

November 19, 2024  
G6283B

**Draft**

Scott Lewis  
PROVOST & PRITCHARD CONSULTING GROUP  
19969 Greenley Road, Suite J  
Sonora, CA 95370

**SUBJECT: Summary of Estimated Costs for Pre-Construction Rockfall Monitoring  
and Catchment Fence Installation**  
Canyon Tunnel Portal, Goodwin Dam  
Calaveras County, California

Dear Scott:

Cotton, Shires and Associates, Inc. (CSA) is pleased to provide Provost & Pritchard Consulting Group (P&P), the South San Joaquin Irrigation District, and the Oakdale Irrigation District with this proposal for rockfall monitoring during Canyon Tunnel Portal construction. The portal construction will take place along the right abutment of the dam, and will necessarily be performed beneath the precipitous volcanic slopes of the north canyon wall. We recently performed a rockfall investigation of the right abutment slope and determined that rockfall hazards are present above the portal construction area, and that these hazards present a high risk to the construction zone. We recommended that a rockfall catchment fence be installed above the tunnel portal to help reduce the rockfall hazard to construction zone. As you are aware, we are currently performing pre-construction monitoring of the steep slopes to gain information on the behavior of these steep slopes in advance of construction. It should be understood that the construction cost for the catchment fence is preliminary and should be finalized with a formal construction bid from a qualified engineering contractor with experience installing rockfall catchment fences. We contacted a qualified catchment fence contractor (Global Rope Access) and provided our rockfall investigation results to them for their preliminary cost input.

We anticipate that the type of monitoring we are currently performing (drone-based comparative surveys) would continue for the approximate 3-year construction period, and this would be augmented with real-time instrument monitoring of the identified hazardous rock blocks. Our construction monitoring costs should also be considered preliminary. We are providing the following scope of work, preliminary fee to perform the pre-construction monitoring:

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**Northern California Office**

646 University Avenue  
Los Gatos, CA 95032  
(408) 354-5542

**Central California Office**

6417 Dogtown Road  
San Andreas, CA 95249-9640  
(209) 736-4252

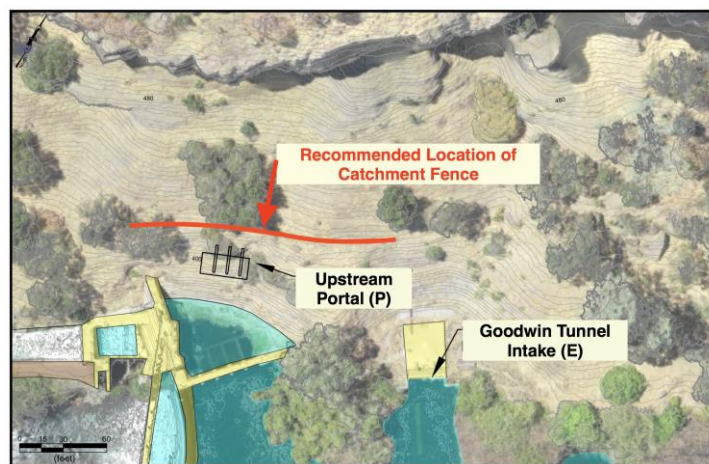
**Southern California Office**

699 Hampshire Road, Suite 102  
Thousand Oaks, CA 91361  
(805) 370-8710

## **PART 1 – INSTALLATION OF A GEOBRUGG CATCHMENT FENCE**

CSA recommended an approximate 200-foot long, 8- to 12-foot high Geobrugg style catchment fence be constructed above the tunnel portal construction zone (see Figure below). Our cost estimate was generated based upon our in-house engineering experience and ballpark costs provided to us from Global Rope Access, a contractor extremely experienced in difficult access construction of rockfall mitigation (Josh Wagner, contact). For the 200-foot long catchment fence, we anticipate the costs to be:

**Part 1 Costs: \$3,000/lineal foot + 50,000 eng. & Insp. = \$650,000**



This cost is approximate and does not include the cost of a barge, which we assume would be in place by the general contractor. A 'spider rig' would be the likely drill rig that would be needed for this installation.

## **PART 2– DRONE BASED SURVEYS:**

Part 2 would include monitoring and photographing the slopes above the dam, similar to our current preconstruction monitoring scope of work:

- A. Field Installation of Survey Markers – We will install (as needed, if our existing monuments have been disturbed or displaced) survey markers along the top and base of the bluff for use in our drone-based comparative photogrammetry analyses.
- B. Drone Monitoring – We will perform focused drone flights of the critical areas of the rock face above Goodwin Dam to obtain close-up photographs of the conditions of each rock slab being monitored. Subsequent flights will be

performed at quarterly intervals, and following extraordinary storm events, to evaluate any changes to the rock face.

- C. Comparative Analysis – Comparative photogrammetry analyses will be performed using Pix4D to generate differential change maps from our drone photos.
- D. Reporting – We will generate quarterly pre-construction monitoring reports.

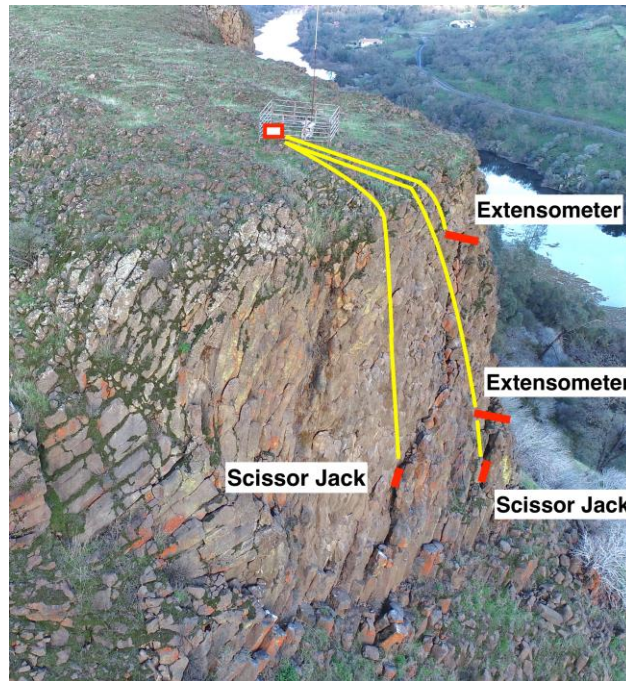
**Part 2: Quarterly Drone Surveying (3 year period) = \$150,000**

**PART 3 – INSTRUMENT MONITORING OF IDENTIFIED ROCK BLOCKS**

Part 3 would include the installation of instruments on the identified loose blocks on the upper cliff for real-time monitoring (see Figure below). Survey prisms would be installed on the blocks on the lower cliffs that would be surveyed using standard theodolite techniques. The Part 2 Drone Surveys would identify any incipient movement outside of the areas of the Part 3 instrumentation:

- E. Instrumentation Research and Consultation – We will research monitoring instruments to obtain the most effective monitoring equipment for the site conditions.
- F. Instrumentation Installation – We will install instruments along the most critical areas of the rock face and will necessarily need to install these instruments utilizing rock climbing techniques. We propose to install ‘Scissor-Jack’ crack meters, extensometer style crack meters, and/or tiltmeters (see photograph below) on the upper cliff’s loose blocks, and utilize traditional survey prisms monitored from the dam on the lower cliff blocks.
- G. Data Recovery/Analysis – We propose to have the crack meters downloading to dataloggers that can transmit data remotely so real-time information can be gathered on critical rock slab movements. We recommend that CSA and the contractor both have access to the remotely retrieved data, and that alarms be set at critical thresholds for instant warnings. Traditional surveying would be performed on the Lower Cliff by CSA, or by a local surveyor who would provide data to CSA.
- H. Reporting – We will provide monitoring results in a format and time frame to be determined at the start of construction; however, for purposes of cost estimating, since the upper cliffs are instrumented with alarms, we propose to review the remote instrument data on a weekly basis and provide monthly reports (unless significant movements occur). The lower cliff blocks would be surveyed on a bi-

weekly basis, or on shorter intervals during winter, or during construction periods that involve vibrations, and these results reported monthly.



**Part 3: Instrument Costs, Installation, and 3 years of monitoring = \$425,000**

**SCHEDULE**

We hope that this provides you with the information that you need at this time. If you have questions, or need additional information, please contact us.

Very truly yours,

**COTTON, SHIRES AND ASSOCIATES, INC.**

John M. Wallace  
Senior Principal Engineering Geologist

Reviewed By: \_\_\_\_\_  
Andrew Mead  
Principal Engineering Geologist

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**COTTON, SHIRES AND ASSOCIATES, INC.**