2	ML		0-2' **SILT w/ GRAVEL (ML):** (<5,10,90,0); Dark yellowish brown (10YR 34/4); trace angular gravels.
2.2			ST-4-5'		2–7 (5)	ML		2-7' **CLAYEY SILT (ML):** (0,5,70,25); Brown (10YR 4/3); very fine sand; slight plasticity; firm; slightly moist.
1.8			ST-4-10'		7–11 (10)	SW GW		7-11' **GRAVELLY SAND (SW/GW):** (40,55,5,0); Dark yellowish brown (10YR 4/4); fine to coarse, sub-angular to sub-rounded gravel; fine to coarse, sub-angular to sub-rounded sand; loose; slightly moist.
7.7					11–20	CL		11-20' **SILTY CLAY (CL):** (0,0,45,55); Brown (10YR 5/3); moderate plasticity; soft; slightly moist to moist.
0.5			ST-4-15'		15			
4.7			ST-4-20'		20			Note: Saturated soil conditions not encountered. Groundwater entered borehole after removing drill rods, reaching 19.5 feet bgs before abandoning borehole.

Name of Geologist: Keith Hoofard

Name of Reviewer

TETRA TECH

BORING LOG

PROJECT NUMBER	100-SWW-T31331 Task 3.62	BORING/WELL NUMBER	ST-5
PROJECT NAME	Upper Berryessa Creek FRMP	DATE DRILLING BEGAN	12/29/2014
LOCATION	Milpitas, CA	DATE DRILLING ENDED	12/29/2014
DRILLING METHOD	Strataprobe Direct Push	NORTHING [CA STATE PLANE ZONE III (NAD 83)]	
SAMPLING METHOD	Continuous Core, 2" Diameter	EASTING [CA STATE PLANE ZONE III (NAD 83)]	
DEPTH TO SATURATED SOIL (ft)		GROUND SURFACE ELEVATION (ft, NAVD 88)	42'(ST-1)-63'(ST-5)
LOGGED BY	Keith Hoofard	REMARKS	

PID (ppm)	BLOW COUNTS	RECOVERY (ft)	SAMPLE ID.	SAMPLE DEPTH	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION (Percent Gravel, Sand, Silt, Clay)
						ML		0-2' **SILT (ML):** (0,10,90,0); Dark yellowish brown (10YR 34/4); very fine sand; slightly moist.
0.0			ST-5-5'		5	ML		2-8' **CLAYEY SILT (ML):** (0,5,70,25); Brown (10YR 4/3); very fine sand; slight plasticity; firm; slightly moist.
0.0			ST-5-10'		10	SW GW		8-11' **GRAVELLY SAND (SW/GW):** (40,55,5,0); Dark yellowish brown (10YR 4/4); fine to coarse, sub-angular to sub-rounded gravel; fine to coarse, sub-angular to sub-rounded sand; loose; slightly moist.
0.0								11-19.5' **SILTY CLAY (CL):** (0,0,45,55); Brown (10YR 5/3); moderate plasticity; soft; slightly moist to moist.
0.0			ST-5-15'		15	CL		@16' - Very fine sand (VFS).
0.0			ST-5-20'		20	SC		19.5-20' **CLAYEY SAND (SC):** (0,70,5,25); Dark yellowish brown (10YR 4/4); medium to coarse, sub angular sand; trace fine, sub rounded gravel; moist to very moist.

Note: Saturated soil conditions not encountered. Groundwater entered borehole after removing drill rods, reaching 20 feet bgs before abandoning borehole.

Keith Hoofard

Name of Geologist

Name of Reviewer

APPENDIX B

Laboratory Analytical Data Sheets and Chain of Custody Forms

TEG Northern California Inc.

14 January 2015

Mr. Ira Mark Artz
Tetra Tech - DIV
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614-6213

SUBJECT: DATA REPORT - TetraTech – DIV Project # 100-SWW-T31331 Task 3.62
Berryessa Creek Channel, Milpitas, California

TEG Project # 41229F

Mr. Artz:

Please find enclosed a data report for the samples analyzed from the above referenced project for Tetra Tech - DIV. The samples were analyzed in TEG's mobile laboratory. TEG conducted a total of 24 analyses on 22 soil 2 water samples.

-- 2 analyses on waters for volatile organic hydrocarbons by EPA method 8260B.

-- 22 analyses on soils for volatile organic hydrocarbons by EPA method 8260B.

The results of the analyses are summarized in the enclosed tables. Applicable detection limits and QA/QC data are included in the tables.

TEG appreciates the opportunity to have provided analytical services to Tetra Tech - DIVon this project. If you have any further questions relating to these data or report, please do not hesitate to contact us.

Sincerely,

Mark Jerpbak
Director, TEG-Northern California

11350 Monier Park Place, Rancho Cordova, CA 95742 • Phone (916) 853-8010 • Fax (916) 853-8020

TEG Project #41229F

teg

Tetra Tech - DIV Project # 100-SWW-T31331 Task 3.62
Berryessa Creek Channel, Milpitas, California

EPA Method 8260B Analyses of SOIL in ug/Kg

SAMPLE NUMBER:		Blank	Blank	ST-1-5'	ST-1-10'	ST-1-10' D	ST-1-15'
COLLECTION DATE:				12/29/14	12/29/14	12/29/14	12/29/14
ANALYSIS DATE:		12/29/14	12/30/14	12/30/14	12/30/14	12/30/14	12/30/14
DILUTION FACTOR:	RL	1	1	1	1	1	1
Dichlorodifluoromethane	5.0	nd	nd	nd	nd	nd	nd
Chloromethane	5.0	nd	nd	nd	nd	nd	nd
Vinyl Chloride	5.0	nd	nd	nd	nd	nd	nd
Bromomethane	5.0	nd	nd	nd	nd	nd	nd
Chloroethane	5.0	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Methylene Chloride	5.0	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	5.4
Chloroform	5.0	nd	nd	nd	nd	nd	nd
Bromochloromethane	5.0	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
Benzene	5.0	nd	nd	nd	nd	nd	nd
Trichloroethene	5.0	nd	nd	nd	5.0	8.1	17
1,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Bromodichloromethane	5.0	nd	nd	nd	nd	nd	nd
Dibromomethane	5.0	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Toluene	5.0	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Tetrachloroethene	5.0	nd	nd	nd	nd	5.3	11
Dibromochloromethane	5.0	nd	nd	nd	nd	nd	nd
Chlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Ethylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
m,p-Xylene	5.0	nd	nd	nd	nd	nd	nd
o-Xylene	5.0	nd	nd	nd	nd	nd	nd
Styrene	5.0	nd	nd	nd	nd	nd	nd
Bromoform	5.0	nd	nd	nd	nd	nd	nd
Isopropylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	5.0	nd	nd	nd	nd	nd	nd
n-propylbenzene	5.0	nd	nd	nd	nd	nd	nd
Bromobenzene	5.0	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
p-Isopropyltoluene	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
n-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	5.0	nd	nd	nd	nd	nd	nd
Naphthalene	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Surrogate Recovery (1,2-DCA-d4)		84%	68%	80%	82%	93%	78%
Surrogate Recovery (Toluene-d8)		95%	87%	83%	85%	81%	81%
Surrogate Recovery (1,4-BFB)		105%	89%	94%	97%	96%	95%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Leif Jonsson

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TEG Project #41229F

teg

Tetra Tech - DIV Project # 100-SWW-T31331 Task 3.62
Berryessa Creek Channel, Milpitas, California

EPA Method 8260B Analyses of SOIL in ug/Kg

SAMPLE NUMBER:		ST-1-20'	ST-2-5'	ST-2-10'	ST-2-15'	ST-2-20'	ST-3-5'
COLLECTION DATE:		12/29/14	12/29/14	12/29/14	12/29/14	12/29/14	12/29/14
ANALYSIS DATE:		12/30/14	12/29/14	12/29/14	12/29/14	12/29/14	12/29/14
DILUTION FACTOR:		1	1	1	1	1	1
	RL						
Dichlorodifluoromethane	5.0	nd	nd	nd	nd	nd	nd
Chloromethane	5.0	nd	nd	nd	nd	nd	nd
Vinyl Chloride	5.0	nd	nd	nd	nd	nd	nd
Bromomethane	5.0	nd	nd	nd	nd	nd	nd
Chloroethane	5.0	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Methylene Chloride	5.0	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Chloroform	5.0	nd	nd	nd	nd	nd	nd
Bromochloromethane	5.0	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
Benzene	5.0	nd	nd	nd	nd	nd	nd
Trichloroethene	5.0	19	nd	nd	nd	nd	nd
1,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Bromodichloromethane	5.0	nd	nd	nd	nd	nd	nd
Dibromomethane	5.0	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Toluene	5.0	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Tetrachloroethene	5.0	14	nd	nd	nd	nd	nd
Dibromochloromethane	5.0	nd	nd	nd	nd	nd	nd
Chlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Ethylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
m,p-Xylene	5.0	nd	nd	nd	nd	nd	nd
o-Xylene	5.0	nd	nd	nd	nd	nd	nd
Styrene	5.0	nd	nd	nd	nd	nd	nd
Bromoform	5.0	nd	nd	nd	nd	nd	nd
Isopropylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	5.0	nd	nd	nd	nd	nd	nd
n-propylbenzene	5.0	nd	nd	nd	nd	nd	nd
Bromobenzene	5.0	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
p-Isopropyltoluene	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
n-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	5.0	nd	nd	nd	nd	nd	nd
Naphthalene	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Surrogate Recovery (1,2-DCA-d4)		71%	77%	112%	83%	79%	72%
Surrogate Recovery (Toluene-d8)		81%	75%	118%	86%	82%	72%
Surrogate Recovery (1,4-BFB)		92%	78%	134%	99%	88%	72%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Leif Jonsson

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Tetra Tech - DIV Project # 100-SWW-T31331 Task 3.62
Berryessa Creek Channel, Milpitas, California

EPA Method 8260B Analyses of SOIL in ug/Kg

SAMPLE NUMBER:	RL	ST-3-10'	ST-3-15'	ST-3-20'	ST-4-5'	ST-4-10'	ST-4-15'
COLLECTION DATE:		12/29/14	12/29/14	12/29/14	12/29/14	12/29/14	12/29/14
ANALYSIS DATE:		12/29/14	12/29/14	12/29/14	12/29/14	12/29/14	12/30/14
DILUTION FACTOR:		1	1	1	1	1	1
Dichlorodifluoromethane	5.0	nd	nd	nd	nd	nd	nd
Chloromethane	5.0	nd	nd	nd	nd	nd	nd
Vinyl Chloride	5.0	nd	nd	nd	nd	nd	nd
Bromomethane	5.0	nd	nd	nd	nd	nd	nd
Chloroethane	5.0	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Methylene Chloride	5.0	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Chloroform	5.0	nd	nd	nd	nd	nd	nd
Bromochloromethane	5.0	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
Benzene	5.0	nd	nd	nd	nd	nd	nd
Trichloroethene	5.0	nd	nd	8.9	nd	17	19
1,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Bromodichloromethane	5.0	nd	nd	nd	nd	nd	nd
Dibromomethane	5.0	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Toluene	5.0	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Tetrachloroethene	5.0	nd	nd	9.1	21	150	150
Dibromochloromethane	5.0	nd	nd	nd	nd	nd	nd
Chlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Ethylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
m,p-Xylene	5.0	nd	nd	nd	nd	nd	nd
o-Xylene	5.0	nd	nd	nd	nd	nd	nd
Styrene	5.0	nd	nd	nd	nd	nd	nd
Bromoform	5.0	nd	nd	nd	nd	nd	nd
Isopropylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	5.0	nd	nd	nd	nd	nd	nd
n-propylbenzene	5.0	nd	nd	nd	nd	nd	nd
Bromobenzene	5.0	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
p-Isopropyltoluene	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
n-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	5.0	nd	nd	nd	nd	nd	nd
Naphthalene	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Surrogate Recovery (1,2-DCA-d4)		74%	75%	73%	65%	89%	69%
Surrogate Recovery (Toluene-d8)		69%	80%	75%	70%	83%	80%
Surrogate Recovery (1,4-BFB)		83%	87%	86%	71%	92%	81%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Leif Jonsson

11350 Monier Park Place, Rancho Cordova, CA 95742 • Phone (916) 853-8010 • Fax (916) 853-8020

EPA Method 8260B Analyses of SOIL in ug/Kg

SAMPLE NUMBER:		ST-4-20'	ST-5-5'	ST-5-10'	ST-5-15'	ST-5-15' D	ST-5-20'
COLLECTION DATE:		12/29/14	12/29/14	12/29/14	12/29/14	12/29/14	12/29/14
ANALYSIS DATE:		12/30/14	12/29/14	12/29/14	12/29/14	12/29/14	12/29/14
DILUTION FACTOR:	RL	1	1	1	1	1	1
Dichlorodifluoromethane	5.0	nd	nd	nd	nd	nd	nd
Chloromethane	5.0	nd	nd	nd	nd	nd	nd
Vinyl Chloride	5.0	nd	nd	nd	nd	nd	nd
Bromomethane	5.0	nd	nd	nd	nd	nd	nd
Chloroethane	5.0	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	5.0	8.4	nd	nd	nd	nd	nd
Methylene Chloride	5.0	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
2,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	5.0	nd	nd	nd	nd	nd	nd
Chloroform	5.0	nd	nd	nd	nd	nd	nd
Bromochloromethane	5.0	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,1-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	5.0	nd	nd	nd	nd	nd	nd
Benzene	5.0	nd	nd	nd	nd	nd	nd
Trichloroethene	5.0	84	nd	nd	nd	nd	nd
1,2-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Bromodichloromethane	5.0	nd	nd	nd	nd	nd	nd
Dibromomethane	5.0	nd	nd	nd	nd	nd	nd
cis-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
Toluene	5.0	nd	nd	nd	nd	nd	nd
trans-1,3-Dichloropropene	5.0	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichloropropane	5.0	nd	nd	nd	nd	nd	nd
Tetrachloroethene	5.0	1800	nd	nd	nd	nd	10
Dibromochloromethane	5.0	nd	nd	nd	nd	nd	nd
Chlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Ethylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
m,p-Xylene	5.0	nd	nd	nd	nd	nd	nd
o-Xylene	5.0	nd	nd	nd	nd	nd	nd
Styrene	5.0	nd	nd	nd	nd	nd	nd
Bromoform	5.0	nd	nd	nd	nd	nd	nd
Isopropylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichloropropane	5.0	nd	nd	nd	nd	nd	nd
n-propylbenzene	5.0	nd	nd	nd	nd	nd	nd
Bromobenzene	5.0	nd	nd	nd	nd	nd	nd
1,3,5-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
2-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
4-Chlorotoluene	5.0	nd	nd	nd	nd	nd	nd
tert-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trimethylbenzene	5.0	nd	nd	nd	nd	nd	nd
sec-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
p-Isopropyltoluene	5.0	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
n-Butylbenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5.0	nd	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Hexachlorobutadiene	5.0	nd	nd	nd	nd	nd	nd
Naphthalene	5.0	nd	nd	nd	nd	nd	nd
1,2,3-Trichlorobenzene	5.0	nd	nd	nd	nd	nd	nd
Surrogate Recovery (1,2-DCA-d4)		76%	72%	96%	71%	67%	84%
Surrogate Recovery (Toluene-d8)		79%	76%	95%	82%	73%	87%
Surrogate Recovery (1,4-BFB)		85%	78%	102%	85%	76%	92%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Leif Jonsson

11350 Monier Park Place, Rancho Cordova, CA 95742 • Phone (916) 853-8010 • Fax (916) 853-8020

Tetra Tech - DIV Project # 100-SWW-T31331 Task 3.62
Berryessa Creek Channel, Milpitas, California

TEG Project #41229F

QA/QC Data - Matrix Spike Analyses / LCS - SOIL

SAMPLE NUMBER	DATE ANALYZED	1,1 DCE ug/Kg	Benzene ug/Kg	Trichloroethene ug/Kg	Toluene ug/Kg	Chlorobenzene ug/Kg
ST-3-5'						
Spiked Conc.	12/29/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		28.4	28.3	28.9	29.6	26.8
% Recovery		114%	113%	116%	118%	107%
Spiked Conc.	12/29/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		29.9	27.9	30.7	28.2	30.0
% Recovery		120%	112%	123%	113%	120%
RPD		5.1%	1.4%	6.0%	4.8%	11.3%
LCS						
Spiked Conc.	12/29/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		22.9	21.5	22.9	23.3	21.5
% Recovery		92%	86%	92%	93%	86%
ST-5-5'						
Spiked Conc.	12/30/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		23.3	20.9	20.7	19.9	24.3
% Recovery		93%	84%	83%	80%	97%
Spiked Conc.	12/30/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		24.1	23.3	21.7	22.0	24.8
% Recovery		96%	93%	87%	88%	99%
RPD		3.4%	10.9%	4.7%	10.0%	2.0%
LCS						
Spiked Conc.	12/30/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		24.7	21.8	23.2	21.8	25.2
% Recovery		99%	87%	93%	87%	101%

Acceptable RPD Limit = 25%

11350 Monier Park Place, Rancho Cordova, CA 95742 • Phone (916) 853-8010 • Fax (916) 853-8020

TEG Project #41229F

teg

Tetra Tech - DIV Project # 100-SWW-T31331 Task 3.62
Berryessa Creek Channel, Milpitas, California

EPA Method 8260B Analyses of WATER in ug/L

SAMPLE NUMBER:		Blank	ST-2-W	ST-3-W
COLLECTION DATE:			12/29/14	12/29/14
ANALYSIS DATE:		12/30/14	12/30/14	12/30/14
DILUTION FACTOR:		1	1	1
	RL			
Dichlorodifluoromethane	1.0	nd	nd	nd
Chloromethane	1.0	nd	nd	nd
Vinyl Chloride	1.0	nd	nd	nd
Bromomethane	1.0	nd	nd	nd
Chloroethane	1.0	nd	nd	nd
Trichlorofluoromethane	1.0	nd	nd	nd
1,1-Dichloroethene	1.0	nd	nd	nd
Methylene Chloride	1.0	nd	nd	nd
trans-1,2-Dichloroethene	1.0	nd	nd	nd
1,1-Dichloroethane	1.0	nd	nd	nd
2,2-Dichloropropane	1.0	nd	nd	nd
cis-1,2-Dichloroethene	1.0	nd	nd	nd
Chloroform	1.0	nd	nd	nd
Bromochloromethane	1.0	nd	nd	nd
1,1,1-Trichloroethane	1.0	nd	nd	nd
1,1-Dichloropropene	1.0	nd	nd	nd
Carbon Tetrachloride	1.0	nd	nd	nd
1,2-Dichloroethane	1.0	nd	nd	nd
Benzene	1.0	nd	nd	nd
Trichloroethene	1.0	nd	1.3	5.6
1,2-Dichloropropane	1.0	nd	nd	nd
Bromodichloromethane	1.0	nd	nd	nd
Dibromomethane	1.0	nd	nd	nd
cis-1,3-Dichloropropene	1.0	nd	nd	nd
Toluene	1.0	nd	nd	nd
trans-1,3-Dichloropropene	1.0	nd	nd	nd
1,1,2-Trichloroethane	1.0	nd	nd	nd
1,2-Dibromoethane	1.0	nd	nd	nd
1,3-Dichloropropane	1.0	nd	nd	nd
Tetrachloroethene	1.0	nd	nd	3.0
Dibromochloromethane	1.0	nd	nd	nd
Chlorobenzene	1.0	nd	nd	nd
Ethylbenzene	1.0	nd	nd	nd
1,1,1,2-Tetrachloroethane	1.0	nd	nd	nd
m,p-Xylene	1.0	nd	2.0	nd
o-Xylene	1.0	nd	1.2	nd
Styrene	1.0	nd	nd	nd
Bromoform	1.0	nd	nd	nd
Isopropylbenzene	1.0	nd	nd	nd
1,1,2,2-Tetrachloroethane	1.0	nd	nd	nd
1,2,3-Trichloropropane	1.0	nd	nd	nd
n-propylbenzene	1.0	nd	nd	nd
Bromobenzene	1.0	nd	nd	nd
1,3,5-Trimethylbenzene	1.0	nd	nd	nd
2-Chlorotoluene	1.0	nd	nd	nd
4-Chlorotoluene	1.0	nd	nd	nd
tert-Butylbenzene	1.0	nd	nd	nd
1,2,4-Trimethylbenzene	1.0	nd	1.1	nd
sec-Butylbenzene	1.0	nd	nd	nd
p-Isopropyltoluene	1.0	nd	nd	nd
1,3-Dichlorobenzene	1.0	nd	nd	nd
1,4-Dichlorobenzene	1.0	nd	nd	nd
n-Butylbenzene	1.0	nd	nd	nd
1,2-Dichlorobenzene	1.0	nd	nd	nd
1,2-Dibromo-3-chloropropane	1.0	nd	nd	nd
1,2,4-Trichlorobenzene	1.0	nd	nd	nd
Hexachlorobutadiene	1.0	nd	nd	nd
Naphthalene	1.0	nd	nd	nd
1,2,3-Trichlorobenzene	1.0	nd	nd	nd
Surrogate Recovery (1,2-DCA-d4)		82%	76%	70%
Surrogate Recovery (Toluene-d8)		91%	92%	89%
Surrogate Recovery (1,4-BFB)		89%	84%	82%

'RL' Indicates reporting limit at a dilution factor of 1

'nd' Indicates not detected at listed reporting limits

Analyses performed by: Mr. Leif Jonsson

Tetra Tech - DIV Project # 100-SWW-T31331 Task 3.62
Berryessa Creek Channel, Milpitas, California

TEG Project #41229F

QA/QC Data - Matrix Spike Analyses / LCS - WATER

SAMPLE NUMBER	DATE ANALYZED	1,1 DCE ug/L	Benzene ug/L	Trichloroethene ug/L	Toluene ug/L	Chlorobenzene ug/L
ST-2-W						
Spiked Conc.	12/30/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		24.3	21.9	22.0	22.4	28.1
% Recovery		97%	88%	88%	90%	112%
Spiked Conc.	12/30/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		27.6	25.0	25.2	26.1	31.6
% Recovery		110%	100%	101%	104%	126%
RPD		12.7%	13.2%	13.6%	15.3%	11.7%
LCS						
Spiked Conc.	12/30/14	25.0	25.0	25.0	25.0	25.0
Measured Conc.		25.2	21.8	21.4	21.9	28.6
% Recovery		101%	87%	86%	88%	114%

Acceptable RPD Limit = 25%

TEG Northern California Inc.

11350 Monier Park Place   Ph: 916.853.8010
Rancho Cordova, CA 95742   Fax: 916.853.8020

Chain of Custody Record

Client: TETRA TECH - DIV

Address: 17885 VON KARMAN AVE, SUITE 500
IRVINE, CA 92614-6213

Phone: 949-809-5000   Fax: 949-809-5010

Project Manager: IRA MARK ARTZ   E-Mail: IRA.ARTZ@TETRATECH.COM

TEG Project #: 41229F   Client Project #: 100SWW-T3131 task 3.6.2

Location: BERRYESSA CREEK CHANNEL, MILPITAS, CA

Collector: KEITH HOFFARD   Date of Collection: 12-29-14

Sample Designation	Depth	Time	Sample Matrix	Container Type	EPA 8260B (Full List)	EPA 8260B (DTSC List)	EPA 8260B (BTEX & MTBE)	5 Oxygenates, BTEX (8260B)	TPH gasoline (8260)	EPA 8021 (BTEX)	EPA 8021 (HVOCs)	TPH 8015mod (gas)	TPH 8015mod (diesel)	TPH 8015mod (motor oil)				Field Notes	# of containers
ST-2-5'	5'	0823	SOIL	ACETATE TUBE	X														
ST-2-10'	10'	0827	↓	↓	↓														
ST-2-15'	15'	0830	↓	↓	↓														
ST-2-20'	20'	0835	↓	↓	↓														
ST-2-W	—	0907	H2O	3 VOAs	↓														
ST-3-5'	5'	0948	SOIL	ACETATE TUBE	↓														
ST-3-10'	10'	0953	↓	↓	↓														
ST-3-15'	15'	0957	↓	↓	↓														
ST-3-20'	20'	1000	↓	↓	↓														
ST-3-W	—	1025	H2O	3 VOAs	↓														
ST-5-5'	5'	1050	SOIL	ACETATE TUBE	↓														
ST-5-10'	10'	1052	↓	↓	↓														
ST-5-15'	15'	1055	↓	↓	↓														
ST-5-15'D	15'	1055	↓	↓	↓														
ST-5-20'	20'	1058	↓	↓	↓														

Relinquished by:	Date / Time	Received by	Date / Time
Keith Hofford	12-29-14 1300	[signature]	12/29/14 1300
Relinquished by:	Date / Time	Received by	Date / Time
Relinquished by:	Date / Time	Received by	Date / Time

Sample Receipt:

Good Condition?	good
Cold?	NA
Seals Intact?	NA
Total Number of Containers	

Remarks:

Distribution: White - Lab, Yellow - File, Pink - Originator

Sample disposal instructions:* __ *TEG disposal @ $4.00 ea.* __ *Return to client* __ *Pickup

TEG Northern California Inc.
11350 Monier Park Place
Rancho Cordova, CA 95742
Ph: 916.853.8010
Fax: 916.853.8020

Chain of Custody Record

Client: TETRA TECH - DIV
Address:
IRVINE, CA
Phone: Fax:

Project Manager: IRA MARK ARTZ E-Mail:
TEG Project #: 41229F Client Project #: see p. 1
Location:
Collector: KEITH HOOFARD Date of Collection: 12-29-14

Sample Designation	Depth	Time	Sample Matrix	Container Type	EPA 8260B (Full List)	EPA 8260B (DTSC List)	EPA 8260B (BTEX & MTBE)	5 Oxygenates, BTEX (8260B)	TPH gasoline (8260)	EPA 8021 (BTEX)	EPA 8021 (HVOCs)	TPH 8015mod (gas)	TPH 8015mod (diesel)	TPH 8015mod (motor oil)					Field Notes	# of containers
ST-4-5'	5'	1134	SOIL	ACETATE TUBE	X															
ST-4-10'	10'	1138																		
ST-4-15'	15'	1139																		
ST-4-20'	20'	1142																		
ST-1-5'	5'	1221																		
ST-1-10'	10'	1224																		
ST-1-10'D	10'	1224																		
ST-1-15'	15'	1228																		
ST-1-20'	20'	1232																		
END																				

Relinquished by:	Date / Time	Received by	Date / Time
[signature]	12-29-14 1300	[signature]	12-29-14 1330
Relinquished by:	Date / Time	Received by	Date / Time
Relinquished by:	Date / Time	Received by	Date / Time

Sample Receipt:

Good Condition?	Good
Cold?	NA
Seals Intact?	NA
Total Number of Containers	

Remarks:

Distribution: White - Lab, Yellow - File, Pink - Originator

Sample disposal instructions: __ ***TEG disposal @ $4.00 ea.*** __ ***Return to client*** __ ***Pickup***

Appendix F Tree and Shrub Survey Report and Impact Analysis

Santa Clara Valley Water District

Technical Memorandum: Mitigation for Native Trees/Shrubs Removed During Construction of Upper Berryessa Creek Flood Risk Management Project

Prepared By: James Manitakos, Environmental Planner II

Date: September 14, 2015

Summary
Mitigating for the removal of trees and shrubs per mitigation measures included in the project environmental documents will require planting of roughly 550 native trees/shrubs in the project area.

Purpose
The U.S. Army Corps of Engineers (USACE) is the lead agency for the Upper Berryessa Creek Flood Risk Management Project. The District is the local partner and non-federal sponsor. In March 2014, USACE issued a Final Environmental Impact Statement (EIS) for the project. The Final EIS includes the following measure to mitigate for removal of native vegetation during project construction:

> If a native tree or shrub with a diameter at breast height (dbh) of 2 inches or greater is removed, it should be replaced in-kind so that the combined diameter of the container plantings is equal to the combined diameter of the trees removed.

This measure is based on recommendations in the U.S Fish and Wildlife Coordination Act Report prepared for the project.

Evaluation
To determine the number of native trees/shrubs that would be removed by the project, the District contracted with HT Harvey for a field inventory of the project area in July 2015. The field inventory found that a total of 432 trees and shrubs with dbh of 2 inches or greater occur in or near the project area. Most of these are non-native, but a number of native trees/shrubs would be either directly removed or subject to substantial root damage which would threaten their viability) during construction. Based on the 60% design plans for the project, a total of 53 native trees/shrubs would be affected. Table 1 provides information on those trees and shrubs.

Table 1: Native Trees/Shrubs to be Impacted By Project Construction

Designator	Common Name	DBH (inches)	Type of Impact	Reach
7	Redwood	28	Constructing crane pad on east bank upstream Calaveras Blvd will remove	1
54	Coast live oak	12	Connection of access road to Los Coches St will remove this street tree	2
61	Toyon	3	Channel enlargement on east bank upstream of Arroyo de Los Coches will remove	2
62	Coast live oak	12		
63	Toyon	15		
64	Toyon	22		
66	Toyon	14		
67	White alder	11		
68	White alder	12		
69	Toyon	12		
70	Toyon	12		
71	White alder	8		
72	Toyon	28		
73	Toyon	12		
74	Toyon	16		
75	Toyon	31		
76	Toyon	16		
77	Toyon	17		
80	Toyon	11		
81	Toyon	11		
82	Toyon	16		
83	Toyon	15		
84	Toyon	10		
85	Toyon	14		
86	Toyon	8		
87	Fremont Cottonwood	17		
88	Fremont Cottonwood	14		
89	Toyon	10		

Designator	Common Name	DBH (inches)	Type of Impact	Reach
113	California nutmeg	23	Channel enlargement on east bank upstream of Arroyo de Los Coches will remove	2
118	California nutmeg	17		
120	California nutmeg	20		
122	California nutmeg	14		
126	White alder	7		
130	White alder	9		
132	White alder	10		
164	Coast live oak	6	Constructing RR culvert wing wall will remove	3
165	Coast live oak	6		
166	Coast live oak	34		
167	Coast live oak	17		
168	Coast live oak	5	Channel enlargement downstream of UPRR trestle will remove	3
170	Elderberry	46		
171	Valley oak	8		
173	Elderberry	10		
174	Coast live oak	6		
176	Coyote brush	16	Constructing access road connection to Montague Exwy will remove	3
214	Arroyo Willow	14	Constructing access road will remove	4
390	Coast live oak	24	Removing sediment at bend downstream I-680 will damage roots	4
421	Coast live oak	5		
425	Coast live oak	8		
426	Coast live oak	8		
427	Fremont cottonwood	124		
428	Fremont cottonwood	18		
430	Fremont cottonwood	28		

Table 2 provides a summary the number of native trees and shrubs impacted and their cumulative DBH for Reaches 1 through 3, Reach 4, and for the overall project. A total of 53 native trees/shrubs would be impacted during project construction. Based on the replacement formula contained in the CAR and EIS, native trees and shrubs with cumulative diameter of 890 inches would have to be planted to mitigate for the project impact to native trees and shrubs. These plantings should occur within the project vicinity.

Table 2: Impacted Trees/Shrubs by Reach

Reach	No. Tree/Shrubs Impacted	Type (no.)	Total dbh (in)
1	1	Redwood	28
2	34	California nutmeg (4) Coast live oak (2) Fremont cottonwood (2) Toyon (20) White Alder (6)	479
3	10	Coast live oak (6) Coyote brush (1) Elderberry (2) Valley oak (1)	154
4	8	Arroyo willow (1) Coast live oak (4) Fremont cottonwood (3)	229
Total Project	**53**		**890**

ATTACHMENTS

1. H.T. Harvey and Associates. Upper Berryessa Creek Flood Risk Management Project Tree and Shrub Survey, Milpitas and San Jose, CA. August 4, 2015.
2. Figure 1a, Trees and Shrub Map, Upper Berryessa Creek, July 2015.
3. Figure 1b, Trees and Shrub Map, Upper Berryessa Creek, July 2015.
4. Figure 1c, Trees and Shrub Map, Upper Berryessa Creek, July 20

ATTACHMENTS

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Upper Berryessa Creek Flood Risk Management Project
Tree and Shrub Survey
Milpitas and San Jose, California

Project #3270-52

Prepared for:

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Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

Prepared by:

H. T. Harvey & Associates

4 August 2015

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List of Preparers

Steve Rottenborn, Ph.D., Senior Wildlife Ecologist, Principal
Kelly Hardwicke, Ph.D., Senior Plant Ecologist, Project Manager
Élan Alford, Ph.D., Plant Ecologist

Section 1. Introduction

H. T. Harvey & Associates conducted a tree survey for the Upper Berryessa Creek Flood Risk Management Project (Project), which is in the City of Milpitas and the City of San Jose, California, for the Santa Clara Valley Water District (District). The data presented herein represent a complete inventory of all trees in the survey area that are greater than or equal to 2 inches in diameter at breast height ([dbh] measured at 4.5 feet (ft) above ground level) for single stem trees or additive diameter for multiple stem trees. Shrubs with stem dbh greater than 2 inches were also included. The data collected includes species identity, native status, diameter, health, and location in the survey area. The purpose of this survey is to allow planners to determine which trees are to be removed, relocated, or preserved in place. The report does not determine the fate of the trees.

1.1 General Project Area Description

The Upper Berryessa Creek channel is west of Interstate 680 in the city limits of Milpitas and San Jose, California (Figure 1). The Project site study area encompasses the maximum area of anticipated temporary and permanent construction effects resulting from the Project. The site includes the downstream section of the existing bridge crossing at E. Calaveras Blvd. and continues for approximately two miles upstream to the upstream section beyond Landess Ave (Figure 1). The study area for this survey includes the stream bed, channelized banks, and staging areas above the top-of-bank, as well as an approximately 5-ft buffer on the Project site limits. The purpose of the 5-ft buffer is to identify trees located outside the project footprint that may be substantially harmed by root damage due to project construction. Upper Berryessa Creek traverses an urban area with residences, businesses, multilane streets, and railroad tracks. The streambed is primarily earthen, approximately 10-15 feet wide, and is flanked by channelized riparian grassland. The majority of the trees within the Project site corridor occur above top of bank and few occur within the riparian banks.

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 1a. Tree and Shrub Map
Upper Berryessa Creek (3270-52)
July 2015

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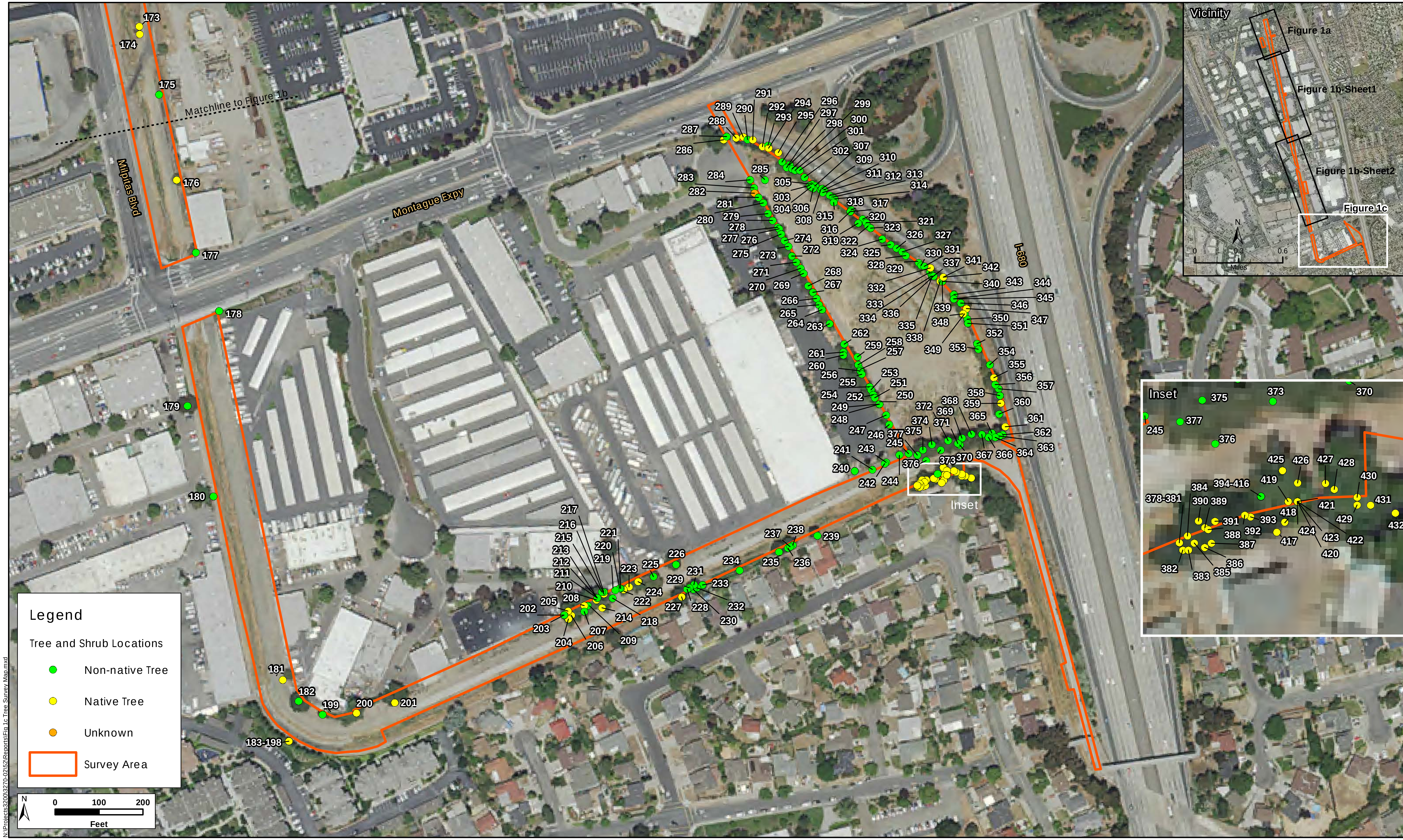
Figure 1b. Tree and Shrub Map
Upper Berryessa Creek (3270-52)
July 2015



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 1c. Tree and Shrub Map
Upper Berryessa Creek (3270-52)
July 2015

Section 2. Methodology

For the purposes of this report, a "tree" was defined as a woody species that typically grows with a single trunk and with a dbh of 2 inches or greater. Trees with multiple stems were included in the survey when at least one stem was larger than 2 inches dbh. Shrub species such as coyote brush (*Baccharis pilularis*) and manzanita (*Arctostaphylos sp.*) were also included if at least one stem dbh was 2 inches or greater. Small shrubs, small trees, or saplings (e.g. those less than 2 inches dbh) were not included in this survey. Plant identification was conducted according to the Jepson eFlora (Jepson Flora Project 2015), *Trees of the California Landscape* (Hatch 2007), and *A Californian's Guide to the Trees among Us* (Ritter 2011).

H.T. Harvey & Associates plant ecologists Élan Alford, Ph.D. and Brian Cleary, M.S. visited the Project site on 30 June, 1 July, and 2 July 2015 to conduct the tree survey. All trees of 2 inches dbh or larger within the Project site were recorded, and all accessible trees were tagged with aluminum labels. Inaccessible trees were recorded but not marked in the field. Information on tree species, native status, dbh, health, and tree location were collected. For accessible trees, the dbh of each tree was measured with a Biltmore stick at approximately 4.5 ft above ground level. The dbh for trees with multiple stems was calculated by adding all stem diameters larger than 2 inches. The dbh of inaccessible trees was visually estimated and recorded. Tree health was scored by visual inspection using a three-tiered scoring system (healthy, stressed, dead). Indicators of good health included high leaf production, a normal growth pattern, and no evidence of disease. Indicators of stressed included adequate, but not high, leaf production, reduced growth because of competition for space or light, and the presence of minimal levels of stump sprouting, limb loss, an abundance of brown leaves, and/or disease. Dead trees were indicated by the presence of only brown leaves or no leaf production.

Section 3. Results

A total of 432 trees or shrubs with a dbh of 2 inches or greater were recorded in the Project site (Figure 1). Figure 1 shows all tree locations and is consecutively numbered. The field tags differ from the report numbering, but the provided database (Appendix A and the corresponding electronic excel file) correlates these two numbering systems, The tree database includes tag numbers for trees marked in the field and the consecutive order in which the trees are labelled in the report figures.

Table 1 summarizes the all trees within the Project site by species, whether the species is native or non-native, the number of individuals that occur, and their average diameter. One tree was not identified to a degree such that it can be included in the summary of native or non-native trees. A total 145 native trees occur in the Project site. The average dbh of the native trees is 18 inches. The native trees most frequently encountered within the study area were redwood (*Sequoia sempervirens*, although it should be noted that redwoods would not be native to Berryessa Creek and many if not all of these specimens were likely planted) and coast live oak (*Quercus agrifolia*). A total of 286 non-native trees occur in the Project site. The average dbh of the non-native trees is 17 inches. The most common non-native species were Washington fan palm (*Washingtonia robusta*) and holly oak (*Quercus ilex*). The largest tree within the Project site is an approximately 112-inch dbh Fremont cottonwood (*Populus fremontii*). Appendix A lists each tree recorded in the survey by its designated report number, tag number marked in the field, common name, scientific name, dbh per stem, total diameter, whether the dbh was measured or estimated, and tree health. Appendix A is also provided as an excel file.

Table 1. Tree Summary Statistics

Common Name	Scientific Name	Native Status	Count	Average Total DBH (inch)
Native Trees	***n/a***	***Yes***	***145***	***18***
Non-native Trees	***n/a***	***No***	***286***	***17***
Unknown Tree	***n/a***	***n/a***	***1***	***6***
Aleppo pine	*Pinus halepensis*	No	29	16
Apple	*Malus* sp.	No	1	10
Arroyo willow	*Salix lasiolepis*	Yes	6	47
Ash	*Fraxinus* sp.	Yes	9	13
Black poui	*Jacaranda mimosifolia*	No	1	22
Blackwood acacia	*Acacia melanoxylon*	No	5	12
California nutmeg	*Torreya californica*	Yes	4	19
Canary Island pine	*Pinus canariensis*	No	1	3
Carob tree	*Ceratonia siliqua*	No	5	27
Chinese photinia	*Photinia sp.*	No	13	11
Chinese pistachio	*Pistacia chinensis*	No	10	15

Common Name	Scientific Name	Native Status	Count	Average Total DBH (inch)
Coast live oak	*Quercus agrifolia*	Yes	46	10
Coyote brush	*Baccharis pilularis*	Yes	1	16
Crapemyrtle	*Lagerstroemia indica*	No	2	2
Elderberry	*Sambucus nigra*	Yes	3	38
Elm	*Ulmus* sp.	No	1	21
European white birch	*Betula pendula*	No	1	15
Fremont cottonwood	*Populus fremontii*	Yes	12	52
Holly oak	*Quercus ilex*	No	51	10
Horsetail tree	*Casuarina equisetifolia*	No	10	35
Italian cypress	*Cupressus sempervirens*	No	4	8
Lollypop tree	*Myoporum laetum*	No	23	28
London planetree	*Platanus hybrida*	No	10	14
Manzanita	*Arctostaphylos* sp.	Yes	8	10
Mock orange	*Pittosporum tobira*	No	1	14
Monterey pine	*Pinus radiata*	Yes	1	18
Olive	*Olea europaea*	No	14	10
Orange	*Citrus* sp.	No	3	22
Ornamental plum	*Prunus* sp.	No	2	16
Pepper tree	*Schinus* sp.	No	7	12
Red ironbark	*Eucalyptus sideroxylon*	No	10	31
Redwood	*Sequoia sempervirens*	Yes	20	13
Silk tree	*Albizia julibrissin*	No	1	46
Silver dollar gum	*Eucalyptus polyanthemos*	No	12	17
Sweetgum	*Liquidambar styraciflua*	No	13	14
Toyon	*Heteromeles arbutifolia*	Yes	20	15
Tulip tree	*Liriodendron tulipifera*	No	2	14
Unknown dead tree	*Unknown*	Unknown	1	6
Unknown pine	*Pinus* sp.	No	2	22
Unknown shrub	*Rosaceae*	No	4	12
Valley oak	*Quercus lobata*	Yes	2	42
Washington fan palm	*Washingtonia robusta*	No	42	17
Weeping juniper	*Juniperus scopulorum*	No	6	14
White alder	*Alnus rhombifolia*	Yes	13	10

Common Name	Scientific Name	Native Status	Count	Average Total DBH (inch)
Grand Total			**432**	**17**

Section 4. References

Hatch, C. R. 2007. Trees of the California Landscape. University of California Press, Berkeley.

Jepson Flora Project (Baldwin, B.G., Keil, D.J., Markos, S., Mishler, B.D., Patterson, R., Rosatti, T.J., Wilen, D.H.). 2015. *Jepson eFlora. Available at* http://ucjeps.berkeley.edu/IJM.html. Accessed through July 2015.

Ritter, M. 2011. A Californian's Guide to the Trees among Us. Heyday, Berkeley, California.

Appendix A. Tree and Shrub Survey

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
1	178	Sweetgum	*Liquidambar styraciflua*	No	14	14	Measured	Stressed
2	180	London planetree	*Platanus hybrida*	No	30	30	Measured	Stressed
3	179	Sweetgum	*Liquidambar styraciflua*	No	7	7	Measured	Stressed
4	177	Sweetgum	*Liquidambar styraciflua*	No	24	24	Measured	Healthy
5	181	Sweetgum	*Liquidambar styraciflua*	No	5	5	Measured	Stressed
6	40	Unknown shrub	*Rosaceae*	No	1,2,3,5	11	Measured	Healthy
7	39	Redwood	*Sequoia sempervirens*	Yes	28	28	Measured	Healthy
8	41	Unknown shrub	*Rosaceae*	No	1,1,2,1,1	6	Measured	Healthy
9	42	Redwood	*Sequoia sempervirens*	Yes	11	11	Measured	Healthy
10	43	Washington fan palm	*Washingtonia robusta*	No	21	21	Measured	Healthy
11	44	Pepper tree	*Schinus sp.*	No	20	20	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
12	45	Washington fan palm	*Washingtonia robusta*	No	18	18	Measured	Healthy
13	46	Olive	*Olea europaea*	No	5,4,6,3,2, 10	30	Measured	Healthy
14	47	Silver dollar gum	*Eucalyptus polyanthemos*	No	9, 3,8,2	22	Measured	Stressed
15	48	Unknown shrub	*Rosaceae*	No	2, 4,3,2	11	Measured	Healthy
16	49	Redwood	*Sequoia sempervirens*	Yes	8	8	Measured	Healthy
17	50	Washington fan palm	*Washingtonia robusta*	No	16	16	Measured	Healthy
18	51	Washington fan palm	*Washingtonia robusta*	No	28	28	Measured	Healthy
19	52	Holly oak	*Quercus ilex*	No	2,2,2,1,2	9	Measured	Healthy
20	53	Holly oak	*Quercus ilex*	No	2,2	4	Measured	Healthy
21	176	Orange	*Citrus sp.*	No	20	20	Measured	Stressed
22	175	Orange	*Citrus sp.*	No	6,4,4,1,3,3	21	Measured	Healthy
23	54	Washington fan palm	*Washingtonia robusta*	No	20	20	Measured	Healthy
24	55	Elm	*Ulmus sp.*	No	9,6,6	21	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
25	56	Washington fan palm	*Washingtonia robusta*	No	20	20	Measured	Healthy
26	57	Washington fan palm	*Washingtonia robusta*	No	16	16	Measured	Healthy
27	58	Washington fan palm	*Washingtonia robusta*	No	19	19	Measured	Healthy
28	60	Washington fan palm	*Washingtonia robusta*	No	19	19	Measured	Healthy
29	59	Washington fan palm	*Washingtonia robusta*	No	19	19	Measured	Healthy
30	61	Washington fan palm	*Washingtonia robusta*	No	21	21	Measured	Healthy
31	62	Washington fan palm	*Washingtonia robusta*	No	21	21	Measured	Healthy
32	63	Washington fan palm	*Washingtonia robusta*	No	20	20	Measured	Healthy
33	64	Washington fan palm	*Washingtonia robusta*	No	17	17	Measured	Healthy
34	65	Washington fan palm	*Washingtonia robusta*	No	26	26	Measured	Healthy
35	67	Washington fan palm	*Washingtonia robusta*	No	14	14	Measured	Healthy
36	66	Washington fan palm	*Washingtonia robusta*	No	14	14	Measured	Healthy
37	68	Washington fan palm	*Washingtonia robusta*	No	14	14	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
38	69	Washington fan palm	*Washingtonia robusta*	No	13	13	Measured	Healthy
39	70	Washington fan palm	*Washingtonia robusta*	No	11	11	Measured	Healthy
40	73	Washington fan palm	*Washingtonia robusta*	No	14	14	Measured	Healthy
41	74	Washington fan palm	*Washingtonia robusta*	No	14	14	Measured	Healthy
42	71	Washington fan palm	*Washingtonia robusta*	No	12	12	Measured	Healthy
43	72	Washington fan palm	*Washingtonia robusta*	No	12	12	Measured	Healthy
44	79	Red ironbark	*Eucalyptus sideroxylon*	No	16	16	Measured	Stressed
45	76	Red ironbark	*Eucalyptus sideroxylon*	No	14	14	Measured	Healthy
46	75	Washington fan palm	*Washingtonia robusta*	No	15	15	Measured	Healthy
47	77	Washington fan palm	*Washingtonia robusta*	No	16	16	Measured	Healthy
48	78	Washington fan palm	*Washingtonia robusta*	No	14	14	Measured	Healthy
49	80	Red ironbark	*Eucalyptus sideroxylon*	No	26	26	Measured	Healthy
50	81	Italian cypress	*Cupressus sempervirens*	No	6	6	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
51	82	Italian cypress	*Cupressus sempervirens*	No	6	6	Measured	Stressed
52	83	Redwood	*Sequoia sempervirens*	Yes	28	28	Measured	Healthy
53	84	Chinese pistachio	*Pistacia chinensis*	No	3	3	Measured	Stressed
54	85	Coast live oak	*Quercus agrifolia*	Yes	12	12	Measured	Healthy
55	86	Coast live oak	*Quercus agrifolia*	Yes	8	8	Measured	Stressed
56	87	Coast live oak	*Quercus agrifolia*	Yes	12	12	Measured	Healthy
57	88	White alder	*Alnus rhombifolia*	Yes	10	10	Measured	Healthy
58	89	Coast live oak	*Quercus agrifolia*	Yes	8	8	Measured	Healthy
59	90	Ornamental plum	*Prunus sp.*	No	7,9	16	Measured	Stressed
60	91	Ornamental plum	*Prunus sp.*	No	9,6	15	Measured	Healthy
61	95	Toyon	*Heteromeles arbutifolia*	Yes	3	3	Measured	Stressed
62	94	Coast live oak	*Quercus agrifolia*	Yes	12	12	Measured	Healthy
63	93	Toyon	*Heteromeles arbutifolia*	Yes	5,4,3,1,2	15	Measured	Dead

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
64	92	Toyon	*Heteromeles arbutifolia*	Yes	3,3,4,2,2,3,3,2	22	Measured	Healthy
65	174	Orange	*Citrus sp.*	No	4,4,6,3,1,2,1,2,2	25	Measured	Stressed
66	96	Toyon	*Heteromeles arbutifolia*	Yes	3,2,1,1,4,3	14	Measured	Healthy
67	98	White alder	*Alnus rhombifolia*	Yes	11	11	Measured	Stressed
68	97	White alder	*Alnus rhombifolia*	Yes	2,2,2,2,2,1,1	12	Measured	Dead
69	99	Toyon	*Heteromeles arbutifolia*	Yes	4,2,2,1,1,2	12	Measured	Healthy
70	100	Toyon	*Heteromeles arbutifolia*	Yes	3,2,2,1,1,2,1	12	Measured	Healthy
71	103	White alder	*Alnus rhombifolia*	Yes	8	8	Measured	Stressed
72	101	Toyon	*Heteromeles arbutifolia*	Yes	4,4,3,3,3,3,4,1,2,1	28	Measured	Stressed
73	102	Toyon	*Heteromeles arbutifolia*	Yes	3,3,1,1,1,1,1,1	12	Measured	Healthy
74	104	Toyon	*Heteromeles arbutifolia*	Yes	3,4,3,1,2,1,1,1	16	Measured	Healthy
75	105	Toyon	*Heteromeles arbutifolia*	Yes	4,4,3,2,3,3,4,2,2,1,1,1,1	31	Measured	Dead
76	106	Toyon	*Heteromeles arbutifolia*	Yes	1,1,2,1,1,1,1,2,1,1,1,1,1,1	16	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
77	107	Toyon	*Heteromeles arbutifolia*	Yes	4,2,2,1,1,1,2,1,1,2	17	Measured	Stressed
78	108	Crapemyrtle	*Lagerstroemia indica*	No	2	2	Measured	Healthy
79	109	Crapemyrtle	*Lagerstroemia indica*	No	2	2	Measured	Healthy
80	110	Toyon	*Heteromeles arbutifolia*	Yes	2,2,1,1,1,1,1,1,1	11	Measured	Healthy
81	111	Toyon	*Heteromeles arbutifolia*	Yes	1,2,2,1,1,1,1,2	11	Measured	Healthy
82	112	Toyon	*Heteromeles arbutifolia*	Yes	4,3,3,1,2,1,1,1	16	Measured	Healthy
83	113	Toyon	*Heteromeles arbutifolia*	Yes	3,3,2,1,1,2,1,1,1	15	Measured	Stressed
84	114	Toyon	*Heteromeles arbutifolia*	Yes	2,2,1,1,1,1,1,1	10	Measured	Healthy
85	115	Toyon	*Heteromeles arbutifolia*	Yes	2,2,2,2,1,1,1,1,1,1	14	Measured	Healthy
86	116	Toyon	*Heteromeles arbutifolia*	Yes	2,2,1,1,1,1	8	Measured	Healthy
87	117	Fremont cottonwood	*Populus fremontii*	Yes	10,2,2,1,1,1	17	Measured	Healthy
88	118	Fremont cottonwood	*Populus fremontii*	Yes	4,3,3,3,1	14	Measured	Healthy
89	119	Toyon	*Heteromeles arbutifolia*	Yes	2,2,1,1,1,1,1,1	10	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
90	184	Sweetgum	*Liquidambar styraciflua*	No	16	16	Measured	Healthy
91	185	Sweetgum	*Liquidambar styraciflua*	No	21	21	Measured	Healthy
92	186	Sweetgum	*Liquidambar styraciflua*	No	17	17	Measured	Stressed
93	187	Sweetgum	*Liquidambar styraciflua*	No	15	15	Measured	Stressed
94	188	Sweetgum	*Liquidambar styraciflua*	No	15	15	Measured	Stressed
95	189	Sweetgum	*Liquidambar styraciflua*	No	10	10	Measured	Stressed
96	190	Sweetgum	*Liquidambar styraciflua*	No	18	18	Measured	Stressed
97	193	Sweetgum	*Liquidambar styraciflua*	No	18	18	Measured	Healthy
98	194	Italian cypress	*Cupressus sempervirens*	No	12	12	Measured	Healthy
99	192	Sweetgum	*Liquidambar styraciflua*	No	5	5	Measured	Stressed
100	191	European white birch	*Betula pendula*	No	15	15	Measured	Stressed
101	195	Italian cypress	*Cupressus sempervirens*	No	8	8	Measured	Healthy
102	173	Chinese photinia	*Photinia sp.*	No	4,1,2,2,3,3,1	16	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
103	166	Washington fan palm	*Washingtonia robusta*	No	20	20	Measured	Healthy
104	172	Silver dollar gum	*Eucalyptus polyanthemos*	No	8	8	Measured	Healthy
105	171	Silver dollar gum	*Eucalyptus polyanthemos*	No	9	9	Measured	Stressed
106	170	Silver dollar gum	*Eucalyptus polyanthemos*	No	22	22	Measured	Healthy
107	169	Silver dollar gum	*Eucalyptus polyanthemos*	No	12	12	Measured	Healthy
108	168	Silver dollar gum	*Eucalyptus polyanthemos*	No	6	6	Measured	Stressed
109	167	Silver dollar gum	*Eucalyptus polyanthemos*	No	12	12	Measured	Stressed
110	165	Silver dollar gum	*Eucalyptus polyanthemos*	No	20	20	Measured	Stressed
111	164	Silver dollar gum	*Eucalyptus polyanthemos*	No	22	22	Measured	Stressed
112	163	Washington fan palm	*Washingtonia robusta*	No	20	20	Measured	Healthy
113	162	California nutmeg	*Torreya californica*	Yes	7,6,7,3	23	Measured	Healthy
114	161	Silver dollar gum	*Eucalyptus polyanthemos*	No	24	24	Measured	Stressed
115	160	Silver dollar gum	*Eucalyptus polyanthemos*	No	30	30	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
116	159	Aleppo pine	*Pinus halepensis*	No	15	15	Measured	Stressed
117	158	Aleppo pine	*Pinus halepensis*	No	16	16	Measured	Stressed
118	157	California nutmeg	*Torreya californica*	Yes	4,4,2,3,2,2	17	Measured	Healthy
119	156	Aleppo pine	*Pinus halepensis*	No	12	12	Measured	Stressed
120	155	California nutmeg	*Torreya californica*	Yes	8,3,4,5	20	Measured	Healthy
121	154	Aleppo pine	*Pinus halepensis*	No	14	14	Measured	Stressed
122	153	California nutmeg	*Torreya californica*	Yes	14	14	Measured	Healthy
123	152	Aleppo pine	*Pinus halepensis*	No	10	10	Measured	Stressed
124	151	Aleppo pine	*Pinus halepensis*	No	18	18	Measured	Healthy
125	150	Aleppo pine	*Pinus halepensis*	No	18	18	Measured	Stressed
126	149	White alder	*Alnus rhombifolia*	Yes	7	7	Measured	Healthy
127	148	Blackwood acacia	*Acacia melanoxylon*	No	6	6	Measured	Healthy
128	147	White alder	*Alnus rhombifolia*	Yes	4	4	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
129	146	Blackwood acacia	*Acacia melanoxylon*	No	7	7	Measured	Healthy
130	145	White alder	*Alnus rhombifolia*	Yes	9	9	Measured	Stressed
131	144	Blackwood acacia	*Acacia melanoxylon*	No	7	7	Measured	Stressed
132	143	White alder	*Alnus rhombifolia*	Yes	10	10	Measured	Healthy
133	142	White alder	*Alnus rhombifolia*	Yes	10	10	Measured	Healthy
134	140	White alder	*Alnus rhombifolia*	Yes	12	12	Measured	Healthy
135	141	White alder	*Alnus rhombifolia*	Yes	3,1	4	Measured	Stressed
136	120	Ash	*Fraxinus sp.*	Yes	4,3,3,3,3,4,3,2,1,1,2,1	30	Measured	Healthy
137	121	Ash	*Fraxinus sp.*	Yes	4,5,2,1,1,1	14	Measured	Healthy
138	139	London planetree	*Platanus hybrida*	No	14	14	Measured	Stressed
139	138	London planetree	*Platanus hybrida*	No	14	14	Measured	Healthy
140	137	London planetree	*Platanus hybrida*	No	10	10	Measured	Healthy
141	136	London planetree	*Platanus hybrida*	No	12	12	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
142	135	London planetree	*Platanus hybrida*	No	11	11	Measured	Healthy
143	134	London planetree	*Platanus hybrida*	No	13	13	Measured	Stressed
144	133	London planetree	*Platanus hybrida*	No	12	12	Measured	Healthy
145	132	London planetree	*Platanus hybrida*	No	9	9	Measured	Stressed
146	131	London planetree	*Platanus hybrida*	No	15	15	Measured	Healthy
147	130	Pepper tree	*Schinus sp.*	No	5,5,4,3,2,1,1,2	23	Measured	Healthy
148	129	Pepper tree	*Schinus sp.*	No	6,4,3	13	Measured	Healthy
149	128	Pepper tree	*Schinus sp.*	No	8	8	Measured	Healthy
150	127	White alder	*Alnus rhombifolia*	Yes	20	20	Measured	Stressed
151	126	White alder	*Alnus rhombifolia*	Yes	11	11	Measured	Stressed
152	125	Pepper tree	*Schinus sp.*	No	6	6	Measured	Healthy
153	124	Pepper tree	*Schinus sp.*	No	5	5	Measured	Healthy
154	123	Aleppo pine	*Pinus halepensis*	No	24	24	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
155	122	Aleppo pine	*Pinus halepensis*	No	18	18	Measured	Healthy
156	349	Mock orange	*Pittosporum tobira*	No	2,1,4,1,2,2,2	14	Measured	Healthy
157	348	Unknown shrub	*Rosaceae*	No	6,4,7,1,1	19	Measured	Healthy
158	347	Ash	*Fraxinus sp.*	Yes	2,3,4,4,5,4,3,2	27	Measured	Stressed
159	346	Ash	*Fraxinus sp.*	Yes	2,1,2,4,3,3,2,2	19	Measured	Stressed
160	345	Washington fan palm	*Washingtonia robusta*	No	10	10	Measured	Healthy
161	BW	Coast live oak	*Quercus agrifolia*	Yes	12	12	Estimated	Healthy
162	BV	Coast live oak	*Quercus agrifolia*	Yes	14	14	Estimated	Healthy
163	BU	Coast live oak	*Quercus agrifolia*	Yes	14	14	Estimated	Healthy
164	342	Coast live oak	*Quercus agrifolia*	Yes	6	6	Measured	Healthy
165	343	Coast live oak	*Quercus agrifolia*	Yes	6	6	Measured	Healthy
166	341	Coast live oak	*Quercus agrifolia*	Yes	10,10,8,6	34	Measured	Healthy
167	340	Coast live oak	*Quercus agrifolia*	Yes	6,8,1,2	17	Measured	Healthy
168	339	Coast live oak	*Quercus agrifolia*	Yes	3,2	5	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
169	338	Valley oak	*Quercus lobata*	Yes	76	76	Measured	Healthy
170	BR	Elderberry	*Sambucus nigra*	Yes	3,4,3,4,4,4,6,8,10	46	Estimated	Healthy
171	337	Valley oak	*Quercus lobata*	Yes	2,2,2,2	8	Measured	Stressed
172	336	Washington fan palm	*Washingtonia robusta*	No	12	12	Measured	Healthy
173	BQ	Elderberry	*Sambucus nigra*	Yes	2,2,2,1,1,2	10	Estimated	Healthy
174	335	Coast live oak	*Quercus agrifolia*	Yes	2,4	6	Measured	Healthy
175	BS	Washington fan palm	*Washingtonia robusta*	No	10	10	Estimated	Healthy
176	BT	Coyote brush	*Baccharis pilularis*	Yes	2,2,2,2,2,2,2,2	16	Estimated	Healthy
177	344	Unknown pine	*Pinus sp.*	No	40	40	Measured	Dead
178	334	Washington fan palm	*Washingtonia robusta*	No	24	24	Measured	Healthy
179	AX	Silver dollar gum	*Eucalyptus polyanthemos*	No	22	22	Estimated	Healthy
180	AZ	Pepper tree	*Schinus sp.*	No	12	12	Estimated	Stressed
181	273	Elderberry	*Sambucus nigra*	Yes	11,8,3,3,6,8,4,6,5,1,1,1	57	Measured	Healthy
182	285	Holly oak	*Quercus ilex*	No	12,11,10,5,13,16,7,9,10,9,5	107	Measured	Healthy
183	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
184	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
185	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
186	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
187	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
188	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
189	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
190	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
191	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
192	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
193	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
194	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
195	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
196	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
197	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
198	AY	Redwood	*Sequoia sempervirens*	Yes	12	12	Estimated	Healthy
199	274	Holly oak	*Quercus ilex*	No	5	5	Measured	Healthy
200	275	Fremont cottonwood	*Populus fremontii*	Yes	28,9	37	Measured	Healthy
201	276	Arroyo willow	*Salix lasiolepis*	Yes	28,20,18,20,18	107	Measured	Healthy
202	BP	Chinese photinia	*Photinia sp.*	No	2,3,4	9	Estimated	Healthy
203	BP	Chinese photinia	*Photinia sp.*	No	2,2,2,1	7	Estimated	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
204	333	Arroyo willow	*Salix lasiolepis*	Yes	10,6	16	Measured	Healthy
205	BO	Arroyo willow	*Salix lasiolepis*	Yes	34,30	64	Estimated	Healthy
206	332	Arroyo willow	*Salix lasiolepis*	Yes	12	12	Measured	Healthy
207	BN	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
208	BM	Fremont cottonwood	*Populus fremontii*	Yes	20,20,30	70	Estimated	Healthy
209	BL	Holly oak	*Quercus ilex*	No	12	12	Estimated	Healthy
210	BK	Coast live oak	*Quercus agrifolia*	Yes	4	4	Estimated	Healthy
211	BJ	Chinese photinia	*Photinia sp.*	No	2,2,2,2,3,3	14	Estimated	Healthy
212	BJ	Chinese photinia	*Photinia sp.*	No	4,2,2	8	Estimated	Healthy
213	BJ	Chinese photinia	*Photinia sp.*	No	6	6	Estimated	Healthy
214	331	Arroyo willow	*Salix lasiolepis*	Yes	8,6	14	Measured	Healthy
215	BI	Chinese photinia	*Photinia sp.*	No	2,3,1	6	Estimated	Healthy
216	330	Arroyo willow	*Salix lasiolepis*	Yes	12,8,36,2,2,3,1,1,1	66	Measured	Healthy
217	BH	Chinese photinia	*Photinia sp.*	No	2,4,2,2,1,1,1	13	Estimated	Healthy
218	329	Holly oak	*Quercus ilex*	No	12	12	Measured	Healthy
219	328	Holly oak	*Quercus ilex*	No	2,2,1,1	6	Measured	Healthy
220	327	Holly oak	*Quercus ilex*	No	3,1,1,1	6	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
221	326	Holly oak	*Quercus ilex*	No	3	3	Measured	Healthy
222	325	Fremont cottonwood	*Populus fremontii*	Yes	42,12,2,1,1,1	59	Measured	Healthy
223	324	Coast live oak	*Quercus agrifolia*	Yes	2	2	Measured	Healthy
224	323	Fremont cottonwood	*Populus fremontii*	Yes	12,14	26	Measured	Healthy
225	322	Silk tree	*Albizia julibrissin*	No	20,26	46	Measured	Healthy
226	321	Holly oak	*Quercus ilex*	No	24	24	Measured	Healthy
227	320	Coast live oak	*Quercus agrifolia*	Yes	34	34	Measured	Healthy
228	319	Holly oak	*Quercus ilex*	No	8	8	Measured	Healthy
229	318	Holly oak	*Quercus ilex*	No	10	10	Measured	Healthy
230	316	Holly oak	*Quercus ilex*	No	2	2	Measured	Healthy
231	317	Holly oak	*Quercus ilex*	No	12	12	Measured	Healthy
232	315	Holly oak	*Quercus ilex*	No	3	3	Measured	Healthy
233	314	Holly oak	*Quercus ilex*	No	16	16	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
234	313	Holly oak	*Quercus ilex*	No	6,6,4,4,6,6,6,8,8,4	58	Measured	Healthy
235	312	Holly oak	*Quercus ilex*	No	10,6	16	Measured	Healthy
236	310	Holly oak	*Quercus ilex*	No	6	6	Measured	Healthy
237	311	Holly oak	*Quercus ilex*	No	10	10	Measured	Healthy
238	309	Holly oak	*Quercus ilex*	No	8,6,10,14,6,6	50	Measured	Healthy
239	308	Holly oak	*Quercus ilex*	No	24	24	Measured	Healthy
240	BG	Tulip tree	*Liriodendron tulipifera*	No	10	10	Estimated	Stressed
241	BF	Washington fan palm	*Washingtonia robusta*	No	18,6	24	Estimated	Healthy
242	BE	Washington fan palm	*Washingtonia robusta*	No	18	18	Estimated	Healthy
243	BD	Washington fan palm	*Washingtonia robusta*	No	18	18	Estimated	Healthy
244	BC	Washington fan palm	*Washingtonia robusta*	No	18	18	Estimated	Dead
245	271	Weeping juniper	*Juniperus scopulorum*	No	18,8	26	Measured	Stressed
246	AW	Olive	*Olea europaea*	No	6,6,4	16	Estimated	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
247	AV	Apple	*Malus sp.*	No	10	10	Estimated	Stressed
248	AU	Washington fan palm	*Washingtonia robusta*	No	20	20	Estimated	Healthy
249	AU	Washington fan palm	*Washingtonia robusta*	No	20	20	Estimated	Healthy
250	AU	Washington fan palm	*Washingtonia robusta*	No	20	20	Estimated	Healthy
251	AT	Olive	*Olea europaea*	No	6,6	12	Estimated	Healthy
252	AS	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
253	AR	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
254	AQ	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
255	AP	Aleppo pine	*Pinus halepensis*	No	12	12	Estimated	Stressed
256	AO	Washington fan palm	*Washingtonia robusta*	No	12	12	Estimated	Stressed
257	AN	Aleppo pine	*Pinus halepensis*	No	20	20	Estimated	Stressed
258	AM	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
259	AL	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
260	AK	Aleppo pine	*Pinus halepensis*	No	20	20	Estimated	Stresse d
261	AJ	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stresse d
262	AI	Aleppo pine	*Pinus halepensis*	No	14	14	Estimated	Stresse d
263	AH	Olive	*Olea europaea*	No	12,12, 8,1,1,1	35	Estimated	Stresse d
264	AG	Red ironbark	*Eucalyptus sideroxylon*	No	12, 12,10,10	44	Estimated	Stresse d
265	AF	Red ironbark	*Eucalyptus sideroxylon*	No	12,10,8,8,6,2,1	47	Estimated	Stresse d
266	AE	Red ironbark	*Eucalyptus sideroxylon*	No	6,8,6,8,10	38	Estimated	Stresse d
267	AD	Red ironbark	*Eucalyptus sideroxylon*	No	12,10,10,10	42	Estimated	Stresse d
268	AC	Red ironbark	*Eucalyptus sideroxylon*	No	10, 6,6,6,8,8	44	Estimated	Stresse d
269	AB	Red ironbark	*Eucalyptus sideroxylon*	No	10,2,2,2,2,2,1	21	Estimated	Stresse d
270	AA	Red ironbark	*Eucalyptus sideroxylon*	No	8,6,4	18	Estimated	Stresse d
271	Z	Aleppo pine	*Pinus halepensis*	No	24	24	Estimated	Healthy
272	Y	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stresse d

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
273	X	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
274	W	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
275	V	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
276	U	Olive	*Olea europaea*	No	6	6	Estimated	Healthy
277	T	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
278	S	Aleppo pine	*Pinus halepensis*	No	12	12	Estimated	Stressed
279	R	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
280	Q	Aleppo pine	*Pinus halepensis*	No	16	16	Estimated	Stressed
281	P	Aleppo pine	*Pinus halepensis*	No	22	22	Estimated	Healthy
282	O	Unknown dead tree	*Unknown*	Unknown	6	6	Estimated	Dead
283	286	Chinese photinia	*Photinia sp.*	No	3	3	Measured	Healthy
284	N	Tulip tree	*Liriodendron tulipifera*	No	18	18	Estimated	Stressed
285	287	Washington fan palm	*Washingtonia robusta*	No	22	22	Measured	Healthy
286	198	Monterey pine	*Pinus radiata*	Yes	18	18	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
287	196	Holly oak	*Quercus ilex*	No	3,3	6	Measured	Healthy
288	197	Coast live oak	*Quercus agrifolia*	Yes	8,8,6	22	Measured	Healthy
289	201	Manzanita	*Arctostaphylos sp.*	Yes	1,1,1,2,1,1,1,1,1	10	Measured	Dead
290	202	Olive	*Olea europaea*	No	9	9	Measured	Healthy
291	203	Manzanita	*Arctostaphylos sp.*	Yes	2,2,1,2,1,1	9	Measured	Stressed
292	204	Manzanita	*Arctostaphylos sp.*	Yes	4,3,3,2,1,1	14	Measured	Stressed
293	205	Unknown pine	*Pinus sp.*	No	3	3	Measured	Healthy
294	206	Coast live oak	*Quercus agrifolia*	Yes	3,2,1,1,2	9	Measured	Healthy
295	207	Manzanita	*Arctostaphylos sp.*	Yes	2,1,1,1,1,1	7	Measured	Stressed
296	208	Lollypop tree	*Myoporum laetum*	No	10,10,5,6	31	Measured	Stressed
297	210	Lollypop tree	*Myoporum laetum*	No	6,1	7	Measured	Stressed
298	209	Lollypop tree	*Myoporum laetum*	No	7,4,3,4,6,5,5,6,4	43	Measured	Stressed
299	211	Lollypop tree	*Myoporum laetum*	No	9,5,1,1,1,3	20	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
300	212	Lollypop tree	*Myoporum laetum*	No	6,4,4,4,2,3,4,4,3,4,2,3	43	Measured	Stressed
301	213	Lollypop tree	*Myoporum laetum*	No	5,4,3,4,3,3,1,4,2,3,1,2	35	Measured	Stressed
302	214	Lollypop tree	*Myoporum laetum*	No	4,5,2,3,1,1,1,1	18	Measured	Stressed
303	218	Lollypop tree	*Myoporum laetum*	No	4,1	5	Measured	Stressed
304	219	Lollypop tree	*Myoporum laetum*	No	3,1,1,1	6	Measured	Dead
305	215	Lollypop tree	*Myoporum laetum*	No	6,1,3,5,3,2,4,6,2,3,2,3,3,1	44	Measured	Stressed
306	217	Lollypop tree	*Myoporum laetum*	No	5,6	11	Measured	Stressed
307	216	Lollypop tree	*Myoporum laetum*	No	8,9,2,3,4,4	30	Measured	Stressed
308	220	Lollypop tree	*Myoporum laetum*	No	6,5,3,4,2,1,1	22	Measured	Stressed
309	221	Lollypop tree	*Myoporum laetum*	No	4	4	Measured	Stressed
310	222	Lollypop tree	*Myoporum laetum*	No	3	3	Measured	Dead
311	223	Lollypop tree	*Myoporum laetum*	No	4	4	Measured	Stressed
312	224	Lollypop tree	*Myoporum laetum*	No	3,8,2,2,4,2	21	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
313	235	Lollypop tree	*Myoporum laetum*	No	2,1	3	Measured	Healthy
314	226	Chinese pistachio	*Pistacia chinensis*	No	3,5,4,4	16	Measured	Stressed
315	227	Chinese pistachio	*Pistacia chinensis*	No	2,1,1,1,1,1,1,1,1,1,1	12	Measured	Stressed
316	M	Ash	*Fraxinus sp.*	Yes	3,1,1,1	6	Estimated	Stressed
317	M	Chinese photinia	*Photinia sp.*	No	2,1,1,1,1	6	Estimated	Stressed
318	228	Canary Island pine	*Pinus canariensis*	No	3	3	Measured	Healthy
319	272	Blackwood acacia	*Acacia melanoxylon*	No	14,6,12,2,1,1,1,1	38	Measured	Healthy
320	229	Chinese pistachio	*Pistacia chinensis*	No	5	5	Measured	Stressed
321	230	Blackwood acacia	*Acacia melanoxylon*	No	3	3	Measured	Healthy
322	231	Chinese pistachio	*Pistacia chinensis*	No	4,3,2,1	10	Measured	Healthy
323	232	Chinese pistachio	*Pistacia chinensis*	No	2,4,2,2,3,1,1,2	17	Measured	Healthy
324	233	Lollypop tree	*Myoporum laetum*	No	4,2,2,2,4,1,2,1,4,5,3,3,2,1,3,1,2,2,4,3,2,2,2,1,3	61	Measured	Stressed
325	234	Lollypop tree	*Myoporum laetum*	No	4,4,2,1,1,1,2,3,4,2,5,4,3,2,1	41	Measured	Stressed

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
326	235	Lollypop tree	*Myoporum laetum*	No	8,6,4,4,2,1,3,2,4,2,2,1,6,8,4,6,5,2,3,4,4	81	Measured	Stressed
327	236	Lollypop tree	*Myoporum laetum*	No	6,5,5,3,3,2,2,4,5,6,4,4,2,1,3	55	Measured	Stressed
328	237	Lollypop tree	*Myoporum laetum*	No	4,4,4,2,2,2,2,4,3,4,4,2,2,4,2,1,4	50	Measured	Stressed
329	238	Chinese pistachio	*Pistacia chinensis*	No	3,2,2,3,4,1	15	Measured	Stressed
330	239	Chinese pistachio	*Pistacia chinensis*	No	4,4,4,3,3,3,4	28	Measured	Stressed
331	L	Olive	*Olea europaea*	No	2	2	Estimated	Healthy
332	243	Manzanita	*Arctostaphylos sp.*	Yes	2,2,2,3,3	12	Measured	Stressed
333	240	Chinese pistachio	*Pistacia chinensis*	No	4,2,2,2,1,2	13	Measured	Stressed
334	241	Olive	*Olea europaea*	No	4	4	Measured	Healthy
335	242	Olive	*Olea europaea*	No	2,2,2	6	Measured	Healthy
336	A	Olive	*Olea europaea*	No	3	3	Estimated	Healthy
337	A	Olive	*Olea europaea*	No	2,1,1	4	Estimated	Healthy
338	B	Ash	*Fraxinus sp.*	Yes	3,3,3	9	Estimated	Healthy
339	C	Olive	*Olea europaea*	No	3,2	5	Estimated	Healthy
340	C	Olive	*Olea europaea*	No	3	3	Estimated	Healthy
341	D	Manzanita	*Arctostaphylos sp.*	Yes	2,3,3,2	10	Estimated	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
342	D	Manzanita	*Arctostaphylos sp.*	Yes	2,3,3,2	10	Estimated	Healthy
343	244	Chinese pistachio	*Pistacia chinensis*	No	6,6,4,5,2,3,3,2,1	32	Measured	Stressed
344	E	Chinese photinia	*Photinia sp.*	No	3,3,2	8	Estimated	Healthy
345	E	Chinese photinia	*Photinia sp.*	No	2	2	Estimated	Healthy
346	F	Carob tree	*Ceratonia siliqua*	No	12	12	Estimated	Healthy
347	G	Manzanita	*Arctostaphylos sp.*	Yes	2,2,2	6	Estimated	Healthy
348	H	Ash	*Fraxinus sp.*	Yes	4	4	Estimated	Healthy
349	245	Chinese photinia	*Photinia sp.*	No	2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2	50	Measured	Stressed
350	246	Holly oak	*Quercus ilex*	No	6	6	Measured	Healthy
351	247	Holly oak	*Quercus ilex*	No	3	3	Measured	Stressed
352	248	Holly oak	*Quercus ilex*	No	4	4	Measured	Healthy
353	K	Carob tree	*Ceratonia siliqua*	No	16,10	26	Estimated	Healthy
354	I	Carob tree	*Ceratonia siliqua*	No	10,5,3,3,3,3,3,3	33	Estimated	Healthy
355	249	Coast live oak	*Quercus agrifolia*	Yes	16,3	19	Measured	Healthy
356	J	Carob tree	*Ceratonia siliqua*	No	10,10,8,6	34	Estimated	Healthy
357	250	Holly oak	*Quercus ilex*	No	4,2	6	Measured	Healthy
358	251	Black poui	*Jacaranda mimosifolia*	No	14,8	22	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
359	252	Ash	*Fraxinus sp.*	Yes	3,2	5	Measured	Stressed
360	253	Carob tree	*Ceratonia siliqua*	No	6,4,8,10	28	Measured	Stressed
361	254	Ash	*Fraxinus sp.*	Yes	2	2	Measured	Stressed
362	255	Weeping juniper	*Juniperus scopulorum*	No	8	8	Measured	Stressed
363	256	Horsetail tree	*Casuarina equisetifolia*	No	44	44	Measured	Healthy
364	257	Weeping juniper	*Juniperus scopulorum*	No	6,2,2	10	Measured	Stressed
365	258	Horsetail tree	*Casuarina equisetifolia*	No	18	18	Measured	Healthy
366	259	Weeping juniper	*Juniperus scopulorum*	No	16	16	Measured	Stressed
367	260	Horsetail tree	*Casuarina equisetifolia*	No	32	32	Measured	Healthy
368	261	Horsetail tree	*Casuarina equisetifolia*	No	36	36	Measured	Healthy
369	262	Horsetail tree	*Casuarina equisetifolia*	No	36	36	Measured	Stressed
370	263	Weeping juniper	*Juniperus scopulorum*	No	9	9	Measured	Dead
371	264	Horsetail tree	*Casuarina equisetifolia*	No	23	23	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
372	265	Horsetail tree	*Casuarina equisetifolia*	No	40	40	Measured	Stressed
373	266	Horsetail tree	*Casuarina equisetifolia*	No	34	34	Measured	Stressed
374	267	Horsetail tree	*Casuarina equisetifolia*	No	34	34	Measured	Healthy
375	268	Horsetail tree	*Casuarina equisetifolia*	No	50	50	Measured	Stressed
376	269	Olive	*Olea europaea*	No	2,1,1,1	5	Measured	Healthy
377	270	Weeping juniper	*Juniperus scopulorum*	No	12	12	Measured	Stressed
378	BB	Coast live oak	*Quercus agrifolia*	Yes	6	6	Estimated	Healthy
379	BB	Coast live oak	*Quercus agrifolia*	Yes	4	4	Estimated	Healthy
380	BB	Coast live oak	*Quercus agrifolia*	Yes	3	3	Estimated	Healthy
381	BB	Coast live oak	*Quercus agrifolia*	Yes	2	2	Estimated	Healthy
382	306	Coast live oak	*Quercus agrifolia*	Yes	10	10	Measured	Healthy
383	307	Coast live oak	*Quercus agrifolia*	Yes	6,6,6	18	Measured	Stressed
384	305	Coast live oak	*Quercus agrifolia*	Yes	3	3	Measured	Healthy
385	304	Coast live oak	*Quercus agrifolia*	Yes	4	4	Measured	Healthy
386	301	Coast live oak	*Quercus agrifolia*	Yes	2	2	Measured	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
387	302	Coast live oak	*Quercus agrifolia*	Yes	18	18	Measured	Healthy
388	303	Coast live oak	*Quercus agrifolia*	Yes	16	16	Measured	Healthy
389	299	Coast live oak	*Quercus agrifolia*	Yes	3	3	Measured	Healthy
390	300	Coast live oak	*Quercus agrifolia*	Yes	6,6,6,6	24	Measured	Healthy
391	298	Coast live oak	*Quercus agrifolia*	Yes	10	10	Measured	Healthy
392	297	Coast live oak	*Quercus agrifolia*	Yes	8,8,4	20	Measured	Stressed
393	294	Coast live oak	*Quercus agrifolia*	Yes	6	6	Measured	Healthy
394	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
395	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
396	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
397	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
398	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
399	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
400	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
401	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
402	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
403	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy

Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
404	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
405	BA	Holly oak	*Quercus ilex*	No	5	5	Estimated	Healthy
406	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
407	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
408	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
409	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
410	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
411	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
412	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
413	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
414	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
415	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
416	BA	Holly oak	*Quercus ilex*	No	2	2	Estimated	Healthy
417	296	Coast live oak	*Quercus agrifolia*	Yes	8,8	16	Measured	Stressed
418	295	Coast live oak	*Quercus agrifolia*	Yes	8	8	Measured	Stressed
419	288	Coast live oak	*Quercus agrifolia*	Yes	2	2	Measured	Healthy
420	289	Coast live oak	*Quercus agrifolia*	Yes	3	3	Measured	Healthy
421	290	Coast live oak	*Quercus agrifolia*	Yes	5	5	Measured	Healthy

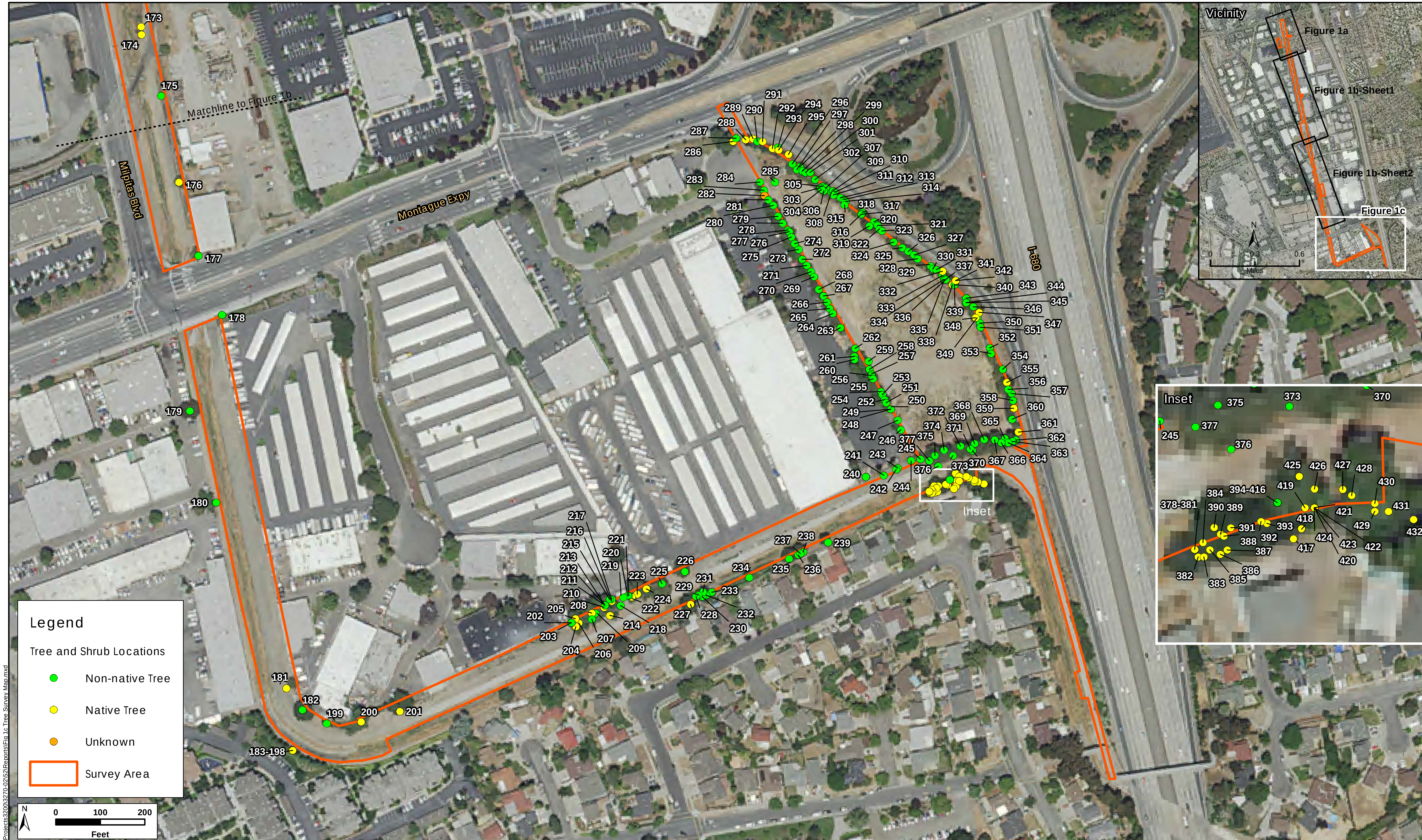
Tree Number	Field Tag	Common Name	Scientific Name	Native Status	Stem dbh (inch)	Total dbh (inch)	Measurement Type	Health
422	291	Coast live oak	*Quercus agrifolia*	Yes	2	2	Measured	Healthy
423	292	Coast live oak	*Quercus agrifolia*	Yes	4	4	Measured	Healthy
424	293	Coast live oak	*Quercus agrifolia*	Yes	4	4	Measured	Stressed
425	283	Coast live oak	*Quercus agrifolia*	Yes	8	8	Measured	Healthy
426	284	Coast live oak	*Quercus agrifolia*	Yes	6,2	8	Measured	Healthy
427	282	Fremont cottonwood	*Populus fremontii*	Yes	40,24,20,10,18,24,18	124	Measured	Healthy
428	281	Fremont cottonwood	*Populus fremontii*	Yes	18	18	Measured	Stressed
429	279	Fremont cottonwood	*Populus fremontii*	Yes	10,3,14	27	Measured	Stressed
430	280	Fremont cottonwood	*Populus fremontii*	Yes	20,8	28	Measured	Stressed
431	278	Fremont cottonwood	*Populus fremontii*	Yes	40,14,12,20	86	Measured	Stressed
432	277	Fremont cottonwood	*Populus fremontii*	Yes	44,32,8,10,18	112	Measured	Stressed

Figure 1a. Tree and Shrub Map
Upper Berryessa Creek (3270-52)
July 2015

H. T. HARVEY & ASSOCIATES
Ecological Consultants

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 1b. Tree and Shrub Map
Upper Berryessa Creek (3270-52)
July 2015



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 1c. Tree and Shrub Map
Upper Berryessa Creek (3270-52)
July 2015

Appendix G: Public Comments on the DEIR

Letter No. 1

Santa Clara County Parks and Recreation Department

Date Received: 10/2/2015

County of Santa Clara

Parks and Recreation Department

298 Garden Hill Drive
Los Gatos, California 95032-7669
(408) 355-2200 FAX 355-2290
Reservations (408) 355-2201
www.parkhere.org

October 2, 2015

James Manitakos, Environmental Planner II
Santa Clara Valley Water District, D-2017
5750 Almaden Expressway
San Jose CA 95118

Subject: **Notice of Completion, Draft Environmental Impact Report**

Project: **Upper Berryessa Creek Flood Risk Management Project**

Dear Mr. Manitakos,

The County of Santa Clara Parks and Recreation Department has reviewed the Draft Environmental Impact Report for the Upper Berryessa Creek Flood Risk Management Project and offers the following comments to be considered.

Section 3.10: Land Use and Planning
As described on page 3-128 of the DEIR, the entire length of the project area is a planned multiple-use recreational trail alignment (Berryessa Creek Trail) as adopted by the City of Milpitas in the *Milpitas Trails Master Plan* (1997), *Bikeway Master Plan Update* (2009), and the *General Plan*. A multiple-use trail along this creek corridor is also consistent with the goals and policies of the *Santa Clara Countywide Trails Master Plan* (1995) which includes goals and policies for multi-agency collaboration for implementation of trail projects of regional significance, such as the Berryessa Creek Trail.

The project description does not include recreational trail improvements along the creek channel. Because of the project's lack of a trail component, as described on page 3-129, "the proposed project would conflict with the Milpitas Trails Master Plan, which would be a significant impact." To mitigate this impact, mitigation measure LND-A would require that the District work with the City of Milpitas to allow public trail access through a Joint Use Agreement.

For the purposes of regional trail planning, and establishing an interconnected regional multi-use trail system, it is important to consider the development of the proposed trail alignment in the future.

Thank you for your consideration.

Sincerely,

Will Fourt
Park Planner III

CC: Kimberly Brosseau, Acting Principal Planner
Aruna Bodduna, County Roads & Airports Department

Letter No. 2

California Department of Transportation (Caltrans)

Date Received: 11/10/2015

STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY EDMUND G. BROWN Jr., Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
P.O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
FAX (510) 286-5559
TTY 711
www.dot.ca.gov

Serious Drought.
Help save water!

SCVWD NOV10'15AM11:18

November 10, 2015

SCL000140
SCL/GEN/PM VAR
SCH# 2001104013

Mr. James Manitakos
Santa Clara Valley Water District
5750 Alameda Expressway
San Jose, CA 95118

Dear Mr. Manitakos:

Upper Berryessa Creek Flood Risk Management Project – Draft Environmental Impact Report

Thank you for continuing to include the California Department of Transportation (Caltrans) in the environmental review process for the project referenced above. The mission of Caltrans is to provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability. Caltrans has reviewed the Draft Environmental Impact Report (DEIR) to ensure consistency with its mission and state planning priorities of infill, conservationism, and efficient development. Please refer to the previous comment letters on this project. Caltrans provides these comments consistent with the State's smart mobility goals to support a vibrant economy and build communities, not sprawl.

Project Understanding

The project addresses potential impacts of the proposed Upper Berryessa Creek Flood Risk Management Project within the cities of Milpitas and San Jose, running from under Interstate (I-) 680 south of the I-680/Montague Expressway interchange and to the north along I-680 approximately one-half mile to the west. Proposed channel modifications include flood risk improvements along 2.2 miles of Upper Berryessa Creek. The proposed project has been designed to provide flood damage reduction benefits along Upper Berryessa Creek from the overpass of I-680 in the City of San Jose to the upstream side of Calaveras Boulevard in the City of Milpitas.

Lead Agency

As the lead agency, the Santa Clara Valley Water District (SCVWD) is responsible for all project mitigation, including any needed improvements to State highways. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

Hydraulics

1. Floodwall Cross Sections: Please clarify whether the corresponding floodwall typical cross sections have been updated to include the new wall extension. The original proposed floodwall will be extended from 1,300 feet (-ft) to 2,200-ft along the west bank in Reaches 2 and 3 with a wall extension from "roughly the Piedmont Creek confluence to 1,500 feet upstream of Los Coches street". Figures 5.1, 5.2 and 5.3 show the original typical cross sections for alternatives 2A, 2B and 4. Figure 2.7 shows the typical cross sections for the revised project. It appears both Figures 2.7 and 5.1 show the same floodwall limits unchanged from stations 103+50 to 116+23.43 (1273-ft).
2. Figures 2.7 and 5.1: Please clarify why the 450-ft second floodwall in Reach 4 (171+00 to 175+50) was shown on Figure 5.1 (alternative 2A sections, south of Montague Expressway) but not on the revised typical cross sections of Figure 2.7.
3. Federal Emergency Management Agency (FEMA) Flood Map: The DEIR states that the proposed project would remove an estimated 500 parcels of land from the flood hazard zone. Caltrans recommends that the FEMA flood map be included in the DEIR with an exhibit showing the approximate areas where flood hazard will be lifted.
4. Fourth sentence of the third paragraph of Section 3.17.2.2 (p. 3-189): This sentence states, "Numerous storm drains empty into the system…." It is unclear the kind of "storm drains" being referred to and discharged into which "system" (i.e., is the "system" referring to the channels/creek or the drainage systems as a whole?). Please clarify in the DEIR which storm drains and system.
5. Page 3-190 of Section 3.17.2.2, Hydrology and Flooding: This section describes the existing conditions as "there is essentially no floodplain" for Reaches 1-3 and "almost complete disconnection from the floodplain" for Reach 4. Based on Figure 2.4, it appears that the floodplain mainly contained in the channel and overtops to the surrounding area with the depth less than 1 foot during a 100-yr flood event.

Encroachment Permit

Please be advised that any work or traffic control that encroaches onto the State ROW requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating State ROW must be submitted to: David Salladay, District Office Chief, Office of Permits, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. See this website for more information: www.dot.ca.gov/hq/traffops/developserv/permits.

Should you have any questions regarding this letter, please contact Brian Ashurst at (510) 286-5505 or brian.ashurst@dot.ca.gov.

Sincerely,

PATRICIA MAURICE
District Branch Chief
Local Development - Intergovernmental Review

c: Scott Morgan, State Clearinghouse
Tyler Stalker, U.S. Army Corps of Engineers – facsimile (916) 323-3018
Robert Swierk, Santa Clara Valley Transportation Authority (VTA) – electronic copy
Robert Cunningham, Santa Clara Valley Transportation Authority (VTA) – electronic copy

Letter No. 3

San Francisco Bay Regional Water Quality Control Board

Date Received: 11/12/2015

Sent via electronic mail: No hard copy to follow

November 12, 2015
CIWQS Place ID 818597 (SG)
Regulatory Measure ID 403119

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686

Attention: Mr. James Manitakos
Email: JManitakos@valleywater.org

Subject: Comments on the Draft Environmental Impact Report for Upper Berryessa Creek Flood Risk Management Project, Santa Clara County, SCH No. 2001104013

Dear Mr. Manitakos:

San Francisco Bay Regional Water Quality Control Board (Water Board) staff has reviewed the *Public Review Draft Environmental Impact Report for the Upper Berryessa Creek Flood Risk Management Project (State Clearinghouse No. 2001104013)* (DEIR) prepared by the Santa Clara Valley Water District (District) pursuant to the California Environmental Quality Act (CEQA). The project purpose is to convey the 1 percent exceedance probability flood event in Berryessa Creek from U.S. Interstate 680 in the City of San Jose for 2.2 miles downstream to Calaveras Boulevard in the City of Milpitas (Project).

The District is the local sponsor for the Project that the U.S. Army Corps of Engineers is constructing. The District is contributing a significant portion of the project cost; managing all real estate transactions for right-of-way land acquisition and easements; and will own and operate the project after it is constructed. Although the Corps previously screened alternatives in the *General Reauthorization Report/Environmental Impact Statement* (GRR/EIS) (March 2014), the District must also analyze alternatives pursuant to CEQA. The Corps-selected project design includes (but is not limited to) a roughly 1,300 foot long, 1.5 foot high floodwall. The District's preferred alternative is the same as the Corps' but with modifications which increase the length of the floodwall to about 2,200 feet, and the height by up to 0.5 feet. The added length and height would bring Alternative 2A to meet the Federal Emergency Management Administration's (FEMA) standards. As described further below, we provide the following comments on the DEIR, including, but not limited to:

- The DEIR alternatives analysis is limited to that of the Corps' GRR/EIS, so does not meet CEQA requirements to include a full array of feasible alternatives.

- Inconsistencies related to sediment and vegetation maintenance activities and mitigations.

- The Project preferred alternative would not comply with the *San Francisco Bay Water Quality Control Plan* (Basin Plan) requirement that impacts to wetlands and other waters of the State be avoided and minimized to the extent practicable.

- Mitigation for impacts on waters of the U.S. and waters of the State does not comply with the State and Regional Water Board policies.

COMMENTS

1) **Pre-selected Alternative.** The District only analyzed alternatives that were previously screened by the Corps for the Corp' Final GRR/EIS (March 2014). Therefore, the DEIR's alternatives analysis does not constitute a full array of feasible alternatives, so does not fully meet the CEQA requirements. This is particularly relevant because the Water Board cannot permit or certify the Project unless we concur with the lead agency's CEQA determination. As currently proposed, the Project does not meet the Water Board's policies, nor does it adequately meet CEQA requirements for reasons discussed in the following comments.

2) **Sediment Transport.** The Project will result in a wider and deeper channel than the existing channel morphology, but the DEIR does not explain how sediment will be transported through the Project reach. Without explaining sediment transport in the Project, the DEIR does not adequately describe the potential post-Project impacts or mitigations necessary to address impacts for sediment removal maintenance activities. The DEIR, section 3.1 (last paragraph) states:

    > *Because the proposed project is being designed to result in less erosion due to lower flow velocities, more stable bank design, and enhanced flow conveyance through bridges and culvert openings, operations and SMP2 maintenance actions associated with sediment removal and repair of eroded banks or access roads are likely to be reduced in magnitude compared to existing channel operations and maintenance activities.*

This statement is unfounded because the DEIR does not include data about existing sediment maintenance and how the Project will cause less sediment maintenance needs. In addition, without a sediment transport analysis, there is no evidence to show that the source of sediment is from eroding banks within the Project reach.

Water Board staff's best professional judgment regarding sediment transport in the Project reach is that the existing channel expresses a sustainable shape throughout the system, and the Project documents do not support that the proposed channel design is sustainable (Attachment A1 through A3). For example, the channel models could not identify depositional areas due to the ongoing maintenance to remove sediment (Attachment A-3: GRR/EIS, Appendix B, Part III-*Geomorpologic and Sediment Transport Assessment*, pg. 2-17). The existing channel width is consistently about 10 to 12 feet, including areas upstream and downstream of the Project reach as Water Board staff observed on September 4, 2015 and as shown in the Corps' draft 60 percent 60 percent design plans (June 2015). The sediment processes in the Project reach will result in sediment accumulation and eventually the same channel dimensions as existing conditions. This could adversely impact flow conveyance, which would not be consistent with the Project objectives.

Based on these findings, the Project will require ongoing, repetitive maintenance for sediment removal, which will result in repetitive impacts on the creek habitat which the DEIR does not disclose. Although the DEIR states that the District plans to conduct sediment maintenance to maintain conveyance (sections ES-5, 3.5.2.1), the maintenance needs may exceed the District's Stream Maintenance Program ("SMP2") thresholds, but this is not addressed in the DEIR. Please revise the DEIR to adequately explain the sediment transport processes in the Project, and the associated impacts due to future sediment maintenance activities and mitigations for the impacts.

3) **Project Objectives.** The DEIR lists the following three objectives for the Project (section 2.3.5):

- *Objective 1:* Reduce flood damages from Berryessa Creek upstream of Calaveras Boulevard throughout the study reach during the 50-year period of analysis beginning in 2017. Completed project would meet FEMA certification standards in all 4 project reaches.
- *Objective 2:* Use environmentally sustainable design practices in addressing the flood risk management purpose of the project wherever possible within the study reach, including taking advantage of restoration opportunities that may be pursued incidentally to the flood damage reduction purpose.

- *Objective 3:* Be consistent with Berryessa Creek Flood Risk Management Project Plan selected by USACE in the Director's Report of May 29, 2014.

Regarding Objective 2, the DEIR does not define "environmentally sustainable design practices." Please revise the DEIR to include the District's definition for this and to specify how the proposed Project meets this objective. Given Water Board staff's concerns regarding sediment transport in the Project (see Comment 2), the ongoing maintenance we anticipate will be necessary would not be consistent with an environmentally sustainable design.

Regarding Objective 3, the DEIR is not entirely consistent with the GRR/EIS because it does not include the GRR/EIS objective to "reduce sedimentation and maintenance requirements" (GRR/EIS, section 1.1). Please revise the DEIR to reconcile this discrepancy in consistency with the GRR/EIS.

4) **Impacts on Biological Resources.** The DEIR, section 2.5.5 states that the District plans to operate the Project under the District's existing Stream Maintenance Program (SMP2) for sediment removal tasks to maintain flow conveyance capacity and vegetation removal to maintain access and for fire prevention.

However, this contradicts the District's statement that the existing open water/aquatic vegetation (1.25 acres) and transitional vegetation ranging from the active channel to the channel uplands (up to about 3.27 acres) that will be removed for the Project would recolonize and thus serve to mitigate for what the District is calling a temporary impact that is less than significant with mitigation. The following excerpt is the District's rationale for this finding (section 3.5.5.1):

> *It is anticipated that wetland and transitional vegetation would regenerate naturally over the course of the first two growing seasons, and since the bottom width of the stream channel would be wider than under existing conditions, additional areas of wetland plant communities are likely to form. Because wetland vegetation would regrow after construction is complete and the area of wetlands vegetation would increase when compared to the existing condition, this impact would be less than significant.*

Water Board staff does not agree that the impacts would be less than significant, given that the DEIR contains no plans or evidence to support that the same or comparable hydrophytic vegetation would colonize naturally and meet or surpass the functions and values of the existing vegetation. In addition, the District plans to remove sediment and vegetation (section 2.5.5), so the assumption that the impacted vegetation would recolonize is unfounded.

Please revise the DEIR to include appropriate mitigation to compensate for both temporal and spatial losses in functions and values of the open water/aquatic vegetation and transitional vegetation. Such a plan would need to include, at least at the conceptual level, the types, numbers, densities, and locations of vegetation plantings, and success criteria. The details would need to be further developed in a mitigation and monitoring plan. We note that while the DEIR includes plans to hydroseed the banks to promote bank stabilization, particularly after coconut-fiber blanket biodegrade (3+ years), the DEIR does not discuss the nature of hydroseed (e.g., the species make-up), monitoring plans, or other details to demonstrate appropriate level of compensation for impacts on open water/aquatic and transition vegetation.

5) **Impacts on Beneficial Uses.** The DEIR repeatedly states or implies that the existing habitat is of marginal quality (e.g., sections 3.5.2.1, 3.5.2.3, and Table 3.12) and uses this as a basis for maintaining the status quo or even reducing the Project reach's beneficial uses. Water Board staff observed flowing and ponded water and egrets and mallard ducks in multiple sites along Reaches 1-3 during a site visit on September 4, 2015, despite the inspection occurring in the end of the dry season in the midst of a severe drought. These observations are consistent with the REC-2 (non-contact recreation such as bird-watching) and WILD (wildlife habitat) beneficial uses of the Project reach designated by the Water Board and listed in the Basin Plan, Table 2.1. The other beneficial uses are for body-contact recreation (REC-1); and warm water aquatic habitat (WARM). Because the Project would impact aquatic and transitional vegetation, the habitat the vegetation supports would be impacted. However, the DEIR does not address this. Please revise the DEIR to recognize the Project reach's designated beneficial uses and a plan to appropriately mitigate any unavoidable impacts on the creek habitat, especially the REC-2 and WILD beneficial uses.

6) **Description of Impacts on Creek Hydrology.** The District's alternatives analysis does not adequately address the potential of exposing the water table in new areas and resultant alterations in the creek's hydrology. Consequently, the DEIR does not include any mitigation for this potential impact on the post-Project hydrology. The Project would excavate to variable depths of 9 to 20 feet (Table 5.4). Given that the depth to groundwater ranges from about 7 to 20 feet below grade (DEIR, Appendix D-Geotechnical Report), the post-Project conditions would likely result in more area of the channel invert being in the groundwater table than existing conditions. Please revise the DEIR to address the post-Project hydrology conditions, and the impacts from vegetation and sediment maintenance activities on the creek's functions, values, and beneficial uses.

7) **Bank stabilization**
   A. **Discrepancies in DEIR and Appendix D.** The DEIR main body discusses that biodegradable coconut mats will be used for erosion control and bank stabilization (sections ES4, 2.5, and others). However, Appendix D-

Geotechnical Report (April 2015), section 2.1 states: “The erosion protection will consist of rip rap on the lower portion of the slope and geocells filled with aggregate or concrete on the upper portion of the slope,” and this is reiterated in section 23. In addition, Appendix D, section 12 states: “Rip rap is also being used for the channel invert between approximately Stations 115+00 and 164+00.” Please revise the DEIR to reference any inaccuracies and inconsistencies in the Geotechnical Report (or any other appendices, as appropriate). Please note that the Water Board staff has communicated to the Corps-District design team that the use of geocell bank stabilization does not comply with Water Board policies or the requirements in the Basin Plan to avoid and minimize impacts to the extent practicable.

B. **Hydroseed**. The DEIR states: “Channel banks would be protected with biodegradable erosion control blankets and hydroseeded” (ES-4; Table ES-2; section 2.5.2; and others). We caution that erosion control treatments such as hydroseeding, hydraulic mulch, tackifiers, soil binders, and straw mulch could wash into the channel rendering the erosion prevention method ineffective. Other soil bioengineering methods such as the planting of willow stakes and emergent in-stream vegetation could be used to stabilize the bed and banks below the mean high water level. Has the District considered integrating willow stakes or other bioengineering methods in the Project for bank stabilization?

8) **Alternatives Analysis for the 401 Certification**. Please note that for the Water Board to permit the proposed Project pursuant to the Clean Water Act, section 401, we require a project proponent to conduct an alternatives analysis consistent with the U.S. Environmental Protection Agency’s 404(b)(1) Guidelines. The Basin Plan incorporates the 404(b)(1) Guidelines by reference to determine the circumstances under which filling of wetlands, streams or other waters of the U.S. and/or the State, as the District proposes with this Project, may be permitted. In accordance with the Basin Plan, filling, dredging, excavating and discharging into a wetland or water of the state is prohibited unless the project meets the least environmentally damaging practicable alternative (LEDPA) standard as determined through the 404(b)(1) alternatives analysis. Although the LEDPA analysis is not required by CEQA, a project proponent may tailor their alternative analysis to fulfill both the CEQA and 404(b)(1) requirements to help expedite the Water Board’s Project review to issue a 401 Certification.

For example, during pre-CEQA interagency meetings, Water Board staff made suggestions that would help the Project meet the LEDPA standard by minimizing impacts in the creek and maximizing its beneficial uses (Interagency meetings, August 4 and August 11, 2015). This input includes: (1) planting willow stakes in the streambed edges; (2) installing the proposed pre-cast concrete culverts at grades that allow the formation of earthen bottoms; (3) using bioengineering methods in place of concrete for bank armoring and/or some or all floodwalls; and (4) identifying opportunities to maximize both flood conveyance capacity and opportunities for future adaptive management of the channel by increasing channel cross section. For example, such adaptive management practices could be completed where the Corps' preferred alternatives propose reaches with maintenance access roads on both sides of the channel, by removing or lowering the road on the non-multi-purpose path side.

The District did not incorporate the Water Board staff's suggestions in the CEQA analysis, except for DEIR Alternative 4. At three times the cost of the District-preferred alternative, Alternative 4 is cost-prohibitive because it apparently incorporates the "all options" scenario (though this is not explicitly explained in the DEIR). Water Board staff recommends the District revise the CEQA alternatives analysis to include feasible alternatives to meet the LEDPA standard. This would help expedite Water Board staff's Project review for the 401 Certification process.

In summary, Water Board staff appreciates the opportunity to provide comments on the DEIR. The DEIR is well-organized, but it does not adequately describe the proposed Project's environmental impacts and associated mitigations. In addition, the proposed Project would not meet the Water Board's requirements for project proponents to avoid and minimize impacts and to appropriately compensate for any unavoidable impacts in accordance with the Basin Plan and (404(b)(1) Guidelines. If you have any questions about our comments, please contact Susan Glendening of my staff at (510) 622-2462 or via email to Susan.Glendening@waterboards.ca.gov.

Sincerely,

William B. Hurley
Senior Engineer

Attachments:

A-1: Section 6.2 excerpt from the *GRR/EIS,* March 2014

A-2: Pages iii, and A-4 through A-6 from the *Final Independent Peer Review Report, Berryessa Creek*, March 6, 2013

A-3: GRR/EIS, Appendix B, Part III-*Geomorphologic and Sediment Transport Assessment,* March 2012

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Attachment A-1

GRR/EIS, Section 6.2

General Reauthorization Report/Environmental Impact Statement

Prepared by U.S. Army Corps of Engineers, Sacramento

March 2014

6.2 COMPARISON OF ALTERNATIVE PLANS

The purpose of this step is to compare the results from the evaluations completed, for the purpose of developing a recommended plan that addresses the flooding problems in Berryessa Creek. A more detailed project footprint, including temporary construction easements, staging areas, and access routes, is presented in the overview exhibits at the end of Chapter 6.

6.2.1 Hydraulic Design

6.2.1.1 Hydrologic Effects

With-project discharges are actually higher within the creek than the without-project discharges. This is typical of flood risk management projects that maintain flow within the channel that otherwise would overflow onto the floodplain in the without-project condition. The discharges for the without- and with-project conditions upstream of I-680 remain the same in Alternatives 2A/d and 4. On the other hand, the difference between without- and with-project discharges upstream of I-680 is less pronounced in Alternative 5.

6.2.1.2 Water Surface Profiles

The with-project water surface elevations resulting from the additional discharge in Alternatives 2B/d, 4/d, and 5 are generally higher than in Alternative 2A/d, but the amount of increase is highly variable. These results are for fully contained flows. Comparison to existing conditions is therefore hypothetical only; the computed without-project (Alternative 1) water surface elevation at any point assumes full containment at each upstream section, and flows are restricted to the extent of each cross section in the event of breakout.

Among different alternatives, the different channel configurations downstream of I-680 affect water surfaces that vary by reach. The vegetated terraces in Alternative 4/d tend to reduce the available conveyance in the channel in comparison to Alternatives 2A/d and 2B/d.

6.2.2 Sediment Transport

The quantitative sediment analysis was conducted for the without-project, Alternatives 2A/d, 2B/d, and 4/d using hydraulic models developed for previous phases of this study for existing conditions between Old Piedmont Road and I-680. In addition, analyses were conducted for Alternatives 2B/d and 4/d assuming the proposed SCVWD bypass alternative was in place between Old Piedmont Road and I-680.

The analysis indicated an increase in sediment transport through the I-680 to Montague Expressway and Montague to Calaveras Boulevard for Alternatives 2A/d and 2B/d. The increased transport results in a decrease in deposition in the I-680 to Montague reach for the alternatives. With a larger amount of sediment being transported through the upstream reach, there is an increase in the amount of deposition in the Montague to Calaveras Boulevard reach for all alternatives over the without-project alternative. Overall, the total amount of sediment deposited in the study area for Alternatives 2A/d and 2B/d is nearly equal to that under the without-project conditions. In contrast, the analysis showed a marked increase in deposition in for Alternative 4/d.

The analysis also showed a significant reduction in the deposition in the sediment basin below the Piedmont-Cropley culvert over existing conditions. This is due to a majority of flood flows being transported through the proposed SCVWD bypass culvert. The reduction in the flood flows to the Greenbelt reach results in a significant reduction in the sediment supply to the downstream reach. The sediment supply conveyed through the bypass culvert adds to the supply to the downstream reach, but accounts for only a small portion of the reduced Greenbelt sediment supply. The sediment transport rate for the Morrill to I-680 reach is greater than the combined sediment supply for the Greenbelt and bypass culvert. Since the sediment transport capacity through the reach is greater than the incoming supply, no deposition is seen in the reach. For Alternatives 2B/d and 4/d, there is an increase in sediment transport through the I-680 to Montague and Montague to Calaveras reaches over the without-project alternative. The increased transport results in no deposition in the I-680 to Montague reach. Normally, a larger amount of sediment being transported through the upstream reach would result in an increase in the amount of deposition in the Montague to Calaveras Boulevard reach. But since the supply from the Greenbelt reach is limited, the transport capacity of Alternative 2B/d can transport the entire supply to the downstream reach with no deposition and Alternative 4/d showing a small amount of deposition.

Throughout the study area, there are large variations in velocities and shear stresses that can cause localized sedimentation and scour problems. During the design phase, the project design needs to be further refined to reduce the level of these changes. Additionally, the measures used to provide passage of the design event through bridges should be reviewed. There may be the creation of significant backwater conditions in cases in which walls were extended above the bridge deck to contain flows. The reduced velocity and shear stress may cause an additional potential for additional, localized deposition in an area that in some cases already experiences deposition.

Currently, the study area is a deposition zone, and a reduction in velocity will further increase deposition and the need for maintenance. Constructed features should facilitate removal of deposited sediments.

6.2.3 Floodplains

The final array of alternative plans was analyzed using the Lower Berryessa Creek FLO-2D model. Of the four project alternatives, only Alternatives 2A/d and 5 have breakouts from the Berryessa Creek channel for the modeled events. Alternatives 2B/d and 4/d were developed to meet FEMA certification requirements using risk-based principles assuming SCVWD's bypass structure upstream of I-680 is implemented. The bypass design resulted in higher flow rates at I-680 resulting in Alternatives 2B/d and 4/d to have a larger conveyance capacity allowing both alternatives to convey up to the 0.002 exceedance probability event. Thus, no residual floodplains were mapped for these alternatives.

Attachment A-2

Pages iii; A-4, A-5, and A-6

Final Independent External Peer Review Report
Berryessa Creek, Santa Clara County, California,
General Reevaluation Study (GRS)

March 6, 2013

Prepared by Battelle Memorial Institute

Prepared for Department of the Army
U.S. Army Corps of Engineers
Flood Risk Management Planning Center of Expertise for the Baltimore District
Contract No. W912HQ-10-D-0002
Task Order: 0030

March 6, 2013

Final Independent External Peer Review Report Berryessa Creek, Santa Clara County, California, General Reevaluation Study (GRS) Draft General Reevaluation Report and Environmental Impact Statement/Environmental Impact Report

these, six were identified as having high significance, eight had medium significance, and one had low significance.

Results of the Independent External Peer Review

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Berryessa Creek review documents. The Panel found that, overall, the Berryessa Creek report is well organized and comprehensive. An extensive array of engineering measures was considered in the development of alternatives and the criteria to eliminate plans from future study are well described and logical although the impact of sedimentation on the channel design has not been considered adequately. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following statements summarize the Panel's findings.

Engineering – The Berryessa Creek GRS/Draft GRR/EIS/EIR contains extensive details on the hydrologic and hydraulic analyses performed. In general, the assumptions that underlie the engineering aspects are technically sound and appropriate. The hydrologic and hydraulic modeling procedures as presented in the report are technically sound and acceptable. Although the report presents overwhelming evidence of sedimentation issues within the project area, neither the impact of sedimentation issues on the channel design nor details on the maintenance activities with relation to sedimentation have been presented. In addition, there are insufficient details on the maintenance activities with relation to sedimentation. The Panel has expressed significant concern about the lack of details on the operation and maintenance (O&M) plan and has identified the need for a detailed O&M plan to ensure the design assumptions concerning sedimentation are valid.

Economics – The Panel determined that the adequacy and acceptability of the structure and content values, total annual costs, and the results of the economic risk analysis could not be determined due to lack of documentation. The report does not describe the methods used to develop the structure inventory, conduct and verify the content survey, and calculate structure values. The Panel was unable to determine if the structure and content data used in the analysis are accurate and if they reflect the current conditions in the study area. Several issues pertaining to the calculation of annual equivalent damages (AED) to structure and content, the unexplained increase in benefits resulting from the incorporation of risk and uncertainty, and the presentation of the results of the economic analysis are identified that could significantly impact the findings of the economic analysis. In addition, the report contains little documentation describing the development of the lands, easements, rights-of-way, relocations, and disposal areas (LERRD) costs and the annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs, preventing an accurate assessment of the total annual costs used in estimating the benefit to cost ratios. Based on the analysis presented in the reviewed documents, the Panel cannot accurately assess the economic feasibility of the Recommended Plan.

Environmental – The Berryessa Creek GRS/Draft GRR/EIS/EIR adequately describes existing conditions of vegetation in the project area, but does not include a thorough review of special-

Final Panel Comment 1

The impact of sedimentation is not included in the hydraulic modeling aspect of channel design.

Basis for Comment:

The Main Report and Appendices provide overwhelming evidence of active sediment transport throughout the project reach as explained below:

- Appendix B, Part III, Section 2.2.1 describes the presence of a high sediment production zone in the upper watershed with erosive soils/landslides and steep channels capable of transporting the large quantities of sediment to the downstream watershed.
- Appendix B, Part III, Section 2.2.1.4 (p. 2-17) states that HEC-6T sediment modeling results indicate "a mixture of aggradation and degradation scattered throughout the project area."
- Main Report, Section 2.2.1.1 presents the results of sediment yield analysis showing estimated sediment delivery as:
  1. Berryessa Creek at Old Piedmont Road = 9,900 tons/year
  2. Sweigert, Crosley, and Sierra Creeks = 1,900 tons/year
  3. Piedmont Creek = 700 tons/year
  4. Arroyo de los Coches = 3,200 tons/year.
- Appendix B, Part III, Section 2.2.2 presents the sediment removal history based on Santa Clara Valley Water District (SCVWD) maintenance records. These records show sediment removal occurring throughout the project area.
- Appendix B, Part III, Section 2.2.2 (p. 2-21) describes the possibility of sediment being transported through the project area to the reach downstream of Calaveras Boulevard.
- Main Report, Section 2.4.1 states, "Winter flows tend to be turbid, due to sediment loading from the surrounding foothills and from bank erosion along the creek."
- Appendix B, Part I, Section 5.3.2 states, "Based on the observations of David Adams of the SCVWD, sediment removed in the maintenance reaches upstream of Calaveras Boulevard is approximately uniformly distributed within each channel reach (rather than concentrated at bridge locations)."

Although there is overwhelming evidence that sedimentation occurs throughout the project reach, according to Main Report, Section 4.4.2.6, "For the hydraulic analysis, it was assumed that the channel is in its maintained state with the sedimentation basin downstream of Piedmont-Cropley cleaned out and the invert of bridges the same as those in the USACE model."

The hydraulic modeling performed in the study assumed clear channel conditions and did not analyze the potential reduction in channel capacity due to sediment deposition in the channel bed. In addition, high sediment concentrations can create "bulking" (Mussetter et al., 1994) of the flows, where the sediment volume becomes significant compared to water volume so that higher water surface elevations may result due to the presence of suspended sediment load. The impact due to "bulking" of flows is not considered as part of the hydraulic (HEC-RAS and FLO-2D) modeling. The design discharges were not adjusted to accommodate "bulking" of the flows due to sediment load.

Significance – High:

Reduction in channel capacity due to sediment deposition and bulking can impact the flow containment and extent of flooding, which will affect the project objective of reducing flood damages and the level of risk reduction achieved can be less than the project objective of 90-95 assurance for the 1-percent flood event.

Recommendations for Resolution:

1. Investigate post-sedimentation within the channels using post-sedimentation cross-sections from the sediment transport model.
2. Adjust design discharges to accommodate bulking of the flows due to sediment load.

Literature Cited:

Mussetter, R. A., P.F. Lagasse and M. D. Harvey (1994). Sediment Erosion and Design Guide. Prepared for the Albuquerque Metropolitan Arroyo Flood Control Authority by Resource Consultants and Engineers, Inc., Fort Collins, CO.

Final Panel Comment 2

The operations and maintenance plan does not present sufficient details related to sediment removal and maintenance of clear channel conditions.

Basis for Comment:

Sediment management is key to the success of the project as the project design is developed on the assumption of clear channel conditions. It is critical to ensure that the operations and maintenance (O&M) plan contains adequate details describing the process that will be adopted to maintain the channel through sediment removal. However, the O&M plan as presented in the Main Report Section 7.4 consists of only a single paragraph and does not provide sufficient details on the sediment removal process, sediment removal locations, or sediment removal frequency.

There are other sections of the Main Report that discuss the need for sediment removal through maintenance:

- Main Report (p. 2-17) describes the significant blockage of the Cropley and Piedmont Culvert.
- Both the Authorized Plan and the National Economic Development (NED) Plan identified removal of sediment at the downstream face of I-680 as a project task.
- Appendix B, Part III, Section 3.1.1 describes the need for sediment removal maintenance to preserve adequate flood conveyance capacity.
- Appendix B, Part III, Section 3.1.4 describes the need for identifying and creating designated locations for sedimentation-related maintenance activities.
- Appendix B, Part III, 3.1.5.2 describes the need to maintain vegetation growth within the channels so that sediment can effectively be conveyed by the channel.

In addition, the hydraulic analysis presented in Main Report, Section 4.4.2.6 assumes clear channel conditions without sediment depositions in the channel bed. The Authorized Plan had identified a primary sediment basin near Old Piedmont. In comparison, the NED Plan does not include any improvements upstream of I-680 and therefore does not include a sediment basin to capture the sediment from the upper watershed. As a result, sediment deposition can occur at various locations within the project study area. This section of the report, as well as the Section 7.4 on operations and maintenance, does not clearly describe how the sediment maintenance will be performed or identify all the locations where sediment removal will be performed.

One of the statements presented in Appendix B, Part III explains that existing deposition trends will be exacerbated due to design modifications. The with-project conditions are expected to worsen the sediment deposition, so additional maintenance efforts may be required to counter the increased sedimentation. No details on additional maintenance requirements are presented in this appendix.

Appendix B, Part III (p. 2-21) discusses the possibility of increased deposition in the reach below Calaveras Boulevard. The main report does not present any discussion on downstream impacts and mitigation needed to reduce the amount of sediment carried to downstream reaches outside the project study area.

Attachment A-3

Appendix B, Part III: Geomorphologic and Sediment Transport Assessment

General Reauthorization Report and Environmental Impact Statement

Berryessa Creek Element

Coyote and Berryessa Creeks, California

Flood Control Project

Santa Clara County, California

March 2012

Berryessa Creek Element
Coyote and Berryessa Creeks
Flood Control Project
Santa Clara County, California

Appendix B: Engineering and Design

Part III

Geomorphologic and Sediment Transport Assessment

BERRYESSA CREEK PROJECT

APPENDIX B, Part III: Geomorphic and Sediment Transport Assessment

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CHAPTER 1: INTRODUCTION

This appendix is Part III of the engineering appendices supporting the Berryessa Creek Flood Control Project Post-Authorization Study. The engineering appendices are as follows:

- Part I. Hydraulic Analysis of Alternatives
- Part II. Floodplain Development
- Part III. Geomorphic and Sediment Transport Assessment
- Part IV. Design and Cost of Alternatives

This appendix refers to figures, tables, and results in the accompanying appendices and in the main body of the report. This appendix provides supporting fluvial geomorphology and sediment transport analyses for the formulation and evaluation of the Berryessa Creek Project Alternatives. A summary and interpretation of previous work related to the geomorphology of the system is also included. In addition, insight from observations by the project team is provided, particularly in reference to supply of sediment from the upstream watershed.

Sediment transport analyses of the existing condition are summarized in light of available sediment removal records. The results of the hydraulic analysis of the alternatives is utilized to qualitatively address potential changes in sediment transport conditions under project scenarios compared to the without-project condition. This information is utilized to provide recommendations on design refinements to address fluvial geomorphic and sediment transport aspects of the project design as well as recommendations for additional analyses to support the design effort.

Figure 1-1 shows the delineations of watersheds draining to the project area, as presented in the NHC hydrology report (2003). Figure 1-2 shows the project footprint relative to the road crossings and other features within the project area.

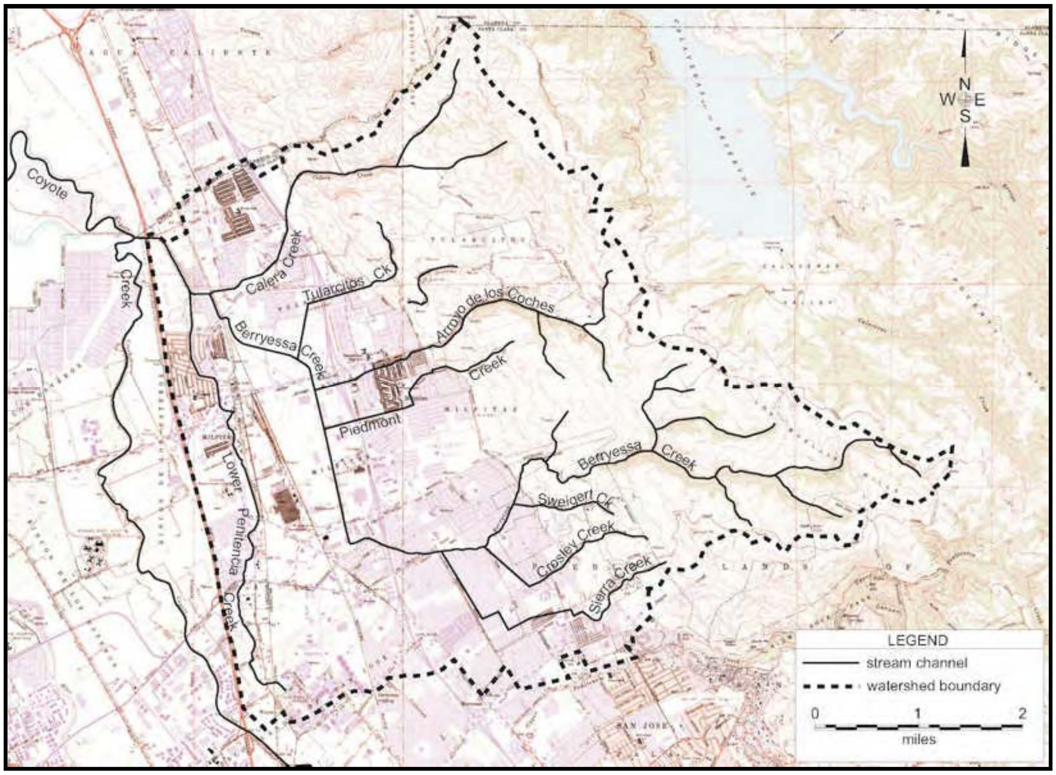

Figure 1-1 Watershed Map (Source: NHC 2003)

Figure 1-2 Project Footprint

A number of issues were identified as important for this analysis to address. An evaluation of the stability of the alternatives in terms of their sediment transport response is necessary. Because of the urbanized nature of the area and the limited area available for the project, it was determined early in the plan formulation process that the channel would be protected in most areas to prevent erosion. However, the channel bed will remain mobile so it is necessary to assess the potential for channel bed aggradation and degradation. The project alternatives should be designed to prevent excessive scour or deposition. The influence of the proposed alternatives on sediment removal requirements is another important issue. Historically, sediment removal in the project area (see Table 2-1) has averaged on the order of 1,046 cubic yards per year upstream and 616 cubic yards per year downstream of I-680 for the project reach with a total of 7,179 cubic yards per year from the entire Berryessa Creek channel. Also tied to sediment removal is the potential for changes to the existing sediment retention basin and construction of additional sediment management structures under consideration by others. The Corps GDM (USACE 1993) included a sediment basin above Old Piedmont Road. To address issues surrounding the reconfiguration of the sediment basin, the watershed was evaluated to determine if there were areas further upstream in which sediment management activities could be applied to reduce sediment delivery to the basin area.

Besides the sediment transport aspects of the design, fluvial geomorphology concepts were applied to evaluate the design and provide recommendations for potential refinements as necessary. Though the project is located in a highly urban environment with limited right of way and numerous constraints created by bridges, roads, utilities, and buildings; the concepts of fluvial geomorphology are still useful in developing an appropriate design. These concepts can help in evaluating the system response to the alternatives and provide input on ways of developing a more sustainable project in terms of maintenance and environmental quality. Application of fluvial geomorphology assisted in the evaluation of the sediment transport issues identified in the previous paragraph. In addition, recommendations for sizing the channel and evaluation of the response of the Greenbelt Reach, which will not be as constrained as the project area, are addressed.

The with-project alternatives evaluated in the current effort were carried forward from the conceptual alternatives presented in the F3 report (Tetra Tech 2004) and subsequently narrowed down to three alternatives by the Corps. Typical cross sections of each alternative are presented in *Appendix B, Part IV: Design and Cost of Alternatives* in this engineering appendix. An important purpose of these alternatives was to evaluate large-scale economic issues between general approaches to flood control. Alternative 1 is the without-project condition. Project alternatives under consideration by others include floodwall construction and excavation of a floodplain terrace within the Greenbelt Reach upstream of I-680 along with a high-flow bypass culvert running beneath Cropley Road. Downstream of I-680, Alternatives 2A/d and 2B/d were formulated to provide flood control utilizing channel excavation and bridge modifications to increase conveyance in a project footprint that could be constructed within the existing right of way. As a result, a large main channel is excavated that has the capacity to convey the 1% chance exceedance event. Alternative 2A/d is designed to pass the 1% chance exceedance event with a 50% conditional non-exceedance probability (CNP) using risk and uncertainty principles with Alternative 2B/d passing the 1%

chance exceedance event with 90% CNP (meeting the FEMA certification criteria). Levees or floodwalls are extended as needed to maintain a consistent capacity throughout the project with the appropriate certainty. Alternative 4/d incorporates vegetated floodplain benches along the low-flow channel, with concrete floodwalls extended vertically from the outer edges of the floodplain bench. This allows Alternative 4d/ to be constructed within the existing right of way.

Alternatives 2B/d and 4/d include the complete replacement of all bridge and culvert crossings with the exception of the Ames Avenue and Yosemite Drive crossings, which would require shoring/stabilization of existing abutments and construction of transition structures, and the I-680 crossing, which would not be affected. Modifications within channel reaches include excavation and levee/floodwall construction. Levees, floodwalls, and tops of bank are designed according to risk and uncertainty principles. Further details on the flow profiles and modeling methodology are described in *Appendix B, Part I: Hydraulic Analysis of Alternatives* in this engineering appendix. The analyses and recommendations presented in this appendix will be utilized to guide future sediment transport modeling efforts supporting more detailed designs that are carried forward.

CHAPTER 2: EXISTING CONDITIONS

2.1 Summary of Geomorphology

This report generally assesses the impacts of the sediment generated in the upper watershed on the proposed project alternatives in the lower watershed. Two primary documents provide information describing the geomorphology of Berryessa Creek within the project area and the upstream watershed: the Sacramento District's GDM (USACE 1993) and "Upper Berryessa Creek GRR Basin Geomorphology Technical Memorandum" (NHC 2001). "An Urban Geomorphic Assessment of the Berryessa and Upper Penitencia Creek Watersheds in San Jose, California," a Colorado State University dissertation by Jordan (2009), contains data and conclusions applicable to the site geomorphology and will likely be published in the near future. Preliminary results and analysis methods are summarized at the end of this report in Addendum 1. In addition, Tetra Tech has conducted several site visits to the project area and the upstream watershed to observe and document conditions related to fluvial geomorphology. The summary of existing geomorphic conditions is based on these three sources.

2.1.1 Geology and Soils

The Berryessa watershed consists of two distinct landforms. The watershed above the urbanized area is mountainous terrain consisting of the Los Buellis Hills, part of the Diablo Range. The highest point in the watershed is Monument Peak at an elevation 2,594 feet. Within the project area, Berryessa Creek flows across an alluvial fan created by Berryessa Creek and its tributaries. The minimum elevation in the watershed is 3 feet at the confluence with Penitencia Creek. At the downstream limits, Berryessa Creek is tidally influenced. Under existing conditions, the upland portion of the watershed is mostly undeveloped with a few residences scattered mostly along the basin divide. The primary land use in the upland portion of the watershed is grazing. Due to zoning practices, the future condition is not anticipated to change significantly in terms of land use. In contrast the alluvial fan portion of the watershed is almost entirely urbanized.

In the uplands, the geology consists mainly of Tertiary and Quaternary age sedimentary rocks composed primarily of sandstone, siltstone and shale. Minor tuff, claystone and partially to completely serpentinized ultramafic rock outcrop in the basin in smaller amounts (NHC 2001). As shown in Figure 2-1, two major faults cross the lower and upper extents of the watershed. The Hayward Fault zone trends across the base of the Los Buellis Hills and the Calaveras Fault passes along the upper watershed boundary. These two major faults and numerous minor faults cross the Berryessa Creek watershed in northwest to southeast direction.

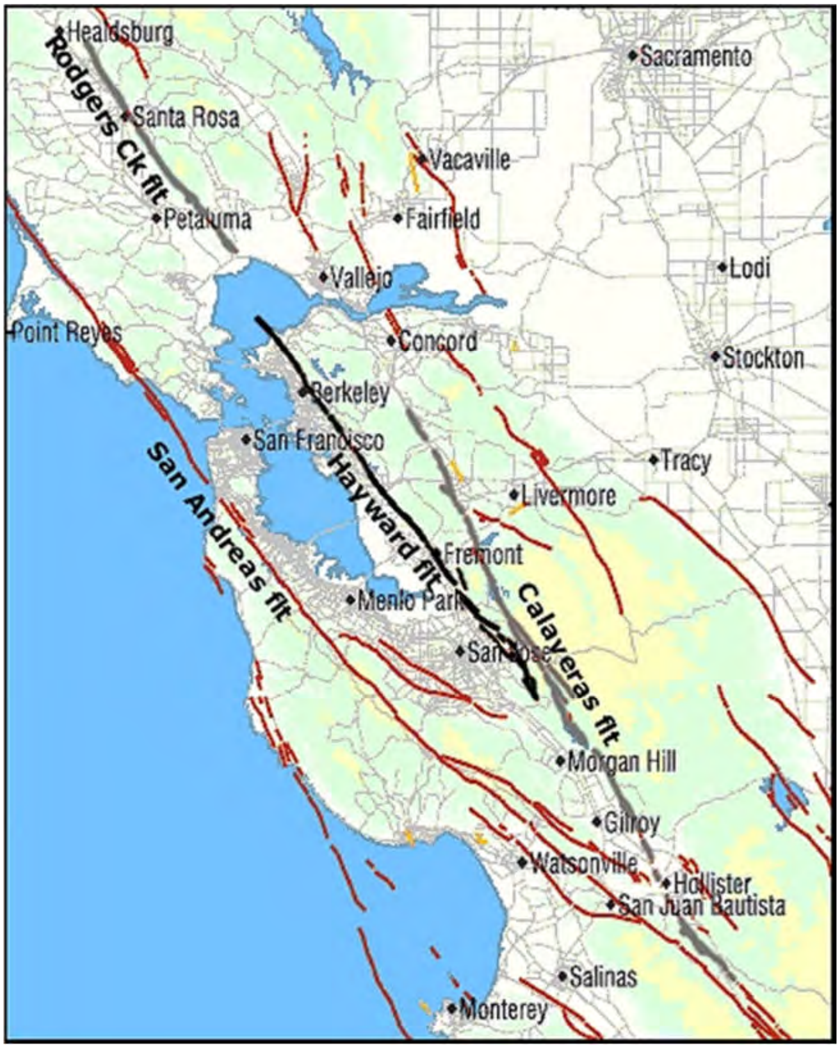

Figure 2-1 Bay Area Fault Zones (Source: USGS)

An important feature of the watershed occurs in the Hayward Fault zone, an area referred to in the previous reports as the “canyon” reach, extending from about 1,000 to 4,000 feet upstream of Old Piedmont Road. Underlying bedrock in this reach is composed of poorly consolidated, highly fractured Tertiary age rocks that contain swelling clays (NHC 2001). This is a high sediment production zone with erosive soils, large sediment supply from landslides, and a steep channel section capable of transporting large quantities of sediment. This is the only reach observed during the Tetra Tech watershed reconnaissance that had evidence of debris flows and transport of large boulders, several feet in diameter and larger. It also contained the only adjacent watershed area that was observed to have numerous active landslides scarps. The GDM (USACE 1993) supports this statement, indicating, “Upstream of the canyon zone, the ravines in Berryessa Creek and its larger tributaries are well treed and appear to be relatively stable.”

Soils in the upland portion of Berryessa Creek are said to be of two types: clay loams on the relatively gentle slopes, and coarse rocky or gravelly soils on steeper slopes. Both types are derived from the underlying sedimentary rocks, the clay loams by weathering and vegetation, and the rocky soils by physical disintegration especially in the fault and shear zones (USACE 1993).

The geology of the alluvial fan in the Santa Clara Valley portion of the watershed is limited to Quaternary age, semi-consolidated alluvium near the base of the Los Buellis Hills with younger, unconsolidated alluvium further downslope. The alluvial sediments are largely fine grained, consisting primarily of moderate to poorly sorted fine sand, silt, and clay (NHC 2001). Borehole data from this lower portion of the creek, particularly downstream of I-680 show the creek to be underlain by large amounts of clayey soils.

In general, the Santa Clara Valley is underlain by some 1,000 to 1,500 feet of alternating estuarial and alluvial fan deposits of Quaternary age. The estuarial deposits were laid down under episodes of marine flooding and the alluvial fans during dryland episodes when the sea level was lowered during the major glaciations. The surficial materials in the valley are partly coarse alluvial fan deposits from stream channels, and partly fine materials derived from suspended load deposition during floods in areas between the stream channels (USACE 1993).

Within the project area, the streambanks are formed of fairly erosion-resistant material; the soils contain a large clay component primarily consisting of silty and sandy clay. Upstream of I-680, soils retain a significant clay component but exhibit more frequent clayey silt and clayey sand lenses with occasional gravels (NHC 2001). As a result, eroded sections of streambanks in this area are near vertical. Within the project area, bed material is somewhat variable due to the high level of channel alteration and the presence of numerous bridges and several other hydraulic structures. In general, the bed material is composed of sands and gravels. The average distribution for the entire urbanized reach upstream of Calaveras Boulevard, as presented in NHC (2003), is 28 percent sand, 69 percent gravel and 3 percent cobble with a median diameter of 5.5 mm (fine gravel).

The watershed upstream of Old Piedmont Ave. was broken into reaches with common characteristics based on field observations. Classification of these characteristics by reach allows for explanation of sediment transport-related trends and prediction of future erosion and deposition zones on a qualitative basis. The reach breakdown is shown in Figure 2.2 along with the locations of photographs presented below.

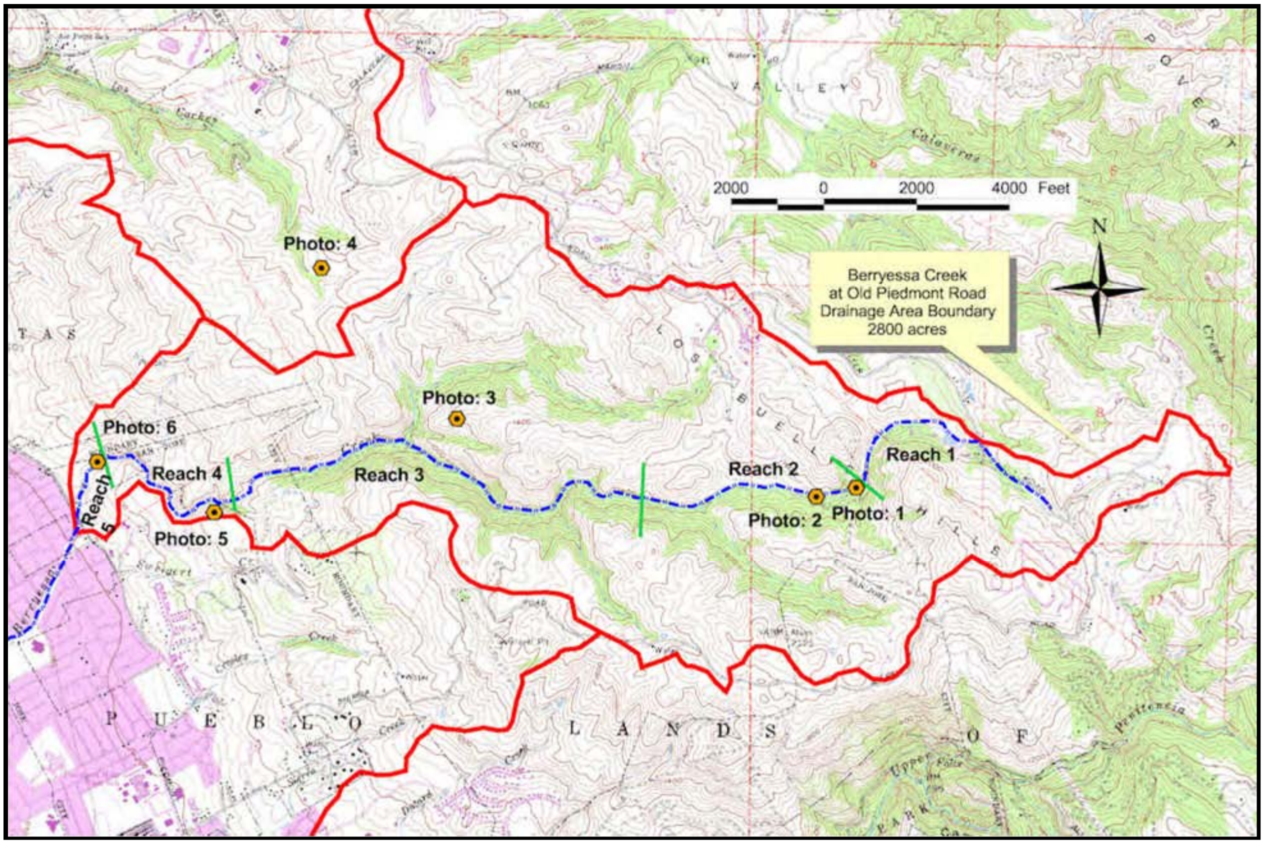

Figure 2-2 Upper Watershed Boundary, Reaches, and Photo Locations

2.1.2 Stream Profile

There is a distinct difference between the profile of Berryessa Creek in the uplands and on the alluvial fan within the Santa Clara Valley. Figure 2-3 shows the profile for the entire length from the estuary downstream from the confluence with Coyote Creek, upstream to the headwaters. Within the valley reach, which includes the project area, the channel gradient averages less than 1 percent. In contrast, the upland reach averages over 6 percent.

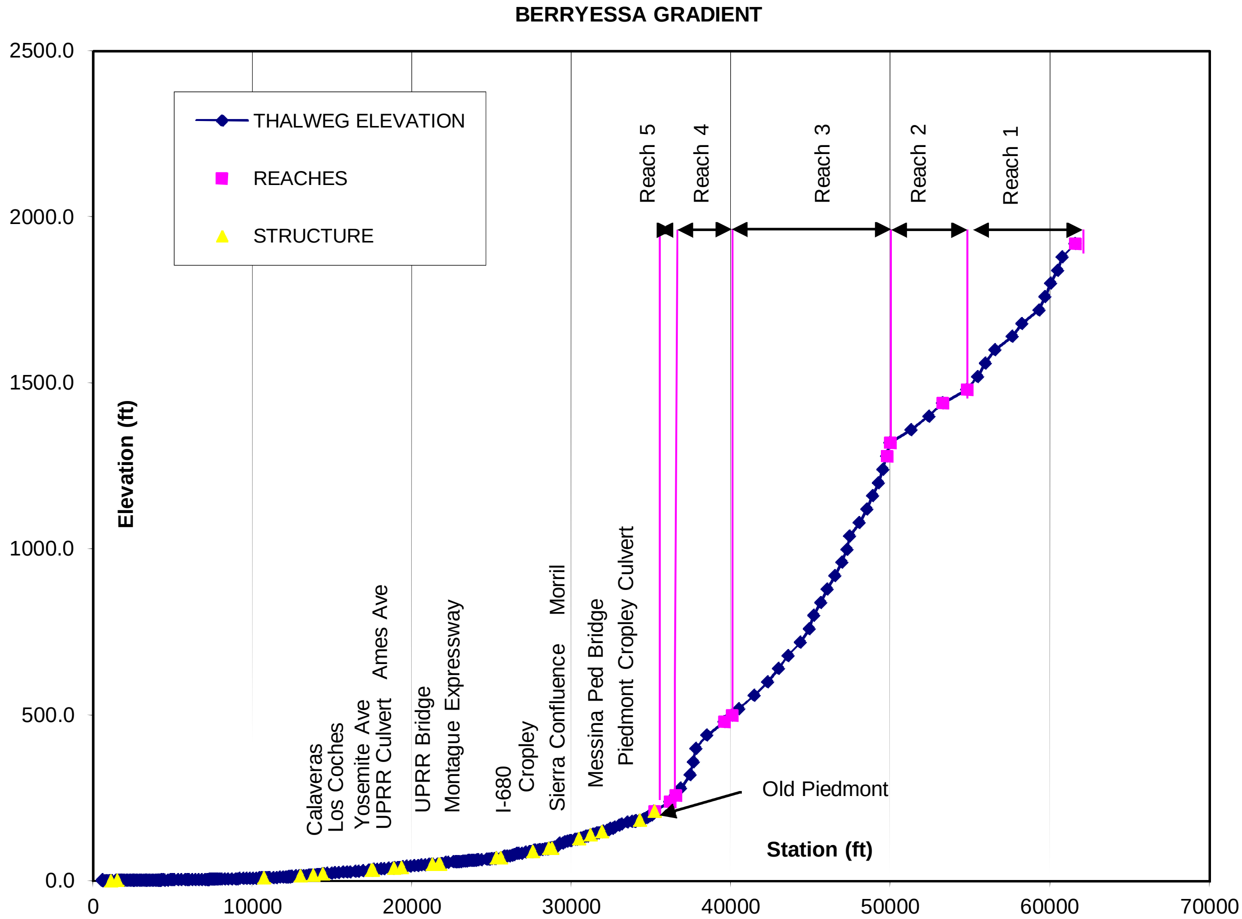

Figure 2-3 Berryessa Creek Profile from the Estuary to the Headwaters

Upstream of Calaveras Boulevard, the gradient follows the expected pattern of downstream reduction, with one exception. Starting at Old Piedmont Road, channel gradients are listed below:

Old Piedmont Road to Cropley Avenue	0.0271
Cropley Avenue to D/S of Piedmont Sediment Basin	0.0180
D/S of Sediment Basin to U/S of Sierra Cr. Drop	0.0156
Drop Structure to Cropley Avenue	0.0135
Cropley Avenue to I-680	0.0106
I-680 to Montague Expressway	0.0035
Montague Expressway to Calaveras Boulevard	0.0049

The channel leaves the uplands at a gradient of about 3 percent and gradually reduces to a slope on the order of 1 percent at I-680. However, below I-680, the gradient abruptly decreases by a factor of 3 to 0.35 percent between I-680 and Montague Expressway. Below Montague, the slope increases to approximately 0.5 percent.

There are numerous bed controls throughout the project area. These are formed by bridges or box culverts with concrete bottoms, drop structures, and segments of channels lined with concrete. Figure 2-4 identifies locations along the profile that act as grade controls.

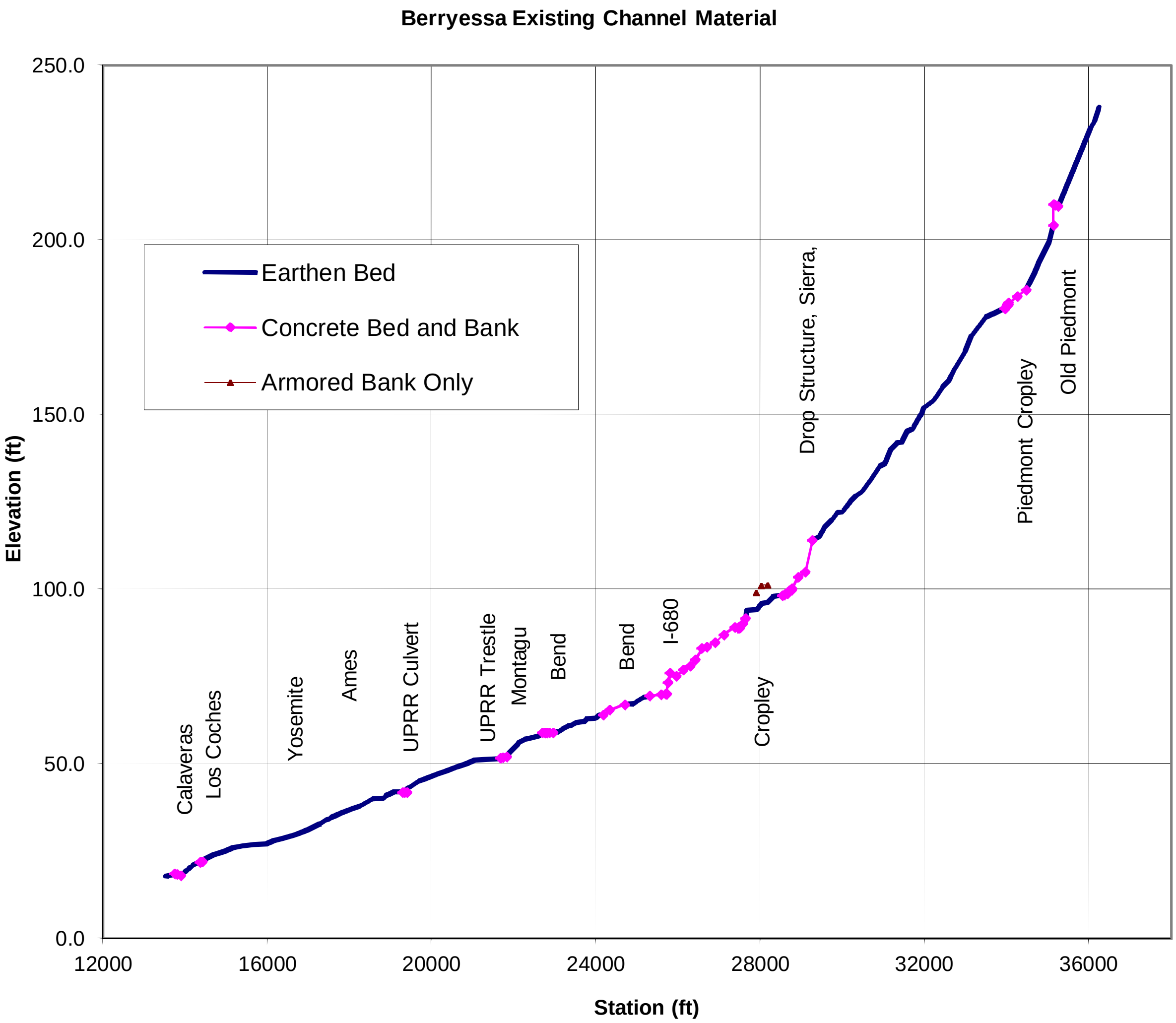

Figure 2-4 Location of Current Bed Controls along Berryessa Creek

The stream through the upper watershed was divided into five segments. Figure 2-5 provides a profile of the upland portion of Berryessa Creek. For the upper 1.3 miles, the gradient averages 6.5 percent. For about a mile, the gradient flattens to 3 percent. The gradient increases for the next two miles, averaging 8 percent with a gradual decrease in the downstream direction. The gradient then picks up as the stream crosses the Hayward Fault zone and passes through the "canyon" reach (Reach 4). The average gradient thought this segment is 8 percent with a portion of the stream near the center of the reach with a gradient of 15 percent. In the downstream 1,500 feet above Old Piedmont Road, Berryessa Creek transitions from the uplands to the alluvial fan with an average gradient of 4 percent.

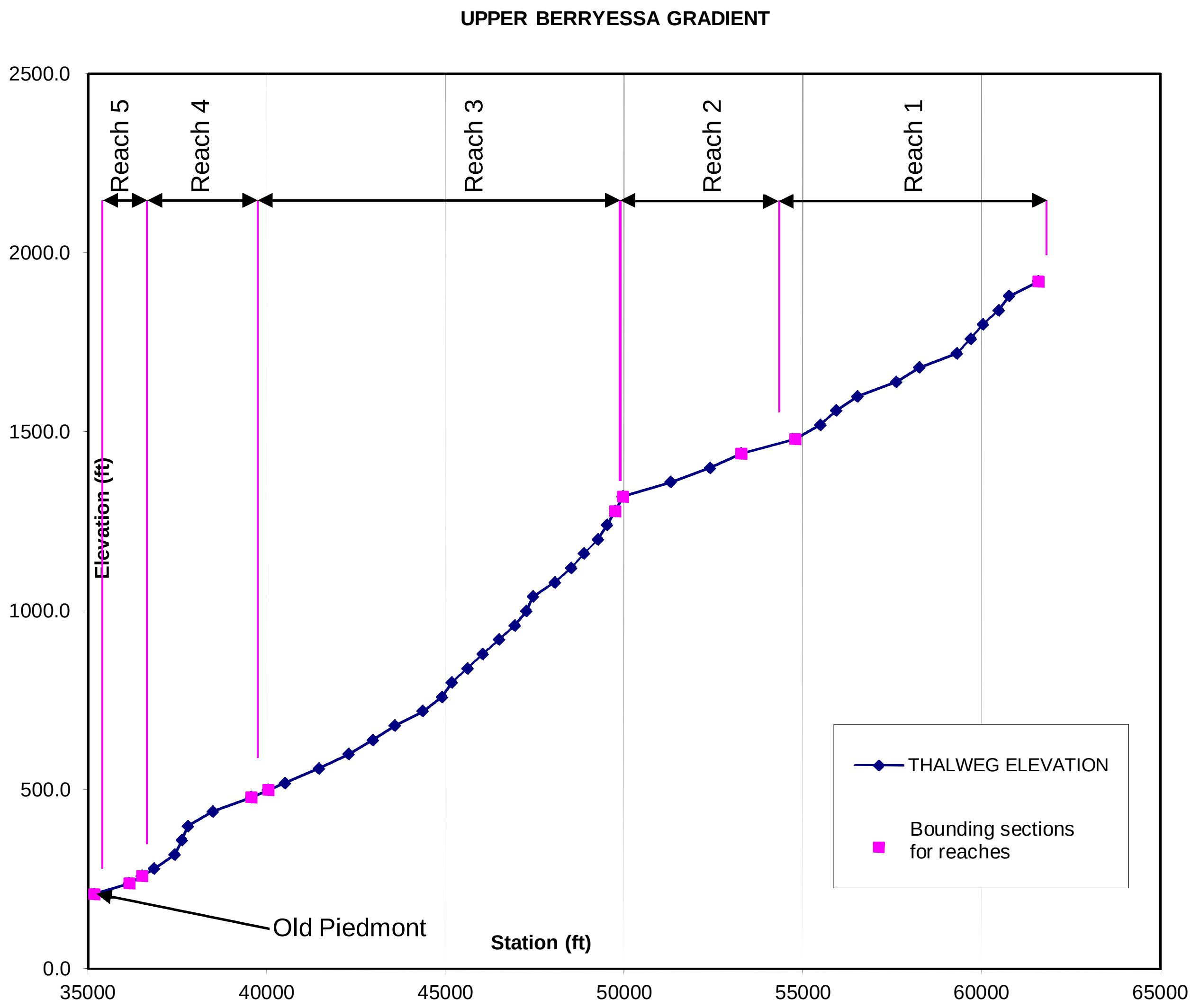

Figure 2-5 Berryessa Creek Profile from Old Piedmont Road to Headwaters

2.1.3 Channel Geometry

Within the project area, Berryessa Creek occupies a constructed channel that is heavily constrained by bridges, bank protection, channel lining and other constructed features. Thus channel dimensions are more a result of these influences as opposed to natural geomorphic processes. For description of the channel geometry, the project area was divided into eight reaches. During the analysis of the preliminary array of alternatives it was found that the portion of the project between Old Piedmont Road and I-680 was not justified and those portions of the project were removed from the final alternatives. Nevertheless, the six reaches between Old Piedmont Road and I-680 are described here to ensure continuity with the preliminary analysis completed prior to 2009. Descriptions of each reach are provided below. Additional details on channel cross sections can be found in the *Part I: Hydraulic Analysis of Alternatives* and *Part IV: Design and Cost of Alternatives* in this engineering appendix.

Calaveras Boulevard to Montague Expressway (Sta 138+03 to 217+38) – This reach is a straight, excavated earthen channel. It appears to have originally been excavated as a trapezoidal channel, but in some areas erosion and incision have resulted in the formation of steep, near vertical banks. The channel averages on the order of 10 to 12 feet in depth. The top width varies from a narrow 35 feet near the railroad trestle to on the order of 50 feet in other locations. The channel conveyance capacity ranges from 1,300 to 2,500 cfs.

Montague Expressway to I-680 (Sta 217+38 to 255+75) – This is another section of constructed trapezoidal earthen channel; with the exception that the channel bed and banks have been lined with concrete through the three 90 degree bends in this reach. The channel is approximately 40 feet wide with a depth of 7 to 8 feet. The conveyance capacity ranges from 800 to 1,500 cfs.

Upstream of the project area, the channel configuration and constraints vary significantly:

I-680 to Cropley Avenue (Sta 255+75 to 275+69) – This reach of Berryessa Creek is contained in a trapezoidal concrete channel with a top width on the order of 40 feet and a depth of 10 feet. These dimensions include the upper one to two feet of earthen material that continues to form channel sideslopes above the concrete. This segment of Berryessa Creek can contains approximately 2,800 cfs.

Cropley Avenue to Morrill Avenue (Sta 275+69 to 285+93) – This reach is a constructed trapezoidal, earthen channel with 2:1 sideslopes. The beds have been protected with concrete. The top width is on the order of 45 to 50 feet and the depth is typically 8 feet. The channel can contain flows up to approximately 1,500 cfs. The Cropley Avenue Bridge is a major constriction that creates a backwater upstream through much of the reach.

Morrill Avenue to Sierra Creek (Sta 285+93 to 292+00) – This reach is a combination of constructed channels. The downstream portion is a rectangular concrete channel with a 20 foot top width. The middle section is a trapezoidal channel with a gravel bed and banks protected by sacks filled with concrete. The top width is approximately 40 feet. The most upstream section is a drop structure that continues with banks protected by sacks filled with concrete, but has a concrete channel bottom. The top width of this segment is also approximately 40 feet. All three sections have depths on the order of 8 to 10 feet and contain flows up to approximately 1,500 cfs.

Sierra Creek to Piedmont Sediment Retention Basin (Sta 292+00 to 338+04) – This reach is referred to as the Greenbelt Reach. It contains the only section of channel that is not an excavated section constructed on an engineered alignment. The reach has only minor influences from bridges within its boundaries, with one pedestrian bridge crossing the channel without restricting it. The 20 to 30 foot wide channel varies from about 3 to 6 feet in depth. Portions of the channel have incised some, but banks remain stable due to vegetation and the silt and clay content which was reported to be roughly 50 percent (NHC 1990). Though the channel is free to meander within the 100 to 150 foot wide floodplain, the channel is fairly straight at a sinuosity of 1.06. The channel capacity is more representative of a natural stream section in this reach than in other reaches with a bankfull capacity of approximately 500 cfs. The treed floodplain, which in some areas has berms and fill to help contain floods, can convey on the order of 1,300 cfs before flows breakout. Two tributaries, Crosley Creek and Sweigert Creek, enter in this portion of Berryessa Creek.

Piedmont Road Sediment Basin to Cropley Avenue (Sta 338+04 to 344+67) – This reach is comprised of two features. The downstream 250 feet is a sediment basin and the upstream 410 is a 12-ft by 7-ft concrete box culvert. To form the sediment retention basin, the channel has been widened and the banks protected to create an area to slow velocities and reduce shear stresses in order to collect upstream sediments. The sediment is then removed with construction equipment from the basin. The channel widens to 80 feet in the basin and has a depth that varies from 9 feet at the upstream end to about 6 feet as the basin transitions to the Greenbelt Reach. Santa Clara Valley Water District (SCVWD) records indicate that on the average nearly 527 cubic yards of sediment (see Table 2-1) are removed from the Piedmont Sediment Basin per year. The 410 foot long culvert that passes beneath the intersection of Piedmont Road and Cropley Avenue experiences deposition of coarse bed load from the build-up of material in the sediment retention basin. The basin will convey flows on the order of 1,500 cfs, but the culvert capacity is limited to passing approximately 900 cfs. The culvert capacity is often further restricted by sediment deposition within the culvert that can reduce the capacity to approximately 600 cfs or less.

Cropley Avenue to Old Piedmont Road (Sta 344+67 to 351+70) – This is an incised channel section with a width of approximately 40 feet and a depth of 10 feet. The channel banks in this reach have considerable gravel and small cobbles, though there is sufficient finer material for cementation to hold the banks near vertical. The channel capacity is approximately 1,500 cfs.

2.1.4 Current and Historical Channel Planform

The channel planform in the project area has undergone large changes since the middle of the 19th century. These are discussed in detail by NHC (2001) and summarized in this section. Of importance to understanding of the current conditions and the influences on the development of the flood control project is a comparison of the historic and current conditions. Before development, Berryessa Creek and its major tributaries flowed onto the alluvial fan for several thousand feet before spreading into distributary channels or infiltrating to the point that they were no longer shown on maps. As development increased, the streams were channelized to provide flood control and to supply irrigation water. It is also indicated that subsidence in the Santa Clara Valley may have contributed to the down fan progression of the defined stream channels.

By 1943, maps indicate that Berryessa Creek joined Penitencia Creek about 2 miles upstream of their current confluence. Significant realignment occurred between 1953 and 1961 when the creek was realigned to flow northward. This realignment placed the channel within its general flow path from the current I-680 crossing to Penitencia Creek. As a result of this realignment, the channel gradient was reduced from close to1 percent to less than 0.5 percent. The prior west flowing alignment was directly down the fan gradient whereas the realignment flows across the fan. This is the reason for the abrupt reduction in gradient previously discussed for the reach mentioned from I-680 to the Montague Expressway. In 1976 the downstream-most portions of Berryessa Creek was realigned by the SCVWD as part of a flood control program. The current alignment from the fan apex to I-680 is close to that identified for 1943. The uppermost section of Berryessa Creek, from the apex to the middle of the Greenbelt Reach, is currently in the same general location as identified in 1899 maps.

2.1.5 Upper Watershed Site Inspection

An inspection of the Berryessa Creek watershed upstream of Old Piedmont Road was performed in August 2004. Participants in the field trip included representatives of the Sacramento District and Tetra Tech. The purpose of the field trip was to observe watershed and stream conditions that influenced sediment production and yield in order to develop potential strategies to reduce downstream sediment loading. More specifically the inspection was conducted to identify sediment sources, watershed processes controlling erosion and sedimentation, potential locations for sediment control facilities and the potential for land management activities to control sediment supply.

There were five distinct areas or zones observed in the stream and adjacent watershed. In the upper most 1.3 miles (Reach 1, upstream of the 1,480 foot contour), the creek is of moderately steep gradient averaging 6.5 percent and has a bed comprised of a wide range of material from gravels and cobbles to fines. The channel may be incised in some areas by several feet. There did not appear to be a high transport rate of the larger bed material (gravel and cobble) as there were few depositional bed features and there was a significant amount of finer material in the bed and heavy vegetation on the banks (Photo 2.1). On the hillsides, some minor gullying was observed where flow had been concentrated by roads or trails, but in the small gullies there were only a scattering of coarser materials so that it does not appear that this process is a significant source for coarser sediments in the upper portion of the watershed.

Photo 2.1 Typical Channel in Reach 1, Heavy Vegetation on Banks

The second segment of the channel (Reach 2) is relatively low gradient, particularly considering its location high in the watershed. This flatter section extends for approximately one mile at an average gradient of 3 percent, from the 1,480 foot contour on downstream to the 1,320 foot contour. Though the gradient flattens, the channel still has an incised appearance in areas. A significant depositional area of coarse material was not observed in this reach. This implies that the sediment production, of coarser materials is not high in the upper reach, otherwise the material would deposit in the area of reduced slope. The bed was comprised of sands and silts in portions of this reach, with only a scattering of angular gravels and cobbles (Photo 2.2). These larger materials may have fallen into the channel from the adjacent banks. In some areas where the bank material was exposed, there was a fairly heterogeneous matrix of material ranging from fines to small cobbles.

Photo 2.2 Typical Channel in Reach 2, Low Gradient

The third segment (Reach 3) of the upper channel starts as the stream gradient steepens and the channel becomes confined by steep hillsides. The bed material becomes dominated by gravels, cobbles and boulders with some bed rock outcroppings (Photo 2.3). The gradient was estimated at 8 percent for this reach which extends for approximately 2 miles to the 500 foot contour. Passage down the creek became difficult, so the inspection team walked along the hillside on the north side of the channel. At the several locations where the team returned to the creek bed, it was evident that the channel was capable of transporting materials up to boulders of over a foot in diameter. At several locations, bedrock was exposed in the channel and small falls were created. Though the watershed is very steep in this reach, the only landslides were observed near the downstream boundary of this reach. The south side of the valley wall is heavily forested while the north side is dominated by shrubs and grasses, except for a strip along the very bottom of the valley near the channel.

Photo 2.3 Typical Channel Section in Reach 3, Gradient of 8 Percent

Reach 4 begins where the stream enters what was referred to in previous reports (USACE 1993 and NHC 2001) as the canyon reach. The reach extends for approximately 0.6 miles at an average gradient of 8 percent with a short steep section of over 15 percent in the center of the reach. The most striking feature in this reach are a number of larger landslides that start hundreds of feet up on the hillside and continue down to the creek (Photo 2.4). These features are the largest concentrated sediment sources observed. The creek bed in this area is dominated by coarse material ranging from gravels and cobbles up to boulders on the order of 4 feet in diameter and greater. There is evidence that at times, the channel has transported debris torrents or flows. The formation comprising the surficial geology in this portion of the watershed is more susceptible to erosion and mass wasting than further upstream (Photo 2.5). This condition is further influenced by the Hayward Fault zone. The reduction in vegetative cover as elevation and rainfall decreases may also be a factor.

Photo 2.4 Mass Wasting Directly into Creek near Upstream Limits of Reach 4

Photo 2.5 Landslide Scarp on North Valley Wall in Reach 4 (Canyon Reach)

Reach 5 is a transition zone from the steeper upper watershed to the much flatter alluvial fan. The average gradient through this 0.3 mile reach is 4 percent. The channel bed in this reach is still comprised of material ranging from gravels to large boulders (Photo 2.6). Most or all of the larger boulders generated upstream appear to be deposited in this reach and do not cross Old Piedmont Road.

Photo 2.6 Typical Reach 5 Channel in Transition from Uplands to the Alluvial Fan

2.1.5.1 Implications of Watershed Inspection

Based on the observations during the site visit, control of sediments from the upper two segments (Reaches 1 and 2) of the watershed would have minor influence on delivery of coarse sediments (gravel and cobbles) to the reaches below Old Piedmont Road since it appears very little of this size material would make it through the flatter gradient of Reach 2. Sands and finer sediments may be produced in these areas, but their relative contribution would appear to be smaller than the portions of the watershed further downstream.

Based on the coarse bed material and steep gradient in Reach 3, a significant amount of gravel and cobble can be transported through this reach. However, no large point sources were identified. The team did not walk this portion of the creek bed so it could not be observed if there were large areas of bank erosion or contributions of sediments from point sources along the creek. This statement is based mainly on the lack of gullies crossed in walking along the north side of the valley wall and no visual identification of larger landslides on either the north or south valley wall. Construction of a sediment retention facility in this reach would be difficult due to the limited access and the small amount of storage volume per foot of structure height because of the steep channel gradient and steep confining valley walls.

Reach 4, the 0.6 mile length of the creek and associated watershed above Old Piedmont Road, appears to be the most significant area of sediment production. This is the area that several large point sources of sediment were identified, in the form of landslides in which feed directly into the creek. If a sediment retention or trap facility were to be constructed, it would appear that the best location would be in Reach 5 as the gradient decreases and the area adjacent to the channel increases. This area would control the large contribution of sediment from Reach 4. Lastly, this area has the best access for construction and maintenance.

In terms of land management, much of the upper watershed is grazed. There are a few residences, mainly along the watershed divide. The primary road serving the watershed travels near the watershed divide and in the majority of locations is in the adjacent watershed. There did not appear to be significant erosion problems created by any of these watershed disturbances. For example, there were no gullies observed as the result of concentration of flows from roadside drainage or from residential development. Likewise, there was no evidence of significant rilling or gullying occurring on the grazing lands or of trampling of streambanks by livestock. However, the influence of grazing was quite apparent with numerous trails contouring the hillsides and some locations with hillsides covered with hoof imprints left from the rainy season. Any control measures adopted to limit grazing activities along the channel banks would primarily reduce the fine sediment yield.

2.2 Summary of Sediment Transport Conditions

This section presents information on the current sediment transport conditions for the project area and upstream reaches that were presented in previous studies. The sediment removal history is also reviewed. The results of the hydraulic analysis for the with-project alternatives are utilized to qualitatively determine changes in sediment transport and removal requirements that would be induced by the project.

2.2.1 Previous Studies - Sediment Budget and Modeling

Previous analyses of the sediment budget (HMC 1990), geomorphology (NHC 2001) and sediment transport (NHC 2003) for the without-project condition of Berryessa Creek indicated two potential problems. The first was potential areas of deposition and the second was potential areas of degradation.

2.2.1.1 1990 Sediment Budget Analysis

An overall estimate of the sediment yield for Berryessa Creek was developed by NHC (1990). The results of this analysis indicated the following sediment yields:

Berryessa Creek at Old Piedmont Road	=	9,900 tons/year
Sweigert, Crosley, and Sierra Creeks	=	1,900 tons/year
Piedmont Creek	=	700 tons/year
Arroyo de los Coches	=	3,200 tons/year

The values provided for the tributaries are at their confluence with Berryessa Creek. The total yield is 15,700 tons/year. If a dry unit weight of 100 lbs/ft^3 is assumed for sediments, this represents 11,600 cubic yards per year.
The sediment budget performed by NHC (1990) estimated the mean annual inflowing sediment load at Calaveras Boulevard to be 9,200 tons/year or 6,800 cubic yards per year. This budget was based on deposition of 6,700 tons/year of sediment between Piedmont Road and Calaveras Boulevard. The study utilized a value of 5,000 cubic yards per year of sediment removal upstream of Calaveras Boulevard.

It should be noted that the 1990 study used a value of 23,800 cubic yards of sediment removed in 1983 between Sierra Creek and Calaveras Boulevard.

2.2.1.2 2001 Geomorphology Study

In 2001 NHC updated the 1990 sediment budget analysis (NHC 2001). One major change aside from the additional sediment removal data available was that the large value of 23,800 cubic yards of sediment removed in 1983 between Sierra Creek and Calaveras Boulevard was not included. If this large volume of removal is not included, the average annual rate for the 10-year period referenced in the 1990 Sediment Budget Analysis (NHC 1990) would be 2,620 cubic yards per year or 3,200 tons/year (NHC assumed 90 lbs/ft^3 for deposited sediments). This change in assumptions and additional sediment removal data resulted in the sediment budget resulting in 12,400 tons/year of sediment passing Calaveras Boulevard as opposed to the 9,200 tons/year as indicated in the 1990 study.

2.2.1.3 2003 Sediment Transport Modeling

In 2003 estimates of sediment yield and budget were developed by NHC based on an HEC-6T sediment transport analysis (NHC 2003). The sediment yield was computed by integrating the HEC-6T simulated bed material load yields for the single storm events to determine average annual yields utilizing the method described by Mussetter *et. al.* (1994). This resulted in an average annual bed material yield at Old Piedmont Road of 2,500 to 3,000 tons per year. The overall budget identified a total of 170 tons per year of net erosion from the reach, indicating this reach is currently slightly degradational. This minimal amount of degradation translates into an average of 0.05 inches per year if the total volume were to be spread out over the entire reach. The sediment budget presented in the 2003 report did not indicate it accounted for sediment removal that takes place at several locations throughout the reach. The budget also did not provide an indication of the simulated tributary inflows and how or if they were accounted for in the budget.

2.2.1.4 Analysis of Previous Studies

If the 9,900 tons per year average annual sediment yield at Old Piedmont Road computed in the 1990 Sediment Budget Analysis is assumed to be 35 percent bed material load (sand, gravel and cobble) and 65% wash load (silts and clays), the resulting average annual bed material supply at Old Piedmont Road is 3,500 tons. This is in fairly close agreement with the 2003 HEC-6T Sediment Transport Study which indicated an average annual upstream loading on the order of 2,500 tons per year. In terms of the sediment balance in the reach, the HEC-6T modeling by NHC indicated a slight degradational trend. However, the modeling did not appear to include the sediment removal in the analysis. Accounting for sediment removal increases the degradational trend by several thousand tons per year. An overall degradational trend is supported by comparisons of the 1968 and 1998 channel thalweg profiles in the 2001 Geomorphic Study (NHC 2001). Comparison of these profiles indicates that the 1998 profile is at or below the 1967 profile throughout the project area. Continued sediment removal prevents the areas of deposition from being revealed on the profile comparison.

Because of the highly manipulated nature of the Berryessa Creek channel within the project area, its ability to transport sediment varies widely. Though there are segments of considerable deposition that require sediment removal to maintain flood conveyance capacity, there are areas with higher sediment transport capacity that result in channel degradation. This is supported by the comparison of the 1967 and 1998 thalweg profiles presented by NHC in the 2001 Geomorphic Study. The 2003 HEC-6T sediment modeling results show similar behavior with a slight overall trend for degradation, but a mixture of aggradation and degradation scattered throughout the project area.

The 2003 HEC-6T model results indicated that the bed material load from a single 1% chance exceedance event would be on the order of 13,000 tons at Old Piedmont Road, which is on the order of four to five times the estimated average annual bed material loading. During a 1% chance exceedance event, the maximum predicted aggradation is over 4 feet at the Piedmont/Cropley culvert and over 2 feet just upstream of the Ames Avenue Railroad trestle. At all other locations the aggradation is on the order of one foot or less. The maximum predicted degradation is 2 feet in the Greenbelt Reach just downstream of the sediment basin and just over one foot about 500 to 1,000 feet upstream of Los Coches Street. Based on these results the modeling indicates a mixture of aggradation and degradational areas. Though the actual historic profiles indicate primarily equilibrium or degradational reaches, the model did not appear to account for the sediment removal in the aggradation areas. If all sediment deposits indicated by the model results are removed, the required sediment removal predicted by the HEC-6T model would be on the order of 3,700 cubic yards per year. A further discussion of actual sediment removal history is presented in the next section.

2.2.2 Sediment Removal History

The SCVWD performs removal of sediment on an as needed basis to maintain the conveyance capacity of Berryessa Creek throughout the project area and upstream reaches. The two concentrated areas of removal upstream of the project area are the sediment retention basin below Piedmont Road and the reach between the Sierra Creek confluence downstream to Cropley Avenue. Additionally, sediment is removed at various locations throughout the project area. Table 2-1 presents the reported maintenance records of sediment removal from five reaches within the Berryessa Creek channel. The sediment removal for the study area between Old Piedmont Road and I-680 is divided into two reaches, the sediment retention basin below Piedmont Road and the area from Sierra Creek to Cropley Avenue. The sediment removal for the study area downstream of I-680 is also subdivided into two areas; I-680 to Montague Expressway and Montague Expressway to Calaveras Boulevard. The final reporting reach downstream of Calaveras Blvd and is outside of the project area.

Based on 33-years of maintenance records from 1977 to 2011 the most concentrated area of sediment deposition in the study area is at the sediment retention basin below Piedmont Road. In this several hundred foot long reach, an estimated average annual removal of 527 cubic yards occurs. This is the highest removal at any location in the study area and also represents the shortest stream reach of all the removal areas. The next highest sediment removal area is Sierra Creek to Cropley Avenue. In this 1,600 foot long reach, the estimated average annual removal is 525 cubic yards. In the 3,600 foot long reach from I-680 to Montague Expressway, the level of sediment removal is slightly less than the two upstream sites at 430 cubic yards per year. The lowest annual sediment removal is found in the downstream-most reach in the study area, from Montague Expressway to Calaveras Boulevard, an annual average of 205 cubic yards is removed in its 7,700 foot length.

Table 2-1 Summary of SCVWD Sediment Removal Maintenance Records on Berryessa Creek (NHC 2001 and SCVWD)

Year	Removal in Deposition Areas (cu. yd.)					Total (cu. yd.)
	DS of Calaveras	Montague to Calaveras	I-680 to Montague	Cropley to Sierra Creek	Piedmont Sed. Basin	
1977	0	0	0	0	0	0
1978	0	0	0	0	0	0
1979	0	0	0	0	0	0
1980	0	0	0	0	0	0
1981	4,210	4,100	0	0	0	8,310
1982	23,510	0	2,890	0	0	26,400
1983	0	0	0	0	0	0
1984	19,500	0	0	0	0	19,500
1985	14,352	0	1,136	1,137	1,137	17,762
1986	460	1,320	0	3,260	900	5,940
1987	9,820	800	250	0	0	10,870
1988	0		0	10	2,724	2,734
1989	13,330	400	0	432	0	14,162
1990	10,520	0	0	0	0	10,520
1991	4,066	0	0	0	300	4,366
1992	0	0	0	0	0	0
1993	2,800	0	0	2,500	1,250	6,550
1994	0	0	0	0	0	0
1995	0	0	0	0	0	0
1996	0	0	0	0	5,600	5,600
1997	30,000	0	0	700	810	31,510
1998	0	0	0	3,850	1,000	4,850
1999	1,250	0	8,850	0	0	10,100
2000	0	0	0	0	1,300	1,300
2001	7,189	0	0	3,165	1,525	11,879
2002	0	0	0	0	0	0
2003	4,640	0	0	0	0	4,640
2004	7260	0	20	0	450	7,730
2005	0	0	0	0	0	0
2006	0	90	0	1,744	930	2,764
2007	6,320	67	500	0	0	6,887
2008	0	0	964	0	0	964
2009	0	0	0	0	0	0
2010	0	0	0	1,040	0	30,040
2011	34,000[1]	0	0	0	890	34890
Average Annual	5,521	199	417	509	537	7,179
Totals	193,227	6,777	14,610	17,838	18,816	251,268

Note: 1. Maintenance has been deferred for the reach downstream of Calaveras from 2008 to present pending reconstruction of the reach by SCVWD. The current estimate by the SCVWD Water Operation Staff of 34,000 cubic yards of sediment in this reach is used to account for this deferred maintenance. (SCVWD 2011a)

The sediment deposition basin below Piedmont Road was developed to collect sediment as the channel leaves the upstream watershed and flows onto the alluvial fan. At the Piedmont Road sedimentation basin, the channel gradient has been reduced and the width increased to form the basin. In the Sierra Creek to Cropley Avenue reach, a combination of drop structures, energy dissipaters and restrictive bridges, as well as the possibility of supply of additional sediments from the Greenbelt Reach and Sierra Creek, result in an area of concentrated deposition. Below I-680, the overall gradient dramatically decreases by a factor of 2 to 3 compared with the reach from Cropley Avenue to I-680. As a result of this gradient reduction, the reach is subject to aggradation in areas where the channel widens or flows are backwatered upstream of restrictive bridges.

The results of the 2003 Sediment Transport Modeling were compared to the maintenance records sediment removal results presented in Table 2-1. In order to compare the two analyses, the results for the SCVWD sediment removal reaches reported in Table 2-1 were developed from the 2003 HEC-6T modeling. Note that the reported HEC-6T model estimated volumes do not include some areas of lesser deposition not included in Table 2-1, resulting in the total estimated average annual deposition for the sediment removal reaches not equaling the 3,700 cubic yards per year reported for the study area in the previous section. The resulting average annual sediment removal volumes for the SCVWD sediment removal reaches predicted in the HEC-6T model are listed in Table 2-2.

Table 2-2 Comparison of SCVWD Sediment Removal Records and NHC 2003 HEC-6T Sediment Transport Modeling

Sediment Removal Reach	Average Annual Sediment Removal Estimates (Cubic Yards per Year)		
	SCVWD Maintenance Records	2003 NHC HEC-6T Modeling	Percent Difference from SCVWD Records
Piedmont Sediment Basin	527	890	69%
Sierra Cr. to Cropley Avenue	525	390	-26%
I-680 to Montague Expressway	430	720	67%
Montague Expressway to Calaveras Boulevard	205	860	319%
TOTAL	**1,687**	**2,860**	**69%**

The 2003 Sediment Transport Modeling results reported in Table 2-2 are approximately 70 percent higher than those reported by SCVWD maintenance records for the total study area and of the two removal reaches. The only reach underestimated by the 2003 HEC-6T modeling in comparison to maintenance records is from Sierra Creek to Cropley Avenue where the HEC-6T results indicate 390 cubic yards and the maintenance records identify 525 cubic yards per year. In contrast, the HEC-6T model overestimates the required sediment removal in the Montague Expressway to Calaveras Boulevard reach by over 319%.

It should be noted that significant sediment deposition requiring removal occurs in the 8,500 foot reach from Calaveras Boulevard downstream to the Penitencia Creek confluence. This reach is tidally influenced and therefore sediment deposition is expected. In the GDM (USACE 1993), based on removal records from 1981 to 1990, the removal in this reach was equal to the total removal for all upstream reaches averaging 5,000 cubic yards per year.

Correspondence from the SCVWD indicated sediment removal operations has been performed downstream of Calaveras Boulevard eight times since 1990 with removal volumes ranging from 1,250 cubic yards in 1999 to 30,000 yards in 1997. In addition, recently sediment maintenance activity has been deferred for this reach because of pending reconstruction activity by SCVWD. To account for the sediment deposition in the reach from 2008 to present, the SCVWD Water Operation Staff has estimated that the volume of sediment that would have been removed for routine sediment operations in the reach is 29,000 cubic yards (SCVWD 2011a). The addition of the sediment removal activity since 1990 results in an average annual sediment removal of 4,683 cubic yards per year for Berryessa Creek from the confluence of Penitencia Creek to Calaveras Boulevard.

In evaluating the influence of with-project alternatives, consideration must be given to the portion of Berryessa Creek downstream of the project limits. Two important aspects of the sediment balance need to be incorporated into the overall project evaluation. First, if additional sediment is generated from bank erosion or bed degradation in the project area, if it is not deposited in the project area, most of the sediment would be deposited in the reach below Calaveras Boulevard. Second, any reduction in maintenance requirements that results from increasing sediment transport capacity within the project area will pass sediment through the project area, but will result in increased deposition in the reach below Calaveras Boulevard.

CHAPTER 3: WITH-PROJECT CONDITIONS

This chapter applies the information from the existing conditions assessment of geomorphology and sediment transport investigations to identify design considerations and issues to be addressed in the with-project alternatives. Results of the hydraulic analysis of the without and with-project alternatives are compared to qualitatively identify potential channel responses. The information is applied to identify recommendations as to potential modifications or refinements of the with-project alternatives. Sediment management features between Old Piedmont Road and I-680 are not part of the current project but are under consideration by others. These features are included herein for discussion purposes as the sediment supply through the upstream reaches affects the configuration of sediment management features in Alternatives 2A/d, 2B/d and 4B/d downstream of I-680.

3.1 Design Issues and Considerations

The following section identifies the issues or considerations, and then provides recommendations as to how they may be addressed in the alternatives. The general categories of issues to address are:

- Management of coarse sediment
- Minimize aggradation and degradation
- Provide opportunities for environmental enhancement

3.1.1 Management of Coarse Sediment

The Berryessa Creek Project Area extends from I-680 to Calaveras Boulevard and lies within an alluvial fan. Alluvial fans are created by sediment deposition as streams carrying large sediment loads exit the steep confined channel of the uplands and meet the lower gradient unconfined valley. As a result, sediment deposition is an inevitable process on an alluvial fan and any channel improvements must recognize this behavior. On the Berryessa Creek fan, at some point, between the apex of the fan and the Bay, all but the finest sediments will be deposited. Since the gradient decreases in the downstream direction along the fan, and the ability to transport sediment decreases along with it, the larger sediments are deposited furthest upstream.

Deposition in the project area currently requires on the order of 1,046 cubic yards per year of sediment between Old Piedmont Road and I-680 and 616 cubic yards per year of sediment downstream of I-680 be removed. Additional sediment deposits are also removed downstream of the project area. Even if a concrete channel that confined all the flow and maximized velocities and shear stresses were installed, though the coarse sediments would be conveyed further, they would either deposit in the lower gradient project area downstream of I-680 or in the tidally influence reach further downstream. Therefore at some point along Berryessa or Penitencia Creek, the sediments become a maintenance issue because removal is required to maintain flood conveyance capacity and prevent the eventual plugging of the channel. Coarse sediment management approaches to be considered include reducing the supply of sediment and promoting sediment deposition in areas that will not induce flood problems and are readily accessible to perform periodic sediment removal.

3.1.2 Reduction of Coarse Sediment Supply

Coarse sediment supply is generated primarily upstream of the project on the mainstem of Berryessa Creek and passes through the bridge at Old Piedmont Road. Additional quantities of sand and gravel are supplied by the larger tributaries and some sediment may be generated from channel degradation and bank erosion within the project area. Inspection of the upland watershed and information contained in past studies indicate that the majority of coarse sediment is generated in the lower steep canyon reaches (Reach 4) of Berryessa Creek as a result of mass wasting and erosion of the steep hillsides immediately adjacent to the creek. Because of the scale of these sources and the fact that they are a result of natural process and conditions, including the presence of active fault zones and unstable geologic formation, controlling the coarse sediment supply at its source is not practical.

Another option would be to create a sediment retention basin upstream of Old Piedmont Road in the transition zone from the steep canyon to the alluvial fan. This is the zone that the large boulders that may be transported in debris torrents and flows are deposited in. Additionally, smaller boulders and cobble are also deposited in this area. The 1989 Authorized Plan and 1993 GDM (USACE 1993) included a sediment basin at this location with a capacity of 17,000 cubic yards which exceeds the volume of sediments deposited in a 1% chance exceedance event (12,000 cubic yards) plus the average annual sediment deposition (3,000 cubic yards).

The difficulty with such a large basin is that it would trap nearly all of the sediments from sand size and larger. This would result in the “hungry water” released from the sediment basin picking up sediments further downstream which would result in bed and bank erosion. This would likely cause the channel through the Greenbelt Reach to become incised and less connected to its floodplain. In the case of the channel design presented in the 1993 GDM, a concrete channel would be installed downstream of Old Piedmont Road. The concrete channel would have prevented bed degradation and bank erosion. However, with the “natural” channel bottom being proposed in the current with-project alternatives, the bed would be subject to degradation. Thus installation of a large sediment basin above Old Piedmont Road does not appear to be compatible with the implementation of a project with an alluvial bed. Given the limitations of a sediment basin at this location, a debris trap is considered as a possible future refinement of the GDM design. For the purposes of this study, the sediment basin upstream of Old Piedmont Road was analyzed as designed in the 1993 GDM since this was a component of the Authorized Project which needs to be analyzed as designed.

3.1.3 Debris Torrents and Flows

Based on site observations and past reports (USACE 1993 and NHC 2001), the potential for transport of large boulders in the form of debris torrents and flows exists. It appears that this material is transported almost as far as the Old Piedmont Road crossing and could cause problems with the culvert. To reduce the possibility of plugging the culvert, which could result in the flows breaking out of the channel, an installation of a debris fence or other permeable structure designed to strain debris flows will be investigated upstream of Old Piedmont Road during the next phase (design of the selected plan) of the GRR. Such a structure would catch the larger material but allow passage of the majority of cobble and finer material. The structure would have little influence on normal flows. By only catching the larger material and debris, the volume of storage behind the structure is much smaller than for a sediment basin. Additionally, since it passes the majority of the sediment load, it does not have the potential to induce channel degradation downstream. The structure will need access for removal of trapped material; however, removal will only need to be performed after large events that mobilize boulders. The inclusion of the debris fence would not affect plan selection.

3.1.4 Coarse Sediment Management within the Project

Currently, coarse sediment is managed in the project by periodic removal of deposits. In most cases, sediment is removed from locations within the project area on an as-needed basis. The sediment retention basin upstream of the project area at Piedmont Road has been designed to facilitate sediment removal. This basin collects bed material load by providing a wide area with reduced flow velocity and shear stress. The capacity of the basin is on the order of 1,000 to 1,500 cubic yards. A significant problem with the basin is that once sediments start depositing in the basin, they quickly create a backwater that causes sediment to deposit in the 410 foot long culvert immediately upstream. This reduces the flood conveyance capacity of the culvert, which can result in flows breaking out upstream of the culvert at much lower return periods and increasing the frequency of flooding. In addition, it is extremely difficult to remove deposits from the culvert due to the limited workspace and clearance.

Several modifications should be considered for the basin to improve its performance. Potential modifications include regrading the basin to have a steep slope immediately downstream of the culvert outlet. This would provide sediment storage below the culvert invert and reduce the tendency for deposits to build up in the culvert. Additionally, the culvert invert could be altered to have a V-bottom. This would help concentrate flows and increase the transport capacity during low flows. Another potential option is to move the basin a short distance downstream so that there is some distance between the basin and the culvert outlet. The area between the two features should have a steep slope to prevent backup of deposits into the culvert. It is noted that increasing the storage volume of the basin may not be a good option. A significant increase in the volume would increase the trap efficiency which could induce channel degradation and incision in the Greenbelt Reach.

Accommodating the steep chute below the culvert or the shifting of the basin further downstream would require lowering the basin and possibly alteration of some of the channel in the Greenbelt Reach. Changes to the channel in the Greenbelt Reach should be analyzed carefully and kept to a level that does not create problems with the stability of this reach. Potential problems that would have to be mitigated would be reduced stability after disturbing the vegetation on the banks and increased flow confinement if the channel was lowered.

In addition to improvements to the Piedmont sediment retention basin, additional coarse sediment management might be provided by creation of locations that were designed to conduct sediment removal operations. This would involve providing access to the channel bottom and possibly altering channel hydraulics to encourage sediment deposition. Based on historical sediment removal, likely locations would be between the Sierra Creek confluence and Cropley Avenue crossing and between I-680 and Montague Expressway. Sediment transport modeling of these facilities would be necessary to ensure that they function properly and do not trap so much sediment that downstream degradation problems are created. Additionally, locations for the facilities should be determined after sediment transport modeling of the with-project condition since the channel alterations under the with-project condition may alter the locations most prone to sediment deposition.

A high-flow bypass culvert running beneath Cropley Avenue is being considered by the SCVWD to reduce flooding in the Greenbelt reach. Detail planning for the SCVWD bypass plan has not been completed at the time of this study. Approximate sediment management implications are presented in this report and will be added to future design reports. The bypass alternative was only considered for the design of Alternatives 2B/d and 4/d.

3.1.5 Minimize Channel Bed Aggradation and Degradation

Berryessa Creek has areas that experience aggradation and others that have experienced degradation. If not properly accounted for, alteration of the system for flood control has the potential to increase either or both of these processes at various locations within the project area.

3.1.5.1 Flow Confinement

Confinement of higher flows to a limited area by excavation of a larger channel or construction of levees increases shear stresses which can mobilize larger sediments and increase transport rates. As a result, the flows erode sediments from the bed to satisfy the increase in sediment transport capacity. These sediments may be deposited downstream when the flows reach a portion of the channel where the hydraulic conditions become less severe. Evaluation of the Berryessa Project alternatives needs to account for this potential since much of the project involves measures that increase the flow confined to a main channel.

Sediment transport analysis and modeling should be conducted to refine the design of the selected alternative to assess areas where this may be a problem. If such locations are identified, then the channel dimensions need to be modified to reduce the potential for degradation. If this cannot be done, while maintaining flood control objectives, then the inclusion of grade controls to limit future degradation should be considered.

3.1.5.2 Channel Widening

In some cases excavation of a wide channel to create sufficient cross-sectional area to pass the design flows can actually result in reducing sediment transport capacity for smaller events. Though very large floods pass a greater amount of sediment on a single event basis, smaller flows, owing to their greater frequency of occurrence, are typically responsible for the greatest portion of sediment transport over the long term. The flood responsible for the greatest portion of sediment transport is referred to as the dominant or formative discharge and often ranges between the 20- to 75% chance exceedance events. Therefore, a reduction in sediment transport capacity at the lower return period floods, by spreading across the wider channel bed, may off-set the increase in sediment transport capacity created by confining the larger floods to the enlarged channel. Depending on the magnitude of the changes, the two factors may offset creating a condition of dynamic equilibrium or the change may be so large as to shift the channel into an aggrading mode. In some widened channels, alternate bars may form during low flows that become vegetated and cannot be removed at higher flows in some reaches. Though the channel might have the capacity to transport the sediment stored in the bars, the vegetation in some reaches prevents them from becoming scoured and they may need to be removed as part of a maintenance program. Since portions of the Berryessa Creek channel are widened, this behavior is also a possibility.

Sediment transport analysis and modeling for the selected alternative should identify any areas where channel widening is causing excessive degradation. If such locations are identified, the design should determine whether the channel can be narrowed while still meeting flood control objectives. This may require increasing levee or floodwall heights. In the former case, additional right of way may be needed to accommodate the wider levee footprint. Additionally, the evaluation should consider whether the problem could be remedied by slope alteration or modification to downstream structures that constrict the flow and cause backwater into the area of concern.

3.1.5.3 Gradient Alteration

The current channel gradient varies dramatically from near 3 percent at the upstream end to below 0.5 percent at the downstream end. Though there is a strong trend for decreasing gradient in the downstream direction, there are localized areas where the gradient changes abruptly. This is partially due to the wide range of channel configurations currently found in the project area. At the current level of design, the proposed channel sections have been superimposed on the existing channel gradient. In the next level of design, the profile needs to be refined considering minimizing changes in sediment transport capacity that result from local variations in the gradient. Additionally, this exercise will likely have benefits to the providing the most efficient flood control design.

3.1.5.4 Structures

Numerous structures are located throughout the project area and upstream reaches, including 13 stream crossings and several energy dissipators. Some of the bridges create constrictions that result in backwater and induce sediment deposition upstream. It is believed that the modifications to these bridges to provide passage of floods should solve these problems, but sediment transport modeling should still be performed to substantiate this. Because of the channel alterations, the energy dissipation structures will be removed by others and will not be a factor under the with-project condition.

3.1.6 Provide Opportunities for Environmental Enhancement

Though the purpose of the project is flood control, environmental features have been identified as important aspects to local stakeholders. Therefore existing areas with higher environmental values should be preserved and in other areas it may be possible to increase the environmental values over current conditions. Channel morphology and sediment transport aspects of the channel design can play a role in preventing loss of existing high environmental value areas and to enchaining the environmental values in other areas. For example, the Greenbelt Reach upstream of the project area has environmental values that are not found in the project area. However, this is the reach that would likely be most susceptible to increase in changes in sediment supply. In other portions of the channel, creation of benches to provide at least limited floodplain can provide environmental enhancement. Also, the design of the channel influences the aquatic habitat. The most significant opportunities to provide environmental enhancement that relate to sediment transport, geomorphology and channel stability are listed below:

- Create a channel with an alluvial bed
- Utilize vegetation to the extent possible to provide bank stability
- Develop a main channel that conveys flows that are on the order of the 50% chance exceedance event
- Provide an area adjacent to the main channel that serves as a floodplain
- Promote growth of vegetation on the floodplain
- Avoid overly wide channels that spread flows very shallow

These opportunities have all been taken advantage of in alternatives 4B, with the extent of vegetation dependent on the further selection of vegetation types for the benches. Alternative 2B incorporates an alluvial channel and may incorporate some vegetation, but does not address the other environmental opportunities listed.

3.2 Qualitative Evaluation of Sediment Transport

This section presents a qualitative assessment of changes in sediment transport conditions and the potential changes in channel response based on comparisons of with- and without-project hydraulic conditions. The two hydraulic parameters chosen to perform the evaluation are velocity and shear stress. Sediment transport is sensitive to these parameters with sediment transport capacity typically increasing with velocity raised to a power of 3 to 5. Shear stress determines the sizes of bed material that can be mobilized. The qualitative evaluation of sediment transport is presented for the preliminary array of alternatives and for the final array of alternatives.

3.2.1 Preliminary Array of Alternatives

As described in Section 2.1 and Chapter 4 of *Part I: Hydraulic Analysis of Alternatives* of this engineering appendix, HEC-RAS models were developed to model the without-project condition and preliminary array of alternatives. To assess potential changes in sediment transport conditions within the project area, velocity and shear stress values from the original GRR methodology (see Section 2.1 of *Part I: Hydraulic Analysis of Alternatives* of this engineering appendix) HEC-RAS models were compared from reach to reach along the channel. The plots were reviewed for without-project baseline and the with-project alternatives. The velocity plots are presented in Figure 3-1 and Figure 3-2 for the 50% chance exceedance events and Figure 3-5 and Figure 3-6 for the 1% chance exceedance events. Similar shear stress versus project station plots are provided in Figure 3-3 and Figure 3-4 for the 50% chance exceedance events and Figure 3-8 for the 1% chance exceedance events. All figures have been separated into two plots (part 1 containing baseline, Alternatives 2A, 3A, and 3B and part 2 containing baseline, Alternative 4B and Alternative 5), plotted at the same scale, to facilitate easy comparison with baseline conditions. Results have been smoothed with running average values over two cross sections upstream and downstream of each station. Sections 2.1.2 and 4.3 of Part I: Hydraulic Analysis of Alternatives of this engineering appendix contains more comprehensive results for the original GRR methodology without-project and preliminary alternatives.

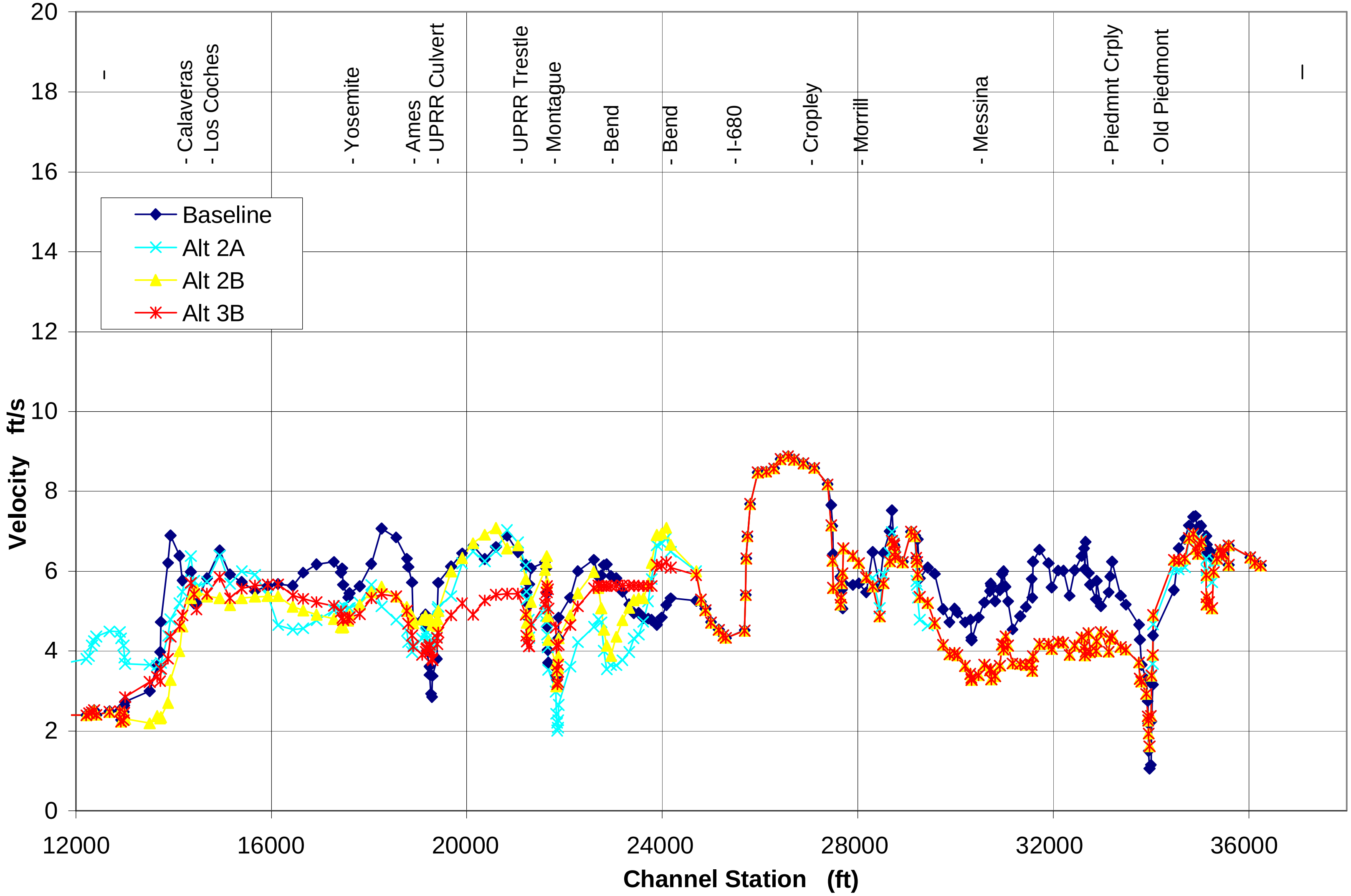

Figure 3-1 (Part 1 of 2) – Main Channel Velocity for Without- and With-Project Conditions, 50% Chance Exceedance Event

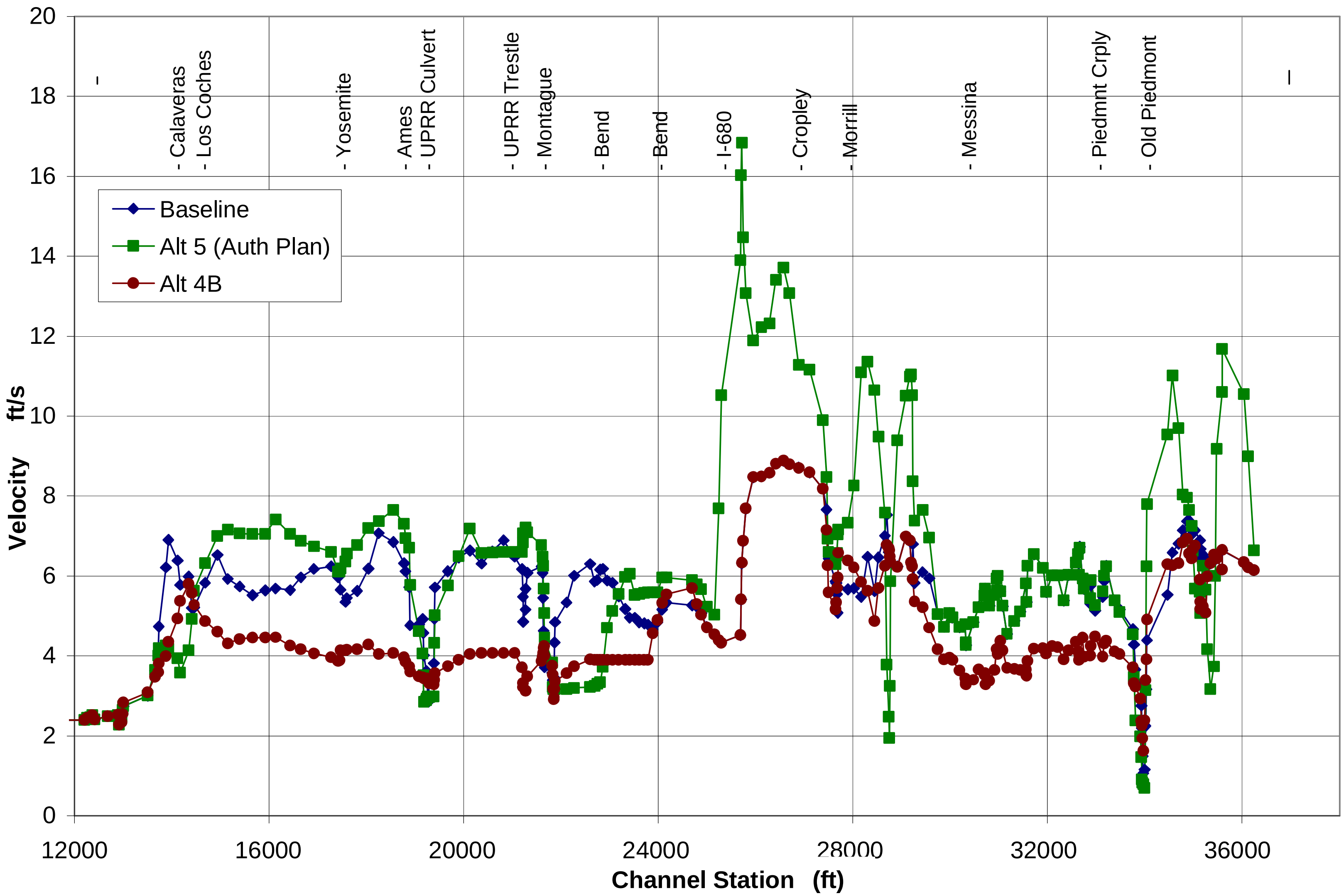

Figure 3-2 (Part 2 of 2) – Main Channel Velocity for Without- and With-Project Conditions, 50% Chance Exceedance Event

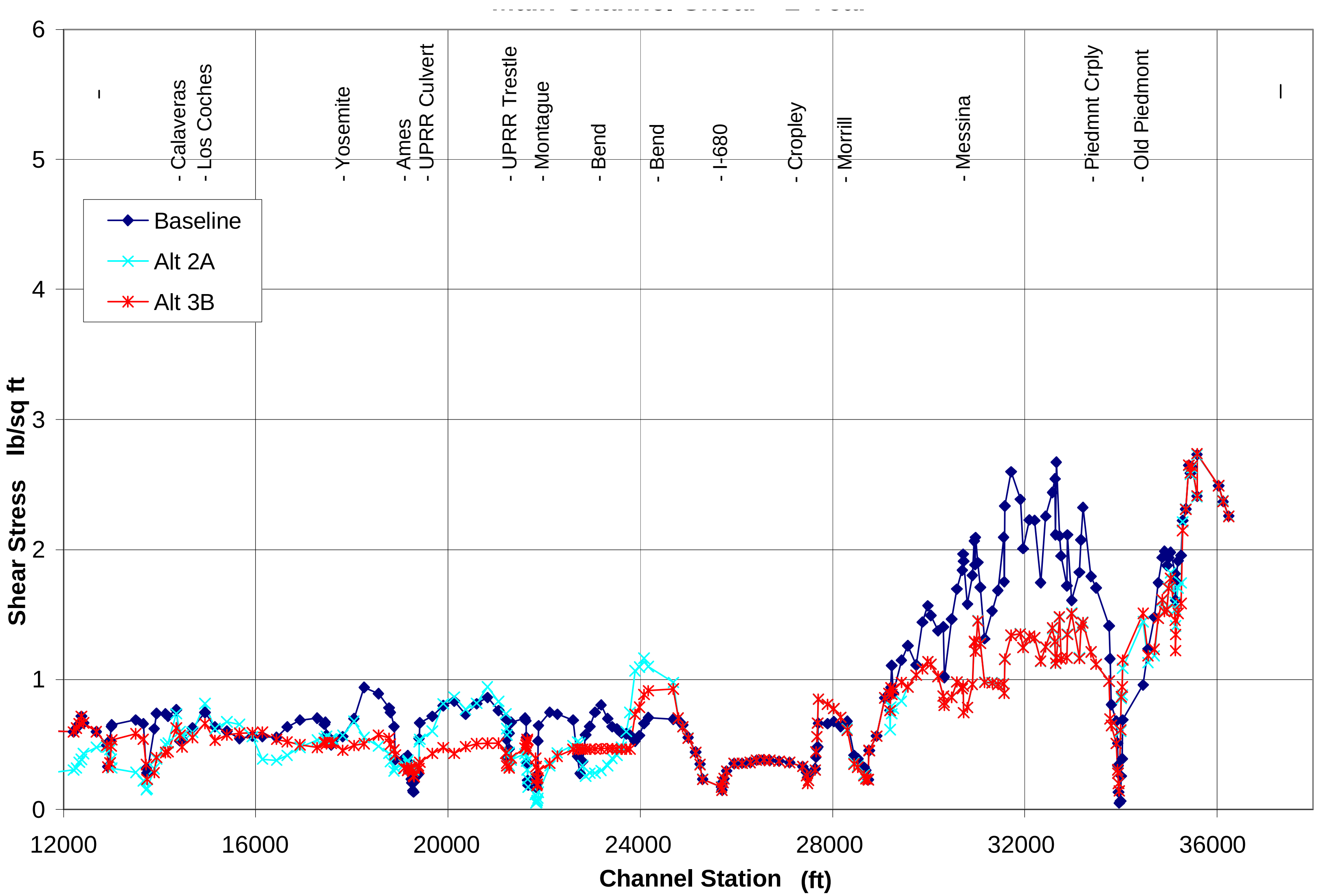

Figure 3-3 (Part 1 of 2) – Main Channel Shear Stress for Without- and With-Project Conditions, 50% Chance Exceedance Event

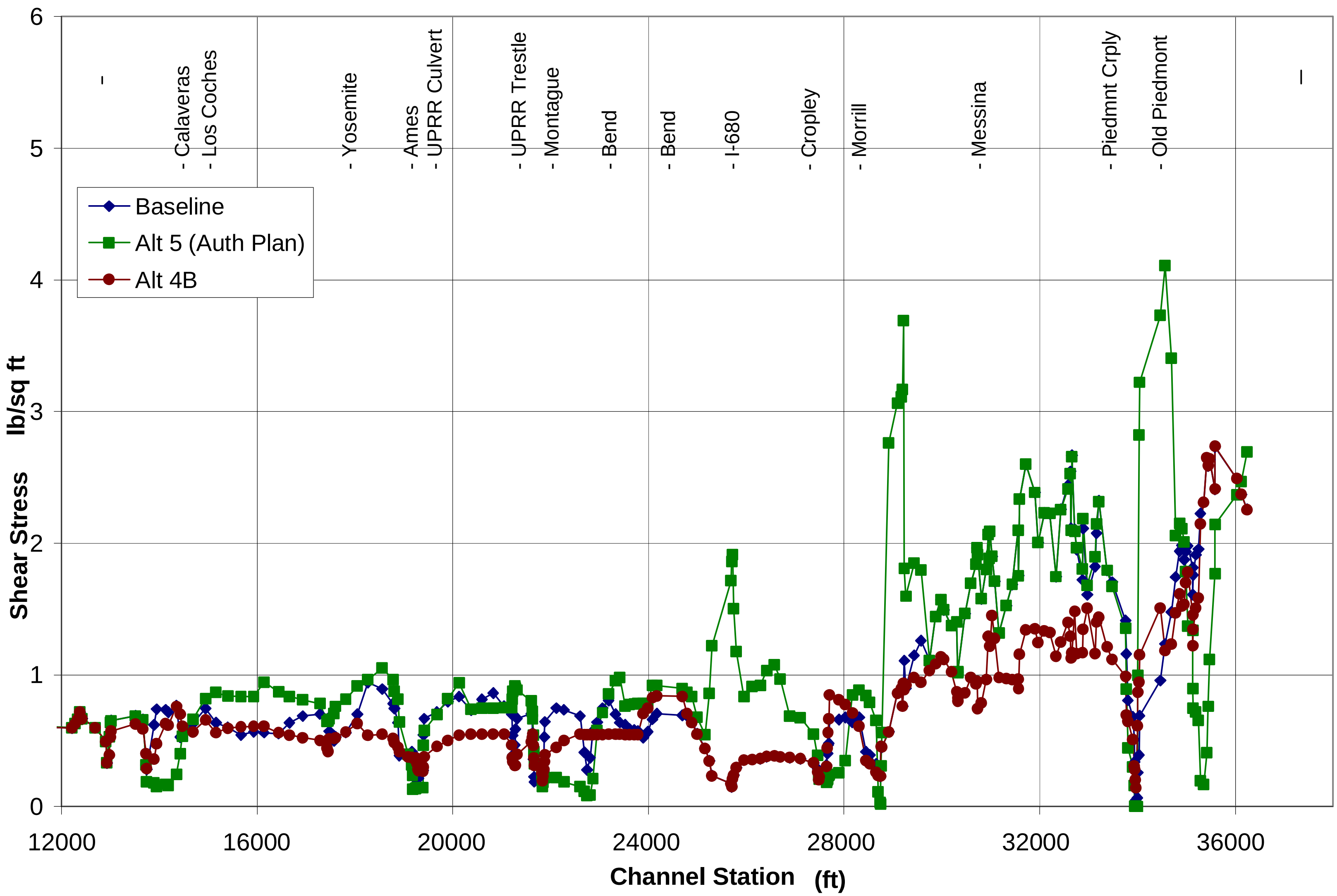

Figure 3-4 (Part 2 of 2) – Main Channel Shear Stress for Without- and With-Project Conditions, 50% Chance Exceedance Event

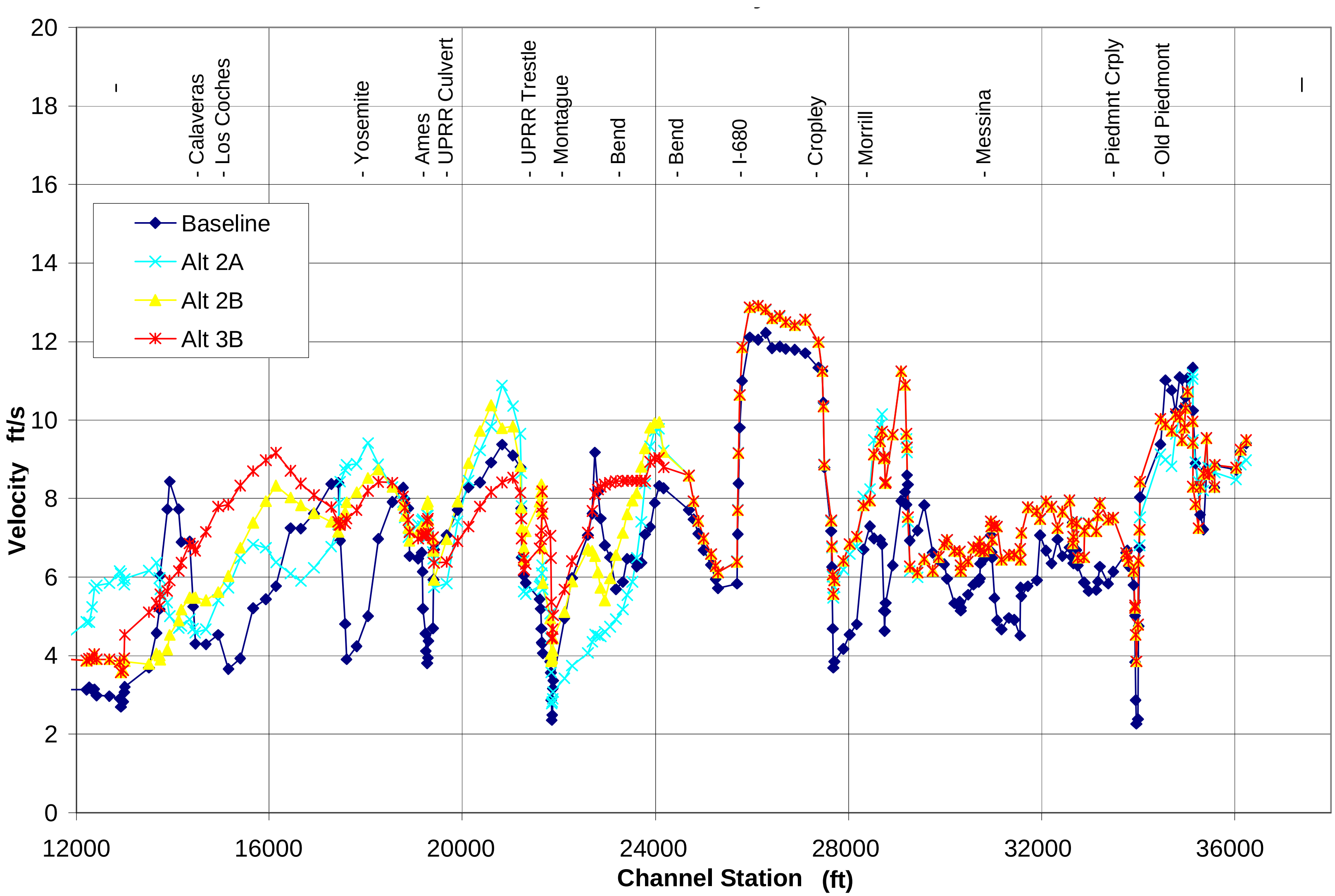

Figure 3-5 (Part 1 of 2) – Main Channel Velocity for Without- and With-Project Conditions, 1% Chance Exceedance Event

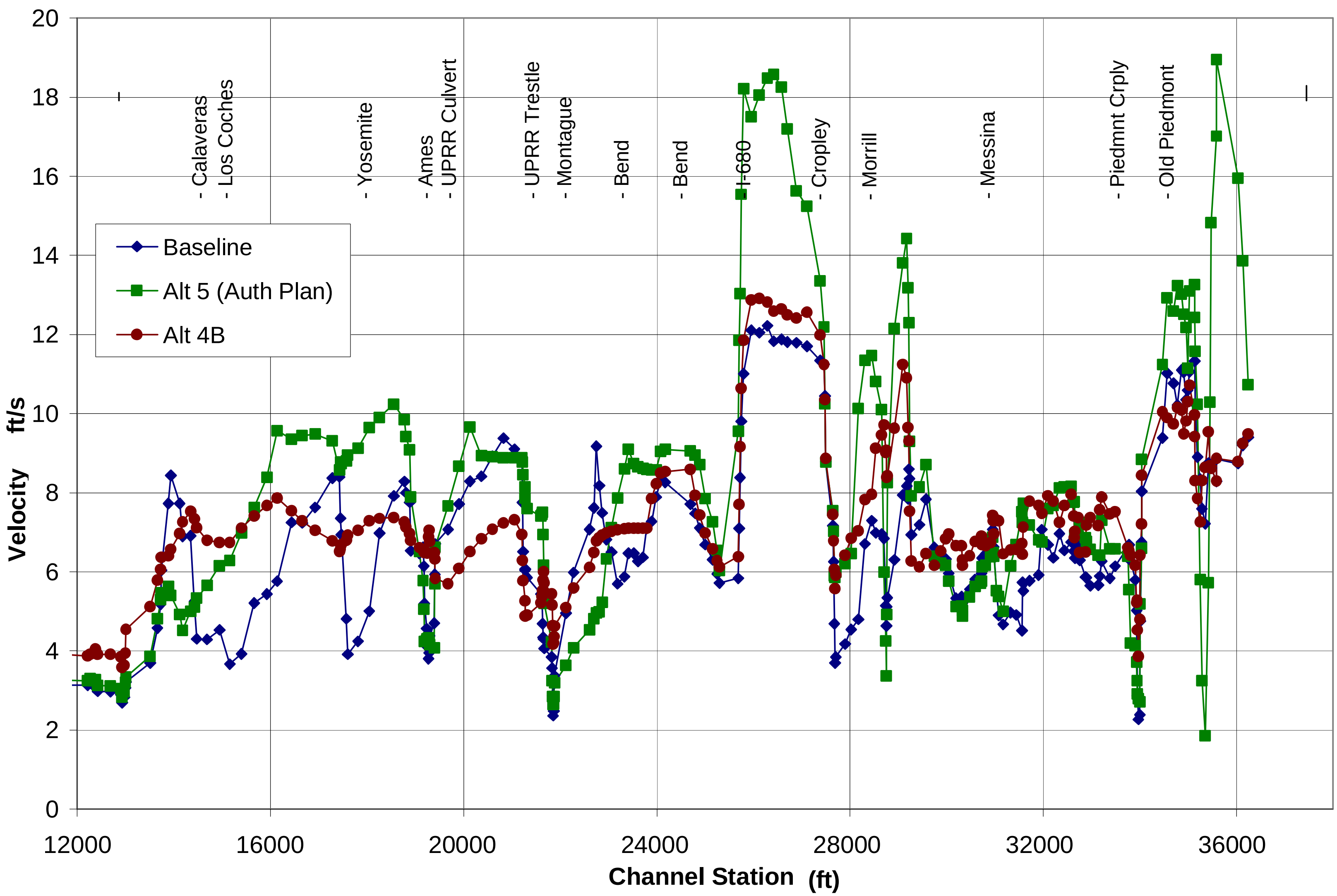

Figure 3-6 (Part 2 of 2) – Main Channel Velocity for Without- and With-Project Conditions, 1% Chance Exceedance Event

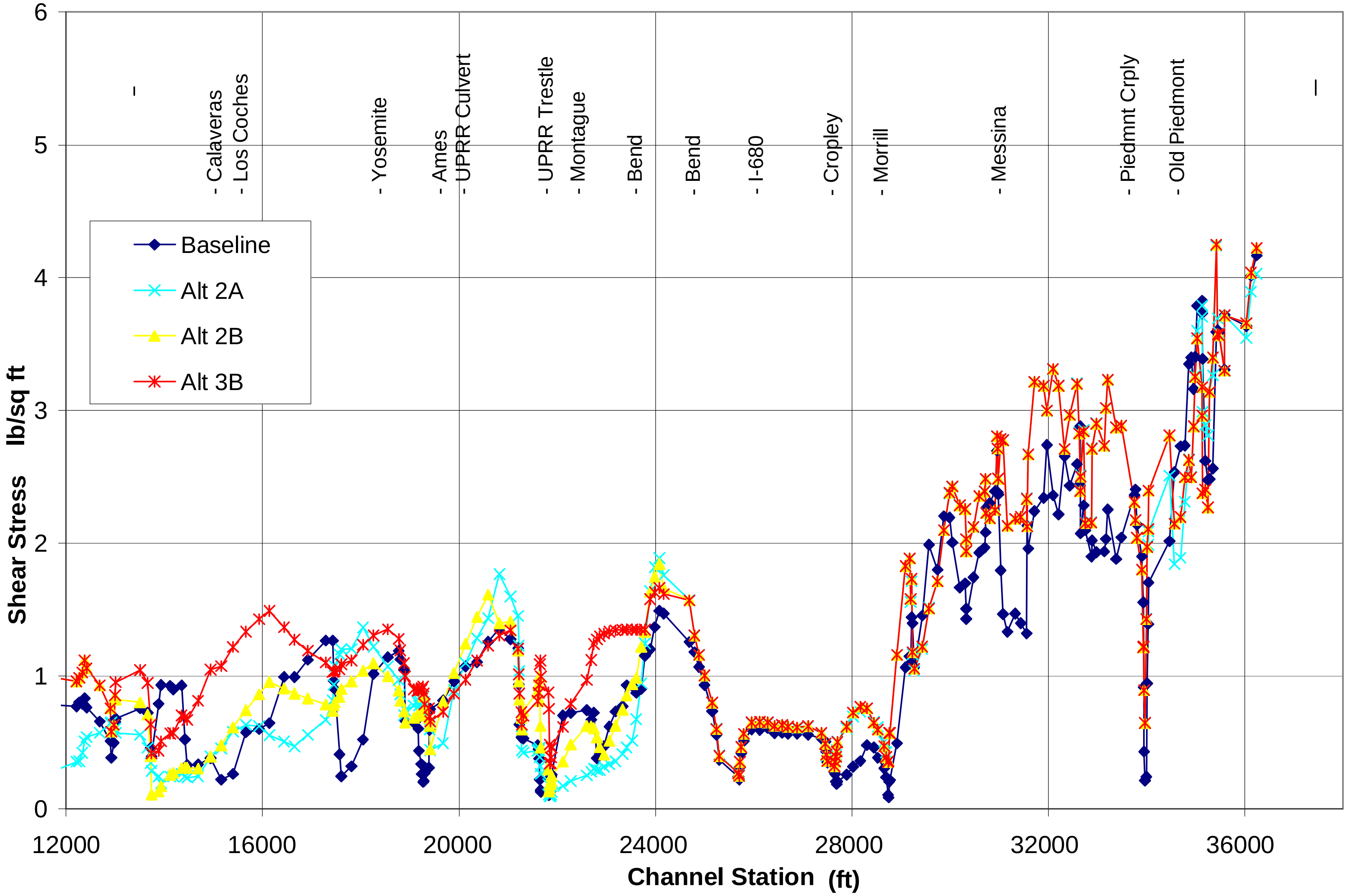

Figure 3-7 (Page 1 of 2) – Main Channel Shear Stress for Without- and With-Project Conditions, 1% Chance Exceedance Event

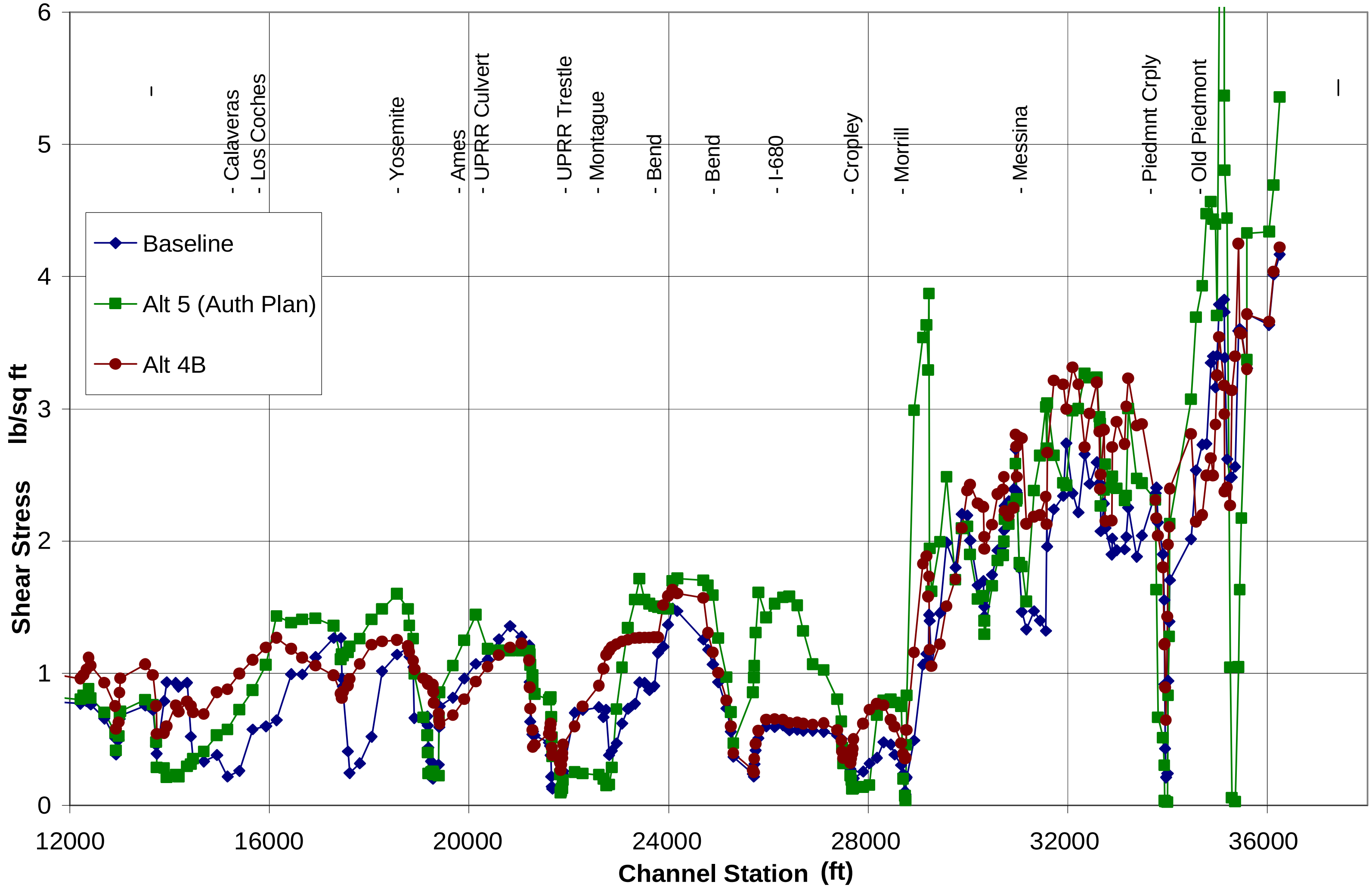

Figure 3-8 (Page 2 of 2) – Main Channel Shear Stress for Without- and With-Project Conditions, 1% Chance Exceedance Event

The values in both sets of plots are for the main channel since this is the portion of the flow that is responsible for nearly all the bed material load transport and it is the bed material load transport that determines the aggradation and degradation characteristics within the project area. Additionally, it is the sand and larger material that has been removed from the channel and sediment basin by past maintenance activities. The larger variation in shear stresses and velocities in the alternatives are related to the in-line detention basins, with backwater conditions behind and weir flow over the crest.

3.2.1.1 Comparison of 50% Chance Exceedance Event

The 50% chance exceedance event was used in the comparison because this event is considered to be approximately the channel forming flow, i.e. most representatives of typical conditions that determine the behavior of the channel over the long term.

Velocity

There is a general trend in reduction of the 50% chance exceedance event velocity for the with-project condition in the Calaveras Boulevard to Montague Expressway reach. Starting from the downstream end of the project, in the reach extending 500 feet upstream of Calaveras Boulevard, the velocities for all alternatives decrease by between 2 and 7 feet per second. The without-project velocity spikes at station 141+21 at 11 feet per second while the with-project velocities range from 3 to 7 feet per second. The largest decrease in this area is with Alternatives 2B and Alternative 5. For the rest of the distance up to Montague Expressway, the velocities for Alternatives 2A, 2B and 3B are similar to without-project condition, except where the velocity spikes (to almost 10 feet per second) downstream on the UPRR culvert; these higher values are eliminated for these with-project alternatives. A high velocity spike of nearly 9 feet per second is introduced in Alternative 2B immediately upstream of the UPRR culvert. The velocities for Alternative 4B are generally lower than the without-project condition in this reach, and the velocities for Alternative 5 are slightly higher than the without-project condition.

Upstream of I-680 to Morrill Avenue, the with-project conditions are extremely similar to the without for all alternatives except Alternative 5. Alternative 5 contains similar velocities to the without-project condition in some of this reach, but varies in particular in the vicinity of bridges due to differing conveyance capacity of the bridges and culverts in this alternative.

Upstream of Morrill Avenue to the upper extent of the Greenbelt area, the velocities of the without-project condition are generally higher than Alternative 2A, 2B, 3B and 4B, oscillating between roughly 3 and 8 feet per second. Many of the spikes are approximately 50 % higher than the values for these Alternatives (8 feet per second compared at 5 to 6 feet per second). Conversely, Alternative 5 has very similar velocities to the without-project condition in this reach, with the exception of two very high velocity spikes of 16 and 17 feet per second at stations 344+67 and 355+86 respectively.

Shear Stress

The comparison of shear stress for the 50% chance exceedance event show similar trends to the velocity comparison described previously. In the vicinity of Calaveras Boulevard, the shear stresses drop by 0.5 to 1 lbs/ft^2 for all with-project Alternatives. In the reach extending from Calaveras Boulevard up to I-680, shear stresses for all Alternatives are on average slightly lower than the without-project condition. Between I-680 and Morrill Avenue shear stresses of Alternatives 2A, 2B, 3B and 4B are identical to the with-project condition, typically 0.5 to 1 lbs/ft^2. From Morrill Avenue to the project upstream limit, shear stresses of the without-project condition oscillate considerably between 1 and 4 lbs/ft^2. Values for Alternatives 2A, 2B, 3B and 4B oscillate, generally between 1 and 2.5 lbs/ft^2. Alternative 5 differs significantly from the other with-project alternatives, due to the presence of in-line detention basins and the differing conveyance capacities of the bridges and culverts.

3.2.1.2 Comparison of 1% Chance Exceedance Event

The 1% chance exceedance event was used in the comparison because it is a large event that is typically utilized to represent the most severe conditions that the project is likely to experience during its design life. Though the 50% chance exceedance event indicates the general behavior of the project over a long period, the response during the 1% chance exceedance event can cause damages that can require significant maintenance or destroy project features.

Velocity

For the 1% chance exceedance event velocity, the velocity changes in the area of Calaveras Boulevard are more significant than for the 50% chance exceedance event. From 1,000 feet downstream to Calaveras Boulevard, they increase by about 1 foot per second for all with-project conditions, Alternative 2A showing a greater increase of up to 3 feet per second. At station 141+21, the without-project velocity spikes to 12 feet per second, whereas the velocities for the with-project alternatives are lower ranging from 5 and 8 feet per second. From upstream of Calaveras Boulevard to I-680, there is no clear trend between the with- and without-project conditions. Though the velocities are not the same, they all vary widely from about 4 feet per second to 12 feet per second, with similar averages through the reach but with significant differences at individual locations. Generally, velocities for the without-project condition spike and fall to a greater degree than for the with-project alternatives. Between the UPRR culvert and Trestle, Alternative 2A has two spikes over 12 feet per second, whereas Alternatives 2B, 3B, 4B and 5 are consistently between 8 to 10 feet per second. The baseline condition varies from 6 to 10 feet per second in this reach.

From Montague Expressway and upstream for 1,000 feet, the velocities drop by several feet per second for all alternatives, with Alternative 2A having the largest drop. The with-project conditions in this segment are the lowest in the entire project area, generally dropping to a maximum of 3 feet per second. Whereas the without-project condition has velocities of 3 to 4 feet per second only in the area of the Montague Expressway bridge, the with-project conditions velocities remain in the 3 to 4 feet per second range for approximately 1,000 feet upstream. This is not desirable, since the area already experiences sediment deposition.

Further upstream between stations 260+00 and 300+00 the velocities for Alternatives 2A, 2B, 3B and 4B are extremely similar to the without-project condition. In the vicinity of the I-680 crossing, velocities under all project scenarios drop to 5 feet per second, but upstream of this the velocities in all cases increase to 12 to 13 feet per second. Alternative 5 shows much larger velocity spikes, over 20 feet per second, in this reach. Between Old Piedmont Road and I-680 to the upstream project limit, velocities oscillate to a greater degree for all Alternatives and the without-project condition, with values ranging between 5 and 10 feet per second. Again, Alternative 5 is the exception with spikes near to the project upstream limit of over 25 feet per second.

Shear Stress

The comparison of shear stress for the 1% chance exceedance event show similar trends to the velocity comparison. The with- and without-project conditions shear stresses overall for the 1% chance exceedance event indicate a drop of around 1 lbs/ft^2 for the with-project conditions. Overall the drop is least for Alt 3B and most substantial for Alt 2B. Alternative 2A has a high spike in shear stress at two locations between the UPRR culvert and trestle greater than 2 lbs/ft^2. Similar to velocity, there is a significant drop in shear stress in the vicinity and upstream of Montague Expressway. Values drop below 0.2 lbs/ft^2 for all alternatives. Between station 240+00 and 280+00 the shear stresses for all Alternatives except Alternative 5 are identical to the without-project condition. Between Old Piedmont Road and I-680, the with- and without-project shear stresses oscillate considerably between 1 and 6 lbs/ft^2. This is true mostly for Alternative 5, except for two large spikes of 11 and 17 lbs/ft^2.

3.2.2 Final Array of Alternatives

As described in Section 2.2 and Chapter 5 of *Part I: Hydraulic Analysis of Alternatives* of this engineering appendix, unsteady HEC-RAS models were developed as part of this study to model the without-project and final array of project alternatives. To assess potential changes in sediment transport conditions within the project area, velocity and shear stress values from the revised GRR methodology (see Section 2.2 of *Part I: Hydraulic Analysis of Alternatives* of this engineering appendix) HEC-RAS models were compared from reach to reach along the channel. During the analysis of the preliminary array of alternatives it was found that the portion of the project between Old Piedmont Road and I-680 was not justified and those portions of the project were removed from the final alternatives. Therefore, the following figures show only the downstream of I-680 results. The trends apparent in the plots were reviewed for without-project and with-project alternatives. The velocity plots are presented along the project station line in Figure 3-9 and Figure 3-11 for the 50% and 1% chance exceedance events, respectively. Similar plots are provided in Figure 3-10 and Figure 3-12 for shear stress. Results have been smoothed with running average values over two cross sections upstream and downstream of each station. Sections 2.2.2 and 5.4 of *Part I: Hydraulic Analysis of Alternatives* of this engineering appendix contains more comprehensive results for the revised GRR methodology without-project and final array of alternatives.

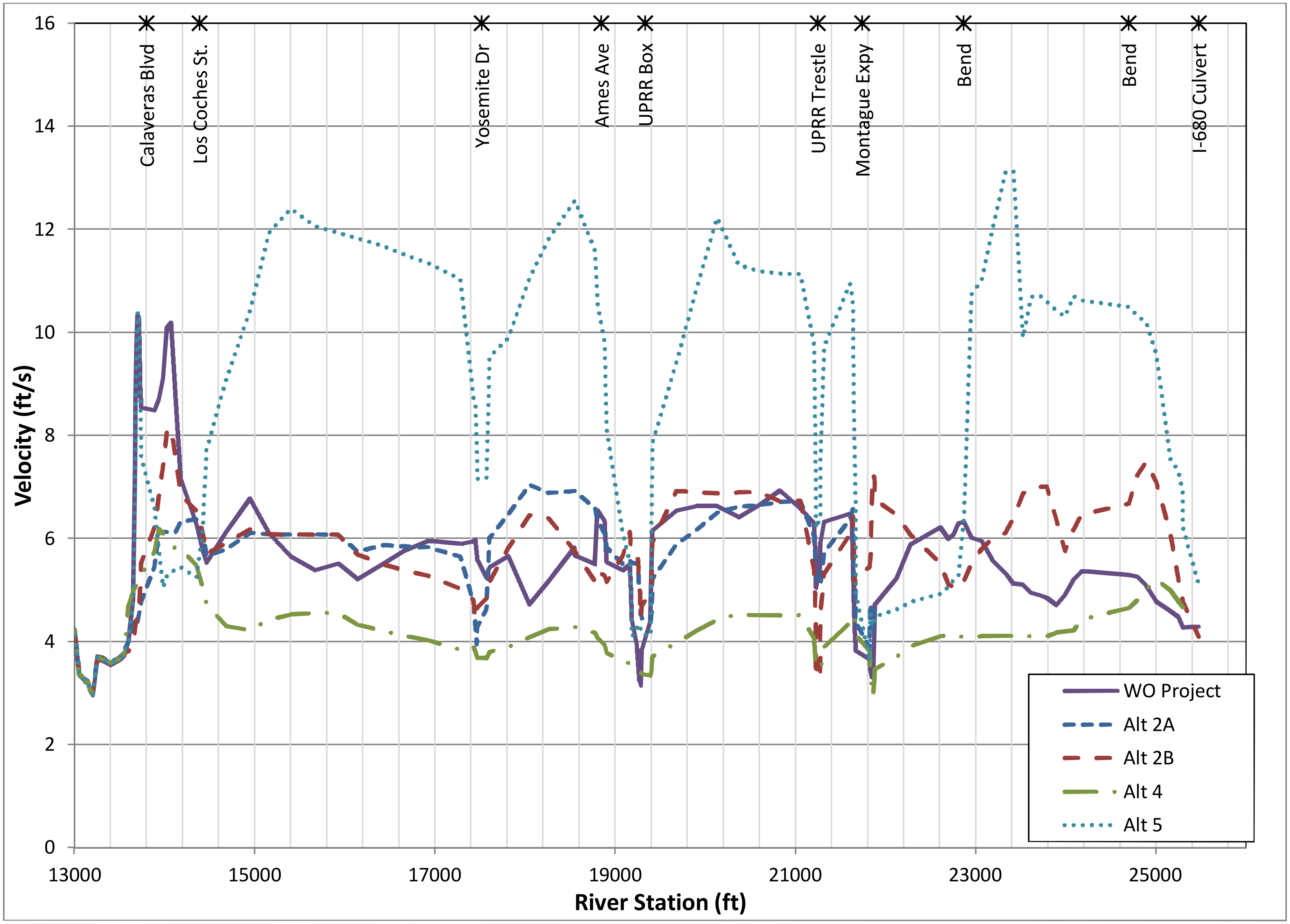

Figure 3-9 Main Channel Velocity Comparison of Without- and With-Project Conditions, 50% chance exceedance Event

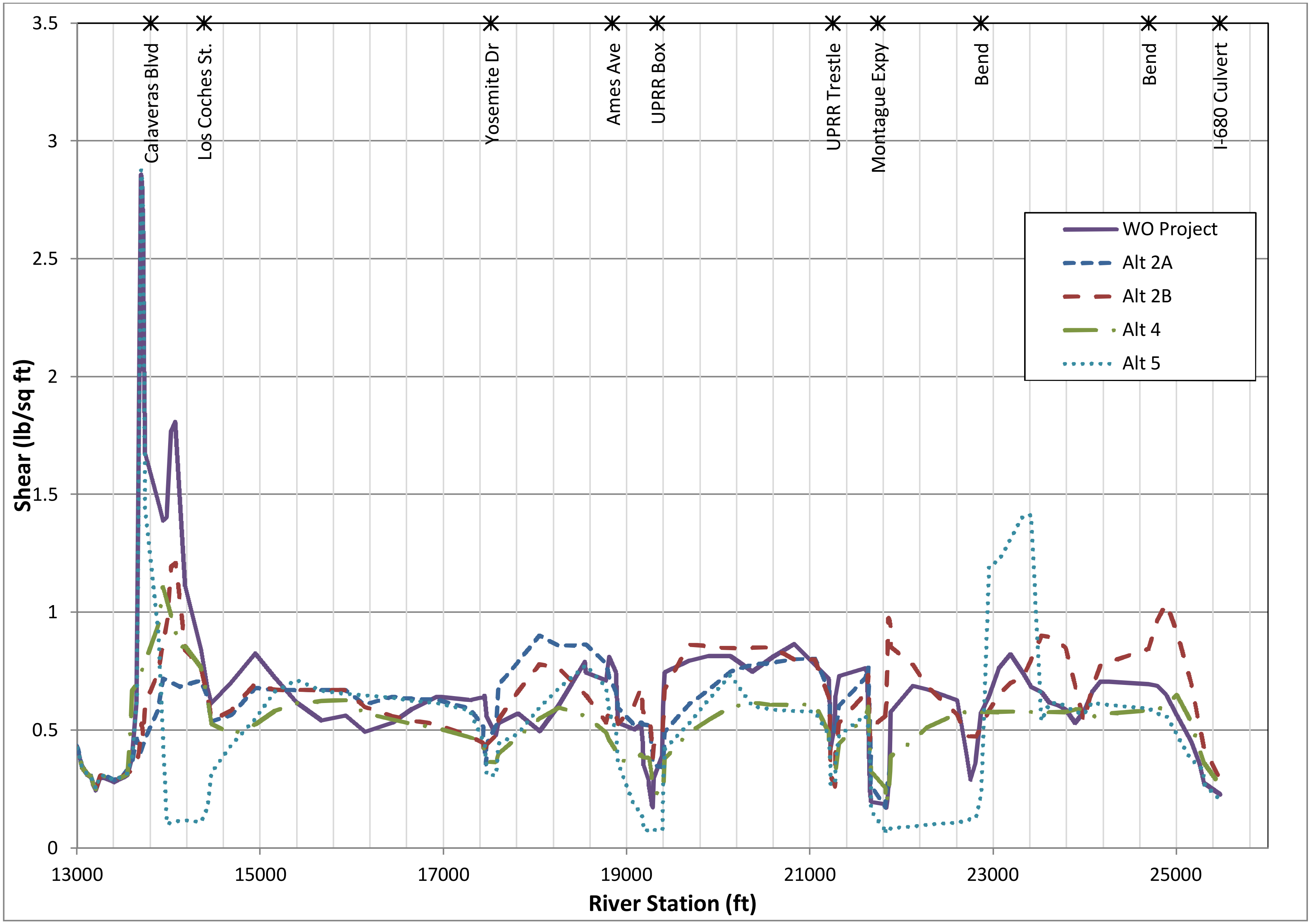

Figure 3-10 Main Channel Shear Stress Comparison of Without- and With-Project Conditions, 50% chance exceedance Event

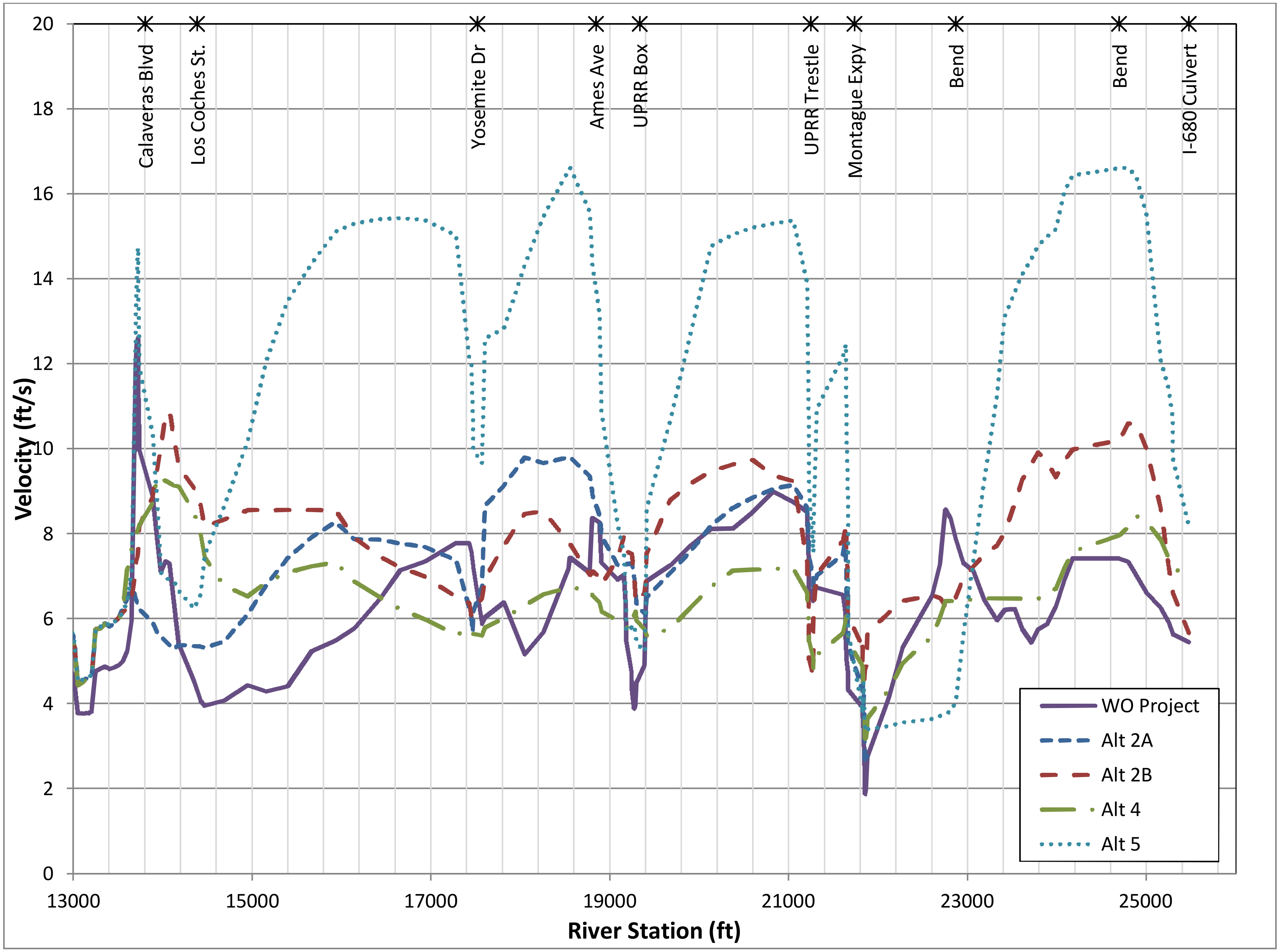

Figure 3-11 Main Channel Velocity Comparison of Without- and With-Project Conditions, 1% chance exceedance Event

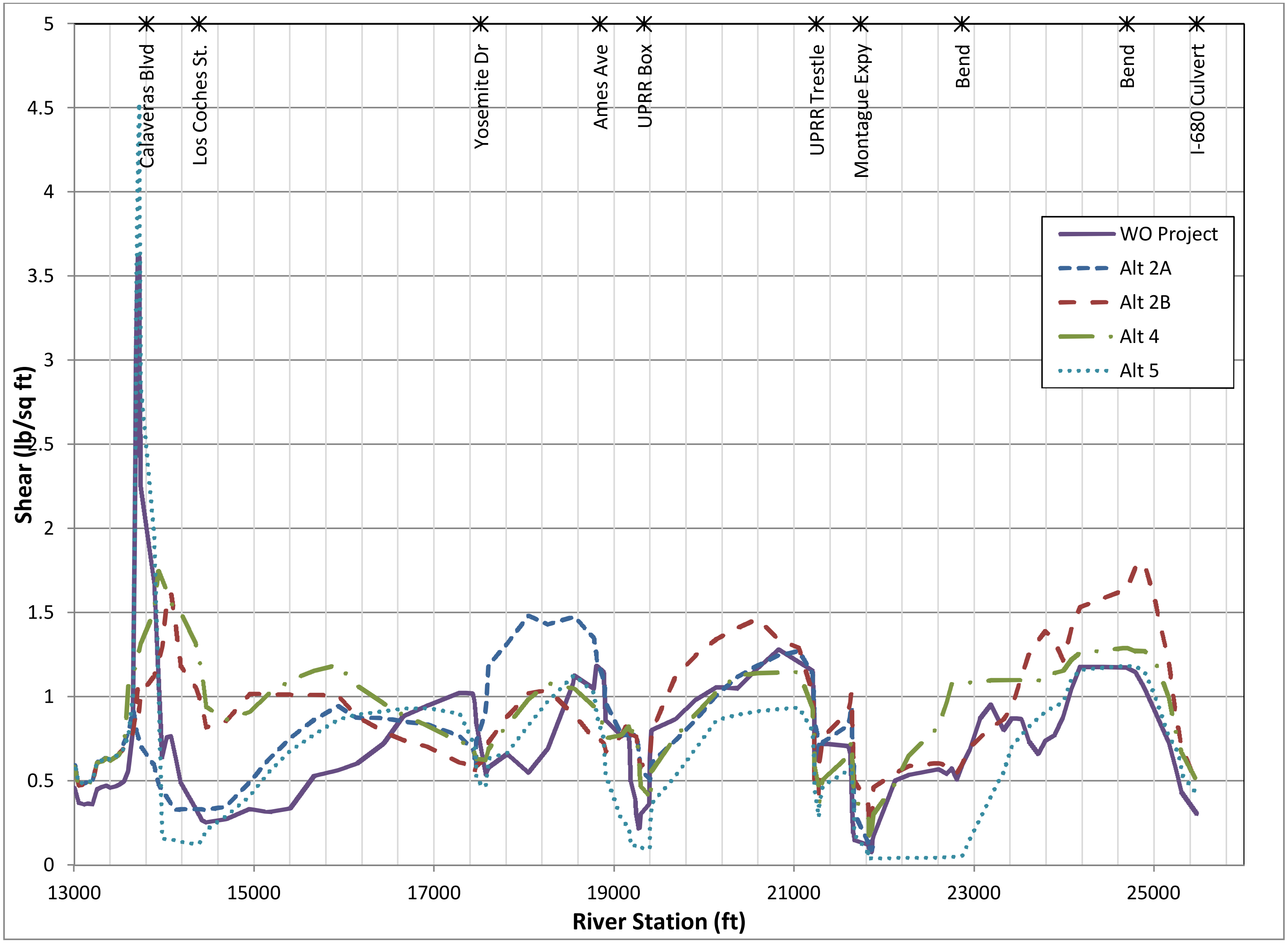

Figure 3-12 Main Channel Shear Stress Comparison of Without- and With-Project Conditions, 1% chance exceedance Event

The values in both sets of plots are for the main channel since this is the portion of the flow that is responsible for nearly all the bed material load transport and it is the bed material load transport that determines the aggradation and degradation characteristics within the Greenbelt and the project area. Additionally, it is the sand and larger material that has been removed from the channel and sediment basin by past maintenance activities.

3.2.2.1 Comparison of 50% Chance Exceedance Event

The 50% chance exceedance event was used in the comparison because this event is considered to be approximately the channel forming flow, i.e., the most representative of typical conditions that determine the behavior of the channel over the long-term.

The general trend in velocity is for Alternatives 2A/d and 2A/b is to approximately follow the without-project velocities with minor reductions in velocities upstream of Montague. Alterative 4/d shows a general reduction of the 50% chance exceedance velocity for the with-project condition relative to the without-project. The decrease is generally on the order of 0.5 up to 2.0 feet per second. In some isolated areas for Alternative 2A/d, 2B/d, and 4/d, particularly where the modification of bridges removed backwater effects, velocities show an increase. Alternative 5 shows a large increase in velocity over the without-project based on the concrete lined channel proposed. The highest running average velocity exhibited under with-project conditions is approximately 7.5 feet per second in Alternative 2B/d.

A comparison of shear stresses for the 50% chance exceedance event shows similar trends to the velocity, with shear stresses for Alternatives 2A/d, 2B/d, and 4/d on average equal to or slightly lower than the without-project condition. In a few areas, specifically above Montague Blvd and downstream of Yosemite Ave., the alternative shear stress is higher than the without project conditions. Shear stress for Alternative 5 is generally lower than the without-project conditions with the exception of two locations, one upstream of Montague Blvd. and one downstream of Yosemite Ave., that are higher than the without project condition.

3.2.2.2 Comparison of 1% Chance Exceedance Event

The 1% chance exceedance event was used in the comparison because it is a large event that is typically utilized to represent the most severe conditions that the project is likely to experience during its design life. Though the 50% chance exceedance event indicates the general behavior of the project over a long period, the response during the 1% chance exceedance event can cause damages that can require significant maintenance or destroy project features. Under existing conditions, the 1% chance exceedance discharge breaks out of the channel in several locations. The with-project alternatives contain a larger discharge and result in velocity and shear stress increases downstream of breakout locations. The increases in velocity are most pronounced in the reaches where the right-of-way is constrained. The maximum running average velocities exhibited under with-project conditions are approximately 16.5 feet per second in Alternative 5.

A comparison of shear stresses for the 1% chance exceedance event shows similar trends to the velocity comparison. The maximum running average shear stress under with-project conditions is approximately 1.8 lbs/sq ft for both Alternatives 2B/d and 4/d.

3.3 Quantitative Sediment Transport Analysis of the Final Array of Alternatives

A quantitative sediment transport analysis was conducted for the final array of alternatives. The purpose of the analysis was to develop an estimate of the potential O&M sediment removal quantities for the Final Array of Alternatives assuming existing conditions between Old Piedmont Road and I-680. In addition, an analysis was conducted assuming the SCVWD Bypass Alternative was in place between Old Piedmont Road and I-680 for Alternatives 2B/d and 4/d.

3.3.1 Methodology

This section presents the methodology used to conduct the sediment transport analysis. Due to differing levels of information being available between Old Piedmont Road and I-680 for the existing conditions and SCVWD Bypass alternatives, different methodologies were used for each analysis.

3.3.1.1 Existing Conditions between Old Piedmont Road and I-680 Methodology

A spreadsheet analysis of the sediment transport capacity through the study area was conducted to determine the potential O&M requirements for the final array of alternatives. The study area was divided into four reaches based on the reaches used to report sediment removal maintenance provided by SCVWD (as discussed in Section 3.1.4). Additionally, *Upstream of the Piedmont-Cropley Culvert* and the *Greenbelt between the Piedmont-Cropley Culvert and Morrill Avenue* were added as supply reaches, since these reaches are a source of sediment supply to the downstream reaches. The transport reaches used are listed in Table 3-1.

Table 3-1 Analysis Reaches

Reach	Reach Type
Upstream of the Piedmont-Cropley Culvert	Supply
Greenbelt between Piedmont-Cropley Culvert and Morrill Ave	Supply
Morrill Ave to I-680	Transport
I-680 to Montague Expressway	Transport
Montague Express to Calaveras Blvd	Transport
Downstream of Calaveras Blvd	Transport

The Yang sediment transport equation was used to estimate the sediment transport through each reach. The Yang sediment transport equation was chosen based on the research conducted by Brett Jordan on Berryessa Creek for his dissertation in 2009 (Jordan, 2009). Jordan concluded that the Yang equation best represented Berryessa Creek based on an analysis of potential sediment transport equations. The Yang equation has two variations based on whether the transport of sand and gravel is being estimated. The Yang equation estimates the sediment transport rate based on a representative diameter and reach-averaged hydraulics.

Sediment gradation curves were obtained from sediment sampling conducted for the Northwest Hydraulic Consultants' *Upper Berryessa Creek Existing Conditions Sediment Transport Assessment* (NHC, 2003). A number of samples were collected along each reach during different times of the year. For the purposes of this analysis samples taken during the winter season were used since the high flows in Berryessa Creek occur primarily during the winter rainy season. For the purpose of this analysis, the sediment gradation curves were divided into ten sediment size classes with a representative diameter assigned to each. The size fraction of each sediment size class was determined for each reach. Table 3-2 lists the minimum, maximum, and representative diameters for each of the sediment sizes classes used. Table 3-3 lists the fraction of the total for each sediment size class for each reach.

Table 3-2 Sediment Size Classes

Grain Size Interval	Min Diameter	Max Diameter	Representative Diameter
Fine/Very Fine Sand	0	0.25	0.125
Medium Sand	0.25	0.5	0.35
Course Sand	0.5	1	0.71
Very Coarse Sand	1	2	1.4
Very Fine Gravel	2	4	2.8
Fine Gravel	4	8	5.7
Medium Gravel	8	16	11.3
Course Gravel	16	32	22.6
Very Course Gravel	32	64	45.8
Small Cobble	64	128	91.6
Total			

Table 3-3 Sediment Class Size Distribution by Reach

Grain Size Interval	Sediment Class Size Distribution					
	Upstream of the Piedmont-Cropley Culvert	**Greenbelt from Piedmont-Cropley Culvert to Morrill Ave**	**Morrill Ave to I-680**	**I-680 to Montague Expressway**	**Montague Express to Calaveras Blvd**	**Downstream of Calaveras Blvd**
Fine/Very Fine Sand	6%	5%	6%	4%	3%	4%
Medium Sand	6%	6%	7%	7%	6%	10%
Course Sand	4%	5%	6%	7%	6%	10%
Very Coarse Sand	7%	7%	9%	14%	14%	13%
Very Fine Gravel	7%	12%	13%	18%	16%	15%
Fine Gravel	10%	17%	17%	16%	20%	18%
Medium Gravel	12%	20%	17%	19%	22%	18%
Course Gravel	21%	18%	16%	11%	11%	9%
Very Course Gravel	8%	6%	7%	4%	2%	3%
Small Cobble	19%	4%	2%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The average hydraulics for the 50% to 0.2% chance exceedance events were developed for each reach using the results of the FLO-2D and HEC-RAS modeling discussed in *Part I: Hydraulic Analysis of Alternatives* and *Part II: Floodplain Development of Alternatives*. Since the bulk of the average annual sediment transport is conveyed proportionally by smaller, more frequent events, a 67% chance exceedance event was developed. The 67% chance exceedance event was developed by plotting the inflows to the FLO-2D and HEC-RAS models and estimating the 67% chance exceedance event inflows. The ratio of the 67% to the 50% chance exceedance inflows was then computed and applied to the FLO-2D and HEC-RAS 50% chance exceedance inflows used to develop the hydraulics for the 67% chance exceedance event.

The reach-averaged hydraulics were used in conjunction with the sediment size class data to calculate the sediment transport for each sediment size class for each event. The total sediment transport rates for each event were developed by combining the calculated transport rates for each sediment class size based on based on the fraction of the total sediment gradation each class represented. Finally, the sediment transport rates for each event were probability-weighted to develop the average annual sediment transport rate for each reach.

The potential deposition in each reach was determined by subtracting the sediment transport through the reach from the transport rate of the reach upstream. A positive result indicated a reduction in the sediment transport capacity through the reach resulting in deposition. A negative result indicated an increase in sediment transport capacity through the reach resulting in pass-through conditions and potential erosion in unarmored section of channel.

Deposition in the sediment basin below the Piedmont-Cropley culvert was developed assuming that 100% of the gravels from the upstream reach were captured in the sediment basin. The amount of sand captured in the sediment basin was calculated based on the assumption that captured sediment matrix was composed of 75% gravel and 25% sand, with the sand filling voids in the gravel.

The initial without-project alternative results were compared to the average annual sediment removal based on maintenance records (see Section 3.1.4) to determine how well the spreadsheet analysis reflected observed deposition trends. As seen in Table 3-4, the initial results did not reflect the observed trend well. To better model the observed deposition calibration coefficients were applied to the sediment transport equations for each of the reaches to better match the observed deposition trends. As seen in Table 3-4 the application of calibration coefficients ranging from 0.98 to 5.31 produced results that matched the observed deposition. The remaining alternatives were analyzed by using the calibrated spreadsheet model and the alternative hydraulics.

Table 3-4 Model Calibration Results

Reach	Average Annual Sediment Deposition (cy)			Calibration Coefficient
	SCVWD Maintenance Records	Initial Results	Calibrated Results	
Upstream Old Piedmont to Piedmont-Cropley Sediment Basin[1]	537	2281	537	0.2355
Piedmont-Cropley Culvert to Morrill Ave (Greenbelt)	0	0	0	2.38
Morrill Ave to I-680	510	-1417	510	0.999
I-680 to Montague Expressway	418	2230	418	4.113
Montague Express to Calaveras Blvd	199	12	199	3.85
Downstream of Calaveras Blvd	5521	557	2180	1

[1]The average annual sediment deposition for this reach is based on the sediment captured in the sediment basin only with no deposition in the reach upstream of the sediment basin.

It should be noted that this methodology was developed based on the limited available hydraulic information. The use of average hydraulics and peaks flows to determine sediment concentrations through reaches represent one point on the sediment rating curve. This approach tends to overestimate the total sediment transport when applied to the entire flow volume from the storm event. A much more intensive modeling approach, beyond the scope of this study, would be required to truly develop the transport based on the sediment transport over the entire range of a storm event. Calibrating the equations to observed deposition trends largely accounts for this effect, thought the results will still be conservative. Therefore, the methodology presented above satisfies the intent to estimate the change in the sediment deposition through the study area.

3.3.1.2 SCVWD Bypass Alternative between Old Piedmont Road and I-680 Methodology

The local sponsor (SCVWD) has proposed a future project between Old Piedmont Road and I-680 consisting of a bypass culvert diverting most of the flood flows around the Greenbelt reach to help alleviate flooding in the Greenbelt reach. The proposed bypass would divert most of the flood flow from Berryessa Creek just upstream of the Piedmont-Cropley culvert, convey the flow down a culvert under Cropley Avenue, and finally discharge the flow at a point near the Cropley Avenue Bridge. The SCVWD bypass alternative is discussed in more detail in Section 5.2.3 in *Part I: Hydraulic Analysis of Alternatives*. The impacts to the sediment maintenance requirements for alternatives 2B/d and Alt 4d were analyzed.

To evaluate the impacts of the SCVWD bypass, the *existing conditions between Old Piedmont Road and I-680* spreadsheet model required modification as detailed hydraulics were not available for the SCVWD bypass alternative. The bypass alters the potential amount of sediment supply from the Greenbelt as well as transporting sediment through the bypass culvert. The transport through the Greenbelt was approximated using the bypass diversion rating curve, the Berryessa Creek flows at the downstream of the Greenbelt, and the existing conditions between Old Piedmont Road and I-680 sediment rating curve for the Greenbelt reach. First the Berryessa Creek peak flows for the *existing conditions between Old Piedmont Road and I-680* at the downstream end of the Greenbelt were determined from the without-project HEC-HMS hydrologic modeling. Then the Berryessa Creek peak flow for the *SCVWD bypass alternatives between Old Piedmont Road and I-680* was developed using the SCVWD bypass HEC-HMS model. A sediment rating curve for the Greenbelt reach was developed using the *existing conditions between Old Piedmont Road and I-680* flows and the calculated sediment transport for each flow event. The sediment rating curve was then used to approximate the sediment transport rate through the greenbelt supply reach based on the Berryessa Creek *with SCVWD bypass alternatives between Old Piedmont Road and I-680* flows at the downstream end of the Greenbelt. .

In addition to altering the sediment transport rate in the greenbelt reach, the SCVWD bypass would also alter the deposition in the sediment basin below the Piedmont-Cropley culvert. To determine the deposition in the sediment basin, the sediment transport through the Piedmont-Cropley culvert was determined for the gravel fraction. A sediment rating curve based on the flow at the culvert for the existing conditions was developed for gravels. The flow through the culvert with the SCVWD bypass in place was then used to approximate the gravel transport through the culvert with the bypass. As for the *existing conditions between Old Piedmont Road and I-680* methodology, it was assumed that 100% of the gravel transported through the culvert would be captured in the basin and that the captured sediment matrix would consist of 75% gravel and 25% sands. Since the invert of the bypass culvert is one foot above the invert of the Piedmont–Cropley culvert, the gravel bed load is prevented from being conveyed through the bypass culvert. Therefore, the remaining portion of the gravel supply from upstream of the bypass will deposit in the reach. Since no detailed hydraulic results were available for the SCVWD bypass alternative, the location of deposition of this material cannot be determined. The remainder of the sand supply was assumed to be conveyed through the bypass culvert and was added to the sediment supply estimate calculate for the Greenbelt reach.

The deposition estimates for the remaining reaches was then developed using the same procedures as the existing conditions *between Old Piedmont Road and* I-680 methodology. The average hydraulics for the study reaches were developed with the HEC-RAS models run with inflows reflecting the SCVWD bypass in place between Old Piedmont Road and I-680.

3.3.2 Results

The quantitative sediment analysis was conducted for the without-project, alternative 2A/d, 2B/d, and 4/d using hydraulic models developed for previous phases of this study for existing conditions between Old Piedmont Road and I-680. In addition, analyses were conducted for alternatives 2B/d and 4/d assuming the proposed SCVWD bypass alternative was in place between Old Piedmont Road and I-680. The potential deposition for each alternative was developed for each reach.

Table 3-5 lists the estimated average annual sediment transport rates and deposition for the without-project, Alternative 2A/d, 2B/d, and 4/d models using existing conditions between Old Piedmont Road and I-680. As seen in the table, for Alternatives 2A/d and 2B/d there is an increase in sediment transport through the I-680 to Montague and Montague to Calaveras. The increased transport results in a decrease in deposition in the I-680 to Montague reach for alternatives. With a larger amount of sediment being transported through the upstream reach, there in an increase in the amount of deposition in the Montague to Calaveras Boulevard reach for all alternatives over the without-project alternative. Overall, the total amount of sediment deposited in study area for Alternatives 2A/d and 2B/d is nearly equal to that under without-project conditions. For Alternative 4/d there is a marked increase in deposition in the study.

Table 3-5 Average Annual Sediment Transport and Deposition using Existing Conditions between Old Piedmont Road and I-680

Alternative	Reach						
	US of Old Piedmont Rd to Piedmont Cropley Culvert	Piedmont Cropley Sediment Basin	Piedmont-Cropley Culvert to Morrill Ave (Greenbelt)	Morrill Ave to I-680	I-680 to Montague Expressway	Montague Expressway to Calaveras Blvd	DS of Calaveras Blvd
Average Annual Sediment Transport Rate (cy)							
Without-Project	537	0	3318	2809	2391	2192	12
Alt 2A/d	537	0	3318	2809	3166	2161	10
Alt 2B/d	537	0	3318	2809	3836	2202	9
Alt 4/d	537	0	3318	2809	2208	1501	14
Average Annual Deposition (cy)							
Without-Project[1]	-na-	537	-na-	509	418	199	2180
Alt 2A/d	-na-	537	-na-	509	0	648	2151
Alt 2B/d	-na-	537	-na-	509	0	607	2192
Alt 4/d	-na-	537	-na-	509	601	707	1487

-na- not applicable as no deposition was modeled in these reaches since they act as supply reaches to the reaches below them and no deposition was reported in the SCVWD maintenance records.
[1]The without-project deposition values were calibrated to SCVWD sediment removal maintenance records.

Table 3-6 lists the average annual sediment transport rates and deposition results for Alternatives 2B/d and 4/d with the SCVWD Bypass between Old Piedmont Road and I-680. The without-project for existing conditions between Old Piedmont Road and I-680 alternative was included in the table for comparison purposes. As seen in the table there is a significant reduction in the deposition in the sediment basin below the Piedmont-Cropley culvert over existing conditions. This is due to a majority of flood flows being transported through the bypass culvert. The reduction in the flood flows to the Greenbelt reach results in a significant reduction in the sediment supply to the downstream reach. The sediment supply conveyed through the bypass culvert adds to the supply to the downstream reach, but accounts for only a small portion of the reduced Greenbelt sediment supply. As seen in the table, the sediment transport rate for the Morrill to I-680 reach is greater than the combined sediment supply for the Greenbelt and Bypass culvert. Since the sediment transport capacity through the reach is greater than the incoming supply, no deposition is seen in the reach. For both alternatives there is an increase in sediment transport through the I-680 to Montague and Montague to Calaveras reaches over the without-project alternative. The increased transport results in no deposition in the I-680 to Montague reach. Normally, a larger amount of sediment being transported through the upstream reach would result in an increase in the amount of deposition in the Montague to Calaveras Boulevard reach. But since the supply from the Greenbelt reach is limited, the transport capacity of Alternative 2B/d can transport the entire supply to the downstream reach with no deposition and Alternative 4/d showing a small amount of deposition.

Table 3-6 Average Annual Sediment Transport and Deposition for the SCVED Bypass between Old Piedmont Road and I-680

Alternative	Reach								
	US of Old Piedmont Rd to Piedmont Cropley Culvert	Piedmont Cropley Sediment Basin	Bypass Culvert	Piedmont-Cropley Culvert to Morrill Ave (Greenbelt)	Total Sediment Supply entering the Morrill Ave to I-680 Reach[1]	Morrill Ave to I-680	I-680 to Montague Expressway	Montague Expressway to Calaveras Blvd	DS of Calaveras Blvd
Average Annual Sediment Transport Rate (cy)									
Without-Project for existing conditions between Old Piedmont Road and I-680[2]	537	0	-	2219	2219	1709	1292	1092	38
Alt 2B/d with Bypass	537	0	88	1631	1718	2809	3774	2263	9
Alt 4/d with Bypass	537	0	88	1631	1718	2809	2283	1630	16
Average Annual Deposition (cy)									
Without-Project for existing conditions between Old Piedmont Road and I-680[2]	-na-	537	-	-na-	-na-	509	417	200	1057
Alt 2B/d with Bypass	-na-	450	-na-	-na-	-na-	0[3]	0[3]	0[3]	1709
Alt 4/d with Bypass	-na-	450	-na-	-na-	-na-	0[3]	0[3]	89	1702

1. The sediment supply to Morrill Avenue to I-680 reach is a combination of the transport from the Bypass Culvert and the Greenbelt reaches.
2. The without-project for existing conditions between Old Piedmont Road and I-680 alternative is included for comparison purposes.
3. Since the total supply from the Greenbelt to the reach is less than the transport through the reach zero deposition was recorded and potential erosion was not considered in this analysis.

-na- not applicable: no deposition was modeled in these reaches since they act as supply reaches to the reaches below them and no deposition was reported in the SCVWD maintenance records.

3.4 Conclusions

Several significant conclusions can be drawn from the comparisons of velocities and shear stress between the with- and without-project conditions in reference to the influence of the current alternatives on sediment transport conditions.

Throughout the project area, there are large variations in velocities and shear stresses that can cause localized sedimentation and scour problems. The project design needs to be further refined to reduce the level of these changes. Additionally, the measures used to provide passage of the design event through bridges should be reviewed. In cases in which walls were extended above the bridge deck to contain flows, there may be the creation of significant backwater conditions. The reduced velocity and shear stress may cause an additional potential for additional, localized deposition in an area that in some cases already experiences deposition.

Currently, the project area is a deposition zone and a reduction in velocity will further increase deposition and the need for maintenance. Constructed features should facilitate removal of deposited sediments.

Five sediment basin configurations have been previously evaluated upstream of the project area in order to reduce the downstream maintenance needs. The basin configurations are shown in Table 3-7. The schematic locations are shown in plan view and profile view in Figure 3-13 and Figure 3-14, respectively.

Table 3-7 Summary of Sediment Basin Location Alternatives

Alternative	Name	Description
A	F4A	F4A design concept. Existing basin bed lowered approximately 5 feet with 700-foot length excavated channel at basin outlet.
B	Reduced F4A	F4A design concept with reduced basin lowering (approximately 2.5 feet) and excavated channel length (approximately 350 feet).
C	Downstream Adjacent	Channelization of Berryessa Creek through the existing basin, with construction of a new basin located near the existing basin outlet.
D	Morrill	Channelization of Berryessa Creek through the existing basin, with construction of a new basin downstream of the Greenbelt Reach near Morrill Avenue.
E[1]	Authorized	Construction of a new sediment basin upstream of Old Piedmont Road and modification of existing basin with plunge pool, outlet weir, and 3-foot diameter culvert drain.

Notes: 1. Alternative E is the Proposed Sediment Basin per the 1993 GDM Authorized Project Design. (USACE 1993).

An evaluation of the advantages and disadvantages of each configuration concluded that a combination of the above alternatives would best balance maintenance needs against environmental impacts and hydraulic conveyance capacity. These alternatives are currently under consideration by others, and the design of features within the project reach should be coordinated with the design process of the upstream sediment basin in order to ensure consistent approaches. Recommendations and further details on the sediment basin evaluation are presented in a Technical Memorandum dated January 21, 2009 by Tetra Tech, Inc. (2009a).

Figure 3-13 Plan View of Alternative Sediment Basin Configurations

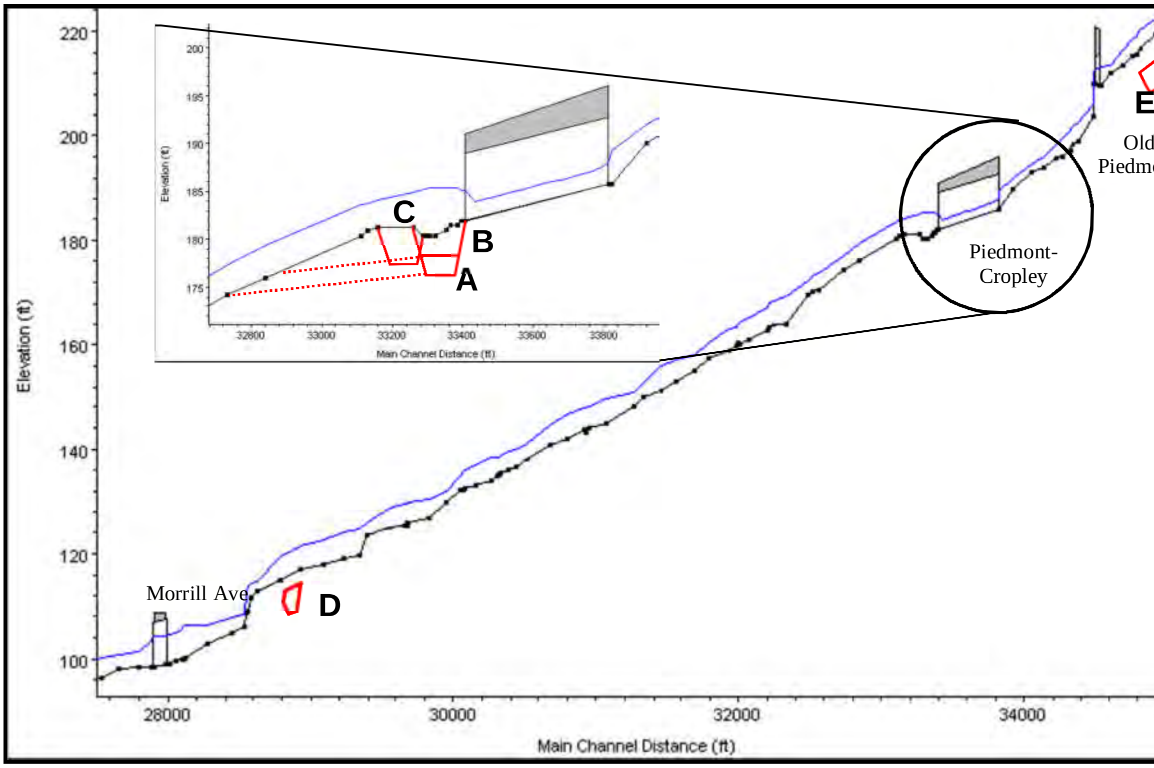

Figure 3-14 Profile View of Alternative Sediment Basin Configurations

CHAPTER 4: RECOMMENDATIONS FOR ADDITIONAL ANALYSES

To support the further development of the preferred alternative once selected, additional analyses and investigations related to the determination of sediment transport conditions within the project area should be performed. These analyses will assist in refining the design and providing a project that functions properly in relation to geomorphic and sediment transport conditions. The recommended investigations and analyses include the following:

- Perform inspections of the major tributaries entering the project to assess their sediment contribution and whether there are opportunities for sediment management on the tributaries. Past studies have focused on the main Berryessa Creek drainage since it is the largest sediment source; however, some opportunities may exist to improve sediment transport conditions within the project by addressing the supply of sediment from the tributaries.

- The HEC-6T model developed for the without-project condition should be applied to with-project condition. The results from the without-project condition showed that the model reasonably predicts the locations of sediment deposition and scour. The following are specific recommendations for the HEC-6T effort:

    - The model should be developed as an assessment and design tool for the preferred alternative rather than being applied in the alternative selection process. Application of the sediment transport and geomorphic assessment presented in this report should be adequate during the plan selection effort.

    - The current model uses only one sediment size distribution for the entire project area. This assumption should be reviewed and the possibility of utilizing several distributions as conditions change should be evaluated. This should be considered in terms of both the surface and subsurface distributions.

    - Based on the review of the NHC (2003) report, it did not appear the sediment removal was incorporated into the modeling effort. Consideration of running multiple events and incorporating sediment removal should be considered.

    - In applying the HEC-6T model some thinning of cross sections may be necessary from those used in the current HEC-RAS hydraulic model.

- Further refinement of the project design in terms of the channel sections should be undertaken to reduce the wide variations in velocities that occur within short distances. Many of these rapid variations may be due to the concentration of the initial design effort on determining the levee heights and bridge modifications to contain the design floods. The initial design modifications addressed the channel cross section size and levee heights primarily. In the next level of design, some adjustment of the channel gradient may be incorporated to provide a design with more consistent hydraulic conditions.

- Design modifications for the alternatives at several of the bridges downstream of I-680 result in increased flow areas that consequently cause existing deposition trends to be exacerbated. Specific problem areas identified are at Calaveras Boulevard, the UPRR trestle and Montague Expressway.

- Scour analyses need to be conducted to determine toedown depths for toe protection. General scour from the HEC-6T analysis should be added to bend and toe scour estimates. Because of the many modifications at bridges, the adequacy of the piers and abutments must also be evaluated in terms of scour, both local and general.

- Sizing of bank protection needs to be undertaken. Additionally, the ability of the upper bank protection and the vegetation on the floodplains to prevent erosion needs to be assessed based on shear stress and velocities.

- The n-values (roughness coefficients) assigned to the various channel components need to be adjusted if further refinements are made in terms of decisions on the types of vegetation that will be established in each area.

- Further analysis of potential changes in the configuration of the Piedmont sediment retention basin and other sediment retention facilities upstream of Old Piedmont Road need to be performed to quantify sediment removal.

- A more quantitative comparison should be made between these sediment modeling results and other modeling carried out by Jordan (2009) using SIAM and GSTARS-1D where possible, to reinforce confidence in model results.

CHAPTER 5: REFERENCES

Jordan, B., 2009. An Urban Geomorphic Assessment of the Berryessa and Upper Penitencia Creek Watersheds in San Jose, California. Colorado State University, Fort Collins, CO.

Mussetter, R. A., P.F. Lagasse and M. D. Harvey, 1994. Sediment Erosion and Design Guide. Prepared for the Albuquerque Metropolitan Arroyo Flood Control Authority by Resource Consultants and Engineers, Inc., Fort Collins, CO.

Northwest Hydraulic Consultants, Inc., 1990. Sediment Engineering Investigation and Preliminary Hydraulic Design of the Berryessa Creek Flood-Control Project. Prepared for U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.

Northwest Hydraulic Consultants, Inc., 2001. Upper Berryessa Creek GRR Basin Geomorphology Technical Memorandum. Prepared for U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.

Northwest Hydraulic Consultants, Inc., 2003. Upper Berryessa Creek Existing Conditions Sediment Transport Assessment. Prepared for U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.

Santa Clara Valley Water District, 2011a. Personal Communication. Email from Scott Katric (SCVWD) to Richard McCallan (Tetra Tech). March 31, 2011.

Tetra Tech, Inc., 2009a. Berryessa Creek Sediment Basin Design Options. Prepared for U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA. January 21, 2009.

Tetra Tech, Inc., 2004. Berryessa Creek Project, California General Reevaluation Study and Supplemental Environmental Impact Statement/Environmental Impact Report (GRR/SEIS-EIR). Prepared for U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.

U.S. Army Corps of Engineers, 1993. General Design Memorandum Coyote and Berryessa Creeks, California – Berryessa Creek, Volume 1. Sacramento District, Sacramento, CA.

CHAPTER 6: ADDENDUM 1

6.1 Summary and Excerpts from Colorado State University Doctoral Dissertation

A detailed study comparing Berryessa Creek with Penitencia Creek was conducted as part of a PhD dissertation by Brett Jordan at Colorado State University. Full citation information and a summary of parts of the dissertation most pertinent to this study prepared by Tetra Tech, Inc. are presented in the following paragraphs.

Jordan, B. (2009). *An Urban Geomorphic Assessment of the Berryessa and Upper Penitencia Creek Watersheds in San Jose, California*. Colorado State University, Fort Collins, CO.

6.1.1 Summary of Abstract

- A quantitative urban geomorphic assessment was conducted for the Berryessa Creek watershed to investigate the effects of urban hydrologic change, valley subsidence and river infrastructure elements on channel stability.
- 47 monumented cross sections over a 3000-meter reach of Berryessa Creek were surveyed in 2004. Cross sections were surveyed yearly after high flow season (winter) for 3 years to document changes in river processes and form.
- Detailed geomorphic field data were used to conduct hydrologic and sediment transport modeling and investigate the relative effects of hydrologic alteration, valley subsidence and river infrastructure on water yield, sediment yield and channel stability.
- Results of this analysis indicate system instability in the urbanized valley portion of Berryessa Creek is caused primarily by drainage area capture by the urban storm sewer network and engineered river infrastructure elements.
- Hydrologic and sediment modeling indicates that these drainage system modifications have caused a water yield increase of 48 % and sediment yield increase of 9 % to 61 % based on historic conditions.
- Changes in the Berryessa Creek hydrological regime have transformed previously depositional reaches into incised reaches. Results of modeling indicate the maximum incision due to valley subsidence would be 0.27 m.
- Effects of base level lowering will be at a maximum approximately 500m upstream of the zone of maximum subsidence, which is minor increase in sediment yield of 0.3 % to 11 %. River infrastructure (an online sedimentation basin and 1.85 m grade control structure) has reduced the downstream sediment yield by 15 %.
- Subsidence effects from groundwater extraction are obscured by current channel instability caused by urban development which dominate system changes.

6.1.2 Summary of Introduction

- Methods of analysis: 1. time series aerial photos, topographic data, long profile analysis. 2. Field data collection. 3. Numerical hydrology and sediment transport modeling.

- The Berryessa watershed is an alluvial fan that has been anthropogenically manipulated along the valley floor to facilitate agriculture and urban development.
- Berryessa has been subject to channel realignment, engineering infrastructure, floodplain encroachment, drainage area expansion via storm sewers and has suffered severe erosion and sedimentation problems (e.g. in Summer 2004 approximately 7,100 m^3 sediment was dredged from two reaches of Berryessa; in comparison there was very little removal of sediment from fish ladder structures on the less modified Penitencia Creek).
- This dissertation contains a large literature review about effects of urbanization on watershed hydrology, sediment transport and ecology.
- Land subsidence of up to 3.5m was observed in parts of the Santa Clara Valley between 1934 and 67 due to groundwater pumping.

6.1.3 Summary of Methodology

- Page 29 contains useful table of all data collected.
- The study examined a time series of long profiles. Berryessa Creek has undergone 1.5m or more incision or mechanical sediment removal in reach where the steep upland transitions in valley flat, this reach would be expected to be depositional. The reason for this is channelization and floodplain encroachment.
- Page 36 presents the change in bed level over time. More scour than deposition is evident on Berryessa Creek.
- Historical aerial photography analysis showed in 1899 there was no defined channel on Berryessa Creek below mountain range, just the alluvial fan with multiple small paths. By 1939 the single thread channel had been formed by channelization to permit agriculture on the fan, development and flood control. Lengthening of the channel decreased the slope significantly. In 1899 it was 0.02, 1930s it was 0.01, 1950s it was 0.005. The natural stream response of reducing the gradient was to aggrade.
- Subsidence by reach on Berryessa: Reach 1: 1125-2000: 0.11m, Reach 2: 710-1125: 0.14m, Reach 3: 250-710: 0.23m. Normal base-level lowering causes increase in sinuosity. Conversely an increase in urbanization normally results in decrease in sinuosity due to lateral restraints and channelization.
- Reach 1: most upstream. Between 1939 and present a decrease in sinuosity due to channelization 1960-80 is observed. Reaches 2 and 3: no channelization has taken place, trend of increased sinuosity, likely due to increased discharge and reduced sediment load.
- Similar trends were observed in the meander belt width.
- Urbanization mainly occurred in the valley areas between 1960s and 1980s; little urbanization has taken place in the upper watershed.
- A drainage area expansion took place on Berryessa due to addition of two historic alluvial fan streams. In 1899 the drainage area was 13.0 sq km, in 2002 it was 15.5 sq km.
- The watershed is located on active Hayward fault. Large landslide activity delivers large sediment load to channel.
- Previously change in valley grade from steep uplands to flatter valley means sediment is deposited at interface. Berryessa sediment basin was constructed in 1962 has

reduced sediment deposition and can easily be excavated but sediment continuity downstream has been disrupted.

- Sediment has been dredged every 2 years between 1984 and 2004. The basin is effective at capturing large particles (>16 mm) transported as bedload. This has caused channel incision downstream.
- Summary: Upper Berryessa watershed is not urbanized, the lower watershed has become 85 % urbanized over last 100 years. Changes in hydrology magnify peaks and duration of flows capable of producing bedload transport in Berryessa Creek. A trend for downgrading and incision has been observed. (1.5m of incision between 1967 and 2004 downstream of the sedimentation basin). Berryessa has only subsided 0.23m (Penitencia 1.1m).
- Cross sections were resurveyed and the average bed change was calculated. Over 65% of Berryessa cross sections are degrading.
- Manning's n for Berryessa was considered to range between 0.037 and 0.064, with a mean of 0.047.
- Pebble counts conducted at each cross section. Page 89 contains a bed material size plot over the long profile.
- Bulk sampling was carried out. Berryessa shows fining (as would be expected) moving downstream. There is a sharp drop in size after the sediment basin as coarse particles are trapped in the sediment basin.
- Bank condition reconnaissance was carried out and the following sediment properties were recorded: depth of layer, sphericity (round, angular), texture, color, clast matrix supported structure, grain size, sorting.
- Bank height and angles were measured visually for stable and unstable bends. Bank height to depth ratio has been proposed as a measure of stability.
- Erosion pins (referred to as "bank rods") were installed for the winter 2004 season and monitored until 2006. Bank retreat ranged from 0 to 0.36m/yr.
- Bank material varies considerably between stratigraphic units.
- 15 min stage and discharge data was collected in 2005 and 2006. Bedload and suspended load were measured to develop a rating curve. Bedload sizes were measured at two locations on Berryessa.
- Rating curves for bedload and suspended were developed, although plots exhibit a considerable amount of scatter even with log-log axes. Comparing Berryessa to Penitencia, Berryessa has much large supply of sediment than Penitencia. Upland reaches of Berryessa have a considerable amount of landslide activity and colluvial sediment sources.

6.1.4 Hydrological Modeling

- Processes that have lead to flow regime changes on Berryessa Creek include increase in watershed impervious area and increased connectivity/changes in catchment area.
- A calibrated hydrological model was created in HEC-HMS. Three different simulations carried out.
- Upper watershed is characterized by steep slopes, clay/gravely loam soils with low infiltration rates. The valley has low relief, sandy soils and higher infiltration rates.

- Urbanization in the Berryessa watershed has caused a net increase of 14 % in urbanized land use for whole watershed. Diversions have created a 20 % increase in effective catchment area, causing higher peak flows and volumes.
- Hydrographs currently have higher peak discharges and more flashy time to concentration due to efficiency of the storm drains than historical conditions, resulting in multiple peaks for an event that would previously have a single peak.

6.1.5 Sediment Transport Modeling

- Two sediment transport models were used to evaluate urbanization and valley subsidence effects on channel stability: SIAM (snapshot in time) and GSTARS-1D (continuous simulation used to predict long term channel changes).
- Six versions of each model were produced for Berryessa Creek: two different geometries – historic (1939), current (2004) with urban infrastructure, current (2004) without urban infrastructure.
- As part of the dissertation efforts, a HEC-RAS model was developed by Colorado State University (CSU) independently from the Corps of Engineers model. The CSU HEC-RAS model was used to create the SIAM model. Ten SIAM reaches were used.
- A sediment transport function sensitivity analysis was carried out. Ten equations were tested. The synthesized results were compared with measured suspended load and bedload data, and observed morphology changes. Yang (1973) and Yang (1984) appeared to be most accurate and were selected for model use.
- 30-year simulations carried out with GSTARS-1D. The models do not include subsidence.
- Model results were compared to field observations. SIAM produced results closer to observed results than GSTARS-1D. Both models provide reasonably close predictions. SIAM showed a good agreement with amount of sediment deposited in the Berryessa basin on annual basis (compared against the dredging records).
- Models indicate that the watershed changes on Berryessa would induce significant channel change, especially in downstream reaches: change from deposition to incision, increase in sediment yield.
- Models indicate that instability problems may be introduced to the upstream reaches by removing the grade control structure on Berryessa Creek: degradation upstream, aggradation downstream.

6.1.6 Appendices

- Bankfull dimensions by cross section, superimposed surveyed cross sections from 2004/2005/2006 and bed material size data are presented.

Letter No. 4

Valley Transportation Authority

Date Received: 11/13/2015

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From:	Molseed, Roy
To:	James Manitakos
Subject:	Berryessa Creek DEIR
Date:	Friday, November 13, 2015 9:16:10 AM

James,

VTA has no comments on the Draft EIR for the above referenced project. Thanks.

Roy Molseed
VTA
(408) 321-5784

Letter No. 5

Citizens Committee to Complete the Refuge and Santa Clara Valley Audubon Society

Date Received: 11/30/2015

November 30, 2015 ***Via E-mail***

James Manitakos
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118
JManitakos@valleywater.org

RE: Draft EIR for the Upper Berryessa Creek Flood Risk Management Project

Dear James:

On behalf of the Citizens Committee to Complete the Refuge (CCCR) and the Santa Clara Valley Audubon Society, this letter provides comments responding to the Draft EIR (DEIR) for the Upper Berryessa Creek Flood Risk Management Project (Project) of the US Army Corps of Engineers (Corps) with the Santa Clara Valley Water District (District) as local partner.

We are very grateful for the extension of time that the District provided to us, past the published deadline. It is unfortunate that we were not aware of the Project and its comment period earlier. Together we represent environmental groups that see the interconnectedness of the health of our streams from top to bottom of our watersheds. Actions taken on any portion of a watershed's drainage can have significant upstream or downstream impacts. To that end, the CCCR and several other local environmental groups have been active participants in Stakeholder meetings of the District's Integrated Water Resources Plan, now called OneWater. We bring that perspective to these comments.

Despite the fairly short time we've had for review, and given the 14-year history of this Project, its public process and accumulated documentation, we have found some areas of concern or of questions that we present here.

Project Overview: The Project is intended to reduce the flood risk associated with the Project area (existing Berryessa Creek channel and levees extending northward from I-680 to Calaveras Boulevard) most of it located in the City of Milpitas but with a small southerly segment in the City of San Jose. The Project will be consistent with the Project Plan selected by the Corps' Director's Report of May 29, 2014 with changes needed to allow the Project to meet Federal Emergency Management Agency (FEMA) certification standards. The actions will include channel widening, changes to reduce instream erosion, floodwall construction on the west bank, replacement of a railroad trestle with a concrete box culvert, installation of new culverts at intersections with two creeks, vegetation removal and replacement, construction or upgrade of access roads and replacement of storm drains. Actions will result in the removal of a pocket park.

Summary of Key Concerns and Questions

NEPA and CEQA processes: Chronology, preparation and coordination of the NEPA and CEQA documents of the Project were inconsistent with the need to inform the public and involve all responsible agencies.

Adequacy under CEQA: On a number of important issues, the DEIR lacks sufficient information to provide adequate analysis. These include characterization of affected areas of Los Coches and Piedmont Creeks, classification of dredge soils and modelling that would demonstrate probable sediment deposition outcomes.

Project design: The Project design is based solely on the purpose of flood control using the antiquated trapezoidal design without attempt to incorporate, wherever possible, design elements that better mimic natural creek hydrology, ecological contribution and aesthetics.

NEPA and CEQA

We appreciate the District's recognition that FEMA certification needs to be an outcome of the Project, therefore initiating this DEIR. There is the question: wasn't that concern known when the Corps was preparing its Environmental Impact Statement (EIS), prior to 2013? As the Draft EIS was an integrated document, why didn't the District participate in it or, in parallel, prepare a DEIR? Wouldn't it have been suitable to include a FEMA certifiable alternative at that time?

These questions come to mind in light of the Corps' decision that it may invoke the Clean Water Act (CWA) 404r exemption. Under that action the Corps proposes replacing the San Francisco Bay Regional Water Quality Control Board (RWQCB) for Section 401 Water Quality Certification. Through our experience with other projects, we are aware that the certification process of the RWQCB requires the review of a Final EIR, per obligations of the State of California established under the Porter Cologne Act. While acting as the agent for the federal responsibility, the RWQCB also assures that particular water quality interests of the State are fulfilled, oversight that the 404r will not provide. Aren't the State's interests of value to this Project and to the District? If the District had produced a Final EIR in 2013, wouldn't that have provided time for a RWQCB 401 certification process to complete in time for construction to begin in 2016?

There is substantive concern that the Notice of Preparation of record is 14 years old. In this DEIR, the District explained that it tried but was unable to contact commenters to that NOP. The District must explain why a new NOP was not issued for this DEIR. It is quite likely that the affected and interested parties may have changed. For instance, are today's Milpitas residents and that City's park officials aware that they will lose a pocket park and its associated pocket ecosystem? Based on these considerations, It appears that the NOP should have been recirculated. That was the path the District followed not long ago, for its CEQA process for the Shoreline Feasibility Study, again local partner to the Corps. Please respond to these concerns.

Finally, the Notice of Availability (NOA) for this DEIR was inadequate, it being notable that five major, local environmental organizations were not noticed on it (Joint Letter to J. Manitakos, 11/12/15). Given the long, forgotten NOP, the District needed to make a very significant effort to deliver the NOA to interested parties which it did not.

ADEQUACY UNDER CEQA

Under the heading of "Basic Purposes of CEQA" in the General Concepts, 14 CCR § 15002, the first listed purpose is:

> (1) Inform governmental decision makers and the public about the potential, significant environmental effects of proposed activities.

Toward that end, we share comments here on issues that inadequately meet the need to inform by omission, by use of assumption or, perhaps, by simple oversight of information relevant to associated impacts and mitigations.

Piedmont and Los Coches Creeks: The Project Description includes the following statement:

> "Installation of concrete box culverts and wingwalls at Los Coches and Piedmont Creeks, with access roads constructed over the top of the culverts."

Subsequently the DEIR explains that the new culverts will improve contributory creek hydrology, angled to direct flow downstream and a change removing the current right angle juncture. These are major changes to creeks that contribute to the flood risks of upper Berryessa and for which a full characterization is needed of the affected area of each creek. What are the existing uses on the adjoining land such as where the access road will go? Might the new culvert have upstream impacts and are they beneficial? Given Los Coches upstream extent, what level of sediment does it transport?

Sediment Deposition and Maintenance: In discussion of Hydrology Impact WAQ-3, the section on operations includes the following:

> "Although reduced velocities and lower water surface elevations *may* reduce the sediment transport capacity, this effect *is likely* to be balanced by decreased erosion and diminished sediment input. Furthermore, any backwater effect that occurs where the downstream end of Reach 1 at Calaveras Boulevard transitions into the Lower Berryessa Creek channel *would be* eliminated when the Lower Berryessa Creek Program is constructed, further reducing sediment deposition in the lower end of Reach 1." (Ed. Note: italics added)

This argument, supporting a conclusion of less than significant impact, uses the assumptive "may", "likely" and "would" as its basis. Were these assumptions tested through hydrologic modelling? This is a 2.2 mile long project. How can it be known if the Lower Berryessa Project "would" have a beneficial sediment transport impact in Reach 1 or possibly further upstream? The geomorphology discussed in Section 3.17.2.1 is of a stream with minimal gradient throughout its length, with slope in the range of a mere 0.35% to 0.5%. With the widened channel reducing water velocity, detailed analysis needs to be evident to demonstrate whether or not sediment deposition is significant. Will the Project necessitate increased frequency for maintenance dredging to ensure the flood risk reduction is achieved long term? If analysis exists that supports the DEIR's conclusion, please provide it.

Contaminated Soil Testing and Disposal: As discussed in detail in the DEIR, a substantial area of Reach 2 of the Project is affected by locally historic spills of hazardous materials at sites adjoining or near enough to have produced large plumes that run below the creek. These spills introduced a number of volatile organic compounds (VOC) and other hazardous materials into the environment. While the responsible businesses no longer exist, monitoring and mitigation of these spills is ongoing.

Two of the sites are each the source of the separate, large plumes: The former Jones Chemicals Inc. adjoins and is parallel to the creek. The other, the former Great Western Chemical Company, is set back about a block from the creek. Due to their proximity, additional testing was performed for the DEIR along that area of Reach 2. Soil tests were conducted of core samples collected by boring along the creek's access road. Results showed that VOC concentrations detected in the upper 15 feet (as deep as the Project expects to dredge the channel) are below risk-based screening levels. On this basis, the DEIR states that reuse and transport of soils off-site for disposal would be classified non-hazardous. As a result, no hazardous waste impact addresses soil testing.

While the tests results are relevant, the expanse of the contaminated area and the possibility that pockets of higher contamination levels may exist questions whether such a conclusion is adequate environmentally. The existing conditions imply that all due caution is needed. We are aware that clean soils from other District creek projects are transported for reuse by the South Bay Salt Pond Restoration Project for sensitive restoration actions. As a responsible agency, all appropriate precaution should be taken by the District to assure that there is no likelihood that hazardous levels of VOCs or other contaminants are present before transport for any other reuse. Prior to transport, the Project should be monitoring soil for such hazards.

<u>State Regulation of Plants and Wildlife</u>: The Project took guidance for Biological Resources impacts from the US Fish & Wildlife Service response to the Corp's Integrated Document, finalized in 2013. While that guidance is appropriate, it is not sufficient in California. The California Department of Fish & Wildlife (CDFW) sets requirements that provide protection for Species of Special Concern as well as for protection of sensitive habitats e.g. nesting birds. These regulations need to be applied in mitigation BIO-A (p. 3-69) during construction, in addition to the USFWS requirements. From the DEIR:

> "Mitigation Measure BIO-A would require pre-construction nesting bird surveys and establishment of appropriate buffers, reducing impacts to nesting resident bird species. "

This statement leaves open the question of what "pre-construction" means nor does it establish a time-of-year. Whenever possible, construction should not occur during nesting season. If done during nesting season, then special precautions are necessary. Birds can build a nest, lay eggs, and start raising young within two weeks, and an entire reproductive cycle may start and end within 30 days. Mr. Dave Johnston, Environmental Scientist, CDFW, recommends that pre-construction and pre-vegetation removal surveys should occur no more than 24 hours before work commences. If work in a particular location stops for more than 24 hours (such as over a weekend or holiday), surveys should be done again before work recommences. Surveys should take place at all locations within 300 feet of actual project activity and if the project 'moves" to a new location then the buffer and surveys should move as well. Mr. Johnston also recommends a preliminary survey 30 days ahead of time to give the project proponent an idea of what to expect once they are ready to begin work.

It is important too to survey for ground-nesting birds in addition to those that nest in shrubs and trees. Surveys for ground-nesting birds should be performed 24-hours prior to vegetation removal or disturbance. If nests are found, buffers would be set and work within the buffer areas should be postponed until the nestlings have fledged. If raptors or special status species nests are found, CDFW should be called on to set appropriate buffers.

<u>Pocket Park</u>: The pocket park near the juncture with Los Coches Creek, is planned for removal by the Project to make way for an access road. As mentioned previously, we are curious as to whether the current residents are informed on the removal. In the Recreation analysis, it is noted that the next closest city park is a mile from the Pocket Park site, on the other side of I-680. Under the DEIR's land use analysis, the existing conditions mention "relatively small amounts of single family residential and parks/open space" and then does not further address the impact of replacing the park/open space with an access road. The Land Use and Recreation sections both refer to Milpitas trail plans but do not explain if the possibility of using the access road in a trail system is accepted as suitable mitigation for

loss of the Pocket Park and of the pocket-ecosystem it provided. The loss requires formal, specified mitigation.

PROJECT DESIGN

Our review of this Project sparked disappointment. Here we see again a long trapezoidal channel designed only for the purpose of water transport, having long spans devoid of any shade nor of any other functions that a creek can provide. This is inconsistent with the direction that creek actions have taken in recent decades and is not the preference of local jurisdictions.

The DEIR reports the expectation that the City of Milpitas will one day incorporate the extended access roads in its trail system. To that point the DEIR provides the following quotes from the City's General Plan:

> 4.g-I-7. Ensure that all landscaping within and adjoining a Scenic Corridor or Scenic Connector enhances the City's scenic resources by utilizing an appropriate scale of planting, framing views where appropriate, and not forming a visual barrier to views; and relates to the natural environment of the Scenic Route; and provides erosion control.
>
> 4.g-I-13 - Develop the section of Berryessa Creek which runs through the Town Center into a scenic as well as a recreational resource for the Town Center. Town Center is found on both sides of the creek along the Calaveras Boulevard corridor, and includes approximately 800 feet of the channel area in Reach 1.
>
> 2.a-I-17. Foster community pride and growth through beautification of existing and future development.

Or consider DEIR quotes from Envision 2040, the San Jose General Plan:

> Development adjacent to creekside areas should incorporate compatible design and landscaping, including appropriate setbacks and plant species that are native to the area or are compatible with native species.
>
> Development should maximize visual and physical access to creeks from the public right-of-way while protecting the natural ecosystem. Consider whether designs could incorporate linear parks along creeks or accommodate them in the future.

Clearly these jurisdictions value the aesthetic contribution that a shaded, vegetation-lined creek can provide.

The 2001 NOP listed the following objectives:

1) Improve flood protection in the cities of San Jose and Milpitas;
2) Reduce sedimentation and maintenance requirements in the creek;
3) Provide for recreational amenities;
4) Integrate ecosystem restoration into the project.

Unfortunately, that NOP describes a project that would involve a much longer length of the creek and does not help us know what the intentions were for the portion that is now this Project. Even so, the principle of ecological consideration as part of the design is consistent with inclusion of such action at whatever location it is possible, improving and going above and beyond, in this case, the function of flood control. This Project plans to hydroseed the slopes of the rebuilt creek and plant replacement trees within the Project but it does not discuss such planting as ecological improvements nor suggest an objective to produce an attractive, multi-functional, waterway-focused community amenity.

This Project is funded, in part, by the District's Safe, Clean Water & Natural Flood Protection Program, a program that was approved in 2012 by well over two thirds of the voters. The Programs web page has the following:

> "The voters of Santa Clara County clearly recognize the importance of a safe, reliable water supply. They value wildlife habitat, creek restoration and open space."

Considering these planning principles together, it saddens us to see a District Project that is so out of sync with the design preferences of today. The mitigation for tree removal states that the Corps will plant replacement trees in the "vicinity." The Project should develop that action jointly with the local jurisdictions, toward an outcome of an improved water course that attracts and enriches the community.

We again thank you for this opportunity to comment. Our 501(c)(3)nonprofit organizations make it a practice to review and comment on projects that are of environmental importance to the community and wildlife alike. If there is any need for further contact on this matter, the District should contact Eileen McLaughlin at wildlifestewards@aol.com or 408-257-7599.

Sincerely,

Eileen McLaughlin, Board Member,
Citizens Committee to Complete The Refuge

Shani Kleinhaus, Environmental Advocate,
Santa Clara Valley Audubon Society

Appendix H Draft Groundwater Management Plan

DRAFT

GROUNDWATER MANAGEMENT PLAN

UPPER BERRYESSA CREEK FLOOD RISK MANAGEMENT PROJECT
JONES CHEMICAL INC. PLUME AREA
MILPITAS, SANTA CLARA COUNTY, CALIFORNIA

Prepared for:

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686

Prepared by:

Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614-6213

January 6, 2016

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ABBREVIATIONS AND ACRONYMNS

AOI	Area of Interest
bgs	below ground surface
DCA	dichloroethane
DCE	dichloroethene
DDR	Design Documentation Report
EPA	Environmental Protection Agency
ESL	Environmental Screening Levels
FEMA	Federal Emergency Management Agency
GAC	granular activated carbon
gpm	gallons per minute
GWMP	Groundwater Management Plan
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
JCI	Jones Chemical, Inc.
JSAs	Job Safety Analyses
MCL	maximum contaminant level
ND	not detected
NPDES	National Pollutant Discharge Elimination System
PCE	Tetrachloroethylene
PVC	Polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
VC	vinyl chloride
VOC	volatile organic compound
µg/L	micrograms per liter

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1.0 INTRODUCTION

This Groundwater Management Plan (GWMP) has been prepared to guide field activities within the Jones Chemical, Inc. (JCI) groundwater plume during implementation of the Berryessa Creek Flood Risk Management Project (the Project). This GWMP will be implemented by the Construction Contractor as part of the Project that is being managed by the United States Army Corps of Engineers. In general, the GWMP defines the conceptual approach for the extraction, conveyance, and treatment of groundwater within the Area of Interest (AOI) that is bound by the intersection of the Project and the JCI groundwater plume (see Figures 1 and 2). This GWMP does not apply to any work performed outside the AOI and will only be utilized if groundwater is encountered by the Construction Contractor while performing work within the AOI.

2.0 SUMMARY OF GROUNDWATER CONDITIONS

This section summarizes the AOI boundaries, Project area hydrogeology, and the conditions associated with the JCI groundwater plume.

2.1 Area of Interest Boundaries

The AOI is bound by the Project boundaries and the JCI groundwater plume. As shown on Figure 2, the dimensions of the AOI where channel construction will take place are approximately 70 feet wide by approximately 1000 feet long, or approximately from Station 155+00 to Station 165+00 on the construction plan sheets The sequencing of work within the AOI will be at the discretion of the Construction Contractor. However, for the purposes of this GWMP, it is assumed that the Construction Contractor will perform work in 300-foot sections, excavating and backfilling each 300-foot section before progressing to the next section. It will take approximately 2-4 weeks to complete the work within the AOI.

2.2 Project Area Hydrogeology

The Project area is underlain by interbedded alluvial sediments composed of sand, gravel, silt, and clay. The uppermost 5 to 10 feet of the subsurface consists of fill material, which is clay, gravely clay, sand, and gravel. Sediments underlying the fill material predominantly consist of clay, silty clay, and sandy clay, with variable amounts of sand and gravel. The clays encountered in soil borings contain intervals of sand ranging in thickness from several inches to approximately 11 feet. Historically, the depth to groundwater within the AOI has ranged between approximately 7 to 20 feet below ground surface (Tetra Tech, 2015a, and http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL18213593).

Tetra Tech drilled a soil boring in the AOI in December 2014 (Tetra Tech, 2015a); a saturated zone was encountered from 15.5 feet bgs to 19 feet below ground surface (bgs), returning to slightly moist soil conditions from 19 feet to 20 feet bgs. Upon removal of the drilling rods, the groundwater level rose to 13 feet below grade in the boring.

Historical groundwater elevation data collected at and near the project area indicate groundwater flows generally toward the west-northwest.

2.3 Contaminants

The groundwater beneath the AOI is impacted by volatile organic compounds (VOCs), attributed to the 1982 chlorinated solvent spill at the former JCI Facility. The following VOCs have recently been detected in shallow groundwater within the AOI at concentrations exceeding maximum contaminant levels (MCLs): tetrachloroethylene (PCE), trichloroethylene (TCE), trans–1,2-dichloroethene (t-1,2-DCE), cis-1,2-DCE, 1,1-dichloroethane (1,1-DCA), 1,1-DCE, and vinyl chloride (VC). The Semiannual Groundwater Monitoring Reports dated February 27, 2015 (Arcadis, 2015a) and August 31, 2015 (Arcadis, 2015b) for the former JCI facility indicate that VOCs were detected during these two reporting periods in JCI groundwater monitoring wells B14, B15, B19, B58, and B59 (the JCI groundwater monitoring wells that are closest to the AOI) at concentrations that ranged from not detected above the laboratory reporting limit (ND) to 1,400 micrograms per liter (ug/L) as shown on Figure 1. These data are summarized and compared to the pertinent MCL and San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) Environmental Screening Levels (ESL) in Table 1 in the Tables Section following the report narrative.

3.0 BERRYESSA CREEK WIDENING PLANS

Upper Berryessa Creek will be redesigned to provide flood damage reduction benefits from the overpass of I-680 to the upstream side of Calaveras Boulevard. The increased flood protection will include Widening to add capacity and bank protection to provide channel stability.

The major features of the project in the AOI include widening the creek channel, installing a concrete box culvert to replace an existing railroad trestle, and expanding or surfacing existing access roads with aggregate paving. Figure 3 shows the following features:

- The channel banks would be excavated with 2H:1V channel sideslopes.
- Buried rock revetment would be placed for scour protection from the toe of bank to between the 2.5-year and 10-year flood elevation, with the installation of biodegradable erosion control blankets and vegetation between the top of the rock revetment and the top of the bank
- The existing Union Pacific Railroad (UPRR) trestle bridge would be replaced with a double-barreled box culvert, with Concrete, warped wingwall transition structures upstream and downstream of the newly-constructed UPRR trestle.
- Two aggregate-paved maintenance roads, 18 feet wide and 15 feet wide will be located on the right and left banks looking downstream, respectively, within this area.

As shown in the profile on Figure 3, proposed excavation typically ranges from 1-3 feet below the current channel bottom and approximately 12-13 feet below ground surface (bgs) at areas proposed for widening of the channel. In the AOI, borings conducted in 2014 found saturated soils approximately 15-20 feet bgs. Results from 2014 monitoring well data for this location yielded an average depth to groundwater of 12.1 feet bgs.

3.1 Construction Methodology

The main construction components listed below are provided in roughly the sequence in which they would occur, although several of the components may occur concurrently. In addition to these construction components, the railroad trestle bridge that is within the AOI will be replaced. This replacement includes removal of the existing bridge and placing a prefabricated concrete box culvert upon which UPRR will replace the track.

- Utility relocations
- Clearing and grubbing
- Excavation with dewatering as required
- Placement and compaction of fill
- Placement of geotextile fabric
- Importing and placement of rock revetment
- Placement of biodegradable turf reinforcement mats
- Plantings as required
- Placement of aggregate base on the access roadways

3.2 Import and Disposal

Soil, reinforcing steel, vegetation, and concrete will be excavated during construction. Some of the clean excavated soils will be reused on-site. Vegetation will be composted, steel and concrete debris will be recycled, and the balance of the materials will be disposed of at one or more approved landfills.

3.3 Construction Equipment and Workers

The following equipment is anticipated to be used during Project implementation within the AOI:

- Backhoes
- Bulldozers
- Cranes
- Compactors
- Concrete trucks
- Graders
- Excavators
- Jackhammers
- Dump trucks/haul trucks
- Loaders
- Pumps
- Scrapers

Construction will either occur over two dry seasons from May to October, or continuously for one year. Construction hours will generally be during normal business hours, but after-hours work may be needed for concrete pours or replacement of the existing UPRR trestle with a concrete box culvert. The types of construction equipment in use and the number of workers actively working at the project area will vary depending on the phase of construction. The number of workers present on any given day is estimated at 25 in general, and up to 40 on occasion.

4.0 PERMITTING EVALUATION

A Notice of Intent will not be submitted to obtain coverage for managing groundwater associated with the AOI under the National Pollutant Discharge Elimination System (NPDES) general permit. As a result of not obtaining this permit, the SFBRWQCB has required the preparation and submittal of this GWMP which provides the methods and procedures for controlling and diverting groundwater, if necessary, while working within the AOI, as identified in their August 14, 2015 non-enforcement letter and included in Attachment A.

Prior to discharge, the AOI groundwater will be treated to meet the standards set forth in the NPDES General Permit No. CAG912002 (NPDES Permit) for fuel and VOC impacted sites under the requirements of SFBRWQCB Order No. R2-2012-0012 (SFBRWQCB, 2015).

If dewatering wells are installed to lower the water table (see Section 5.0), the Construction Contractor will obtain all appropriate permits which can include permits and/or authorization from the Santa Clara Valley Water District to install and abandon the wells.

5.0 DIVERSION AND CONTROL OF AOI GROUNDWATER

Depending on field conditions at the time of Project implementation, it may be necessary to control and divert groundwater to achieve the Project objectives and comply with Project requirements including excavation, placement of material, and soil compaction. As is the case throughout the Project reach, the Construction Contractor will determine whether groundwater control and diversion is necessary in order to, for example, lower the groundwater level at the start of construction or limit water seepage into the construction zone during construction.

This GWMP applies only to work within the AOI. In addition to this GWMP, all work within the AOI shall be performed in accordance with the Project Rain Event Action Plan, design drawings, specifications, permits, Design Documentation Report (DDR), and other pertinent requirements that are part of overall Project construction.

If the Construction Contractor (1) determines that groundwater will be exposed and/or encountered within the AOI, or (2) if groundwater is exposed and/or encountered within the Project AOI during construction, the Construction Contractor will control and collect the groundwater, prior to treatment and discharge, by selecting and implementing one or a combination of the following methods. Both are considered acceptable. The Contractor's selection will consider the observation of field conditions, effectiveness of the methods, and relative time and cost.

- Constructing cofferdams at the downgradient end of the AOI or sections of the AOI that are under construction; and/or
- Installing and operating dewatering wells.

5.1 Cofferdam

If the Construction Contractor opts to design, construct, and utilize a cofferdam for groundwater control and diversion, the Construction Contractor will grade the AOI to direct groundwater flow to the cofferdam where the groundwater will be temporarily stored until it is pumped to the groundwater treatment equipment that is described in Section 6.0. If groundwater is too evenly spread across the surface to be effectively pumped to the treatment system, the Construction Contractor may decide to provide interim grading to one location and/or implement a small basin or sump from which to pump. The size of both the cofferdam and any sump that may be required, as well as the period of time that the cofferdam is required to contain water, is dependent on the field conditions at the time of construction.

In accordance with SFBRWQCB guidelines, the Construction Contractor shall submit to the Project Engineer for review, a cofferdam design that, at a minimum, identifies the following:

- Construction material
- Height of structure(s)
- How the area will be dewatered
- Overtopping precautions such that overtopping will not occur, and

- Discharge locations and structures

The treated groundwater will be discharged downstream in Berryessa creek.

5.2 Groundwater Wells

Alternatively, the Construction Contractor may opt to install and operate shallow dewatering wells to lower the water table prior to commencing work within the AOI. Dewatering contractors with extensive San Francisco Bay experience estimated that dewatering groundwater in the project area will require approximately 20 groundwater extraction wells on 50-foot centers to lower the shallow groundwater table.[1] The exact spacing of the dewatering wells may vary based on the amount of groundwater encountered during construction. The extraction wells, if installed, will be located along the west side of Berryessa Creek as shown on Figure 4. The extracted water will be pumped above ground to the treatment plant that is described in Section 6.0 prior to subsequent discharge.

5.2.1 Well Spacing and Expected Pumping Volume

The dewatering wells, if installed, are anticipated to initially operate at approximately 40 gallons per minute (gpm) each. Once the water column in each well and the gravel pack around each well are dewatered, the sustainable extraction rate will likely decrease to a sustainable rate of approximately 5 gpm per well.

Assuming that 20 wells will be installed along the 980-foot length of the AOI, the combined extraction rates are anticipated to range between100 and 800 gpm. Alternatively, the Construction Contractor may opt to dewater one section (see Section 2.1) at a time, in which case the flow rate is expected to range between 30 and 240 gpm.

5.2.2 Typical Dewatering Well Construction Details

The extraction wells, if needed, will be approximately 40 feet deep, screened from 10 to 40 feet below ground surface and will be constructed of six-inch schedule 40 polyvinyl chloride (PVC).[2] The 30-foot length screened interval is anticipated to provide sufficient drawdown for the water elevations that may be encountered during construction. Each well will be equipped with a dedicated, variable-rate pump; the extracted water will be pumped above ground to the treatment plant that is described in Section 6.0 prior to subsequent discharge. The wells shall be powered by a single, portable, trailered diesel-powered generator.

The trailered diesel-powered generator shall be installed on the Project overbank to avoid potential risks associated with rain events and any external fuel tanks will also be placed on the Project overbank. The Construction Contractor shall take necessary precautions that any wiring, conduit, or pipe connecting the generator(s) to the wells shall not be damaged by construction vehicles.

[1] January 17, 2015 telephone conversation between Adam Medina, Viking Drillers, Inc. and Keith Hoofard, Tetra Tech

[2] Depth based on conversations with experienced personnel as referenced in footnote #1 on this page.

6.0 GROUNDWATER TREATMENT AND CONVEYANCE EQUIPMENT

A temporary treatment plant will treat groundwater that becomes exposed and, therefore, subsequently collected per Section 5, above.

As shown on Figure 4, the temporary groundwater treatment plant can be located within the channel, adjacent to the AOI, and effectively isolated from any nuisance flow within the channel, if necessary, through the use of berms, K-rails, or other features at the Construction Contractor's discretion. The Contractor shall provide ramp access as part of the overall construction effort. These ramps shall be available for access to the temporary groundwater treatment plant. As an alternative to the in-channel location of the treatment equipment, at the Contractor's discretion, the equipment can also be located along the top of the channel as long as it does not interfere with construction activities.

A process flow schematic is provided as Figure 5. Groundwater will be pumped from the cofferdam or dewatering wells to the open-top equalization tank to allow sediments to settle out of the groundwater. From the equalization tank, the groundwater will be pumped through a *filtration train* that includes sand filtration and organoclay filtration vessels. These will provide a "polish" to the sediment removal to prevent blockage prior to being pumped through the *treatment train* which will remove VOCs by adsorption within the granular activated carbon (GAC) vessels. The treated water will then flow to a second open-top batch tank for temporary storage (as needed) and to allow a controlled discharge rate to Berryessa Creek. The point of discharge will be at the outlet of the open-top batch tank.

The Construction Contractor shall have sufficient cranes, forklifts, trucks, and personnel onsite while working within the AOI to remove all equipment associated with the temporary groundwater treatment plant within 24 hours of notification of a pending rain event. Typical specifications for a 100 gallon per minute temporary treatment system and a 700 gallon per minute treatment system are provided as Attachments C and D, respectively.

As shown on Figure 5, compliance-sampling ports will be located:

- after the final filter and before the first GAC vessel (INF-001);
- between the two GAC vessels (MID-001); and
- after the second GAC vessel, before mixing with any other water (EFF-001).

The treatment plant and extraction wells will be powered by portable diesel generators. The treatment plant and dewatering system may have to operate 24 hours per day, depending on treatment requirements dictated by the amount of groundwater flow at the time of construction. A photograph of a typical temporary groundwater treatment plant is provided as Attachment B for illustrative purposes. Note that the temporary groundwater treatment system that will likely be needed for the Project will be a smaller scale system compared to that shown in Attachment B.

7.0 COMPLIANCE MONITORING

This section presents procedures for sampling the treated groundwater. The analytical results of the treatment system samples will be reported to the SFBRWQCB as described in Section 9.0.

7.1 Compliance Sampling

Compliance sampling will be performed on the first and fifth days of operation, and will consist of collecting groundwater samples from sampling port INF-001 (see Figure 5) and EFF-001 (see Figure 5) in accordance with Table E-2 of the SFBRWQCB Order; the pertinent information from this table is reproduced in Table 2 in the Tables Section following the report narrative.

7.1.1 Compliance Sampling: Day 1 of Operation

The objective of sampling the influent and effluent groundwater on the first day of operation is to confirm compliance with the discharge standards. Groundwater from the AOI shall not be discharged to Berryessa Creek until compliance with the discharge standards is demonstrated. Thus, the treated groundwater will be discharged to a holding tank for temporary storage to prevent discharge to Berryessa Creek until compliance with the discharge standards is demonstrated as described in the following sections. Furthermore, the groundwater control, diversion, and the Construction Contractor may opt to shut down dewatering activities until compliance is demonstrated to reduce the amount of storage needed. If the system is shut down for more than 120 hours, the compliance sampling shall be repeated. System shutdown to reduce the amount of storage needed shall only occur if no consequences to construction activities within the AOI nor seepage downstream will occur due to a high accumulation of groundwater exposure as a result of the shutdown. If these consequences may occur, then additional storage facilities must be made available to preclude untreated groundwater from migrating downstream.

An influent groundwater sample shall be collected from sampling port INF-001 (see Figure 5) on the first day of operation. This influent groundwater sample shall be monitored in the field for pH and submitted to a state-certified laboratory for analysis of VOCs by Environmental Protection Agency (EPA) Method 8260B.

An effluent groundwater sample shall be collected from sampling port EFF-001 (see Figure 5) on the first day of operation. This effluent groundwater sample shall be monitored in the field for turbidity, pH, temperature, and electrical conductivity and submitted to a state-certified laboratory for analysis of: VOCs by EPA Method 8260B and total dissolved solids (TDS) by SM 2540.

The laboratory analytical results from the startup groundwater samples collected on the first day of operation shall be compared to the effluent concentrations identified in Table 2 of the Order (Column B: Discharge to Other Surface Water Areas), which is reproduced in Table 3 in the Tables Section following the report narrative.

If all of the effluent analytical results are less than the maximum daily effluent limitations listed above, the treated groundwater shall be deemed to be in compliance, and discharge of the treated water to Berryessa Creek may commence. If any of the effluent analytical results exceed the maximum daily effluent limitations listed above, discharge of the treated groundwater shall not be allowed and startup sampling shall be repeated until compliance is demonstrated. At the Construction Contractor's discretion it may be appropriate to replace the GAC to achieve compliance with the discharge standards.

7.1.2 Compliance Sampling: Day 5 of Operation

In accordance with the SFBRWQCB Order, the INF-001 and EFF-001 will be sampled on the fifth day of operation. An influent groundwater sample shall be collected from sample port INF-001, and monitored in the field for pH and submitted to a state-certified laboratory for analysis of VOCs by EPA Method 8260B.

An effluent groundwater sample shall be collected from sample port EFF-001, monitored in the field for turbidity, pH, temperature, and electrical conductivity, and submitted to a state-certified laboratory for analysis of:

- VOCs, EPA 8260B
- 1,4-dioxane, EPA 8270C
- total dissolved solids, SM 2540
- total (unfiltered) metals:
    - antimony, EPA 204.2 reporting limit 0.5 ug/L
    - arsenic, EPA 206.3 reporting limit 2.0 ug/L
    - beryllium, GFAA or ICPMS reporting limit 0.5 ug/L
    - cadmium, GFAA or ICPMS reporting limit 0.25 ug/L
    - hexavalent and total chromium, SM 3500 reporting limit 0.5 ug/L
    - copper, EPA 200.9 reporting limit 0.5 ug/L
    - cyanide, SM 4500-CN C or I reporting limit 1 ug/L
    - lead, EPA 200.9 reporting limit 0.5 ug/L
    - mercury, EPA 1631 reporting limit 0.002 ug/L
    - nickel, EPA 249.2 reporting limit 1 ug/L
    - selenium, SM 3114B or C reporting limit 0.5 ug/L
    - silver, EPA 272.2 reporting limit 0.25 ug/L
    - thallium, EPA 279.2 reporting limit 1 ug/L
    - zinc, EPA 200.8 reporting limit 1 ug/L

7.1.3 Discharge Monitoring

In accordance with the SFBRWQCB Order, the effluent discharge to Berryessa Creek will be monitored daily to verify that the discharge is not causing the following:

- Floating, suspended, or deposited macroscopic particulate matter or foam;
- Bottom deposits or aquatic growths to the extent that such deposits or growths cause nuisance or adversely affect beneficial uses;
- Alteration of temperature, turbidity, or apparent color beyond present natural background levels;
- Visible, floating, suspended, or deposited oil or other products of petroleum origin; and
- Toxic or other deleterious substances to be present in concentrations or quantities that will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentration.

Additionally, standard observations for the groundwater treatment system will be recorded on each day and will include observations of: odor, weather condition (wind direction and estimated velocity), deposits, discolorations, and/or plugging in the treatment system, and operation of the float and/or pressure shutoff valves to prevent system overflow. Any non-compliance with RWQCB standards for discharge will be rectified prior to continuation of treatment/discharge operations.

7.2 Media Breakthrough Monitoring

The GAC vessels shall be sampled a minimum of weekly to monitor for potential breakthrough. A sample will be collected from sample port MID-001 weekly and analyzed for VOCs by EPA Method 8260B to monitor for potential GAC breakthrough. If VOCs are detected in the MID-001 sample at concentrations that exceed the maximum daily effluent limitations identified in Table 4 in the Tables Section following the report narrative (Column B: Discharge to Other Surface Water Areas) of the SFBRWQCB Order, another sample will be immediately collected and analyzed to confirm the breakthrough. If breakthrough is confirmed, the GAC in the lead vessel will be replaced (see Section 3.0), the original lag vessel will become the lead vessel, and the newly replaced GAC will become the lag vessel.

8.0 MEDIA CHANGE-OUT PROCEDURES

The treatment system will be shut down to replace the spent GAC in the lead vessel. The need to stop the groundwater diversion or extraction during the GAC change-out will be evaluated based on the following: the current available volume to store diverted/extracted water in the equalization tank and the GAC Contractor's time estimate to remove the spent GAC and emplace the new GAC. The above ground extraction water piping will be reconfigured so the former second GAC vessel (lag vessel) becomes the lead vessel and the vessel with the replaced GAC becomes the lag vessel (second in the series).

The GAC Contractor will remove the GAC from the lead vessel after the water has been drained from the vessel. The Contractor will remove the GAC using a vacuum hose, containerize the spent material, and fill the vessel with new GAC. The spent GAC will be profiled for disposal by submitting a sample for analysis of total VOCs and for the Toxicity Characteristic Leaching Procedure (TCLP) for VOCs. The GAC Contractor will remove the spent GAC from the project area and regenerate and/or dispose of the spent GAC appropriately, depending upon whether the profile results exceed hazardous waste thresholds. (Reuse of the GAC would be up to the GAC Contractor but in no instance would it be reused at the Project site.) Hazardous waste thresholds for the chemicals of concern associated with the AOI are presented in Table 4 in the Tables Section following the report narrative.

The EPA regulations establish two ways of identifying solid wastes as hazardous under the Resource Conservation and Recovery Act (RCRA). A waste may be considered hazardous if it exhibits certain hazardous properties ("characteristics") or if it is included on a specific list of wastes EPA has determined are hazardous ("listing" a waste as hazardous) because EPA found the characteristics to pose substantial present or potential hazards to human health or the environment. EPA defines four hazardous waste characteristic properties: ignitability, corrosivity, reactivity, or toxicity. A waste is ignitable if it is:

- a liquid with a flash point of less than 140 degrees F using an approved flash point test,
- a non-liquid that can readily catch fire under standard temperature and pressure, and burns vigorously after ignition so as to create a hazard, and
- is an ignitable compressed gas or a Department of Transportation oxidizer.

A waste is corrosive if it is:

- an aqueous waste with a pH of less than or equal to 2 or greater than or equal to 12.5, and
- a waste that can corrode steel at a rate of ¼ inch or more per year.

A material is a reactive hazardous waste if it is normally unstable, reacts violently with water, generates toxic gas if exposed to water or corrosive materials, or is capable of detonation if exposed to heat or flame.

A waste is determined to be hazardous based on the toxicity characteristic if a sample of the waste is subject to the TCLP for VOCs at a state-certified analytical laboratory and the results exceed the TCLP limits.

There are four different lists of hazardous wastes (40CFR 261), which are:

- **The F list (non-specific source wastes) –** contains waste from non-specific sources. This list includes solvents commonly used in degreasing, metal treatment baths and sludges, wastewaters from metal plating operations, and dioxin containing chemicals and their precursors.
- **The K list (source-specific wastes) –** designates particular solid wastes from certain specific industries. This listing includes descriptions that are very specific and clear such as wood preservation, pigment production, chemical production, petroleum refining, iron and steel production, explosive manufacturing, and pesticide manufacturing.
- **The P list and the U list (discarded commercial chemical products) –** contain discarded commercial products, off-spec chemicals, contain residues, and residues from chemical spills. The main differences between the two lists are the quantities of chemicals regulated.

It is the generator's responsibility to determine if the waste is a listed waste. The EPA defines a generator as "any person, by site, whose act or process produces hazardous waste identified or listed in part 261 of Title 40 of the Code of Federal Regulations (CFR)".

8.1 Hazardous Waste Disposal Site

Hazardous and non-hazardous waste will be disposed of in accordance with federal, state, and local regulations; the disposal facility will be selected by the contractor, subject to client approval.

9.0 REPORTING

Any non-compliance releases and spills that may endanger health or the environment must be reported to the National Response Center (NRC)[1] as well as the SFBRWQCB, the Project Engineer, and the Santa Clara Valley Water District within 24 hours of becoming aware of the circumstance. A written submission of the non-compliance, if any, shall be uploaded to GeoTracker within five days of becoming aware of the circumstance.

All analytical results from the AOI will be submitted to the SFBRWQCB within 24 hours of receipt and uploaded to GeoTracker within five days.

10.0 DEMOBILIZATION

The Construction Contractor will prepare a Rain Action Event Plan (REAP) meeting guidelines of the California Stormwater Quality Association best management practices for construction activities. The REAP will include detailed directions for removing equipment and materials from the channel if substantial rain is forecast. As noted in Section 6.0, the Construction Contractor shall have sufficient cranes, forklifts,

[1] The NRC is the sole federal point of contact for reporting all hazardous substance spills and releases, including the VOCs found in the AOI. See their website for more information (http://www.nrc.uscg.mil/nrcrpttxt.htm. See also the reportable quantities promulgated by 40 CFR Part 302.4 and found in Table 302.4 of the following website: https://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol28/pdf/CFR-2011-title40-vol28-sec302-4.pdf

trucks, and personnel onsite while working within the AOI to remove all equipment associated with the temporary groundwater treatment plant within 24 hours of notification of a pending rain event.

Prior to removing the treatment equipment from the Site, The sand filter media, organoclay from the organoclay filter, bag-filter sediment, and GAC from both the lead and lag vessels shall be sampled and analyzed by a state-certified laboratory for total VOCs and TCLP for VOCs for profiling purposes, as required prior to disposal at receiving facilities. The waste classification shall be determined based on the laboratory analytical results federal, state, and local regulations as described in Section 8.0. Hazardous waste thresholds for the chemicals of concern associated with the AOI are presented in Table 4.

Following the waste classification, the sand filter media, organoclay from the organoclay filter, bag-filter sediment, and GAC shall be removed from the respective vessels and transported offsite for lawful disposal. The GAC will be removed and either (1) regenerated and reused, or (2) disposed of off-site, depending whether the profiling results exceed hazardous waste thresholds.

Once the media have been removed, the piping of the components of the portable treatment plant will be disconnected and the individual components will be removed from the site using cranes, forklifts, and/or trucks, as appropriate. The aboveground components of the groundwater conveyance system and the connections to the portable treatment system will be reused by the Construction Contractor or disposed of as inert waste.

As mentioned in Section 4.0, if dewatering wells are installed to lower the water table as discussed in Section 5.0, the Construction Contractor will obtain all appropriate permits which can include permits and/or authorization from the Santa Clara Valley Water District for abandonment of the wells.

11.0 HEALTH AND SAFETY OVERVIEW

The dewatering contractor and the contractor performing the groundwater extraction and treatment system operation and monitoring will be required to be Hazardous Waste Operations and Emergency Response (HAZWOPER) trained (40-hour training with 8-hour annual updates), in compliance with 29 CFR 1910.120. The contractors are required to prepare their own Health and Safety Plan (HASP) with Job Safety Analyses (JSAs) for each task. At a minimum, the HASP will identify the following:

- Key personnel, general safety guidelines and protocols
- Job hazards
- Training requirements
- Personal protective equipment and engineering controls
- Exposure monitoring plan
- Emergency first aid and decontamination procedures
- Standard operating procedures

12.0 REFERENCES

Arcadis, 2015a. *Semiannual Groundwater Monitoring Report, August 1, 2014 through January 31, 2015, Former JCI Jones Chemical Facility, 985 Montague Expressway, Milpitas, California.* February 27, 2015.

Arcadis, 2015b. Semiannual Groundwater Monitoring Report, February 1, 2015 through July 31, 2015, Former JCI Jones Chemical Facility, 985 Montague Expressway, Milpitas, California. August 31, 2015.

SFBRWQCB, 2015. Letter from Bruce Wolfe to Amanda Cruz. *Berryessa Creek Channel Modification Project, adjacent to the former JCI Jones Chemical Facility, 985 Montague Expressway, Milpitas, Santa Clara County.* August 14, 2015.

Tetra Tech, 2015a. HTRW Soil Sampling Report Including Two Groundwater Grab Samples, Upper Berryessa Creek Flood Risk Management Project Between Montague Expressway and Yosemite Drive, Santa Clara County, Milpitas, California.

Tetra Tech, 2015b. Geotechnical Appendix. Upper Berryessa Creek Flood Risk Management Project I-680 to Calaveras Boulevard Santa Clara County, Milpitas, California. November 24, 2015.

TABLES

Table 1
Volatile Organic Compound in Area of Interest Groundwater
Berryessa Creek Widening Project Groundwater Management Plan

Constituent	**December 2014 & June 2015 Concentration Range (µg/L)**	**MCL (µg/L)**	**ESL (µg/L)**
Tetrachloroethylene	2.6 – 1,400	5	5
Trichloroethylene	0.6 – 86	5	5
Trans-1,2-dichloroethylene	0.6 – 16	10	10
Cis-1,2-dichloroethylene	<0.5 – 110	6	6
1,1-dichloroethane	<0.5 – 13	5	5
1,1-dichlorethene	<0.5 – 29	6	6
Vinyl Chloride	0.3 – 3.4	0.5	0.5

Notes:
ESL = Environmental Screening Levels
MCL = Maximum Containment Level
SFBRWQCB = San Francisco Bay Regional Water Quality Control Board
µg/L = micrograms per liter

Table 2
Extracted Groundwater Sampling Requirements
Berryessa Creek Widening Project Groundwater Management Plan

	Influent (INF-001)						Effluent (EFF-001)						
Parameter	**1st day**	**5th day**	**Monthly**	**Quarterly**	**Semiannually**	**Annually**	**1st day**	**5th day**	**Monthly**	**Quarterly**	**Semiannually**	**Annually**	**Once every 3 yrs**
Discharge Flow (gpm)							continuous	continuous	continuous	continuous	continuous	continuous	continuous
Fish Toxicity 96-hr % survival										x (1st yr)		x (after 1st yr)	
Standard Observations	x	x	x				x	x	x				
VOCs	x	x			x		x	x	x				
1,4-Dioxane								x			x		
Turbidity							x	x		x		x (after 1st yr)	
pH	x	x	x (1st yr)	x (2nd yr)		x (after 2nd yr)	x	x	x (1st yr)	x (2nd yr)		x (after 2nd yr)	
Total dissolved solids							x	x	x				
temperature							x	x	x (1st yr)	x (2nd yr)		x (after 2nd yr)	
Electrical conductivity							x	x	x (1st yr)	x (2nd yr)		x (after 2nd yr)	
Metals								x					x
Discharge Flow Volume									X				

Notes:
Standard Observation for Groundwater Treatment Systems include: odor; weather condition (wind direction and estimated velocity); deposits, discolorations, and/or plugging in the treatment system; operation of the float and/or pressure shutoff valves to prevent system overflow

Table 3
Groundwater Treatment Standards
Berryessa Creek Widening Project Groundwater Management Plan

Compound	CAS Number	Discharge to Other Surface Water Areas	
		Average Monthly Effluent Limitation (µg/L)	Maximum Daily Effluent Limitation (µg/L)
Benzene	71432	---	5
Carbon Tetrachloride	56235	4.4	5
Chloroform	67663	---	5
1,1-Dichloroethane	75343	---	5
1,2-Dichloroethane	107062	---	5
1,1-Dichloroethylene	75354	3.2	5
Ethylbenzene	100414	---	5
Methylene Chloride	75092	---	5
Tetrachloroethylene (PCE)	127184	---	5
Toluene	108883	---	5
Cis 1,2-Dichloroethylene	156592	---	5
Trans 1,2- Dichloroethylene	156605	---	5
1,1,1-Trichloroethane	71556	---	5
1,1,2-Trichloroethane	79005	---	5
Trichloroethylene (TCE)	79016	---	5
Vinyl Chloride	75014	---	1
Total Xylenes	1330207	---	5
Methyl Tertiary Butyl Ether (MTBE)	1634044	---	5
Total Petroleum Hydrocarbons [TPHs (as gasoline or as diesel)]	---	---	50
Ethylene Dibromide (1,2-Dibromoethane)	106934	---	5
Trichloro- trifluoroethane	76131	---	5
Total Chlorine Residual	---	---	0.0[1]

Notes:
µg/L = micrograms per liter

[1] = There shall be no detectable levels of residual chlorine in the effluent (a non-detect result using a detection level equal or less than 0.08 milligram per liter (mg/L) will not be deemed to be out of compliance). This limit only applies to Dischargers that chlorinate their extracted groundwater.

Table 4
Hazardous Thresholds for Granular Activated Carbon
Berryessa Creek Widening Project Groundwater Management Plan

Volatile Organic Compound	**Regulatory Level (mg/L)**
Benzene	0.5
Carbon Tetrachloride	0.5
Chlorobenzene	100
Chloroform	6.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
Tetrachloroethylene	0.7
Trichloroethylene	0.5
Vinyl Chloride	0.2

Notes:
mg/L = milligram per liter

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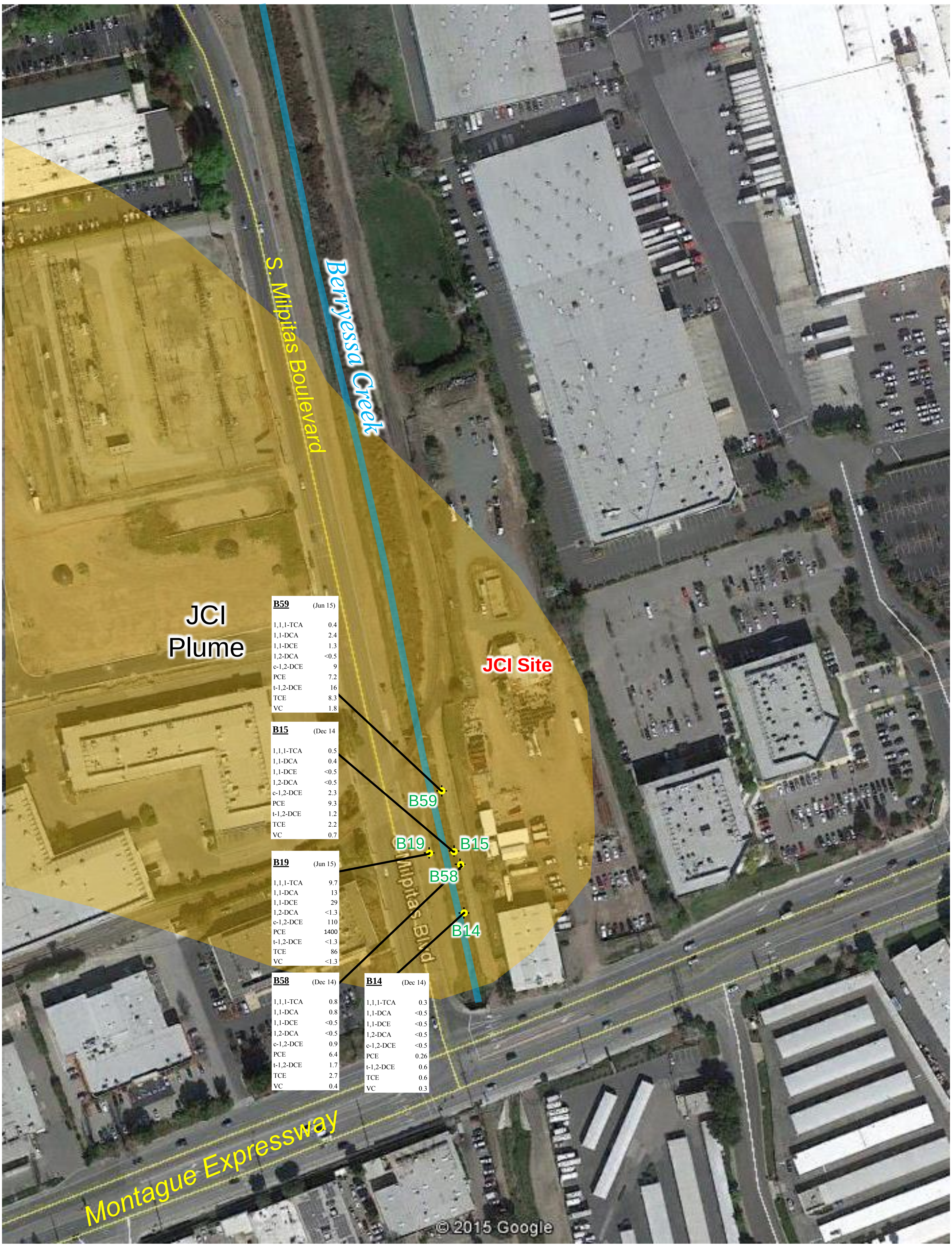
FIGURES



SOURCE: ***Google Earth Pro, February 23, 2014.***

B19 ✛ JCI shallow well (screened <40 feet bgs)

Approximate extent of JCI VOC Groundwater Plume

Location ID — **B14** (Dec 14) — Sample Date

Analyte — PCE 0.26 — Concentration (µg/L)

N

0 feet 150

Abbreviations:

1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane
c-1,2-DCE	cis-1,2-Dichloroethene
PCE	Tetrachloroethene
t-1,2-DCE	trans-1,2 Dichloroethene
TCE	Trichloroethene
VC	Vinyl Chloride

TITLE:

JCI Shallow Groundwater Plume

LOCATION:

Upper Berryessa Creek FRMP
Between Montague Expressway and Yosemite Drive
Milpitas, California

TETRA TECH

CHECKED:	IA	**FIGURE:**
DRAFTED:	KDH	**1**
FILE:	100-SWW-T31331	
DATE:	10-15-15	

RCE: *Google Earth Pro, February 23, 2014.*

N

0 feet 75

Area of Interest

Approximate extent of JCI VOC Groundwater Plume

TITLE:

Area of Interest

LOCATION:

Upper Berryessa Creek FRMP
Between Montague Expressway and Yosemite Drive
Milpitas, California

TETRA TECH

CHECKED:	IA	FIGURE:
DRAFTED:	KDH	2
FILE:	100-SWW-T31331	
DATE:	10-15-15	

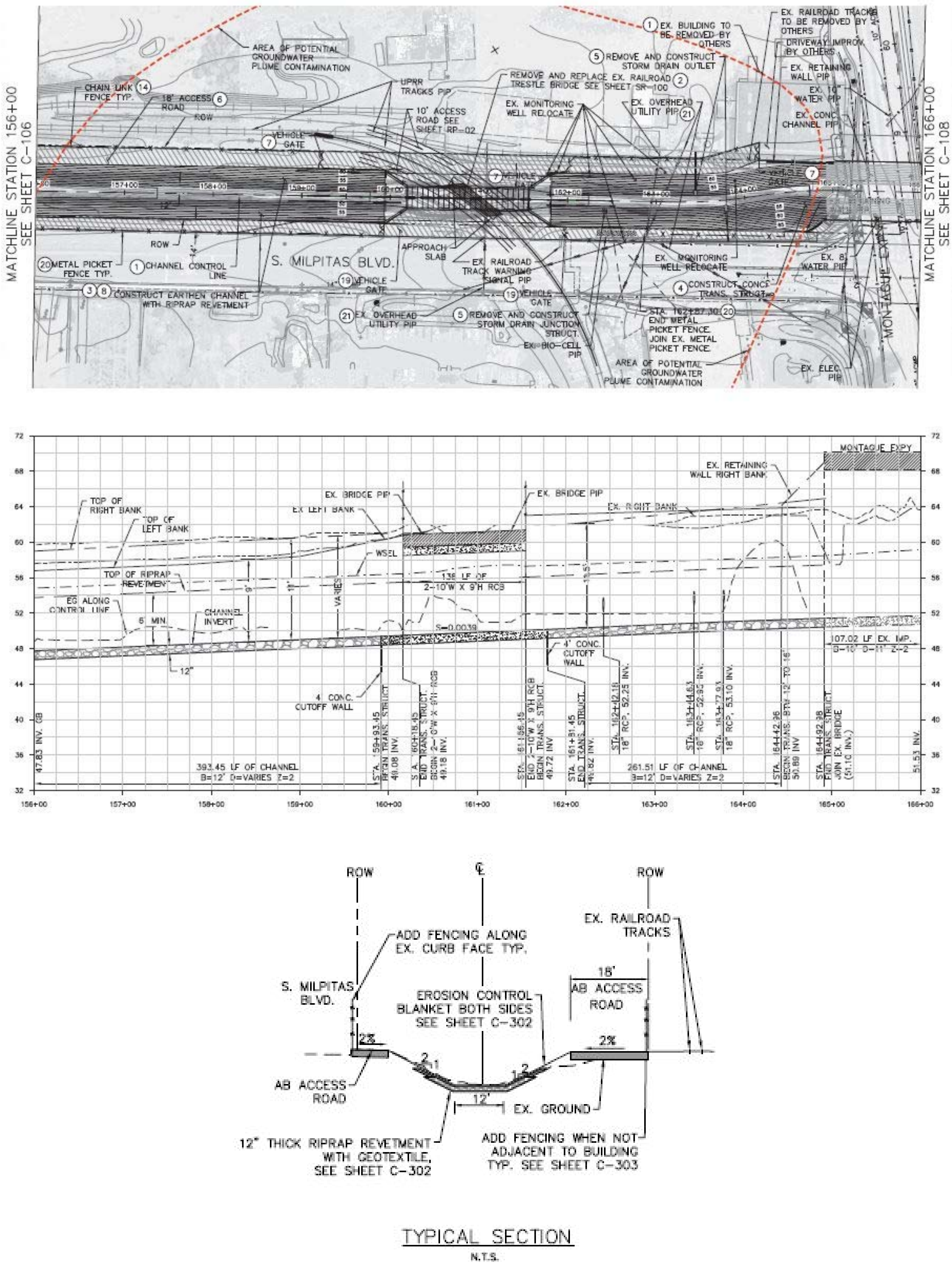
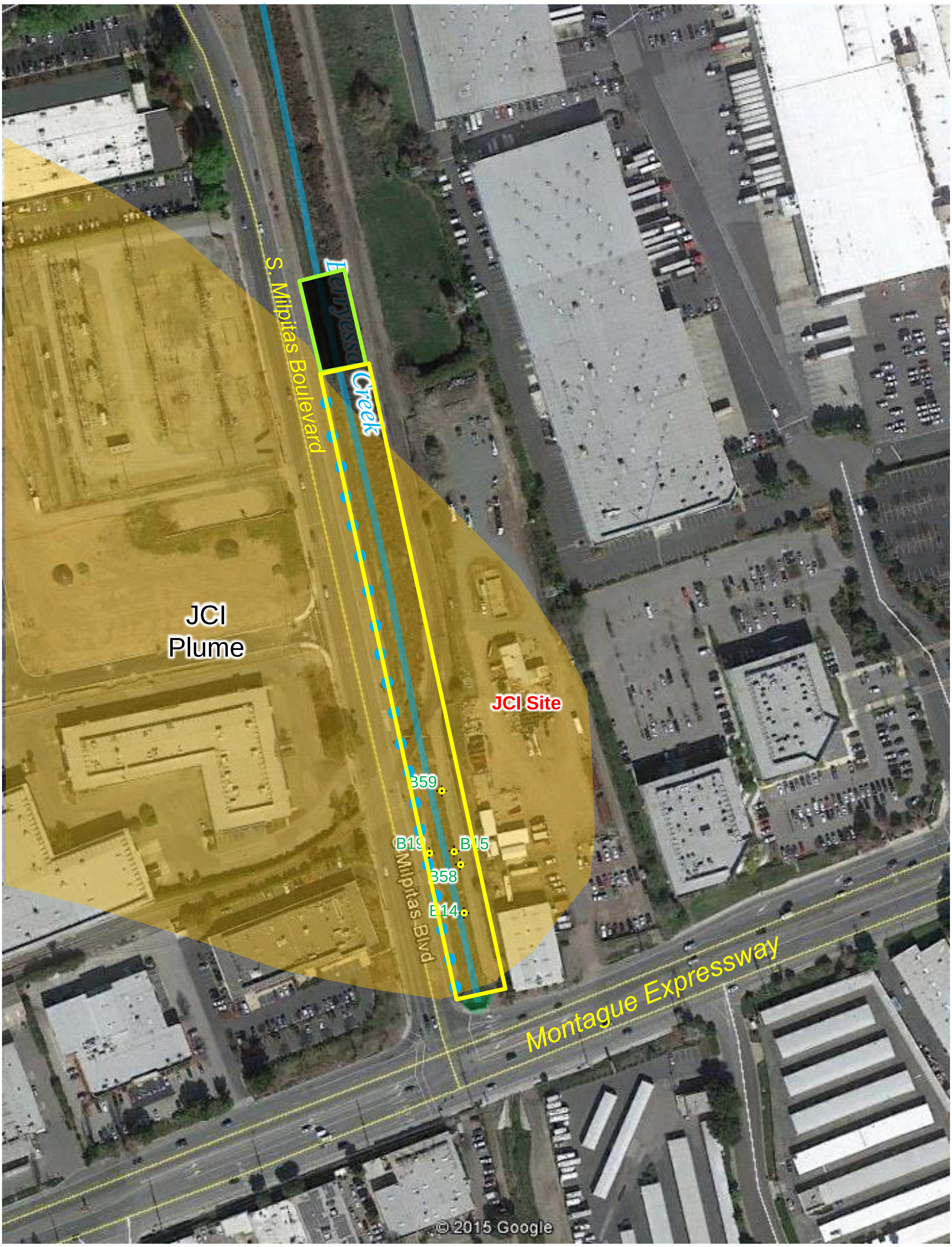


FIGURE 3. Proposed Project Construction Plans and Cross Section in the AOI



SOURCE: ***Google Earth Pro, February 23, 2014.***

Approximate location of shallow groundwater extraction well

B19 JCI shallow well (screened <40 feet bgs)

Approximate extent of JCI VOC Groundwater Plume

Area of Interest

Proposed Temporary Groundwater Treatment System Location

N

0 feet 150

TITLE: **Approximate Location of Shallow Groundwater Extraction Wells in AOI**

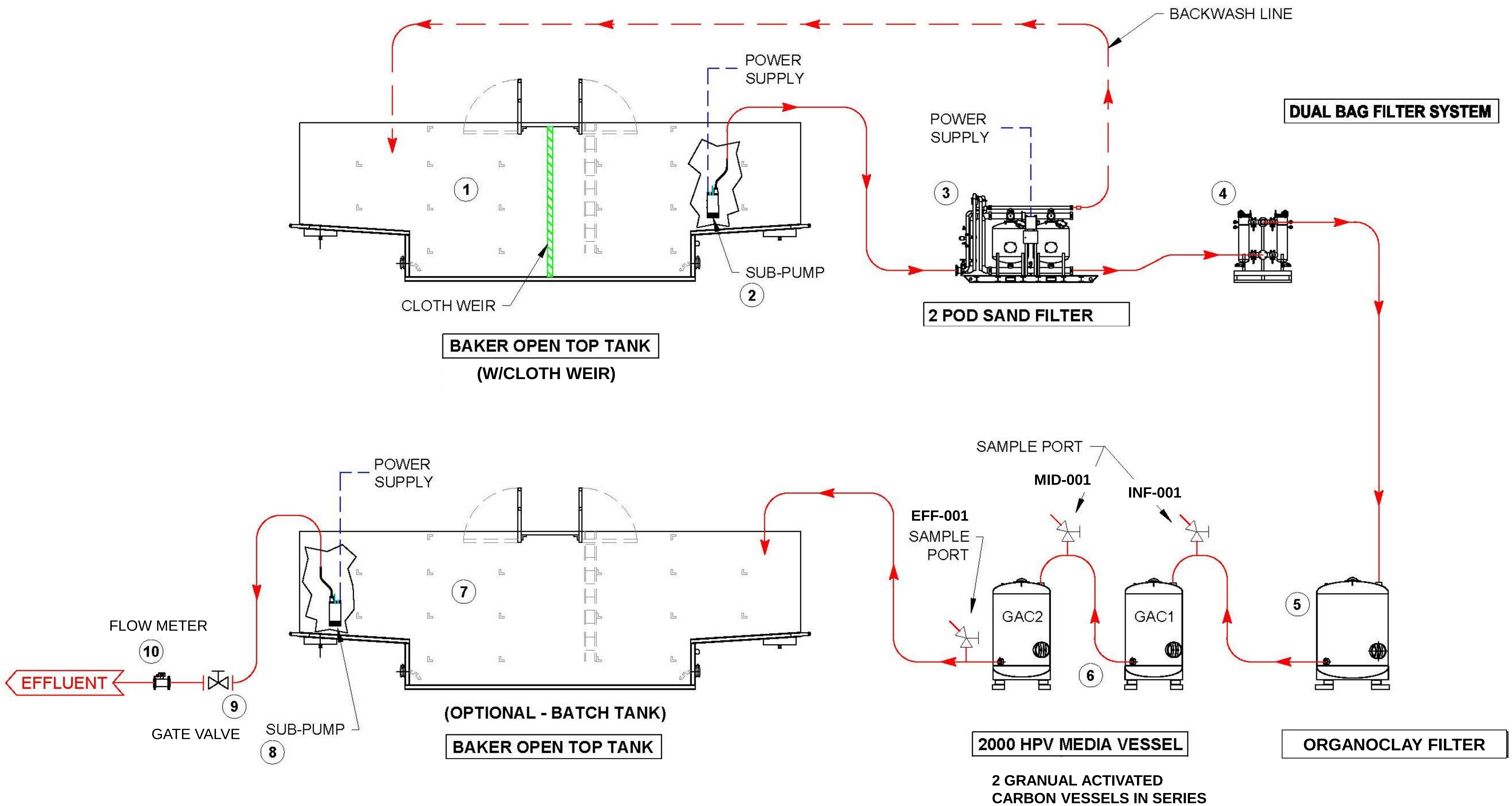
LOCATION: **Upper Berryessa Creek FRMP Between Montague Expressway and Yosemite Drive Milpitas, California**

TETRA TECH

CHECKED:	IA
DRAFTED:	KDH
FILE:	100-SWW-T31331
DATE:	10-15-15

FIGURE: 4

P:\PROJECTS\Tt DIV - Water\Berryessa Creek Soil Water Mngmnt\Process Flow Schematic.pptx



TITLE: **Process Flow Schematic**

LOCATION: **Upper Berryessa Creek FRMP**
Between Montague Expressway and Yosemite Drive
Milpitas, California

TETRA TECH

CHECKED:	SEP
DRAFTED:	JAA
FILE:	100-SWW-T31331
DATE:	10-30-15

FIGURE: **5**

ATTACHMENTS

Attachment A
SFBRWQCB Non-Enforcement Letter Dated August 14, 2015

August 14, 2015
File No. 43S0065 (mej)

Amanda Cruz
San Francisco Planning Branch
US Army Corps of Engineers
1455 Market Street
San Francisco, CA
Amanda.B.Cruz@usace.army.mil

SUBJECT: Berryessa Creek Channel Modification Project, adjacent to the former JCI Jones Chemicals Facility, 985 Montague Expressway, Milpitas, Santa Clara County

Dear Ms. Cruz:

Thank you for meeting with Regional Water Board staff to discuss the upcoming creek channel modification project being conducted by the U.S. Army Corps. of Engineers and the Santa Clara Valley Water District. As we have discussed, the groundwater contaminant plume of volatile organic compounds (VOCs) originating from the former JCI Jones facility passes beneath passes beneath Berryessa Creek, immediately to the west of the former facility.

We understand that you will be working in the creek bed immediately adjacent to the former Jones site. As part of the construction, groundwater may be encountered. To manage groundwater that may be encountered during construction, a groundwater management plan will be developed that will include control and diversion of water, if necessary, using the most efficient means such as coffer dams, sump pumps, dewatering wells or other techniques. Any water that may be generated will be treated and discharged downstream or to a storm drain. The treatment standards for this discharge water will comply with those set forth in our NPDES General Permit (R2-2012-0012) for fuel and VOC impacted sites. However, you will not be obtaining an NPDES permit for this work. A copy of the groundwater management plan will be submitted to this agency for our review and comment.

Based on our understanding of the work outlined above and with the condition that the groundwater is treated to the standards described, we will not recommend enforcement for discharging without a permit.

The work in the creek bed will also include movement of soil/sediment as part of the construction activities. As discussed, there is no reason to believe shallow soil/sediment in the area adjacent to the former Jones facility is impacted. This being the case, no soil/sediment management plan is necessary for movement of the materials. In the case that impacted soil is encountered, it will be segregated and stockpiled for offsite disposal. We find this acceptable.

If you have any questions, please contact Mark Johnson of my staff at (510) 622-2493 [e-mail mjohnson@waterboards.ca.gov].

Sincerely,

[Original digitally signed and furnished upon request;
does not transfer as PDF copy]

Bruce H. Wolfe
Executive Officer

cc: Ira Artz, Ira.Artz@tetratech.com
Susan Glendening, susan.glendening@waterboards.ca.gov
Tim Gaffney, JCI Jones Chemicals, Inc. tgaffney@jcichem.com
Chuck Pardini, Arcadis Chuck.Pardini@arcadis-us.com

Attachment B
Photograph of Typical Temporary Groundwater Treatment Plant

Attachment C
Typical Specifications for a 100 Gallon Per Minute Temporary Groundwater Treatment Plant

PRODUCT DATA SHEET
January, 2007

2" DUPLEX BAG FILTER SYSTEM

GENERAL INFORMATION

Two independent filter housings are skid-mounted and piped such that one filter unit is active while the other is out of service. Inlet and outlet connections are provided on each end of the skid. Use for filtering a wide range of industrial and commercial process fluids, groundwater discharge from construction sites, stormwater or urban runoff.

WEIGHTS AND MEASURES

Capacity:	50 - 110 gpm per filter when clean (depends on filter media micron rating)
Design Pressure:	150 psi
Design Temp:	140°F max.*
Height:	4'-9" (overall)
Width :	4'-8"
Length:	5'-8"
Weight:	550 lbs. (approx.)

SKID DESIGN

Outer Frame:	6 x 8.2 A36 carbon steel channel
Inter. Frame:	2"x2 "x3/16" A36 carbon steel angle
Filter Housing Pad:	15 x 33.9 A36 carbon steel channel
Forklift Pockets:	Through front and rear framing channels
Cover:	Expanded metal grating
Lifting Eyes:	All four corners

*Practical limit for the PVC header piping. Unit could be used up to 225°F if carbon steel piping is used instead.

FILTER DESIGN

Filter Housing	Rosedale model 8-30-2F-2-150-C-B-S-PB
Top Cover:	Three eyenuts; hinged for easy access
Piping:	2" schedule 80 PVC (inlet and outlet headers)
Inlet & Outlet:	2" 150# ANSI flanges
Cover Seal:	Buna N (Nitrile) o-ring
Housing Material:	Carbon Steel
Filter Basket:	30" deep, 6.7" diameter, 4.4 sq. ft. surface area, 1000 cu. in. volume, 9/64" dia holes (51% open)
Filter Media:	Filter bags, size #2. Wide range of micron ratings is available, down to 1.0.
Vent Valves:	1/4" ball valve on top cover
Drain Valves:	1" ball valve on the bottom of each housing

SURFACE DETAILS

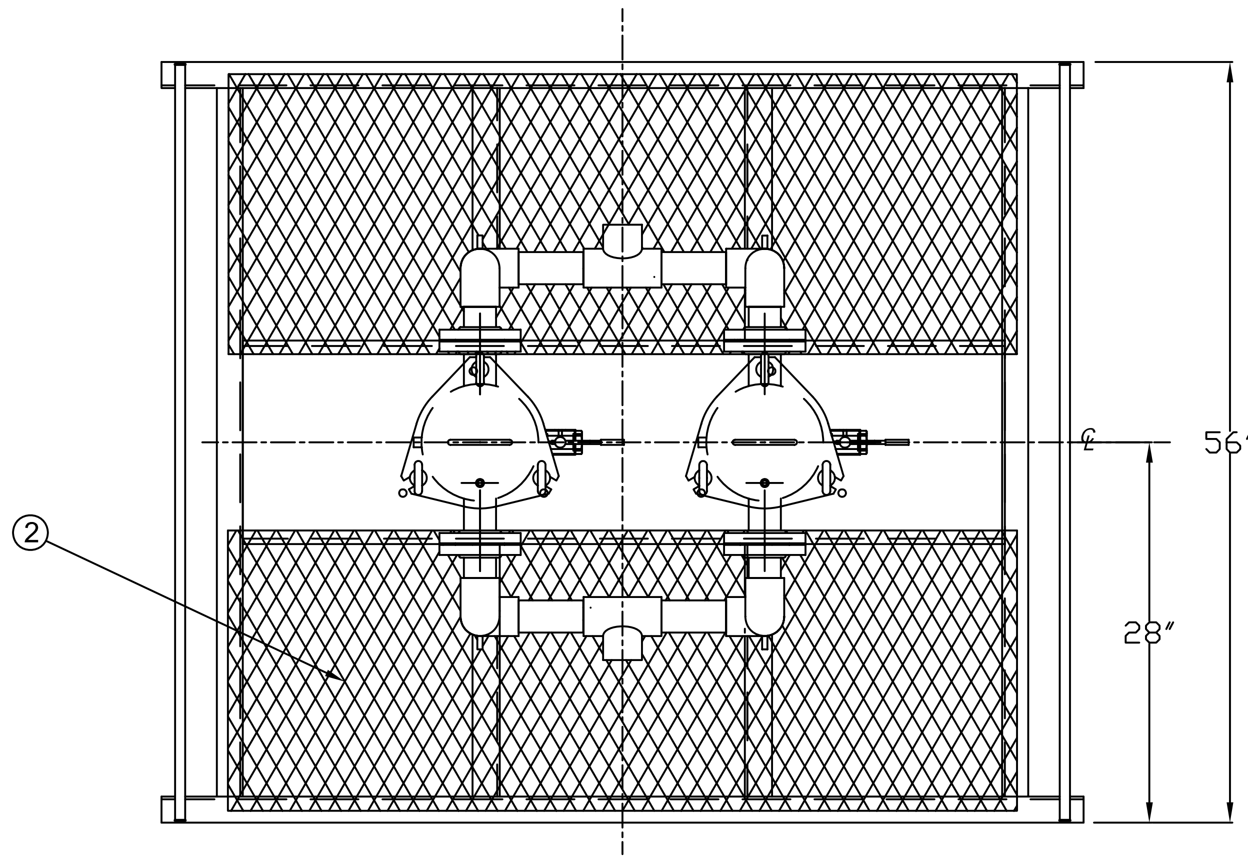
Exterior Coating:	High gloss polyurethane

TESTS / CERTIFICATIONS

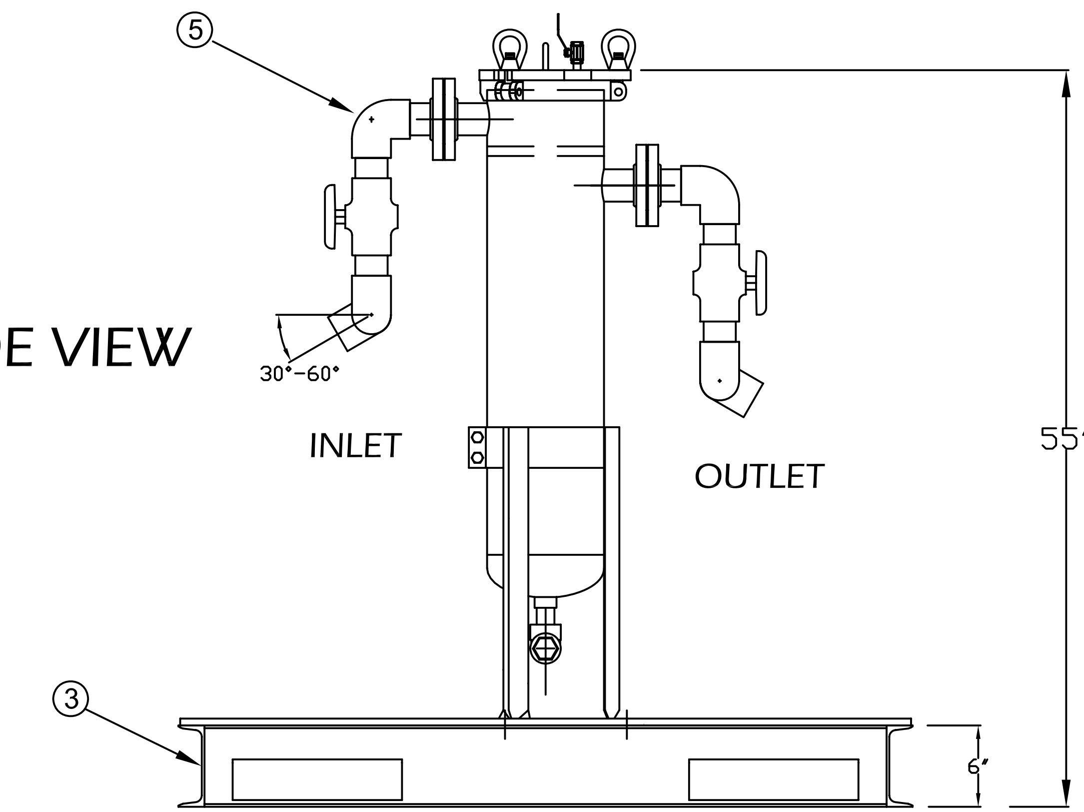
Test Performed:	Scheduled QMS inspections

BAKERCORP

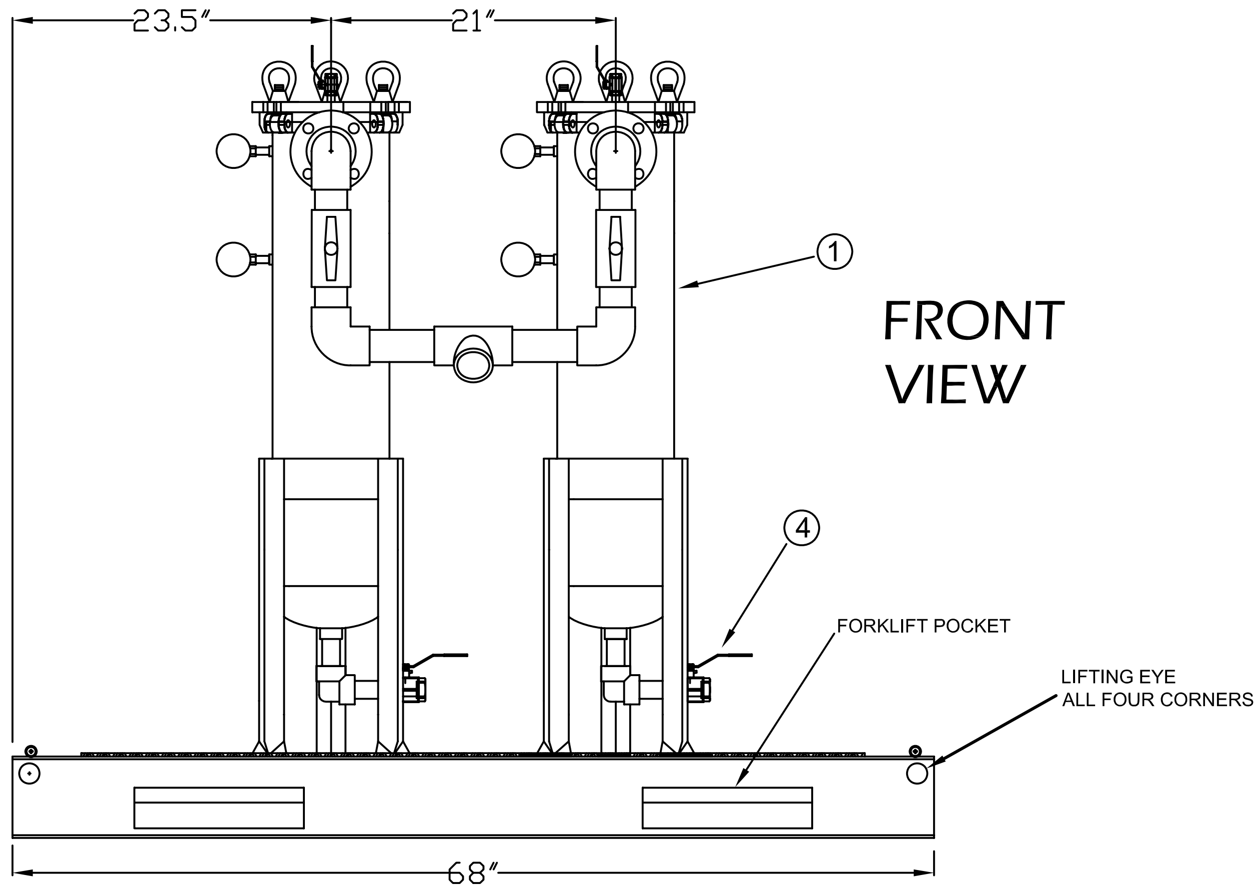
ITEM	DESCRIPTION
1	Rosedale Model 8302F2150CBS-PB Bag Filter, all welded construction, carbon steel wetted parts; Design Pressure: 150 psi; Design Temperature: 400°F; Filter Basket: 304 SS, 4.4 sq. ft. area, 9/64" dia. holes (51% open).
2	Expanded metal grating
3	Mounting skid with forklift pockets
4	1" bottom drain
5	2" PVC piping



TOP VIEW



SIDE VIEW



FRONT VIEW

BAKERCORP™
3020 OLD RANCH PARKWAY
SEAL BEACH, CA 90740-2751

REV.	DESCRIPTION	DATE	BY
G			
F			
E			
D			
C			
B			
A	Changed drawing title	2/18/05	PJB

SCALE: To Scale	SIZE B	ORIGINAL DWG. DATE 18AUG03
DRAWN BY: P.J.B.	APPROVED BY: –	CAT/CLASS ––
TITLE 2" BAG FILTER UNIT		SHEET 1 OF 1
DRAWING NO. S-9-M0010-1-		REV. A

OC Organoclay/Carbon Blend

BakerCorp's OC series filtration media is available for liquid phase applications and is a blend of "R 8x30" activated carbon and "Z-200" modified zeolite (often referred to as organoclay). This carbon/organoclay mixture is ideal for the filtration of oil and grease from contaminated water. This media also has some catalytic abilities to adsorb anions such as chromate, selenate, sulfate, hydrocarbons (such as Benzene, Toluene, and Xylene), heavy metals (such as lead and cadmium), and various petroleum products (such as oil) from aqueous waste streams.

ORGANOCLAY PHYSICAL PROPERTIES:

Cation Exchange Capacity:	2.20 meq/g
Bulk Density (lbs./cu.ft.):	58
Hardness (Mohs Scale):	5.1
Pore Size:	4.0 A
Specific Surface Area:	40 sq. m/g
Thermal Stability:	1,202 F
Crushing Strength:	2,500 lbs/sq inch
Blended Bulk Density (lbs./cu. Ft.)	44

These specifications represent general parameters and are subject to change. Please consult with BakerCorp before proceeding with your application.

4306 W. 190th Street, Torrance, California 90504
Phone: 310.303.3700 ♦ Fax: 310.406.3001

PRODUCT DATA SHEET

January, 2007

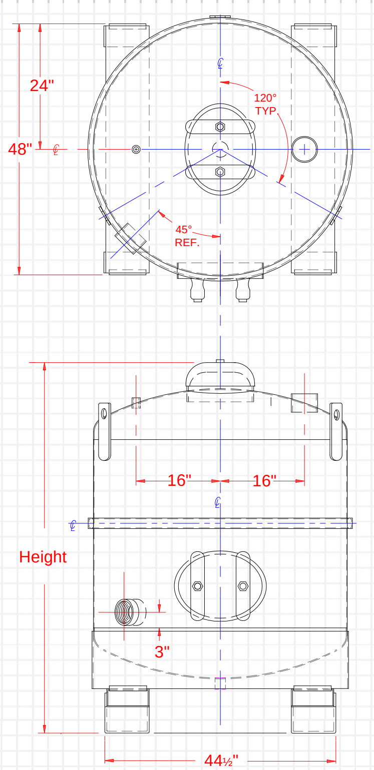
KLEEN.WATER 1000HPV & 2000HPV

GENERAL INFORMATION

These units are designed for the efficient purification of contaminated water or liquid streams. These filters have the ability to remove contaminants to non-detectable levels. The vessels are constructed of heavy-duty mild steel and are lined with a double-layer epoxy coating.

WEIGHTS AND MEASURES

» Max. Flowrate:	*1000HPV:* 80 gpm *2000HPV:* 100 gpm
» Max. Pressure:	75 psi
» Max. Temp:	150°F
» Height:	*1000HPV:* 70″ *2000HPV:* 96″
» Diameter:	48″
» Shipping Wt*: (drum + media) (*Media dependent)	1000HPV: 2050 lbs. – 3050 lbs. 2000HPV: 3100 lbs. – 5100 lbs.



Downflow operation is recommended

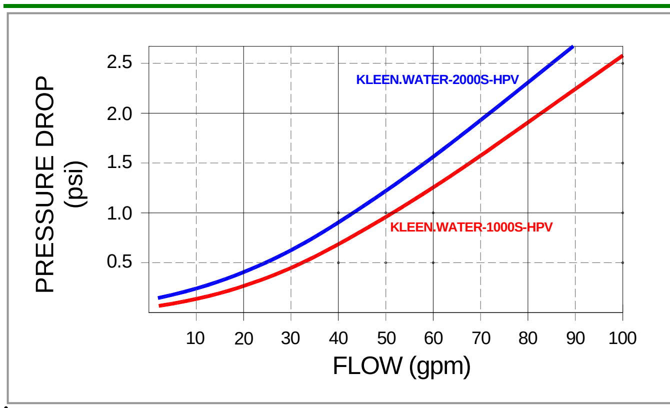
FILTER MEDIA

» Types:	•Activated Carbon •Organoclay •Ion Exchange Resin •Specialty Media
» Volume:	*1000HPV:* 34 cu. ft. *2000HPV:* 68 cu. ft.
» Weight*: (*Media dependent)	*1000HPV:* 1000 lbs. – 2000 lbs. *2000HPV:* 2000 lbs. – 4000 lbs.

MISCELLANEOUS

» Inlet:	4″ FNPT
» Outlet:	4″ FNPT
» Interior Coating:	Double-layered epoxy coating
» Internals:	PVC underdrain
» Media Access:	Top & side 12″x16″ manways (neoprene gaskets)

PRESSURE DROP DATA



NOTE:

1. Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate procedures for potentially low oxygen spaces must be followed, including all federal and state requirements.

BAKERCORP™

3020 Old Ranch Parkway • Suite 220 • Seal Beach, CA • 562-430-6262

TSURUMI PUMP | LB - SERIES | SPECIFICATIONS

SEMI-VORTEX - DEWATERING PUMP

FEATURES

1. Semi-vortex Urethane Rubber or high chrome cast iron impeller solids and allows for pumping of sand and stringy material.

2. Highly efficient, continuous duty air filled, copper wound motor with class E, insulation minimizes the cost of operation.

3. Built in thermal protection prevents motor failure due to overloading, accidental run-dry and single phasing in three phase units.

4. Double inside mechanical seals with silicon carbide faces running in an oil filled chamber provide for one the most durable seal designs available.

5. Double shielded, permanently lubricated, high temperature C3 ball bearings rated for a B-10 life of 60,000 hours provide for extended operational life.

6. Model LB-480A & LB-800A Automatic Submersible pump performs like the non-automatic version in every aspect of construction site usage requiring a tough and durable pump

7. Slime design allows pumps fit Into 8” pipes. (Manual type only)

APPLICATIONS

1. Residential, commercial, industrial wastewater and site drainage.

2. Decorative waterfalls and fountains.

3. Raw water supply from lakes or rivers.

4. Sediment removal from small sumps or basins.

Intertek

OIL LIFTER EQUIPPED

SPECIFICATIONS	STANDARD	OPTIONS
Discharge Size	2 - 3 "Npt (50 - 80 mm)	
Horsepower Range	1/2 - 2Hp. (0.40 - 1.5kW)	
Performance Range Capacity	15.9 - 111.0 GPM. (0.06 - 0.42 m^3/min)	
Head	13.1 Ft. - 68.9 Ft. (4.0 - 18.9 m)	
Maximum water temperature	104^o F. (40^o C.)	
Materials of Construction		
Casing	Butadiene Rubber + Natural Rubber + Steel [LB(T)-1500]	
Impeller	Urethane Rubber , High Chrome Cast Iron [LB(T)-1500]	
Shaft	403 Stainless Steel	
Motor Frame	Aluminum alloy	
Fasteners	304 Stainless Steel	
Mechanical Seal	Silicon Carbide	
Elastomers	NBR (Nitrile Butadiene Rubber)	
Impeller Type	Semi-vortex, solids handling.	
Solids Handling Capability	0.236” (6.0mm)	
Bearings	Prelubricated, Double Shielded	
Motor Nomenclature		
Type, Speed, Hz.	Air Filled, 3600 Rpm, 60 Hz.	
Voltage, Phase	115 / 230V., 1 Phase 230 / 460 / 575V., 3 Phase	
Insulation	Class E, B	
Accessories	Submersible Power Cable 32 - 50' (10 - 15m)	Length as Required, TS-301 Float Switch
Operational Mode	Manual , Automatic(LB-480A / 800A)	

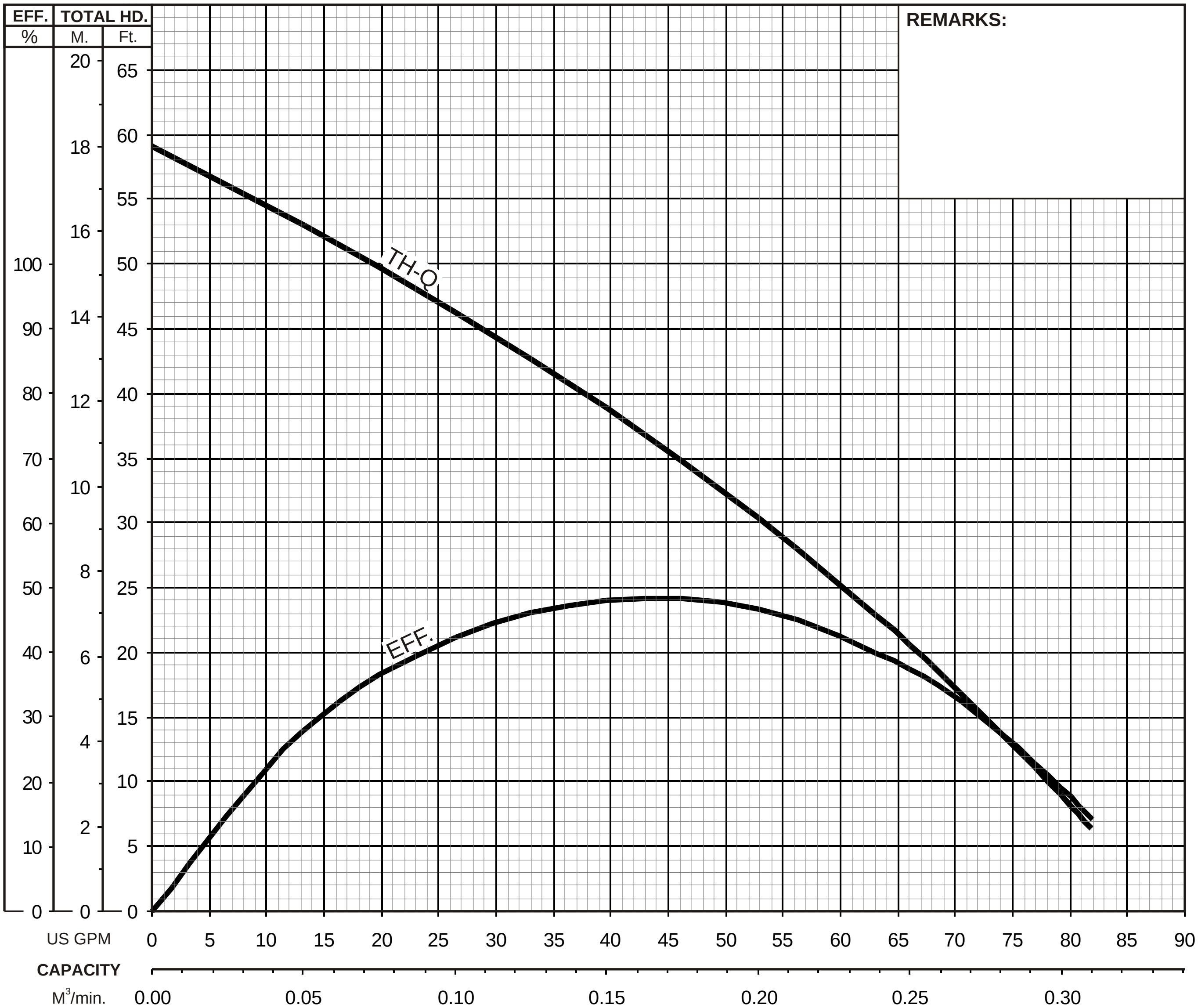
TSURUMI PUMP

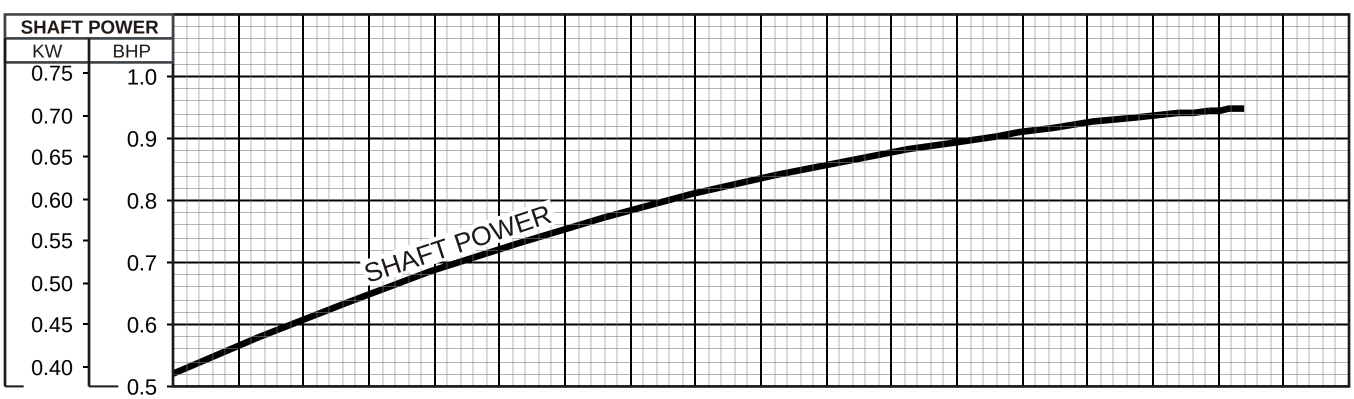
LB - SERIES

SEMI-VORTEX - DEWATERING PUMP

PERFORMANCE CURVE

MODEL		BORE	HP	KW	RPM	SOLIDS DIA	LIQUID	SG.	VISCOSITY	TEMP.
LB(Z)-800(A)-61		2"/50mm	1	0.75	3300	0.236"/6mm	Water	1.0	1.123 cSt.	60°F
PUMP TYPE		PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
Semi-Vortex - Dewatering Pump		Single	115-120 / 230		9.6-9.2 / 5.1	60	Capacitor Start		E	
CURVE No.	DATE	PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
-	-	-	-		-	-	-		-	



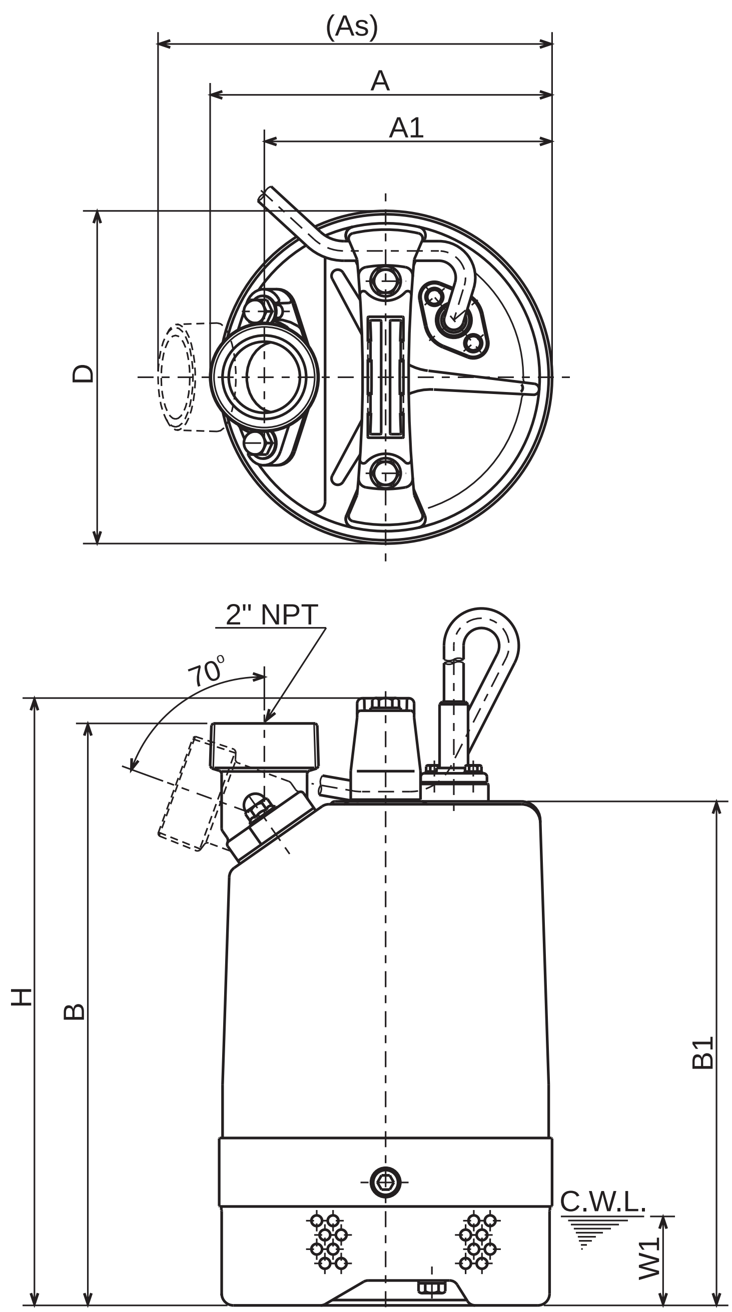


TSURUMI PUMP

LB - SERIES
SEMI-VORTEX - DEWATERING PUMP

DIMENSIONS

LB-800-61
LBT-800-61



C.W.L. : Continuous running Water Level

DIMENSIONS:USCS (Inch)

Model	HP	NOM.	Pump & Motor							C.W.L.	Wt.
		SIZE	A	As	A1	B	B1	D	H	W1	(lbs.)
LB-800-61	1	2"	7 9/16	8 11/16	6 3/8	12 7/8	11 1/8	7 3/8	13 7/16	2	29
LBT-800-61	1	2"	7 9/16	8 11/16	6 3/8	12 7/8	11 1/8	7 3/8	13 7/16	2	28

DIMENSIONS:METRIC (mm)

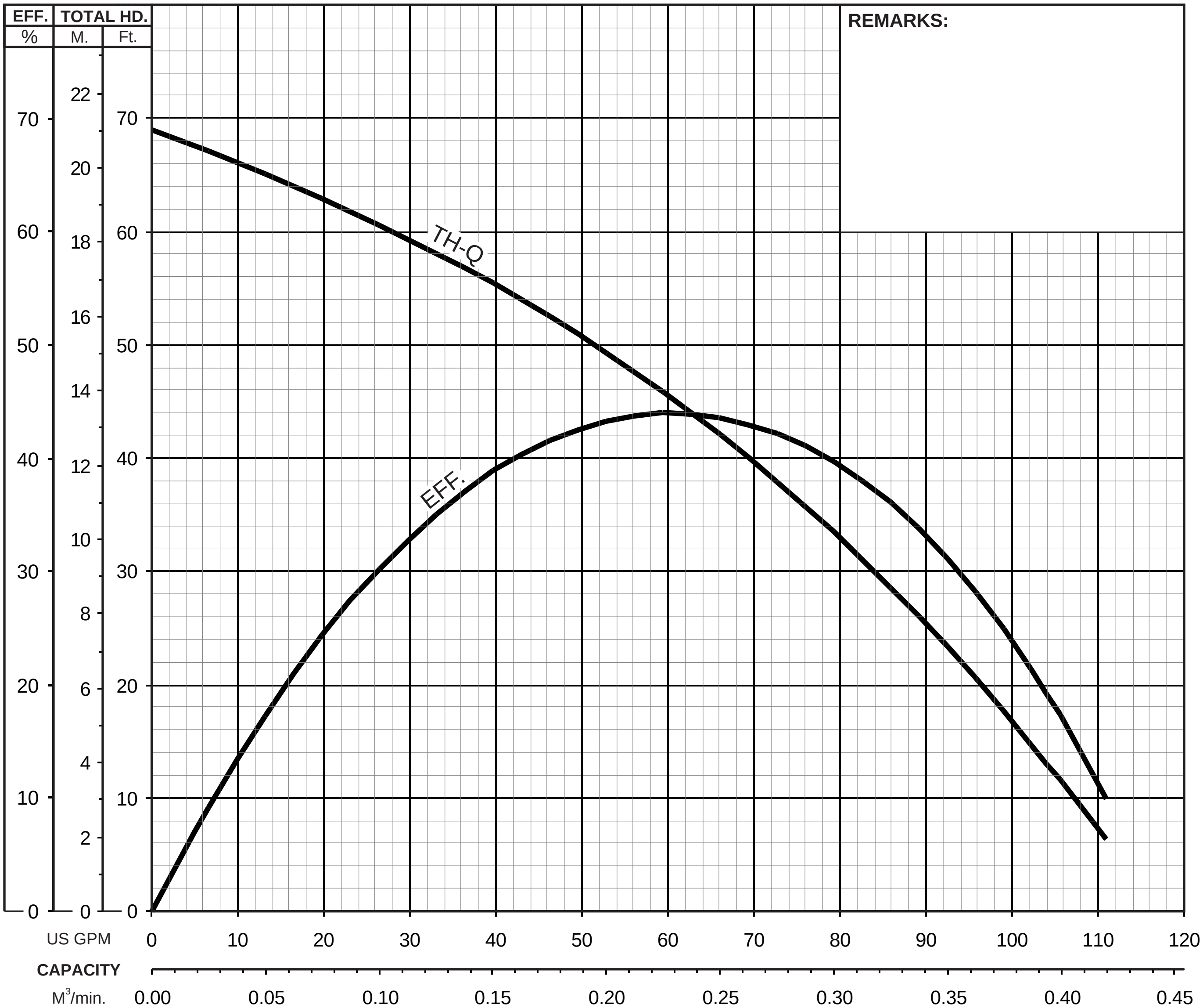
Model	kW	NOM.	Pump & Motor							C.W.L.	Wt.
		SIZE	A	As	A1	B	B1	D	H	W1	(kg)
LB-800-61	0.75	50	192	221	162	327	283	187	341	50	13.2
LBT-800-61	0.75	50	192	221	162	327	283	187	341	50	12.8

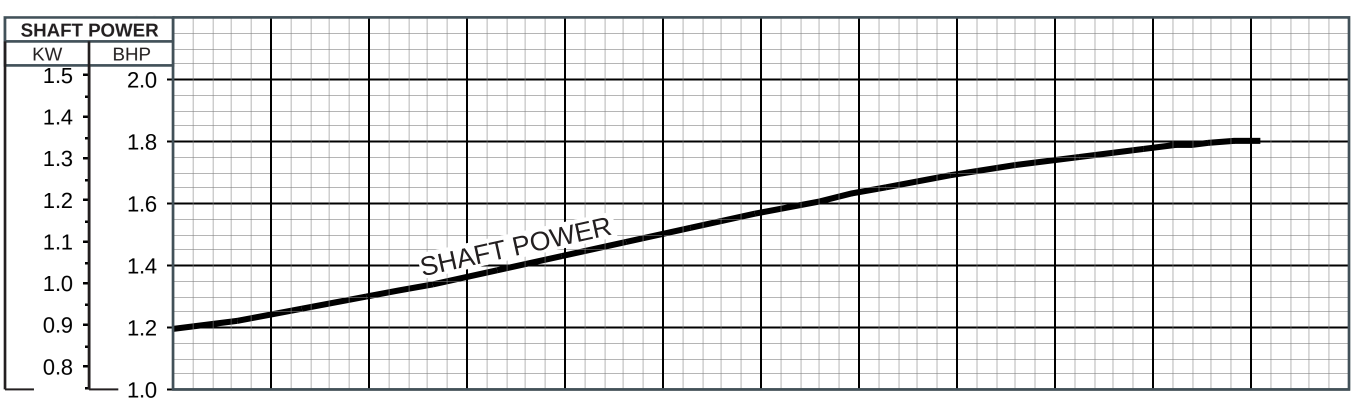
TSURUMI PUMP

LB - SERIES
SEMI-VORTEX - DEWATERING PUMP

PERFORMANCE CURVE

MODEL		BORE	HP	KW	RPM	SOLIDS DIA	LIQUID	SG.	VISCOSITY	TEMP.
LB-1500-60		3"/80mm	2	1.5	3480	0.236"/6mm	Water	1.0	1.123 cSt.	60°F
PUMP TYPE		PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
Semi-Vortex Dewatering Pump		Single	110/115/120, 230		27.1/26.2/27.0, 13.2	60	Capacitor Start		B	
CURVE No.	DATE	PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
-	-	-	-		-	-	-		-	





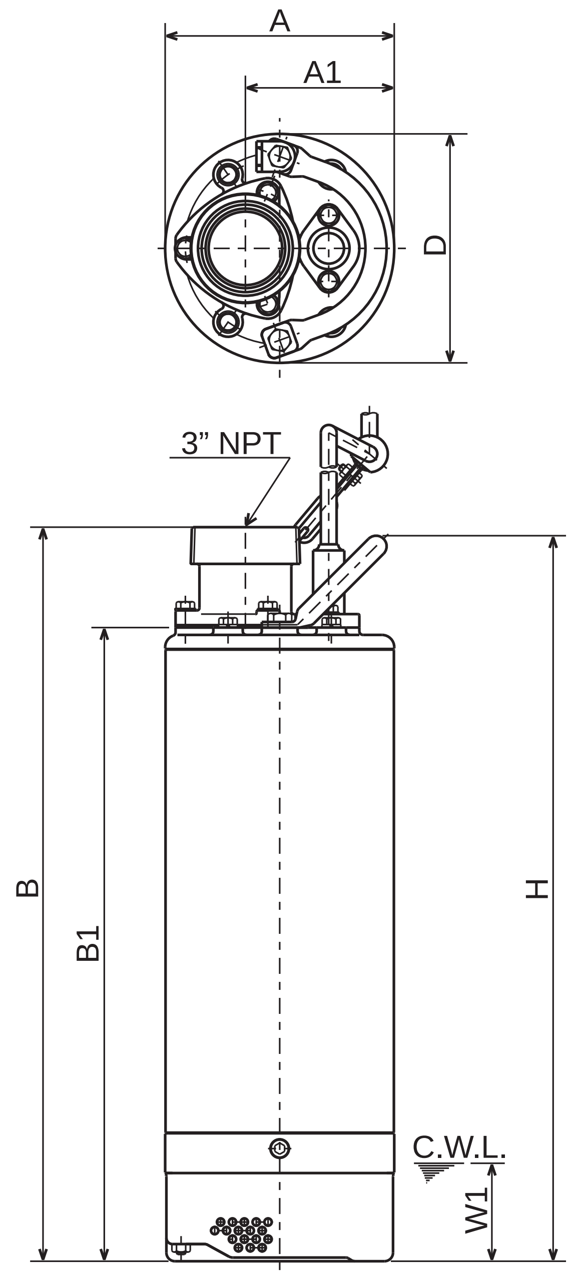
TSURUMI PUMP

LB - SERIES

SEMI-VORTEX - DEWATERING PUMP

DIMENSIONS

LB-1500-60
LBT-1500-60



C.W.L. : Continuous running Water Level

DIMENSIONS:USCS (Inch)

Model	HP	NOM. SIZE	Pump & Motor						C.W.L.	Wt.
			A	A1	B	B1	D	H	W1	(lbs.)
LB-1500-60	2	3"	7 3/8	4 13/16	23 5/8	20 3/8	7 3/8	23 5/16	3 1/8	72
LBT-1500-60	2	3"	7 3/8	4 13/16	23 5/8	20 3/8	7 3/8	23 5/16	3 1/8	70

DIMENSIONS:METRIC (mm)

Model	kW	NOM. SIZE	Pump & Motor						C.W.L.	Wt.
			A	A1	B	B1	D	H	W1	(kg)
LB-1500-60	1.5	80	187	122	600	518	187	593	80	32.5
LBT-1500-60	1.5	80	187	122	600	518	187	593	80	32.0

TSURUMI PUMP

HS - SERIES

SEMI-VORTEX - WASTEWATER PUMP - WITH AGITATOR

SPECIFICATIONS

FEATURES

1. Semi-vortex Urethane Rubber impeller with agitator suspends solids and allows for pumping of sand and stringy material.

2. Highly efficient, continuous duty air filled, copper wound motor with class E, insulation minimizes the cost of operation.

3. Built in thermal protection prevents motor failure due to overloading, accidental run-dry and single phasing in three phase units.

4. Double inside mechanical seals with silicon carbide faces running in an oil filled chamber provide for one the most durable seal designs available.

5. Double shielded, permanently lubricated, high temperature C3 ball bearings rated for a B-10 life of 60,000 hours provide for extended operational life.

HSZ : HS series dewatering pump is available in an automatic Type with simple float switch.

HSD : Single Phase compact pump fit for use in slurry dewatering in foundation works.

APPLICATIONS

1. Residential, commercial, industrial wastewater and site drainage.

2. Decorative waterfalls and fountains.

3. Raw water supply from lakes or rivers.

4. Sediment removal from small sumps or basins.

HSZ

HSD

Intertek

OIL LIFTER EQUIPPED

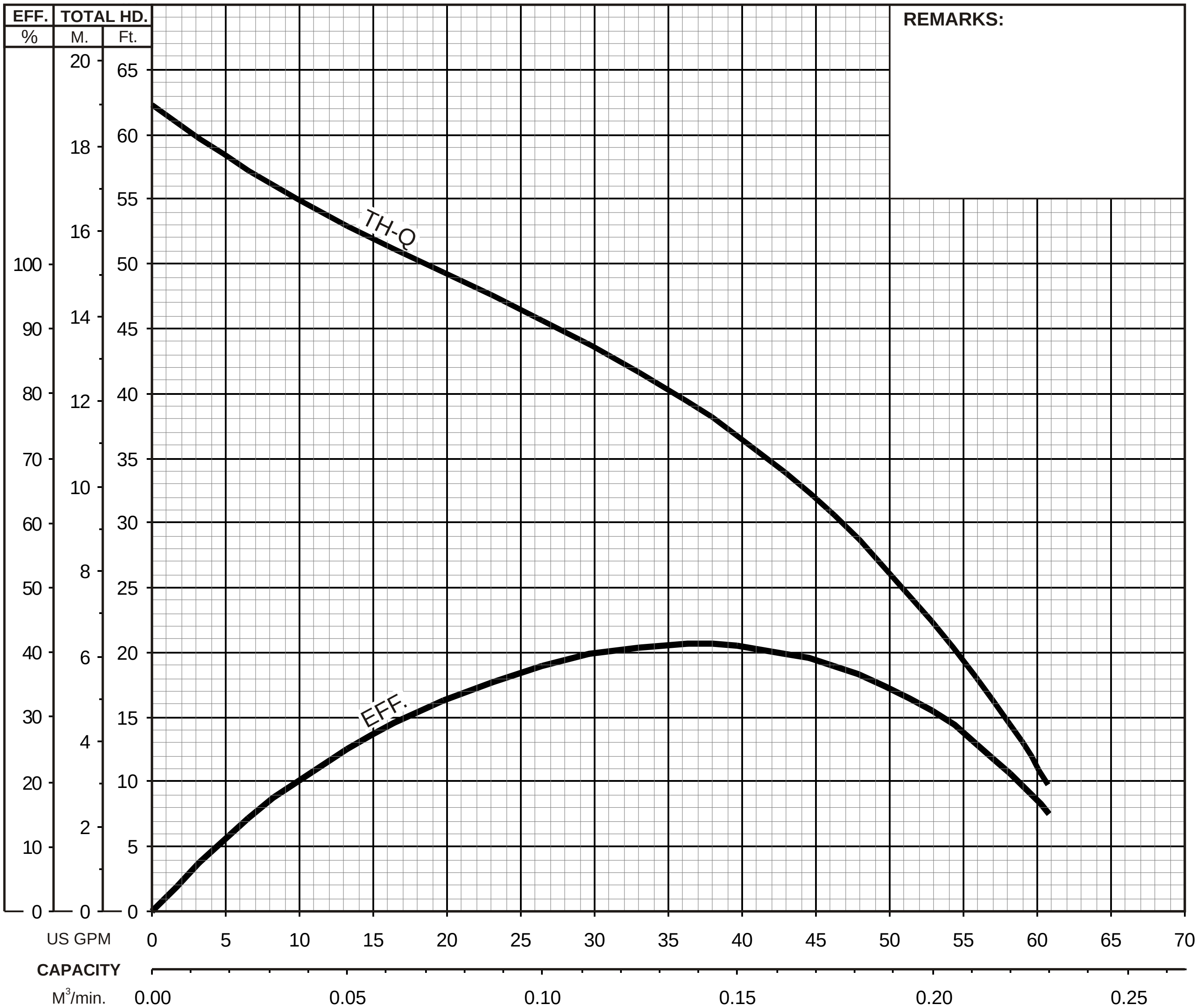
SPECIFICATIONS	STANDARD	OPTIONS
Discharge Size	2 - 3 "Npt (50 - 80 mm)	
Horsepower Range	1/2 - 1Hp. (0.40 - 0.75kW)	
Performance Range Capacity	13.2 - 61.0 GPM. (0.05 - 0.23 m^3/min)	
Head	13.1 Ft. - 62.0 Ft. (4.0 - 18.9 m)	
Maximum water temperature	104^o F. (40^o C.)	
Materials of Construction		
Casing	Cast Iron , Ductile Cast Iron(HSD)	
Impeller	Urethane Rubber , High Chrome Cast Iron(HSD)	
Shaft	403 Stainless Steel	
Motor Frame	Aluminum alloy	
Fasteners	304 Stainless Steel	
Mechanical Seal	Silicon Carbide	
Elastomers	NBR (Nitrile Butadiene Rubber)	
Impeller Type	Semi-vortex, solids handling.	
Solids Handling Capability	0.276 - 0.393" (7.0 - 10.0mm)	
Bearings	Prelubricated, Double Shielded	
Motor Nomenclature		
Type, Speed, Hz.	Air Filled, 3600 Rpm, 60 Hz.	
Voltage, Phase	115 / 230V., 1 Phase	
Insulation	Class E	
Accessories	Submersible Power Cable 20 - 32' (6.2 - 10m)	Length as Required,
Operational Mode	Manual , Automatic(HSZ)	TS-301 Float Switch

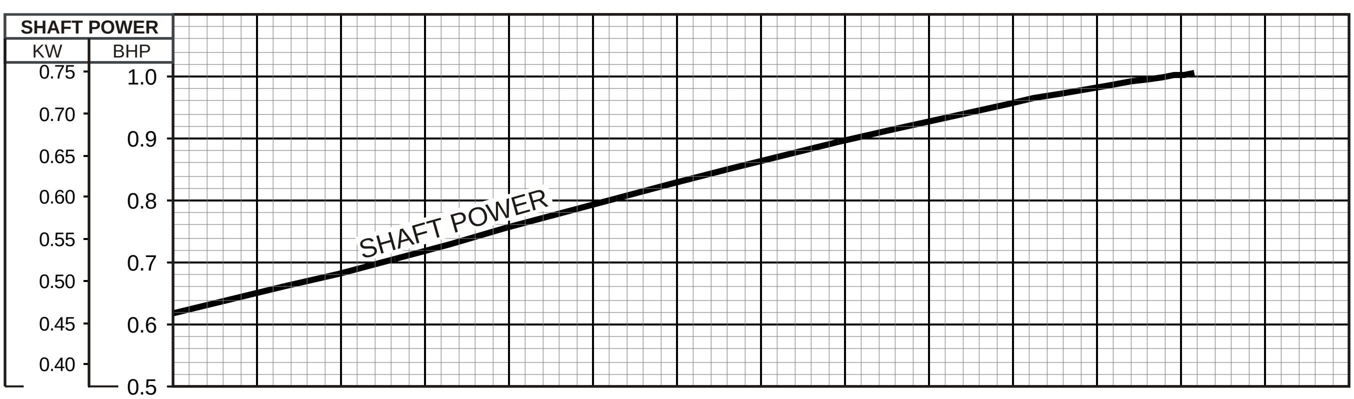
TSURUMI PUMP

HS - SERIES
SEMI-VORTEX - WASTEWATER PUMP

PERFORMANCE CURVE

MODEL		BORE	HP	KW	RPM	SOLIDS DIA	LIQUID	SG.	VISCOSITY	TEMP.
HS(Z)3.75S-61		3"/80mm	1	0.75	3408	0.276"/7.0mm	Water	1.0	1.123 cSt.	60°F
PUMP TYPE		PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
Semi-Vortex - Wastewater Pump		Single	110/115/120, 230		10.0 / 9.6 / 9.4 , 4.6	60	Capacitor Start		E	
CURVE No.	DATE	PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
-	-	-	-		-	-	-		-	



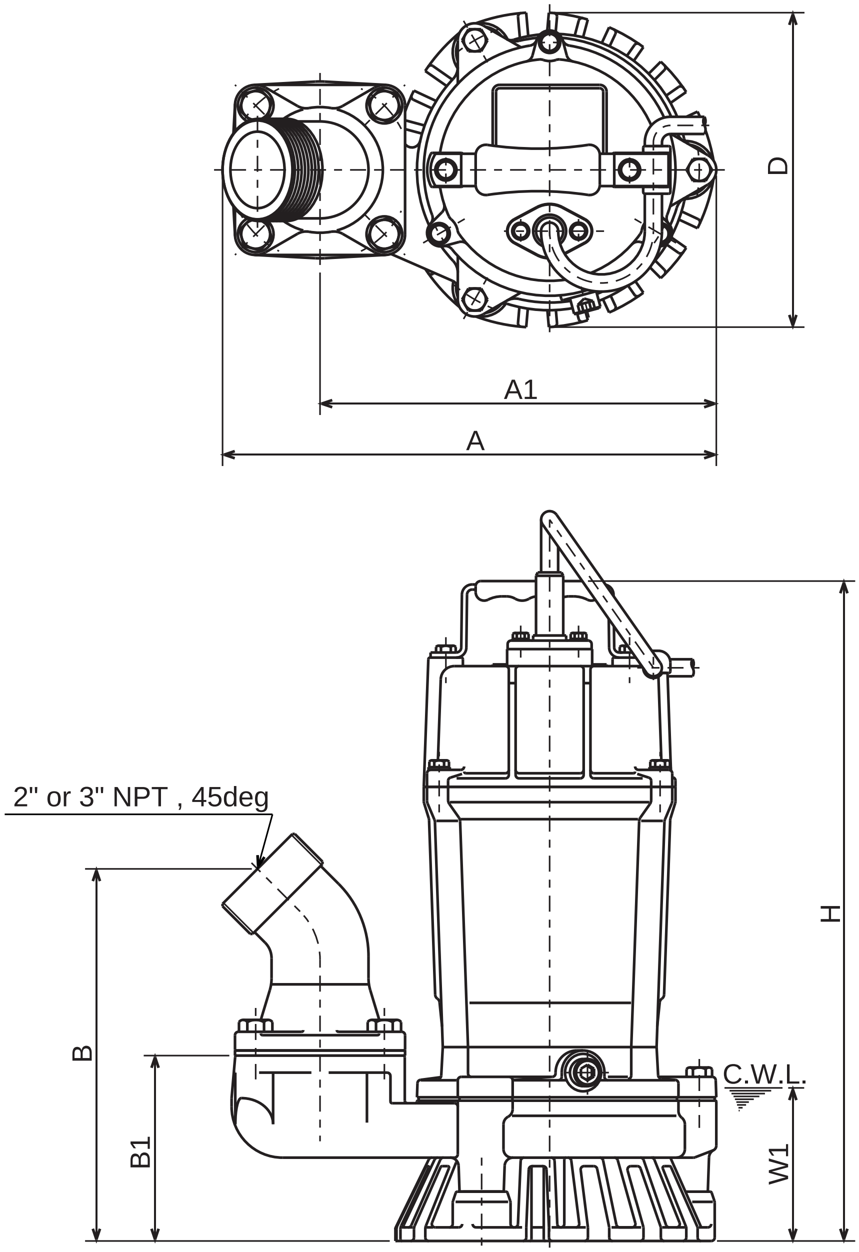


TSURUMI PUMP

HS - SERIES
SEMI-VORTEX - WASTEWATER PUMP

DIMENSIONS

HS2.75S-61
HS3.75S-61



C.W.L. : Continuous running Water Level

DIMENSIONS:USCS (Inch)

Model	HP	NOM.	Pump & Motor						C.W.L.	Wt.
		SIZE	A	A1	B	B1	D	H	W1	(lbs.)
HS2.75S-61	1	2"	11 7/16	9 3/16	8 5/8	4 5/16	7 5/16	15 1/4	3 1/2	40
HS3.75S-61	1	3"	12 7/16	9 3/16	9 1/2	4 5/16	7 5/16	15 1/4	3 1/2	42

DIMENSIONS:METRIC (mm)

Model	kW	NOM.	Pump & Motor						C.W.L.	Wt.
		SIZE	A	A1	B	B1	D	H	W1	(kg)
HS2.75S-61	0.75	50	290	233	219	109	185	388	90	18.2
HS3.75S-61	0.75	80	317	233	241	109	185	388	90	19.0

TSURUMI PUMP | NK - SERIES SEMI-VORTEX - DEWATERING PUMP | SPECIFICATIONS

FEATURES

1. Double inside mechanical seals with silicon carbide faces, running in an oil filled chamber and further protected by a lip seal running against a replaceable, stainless steel shaft sleeve, provides for the most durable seal design available.

2. Highly efficient, continuous duty air filled, copper wound motor with class B, insulation minimizes the cost of operation.

3. Built in thermal & amperage sensing, protector prevents motor failure due to overloading or accidental run dry conditions.

4. Double shielded, permanently lubricated, high temperature C3 ball bearings rated for a B-10 life of 60,000 hours, extend operational life.

5. Top discharge, flow-thru design enables operation at low water levels for extended periods.

Sand Kit : NK2-15SK / NK2-22SK
The Sand Kit can be added to the NK series to suspend sand and prevent sand lock.

APPLICATIONS

1. Residential, commercial, industrial wastewater and construction site drainage.

2. Effluent transfer.

3. Decorative waterfalls and fountains.

4. Raw water supply from rivers or lakes..

OIL LIFTER EQUIPPED

C ETL US LISTED Intertek

SPECIFICATIONS	STANDARD	OPTIONS
Discharge Size	3" Npt (80 mm)	
Horsepower Range	2 ~ 3 Hp. (1.5 ~ 2.2 kW)	
Performance Range Capacity	55.5 ~ 211.0 GPM. (0.21 ~ 0.80 m^3/min)	
Head	34.4 ~ 85.0 Ft. (10.50 ~ 25.91 m)	
Maximum water temperature	104° F. (40.0° C.)	
Materials of Construction		
Casing	Butadiene Rubber + Natural Rubber , Cast Iron (NK2-22L)	
Impeller	Ductile Cast Iron , High Chrome Cast Iron (NK2-22L , NK2-15SK/22SK)	
Shaft	420 , 403 Stainless Steel	
Motor Frame	Aluminum alloy	
Fasteners	304 Stainless Steel	
Mechanical Seal	Silicon Carbide	
Elastomers	NBR (Nitril Butadiene Rubber)	
Impeller Type	Semi-vortex, solids handling.	
Solids Handling Capability	0.334” (8.5mm)	
Bearings	Prelubricated, Double Shielded	
Motor Nomenclature		
Type, Speed, Hz.	Air Filled, 3600 Rpm, 60 Hz.	
Voltage, Phase	110/220 V., 1 Ph (NK2-15 Dual Voltage)	
Insulation	Class B	
Accessories	Submersible Power Cable 32' (10.0 m)	Length as Required
Operational Mode	Manual	TS-301 Float Switch

TSURUMI PUMP

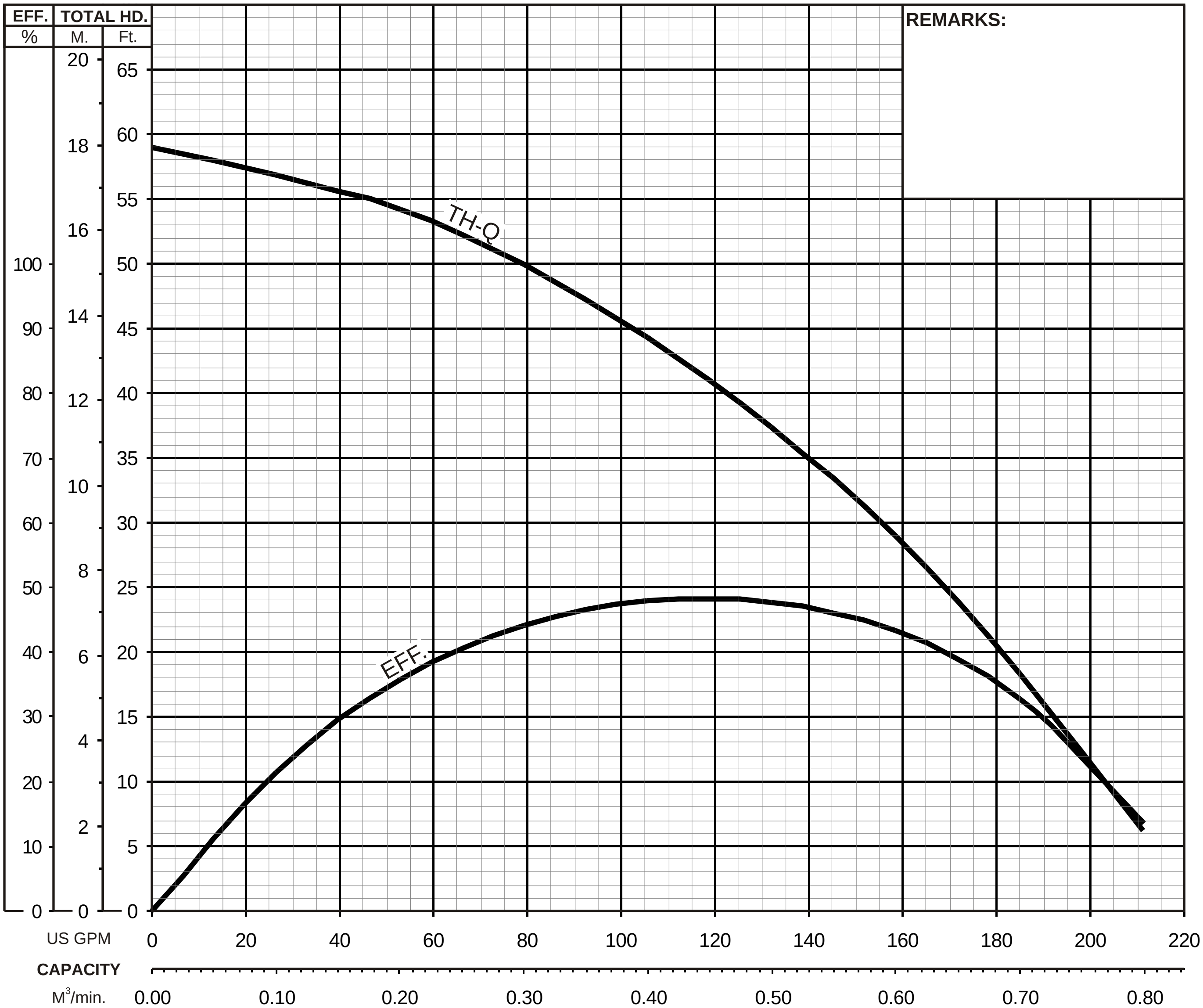
NK - SERIES
SEMI-VORTEX - DEWATERING PUMPS

PERFORMANCE CURVE

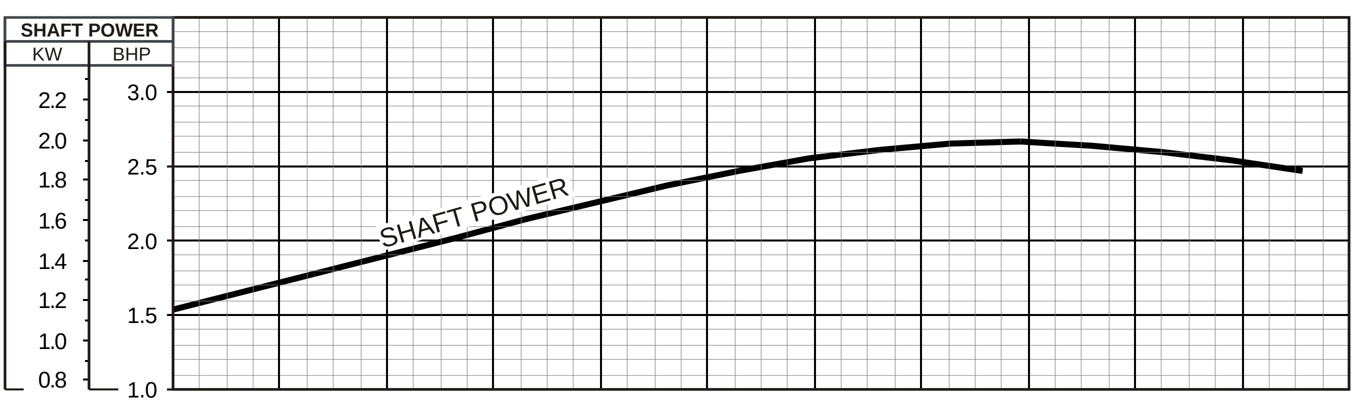
MODEL	BORE	HP	KW	RPM	SOLIDS DIA	LIQUID	SG.	VISCOSITY	TEMP.
NK2-22L	3"/80mm	3	2.2	3465	0.334"/8.5mm	Water	1.0	1.123 cSt.	60°F

PUMP TYPE	PHASE	VOLTAGE	AMPERAGE	HZ	STARTING METHOD	INS. CLASS
Semi-Vortex - Dewatering Pump	Single	220	13.0	60	Capacitor Start	B

CURVE No.	DATE	PHASE	VOLTAGE	AMPERAGE	HZ	STARTING METHOD	INS. CLASS
-	-	-	-	-	-	-	-



REMARKS:

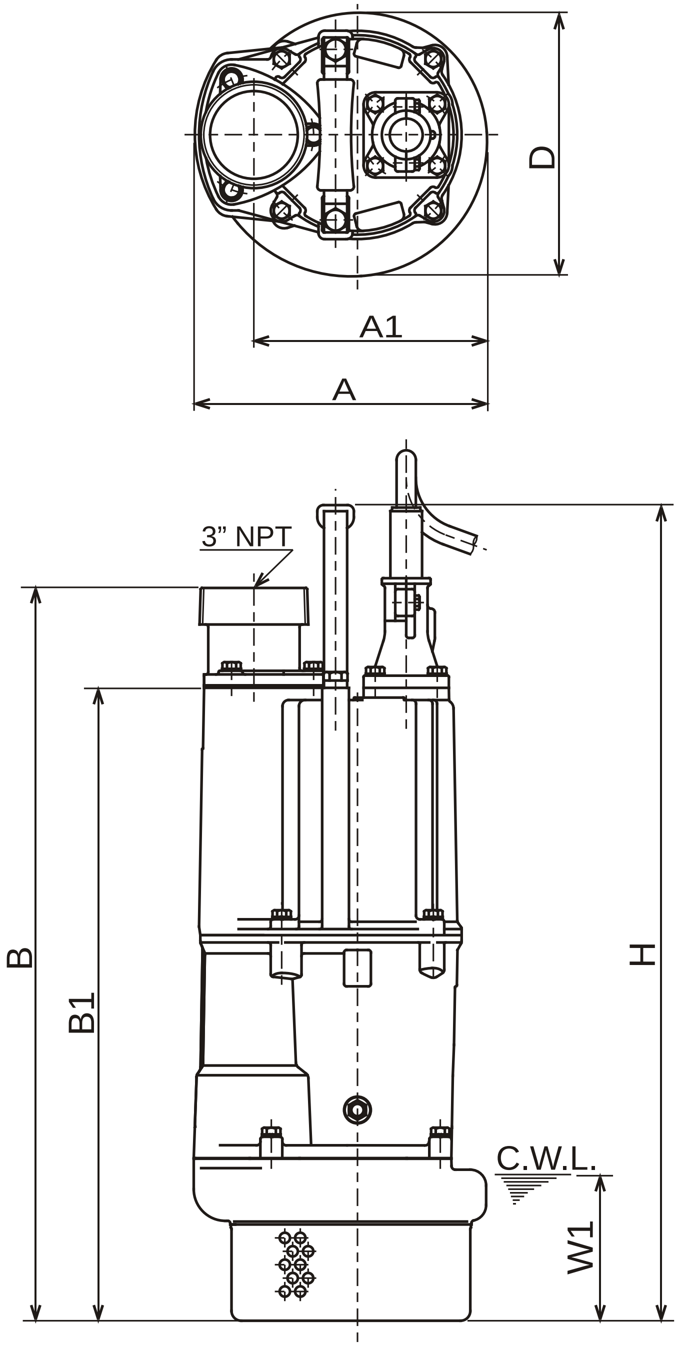


TSURUMI PUMP

NK - SERIES
SEMI-VORTEX - DEWATERING PUMPS

DIMENSIONS

NK2-22L



C.W.L. : Continuous running Water Level

DIMENSIONS:USCS (Inch)

Model	HP	NOM.	Pump & Motor						C.W.L.	Wt.
		SIZE	A	A1	B	B1	D	H	W1	(lbs.)
NK2-22L	3	3"	9 1/4	7 1/2	23 5/8	20 3/8	8 1/2	26 1/2	4 3/4	73

DIMENSIONS:METRIC (mm)

Model	kW	NOM.	Pump & Motor						C.W.L.	Wt.
		SIZE	A	A1	B	B1	D	H	W1	(kg)
NK2-22L	2.2	80	235	192	601	519	216	669	120	33.0

PRODUCT DATA SHEET

January, 2007

EZ CLEAN TANK

GENERAL INFORMATION

Vapor tight steel tank with two sealed top access hatches and pressure/vacuum relief valve. Smooth interior walls for easy cleaning.

WEIGHTS AND MEASURES

» Capacity:	500 BBL (21,000 gal.)
» Height:	12′-4″
» Width :	8′-0″
» Length:	37′-6″ (40′-0″ incl. stairway)
» Weight:	26,000 lbs.

STRUCTURAL DESIGN

» Floor:	¼" thick ASTM A36 carbon steel, "V" shaped bottom
» Sides/Ends:	¼″ thick ASTM A36 carbon steel
» Roof Deck:	¼″ thick ASTM A36 carbon steel
» Wall Frame:	4″x4″ steel tubing (on exterior of wall surfaces)
» Floor Frame:	4″x4″ steel tubing (on exterior of floor surface)
» Roof Frame:	4″x4″ steel tubing (on exterior of roof surface)
» Internal Cross Bracing:	(3) - 2" sch. 80 pipes
» Skid Rails:	4″ x 4″ steel tubing

FEATURES

» Valves:	Typically 1-4″ butterfly valve on front end and1-6″ butterfly valve on rear end
» Relief Valve:	16 oz./in^2 pressure setting, 0.4 oz./in^2 vacuum setting; Buna-N seal
» Roof Piping Connection:	1-4″ 150# flanged (blinded) connection, driver side on rear end
» Misc. Pipe Connections:	Typically 1-4″ nipple with cap on front end below poop deck and 1-2″ collar with plug on top deck

FEATURES – cont.

» Top Access Hatches:	2-30″x45″ hinged vapor-proof hatches
» Hatch and Manway Seals:	Neoprene gasket
» End Manway:	1-20″ diameter end hatch (front end)
» Exterior Stairway:	Rear end of tank – lower section folds for extension and retraction
» Guardrails:	Around top deck; fold-down
» Internal Ladder:	Nearest manhole to stairway
» Bottom Sump:	One on each end of tank, either flat bottomed, 12″ diameter, 3″ deep, or domed, 14″ diameter, 4″ deep
» Level Gauge:	Ball float style, 2-8″ 304 SS floats
» Rear Wheels:	Removable dolly (not a fixed axle)

SURFACE DETAILS

» Exterior Coating:	High Gloss Polyurethane
» Interior Coating:	Chemical resistant coating (SS float balls are not coated)
» Safety Paint:	Safety yellow on all moveable safety equipment, handrails, stairs etc.

TESTS/CERTIFICATIONS

» Test Performed:	Major repairs – hydrotest Scheduled- Level I, II and III inspections, including NESHAP testing

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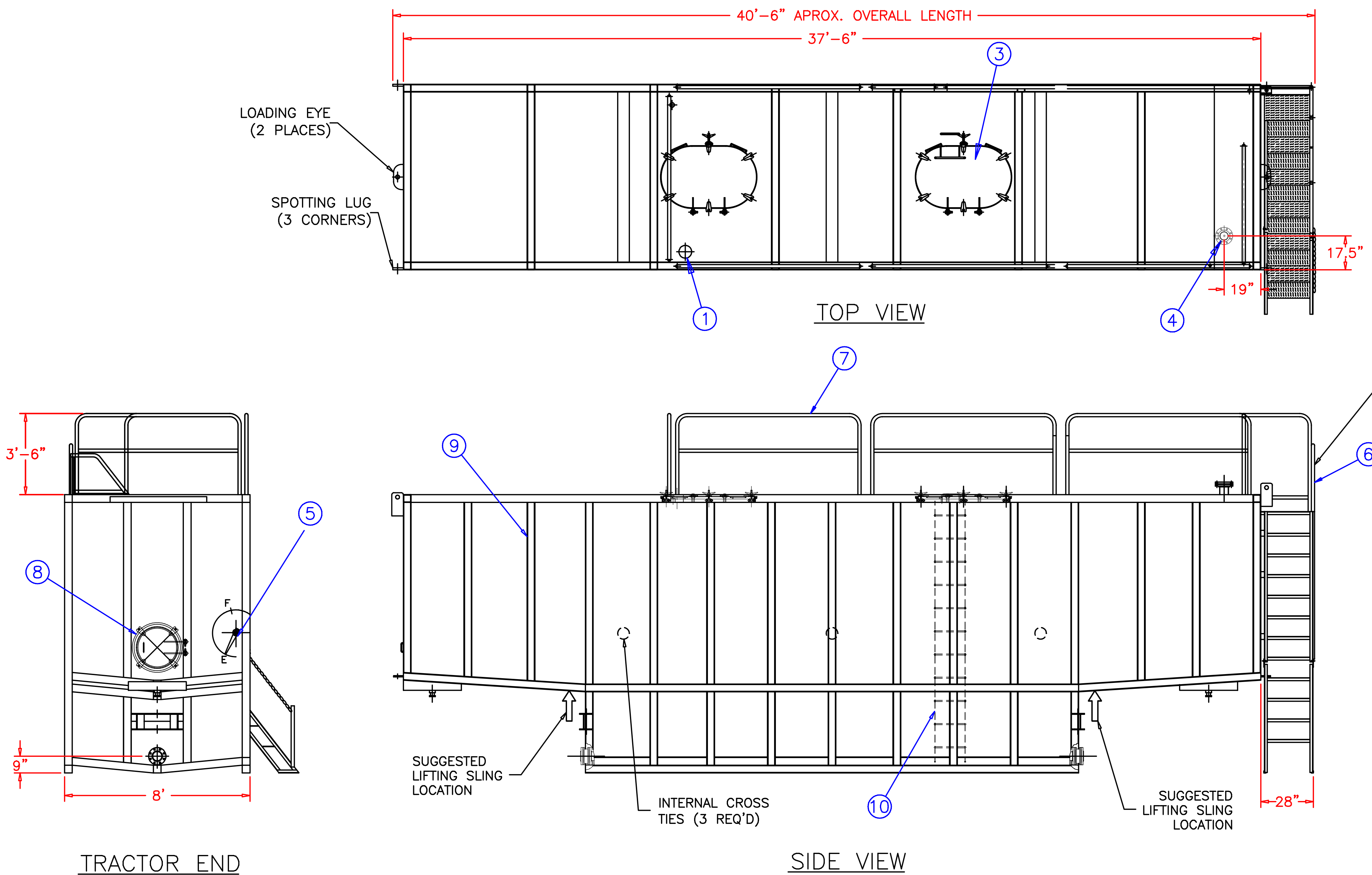
ITEM	QTY	DESCRIPTION
1	1	PRESSURE/VACUUM RELIEF VALVE
2	2	4" BUTTERFLY VALVE (SEE NOTE 1)
3	2	HINGED VAPOR PROOF HATCH
4	2	6" FLANGE WITH BLIND FLANGE (SEE NOTE 1)
5	1	LEVEL POINTER
6	1	OSHA COMPLIANT STAIRWAY & RAILS
7	1	OSHA COMPLIANT GUARD RAILS
8	1	20" END HATCH
9	1	4" x 4" STRUCTURAL TUBING FRAME, TYPICAL
10	1	INTERNAL LADDER



SPECIFICATIONS:

1) Tank Capacity: 21,000 gallons (500 BBL)
2) Tank Weight: 26,000 lbs. (empty)

NOTES:

1. This drawing is a baseline representation for this model of tank. Variations between this drawing and the actual equipment in the field can and do exist, primarily with appurtenance locations, sizes and quantities. Consult your local BakerCorp representative if specific needs exist.
2. THIS TANK IS *NOT DESIGNED FOR TRANSPORTING LIQUIDS*. It should be moved only when empty.
3. Tanks of this type have an internal lining (coating) on the wetted surfaces.
4. This tank is equipped with a pressure/vacuum relief valve set at 1.0 1bs/sq. in. pressure and 0.4 oz/sq.in. vacuum.

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SEAL BEACH, CA 90740-2751

REV.	DESCRIPTION	DATE	BY
G			
F			
E			
D			
C			
B			
A	ADDED HIDDEN LINES / LIGHTENED HANDRAILES	7/12/05	Z.E.R

SCALE:	SIZE B	ORIGINAL DWG. DATE 25FEB02
DRAWN BY: A. R.	APPROVED BY: –	CAT/CLASS ––
TITLE EZ CLEAN VAPOR–TIGHT		SHEET 1 OF 1
DRAWING NO. S-1-M0007-1-		REV. A

BAKERCORP™

VCC 8x30 Virgin Coconut Shell Carbon

BakerCorp's VCC 8x30 mesh virgin carbon made from select grades of coconut shell. These activated carbon granules are a uniform adsorbent with well developed pore structure, allowing for a wide range of adsorbate retention. This carbon is ideal for purification of potable water, industrial wastewater treatment and groundwater treatment. This product is also suitable for refinement of organic liquids requiring purification and color reduction, such as amine and glycol solutions and will remove MTBE from groundwater.

PHYSICAL PROPERTIES:

Carbon Tetrachloride Activity:	60% minimum
Apparent Density (lbs./cu.ft.):	29 average
Total Ash Content:	3% maximum
Hardness (Ball Abrasion):	98% minimum
Iodine Number:	1,000 minimum
Moisture (as packed):	5% maximum
Mesh Size:	8x30

Standard Packaging: 1000 lb. super sacks. Other packaging available upon request.

These specifications represent general parameters and are subject to change. Please consult with BakerCorp before processing with your applications.

4306 W. 190th Street, Torrance, California 90504
Phone: 310.303.3700 ♦ Fax: 310.406.3001

PRODUCT DATA SHEET

April, 2007

3" 304 S.S. BAG / CARTRIDGE FILTER SYSTEM

GENERAL INFORMATION

Two parallel-piped bag filters are followed by a single cartridge filter (can be converted to hold a single #2 bag instead) and are mounted on a forkliftable skid. Housings are not ASME code stamped. Different bag and cartridge elements are available depending on job requirements and should be specified by the customer prior to use.

WEIGHTS AND MEASURES

» Capacity*:	100 gpm (2 bag/ 1 cartridge) 200 gpm (3 bags, 5 microns and up) 300 gpm (parallel flow w/5 micron bags)
» Design Press:	150 psig
» Design Temp:	225°F max.
» Height:	5'-1" (overall)
» Width:	4'-0"
» Depth:	6'-2"
» Weight:	1175 lbs. (approx.)

*Capacity (flowrate) depends on factors such as liquid viscosity, micron value of the filter media, solids loading etc. Assuming a 10 micron rating, the clean pressure drop through the bag filter would be 2-3 psi and the drop through the cartridge about 2 psi additional. Lowering the micron rating of the cartridge below 10 will increase the drop into the 4-6 psid range. Cartridges are normally spent at 24-28 psid.

SKID DESIGN

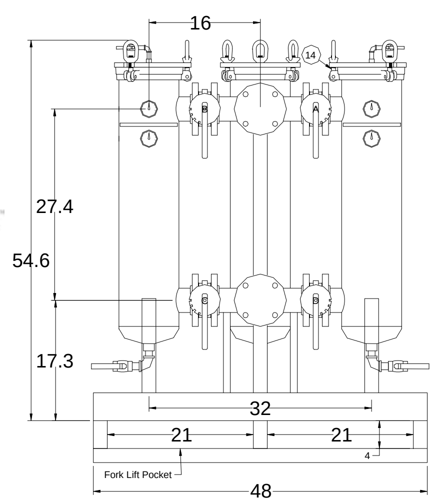
» Skid:	2"x2" and 2"x4" c.s. structural tubing
» Vessel Mount:	Legs are attached to cross supports on skid
» Forklift Pockets:	Through front and rear framing channels (Each pocket is 21" wide)

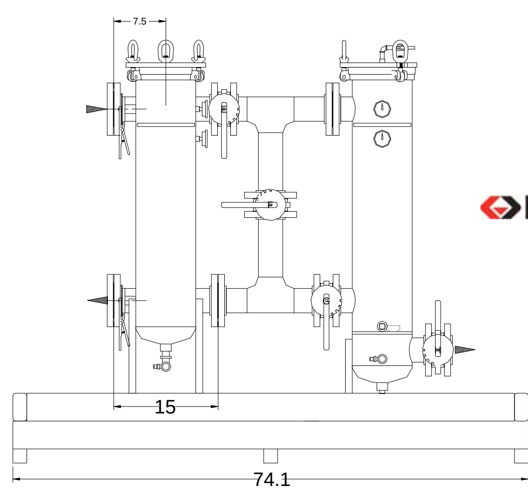
FILTER DESIGN

» Assembly Number:	Krystil Klear L88(CL)303FA41523F4DF
» Vessel Covers:	Three eye nuts; hinged for easy access
» Piping:	3" Sch. 40 304 SS (SA-312-304)
» Inlet & Outlet:	3" Male Cam Lock
» Cartridge Elements:	6 required; Double Open End, 2-1/2" o.d. and 30 inches long; typically polyester or polypropylene string wound; 0.5 micron range and up.
» Bag Elements:	One size #2, 7-1/16" snap ring & 30" length required in each housing; Available fibers range from 1 to 1500 microns.
» Lid Seals:	Buna N
» Valves:	3" 150" butterfly with Buna packing
» Internal Hardware:	*Bag Filter*: 316 SS strainer basket with 9/64" perforations, 30" deep. 6.7" dia. *Cartridge Filter*: 316 SS center guide post, cup & spring assemblies

TESTS / CERTIFICATIONS

» Test Performed:	OEM Hydrotested @ 195 psi. Scheduled QMS inspections after purchase by BakerCorp.





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PRODUCT DATA SHEET

January, 2007

FLIP TOP WEIR TANK

(VE ENTERPRISES VERSION)

GENERAL INFORMATION

This fixed-axle tank is fitted with two internal weirs and 14 top inspection doors.

WEIGHTS AND MEASURES

» Capacity:	20,000 gallons
» Height:	8'-6¼" (grade to tank roof) 12'-8½" (grade to top of handrails when up)
» Width :	8'-6"
» Length:	45'-7½" (tank only), 50'-0" (nose-to-bumper)
» Weight:	33,000 lbs.

STRUCTURAL DESIGN

» Floor:	¼″ ASTM A36 carbon steel. "V" bottom sloping from each side to centerline of tank
» Sides/Ends:	¼″ ASTM A36 carbon steel, corrugated shape
» Roof Deck:	¼″ ASTM A36 carbon steel
» Wall Frame:	Corrugations only, no internal frame
» Internal Weirs:	Two internal steel weirs equally spaced to create three compartments inside tank. Overflow weir (forward weir) extends from floor up to one foot from top of tank. Underflow weir extends down from roof and terminates one foot from floor seam at sidewalls. Designed for 16 lbs. per gallon liquid on one side of weir and no liquid on the other side.

FEATURES

» Relief Valve:	None
» Valves:	(2) 4″ wafer style butterfly valve, Bray series 30 or equivalent, with cast iron body, Buna-N seat and seals, 316 SS stem, Nylon 11 coated ductile iron disk

FEATURES – cont.

» Fill Line:	One 3-inch schedule 40 ASTM A106B pipe with cap and securing chain. Line enters front of tank near top with dip tube into first compartment down approx. halfway from bottom of tank where it 90° elbows into compartment.
» Front Drain:	One 4″ wafer style butterfly valve. Mounted on 150# weld neck flange on tank side and 150# FPT flange on outside with plug and chain.
» Rear Drain:	One 4″ wafer style butterfly valve. Mounted on 150# weld neck flange on tank side and 150# FPT flange on outside with plug and chain. Remote-operation handle.
» Rear Process Outlet:	One (1) 4″ flanged and blinded nozzle 18″ below roof deck
» Top Doors:	14- 51"x39"x10ga plate lids
» Manways:	Three (3) 22" diameter, passenger side
» Manway Seals:	Buna-N (NBR)
» Stairway:	OSHA compliant non-slip stairway with handrails and guardrails
» Walkway:	Full length of tank with guardrails on both sides; door handles accessible

SURFACE DETAILS

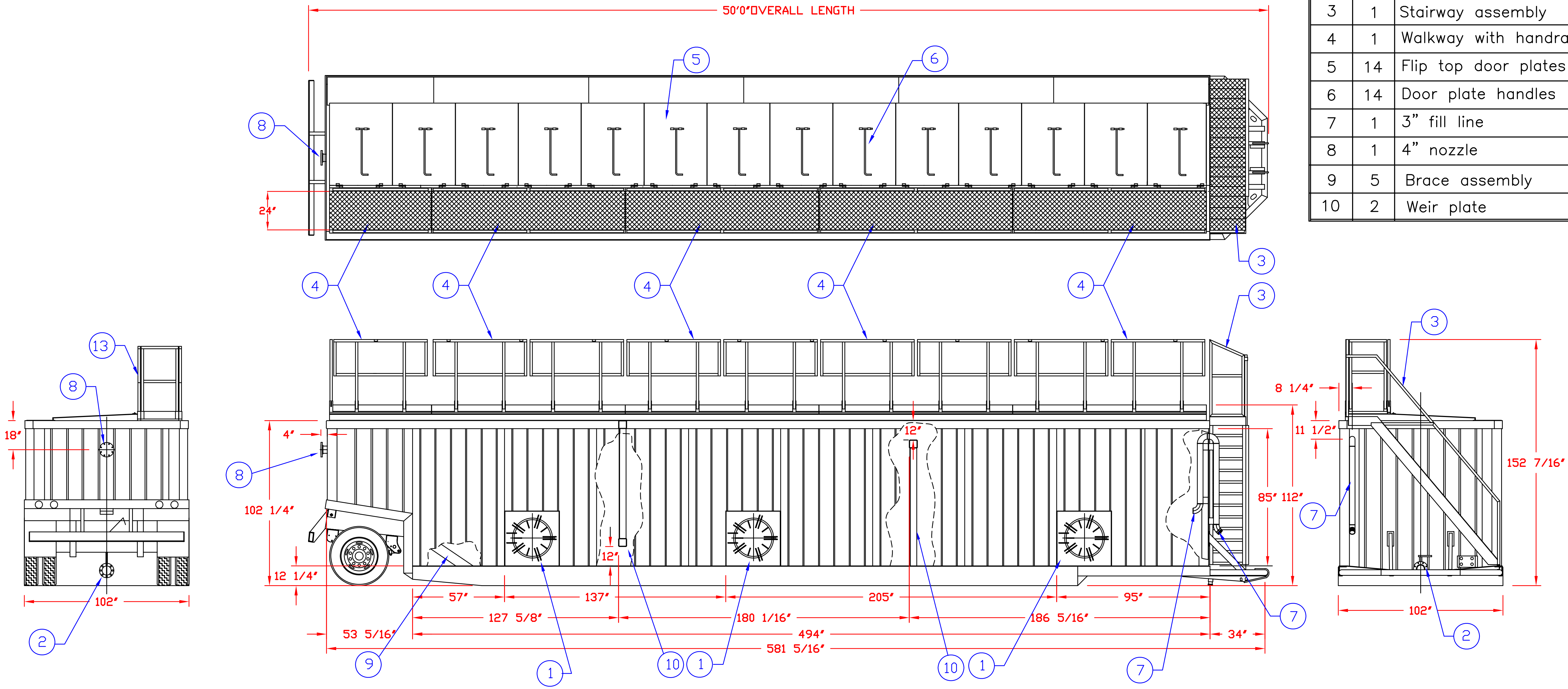
» Exterior Coating:	High gloss polyurethane
» Interior Coating:	Chemical resistant lining

TESTS/CERTIFICATIONS

» Test Performed:	100% water-tested to full capacity by OEM, plus level 1, 2 &3 QMS inspections by Baker Tanks

BAKERCORP™

ITEM	QTY	DESCRIPTION
1	3	22" diameter manway
2	2	4" drain conn. w/butterfly valve
3	1	Stairway assembly
4	1	Walkway with handrail
5	14	Flip top door plates
6	14	Door plate handles
7	1	3" fill line
8	1	4" nozzle
9	5	Brace assembly
10	2	Weir plate



SPECIFICATIONS:

1) Tank Capacity: 20,000 gallons (476 BBL)
2) Tank Weight: 33,000 lbs. (empty)

NOTES:

1. This drawing is a baseline representation for this model of tank. Variations between this drawing and the actual equipment in the field can and do exist, primarily with appurtenance locations, sizes and quantities. Consult your local BakerCorp representative if specific needs exist.
2. THIS TANK IS *NOT DESIGNED FOR TRANSPORTING LIQUIDS*. It should be moved only when empty.
3. Tanks of this type have an internal lining (coating) on the wetted surfaces.
4. This tank is constructed from A36 carbon steel.

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3020 OLD RANCH PARKWAY
SEAL BEACH, CA 90740-2751

REV.	DESCRIPTION	DATE	BY
G			
F			
E			
D			
C			
B			
A	FIXED CUTAWAYS / LINEWEIGHT	7/12/05	Z.E.R

SCALE: DO NOT SCALE	SIZE: B	ORIGINAL DWG. DATE: 16JUL02
DRAWN BY: P.J.B.	APPROVED BY:	CAT/CLASS: --
TITLE: VE ENTERPRISES FLIP TOP WEIR TANK		SHEET: 1 of 1
DRAWING NO.: S-2-M0005-1-		REV.: A

Attachment D
Typical Specifications for 700 Gallon Per Minute Temporary Groundwater Treatment Plant

PRODUCT DATA SHEET

March, 2007

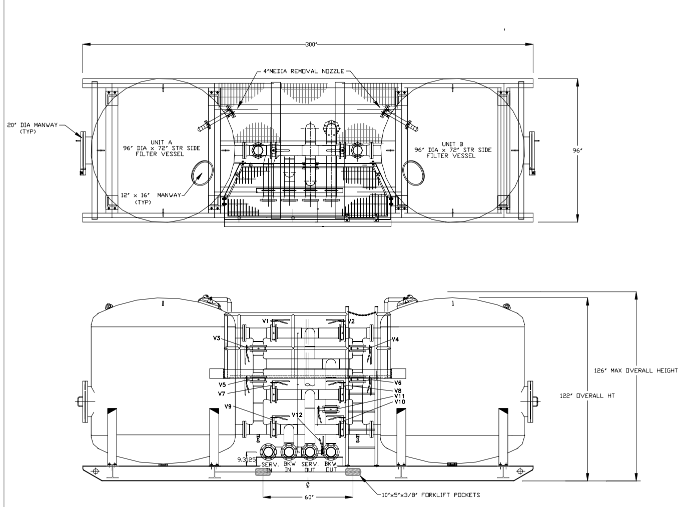
D-KLEEN.WATER 10K

GENERAL INFORMATION

This system is designed for continuous aqueous phase treatment of groundwater or wastewater, and has the ability to remove contaminants to non-detectable levels. The influent stream may be drawn in through the system in either series or parallel flow, and can operate on one vessel only while the other is in backwash mode. BakerCorp can provide a number of service and disposal options for the spent media,

WEIGHTS AND MEASURES

» Max. Flowrate:	Up to 600 gpm in series or 1200 gpm in parallel (application dependent)
» Max. Pressure:	100 psi
» Max. Temp:	150°F
» Height:	10'-6" (overall)
» Width:	8'-0" (skid)
» Length:	25'-0" (skid)
» Diameter:	96" (each vessel)
» Shipping Wt.: (empty)	40,000 lbs.(equipment – 20,000 lbs; activated carbon – 20,000 lbs)
» Operating Wt.:	80,000 lbs. (including 40,000 lbs. water)



FILTER MEDIA

» Types:	▪Activated Carbon ▪Organoclay ▪Ion Exchange Resin ▪Specialty Media
» Volume:	320 cu. ft per vessel (640 cu. ft. total)
» Weight:	~10,000 lbs. each vessel (20,000 lbs. total)

MISCELLANEOUS DATA

» Vessel Code:	ASME Code stamped for 100 psi @ 150°F.
» Service In/Out:	6" Flanged connection w/ sch. 40 piping
» Backwash In/Out:	6" Flanged connection w/ sch. 40 piping
» Manifold Valves:	6" Lever-operated cast iron butterfly
» Media Removal:	4" top-mounted nozzle with draw connection at grade
» Internals:	Lower Underdrain: 6" header/2"x1" drop strainer type constructed of 316 SS Upper Distributor: 6" header/3" open end riser type constructed of 316 SS
» Platform:	Galvanized grating with perimeter guardrails
» Vessel Interior Access:	Top manway – 12"x16" elliptical Side manway – 20" round
» Manway Gaskets:	Neoprene
» Interior Coating:	Polyamine epoxy coating

PRESSURE DROP DATA & OPTIONS AVAILABLE

Contact BakerCorp

NOTE:

1. Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate procedures for potentially low oxygen spaces must be followed, including all federal and state requirements.

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PRODUCT DATA SHEET

January, 2007

YARDNEY 4-POD SAND FILTER

(Equip. # SFL21988 and earlier)

GENERAL INFORMATION

Skid mounted high rate automatic backwashing sand media filter (4 tanks (pods)) designed for general-purpose water filtration of organic and inorganic solids (Yardney Model # IL5424-4AS2). Powered by 110 V external power supply, or battery with solar cell recharge for remote operation.

WEIGHTS AND MEASURES

Capacity:	504 – 756 gpm (Normal flow range) 1000 gpm (Peak flow)
Design Press:	80 psi maximum
Temperature:	Limit to ambient. Consult BakerCorp if temperature exceeds 100 degrees.
Filtration:	To 50 microns
Height:	8'-11" (overall)
Width :	6'-3"
Length:	20'-1"
Weight:	6,326 lbs. – equipment only 14,500 lbs. – media only 28,000 lbs. - operational
Backflush:	240 gpm, automatic

OPERATING REQUIREMENTS

Compressed Air:	5 cfm minimum at 60 psi **[Note: external air supply required]**
Sand Media:	Crushed silica, 0.47MM (#80 grit)
Gravel Media:	#3 crushed rock, ½" x ¾"
Input Power:	Selectable input power of customer supplied 110 V AC, or 12V DC from a unit mounted solar package.
Output Power:	12V DC

FEATURES

System Controller:	Automatic Filter Controller. Flush activation based on elapsed time and/or pressure differential.
Piping:	Inlet & outlet pipe is 6" A53B, 3/16" wall; weld fittings are A234; flanges are A106. Backflush piping is 4" schedule 40 PVC.
Solar Panel:	Uni-Solar Model UA-5 (5 watts) module.

FEATURES – con't

Press. Gauge:	2" face, ¼" NPT bottom connection, stainless steel case, plexiglass lens, brass bourdon tube, 0-100 psi range.
Flowmeter:	Six-inch propeller type meter, AWWA C704-92 compliant. Instantaneous flowrate indicator and six-digit totalizer. Accuracy is ±2% of reading. Repeatability of 0.25%. Rated at 90-1200 gpm, 150 psi, 160°F. Tube: epoxy-coated carbon steel; Impeller: high-impact plastic.
Butterfly Valves:	Effluent / Influent: 6" with cast iron body (epoxy coated), EPDM seat, 304 SS stem and aluminum bronze disc. Tank Isolation: 4" grooved ends, EPDM disc coating
Ball Valves:	Four-inch, bronze body and brass ball; seat is carbon/glass-filled PTFE. ¼ turn open or close.
Solenoid Valve:	12V DC, normally closed type 7121V (energizing opens valve).
Differential Press. Switch:	0-30 psid. Two-inch dial, plated steel case, ±3% accuracy.
Air / Vacuum Release Valve:	2" Bernard Model 4415 valve, mounted on backwash, influent and effluent lines
Battery:	Sealed rechargeable lead-acid, 12V, NP2.6-12
Battery Charger:	Power-Sonic Model PSC-12500A, 12 volts.
Tubing:	Pressurized – ¼" 304 ss w/ Hoke fittings; Drain - ¼" polypropylene; Vent – schedule 80 PVC

SURFACE DETAILS

Interior Coating:	3M Skotchkote 134
Exterior Coating:	High Gloss Polyurethane

TESTS/CERTIFICATIONS

Tests Performed:	OEM pressure tested. BakerCorp performs scheduled QMS inspections.

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PRODUCT DATA SHEET

March, 2008

8" 304 STAINLESS STEEL 12-BAG FILTER SYSTEM

GENERAL INFORMATION

Single vessel mounted on a forkliftable skid. Housing is not ASME code stamped. Different filter elements are available depending on job requirements and should be specified by the customer prior to use.

WEIGHTS AND MEASURES

» Capacity*:	1200 – 2000 gpm (@ 1 micron and up)
» Design Press:	150 psig
» Design Temp:	225°F max. (gasket dependent)
» Height:	7'-5" (overall)
» Width:	4'-11"
» Depth:	7'-5"
» Weight (dry):	1075 lbs. (approx.)

*Capacity (flowrate) depends on factors such as liquid viscosity, micron value of the filter media, solids loading etc. Assuming water as a filtrate and factoring in pressure drop only, 2000 gpm is a practical upper limit for a size #2 bag with a 100 micron rating; 1200 gpm with 1-micron rated bags.. Clean pressure drop would be 2-3 psi. Lowering the micron rating increases the pressure drop. The minimum pressure drop for this unit at higher micron ratings is 1-2 psi. Filter bags should be changed out at 15-18 psid, or earlier if the process requires it.

SKID DESIGN

» Skid:	2"x2"x0.25" A36 c.s. structural tubing
» Vessel Leg Supports:	3x3x.375 angle, SA-36
» Forklift Pockets:	Through front and rear framing channels

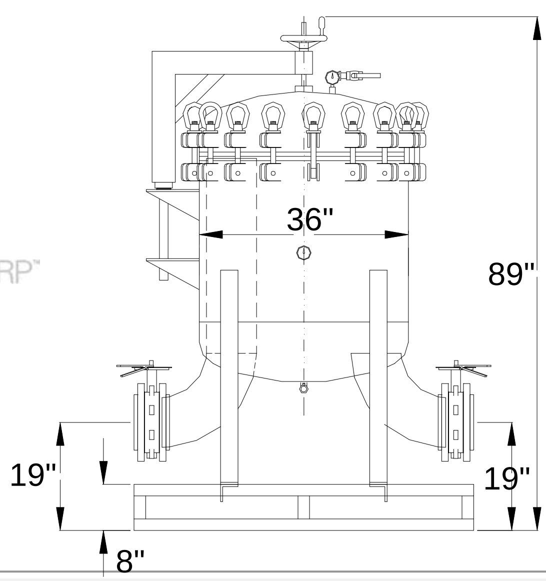
FILTER DESIGN

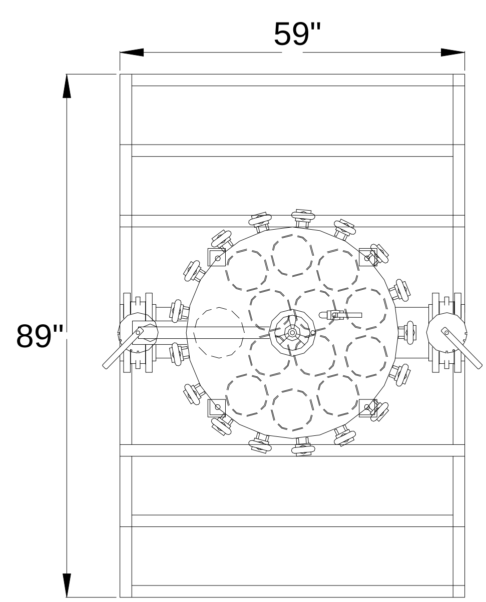
» Assembly Number:	Krystil Klear LR12-36-30-8F-A-4-15-SP
» Top Head:	(17) closure bolts and nuts with davit lift assembly. 36" O.D., 0.25" thk, SA-240 Gr. 304 stainless steel
» Shell:	36" O.D., 0.25" thick x 28" L . R & T, SA-240 Gr. 304 stainless steel
» Inlet & Outlet:	8" 150# RFSO flanges, SA-182 Gr. 304 S.S.
» Bag Elements:	12 required: size #2, 7-1/16" snap ring & 30" length required; Available fibers range from 1 to 1500 microns.
» Lid Seal:	Buna N O-ring
» In/Out Valves:	8" 150" butterfly with Buna seat
» Internal Hardware:	SA-240 Gr. 304 S.S. tube sheet

TESTS / CERTIFICATIONS

» Test Performed:	OEM Hydrotested @ 195 psi. Scheduled QMS inspections after purchase by BakerCorp.

BAKERCORP





BAKERCORP

PRODUCT DATA SHEET

1/4/2012

BP44LS-GD66AT

BakerPrime 4x4 Low Pressure Solids Handling Unit (Attenuated, Trailer)

GENERAL INFORMATION

The compressor/venturi priming system uses a compressor to blow compressed air through a jet into a tapered tube to create a vacuum on the suction.

PERFORMANCE DATA

» Flow (min/max):	-	60 gpm / 925 gpm
» Minimum Shutoff Head:	-	87 feet (38 psi) @ 1550 rpm (1)
» Maximum Shutoff Head:	-	152 feet (66 psi) @ 2100 rpm (1)
» Minimum Speed:	-	1550 rpm
» Maximum Speed:	-	2100 rpm
» Maximum Suction Lift:	-	25 feet (2)
» Maximum Casing Press:	-	99 psi
» Maximum Temperature:	-	160°F (7)
» Maximum Solids Size:	-	3" spherical diameter

PUMP SPECIFICATIONS

» Impeller:	-	9.75"
» Bearing Lubrication:	-	SAE No. 30 Oil
» Vacuum System:	-	8.5 cfm Compressor/Venturi
» Mechanical Seal Lube:	-	SAE No. 30 Oil (3)

PHYSICAL SPECIFICATIONS

» Suction Size:	-	4" flange
» Discharge Size:	-	4" flange
» Approximate Weight:	-	5223 lbs dry / 5720 lbs wet
» Overall Height:	-	89" (to top of lifting eye)
» Overall Width:	-	63" (outer most edges)
» Overall Length:	-	137" (nose to tail)

Enclosure

> Enclosure is made from Galvaneal. Hinged doors on each side provide easy interior access for servicing. Soundproof insulation provides the quietest operation in the industry, and the entire unit, including controls, can be locked for added security.

» Sound Rating:	-	67 dBA at 23 feet

BakerCorp Reference # 404-0105

MATERIAL SPECIFICATIONS

» Pump Casing:	-	Gray Iron No. 30
» Shaft Sleeve:	-	17-4 PH S.S.
» Wear Rings:	-	Carbon Steel No. 1018
» Mechanical Seal Faces:	-	Silicon-Carbide/Silicon-Carbide
» Pump Shaft:	-	Alloy Steel No. 4140
» O-rings:	-	Buna-N
» Impeller:	-	Ductile Iron No. 4140
» Check Valve Body:	-	Gray Iron No. 30
» Check Valve Flapper:	-	Buna-N

ENGINE SPECIFICATIONS

» Engine Make/Model:	-	Deere 4024H
» Total Displacement:		2.4 Liter
» Aspiration:	-	Turbocharged
» Max. Continuous BHP:	-	66 @ 2400 rpm (4)
» Crankcase Oil:	-	SAE 10W40 (5)
» Coolant:	-	50/50 Water/Antifreeze
» Safety Shutdowns:	-	High Water Temp & Low Oil Pressure
» Fuel Consumption:	-	2.78 gal/hr @ 1800 rpm (6)
» Run Time:	-	25 hours at 1800 rpm at 80% Engine Load
» Fuel Capacity/Type:	-	70 gal of No. 2 diesel
» Number of Cylinders:	-	Four

Notes:

(1) Based on 1.0 specific gravity

(2) Depends on flow rate, pump speed, and elevation. See performance curve.

(3) Should always be visable and clear in appearance thru sight glass.

(4) WARNING – this is the rated speed for the ENGINE ONLY. The rated speed of the pump is less. See curve for max pump RPM.

(5) Must be changed every 250 hours of runtime.

(6) Run time fluctuates with speed and engine loads.

(7) Equipment material limitation. Lower max temperature may be necessary due to application conditions and pump NPSH requirements.

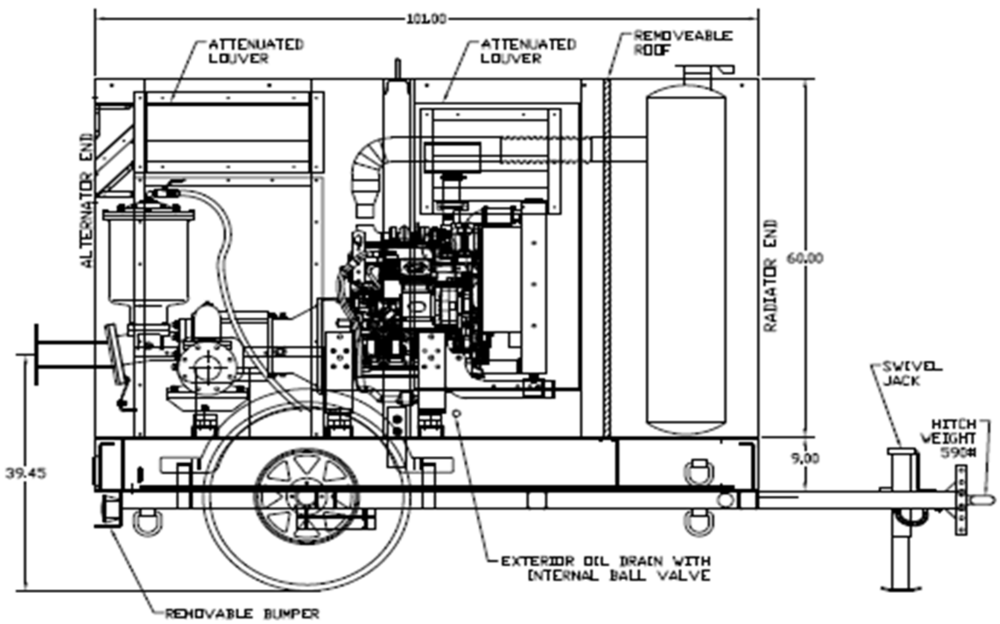
PRODUCT DATA SHEET

1/4/2012

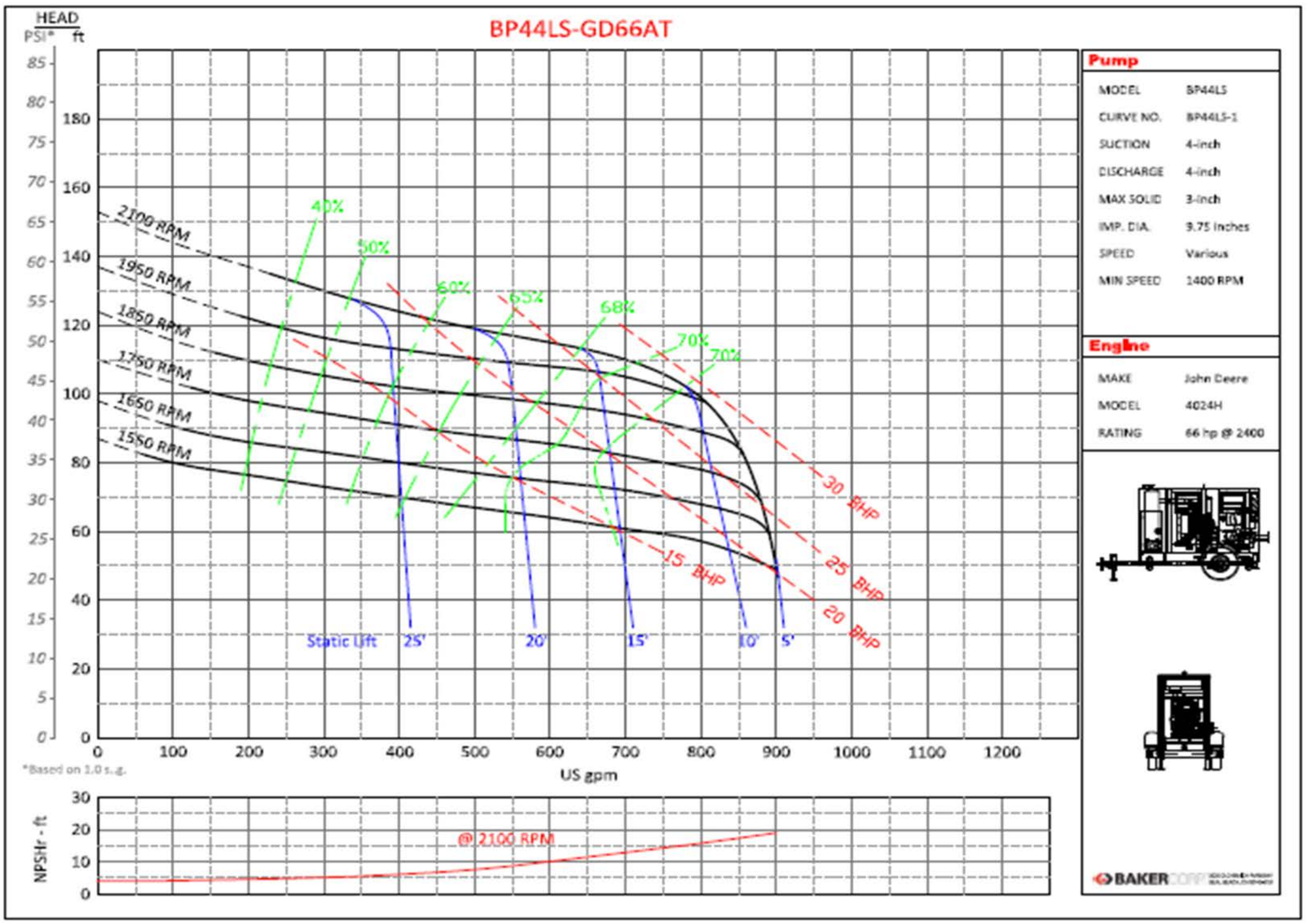
BP44LS-GD66AT

BakerPrime 4x4 Low Pressure Solids Handling Unit (Attenuated, Trailer)

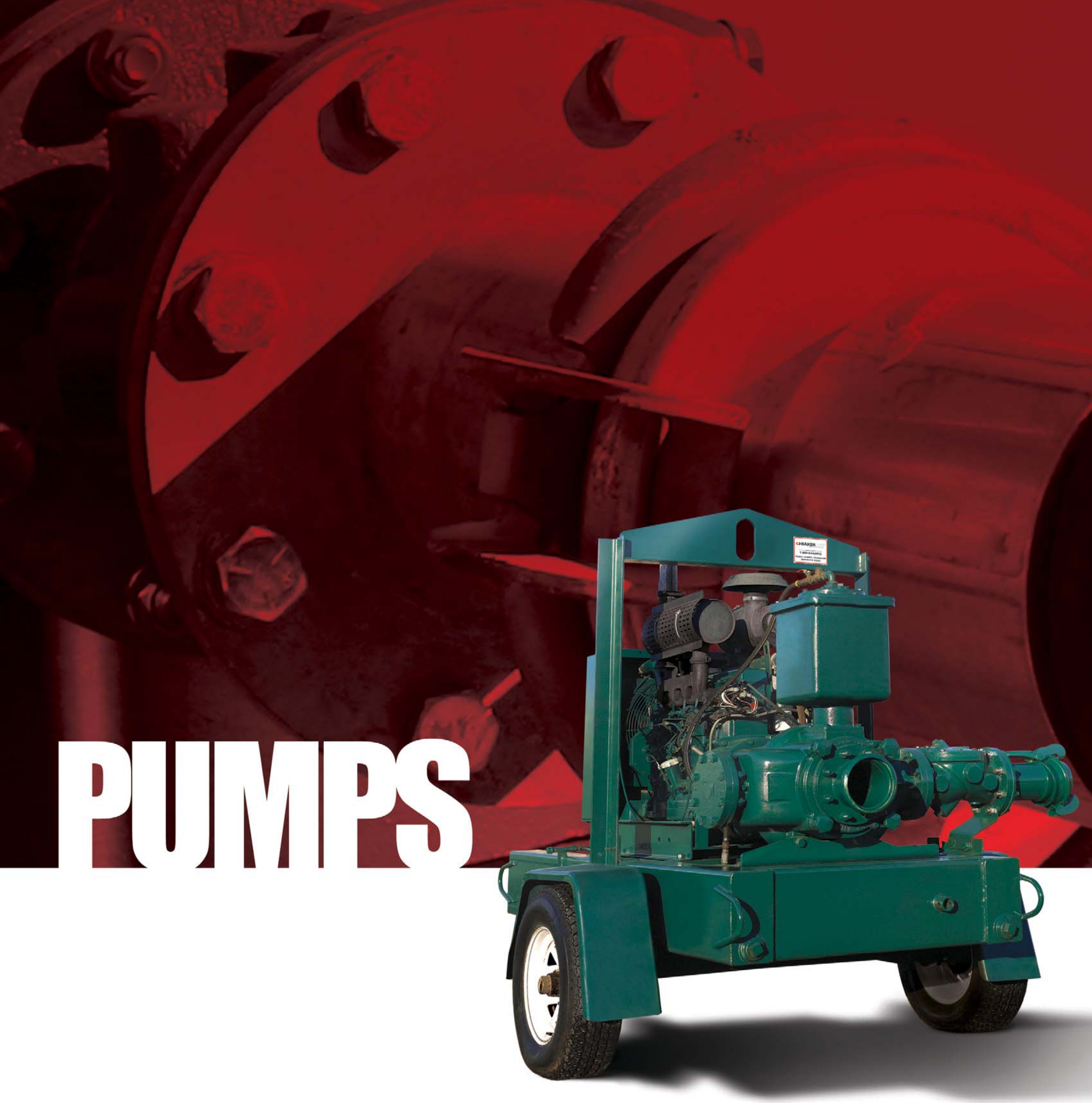
PHYSICAL SPECIFICATIONS



PERFORMANCE CURVE



PUMPS



BAKERCORP™

PEOPLE. EQUIPMENT. SOLUTIONS.

TOUGH JOBS. PROVEN RESULTS.

PUMPS FROM BAKER. MAXIMUM PERFORMANCE. ZERO HASSLE.

Since 1942, BakerCorp has thrived in a very demanding business. We began by renting temporary steel storage tanks to the oilfield industry. Today, we are the largest, most experienced containment, pump and filtration company in the world with over 90 locations nationwide and international operations in Europe, Canada and Mexico. We serve a breadth of market segments including chemical, manufacturing, refining, oil and gas, construction, municipal, industrial services and environmental remediation.

BakerCorp has achieved this success by adhering to the highest standard of excellence throughout every area of our business. We stock the largest inventory of quality equipment and keep it running with the most comprehensive maintenance program in the industry. Our teams are comprised of highly-trained professionals with years of experience and vast product knowledge. Their dedication to providing customers with unparalleled, 24/7/365 personal service is constant and unwavering. From the earliest stages of your project's planning through its completion, BakerCorp will work closely with you to design the best solution based upon the specific needs of your application.

Partnering with BakerCorp on your projects means that you will work alongside professionals dedicated to providing quality solutions—integrated solutions that pull from a deep pool of talent, equipment and experience. It means that your challenges will be resolved using the most logical and comprehensive mix of tanks, pumps and filtration systems available anywhere. BakerCorp's depth of experience and reputation for innovative system design ensures your project will be brought to a successful conclusion—the first time and every time.

We know pumps. We know systems. And we know how to get the job done. Whatever the challenge—wastewater removal, flood control, sewer bypass or hydroblast pad water recirculation—you'll find BakerCorp on the job.

Nobody is better equipped than BakerCorp. We inventory an extensive fleet of the highest quality prime assist, self-prime, diesel-driven, electric drive, centrifugal and submersible pumps along with a broad range of pipe, hose and fittings. Our pumps perform at the maximum level because each pump undergoes a rigorous maintenance program completed by certified mechanics to insure the highest level of dependability before it is delivered to the jobsite.

BakerCorp offers an unbeatable combination of equipment selection and application expertise that you can rely on when you're up against a tough pumping project. Our field personnel are cross-trained to be technical experts who specialize in pumps, and nothing but. Closer to application engineers than sales people, they'll point you to solutions that will be cost-effective, labor-friendly and dependable. From system design and set-up to removal after a completed job, you can count on pumping solutions from BakerCorp.

PROVIDING PROVEN SOLUTIONS TO INDUSTRY FOR OVER 65 YEARS.

MUNICIPAL

- Sewer bypass and pipeline projects
- Lift station repair
- Temporary pumps used during sanitary sewer overflow
- Sludge pumping for wastewater lagoon clean-up

CONSTRUCTION

- Dewatering
- Temporary firewater systems
- Dust control
- River, lake and stream dredging projects

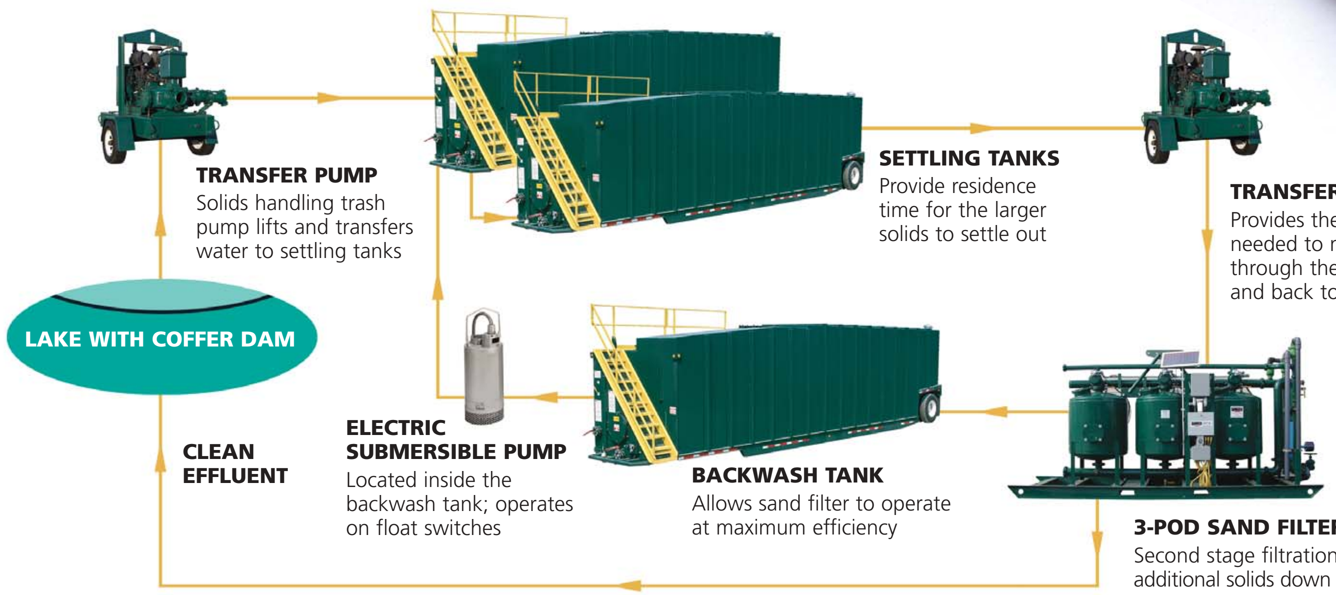
MANUFACTURING

- Liquid transfer for treatment plant projects
- Temporary pumping for stormwater runoff control
- Additional liquid transfer capacity during maintenance or repairs

REFINERIES

- Pumping for cooling tower liquids and sludges
- Hydroblast pad water recirculation
- Hydrotesting
- Portable pumps for wastewater treatment plant overloads

RENTALS, SALES AND 24/7/365 NATIONWIDE SERVICE... BAKER DELIVERS.



ANATOMY OF AN INTEGRATED BAKERCORP DEWATERING SYSTEM
The above diagram shows a typical dewatering system for lakeside construction. Using this system, a large volume of dirty, silty water can be pumped from inside a coffer dam and through the filtration process efficiently. The construction can then be completed inside the coffer dam while the clean effluent water is safely returned to the lake.

Our emergency response service is available 24/7/365 by field technicians that work exclusively on pumps. Their expertise in the field is unmatched and supplemented with ongoing specialized technical and mechanical training.

SETTING THE STANDARD—THE BEST MAINTAINED PUMPS IN THE INDUSTRY.

You can count on BakerCorp's vast network and inventory for immediate delivery of the highest quality pumps and systems. Our rigorous QMS maintenance program—patterned after ISO 9000 certification guidelines—helps insure consistent delivery of peak performance and dependability. Designed and tested to meet NESHAP and OSHA standards, every pump must pass up to three levels of inspection by a BakerCorp certified mechanic before release into the field.

Performance tests are conducted on the engine and pump including starting, idling and shut down operations. All seals, gaskets, valves, discharge manifolds, guards, plugs, filters, pipes, hoses and fittings are carefully checked for any breach of integrity. Fluid levels are topped off and equipment is given a final check for cleanliness and instructions for operation.

A Reputation for Excellence
Our technical sales staff's ability to accurately evaluate the needs of your project, design an effective solution and manage its timely delivery and installation is second to none.

Other team members regularly participate in Pump Application Training (P.A.T.) to keep informed of current technologies and trends.

In addition, stringent safety programs focusing on both site and product specific training help ensure that our people bring an unparalleled level of expertise to each and every job.

SEWER BYPASS

REFINERY TURNAROUND

RESIDENTIAL DEWATERING

In addition to the industry's most comprehensive pump solutions, BakerCorp's tank and filtration divisions deliver the same levels of expertise, service and quality synonymous with our pump solutions.

TANKS. NO BIGGER INVENTORY. NO BETTER SERVICE.

Nobody knows temporary containment like BakerCorp. With an unmatched inventory of tanks and accessories, we rent 17 varieties of steel tanks alone, along with poly tanks, roll off boxes, and specialty equipment.

Our unrivaled history and experience, combined with our world-class applications expertise and 24/7/365 emergency-ready support, BakerCorp gets the call on the toughest containment challenges. Our engineers analyze every aspect of your project resulting in a highly efficient solution. Then we deliver it directly to your jobsite, set it up and remove it once the project is complete.

Whatever the job—construction runoff, cooling tower cleaning, wastewater storage/treatment or environmental remediation—BakerCorp delivers.

FILTRATION. LIQUID OR VAPOR. CLEARLY SUPERIOR SOLUTIONS.

From engineered solutions to on-site services and waste management, BakerCorp provides filtration expertise in the fields of specialty media, applied science, and hazardous materials. Our scientists and engineers—with extensive knowledge of contaminants, environmental laws and regulations, hazardous material management and health and safety—enable us to customize solutions to meet exact requirements. And once in place, our on-site service technicians and waste management teams provide comprehensive support.

Whatever your needs, BakerCorp is on call, nationwide, wherever and whenever.

PUMPS




	Priming Assisted	Self Priming	High Pressure	Electric
Ideal Usage	Construction site dewatering, sewer bypass, tank cleaning, flood management, municipal projects.	Refineries, chemical facilities, waste water treatment plants, construction site dewatering.	Industrial water blasting, Pipeline pigging, irrigation, standby fire protection, environmental cleanups.	Construction and industrial applications of all types where diesel engines are not allowed or are impractical.
Benefit	Can operate in flooded conditions and pull a suction lift. Fully automatic priming. Dry-run capability.	Low maintenance. Easy access with large cleanout port. Emergency shutdown features.	Produces enough pressure to eliminate multiple pumps. Operates in flooded conditions. Unattended operation.	Clean and quiet operation. Refueling is not required.
PERFORMANCE				
Suction Size	4" – 12"	3" – 6"	4" – 10"	3" – 10"
Discharge Size	3" – 12"	3" – 6"	3" – 8"	3" – 8"
Max Flow Range	300 gpm – 6,000 gpm	450 gpm – 1,700 gpm	800 gpm – 5,200 gpm	Up to 5,200 gpm
Suction Lift	Up to 28'	Up to 28'	Up to 28'	Up to 28'
Max Shut Off Head Range	90' – 490'	112' – 171'	285' – 490'	Up to 480'
Max Solids Size	Up to 3.35"	Up to 3"	1/2" – 3.35"	Up to 3.35"
Max Operating Temp	150° F – 190° F	Up to 160° F	150° F – 175° F	Up to 160°F
Fuel	No. 2 Diesel	No. 2 Diesel	No. 2 Diesel	Electric; 115/230/460 volts
Run Time per Full Tank	Typically 24 hrs. Call for details.	Typically 24 hrs. Call for details.	8 – 24 hours	N/A
Fuel Capacity	30 gallons – 171 gallons	50 gallons – 88 gallons	60 gallons – 235 gallons	N/A
Operating Speed	1,000 rpm – 2,400 rpm	1,000 rpm – 2,200 rpm	1,000 rpm – 2,400 rpm	Typically 1,800 rpm
GENERAL INFORMATION				
Weight	2,050 lbs – 7,900 lbs	2,000 lbs – 3,900 lbs	3,300 lbs – 7,900 lbs	Less than diesel counterparts
Standard Mount	Trailer or skid	Trailer or skid	Trailer or skid	Skid
Prime Mover	Diesel engine and electric motor	Diesel engine and electric motor	Diesel engine and electric motor	Typically open drip proof motors
Casing Material	Ductile iron, cast iron and 316 stainless steel	Cast iron	Cast iron and stainless steel	Ductile iron or cast iron
Seal Type	Silicon carbide/silicon carbide or silicon carbide/tungsten carbide	Tungsten/tungsten or silicon/silicon	Silicon carbide and tungsten carbide	Silicon carbide and tungsten carbide
Safety Features	Coupling guards; high water temperature and low oil pressure shutdowns on diesel engines.	Coupling guards; high water temperature and low oil pressure shutdowns on diesel engines.	Coupling guards; high water temperature and low oil pressure shutdowns on diesel engines.	Coupling guards. Circuit breakers and overload protection in NEMA 3R enclosures.

VISIT www.bakercorp.com FOR ADDITIONAL SPECIFICATIONS. CALL YOUR LOCAL BRANCH FOR PRODUCT AVAILABILITY. 1-800-BAKER 12





	Electric Submersible	Hydraulic Submersible	Air Diaphragm	Sound Attenuated	Utility
Ideal Usage	Removing water and handling solids up to 3.15" when electric power source is available.	High suction lift applications such as sewer bypass jobs. Dewatering of mines, quarries and gravel pits.	Sludge and slurries, flood control and dewatering situations associated with refineries. Applications where compressed air is available.	Sewer bypass projects in residential areas. "Quiet Zones" such as hospitals or retail commercial areas.	Construction site dewatering, product transfer, emergency standby, sewage transfer, irrigation and farm use.
Benefit	Around–the–clock unattended operation. User-friendly. Quiet operation. Lower labor costs.	No suction line limitations. Unattended operation. Submerged pump head. Variable speed. No electrical requirements.	Light and portable. Adjustable flow rates. Non-stall air valves. Easy to use. Flexible. Reduces down time.	Sound enclosures significantly reduce noise. Tested to meet CPB standards.	Light and portable. Easy access to pump. Economical, maintenance-free, self-lube mechanical seal.
PERFORMANCE					
Suction Size	—	—	1"– 3"	4" – 8"	2" – 3", NPT
Discharge Size	3" – 10"	4" – 6"	1"– 3"	4" – 8"	2" – 3", NPT
Max Flow Range	100 gpm – 5,000 gpm	Up to 1,750 gpm	40 gpm – 250 gpm	150 gpm – 2600 gpm	225 gpm – 425 gpm
Suction Lift	N/A	N/A	Up to 24'	Up to 28'	Up to 20'
Max Shut Off Head Range	Up to 375'	65' – 130'	Up to 230'	Up to 195'	Up to 98'
Max Solids Size	3/8" – 4"	Up to 4"	1/4" – 2"	3"	Up to 1 1/2"
Max Operating Temp	100° F – 120° F	150° F – 190° F	212° F	160° F	150° F
Fuel	Electric; 115/230/460 volts	No. 2 Diesel (for the hydraulic power unit)	Compressed air	No. 2 Diesel	Gasoline
Run Time per Full Tank	N/A	24 hours	N/A	24 hours	Two hours
Fuel Capacity	N/A	50 gallons – 112 gallons	N/A	61 gallons – 84 gallons	1 gallon – 1.5 gallons
Operating Speed	Typically 1,800 rpm or 3,600 rpm	1200 rpm – 2200 rpm (engine speed)	N/A	1,000 rpm – 2,200 rpm	2,000 rpm – 3,600 rpm
GENERAL INFORMATION					
Weight	30 lbs – 1,500 lbs	135 lbs – 420 lbs (pump head)	79 lbs – 379 lbs	4,100 lbs – 4,700 lbs	90 lbs – 150 lbs
Standard Mount	N/A	HPU's are trailer mounted	Skid or roll cage	Skid or trailer	Roll cage
Prime Mover	Electric motor	Diesel engine/Hydraulic fluid	Air operated reciprocating diaphragms	Diesel engine	Gasoline engine
Casing Material	Cast iron, aluminum and stainless steel	Cast iron or carbon steel	Aluminum, stainless steel, and polypropylene	Cast iron or ductile iron	Aluminum
Seal Type	Tandem, oil lubricated.	Tungsten/tungsten or carbon/ Ni-hard steel	N/A	Silicon carbide and tungsten carbide	Silicon carbide; grease lubricated
Safety Features	Circuit breaker and motor overload protection in NEMA 3R enclosures.	High water temperature and low oil pressure shutdowns on diesel engines. Hydraulic system overpressure protection.	No fuel handling required. No electrical hook-ups required.	Coupling guards; high water temperature and low oil pressure shutdowns on diesel engines.	Auto shutdown on low oil level. Roll cage.

PIPE, HOSE AND FITTINGS

BakerCorp inventories a complete range of pipe, hose and fittings in various diameters to handle any required flow capacity, including high pressure pumping. BakerCorp can exceed the requirements for any application.

ALL TYPES OF PIPE AND HOSE

- Steel
- Aluminum
- Industrial groove

HDPE FOR HIGH PRESSURE AND FLOW

- Up to 30" diameters
- Fusion machines

MULTIPLE END CONNECTORS

- Bauer
- Quick disconnect
- Camlock
- Flanged

ACCESSORIES

BakerCorp offers a variety of accessories including:

- Secondary Containment Berms
- Road Crossings
- Generators
- Fuel Tanks
- Spill Guards
- Auto-Start Options

MORE EQUIPMENT. MORE LOCATIONS.

3020 Old Ranch Parkway, Suite 220
Seal Beach, California 90740
1-800-BAKER 12
1-562-430-4865 Fax
www.bakercorp.com

FILTRATION

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TOUGH JOBS. PROVEN RESULTS.

FILTRATION FROM BAKER. LIQUID OR VAPOR. CLEARLY SUPERIOR SOLUTIONS.

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From engineered solutions to on-site services and waste management, BakerCorp provides filtration expertise in the fields of specialty media, applied science, and hazardous materials. Our team of scientists and engineers—with extensive knowledge of contaminants, environmental laws and regulations, hazardous material management and health and safety—enable us to customize solutions to meet specific project requirements for both temporary and permanent applications. And once in place, our on-site service technicians and waste management teams provide comprehensive support. BakerCorp is on call, nationwide, wherever and whenever you need us.

Whatever your needs—vapor & liquid, organic & inorganic, high-flow & low-flow—BakerCorp provides superior solutions. Specialty media applications include activated carbon, ion exchange resins, impregnated media, organoclay, sand and gravel. Our equipment lineup includes high and low-pressure carbon and specialty media vessels, odor control systems, sand filters, duplex cartridges, bag filters and auxiliary equipment.

From timely delivery, installation, pumping and vacuuming to packaging, transporting, recycling, incineration and disposition, BakerCorp offers a full complement of unsurpassed filtration systems and support services.

PROVIDING PROVEN SOLUTIONS TO INDUSTRY FOR OVER 65 YEARS.

ENVIRONMENTAL REMEDIATION
- Contaminated groundwater/soil treatment
- Dredging
- MTBE, perchlorate and metals removal

OIL, NATURAL GAS AND CHEMICAL
- Tank and sump venting
- Tank cleaning and turnaround projects
- Pipeline pigging and maintenance
- Vapor recovery, amine and glycol applications
- Hydrogen sulfide and mercaptans removal

PROCESS EMISSION CONTROL
- Fugitive emission control
- Purification/separation
- Wastewater
- Municipal water and wastewater plants

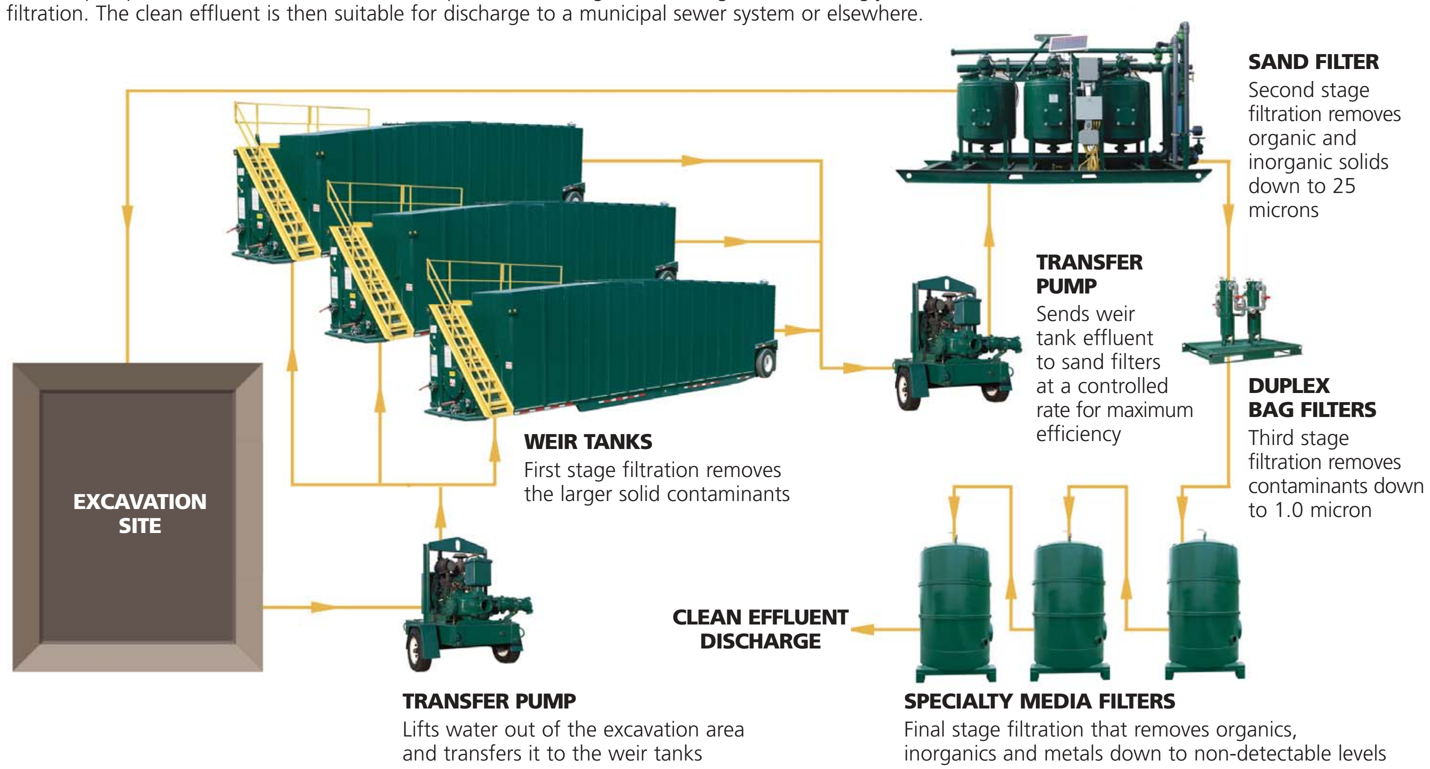
CONSTRUCTION
- Removal of turbidity, organic, inorganic and metals in dewatering projects
- Odor control for sewer bypass work
- Stormwater runoff, phase II of NPDES

EMERGENCY RESPONSE
- Filtration of contaminants in natural and man-made incidents and disasters

DESIGN. INSTALLATION. ON-SITE SERVICE. BAKER IS ON CALL...NATIONWIDE.

ANATOMY OF AN INTEGRATED BAKERCORP FILTRATION SYSTEM

The diagram below shows a typical groundwater treatment system in which contaminated runoff water and soil drainage can be removed and safely disposed of before new construction begins. Contaminated water is pumped out of the excavation site and processed through several stages of increasingly fine filtration. The clean effluent is then suitable for discharge to a municipal sewer system or elsewhere.



UNSURPASSED FILTRATION SYSTEMS AND SERVICES.

High and low-pressure carbon and specialty media vessels. Odor control systems. Sand filters. Duplex cartridges. Bag filters and auxiliary equipment. No other company offers a more comprehensive lineup of filtration equipment than BakerCorp. We have individual units capable of handling up to 1000 gallons per minute and multiple units can be manifolded together for greater capacity. Our specialty media applications include activated carbon, ion exchange resins, impregnated media, organoclay, sand and gravel and enable us to provide clearly superior solutions to today's filtration challenges.

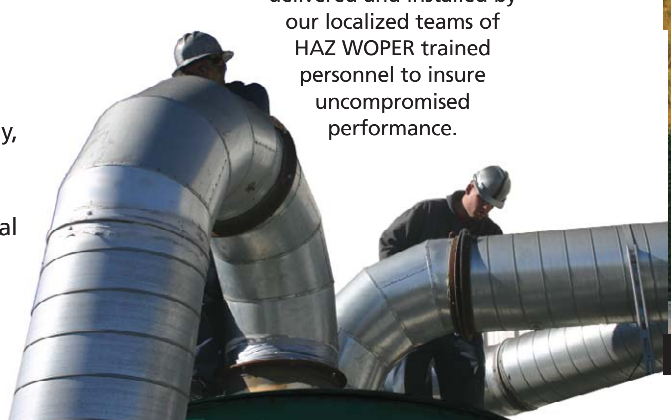
Custom Engineered Solutions

Leading experts in the fields of specialty media, applied science, and hazardous materials, our scientists and engineers set the industry standard for excellence in custom application solutions. Detailed analysis of every requirement of your project ensures that the system we design meets all of your budgetary and regulatory requirements.

On-Site Services

With regional service centers nationwide, BakerCorp is able to provide an unmatched level of on-site services to complement its filtration solutions. Our specialty teams provide a turn-key, cradle-to-grave solution that includes vacuuming, packaging, transporting, recycling, incineration and land disposal of your spent filtration media. Our OSHA trained technicians, hazardous transportation network, hazardous and non-hazardous recycling facilities and fully permitted incineration facilities provide you with peace of mind while meeting regulatory compliance for any type of waste stream you may encounter.

All of our systems are delivered and installed by our localized teams of HAZ WOPER trained personnel to insure uncompromised performance.



ENVIRONMENTAL REMEDIATION

STORMWATER RUNOFF

SEWER BYPASS ODOR CONTROL

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Whatever the job—construction runoff, cooling tower cleaning, wastewater storage/treatment or environmental remediation—BakerCorp delivers.

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Whatever the challenge—wastewater removal, flood control, sewer bypass or hydroblast pad water recirculation—you'll find BakerCorp on the job.

FILTRATION

	Specialty Media	Sand	Duplex Cartridge	Duplex Bag	Odor Control
Ideal Usage	Environmental and industrial contaminant removal, liquid and vapor phase.	Construction, environmental, and industrial sediment removal.	Construction, environmental, and industrial applications.	Industrial and commercial process fluids, urban runoff, groundwater discharge from construction sites or stormwater.	Sewer by-pass and other temporary odor control projects. SCAQMD approved.
Benefit	Skid mounted for portability. Backwashing capabilities. Influent/ effluent gauges and sample ports.	Fully automated. Anti-siphon valves. Easy-to-read gauges. Tool-free plumbing connections. User-friendly. Energy efficient. Lower labor costs.	Portability. Flange-to-flange connections. Continuous operation even during maintenance or filter changes. Reduced mobilization costs.	Coarse filtration in a portable unit. Low or moderate flow particulate removal. Quick installation. Meets municipal requirements for nationwide use.	Adjustable flow range. Variable frequency drive. Sound attenuation. Inlet/outlet sample ports. Simple operation. Meets local regulations.
PERFORMANCE					
Capacity	Liquid: 10 gpm – 1000 gpm; Vapor: 120 cfm – 20,000 cfm	74 gpm – 954 gpm (max normal flow range), depending on model	800 gpm	50 gpm – 200 gpm per clean filter	10,000 cfm
Pressure	Liquid: 0 psi – 75 psi; Vapor: 0 psi – 75 psi	80 psi – 100 psi depending on model	150 psi	150 psi	2 psi
Temperature	Liquid: Ambient to 150° F; Vapor: Ambient to 150° F	Limit to ambient. Consult BakerCorp if temp exceeds 100°	400° F max	w/ PVC Pipe: 140° F; w/ Steel Pipe: 225° F	150° F
Filtration	Down to non-detect levels	Down to 25 microns	Down to 0.5 micron	Down to 1.0 micron	Odor removal
Media Weight Range	Liquid: 100 lbs – 20,000 lbs; Vapor: 100 lbs – 20,000 lbs	1,800 lbs – 14,500 lbs	N/A	N/A	4,000 – 8,000 lbs
Height Range	Liquid: 30" – 190"; Vapor: 30" – 168"	6' 3" – 7' 7"	8' 5" overall	5' 0" – 12' 0"	Approx 14'
Width/Diameter Range	19" – 120"	3' 10" – 5' 0"	7' 0"	3' 8" – 4' 9"	8 0"
Length Range	Skid units available. Call for details.	10' – 21' 3"	15' 0"	4' 8" – 5' 8"	Approx 16'
Equipment Weight Range	45 lbs up. Contact BakerCorp.	1,750 lbs – 6,400 lbs	2,000 lbs	550 lbs – 900 lbs (approx)	Contact BakerCorp.
FEATURES					
Type of Media Used	Granular activated carbon, ion exchange resin, zeolite, organoclay.	Silica, sand, gravel	40" long replaceable cartridges	Filter bags, size #2.	Specialty media
Material of Construction	Carbon steel with epoxy coating on interior surfaces. Some models available in polyethylene.	Carbon steel vessels with epoxy interior coating.	304 stainless steel housings; PVC pipe.	Carbon steel and 304 stainless steel vessels.	Filter vessel is epoxy lined carbon steel with stainless steel screen.
Options	Vapor phase units available in deep bed and radial flow design.	Two, three and four pod models are available.	Combination bag/cartridge units are available.	Combination bag/cartridge units are available.	N/A

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ALL TYPES OF PIPE AND HOSE

- Steel
- Aluminum
- Industrial groove

HDPE FOR HIGH PRESSURE AND FLOW

- Up to 30" diameters
- Fusion machines

MULTIPLE END CONNECTORS

- Bauer
- Quick disconnect
- Camlock
- Flanged

SPECIALTY MEDIA TO HANDLE ANY JOB

Activated Carbon—Granular, pelletized and powdered media to remove organic contaminants from vapor and liquid streams.

Impregnated Media—Effective removal of inorganic contaminants using activated carbon and zeolite based media. Impregnated with chemical reagents.

Ion Exchange Resins—Synthetically manufactured to carry an ionic charge, either positive or negative, ion exchange resins are an effective solution to highly complex applications such as perchlorate and dissoved metals removal.

Metals Removal Media—Specialty media to remove arsenic and other heavy metals.

Oil Removal Media—Specifically manufactured to remove oil and heavy organics from water. This media acts as a cost-effective prefilter for carbon adsorbers.

QUALITY ASSURANCE PROGRAM

BakerCorp has a rigorous maintenance program patterned after ISO 9000 certification guidelines. This QMS program is exclusive to BakerCorp. It ensures each and every one of our filtration units is inspected and of the highest quality each time it's ready for use by a customer.

LEVEL I—BEFORE DELIVERY

- Visual inspection of entire system including influent and effluent connections as well as gaskets, fittings and hatches to make sure they are operating properly and meet job requirements
- Load media if job requires

UPON DELIVERY:

- Review operation of bleed valve, drain valve and if applicable, isolation valves with customer
- Review plumbing—which is influent, effluent, and if customer is installing piping, torque specs
- Review any weather related issues like extreme heat or freezing temperatures

LEVEL II—UPON PICKUP

- All Level I "Before Delivery" inspections
- Inspect interior for lining condition and cleanliness

LEVEL III— MAINTENANCE CHECKUP

- Pressure test filter vessels using compressed air. Check all connections and openings for leaks
- Perform any necessary repairs found in Levels I–II

WASTE MANAGEMENT SERVICES

BakerCorp is your single source for pollution management. Our OSHA trained technicians, hazardous transportation network, hazardous and non-hazardous recycling facilities and fully permitted incineration facilities provide you with peace of mind while meeting regulatory compliance for any type of waste stream you may encounter.

- Contaminated soil & water
- Contaminated debris
- Industrial waste

MORE EQUIPMENT. MORE LOCATIONS.

BAKERCORP™

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