



Potter Valley Project Ad Hoc Committee

Fish Passage Profiles Evaluation

EXECUTIVE SUMMARY

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Developed by the Fish Passage Working Group

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The **scenarios subgroup** developed the conceptual passage scenarios and options.

The **scoring subgroup** developed and used a passage scoring matrix to evaluate the passage options.

Facilitation Team

Facilitators Gina Bartlett and Stephanie Horii of Consensus Building Institute assisted the subgroups to document the process and compile results into this final report.

Executive Summary

Background and Purpose

The Potter Valley Project on the Eel River is a set of hydroelectric facilities that includes two large dams (Scott and Cape Horn), water-diversion facilities, and a powerhouse. The project involves an inter-basin transfer that stores winter runoff from the upper Eel River and diverts much of that water to the Russian River to generate hydroelectric power and meet contract water demands. Scott Dam, which creates Lake Pillsbury, is a complete barrier to native fish species, preventing access to high value habitat for federally Endangered Species Act (ESA)-listed anadromous salmonids.

To balance diverse Potter Valley Project interests, Congressman Jared Huffman established an Ad Hoc Committee comprised of representative stakeholder groups across four counties, who have agreed to work collaboratively towards a *two-basin solution*. The primary tenet of the two-basin solution is achieving co-equal goals for a future Potter Valley Project, as stated:

1. Improve fish passage and habitat on the Eel River sufficient to support recovery of naturally reproducing, self-sustaining and harvestable native anadromous fish populations including migratory access upstream and downstream at current project dam locations.
2. Minimize or avoid adverse impacts to water supply reliability, fisheries, water quality, and recreation in the Russian River and Eel River basins.

To address the co-equal goal of fish passage, the Ad Hoc Committee formed a Fish Passage Working Group to identify a prioritized list of conceptual-level fish passage scenarios that would facilitate the ability of migratory fish to reach critical habitats beyond the Potter Valley Project (*i.e.*, above Scott Dam) and promote the recovery and long-term viability of currently depressed populations in the Eel River. To achieve this, the Fish Passage Working Group has strived to identify fish passage alternatives that meet the following three objectives:

1. Population viability of Upper Eel River anadromous fishes;
2. Access to abundant high quality habitat; and
3. Functional fish passage.

The Fish Passage Working Group is primarily composed of fish passage engineers, hydrologists, and fish biologists with extensive knowledge of Eel River natural resources and current Potter Valley Project operations.

Focal Fish Species

- Steelhead Trout (*Oncorhynchus mykiss*)
- Chinook Salmon (*Oncorhynchus tshawytscha*)
- Pacific Lamprey (*Entosphenus tridentatus*)
- Sacramento Sucker (*Catostomus occidentalis*)

The analysis focused on specific life history stages that would be most influenced by fish passage modifications.

Evaluation Approach

To identify and evaluate potential fish passage alternatives for the Potter Valley Project, the Fish Passage Working Group initially conducted an academic review of existing large scale fish passage facilities and fish passage technologies that are potentially applicable to the Scott and Cape Horn dams. After considering a wide range of options, the working group narrowed the scope to four primary fish passage scenarios that had the highest probability of success given the specific hydrologic setting, geologic and infrastructure constraints, and target species life-history considerations.

Due to the extensive challenges with achieving habitat access beyond the Potter Valley Project, the working group focused on the complete barrier and larger of the two project dams, Scott Dam (134-foot-high, 805-foot-long). Cape Horn Dam (63-foot-high barrier; 96-foot-high total; 515-foot-long) is located approximately 13 miles downstream of Scott Dam and currently has a pool-and-weir and orifice fishway. For this analysis, the working group assumed that the Cape Horn Dam fishway is functioning at current regulatory standards (California Department of Fish and Wildlife [CDFW] and National Marine Fisheries Service [NMFS]), effectively passing fish upstream and downstream.¹ US Fish and Wildlife Service (USFWS) and CDFW are currently conducting preliminary fish passage investigations to gain a better understanding of how fish are currently using the Cape Horn Dam fishway; however, a formal fish passage compliance evaluation will need to occur in the near future.

Fish Passage Scenarios and Options

The fish passage scenarios evaluated in this analysis include: (1) technical fishway; (2) trap and haul; (3) lowering and/or partial removal of Scott Dam; and (4) complete dam removal of Scott Dam with or without removal of Cape Horn Dam.

Scenarios (1) and (2) included minimal modification to existing water supply infrastructure and recreational facilities at Lake Pillsbury reservoir. Scenarios (3) and (4) included lowering (partial removal) or removing dams, which would require substantial changes in the approach to water diversions and associated operations to achieve the co-equal goals of the two-basin solution. Within each fish passage scenario, the working group developed two-to-three options to explore optimal configurations of each fish passage concept.

The Fish Passage Working Group formed two multi-disciplinary technical subgroups representing tribal, federal, state, county, and private entities to refine the details of each scenario's options to subsequently evaluate and score. Each of these scenario options were scored utilizing a standardized scoring matrix that evaluated biological and non-biological parameters. Fish passage scenario options were evaluated

Scenarios Overview

Scenario 1 | Fishway at Scott Dam

Scenario 2 | Trap and Haul

Scenario 3 | Partial Scott Dam Removal

Scenario 4 | Remove Scott Dam & Modify or Remove Cape Horn Dam

¹ The results of this analysis are contingent on the assumption the fishway meets CDFW and NMFS standards; however, the efficacy of the Cape Horn Dam fishway is unknown. USFWS and CDFW are currently investigating due to observed operational constraints from flooding and sediment deposition, predation, and fish behavior issues.

independently on the passage concept's unique merit and not against each other during the scoring process. Hence, scores reflect the potential of a passage concept to achieve anticipated performance standards independent of a scorer's passage concept preference.

All parameters were scored on a scale of low performance (1) to high performance (10). Scoring was considered through a lens of four native fish species that are of management significance and directly influenced by the project.

Scoring Results and Key Takeaways

Average Biological Feasibility for Fish Passage Scores

The average scores for biological feasibility of upstream and downstream fish passage scenario and options, are presented in Figures 1 and 2. Each marker indicates the average score for a scenario option within each scenario group (*i.e.*, fishway, trap and haul, partial removal, and dam removal) from the multi-disciplinary scoring subgroup.

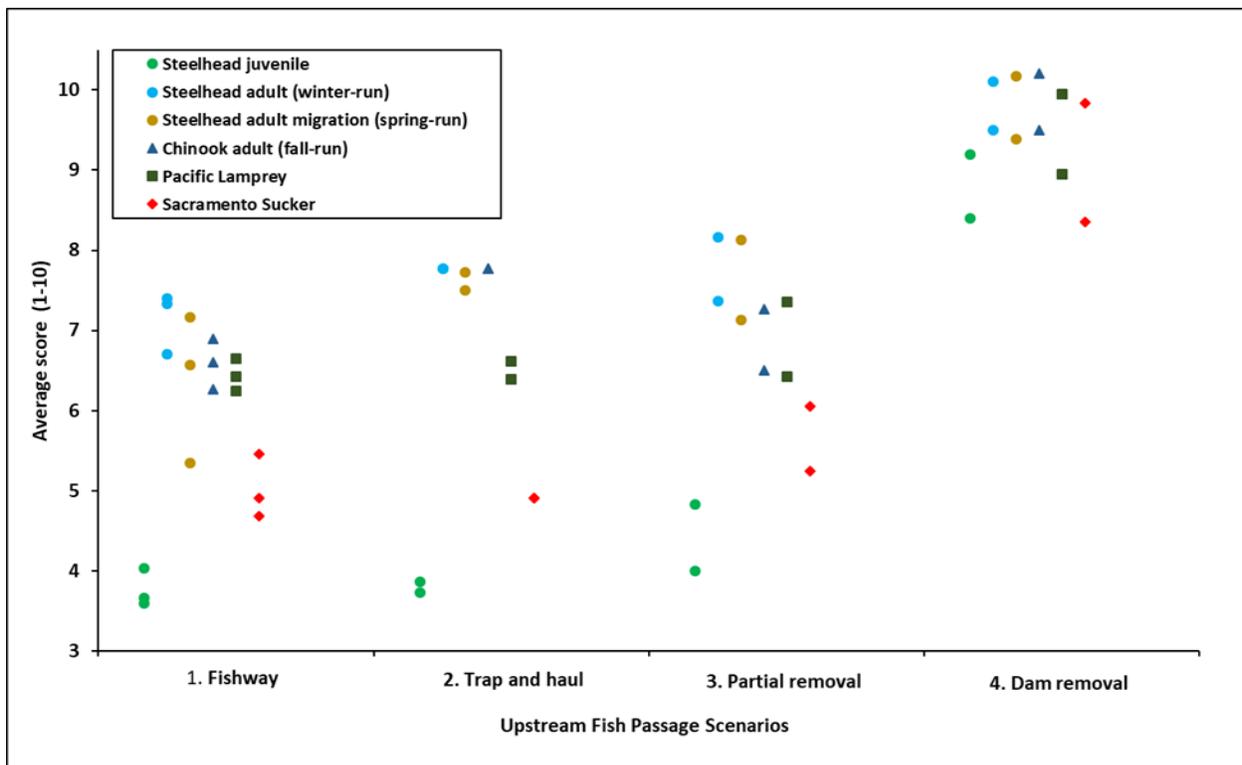


Figure 1. Biological feasibility for upstream fish passage is the ability for targeted species and associated life stages to successfully find the fishway and migrate to spawning/rearing tributaries above Scott Dam (upper Eel River, Rice Fork, and Salmon Creek, etc.). Allows for the potential benefit to the species by reestablishing occupancy of habitats, thereby promoting ecological and evolutionary processes responsible for local adaptation and diverse life histories.

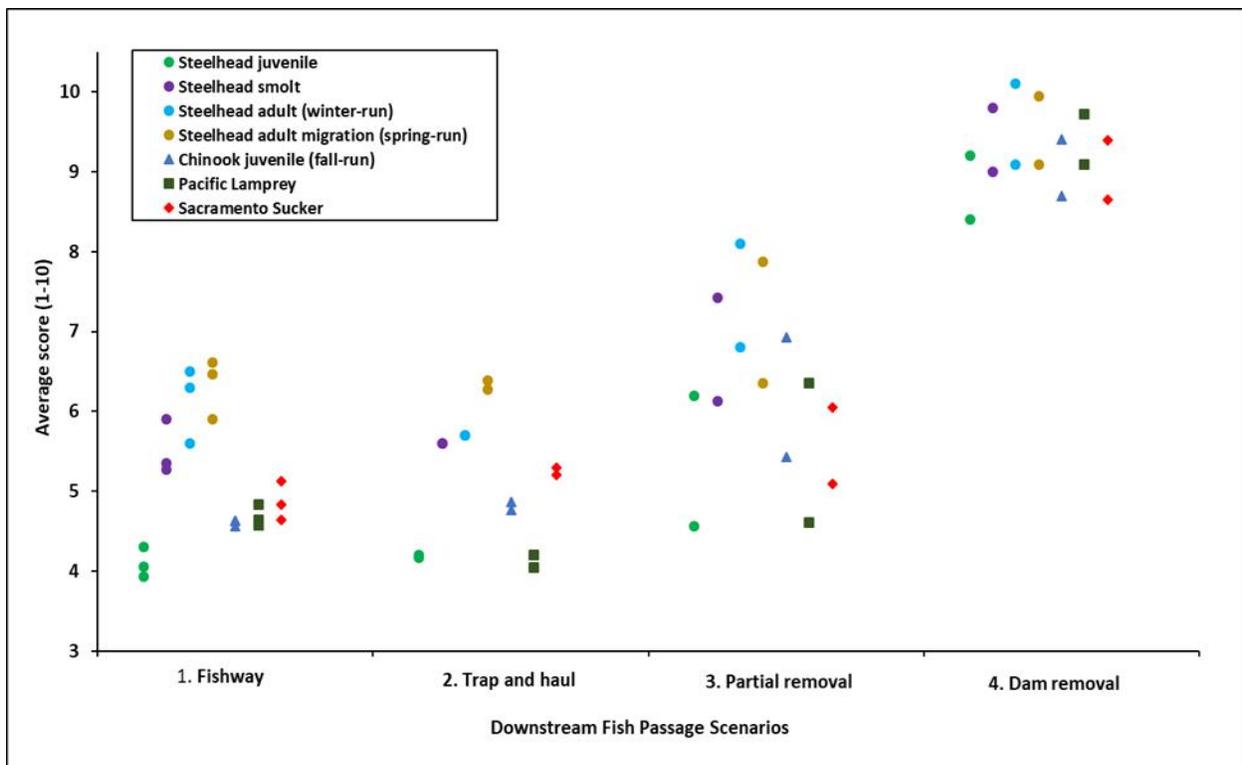


Figure 2. Biological feasibility for downstream fish passage is ability for targeted species and associated life stages to successfully migrate from spawning/rearing tributaries above Scott Dam (upper Eel River, Rice Fork, and Salmon Creek, etc.) to the lower Eel River and ocean. Allows for the potential benefit to the species by reestablishing occupancy of habitats, thereby promoting ecological and evolutionary processes responsible for local adaptation and diverse life histories.

Other scoring information collected includes the range of each scored passage option (i.e., level of uncertainty or divergent scores) and the associated biological and non-biological parameters scored (e.g., passage operations, engineering feasibility, and cost considerations, etc.). Refer to the main report for this information.

Key Takeaways

Dam removal options were rated to have the highest potential for successful fish passage while achieving maximum biological benefit, as reflected in the scored biological viability parameter (Figure 3). This result was shared by nearly all parameters, species, and life stages. However, dam removals also presented significant uncertainty with water supply and reliability for Lake Mendocino in the Russian River. Therefore, it is uncertain whether Scenario 4 could achieve a two-basin solution and is beyond the scope of this fish-passage analysis. A separate water balance effort is underway to look at alternative water diversion operations to the Russian River under each of these scenarios.

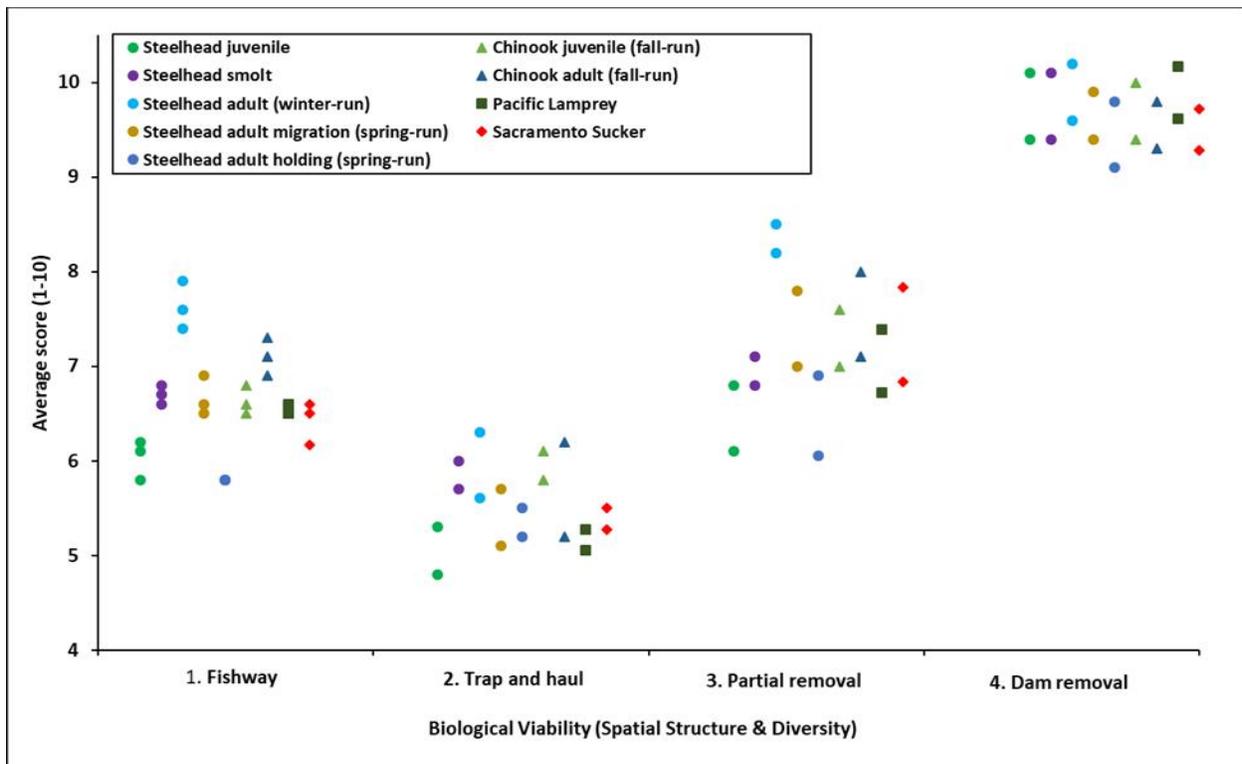


Figure 3. Biological viability (spatial structure and diversity) refers to the natural behavior and life history expression of a focal species life stage relevant habitat access and a fish passage option. The passage option allows adult fish to make choices related to spawning location and timing (e.g., site fidelity, mainstem or tributary, no delays). The passage option allows juvenile fish to imprint on natal streams and express diverse rearing and migration strategies. The extent of which the fish passage option includes selective pressures (e.g., degree of human intervention, unnatural environmental constraints, etc.) that could limit life history adaptation and phenotype or genotype expression.

Excluding dam removals, all other scenarios were found to have substantial uncertainties that would have to be overcome to support recovery of native anadromous fish. Generally, the sediment basin partial dam removal option (50') was scored as having a higher probability of meeting biological goals when compared to all other scenario options. These scores were driven by a range of parameters; however, the biological feasibility for downstream passage and biological viability (spatial structure and diversity) were a primary concern for scenarios other than dam removal (Figures 1 and 3). More specifically, concerns included the ability of fish to successfully navigate through Lake Pillsbury reservoir due to muted flow and/or other environmental cues, the ability to find the targeted downstream migration route, and the high probability of predation on focal juvenile fish species by non-native fish that occupy Lake Pillsbury and Van Arsdale reservoirs.

The Fish Passage Working Group identified several next steps for the Potter Valley Project to seek a two-basin solution. The coupling of potentially high performing fish passage options with water supply operations and further analyses of identified non-biological factors that require in-depth investigations to be properly incorporated into this fish passage evaluation process.

Scenarios and Options Overview

Scenario 1 | Fishway at Scott Dam

Construction of a fishway for volitional upstream and downstream passage at Scott Dam. Three different options of a fishway were explored, including a semi-natural channel (**Option 1.1**), a conventional fishway design proposed by Mead & Hunt 2018 (**Option 1.2a**), and a conventional fishway based on the Mead & Hunt design but modified to facilitate passage at a wider range of reservoir elevations (**Option 1.2b**). The three options were generally similar in nature but varied in location, construction materials, and several specific design features. All options facilitated volitional passage (no trapping or handling) and would require little if any change to current reservoir operations.

Scenario 2 | Trap and Haul

Explored trap-and-haul approaches that would require active management of collecting, loading, and transporting fish upstream and downstream above/below dam infrastructure. Two general options were assessed under this scenario: collecting upstream migrating fish at Cape Horn Dam (**Option 2.1**) or at Scott Dam (**Option 2.2**). In either option, facilities would be developed to collect fish migrating upstream, loaded and transported upstream, and placed at the top of Scott Dam or transferred into a barge for release in the reservoir. A floating downstream migrant trap and extensive guide nets would facilitate downstream passage.

Scenario 3 | Partial Scott Dam Removal

Investigated the concept of lowering Scott Dam to improve the probability of successful fish passage while maintaining some level of reservoir function. Two options were considered under this scenario: lowering Scott Dam to 80 ft to maintain water storage sufficient to meet minimum Potter Valley Irrigation District water demand (**Option 3.1**) or lowering Scott Dam to 50 ft sufficient to contain potentially contaminated sediments (**Option 3.2**). Both options would require a truncated fishway described in Scenario 1.

Scenario 4 | Remove Scott Dam & Modify or Remove Cape Horn Dam

Complete removal of Scott Dam and either modification (**Option 4.1**) or removal of Cape Horn Dam (**Option 4.2**). Under this scenario no fish passage facilities would be needed at Scott Dam, providing unrestricted fish passage. Fish passage would be further unrestricted with Cape Horn Dam Removal (Option 4.2). Substantial modifications to approaches in water management would be required to meet the needs of water users in the Russian River to compensate for lost Lake Pillsbury water storage.