PUBLIC UTILITIES
REVENUE BOND OVERSIGHT COMMITTEE
CITY AND COUNTY OF SAN FRANCISCO
MINUTES - DRAFT

Public Utilities Commission Building
525 Golden Gate Ave., 2nd Floor
Yosemite Conference Room
San Francisco, CA 94102

October 17, 2016 - 9:00 AM

Regular Meeting

Purpose: The purpose of the RBOC is to monitor the expenditure of revenue bond proceeds related to the repair, replacement, upgrading, and expansion of the City's water collection, power generation, water distribution, and wastewater treatment facilities.

Mission: The goal of the RBOC is to make certain public dollars are spent according to authorization and applicable laws. Its purpose is to facilitate transparency and accountability in connection with the expenditure of revenue bond proceeds. The General Public is invited and welcomed to attend RBOC meetings and to provide input.

1. **Call to Order and Roll Call**

Seat 1	Holly Kaufman (Holdover status)
Seat 2	Kevin Cheng, Chair (Holdover status)
Seat 3	Vacant
Seat 4	Vacant
Seat 5	Dari Barzel
Seat 6	Christina Tang, Vice Chair
Seat 7	Jadie Wasilco

Chair Cheng called the meeting to order at 9:07 a.m. On the call of the roll, Chair Cheng, Vice Chair Tang, and Members Barzel and Wasilco were noted present. Member Kaufman was noted not present. There was a quorum.

2. **Agenda Changes**

There were no agenda changes.

3. **Public Comment:** Members of the public may address the Revenue Bond Oversight Committee (RBOC) on matters that are within the RBOC's jurisdiction but are not on today's agenda.

Public Comment. Speakers: Gypsy; Nico Barawid; provided information on their professional backgrounds and expressed interest in applying to a vacant seat on the Committee.

4. **San Francisco Public Utilities Commission (SFPUC) Staff Report:** Sewer System Improvement Program (SSIP) Quarterly Update and Communications Report

Karen Kubick, SSIP Director, and Chris Colwick (SFPUC); provided an update on the Sewer System Improvement Program, including program status and upcoming milestones, project count by phase, expenditures, green infrastructure early implementation projects status, recent accomplishments and challenges, stakeholder outreach, and communications goals and strategy. Mike Brown (SFPUC); provided information and responded to questions and answers throughout the discussion.

Public Comment. Speakers: None.

5. **Mountain Tunnel 101 Presentation:** overview of the issue, how it is being addressed, project update, project scope and budget, why Mountain Tunnel was not included as part of WSIP, possibility of inclusion in WSIP, project going forward

Mike Brown (SFPUC); requested that this item be continued to the December 12, 2016, RBOC meeting, as PUC staff will be presenting new data on this topic to several bodies at that time.

Public Comment. Speakers: None.

6. **Updates to RBOC Mission Statement**

Committee members are to send any edits to the Clerk, which will be included in the packet material for the next agenda.

Public Comment. Speakers: None.

By unanimous consent, this item was APPROVED with recent edits from Member Kaufman, which were included in the agenda packet.
Ayes: 4 - Cheng, Barzel, Tang, Wasilco
Absent: 1 - Kaufman

7. **Annual Report Preparation**

Committee members are to send any edits to the Clerk. A working draft will be complied and included in the packet material for the November 7, 2016, Revenue Bond Oversight Committee meeting agenda.

Public Comment. Speakers: None.

8. **Strategic Planning Follow Up: Identifying Studies for Initiation, Metrics for Measuring Committee Performance**

Clerk Derek Evans provided information on outreach to strategic planning session facilitator Carmen Clark regarding a follow-up meeting to be held in January 2017.

Public Comment. Speakers: None.

9. **Announcements, Comments, Questions, and Future Agenda Items**

Chair Cheng requested a presentation on the capital budget overview, including funding for all projects, and the wastewater side to be presented by Eric Sandler and Karen Kubick.

The Committee requested the following updates to the next SSIP presentation: include SSIP binder; lessons learned from WSIP being applied to SSIP; how do green projects integrate with other projects; where are the assets? how old are assets? what are the lessons learned on green projects? what are the community benefit requirements? and what is the jobs report for SSIP on local hiring?

The Committee acknowledged email from Steve Lawrence regarding the Calaveras Dam Replacement project, capital improvements and financing, ratepayer protection, whistleblowers, and the RBOC annual report, and further requested that the meeting minutes include previous responses.

Public Comment. Speakers: None.

10. **Adjournment**

There being no further business, the meeting adjourned at 10:15 a.m.

N.B. The Minutes of this meeting set forth all actions taken by the Revenue Bond Oversight Committee on the matters stated but not necessarily in the chronological sequence in which the matters were taken up.

Agenda Item Information

Each item on the agenda may include: 1) Department or Agency cover letter and/or report; 2) Public correspondence; 3) Other explanatory documents. For more information concerning agendas, minutes, and meeting information, such as these documents, please contact RBOC Clerk, City Hall, 1 Dr. Carlton B. Goodlett Place, Room 244, San Francisco, CA 94102 – (415) 554-5184.

Audio recordings of the meeting of the Revenue Bond Oversight Committee are available at: http://sanfrancisco.granicus.com/ViewPublisher.php?view_id=97

For information concerning San Francisco Public Utilities Commission please contact by e-mail RBOC@sfgov.org or by calling (415) 554-5184.

Meeting Procedures

Public Comment will be taken before or during the Committee's consideration of each agenda item. Speakers may address the Committee for up to three minutes on that item. During General Public Comment, members of the public may address the Committee on matters that are within the Committee's jurisdiction and are not on the agenda.

Procedures do not permit: 1) persons in the audience to vocally express support or opposition to statements by Commissioners by other persons testifying; 2) ringing and use of cell phones, pagers, and similar sound-producing electronic devices; 3) bringing in or displaying signs in the meeting room; and 4) standing in the meeting room.

The ringing of and use of cell phones, pagers and similar sound-producing electronic devices are prohibited at this meeting. Please be advised that the Chair may order the removal from the meeting room of any person(s) responsible for the ringing or use of a cell phone, pager, or other similar sound-producing electronic devices.

LANGUAGE INTERPRETERS: Requests must be received at least 48 hours in advance of the meeting to help ensure availability. Contact Peggy Nevin at (415) 554-5184. AVISO EN ESPAÑOL: La solicitud para un traductor debe recibirse antes de mediodía de el viernes anterior a la reunion. Llame a Derek Evans (415) 554-5184. PAUNAWA: Ang mga kahilingan ay kailangang matanggap sa loob ng 48 oras bago mag miting upang matiyak na matutugunan ang mga hiling. Mangyaring tumawag kay sa (415) 554-5184.

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翻譯 必須在會議前最少四十八小時提出要求
請電 (415) 554-7719

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Government's duty is to serve the public, reaching its decisions in full view of the public. Commissions, boards, councils, and other agencies of the City and County exist to conduct the people's business. This ordinance assures that deliberations are conducted before the people and that City operations are open to the people's review.

For more information on your rights under the Sunshine Ordinance (San Francisco Administrative Code, Chapter 67) or to report a violation of the ordinance, contact by mail: Sunshine Ordinance Task Force, 1 Dr. Carlton B. Goodlett Place, Room 244, San Francisco, CA 94102; phone at (415) 554-7724; fax at (415) 554-7854; or by email at sotf@sfgov.org.

Citizens may obtain a free copy of the Sunshine Ordinance by printing San Francisco Administrative Code, Chapter 67, at http://www.sfbos.org/sunshine.

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Individuals and entities that influence or attempt to influence local legislative or administrative action may be required by the San Francisco Lobbyist Ordinance [SF Campaign & Governmental Conduct Code, Section 2.100, et. seq.] to register and report lobbying activity. For more information about the Lobbyist Ordinance, please contact the Ethics Commission at: 25 Van Ness Avenue, Suite 220, San Francisco, CA 94102; telephone (415) 581-3100; fax (415) 252-3112; website www.sfgov.org/ethics.

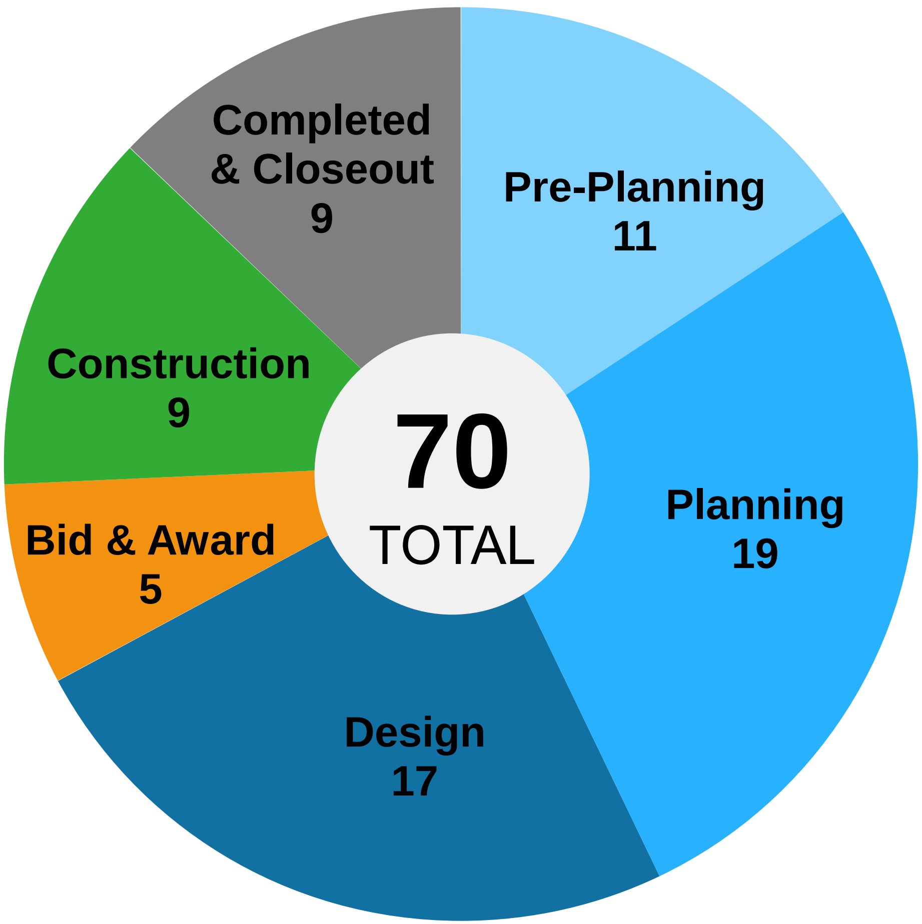
SSIP Quarterly Update and Communications Report

October 17, 2016

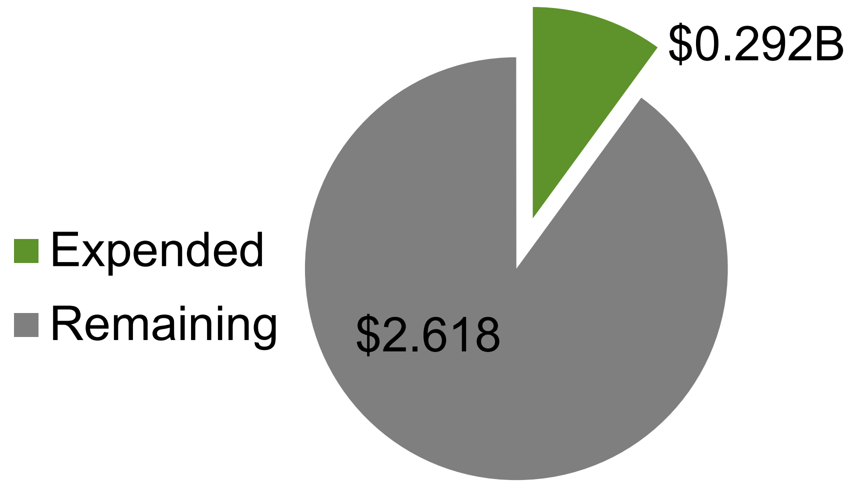
Karen Kubick, Wastewater Enterprise Capital Program Director
Chris Colwick, SSIP Communications Manager

Program Status *(as of June 2016)*

Project Count by Phase



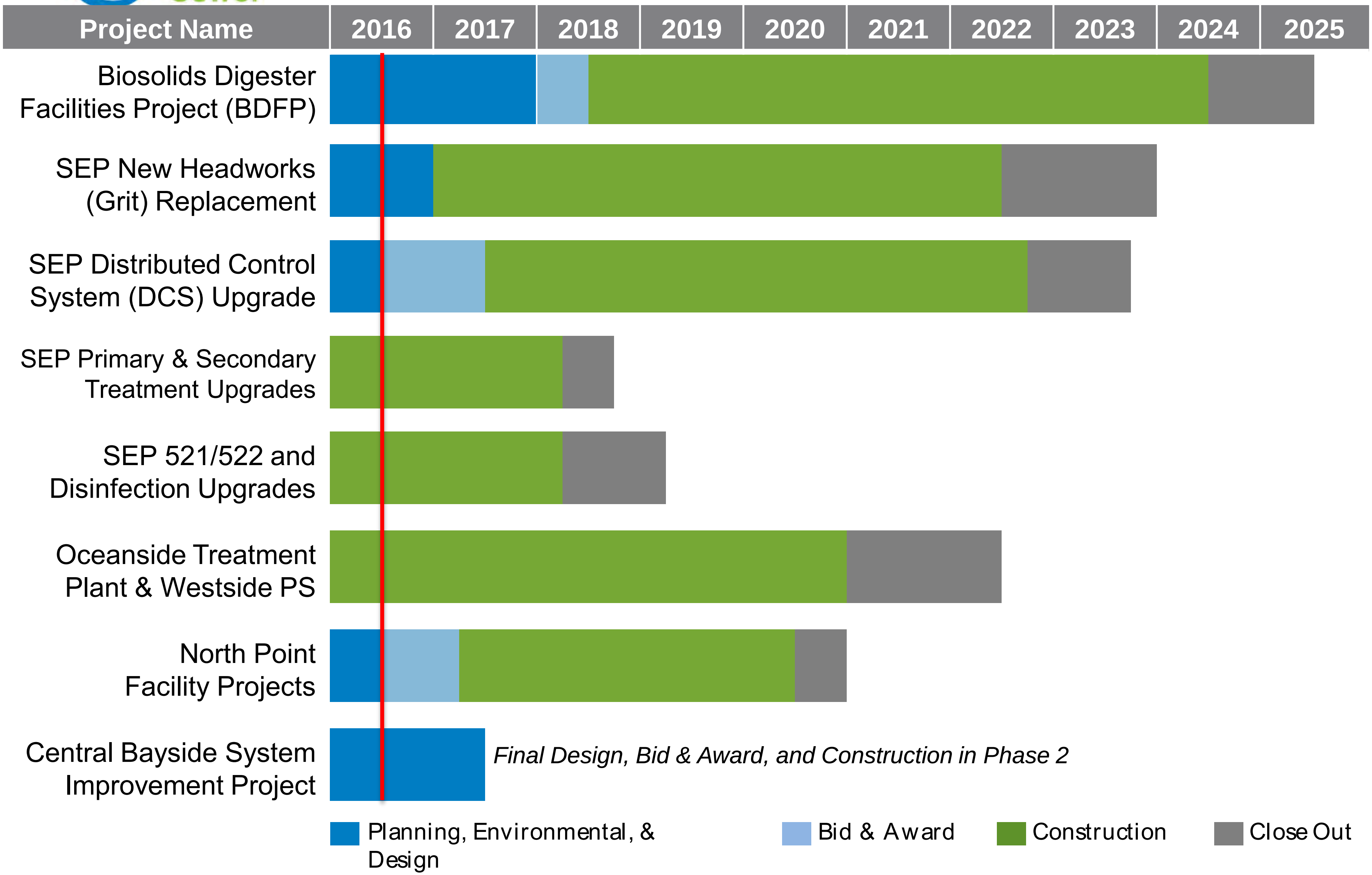
Expenditures ($)



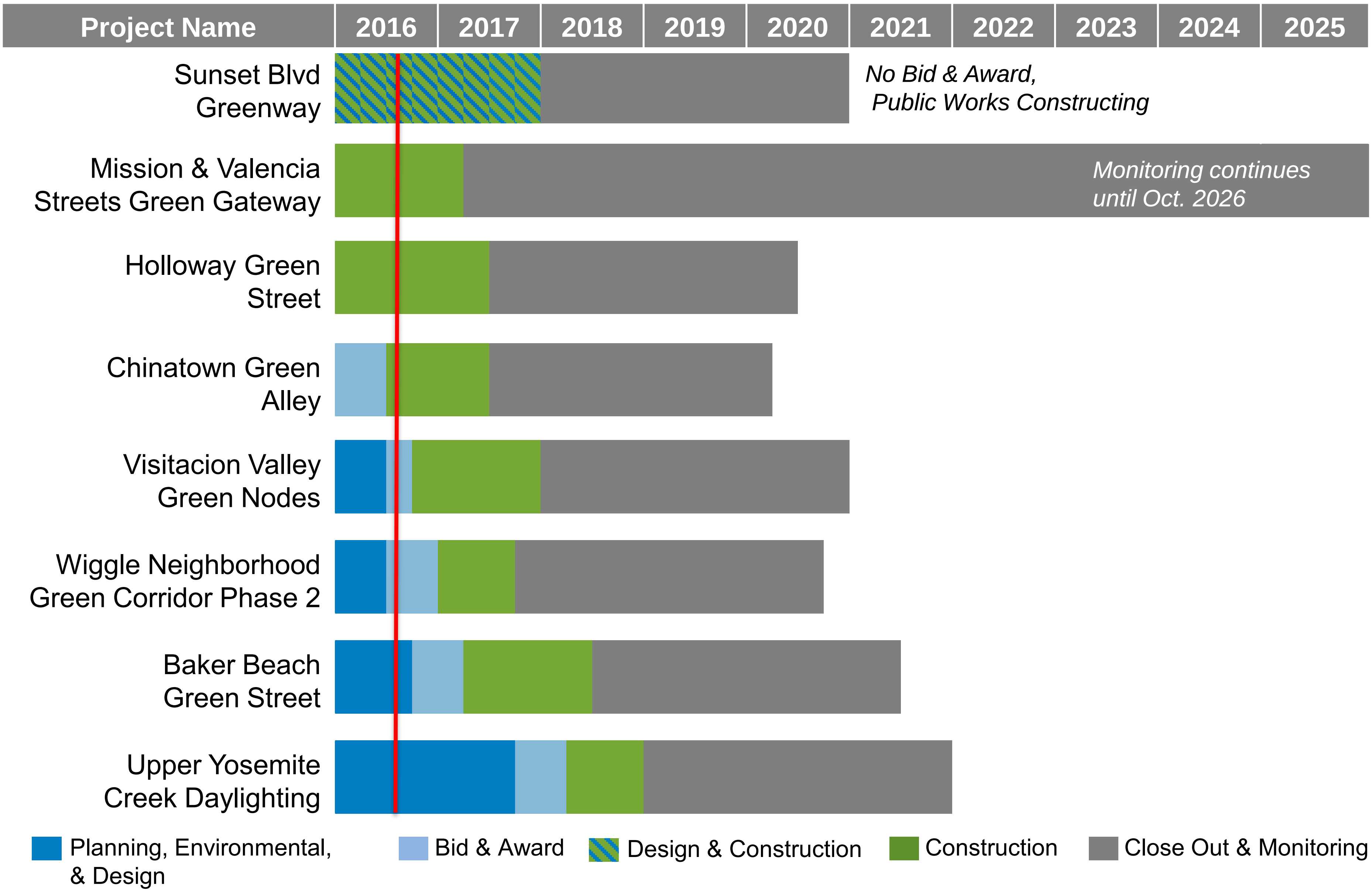
% Complete

12.5% of Phase 1 Projects

Program-Wide Status (as of Sept 2016)



Green Infrastructure Early Implementation Projects (EIPs) Status *(as of Sept 2016)*



Major Phase 1 Project Updates

- Headworks $358M
  - Current Phase: Design (65% by end of year)
  - Contracts: CM/GC contract awarded to Sundt/Walsh JV in May ‘16, NTP Aug ‘16; CM RFP anticipated this Fall
  - Environmental: MND
  - Construction: Anticipated NTP February 2017

- Biosolids $1,276M
  - Current Phase: Design (35% by end of year)
  - Contracts: CM/GC contract will be re-bid after additional outreach; CM RFP anticipated Spring 2017
  - Environmental: Active EIR
  - Construction: Anticipated NTP Summer 2018

San Francisco Water Power Sewer

Achievements

- Successful PLA signing event on August 4th at the Southeast Community Facility
- Issued certified green bonds for eligible projects in sustainable stormwater management
- Participated with WEF and DC Water in the development of National Green Infrastructure Certification Program (NGICP) for contractors

NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM
ngicp

Challenges

- Funding
- Staff Retention
- Land Acquisition and Site Control
- Shutdowns and Scheduling
- Economy and Qualified Contractor Availability
- Staging & Security
- Technology and Network Support

Stakeholder Outreach to Date

- 50+ Street Fairs
- 93 Workshops
- 250+ Tours with 3,500+ Attendees
- 95+ Presentations
- 1,900+ IPad Surveys
- 4,800+ MetroQuest Surveys
- 1.5+ Million reached on Social Media

5,656 Facebook Likes

13,313 Twitter Followers

2,504 LinkedIn Connections

SFGATE | Autos | Jobs | Real Estate | e-edition | Account

San Francisco Chronicle — Arts & Entertainment

Waste time in SF on the great sewer tour

By Beth Spotswood | August 23, 2016 | Updated: August 24, 2016 3:08pm

Photo: Beth Spotswood

San Francisco's Oceanside Wastewater Treatment Plant offers public tours on Saturday mornings.

Thirteen of us sat in a conference room at the Oceanside Wastewater Treatment Plant, all oddly excited to spend the next two hours talking about poop. The walls of the conference room were stacked with hundreds of

Upcoming Topics for Commission

• SSIP Communications	October 25, 2016
• Construction Manager/General Contractor	December 13, 2016
• Flood Resiliency	January 2017
• Central Bayside System Improvement Project (CBSIP)	February 2017
• Green Infrastructure Monitoring	April 2017

Communications Update

- Communication Goals for SSIP and our Southeast Initiatives

- Communication Strategies and Accomplishments

- Upcoming Milestones/Planning for 2017 and Beyond

SSIP Communications Goals

1. Engage and empower our stakeholders to help implement the Sewer System Improvement Program.

SECF Community Event

Digester Repairs

2. AND…Be a Good Neighbor

San Francisco Water Power Sewer

Strategy: Engage at Point of Discovery

- Go to our stakeholders, don't make them come to us
- Make information relevant to audience and venue
- Provide context: local/Citywide, repairs/upgrades


Sunday Streets


iPad Interviews on the Street

50+ Street Fairs

1,900+ IPad Surveys

Strategy: Community Based Participatory Planning

- Gain community buy-in
- Jointly explore challenges and constraints
- Dialogue around expectations

SECF Engagement

95+ Presentations

Planning Workshop

1.5+ Million reached on Social Media

93 Workshops

Strategy: Innovative Communication Tools

- Make information engaging and accessible
- Get youth involved
- Expand our reach

Mobile Technologies


Sewer Rap

Spin-Wheel and Prizes

4,800+ MetroQuest Surveys

30,000 Sewer Rap Views

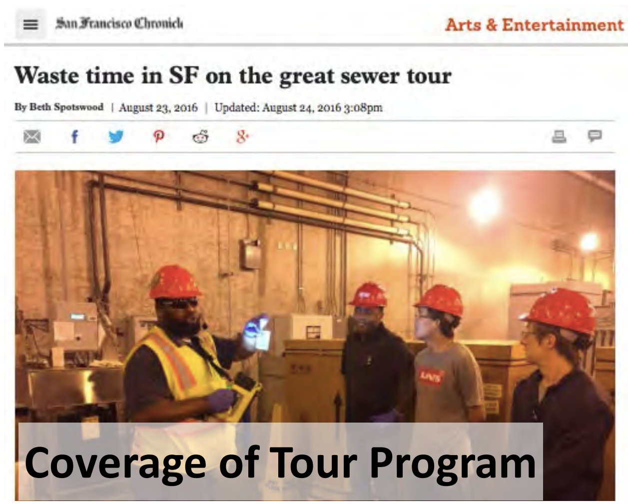
5,656 Facebook Likes

13,313 Twitter Followers

2,504 LinkedIn Connections

Strategy:
Arts and Educational Components

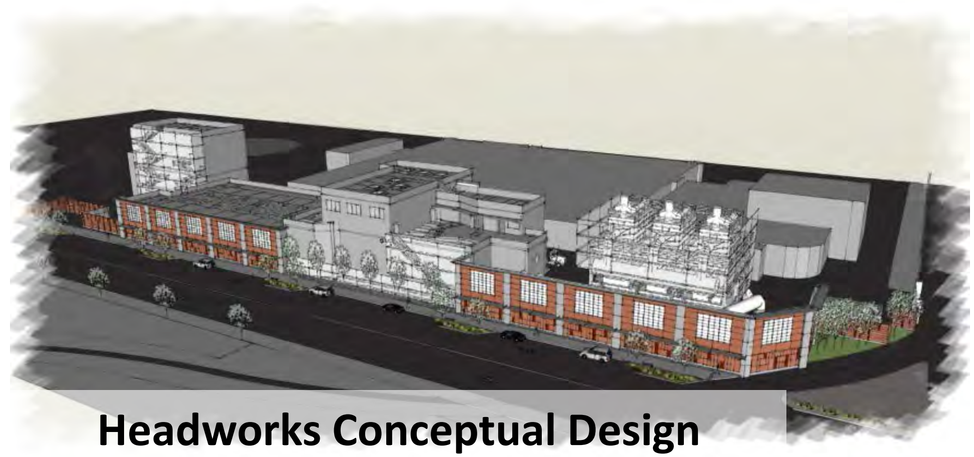
- Engage diverse audiences
- Expand opportunities to integrate with community
- Build excitement for artistic, architectural elements


San Francisco Chronicle Arts & Entertainment

Waste time in SF on the great sewer tour

By Beth Spotswood | August 23, 2016 | Updated: August 24, 2016 3:08pm

Coverage of Tour Program

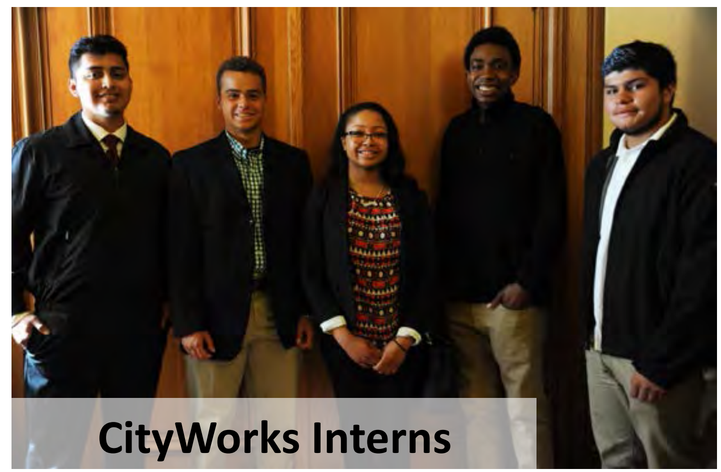

Headworks Conceptual Design

250+ Tours with 3,500+ Attendees

Strategy: Utilize Community Benefit Activities

- Expand training capacity and develop career skills
- Leverage investment to revitalize the community
- Raise awareness about work force development

Contractor's Assistance Center



CityWorks Interns

874 SF residents graduated from CityBuild

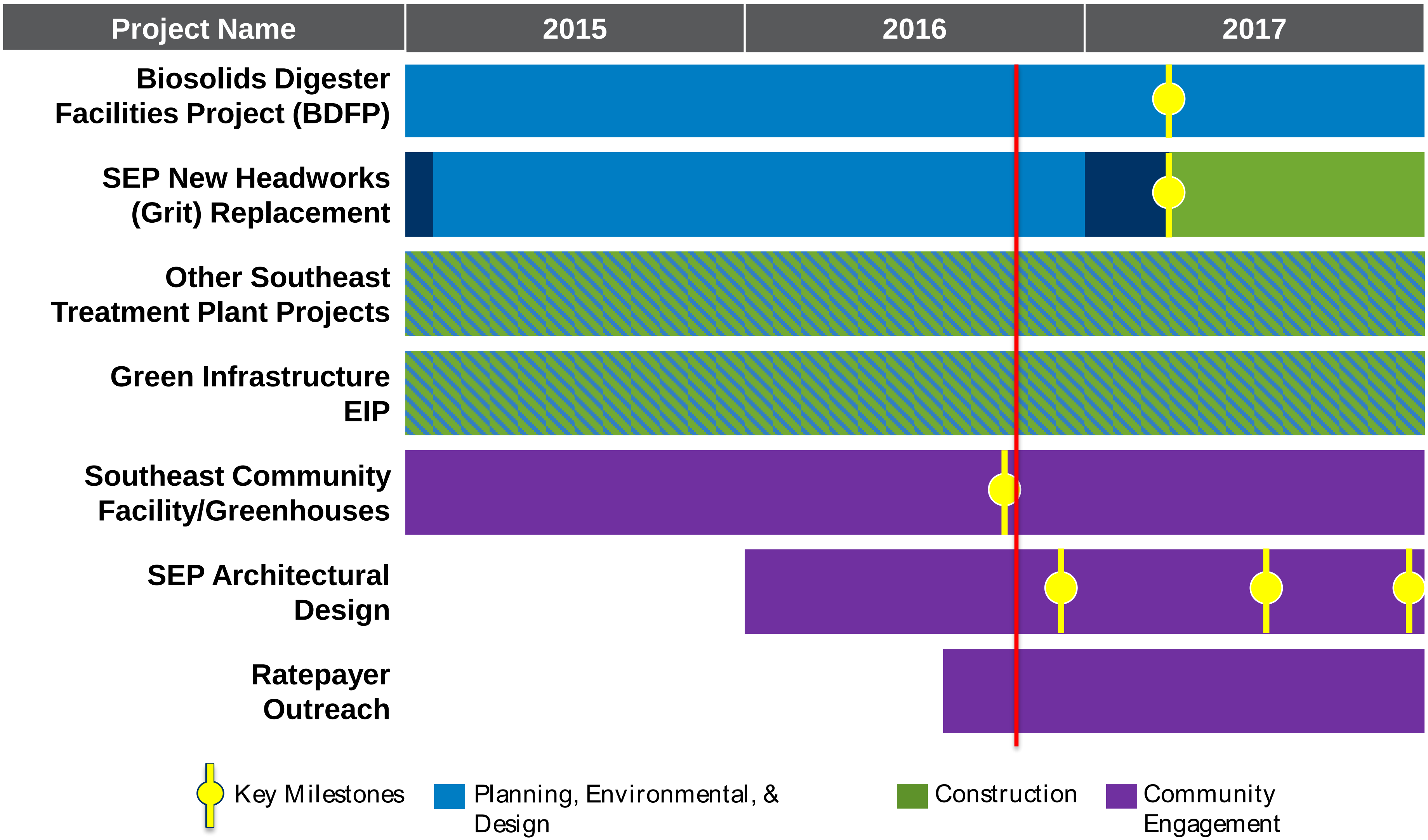
Opportunities: Transition from Planning to Construction

- Build on collaborative planning process
- Integrate SSIP and other SFPUC programs and initiatives


PLA Signing


Green Infrastructure Construction

Program Status and Upcoming Milestones
(As of September 2016)



Thank You

RBOC DRAFT MISSION AND GOALS

March 7, 2016 HK edits 10/7/16

MISSION: The purpose of the Revenue Bond Oversight Committee (RBOC) is to monitor the expenditure of revenue bond proceeds related to the repair, replacement, upgrade and expansion of the SFPUC's water, power and sewer infrastructure. The RBOC's goal is to ensure that specific SFPUC revenue bond proceeds are spent appropriately and according to authorization and applicable laws. The RBOC provides oversight to ensure transparency and accountability in connection with expenditure of the proceeds. The public is welcome to attend RBOC meetings and provide input.

GOALS:

1) Monitoring – The Committee maintains awareness of program scope, schedule and budget, and any major issues in planning and implementation of the program.

    Activities:

    - Through review of staff documents and discussions during staff presentations, members learn about milestone, schedule and budget adherence; question staff and consultants; and provide suggestions on remedial strategies as needed.
    - RBOC commissions reports from expert consultants when the RBOC requited additional technical assistance.
    - [Routine reporting is in place – not sure what this means. Is it any different than the first bullet?], diagnostics of project delay are handled expeditiously, and course correction advice is provided in a timely manner.Cut this whole bullet. Repeat of first one.]
    - Conducts site visits.

2) Accountability – The RBOC [be consistent – either RBOC or Committee] is accountable to ………. [see updated version:] SFPUC customers to ensure that the rates they pay fund projects that materially improve the services they receive. [Not exactly – shouldn't this relate more to our mission, above?]

    Activities:

    - RBOC members have an in depth knowledge of SFPUC staff roles and responsibilities. When program or project delay or advancement occurs, the RBOC understands where the accountability lies for delivery of program components.
    - The Committee ditto also takes steps [like what? Add specific/s]to keep the Commission, the Mayor's Office and the public informed of the results of the monitoring and oversight activities, and summarizes these activities in its Annual Report.

3) Transparency - The Committee practices transparency in its operations.

    Activities:

    - Transcripts of all meetings are available in various formats.
    - Meetings are open to the public and some meetings are held at community locations [are they really?]
    - Add website, refer to annual report, above

4) Efficiency – The Committee utilizes staff and consultant time in cost effective ways.

    Activities:

    - The Committee meetings are well run. [revise…]
    - Meeting attendance is nearly one hundred percent.
    - Preparation and participation by members is active and involved.
    - When a subject needs more detailed work than the entire RBOC has available, the Chair establishes ad hoc subcommittees. Contractual assistance is competitively bid and the resulting recommendations used for improved program or project implementation.

Evans, Derek

From: Steve Lawrence <steveinsf@outlook.com>
Sent: Sunday, September 18, 2016 12:37 PM
To: RBOC, (BOS); Evans, Derek
Subject: RBOC matters

(Derek, if you will and can, please provide copies and/or email; may this be considered in lieu of public comment?)

RBOC:

I have followed RBOC since inception. For this meeting I asked for proposed mission language; I was invited to ask or express any time, and by this do so.

Leaving aside RBOC's mission, which I understand to be to see that revenue bond proceeds are well spent, I ask:

1. Do you believe that money was well spent for Calaveras Dam? Change costs exceed the original contract price. Spending on changes is IMO highly inefficient; the contractor need not bid for the work, and is likely to take advantage. Spending hundreds of millions in this way is concerning. Additionally, where did all the excavated material go? The contractor was paid to dig out lots, and paid to import higher quality rock as well, I believe. He trucked the spoil somewhere; what happened to it? Did he sell it so that he not only made out well on the change work, but also profited from the disposition?

2. The largest WSIP project (Calaveras) more than doubled with changes. Half was not bid work. But the largest SSIP project is not to be bid at all. This billion dollar behemoth is to be let unconventionally to a construction manager. Perhaps this shelters change work from recognition as such. Without competitive bids, how are ratepayers to feel assured that the best price is paid? Are there solid plans and specs? Or will this work be design/build? If design/build, or similar, how does an Independent Engineer certify that the work is “to utility standard?” If the ultimate price is unknown, how does a Qualified Independent Consultant certify that revenues will be sufficient?

3. Both of the last two questions (and terms) are taken from the debt policies adopted by the Commission earlier this month. These policies generate questions. A few of mine are:
a) Must capital improvements financed by debt be owned by SFPUC? Apparently not; are there rules (which I don’t find) governing when improvements not owned by SFPUC are permissible? Lease back arrangements are permitted; when, are there restrictions?
b) Bonds may be issued by negotiated sales or private placement at discretion of GM. Does this not invite corruption or favoritism? Should policy be designed to avoid or minimize temptation; “lead us not into temptation?”
c) Green Bonds are enabled. While perhaps not revenue bonds, these debts suck from revenues needed to pay for SSIP and like capital improvements. I remain unconvinced that the semi-political Commission is a sufficient check on over-issuance. What (presumably higher) interest rates are paid?

4. A Commissioner, Ike Kwon, is to protect ratepayers. What does he do in furtherance? Does or should RBOC coordinate?

5. Does or should RBOC enable whistleblowers? Should the RBOC annual report state how rates have risen over the last decade, and how they are projected to rise over the next? Should it address salaries, median and top, and the growth of them? of operating costs? Could the report or synopsis be press material?

These are a few questions I commend to you. Thank you for your consideration.

Steve Lawrence
steveinsf@outlook.com

Evans, Derek

From:	Evans, Derek
Sent:	Wednesday, April 27, 2016 4:55 PM
To:	'Steve Lawrence'
Subject:	FW: Due diligence review re Calaveras; was: RBOC annual report
Attachments:	2012-06-18 CM Letter No. 114 - Geotech Observation.pdf; 2013 02 22 CM DSC Summary.pdf; 2013 02 22 Eval of L Abutment Excav Slope TM.pdf; 2015-05-20 CM Reference Contract Summary.pdf; 2012-09-20 CM Letter No. 129 - DSC, Layback Plan.pdf

Hopefully this isn't too big. Please confirm receipt.

Thank you,

Derek K. Evans
Assistant Clerk, Board of Supervisors
(415) 554-7702

From: Evans, Derek
Sent: Thursday, May 21, 2015 12:56 PM
To: Steve Lawrence <steveinsf@outlook.com>
Subject: RE: Due diligence review re Calaveras; was: RBOC annual report

Yes, here you go. Let me know if you have any trouble with the attachments.

Regards,

Derek K. Evans
Assistant Clerk, Board of Supervisors
1 Dr. Carlton B. Goodlett Place, City Hall, Room 244
San Francisco, CA 94102
Phone: (415) 554-7702 | Fax: (415) 554-5163
Derek.Evans@sfgov.org | www.sfbos.org

From: Steve Lawrence [mailto:steveinsf@outlook.com]
Sent: Thursday, May 21, 2015 12:47 PM

To: Evans, Derek
Subject: RE: Due diligence review re Calaveras; was: RBOC annual report

I can download these files, but can't open them so I can actually read them. Is there a pdf version? I don't think I can un-zip a file that is in that format. (My computer is old, slow, and operated by Mr Confused.)

From: derek.evans@sfgov.org
To: steveinsf@outlook.com
CC: mbrown@sfwater.org; kevinwucheng@hotmail.com
Subject: RE: Due diligence review re Calaveras; was: RBOC annual report
Date: Thu, 21 May 2015 19:06:30 +0000

Hello Steve,

Please see the following link, provided by Dan Wade, WSIP Director, containing several documents that in response to your last email:

https://sfpuc.sharefile.com/d-s07ea8c1738946738

Please let me know if there are any further questions on this matter.

Regards,

Derek K. Evans
Assistant Clerk, Board of Supervisors
1 Dr. Carlton B. Goodlett Place, City Hall, Room 244
San Francisco, CA 94102
Phone: (415) 554-7702 | Fax: (415) 554-5163
Derek.Evans@sfgov.org | www.sfbos.org

From: Steve Lawrence [mailto:steveinsf@outlook.com]
Sent: Friday, February 13, 2015 3:40 PM
To: Evans, Derek
Cc: Brown, Mike (PUC); kevinwucheng@hotmail.com
Subject: Due diligence review re Calaveras; was: RBOC annual report

Thank you.

My notes on the draft CER for Calaveras Dam (4-25-05) contain "Landslide 3-400' wide and about 1200' to be removed as part of excavation for foundation." Also, "Left abutment is highly to intensely fractured temblor sandstone, with occasional thin shale and conglomerate" and "seepage control left abutment to extend to 100' below grade (temblor sandstone)."

At least one landslide was known. Where there is one cockroach....

"Highly to intensely fractured." Also, .3 miles from fault, max credible quake 7.25.

With the above, a steeper than 2:1 slope was designed? Wow.

Further, my faint understanding was that the contractor chose a method of construction that boxed him in once the slope turned out (surprise, not) to be unstable. Yet he gets fully compensated. Whatever happened to all that aggregate he removed? Sold at profit? If so, sweet for the contractor, very sweet.

Steve Lawrence

(I also noted re the TAP's concern about temblor sandstone at left abutment "least option chosen." Frankly I do not recall what this means, and I no longer have easy access to my email which might expand on my words, which relate to engineering data sheets. That choice *might* have meaning.)

From: derek.evans@sfgov.org
To: steveinsf@outlook.com
CC: mbrown@sfwater.org
Subject: RE: RBOC annual report
Date: Fri, 13 Feb 2015 19:38:32 +0000
Hello Steve,

Thank you for your email, which will be included with the March 9th meeting agenda packet.

Also, to address your further comments, I would direct your attention to the February 9, 2015, meeting minutes to find more information on the RW Block Lessons Learned report, as well as the SSIP director's response to the lessons learned.

You may also want to review the Due-Diligence Review Investigations and Design of the Left Abutment, which was presented by Steve Verigin of GEI Consultants at the June 9, 2014, RBOC meeting. Audio of his presentation is available here.

Let me know if you have further questions and/or comments and how I can be of assistance.

Regards,

Derek K. Evans
Assistant Clerk, Board of Supervisors
1 Dr. Carlton B. Goodlett Place, City Hall, Room 244
San Francisco, CA 94102
Phone: (415) 554-7702 | Fax: (415) 554-5163
derek.evans@sfgov.org | www.sfbos.org

From: Brown, Mike [mailto:MBrown@sfwater.org]
Sent: Friday, February 13, 2015 10:12 AM
To: Steve Lawrence
Cc: Evans, Derek; kevinwucheng@hotmail.com
Subject: RE: RBOC annual report

Hi Steve,

I've copied Derek Evans (Derek.Evans@sfgov.org), the clerk for RBOC; he can include your message as part of the next agenda I believe. I've also cc'd Kevin Cheng, the RBOC Chair.

Mike

From: Steve Lawrence [mailto:steveinsf@outlook.com]
Sent: Thursday, February 12, 2015 8:26 AM
To: Brown, Mike
Subject: RE: RBOC annual report

Mike, thank you for sending the link. The report is a bit of a tease. It says, "RBOC recommended corrective actions to WSIP, as a consequence of these findings [Calaveras overruns due to unforeseen site conditions, and soft costs are coming in high]." But it fails to say what corrective actions are recommended, or where these recommendations are found. Do you know where I can find the recommendations made?

Also, the next two items (page 2) say that RBOC reviewed cost containment measures for Calaveras, and dispute resolution, to come up with lessons learned. RBOC's outside professional concluded that changes are coming in high. Are there lessons learned that were put into writing, perhaps for SSIP?

Finally, did RBOC review whether there was a compensable unforeseen site condition? There will be a contract clause in the prime contract, and of course there is a large body of federal differing site condition law. Is there a written analysis of why on the Calaveras job the contractor is entitled, under the unforeseen site conditions clause, to extra compensation for the left abutment ancient landslide conditions? If so, I'd like to see it.

Thank you, Steve Lawrence

From: MBrown@sfwater.org
To: steveinsf@outlook.com
CC: HKelly@sfwater.org; RBOC@sfgov.org; Mark.Blake@sfgov.org; kevinwucheng@hotmail.com;

Derek.Evans@sfgov.org; PublicRecords@sfwater.org; RMorales@sfwater.org; CPerl@sfwater.org
Subject: RE: RBOC annual report
Date: Wed, 11 Feb 2015 20:27:50 +0000
Hi Steve,

I apologize, I thought you meant the PUC's annual report. Please see the link below to RBOC's annual report, which was presented to the Commission on October 28. For your reference, I've included on this email the RBOC Chair, Kevin Cheng and the RBOC Clerk, Derek Evens.

Link to RBOC Annual Report for 2013-2014:
https://infrastructure.sfwater.org/fds/fds.aspx?lib=SFPUC&doc=971307&ver=1&data=373953195

Thank you,
Mike
415-487-5223

From: Steve Lawrence [mailto:steveinsf@outlook.com]
Sent: Tuesday, February 10, 2015 6:32 PM
To: Brown, Mike
Cc: Kelly Jr, Harlan; RBOC; Blake, Mark
Subject: RE: RBOC annual report

Thank you, but those are not RBOC's annual reports. RBOC is supposed to produce an annual report by Jan 31 of each year. But, having read further since writing you, I gather they are skipping that and providing one in draft in July. The annual report requirement was part of the 2002 authorizing statute, and also was put in their bylaws. But alas, there are no penalties for ignoring such requirements, so....

(I used to keep much better track of what RBOC does. Recently, not so much. But one reading a year seemed doable.)

But I did find the RW Block report, and a two person report on the report. Quite interesting.

Yet these still do not address the big question I have. I wonder if the Calaveras Dam contractor isn't laughing all the way to the bank that he got PUC to *pay* him for all that extra aggregate. And pay *big*. What a coup! I've never seen an analysis of the claimed differing site condition. There are elements to meet. (There are two types, type one and type two; different elements for each, altho Cal law is arguably different.) When you're paying hundreds of millions of ratepayer dollars for "changes" is it too much to ask that there is an analysis, in writing, of the change--the differing site condition? Without one, am I wrong to wonder if there really was a differing site condition entitling the contractor to extra compensation? Why would RBOC not ask the question?

Steve Lawrence

From: MBrown@sfwater.org
To: steveinsf@outlook.com; RBOC@sfgov.org
CC: PublicRecords@sfwater.org
Subject: RE: RBOC annual report
Date: Tue, 10 Feb 2015 17:41:20 +0000
Please see link below:

http://www.sfwater.org/index.aspx?page=347

From: Steve Lawrence [mailto:steveinsf@outlook.com]
Sent: Tuesday, February 10, 2015 8:32 AM
To: RBOC
Cc: Brown, Mike
Subject: RBOC annual report

Where can I find the recent annual report (for 2014's activity)? (Second request.)

Steve Lawrence

3. REASON FOR CHANGE

The Geotechnical Data Report (GDR) for the Calaveras Dam Replacement Project (CDRP) was issued in July 2008 (re-issued January 4, 2011) and contained geologic information of the Left Abutment area. The GDR contained information from a comprehensive field investigation program that included numerous shallow and deep geotechnical boreholes, test pits, imagery produced by down-hole televiewer, rock and soil sample testing, geophysical surveys, and field geologic mapping.

Construction of the CDRP started in the fall 2011, and in the spring 2012, excavation was initiated in the Left Abutment area. In early June 2012, the potential presence of a large area of the upper permanent design slope of the Left Abutment, postulated to be underlain by an ancient landslide, was identified by the Contractor who notified the City of a potential Differing Site Condition (DSC) indicating that these pre-existing landslides within the Left Abutment were not indicated in the Contract Documents thus affecting the “false cut” and rendering it potentially unsafe and un-workable. This false cut feature is a key component of the design and sequencing of construction activities in order to keep the project on the approved Baseline Schedule.

As a result of the identification of this potential slope stability issue and the large potential subsequent impact to the project, the City requested the Design Engineer to perform supplemental Geologic explorations and evaluation of the alleged slides and its potential impact to the permanent design excavation face of the Left Abutment and, if present, provide information to constrain the distribution and geometry of potentially adverse conditions that could affect the stability of the Left Abutment design slope. This supplemental geologic exploration also served two purposes: (1) provide additional information in order to help in the evaluation of determining merit of the DSC; and, (2) provide additional information to evaluate the suitability of the Permanent Design Excavation Face. These supplemental Geotechnical exploration activities were conducted between late June and early September 2012.

On 7/18/2012, the Design Engineer issued a Memorandum to the City confirming the presence of a Differing Site Condition (DSC) in the Left Abutment Excavation area as identified. On the same day under City Letter No. 144, the City confirmed the same DSC with the Contractor under the terms of our Contract and requested the Contractor to begin a collaborative effort to tackle this difficult issue with the goal of reducing the schedule and cost of this matter to the maximum extent possible”. Refer to **Attachment F** for the URS Memo and City Letter to the Contractor.

On 2/22/2013, the Design Engineer issued the “Final Technical Memorandum” for the complete evaluation of the Left Abutment Excavation Slope” (Refer to **Attachment G**)

In summary, there were four areas that have been identified that contain materials interpreted as in-place weathered bedrock, transported slide debris, or fault-zone material and are listed below:

- Area A includes most of the northeastern flank of Observation Hill.
- Area B is located on the western sidewall of the Calaveras Creek valley.
- Areas C and D are northeast and downstream of the Left Abutment and are surficial debris flow or colluvial gulley-fill deposits.

3.1 Area A

The selection of the alternative design for Area A depends on an assessment of schedule, cost and risk for the full slope layback (2H:1V overall cut slope for the entire Left Abutment) and the north half slope layback (2H:1V overall cut slope for the north part of the Left Abutment and 1.3H:1V overall cut slope for the south part). Given the uncertainty about the rock mass strength of the Spillway fault zone and its impact on the seismic stability of the southern portion of Observation Hill cut slope and the extent of the delineation of Area A, URS recommended that the full Left Abutment excavation in Observation Hill be laid back to a 2H:1V overall slope.

3.2 Area B

The base of Area B is at a higher elevation than the finished grade of the spillway excavation in Observation Hill and thus will be removed. Also this area appears to underlie the dam foundation and possibly a portion of the upper chute of the spillway. At this time, there are no excavation or stabilization measures planned for

Area B. The plan will be to observe the materials during the excavation process and devise the plan of action at that time, if necessary. If landslide materials are found, they will be removed from the dam foundation.

3.3 Areas C and D
These two areas are surficial debris-flow or colluvial gulley fill deposits. As shown on Drawings FD-1A and FD-1B, these two areas are in the vicinity of the spillway and shall be removed.

This CO is a culmination of all of the extensive management, coordination, investigation, analysis, design and negotiation works performed by the City, Design Engineer, the CM and the Contractor working together to develop the most effective means of addressing this Left Abutment DSC.

The reason for the Cost and Schedule Impact for the Changes to the Left Abutment - Spillway Excavation is "Differing Site Condition"

REVISED TECHNICAL MEMORANDUM

EVALUATION OF LEFT ABUTMENT EXCAVATION SLOPE

CALAVERAS DAM REPLACEMENT PROJECT
Project No. CUW 37401

Prepared for
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 12th Floor
San Francisco, CA 94102

February 22, 2013

URS

1333 Broadway, Suite 800
Oakland, CA 94612

26818183

URS

February 22, 2013

Mr. Gilbert Tang, P.E.
San Francisco Public Utilities Commission
525 Golden Gate Avenue
San Francisco, CA 94102

Subject: **Calaveras Dam Replacement Project**
Project No. CUW 37401
Evaluation of Left Abutment Excavation Slope
Revised Technical Memorandum

Dear Mr. Tang:

This revised technical memorandum on the evaluation of the left abutment excavation slope discusses the geologic model, stability analyses, and slope protection measures and presents conclusions and recommendations for the left abutment slope excavation. This revised version was updated to reflect the results of the September 19, 2012, meeting with DSOD and the CTAP. This technical memorandum also includes revised construction drawings for the left abutment excavation and slope protection.

As discussed in the technical memorandum, four areas have been identified that contain materials interpreted as in-place weathered bedrock or transported slide debris, and are listed below:

- Area A includes most of the northeastern flank of Observation Hill.
- Area B is located on the western sidewall of the Calaveras Creek valley.
- Areas C and D are northeast and downstream of the left abutment and are surficial debris-flow or colluvial gulley-fill deposits.

We are available to discuss this revised technical memorandum with SFPUC.

If you have any questions, please contact us.

Sincerely,

URS Corporation

M. P. Forrest

REGISTERED PROFESSIONAL ENGINEER
MICHAEL PAUL FORREST
No. GE319
Exp. 3/31/14
GEOTECHNICAL
STATE OF CALIFORNIA

Michael P. Forrest, P.E., G.E.
Design Project Manager

Keith I. Kelson, C.E.G.

Carlos A. Jaramillo

cc: Dan Wade
Enclosures: Evaluation of Left Abutment Excavation Slope, Revised Technical Memorandum

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Appendices

The Geotechnical Data Report (GDR) for the Calaveras Dam Replacement Project (CDRP) was issued in July 2008 (re-issued January 4, 2011) and contained geologic information of the left abutment area. The GDR contained information from a comprehensive field investigation program that included numerous shallow and deep geotechnical boreholes, imagery produced by down-hole televiewer, rock and soil sample testing, geophysical surveys, and field geologic mapping.

Construction of the CDRP started in the fall 2011, and in the spring 2012, excavation was initiated in the left abutment area. In early June 2012, the potential presence of landslide material was identified in a "false cut" (temporary excavation) by the Contractor's geologist. A large area of the upper permanent design slope for the left abutment was postulated to be underlain by landslide debris, which was deemed to be a potential safety hazard by the Contractor and excavation work ceased. As a result of the identification of this potential slope stability issue, a geotechnical investigation was initiated to assess the possibility of slide debris in the left abutment area and, if present, provide information to constrain the distribution and geometry of potentially adverse conditions that could affect the stability of the left abutment design slope. The geotechnical investigation was conducted between late June and early September 2012.

The purpose of this technical memorandum is to discuss the geologic model resulting from interpretation of the geotechnical investigations, stability analyses, and stabilization measures and to present conclusions and recommendations for the left abutment slope excavation. This technical memorandum also includes revised construction drawings for the left abutment excavation and slope protection.

This technical memorandum supersedes the July 18, 2012, draft memorandum on the Observation Hill excavation slope stability (URS, 2012).

This section summarizes the current understanding of geologic conditions in the vicinity of the left abutment of the Calaveras Dam Replacement Project (CDRP). The objective of this section is to provide geologic data and their associated uncertainties, and to present reasonable geologic interpretations that are consistent with the available data. This information provides a basis for stability analyses and design recommendations for the left abutment and spillway, as presented in subsequent sections of this technical memorandum.

2.1 BACKGROUND

The Geotechnical Data Report for the CDRP (URS, 2008a) describes geologic conditions of the left abutment area based on a comprehensive, 3-year field investigation program. Investigations included analysis of numerous shallow and deep geotechnical boreholes, imagery produced by down-hole optical and acoustic televiewer logging, rock and soil sample testing, surface seismic refraction surveys, down-hole geophysical surveys, and field geologic mapping.

As stated in Section 1.0, construction for the CDRP started in fall 2011, and in spring 2012 excavation was initiated in the left abutment area. In early June 2012, the presence of possible landslide material was identified by the construction Contractor's geologic consultant in an initial "false cut" excavation. A large area of the upper permanent design slope for the left abutment was postulated to be underlain by landslide debris. As a result of the identification of this possible slope stability issue, field investigations were initiated to assess the possibility of slide debris in the left abutment area and, if present, provide information on the distribution and geometry of possible adverse geologic conditions. These field activities, as described below, were conducted between late June and early September 2012. Collectively, the data from URS (2008a) and these efforts form the basis of the geologic model summarized in this technical memorandum.

2.2 DATA SOURCES

Geologic and geotechnical data used in the development of this geologic interpretation were derived from the sources listed below. The types and locations of data collected and analyzed were revised as the understanding of geologic conditions evolved.

- Geologic, geotechnical and geophysical data provided in the Geotechnical Data Report (GDR) (URS, 2008a), including "CB" series borings, optical and acoustic televiewer data, geophysical profiles, and geologic mapping (Figure 2-1)
- Core samples of CB-series borings from the left abutment area, examined in the Staging Area 3 core-storage area along Calaveras Road
- Twenty-six borings and associated optical and acoustic televiewer data completed for this effort (borings LA2012-01 to -26), including field logs and HQ-sized core samples available at the drilling sites or stored at the indoor laboratory adjacent to the CM office trailers.
- One large-diameter auger boring (boring LA2012-5BA) exposure at the location of boring LA2012-05.
- Three "G-" series borings completed at the northern end of the existing spillway to evaluate shallow geotechnical conditions; these borings had limited recovery of core samples.

- Field exposures provided by various activities of the contractor and construction management (CM) firms, including test pits and roadcuts directed by the CM geologist.
- Aerial imagery provided by publicly available internet sites (e.g., Google Earth, www.historicaerials.com).
- Historical maps, reports, and ground-based photography from the SFPUC archives, including more than 1,000 photographs, taken between August 1911 and December 1917 during the original construction of the existing dam.

2.3 RESULTS

The data produced by additional field investigations since June 2012 have resulted in an updated geologic model that reflect improvements in the understanding of geologic conditions near the left abutment. Figure 2-2 depicts the locations of boreholes and test pit exposures that form the basis for the improved understanding of the geologic conditions. Figures 2-3 through 2-10 present simplified geologic cross sections based on these borehole data and other field exposures. These figures provide first-order compilations of the locations and geometries of near-surface materials in the left abutment area. Uncertainties in the geologic conditions in the left abutment areas exist because of substantial recent ground modification related to construction activities. As a result, there are extensive areas underlain by thick construction debris and areas that are inaccessible because of steep topography or rockfall hazards. The conditions depicted on the geologic map and geologic cross sections will be confirmed during future excavations near the left abutment.

2.3.1 Generalized Geologic Domains

The GDR geologic map (Figure 2-1) indicates the presence of three secondary, north-striking fault zones east of the Calaveras fault, including from west to east: the Gully fault, the Spillway fault zone, and the Quarry fault zone. The activities of these faults were documented by URS/WLA (2005), with the Calaveras fault acknowledged as a major, active fault, the Gully fault having unknown activity (considered “Conditionally Active” per DSOD criteria), and the Spillway and Quarry fault zones shown to be Inactive per DSOD criteria. These faults divide bedrock units into two north-trending slivers, or geologic domains, each with distinct characteristics that affect near-surface conditions. The left abutment area is transected by the Spillway fault zone, which influences the overall geologic conditions in the left abutment area. The orientations of bedrock units to the west and east of this fault zone differ significantly on adjacent sides of the Spillway fault zone. For the purposes of description in this memorandum, the left abutment area is divided into (a) the area west of the Spillway fault zone (and east of the Gully fault), (b) the Spillway fault zone, and (c) the area east of the Spillway fault zone (and west of the Quarry fault zone) (Figure 2-1). The overall characteristics of bedrock units are described in the GDR (URS, 2008a) and are not reproduced here.

West of Spillway fault zone, bedrock consists of various rock types within the Franciscan assemblage, including blueschist, greenstone, serpentinite, and shale mélange (collectively, map unit “KJf”), as well as the overlying Temblor Formation sandstone (map unit “Tts”). On the southern flank of Observation Hill and directly west of the Spillway fault, Franciscan rocks are overlain unconformably by Tts sandstone that dips moderately to the northeast. Recently cut exposures at the top of Observation Hill show that resistant beds of Tts underlie the ridge crest;

these beds have strikes of about N40W to N50W, and dips of about 40 to 50NE. These beds are highly fractured, with numerous open fractures that are subparallel with observed bedding planes, and that cut obliquely across bedding planes. The bedded Tts sandstone contains abundant bedding-plane parallel shears and fracture in-fill deposits, such that locally the small-scale indicators of strata are difficult to identify. The bedding-plane shears have striations that indicate components of down-dip and lateral movement. Locally, these shears also cut obliquely across bedding, but ultimately merge with the bedding-parallel shears. Cross-cutting relationships between the bedding-parallel and bedding-oblique shears are not consistent, suggesting that they probably formed simultaneously. The northern flank of Observation Hill slopes steeply to moderately northeast, and near the ridge crest has an aspect and gradient comparable with the orientation of the Tts beds. The upper part of this slope appears to be a “dip-slope” controlled by the orientation of sandstone beds. The lower parts of the slope are covered by surficial deposits, and there are no documented exposures in bedrock north of the Observation Hill ridge crest in this domain.

The Spillway fault zone extends northward from the northern shore of Calaveras Reservoir and along the eastern end of Observation Hill (URS/WLA, 2005; URS, 2008a). The fault zone is exposed at the truncated southeastern end of Observation Hill, where it is about 200 to 300 ft wide and contains planes that are vertical or steeply dipping to the east. This hillside exposure shows sheared KJf in juxtaposition with deformed Tts at lower structural levels, and deformed Tts rocks on both sides of the zone at higher structural levels. The field relations indicate that the fault zone has at least several hundred feet of east-down normal vertical separation. Excavations for a temporary “false cut” in the left abutment in June 2012 exposed multiple zones of northerly and northwesterly shears that may be parts of the Spillway fault zone, or splays that extend northwesterly away from the fault zone. Overall, the Spillway fault zone consists of a wide zone of shearing that dips steeply to the east; in the shallow subsurface in the left abutment area, the fault zone is bordered on both sides by deformed Tts sandstone.

East of the Spillway fault zone, surface and subsurface information shows that bedrock between the Spillway and Quarry fault zones consists of KJf, a thick section of Tts sandstone, and the basal part of the Claremont Formation sandstone, siltstone, and claystone (map unit “Tcs”; Figure 2-1). The unconformable contact between the basal Tts and underlying KJf is interpreted in the subsurface near the axis of the Calaveras Creek valley (URS, 2008a). Field data from the GDR (URS, 2008a) and recent observations show that the Tts and overlying Tcs beds strike about N40E to N50E and dip shallowly northwest (about 13NW to 40NW) (Figure 2-1). Overall, the geologic domain between the Spillway and Quarry fault zones is a graben that contains bedrock strata that overlie KJf in the subsurface, and dip shallowly northwest. The northwesterly bedding orientation east of the Spillway fault contrasts with the northeasterly dip of Tts sandstone in the geologic domain west of the fault zone (Figure 2-1).

2.3.2 Weathered Bedrock, Surficial Deposits and/or Fault-Zone Materials

The GDR provides subsurface information that suggests the presence of thick, weathered, highly fractured material in the left abutment area (URS, 2008a). This material was interpreted to be as much as 100 ft thick, and located beneath the northeastern flank of Observation Hill and the western valley sidewall of Calaveras Creek. The Contractor’s geologist interpreted subsequent exposures provided by the interim “false cut” excavation to indicate the presence of a deep-seated landslide mass (Terrestrial Solutions, Inc., 2012). Subsurface investigations were recently completed to address the distribution and geometry of this material in the left abutment area. Figure 2-2 shows the locations of previous relevant borings (CB-series from the GDR), recent borings (LA2012-series and G-series), local field geologic mapping, and test pit exposures. Figure 2-2 also shows the locations of geologic cross-sections (Figures 2-3 through 2-10) developed to interpret the geologic conditions in the left abutment. Appendix A provides simplified data from the previous and existing borings that were used in developing the geologic cross sections (Figures 2-3 to 2-10).

The results of the recent and previous borings confirm the presence of fractured and highly weathered materials in the subsurface in the left abutment, as well as the presence of deformed and fractured bedrock within the Spillway fault zone. The interpretation of the origin of these materials is critical to the development of a reasonable geologic model in the left abutment area; a distinction must be made to interpret whether materials exposed in boreholes and excavations are (a) weathered in-place bedrock, (b) weathered transported bedrock blocks, or (c) weathered and fractured fault zone materials. Uncertainties in differentiating such materials can be large, and often the only diagnostic criteria for differentiating between “weathered”, “landslide”, and “faulted” materials are the overall geometry of the deposits and the geologic setting of the site (Hanson et al., 1999; Cotton, 1999). In constructing the geologic cross sections shown on Figures 2-3 through 2-10, we assessed the previous and recent borings by using the following characteristics, if present in the core samples:

- Abrupt planar features in core samples
- Orientations of planar features with respect to geomorphic position of the boring
- Density and orientations of fractures, joints, or faults
- Presence/absence of discernible bedding planes within sedimentary bedrock
- Slickensides, striations or other kinematic indicators
- Material color (dark yellowish brown vs. gray) and other weathering products
- Qualitative rock strength observations from cores (“strong” vs. “weak”)
- Presence of fracture fillings or other relatively weak materials in outcrops and core borings
- Articulated or non-articulated pieces of rock materials in outcrops and core borings
- Abrupt changes in rock types and bedding orientations in core samples
- Presence of zones of no core recovery
- Abrupt changes in Rock Quality Designation (RQD) or percent recovery in core samples
- Abrupt changes in drilling conditions
- Comparison with cores from adjacent or nearby borings
- Comparison with nearby geologic and geophysical data

We assessed the cores, logs and televiewer data (where available) from the 26 recent LA2012-series borings, three G-series borings, and 18 of the CB-series borings (Appendix A). We also considered field exposures of possible landslide planes and transported debris in the temporary cut (in June and July), in subsequent excavations throughout the left abutment area (in August and September), in order to calibrate the interpretation of boring data. We used historical archived maps and photography to obtain pre-construction images showing geomorphic conditions in the left abutment area. On the basis of the available information, including analysis of the boring data using the criteria listed above, we interpret four areas that contain materials interpreted as in-place weathered bedrock, transported slide debris, or fault zone material. The four areas are described below (Areas A through D; Figure 2-2); interpretations of possible origins of the materials are provided in a latter section (see Section 2-4).

2.3.3 Area A

Area A includes most of the northeastern flank of Observation Hill, which slopes steeply to the northeast and is underlain by deeply weathered bedrock and/or landslide material. Cross-section A10 (Figure 2-3) shows a representative geologic cross section perpendicular to the slope, as defined by field observations and borings LA2012-03, -04, -07, and -08 (from southwest to northeast). The upper part of the section is underlain by steeply northeast-dipping beds of the Tts sandstone, and the lower part of the section is underlain by shallowly northwest-dipping upper beds of Tts sandstone. The Spillway fault zone separates these two geologic domains; this zone is thought to be approximately 200 to 300 ft wide and composed of highly fractured and sheared rocks.

Boring LA2012-03 exposed highly weathered, dark yellowish brown sandstone material to a depth of about 100 ft (elevation 831 ft). This material is fractured and highly weathered, with fractures generally having shallow to moderate dips that are not consistent with the near-vertical deformation associated with the Spillway fault zone. The core samples and the acoustic televiewer data from this boring show that the interval between about 100 and 164 ft depth (elevation 831 to 750 ft) is an unlithified mixture of angular Tts sandstone fragments in a silty matrix, with occasional zones having some lean clay. This material is gray in color, but has variable fracture orientations that are similar with the overlying dark yellowish brown material; the gray color at depth may be a result of less oxidations resulting from restricted groundwater percolation beneath the topographic bench. Directly below the weak breccia material at 164 ft depth in boring LA2012-03 is strong, relatively unfractured gray sandstone; the contact is represented by an abrupt downward increase in RQD. The contact between the brown, highly fractured material (and associated lowermost gray breccia) with underlying hard, gray sandstone is abrupt (less than 0.25 in thick), and exhibits locally polished and grooved areas. The striations are oriented in the dip direction of the surface, which dips approximately 10 to 20 degrees (in an unknown direction). There is no remolded clay gouge identified in this part of boring LA2012-03. Near the bottom of boring LA2012-03 (depths of 187 to 194 ft), sub-vertical fractures and faults are distinct from the fractures in the upper part of the boring, and probably represent strands of the Spillway fault zone.

Borings LA2012-04 and LA2012-07 show similar stratigraphic relationships as those exposed in boring LA2012-03 (Figure 2-3). At depths of 36 to 108 ft, boring LA2012-04 consists of weathered and fractured, dark yellowish brown sandstone and siltstone, overlying strong, relatively unfractured gray sandstone. The basal part of the dark yellowish brown sandstone and siltstone consists of a 6-ft-thick clayey breccia from a depth of approximately 103 to 109 ft (at elevation 793 to 787 ft). The contact between the clayey breccia and the underlying hard gray sandstone is a shallowly dipping (10 degrees) planar surface. Similarly, boring LA2012-07 contains fill and weathered, fractured dark yellowish brown sandstone and siltstone material to a depth of approximately 81 ft (elevation 808 ft) This material is associated with a smooth, basal surface that dips approximately 5 degrees (in an unknown direction) and lacks remolded clay gouge. Below this plane is light bluish gray sandstone that has substantially higher RQD and relatively few fractures. In these three borings (LA2012-03, -04 and -07, Appendix A), the contact between highly weathered, fractured material and fresh to slightly weathered gray sandstone is associated with a basal intensely fractured clayey breccia and an abrupt, shallow dipping striated plane. The overall geometry of the contact based on the three borings is shown on Figure 2-3.

Figure 2-3 also shows the generalized stratigraphic relationships exposed in boring LA2012-08. This boring shows the presence of a thin artificial fill (either from recent activities or original construction in 1911-1918), overlying strong, gray Tts sandstone with few fractures. This boring did not contain a thick section of weathered, dark yellowish brown sandstone material as in the borings to the west. The presence of strong gray Tts sandstone throughout this entire boring provides data that defines the northeastern boundary of the landslide material (unit Qls?, Figure 2-3).

Figure 2-4 shows a geologic cross section along the dam axis that traverses the southeastern part of Area A. Materials exposed in boring LA2012-01 have similar stratigraphic relationships as LA2012-03, -04 and -07. As illustrated on Figure 2-4, boring LA2012-01 exposed weathered and fractured, dark yellowish brown sandstone, which directly overlies strong, relatively unfractured gray sandstone at a depth of about 95 ft (elevation 836 ft). This contact is associated with an abrupt downward decrease in RQD, which is at the base of a breccia zone of sandstone fragments between about 80.5 and 89.3 ft depth. As illustrated on Figure 2-4, these relationships are consistent with the geometry of the stratigraphic relationships shown on Figure 2-3 in the central part of Area A.

2.3.4 Area B

Area B is located on the western sidewall of the Calaveras Creek valley, and includes materials in the shallow subsurface on the eastern flank of Observation Hill, beneath the valley wall, and possibly down to the floor of the valley (Figure 2-2). The western part of this area is underlain by moderately northeast-dipping Tts strata beneath Observation Hill, by the Spillway fault zone, and by shallowly northwest-dipping Tts strata east of the Spillway fault zone. Along the design dam axis (Figure 2-4), boring LA2012-05 exposed highly fractured, weathered dark yellowish brown siltstone and sandstone material to a depth of about 89 ft (elevation 663 ft), including an intensely fractured brown clayey breccia. This material overlies strong, gray Tts sandstone, which contains few fractures to the total depth of 105 ft. The gray sandstone contains subhorizontal beds (and pectin shells) that are consistent with the shallow dip of beds exposed elsewhere in the area east of the Spillway fault zone. A large-diameter bucket auger boring at the same location (boring LA2012-5BA) confirms the presence of the clayey breccia at the contact of these two units, and shows that the breccia includes discontinuous, clay-rich shears that dip moderately to the east and are parallel with a distinct planar surface at the top of the gray sandstone (orientation approximately N5E, 20E) (Figure 2-11). The 20-degree eastward dip of this surface is in contrast with the shallow northwesterly dip of bedding within the gray Tts sandstone, and thus cuts across bedding of the sandstone. The planar surface at the top of the gray sandstone is oriented in the same direction as the easterly slope of the pre-construction Calaveras Creek valley sidewall.

As summarized on Figure 2-4, material characteristics exposed in borings CB-45/45A, CB-52, CB-29 are similar to those provided in the core from boring LA2012-05 and the exposure provided by bucket auger LA2012-05BA. A mixed/breccia zone of sandstone fragments, clay and silt was observed in CB-45 at a depth of 92.4 to 94.4 ft, overlying a 2-ft-thick zone of fractured yellowish brown sandstone (and a zone of no recovery) directly above hard gray sandstone. Similar breccia zones were not observed in borings CB-52 and CB-29 directly above the hard gray sandstone. Dark yellowish brown, weathered material is present to depths 96 ft (elevation 659 ft) in boring CB-45A, of 79 ft (elevation 874 ft) in boring CB-52, and 75 ft (elevation 587 ft) in boring CB-29 (Appendix A). In all three of these borings this fractured material overlies hard gray sandstone along a sharp, non-gradational contact. The eastward-dipping geometry of this contact among all these borings (as shown on Figure 2-4) is consistent with the shallow east-dipping contact exposed in bucket auger LA2012-5BA.

Area B extends south of the design dam axis, and contains material that is similar to the weathered material shown by borings along the dam axis (Figure 2-4), as illustrated on geologic cross section A12 (Figure 2-5). This section crosses the dam axis near boring CB-29 (Figure 2-2). Borings CB-51, CB-27, and CB-2 exposed materials at shallow depths that are similar to the weathered, fractured dark yellowish brown materials along the dam axis. The contact between these materials and underlying hard gray sandstone is about 100 ft deep and was interpreted as the base of the weathering zone by URS (2008a). Figure 2-5 shows this material as unit “WB/Qls?” to reflect the interpretation that the material could be weathered bedrock or transported material. Additional information along this geologic cross section is provided by recent borings LA2012-13 and -18, both of which exposed steeply dipping shears and faults within intervals of brown and gray Tts sandstone. In boring LA2012-13, sheared zones at depths of about 145 ft and 175 ft have steep (50 to 70 degrees) dips and are as much as 2 ft wide in true thickness. Abundant fractures sets that have comparable dips are present above and below these prominent shears, within alternating intervals of brown and gray sandstone, suggesting that the shears are western splays of the Spillway fault zone (Figure 2-5). In boring LA2012-18, material above a depth of 114 ft (elevation 934 ft) is highly fractured and sheared, has a low RQD, and contains intervals of both dark yellowish brown and light gray sandstone. This material is interpreted to be part of the Spillway fault zone.

Figure 2-6 shows a geologic cross section along alignment A8, which has a western end in Area A but extends southeastward toward the dam axis (located on Figure 2-2). As shown on this section, boring LA2012-07 suggests the presence of distal landslide deposits from the northeastern flank of Observation Hill, and boring LA2012-06 shows the presence of hard, gray Tts sandstone in the shallow subsurface on the rim of the Calaveras Creek valley. On the southeast-facing valley sidewall, borings CB-53 and CB-29 were interpreted to expose highly weathered, fractured dark yellowish brown Tts sandstone bedrock, overlying hard gray Tts sandstone. The abrupt contact between these materials is associated with a sudden downward increase in RQD, but is not associated with a remolded clay gouge layer in these borings. Recent boring LA2012-09 (Figure 2-6) confirms these overall conditions, and exposed a similar discontinuity at a depth of about 76 ft (elevation 665 ft, Appendix A). However, drilling conditions did not allow recovery of material at the upper contact of the gray sandstone, instead providing only angular sandstone fragments washed of fine-grained material. Because of uncertainty in the geologic origin of the materials above the hard, gray sandstone, Figure 2-6 shows this material as unit “WB/Qls?” to reflect either weathered bedrock or landslide material.

Figure 2-7 shows a geologic cross section along alignment A14, which extends from the top of Observation Hill, across the Spillway fault, and then down to the Calaveras Creek valley near the outlet of the 19-ft Conduit (Figure 2-2). As shown on this section, boring LA2012-22 encountered material similar to unit “WB/Qls?” in nearby borings. As in other borings on the steep sidewall of the Calaveras Creek valley, boring LA2012-22 encountered weathered, fractured brown sandstone material, directly overlying hard, gray Tts sandstone in the shallow subsurface at a depth of about 90 ft (elevation 653 ft, Appendix A). Because of uncertainty in the geologic origin of the materials above the hard, gray sandstone, Figure 2-7 shows the overlying material as unit “WB/Qls?” to reflect either weathered bedrock or landslide material.

The location and geometry of the Spillway fault zone beneath Area B is also constrained by boring LA2012-19 (Figure 2-8). This boring, which was inclined approximately 60 degrees toward N45W, encountered hard gray sandstone from the ground surface to a length of about 155 ft (elevation about 690 ft). At this location, the boring encountered a 1-ft-wide void with a strong sulfur odor. The boring was terminated at that interval. These conditions suggest that the boring encountered the eastern limit of the Spillway fault zone, where it is bordered by relatively intact, strong gray sandstone. Boring CB-1 also encountered hard gray sandstone at a shallow depth, including multiple conglomeratic beds with shallow dip angles that are consistent with the northwesterly dip within the geologic domain east of the Spillway fault zone (Figure 2-1).

2.3.5 Areas C and D

Recent field observations in the area northeast and downstream of the left abutment indicate the presence of surficial debris-flow or colluvial gulley-fill deposits. In numerous test pit exposures available during excavations for the new spillway, a distinct, slickensided contact between surficial deposits and weathered bedrock suggests that debris-flow deposits are locally preserved along the western wall of the Calaveras Creek valley. In Area C along cross-section A7 (Figure 2-9), a test-pit exposure shows that debris-flow deposits overlie bedrock at an elevation of 730 ft (Figure 2-2). Nearby Boring CB-54 (Figure 2-2) suggests an absence of this distinct contact, suggesting that the deposit is shallow and limited in extent. Boring LA20120-08 also shows the presence of in-place Tts sandstone throughout its depth (Figure 2-9), indicating that the transported surficial deposit was located only along the sidewall of the Calaveras Creek valley. Other test pit and roadcut exposures along the strike of the slickensided contact show that the contact varies in elevation, and likely represents a southeast-directed debris-flow within a topographic swale present prior to construction activities in the 1910s. The southwestern margin of the deposit may merge with or be in contact with the possible landslide deposits in Area B as defined above.

Cross section A6 (Figure 2-10) illustrates the presence of a similar contact exposed in test pits farther northeast along the spillway excavation. In Area D, near cross section A6 (see Figure 2-2), two test pits show the presence of gulley-fill colluvium or landslide debris overlying sandstone bedrock along a striated contact. Bedrock exposures in southeast-facing roadcuts to the northwest of these test-pits lack evidence of the surficial deposits, and thus constrain them to be limited in extent. This material is also likely to be a southeast-directed debris-flow deposit within a pre-construction topographic swale.

2.4 INTERPRETATION: GEOLOGIC MODEL

The geologic cross sections presented above represent a summary of geologic data and first-order interpretations available from previous and recent field geologic, geotechnical, and geophysical investigations in the left abutment area. These data indicate the presence of materials that vary according to geologic domain, and which are grouped into four areas (Areas A through D, as described above). Figure 2-12 provides contours of the basal elevations of the weathered, fractured materials in these four areas. The following paragraphs provide an overview of the geologic model supported by the geologic data available at this time.

In the geologic domain west of the Spillway fault zone, steeply to moderately northeast-dipping beds of Tts sandstone are overlain by thin colluvium on steep slopes that parallel bedding planes. Along the ridge crest of Observation Hill, surficial material is thin, weathering extends into bedded sandstone, and there are abundant bedding-plane parallel shears and fracture in-fill deposits. The bedding-plane shears have striations that indicate components of down-dip and lateral movement. In places, the shears cut obliquely across bedding but merge with other nearby bedding-parallel shears.

Considering the proximity of the ridge crest to the active Calaveras fault, and a recurrence interval of approximately 550 years for large-magnitude earthquakes on this fault (Kelson et al., 1996), it is reasonable to assume that many or all of these striations were formed as a result of strong ground motions, perhaps accentuated by ridge top amplification. The northeastern flank of Observation Hill has a steep gradient that is comparable with the resistant sandstone bedding planes along the ridge crest, and the upper part of the ridge is a “dip-slope”.

In the mid-slope areas of the northeastern flank, material overlying strong bedrock is weathered and consists of blocks of fractured Tts sandstone, and is shown by the contours in Area A on Figure 2-12. These materials thicken in a northeasterly direction, toward the Spillway fault zone, which forms a 200- to 300-ft-wide zone of highly deformed sandstone that transects the eastern flank of Observation Hill. The fault zone probably dips steeply to the east, and consists of pulverized and steeply fractured materials. In cross sections drawn across the fault zone, weathered materials overlying strong bedrock appear to be thickest in the area of the Spillway fault zone and, based on core samples from boring LA2012-03, have a subhorizontal fabric and a basal contact that contrasts with the near-vertical fabric within the Spillway fault zone. This contact is associated with a breccia zone and an abrupt, striated planar contact with underlying hard, gray Tts sandstone. To the northeast, this material extends in a direction perpendicular to the flank of Observation Hill, and underlies an irregular topographic bench with an original, pre-1911 elevation of about 900 ft. The bench forms a plateau between the unnamed north-trending, landslide-filled valley containing the sites of fault trenches FT-4 and FT-5 (Figure 2-1), and the deeply incised Calaveras Creek valley to the east. The material underlying this bench thins northeastward, where it overlies upper beds of the Tts sandstone that dip shallowly to the northwest.

2.4.1 Area A

The southeastern boundary of the weathered material in Area A coincides with the rim of the steep-sided Calaveras Creek valley (Figure 2-12). The northwestern boundary of the material is poorly defined at this time, but is estimated to extend along nearly the entire northeastern flank of Observation Hill. The presence of thick landslide material in fault trenches FT-4 and FT-5

(URS/WLA, 2005), located at the base of Observation Hill, suggests that large slide blocks have been transported northward from the high topographic relief of Observation Hill (Figure 2-1).

Considering the entire set of surface and subsurface geologic evidence in Area A, including the overall geometry of the material, the most reasonable interpretation is that the weathered material in Area A along the northeastern flank of Observation Hill is a deep-seated landslide complex. The overall cross-sectional geometry might suggest a rotational slide mechanism, although the along-strike extent suggests instead that the landslide material was derived locally from near-surface bedding planes flanking the ridge crest. Perhaps as a result of strong ground motions during a large earthquake, weathered and fractured sandstone bedrock was shed from the steep dip-slope on the northeastern flank of the ridge, and was transported as a complex package of bedrock blocks and slabs to lower elevations. Highly fractured rocks within the Spillway fault zone probably were involved in the slide material, although it is not certain that the fault zone is a controlling factor in the development of the slide.

The timing of the mass movement in Area A is constrained by limited radiometric dating and qualitative geomorphic relationships. Radiocarbon dating of colluvial deposits exposed in fault trench FT-5 (Figure 2-1; URS/WLA, 2005) yielded an age-date of about 18,000 years from colluvial deposits overlying thick landslide debris. This debris probably was derived from the northeastern flank of Observation Hill. If these deposits are part of the Area A materials, then the complex is at least late Pleistocene in age, and perhaps older. This is supported by the relatively smooth slope, and the lack of prominent landslide-related geomorphic features along the northeastern flank of Observation Hill.

2.4.2 Area B

The geologic information in Area B (Figures 2-4 through 2-8) provides a means to delineate basal contours for the weathered material, as shown on Figure 2-18. The contours represent the base of the weathered, fractured material, where it overlies strong, gray Tts sandstone, and commonly are not different from the interpretation of the base of the weathered material developed in the GDR (URS, 2008a). As described in the Geotechnical Interpretive Report (URS, 2008b), several characteristics of this material support the interpretation that the near-surface materials in Area B are a result of deep, long-term weathering of the fractured Tts sandstone beds. The moderate to steep dip of the beds on the ridge crest of Observation Hill, and the abundant bedding-parallel fractures and shears, likely promote deep weathering of the material. Weathering also probably occurs to substantial depths within the Spillway fault zone, as a result of downward percolating waters. However, recent field observations may support an interpretation that this weathered material, at least locally, has been transported downslope from the eastern end of Observation Hill to the Calaveras Creek valley floor. Observations in bucket auger boring LA2012-05BA of breccia and with east-dipping clayey shears, directly overlying a moderately east-dipping abrupt contact with unfractured gray Tts sandstone, are consistent with similar geologic relationships at similar elevations in the nearby borings CB-2, CB-45, CB-28, CB-29, and LA2012-09 (as described above). The characteristics of the basal material and the overall geometry and location of the entire mass suggest that this is a large complex of transported material. The sources of the material are the highly fractured bedrock material at the top of Observation Hill and deformed rocks within the Spillway fault zone. Also, because the Area B material appears to have been derived from the weathered, deformed, and previously transported landslide material in Area A (Figure 2-4), at least some of the surficial deposits in Area B are likely to be landslide material.

If the upper surficial deposits in Area B have been transported downslope, their characteristics (i.e., a collection of weathered sandstone blocks and intensely fractured material), and the steep sidewall of the Calaveras Creek valley, support a complex mechanism of slumping, raveling, sliding, and near-surface downslope creep. This material can be characterized as a deformed zone of variable weathered and fractured sandstone blocks under the influence of mass wasting. The absence of a continuous, ubiquitous low-strength remolded clay seam at the base of the material indicates that the mechanism of transport is not a classic translational or rotational landslide, or that the limited observations are along basal surfaces that have moved by mechanisms other than large-scale sliding (as required to develop a remolded basal clay seam). The steepness of terrain and the highly fractured source material suggest that a basal clay seam is not required for the jumbled transport of material down the east-facing sidewall of the incised Calaveras Creek valley. If this is landslide material, a likely mechanism is initial movement along bedding planes or sets of oblique fractures or joints in the weathered Tts sandstone beds near the top of Observation Hill, or from deformed rocks within the Spillway fault zone. The substantial relief between these areas and the Calaveras Creek valley floor would allow a large, semi-articulated bedrock mass to bulldoze downhill, incorporating blocks of the northwest-dipping sandstone beds east of the Spillway fault zone. The rates of transport of such a mass are not known, although catastrophic deposition is not required to explain the partially articulated weathered bedrock within the mass.

If the Area B materials comprise a landslide, the age of the movement is poorly known. The Area B materials appear to be, in part, derived from the Area A landslide complex, and thus are younger. This is consistent with the presence of the Area B materials extending down to the Calaveras Creek valley floor, which is probably a Holocene landform. Also, a Holocene age estimate is consistent with geomorphic relationships, such as irregular topography in the mid-slope part of the northeastern flank of Observation Hill and a steeper slope near the top of the ridge crest.

2.4.3 Areas C and D

Areas C and D are characterized by local, southeast-directed debris-flow masses that occupy pre-existing topographic swales. The geometry and distribution of these deposits indicate that they are limited in extent. The mode of transport from was probably as jumbled debris masses, locally sliding along fracture planes oblique to the northwest-dipping beds of Tts sandstone. The ages of these deposits are not known, but are estimated to be late Holocene in age because they appear to be related to recent gullies developed on the Calaveras Creek valley sidewall. These debris flows may be quite young, perhaps even post-dating the construction cuts into the valley sidewall made between 1911 and 1918.

2.5 SUMMARY OF GEOLOGIC FINDINGS

The available geologic data suggest the presence of a large landslide complex on the northeastern flank of Observation Hill. The distribution of the landslide complex indicates that some of the transported material may remain in the alternative left abutment permanent cut slope in Area A (see Section 3.0). The geologic information also shows the presence of a highly weathered, fractured mass of semi-articulated bedrock and surficial deposits on the east-facing margin of the

Calaveras Creek valley, near the left abutment (Area B). This material may represent a zone of deep weathering, perhaps related to the highly deformed rocks within the Spillway fault zone, or it may have been transported downslope along the Calaveras Creek valley margin. It appears possible that transport may have taken place as a mass of large, coherent to partially articulated blocks of weathered material, moving as a result of the steep valley sidewall and varied mass wasting processes. There are also two small remnants of debris-flow material perched on the western sidewall of the Calaveras Creek valley, near the design elevations for the new spillway (Areas C and D). Figure 2-12 provides a summary of the basal elevations of the weathered or transported material in the left abutment area.

3.1 FACTORS AFFECTING SLOPE STABILITY

The Contract Drawings show that the Observation Hill slope will be excavated with a N5E strike and an average inclination of 1.3H:1V. This slope is bound to the north by a natural slope striking about N60W and dipping about 55NE. The south side of Observation Hill is formed in part by the existing Calaveras Dam spillway slope, which strikes about N60E and dips about 45SE. The stability of Observation Hill is affected by the presence of these existing slopes, and controlled by the presence of large-scale geologic structures, groundwater conditions, and rock mass strength, which are discussed below.

3.1.1 Large Scale Structure

The presence of geologic structures or features oriented unfavorably with respect to a cut slope may influence its stability, forming potentially unstable blocks or wedges. If these geologic features are also persistent, the blocks may become sufficiently large and thereby affect the global stability of the slope. The geologic structures considered during this evaluation of stability are listed in Table 3-1 and include joints, bedding and the Spillway fault zone. Available information indicates that most joints in the Temblor Sandstone have low persistence, except for those joints associated with bedding, which extend for tens of feet. Additionally, the Spillway fault zone extends for thousands of feet. All features had been identified and presented in the GDR (see Figure 2-1 in URS, 2008a), but the persistency of joints following bedding B2 (Table 3-1) appears to be more extensive as observed in the excavation to date. The joint orientation data shown in Table 3-1 is considered representative of the range of variation in strike and dip of the geologic structures listed.

Table 3-1. Temblor Sandstone Joint Orientation Data

Discontinuity type	Strike/Dip
Televiewer Survey - J1	N25E/55SE
Bedding – B1 East of Spillway Fault	N30E/30NW
Bedding – B2 West of Spillway Fault	N45W/60NE
Spillway Fault Zone	N/70E

3.1.2 Groundwater Conditions

The effect of groundwater is apparent as an additional driving force, but it also affects the resisting forces. Natural groundwater is depressed in the left abutment, and it should not impact the stability of the spillway cut slopes. However, seasonal perched groundwater surfaces can develop and create local unfavorable conditions. The effect of the seasonal perched groundwater is usually local and impacts only minor blocks, or surficial slides (URS, 2006). Information gathered during initial excavation of Observation Hill does not change these initial assumptions.

3.1.3 Rock Mass Strength

Rock mass strength failures are usually related to high slopes, highly fractured rock masses, or relatively weak rock masses. Rock mass strength failures usually follow curved failure surfaces controlled by the shear strength of the rock mass, and follow a failure surface partly through pre-existing discontinuities, and partly through intact rock. Temblor Sandstone has been differentiated into two types, brown and gray, based on its weathering. Each one of these types has a different rock mass strength. The shear zone associated with the Spillway fault zone has an impact on the rock mass strength, and is included as a separate material in the analyses.

3.2 FAILURE MODES

3.2.1 Structurally Controlled Failures

Most structural features in the geologic formations at the dam site, with the exception of bedding in the Temblor Sandstone, the Spillway fault zone, and the slide planes or sliding zones, are non-persistent, extending continuously 10 feet or less. Under these conditions, most structurally controlled failures will be constrained to smaller blocks and wedges. Structurally controlled block or wedge failures were studied using kinematic analysis methods and limit equilibrium evaluations. The kinematic analysis identified blocks that could be displaced out of the slope due to their geometry, and the limit equilibrium analysis was used to estimate the factor of safety for those “removable” or geometrically feasible blocks/wedges (URS, 2006).

3.2.2 Rock Mass Strength Failure

The Observation Hill slope excavation is a high slope reaching up to 400 feet from the spillway crest to the peak of the hill. The Temblor Sandstone which forms the slope is jointed with a full range of joint orientations, with the most prominent sets being parallel to bedding. The Spillway fault is a zone of shearing as much as 300 feet wide in places. The combination of a high slope and a fractured rock mass is conducive to rock mass strength failures. Rock mass strength failures were evaluated using limit equilibrium methods.

3.3 SHEAR STRENGTH PARAMETERS

Evaluation of the stability of Observation Hill requires definition of shear strength parameters for the materials and geologic features involved in the failure modes discussed above, structurally controlled failure and rock mass strength failure. The shear strength parameters of joints and shears within the rock mass, and of the rock mass itself were developed based on examination of rock core, results of laboratory testing (URS, 2008a and 2008b) and empirical methods (Barton 1980; Hoek and Brown, 1980; Marinos and Hoek, 2000).

The start of the permanent excavation for the spillway and the excavation of the “false cut” performed by the contractor to open the dam foundation, allowed additional observations of geologic features and rock mass. These observations confirm the characteristics of the rock mass, which ranges from highly weathered and fractured to slightly weathered and blocky (Figure 3-1), as was inferred from the pre-construction exploratory boreholes and used for the original stability analysis (URS, 2006). The excavation advance as of early September 2012 and subsurface exploration performed in July, August, and September 2012, also showed additional geologic features not identified previously as being present in Observation Hill cut. These features include the Spillway fault zone, steeply dipping bedding, and other planes of weakness or slide planes.

3.3.1 Rock Mass

3.3.1.1 Temblor Sandstone

The strength of the Temblor Sandstone rock mass was evaluated separately for the two distinct rock weathering conditions identified during the pre-construction subsurface exploration: a highly weathered and fractured rock mass, usually brown in color, and a slightly weathered and blocky/massive rock mass, usually gray. These rock masses were characterized using the GSI method (Marinos and Hoek, 2000) as shown in Figures 3-1 and 3-2, and their shear strength parameters estimated using Hoek-Brown criterion (Hoek and Brown, 1980), as shown in Table 3-2 (from URS, 2006).

Table 3-2. Temblor Sandstone Shear Strength Values

Description of Material	Friction Angle (degrees)	Cohesion (ksf)
Highly weathered – Brown Intensely to highly fractured - Highly weathered Moderately fractured – Moderately weathered	29	3.9
Slightly weathered – Gray Moderately fractured - Slightly weathered Massive – Fresh	50	7.2

3.3.1.2 Spillway Fault Zone

As mentioned above, it can be inferred from construction activities and additional subsurface exploration performed in the last two months that the Spillway fault zone affects an up to 300-foot wide zone of Observation Hill excavation. The Spillway fault zone impact on the stability of Observation Hill was assumed to be minimal in URS (2006), as surface mapping evidence indicated its trace was a fault plane behaving as a discontinuity (URS, 2008b). Current assessment indicates that the Spillway Fault has an associated shear zone up to 300 feet wide. The size of the shear zone makes it a significant part of the rock mass of Observation Hill and will thus have a significant impact on stability.

The strength of the material forming the Spillway fault zone was conservatively estimated using multiple approaches discussed below:

- Back Calculation of Existing Slope: The existing south slope of Observation Hill is steep, having an average slope of about 1H:1V. The slope has remained stable for the past 100 years since construction of the original hydraulic fill dam. A significant portion of the 1H:1V slope is formed by the shear zone. It was assumed that this existing slope is at a state of equilibrium and has a factor of safety of 1.1. No groundwater was assumed, based on the observations made during the subsurface exploration (URS, 2008a and 2008b). The results of stability back-calculations of the existing slope indicated a friction angle of 25° and no cohesion. This result is lower than would be expected for the materials in the fault zone demonstrating that the slope is more stable than assumed in the back-calculation. The

Spillway fault zone (Forbes, 1916) exposed in a trench excavated during construction of the existing dam is described as an intensely fractured sandstone material and, where it is visible in the south slope of Observation Hill, the fault zone appears to be a zone of highly fractured sandstone. These descriptions and observations indicate a material that would act more like a coarse soil with a frictional component that is greater than 25°.

- GSI methodology was applied to the portion of the false cut that may have been within the Spillway fault zone followed by application of the Hoek-Brown criterion to define shear strength parameters. The values of friction angle and cohesion estimated using this process ranged from 33° and 1.7 ksf to 36° and 2 ksf. See Figures 3-1 and 3-2.
- Back Calculation of Failed Rock Mass: A large rock mass failed during excavation of the "false cut." The geometry of this mass, and of the sliding plane were well known, and allowed performance of a well-constrained back calculation. The rock mass slid along a persistent wavy and smooth joint. The back-calculation provided a series of shear strengths represented by pairs of friction angle and cohesion values ranging from 30° and 0.6 ksf, to 48° and no cohesion, and including 35° and 0.475 ksf.

These results of these parallel approaches were used to bracket the strength of the Spillway fault zone. Based on the results of the approaches described above, the estimated shear strength parameters for the Spillway fault zone are 35° and 1.0 ksf.

3.3.2 Discontinuities

3.3.2.1 Joints

The shear strength of joints used in kinematic analyses is presented in Table 3-3 (URS, 2006). The shear strengths were developed using Barton's procedure (Barton and Bandis, 1980). The joints were observed in outcrop and in core recovered during the subsurface exploration, and these observations were used to assign Joint Roughness Coefficients (JRC) and calculate shear strengths. This procedure is more appropriate for non-persistent discontinuities that could form wedges and blocks of smaller dimensions, not for bedding planes or other discontinuities that extend scores of feet where scale effects become important (Barton and Bandis, 1980).

Table 3-3. Shear Strength of Joints for Temblor Sandstone

Description of Material	Friction Angle (degrees)	Cohesion (ksf)
Highly weathered – Brown (Joints)	30	0
Slightly weathered – Gray (Joints)	35	0

3.3.2.2 Bedding

The shear strength of bedding and other highly persistent discontinuities was bracketed based on the back analysis of a failed rock mass documented during excavation of the "false cut" described above in Section 3.3.1. As observed, this failed mass slid along a persistent, well-defined joint, not a bedding plane. However, the shear strength from the back analysis of the failed rock mass represented by pairs of friction angle and cohesion values ranging from 30° and

0.6 ksf, to 48° and no cohesion, and including 35° and 0.475 ksf, provides support for the selection of a friction angle of 35° and 0.65 ksf (Table 3-5) a conservative value for shear strength of bedding and other persistent discontinuities.

3.3.2.3 Slide Planes

A particularly important set of discontinuities are the postulated slide plane or sliding zone bounding Area A. The toe of this slide is considered "ancient" based on dating of colluvium deposits that cover its toe (more than 18,000 years). The shear strength characteristics of this slide zone were bracketed using a multi-faceted approach, as follows:

- Observation of core samples: The presumed slide zone observed in the core samples appears to be a wavy and slickensided surface. However, the stability analyses performed for this technical memorandum are at an angle of 45° to 90° from the postulated slide movement direction. The shear strength of this surface was evaluated to be 35° to 45° and no cohesion using Barton's method (Barton and Bandis, 1980).
- Static Back-Analysis: The back analysis of the static stability of Area A was calculated assuming FS=1.0. Locations of the cross-sections considered in the back analysis are shown on Figure 3-3. Section geometry and static back-analysis results are shown on Figures 3-4 to 3-6 and are summarized in Table 3-4. The stability back-analysis indicates friction angles ranging from 11.5^{o} to 17.5° assuming no cohesion. This low friction angle is not considered representative for a slide in sandstone that apparently has not moved in a long time. Thus, the factors of safety of the analyzed sections are greater than assumed for the back analyses.
- Rock Mass Characterization: The "surface" bounding Area A was observed during the excavation of the "false cut" and apparently corresponds to an up to 5-foot-thick zone of highly fractured rock. This zone was characterized using GSI, and defining the shear strength using Hoek-Brown criterion. The shear strength defined using this process range from a friction angle of 35° and 1 ksf, to 37° and 0.3 ksf.
- Seismic Back-Analysis: As mentioned above, the toe of the slide is overlain by colluvium deposits dated to about 18,000 years ago that suggest that the slide may not have moved since that time. A likely scenario for the original movement is a failure triggered by large seismic event along the Calaveras Fault. In order to further refine the estimate of strength, a pseudo-static back-analysis was also conducted. Results of pseudo-static analyses using a friction angle of 35^{o} for each section are shown in Table 3-4. These results can be tied indirectly to the seismic hazard of the site and the age of the landslide as discussed below.

  The peak ground acceleration generated by the design earthquake along Calaveras fault, which is estimated to have a recurrence interval of about 500 years, is about 1.1g, and approximately corresponds to pseudo-static coefficients on the order of 0.4 to 0.8 for a deep-seated slip surface. The results of the back-analysis for each section are summarized in Table 3-4. Yield acceleration coefficients of 0.4 to 0.6 are calculated using a friction angle of 35^{o}. These yield acceleration coefficients approximately correspond to the level of shaking expected for the design earthquake event (MCE). The results are shown in Table 3-4 and indicate that the slide would begin to show movement under shaking at the 500-year level. Because the age of the slide appears to be significantly older than 500 years, the selected friction angle of 35° is probably conservative.

Table 3-4. Back-Analysis Results

Section	Back-calculated ϕ' for static stability (degrees)	Yield acceleration coefficient, k_y for ϕ' = 35 deg
1	11.5	0.60
2	14.0	0.50
3	17.5	0.40

Bedding and slide plane shear strength values selected considering the approaches described above are summarized in Table 3-5.

Table 3-5. Shear Strength of Bedding and Slide Planes for Temblor Sandstone

Description of Material	Friction Angle (degrees)	Cohesion (ksf)
Bedding planes	35	0.65
Slide planes	35	0

3.4 STATIC AND SEISMIC STABILITY OF NORTH PORTION OF SPILLWAY EXCAVATION SLOPE

3.4.1 Analysis of Proposed 2H:1V Slope

In order to meet static stability criteria, reduce seismic deformations, and remove much of the Area A landslide mass from the northern half of the Observation Hill excavation, a design with an overall slope of 2H:1V (including benches) is proposed as shown on Drawings FD-1 and FD-1A. Analysis of a section using the 2H:1V slope is shown on Figure 3-7. Slides with depths of 30, 60, and 100 feet below the design surface, representing the Area A landslide mass at 75, 125, and 200 feet north of the dam axis, were analyzed. Only pre-defined slip surfaces were considered. This analysis shows that the flattened slope meets static stability criteria with a minimum factor of safety of 1.52. The yield acceleration coefficients (F.S. = 1.0) for these slip surfaces are also shown on Figure 3-7 and are summarized in Table 3-6.

Table 3-6. Slope Stability Analyses Results

Section Distance from Dam Axis (ft)	Slide Depth (ft)	Static FS	Yield Acceleration Coefficient, k_y
75	30	1.52	0.19
125	60	1.58	0.21
200	100	1.69	0.25

3.4.2 Seismic Deformation Analysis

The original 1.3H:1V slope was modeled using QUAD4 (Hudson, et al., 1994) as part of the original design (URS, 2007). This previous analysis was modified to reflect the flattened slope and include the three slip surfaces described above. All properties are identical to the previous analysis, except that the upper brown (weathered) Temblor sandstone is no longer present as it lies above the new 2H:1V excavation slope. The new model consists entirely of gray (unweathered) Temblor sandstone with Vs = 3000 ft/s. The mesh geometry and slip surfaces used for input are shown in Figure 3-8.

Calculated PGAs for the new model are shown on Figures 3-9 to 3-11 for the three input motions used in the previous design analysis. The ground surface PGAs compare well to the PGAs calculated at the top of the gray Temblor sandstone in the previous design analyses (URS, 2007).

Seismic deformations were calculated for all three slip surfaces using the Newmark procedure. Results for the slip surface with a depth of 30 feet using the modified Landers motion are shown on Figure 3-12. Figure 3-12 shows a calculated seismic coefficient time history (also referred to as an average acceleration time history) with a peak of about 2.0 g and calculated deformations on the order of 40 feet. This seismic coefficient time history is calculated by summing horizontal shear stresses along the slip surface during shaking and dividing by the mass of the sliding block. In this case, the peak of the seismic coefficient time history is significantly greater than the nodal PGAs shown on Figure 3-9 which are on the order of 1.0-1.1 g. Because of this discrepancy, we believe that the “average” acceleration time history as calculated by QUAD4 is not reasonable for use in this Newmark deformation analysis.

As an alternative, the seismic coefficient time histories for use in the Newmark deformation analyses were calculated by averaging five to ten nodal acceleration time histories within each slip surface. Results for each slip surface and input motion are shown on Figures 3-13 to 3-21. Figures 3-13 to 3-21 show that the peak average accelerations for the slide masses are on the order of 1.0 g, which is in good agreement with the nodal PGAs. The ranges of deformations from the three motions are summarized in Table 3-7. Based on these results, the Slide A remnant will meet the seismic deformation criteria of less than five feet without slope reinforcement measures.

Table 3-7. Seismic Deformation Analysis Results

Section Distance from Dam Axis (ft)	Slide Depth (ft)	Yield Acceleration Coefficient, k_y	Seismic Deformation (ft)
75	30	0.19	3.8 – 2.9
125	60	0.21	3.2 – 2.2
200	100	0.25	2.6 – 1.4

3.5 STATIC AND SEISMIC STABILITY OF SOUTH PORTION OF SPILLWAY EXCAVATION SLOPE

A seismic stability analysis of the 1.3H:1V slope south of the dam axis was conducted to check the stability of that slope considering the presence of the Spillway fault zone and the bedding upslope and downslope from the fault zone. The analysis section and properties used for the analysis are shown on Figure 3-22. Outside of the Spillway fault zone, the Temblor sandstone is modeled with bedding properties when slip surfaces are within 5 degrees of the bedding apparent dip. Rock mass properties are used for the Temblor sandstone when slip surfaces are greater than 5 degrees of the bedding apparent dip. Static stability analysis results shown on Figure 3-22 indicate that the design criteria for static stability are met.

The QUAD4 model shown on Figure 3-23 was used to calculate seismic deformations for the 1.3H:1V slope. Properties are as selected in the previous design analyses (URS, 2007), with the exception of the Spillway fault zone, which is assumed to have a shear wave velocity of 1200 ft/s, slightly lower (softer) than for the weathered brown sandstone (Vs=1500 ft/s). The analysis was run using the sliding blocks defined by the slip surfaces shown on Figure 3-23.

The calculated PGAs for all three input motions are shown on Figures 3-24 to 3-26. These figures show that the accelerations agree favorably with those calculated in previous analyses and that the presence of the Spillway fault zone does not significantly affect the dynamic response of the slope. Newmark deformation analyses indicate deformations of 1.5 feet for the deepest sliding block ("SS1") and up to about four feet for the shallowest ("SS3").

The strength characterization of the Spillway fault zone discussed in Section 3.3.1.2 involves uncertainties. As such, a sensitivity analysis was performed using a friction angle of 35^o and a cohesion of 500 psf for the Spillway fault zone. The results of these analyses yielded a minimum static factor of safety of 1.3 for "SS3" (which does not meet the F.S. =1.5 criterion) and seismic deformations of up to 11 feet, which exceeds the 5-foot limitation.

4.1 AREA A

4.1.1 Slope Inclination

A key concern for the left abutment slope is the width of the Spillway fault zone, which having not yet been determined, is estimated to be up to 300 feet wide. The Spillway fault zone is characterized as intensely fractured highly weathered sandstone.

As discussed in Section 3.0, the results of stability analyses show that the north half of the Observation Hill excavation needs to be laid back from the 1.3H:1V slope shown in the Contract Documents to a 2H:1V slope due to the slide remnant that will need to be left in place in this portion of the slope. With a slope layback of 2H:1V, the slide remnant beneath the northern most side of the excavation is estimated to be up to about 170 feet thick (see Figure 4-1).

There does not appear to be a slide located below the south half of the Observation Hill excavation. The south half of the Observation Hill excavation is shown to be a 1.3H:1V slope in the Contract Drawings. Based in part on seismic stability considerations given uncertainties associated with the strength of the Spillway fault zone, the stability analyses show that it would be prudent to flatten this slope to a 2H:1V to maintain seismic stability. The rationale for laying back this slope is discussed in Section 5.0.

A 25-foot-wide maintenance bench will be located at elevation 820. This bench will be used to catch rock debris that rolls down the excavated slope before it falls into the spillway chute.

The additional excavation volume (above the Contract slope) for the north half layback slope is estimated at about 720,000 cy and for the full layback slope the estimated excavation volume is about 1,300,000 cy. See Drawings FD-1 for the full slope layback and FD-1A for the north half slope layback. The section through the excavation along the dam axis is shown on Drawing FD-9.

4.1.2 Slope Protection

Slope netting will be required to mitigate rockfall hazards. The area of slope protection netting is shown on Drawings FD-9.2 (full slope layback) and FD-9.2A (north half slope layback). The required area of netting for a 1.3H:1V is much greater than for a 2H:1V slope; the 2H:1V slope only has netting at the perimeter of the excavation. The basis for the area of netting shown on Drawings FD-9.2 and FD-9.2A for both slope configurations follows:

- Borehole data were reviewed for RQD and rock descriptions at the boring depth that corresponds with the final grade of the cut slope.
- Areas were identified where the borehole data at final grade indicated RQD values less 60 and the rock was described as generally highly weathered and highly and/or intensely fractured. Such areas were considered likely to need netting.
- Due to the intense fracturing of the rock mass in the Spillway fault zone, the entire fault zone on the 1.3H:1V and transition cut slopes was considered likely to need netting.
- The topmost cut slope (down to the first bench) and a 30-foot wide section (to cover the expected "weathering rind") along the entire northern side of the cut was considered likely to need netting.

- Other than the areas noted above, the 2H:1V slope was considered unlikely to require netting.

The estimated preliminary total areas that are likely to require rock slope netting follows:

- Full Slope Layback (at perimeter of slope): 134,000 square feet
- North Half Slope Layback: 287,000 square feet

Slope netting installation details are shown on Drawing FD-9.3.

Rock bolting and shotcrete will be applied as required by the Construction Manager and Designer geologists based on actual conditions observed during construction.

4.2 AREA B

The base of Area B is at a higher elevation than the finished grade of the spillway excavation in Observation Hill and will thus be removed. Also as discussed in Section 2.0, this area appears to underlie the dam foundation and possibly a portion of the upper chute of the spillway. At this time, there are no excavation or stabilization measures planned for Area B. The plan will be to observe the materials during the excavation process and devise the plan of action at that time, if necessary.

4.3 AREAS C AND D

Section 2.0 describes these two areas as surficial debris-flow or colluvial gulley fill deposits. As shown on Drawing FD-1, these two areas are in the vicinity of the spillway and will be removed.

This technical memorandum discusses the geologic model, stability analyses, and slope protection measures and also includes revised construction drawings for the left abutment excavation, slope protection.

Four areas have been identified that contain materials interpreted as in-place weathered bedrock or transported slide debris, and are listed below:

- Area A includes most of the northeastern flank of Observation Hill.
- Area B is located on the western sidewall of the Calaveras Creek valley.
- Areas C and D are northeast and downstream of the left abutment and are surficial debris-flow or colluvial gulley-fill deposits.

5.1 AREA A

The selection of the alternative for Area A will depend on an assessment of schedule, cost and risk for the full slope layback (2H:1V overall cut slope for the entire left abutment) and the north half slope layback (2H:1V overall cut slope for the north part of the left abutment and 1.3H:1V overall cut slope for the south part). This assessment is discussed in this section.

The original Contract Drawings show a 1.3H:1V overall left abutment excavation slope above the spillway in Observation Hill. To mitigate potential instability of the excavated slope, two options were considered for the cut slope layback configurations:

- Option A: Partial layback of the slope to 2H:1V for the northern half of the Observation Hill slope, with the southern half of the slope remaining at 1.3H:1V, with transition between the two slopes.
- Option B: Full layback of the Observation Hill slope to 2H:1V for the entire left abutment.

The additional excavation volume (above the original contract scope of work) for Option A - partial slope layback is estimated at about 720,000 cubic yards (cy) and for Option B - full slope layback the estimated excavation volume is about 1,300,000 cy.

The selection of the cut slope configuration option was based on an assessment of risk, schedule, and cost for both slope configurations. In making the decision between the partial slope layback versus full slope layback, the following key risk elements were considered:

- The Spillway Fault Zone has not yet been fully observed in the left abutment excavation. Based on the results of 25 supplemental geotechnical core borings drilled between June and September 2012, the Spillway Fault Zone is located further to the east and is wider than was previously known prior to construction. This fault zone is now understood to intersect the spillway cut slope and would be exposed at the surface in a significant portion of the new cut slope surface. The Spillway Fault Zone consists of highly fractured weathered sandstone, leading to uncertainties about the rock mass strength characteristics of this zone. Such uncertainties influence the evaluation of seismic stability of the original 1.3H:1V overall cut slope design, with considerable uncertainty as to whether or not the slope as originally designed is able to meet the minimum design criteria.
- Rock conditions will be observed in the left abutment excavation by the Project engineering geologists and geotechnical engineers as it progresses to ascertain the conditions of the newly exposed areas. With the 2H:1V slope, if conditions are better than assessed from the

geotechnical investigation, the south half may be steepened by leaving a wide bench between the 2H:1V slope and the steepened slope. However, starting with the 1.3H:1V slope with the uncertainty about rock conditions in the left abutment would pose a risk. If conditions are observed to be worse than assessed and require a flatter slope, the excavation would have to be started over from the top of the excavation and all slope protection measures that were previously installed would have to be removed. Both cost and schedule would increase due to space limitations and reduced excavation production between the 1.3H:1V slope and 2H:1V slope.

- The delineation of the ancient landslide has uncertainties. If this area extends further than estimated, the stability of the 1.3H:1V slope and the transition slope between the 1.3H:1V and 2H:1V slopes would have to be reevaluated and modifications made to the excavation slope.
- The 2H:1V slope would have less potential for local failures than for the 1.3H:1V slope. As such, laying back the entire slope would require less slope protection netting and slope stabilization measures (shotcrete and rock bolts).

The decision on the slope layback option was based on a combination of front-end costs and the additional anticipated costs that could occur due to uncertainties and risks in the work. The decision on which option should be selected to proceed depends on a tradeoff between the more costly full slope layback and the risk that the original design of 1.3H:1V slope in the southern half of the spillway cut would be found to be unacceptable as the excavation progresses, requiring a return to the top of the excavation to re-start at a flatter slope.

Given the risk elements discussed above and their associated cost and schedule impacts, URS recommends that the full left abutment excavation in Observation Hill be laid back to a 2H:1V overall slope (Option B).

5.2 AREA B

The base of Area B is at a higher elevation than the finished grade of the spillway excavation in Observation Hill and will thus be removed. Also as discussed in Section 2.0, this area appears to underlie the dam foundation and possibly a portion of the upper chute of the spillway. At this time, there are no excavation or stabilization measures planned for Area B. The plan will be to observe the materials during the excavation process and devise the plan of action at that time, if necessary.

5.3 AREAS C AND D

These two areas are surficial debris-flow or colluvial gulley fill deposits. As shown on Drawings FD-1, these two areas are in the vicinity of the spillway and will be removed.

5.4 OBSERVATIONAL APPROACH FOR DESIGN CONFIRMATION

An observational approach will be utilized as the abutment rock conditions are exposed during excavation and as geologic mapping is performed. The results of such observations and mapping will be used to confirm the overall design of the slope and stabilization measures.

The professional judgments presented in this technical memorandum regarding the geology and anticipated subsurface conditions are based on information obtained from the geologic and geotechnical investigations conducted between June and September 2012, the Geotechnical Data Report, Geotechnical Interpretive Report, and observation of the surface conditions of the partially excavated slope as of September 2012.

URS represents that the services and the geotechnical design recommendations were conducted in a manner consistent with the standard of care ordinarily applied as the state of practice in the profession within the limits prescribed by our client. No other warranties, either expressed or implied, are included or intended in this technical memorandum.

Barton, N. and Bandis, S. (1980). “Some effects of scale on the shear strength of joints,” Int. J. Rock Mech. Min. Sci. Geomech. Abst., Vol. 17, Pergamon.

Cotton, W. R. (1999). Faults Aren't Always What They're Cracked Up to Be: Appendix B, Techniques for Identifying Faults and Determining Their Origins: NUREG/CR-5503, Prepared for Division of Engineering Technology, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC, 467 p.

Forbes, Hyde (1916). Calaveras Dam – Geology, letter report to Spring Valley Water Company, July 28.

Hanson, K. L., K I. Kelson, M. A. Angell, and W. R. Lettis (1999). Techniques for Identifying Faults and Determining Their Origins: NUREG/CR-5503, Prepared for Division of Engineering Technology, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC, 467 p.

Hoek, E. and Brown, E. T. (1980). Empirical Strength Criterion for Rock Masses, J. Geotechnical Engineering, V106 N9, ASCE.

Hudson, M., Idriss, I.M., and Beikae, M. (1994). QUAD4M, A computer program to evaluate the seismic response of soil structures using finite element procedures and incorporating a compliant base. Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, University of California, Davis, California. May.

Kelson, K.I., Simpson, G.D., Lettis, W.R., and Haraden, C.C. (1996). Holocene slip rate and recurrence of the northern Calaveras fault at Leyden Creek, northern California: Journal of Geophysical Research, Solid Earth, v. 101, p. 5961-5975.

Marinos, P. and Hoek, E. (2000). GSI: A Geologically Friendly Tool for Rock Mass Strength Estimation, Geo2000.

RocScience (2006a). DIPS.

——— (2006b). RocLab.

——— (2006c). SWEDGE.

Terrestrial Solutions, Inc. (2012). Memorandum Regarding Temporary Cut Slope for the Left Abutment Area, Calaveras Dam Replacement Project, California; submitted to Dragados/Flatiron/Sukut Joint Venture, Project No. 11-038, dated June 12, 2012, 5 p.

URS Corporation (URS) (2006). Spillway Excavation Slope Stability, Technical Memorandum, Draft, Calaveras Dam Replacement Project, November 21.

——— (2007). Spillway Excavation Slope Seismic Deformation, Technical Memorandum, Draft, Calaveras Dam Replacement Project, March 28.

——— (2008a). Geotechnical Data Report, Calaveras Dam Replacement Project, Project No. CUW 37401, July 28; Final Reissued, dated January 4, 2011.

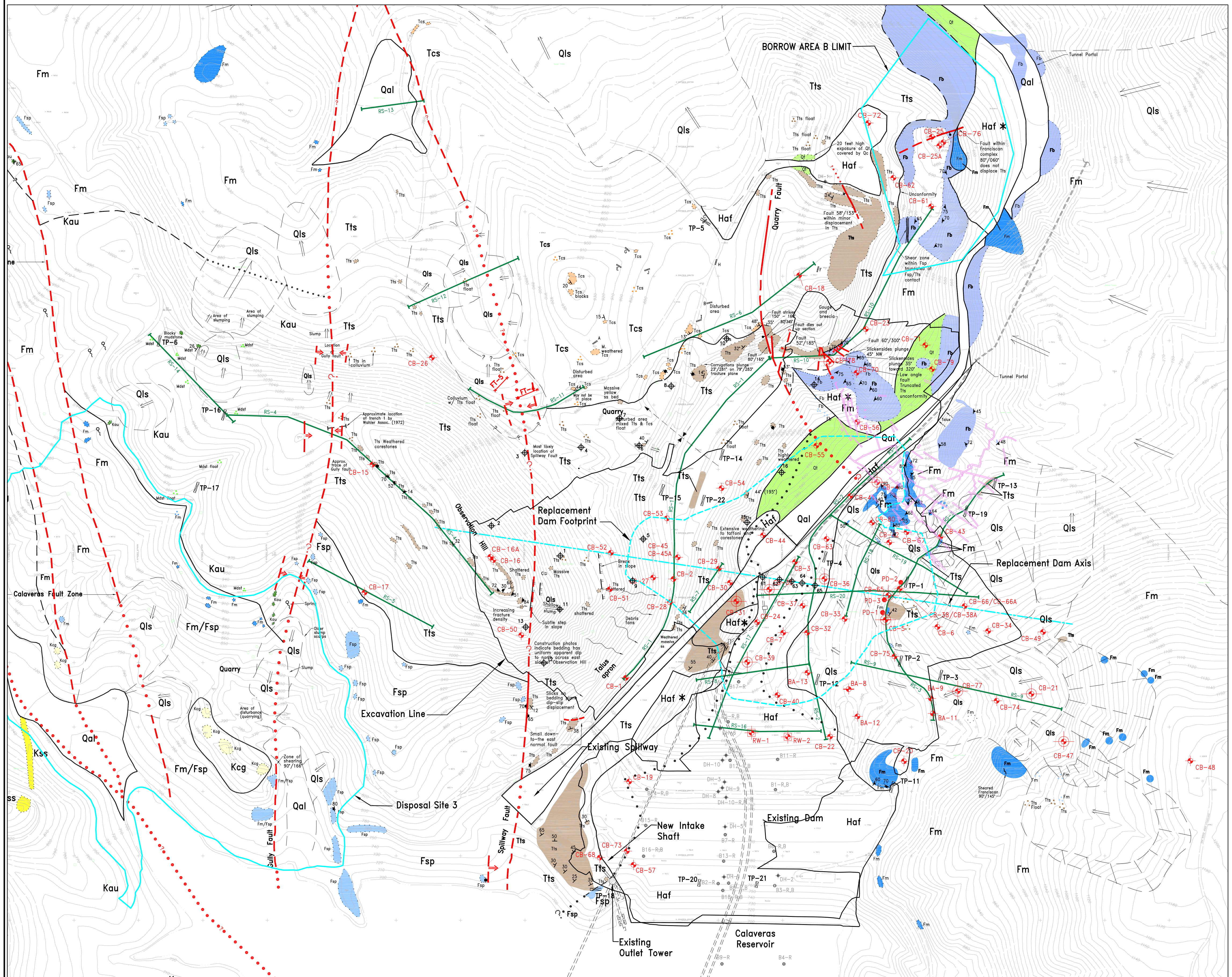
——— (2008b). Geotechnical Interpretive Report, Calaveras Dam Replacement Project, Project No. CUW 37401, August 15.

——— (2012). Calaveras Dam Replacement Project, Observation Hill Slope Stability Excavation, Draft Memorandum, July 18.

URS/WLA (URS Corporation/William Lettis & Associates Inc.) (2005). Investigation of Fault Rupture Potential at Calaveras Dam, January 25.

Wright, S.G. (1991). UTEXAS3, A Computer Program for Slope Stability Calculations, Shinoak Software, May.

Figures



LEGEND

OBJECT | EXPLANATION

FAULT, SOLID WHERE WELL LOCATED, DASHED WHERE APPROXIMATE, DOTTED WHERE CONCEALED, QUERIED WHERE UNCERTAIN, TICK INDICATES DIP DIRECTION AND AMOUNT, ARROWS INDICATE APPARENT SENSE OF STRIKE SLIP DISPLACEMENT, U = UP, D = DOWN

ZONE WITHIN WHICH FAULT IS CONSTRAINED (APPROXIMATE)

GEOLOGIC CONTACT, SOLID WHERE WELL LOCATED, DASHED WHERE APPROXIMATE, DOTTED WHERE CONCEALED, QUERIED WHERE UNCERTAIN

SYNCLINAL AXIS, APPROXIMATE AND UNCERTAIN, ARROWS SHOW DIRECTION OF PLUNGE

APPROXIMATE OUTLINE OF EXCAVATION AND STRUCTURES

CB-1 URS CORE BORING

BA-1 URS BUCKET AUGER BORING

CB-4 URS CORE BORING WITH PIEZOMETER

RW-1 URS ROTARY WASH BORING WITH PIEZOMETER

PD-1 URS PERCUSSION DRILL BORING

RS-1 SEISMIC REFRACTION LINE

FT-1 FAULT TRENCH

TP-1 URS TEST PIT

A WA TEST PIT (WAHLER, 1974)

Tts FLOAT OBSERVED IN FIELD

SPRING

SHEAR

30 STRIKE AND DIP OF BEDDING (QUERY INDICATE UNCERTAIN IN BEDDING OR FRACTURE)

77 STRIKE AND DIP JOINT OR FRACTURE

80 STRIKE AND DIP OF CLEAVAGE OR FOLIATION

EXISTING EXPLORATORY ADITS

LANDSLIDE (HEADSCARP INDICATED)

DH-1 BORING, (WAHLER. 1972 & 1974)

B1-R,B BORING, (OCC, 2001 & 2002)

900 TOPOGRAPHIC CONTOURS (FEET)

QUATERNARY

Haf ARTIFICIAL FILL

Haf * ARTIFICIAL FILL (debris on slope)

Qls LANDSLIDE

Qal ALLUVIUM

Qt FLUVIAL TERRACE DEPOSIT

TERTIARY

Tcs CLAREMONT FORMATION

Tts TEMBLOR SANDSTONE

CRETACEOUS

BERRYESSA FORMATION

Kau MUDSTONE (Mdst)

Kcg CONGLOMERATE

Kss SANDSTONE

JURASSIC-CRETACEOUS

FRANCISCAN COMPLEX

Fsp SERPENTINITE

Fb GLAUCOPHANE BLUESCHIST

Fm MELANGE/UNDIFFERENTIATED

NOTES:

1. Base map was prepared using computer assisted, photogrammetric methods by HJW Geospatial, Inc., in Oakland, California.
2. Date of aerial photography 10-29-03.
3. Control survey performed by McGill Martin Self, Inc., Walnut Creek, CA.
4. The grid is based on the California Coordinate System, Zone III, NAD 1983.
5. Elevations are based on USGS datum.
6. In areas of dense vegetation, accuracy of contours may deviate from accepted accuracy standards.
7. Geology based on field mapping, air photo interpretation, and in part modified from Dibblee (1972) and Marliave (1935). Landslides are modified from Nilsen et al. (1975).
8. Geologic mapping was conducted by URS and WLA between Oct. 28, 2003 & April 15, 2004, & between Nov.14, 2005 & July 28, 2006.

SURVEY NORTH

N

200' 0' 200' 400' 800'

1" = 200'

PRELIMINARY DRAFT

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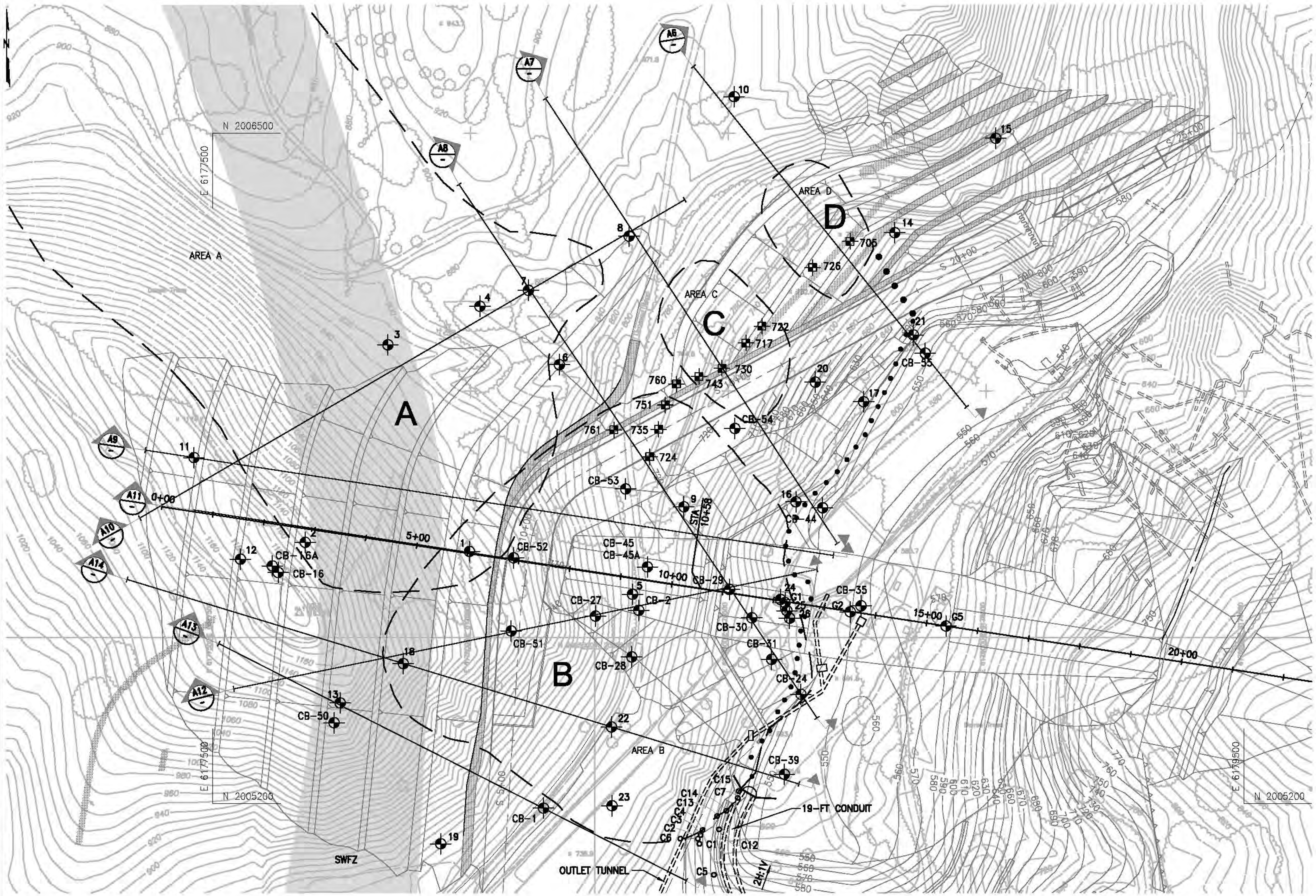
GEOLOGIC MAP AND EXPLORATION PLAN (Figure 2-1 from URS, 2008a)

FIGURE 2-1

Aug 09, 2012 – 1:40pm X:\x_geo\Calaveras Final Design\Drawings\FIG2-1_021208.dwg



NOTES

1. DAM FOUNDATION, SPILLWAY AND LANDSLIDE EXCAVATION LIMITS AND EXCAVATION CONTOURS ARE ESTIMATED AND WILL VARY DEPENDING ON CONDITIONS ENCOUNTERED DURING CONSTRUCTION. DEEPER EXCAVATION MAY BE REQUIRED TO REMOVE UNACCEPTABLE MATERIALS.
2. ZONE 1 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 1 FOUNDATION OBJECTIVE.
3. ZONES 2 AND 5 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 2 AND 5 FOUNDATION OBJECTIVES.
4. EXCAVATE FINAL SURFACES OUTSIDE OF DAM EMBANKMENT FOOTPRINT AT 2H:1V UNLESS OTHERWISE SHOWN.
5. CLEAR AND GRUB TO NO MORE THAN 10' BEYOND THE LIMITS OF EXCAVATION.
6. FOR SPILLWAY DETAILED EXCAVATION, SEE SP DRAWINGS.
7. TREAT EXISTING ADITS AS SHOWN ON FD-6 AND FD-7.
8. FOR DETAILED BENCH GEOMETRY SEE FD-3 AND FD-4.

?	ESTIMATED FRANCISCAN–TEMBLOR CONTACT, SOLID WHERE WELL LOCATED, DASHED WHERE APPROXIMATE, DOTTED WHERE CONCEALED, QUERIED WHERE UNCERTAIN
726	TEST PIT (CONTACT ELEVATION IN FEET)
CB-53	BORING (CB-SERIES, 2003 TO 2006)
G2	BORING (G-SERIES, 2012)
11	BORING (LA 2012-SERIES, 2012)
C1	MAPPED CONTACTS
SWFZ	APPROXIMATE LOCATION OF SPILLWAY FAULT ZONE

100' 0 100' 200'
SCALE 1"=100'

PLOT: EXTEND
SCALE: 1:1
BORDER: 22,34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM FILE:

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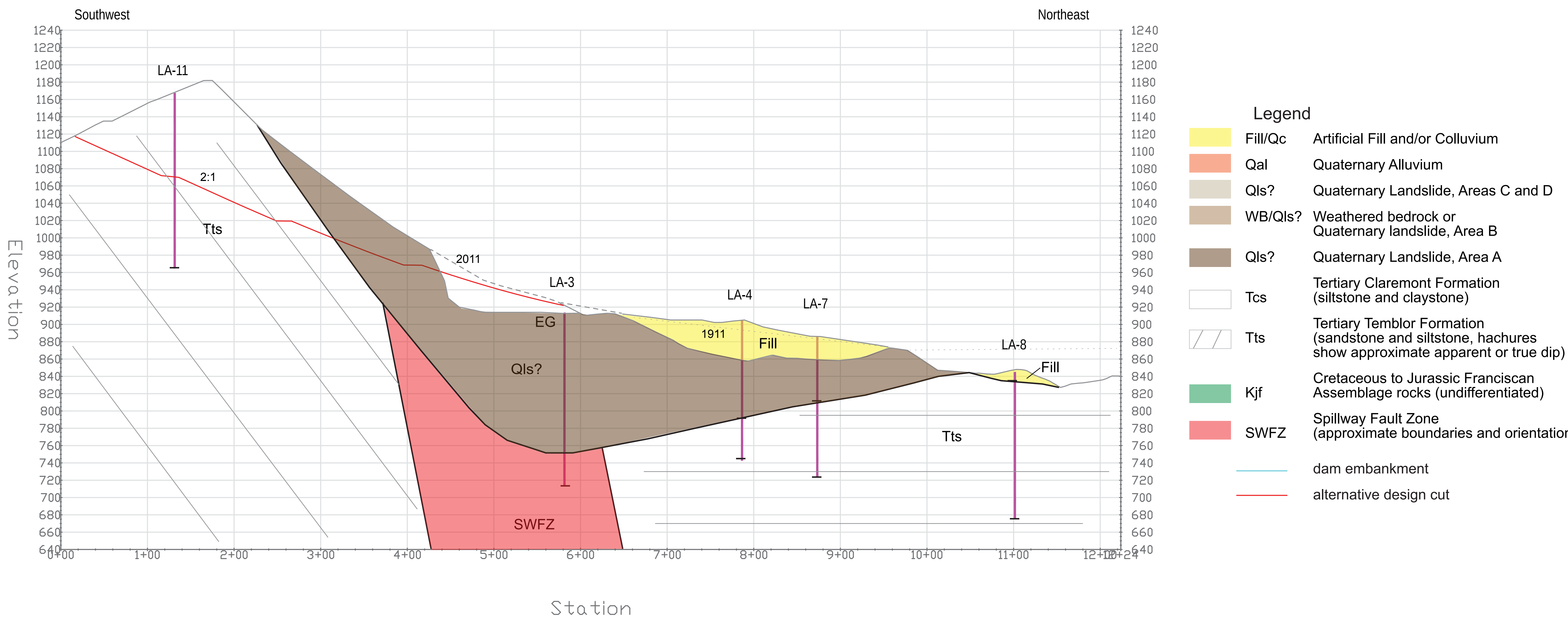
SFPUC CALAVERAS DAM REPLACEMENT PROJECT

INVESTIGATION AND CROSS SECTION LOCATIONS

FIGURE 2-2



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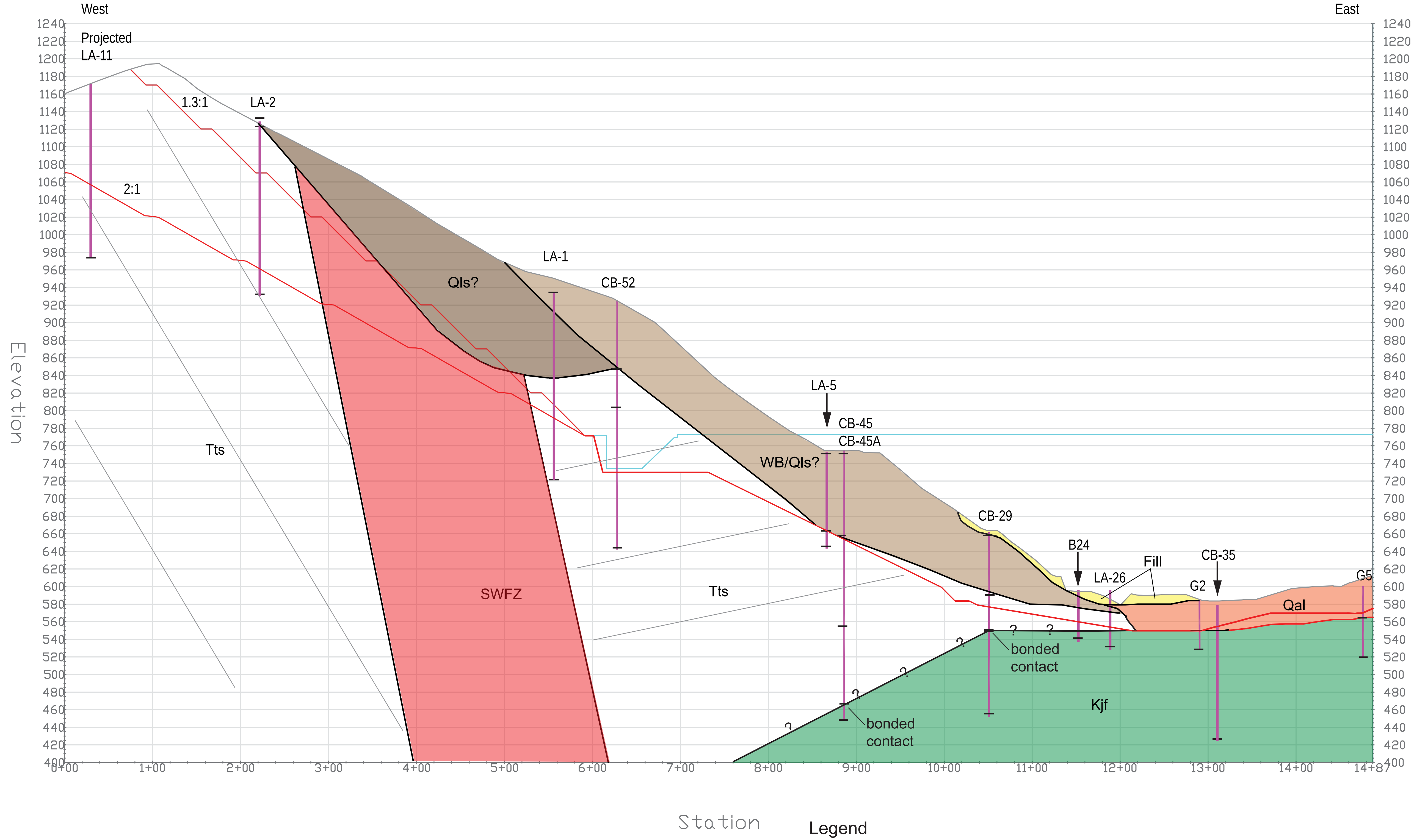
Project No. 26818183 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	GEOLOGIC CROSS SECTION ALONG ALIGNMENT A-10	FIGURE 2-3



Legend

Fill/Qc	Artificial Fill and/or Colluvium	
Qal	Quaternary Alluvium	
Qls?	Quaternary Landslide, Areas C and D	
WB/Qls?	Weathered bedrock or Quaternary landslide, Area B	
Qls?	Quaternary Landslide, Area A	
Tcs	Tertiary Claremont Formation (siltstone and claystone)	
Tts	Tertiary Temblor Formation (sandstone and siltstone, hachures show approximate apparent or true dip)	
Kjf	Cretaceous to Jurassic Franciscan Assemblage rocks (undifferentiated)	
SWFZ	Spillway Fault Zone (approximate boundaries and orientation)	

dam embankment

alternative design cut

PRELIMINARY DRAFT

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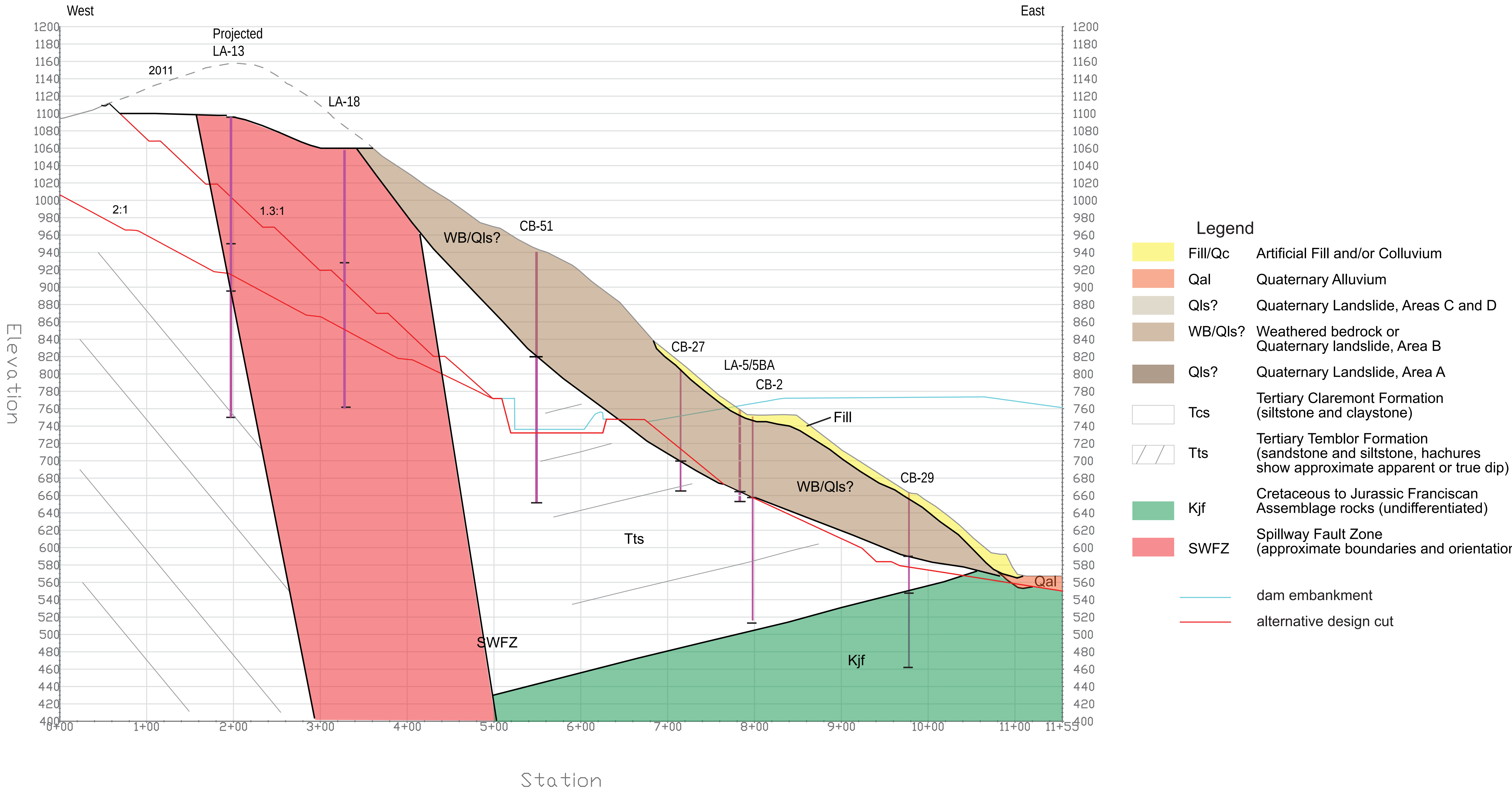
REPLACEMENT PROJECT

GEOLOGIC CROSS SECTION
ALONG ALIGNMENT A-11

FIGURE
2-4



PRELIMINARY DRAFT

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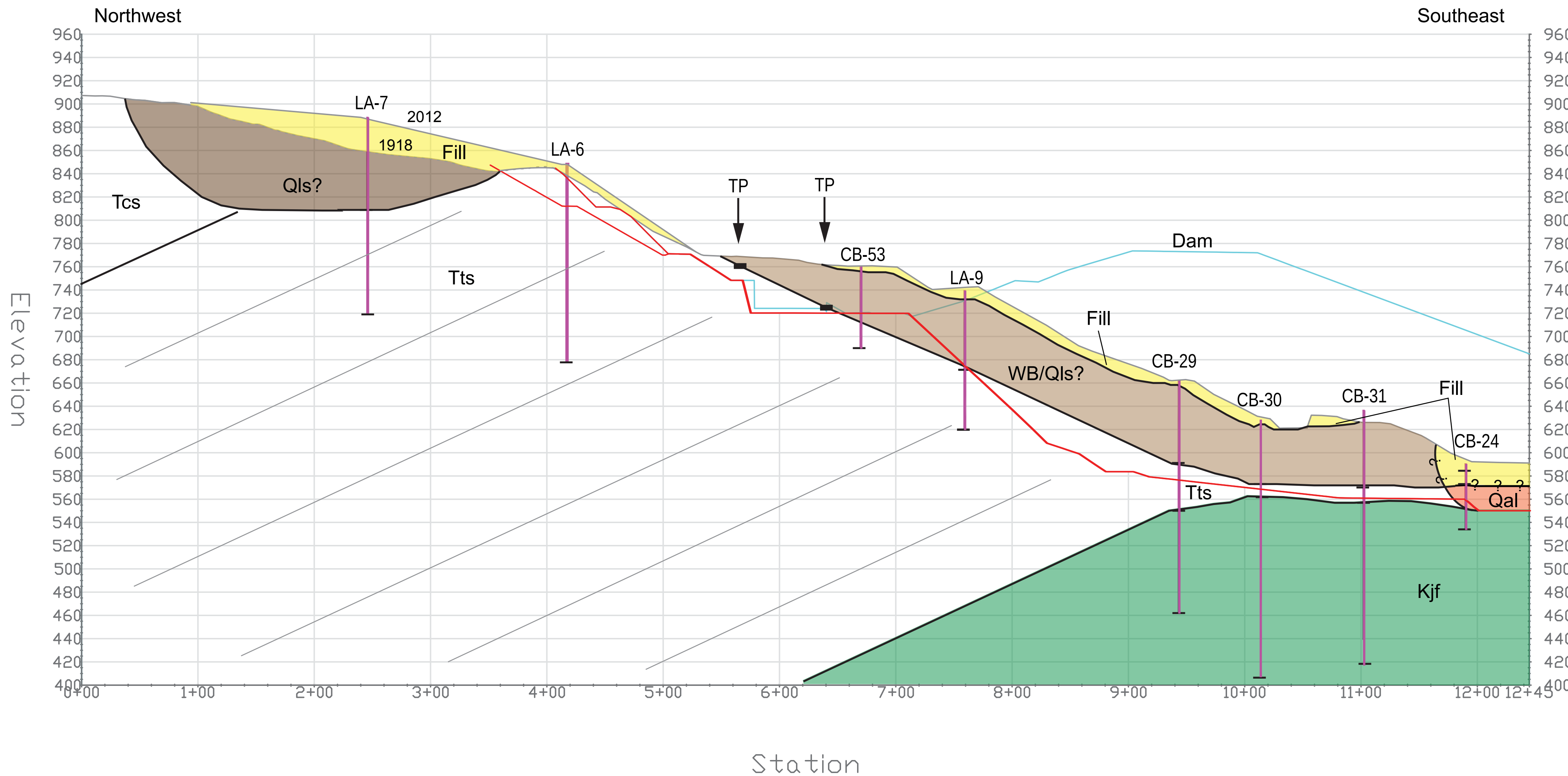
REPLACEMENT PROJECT

GEOLOGIC CROSS SECTION
ALONG ALIGNMENT A-12

FIGURE
2-5



Legend

	Fill/Qc	Artificial Fill and/or Colluvium
	Qal	Quaternary Alluvium
	Qls?	Quaternary Landslide, Areas C and D
	WB/Qls?	Weathered bedrock or Quaternary landslide, Area B
	Qls?	Quaternary Landslide, Area A
	Tcs	Tertiary Claremont Formation (siltstone and claystone)
	Tts	Tertiary Temblor Formation (sandstone and siltstone, hachures show approximate apparent or true dip)
	Kjf	Cretaceous to Jurassic Franciscan Assemblage rocks (undifferentiated)
	SWFZ	Spillway Fault Zone (approximate boundaries and orientation)
		dam embankment
		alternative design cut

PRELIMINARY DRAFT

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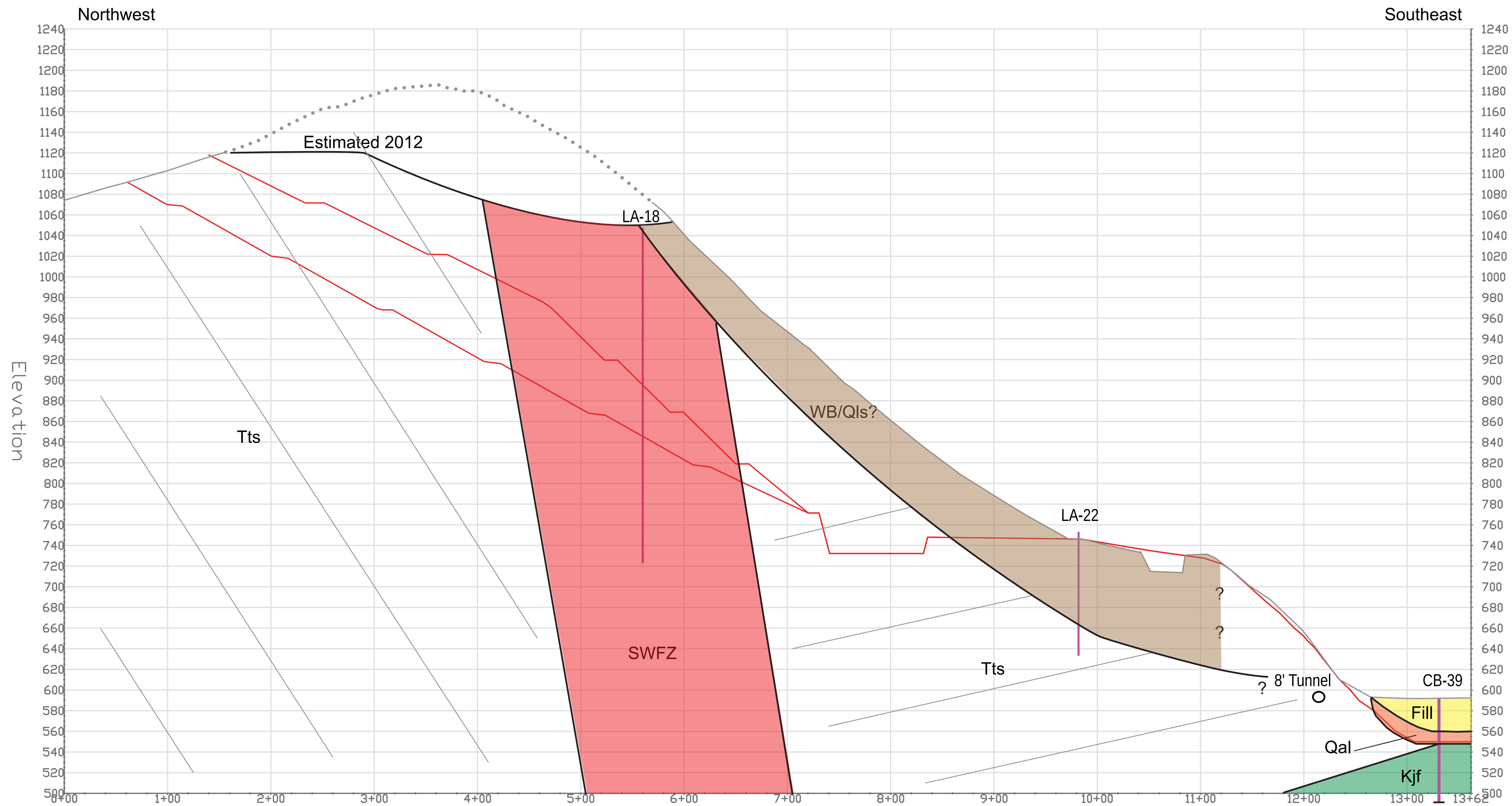
REPLACEMENT PROJECT

GEOLOGIC CROSS SECTION
ALONG ALIGNMENT A-8

FIGURE
2-6



Legend

Fill/Qc	Artificial Fill and/or Colluvium
Qal	Quaternary Alluvium
Qls?	Quaternary Landslide, Areas C and D
WB/Qls?	Weathered bedrock or Quaternary landslide, Area B
Qls?	Quaternary Landslide, Area A
Tcs	Tertiary Claremont Formation (siltstone and claystone)
Tts	Tertiary Temblor Formation (sandstone and siltstone, hachures show approximate apparent or true dip)
Kjf	Cretaceous to Jurassic Franciscan Assemblage rocks (undifferentiated)
SWFZ	Spillway Fault Zone (approximate boundaries and orientation)

dam embankment

alternative design cut

PRELIMINARY DRAFT

URS

Project No. 26818183

SFPUC CALAVERAS DAM REPLACEMENT PROJECT

GEOLOGIC CROSS SECTION ALONG ALIGNMENT A-14

FIGURE 2-7

Legend

	Fill/Qc	Artificial Fill and/or Colluvium
	Qal	Quaternary Alluvium
	Qls?	Quaternary Landslide, Areas C and D
	WB/Qls?	Weathered bedrock or Quaternary landslide, Area B
	Qls?	Quaternary Landslide, Area A
	Tcs	Tertiary Claremont Formation (siltstone and claystone)
	Tts	Tertiary Temblor Formation (sandstone and siltstone, hachures show approximate apparent or true dip)
	Kjf	Cretaceous to Jurassic Franciscan Assemblage rocks (undifferentiated)
	SWFZ	Spillway Fault Zone (approximate boundaries and orientation)

dam embankment

alternative design cut

PRELIMINARY DRAFT

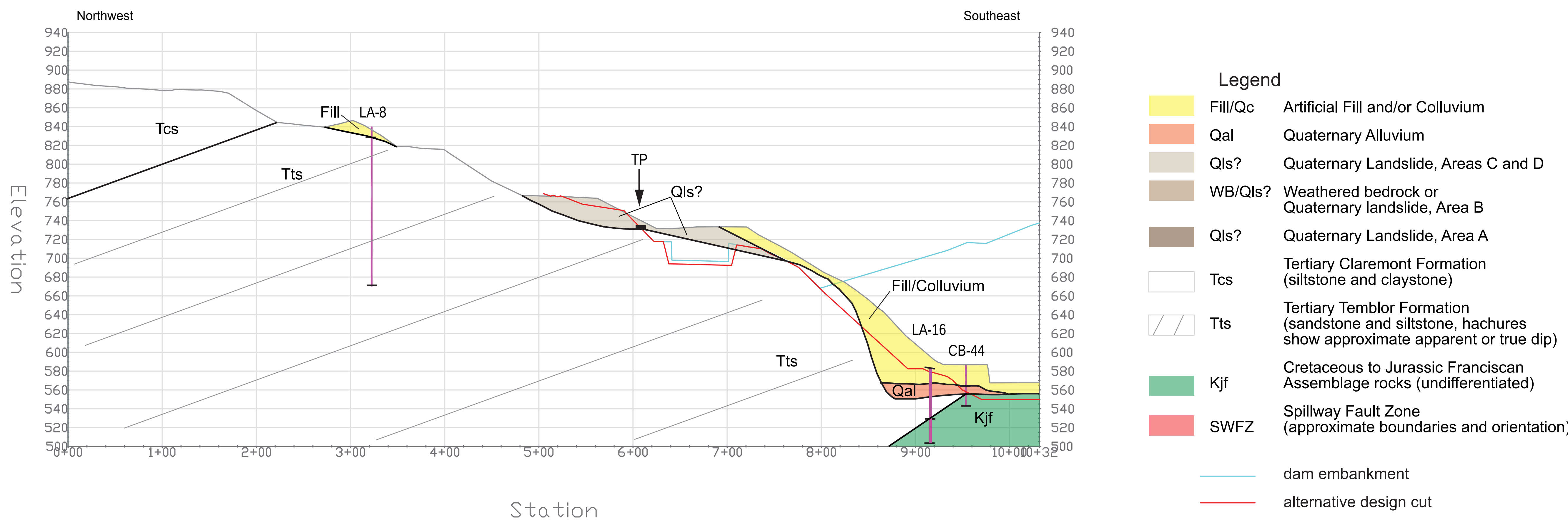
URS

Project No. 26818183

SFPUC
CALAVERAS DAM
REPLACEMENT PROJECT

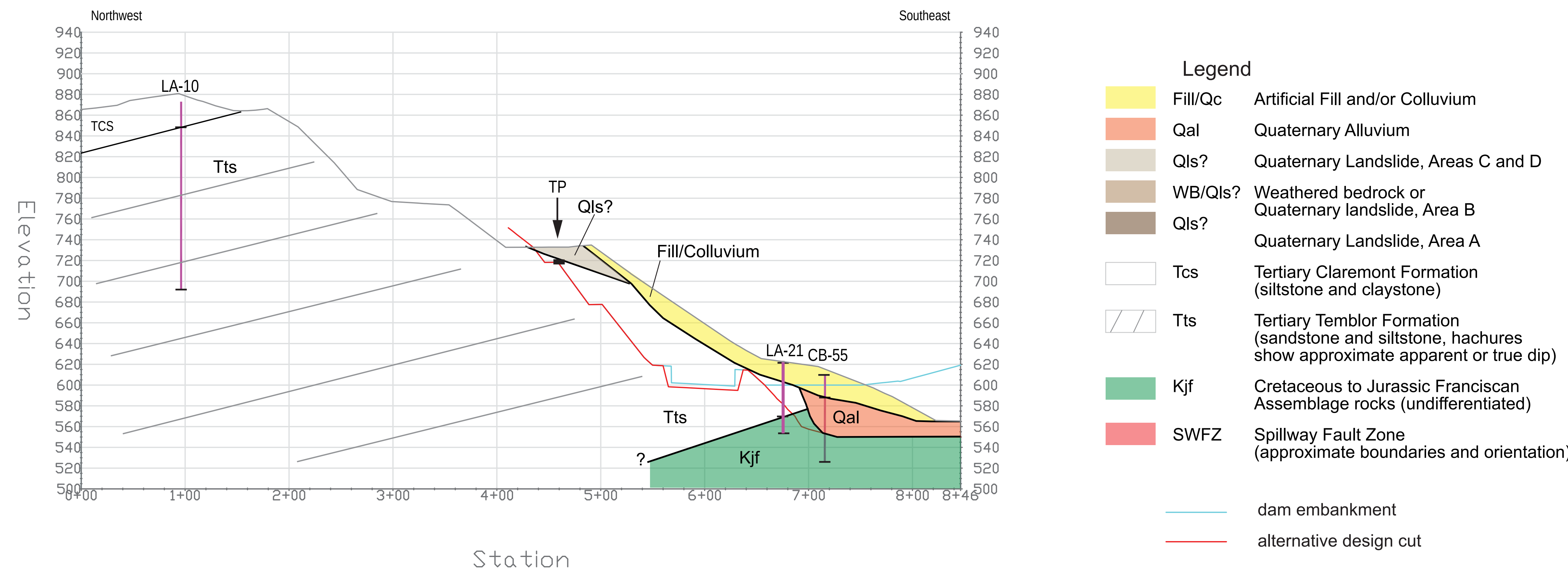
GEOLOGIC CROSS SECTION
ALONG ALIGNMENT A-13

FIGURE
2-8



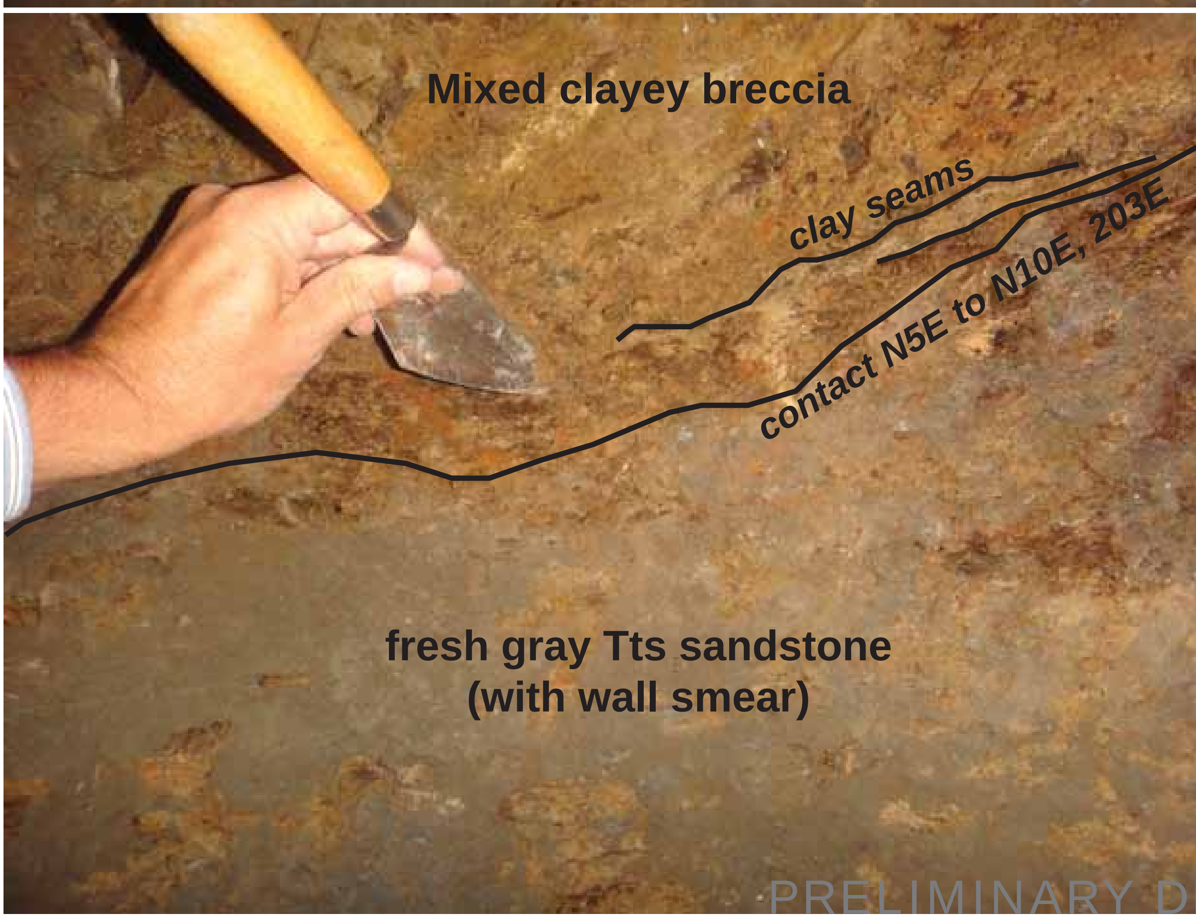
PRELIMINARY DRAFT

URS	Project No. 26818183 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	GEOLOGIC CROSS SECTION ALONG ALIGNMENT A-7	FIGURE 2-9



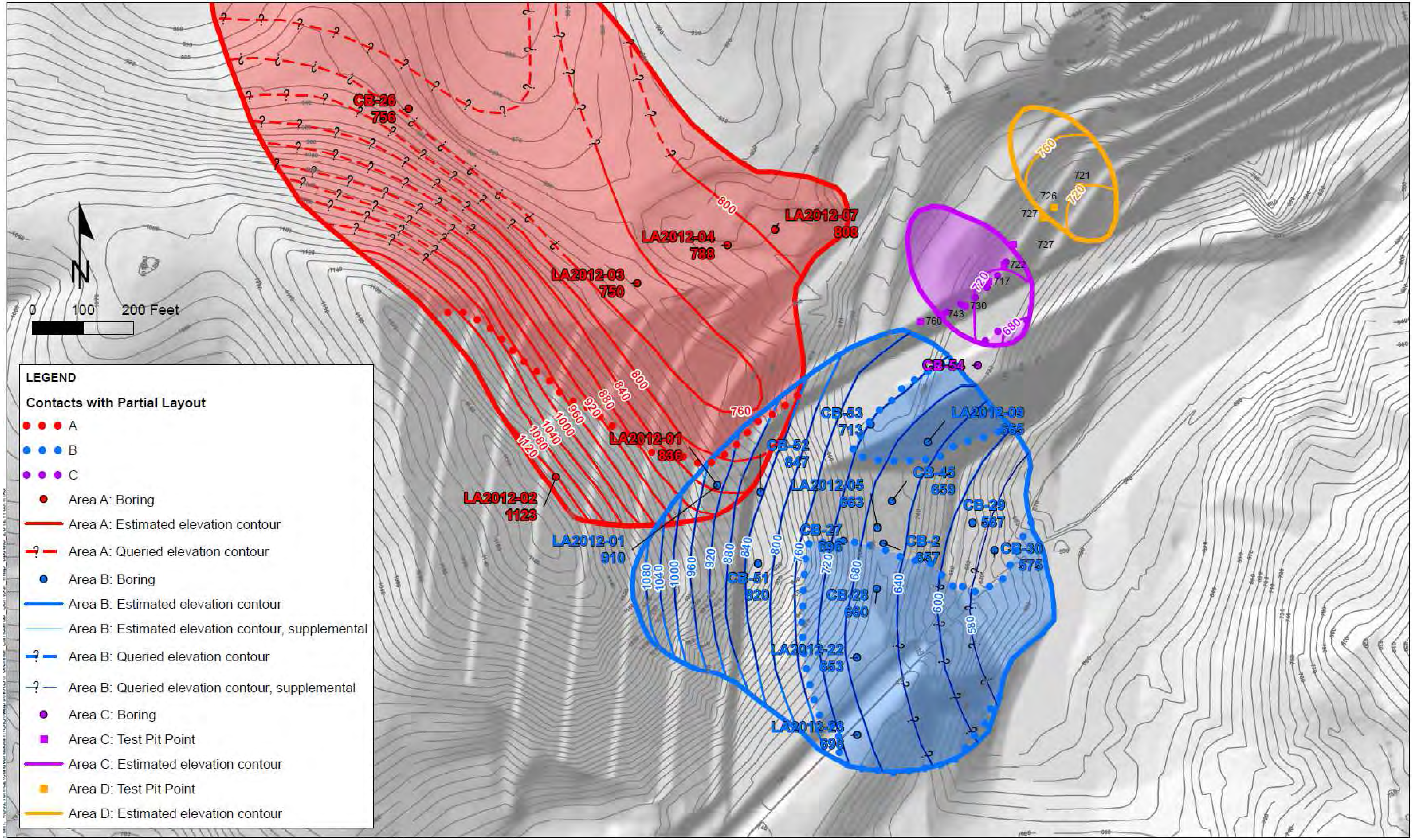
PRELIMINARY DRAFT

URS	Project No. 26818183 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	GEOLOGIC CROSS SECTION ALONG ALIGNMENT A-6	FIGURE 2-10



PRELIMINARY DRAFT

URS	Project No. 26818183 SFPUC CALAVERAS DAM REPLACEMENT PROJECT	PHOTOGRAPH Of EXPOSURE ON BORING LA2012-58A OF SOUTH WALL, DEPTH APPROXIMATELY 88 FEET	FIGURE 2-11



PRELIMINARY DRAFT

Project No. 26818183	SFPUC Calaveras Dam Replacement Project	CONTOURS OF BASAL CONTACTS OF LANDSLIDE MATERIAL OR WEATHERED BEDROCK BENEATH AREAS A THROUGH D	Figure 2-12
	URS		

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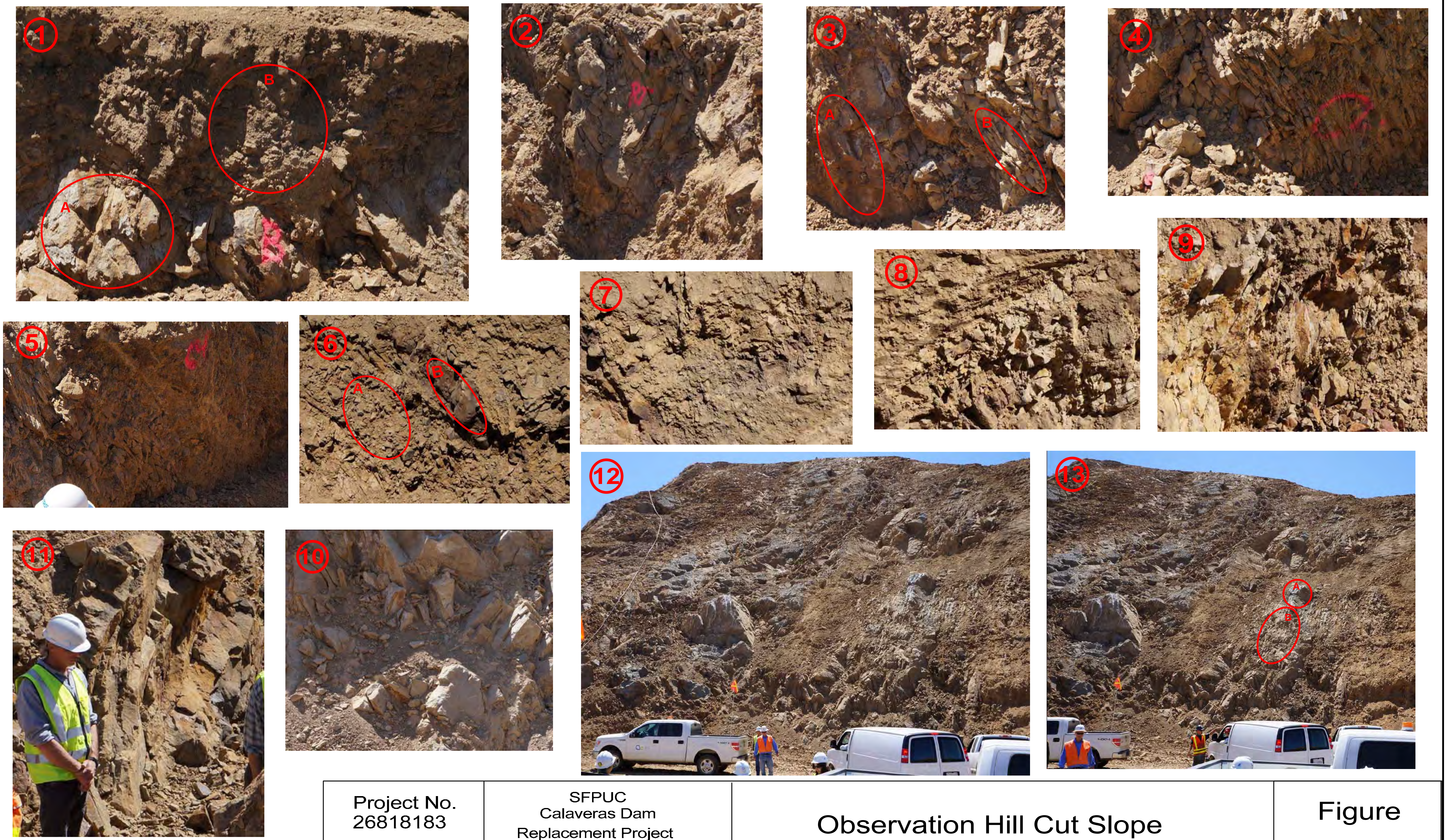
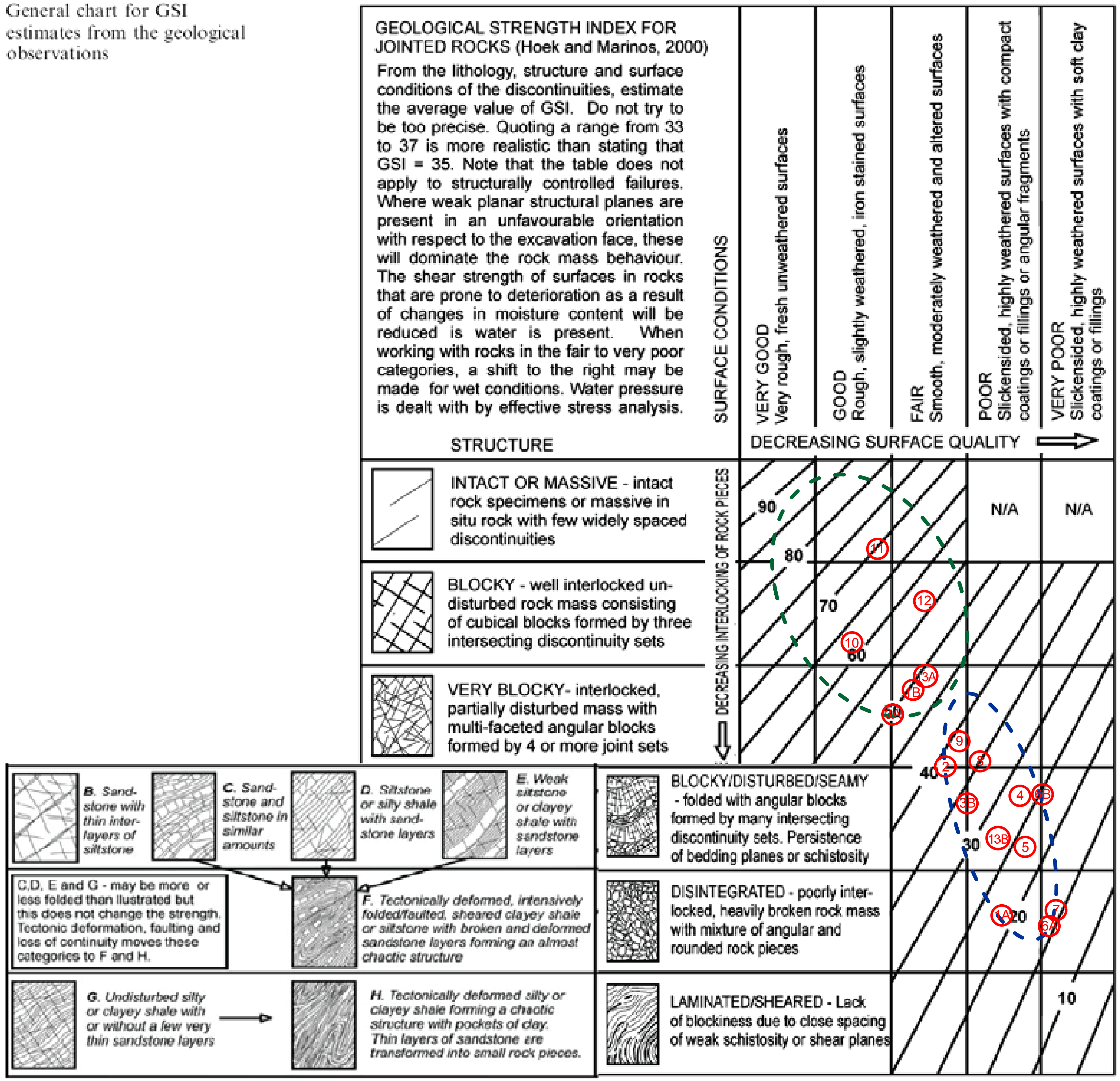


Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Observation Hill Cut Slope GSI for Temblor Sandstone (1 of 2)	Figure 3-1
URS			

General chart for GSI estimates from the geological observations

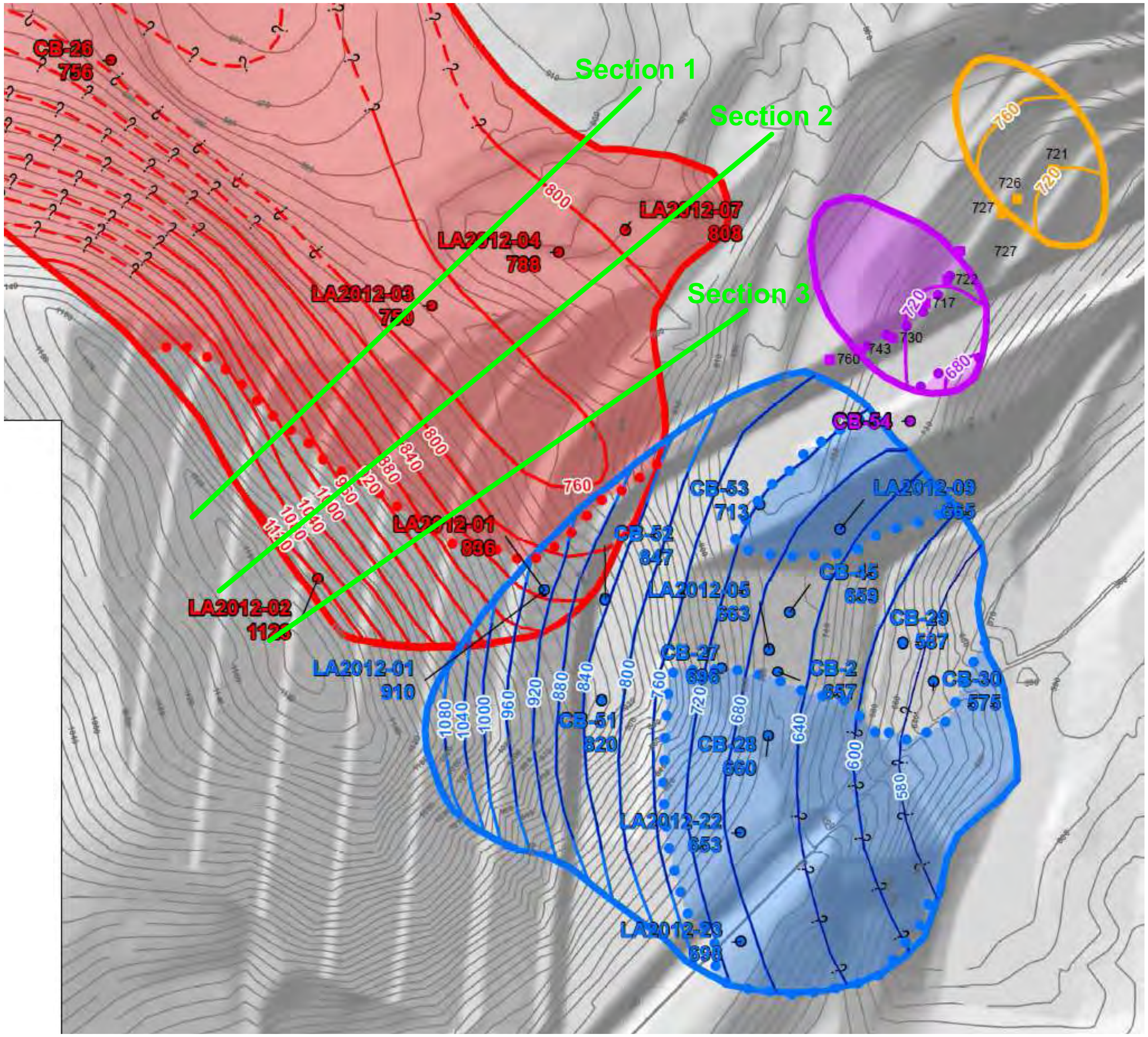


Modified from Hoek and Marinos (2000)

Gray Temblor Sandstone GSI Range

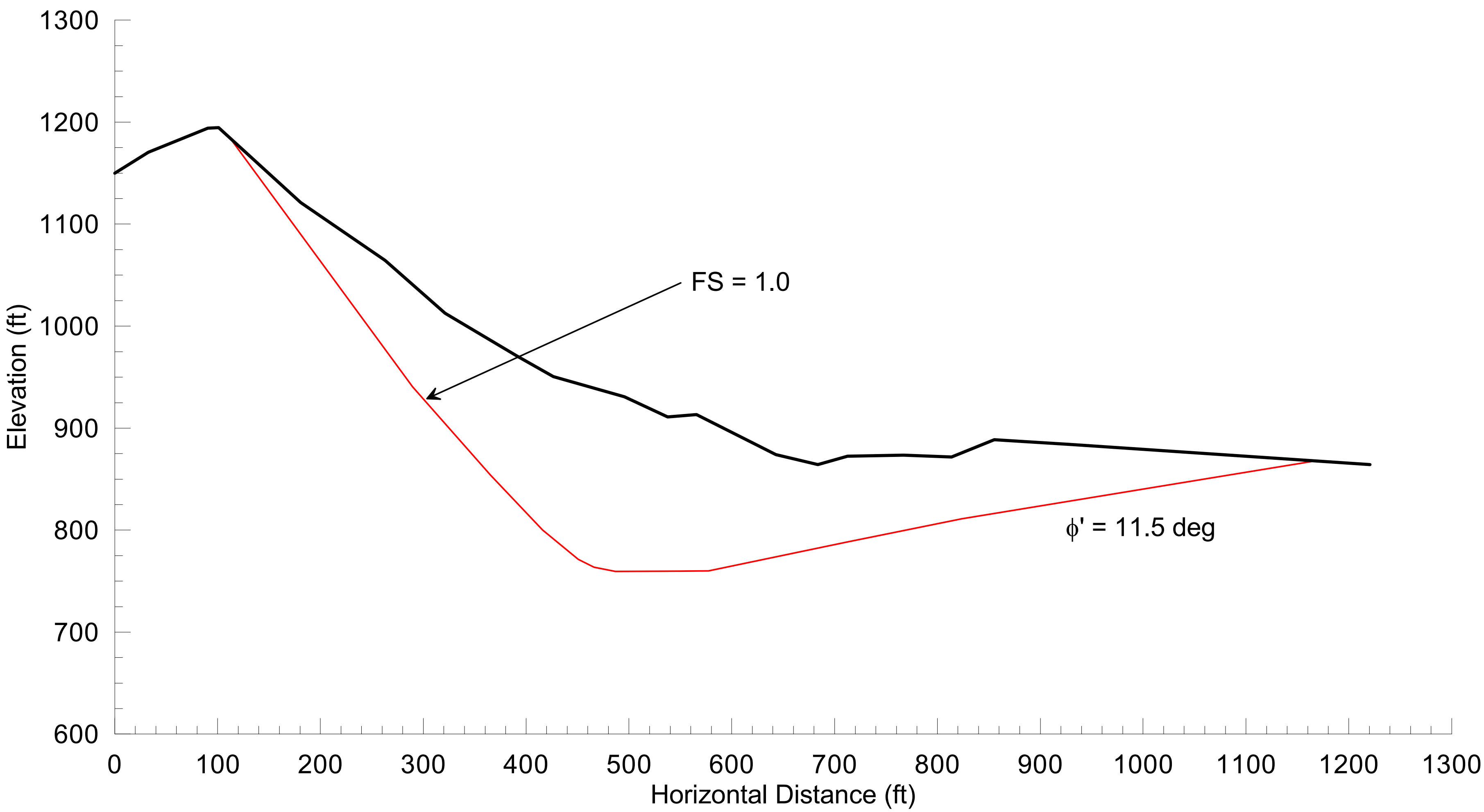
Brown Temblor Sandstone GSI Range

Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Observation Hill Cut Slope GSI for Temblor Sandstone (2 of 2)	Figure 3-2
URS			

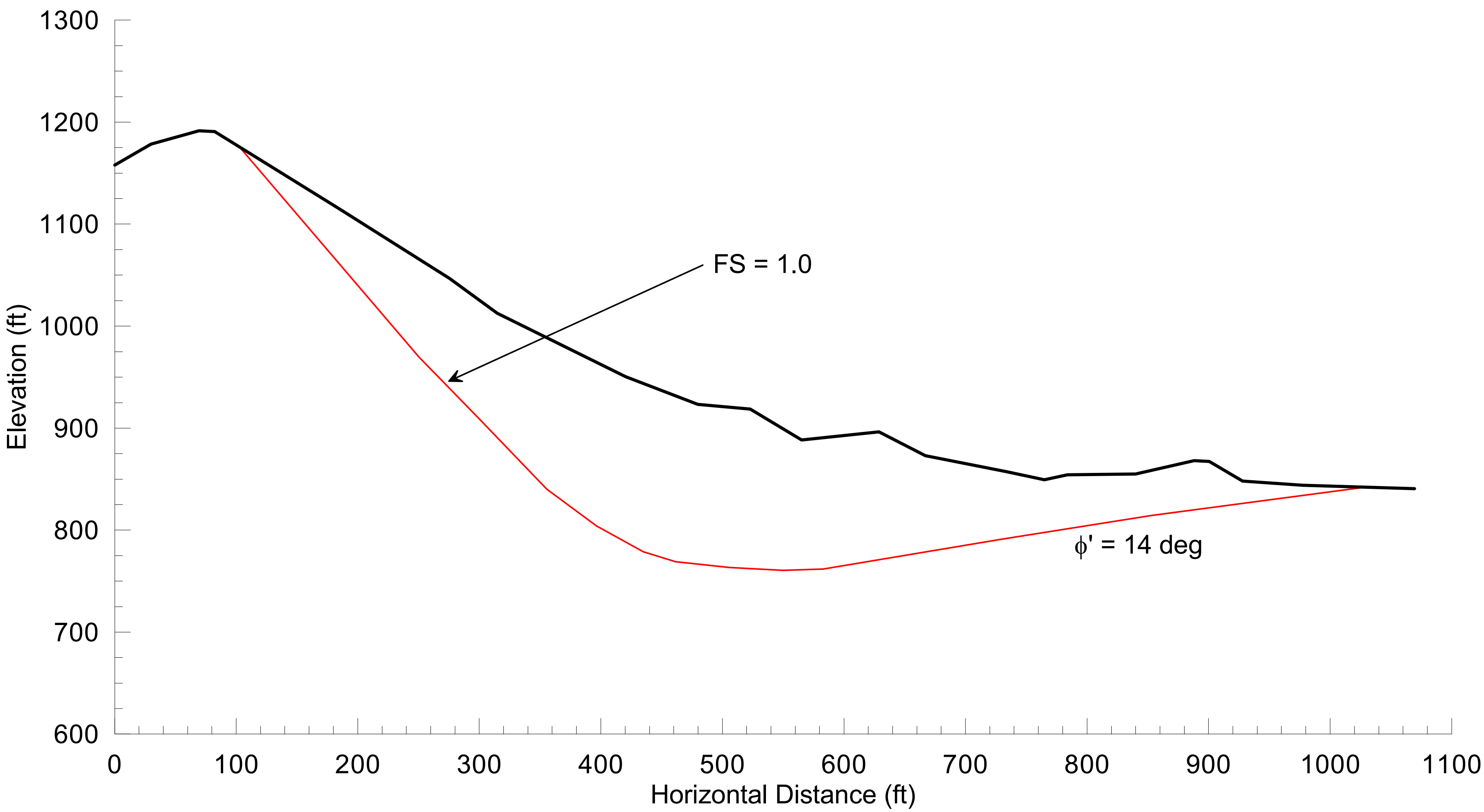


Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Plan view showing location of sections for back-analysis	Figure 3-3
	URS		

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\Figures Sec 3\Fig 3-3 Back-analysis section location.grf

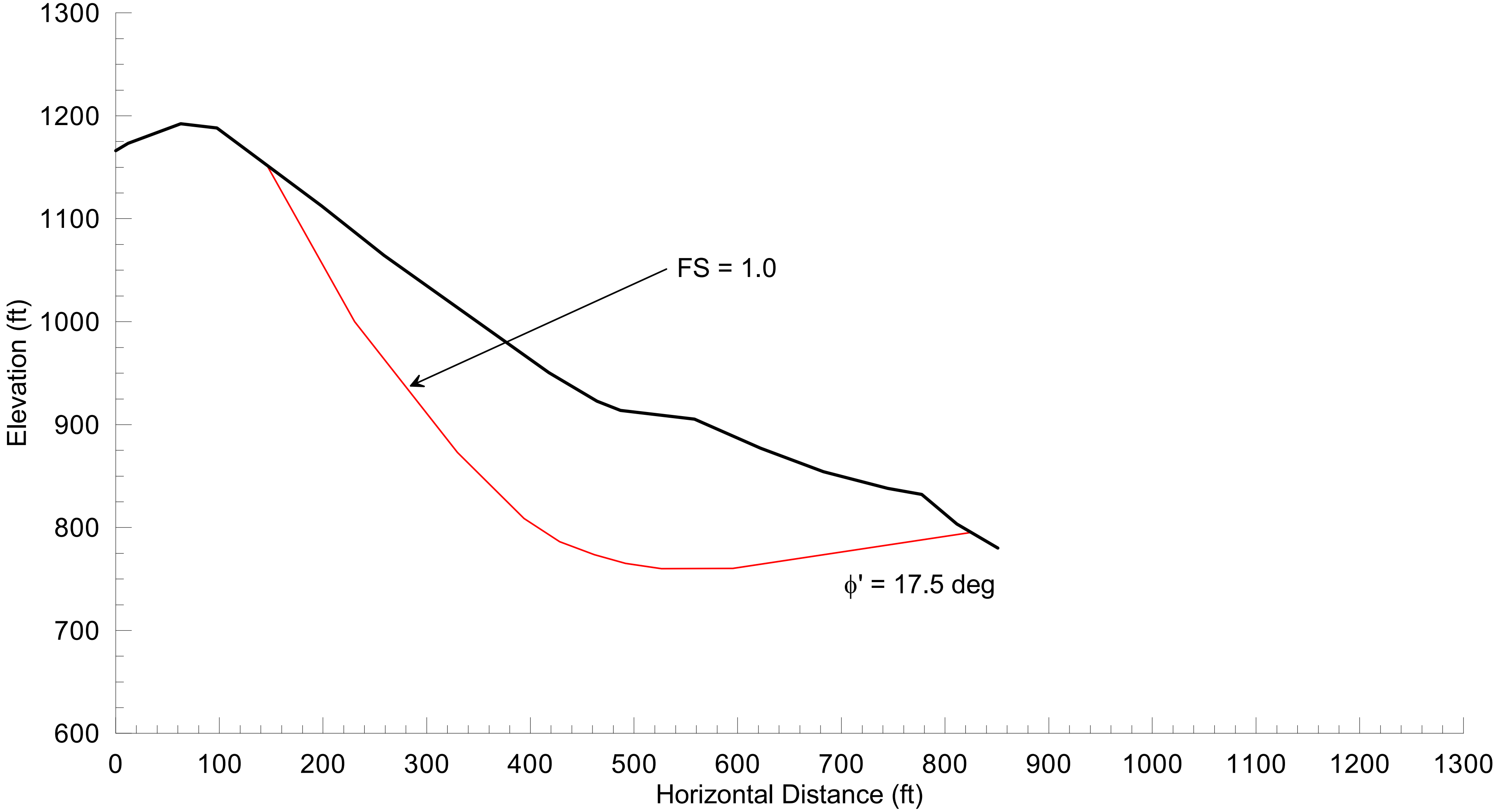


Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Back-analysis of Section 1 for existing conditions	Figure 3-4
URS			



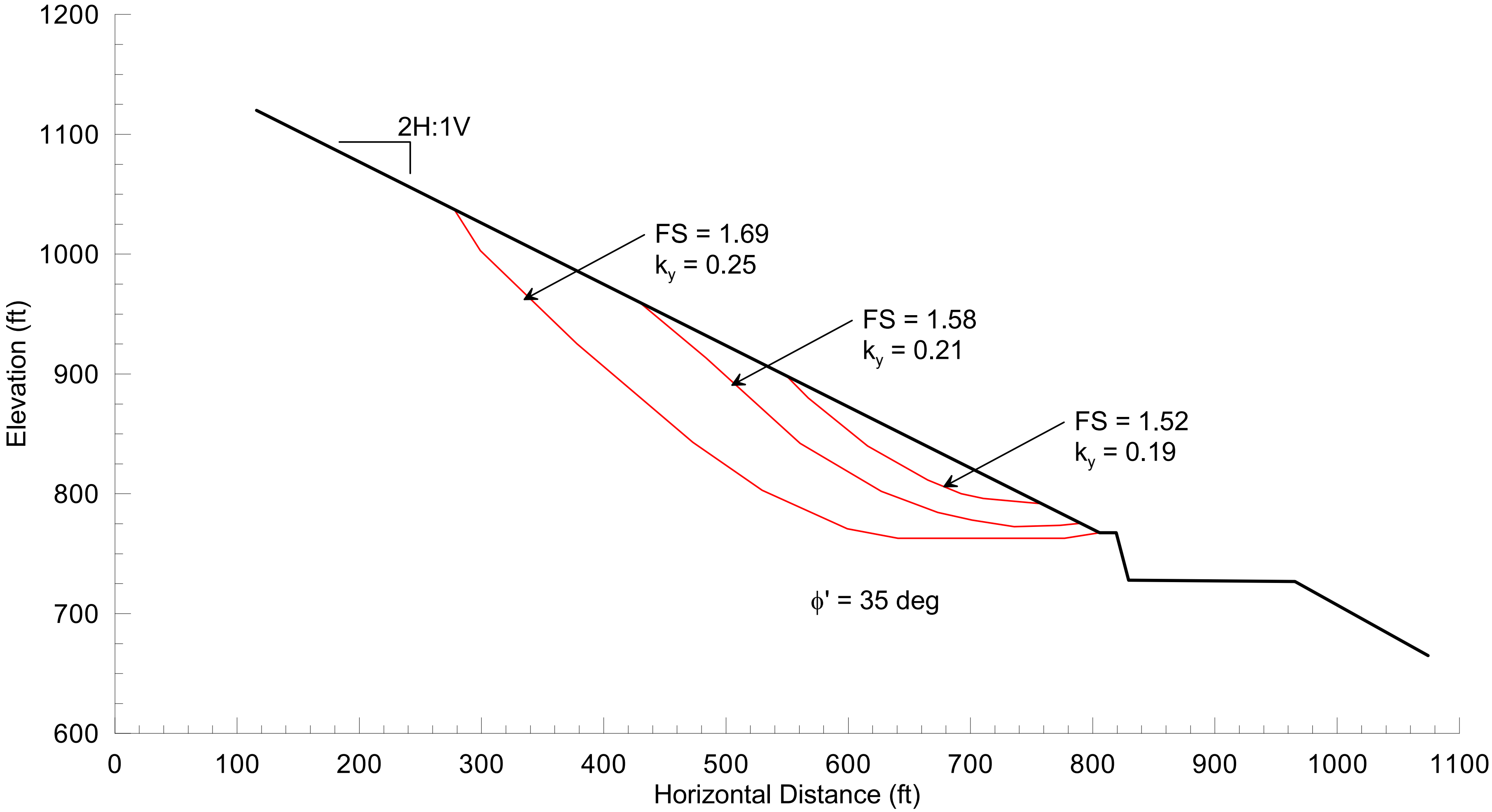
Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Back-analysis of Section 2 for existing conditions	Figure 3-5
URS			

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\Figures Sec 3\Fig 3-5 Static back-analysis 2.grf



Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Back-analysis of Section 3 for existing conditions	Figure 3-6
URS			

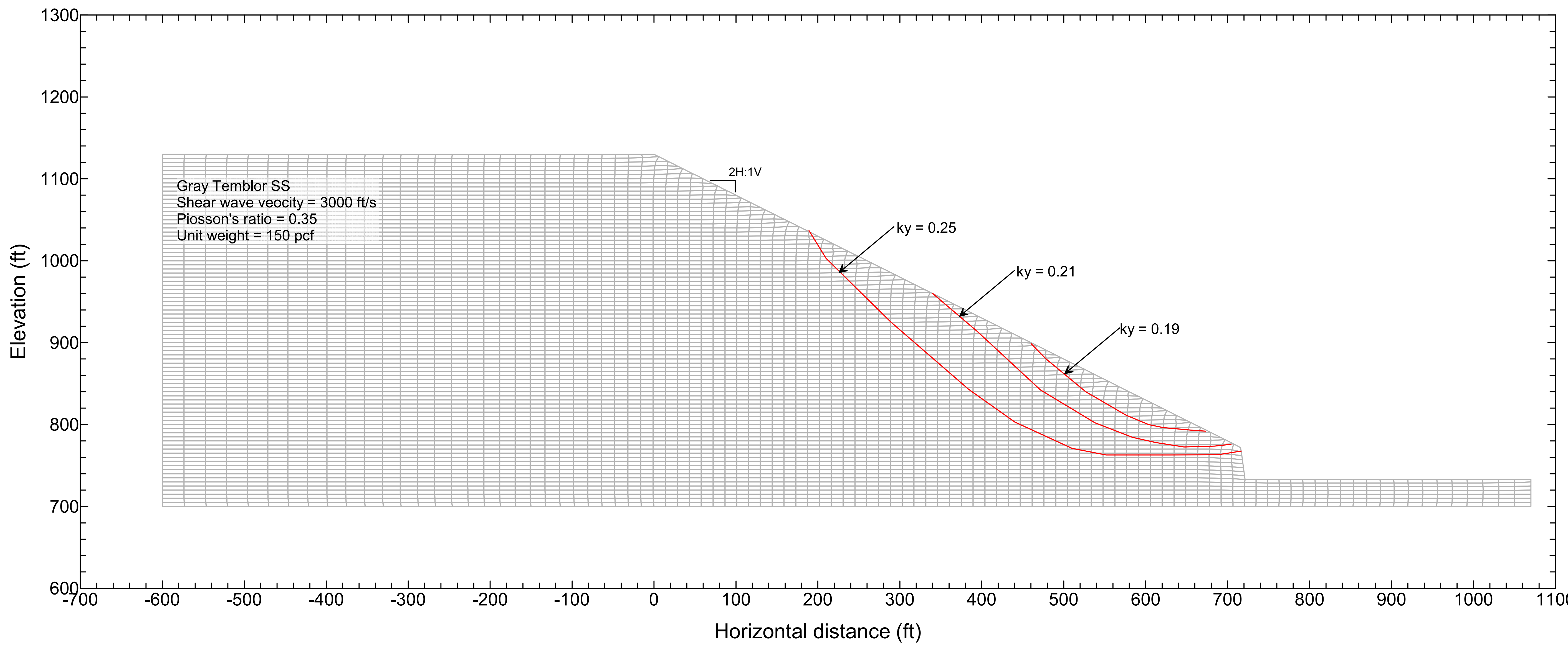
\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\Figures Sec 3\Fig 3-6 Static back-analysis 3.grf



Section Locations

Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Static and pseudo-static stability analysis of 2H:1V design slope	Figure 3-7
	URS		

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\Figures Sec 3\Fig 3-7 Static stability.grf



Project No. 26818183	SFPUC Calaveras Dam Replacement Project	2H:1V Spillway Cut Slope Model for QUAD4 Analysis	Figure 3-8
	URS		

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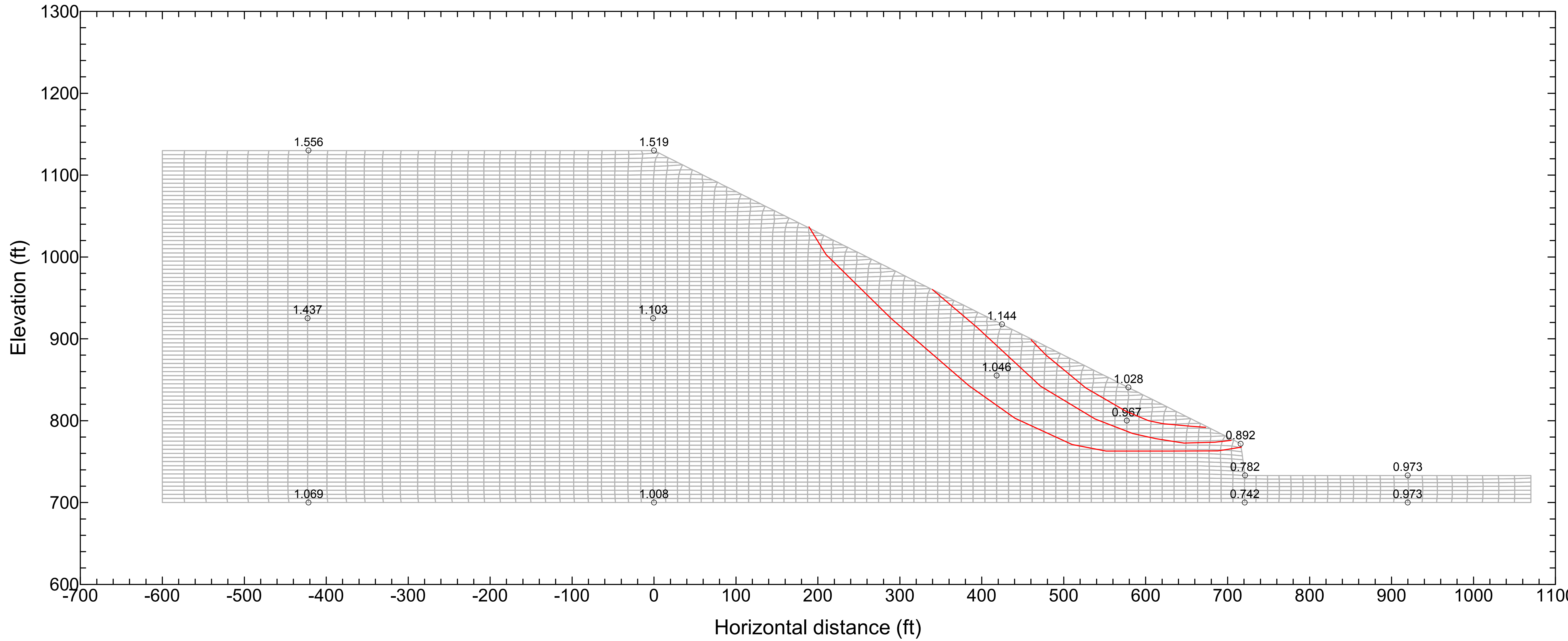
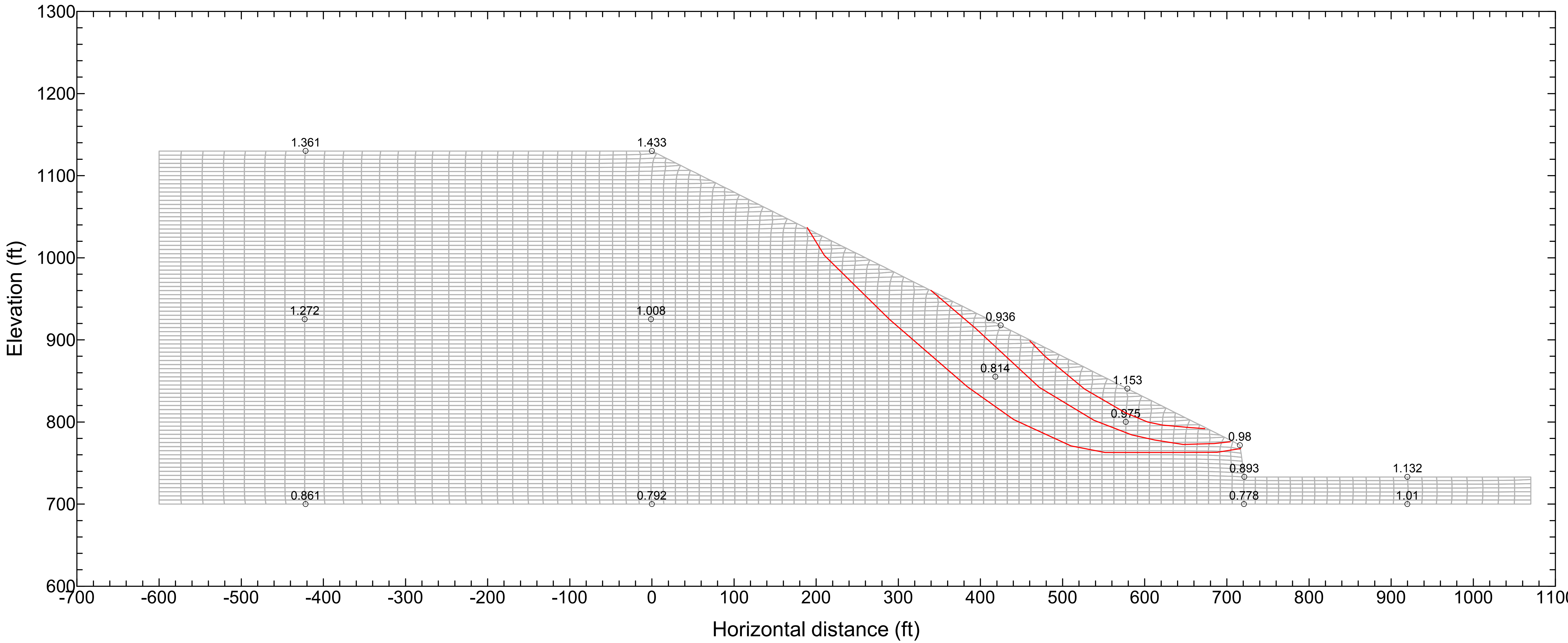


Project No. 26818183	SFPUC Calaveras Dam Replacement Project	PGA (g) 2H:1V Spillway Cut Slope Modified Landers Motion	Figure 3-9
	URS		



Project No. 26818183	SFPUC Calaveras Dam Replacement Project	PGA (g) 2H:1V Spillway Cut Slope Modified Tabas Motion	Figure 3-10
	URS		

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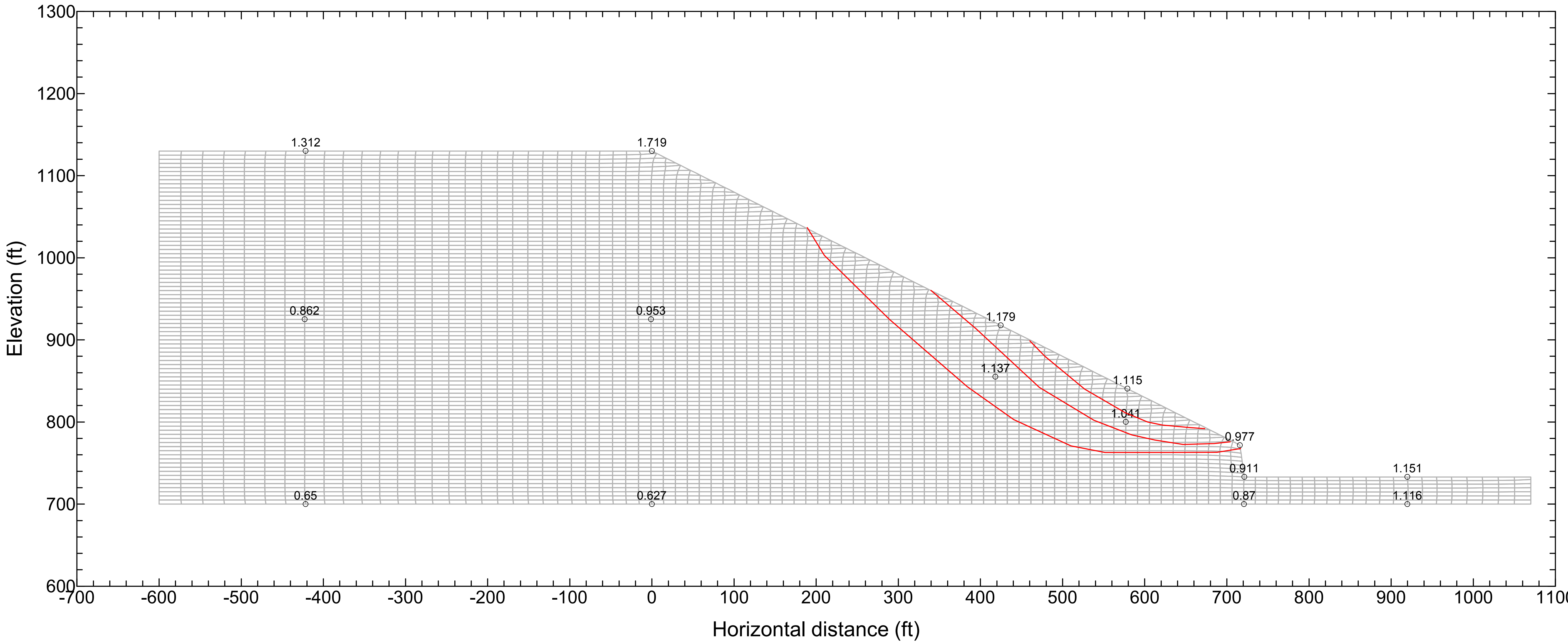

Project No. 26818183	SFPUC Calaveras Dam Replacement Project	PGA (g) 2H:1V Spillway Cut Slope Modified Kocaeli Motion	Figure 3-11
	URS		

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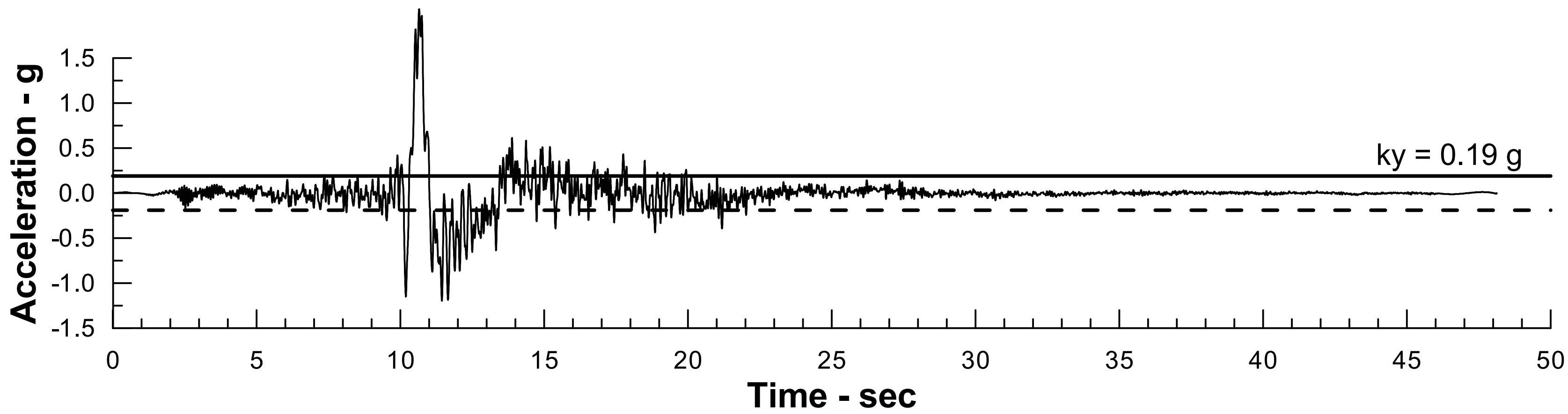
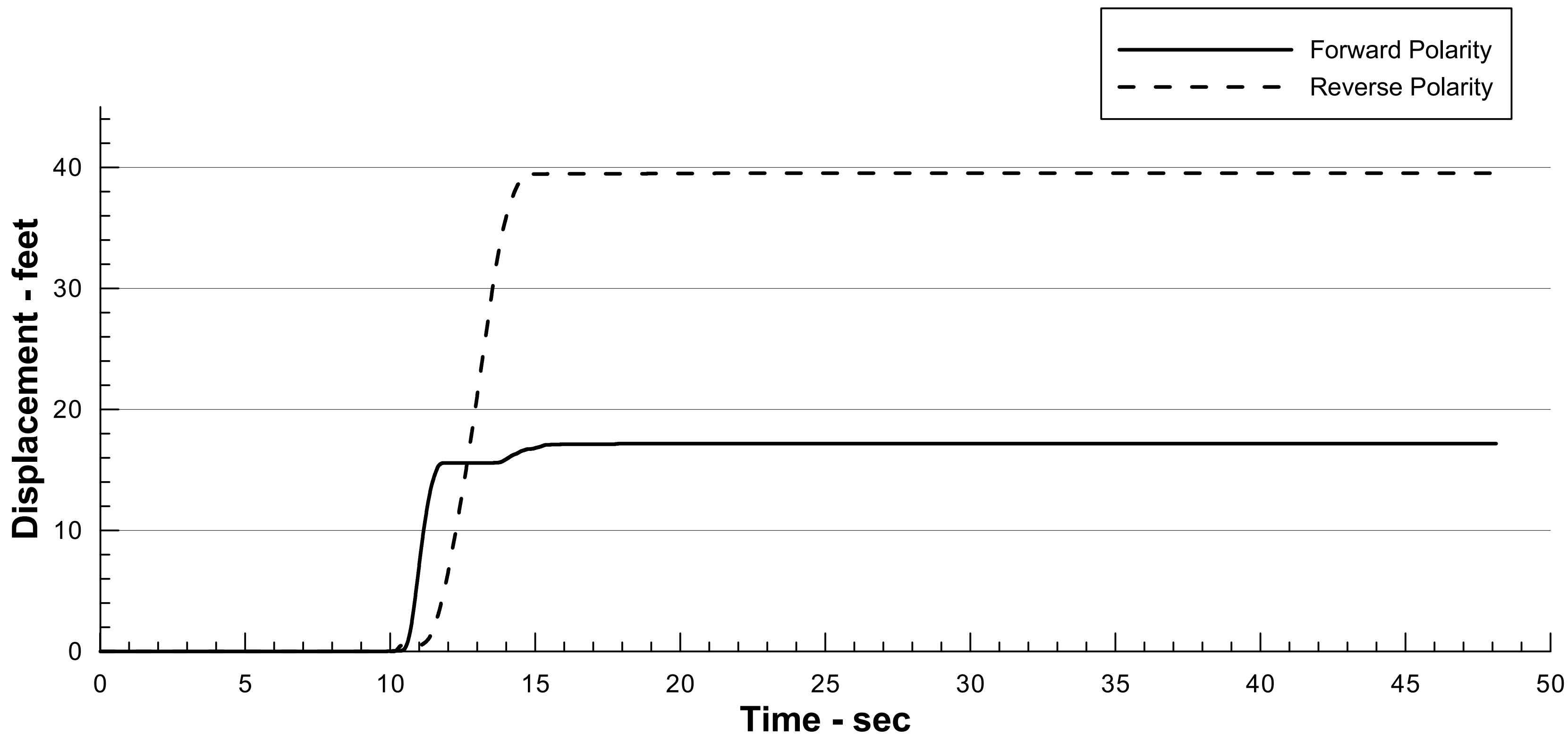
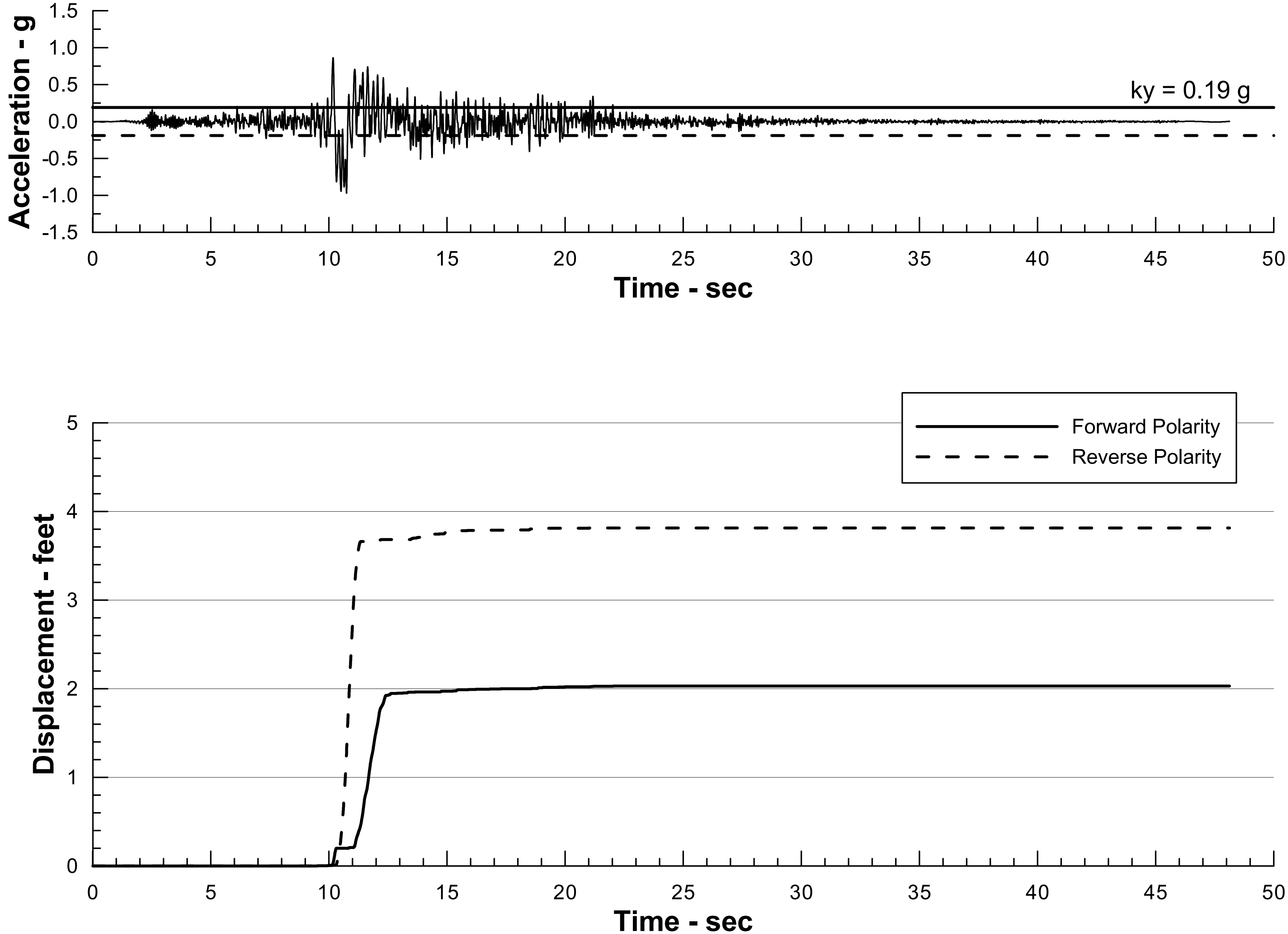




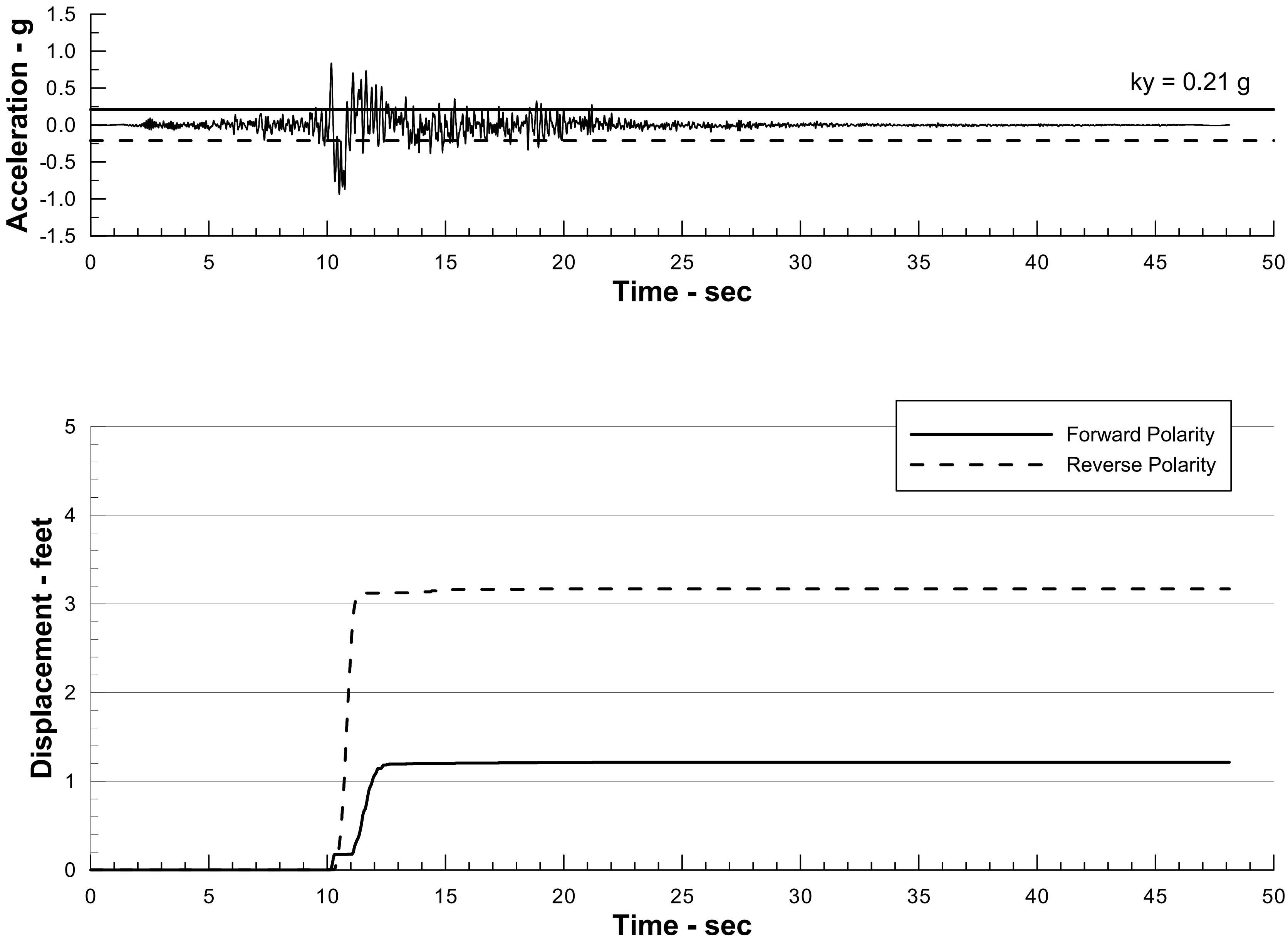
URS	Project No. 26818183 SFPUC Calaveras Dam Replacement Project	Newmark Deformation Analysis with Modified Landers Motion, Block #1, 2H:1V Design Slope Using Seismic Coefficient History from QUAD4	Figure 3-12

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\TM_Revised Drafts\Figures\Fig 3-12 OHEq1B1.grf



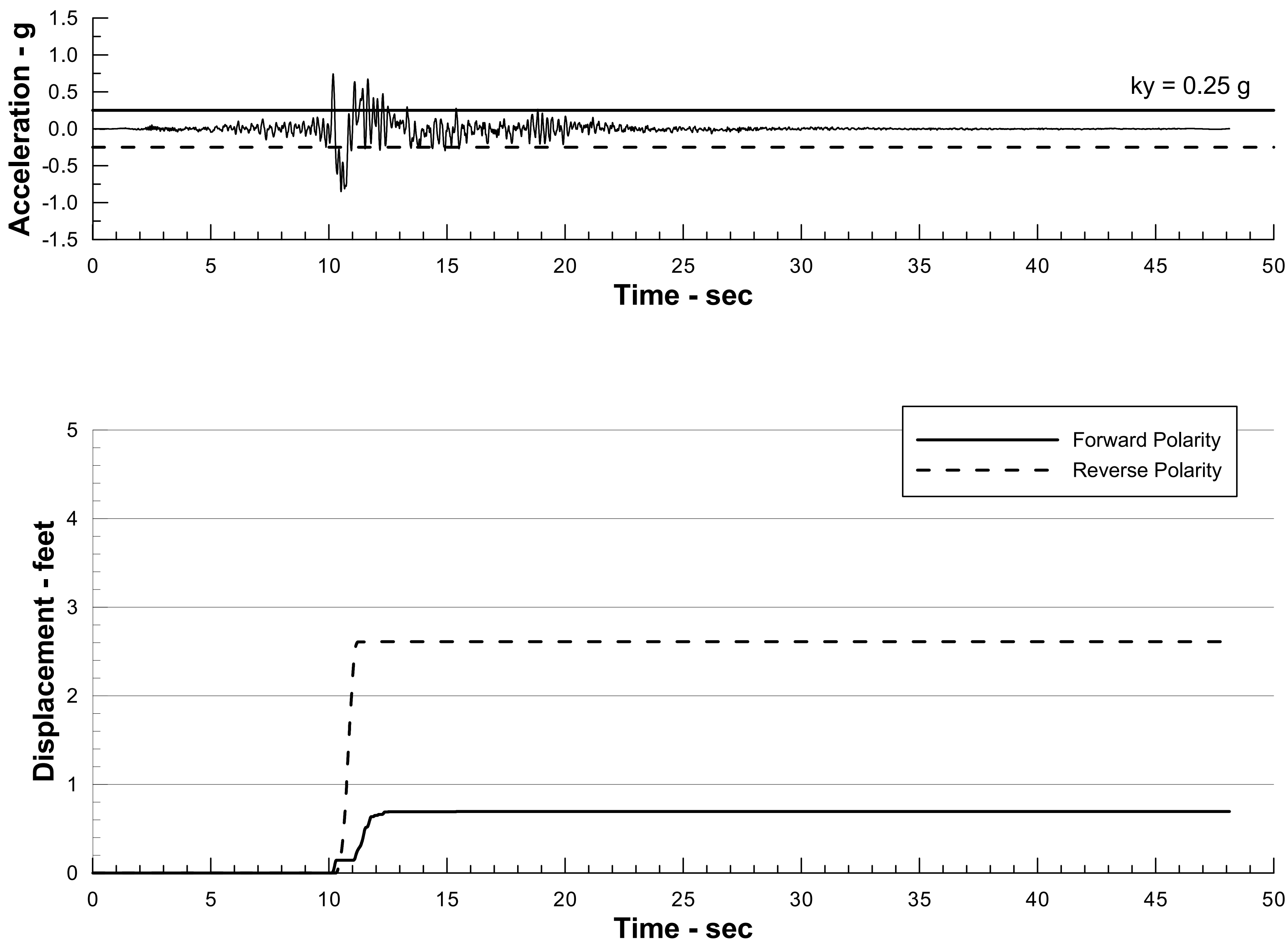
URS	Project No. 26818183 SFPUC Calaveras Dam Replacement Project	Newmark Deformation Analysis with Modified Landers Motion, Block #1, 2H:1V Design Slope	Figure 3-13

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\TM_Revised Drafts\Figures\Fig 3-13 OHEq1B1.grf

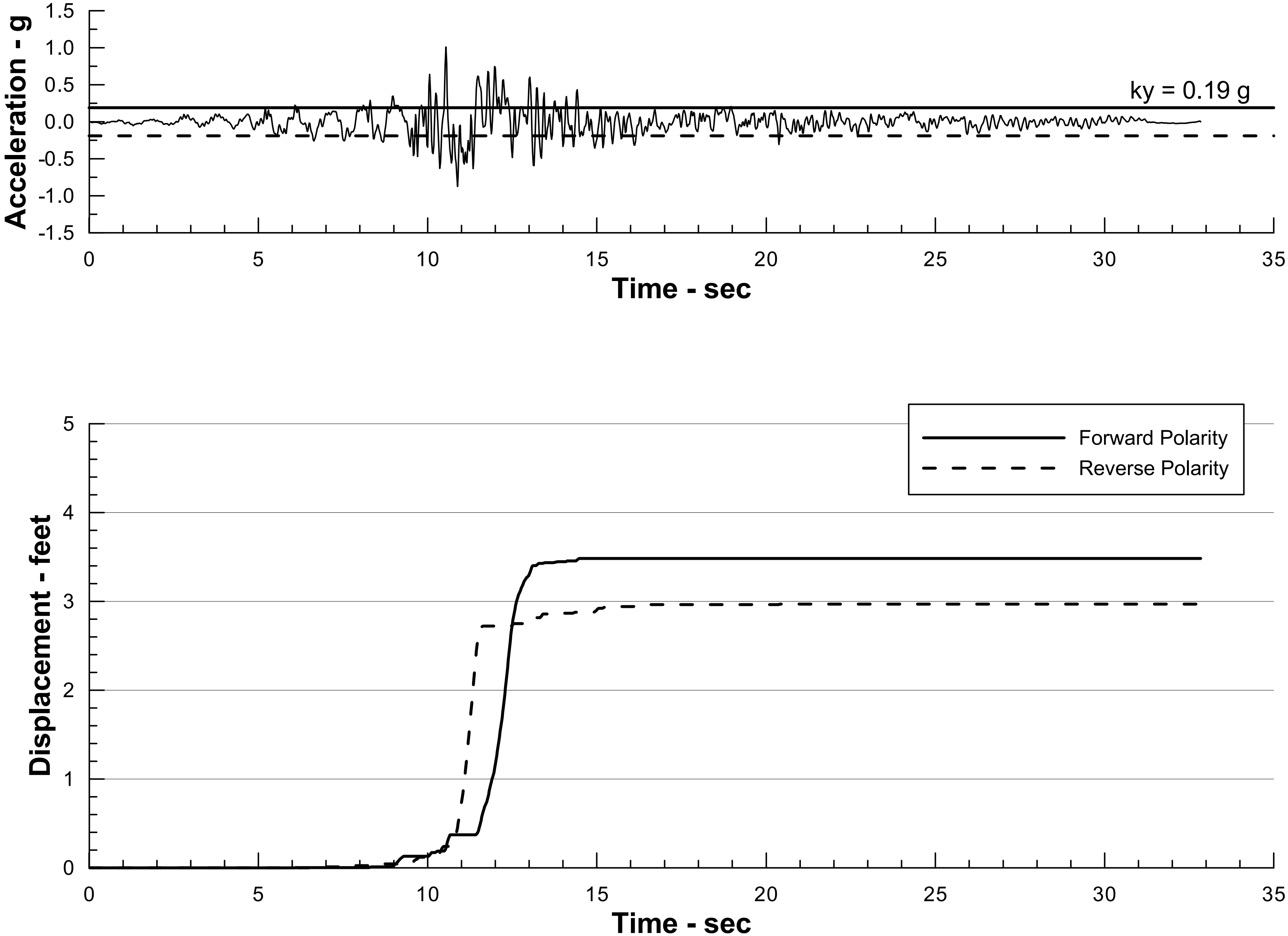


URS	Project No. 26818183 SFPUC Calaveras Dam Replacement Project	Newmark Deformation Analysis with Modified Landers Motion, Block #2, 2H:1V Design Slope	Figure 3-14

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\TM_Revised Drafts\Figures\Fig 3-14 OHEq1B2.grf

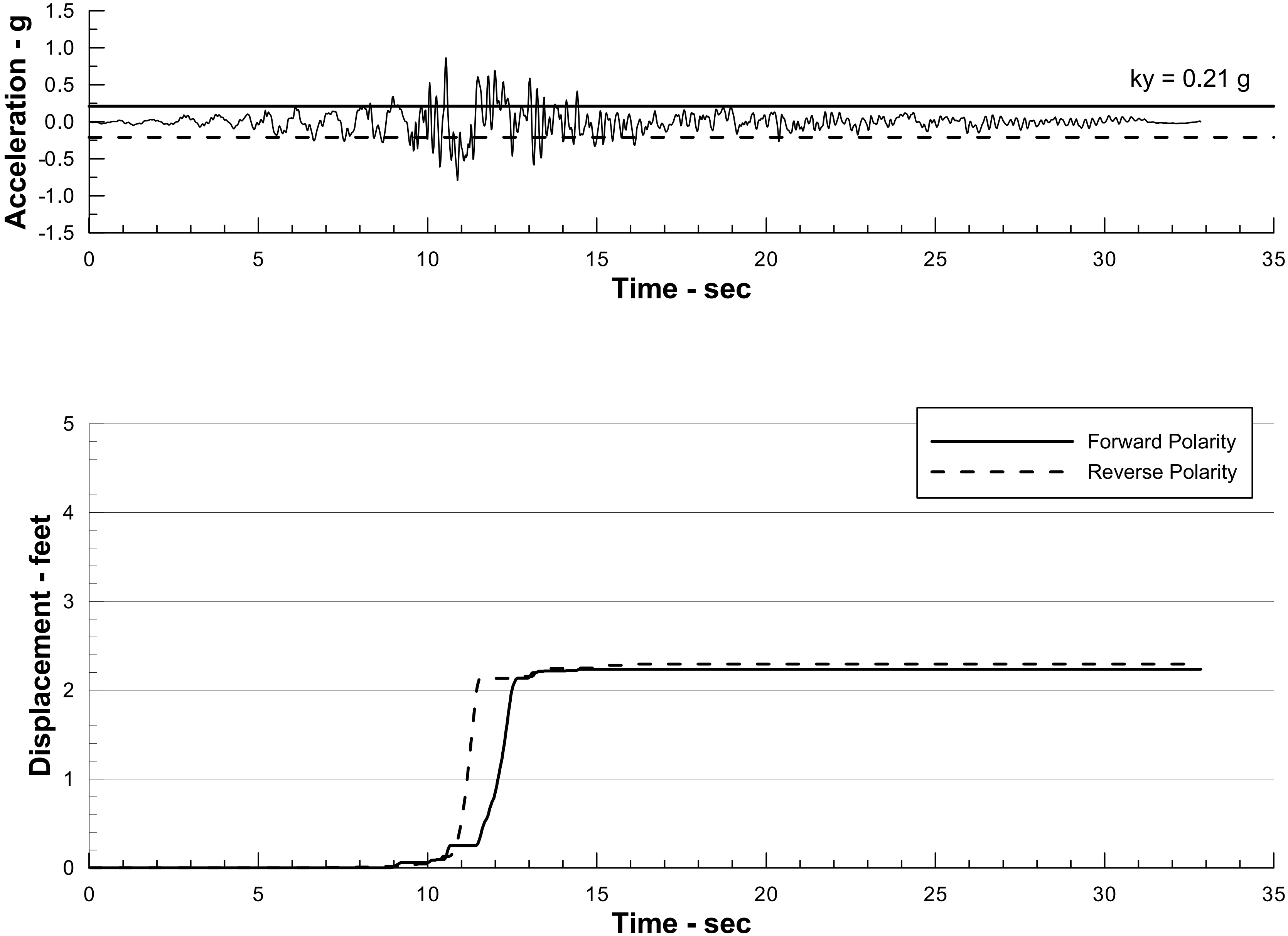


URS	Project No. 26818183 SFPUC Calaveras Dam Replacement Project	Newmark Deformation Analysis with Modified Landers Motion, Block #3, 2H:1V Design Slope	Figure 3-15



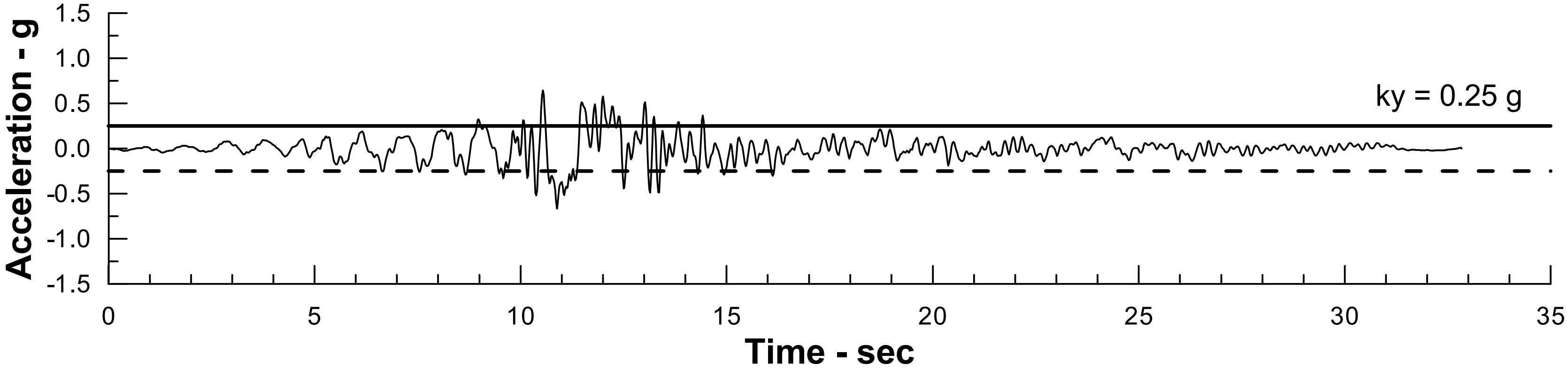
URS	Project No. 26818183 SFPUC Calaveras Dam Replacement Project	Newmark Deformation Analysis with Modified Tabas Motion, Block #1, 2H:1V Design Slope	Figure 3-16

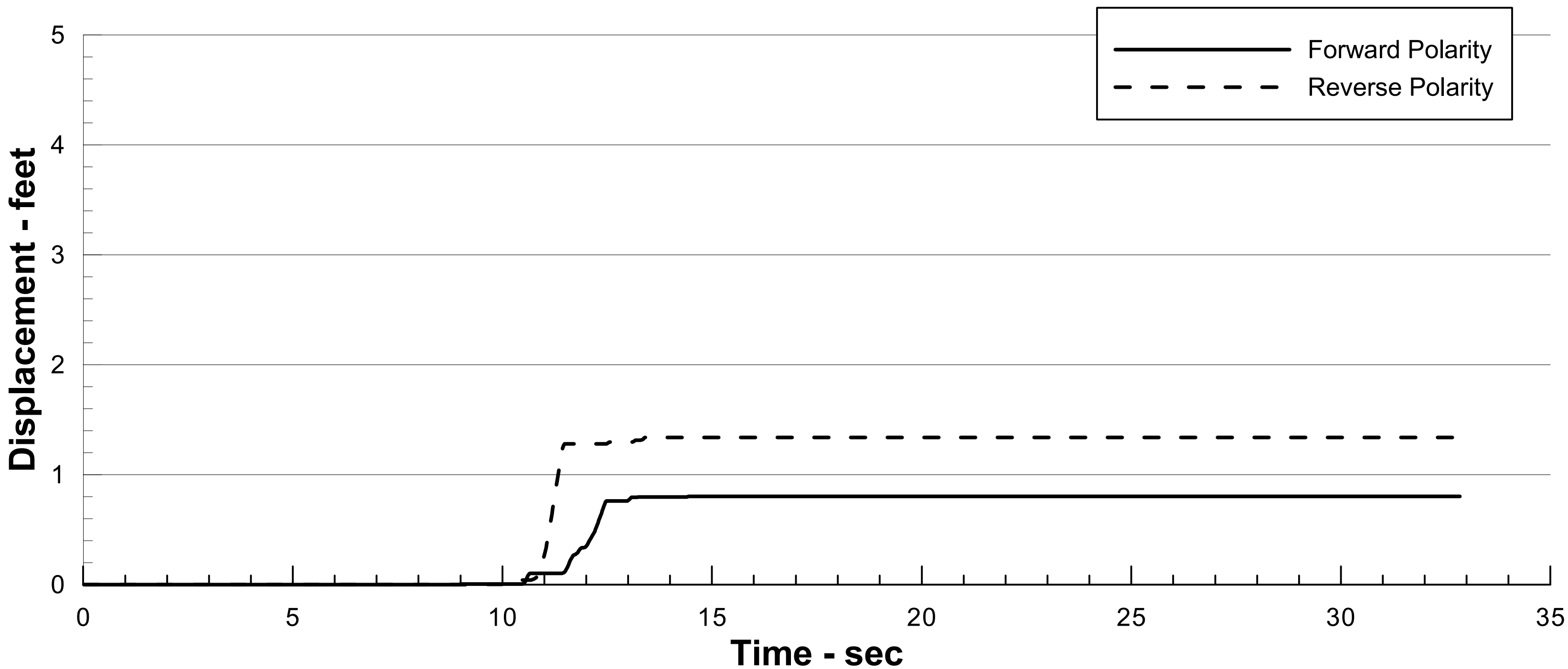
\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\TM_Revised Drafts\Figures\Fig 3-16 OHEq2B1.grf



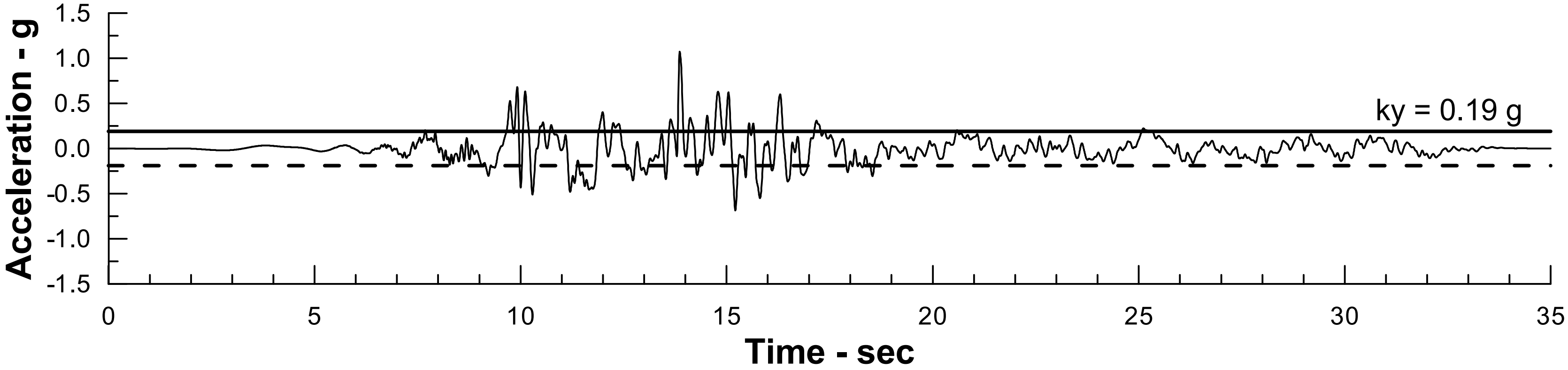
URS	Project No. 26818183	Newmark Deformation Analysis with Modified Tabas Motion, Block #2, 2H:1V Design Slope	Figure
	SFPUC Calaveras Dam Replacement Project		3-17

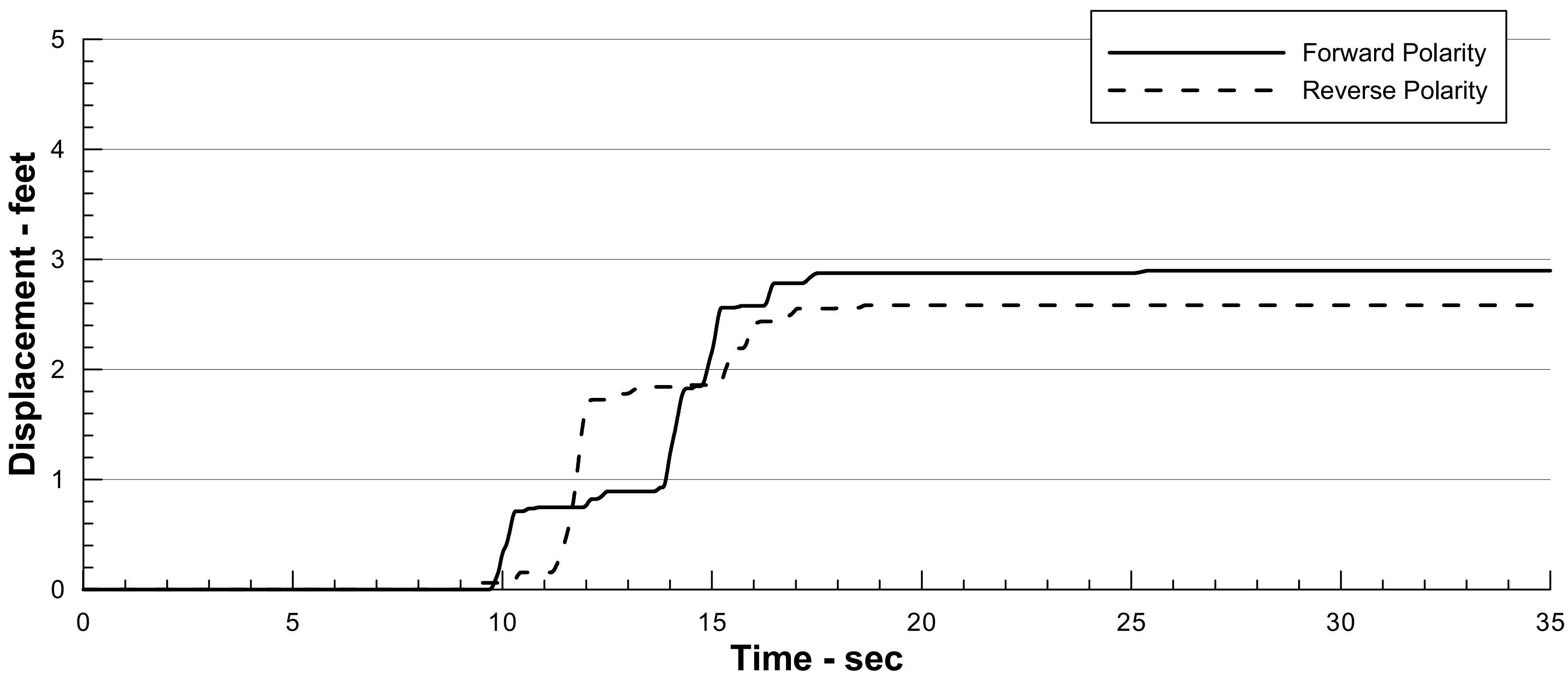
\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\TM_Revised Drafts\Figures\Fig 3-17 OHEq2B2.grf



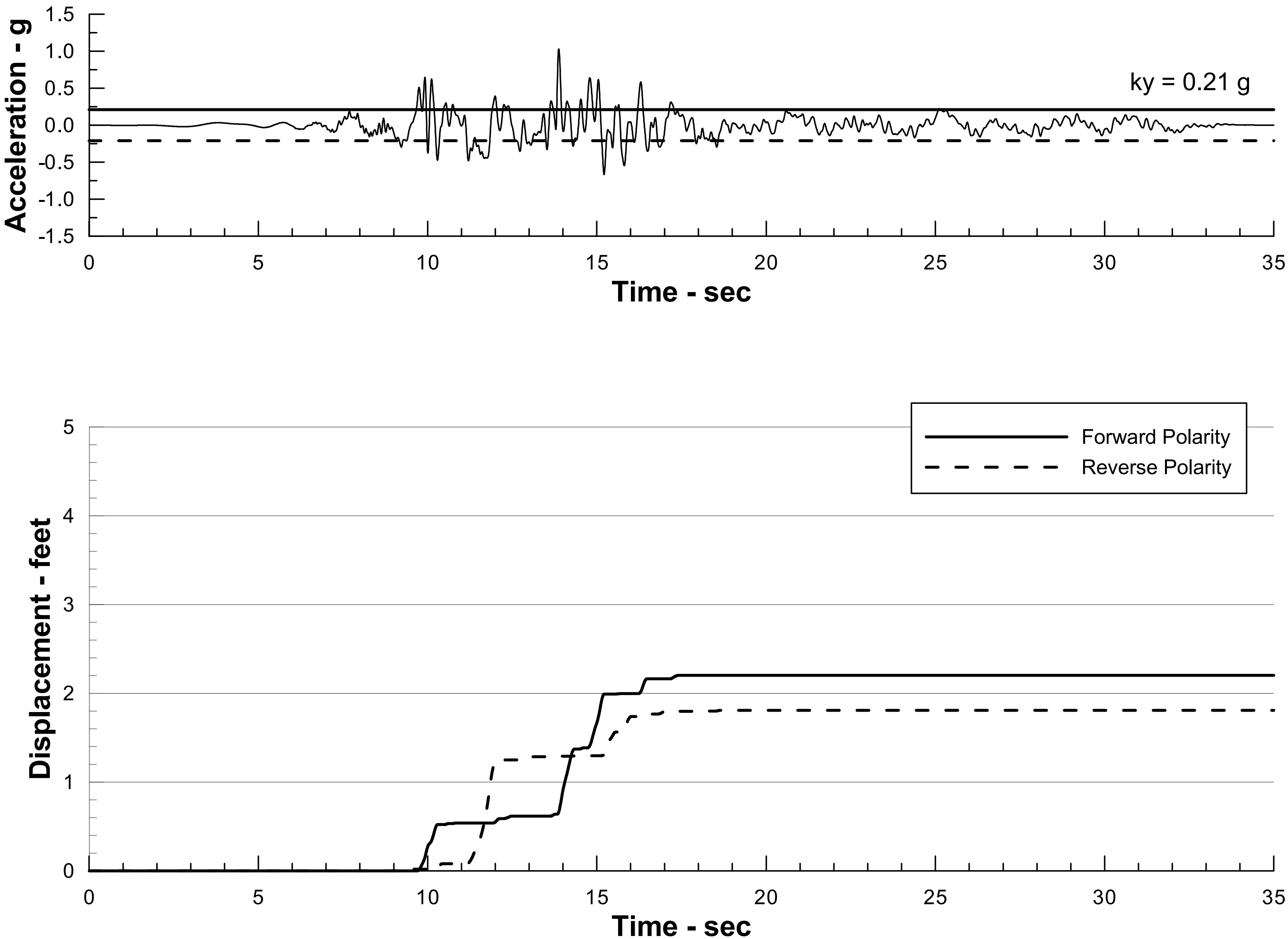


URS	Project No. 26818183 SFPUC Calaveras Dam Replacement Project	Newmark Deformation Analysis with Modified Tabas Motion, Block #3, 2H:1V Design Slope	Figure 3-18



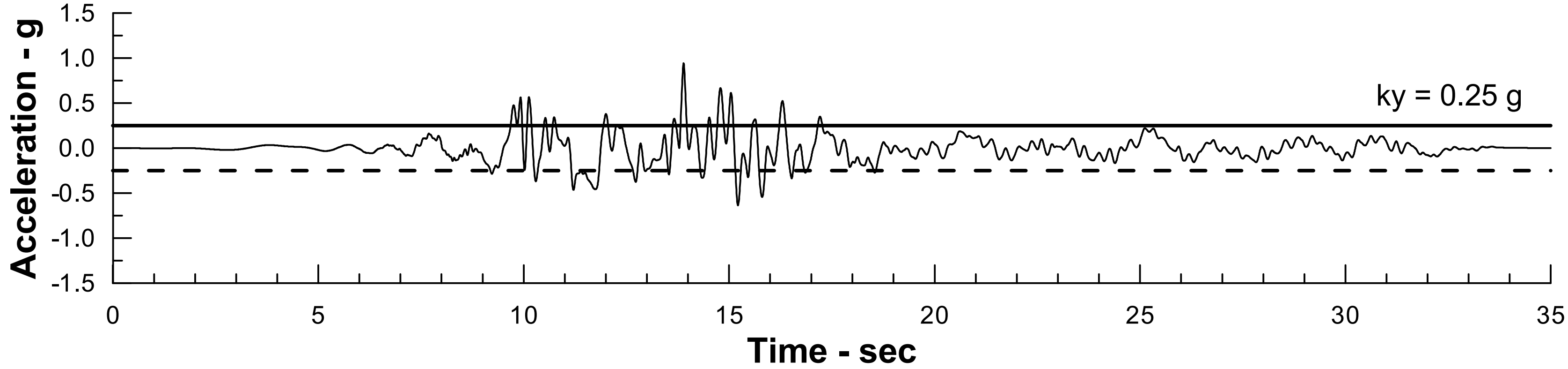


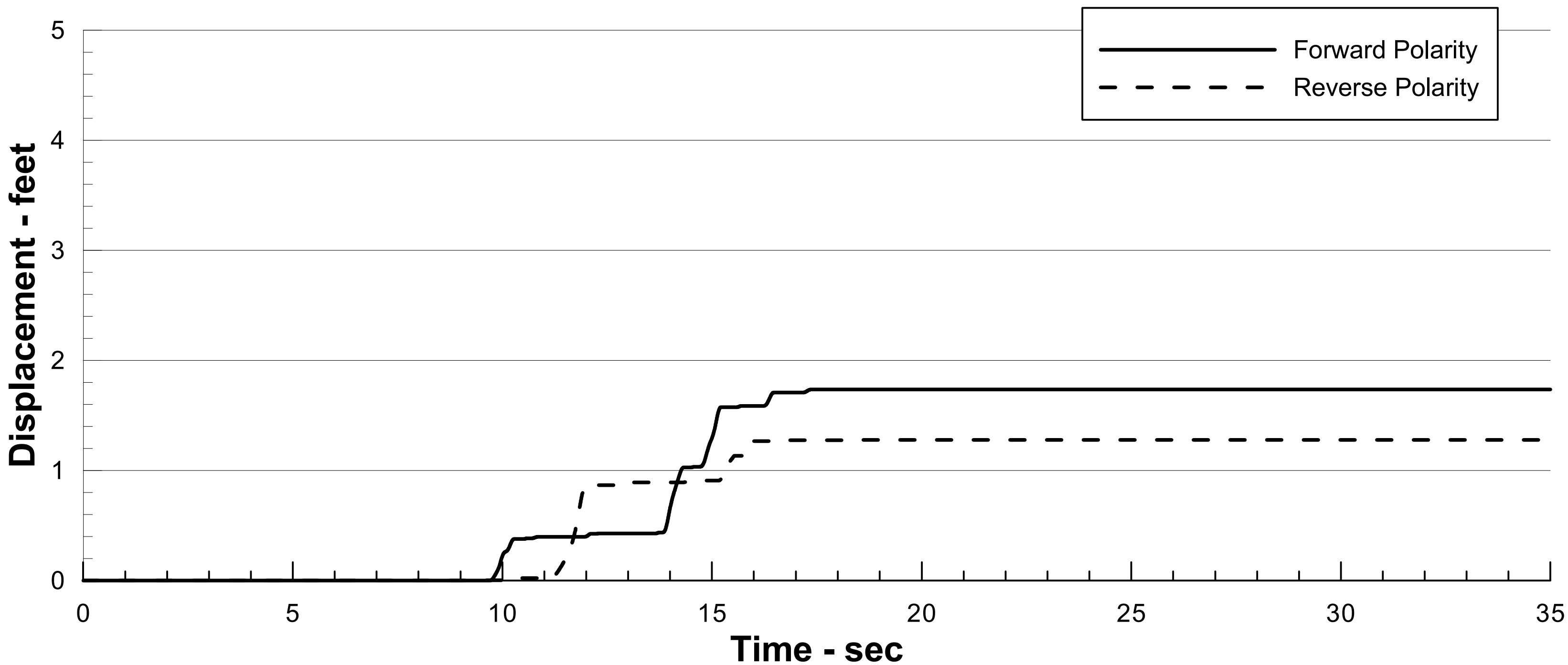
URS	Project No. 26818183	Newmark Deformation Analysis with Modified Kocaeli Motion, Block #1, 2H:1V Design Slope	Figure
	SFPUC Calaveras Dam Replacement Project		3-19



URS	Project No. 26818183 SFPUC Calaveras Dam Replacement Project	Newmark Deformation Analysis with Modified Kocaeli Motion, Block #2, 2H:1V Design Slope	Figure 3-20

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\TM_Revised Drafts\Figures\Fig 3-20 OHEq3B2.grf





URS

Project No. 26818183

SFPUC
Calaveras Dam
Replacement Project

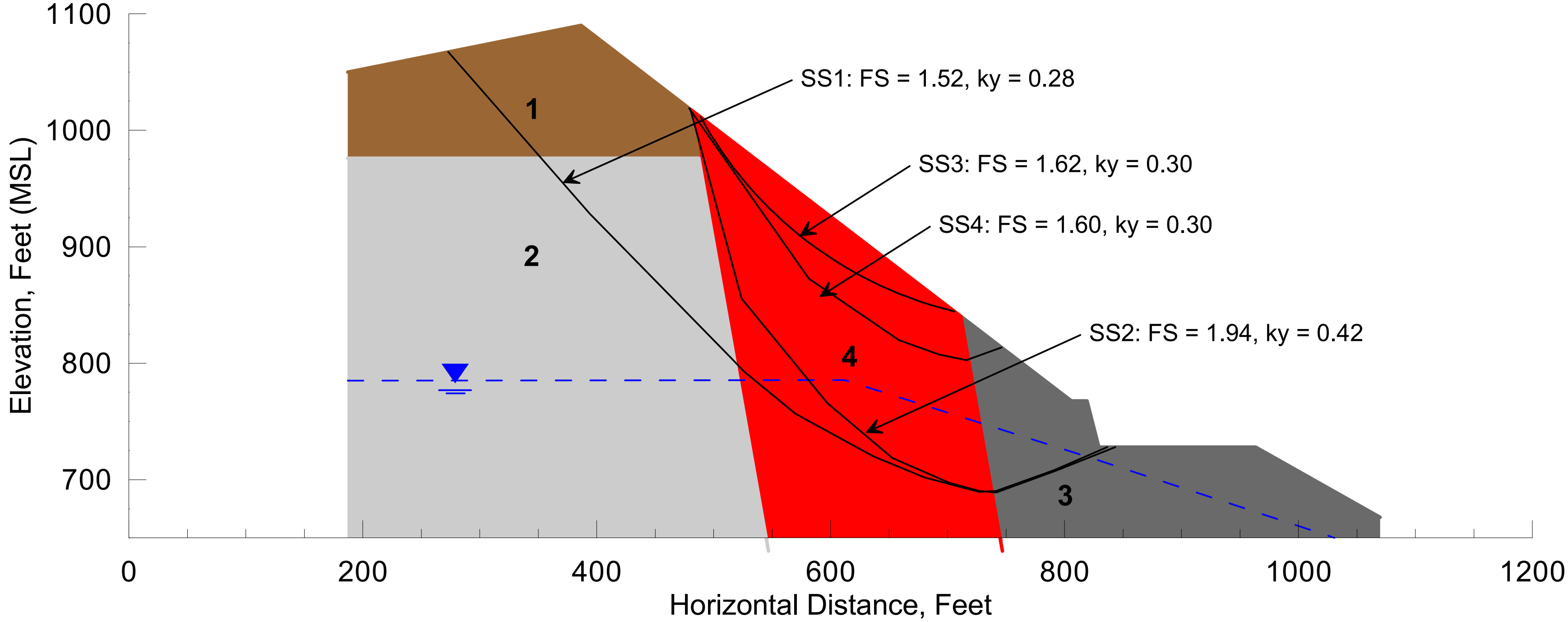
Newmark Deformation Analysis with Modified Kocaeli Motion, Block #3, 2H:1V Design Slope

Figure

3-21

Number	Material	Cohesion (psf)	Friction Angle (Degree)	Bedding		
				Dip (deg)	Cohesion (psf)	Friction Angel (Deg)
1	HW SS	3850	29	45-55	650	35
2	SW SS	7200	50	45-55	650	35
3	SW SS	7200	50	20-30	650	35
4	SFZ	1000	35	-	-	-

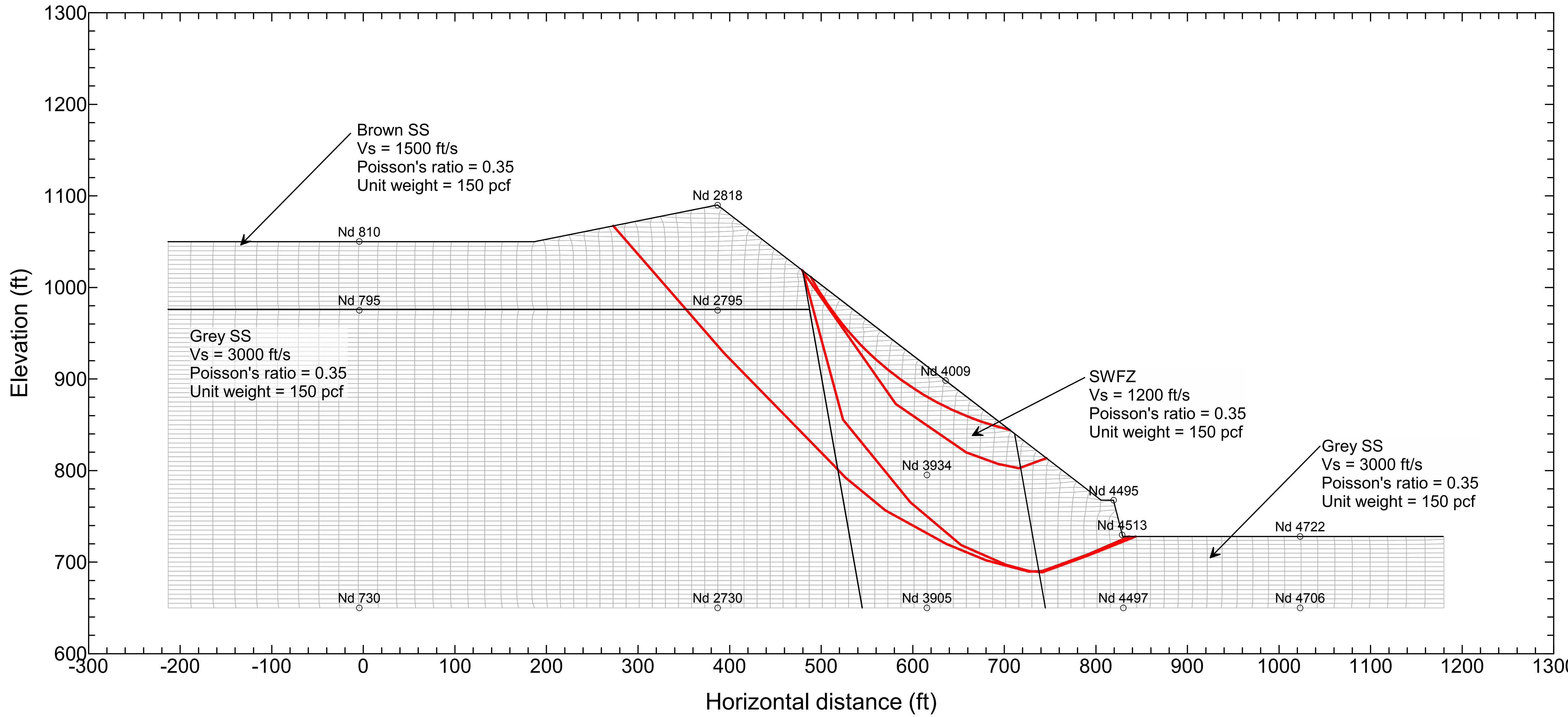
HW SS - Highly Weathered Sandstone
SW SS - Slightly Weathered Sandstone
SFZ - Spillway Fault Zone



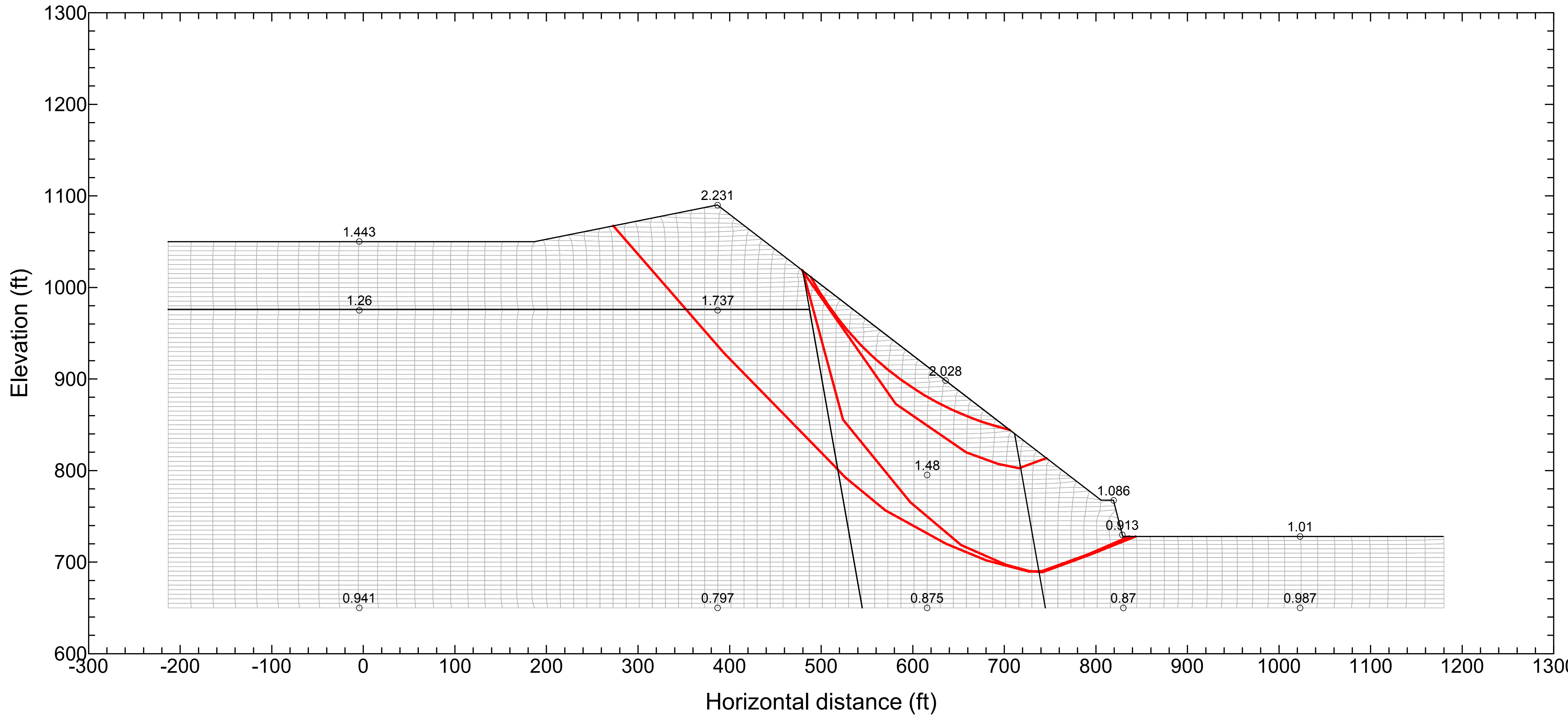
Section Location

Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Static and pseudo-static stability analysis of 1.3H:1V design slope	Figure 3-22
URS			

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\TM_Revised Drafts\Figures\Fig 3-22 Aniso 1.3V - Rev. Dip.grf



Project No. 26818183	SFPUC Calaveras Dam Replacement Project	1.3H:1V Spillway Cut Slope Model for QUAD4 Analysis	Figure 3-23
	URS		



Project No. 26818183	SFPUC Calaveras Dam Replacement Project	PGA (g) 1.3H:1V Spillway Cut Slope Modified Landers Motion	Figure 3-24
	URS		

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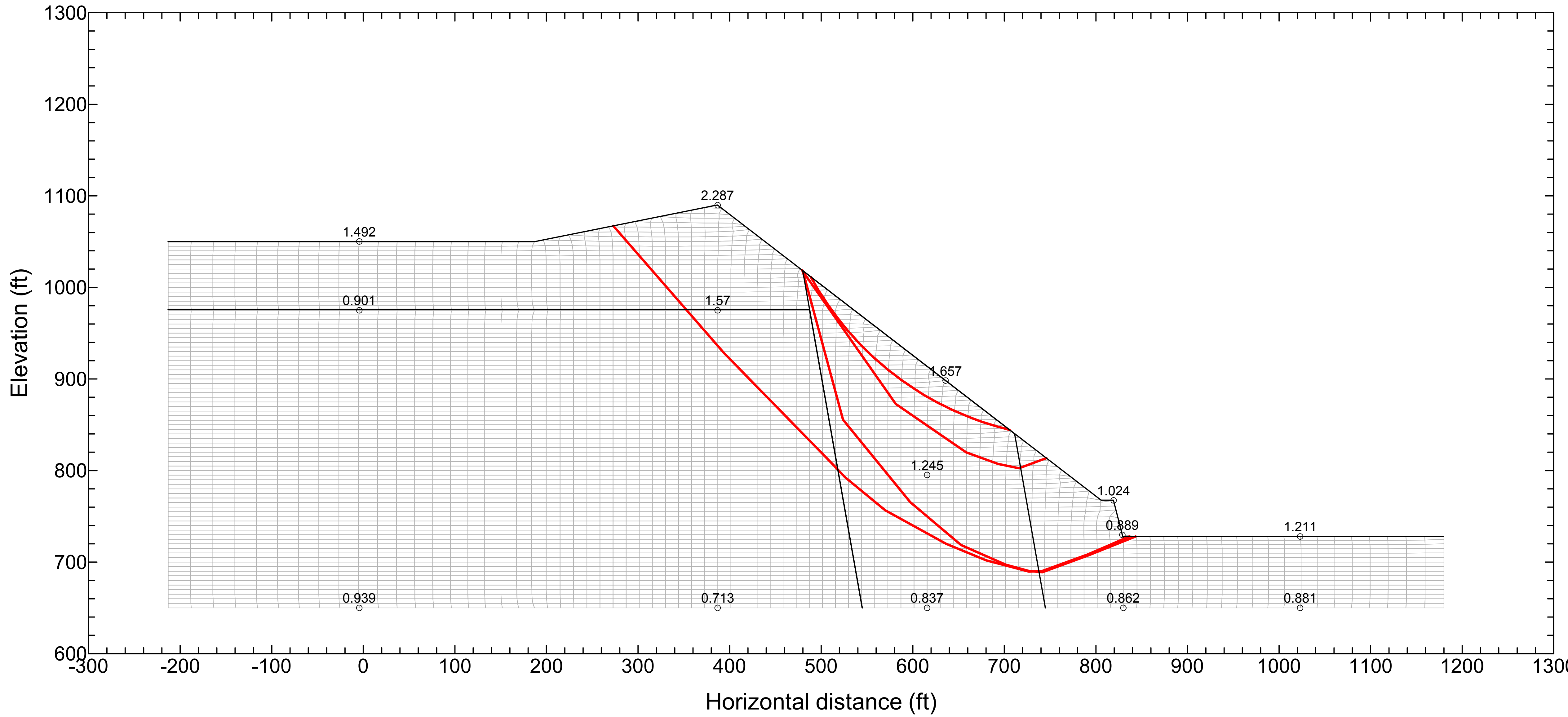
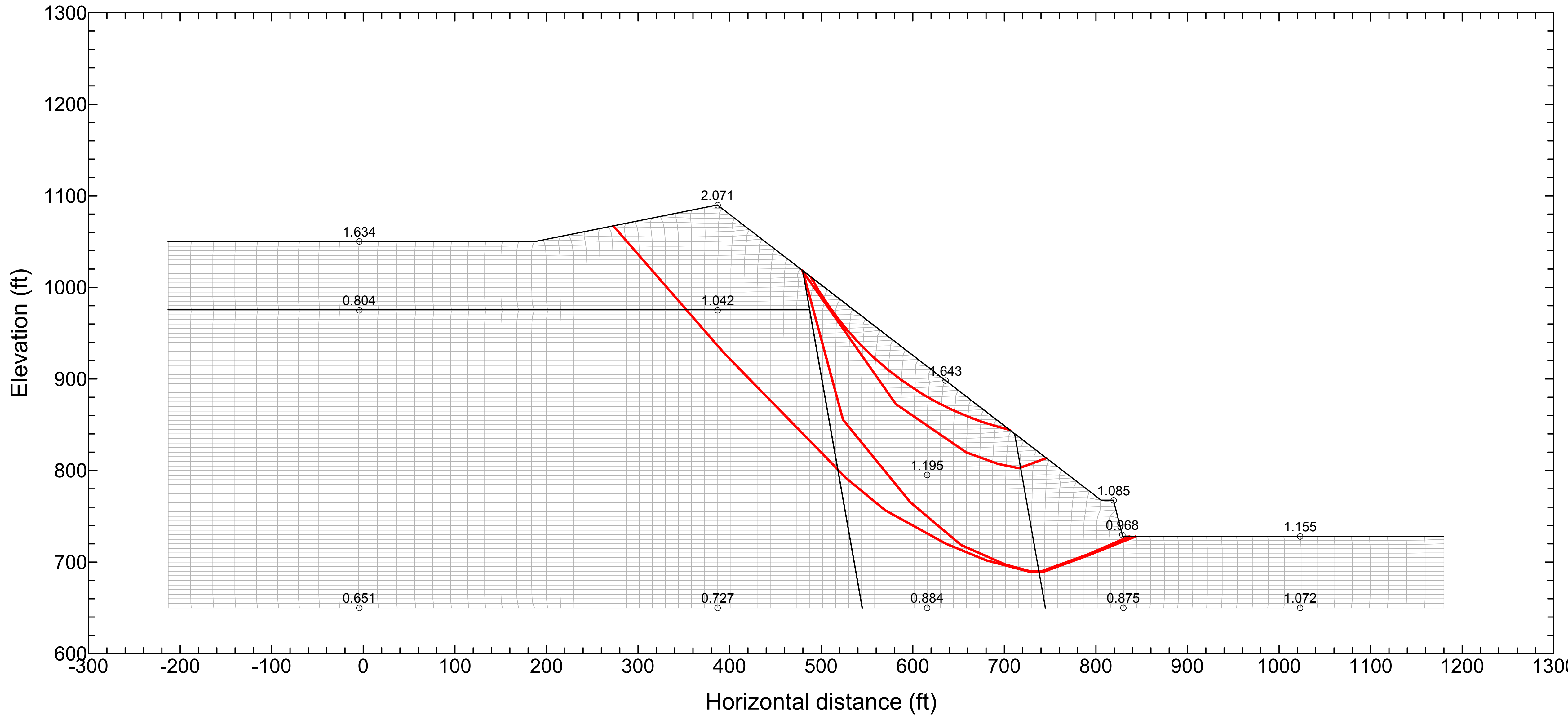
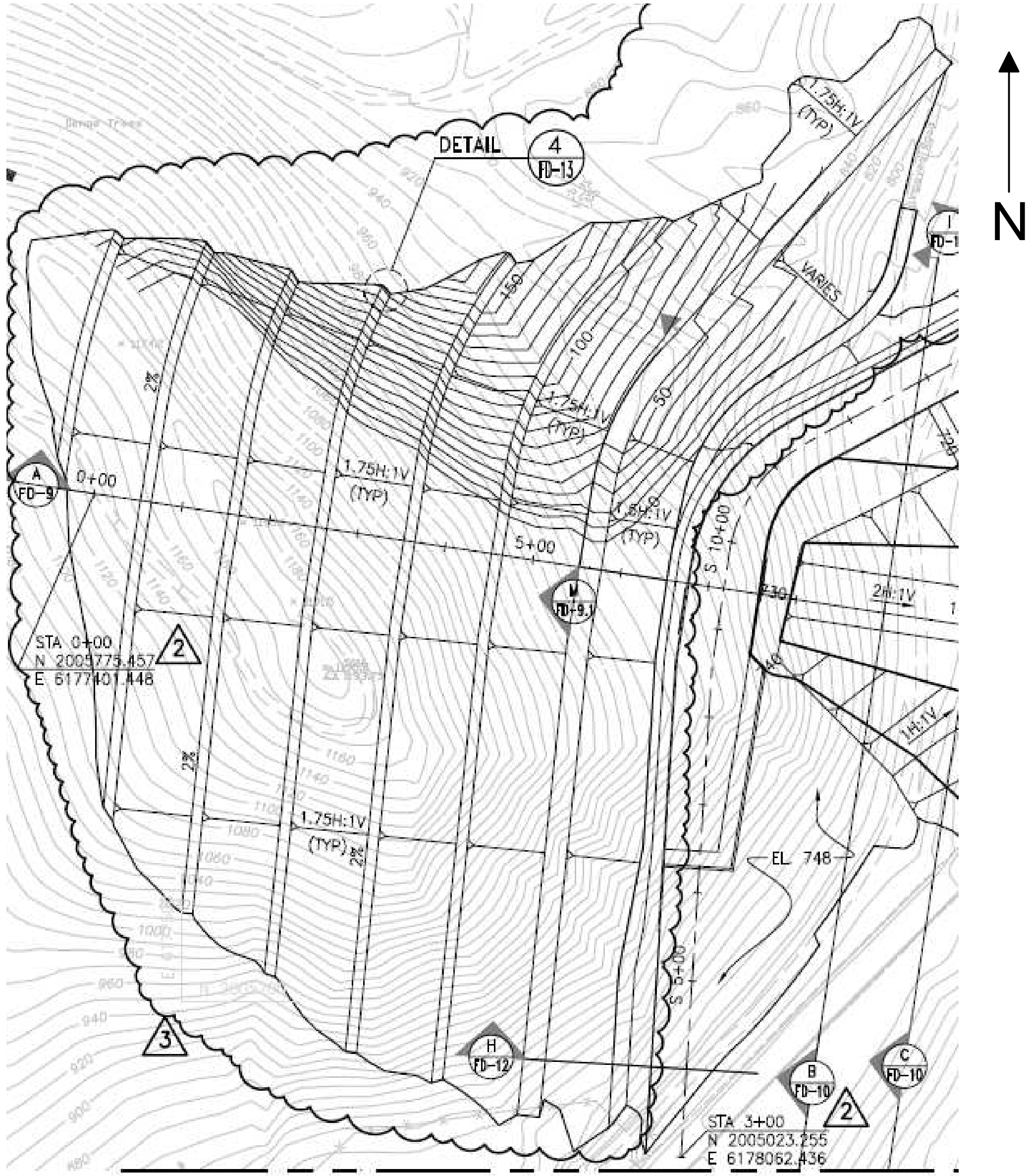


Project No. 26818183	SFPUC Calaveras Dam Replacement Project	PGA (g) 1.3H:1V Spillway Cut Slope Modified Tabas Motion	Figure 3-25
	URS		



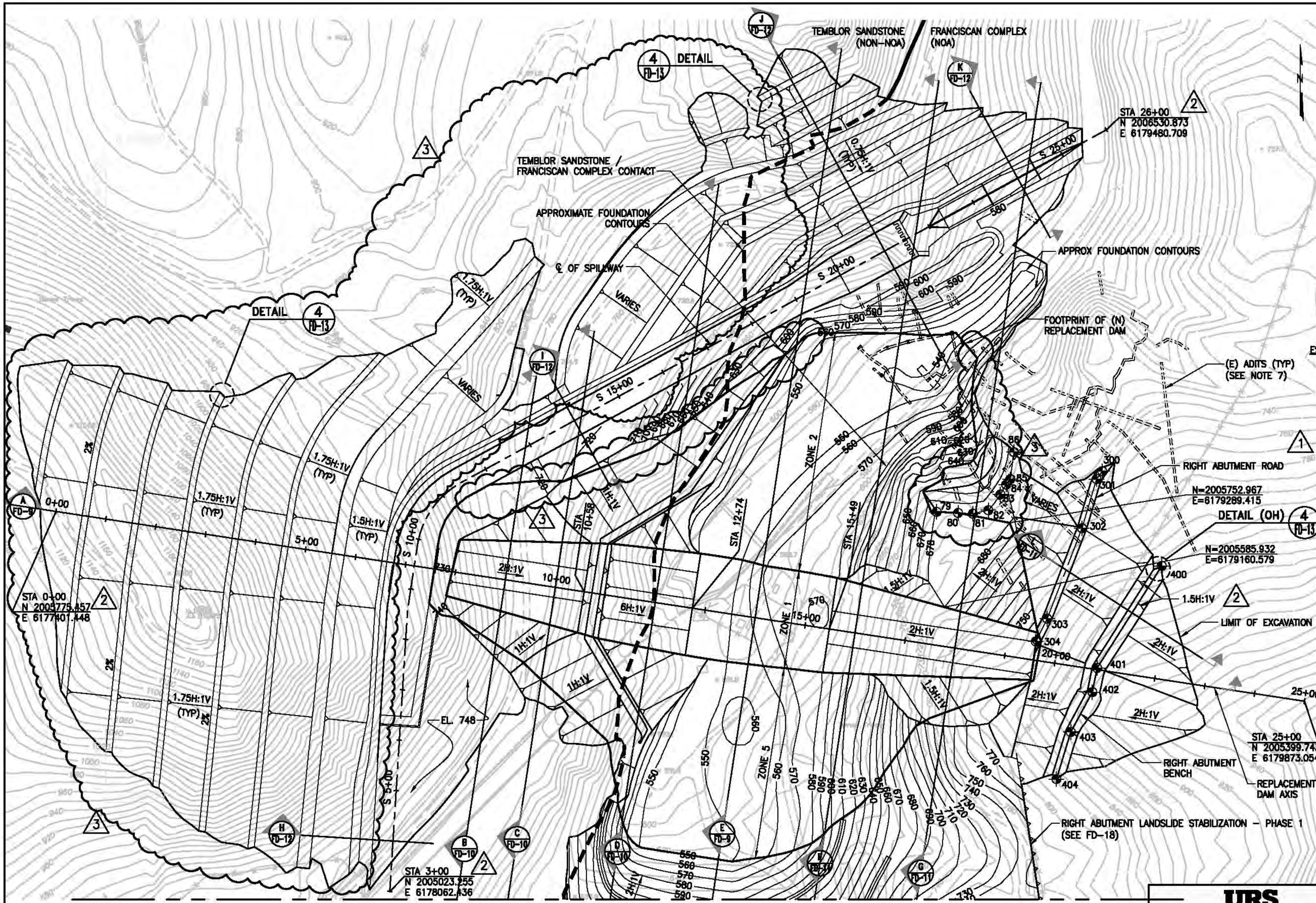
Project No. 26818183	SFPUC Calaveras Dam Replacement Project	PGA (g) 1.3H:1V Spillway Cut Slope Modified Kocaeli Motion	Figure 3-26
	URS		



Project No. 26818183	SFPUC Calaveras Dam Replacement Project	Isopachs of Slide A Remnant After Excavation of Spillway Cut Slope	Figure 4-1
	URS		

\\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\14-Engineering & Design Support\Spillway Cut Slope_Lt Abut\Memo_URS\Tech Memo_LA\Figures Sec 4\Fig 4-1 Slide A isopachs.grf

Revised Drawings



NOTES

1. DAM FOUNDATION, SPILLWAY AND LANDSLIDE EXCAVATION LIMITS AND EXCAVATION CONTOURS ARE ESTIMATED AND WILL VARY DEPENDING ON CONDITIONS ENCOUNTERED DURING CONSTRUCTION. DEEPER EXCAVATION MAY BE REQUIRED TO REMOVE UNACCEPTABLE MATERIALS.
2. ZONE 1 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 1 FOUNDATION OBJECTIVE.
3. ZONES 2 AND 5 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 2 AND 5 FOUNDATION OBJECTIVES.
4. EXCAVATE FINAL SURFACES OUTSIDE OF DAM EMBANKMENT FOOTPRINT AT 2H:1V UNLESS OTHERWISE SHOWN.
5. CLEAR AND GRUB TO NO MORE THAN 10' BEYOND THE LIMITS OF EXCAVATION.
6. FOR SPILLWAY DETAILED EXCAVATION, SEE SP DRAWINGS.
7. TREAT EXISTING ADITS AS SHOWN ON FD-6 AND FD-7.
8. FOR DETAILED BENCH GEOMETRY SEE FD-3 AND FD-4.

ESTIMATED FRANCISCAN–TEMBLOR CONTACT AT EXCAVATION GRADE

LOCATED

APPROXIMATE LOCATION

CONTROL POINTS ON BENCH

POINT	NORTHING	EASTING	ELEV.
79	2005774.582	6179144.933	678
80	2005772.517	6179187.233	678
81	2005771.098	6179216.549	678
82	2005777.950	6179247.285	678
83	2005809.161	6179271.116	678
84	2005828.544	6179282.431	678
85	2005839.144	6179290.551	678
86	2005893.011	6179297.872	678

RIGHT ABUTMENT ROAD ALIGNMENT

POINT	NORTHING	EASTING	ELEV.
300	2005855.061	6179472.722	742.620
301	2005839.474	6179461.408	742.780
302	2005742.268	6179432.539	743.480
303	2005563.238	6179363.828	766.000
304	2005518.152	6179341.059	770.350

RIGHT ABUTMENT BENCH ALIGNMENT

POINT	NORTHING	EASTING	ELEV.
400	2005667.694	6179590.520	825.053
401	2005465.589	6179462.645	830.000
402	2005417.876	6179453.153	829.024
403	2005338.963	6179410.519	827.235
404	2005245.866	6179382.066	825.432

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CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

GENERAL EXCAVATION PLAN
SHEET 1 OF 2

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

DRAWN E. HULBERT
DESIGNED V. CHIO
CHECKED J. ROADIFER/M. FORREST

REGISTERED PROFESSIONAL ENGINEER MICHAEL PAUL FORREST No. 27656 CIVIL STATE OF CALIFORNIA

NO.	DATE	DESCRIPTION	BY	APPR'D
3	02/08/13	PCO NO. 020		
2	4/17/12	PCO NO. 014	JRR	MPF
1	3/16/11	ADDENDUM NO. 5	JRR	MPF

REVISIONS

ELEVATION DATUM NGVD29

SCALE 1"=100'

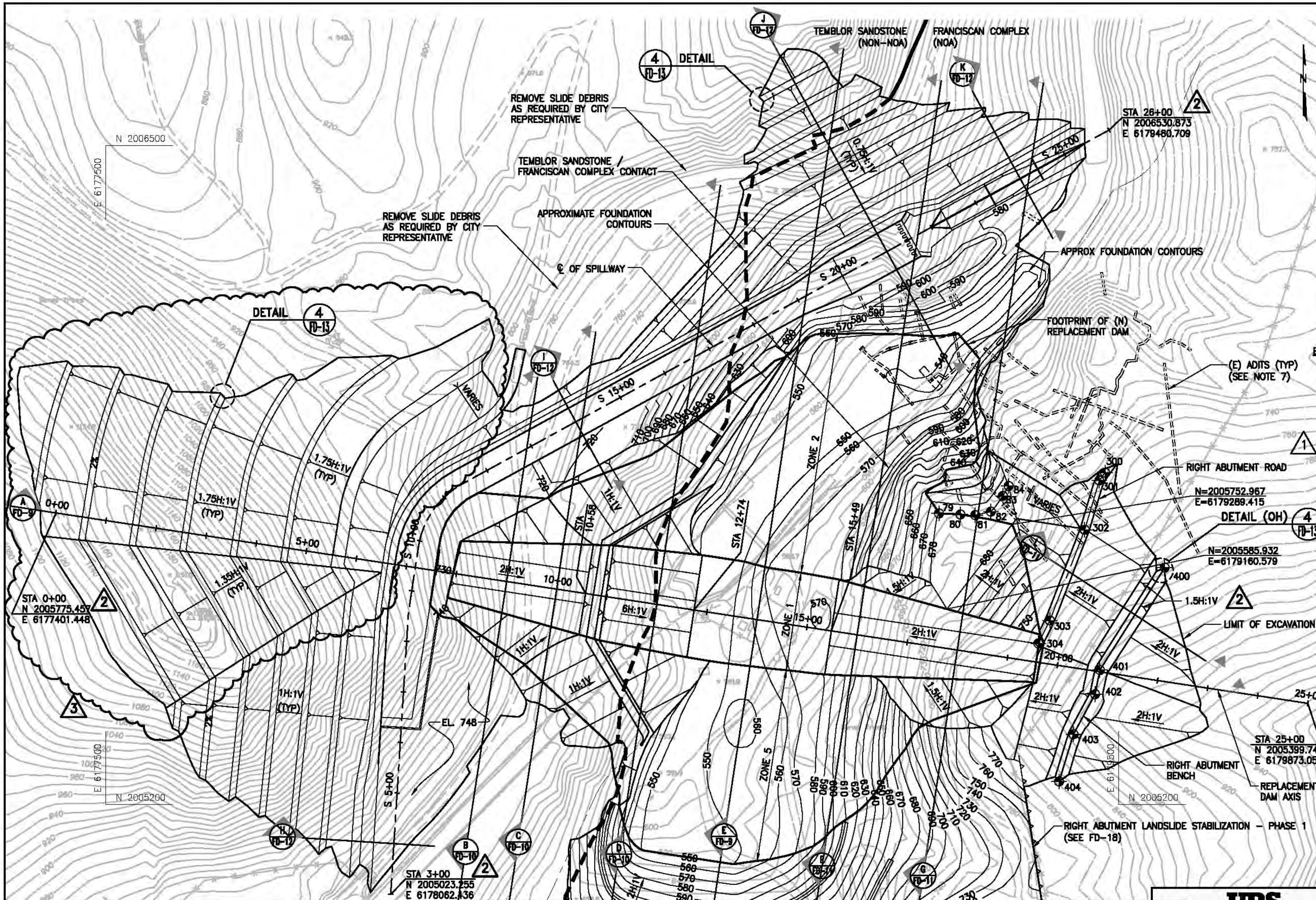
SHEET – OF | FD-1 | DRAWING NO. E-21962 | REVISION NO. 3

100' 0 100' 200'
SCALE 1"=100'

PLOT: EXTEND
SCALE: 1:1
BORDER: 22.34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM

FILE: P:\24B – CADD\Sheets\FD-1 R3.dwg Feb 22, 2013 – 11:37am

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES



NOTES

1. DAM FOUNDATION, SPILLWAY AND LANDSLIDE EXCAVATION LIMITS AND EXCAVATION CONTOURS ARE ESTIMATED AND WILL VARY DEPENDING ON CONDITIONS ENCOUNTERED DURING CONSTRUCTION. DEEPER EXCAVATION MAY BE REQUIRED TO REMOVE UNACCEPTABLE MATERIALS.
2. ZONE 1 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 1 FOUNDATION OBJECTIVE.
3. ZONES 2 AND 5 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 2 AND 5 FOUNDATION OBJECTIVES.
4. EXCAVATE FINAL SURFACES OUTSIDE OF DAM EMBANKMENT FOOTPRINT AT 2H:1V UNLESS OTHERWISE SHOWN.
5. CLEAR AND GRUB TO NO MORE THAN 10' BEYOND THE LIMITS OF EXCAVATION.
6. FOR SPILLWAY DETAILED EXCAVATION, SEE SP DRAWINGS.
7. TREAT EXISTING ADITS AS SHOWN ON FD-6 AND FD-7.
8. FOR DETAILED BENCH GEOMETRY SEE FD-3 AND FD-4.

ESTIMATED FRANCISCAN-TEMBLOR CONTACT AT EXCAVATION GRADE

—— LOCATED

– – – APPROXIMATE LOCATION

CONTROL POINTS ON BENCH

POINT	COORDINATE		
	NORTHING	EASTING	ELEV.
79	2005774.582	6179144.933	678
80	2005772.517	6179187.233	678
81	2005771.098	6179216.549	678
82	2005777.950	6179247.285	678
83	2005809.161	6179271.116	678
84	2005828.544	6179282.431	678

RIGHT ABUTMENT ROAD ALIGNMENT

POINT	COORDINATE		
	NORTHING	EASTING	ELEV.
300	2005855.061	6179472.722	742.620
301	2005839.474	6179461.408	742.780
302	2005742.268	6179432.539	743.480
303	2005563.238	6179363.828	766.000
304	2005518.152	6179341.059	770.350

RIGHT ABUTMENT BENCH ALIGNMENT

POINT	COORDINATE		
	NORTHING	EASTING	ELEV.
400	2005667.694	6179590.520	825.053
401	2005465.589	6179462.645	830.000
402	2005417.876	6179453.153	829.024
403	2005338.963	6179410.519	827.235
404	2005245.866	6179382.066	825.432

PLOT: EXTEND
SCALE: 1:1
BORDER: 22,34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM

100' 0 100' 200'
SCALE 1"=100'

ELEVATION DATUM NGVD29

REGISTERED PROFESSIONAL ENGINEER MICHAEL PAUL FORREST No. 27855 CIVIL STATE OF CALIFORNIA

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

XXXXXX	DRAWN E. HULBERT
XXX	DESIGNED V. CHIO
XXX XXXX	CHECKED J. ROADIFER/M. FORREST

CIVIL | ELECT. | MECH. | PIPING | GEOTECH.

NO.	DATE	DESCRIPTION	BY	APPR'D
3	9/17/12	LEFT ABUTMENT UPDATES		
2	4/17/12	PCO NO. 014	JWR	MPF
1	3/16/11	ADDENDUM NO. 5	JWR	MPF

REVISIONS

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

GENERAL EXCAVATION PLAN SHEET 1 OF 2

CHECKED / APPROVED | DRAWN | SCALE 1"=100'
SECTION MANAGER | DESIGNED | DATE
APPROVED MANAGER, ENGINEERING MANAGEMENT BUREAU | APPROVED MANAGER, WATER SUPPLY AND TREATMENT DIVISION

SHEET	PLAN NO.	DRAWING NO.	REVISION NO.
– OF	FD-1A	E-21962	3

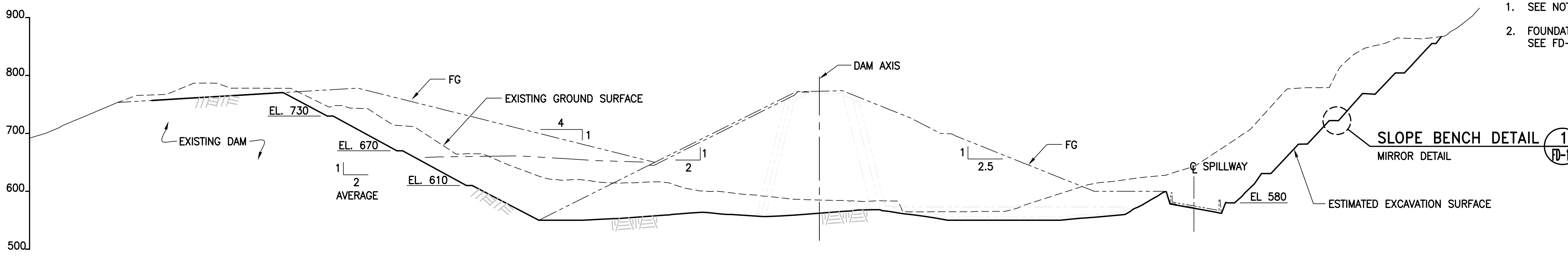
ARCH. | CIVIL | ELECT. | MECH | PIPING | STRUC. | OTHERS

FILE: \\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\24B - CADD\Working\Steve T\Foundation Excavation FD-1\FD-1 R3 (half layback).dwg Dec 19, 2012 FOR REVISED PLANS ORIGINAL SCALE IS IN INCHES

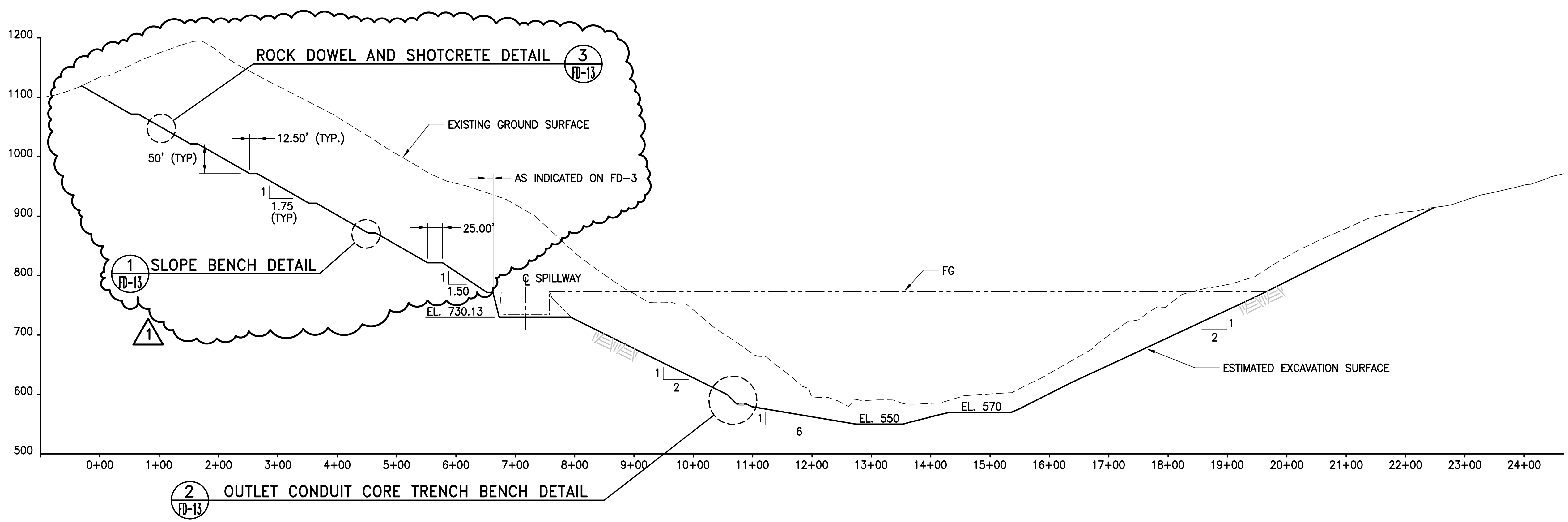
0 1 4

NOTES

1. SEE NOTES ON FD-1
2. FOUNDATION GROUT CURTAIN NOT SHOWN. SEE FD-15 AND FD-16 FOR LOCATION.



SECTION AT STATION 14+00 (E / FD-1, FD-2)
SCALE 1"=100'



PROFILE THROUGH DAM AXIS (A / FD-1)
SCALE 1"=100'

100' 0 100' 200'
SCALE 1"=100'

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CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

DAM FOUNDATION EXCAVATION SECTIONS
SHEET 1 OF 3

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

DRAWN: E. HULBERT
DESIGNED: V. CHIO
CHECKED: J. ROADIFER/M. FORREST

REGISTERED PROFESSIONAL ENGINEER MICHAEL PAUL FORREST No. 27855 CIVIL STATE OF CALIFORNIA

ELEVATION DATUM NGVD29

NO.	DATE	DESCRIPTION	BY	APPR'D
1	10/4/12	PCO NO. 020		

REVISIONS

CHECKED / APPROVED — SECTION MANAGER — APPROVED — MANAGER, ENGINEERING MANAGEMENT BUREAU
DRAWN — DESIGNED — APPROVED — MANAGER, WATER SUPPLY AND TREATMENT DIVISION
SCALE 1"=100' — DATE

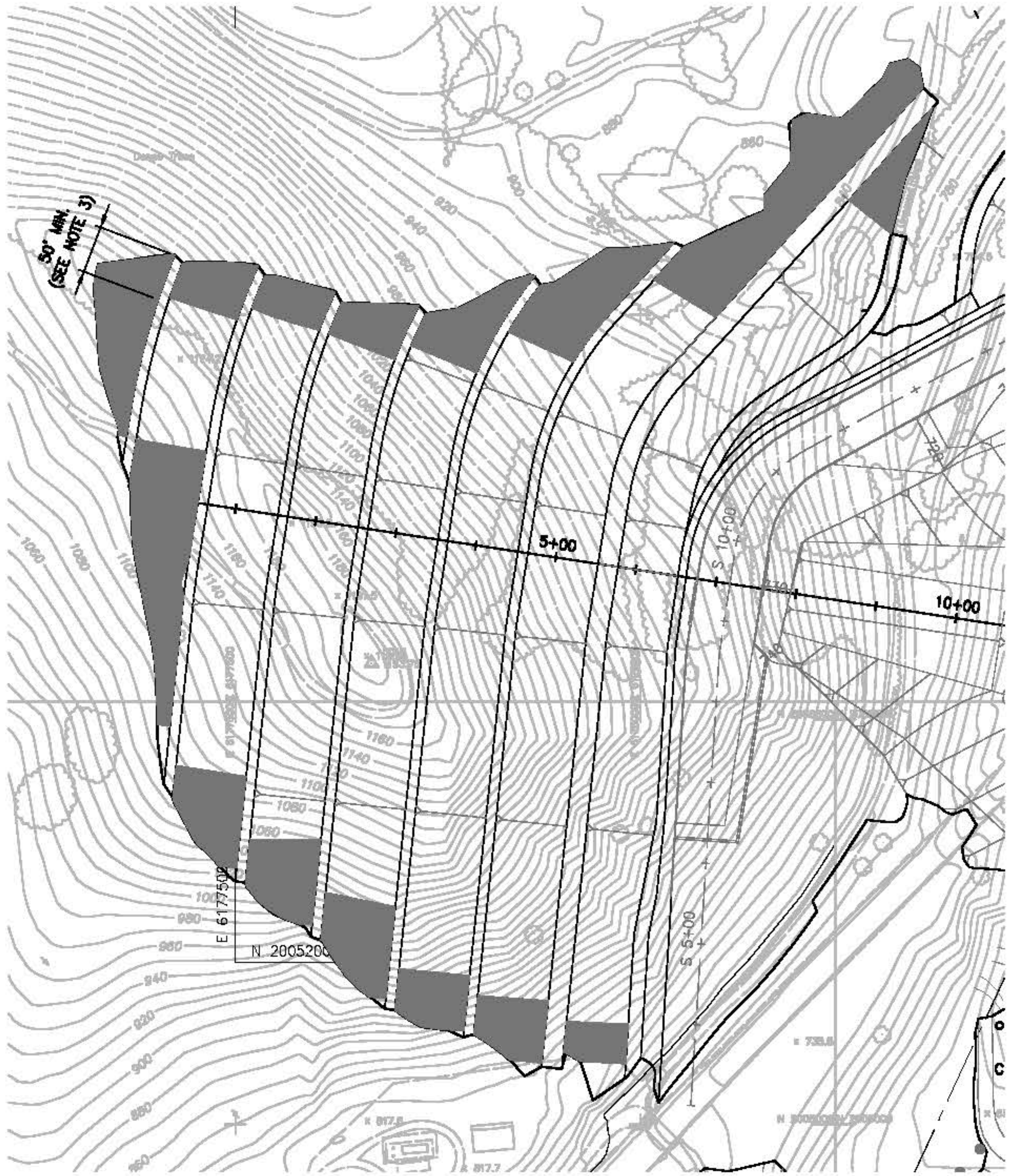
SHEET	PLAN NO.	DRAWING NO.	REVISION NO.
— OF	FD-9	E-21970	1

ARCH. CIVIL ELECT. MECH PIPING STRUC. OTHERS

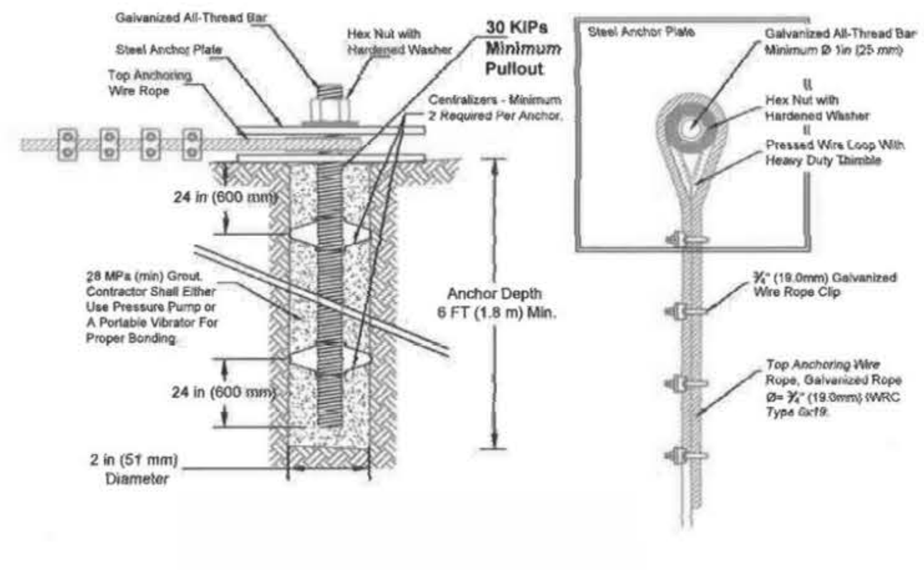
PLOT: EXTEND
SCALE: 1:1
BORDER: 22,34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM

FILE: P:\24B\Sheets\Shts\FD-9 R1.dwg Oct 04, 2012 - 3:58pm

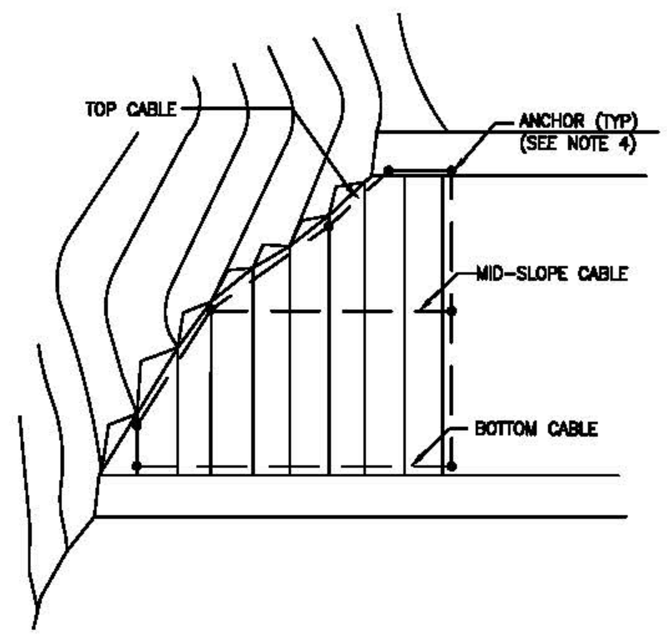
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 4



PLAN
SCALE: 1"=100'



ROCK NETTING ANCHOR DETAIL (TYP.)
NTS



TYPICAL NETTING PLAN
NTS

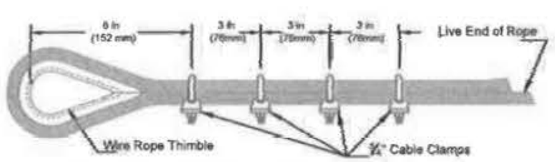
NOTES

1. ROCK NETTING SHALL BE MACCAFERRI ROCK MESH 4000 – OR SIMILAR.
2. ROCK NETTING SHALL BE GALVANIZED.
3. ROCK NETTING SHALL EXTEND BEYOND THE LIMIT OF THE EXCAVATION, AS NEEDED.
4. ANCHORS TO SUPPORT THE ROCK NETTING SHALL BE PLACED AS FOLLOWS:

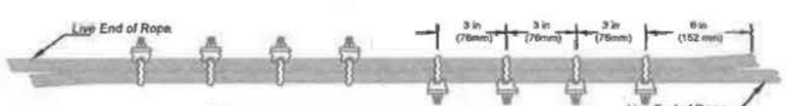
   TOP OF SLOPE (BENCH) – 1 INCH THREADED BAR IN A 4 INCH HOLE, 6 FEET LONG IN ROCK, 9 FEET LONG IN SOIL, EVERY 30 FEET (MAX).

   MID-SLOPE 1 INCH THREADED BAR IN A 4 INCH HOLE, 6 FEET LONG EVERY 30 FEET (MAX)

   BOTTOM OF SLOPE (BENCH) – 1 INCH THREADED BAR IN A 4 INCH HOLE, 6 FEET LONG EVERY 60 FEET (MAX).
5. CONNECTION BETWEEN ANCHOR AND NETTING SHALL BE AS PER NETTING MANUFACTURER RECOMMENDATIONS SHOWN AS DETAILS ON SHEETS FD-9.2 THROUGH FD-9.3.
6. ANCHORS SHALL HAVE A MINIMUM PULLOUT STRENGTH OF 30 kips (111 kN). ANCHORS SHALL BE PROOF TESTED AFTER THE GROUT HAS ACHIEVED SPECIFIED COMPRESSIVE STRENGTHS (TYPICALLY 72 HOURS CURE TIME). FIVE PERCENT OF THE TOTAL NUMBER OF ANCHORS SHALL BE PROOF TESTED BY THE CONTRACTOR IN THE PRESENCE OF CITY REPRESENTATIVE AT LOCATIONS OF THE CITY REPRESENTATIVES CHOOSING. IF AN ANCHOR FAILS, ALL OTHER ANCHORS GROUTED AT THE SAME TIME (SIMILAR GROUT MIX CONDITION) SHALL BE TESTED. IF ALL THE ANCHORS WERE GROUTED AT THE SAME TIME AND AN ANCHOR FAILS, THEN ALL THE ANCHORS SHALL BE TESTED. FAILED ANCHORS SHALL BE REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE CITY.
7. GROUT MIX SHALL BE PER SPECIFICATION SECTION 02388 2.01G
8. ACTUAL LOCATIONS FOR REQUIRED NETTING AND ANCHORS SHALL BE DETERMINED BY CITY REPRESENTATIVE.



Detail B.1 - ¾" (19 mm) Wire Rope Clamped Loop



¾" (19 mm) Wire Rope Splicing (Typ.)

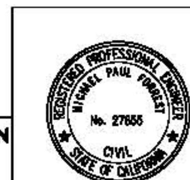
Note: 1.) Always Place Saddle of Clamp on Live Rope End, U-Bolt on Dead End.
2.) First U-Clamp Should Be Placed As Close As Possible To The Thimble.

WIRE ROPE ENDS AND SPLICED CONNECTIONS
NTS

ESTIMATED AREAS REQUIRING ROCK SLOPE NETTING

100' 0 100' 200'
SCALE 1"=100'

ELEVATION DATUM NGVD29



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URS
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DRAWN: N. HUTTON
CHECKED: J. ROADIFER/M. FORREST

NO.	DATE	DESCRIPTION	BY	APP'D
1	11/19/12	PCO NO. 020	JBR	MPF

REVISIONS

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

ROCK SLOPE NETTING PLAN

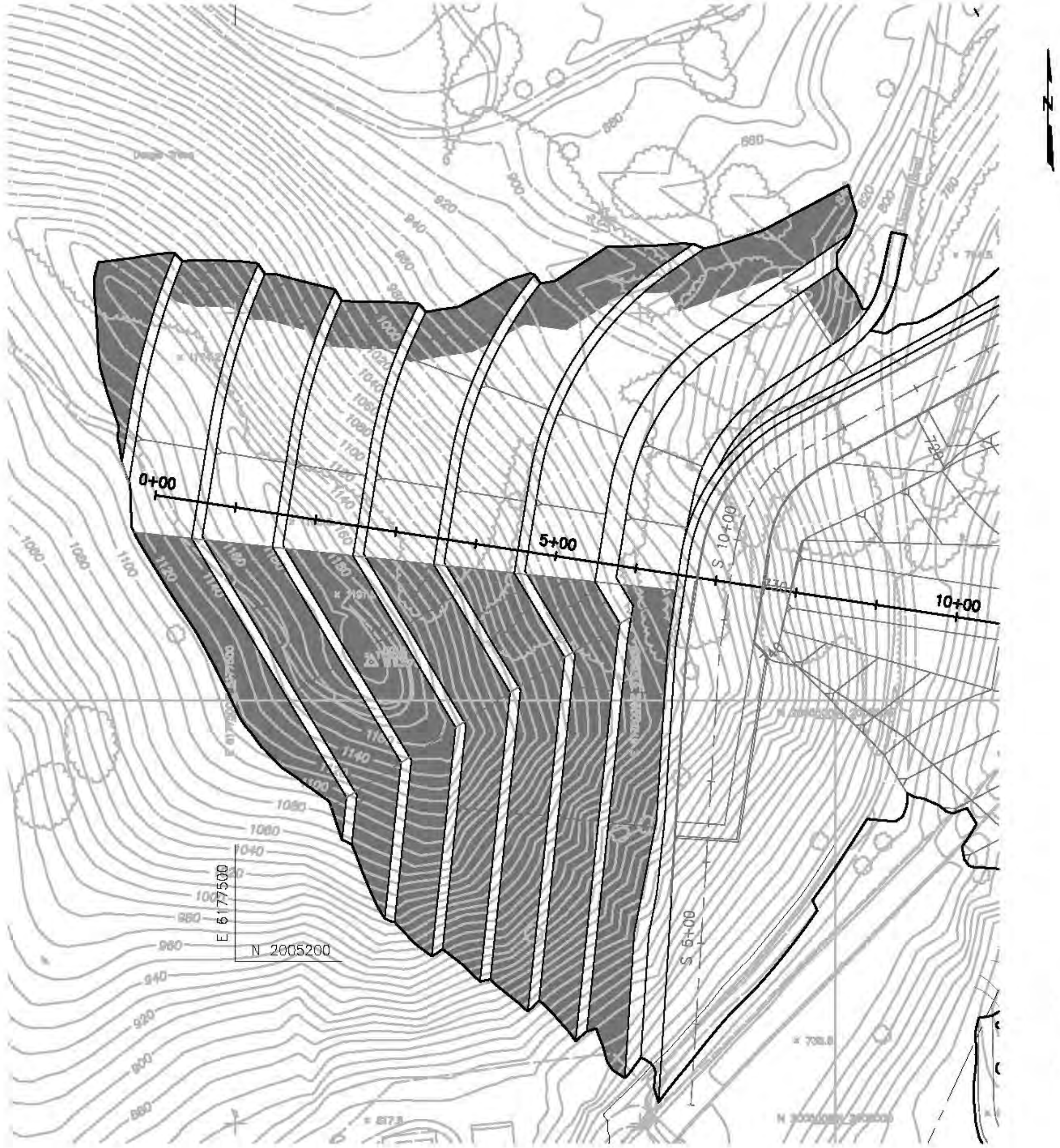
SCALE: AS NOTED

SHEET: – OF
PLAN NO.: FD-9.2
DRAWING NO.: E-21962
REVISION NO.: 1

PLOT: EXTEND
SCALE: 1:1
BORDER: 22,34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM

FILE: \\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\24B – CADD\Working\Vibha\FD-9.2.dwg Dec 19, 2012 – 1:53pm

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES



PLAN
SCALE: 1"=100'

NOTES

1. SEE FD-9.2 FOR NOTES.

ESTIMATED AREAS REQUIRING ROCK SLOPE NETTING

100' 0 100' 200'
SCALE 1"=100'

PLOT: EXTEND
SCALE: 1:1
BORDER: 22,34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM

FILE: \\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\24B - CADD\Working\Nadine\SHEET-FD-9.2A.dwg Dec 19, 2012 - 2:21pm

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

ELEVATION DATUM NGVD29

REGISTERED PROFESSIONAL ENGINEER MICHAEL PAUL FORREST No. 27855 CIVIL STATE OF CALIFORNIA

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

DRAWN N. HUTTON
DESIGNED
CHECKED J. ROADIFER/M. FORREST

NO.	DATE	DESCRIPTION	BY	APPR'D
1	11/16/12	LEFT ABUTMENT UPDATES		

REVISIONS

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

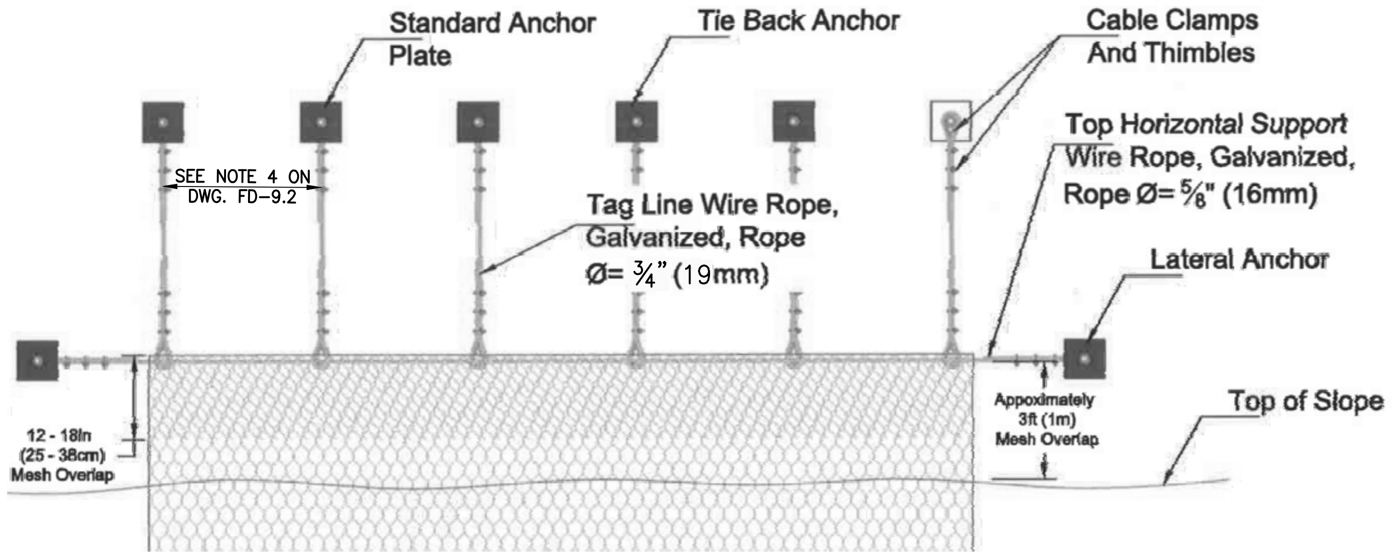
CALAVERAS DAM REPLACEMENT PROJECT

ROCK SLOPE NETTING PLAN

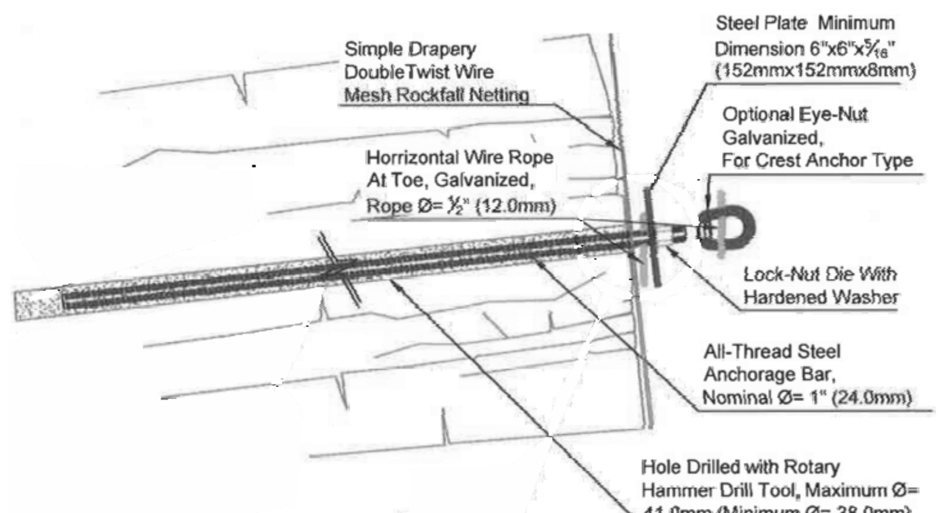
SCALE: AS NOTED

MANAGER, ENGINEERING MANAGEMENT BUREAU
MANAGER, WATER SUPPLY AND TREATMENT DIVISION

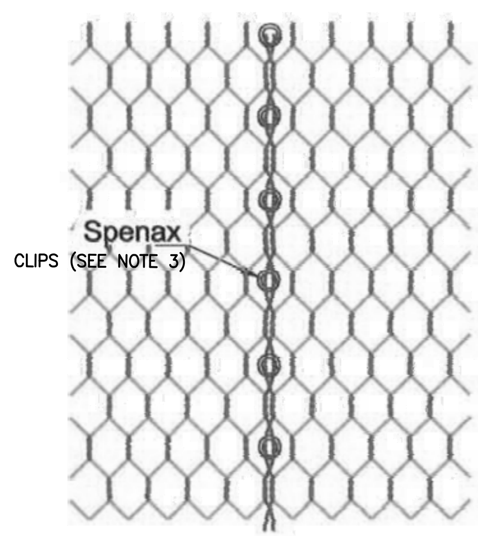
SHEET — OF | PLAN NO. FD-9.2A | DRAWING NO. E-21962 | REVISION NO. 1



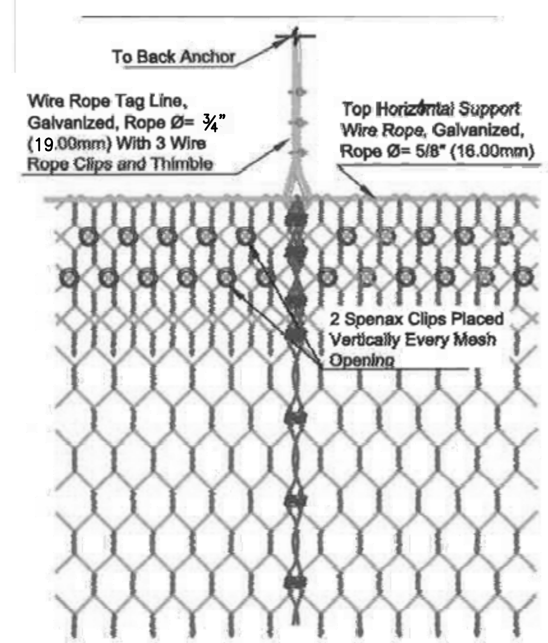
ANCHORAGE DETAIL – WITH TAGLINE SUSPENSION
NTS



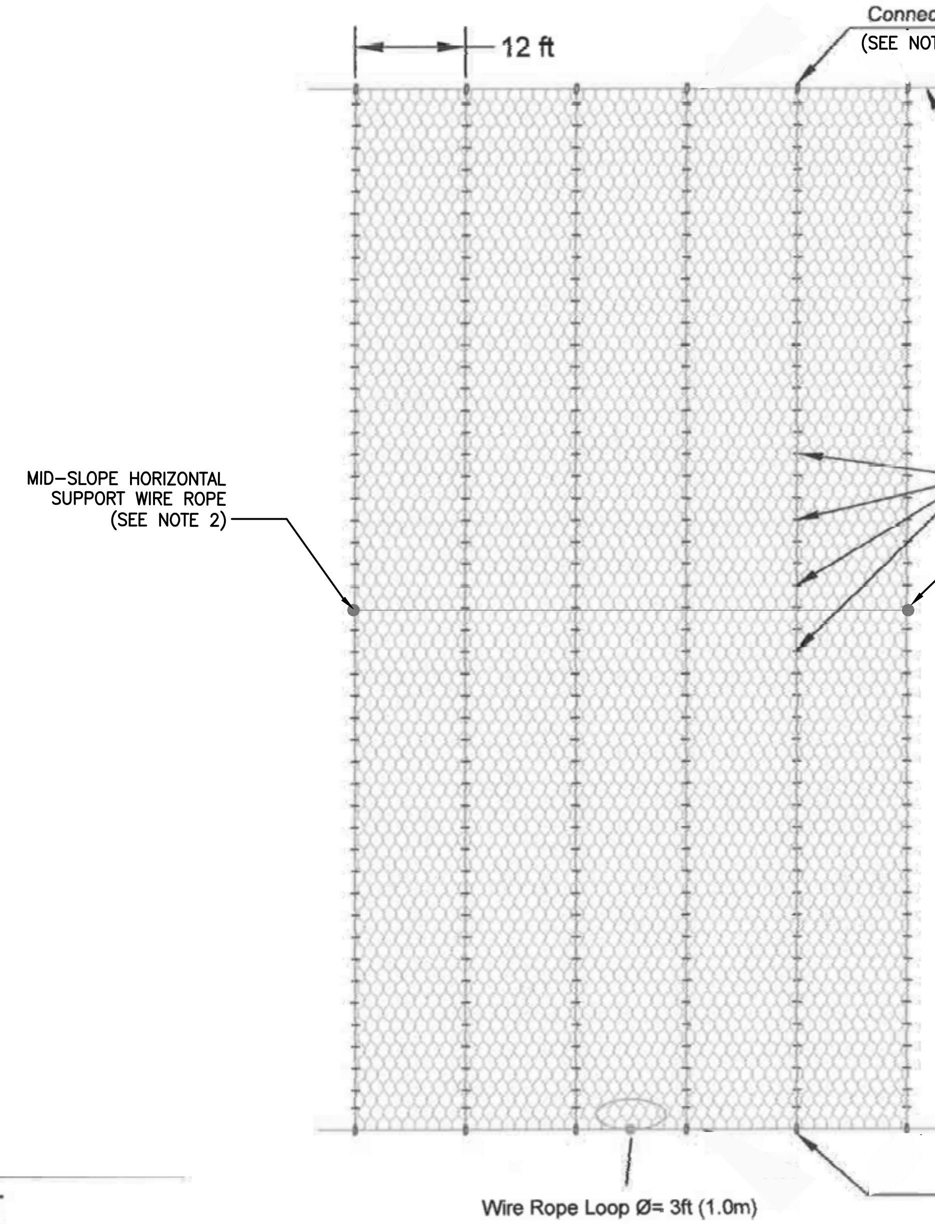
MID-SLOPE AND TOE ANCHORAGE DETAIL
NTS



PANEL TO PANEL SPENAX CONNECTION
NTS



TOP OF SLOPE – DOUBLE TWIST WIRE MESH OVERLAP
NTS



CONNECTION ANCHORAGE LAYOUT AT TOP AND BOTTOM OF THE SLOPE AND CONNECTION OF THE ROCK MESH PANELS
NTS

NOTES:

1. TOP HORIZONTAL SUPPORT WIRE ROPE, GALVANIZED, ROPE ø=⅝" (16.00mm) FIBER CORE TYPE 6x19, (ASTM A 1023 / A1023M – 02).
2. HORIZONTAL CONTAINMENT WIRE ROPE AT MIDSLOPE AND TOE, GALVANIZED, ROPE ø=½" (12.00mm), FIBER CORE TYPE 6x19, (ASTM A1023 / A1023M – 02).
3. SPENAX CLIPS SHALL HAVE A NOMINAL SPACING OF 4 IN. (100 MM) NOT TO EXCEED 6 IN (150 MM) FOR ALL ASSEMBLY AND INSTALLATION. THIS IS BASED ON A 1,400 LB/FT (20.4 kN/m) PULL APART RESISTANCE FOR GALVANIZED MESH WITH THIS SPACING (ASTM A975 SECTION 13.1.2).

100' 0 100' 200'
SCALE 1"=100'

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

ROCK SLOPE NETTING DETAILS

URS
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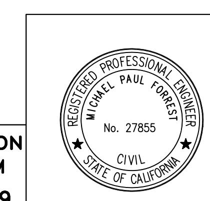
DRAWN N. HUTTON
DESIGNED
CHECKED J. ROADIFER/M. FORREST



ELEVATION DATUM NGVD29

NO.	DATE	DESCRIPTION	BY	APPR'D
1	11/21/12	PCO NO. 020		

REVISIONS

CHECKED / APPROVED | DRAWN | SCALE AS NOTED
SECTION MANAGER | DESIGNED | DATE
APPROVED | APPROVED
MANAGER, ENGINEERING MANAGEMENT BUREAU | MANAGER, WATER SUPPLY AND TREATMENT DIVISION

SHEET	PLAN NO.	DRAWING NO.	REVISION NO.
– OF	FD-9.3	E-21962	1

PLOT: EXTEND
SCALE: 1:1
BORDER: 22,34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM FILE: \\1575SR-PRJ01\Projects\Calaveras_ESDC_26818183\24B – CADD\Working\Vibha\FD-9.3.dwg Dec 19, 2012 – 1:58pm

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 4

Appendix A

Borehole Data from Left Abutment Area Used in Geologic Cross Sections

Borehole	Status	Top Elevation (ft)	Bottom Elevation (ft)	Area A Contacts		Area B Contacts		Comments
				Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)	
LA2012-Series								
LA2012-01	completed 6/29/12	931	721	95	836	21	910	
LA2012-02	completed 7/3/12	1133	934	10	1123	--	--	
LA2012-03	completed 7/13/12	914	714	164	750	--	--	
LA2012-04	completed 8/8/12	896	741	109	787	--	--	Fill to 36 ft depth (el 860 ft)
LA2012-05/05BA	completed 8/11/12	752	648	--	--	89	663	
LA2012-06	completed 8/9/12	848	678	--	--	--	--	
LA2012-07	completed 8/8/12	889	719	81	808	--	--	
LA2012-08	completed 8/16/12	846	646	--	--	--	--	
LA2012-09	completed 8/15/12	741	621	--	--	76	665	
LA2012-10	completed 8/14/12	873	692	--	--	--	--	Tcs @ 844 el.
LA2012-11	completed 8/22/12	1175	975	--	--	--	--	gray Tts @ 1139 el.
LA2012-12	completed 8/18/12	1167	875	--	--	--	--	
LA2012-13	completed 8/15/12	1099	749	--	--	--	--	fault strands at depths 145 and 175 ft (elev 954 and 897 ft)
LA2012-14	completed 8/22/12	725	552	--	--	--	--	
LA2012-15	completed 8/21/12	778	525	--	--	--	--	
LA2012-16	completed 8/23/12	601	525	--	--	--	--	NR from ~50.8 to 54.2 ft.
LA2012-17	completed 8/23/12	610	534	--	--	--	--	Qal/Kjf @ ~555 el.
LA2012-18	completed 8/31/12	1048	723	--	--	--	--	fault strand at depth 114 ft (elev ~934 ft)
LA2012-19	completed 8/28/12	807	673	--	--	--	--	total length 155 ft @ 60deg

Borehole	Status	Top Elevation (ft)	Bottom Elevation (ft)	Area A Contacts		Area B Contacts		Comments
				Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)	
LA2012-20	completed 9/5/12	671	605	--	--	--	--	
LA2012-21	completed 8/29/12	621	556	--	--	--	--	Qal/Tts @ el. ~602 ft; Tts/KJf @ el. ~569 ft
LA2012-22	completed 8/30/12	743	623	--	--	90	653	Tts/KJf @ depth 38 ft (elev. 553 ft)
LA2012-23	completed 9/4/12	734	588	--	--	36	698	
LA2012-24	completed 9/4/12	595	535	--	--	20	575?	
LA2012-25	completed 9/6/12	594	534	--	--	21	573?	
LA2012-26	completed 9/6/12	595	535	--	--	--	--	
G-Series								
G-1	completed 8/28/12	594	523	--	--	30	564	Tts / KJf @ ~535 el.
G-2	completed 8/28/12	586	529	--	--	30	556	Qal / KJf @ ~556 el.
G-5	completed 8/23/12	574	521	--	--			Qal / KJf @ ~565 el.
CB-Series								
CB-1		749	499	--	--	--	--	
CB-2		751	516	--	--	94	657	Qal/KJf @552 el.
CB-24		591	534	--	--	--	--	inclined boring; Qc?/Qal @ elev. 573 ft; Qal/KJf @ elev. 552 ft
CB-16/16A				--	--	--	--	
CB-26		915	715	--	--	159	756	
CB-27		806	665	--	--	110	696	
CB-28		748	549	--	--	94	660	inclined boring
CB-29		662	462	--	--	75	587	Tts/KJf @ ~549 el.
CB-30		629	429	--	--	54	575?	Tts/KJf @ ~556 el.
CB-31		637	439	--	--	68	569?	Tts/KJf @ ~553 el.
CB-35		593	443	--	--	--	--	Qal/KJf @ ~551 el.
CB-39		591	491	--	--	--	--	Qal/KJf @ ~551 el.

Borehole	Status	Top Elevation (ft)	Bottom Elevation (ft)	Area A Contacts		Area B Contacts		Comments
				Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)	
CB-44		587	543	--	--	--	--	Qal/KJf @ el. ~548 ft
CB-45		755	447	--	--	--	--	Tts = gray hard to el. 467 ft (288 ft depth)
CB-45		755	555	--	--	96	659	
CB-51		942	652	--	--	122	820	
CB-52		926	642	--	--	79	847	
CB-53		760	690	--	--	47	713	
CB-54		733	622	--	--	--	--	
CB-55		620	526	--	--	--	--	

3.03 UNFORESEEN OR DIFFERING CONDITIONS

A. Under section 7104 of the California Public Contract Code, if any of the following conditions are encountered at the Site, Contractor shall promptly, and before such conditions are disturbed, notify the City in writing.

1. Material that Contractor believes may be material that is hazardous waste, as defined in section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing Law.
2. Subsurface or latent physical conditions at the Site differing materially from those indicated by information about the Site made available to bidders prior to the deadline for submitting bids.
3. Unknown physical conditions at the Site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in the work of the character provided for in the Contract Documents.

B. Contractor's written notice shall inform the City as to how such conditions affect its Work and recommend methods to overcome such conditions.

C. Differing Conditions shall not include:

1. All that is indicated in or reasonably interpreted from the Contract Documents or Reference Documents;
2. All that could be seen on Site;
3. Conditions that are materially similar or characteristically the same as those indicated or described in the Contract Documents or Reference Documents.
4. Conditions where the location of a building component is in the proximity where indicated in or reasonably interpreted from the Contract Documents or Reference Documents.

UPDATED April 14, 2011

D. The City will promptly investigate the conditions reported in Contractor's written notice, and will issue a written report of findings to Contractor.

E. Only if the City determines that the conditions reported do materially so differ, or do involve hazardous waste, or do cause a decrease or increase in Contractor's scope of Work, will the City issue a Change Order as provided in Article 6 of these General Conditions, and/or a time extension as provided in Article 7 of these General Conditions, as appropriate.

F. Should Contractor disagree with the City's determination, Contractor shall submit a written Notice of Potential Claim to the City as provided in Paragraph 13.02 of these General Conditions. In the event of such disagreement, Contractor shall proceed with all Work to be performed under the Contract Documents, and shall not be excused from any scheduled completion date provided for by the Contract Documents.

G. Contractor shall be responsible for the safety and protection of the affected area of the Work for the duration of the City's investigation of potential Differing Conditions.

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Construction Management Bureau
Alan Johanson, Bureau Manager
525 Golden Gate Ave, 6th Floor
San Francisco, CA 94102
T 415-554-0702
F 415-554-1877

September 20, 2012

City Letter Number WD-2551-**00129**

Dragados/Flatiron/Sukut JV/
12750 Calaveras Road, Ste. B
Fremont, CA 94539

Attention: Alberto Benlloch

Subject: WD-2551 Calaveras Dam Replacement Project
PCO No. 20 - Layback Plan, DSC on Left Abutment Spillway Excavation
(Ref. Issue No. 105)

Dear Mr. Benlloch,

As you are aware, on September 19, 2012, URS Corporation, the designer of record for the Calaveras Dam Replacement Project (CDRP) presented its draft evaluation of the left abutment slope to representatives of the San Francisco Public Utilities Commission (SFPUC), California Division of Safety of Dams (DSOD), the Calaveras Technical Advisory Panel (CTAP), Calaveras Dam Replacement Project, Construction Manager, and Dragados/Flatiron/Sukut JV. As part of their report, URS recommended to the SFPUC that the full left abutment excavation in Observation Hill be laid back to a 2H: 1V overall slope. The Construction Manager concurred with that recommendation. Based upon the presentation by URS and the discussions that ensued, the CTAP also concurred with the recommendation to lay the slope back to a 2H: 1V overall slope. The SFPUC has made the decision to follow the recommendation made by URS that the full left abutment excavation in Observation Hill be laid back to a 2H: 1V overall slope.

Therefore you are hereby directed to immediately implement the full layback of the left abutment in Observation Hill to a 2H: 1V overall slope. In addition to the full layback of the slope, rock slope netting (described in previous correspondence) will be installed around the perimeter of the excavation in addition to shotcrete and rock bolts directed by the City representative as per the original contract. It is also anticipated that concrete piers with steel beams will be installed on portions of the Northern half of the left abutment excavation to add support to a slide remnant that will remain after the excavation has been completed. In order for you to plan and implement this direction I have attached the following draft revisions to the contract drawings:

- FD-1B, Revision 3; Dated 9/17/2012; General Excavation Plan, Sheet 1 of 2 (Full Left Abutment Slope Layback at an Approximate 2H:1V Slope).
- FD-3, Revision 1; Dated 9/19/2012; Detailed Excavation Plan, Sheet 1 of 2.
- FD-9, Revision 1; Dated 9/17/2012; Dam Foundation Sections (Full Left Abutment Slope Layback at an Approximate 2H:1V Slope).
- FD-9.1, Revision 1; Dated 9/17/2012, Left Abutment Slope Reinforcement.

- FD-9.2B, Revision 1; Dated 9/19/2012; Rock Slope Netting Plan (Full Left Abutment Slope Layback at an Approximate 2H:1V Slope).

From the above referenced draft revisions, the City would like to request the JV to provide an order of magnitude estimate of Cost and Schedule Impact as soon as possible.

Currently, URS is preparing formal revisions on these and other drawings to more completely describe the overall scope of this change request. We will provide these revised drawings as soon as we receive them through a formal Proposed Change Order (PCO), upon which we will also include a request for you to submit a detailed PCO Cost Proposal including a full Schedule Impact Analysis and Mitigation Proposals. I also solicit any requested additional information you feel you may need to implement this direction as well as any suggestions you may have to better implement the intent of this direction.

If you have any questions please contact me at your earliest convenience at the Calaveras Dam Replacement Project Field Office, 925-493-4516.

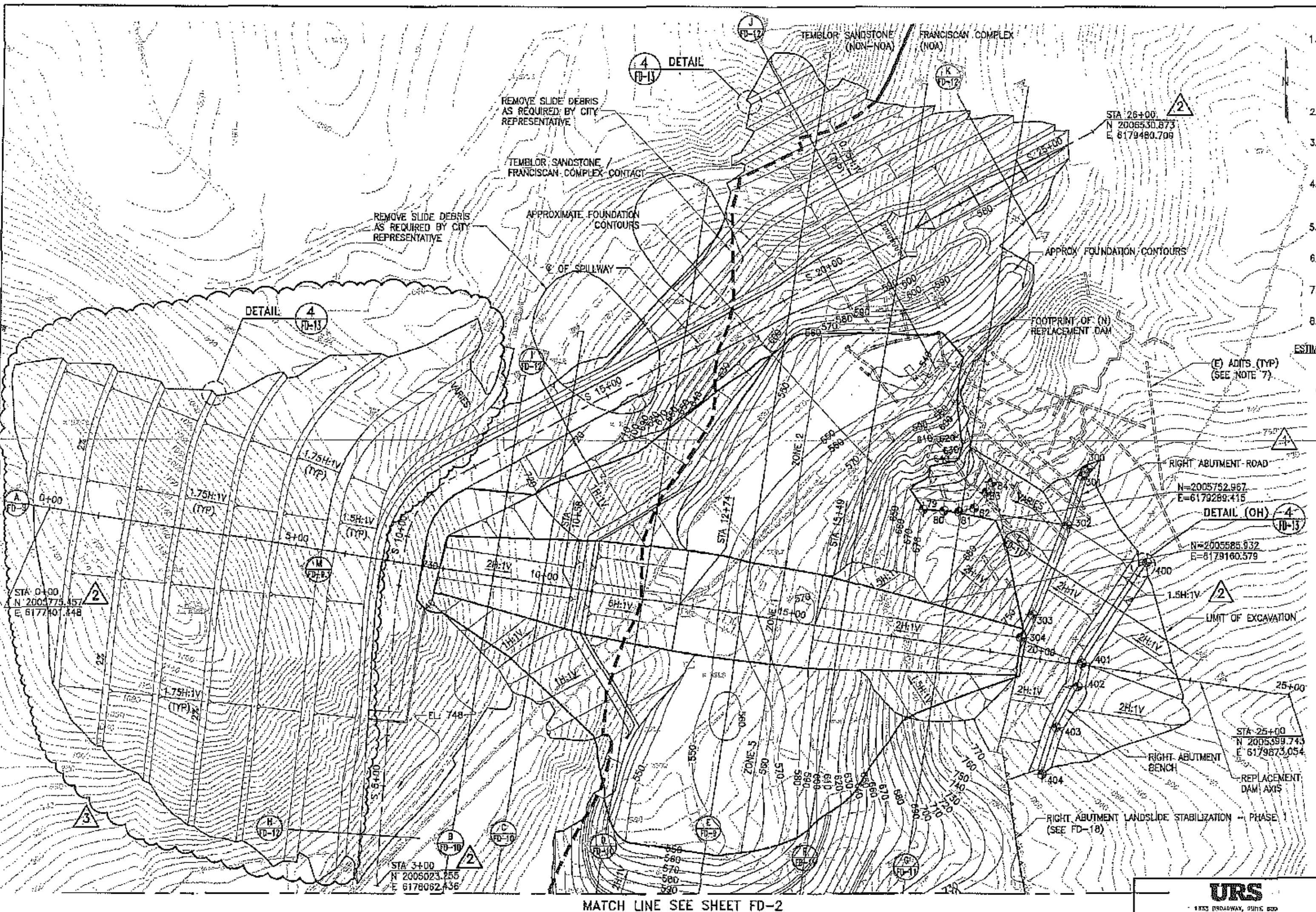
Sincerely,

Terence M. King
Construction Manager, Calaveras Dam Replacement Project
Consultant, **Black and Veatch**
12750 Calaveras Road, Ste. A
Fremont, CA 94539

Attachments:
1) FD-1B, Revision 3; Dated 9/17/2012; General Excavation Plan, Sheet 1 of 2 (Full Left Abutment Slope Layback at an Approximate 2H:1V Slope).
2) FD-3, Revision X; Dated 9/2012
3) FD-9, Revision 1; Dated 9/17/2012; Dam Foundation Sections (Full Left Abutment Slope Layback at an Approximate 2H:1V Slope).
4) FD-9.1, Revision 1; Dated 9/17/2012, Left Abutment Slope Reinforcement.
5) FD-9.2B, Revision 1; Dated 9/20/2012; Rock Slope Netting Plan (Full Left Abutment Slope Layback at an Approximate 2H:1V Slope).

cc:
Daniel Wade (SFPUC Project Management Bureau), Susan Hou (SFPUC Project Management Bureau), Bijan Ahmadzadeh (SFPUC Construction Management Bureau), Chris Mueller (SFPUC Construction Management Bureau), Jeff Bair (SFPUC Construction Management Bureau),

Manolito Del Rosario (SFPUC Construction Management Bureau), Glen Gorski (SFPUC Construction Management Bureau), Bashar Sudah (SFPUC Construction Management Bureau), John Rocca (SFPUC Construction Management Bureau), Cullen Wilkerson (SFPUC Special Inspection - Env.), Emma Jack (SFPUC Special Inspection - Env.), Kevin Braun (SFPUC Special Inspection - NOA), Bradley Erskine (SFPUC Special Inspection - NOA)



NOTES

1. DAM FOUNDATION, SPILLWAY AND LANDSLIDE EXCAVATION LIMITS AND EXCAVATION CONTOURS ARE ESTIMATED AND WILL VARY DEPENDING ON CONDITIONS ENCOUNTERED DURING CONSTRUCTION. DEEPER EXCAVATION MAY BE REQUIRED TO REMOVE UNACCEPTABLE MATERIALS.
2. ZONE 1 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 1 FOUNDATION OBJECTIVE.
3. ZONES 2 AND 5 FOUNDATION – REFER TO SECTION 02200 FOR ZONE 2 AND 5 FOUNDATION OBJECTIVES.
4. EXCAVATE FINAL SURFACES OUTSIDE OF DAM EMBANKMENT FOOTPRINT AT 2H:1V UNLESS OTHERWISE SHOWN.
5. CLEAR AND GRUB TO NO MORE THAN 10' BEYOND THE LIMITS OF EXCAVATION.
6. FOR SPILLWAY DETAILED EXCAVATION, SEE SP DRAWINGS.
7. TREAT EXISTING ADITS AS SHOWN ON FD-6 AND FD-7.
8. FOR DETAILED BENCH GEOMETRY SEE FD-3 AND FD-4.

ESTIMATED FRANCISCAN–TEMBLOR CONTACT AT EXCAVATION GRADE

LOCATED

APPROXIMATE LOCATION

CONTROL POINTS ON BENCH

POINT	COORDINATE		
	NORTHING	EASTING	ELEV.
79	2005774.582	6179144.933	678
80	2005772.517	6179187.233	678
81	2005771.098	6179216.549	678
82	2005777.950	6179247.285	678
83	2005809.161	6179271.116	678
84	2005828.544	6179282.431	678

RIGHT ABUTMENT ROAD ALIGNMENT

POINT	COORDINATE		
	NORTHING	EASTING	ELEV.
300	2005855.061	6179472.722	742.620
301	2005839.474	6179461.408	742.780
302	2005742.268	6179432.539	743.460
303	2005563.238	6179363.828	766.000
304	2005518.152	6179341.059	770.350

RIGHT ABUTMENT BENCH ALIGNMENT

POINT	COORDINATE		
	NORTHING	EASTING	ELEV.
400	2005667.694	6179590.520	825.053
401	2005465.589	6179462.645	830.000
402	2005417.876	6179453.153	829.024
403	2005338.963	6179410.519	827.235
404	2005245.866	6179382.066	825.432

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

GENERAL EXCAVATION PLAN
SHEET 1 OF 2

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

DRAWN: E. HULBERT
DESIGNED: V. CHIO
CHECKED: J. ROADIFER/M. FORREST

SCALE: 1"=100'

NO.	DATE	DESCRIPTION	BY	APP'D
3	9/17/12	LEFT ABUTMENT UPDATES		
2	4/17/12	PCO NO. 014	JWR	MPF
1	3/16/11	ADDENDUM NO. 5	JWR	MPF

REVISIONS

SHEET – OF
PLAN NO. FD-1B
DRAWING NO. E-21962
REVISION NO. 3

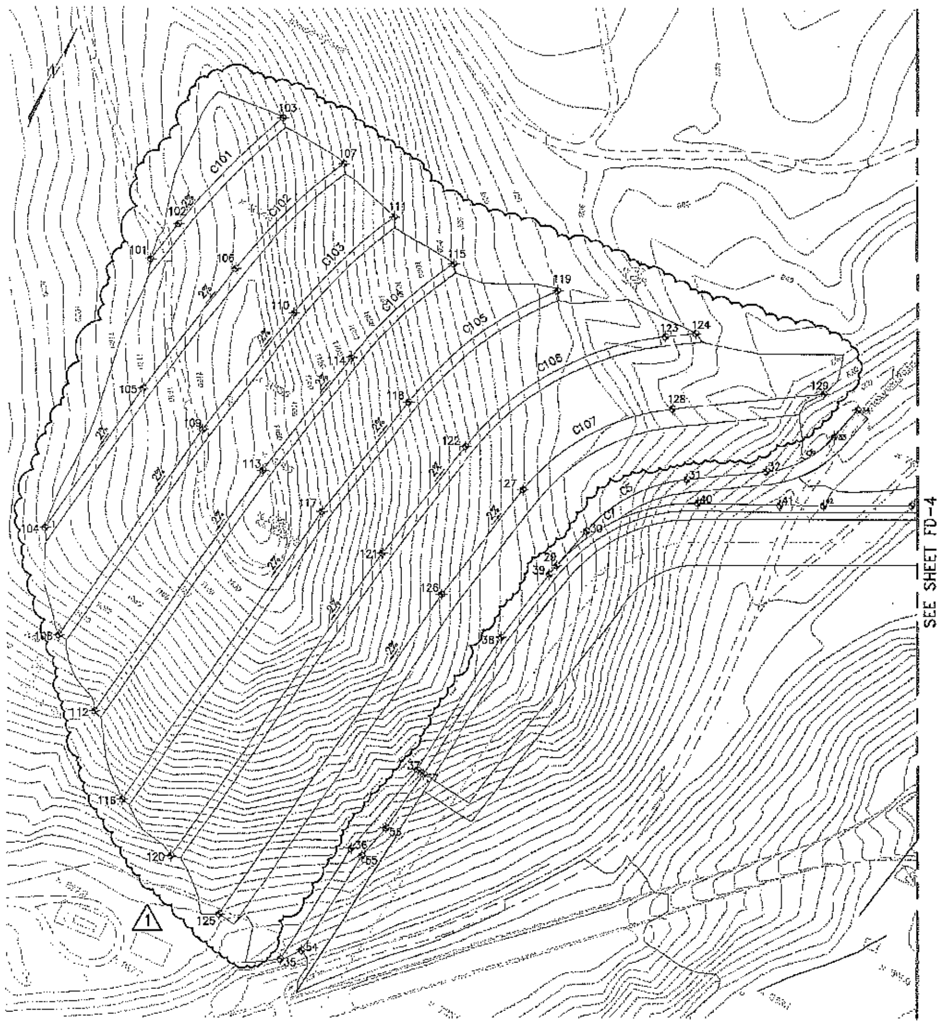
ELEVATION DATUM NGVD29

SCALE 1"=100'

PLOT: EXTENDS
SCALE: 1:1
BORDER: 22.34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
109 0.70MM
210 0.60MM

FILE: \\15755R-PR01\Projects\Calaveras_ESDC_25818183\243 – CADD\Sheets\FD-1A R3.dwg Sep 17, 2012 – 4:16pm

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES



POINT	COORDINATE NORTHING	COORDINATE EASTING	COORDINATE ELEV.
101	2005813.90	6177359.73	1121.10
102	2005877.26	6177369.95	1119.82
103	2006073.88	6177425.26	1118.58
104	2005420.08	6177411.77	1065.11
105	2005654.65	6177436.17	1069.83
106	2005861.34	6177468.68	1069.82
107	2006060.42	6177528.26	1068.39
108	2005300.23	6177499.76	1012.91
109	2005844.28	6177535.64	1019.83
110	2005845.42	6177567.40	1019.82
111	2006028.42	6177623.66	1018.32
112	2005232.22	6177593.25	961.69
113	2005633.91	6177635.10	969.83
114	2005829.50	6177666.13	969.82
115	2006011.49	6177726.72	968.06
116	2005143.23	6177684.47	910.16
117	2005623.53	6177734.56	919.83
118	2005813.57	6177764.85	919.82
119	2006047.51	6177869.54	916.98
120	2005107.58	6177781.30	859.66
121	2005613.19	6177834.02	869.84
122	2005797.85	6177863.58	869.82
123	2006061.58	6178030.60	865.42
124	2006085.48	6178065.37	864.57
125	2005071.21	6177876.05	809.14
126	2005602.87	6177933.49	819.83
127	2005781.73	6177962.30	819.82
128	2005979.17	6178087.25	815.42
129	2006097.25	6178258.99	812.00
29	2005712.34	6178052.44	770.04
30	2005773.47	6178065.47	767.20
31	2005902.76	6178151.89	765.96
32	2005964.49	6178241.68	768.80
33	2006051.92	6178300.11	782.39
34	2006100.06	6178310.37	789.40
35	2005057.05	6177981.02	770.00
36	2005235.63	6177992.48	770.67
37	2005374.66	6178010.94	771.20
38	2005589.48	6178033.71	772.03
39	2005697.09	6178049.69	770.46
40	2005880.95	6178181.10	759.95
41	2005932.50	6178280.79	748.72

CONTROL POINTS ON BENCHES

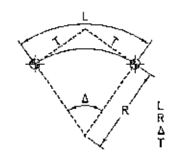
POINT	COORDINATE NORTHING	COORDINATE EASTING	COORDINATE ELEV.
41	2005932.50	6178280.79	748.72
42	2005961.23	6178333.34	746.92
43	2006018.84	6178436.72	738.68
44	2006055.78	6178509.76	713.16
45	2006102.83	6178597.89	680.20
46	2006236.88	6178843.09	596.36
47	2006257.68	6178873.48	585.43
48	2006268.87	6178888.34	580.31
49	2006300.08	6178921.64	580.00
50	2006375.44	6179059.52	580.00
51	2006384.06	6179084.99	580.12
52	2006395.62	6179141.90	580.00
53	2006546.26	6179404.80	580.00
54	2005081.66	6178000.63	770.10
55	2005233.30	6178010.37	770.67
56	2005283.63	6178020.31	770.86
57	2005373.13	6178029.88	771.19
58	2006595.98	6178789.55	901.03
59	2006666.68	6178918.64	916.53
60	2006538.86	6178789.34	859.57
61	2006624.94	6178946.52	866.18
62	2006463.82	6178760.98	799.33
63	2006494.66	6178812.54	800.82
64	2006614.85	6179032.18	807.22
65	2006427.93	6178751.25	779.20
66	2006586.91	6179085.25	757.44
67	2006053.58	6178505.58	714.76
68	2006384.17	6178804.16	719.75
69	2006415.97	6178857.45	720.67
70	2006584.75	6179165.61	727.41
71	2006112.40	6178615.39	674.21
72	2006350.31	6178830.33	580.00
73	2006379.07	6178878.54	580.92
74	2006574.79	6179235.91	686.76
75	2006189.15	6178755.78	626.21
76	2006310.46	6178861.13	629.75
77	2006335.65	6178903.36	630.67
78	2006564.16	6179320.60	640.61

CURVE TABLE

CURVE	LENGTH (FT)	RADIUS (FT)	DELTA	TANGENT (FT)
C101	204.703'	897.000'	13°4'31"	102.798'
C102	208.418'	797.000'	14°58'59"	104.807'
C103	192.043'	697.000'	15°47'12"	96.633'
C104	192.664'	597.000'	18°29'26"	97.177'
C105	259.230'	497.000'	29°53'6"	132.636'
C106	321.008'	397.000'	46°19'42"	169.861'
C107	240.149'	297.000'	46°19'42"	127.075'
C5	159.30	210.00	43°27'44"	83.70
C6	107.72	142.00	43°27'49"	56.60
C7	234.65	248.00	54°12'39"	126.94

NOTE:

1. FINISHED EXCAVATION SHALL BE PLUS OR MINUS 1 FOOT MEASURED NORMAL TO THE SLOPE.



L = LENGTH IN FEET
R = RADIUS IN FEET
Δ = DELTA ANGLE
T = TANGENT

CURVE DEFINITION

80' 0 80' 160'
SCALE 1"=80'

ELEVATION DATUM NGVD29

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

DRAWN E. HULBERT
DESIGNED V. CHIO
CHECKED J. ROADIFER/M. FORREST

NO.	DATE	DESCRIPTION	BY	APP'D
1	9/19/12	LEFT ABUTMENT UPDATES		

REVISIONS

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

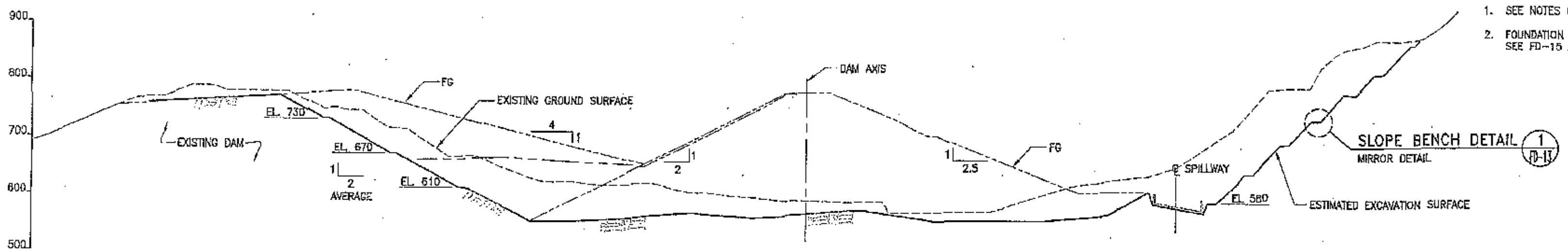
DETAILED EXCAVATION PLAN
SHEET 1 OF 2

SCALE 1"=50'
SHEET — OF
PLAN NO. FD-3
DRAWING NO. E-21964
REVISION NO. 1

PLOT: EXTENE
SCALE: 1:1
BORDER: 22.34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.50MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
13 0.50MM
175 0.70MM
210 0.50MM

FILE: FD\3358\SH6807\SHEdits\FD-3 R1.dwg Sep 15, 2012 – 5:59pm

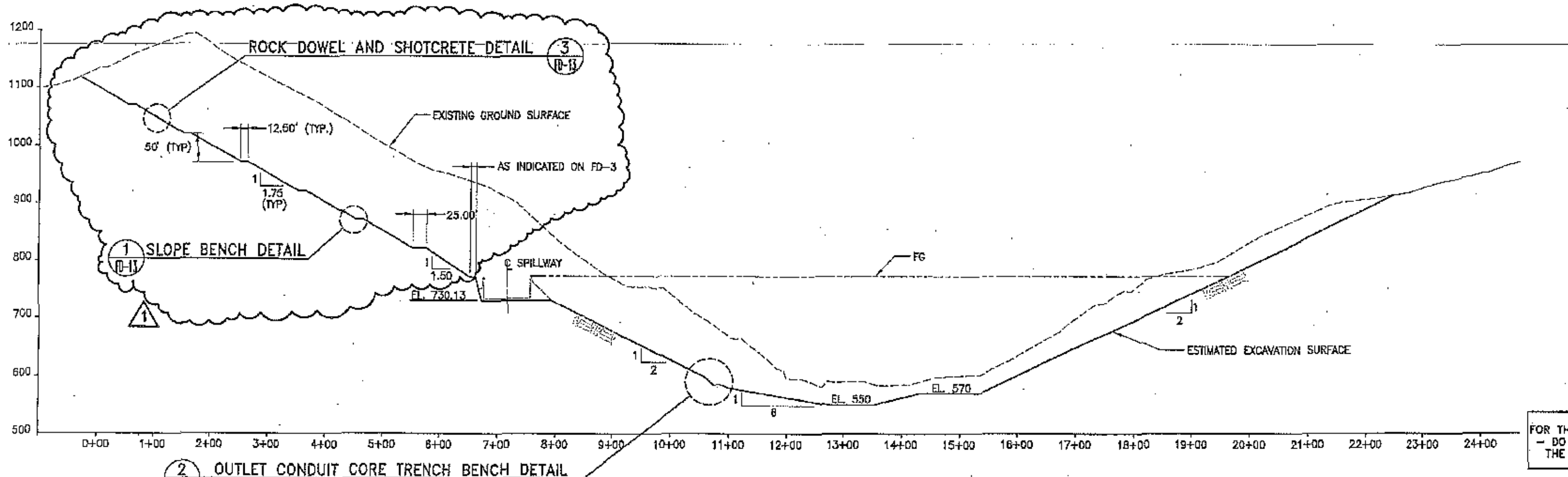
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES



NOTES

1. SEE NOTES ON FD-1
2. FOUNDATION GROUT CURTAIN NOT SHOWN. SEE FD-15 AND FD-16 FOR LOCATION.

SECTION AT STATION 14+00 (E / FD-1, FD-2)
SCALE 1"=100'



PROFILE THROUGH DAM AXIS (A / FD-1)
SCALE 1"=100'

FOR THE SOLE USE OF THE DOCUMENT RECIPIENT – DO NOT CITE, COPY, OR CIRCULATE WITHOUT THE EXPRESSED PERMISSION OF THE SFPUC.

100' 0 100' 200'
SCALE 1"=100'

ELEVATION DATUM NGVD29

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

DRAWN: E. HULBERT
DESIGNED: Y. CHIO
CHECKED: J. ROADIFER/M. FORREST

NO.	DATE	DESCRIPTION	BY	APPR'D
1	9/17/12	LEFT ABUTMENT SLOPE UPDATED		

REVISIONS

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

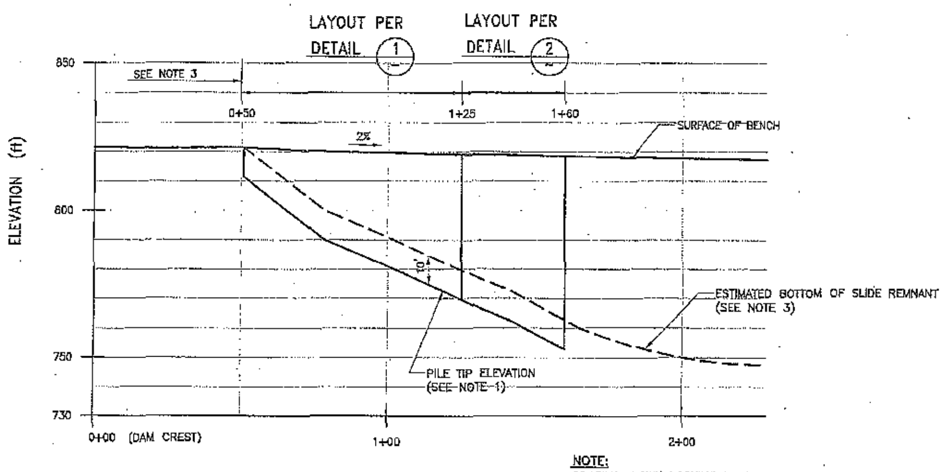
DAM FOUNDATION EXCAVATION SECTIONS
SHEET 1 OF 3

SCALE 1"=100'
SHEET – OF
PLAN NO. FD-9
DRAWING NO. E-21970
REVISION NO. 1

PLOT: EXTEND
SCALE: 1:1

FILE: P:\...\Calaveras_SDDC_26818163\248 – CADD\Sheets\FD-9 R1.dwg Sep 14, 2012 – 5:09pm

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

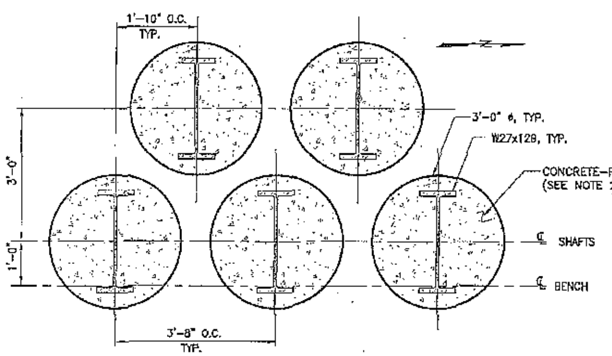


NOTE:
PROFILE SHOWN LOOKING UPSLOPE

SLOPE REINFORCEMENT PROFILE (M / FD-1)
SCALE 1"=20'

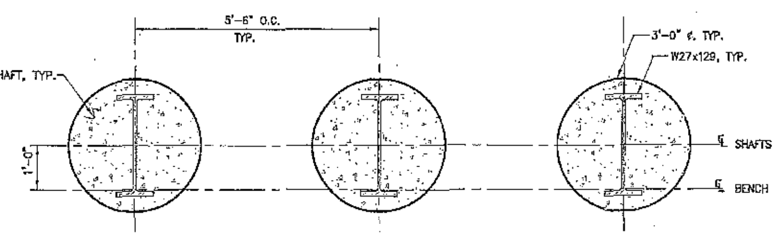
NOTES:

1. TIP OF PIERS SHALL PENETRATE AT LEAST 10 FEET INTO ROCK BENEATH BOTTOM OF SLIDE REMNANT.
2. CONCRETE TO BE 4000A.
3. STARTING LOCATION TO BE CONFIRMED BY CITY REPRESENTATIVE.



STA 0+50 TO STA 1+25

DETAIL (1)
SCALE 3/4"=1'-0"



STA 1+25 TO STA 1+60

DETAIL (2)
SCALE 3/4"=1'-0"

SCALE 1"=20'

SCALE: 3/4"= 1'-0"

FOR THE SOLE USE OF THE DOCUMENT RECIPIENT - DO NOT CITE, COPY, OR CIRCULATE WITHOUT THE EXPRESSED PERMISSION OF THE SFPUC.

ELEVATION DATUM NGVD29

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE (510) 893-3600

DESIGNED: M. HUTTON
DRAWN: V. CHIO
CHECKED: J. ROADIFER/M. FORREST

NO.	DATE	DESCRIPTION	BY	APP'D
1	9/17/12	LEFT ABUTMENT UPDATES		

REVISIONS

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

LEFT ABUTMENT
SLOPE REINFORCEMENT

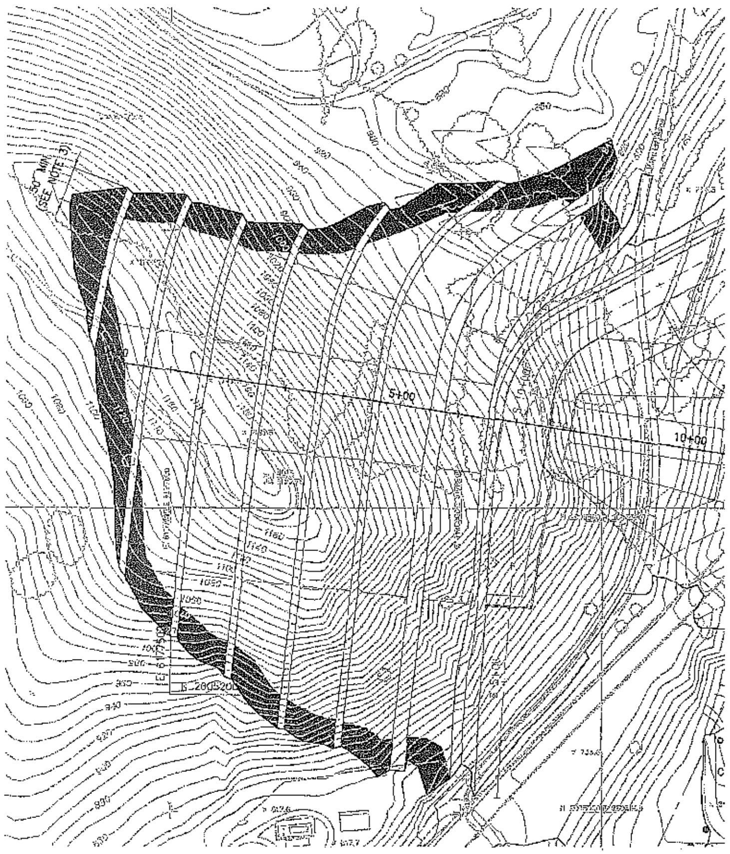
SCALE: AS NOTED

SHEET — OF
DRAWING NO. FD-9.1
E-21970

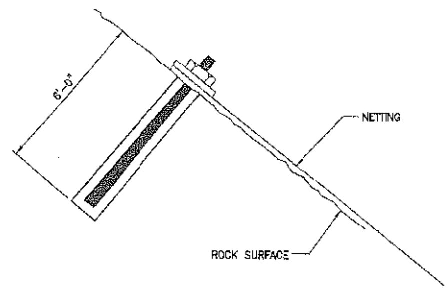
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

PLOT: EXTEND
SCALE: 1:1
BORDER: 22.34

FILE: FD-9.1.dwg Sep 17, 2012 - 4:41pm



PLAN
SCALE: 1"=100'



ROCK NETTING ANCHOR DETAIL (TYP.)
NTS

ESTIMATED AREAS REQUIRING ROCK SLOPE NETTING

SCALE 1"=100'

NOTES

1. ROCK NETTING SHALL BE MACCAFERRI ROCK MESH 4000 – OR SIMILAR.
2. ROCK NETTING SHALL BE GALVANIZED.
3. ROCK NETTING SHALL BE PLACED EXTENDING 10 FEET BEYOND THE LIMIT OF THE EXCAVATION.
4. ANCHORS TO SUPPORT THE ROCK NETTING SHALL BE PLACED AS FOLLOWS:

   TOP OF SLOPE (BENCH) – 1 INCH REBAR IN A 4 INCH HOLE, 6 FEET LONG EVERY 30 FEET.

   MID SLOPE – 1 INCH REBAR IN A 4 INCH HOLE, 6 FEET LONG EVERY 30 FEET.

   BOTTOM OF SLOPE (BENCH) – 1 INCH REBAR IN A 4 INCH HOLE, 6 FEET LONG EVERY 60 FEET.
5. CONNECTION BETWEEN ANCHOR AND NETTING SHALL BE AS PER NETTING MANUFACTURER RECOMMENDATIONS.

CONTRACT NO. WD-2551

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
INFRASTRUCTURE DIVISION
ENGINEERING MANAGEMENT BUREAU

CALAVERAS DAM REPLACEMENT PROJECT

ROCK SLOPE NETTING PLAN

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600

N. HUFTON
J. ROABIFER/M. FORREST

9/19/2012 JMR MFF
REVISIONS

SCALE: AS NOTED

– OF FD-9.2B E-21962

ELEVATION DATUM NGVD29

PLOT: EXTEND
SCALE: 1:1
BORDER: 22,34
COLOR: No.
RED 0.70MM
YELLOW 0.20MM
GREEN 0.25MM
CYAN 0.40MM
BLUE 0.60MM
MAGENTA 0.20MM
WHITE 0.35MM
GRAY 0.15MM
9 0.15MM
10 1.00MM
11 0.70MM
12 0.60MM
100 0.70MM
210 0.60MM FILE: \\15753R-PRJ01\Projects\Calaveras_ESDC_25818183\248 – CADD\Working\Nadine\SHEET-FD-9.2B.dwg Sep 20, 2012 – 11:37am

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Construction Management Bureau
1145 Market Street, 3rd Floor
San Francisco, CA 94103
T 415-554-0702
F 415-554-1877

July 18, 2012

City Letter No. WD-2551-**00114**

Dragados/Flatiron/Sukut JV
12750 Calaveras Road, Ste. B
Fremont, CA 94539

Attention: Alberto Benlloch

Subject: WD-2551 - Calaveras Dam Replacement Project
Issue 105, Geotech Observ Left Abutm

Dear Mr. Benlloch,

Reference is made to the following:

1. SFPUC contract number WD-2551 for the construction of the Calaveras Dam Replacement Project (CDRP)
2. DFSJV letter number SFPUC-219, dated June 6, 2012, Subject: Geotechnical Observations at the False Cut and Final Spillway Cut Slopes from Terrestrial Solutions Inc. (TSI).
3. DFSJV letter number SFPUC-223, dated June 13, 2012, Subject: Notice of Encountering Unforeseen and Differing Site Condition in the Left Abutment False Cut.
4. DFSJV (TSI) presentation on geotechnical findings made to City and Designer on June 19, 2012.
5. DFSJV letter number SFPUC-236, dated July 5, 2012, Subject: Directive to the DSFJV to Proceed with the Permanent Spillway Slope Excavation.
6. DFSJV letter number SFPUC-237, dated July 5, 2012, Subject: Change Order Request #023 – Directive to Install Grout Socks for Rock Dowels on Left Abutment
7. City letter number 105, dated June 21, 2012, Subject: Acknowledge DSC Notice and Good Faith Offer to Compensate.
8. Email correspondence from Terry King to the DFSJV, dated June 22, 2012, Subject: Left Abutment Spillway Cut Geotechnical Exploration Plan.
9. City letter number 107, dated June 27, 2012, Subject: Direction to Proceed with the Permanent Spillway Cut Excavation.

The following is a summary of the main correspondence related to the left abutment false cut issue:

- On June 6, 2012, letter number SFPUC-219, transmitted to the City by the DSFJV included a memorandum from Terrestrial Solutions Inc. (TSI) regarding geotechnical observations and "significant deviations in geologic conditions" which may cause stability issues in the temporary cut slopes in the left abutment. At that time, TSI indicated it would "continue to map the temporary slope as it is being excavated and update the project team if additional deviations are observed or interpreted".

- On June 13, 2012, letter number SFPUC-223, transmitted to the City by the DSFJV, included a notice of encountering Differing Site Conditions in the left abutment false cut, and a memorandum from TSI that "confirms and identifies significant deviations in the geologic conditions encountered in the area of the temporary False Cut slope...". The letter also indicated that the JV has stopped work on the left abutment false cut until the further investigation can be conducted. The DSFJV also requested that the City investigate the conditions and issue a written report of findings, and provide direction on how to proceed with the differing site conditions, as per Specification Section 00700-3.03 D. TSI provided a briefing and presentation of their preliminary findings to the City and URS.

- On June 19, 2012, a second presentation on the stability issue in the left abutment false cut was made by the DSFJV's subcontractor TSI to the City, URS, and some members of the Calaveras Dam Technical Advisory Panel (CTAP). During the meeting, TSI presented their geotechnical findings of the features uncovered during excavation of the false cut to date, and slope stability analysis that showed possible large slope failures if the excavation of the false cut continues downward below the current bench at elevation 925.

- On June 22, 2012, a plan for additional geotechnical exploratory borings and test pits was transmitted to the DSFJV. The plan included three (3) borings and two (2) test pits. The main purpose of the additional geotechnical exploration was to better locate the spillway fault, investigate the TSI postulated slide planes, and to assess the stability of the permanent slopes.

- On June 25, 2012, the City transmitted letter number WD-2551-00105 to the DSFJV acknowledging the receipt of the notice of differing site conditions. The letter indicated that at the time, no conclusions had been reached on whether differing site conditions do exist. The City however, as a show of good faith and partnering, proposed to pay for half of any costs arising from delays or additional work caused by this issue until conclusion is made with regards to the differing site conditions.

- On June 27, 2012, the City transmitted letter number WD-2551-00107 to the DSFJV directing it to continue with the permanent excavation in accordance with the project drawings and specifications. The City directed the JV to proceed with the core borings and televiewer logging in Observation hill as described in the geotechnical exploration plan transmitted to the DSFJV during the week of June 18, 2012. In addition, the City requested that as the excavation continues, access be given to URS and CM geologists to observe and document conditions of the permanent slope. The City also requested that the slope be monitored for potential movement daily on the excavated benches as the excavation proceeds downward. The JV was asked to plan on installing rock dowels and shotcrete for stabilization of the permanent slopes depending on the geologic conditions and to use grout socks where fractures in the rock might prevent proper grouting of the rock dowels.

- On July 5, 2012, the DSFJV transmitted letter number SFPUC-236 to the City indicating intent to begin the permanent excavation in the left abutment per the City's directive once the exploration work is completed. Moreover, the DSFJV requested that the City's "urgent attention and response to the differing site condition issue so that the project team can focus resources to the greatest extent possible on mitigating the project impacts associated with the out-of-sequence excavation".

- On July 5, 2012, the DSFJV transmitted letter number SFPUC-237 to the City requesting a change order arising from the City's directive to install grout socks (letter number WD-2551-00107), notifying the City of the additional costs associated with this change.

Contract provision 00700-3.03 defines UNFORESEEN OR DIFFERING CONDITIONS as follows:

A. Under section 7104 of the California Public Contract Code, if any of the following conditions are encountered at the Site, Contractor shall promptly, and before such conditions are disturbed, notify the City in writing.
   1. Material that Contractor believes may be material that is hazardous waste, as defined in section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing Law.
   2. Subsurface or latent physical conditions at the Site differing materially from those indicated by information about the Site made available to bidders prior to the deadline for submitting bids.
   3. Unknown physical conditions at the Site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in the work of the character provided for in the Contract Documents.

B. Contractor's written notice shall inform the City as to how such conditions affect its Work and recommend methods to overcome such conditions.

C. Differing Conditions shall not include:
   1. All that is indicated in or reasonably interpreted from the Contract Documents or Reference Documents;
   2. All that could be seen on Site;
   3. Conditions that are materially similar or characteristically the same as those indicated or described in the Contract Documents or Reference Documents.
   4. Conditions where the location of a building component is in the proximity where indicated in or reasonably interpreted from the Contract Documents or Reference Documents.

D. The City will promptly investigate the conditions reported in Contractor's written notice, and will issue a written report of findings to Contractor.

E. Only if the City determines that the conditions reported do materially so differ, or do involve hazardous waste, or do cause a decrease or increase in Contractor's scope of Work, will the City issue a Change Order as provided in Article 6 of these General

Conditions, and/or a time extension as provided in Article 7 of these General Conditions, as appropriate.

F. Should Contractor disagree with the City's determination, Contractor shall submit a written Notice of Potential Claim to the City as provided in Paragraph 13.02 of these General Conditions. In the event of such disagreement, Contractor shall proceed with all Work to be performed under the Contract Documents, and shall not be excused from any scheduled completion date provided for by the Contract Documents.

G. Contractor shall be responsible for the safety and protection of the affected area of the Work for the duration of the City's investigation of potential Differing Conditions.

URS completed an evaluation of TSI's memorandum (letter number SFPUC-223) regarding the differing site conditions in the left abutment false cut. URS also observed the geologic conditions of the excavated slopes, and additional borings and test pits. The entire memorandum prepared by URS regarding the differing site conditions at the left abutment false cut is attached. The following is a summary of the findings with regards to the specific differing site conditions in TSI's memorandum made by URS:

- Spillway fault location and geologic conditions: URS observed the spillway fault to be a zone of deformation that is about 200 to 300 feet wide with a location that is different than what is shown in the Geotechnical Data Report (GDR). URS believes that the fault zone material has lower strength properties than reported for the "shattered Temblor Sandstone" in the GDR. It was agreed by URS that these conditions could impact the stability of the excavated slope of the false cut.

- Mass movements (pre-existing large and small landslides): URS agrees that localized slumping exists in the area of the spillway excavation, which was indicated in the GDR. However, URS does not agree with TSI regarding the features observed and interpreted to be continuous, prominent potentially deeper sliding surface, and considers these features to be geologic bedding. In addition, URS does not agree with TSI's interpretation of a large regional slide complex that has moved generally to the north. URS has not observed any geomorphic evidence that would support TSI's interpretation of a significantly larger landslide complex.

- Rock discontinuities: URS agrees with TSI and information included in the GDR that most joints in the left abutment are less than 10 feet long. URS also observed discontinuities in the subsurface that present greater persistency than indicated in the GDR, as did TSI. In addition, URS observed the northeast-dipping strata west of the fault which are not indicated in the GDR, and agrees that slope stability could be adversely affected due to these northeast-dipping strata.

In conclusion, as required by 00700-3.03D of the Contract, the City has completed its investigation of the conditions reported and has concluded that "several key conditions exposed in the excavation vary from indications in the GDR..." and therefore the City believes this constitutes a material Differing Site Condition (DSC) under the terms of the contract.

For the foreseeable future, you shall continue with permanent left abutment excavation in accordance with the contract drawings and specification as previously directed in the City's letter number 107 dated June 27, 2012. Additionally, it is clearly in the interest of both the DSFJV and the City to mitigate as best and quickly as we can the impacts to cost and schedule this DSC has brought to this important WSIP project. The City and the DSFJV have already demonstrated the commitment and an ability to solve difficult issues on the project. We would like to immediately begin a collaborative effort to tackle this issue with you with the goal of reducing the schedule and cost of this matter to the maximum extent possible. I suggest we begin these discussions upon your receipt of this letter.

If you have any questions or comments please contact me at your earliest convenience at the Calaveras Dam Replacement Project Field Office, 925-493-4531

Sincerely,

Terence M. King 7/18/12

Terence M. King
Construction Manager, Calaveras Dam Replacement Project
Consultant, Black and Veatch
12750 Calaveras Road, Ste. A
Fremont, CA 94539

Attachments:
1) Calaveras Dam Replacement Project, Left Abutment Excavation, Evaluation of Notice of Differing Site Conditions, URS, Dated July 18, 2012

cc:
Daniel Wade (SFPUC Project Management Bureau), Susan Hou (SFPUC Project Management Bureau), Alan Johanson (SFPUC Construction Management Bureau), Bijan Ahmadzadeh (SFPUC Construction Management Bureau), Chris Mueller (SFPUC Construction Management Bureau), Jeff Bair (SFPUC Construction Management Bureau), Manolito Del Rosario (SFPUC Construction Management Bureau), John Rocca (SFPUC Construction Management Bureau), Glen Gorski (SFPUC Construction Management Bureau), Cullen Wilkerson (SFPUC Special Inspection - Env.), Kevin Braun (SFPUC Special Inspection - NOA)

URS

Memorandum

Date: July 18, 2012

To: Dan Wade, P.E., and Gilbert Tang, P.E.

From: Mike Forrest, P.E., G.E.; Phil Respess, P.G., C.E.G.; and Keith Kelson, P.G., C.E.G.

M.P. Forrest

Subject: **Calaveras Dam Replacement Project (CUW 37401)**
Left Abutment Excavation
Evaluation of Notice of Differing Site Condition

In response to the Project Construction Manager's request, this memorandum presents our findings with regard to Contractor Letter No. SFPUC-223. That letter states that the Contractor has encountered an Unforeseen and Differing Site Condition (DSC) in the Left Abutment False Cut. We understand that this memorandum will be used by the CM to prepare a response to the Contractor's letter.

The Contractor's letter includes a memorandum dated June 12, 2012, from its consultant, Terrestrial Solutions Inc. (TSI). The letter alleges "significant deviations in geologic conditions encountered in the area of the False Cut slope as compared to those indicated in the Geotechnical Data Report (GDR) for the project." The specific differing conditions are claimed to include:

- Spillway Fault locations and geologic conditions
- Mass Movements (pre-existing large and small landslides)
- Rock Discontinuities, including those with greater length than indicated in the GDR

TSI's memorandum concluded that as a result of these differing conditions, there is an unexpected risk for a large slope failure of the false cut. Specifically, their June 12 memorandum includes the following statements:

> *"The feature of greatest concern is the possible deeper landslide rupture surface that has been most recently encountered on the temporary slope. This surface is dipping nearly parallel to the slope, but may change orientation with depth, or potentially combine with other potential failure surfaces to create significantly out-of-slope conditions for a significant portion of the slope."*
>
> and *"... if the temporary slope is excavated below the planned bench at elevation 925, there is a potential that a large slope failure could occur."*

In response to these concerns, URS observed the features exposed on the false cut slope that TSI identified as belonging to a singular, continuous, potential slide surface. We observed discontinuous planar surfaces with variable orientations, which do not form a single planar surface across the exposed slope. The surfaces are associated with bedding planes within the Temblor Sandstone rather than pre-existing landslide planes. East of the Spillway Fault zone, the Temblor Sandstone is a package of shallowly northwest-dipping strata, and west of the fault, the Temblor Sandstone is moderately northeast dipping. The rock strata are fractured and contain a range of fracture orientations; the most prominent set is parallel with northeast-dipping bedding.

The northeast-dipping strata west of the fault are not indicated in the GDR and may adversely affect false cut slope stability. Otherwise, the presence of small, surficial slides identified in the GDR is consistent with the interpretation of a shallow landslide associated with the "Qls1 plane" presented by TSI.

The Spillway fault is a zone of shearing as much as 200 to 300 feet wide and consists of shattered Temblor sandstone with multiple fractures and shear planes. The full width of the fault zone may not be exposed in the false cut. URS observations confirm the GDR regarding the presence of shattered Temblor Sandstone on the eastern flank of Observation Hill, as a result of deformation adjacent to, and shearing within, the Spillway Fault zone. However, based on field observations and stability analysis of the existing fault zone, URS believes that the fault zone material has lower strength properties than for the "shattered" Temblor Sandstone. Furthermore, this fault zone is now understood to be wider and located further east than reported in the GDR.

Our detailed findings are presented in the attached table, in the order in which the topics are presented in TSI's memorandum. For each of the topics, we have presented a summary of the following:

- TSI Evaluations
- GDR (relevant synopsis)
- URS Field Observations from a review of current conditions encountered

In summary, we did not observe the large, deep landslide ("Qls3") that TSI has reported. However, several key conditions exposed in the excavation vary from indications in the GDR in a way that negatively impact the stability of the false cut that the Contractor has proposed and implemented to date. Therefore, we believe this constitutes a material DSC under the terms of the Contract.

Please let us know if you have any questions or require additional information.

Attachment:
Table - Left Abutment Differing Site Condition Evaluation

SPILLWAY FAULT

Summary of Findings:

- TSI: Did not identify Spillway fault.
- GDR: Spillway fault is depicted on the geologic map GDR Figure 2-1 as a dashed and queried line constrained between limits shown on the geologic map. Upper 100 feet of Temblor Sandstone is intensely fractured.
- URS: Observed Spillway fault; wide zone of deformation (200 to 300 feet wide).
- URS did not observe the same as TSI; but current information shows conditions different than reported in the GDR.
  - Based on current observations, URS believes that the width and location of the Spillway fault in the Observation Hill area are different than indicated in the GDR.
  - Based on field observations and stability analysis of the existing fault zone, URS believes that the fault zone material has lower strength properties than reported for the "shattered Temblor Sandstone".
- This impacts the stability of the excavated slope of the false cut, and thus would constitute a DSC.

TSI Evaluation	Geotechnical Data Report	URS Current Field Observations
• "The Spillway fault, as shown in the GDR (URS 2011), should be located near the upper portion of the currently excavated temporary false cut. However, TSI's mapping has not encountered any significant fault, fracture, or joint features with a north-south orientation that would match the Spillway fault."	• The geologic information summarized on Figure 2-1 of the GDR shows the trace of the Spillway fault extending at least 3400 feet northward from the northern shore of Calaveras Reservoir. The fault trace is shown as a solid line on the southern flank of Observation Hill, but is dashed and queried where it crosses the permanent and false cuts. The map also indicates the zone in which the fault location is constrained. • GDR Figure 2-1 indicates the presence of shattered Temblor Formation sandstone and numerous potentially fault- or slump-related geomorphic features directly east of the mapped Spillway Fault trace. o The rock in the upper ~100 feet from the pre-construction surface tends to be weak to extremely weak, highly to intensely fractured, with numerous clay-infilled joints and shears of various attitudes.	• URS field observations confirm the presence of joints/shears with near north-south orientations within the anticipated zone of deformation associated with the Spillway fault. Geologic mapping on the south-facing slope of Observation Hill, revealed in outcrops that have been exposed by erosion since the design investigations, indicates a 200- to 300-foot-wide zone of deformation, the trace of the Spillway fault lies within this zone. There is a lack of a prominent, major north-striking shear zone at the line mapped as the Spillway fault, but a decrease in rock quality (increase in fracturing) is present from west to east in the recent exposures, suggesting that the projected trace of the Spillway fault borders the western margin of a broad zone of fault-related deformation (and associated fracturing).

Spillway Fault (continued)		
TSI Evaluation	**Geotechnical Data Report**	**URS Current Field Observations**
• "There are, however, several significant and continuous geologic features (fractures and/or faults) that have been mapped on the false cut. The more prominent of these features have a strike of approximately north 35 degrees west, and a moderate to steep (45 to 70 degrees) northeasterly dip. This strike roughly parallels the trend of the northeast facing slope and ridgeline."	• "The results of core borings drilled in the left abutment below about elevation 800 feet show that the upper 100 feet of the Temblor Sandstone is yellow-brown, generally extremely to very weak, completely weathered to highly weathered, and intensely to highly fractured (fracture spacing from <2 inches to 1 foot) with zones of moderately strong, slightly weathered rock. RQD (rock quality designation) values are mostly zero with occasional values up to about 50 percent (see GDR Figs 2-4J to 2-4O and Figure 5-2A)". *(p. 5-5).*	• URS field observations indicate the presence of continuous geologic features in the rock mass exposed on the false cut, including bedding planes and a prominent set of bedding-plane-parallel fractures and joints. These features have strikes of about N35W and dips ranging from 45 to 70 degrees NE (see also "Rock Discontinuities"). The strike of the bedding is consistent with the trend of the Observation Hill ridge crest. This supports the interpretation that the ridge morphology reflects resistant northwest-striking, northeast-dipping sandstone beds within the Temblor Formation.
• "One of these more prominent planes appears to be associated with a shear zone several inches thick, which is currently being interpreted as a fault."	• Not included in GDR.	• URS also observed the presence of multiple sub-planar surfaces in the false cut and the upper part of the permanent cut. Several of these contain clay-rich zones or other infill material that suggests relative movement between the rock masses. The orientation for the prominent feature described in the TSI memorandum is coincident with measurements obtained for bedding (N35-45W/45-65 NE) on the permanent cut slope. This is also coincident with the trend of the ridgeline and the northeast slope. URS observed evidence of minor slip along several northwest-striking, northeast-dipping sandstone bedding plane and/or bedding-parallel fractures, including in the false cut excavation. Kinematic indicators on these features suggest a range in movement directions, including down-dip and lateral (along-strike) orientations.
• "The geologic conditions are different on either side of this [feature] although the sense of movement cannot yet be determined. Several of these northwest trending features have striations that are nearly horizontal indicating strike-slip movement."	• Not included in GDR.	• URS did not confirm the specific location noted where "conditions are different" on either side of the feature. However, URS confirmed the presence of differences in sandstone grain size, degree of weathering, and cementation across bedding planes and fractures/joints that coincide with bedding planes.
• "TSI's mapping indicates that one or more of these [features] extends from the False Cut to the portion of the upper final cut slope that currently has been excavated."	• From the GDR, Figure 2-1, our field mapping along the northern flank of Observation Hill yielded limited data on the location of the Spillway fault, based on the distribution of isolated bedrock outcrops and geomorphic features.	• URS observations in the excavation area confirm the extension of geologic features northwestward from the false cut area to the permanent cut slope as recently exposed. These features are interpreted as bedding planes or bedding-plane-parallel joints or fractures that may have accommodated minor secondary movement during strong ground shaking. It is interpreted that these features probably persist throughout the rock mass beneath Observation Hill because they coincide with continuous bedding within the Temblor Formation sandstone.

Calaveras Dam Replacement Project (CUW 37401)
Left Abutment Differing Site Condition Evaluation

MASS MOVEMENTS

Summary of Findings:

- TSI: Postulated large regional slide and smaller local slides.
- GDR: Past surficial slope movements are indicated (many small landslides are indicated in the GDR)
- URS: No evidence to support large regional slide.
- URS did not observe the "large regional slide" interpreted by TSI.
- Since URS did not observe differences with the GDR on this issue, it does not constitute a DSC.

TSI Evaluation	Geotechnical Data Report	URS Current Field Observations
TSI states that: • "the GDR report and accompanying figures (Figure 2-1) indicate localized slumping in the area of the temporary slope."	• Features on the Observation Hill slope indicate evidence of past slope movements (Geologic Map, Figure 2-1 of GDR) such as "Qls" annotations, hatchmarks indicating headscarps or breaks in slope, annotations of shattered Tts (Temblor Sandstone), and annotation of "shallow slump" with NE movement.	• URS agrees that the GDR does indicate localized slumping, among other observed surface conditions, in the area of the temporary slope.
• "most of the northeast facing natural hillside is underlain by relatively shallow slumping and/or landsliding", • "as the temporary false cut excavation has proceeded, this shallow landslide has increased from less than 20 feet in thickness to greater than 35 feet in thickness."	• GDR Figure 2-1 indicates shallow landslides. • This shallow landslide was uncovered during the false cut excavation, so this specific landslide is not mentioned in the GDR.	• URS agrees with this interpretation of the data presented in the GDR. • The additional exploratory trench and borehole logging confirmed the presence of a shallow-dipping (20-25° NE) slip surface below the temporary El. 925 bench, on the north end of the false cut; material above and to the north of the projection of this surface appears to be slide debris (disorganized mixture of clayey sand and angular rock fragments). The total thickness of this slide debris could be about 25 to 30 feet.
• "A portion of the southeast facing slope (created during the original dam excavation) is also underlain by shallow slumping."	• GDR Figure 2-1 indicates shallow slumping/landslides	• URS agrees that a portion of the southeast-facing slope is likely underlain by shallow slumping.
• "there are geologic features exposed on the temporary cut and geomorphic evidence that suggest the presence of a significantly larger landslide complex" that "has moved generally to the north".	• GDR does not indicate a significantly larger landslide complex or that movement has occurred generally to the north.	• URS has not observed any geomorphic evidence that would support TSI's geologic model. URS has not seen geologic features on the temporary cut that support TSI's interpretation of a significantly larger landslide complex or that movement has occurred generally to the north.

Calaveras Dam Replacement Project (CUW 37401)
Left Abutment Differing Site Condition Evaluation

Mass Movements (continued)		
TSI Evaluation	**Geotechnical Data Report**	**URS Current Field Observations**
• "a continuous, prominent potentially deeper sliding surface has been mapped on the false cut slope", with an approximate orientation of N35W/50-60NE, but "the basal surface of rupture and overall geometry of this potentially larger landslide has not yet been observed."	• GDR does not indicate such a deeper sliding surface.	• The feature described by TSI is considered by URS to be bedding. Some of the joints developing along this orientation have been observed to have open apertures exceeding 6 inches or (partially) filled with clayey sand and angular rock fragments. URS sees no evidence of a "basal surface of rupture" or a "potentially larger landslide".
• TSI postulates that the "larger landslide would essentially be a wedge failure that failed along the observed northwest trending faulting and bedding which is dipping to the northwest. Other landslide configurations could also be possible."	• Not included in GDR.	• URS agrees that wedge failures could develop along a pair of intersecting joints whose plunge is shallower than the inclination of the cut slope. There is currently no evidence to support the contention that a larger landslide-sized wedge failure could develop. URS believes that the original dip of bedding was oriented towards the northeast in the vicinity of the false cut. However, there may be dislocation of bedding due to the shearing associated with the Spillway fault zone.
• In a Powerpoint presentation in June, TSI presented geomorphic "evidence" consisting of the USGS LiDAR imagery for the Calaveras fault zone (dated 10/29/11). TSI suggests that the entire block from Observation Hill to Calaveras Creek, all the way to Alameda Creek to the north, represents an ancient landslide complex.	• GDR does not indicate such a regional landslide.	• URS does not agree with TSI's interpretation of this imagery. We see no evidence for such a large regional landslide.

ROCK DISCONTINUITIES		
Summary of Findings: • TSI: Most joints are less than 10 feet long. • GDR: In general, joints in the Temblor Sandstone were observed to be 10 feet long or less. GDR does not rule out persistent joints. • URS: Observed discontinuities in the subsurface that present greater persistency than indicated in GDR (than what was apparent at the surface during the design investigations). • URS observed the same as TSI; and URS would consider that to be different than the GDR. o The northeast-dipping strata west of the fault are not indicated in the GDR, and may adversely affect false cut slope stability. • Constitutes a DSC.		
TSI Evaluation	**Geotechnical Data Report**	**URS Current Field Observations**
• "TSI generally agrees that most of the observed joints are less than 10 feet in length (per GDR), but that there are several prominent joints observed in the excavations that are more continuous, extending tens of feet both laterally and vertically."	• The GDR states in Section 5.1.2.3 that "In general, joints in the Temblor Sandstone were observed to be 10 feet long or less." Does not rule out presence of persistent discontinuities.	• URS also observed persistent discontinuities.
• "There are, however, several significant and continuous geologic features (fractures and/or faults) that have been mapped on the false cut. The more prominent of these features have a strike of approximately north 35 degrees west, and a moderate to steep (45 to 70 degrees) northeasterly dip." (See also "Spillway Fault.)	• The northeast-dipping strata west of the fault are not indicated in the GDR. .	• URS observed these northeast-dipping strata west of the fault.