FIELD TRIP

October 24, 2014

“CALAVERAS DAM REPLACEMENT PROJECT”

Field Trip Leader: C. Philip Respess, C.E.G.
Senior Project Engineering Geologist, URS Corporation
CALAVERAS DAM REPLACEMENT PROJECT

Field Trip Itinerary

8:45 AM: Participants arrive at New Irvington Tunnel parking area

9:00 AM – Overview of New Irvington Tunnel Project

9:45 AM – Board Bus for Calaveras Dam Replacement Project (CDRP)

10:00 AM: Arrive at Calaveras Dam Replacement Project (CDRP) Conference Room

10:00 AM:

• Visitor Training - Health and Safety, NOA, Environmental Awareness

• Overview Presentation on CDRP Project and Geology

11:00 AM – Noon: Board Bus, Overview of CDRP from top of existing dam

Noon: Lunch

1:00 PM: Visit to Observation Hill Spillway excavation

2:00 PM: Board bus and return to NIT parking area

2:30 PM: Depart

Attachments:

1. CDRP Fact Sheet
2. Description of Geology (From Executive Summary in Geotechnical Data Report (URS, 2008))
3. Regional Geologic Map
4. Site Geologic Map
5. Dam Axis Profile – Left Abutment
6. Dam Axis Profile – Right Abutment
7. Observation Hill Spillway Cut Slope - Annotated Air Photo
8. New Irvington Tunnel Fact Sheet
Project Background
The San Francisco Public Utilities Commission (SFPUC), owner and operator of the Hetch Hetchy Regional Water System, is building a new dam to replace the existing Calaveras Dam. The Calaveras Reservoir, impounded by Calaveras Dam, is our system’s largest drinking water reservoir in the local Bay Area. When full, it provides more than half of our Bay Area storage capacity for 2.6 million customers. The existing earth fill dam is 89 years old and is located within 1,500 feet of the active Calaveras Earthquake Fault. In 2001, the SFPUC lowered water levels in the reservoir to less than 40 percent of normal operating capacity in response to seismic concerns. The Calaveras Dam Replacement Project is the largest project of the $4.6 billion Water System Improvement Program (WSIP) to repair, replace, and seismically upgrade key components of the Hetch Hetchy Regional Water System.

Project Update
Construction began in 2011 to build a new earth and rock fill dam adjacent to the existing dam. To date, the Contractor has moved over five million cubic yards of earth and rock materials and started to construct the new dam. Crews have constructed a new shaft and five adits (tunnels) which connect the outlet pipelines to the reservoir. We have completed grouting operations on the right abutment and started grouting work on the left abutment. Major excavation work for the upper and middle portions of the new spillway and construction of the new concrete spillway has begun. Over 10,000 cubic yards of concrete has been placed in the new spillway structure. Our teams work daily to protect and preserve the pristine watershed lands and natural habitats surrounding the project. As of July 2014, the project was approximately 60% complete. Much work still lies ahead to complete this important feature of the Hetch Hetchy Regional Water System.

Construction Began: August 2011
Projected Completion: Late 2018
Construction Management: Black & Veatch
Designer: URS Corporation
Construction Contractor: Joint Venture of Dragados USA, Flatiron West Inc. and Sukut Construction
**Geological Conditions**

In June 2012, we discovered some unexpected geologic features during excavation of the left abutment area. These uncovered geologic features were not visible at the ground surface during the extensive geotechnical investigation work performed during the planning and design phases of the project. The findings resulted in over 3 million cubic yards of additional material that had to be moved in order to ensure the long-term stability of the slope during the performance life of the dam. More than 10 million total cubic yards of excavation and earthwork placement is required to construct the new dam. As of July 2014, over 5 million cubic yards of material have been moved.

**Project Details**

The project consists of building a new zoned earth and rock fill dam immediately downstream of the existing dam. This work will restore the Calaveras Reservoir to its historic capacity. The reservoir provides approximately half of the Hetch Hetchy Regional Water System’s local Bay Area water storage. This storage is crucial to providing adequate water to our customers in times of drought and when Sierra Nevada resources are not available.

- The new dam will have a structural height of **220 feet**, a crest length of **1,210 feet**, and a width of **80 feet** at the crest and **1,180 feet** at the base
- More than **10 million cubic yards of excavation** is required to construct the new dam. This is equivalent to more than 1,550 football fields buried one yard deep. Approximately 3.5 million cubic yards will go into the construction of the new dam, including a buttress fill to stabilize an existing landslide
- The **new spillway will be 1,550 feet long** utilizing 40,000 cubic yards of concrete
- Upon completion, the Calaveras Reservoir will be restored to its historic nominal storage capacity of **96,850 acre feet** (31 billion gallons)
- The new dam will allow us to **release water into Alameda Creek** in a manner that controls water temperatures and flow rates depending upon the life cycle needs of the fish. We will also install fish screens and a fish ladder at the Alameda Creek Diversion Dam to **support the restoration of Steelhead Trout** to the Alameda Creek Watershed
- A **new intake/outlet shaft tower** will be constructed, consisting of a 20-foot diameter by 163 foot deep vertical shaft and three new adit tunnels. This inlet/outlet structure will convey water to and from the reservoir through a **72-inch diameter steel lined tunnel** and a **78 inch diameter pipeline** downstream

Although 90 percent of the materials for the new dam will come from on-site borrow areas, approximately 300,000 cubic yards of sands and gravels will need to be imported to the site for construction of the internal filters and drains within the zoned embankment dam.

**Future Calaveras Road Closure**

The SFPUC has received permission from Alameda and Santa Clara Counties to temporarily close Calaveras Road south of Geary Road to the Alameda County line for an 18 month period starting sometime in 2016 at the earliest, on weekdays only. The closure is necessary to protect the safety of the public on the road, while large trucks haul sands and gravels to the site.

Visit our website at [sfwater.org/sunolvalley](http://sfwater.org/sunolvalley) to stay updated on road closure dates or email mle@sfwater.org to receive email notifications.

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**For more information**

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**View of Left Abutment**

(left side of valley looking downstream)
Calaveras Dam and Reservoir are located in the western part of the Diablo Range of the Coast Range physiographic province. In general terms, the eastern side of the dam (right abutment) mainly consists of Jurassic to Cretaceous-age rocks of the Franciscan Complex. The western side of the dam (left, or west, abutment) primarily consists of Tertiary-age sedimentary rocks (Temblor Sandstone). The Tertiary rocks overlie the Franciscan Complex as an erosional unconformity that dips northwest under the existing dam fill and Calaveras Creek alluvial sediments.

The results of core borings drilled in the left abutment show that the upper 100 feet of the Temblor Sandstone is brown, generally extremely to very weak, completely weathered to highly weathered, and intensely to highly fractured rock. The hydraulic conductivities in this upper part of the Temblor Sandstone are high (generally greater than 500 lugeons). Below a depth of about 100 feet, geotechnical data show that the sandstone quality improves markedly. The sandstone is gray, generally moderately strong to strong, slightly weathered to fresh, and moderately to slightly fractured, and occasionally massive. The hydraulic conductivities of the underlying gray sandstone are much less than for the overlying brown sandstone. Typically, the hydraulic conductivities of the gray sandstone are less than 20 lugeons, but there are areas of higher hydraulic conductivities.

The Franciscan rocks in the right abutment have been mapped as serpentinite, siliceous schist, graywacke (sandstone), greenstone and blueschist/greenstone as tectonic inclusions in a mélange consisting of sheared sandstones and shales. The Franciscan Complex rocks are characterized by a block-in-matrix structure, with about 30 to 70 percent of the rock mass overall across the site composed of hard blueschist, greenstone, siliceous schist, and graywacke within the shale matrix. The blueschist, greenstone and graywacke are typically fairly strong and massive and represent the only significant hard rock in the project area. The siliceous schist ranges from weak to moderately strong but exhibits strong foliation and fracturing and occasional sheared, weaker zones. The serpentinite and mélange shale/sandstone matrix is very weak to weak, intensely sheared, folded and deeply weathered. The Franciscan Complex generally was found to have low rock mass hydraulic conductivities. With few exceptions, the results of the packer testing indicate values of less than 10 lugeons, and do not show a trend with depth.

Quaternary landslides are common throughout the project area and have been identified on the eastern hillsides in the Franciscan Complex above Calaveras Creek, downstream of the existing
The area downstream of the right abutment of the existing dam is characterized by several landslides ranging from a few tens of feet up to several hundred feet in width and extending from Calaveras Creek to the ridgeline.

Faulting in the vicinity of the dam has been documented over many years by various investigators and was a major focus of the site investigations completed by William Lettis & Associates, Inc. and URS. The main trace of the Calaveras fault is located in the topographic saddle through which Calaveras Road trends, about 2,000 feet west of the dam site.

The material for the core of the dam in Borrow Area E at the upstream (south) end of the reservoir was investigated with test pit excavations and auger borings. The materials primarily consist of sandy to silty lean clays with gravel. Rockfill materials for the upstream shell of the dam will be obtained from the existing quarry (Borrow Area B). The rock in this borrow area primarily includes blueschist/greenstone with some mélange shale. Embankment materials for the downstream shell of the dam will be obtained from Temblor Sandstone materials from the required spillway excavation.
Calaveras Dam Replacement Project
Observation Hill Spillway Cut Slope
Annotations by C. Philip Respess, C.E.G.
Senior Project Engineering Geologist
URS Corporation
Project Update

Following the hole-through, miners completed the installation of the last 14,500 feet of 8.5 foot diameter steel pipe liner in the new tunnel, installed in 50-foot sections and welded together from inside of the tunnel. As with the Vargas West to Irvington Portal heading, the space between the steel pipe and the excavated tunnel has been backfilled with low-density cellular concrete to prevent water seepage. Our crews completed the cellular grouting work in July 2014. The final step is to finish with mortar lining of the New Irvington Tunnel in coming months. We anticipate commissioning the New Irvington Tunnel into service sometime in Fall 2014. Construction for a new portal structure continues at Irvington Portal and habitat restoration work will commence at both Alameda West and the Irvington Portal sites once the tunnel is in service.

Project Background

The existing New Irvington Tunnel is an important part of the Hetchy Hetchy Regional Water delivery system. The New Irvington Tunnel Project is part of the $4.6 billion Water System Improvement Program (WSIP) to repair, replace, and upgrade the system’s aging pipelines, tunnels, and dams.

The New Irvington Tunnel will provide a seismically-designed connection between water supplies from the Sierra Nevada Mountains and the Alameda Watershed to Bay Area water distribution systems. Not only does it provide a seismically sound alternative to the existing tunnel, the new tunnel will allow the San Francisco Public Utilities Commission to take the existing tunnel out of service for much needed maintenance and repair.

Construction Began: August 2011
Construction Bid Cost: $226.6 M
Projected Completion: Mid 2015
Construction Contractor: Southland / Tutor Perini Joint Venture
Construction Management: Hatch Mott MacDonald
Design: URS / Jacobs & Associates
Project Details

- Completed Tunnel Length: 3.5 Miles (18,660 feet)
- Finished Internal Diameter: 8.5 feet
- The new tunnel is designed to withstand a major earthquake and allow the SFPUC to continue to provide water after a seismic event or other disaster
- The New Irvington Tunnel runs parallel to the existing tunnel between the Sunol Valley south of Highway I-680 and Fremont, California
- Alameda West Portal connects the existing and new tunnels to the upstream Alameda Siphons, which in-turn connects to the Coast Range Tunnel in the system
- The New Irvington Portal and manifold connects the tunnel to the five downstream Bay Division Pipelines that deliver water to 2.6 Million Bay Area customers
- The tunnel was excavated using conventional mining methods, including road headers and, in sections of hard rock, controlled detonation
- The Contractor has injected in excess of 7.8 million pounds of cement as part of the pre-excavation grouting program to reduce groundwater inflows into the tunnel and stabilize the tunnel headings

For more information
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