EXHIBIT 3-B

Draft Los Padres Dam Fish Passage Feasibility Assessment Study Plan January 2016

Prepared by:
California American Water Company
Monterey Peninsula Water Management District

In cooperation with:
National Marine Fisheries Service
California Department of Fish and Wildlife

CALIFORNIA AMERICAN WATER

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
http://www.mpwmd.net
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Los Padres Dam Fish Passage
Feasibility Assessment Study Plan

January 2016

Los Padres Dam Fish Passage Technical Review Committee

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Photo source: MPWMD

ACRONYMS AND ABBREVIATIONS

AFY	acre-feet per year
BO	Biological Opinion
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
DSOD	Division of Safety of Dams
DPS	Distinct Population Segment
ESA	Endangered Species Act
Group	Project stakeholders guiding this study, to be determined
LPD or LP Dam	Los Padres Dam
MPWMD	Monterey Peninsula Water Management District
NMFS	National Marine Fisheries Service
Project	Los Padres Dam Fish Passage Project
RPA	Reasonable and Prudent Alternative
RM	River Mile, from the ocean
S-CCC	South-Central California Coast
Study Plan	Los Padres Dam Fish Passage Feasibility Assessment Study Plan
TRC	Technical Review Committee, composed of experts from Cal-Am, MPWMD, NMFS, and CDFW
USFWS	United State Fish and Wildlife Service

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1 Background

In an April 23, 2013 letter to California American Water (Butler to Svindland), or Cal-Am, the National Marine Fisheries Service (NMFS) stated the following:

> "The Los Padres Dam (LPD) has been a known fish passage impediment for both upstream and downstream migrating S-CCC [South-Central California Coast] steelhead as well as impacting the downstream habitat by blocking the natural sediment supply…As a first step towards protecting S-CCC steelhead, NMFS strongly encourages CAW to resolve the fish passage and other potential take issues at LPD [Los Padres Dam] by completing a thorough feasibility study on the merits of either: 1) entirely removing the dam and restoring the reservoir area to its original environs; or 2) improving the dam with appropriate permanent fish passage modifications that allow for unimpeded, safe and effective, upstream and downstream migration of all life stages of S-CCC steelhead."

In its December 2013 "South-Central California [Coast] Steelhead Recovery Plan," NMFS stated:

> "Prior to the removal or modification of …[Los Padres Dam] appropriate investigations and environmental review should be completed to address regional water supply and environmental issues, including, but not limited to any effects on the existing steelhead resources of the Carmel River watershed."

Subsequently, Cal-Am submitted project I15-400101 "Los Padres Dam Long-Term Plan" in its2015-17 General Rate Case Application to the California Public Utilities Commission. The project description stated:

> It is anticipated that if the dam were to remain "in place", then the feasibility study would need to answer critical questions such as: 1) improved upstream fish passage; 2) addressing the present sediment in the reservoir (i.e., what to do with what is presently there, and/or a continuing management/maintenance program); 3) installing appropriate screening on the intake/outlet structures; 4) insuring adequate fish passage through any accumulated sediment in the reservoir; 5) addressing water quality and temperature issues in the reservoir; and 6) replenishment of gravel in key downstream areas to facilitate fish spawning areas.

This study (the Project) is one of several being conducted by Cal-Am and the Monterey Peninsula Water Management District to answer a number of questions about the future of LP Dam, including

the question of "Is the Carmel River and the steelhead fishery better off with or without Los Padres Dam and Reservoir?" In particular, this study is to investigate whether it is feasible to improve juvenile and adult steelhead passage by installing upstream volitional facilities at LP Dam.

1.1 Los Padres Dam and Reservoir

Los Padres Dam, located at River Mile (RM, from the ocean) 24.8 was built in 1949, is 148 feet high and originally held 3,030 AF. Since that time, approximately 40% of the original capacity has been lost to sedimentation with the current capacity estimated at 1,775 AF at spillway elevation 1,040 (NGVD). The usable capacity is about 1,400 AF, as water at the lower level of the reservoir has either unacceptable quality for release or is not recoverable through the lower pipes through the dam. The concrete spillway is 600 feet long and has a height of 90 feet (see photos in Appendix B).

When it was built, the dam had no fish passage facilities, except for a trap located at the base of the dam. Data from the early trapping program, prior to 1982 are spotty, with records available for isolated years. Investigations into the steelhead resource recount that the trap was not functional for several years, resulting in the original trapping station below LP Dam being replaced in 1981. The replacement was operated for the next 18 years, until 2000, when a new Denil ladder and trap was constructed along the left bank of the plunge pool below the dam. Between 2000 and 2006, Cal-Am tried operating both traps below the dam. But, with the steady deterioration of pipeline to the old trap, use of the old trap was abandoned and only the new trap remains functional. Daily trapping records are available at MPWMD. Until 2015, downstream passage was over the spillway.

Downstream passage facilities for outmigrant juveniles and adults were constructed at the dam and spillway in 2015. The facilities include a behavior guidance system (BGS) coupled with a 900-foot long pipeline that places fish just downstream of the existing trap near the downstream end of the "plunge pool" below the spillway. The BGS provides downstream migration opportunities when river flows are at a low level and reservoir levels are below the spillway level – a capability that has not been available to previous generations of fish since the dam was built. No through-reservoir studies have been conducted to determine if fish migrate during periods of low flow. It is noted that at levels below the spillway elevation, fish in the upper two-thirds of the reservoir area (where most of the sediment deposition has occurred) are in open water with no vegetative cover.

The remaining reservoir storage is small, relative to median annual inflow (estimated at about 28,000 acre-feet per year)[1], and normally fills and spills each winter resulting in the watershed being in an uncontrolled state with river flow responding directly to rainfall and runoff. The reservoir provides virtually no flood storage or reduction. Releases from storage are provided in dry periods to

[1] The average flow is much higher at about 50,000 AFY due to high runoff numbers in extremely wet years.

augment flow downstream of the dam. There is no direct connection to a municipal supply system; however, a portion of the flows released from Los Padres Reservoir are diverted to municipal use in the alluvial aquifer downstream of the former San Clemente Dam at RM 18.6.

2 Technical Review Committee (TRC) and Stakeholder Group (Group)

A technical review committee (TRC) is to be formed with representatives from California American Water Company, Monterey Peninsula Water Management District, National Marine Fisheries Service, and California Department of Fish and Wildlife. The TRC will guide the development and review of the Study Plan. It is anticipated that the TRC would be involved in reviewing proposals for conducting the study and recommend a consultant after review of proposals. Cal-Am and MPWMD will make a final determination before MPWMD will authorize work by the consultant on the Project.

- **Technical Review Committee Composition** – The TRC is to have experience in the fields of engineering, geology, and steelhead biology and include representatives of regulatory agencies, including NMFS, and CDFW. The consultant will advise the TRC and prepare technical documents for review. Additional disciplines and/or agency and stakeholder group representatives may be added to the TRC if considered necessary.

- **TRC to be Independent** – The TRC will function independently (i.e., not be controlled by stakeholders, regulators, the dam owner or other interested parties in matters of opinion, conduct, so forth) and maintain the responsibility to objectively conduct the feasibility evaluation and prepare the feasibility report based on professional and technical expertise and experience, supported by the best available information. The TRC is expected to incorporate information from NMFS, CDFW, DSOD, Cal-Am, MPWMD, and others in the implementation of the Study Plan. The Study Plan specifies how and at what points in the evaluation Group participation will be required to assure that the TRC is fully informed prior to completion of the various Study Plan tasks.

- **Stakeholder Group** – members or organizations within the community with an interest or particular expertise will be invited to be part of the study process. [Need to identify stakeholders – potential participants include CRSA, Trout Unlimited, Carmel Valley Association, CRWC, academia (e.g., CSUMB professors).]

- **Facilitated** – MPWMD and Cal-Am will act as facilitators and as lead when necessary during workshops and related interactions with the TRC and Group. The Consultant for the project will complete all work that is not explicitly directed to the TRC or the Group.

- **Responsibility** – Cal-Am and MPWMD are ultimately responsible for implementation of the Study Plan and an evaluation report. MPWMD is subject to the Public Records Act and intends to implement the Study Plan in an independent, transparent, open, and objective manner. Cal-Am shall not be required to provide MPWMD, the TRC, or Group with any confidential, proprietary, or otherwise sensitive information or records as determined by Cal-Am in its sole discretion (Confidential Information). If CAW provides Confidential Information for the purposes of the Project, the Confidential Information shall be treated in the same manner as "Confidential Information" is treated under the California American Water-MPWMD Non-Disclosure Agreement dated June 22, 2009, with the exception that Cal-Am shall not charge MPWMD for the costs of providing Confidential Information.

  It is the TRC's responsibility to assure that the Study Plan is supported by the best available information, including input from the Group. The TRC is responsible for soliciting input from the Group as defined in the Study Plan, determining the utility of the input in implementation of the Study Plan, openly conducting the evaluation by providing the products identified in the Study Plan, including meetings and product review, and objectively conducting and reporting the evaluation as defined in the Study Plan. Group representation at in-person workshops, as well as timely Group review and comment on critical products as they are developed is essential to assure Group participation and ultimately an objective, useful evaluation and conclusion regarding volitional upstream steelhead fish passage feasibility at LP Dam. However, the TRC will be responsible for decision-making involving evaluation criteria, fatal flaw analysis, and prioritizing alternatives.

2.1 Study Plan Audience

The intended audience for this document includes:

a) The TRC, as a guidance document which will be utilized to develop a scope of work, budget, and schedule to implement the Study Plan;
b) Cal-Am, for scope comment and approval, for consultation needs to communicate the approach to address NMFS' requirements for fish passage;
c) NMFS and CDFW for effective collaboration with the TRC and to monitor how the study is conducted;
d) DSOD, for its assessment of compliance with dam maintenance requirements; and
e) Stakeholders interested in the topic.

2.2 Principles of the Study Plan

- Volitional alternatives will be considered concurrent with the existing operation (i.e., trap and transport and BGS/pipe downstream passage facility). At least one upstream volitional alternative will be carried throughout the study.
- Economic feasibility will be addressed in the technical feasibility evaluation focused on relative cost of alternatives. After the feasibility analysis of passage alternatives is completed, a planning level cost estimate will be completed for use in a comprehensive feasibility analysis of passage alternatives.
- Dam removal and river restoration has not been previously studied. Consideration of this option may become part of the overall Long Term Plan for Los Padres Dam, but is not being considered in this Project as an alternative.

3 Approach

This process will document development and the resulting conceptual design configurations for the alternatives, the evaluation criteria, the evaluation process and results, and a recommended fish passage alternative.

The decision criteria for determining feasibility include a combination of technical and biological evaluations which will provide information on the applicability of fish passage alternatives. Technical feasibility is governed by engineering aspects and fish passage aspects. The engineering aspects include the physical dam and reservoir characteristics, hydrology, configuration of the river at the entry point, water storage and release operations, and the geology along the alternative passage alignments. The fish passage aspects include steelhead behavioral responses to site conditions, including migration timing, response to flows and temperatures, and migratory pathways. Economic aspects include project construction costs and operation and maintenance costs. These factors will be integrated and the process conducted iteratively such that intermediate results from each analysis will be used to refine and optimize alternatives throughout this process.

Volitional upstream steelhead passage will be considered by the TRC, and following an objective evaluation, the TRC will provide a recommendation regarding fish passage at LP Dam. If volitional upstream fish passage is considered infeasible or impractical, the justification for this conclusion will be documented.

3.1 Definitions and Applications of Feasibility

Feasibility in this Study Plan means the technical, biological, and economic feasibility of volitional upstream passage at LP Dam for adult and juvenile (> 1 year) steelhead.

Technical Feasibility

"Technical feasibility" is both engineering and fish passage feasibility. Engineering feasibility is governed by physical dam and reservoir characteristics, hydrology, water storage and release operations, geology in the vicinity of fish passage improvements, and operating and construction cost. Fish passage feasibility is governed by steelhead behavioral responses to site conditions, including migration timing, migratory pathways, and water quality through the passage facility.

Will the fish passage alternative be effective in safely collecting and passing fish? Can the fish passage alternative be constructed and operated while maintaining the original purpose of LP Dam to store water in the winter and release it through the dry season? Do the fish passage facilities work at water levels below the spillway?

Technical feasibility will be judged using criteria that are "yes" or "no" (feasible or not) or scalar (presenting relative feasibility among alternatives). The TRC will use thresholds in the scoring of evaluation criteria, such as constructability and safety to assess feasibility. For example, dam safety might have a threshold such that any alternative must score high to be considered feasible; alternatives that do not score at least the minimum value will be considered fatally flawed. Thresholds, or minimum values and scores are subjective; consistent definitions will be necessary to establish these values.

Biological Feasibility

Does the proposed fish passage alternative provide adequate attraction into a facility and meet velocity, depth, and step criteria for the designated life stages? Does the facility operate during all periods of migration and at all flows that fish can migrate at?

Economic Feasibility

The TRC's objective is to recommend a feasible fish passage alternative(s) for LP Dam. However, the evaluation may result in a series of fish passage alternatives that meet the test of technical feasibility, but have inherent risks or uncertainties, and may also significantly vary in cost. This may prompt the Group to further recommend studying "economic feasibility." As applied here, economic feasibility has two components:

1. **Financial feasibility** – Can the proponent afford to implement the recommended fish passage alternative(s)? This will likely require a cost examination by Cal-Am, including impacts assessment on its operations and customers. The evaluation develops and provides much of the information base for Cal-Am to make their decision.

2. **Cost effectiveness analysis –** there are two distinct cost comparisons possible for this Project. One is to compare the cost and effectiveness of volitional upstream passage alternatives. This is a fairly straight-forward analysis using some of the parameters discussed for the evaluation matrix. The other is to compare cost and effectiveness of volitional passage facilities with the existing trap and haul operation. This is less straight-forward as there are more uncertainties to deal with, including fall back data, level of steelhead stress, and different life stages are targeted (the existing ladder does not allow juveniles to migrate in). The TRC and Group may want to consider if and how a comparison may be made. An incremental approach may be one method of comparing (e.g., expected number of passage days for each life stage, design flow range, safety of alternatives).

3.2 Study Overview

The feasibility evaluation includes conduct of six tasks; four tasks to determine feasibility and identify fish passage alternatives, one for alternative development and a Group decision point, and one task to complete a Final Report. These tasks are summarized below, and additional detail is provided in Section 4. A schedule is provided in Section 4.9 that outlines this work plan.

- Task 1: Feasibility Study Preparation (Consultant)
    - Task: Compile and review background information necessary for development of fish passage concepts.
    - Outcome: The deliverables will be base drawings, maps, current operational protocols necessary for fish passage, hydrology, and geology of the site. Additional information needs will be identified and communicated to the Group.

- Task 2: Prepare Biological Performance Tool (Consultant)
    - Task: Develop a spreadsheet-based biological performance tool to be used to estimate the biological performance of fish passage alternatives. [Are there existing biological performance measurements for passage? What types of biological performance would apply? Those applied to adults only and those applied to adults and juveniles?]
    - Outcome: The deliverables for this task are a draft of the biological performance tool with initial data set [?] and sensitivity run output [?].

- Task 3: Identify Fish Passage Concepts (Consultant, TRC)
    - Task: Develop an initial list of fish passage concepts and refine the list by eliminating those with fatal flaws.
    - Outcome: The deliverables for this task are an initial list of potential fish passage concepts, a discussion of the fatal flaw analysis, documentation of concepts

eliminated from further consideration, and a recommendation of fish passage concepts for further development. A spreadsheet analysis of site-specific criteria, hydraulic functional design, preliminary construction and operating cost estimates, general layout, and identification of uncertainties for further examination will used to screen the initial list of alternatives. Concepts will be reviewed by the TRC and those that meet acceptance criteria will move forward as alternatives.

- Task 4: Alternative Development (Consultant, TRC and Group)
    - Task: The TRC and Group will review the information developed in Tasks 1, 2, and 3 and develop fish passage alternatives applicable at LP Dam. Performance of the alternatives will be identified using the biological performance tool (Task 2) and taking into consideration criteria developed in Task 3. Alternatives that are not technically feasible will be dropped from consideration and reasons for them being dropped, will be described. The alternatives and explanation of their operation and biological performance will be presented to the Group and TRC at a workshop focused on evaluating which alternatives should be further developed for review.
    - Outcome: Deliverables include descriptions and drawings, including estimates of biological performance, and a preliminary list of feasible fish passage alternatives.

- Task 5: Fish Passage Alternatives Refinement (Consultant, TRC and Group)
    - Task: The TRC and Group will perform and document an evaluation of the alternatives. Updated drawings and an evaluation of alternatives will be completed by the TRC and Group during a workshop.
        - The final evaluation will summarize fish passage alternatives receiving detailed evaluation, including descriptive text and drawings for each, opinions of probable construction and operating costs, an implementation schedule, and listing of pros and cons for each and a summary of evaluation details.
        - A cost effectiveness analysis will be conducted. The preferred alternative will be the one that meets the goal at least cost among all feasible alternatives.
        - Recommendations will be developed as part of this task, with consideration of the relative certainty of the capability of an alternative to provide fish passage around LP Dam, relative risk, and uncertainties. Recommendations might include identification of fish passage alternative(s) to be pursued, and further studies needed to reduce uncertainties.
    - Outcome: Deliverables include updated descriptions, drawings and the results of the evaluation process.

- Task 6: Reporting and Fish Passage Recommendations (Consultant, TRC and Group)
    - Task: This will consist of four components:
        - The Consultant will document progress and decisions made by the TRC and Group for their input at key milestones. The Consultant will prepare a final report to document:
            - the process followed to prepare the report,
            - development of technically and biologically feasible fish passage alternatives,
            - evaluation criteria,
            - summary of alternatives including those that were eliminated and reasons why they were eliminated, and
            - results of the TRC and Group final evaluation and recommendations for fish passage alternatives at LP Dam.
        - A draft Fish Passage Feasibility Report will be issued.
    - Outcome: Deliverables include a Final Fish Passage Feasibility Study report with recommendations for a preferred fish passage alternative, or a conclusion about the study

4 Study Methods and Work Plan

This section provides additional study detail pertaining to a work plan that is intended to guide the conduct of the feasibility analysis. A work breakdown structure with major task headings is provided with defined tasks that can be used as the basis of a scope of work. A schedule, showing each task and its relationship to other tasks along with a start date, duration, and planned completion date per the descriptions below is provided in Section 4.7 Schedule.

An important component of the study will be communication among and between TRC members, as well as between TRC members and the Group. This will be accomplished through meeting notes associated with the tasks described below, and with the distribution of Draft and Final Fish Passage Feasibility Reports. In terms of direct communication, the TRC may have a series of meetings and web calls that will serve to discuss the TRC's progress on activities that will be used to present and discuss the fish passage concepts under consideration. A series of three meetings is proposed to provide information, receive feedback and discuss the Project. The meetings are scheduled to take place at specific milestones in the Project, when results are available and input is required.

TRC and Group meetings recommended for each task of the Study Plan are identified within each task below.

The following Meeting Protocols are recommended for the Study implementation and have been incorporated into the Study Plan schedule presented in Section 4.9.

- TRC meetings are intended to be facilitated by the Consultant with assistance from Cal-Am and MPWMD. TRC members should physically attend; however, web meetings may be held due to distance and time constraints. Technical experts will be invited from NMFS, CDFW, DSOD, and potentially other agencies or groups as necessary for specific meetings as described below to assure that the TRC has proper and accurate technical information so that technical questions can be answered in a timely manner.

- Similar to TRC meetings, the Consultant will facilitate Group meetings with Cal-Am and MPWMD. All Group members should attend; however, web meetings may be held due to distance and time constraints.

- Reasonable meeting schedule dates and distribution of information prior to the meetings will be managed by the Consultant with assistance from Cal-Am and MPWMD. Meetings will be scheduled at least six weeks in advance, and will be announced with a time, place, expected

attendee list, and a preliminary agenda. Preliminary meeting dates are identified in the schedule, which will be updated once the consultant receives a formal notice to proceed date from MPWMD.

- Information to be discussed at Group meetings will be distributed at least two weeks prior to the scheduled meetings.

- Meeting notes will be taken by the Consultant and a draft meeting record will be distributed within two weeks of each meeting for review and approval. All meeting agendas and notes are intended to be part of the record regarding this study.

4.1 Task 1 – Feasibility Study Preparation

Task 1 is focused on the technical preparation for the concept development described in Section 3 - Approach. The Consultant will compile and review salient background information needed to prepare for a concept development workshop with the TRC, and will prepare workshop materials including passage concepts, evaluation criteria and an evaluation process. The review will allow TRC members to become familiar with the operational, physical, hydrologic, and biological setting of the LP Dam, the range of alternatives that could be considered, and draft criteria to evaluate concepts. This information will be important for identifying concepts and alternatives that can reasonably and realistically fit within the construct of existing operations (including downstream passage), are compatible with hydrological and physical constraints, and that meet the stated objective of improving upstream passage for Carmel River steelhead.

This background information will be utilized and added to as necessary throughout all tasks of the Study, and will be documented in the Final Report.

4.1.1 Task 1-1 Compile Background Information

Information to be compiled and reviewed will include:

- Project and related operations summary, including operation of existing trap and truck and downstream fish passage facilities, with a brief narrative on operations in a:
    - Average water year
    - Wet water year
    - Single-dry water year, and
    - Multiple-dry water year scenarios
- Biological design criteria and data summary that includes:
    - Migration seasons

- Upstream and downstream fish passage hydrologic windows in average, wet and dry years including antecedent conditions. See Figure 1 below for background. Conditions of estuary breaching and river flows necessary to allow for upstream migration from the ocean will be taken into consideration in establishing hydrologic windows for migration at Los Padres Dam.]

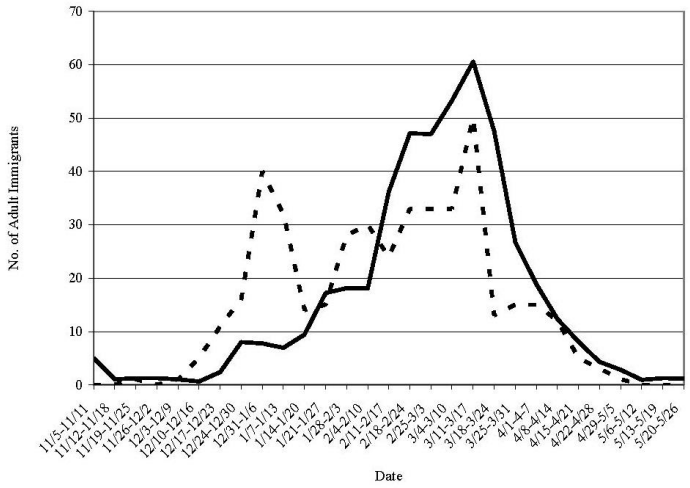

Figure 1. Timing of immigrating adult steelhead in Waddell Creek, Santa Cruz County (1933-1942; dashed line) and the Carmel River, Monterey County (1992-2005; solid line). Source: Waddell Creek information: Shapovalov and Taft (1954) and Carmel River information: Dave Dettman, Monterey Peninsula Water Management District, unpublished data obtained from NMFS.

- Key fish passage design flows; the Consultant and TRC will establish an appropriate range of flows to target for upstream migration
- Reservoir elevations during migration seasons
- Stage-discharge curves at existing entrance to ladder for trap and haul operation
- Project working drawings suitable for initial analysis including:
  - a site plan with topography/channel bathymetry, and features in the vicinity of the ladder, plunge pool, dam, and spillway
  - bathymetry in the reservoir within two hundred feet [?] of the dam.
  - sections through the dam at the west end of the dam, middle of the dam, spillway, and east of the spillway, with design water surface elevations
  - section of western slope immediately downstream of the dam from elevation 1060 to the plunge pool
  - enlarged plan at the plunge pool and existing ladder

- Cal-Am to define protocol for sensitive information

The deliverables for this task include:

- *a compilation of background information related to the project*

4.1.2 Task 1-2 Prepare Evaluation Criteria

Following the compilation, preparation, and review of background information, the Consultant will prepare the draft evaluation criteria using technical, biological and economic feasibility criteria.

The deliverables for this task include:

- *draft feasibility criteria*

4.1.3 Task 1-3 Identify Critical Data Gaps

The Consultant will identify missing or additional desired information and appropriate steps to acquire the necessary material. This process to address any information gaps will be identified based on the specifics of the necessary information, and a plan to address this information need will be formulated for TRC and Group input.

The deliverables for this task include:

- *identification of missing data or information*
- *proposal for acquiring data or information*

4.2 Task 2 – Prepare Biological Performance Tool

This task involves development of a biological performance tool that will be used to estimate potential steelhead passage survival using fish passage concepts to be identified and refined in the feasibility study. In addition, compiling information on upstream steelhead migratory behavior based on LP Dam counts, San Clemente Dam counts, and DIDSON data near the mouth of the river, will help identify the type, location, size, and timing of potential upstream fish passage facility components and the necessary coordination with existing downstream passage facilities. Additional information needs may be defined during the compilation and studies could be designed and implemented to provide such information. The proportion of the migrant population using each alternative and the estimated survival associated with new upstream pathways will determine the biological performance and contribute to the feasibility evaluation of fish passage concepts identified and developed in the study.

Successful steelhead passage at the Project must consider both upstream and downstream migratory pathways and the potential for both upstream and downstream movement to occur at the same time. Upstream fish passage systems are typically designed around considerations of upstream collection and upstream passage. Upstream collection defines the ability to attract and collect fish from downstream of a barrier. This characteristic includes the ability to behaviorally or hydraulically attract or guide the fish from the river into a fish collection chamber. Typical features of an upstream collection feature include a collection facility entrance (weir, orifice, slot, etc.), attraction flow to draw fish into the entrance, and a collection pool that encourages fish to stay, or traps fish in the facility to prepare for transport past the dam. The existing ladder and trap may be sufficient to meet these requirements for adults, but do not meet these requirements for juveniles.

Upstream passage defines the means to move fish from the collection pool to a release site upstream of the dam. Typical features of a volitional upstream passage component include various styles of fish ladders, fish lifts, and fish locks. The existing ladder, trap and transport program is to be evaluated for improvements separately from this study. Its relation to this study may be as an alternative to be considered if volitional passage cannot be achieved.

Upstream Collection and Passage – The upstream collection component is typically the most challenging passage feature to locate and design. This component must accommodate the behavior of the target life stages, complement other flow control operations, river hydrology, site hydraulics, and water quality. When comparing projects, the entrance component is typically the most variable of any other fishway feature. As a result, fishway entrances are often modified after their initial construction to help improve their attraction performance. Once fish are collected, the means to transport them past the dam is may be more straightforward to address.

With respect to upstream passage, effective attraction requires sufficient flows to attract upstream migrants away from other competing flows from spill or other releases. Thus, the frequency, magnitude, and location of flow releases play an important role in determining appropriate attraction flow designs and the feasibility of effective attraction. Effective attraction to fish passage facilities may be further complicated where flow releases occur at separate locations, such as from the spillway or through the existing ladder or through the downstream passage facilities.

Upstream migrants that are successfully attracted to a passage facility must then be effectively collected in such a way that minimizes migratory delay and injury. Dam height and the degree of water surface elevation fluctuations in the upstream reservoir may dictate the relative feasibility of various transport options. Potential thermal shock must also be considered for upstream passage facilities. Fish entering an upstream fish passage facility will be acclimatized to water temperature in

the plunge pool area. If fish are transported upstream around a dam, the transport water and release site must have similar water temperatures or the fish will be exposed to thermal shock and stress. Surface water temperatures at the release location and risk of fallback may affect the location of the exit and length of the passage facility.

Downstream Passage – the existing downstream passage facility may compete with the upstream passage facility for flow releases from the reservoir and there is a potential for exit flow from the upstream passage facility to attract downstream migrants.

Depending on size of migrant, time of year, flow condition, and steelhead behavior, the proportion of the outmigrant population using the downstream passage facilities may change in response to project operations, flow conditions and seasonal timing. Once outmigrants successfully approach the dam spillway, they must successfully find and enter the floating collector Behavioral Guidance System installed to pass the dam. Fish that do not pass downstream through fish passage facilities may seek other pathways, including being attracted to the upstream passage facilities. Consideration should be given to the potential for downstream migrants to attempt to enter the upstream facilities at the point of exit to the reservoir. Understanding the migratory patterns of each life stage will be key to determining the operational protocols for both upstream and downstream migration facilities.

Biological Performance Tool – The biological performance tool will consist of a spreadsheet based fish passage model that tracks steelhead survival through the various alternatives available. The values developed from the fish passage model will be used to compare and evaluate potential fish passage concepts, but will not represent estimates of the size of the steelhead population. Estimates of the proportion of the potential migrant population using each alternative will be integrated with estimates of survival associated with each alternative under representative average, wet and dry hydrologic conditions. An evaluation of the uncertainty associated with each assumption will provide an indication of the robustness of modeling results and the potential influence on recommendations of fish passage feasibility.

4.2.1 Task 2-1 Compile Background Information on Migratory Pathways

Information needed to develop and populate the fish passage model includes physical, hydraulic and biological information on conditions in the watershed and in particular at Los Padres Reservoir, flow releases, and operational characteristics of downstream fish passage facilities. Results of studies conducted at other water control projects, conceptual-level drawings of potential fish passage facilities, and where appropriate the professional opinions of the TRC and Group may also be compiled.

Passage conditions will be evaluated using average daily flow data for representative average, wet, and dry years. Project operations data will include daily reservoir water surface elevations, average daily flow releases through the outlet pipes and spillway, and periodic water quality data. Recent data on releases from storage and reservoir pool levels will be reviewed. This is presumed to be representative of current and proposed future conditions. Representative years will be selected in coordination with the TRC and Group to evaluate fish passage facilities. Information compiled as part of Task 2-1 will be used to populate the fish passage model and will be presented with a progress report at the end of this task. Additionally, this information will be discussed with the Group.

The deliverables for this task include:

- *technical memo characterizing available Los Padres Reservoir data and recommendation of target flows/reservoir elevations for passage*
- *review of studies and concepts appropriate to Los Padres Dam fish passage*

4.2.1.1 Passage Considerations in Los Padres Reservoir

Juvenile and adult steelhead passing the Project must pass through LP Dam and LP Reservoir. During reservoir passage they may be exposed to predation, poor water quality, thermal gradients, or become disoriented and delay or fail to pass through the reservoir. Specific passage related factors within the reservoir include:

- Average daily reservoir inflow under average, wet, and dry water years
- Periodicity of steelhead migration (peak and shoulder periods)
- Monthly reservoir water temperature profiles
- Daily reservoir water surface elevations under representative average, wet, and dry water years
- Relationship of fish migration rate to average daily flow
- Species, abundance and feeding behavior of potential piscivorous predators, including brown trout

4.2.1.2 Fish Passage Facility Considerations

Successful fish passage facilities must attract and guide migrating fish into the facility. Fish attraction and guidance may be enhanced by the volume of attraction flow, the use of barrier or guidance structure or nets, and siting of the facility in a location to intercept migrating fish. Fish safety through the facility is ensured by designing components following guidelines in fish passage design manuals (CDFG 2009, NMFS 2012). However, fish passage facilities that satisfy design guidelines may still function under a range of fish guidance efficiency and survival depending on site specific

conditions and behavior of the target species. Factors associated with the feasibility of fish passage facilities include:

- Style, size, design and volume of facility
- Effectiveness of fish guidance or barrier structure or nets
- Frequency and effectiveness of screen cleaning
- Behavior of target species in response to facility design
- Frequency and duration of operation under representative average, wet, and dry water years

4.2.2 Task 2-2 Review and Identify Critical Biological Data Gaps

The TRC will discuss the information noted above during planned web calls, and determine its completeness for the fish passage biological evaluation needs. Evaluation of upstream and downstream migratory pathways requires structural and hydrologic information and assumptions regarding steelhead behavior. No site specific data are available to make survival estimates, so these will depend on data collected at similar facilities, literature values, or professional opinions of the researchers.

Of note as background on biological data, the value of spawning and rearing habitat upstream of LP Dam in the Miller Fork, main stem, and Danish Creek continues to be a subject of debate and uncertainty. Studies of steelhead in the upper watershed (e.g., Snider, 1983 and Kelley, 1986) showed that steelhead had been unable to access the upper watershed for several years due to an inoperative or poorly functioning fishway and a small resident rainbow trout population had become established. Those earlier studies indicated that up to 50% of the spawning and rearing habitat in the watershed occurred above LP Dam. More recent MPWMD data (including redd surveys, population surveys, and fish rescue data) show that significant spawning and some rearing is occurring downstream of San Clemente Dam, in a reach where investigators from the 1980s had found little or no spawning or rearing and concluded that it was primarily a passage reach. Despite improvements to the ladder and trap facilities at LP Dam, the numbers of adults passing LP Dam continues to be about 25% 45% of the number passing San Clemente Dam and may be 12% to 22% of the annual run.[need confirmation of data here] This may in part be due to harm done to out-migrants prior to installation of downstream passage facilities in 2015, when out-migrating juveniles were required to slide down the 600-foot long LP Dam concrete spillway and kelts were rarely sighted over the spillway (there have been reported sightings of out-migrating kelts using the LP Dam spillway when flow over the spillway exceeds one foot or at flows > 350 cfs).

However, the focus of this Project is not whether a volitional passage facility would result in an increase in anadromous steelhead in the upper watershed. The focus of this Project is on the engineering constraints, biological needs of steelhead (i.e., ability of different life stages to use a

particular alternative), and the economic costs of volitional passage. Should definitive data on steelhead use and population in the upper watershed become available, it could be factored into the recommendations from this Project.

If additional information is needed, the TRC will work with the Group and Consultant to take appropriate steps to acquire the necessary material or develop reasonable assumptions. The process to address information gaps will be identified based on the specifics of the information. If data gaps are identified that prove critical to the feasibility evaluations and TRC recommendations, the TRC will identify the most appropriate means to fill those gaps, including influence on ability to complete an meaningful analysis, timing to acquire and evaluate the information and potential outcomes as they could affect the recommendations by the TRC. The following steps will be utilized in Task 2-2:

- Perform a background review of biological information, and identify information needs.
- Identify any biologically-related critical data gaps.

The deliverables for this task include:

- *technical memo describing data and data gaps*

4.2.2.1 TRC Review of Biological Performance Monitoring Tool

The TRC will review information from Task 1 (background) and Task 2 (biological performance tool) with the Consultant to determine suitability for work to evaluate passage facilities. It is expected that review will be completed using web access.

4.2.3 Task 2-3 Develop and Populate Fish Passage Model with Available Information

The Consultant will evaluate potential fish passage facilities at the Project using the biological performance tool that tracks survival at LP Dam and reservoir. The biological performance tool will be used to conduct a relative comparison of the biological performance of fish passage facilities. An evaluation of the uncertainty and sensitivity of the assumptions used to develop the mathematical functions will provide an indication of the robustness of modeling results. Evaluation of critical parameters, and background information available to define them, will be evaluated to determine the influence of the values in evaluating the potential feasibility of fish passage facilities.

One goal of the fish passage model is to incorporate a mechanism to easily alter the percentage of fish that move through each potential alternative as a function of river flow and reservoir water surface elevation. A flow response factor will be developed for upstream steelhead migrants to identify how migrants respond to flow. An initial response factor may assume that the number of fish entering the project on a given day in the migration period is approximately proportional to the volume of the daily reservoir inflow in relation to the total inflow during the migration period. Using

separate calculations for peak and off-peak migration periods, the total volume of inflow will be calculated and the proportion of fish migrating per day will be based on the percent of total flow for each day under average, wet and dry representative water years. An alternate response factor could assume that an equal number of fish passes each day in the migration period, or migration rates are correlated to water temperature. By incorporating an adjustable value, the sensitivity of the response factor to changing conditions will provide an indication of the influence of the response factor in evaluating total Project survival.

The mathematical functions used to calculate survival between alternatives will be developed in an Excel or other spreadsheet format to ensure transparency and ease of stakeholder review. The results of the biological performance tool will be an estimate of system survival for fish passage for each passage alternative. In addition, similar flow response functions and pathway apportionment will be used to estimate fish passage survival under existing conditions without volitional fish passage facilities. [Is this possible for the trap and truck operation? Is there an estimate of the proportion of fish that are turned back by the ladder or that can't get into the ladder?]

The volume of attraction flow water is an important design feature of facility components. Attraction flow volumes for both upstream and downstream are a balance between site conditions and competing flow releases. Alternate attraction flow volumes can be examined in terms of Project fish survival to assess facility sizing options. The feedback mechanism provided by fish passage model results will assist engineering decisions and allow each concept to be refined so that the optimum design of each fish passage alternative can be used in the feasibility evaluation.

Parameter values will be estimated from site specific data, borrowed from other populations, or professional opinion based on steelhead passage behavior. Each assumption will be identified and documented and major parameters will be accompanied by an evaluation of uncertainty.

The following steps will be utilized in Task 2-3:

- Finalize the biological performance tool, which will be a spreadsheet-based passage evaluation model.
- Populate the model with data and perform sensitivity runs to assess the model's output prior to use on the fish passage concepts and alternatives.

The deliverables for this task include:

- *a compilation of background information related to the project biology,*
- *a draft of the spreadsheet based model and data set, and*

- *a sample of model runs with output and a preliminary sensitivity analysis.*

4.3 Task 3 – Identify Fish Passage Concepts

The Consultant will develop concepts based on studies, experience, and history of other fish passage facilities and specific criteria and guidelines published by NMFS and CDFG. Concepts might be based on components of fish passage facilities, operational procedures, locations of facilities at the LP Dam site, or may replicate an entire facility. Concepts will be presented to the TRC for review.

The concepts will be grouped and organized for an initial evaluation and a "fatal flaw analysis" will be performed to eliminate any concept that cannon meet the basic criteria. Fatal flaws might include dam or personnel safety issues, constructability concerns, or poor chance of satisfying fish passage or other objectives. For concepts that have fatal flaws, the Consultant will document contacts with appropriate review experts and agencies including, but not limited to DSOD, CDFW, and NMFS. Concepts at this early phase of development that are fatally flawed will be documented and presented to the TRC and Group, but will not be further developed unless there is direction from the TRC and Group to do so. Concepts without fatal flaws will be considered technically feasible for further analysis and development in Task 4.

4.3.1 Task 3-1 Meeting #1 – Concept Workshop

The TRC and Consultant will meet to discuss passage concepts and criteria for evaluation. Using the information developed in Tasks 1 and 2, the Consultant will identify design flow ranges, select hydrologic design years, develop preliminary working base drawings, and develop a draft evaluation matrix. An information package containing a summary suitable for use in workshops under Task 3 with the TRC and Task 4 with the Group will be distributed in advance of the meeting. An appropriate review period of three to six weeks is recommended for TRC and Group technical representatives to review and discuss this information prior to workshops.

The deliverables for this task include:

- *technical memo describing design parameters, concepts, evaluation criteria, and initial analysis*
- *base drawings*
- *workshop agenda*

4.3.1.1 Meeting Protocols and Preparation

The session will be conducted with few limitations. A TRC member will be selected as a facilitator prior to the meeting to assure the workshop is conducted in an efficient manner. A designated note taker will also be selected to record and distribute draft meeting notes for review. Workshop facilities will be suitable for a team meeting, with access to web broadcast, presentation screen, and

teleconference facilities. Towards the end of the workshop, roles may be assigned for individual TRC or Group members to further develop alternatives for ongoing discussion.

The stakeholder group is encouraged to provide input to the plan but will not have authority to determine or rank alternatives. In addition, Cal-Am, MPWMD, and the TRC will be responsible for identifying evaluation criteria and what constitutes a fatal flaw.

Comment [LH1]: Added at request of Cal-Am.

The initial list of concepts will be refined using the background information developed in Tasks 1 and 2, and physical considerations described below. Existing and expected future conditions at LP Dam will be considered with the concept development, including the potential for reservoir dredging, dam raise, and/or continued reservoir siltation that may reduce flexibility of releases from storage.

Concepts will be developed based on design considerations described below, NMFS and CDFW fish passage guidelines, and the TRC members' professional experience and opinion regarding fish passage facilities. The identification and design of concepts will include both physical (including biological and environmental) considerations, and specific evaluation criteria, as defined below.

- Physical considerations are the physical background and setting into which fish passage facilities must be built and operated. They describe aspects of the dam, reservoir, stream channel, hydrology, facility operations, and biology that must be considered in the design of fish passage facilities.
- The Consultant will provide evaluation criteria for review in order to estimate each alternative's expected level of success in achieving fish passage and Project purpose. Evaluation criteria are similar to physical considerations though are specific and quantified. An initial list of evaluation criteria is in Appendix C.

In addition to the evaluation criteria (see draft criteria in Appendix C), the following considerations will guide the TRC discussion:

- Additional dam and reservoir considerations include the size, height, structure, layout of the dam, topography around it, access, any potential entrance or exit locations, and any necessary ancillary structures.
- Additional operational considerations include any effects on dam operation both during normal operations and during fish passage facility construction.
- Hydrologic considerations include inflow timing and magnitude, reservoir pool levels and rate of change, the flow release schedule, and spill timing, rate, and frequency. The outflows from the dam are influenced by the quarterly budget process, which will be reviewed by the

TRC and Group and used as a guiding but not limiting factor in the identification, development and evaluation of fish passage facilities. The TRC and Group recognizes that its assessment of alternatives needs to take into account the fact that water releases may change in the future as a result of completion of a Long Term Plan for LP Dam. Nevertheless, in assessing the technical feasibility of passage alternatives, the TRC and Group may consider whether the alternatives can function within the constraints of the potential options for the future of LP Dam and reservoir.

- Biological considerations include life stages to be passed and species present, migration timing and behavior, swimming abilities and behaviors, and water quality.

4.3.1.2 Workshop Agenda

- Review, edit and define meeting rules and protocols, and finalize the agenda.
- Briefly review Project and fish passage feasibility background information.
- Review available biological information, discuss desired information, and discuss how results could impact evaluations. For example, the fallback rate or efficiency of attracting adults into the current trap is unknown and the desire of juveniles to move upstream is also unknown. Assumptions about these unknowns will be made initially but may have to be modified later when additional information is available.
- Review the biological performance tool developed in Task 2, so all participants are aware of its structure, use, sensitivity, and value to the concept development process.
- Review and update evaluation and comparison criteria prior to beginning discussion, so all meeting attendees are familiar with the criteria that must be met or addressed.
- Begin structured brainstorm activity to develop a list of concepts for upstream passage, keeping in mind that they must be compatible with downstream facilities. Concepts will be recorded with limited text and sketches to clearly communicate the concepts.
- Finish brainstorming concepts after a break, to assure all reasonable concepts are identified.
- Group concepts into like categories and consolidate similar ideas. Separate concepts that provide upstream-only passage from those that can provide both upstream and downstream passage.
- Identify risks and uncertainties associated with each concept, and develop a list of study and information needs that will be required to finalize selection of concepts. This will include and information needed to confirm poor viability of any concept with fatal flaws.
- Review concepts with respect to obvious fatal flaws. Any alternatives that are not constructible, or that have less than a good chance of satisfying all crucial criteria (i.e. fatally flawed) will be dropped from consideration. If a concept is to be dropped due to high risk or uncertainty, discuss how this uncertainty could be reduced. Descriptions of those

alternatives and their fatal flaws will be summarized with a meeting record for the final report.

- Review the biological performance tool with respect to the concept list to assure it can accommodate the list of concepts. Run the spreadsheet model with examples to show the expected output and level of sensitivity.
- Conduct further brainstorming and development or refinement of fish passage concepts relative to the evaluation criteria as time allows.
- Assign a priority to develop conceptual designs for short-listed alternatives.
- Document those that were not selected.
- Adopt a common format for alternative development in Task 4.

4.3.2 Task 3-2 Meeting #1 Summary

The deliverable for Task 3-2 will be a meeting summary with the following:

- *Updated criteria document and a draft evaluation spreadsheet.*
- *List of fish passage concepts identified in the session.*
- *List of additional information necessary to reduce uncertainty or risks associated with each concept.*
- *A discussion of the fatal flaw analysis and documentation of concepts eliminated from further consideration at this time.*
- *Status update on the biological performance tool and any further development recommended by the Panel.*
- *A short list of fish passage concepts for further development.*

It is intended that this summary document will be distributed within two weeks of the meeting date to the TRC and to the larger stakeholder Group.

4.4 Task 4 - Alternative Development

Task 4 is to review the list of concepts and develop the fish passage concepts identified in Task 3. The fish passage alternatives will address site-specific constraints, describe the full hydraulic functional design and general layout of each alternative, and will identify any uncertainties associated with each alternative prior to the evaluation process. Both the TRC and the Group will be involved in this Task; stakeholders not involved with the TRC will be encouraged to provide input but will not have authority to determine or rank alternatives.

Comment [LH2]: Added at request of Cal-Am.

Potential volitional fish passage alternatives will be identified and evaluated concurrently with the existing trap and transport program. Volitional passage is the concept of giving fish the choice of

moving upstream or downstream based on their own motivation. The following is the definition of volitional passage:

> *"Volitional fish passage is a means of fish passage with appropriate hydraulic conditions such that all individual migrating adult and juvenile fish of the species of interest have the opportunity to move freely and safely upstream and/or downstream past the Project according to their own motivation."*

Under volitional passage, a barrier is modified such that fish arrive at the site under their own power, swimming through or around and past the former blockage. A concrete fish ladder is an example of a volitional facility for adult steelhead. Volitional fish passage facilities are generally preferred because they operate constantly, require little human interference, and may be mechanically less likely to break. They may be less costly to maintain and operate but may represent a larger capital expenditure. However, volitional facilities often provide little flexibility to accommodate uncertainties, or to adjust to changes in fish behavior, environmental or operating conditions.

Space or engineering constraints may prevent the design of safe and effective, volitional fish passage facilities. Particularly for juveniles, impoundments may present challenges that cannot be overcome with volitional passage if currents confuse fish navigation or if physical constraints preclude construction of upstream passage facilities that can accommodate juvenile migration. In some situations, non-volitional facilities can be a preferred method of providing fish passage.

At least one pure volitional passage alternative for upstream passage will be included in the final set of alternatives throughout the study, regardless of its feasibility. There may also be alternatives that have volitional passage characteristics though are not entirely volitional throughout the hydrologic and reservoir storage and release cycle.

Once alternatives are defined, an initial opinion of probable construction and operating cost will be provided in this task for each alternative. Estimates may be based on comparative analysis to other systems or may be composed of unit estimates for items in an alternative. The level of accuracy of the estimate should be commensurate with a concept-level screening process and – depending on the complexity of an alternative – may have a large expected accuracy range. The estimated performance of the alternatives will be compared using the biological performance tool developed and updated in Tasks 2 and 3. The technical feasibility of constructing facilities will include site-specific constraints including geology, dam safety,

Alternatives that are not feasible will be dropped from consideration and reasons for them being dropped, will be described. It may be the case that an alternative scores low due to a specific uncertainty; in this case, the alternative will be retained and a plan to address this uncertainty developed. Based on the evaluation scores, the Consultant will update the remaining alternatives for additional evaluation by the TRC and Group.

A Group meeting will be held in this Task to discuss the alternatives and their relative scores; the TRC will propose a final list of feasible alternatives for additional development.

4.4.1 Task 4-1 Develop Initial Concepts into Alternatives

Based on the concepts identified in Task 3, the Consultant will further develop alternatives. The primary goals of this task are:

- Define each concept with respect to its hydraulic and operational characteristics.
- Draw and define the concepts so that the design intent is clearly communicated. A common format for drawings will be developed by the Consultant in this task.

For each alternative, the Consultant will provide:

- Plan and sectional drawings to scale, to fully define the concept.
- Hydraulic characteristics and function design features, shown on the sketches, or on separate sheets.
- Brief write-up suitable for review to describe the concept's key characteristics and how the alternative operates.
- List of pros and cons for each alternative relative to operations, biological performance goals, reliability, etc. (Note: it is intended that the biological performance tool be applied to each alternative.)
- Probable opinion of construction and operating cost and complexity (high, medium, or low).
- An evaluation matrix containing alternatives and the evaluation criteria. The evaluation matrix should build on the criteria developed e in Meeting #1 and should be presented in a grid form or Pugh Matrix, which breaks the alternatives down into discrete elements for comparison, evaluation, and optimization.

With the additional investigation, some concepts or alternatives may prove to be infeasible or may be modified. As noted above, at least one upstream volitional alternative will be retained for the duration of the study.

The deliverables for Task 4-1 include:

- *compilation of alternatives*
- *an evaluation matrix*
- *supporting documentation*

4.4.2 Task 4-2 Meeting #2 – Review Alternatives

The TRC, Group and Consultant will meet to discuss and refine passage alternatives to fit LP Dam requirements. Protocols are to be similar to Meeting #1.

The evaluation matrix will be utilized during a meeting to prepare the first evaluation of the alternatives that will challenge the existing state of each alternatives conceptual design for better performance, and will allow a relative comparison of the alternatives. The matrix will result in consolidated scores, which reflect the relative success of achieving criteria, and will thus help rank or prioritize alternatives.

The results of the grid analysis can be used to further refine facility components, identify data gaps, and assess the potential influence of uncertainties. However, the grid analysis is only a decision tool; the results are used to influence but not dictate decisions. The process of developing and using the matrix is explained in Appendix C along with provisional criteria that will be used within it. The characteristics and effectiveness of upstream fish passage facilities will be evaluated, and the results used to refine and optimize the location, size and timing of each type of passage facility.

Based on the results of this initial evaluation, the Consultant will work to update descriptions and drawings for the fish passage alternatives. The results will be presented to the Group at a meeting, with the goals of receiving input and the TRC reaching consensus on a final list of alternatives for final refinement in Task 5.

The deliverable for Task 4-2 is a workshop agenda.

The meeting will be organized as follows:

- The Consultant will present an overview of the work completed to date, and will address any questions from the previously distributed meeting notes.
- Discuss and refine evaluation criteria based on the current state of the alternatives.
- Identify any criteria that, if not satisfied to some degree, would constitute a fatal flaw.
- Identify any uncertainties and/or risks associated with each alternative, and a means to address these issues.
- Review results of the application of the biological performance tool to gain an understanding of the fish passage performance for each alternative.

- Review the alternative evaluation matrix and update the matrix based on input at the meeting.
- Perform a fatal flaw analysis on each alternative, eliminate alternatives with fatal flaws, and record eliminated alternatives for reporting in the meeting notes.
- Combine and consolidate alternatives into distinct, stand-alone fish passage alternatives appropriate for the LP Dam site. This exercise will be the first iteration of defining passage alternatives for further development and additional review (if necessary).

4.4.3 Task 4-3 Meeting #2 Summary

The deliverable for Task 4-3 will be a meeting summary with the following:

- *Status update on the biological performance tool and any further development recommended by the TRC and/or Group.*
- *Final evaluation spreadsheet.*
- *List of fish passage alternatives identified in the session.*
- *List of additional information necessary to reduce uncertainty or risks associated with each alternative.*
- *A discussion of the fatal flaw analysis and documentation of alternatives eliminated from further consideration at this time.*
- *A recommendation of alternatives for further development.*

4.5 Task 5 – Fish Passage Alternatives Refinement and Determination of Feasibility

Task 5 will focus on the refinement of the remaining fish passage alternatives and a determination of whether upstream volitional passage is feasible at LP Dam. In addition to further development of the alternative design drawings, the Consultant will prepare an opinion of probable construction and operating cost for each alternative, describe operational protocols and issues, address comments and/or issues brought up at Meeting #2, perform final runs of the biological performance tool, prepare a final quantitative evaluation of the alternatives using the final Pugh matrix and evaluation criteria, and address constructability issues and any remaining data needs or significant risks. At least one volitional fish passage alternative will be included in the final list of alternatives. A draft outline for the final report will be developed for review by the TRC and Group.

The TRC and Group will review the technical feasibility of the alternative(s), the expected biological performance, and the cost to construct and operate each alternative. Evaluation of alternatives will include strong consideration of the risk and uncertainties associated with the implementation and performance of the alternatives and whether alternatives would include continuation of the existing trap and transport facilities.

If there is a consensus on evaluation of alternatives by the TRC , the Study terminates, and Cal-Am and others may formulate an implementation plan to carry the recommendations forward. If there is no consensus, it is presumed that the status quo would not change (i.e., the trap and transport facilities and program would continue); however, if there is no consensus, Cal-Am, MPWMD and the TRC should consider what, if any, steps should be taken to address upstream passage. This is not included as a Task in this Project.

4.5.1 Task 5-1 Fish Passage Alternatives Refinement

The Consultant will prepare Engineer's Opinions of Probable Construction Costs (OPCC) for the remaining alternatives to a Class 5 level as defined by the American Association of Cost Engineers International (AACE). The cost estimates will be suitable for comparison of the alternatives, but may not reflect an accurate number for capital budgeting as they will be developed based on very limited information.

According to the AACE International Recommended Practices and Standards:

> "AACE International Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. Typically, engineering is 0% to 10% complete. They are typically used for any number of business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, or long-range capital planning. Virtually all Class 5 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric and modeling techniques. Expected accuracy ranges are from -20% to -50% on the low side and +30% to +100% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. As little as 1 hour or less to perhaps more than 200 hours may have been spent preparing the estimate depending on the project and estimating methodology."

Any data gaps or significant risks will be identified for discussion prior to the final Meeting.

The deliverables for Task 5-1 include:

- *draft final evaluation matrix, including OPCC*

- *draft final report outline*

4.5.2 Task 5-2 Final Meeting – Determination of Feasibility and Selection of Alternative

A final meeting of the TRC, Group and Consultant will be conducted to review and critique the alternatives, re-run the biological performance tool based on updated information (if necessary), do a final scoring of alternatives and determine: 1) if upstream volitional passage is feasible; 2) which alternative(s) should be pursued further; and 3) prioritize alternatives (if possible).

Final Meeting Topics

- Review and discuss the updated alternatives. Note any remaining information needs or significant risks associated with the alternative conceptual designs or recommended operation.
- If necessary, re-run the biological performance tool based on the updated designs.
- Review the OPCC, constructability issues, and the technical feasibility of each alternative.
- Finalize the criteria, and perform a final evaluation of the alternatives relative to evaluation criteria, using the Pugh evaluation matrix.
- Eliminate any alternatives that have fatal flaws based on their latest design, or that score low relative to others, and record eliminated concepts for reporting in the meeting notes.
- Develop recommendations for future actions regarding each remaining alternative, including opportunities to improve performance or optimize alternatives based on the comparisons in the evaluation matrix.
- List of final pros and cons for each alternative. If possible, prioritize alternatives.
- Finalize the Fish Passage Feasibility Study report outline.

Up to this point, at least one upstream fish passage alternative should have been carried forward for inclusion in the final report. If, at the conclusion of the Final Meeting, the consensus is that upstream volitional passage is not feasible, state the reasoning for coming to this conclusion.

4.5.3 Task 5-3 Final Meeting Summary

The deliverable for Task 5-3 will be a meeting summary with the following:

- *Final status of the biological performance tool and any further development recommended by the TRC and/or Group.*
- *Final evaluation spreadsheet.*
- *List of fish passage alternatives evaluated at the session.*
- *List of additional information necessary to reduce uncertainty or risks associated with each alternative.*

- *A discussion of the fatal flaw analysis and documentation of alternatives eliminated from further consideration at this time.*
- *A recommendation of alternatives for further development.*

4.6 Task 6 – Reporting and Fish Passage Recommendation

Task 6 is structured to organize and report on the full development of the final fish passage alternatives. A draft and final feasibility report will be developed that will document the process followed, development of fish passage alternatives, evaluation criteria, summary of alternatives eliminated with justification for the eliminations, a final evaluation and the final recommended alternative(s). Each alternative selected will be described with text and conceptual level design drawings, an OPCC, estimate of operating costs, an implementation schedule and description of construction issues, listing of pros and cons, and a summary and details of the final evaluation. At least one volitional alternative for upstream passage will be described, regardless of its feasibility; however, if all volitional alternatives are determined to have one or more fatal flaws, the additional work described in this task may not be carried out.

The final feasibility report will include the TRC and Group recommendation regarding the technical and biological feasibility of providing volitional steelhead passage at LP Dam. If a volitional passage facility cannot be recommended due to site constraints, uncertainties, or other factors the final report will document the rationale. Recommendations for next steps will be developed, which might include: fish passage alternatives to be pursued; further studies, if needed to address uncertainties or risk; or additional analysis to determine economic feasibility. The draft report will be presented to the TRC and Group for input. Depending on the nature of comments, the draft report may be finalized or, if additional issues are raised, the report may be finalized after a Group meeting and consideration of comments.

4.6.1 Task 6-1 Prepare Draft Fish Passage Feasibility Report

A Draft Fish Passage Feasibility Report will be developed in this task to document the scope of the study, background information used, design criteria, the process utilized to conduct the feasibility Analyses, and the results of the Analyses. A draft table of contents for the report is listed below as a guide.

The draft (and final) report will contain at least the following:

- Introduction
    - Problem statement
    - Purpose, objective
        - Fish passage goal statement
        - Relevance to Steelhead Recovery Plan

    - Overview of Fish Passage Panel Process
        - Summary of meetings, coordination, and progress reports
    - Overview of the biological performance tool
        - Overview of the spreadsheet based fish passage model
- Descriptions of alternatives
    - Short descriptions of all initial brainstorm concepts
        - Documentation of concepts that were dropped for fatal flaws or low Ranking
    - Preferred Concepts
        - Detailed physical, functional, and operational descriptions
        - Pros and cons
        - Expected performance for upstream and downstream fish passage (based on the biological performance tool)
        - Implementation challenges and uncertainties
        - Constructability considerations
        - Opinions of probable construction and operating costs
        - Two to five scale drawings will be provided for each alternative, with applicable site overviews, site plans, sections, elevations, and hydraulic design parameters clearly defined.
- Evaluation of Alternatives
    - Description of evaluation process
        - Description of evaluation matrix and criteria
            - Weighting and scoring
        - Criteria that could lead to fatal flaws
    - Graphics and summaries of evaluation
        - Ranking of alternatives based on evaluation matrix
        - Ranking of alternatives based just on fish passage criteria
        - Relative fish passage ranking compared to cost and operations criteria
- Conclusions and Recommendations
- References cited

The Consultant will provide a draft report to the TRC and Group for review. At least thirty (30) calendar days should be provided to prepare written comments. If no substantive issues are raised during the review, the Consultant will move on to production of the Final Report; however, if substantive issues are raised, the Consultant, Cal-Am, and MPWMD may elect to work directly with the commenter(s) to address any issues, or hold a meeting to address issues.

4.7 Schedule

APPENDIX A

Evaluation Process and Draft Evaluation Criteria

This is a description of the process the TRC and Group will use to evaluate alternatives developed in this Project. These alternatives will be evaluated for potential feasibility and effectiveness. A grid analysis technique (Pugh Matrix) will be used, which breaks the alternatives down into discrete elements for comparison, evaluation, and optimization.

A-1. EVALUATION PROCESS

A weighted grid analysis can be used to help develop consensus of design solutions that could be pursued. It is essential to developing a mutual understanding of each alternative, understanding each other's values and points of view, and optimizing alternatives. This basic process is commonly used to assist engineering decisions. The following chart is a schematic example of the grid analysis. This is greatly simplified for the sake of explanation. The LP Dam evaluation will likely consist of three categories of factors – engineering, biological, and economic.

Schematic Example of Weighted Grid Analysis

	Weight	**Default Choice**	**Alternate #1**	**Alternate #2**	**Alternate #3**
Criteria #1	1	0			
Criteria #2	1	0			
Criteria #3	1	0			
Totals					

Benefits of using this method are:

- Quantitative technique to rank multi-dimensional options
- Increases objectivity of evaluation
- Develops a clear common understanding of options being considered
- Helps diverse stakeholders understand each other's values and issues
- Can test sensitivity of objectives and project features
- Rational and consistent.
- Can be a framework for consensus-building.

The process of the analysis is as follows. Each component of the grid is explained further below.

- Define evaluation criteria
- Weight criteria
- Describe alternatives

- Score alternatives for each criterion
- Multiply each score by the criteria weight
- Sum the score-weight products for each alternative

A-1.1 DEFINE EVALUATION CRITERIA

Each criterion is a positive attribute and can be considered an objective of the project by which the alternatives will be evaluated. Some of the criteria may be pass/fail (e.g., meet a threshold score), while most are likely to be satisfied to different degrees by various alternatives. Criteria may have different levels of importance and will be weighed appropriately as part of the alternatives comparison. Initial provisional criteria are described below and will be refined through the Project process. The evaluation criteria will be entered as a column in spreadsheets with the alternatives listed in a row across the top of the spreadsheet.

A-1.2 WEIGHT CRITERIA

The weighting uses a scale of zero to ten. If a criterion scores "zero" it has no influence on the design but it can be left on the list because it might be important to other parties. To challenge users to differentiate among the criteria by not allowing all criteria to be weighed "ten," it will be stipulated that the average weight has to be five. So, for example, if there are 20 criteria, the sum of the weights has to be 100. In the schematic example above, the weights vary from 1 to 10 and averaged 5.

It is helpful for different stakeholders to do their own weighting at some point in the process to reflect their perception of values for this project. The differences in weights among the TRC and Group highlight differences in values and subsequent differences in final scores highlights where discussion is needed to achieve consensus.

A-1.3 SCORE ALTERNATIVES

The next step is to score how well each alternative satisfies each criterion. A ten-point (zero to ten) scoring system is recommended to allow an alternative to be incrementally improved by modifying it. The TRC and Group should come to a consensus about specific criteria that are considered essential and must be satisfied to a high degree, or the alternative might be fatally flawed. For example, alternatives that do not score a value of ten for dam safety would likely be fatally flawed.

Large differences among the products of individual scores and weights highlight differences that most affect the final results and that therefore merit discussion. Large differences may be due to various factors, each of which should be addressed. Each alternative and criterion should be thoroughly understood by each person ranking the alternative. The point is to achieve a true common understanding of each score, not just to agree on a number.

A-1.4 OPTIMIZATION OF ALTERNATIVES

Using simple math to score alternatives offers an opportunity to focus on strengths and weaknesses of alternatives and can be a starting point for a discussion of how to improve an alternative or how to exclude an alternative. The matrices showing the ranking of the alternatives will be included in the text of the report. Relative ranking of alternatives can be considered using all categories or can also be considered using specific categories such as fish passage, operations and maintenance, cost, or other categories of interest.

A-2. DRAFT EVALUATION CRITERIA FOR PREFERRED FISH PASSAGE ALTERNATIVES

The following criteria are proposed for consideration in evaluating the alternatives for upstream passage. These criteria are to be refined and changed as information on alternatives and conditions specific to the Los Padres Dam Project is gathered. Given the site constraints at Los Padres Dam (significant lift over a short distance, canyon walls, steep slopes), some consideration should be given to specific quantitative threshold design criteria (e.g.; maximum flow velocity, minimum water depth, maximum hydraulic jump, pool spacing, etc.). These may not apply at the concept review, but should be considered during alternative development.

A-2.1 CRITERIA OF UPSTREAM FISH PASSAGE FACILITIES

- ***Attraction of juvenile and adult fish to passage facility***

  Attraction is the guidance of fish to find the migration pathway into the passage facility. It includes attraction to the vicinity of and passage into the passage facility entrance. Attraction into the facility is to be evaluated based on entrance flow orientation relative to stream flow, location of the entrance relative to the upstream end of the plunge pool, velocity of flow coming out of the passage facility relative to stream velocity and the ratio of facility flow to total flow in the stream. Specific flow ranges will be identified in the assessment. It is desirable for a facility to pass as much of the natural flow as possible in order to provide the greatest chance for fish to pass into the facility. However, threshold velocities at low and high flow will likely determine lower and upper bounds for flow through the facility. If direct measurement of streamflow velocity is not available for the flows being evaluated, estimates should be made using an equation such as the Manning formula.

- ***Passage of target species through facility***

  Passage of target species through the passage facility pertains to the expected success and efficiency (energy, stress, and time expended to pass) of fish passage. The physical safety of adult and juvenile fish passing through the facility is included in this characteristic. Safety is possibly diminished when fish are expected to leap over weirs or are unintentionally induced

to leap at other locations. Safety is diminished if fish might become stranded in the facility when it is dewatered.

- ***Volitional upstream fish passage***
  Volitional passage is the concept of giving fish the choice of moving upstream into the facility based on their own motivation. There may be alternatives that have volitional passage characteristics though are not volitional for both juvenile and adult fish over the entire range of flows that fish are expected to migrate at. Scoring for volitional passage will reflect the degree of volitional passage; pure volitional alternatives for both juveniles and adults will be scored the highest possible score.

- ***Fish access out of passage facility to Los Padres Reservoir***
  This characteristic describes physical access for fish from the facility through any flow control section and any device for accommodating a range of reservoir elevations. Head differential, depth of flow at the exit, certainty of adequate flow passing into the facility, and safety of exit conditions (such as discharge to a low reservoir level and fallback considerations) are the primary considerations.

- ***Attraction and passage of Non-target Species***
  The target species for fish passage is adult and juvenile steelhead. There might be added ecological value or risk in providing for or blocking passage of other species and life stages. Risks could include the passage of non-native species, including resident brown trout [are there others?].

- ***Potential for fish passage evaluation or biological monitoring***
  This characteristic is the ability to add facilities for trapping and counting fish passage through the facility to either assess performance of the facility or to monitor populations. The primary objective of the feasibility assessment is to provide fish passage alternatives; there is no stated intent of doing population monitoring at this time. Other technologies (cameras, radio tracking) are available for facility evaluation. If continuing monitoring of fish passage is considered a priority, the best means of achieving that goal can be determined in the design process.

- ***Certainty of Collection and Passage***
  This is a measure of how certain the TRC and Group is regarding success of collection and passage. It is based on the combined knowledge of characteristics of the site, hydrology, the Carmel River steelhead population, and precedents of other similar projects.

The aspect of certainty would normally be a heavily weighted criterion but, since other criteria are being applied in the evaluation of alternatives that inform the certainty of each alternative, a lesser weighting can be applied. Low certainty should not diminish the evaluation score of any alternative unless the uncertainty cannot be mitigated.

- ***Relationship to reservoir release operations and downstream passage facilities***
  After the rainy season ends and the reservoir is drawn down below spillway level, storage is metered out to augment downstream flow – often at levels below 10 cfs. The TRC and Group should evaluate whether volitional passage is desired or necessary for either or both directions of migration at low flows and establish guidelines for this condition.

  There may also be periods during different life stages when it is desirable to operate downstream and upstream passage facilities at the same time (e.g., when juveniles or smolts may migrate downstream in early winter while adults are moving upstream). Passage facilities may compete for enough flow to operate at an optimum level. Flow availability during periods associated with operating in both directions should be evaluated. If flow is a constraining factor in operations, the TRC and Group should provide guidelines for prioritizing flow splits and the timing of operational changes. Upstream alternatives can then be evaluated for their effectiveness during such periods.

- ***Adaptability of collection and passage***
  Certainty is increased with adaptability in design and/or operation. For example, an upstream passage alternative might score higher if the attraction flow can be modified in the future.

A-2.2 OPERATION AND MAINTENANCE CRITERIA

- ***Simplicity of fish passage operations***
  More complex and frequent operational demands result in greater uncertainty and risk due to improper operations or possible failure of equipment. Additional entrance gates, auxiliary water systems, and mechanical flow control weirs add to complexity because there is no electrical power to the site.

- ***Debris management***
  Debris is trapped near the spillway by a log boom; however, large loads of debris cannot be fully contained. Fish ladders and fish protection screens are vulnerable to debris. Debris can impair operations and performance if allowed to accumulate, thus compromising its passage effectiveness. Facility water must be screened to exclude debris. This characteristic describes

the likelihood and the consequence of debris accumulation at the exit of or within the facility and at the entry to the facility and the ease of dealing with it.

- ***Durability of structure***
  This is risk of damage of the fish passage structure due to high flows, debris and changes in the channel. Sediment is not likely to be an issue, although some suspended sediment could be entrained into the facility at high flows.