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To: Fish Passage Working Group

From: Mindi Curran, GIT; Geoff Hales, PG

Subject: Geotechnical opinions of south and north bank fish ladder construction options at Scott Dam

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Adult and juvenile fish passage at Scott Dam is part of ongoing Working Group discussions. Recent work and investigations have included conceptual fish ladder designs (Mead & Hunt 2018), as well as related discussions by Working Group members about other types of fish passage opportunities and design ideas. One of the issues that will inform conceptual fish ladder options is geotechnical stability of the hillslopes on the north side and the south side of Scott Dam, to help evaluate suitable location(s) for fish passage facilities (reducing risk of future fish ladder maintenance and/or failure).

Mead & Hunt (2018) placed the conceptual fish ladder on the south bank of Scott Dam, citing more favorable geography compared to the north bank. This could suggest an interpretation of more competent geology and/or better slope stability, but these details are not explained, and no other geologic or geotechnical rationale are provided. To help further evaluate geologic conditions at both the south and north banks, we reviewed a limited group of recent reports and geologic maps that characterize the regional and local geology (e.g., Melosh 2017; Ohlin et al. 2010), as well as a detailed geologic and geotechnical summary of Scott Dam (PG&E 2016).

Generally speaking, the geology at Scott Dam consists of Franciscan Assemblage sedimentary and metamorphic rocks, which are overlain by younger river terrace gravels and sediments. The terrace gravels and sediments range in age from Pleistocene to recent, and are described as ranging from weakly consolidated to unconsolidated. Both banks contain the same rock types, but in different proportions and in different dispositions. Variations in soils, sediments, topography, vegetation and bedrock between north and south banks have a strong influence on the mass wasting potential (surface erosion, landsliding).

Ohlin et al. (2010) show three large landslides on the south bank, all having originated in older alluvial deposits, which suggests that the alluvial deposits are susceptible to mass wasting (Figure 1). As part of a more detailed site-specific investigation, PG&E (2016) summarize the geology and geomorphology at Scott Dam, both in the immediate up- and downstream vicinity. Their mapping is at a much higher resolution than Ohlin et al. (2010), and shows additional earthflows, slumps, and debris flows on both the north and south bank (Figure 2). The most attention in their report has been given to the large landslide complex located on the south bank adjacent to the left bank dam abutment (called the “1920 slide”, this is one of the three slides also mapped by Ohlin et al. 2010; see PG&E 2016 for additional detail and discussion of historic mapping, monitoring, and related analyses). The PG&E investigation is focused primarily on the south bank and contains limited mapping and description of the north bank, yet the north bank mapping identifies three headscarps (topographic features showing displacement resulting from past landslide activity) showing some mass wasting features on this bank as well (Figure 2).

Although more mass movements have been documented on the south bank (in part due to more detailed mapping and investigation focusing on the south bank), the north bank consists of a substantially larger area of alluvial deposits, suggesting that overall there may be a higher risk for future hillslope failure on the north side of the channel (thereby also suggesting the south side is a more suitable location for constructing a fish ladder); however, much of the mapping on the north side of the channel did not include mass movement activity type (e.g., slump, slide, or flow) or activity status (e.g., active, dormant, relict). Additional investigations are recommended to better identify the location and type and activity of landslide (or other mass movement) features which could affect future fish passage facilities at the site, such as aerial photograph and LiDAR review, and geomorphic mapping to better identify, map, and assess the activity of geohazards on both the north and south banks. The results of this investigation can better inform fish passage facility design (e.g., wrap-around fish ladder with shorter hillslope traverse compared to straight ladder with longer hillslope traverse) to help minimize areas of unstable (or potentially unstable) ground.

Sincerely,

Mindi L. Curran, G.I.T.

Geoffrey M. Hales, P.G.

References

Mead & Hunt 2018. Scott Dam Fish Ladder Feasibility Evaluation Executive Summary. Technical memorandum prepared by Stephen Sullivan, P.E. April 30, 2018. 37 p.

Melosh, G. *Geologic Risks at the Potter Valley Project*. Unpublished report prepared for Cal Trout, Arcata, CA. 28 p.

Ohlin, H., R. McLaughlin, B. Moring, and T. Sawyer. 2010. Geologic map of the Bartlett Springs Fault Zone in the vicinity of Lake Pillsbury and adjacent areas of Mendocino, Lake, and Glenn Counties, California. USGS Open-File report 2010-1301. 32 p.

PG&E 2016. 2016 Scott Dam FERC Part 12 Safety Review, Section 5.0.

Figures

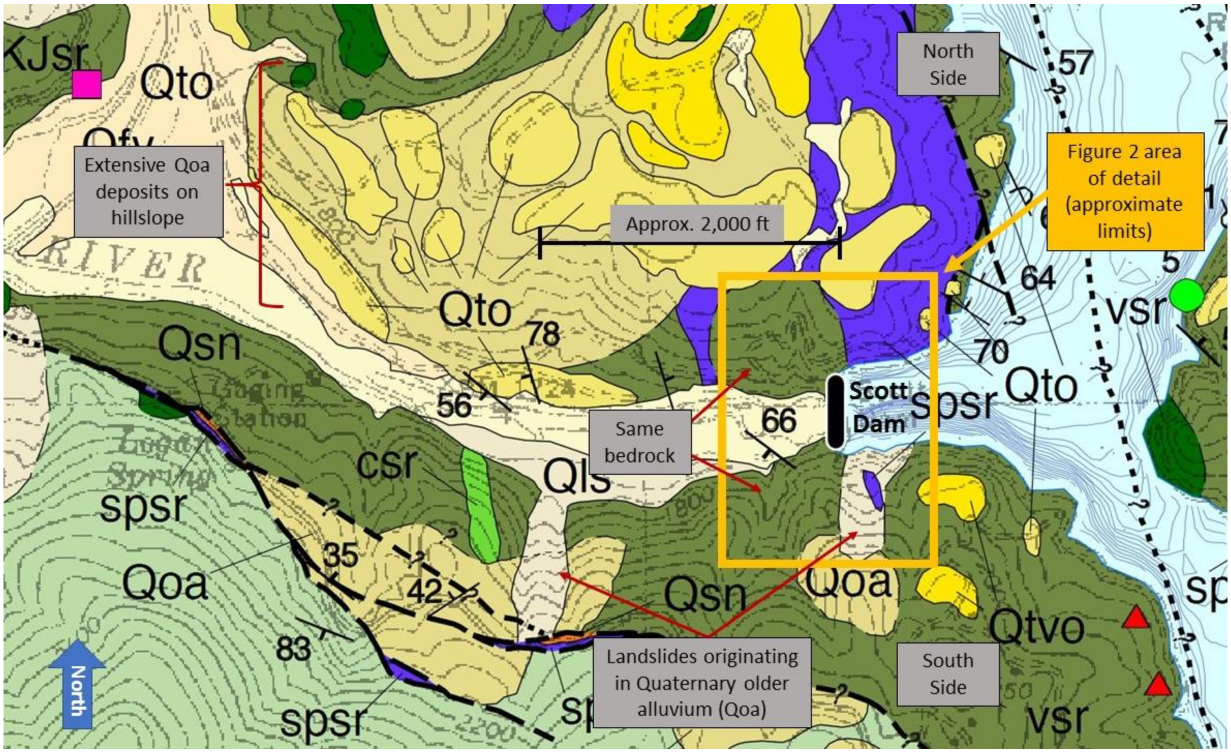

Figure 1. Enlargement of 1:30,000 scale geologic map by Ohlin et al. (2010) in the Scott Dam vicinity, annotations highlight greater proportion of alluvial deposits on the north side of the channel downstream of Scott Dam, including alluvium ranging in age from Holocene to Pleistocene (e.g., Qal, Qto, Qoa).

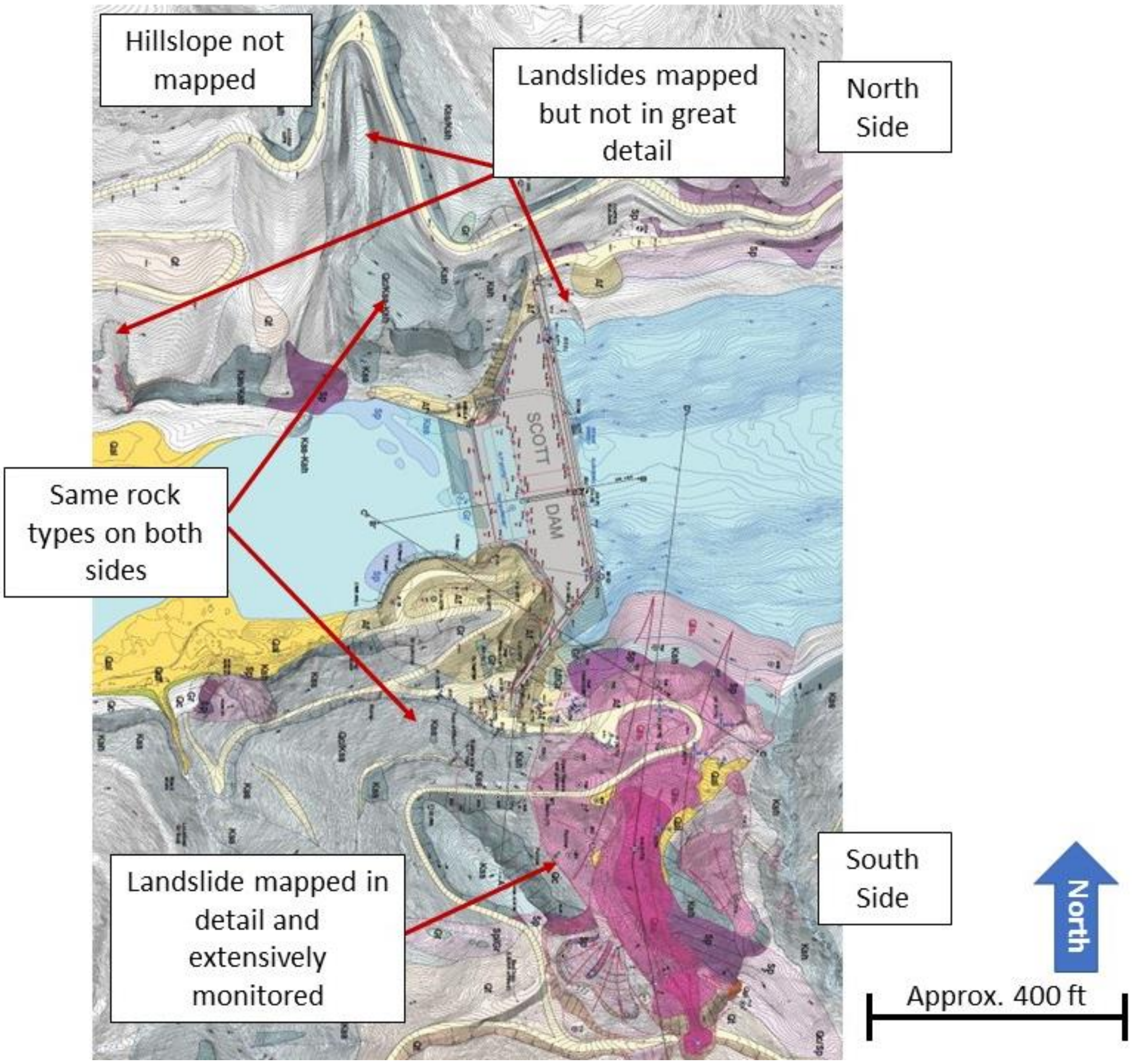

Figure 2. Detailed site geologic and geomorphic map by PG&E (2016); annotations highlight landslide mapping on both north and south banks.