Scope of Work and Methodology

This memorandum documents a proposed scope of work for engineering services to complete the design of a reconstructed outlet works and a reconstructed spillway including replacement of the control section and chute. We propose that GEI perform this proposed work as a subconsultant to AECOM and work in coordination with AECOM as part of the existing contract to replace the existing outlet tower at the Santiago Creek Dam.

The project involves improvements to the outlet works and spillway at Santiago Creek Dam, which is owned and operated jointly by Irvine Ranch Water District and Serrano Water District. Santiago Creek Dam is a 136-foot-high rolled earth embankment located on Santiago Creek in Orange County, California, about 5 miles northeast of the City of Irvine and 4 miles east of the City of Orange. Santiago Creek Dam forms Irvine Lake which provides water supply to the surrounding communities for both agricultural and municipal use. The outlet works and reinforced concrete spillway at Santiago Creek Dam were constructed in 1932. The outlet works consist of a tower, an outlet conduit and downstream control house. The outlet tower is 135-feet high and has an interior diameter of 8-feet and an exterior diameter of 11-feet. The spillway is located at the left end of the dam and includes an approach, control structure, chute and flip bucket. The dam and reservoir are under the regulatory jurisdiction of the California Department of Water Resources, Division of Safety of Dams (DSOD).

At the request of DSOD, an assessment of the spillway was conducted in 2018. Additional field explorations and non-destructive testing were also completed to better understand the spillway deficiencies and to develop a long-term repair plan. As outlined in the (Phase 1 and Phase 2) Spillway Condition Assessment reports by GEI dated July 1, 2018 and December 3, 2019, respectively, it was concluded that the spillway structure is aged, does not meet all current design standards and has various deficiencies. A recommendation was made to implement a long-term repair plan to comprehensively address the deficiencies noted.

The scope of work for this project will be completed in two phases, which include: Phase 1 - Preliminary Design and Phase 2 - Final Design. Phase 1 will involve additional investigations and evaluations of the Site and existing spillway facilities that have not been collected in the previous work by AECOM/GEI. Design criteria, Site and operational constraints, and preliminary layouts for the spillway will be completed and documented for this task. Phase 2 will involve final design of the outlet works, spillway, and ancillary facilities. AECOM/GEI will work closely with IRWD, SWD, and DSOD throughout the design process in order to develop the most economical solution that meets the needs of all project stakeholders.

It is anticipated that AECOM/GEI, IRWD, and SWD will work collaborative as a team with the exchange of information and reviews of potential project solutions, specifically in areas of lake operations, potential Site access constraints, and preferred solutions during the design process. See Figure 1 for the project team organizational chart, which includes key staff and discipline leads for the AECOM/GEI team. Our detailed scope of work is described task-by-task below.

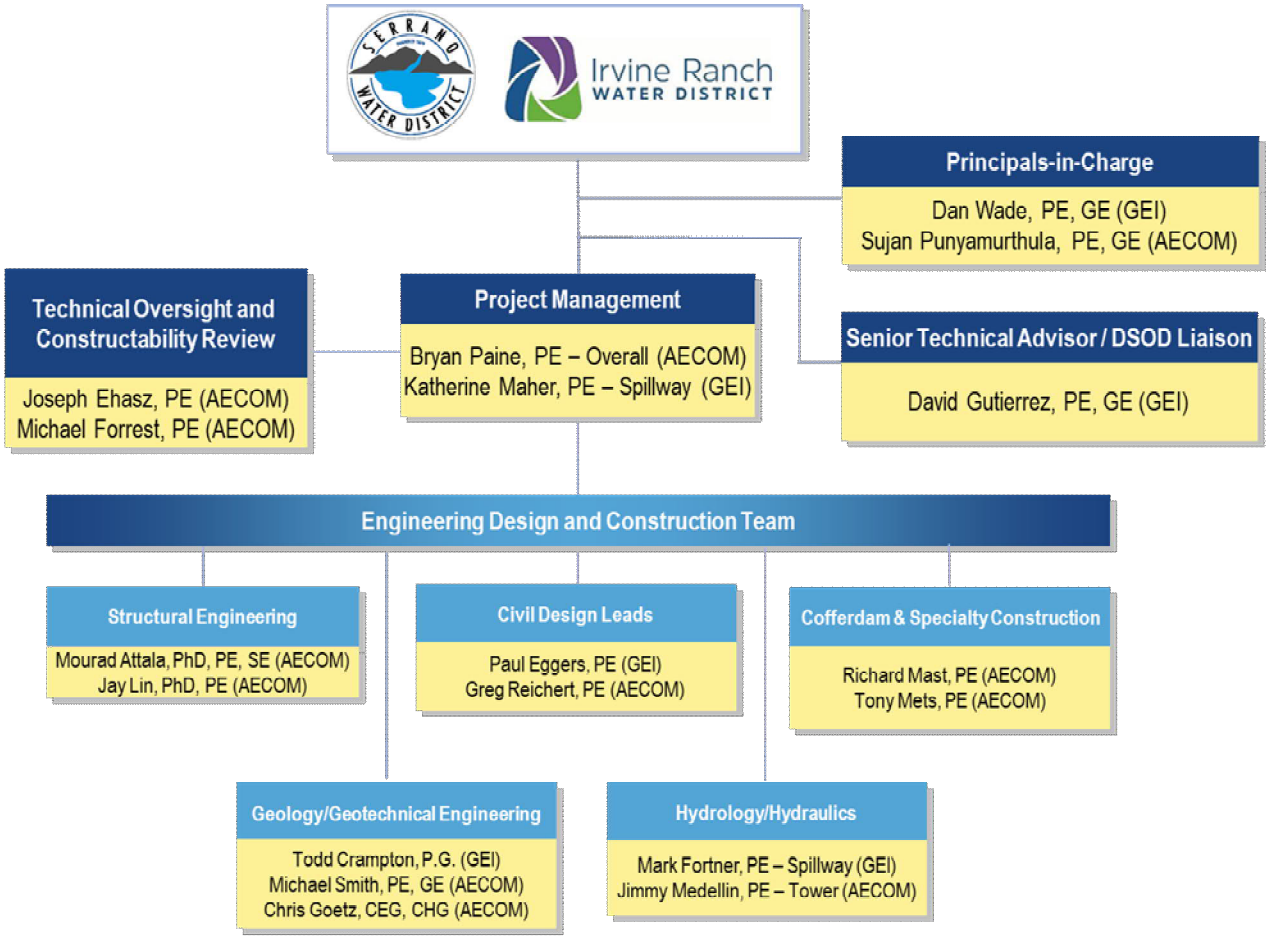


Figure 1 Project Team Organizational Chart

Phase 1 Preliminary Design

1. Project Management and Client Interaction: AECOM will provide project management services for the project. AECOM implements a Project Delivery System (PDS) to assist its project managers in the successful execution of every project. This PDS encompasses elements such as:

    - Project Work Plan (PWP) to define project goals, limits, deliverables, schedule, and scope. The PWP includes plans for quality control and a risk register
    - Staffing and communication plan
    - Document control and management information systems
    - Staffing resources, equipment, and tools
    - QA/QC protocols
    - Risk management issues
    - Safety, Health, and Environment (SH&E) procedures and training needs
    - Subconsultant roles and budgets

    Our Project Manager, Bryan Paine, is responsible for managing project controls and is an AECOM Certified Project Manager. We use several methods of tracking progress such as the critical path

method and earned value management (EVM). By using proven project management tools, such as EVM, we can proactively identify and mitigate issues before they begin to adversely impact schedule and budget. Bryan will provide weekly project status emails to IRWD and SWD and include a monthly progress report with each invoice. AECOM/GEI will jointly prepare a Risk Register for the project that will identify risks for the design and construction of the project.

Bryan will work closely with GEI's Project Manager, Katherine Maher, to coordinate project deliverables. We will conduct regular team meetings using the latest communication technologies, such as Microsoft Teams teleconferencing, to keep all informed and to coordinate all activities.

2. Hydraulic Analysis & Erodibility Study: The purpose of this task is to perform hydraulic analyses to evaluate the performance of the preferred spillway control section, chute and dissipation structure and support the detailed design of the spillway components. An alternative analysis is assumed to have been completed prior to this task which will outline the conceptual layout of the spillway including the general weir type and general arrangement of the chute and dissipation structure including gross dimensions and slopes. Task 2 will be completed to refine the design of the selected alternative. The scope of this task includes:

   a. Hydraulic Modeling: The spillway chute will be initially evaluated using one dimensional analysis during the preliminary design phase to determine flow depths and velocities throughout the profile of the proposed control section and chute. A three-dimensional Computational Fluid Dynamic (CFD) Model will be developed for the final design of the spillway. The CFD model will include the channel and pipe bridge downstream of the spillway to support an erodibility study of the downstream canyon. The downstream limit of the CFD model will be to the dirt road crossing of the stream located approximately 200 feet downstream of the pipe bridge. We assume that no more than ten (10) simulations of the CFD model will be performed. Any proposed converging walls will be evaluated and designed following USBR relationships between acceptable convergence wall angles and the associated Froude numbers from the hydraulic modeling. The chute walls will be designed to minimize cross waves and standing waves and the associated wave run-up on the walls.

      - Freeboard: The spillway chute will be designed to maintain a minimum residual freeboard following DSOD requirements.
      - Cavitation Potential: The spillway chute will be evaluated for cavitation potential following USBR methods and procedures based on the hydraulic modeling results. Evaluation of cavitation potential will be performed using the cavitation index.
      - Flow Profiles and Velocity Calculations: Flow profiles and velocities will be calculated within the spillway for various flow conditions, including the Probable Maximum Flood (PMF). The PMF is the theoretical maximum flood event that could be expected to occur over the life of the project and the spillway will be required to safely pass the PMF to secure regulatory approval from DSOD.
      - End of Chute Design: Hydraulic analysis will include determinations to support an energy dissipation structure at the end of the spillway, which could include a flip bucket and plunge pool, or a stilling basin. The design will follow USBR methods and procedures.
      - Stagnation Pressures: An assessment of the drag force potential will be performed to support the design of the spillway chute anchors and floor joint details.
      - Erodibility Study: AECOM/GEI will conduct an erodibility study of the canyon and creek area downstream of the proposed replacement spillway and the emergency outlet structure using the CFD model results. The area surrounding the pipe bridge downstream of the spillway will be considered as part of the erodibility study.

   b. Spillway Physical Model: It may be necessary to build a physical model study in conjunction with the CFD numerical model in order to verify the CFD model and account for hydraulic uncertainties associated with a complex spillway configuration. CFD models have several weaknesses which

can be offset though the use of a physical model. Some weaknesses of CFD models are the uncertainty of the CFD solution in resolving location specific hydraulic conditions such as highly turbulent regions, vortices, aeration effects, and separation zones. Physical models are an important tool for understanding these hydraulics conditions that aren't well represented in CFD models and a physical model study is generally performed when these hydraulic conditions are of significant concern. Physical models are particularly useful for representing the superelevation of flow found in curved spillway chutes and the highly turbulent flow conditions found in stilling basins. Given the potential complexity of this spillway design and non-standard stilling basin design, it is anticipated that a physical model will be needed to validate the CFD model and accurately capture hydraulic conditions within the spillway. If a physical model is not constructed, additional CFD simulations will be needed to develop a spillway rating curve and perform additional sensitivity analysis on model parameters and cell size to help validate the CFD model. However, not performing a physical model study would limit our understanding of the spillway hydraulics and increase risk of damage to the spillway.

AECOM/GEI will subcontract with a qualified hydraulic laboratory to construct a scale model replica of the proposed spillway in the hydraulics laboratory to test the performance and refine the design for the spillway. By using both the CFD numerical model and physical modeling, confidence in the results of the analysis are increased and more detail becomes available for making engineering judgements and evaluating refinements.

The physical model will be constructed using a combination of wood, concrete, metal and acrylic. The reservoir will be contained in a wood box and will include the topography using mortar to model the spillway approach. The weir, spillway and energy dissipation basin will be built out of acrylic or some other smooth plastic that can be built with high precision. The downstream channel will also be built with a wood box and concrete being set using plywood templates. Water will be provided using a piped delivery system with calibrated flow meters. It is expected that the scale will be between 1:20 and 1:30 depending on the outcome of the preliminary design and the numerical model study. At a 1:20 scale, the physical model footprint would be 50 feet long by 35 feet wide by 7.5 feet tall.

A GEI hydraulics expert will visit the hydraulics laboratory to witness a portion of the modelling. The simulations are expected to take place over a one-month period. For budgeting purposes, GEI would plan to make up to 3 visits of 2 days each during the physical model construction and simulations and that the AECOM project manager will also attend one of the 2-day visits to the physical model. It is anticipated that IRWD and SWD staff will also accompany GEI on one of the model visits to view the physical model simulations.

A draft report will be prepared documenting the results of the physical model study. One round of review comments by IRWD/SWD and DSOD will be incorporated into the final report. The final report will be incorporated into the hydraulic appendix for the Final Design Report.

Deliverable: Hydraulic analysis appendix for the Preliminary Design Report documenting the CFD model results. Hydraulic analysis appendix for the Final Design Report documenting the both the CFD and physical model results.

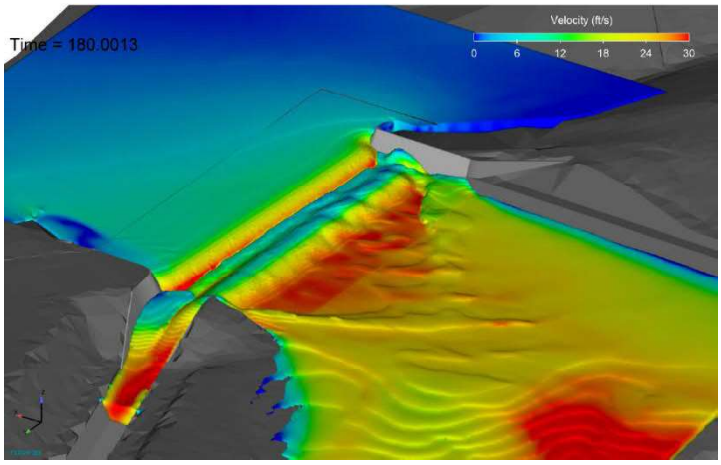


Figure 2 Example of CFD Modeling Results for a Spillway

3. Topographic Field Survey: AECOM/GEI will subcontract with PSOMAS to provide additional topographic survey data for the project. A field survey will be conducted to obtain topography of the area downstream of the existing spillway and Santiago Creek, trees/vegetation, utilities, access roads and other ancillary features for preliminary and final design (assume three 8-hour days of surveying). Field surveying will be provided for the locations identified shown on Figure 3 herein. Mapping will be based upon the County of Orange established horizontal and vertical control network and provided in conformance with FGDC Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering, Construction, and Facilities Management (FGDC-STD-007.4-2002), nominally with a plotting scale of 1"= 40' and vertical accuracy suitable for 1' interval contours. Psomas provided aerial mapping, a field topographic survey of the dam, and a bathymetry survey of Irvine Lake in 2018 that will be used for the project. We will also use high resolution USGS LiDAR survey data that is available online. We are not performing a study or new survey of the lake perimeter and any project impacts to existing facilities (e.g. boat docks, boat launches).

Figure 3 Limits of Field Survey (blue polygon)

Deliverable: Final deliverables will be a CADD base file with a DTM surface in AutoCAD format.

4. Irvine Lake Shoreline Facility Evaluation: We will perform a field inspection of the perimeter of Irvine Lake to determine impacts to existing shoreline facilities that will occur if the high-water level is raised to elevation 796 feet. We assume that this task will involve a one-day site inspection by foot and/or vehicle of the complete lake perimeter. The inspection team will bring a map of the inundation area for elevation 796 feet and take photos of existing private, commercial, and recreational facilities that could be impacted if the spillway crest is raised. We will prepare a technical memorandum to present our findings and photos from the field inspection. The memorandum will provide recommendations for mitigation measures for the facilities that could be impacts.

5. Seismic Design: We will provide an updated Seismic Hazard Analysis Report following the DSOD requirements. We will utilize the latest Ground Motion Prediction Equations (GMPEs) and the latest information for the source characterization (UCERF3) in our analysis. We well develop horizontal and vertical deterministic spectra (DSHA) for the appropriate ground motion level (84th percentile). We will develop horizontal probabilistic spectra (PSHA), using the OpenSHA software, for the appropriate ground motion level. Finally, we will calculate the Arias Intensity Values for the MCE.

6. Geologic Exploration, Evaluation, and Design Parameters: The purpose of this task will be to establish the foundation conditions anticipated along the inclined outlet structure, valve vault, emergency outlet structure, stilling basin, spillway control section and chute alignment, to determine appropriate lateral wall loads and support drainage designs beneath the slab and adjacent to the walls and for anchor design of the spillway chute slab and terminal structure. The spillway is located on the left abutment ridge, which consists of alternating beds of sandstone and shale. The strike of the sedimentary beds is sub-parallel with the flow path of the spillway (Marliave, 1939). A memorandum dated October 2, 1931 indicates that the left abutment was stripped down approximately 12 to 15 feet before the shale was found to be “firm.” This known variability in the engineering properties of the bedrock and the steeply inclined chute present inherent challenges in geologic and geotechnical investigations along the spillway alignment. The following subtasks are proposed to better define the geologic conditions at the Site.

    a. Geotechnical Exploration Workplan: AECOM/GEI will prepare a Geotechnical Exploration Workplan for DSOD review and approval. The workplan will include figures showing the proposed locations for borings, test pits, and other explorations. We will provide descriptions and details for non-invasive and invasive work along with proposed repair plans for all invasive work (e.g. backfilling of boreholes). A draft and final workplan will be prepared with one round of comments from both IRWD/SWD and DSOD for budgeting purposes.

    b. Health and Safety Plan: AECOM/GEI will prepare a Health and Safety Plan (HASP) for all field activities, which will include hazard assessment for activities specific to the project Site, protocols for safe work practices, daily tailgate safety briefings, and reporting procedures. A copy of the HASP will be provided to all AECOM/GEI field personnel and subcontractors working in the field.

    c. Geologic Conditions Evaluation: An evaluation of the geologic conditions in the vicinity of the spillway has already been performed to assess the geomorphic setting of the spillway including the presence of any potential landslides, shear zones, faults, or other features that could impact the design and construction of the replacement chute. The seismicity of Santiago Creek Dam has also been studied in previous investigations of the Site area. These investigations included studies for dam construction, (Marliave, 1939), repair of the spillway (Wahler, 1969), raising of the dam (Boyle, 1971), seismic stability (Woodward-Clyde, 1979), spillway assessment (GEI, 2018) and Phase II Field Investigations (GEI 2019), and Outlet Tower Replacement (AECOM 2019). Observations and findings from these previously completed studies will be relied upon and all available historical photos and records will also be considered and incorporated in the overall evaluation of the foundation conditions.

d. Geologic Mapping: There have been several previous geologic mapping efforts performed at the Site, including in the immediate vicinity of the spillway chute. These efforts have included identifying geologic and geomorphic features that may impact the approach to design. To the degree possible these previous efforts will be incorporated into our interpretation of the geologic conditions. Up to 3 days of additional mapping will be performed in the upstream and downstream areas of the spillway and in the left abutment area of the dam. The project geologic map will be updated to reflect refinements and detail in the area of the spillway chute and "plunge pool" area to inform design.

e. Subsurface Geotechnical Investigation: AECOM/GEI will perform supplementary subsurface geotechnical investigations as required for the final design of the proposed replacement spillway and outlet works. These investigations will provide necessary geotechnical information of the Site subsurface conditions, including depth to and weathering profile of bedrock, bedrock structure (such as bedding and fracture orientation), bedrock lithology, and geotechnical properties of the subsurface materials.

   The geotechnical investigations will be carried out in one phase prior to completion of 30% design and it is assumed that the data from the investigations will not initiate significant changes to the design in the 60% design phase. The fee estimate for the driller subcontractor assumes work is completed in 2020, delay or modification of the exploration schedule may result in higher drilling fees. The anticipated activities are described below:

   - Seven (7) vertical exploratory borings (S-1 and S-3 through S-6, S-8 and S-9) will be performed in the spillway approach and chute, at the locations shown on Attachment A, to determine geotechnical parameters to support anchor, wall design and slope stability. A lightweight drill rig will be mobilized into the spillway chute via a small crane. At the proposed drilling locations, the spillway slab and approach apron will be cored and exploratory borings advanced using rotary-wash drilling methods in the underlying soil and bedrock. Soils and soft (weathered) bedrock will be sampled with Standard Penetration Test (SPT) and modified-California (modCal) drive samples. Harder bedrock will be continuously sampled with HQ diamond core rotary equipment and recovered with wire-line methods in triple core barrels, in general conformance with ASTM D2113, Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation. The HQ bit provides a hole diameter of 3.8 inches and a core diameter of about 2.4 inches. The borings will extend to depths of about 20 feet to 60 feet beneath the existing slab/approach apron elevation. Upon completion of the exploration, the boreholes will be backfilled with grout and the chute slab will be patched with concrete in accordance with DSOD requirements.

   - One (1) angled HQ rock core boring (S-7) will be drilled near the spillway entrance at the location shown on Attachment A. This boring will be inclined at -20 degrees from horizontal and oriented to intersect the steeply-dipping geologic units underlying the spillway. Our review of the available existing mapping indicates there is much variability in the lithology of the geologic units underlying the spillway, with near vertical "layers" of sandstone, siltstone, shale, and conglomerate. The angled boring is intended to penetrate the full extent of the geologic units under and adjacent to the spillway in order to capture the full range of expected foundation conditions. Upon completion, the borehole will be backfilled with grout and the chute slab will be patched with concrete in accordance with DSOD requirements.

   - One (1) angled HQ rock core boring (S-10) will be drilled within the spillway chute at the location shown on Attachment A. This boring will be inclined at -40 degrees from horizontal and oriented to intersect the steeply-dipping geologic units underlying the spillway. The angled boring is intended to penetrate the full extent of the geologic units under and adjacent to the spillway in order to capture the full range of expected foundation conditions. Upon completion, the borehole will be backfilled with grout.

- One (1) angled HQ rock core boring (S-11) will be drilled opposite the downstream spillway channel at the location shown on Attachment A. This boring will be inclined at -20 degrees from horizontal and oriented to intersect the steeply-dipping geologic units underlying the spillway. Similar to the angled boring in the spillway entrance, this boring is intended to penetrate the full extent of the geologic units in the area where a significant cut slope is proposed. Upon completion, the borehole will be backfilled with grout.

- One (1) rotary wash/core boring (O-3) will be drilled to a depth of 50 feet at the location of the proposed outlet works valve structure downstream of the dam (see Attachment A).

- Three (3) rotary wash/core borings (O-1, O-2, and S-2) will be drilled over water to depths of 50 to 75 feet (below ground surface) to explore the proposed upstream spillway foundation and inclined outlet conduit (sloping intake) alignment (see Attachment A). These borings will be advanced from a barge that will be deployed on the lake. We have observed that the existing boat launch ramp does not extend into the lake at the current water level. We have assumed that a crane will be needed to lift the barge into and out of the lake and have included the crane rental in the fee estimate.

- Four (4) test pits will be excavated at the locations shown on Attachment A, to investigate shallow subsurface conditions adjacent to the existing spillway walls, at the new outlet control building in the left abutment of the dam, and near the new outlet works. These include one hand-dug test pit above the left spillway wall to assess depth of colluvium in the area; all other test pits will be excavated with a small backhoe. Up to 4 days of test pitting will be performed to investigate shallow foundation conditions. Test pit T-4 will likely require environmental permits, and completion of this test pit will likely be postponed until the CEQA process has been completed. It is assumed that the T-4 will be completed in the 90% design phase and that minor modification to the design may occur during 90% design once this data is available.

Drilling explorations will be planned for when access conditions within or adjacent to the chute are safe. The supplemental geologic mapping will be undertaken prior to the test pitting and drilling activities as it will inform both activities and allow for slight adjustments to be made to planned boring and test pit locations as feasible.

Laboratory Testing: Subsequent to the field exploration, geotechnical laboratory tests will be conducted on selected samples obtained from the borings to determine engineering properties of the foundation materials. For cost estimating purposes we anticipate the laboratory testing will include:

- 80 water content tests
- 80 dry density tests
- 40 particle-size distribution tests
- 12 corrosivity suites
- 32 liquid limit and plastic limit tests
- 24 direct shear tests
- 20 triaxial shear tests
- 54 unconfined compressive strength tests on rock
- 88 point load strength tests on rock

f. Develop Geotechnical Parameters: Geotechnical design parameters will be developed using laboratory testing data to support design of the slope stability, foundation, underdrain, and

structural elements of the spillway chute replacement. Soil classification and gradations will be determined for the appropriate material type. Parameters will be documented in the Geotechnical Investigation Report.

g. Geotechnical Data Report: AECOM/GEI will prepare a Geotechnical Data Report (GDR) that will present the geotechnical subsurface investigation data collected at the Site to date. The GDR will include the factual data obtained from the investigations, including geologic mapping, boring and test pit logs, core photos, laboratory test data, and field-testing data. Data will be presented in tabular and graphical format. The intent of the GDR will be to include only the factual data without interpretation, so that it can be incorporated as a stand-alone document into the construction bidding documents and used by bidders without interpretation bias. AECOM/GEI will submit six (6) copies of a draft report to IRWD/SWD. For budgeting purposes, we have assumed one round of review and comment by IRWD/SWD and one round of review by DSOD. Six (6) copies of a final report will be provided.

h. Geotechnical Investigation Report: AECOM/GEI will prepare a Geotechnical Investigation Report (GIR) to support the final design of the proposed project facilities. The report will rely on the data presented in the GDR to provide interpretation of subsurface conditions at the spillway, including bearing and other properties required for construction and structural design. Geologic and geotechnical sections will be presented. Conclusions and geotechnical recommendations and design parameters will be presented for each structure. AECOM/GEI will submit six (6) copies of a draft report to IRWD/SWD. For budgeting purposes, we have assumed one round of review and comment by IRWD/SWD and one round of review by DSOD. Six (6) copies of a final report will be provided. This will include:

- Geotechnical recommendations and design parameters for the spillway.
- Foundation design for appurtenant structures, including the Control Building and Outlet Works Structures.

7. Outlet Works and Spillway Demolition: AECOM/GEI will evaluate the extent of the existing facilities that will need to be demolished in order to build the replacement facilities. We will also determine the existing facilities and utilities that will need to be protected-in-place for the project. Exhibits will be prepared to show the limits of infrastructure demolition and the underground and surficial items that will be protected during construction.

8. Outlet Tower Abandonment: This task will include abandonment design for the tower and a portion of the existing outlet conduit. One concept that we will evaluate for final design is removing the top of the existing tower down to the silt line area. AECOM ran a SAP model on the shortened outlet tower and determined that this tower should withstand the MCE event if it is cut and the upper portion removed to below elevation 740 feet. This will likely be a very economical solution for abandoning the existing outlet tower. We will also evaluate a second option to fully remove the tower and the tower foundation.

9. Downstream Outlet Works Improvements: AECOM/GEI will provide a technical memorandum that will include descriptions and figures for proposed improvements, an alternatives analysis, an assessment of the existing equipment and power supply, and a preliminary estimate of probable construction costs for outlet works improvements. We have determined that the valve vault with above-grade enclosure, the emergency outlet structure with fixed cone valve, and the discharge channel to the creek all need to be upsized to meet current DSOD reservoir dewatering requirements. The alternatives analysis will evaluate replacing the valve vault and emergency outlet structure in their current location or in a new location, including how to phase the demolition and construction. We will also evaluate where to house the existing mechanical equipment that resides inside the valve enclosure (e.g. air compressors, water supply pump for dam keeper). AECOM/GEI will submit six (6)

copies of a draft memorandum to IRWD/SWD. For budgeting purposes, we have assumed one round of review and comment by IRWD/SWD. Six (6) copies of a final memorandum will be provided.

10. Emergency Access and Power Supply Plan: AECOM/GEI will conduct a study to determine how the Districts will access the dam, outlet works, and spillway during a major flood or emergency. A technical memorandum will be prepared with exhibits that will provide recommendations for emergency access for vehicles, personnel, and construction equipment. The memorandum will include recommendations and conceptual-level construction costs for improvements such as new access roads or stairways that are identified during the study. AECOM/GEI will submit six (6) copies of a draft memorandum to IRWD/SWD. For budgeting purposes, we have assumed one round of review and comment by IRWD/SWD. Six (6) copies of a final memorandum will be provided.

11. Foundation and Underdrain Design: The purpose of this task is to prepare designs for the spillway chute foundation and the associated foundation treatments, anchoring, and foundation inspection and acceptance procedures. The scope of this task includes:

    a. Foundation Treatment: The spillway chute foundation is known to be founded on erodible shales and sandstone. Foundation treatment evaluations will be developed based on known conditions and further geotechnical investigations. Treatment options may include recommendations and requirements for dental, leveling, shaping or backfill concrete. The end of the chute will be evaluated for erosion and the potential for undercutting. An appropriate design will be completed to mitigate the potential erosion.

    b. Anchor Design: The spillway chute design will include anchors beneath the slab and sloped walls. Anchor design will include evaluations and recommendations for the anchor type, size, length, spacing, embedment depths and loading conditions.

    c. Foundation Acceptance Procedures: Foundation inspection and acceptance procedures will be developed to support the design and construction of the spillway chute foundation. This task will define what is an acceptable foundation condition, treatment measures where inadequate foundation material is identified, and establishing necessary documentation requirements during inspection and construction.

    d. Underdrain System Design: The spillway chute foundation will include drainage features to control excessive water pressures beneath the spillway chute slab and adjacent to walls. The drain system design will include drain pipe size and locations, minimum slot widths, discharge capacity, access and cleanout details, filter material requirements, and cut-offs.

    e. Energy Dissipation Structure: An energy dissipation structure will be needed to reduce the velocity of water at the end of the spillway chute to prevent excessive erosion in the channel downstream. An energy dissipation structure will be incorporated into the design and could include a flip bucket and plunge pool or a stilling basin.

    f. Slope Stability / Erosion Mitigation Design: Slope stability of the steep slopes adjacent to the spillway will be assessed based on the strength of materials assessed under the geotechnical investigation. Slope stabilization mitigation measures (e.g., reinforced shotcrete, rockbolts, slope netting) and/or other stabilization measures will be considered and incorporated into the design documents, as appropriate, to protect the spillway and personnel who may need to enter the spillway periodically for maintenance.

    g. Foundation Design / Stability Analysis for El 796 Weir Structure: The preliminary feasibility-level design for the weir structure at El 796 consists of a mass concrete structure approximately 250 feet long by 100 feet wide and up to 50 feet thick founded on bedrock within the reservoir upstream of the existing spillway. The foundation for this structure will be analyzed for static and

seismic slope stability using limit-equilibrium methods. Cases will be analyzed for stability for both construction and post-construction configurations. The analysis will consider appropriate rock strength parameters obtained during the geotechnical investigation, including parameters for interface strength in rock discontinuities, as appropriate, Foundation design considerations will include rock excavation / benching requirements for placement of mass concrete to ensure long-term stability.

12. Structural Design: The purpose of this task is to perform structural analyses to support the designs for the spillway chute slab and walls. The scope of this task includes:

    a. Stability Analyses: Develop structural loading conditions including live and dead loads, uplift loads, construction loads, and earthquake loads. Perform structural stability analyses of the new spillway control section, chute and wall structures to evaluate overturning and sliding forces, bearing capacity/settlement analysis and evaluations of the reinforced concrete structures.

    b. Reinforced Concrete Design: Develop structural concrete and reinforcing steel design criteria for the new structures. Develop structural details for slabs, walls, foundation keys and miscellaneous connection and metal details.

    c. Joints, Waterstops, and Tolerances: Develop structural details for construction joints, contraction joints, and control joints. Develop structural details for location and size of waterstops and specifications for the types of waterstops to use. Establish surface tolerances and flow surface roughness requirements based on evaluated cavitation indices.

    d. Structural Design & Stability Analysis for El 796 Weir Structure: The preliminary feasibility-level design for the weir structure at El 796 consists of a mass concrete structure approximately 250 feet long by 100 feet wide and up to 50 feet thick founded on bedrock within the reservoir upstream of the existing spillway. Static and seismic structural stability analysis will be performed for both construction and post-construction configurations. Design of the mass concrete weir structure will include consideration for rock anchors with appropriate factors of safety to secure the mass concrete structure in place under both static and seismic considerations.

13. Dam Embankment Stability Analysis with Reservoir at El 796: In order to accommodate raising the reservoir from the current permanent reservoir pool at El 790 to a new El 796, it is anticipated that DSOD will require an updated stability analysis for the dam embankment. Two-dimensional (2D) analysis cross section representative of the section of the dam will be developed and analyzed. 2D steady-state seepage analyses will be performed with the reservoir at full pool using program SEEP/W. 2D limit-equilibrium slope stability analyses will be performed to evaluate steady-state stability, rapid drawdown stability, and to estimate the seismic yield coefficient for a simplified seismic slope displacement analysis using program SLOPE/W. A simplified seismic slope displacement analysis will be performed in accordance with methodology by Bray and Travasarou (2007).

    Deliverable: A technical memorandum (draft and final) will be prepared and submitted to the Districts and DSOD in PDF format.

    Assumptions:
    - Existing data will be reviewed to estimate material properties for engineering analyses.
    - A site-specific acceleration response spectrum representative of a design-level seismic event is available for use as part of the simplified seismic slope displacement analysis.
    - Liquefaction triggering analyses are not included. If found to be required, additional budget would be required to perform liquefaction triggering analyses.
    - If it is found that there is potential for significant strength loss of embankment and/or foundation materials, a more advanced seismic deformation analysis would be required and is outside the scope of this task.

14. Construction Duration, Constructability, and Access: AECOM/GEI will prepare a technical memorandum for this task. The memorandum will include considerations for phasing the demolition and construction of the new sloped intake structure, dam crest widening, downstream outlet works facilities, and spillway. We will evaluate how to handle storm flows into Irvine Lake and work areas during the wet season (e.g. temporary pump station, diversion, cofferdam). Constructability and construction access to the work site is of primary importance for this project. The dam crest access road allows for limited access to the outlet tower area and narrows to around eight feet in one section. Due to this limited access, most of the large construction equipment will need to access the construction site from the reservoir and/or from the downstream end of the spillway. AECOM/GEI will develop a preliminary construction schedule and conduct an evaluation of the constructability and construction access for the outlet tower and spillway replacement project. We will perform an evaluation of the cost difference (e.g. cost/benefit analysis) between performing the construction work in a single dry season versus multiple dry seasons. The findings from this memorandum will be incorporated into the construction drawings and specifications during the Final Design phase. AECOM/GEI will submit six (6) copies of a draft memorandum to IRWD/SWD. For budgeting purposes, we have assumed one round of review and comment by IRWD/SWD. Six (6) copies of a final memorandum will be provided.

15. Permitting Support: AECOM/GEI will support the permit application process during the preliminary design phase. We understand that IRWD/SWD's environmental consultant will manage the permitting effort and will apply for the permits. This task will include preparation of written descriptions, figures, estimates, and other documentation that is required for the permit applications. AECOM/GEI will solely handle the DSOD dam alteration application. The expected permits and licenses will include but may not be limited to: a California Department of Fish and Wildlife Lake or Streambed Alteration Agreement, a U.S. Army Corps of Engineers Section 401 Water Quality Certification, and a County of Orange encroachment permit.

16. CEQA Documentation: AECOM/GEI understands that IRWD/SWD's environmental consultant will prepare and file the CEQA documentation for the project. AECOM/GEI has included an allowance budget for providing IRWD/SWD with data regarding construction activities that will impact the environment. AECOM/GEI's CEQA support may include review of the project description in the environmental document, preparation of exhibits, attendance at up to two meetings, and sharing of project-related information through data requests. Our effort will also include the development of a corridor for relocation of overhead power lines and poles, which will be accounted for in the CEQA document.

17. Preliminary Opinion of Probable Construction Cost: AECOM/GEI will prepare a preliminary Opinion of Probable Construction Costs for all elements of the project. Our professional cost estimator will use recent IRWD construction bids, Caltrans Cost Data Books, bid results from other dam projects we are involved with in California, and other resources to develop the cost estimate.

18. Project Schedule: AECOM/GEI will prepare a project schedule during the preliminary design phase for the design, advertisement, bidding, and construction phases. The schedule will be prepared in Gantt chart format using Microsoft Project. The schedule will identify major design activities, permits, coordination activities, review periods, DSOD coordination, and bid and construction phase activities such as shop drawing review/approval and manufacturing and delivery for long lead time items.

19. Project Meetings: AECOM/GEI will schedule and lead meetings with IRWD and SWD's team to incorporate input for design, operational and maintenance issues. AECOM/GEI will provide agendas of upcoming project coordination meetings five working days in advance of the meeting and prepare meeting minutes and action items within five working days subsequent to the meetings. These efforts are intended to ensure that all technical issues are being addressed and that the project remains on schedule. The meetings will include a two-day design workshop with a panel of technical experts from

AECOM/GEI. The purpose of this workshop is to bring in experts that are not part of the design team to evaluate the overall preliminary design effort and suggest improvements. The workshop will include an in-brief and out-brief attended by IRWD/SWD and the design team. We propose the following meetings during the preliminary design phase.

Meeting/Workshops Task 1 - Preliminary Design	Description
Project Kick-off Meeting	One (1) two-hour meeting
IRWD/SWD Joint Committee Meetings	Two (2) two-hour meetings
Project Kick-off Meeting with DSOD in Sacramento	One (1) two-hour meeting
Progress Meetings with IRWD/SWD	Two (2) two-hour meetings
Design Workshop with Panel of AECOM/GEI Technical Experts	Two (2) eight-hour meetings
IRWD/SWD Meeting to Discuss/Present Preliminary Design	One (1) two-hour meeting
Meeting at DSOD Offices to Present Preliminary Design	One (1) two-hour meeting
Site Visit Meetings	Three (3) two-hour field meetings

20. Task Deliverables:

a. Preliminary Design Report: AECOM/GEI will summarize and compile each of the subtask items listed above into a PDR. The PDR will include design criteria for all elements of the project. AECOM/GEI will provide ten (10) copies of the Draft PDR and Final PDR and electronic files of all documents in MS Word and PDF format. Five (5) copies of the Final PDR will be wet stamped/signed by our California-licensed civil, geotechnical, and structural engineers. We propose the following Table of Contents for the PDR:

Santiago Creek Dam Spillway Replacement Project
Preliminary Design Report
(Proposed Table of Contents)

Section

0.0 EXECUTIVE SUMMARY
1.0 INTRODUCTION
- 1.1 Project Background
- 1.2 Project Purpose
- 1.3 Evaluation of Background Information

2.0 SPILLWAY INVESTIGATION
- 2.1 Existing Spillway As-Builts
- 2.2 Spillway Geological Mapping
- 2.3 Spillway Inspection and Condition Assessment
- 2.4 Recommended Spillway Improvements

3.0 HYDROLOGY, HYDRAULICS, AND EROSION CONTROL
- 3.1 Hydrologic Analysis for Spillway
- 3.2 Hydraulics Analysis for Outlet Works and Spillway
- 3.3 Erodibility of Spillway and Outlet Works Areas
- 3.4 Erosion Control Measures

4.0 SEISMIC DESIGN
- 4.1 Seismic Hazard Analyses
- 4.2 Seismic Design Parameters

5.0 GEOTECHNICAL CONSIDERATIONS
- 5.1 Introduction
- 5.2 Review of Existing Geotechnical Information

6.0 PERMITTING, LICENSES, AND ENVIROMENTAL CONCERNS
- 6.1 Permits and Licenses
- 6.2 Environmental Concerns

7.0 SPILLWAY DESIGN
- 7.1 Design Criteria
- 7.2 Demolition of Existing Spillway
- 7.3 Temporary Shoring and Easement Measures
- 7.4 Slab and Chute Wall Design
- 7.5 Underdrain System
- 7.6 Drainage Systems
- 7.7 Energy Dissipator
- 7.8 Rock Slope Mitigation

8.0 OUTLET WORKS IMPROVEMENTS
- 8.1 Design Criteria
- 8.2 Demolition of Existing Outlet Works
- 8.3 Replacement Valve Vault Design
- 8.4 Replacement Emergency Outlet Structure Design
- 8.5 Drawdown Analysis for Proposed Outlet Works Improvements

9.0 CONSTRUCTION CONSIDERATIONS
- 9.1 Construction Duration and Phasing
- 9.2 Constructability Review
- 9.3 Access to Construction Site & Safety Considerations
- 9.4 Material Deliveries and Associated Lead Times
- 9.5 Project Schedule
- 9.6 Drawing List
- 9.7 Specifications List and Project Manual Outline
- 9.8 Opinion of Probable Construction Costs

b. Preliminary Plans: AECOM/GEI will provide half-size 30% level plans for the spillway control structure, chute, terminal structure, inclined outlet structure, control building, and outlet works. The plans will be placed within an appendix of the PDR or provided separately, if requested.

21. Miscellaneous Preliminary Design Phase Services: This task provides a budget allowance for unforeseen services that may come up in the preliminary design phase. Any expenditures for this task will need to be pre-approved by IRWD/SWD.

Phase 2 Final Design

1. Project Management and Client Interaction: AECOM/GEI will provide project management services for the final design phase of the project. These services will include client and subconsultant coordination, weekly project status emails, monthly invoicing with progress reports. The AECOM/GEI team will also provide updates to the project Risk Register for each deliverable.

2. Outlet Pipe, Outlet Valves, Valve House, and Emergency Outlet Structure: AECOM will provide final design for the inclined outlet pipe, foundation, isolation valves, actuators, screens, ancillary equipment, power supply, valve house, and emergency outlet valve structure for the new outlet works system. The design will include routing electrical, controls, and valve actuation lines from the

proposed Control Building across the proposed pedestrian bridge to the sloped outlet structure. The new valve house downstream of the dam will include a subterranean valve vault below a fire-hardened CMU block building with metal roof. The new emergency outlet structure will include a fixed cone valve, cast-in-place vault, and a downstream stilling basin with riprap revetment.

3. Point of Connection: AECOM/GEI will complete the point of connection notes and details for connection of the new inclined outlet to the existing outlet conduit and for connection of the new downstream outlet works valve structure and emergency outlet structure to the existing outlet conduit.

4. Pedestrian Bridge Across Spillway and Stairway up to Landfill: AECOM/GEI will design a pedestrian bridge over the replacement spillway and stairway up to the landfill that will allow District personnel to access the proposed inclined outlet structure and the west side of the spillway.

    a. Pedestrian Bridge: The bridge will be a prefabricated steel truss structure, which can also be used to carry electrical, control, and valve actuation conduits over the spillway. We estimate that approximately eleven (11) sheets, technical specifications, and structural calculations will be required for the bridge and abutment structures.

    b. Stairway to Landfill: Three conceptual stairway alignments will be developed and a final stairway alignment will be selected with coordination and input from Orange County Waste and Recycling (OCWR). We estimate that approximately four (4) sheets, technical specifications, and structural calculations will be required for the stairway up to the landfill. We assume that IRWD/SWD will perform all activities related to obtaining an easement on OCWR land.

5. Constructability and Access: AECOM/GEI will layout appropriate construction access and staging areas for the project. We will use the findings in Phase 1 to determine if our solutions are constructible and safe for the contractors. Traffic flow/routing, property limits, and environmentally sensitive areas will be considered with laying out the construction access and laydown areas. We will also complete a constructability study during the final design phase using a team of construction experts within AECOM and GEI. Findings and constraints from this task will be incorporated into the construction plans and technical specifications.

6. Stormwater Pollution Prevention Plan (SWPPP): AECOM/GEI's certified Qualified SWPPP Developer (QSD) will prepare a SWPPP document and drawings for the project. The Construction General Permit requires the development of a SWPPP based on the amount of proposed land disturbance that is expected. AECOM will deliver five (5) copies of the draft SWPPP and five (5) copies of the final, signed SWPPP and a CD containing the electronic files.

7. Groundwater Dewatering and Land Disposal Permitting: AECOM/GEI will apply for and obtain an NPDES groundwater and land disposal discharge permit from the Santa Ana Regional Water Quality Control Board (Regional Board) prior to the construction phase of the project. Our services include the Notice of Intent (NOI) and Notice of Termination (NOT) packages and sampling and analytical services required by the Regional Board. We assume that the NOI/NOT fees will be paid by the Districts and that the Districts will submit the monthly dewatering discharge letter to the Regional Board during the construction phase.

8. Permitting Support: AECOM/GEI will support the environmental permit application process during the final design phase, which will be managed by IRWD/SWD's environmental consultant. This task will include preparation of written descriptions, figures, estimates, and other documentation that is required for the permit applications.

9. Final Opinion of Probable Construction Cost: AECOM/GEI will provide IRWD/SWD with an engineer's estimate of probable construction costs for the 60%, 90% 100% and final submittals. AECOM/GEI will incorporate and address comments from IRWD/SWD related to the cost estimate. Construction costs

will be developed by AECOM/GEI's professional cost estimator certified by the Association for the Advancement of Cost Engineering International (AACE). The estimator will use a variety of resources, including: vendor quotes, Caltrans Cost Data Books, recent IRWD/SWD construction bids, and bids from other local dam projects that AECOM/GEI has recently designed.

10. Project Schedule: AECOM/GEI will submit monthly project schedule updates and with each stage of final design submittal, include a construction schedule. The project schedule will reflect coordination items, submittal milestones, critical path items, IRWD/SWD review times, shop drawing approvals, manufacturing, delivery, seasonal weather impacts, and affected construction projects. AECOM/GEI will prepare the schedule in Microsoft Project format.

11. Project Meetings: AECOM/GEI will schedule and lead meetings with IRWD and SWD's team to confirm that all design, operational and maintenance issues are being addressed. AECOM/GEI will provide agendas of upcoming project coordination meetings five working days in advance of the meeting and prepare meeting minutes and action items within five working days subsequent to the meetings. We propose the following meetings, it's assumed that quarterly progress meetings, coordination meetings with OCWR, and miscellaneous meetings will be held via conference call or web meeting.

Meeting/Workshops Task 2 - Final Design	Description
Quarterly Progress Meetings with IRWD/SWD	Six (6) two-hour meetings
60% Design Review Meeting with IRWD/SWD	One (1) two-hour workshop
60% Project Briefing to DSOD in Sacramento	One (1) two-hour workshop
90% Design Review Meeting with IRWD/SWD	One (1) two-hour workshop
90% Project Briefing to DSOD in Sacramento	One (1) two-hour workshop
100% Design Review Meeting with IRWD/SWD	One (1) two-hour workshop
Site Visit Meetings	Six (6) two-hour field meetings
Coordination Meetings with OCWR	Three (3) two-hour meetings
Miscellaneous Meetings	Ten (10) two-hour meetings

12. Bid Period Assistance: During the bidding period, AECOM/GEI will provide bidding support and assistance as it pertains to the contract documents and construction drawings. For budgetary purposes, we have assumed several hours in our fee estimate to answer questions from prospective bidding contractors and assist IRWD and SWD in providing information and clarification of the bid documents. AECOM/GEI will consult with IRWD and SWD to address concerns or answer their questions in support of administering the bid process. AECOM/GEI has budgeted for two (2) addendum to the construction plans and/or Project Manual for prospective bidders, if requested by IRWD/SWD. Bid phase services will include:

    - Plan Revisions: AECOM/GEI has budgeted eighty (80) hours of staff time for plans revisions.
    - Specification Revisions: AECOM/GEI has budgeted forty (40) hours of staff time for revisions to the Project Manual.
    - Bidder Questions: AECOM/GEI has budgeted eighty (80) hours of staff time to address and respond to bidder questions.

- Pre-Bid Meeting: Two senior AECOM/GEI staff will attend one (1) two-hour pre-bid meeting, conducted by IRWD, along with a site visit with potential bidders, if required.

13. Task Deliverables:

a. Improvement Plans: AECOM/GEI will prepare detailed construction drawings in AutoCAD 2020 using NCS V4.0 layering standards. Construction plans will be prepared on IRWD standard 22-inch x 34-inch sheet with IRWD title block. Pipeline plan and profile sheets will be prepared of two-strip (e.g. profile over plan view) at a scale of 1"=40' horizontal and 1"=4' vertical. The horizontal and vertical control will be established with NAD83 and NAVD88 survey standards, respectively. We assume that the construction plans will consist of one hundred and forty-nine (149) sheets.

Construction Drawing List

Sheet No.	Drawing No.	Sheet Title
1	G-1	Title Sheet
2	G-2	Location Map, Vicinity Map, and Sheet Index
3	G-3	Construction Notes, Symbols, Agency Index & Abbreviations
4	G-4	General Notes and Hydrologic Information
5	G-5	Site Access Plan
6	G-6	Construction Storage and Laydown Plan
7	G-7	Overall Site Plan
8	C-1	Site Demolition and Salvage Plan
9	C-2	Site Demolition and Salvage Plan
10	C-3	Site Demolition and Salvage Details
11	C-4	Tower Abandonment Plan, Section, and Details
12	C-5	Spillway Demolition Plan
13	C-6	Temporary Spillway Slope Shoring Plan
14	C-7	Horizontal Control Plan
15	C-8	Inclined Outlet Access Road and Retaining Wall Plan
16	C-9	Dam Access Safety Improvement Plan, Sections, and Details
17	C-10	Temporary Pump Station Plan
18	C-11	Temporary Stormwater/Creek Diversion Plan
19	OW-1	Outlet Works General Plan
20	OW-2	Inclined Outlet Structure Cofferdam Notes and Arrangement
21	OW-3	Inclined Outlet Structure Cofferdam Sections and Details
22	OW-4	Inclined Outlet Structure Cofferdam Details
23	OW-5	Inclined Outlet Structure Excavation Plan and Profile
24	OW-6	Inclined Outlet Structure Plan and Profile
25	OW-7	Inclined Outlet Structure Point of Connection Details
26	OW-8	Inclined Outlet Structure Mechanical Details - 1
27	OW-9	Inclined Outlet Structure Mechanical Details - 2
28	OW-10	Inclined Outlet Structure Platform and Stairway Plan, Profile, and
29	OW-11	Inclined Outlet Structure Structural Notes, Legend, Abbreviations
30	OW-12	Inclined Outlet Structure Structural Plan, Sections, and Details
31	OW-13	Inclined Outlet Structure Structural Details - 1
32	OW-14	Inclined Outlet Structure Structural Details - 2
33	OW-15	Inclined Outlet Structure Structural Details - 3
34	OW-16	Inclined Outlet Structure Structural Details - 4
35	OW-17	Outlet Works Control Building Site Plan

Sheet No.	Drawing No.	Sheet Title
36	OW-18	Outlet Works Control Building Sections
37	OW-19	Outlet Works Control Building Mechanical Plan
38	OW-20	Outlet Works Control Building Structural Notes
39	OW-21	Outlet Works Control Building Foundation Plan
40	OW-22	Outlet Works Control Building Roof Framing Plan
41	OW-23	Outlet Works Control Building Roof Framing Details
42	OW-24	Outlet Works Control Building Sections and Elevations
43	OW-25	Outlet Works Control Building Structural Details - 1
44	OW-26	Outlet Works Control Building Structural Details - 2
45	OW-27	Valve House Plan
46	OW-28	Valve House Sections
47	OW-29	Valve House Mechanical Plan
48	OW-30	Valve House Excavation Plan
49	OW-31	Valve House Structural Notes
50	OW-32	Valve House Foundation Plan
51	OW-33	Valve House Roof Framing Plan
52	OW-34	Valve House Roof Framing Details
53	OW-35	Valve House Sections and Elevations
54	OW-36	Valve House Structural Details - 1
55	OW-37	Valve House Structural Details - 2
56	OW-38	Emergency Outlet Structure Plan
57	OW-39	Emergency Outlet Structure Excavation Plan
58	OW-40	Emergency Outlet Structure Section
59	OW-41	Emergency Outlet Structure Details
60	OW-42	Stilling Basin Plan and Profile
61	OW-43	Stilling Basin Sections and Details
62	SP-1	Spillway General Arrangement
63	SP-2	Spillway Plan
64	SP-3	Spillway Profile
65	SP-4	Spillway Excavation Plan
66	SP-5	Spillway Final Grading Plan
67	SP-6	Spillway Sections – 1
68	SP-7	Spillway Sections – 2
69	SP-8	Spillway Sections – 3
70	SP-9	Spillway Sections – 4
71	SP-10	Spillway Sections – 5
72	SP-11	Spillway Sections - 6
73	SP-12	Spillway Structural Plan Detail – 1
74	SP-13	Spillway Structural Plan Detail – 2
75	SP-14	Spillway Structural Plan Detail – 3
76	SP-15	Spillway Structural Plan Detail – 4
77	SP-16	Spillway Structural Plan Detail – 5
78	SP-17	Spillway Structural Plan Detail - 6
79	SP-18	Spillway Foundation and Drainage Plan – 1
80	SP-19	Spillway Foundation and Drainage Plan – 2
81	SP-20	Spillway Right Training Wall Plan and Elevation
82	SP-21	Spillway Left Training Wall Plan and Elevation
83	SP-22	Spillway Training Wall Sections

Sheet No.	Drawing No.	Sheet Title
84	SP-23	Spillway Stilling Basin Plan
85	SP-24	Spillway Stilling Basin Profile
86	SP-25	Spillway Stilling Basin Sections – 1
87	SP-26	Spillway Stilling Basin Sections – 2
88	SP-27	Spillway Details – 1
89	SP-28	Spillway Details – 2
90	SP-29	Spillway Details – 3
91	SP-30	Spillway Details – 4
92	SP-31	Spillway Details – 5
93	SP-32	Spillway Details – 6
94	SP-33	Spillway Details – 7
95	SP-34	Spillway Details - 8
96	SP-35	Slope Mitigation Plan
97	SP-36	Slope Mitigation Details
98	BR-1	Pedestrian Bridge Structural Notes and Abbreviations
99	BR-2	Pedestrian Bridge General Arrangement Plan
100	BR-3	Pedestrian Bridge Structural Observations and Special Inspections
101	BR-4	Pedestrian Bridge Foundation Plan
102	BR-5	Pedestrian Bridge Elevations
103	BR-6	Pedestrian Bridge Abutment Sections
104	BR-7	Pedestrian Bridge Sections
105	BR-8	Pedestrian Bridge Abutment Details
106	BR-9	Pedestrian Bridge Details - 1
107	BR-10	Pedestrian Bridge Details - 2
108	BR-11	Pedestrian Bridge Miscellaneous Details - 3
109	SW-1	Stairway Plan
110	SW-2	Stairway Profile
111	SW-3	Stairway Sections and Details
112	SW-4	Stairway Details
113	E-1	Overall Electrical Site Plan, Legend & Abbreviations
114	E-2	Single Line Diagram
115	E-3	Control Building Electrical Plan
116	E-4	Valve Vault & EOS Electrical Plan
117	E-5	Control Building Conduit Plan
118	E-6	Outlet Works Valve Vault & EOS Conduit Plan
119	E-7	Control Building Lighting Security, and Grounding Plan
120	E-8	Valve Vault & EOS Lighting Security, and Grounding Plan
121	E-9	Control Building Panel Elevations
122	E-10	Electrical Conduit – Sections and Details
123	E-11	Electrical Service Plan and Details
124	E-12	PLC and Telemetry Schematic
125	E-13	Security Camera and Telemetry Details
126	E-14	Air Schematic Control Diagram
127	E-15	Emergency Outlet Valve Schematic Control Diagram
128	E-16	Electrical Details - 1
129	E-17	Electrical Details - 2
130	E-18	Cable and Conduit Schedule
131	I-1	Instrumentation Legend and Symbols

Sheet No.	Drawing No.	Sheet Title
132	I-2	Outlet Works P&ID
133	I-3	Instrumentation Details
134	I-4	SCADA System Architecture
135	I-5	Telemetry System Details - 1
136	I-6	Telemetry System Details - 2
137	EC-1	SWPPP Index Map and Notes
138	EC-2	SWPPP Notes
139	EC-3	SWPPP Excavation Area 1
140	EC-4	SWPPP Excavation Area 2
141	EC-5	SWPPP Excavation Area 3
142	EC-6	SWPPP Outlet Works Improvements Area 1
143	EC-7	SWPPP Outlet Works Improvements Area 2
144	EC-8	SWPPP Spillway Improvements Area 1
145	EC-9	SWPPP Spillway Improvements Area 2
146	EC-10	SWPPP Details - 1
147	EC-11	SWPPP Details - 2
148	EC-12	SWPPP Details - 3
149	EC-13	SWPPP Details - 4

b. Project Manual: AECOM/GEI will prepare the Project Manual for the project in standard IRWD format and complete IRWD templates for the bidding and contract requirements section of the manual. AECOM/GEI will use the latest version of IRWD's Project Manual for the front-end documents related to bidding, agreements, general provisions, and special provisions. The special provisions will be tailored for the project. The Project Manual will reference the applicable sections of IRWD's General Technical Specifications, modify these sections as needed, and provide new technical sections as needed for the project. The Project Manual will also include an Appendix with District holidays, District Alternating Friday Closure Schedule, standard construction forms, permit documents, NPDES documents, Project Sign figure, and various other forms for construction.

Final Design Deliverable: AECOM/GEI will provide final design deliverables pursuant to IRWD's Design Process Manual. Hard copies of construction plans will be reproduced in half-size tabloid (11"x17") bond format. The Project Manual will be reproduced in double-sided letter-size format per IRWD standards. The submittals will be provided as described below.

i. AECOM/GEI will submit eight (8) half-size bond copies of the first (60%) submittal. Plans for the first submittal will include a draft set of drawings for the entire project. The first submittal will include eight (8) copies of the Project Manual with technical specifications and an engineer's estimate of probable construction cost.

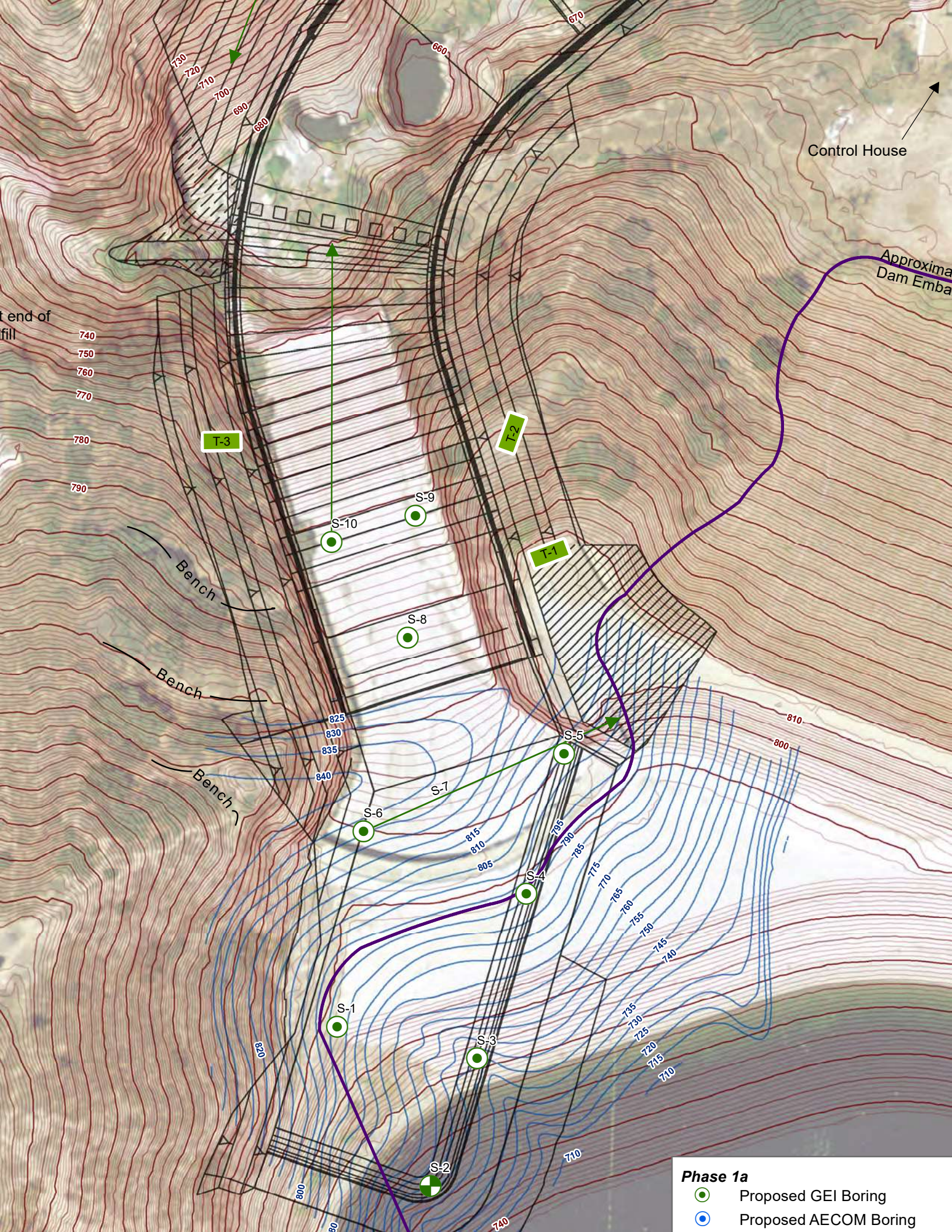
ii. AECOM/GEI will submit eight (8) half-size bond copies of the entire plan set for the second (90%) submittal. Plans for the second submittal will show all the design elements of the 60% Submittal, but in much greater detail. AECOM/GEI will incorporate IRWD/SWD staff comments on the 60% submittal. AECOM/GEI will provide eight (8) copies of the complete Project Manual and engineer's estimate of probable construction cost for this submittal. All sections of the Project Manual will be provided for this submittal, including contract requirements, general provisions, special provisions, general requirements, technical specifications, and appendix.

iii. AECOM/GEI will submit eight (8) half-size bond copies of the entire plan set and eight (8) copies of the Project Manual. This submittal will include the complete plan set and specifications and a notebook with the design calculations (including hydrologic, hydraulic, civil, structural, and geotechnical). AECOM/GEI will incorporate IRWD/SWD staff and DSOD comments on the 90% submittal, as well as comments

received at the 90% plan review meeting. AECOM/GEI will update the Project Manual and engineer's estimate of probable construction cost for this submittal.

iv. AECOM/GEI will submit stamped and signed reproducible plans (with mylar cover) of the final construction plans and original signed Project Manual for IRWD/SWD signatures after incorporating any final District and DSOD comments to the 100% design documents. A CD with electronic files (PDF, AutoCAD, MS Word) will be provided for the entire construction drawing set and Project Manual. AECOM/GEI will attend IRWD/SWD's meeting for signatures to explain the project and answer questions. A final engineer's estimate of probable construction cost will be submitted with the final plans and Project Manual.

14. Miscellaneous Final Design Phase Services: This task provides a budget allowance for unforeseen services that may come up in the final design phase. Any expenditures for this task will need to be pre-approved by IRWD/SWD.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Proposed AECOM Boring

& Spillway Improvement Project)	**506 days**	**Thu 12/14/17**	**Thu 11/21/19**
Spillway Improvement Project)	**801 days**	**Tue 2/25/20**	**Tue 3/21/23**
	25 days	Tue 2/25/20	Mon 3/30/20
	1 day	Mon 5/4/20	Mon 5/4/20
	1 day	Tue 5/19/20	Tue 5/19/20
l Memo	40 days	Tue 5/5/20	Mon 6/29/20
on Technical Memo	15 days	Tue 5/5/20	Mon 5/25/20
CAD Processing	15 days	Tue 5/26/20	Mon 6/15/20
Consultants request for data for Initial Study	10 days	Tue 5/5/20	Mon 5/18/20
GHG Technical Study	58 days	Tue 5/19/20	Thu 8/6/20
aft of Initial Study	20 days	Fri 8/7/20	Thu 9/3/20
ASP	20 days	Tue 5/5/20	Mon 6/1/20
Plan	30 days	Tue 6/2/20	Mon 7/13/20
and Test Pits	30 days	Tue 7/14/20	Mon 8/24/20
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	5 days	Wed 3/15/23	Tue 3/21/23
DD	0 days	Tue 3/21/23	Tue 3/21/23
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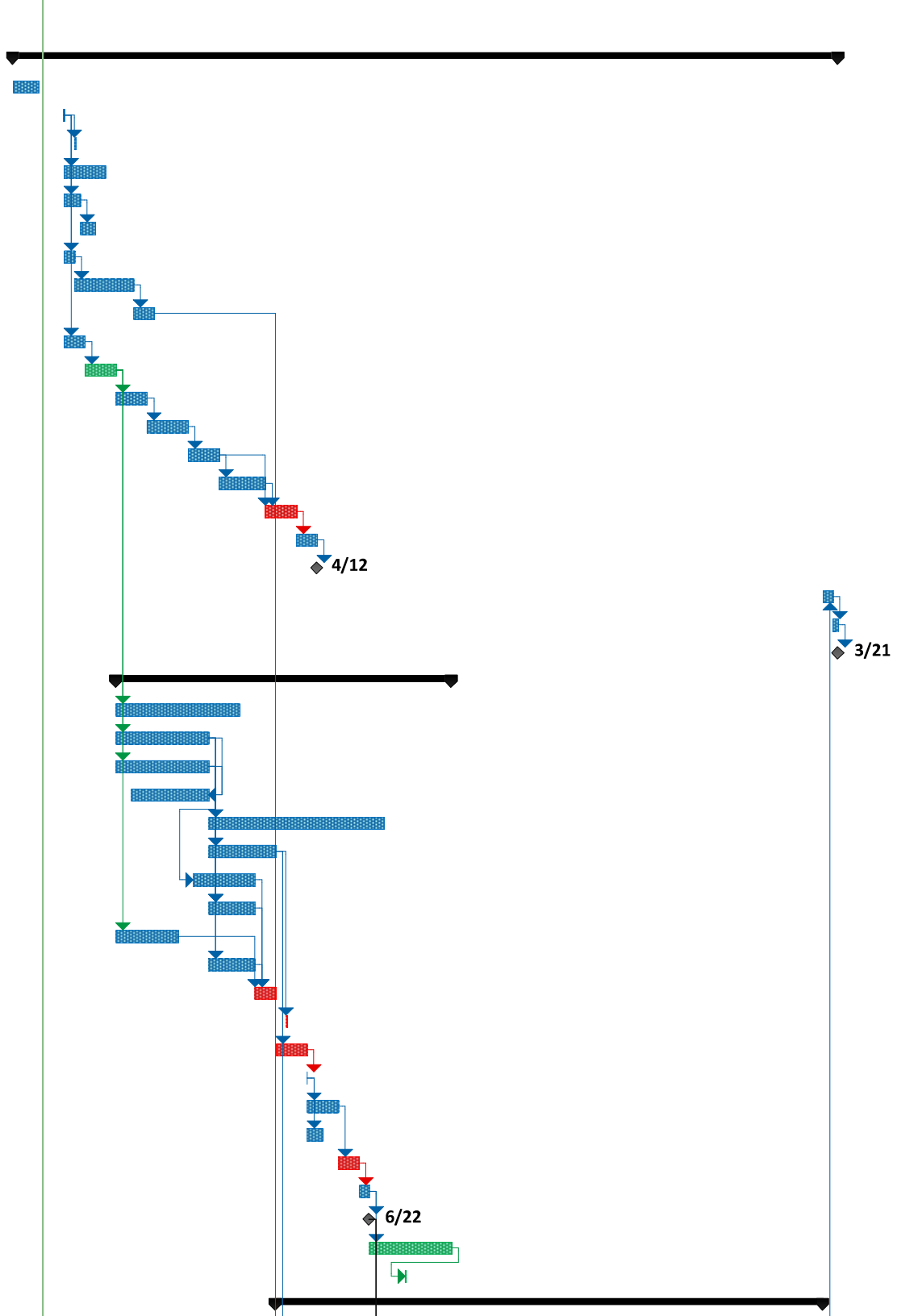
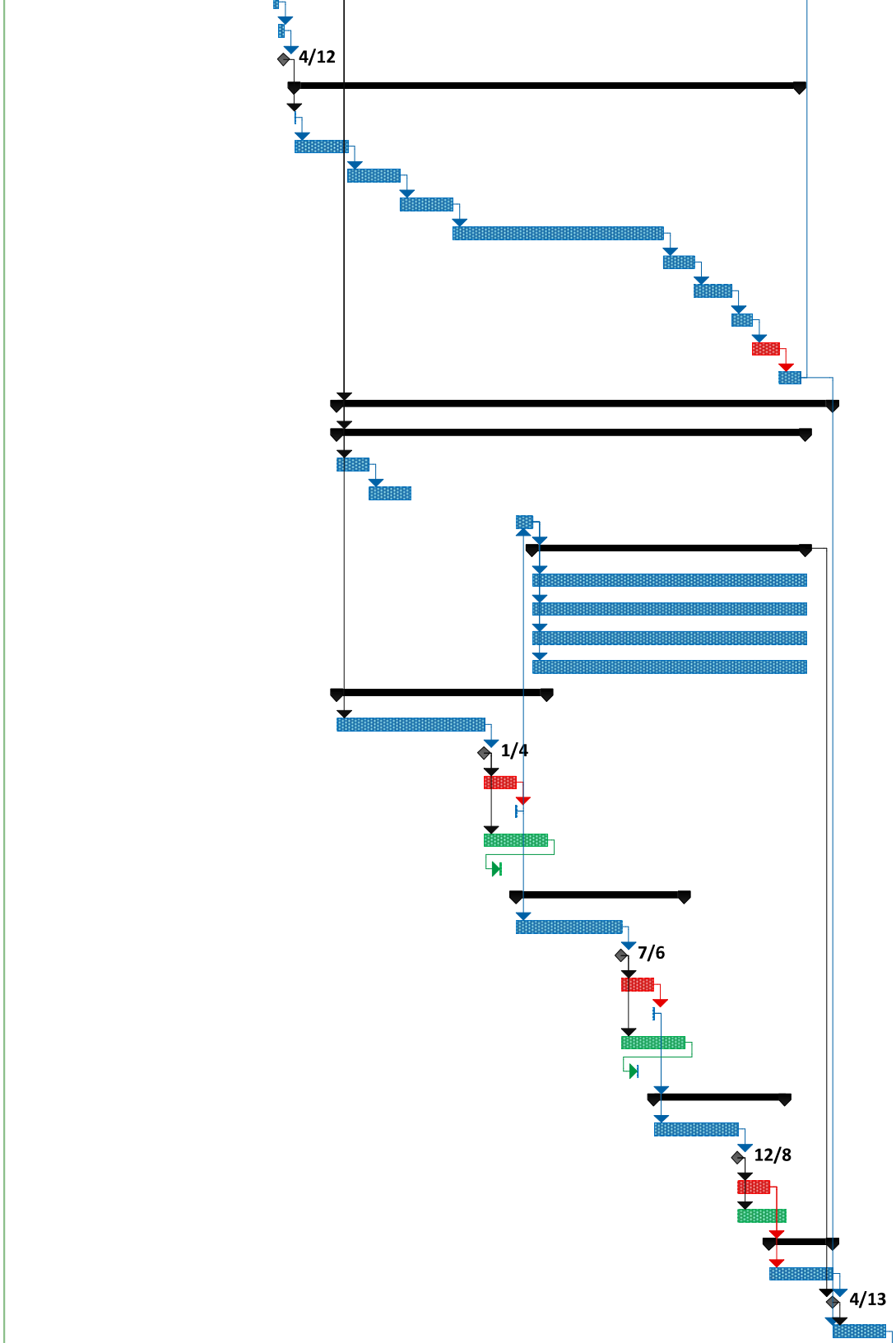
	120 days	Tue 7/14/20	Mon 12/28/20
	90 days	Tue 7/14/20	Mon 11/16/20
	90 days	Tue 7/14/20	Mon 11/16/20
	75 days	Tue 8/4/20	Mon 11/16/20
	170 days	Tue 11/17/20	Mon 7/12/21
	65 days	Tue 11/17/20	Mon 2/15/21
udy Technical Memo as PDR Appendix	60 days	Tue 10/27/20	Mon 1/18/21
ical Memo	45 days	Tue 11/17/20	Mon 1/18/21
al Memo	60 days	Tue 7/14/20	Mon 10/5/20
nical Memo as PDR Appendix	45 days	Tue 11/17/20	Mon 1/18/21
	20 days	Tue 1/19/21	Mon 2/15/21
OM/GEI Experts)	2 days	Tue 3/2/21	Wed 3/3/21
	30 days	Tue 2/16/21	Mon 3/29/21
	1 day	Tue 3/30/21	Tue 3/30/21
	30 days	Wed 3/31/21	Tue 5/11/21
	15 days	Wed 3/31/21	Tue 4/20/21
	20 days	Wed 5/12/21	Tue 6/8/21
	10 days	Wed 6/9/21	Tue 6/22/21
D	0 days	Tue 6/22/21	Tue 6/22/21
	80 days	Wed 6/23/21	Tue 10/12/21
on in Sacramento	1 day	Wed 8/11/21	Wed 8/11/21
	531 days	**Tue 2/16/21**	**Tue 2/28/23**



	5 days	Tue 4/6/21	Mon 4/12/21
ls Professional Services	0 days	Mon 4/12/21	Mon 4/12/21
	481 days	**Tue 4/27/21**	**Tue 2/28/23**
	1 day	Tue 4/27/21	Tue 4/27/21
	50 days	Wed 4/28/21	Tue 7/6/21
	50 days	Wed 7/7/21	Tue 9/14/21
d Notice of Completion	50 days	Wed 9/15/21	Tue 11/23/21
	200 days	Wed 11/24/21	Tue 8/30/22
R	30 days	Wed 8/31/22	Tue 10/11/22
of Availabilty	35 days	Wed 10/12/22	Tue 11/29/22
	20 days	Wed 11/30/22	Tue 12/27/22
se to Comments	25 days	Wed 12/28/22	Tue 1/31/23
Monitoring and Report	20 days	Wed 2/1/23	Tue 2/28/23
vay Improvement Project)	**472 days**	**Wed 6/23/21**	**Thu 4/13/23**
	446 days	**Wed 6/23/21**	**Wed 3/8/23**
n	30 days	Wed 6/23/21	Tue 8/3/21
rmit Applications	40 days	Wed 8/4/21	Tue 9/28/21
s	15 days	Thu 2/17/22	Wed 3/9/22
	260 days	**Thu 3/10/22**	**Wed 3/8/23**
	260 days	Thu 3/10/22	Wed 3/8/23
	260 days	Thu 3/10/22	Wed 3/8/23
	260 days	Thu 3/10/22	Wed 3/8/23
	260 days	Thu 3/10/22	Wed 3/8/23
	200 days	**Wed 6/23/21**	**Tue 3/29/22**
	140 days	Wed 6/23/21	Tue 1/4/22
	0 days	Tue 1/4/22	Tue 1/4/22
	30 days	Wed 1/5/22	Tue 2/15/22
	1 day	Wed 2/16/22	Wed 2/16/22
	60 days	Wed 1/5/22	Tue 3/29/22
	1 day	Wed 1/26/22	Wed 1/26/22
	160 days	**Thu 2/17/22**	**Wed 9/28/22**
	100 days	Thu 2/17/22	Wed 7/6/22
	0 days	Wed 7/6/22	Wed 7/6/22
od	30 days	Thu 7/7/22	Wed 8/17/22
	1 day	Thu 8/18/22	Thu 8/18/22
	60 days	Thu 7/7/22	Wed 9/28/22
	1 day	Thu 7/28/22	Thu 7/28/22
	125 days	**Fri 8/19/22**	**Thu 2/9/23**
	80 days	Fri 8/19/22	Thu 12/8/22
	0 days	Thu 12/8/22	Thu 12/8/22
riod	30 days	Fri 12/9/22	Thu 1/19/23
	45 days	Fri 12/9/22	Thu 2/9/23
	60 days	**Fri 1/20/23**	**Thu 4/13/23**
	60 days	Fri 1/20/23	Thu 4/13/23
OSOD	0 days	Thu 4/13/23	Thu 4/13/23
	50 days	Fri 4/14/23	Thu 6/22/23



Task Description	AECOM Labor Hours							AECOM TOTAL HOURS	AECOM LABOR COSTS	GEI LABOR COSTS (no mark-up)	GEI DIRECT COSTS & MATERIALS[2]	AECOM SUB-CONTRACTOR COSTS (no mark-up)	AECOM DIRE COSTS & MATERIALS
	Principal Engineer	Project Manager / Senior Engineer	Senior Project Engineer / Geologist / Scientist	Project Engineer / Geologist / Scientist	Senior Staff Engineer / Geologist / Scientist	Staff Engineer / Geologist / Scientist / CAD / GIS	Project Admin						
	$290	$250	$190	$160	$130	$110	$100						
Design													
gement and Client Interaction		200					24	224	$52,400	$46,600			
alysis and Erodibility Study		4	8					12	$2,520	$49,640	$500		
Modeling (1D and 3D CFD)		4	8					12	$2,520	$112,000	$50,000		
hysical Model		20						20	$5,000	$109,200	$358,000		$1,000
Field Survey		4				4	2	10	$1,640			$10,800	
horeline Facility Evaluation		16		24		40		80	$12,240				$50
gn	4	4	40				4	52	$10,160	$2,160			
loration, Evaluation, and Design Parameters								-	-	-			
Workplan and DSOD approval	2	4	16		20	24	2	68	$10,060	$12,000			
afe Work Plan		2	4		16			22	$3,340	$4,050			
onditions Evaluation			20		20			40	$6,400	$19,840			
Mapping										$13,680	$2,700		
e Geotechnical Investigation	4		20		50			74	$11,460	$101,940	$15,000	$507,400	$42,980
eotechnical Parameters	4		4		20			28	$4,520	$29,680			
eotechnical Data Report (GDR)	4	6	40	30	40	40	2	162	$24,860	$49,080			$500
eotechnical Investigation Report (GIR)	4	6	40	30	40	40	2	162	$24,860	$49,440			$500
and Spillway Demolition		4				16		20	$2,760	$5,820			
Abandonment	8	2	20	24		24		78	$13,100				
Outlet Works Improvements	4	16	24	20	40	80		184	$26,920				
ccess & Power Supply Plan	4	12	20	20		40	4	100	$15,960				
nd Underdrain Design								-	-	-			
Treatment	2		4					6	$1,340	$21,680			
sign	2		4					6	$1,340	$36,680			
Acceptance Procedures	2		4					6	$1,340	$8,620			
System Design	2		4					6	$1,340	$9,200			
sipater Design	2		4					6	$1,340	$9,200			
lity / Erosion Mitigation Design	2		4					6	$1,340	$9,200			
Design / Stability Analysis for El 796 Weir Structure	2		4					6	$1,340	$75,960			
sign								-	-	-			
nalyses			16					16	$3,040	$77,520			
Concrete Design			16					16	$3,040	$24,520			
terstops, and Tolerances			8					8	$1,520	$23,520			
Design & Stability Analysis for El 796 Weir Structure			8					8	$1,520	$75,960			
ment Stability Analysis with Permanent Reservoir at El 796	8			16				24	$4,880	$95,200			
Duration, Constructability, and Access	16	20	60	40	80	40	4	260	$42,640	$6,680			$100
pport		4	4	16		16		40	$6,080	$12,160			
nentation	4	24			40	40	5	113	$17,260	$17,260			$480
pinion of Probable Construction Cost		4	60			16		80	$14,160	$2,680			
dule		8						8	$2,000	$2,580			
ngs	105	110	82					297	$73,530	$73,900	$15,100		$6,350
ables								-	-	-			
Design Report	4	20	8	40			8	80	$14,880	$98,240			$2,000
inary Plans	16	60	100		200	240		616	$91,040	$54,580			
s Preliminary Design Phase Services								-	-	-			
SUBTOTAL PHASE 1	**205**	**554**	**654**	**260**	**566**	**660**	**57**	**2,956**	**$515,690**	**$1,340,470**	**$441,300**	**$518,200**	**$53,960**
n													
gement and Client Interaction		200					80	280	$58,000	$53,200			
Outlet Valves,Valve House, and Emergency Outlet Structure	4	16	4	24	40			88	$14,960				
nection	8	8	40		60			116	$19,720				
ridge acros Spillway and Stairway to Landfill								-	-	-			
Bridge Across Spillway	46	86	40	80	100			352	$68,240	$5,200			
Landfill	8	8						16	$4,320	$39,920			
ity and Access (includes considerations for Weir at El 796)	24	12	16	40		40		132	$23,800	$19,840			
ollution Prevention Plan		4	8	80		40	4	136	$20,120				$200
Dewatering and Land Disposal Permitting		8		20	80	20	4	132	$18,200			$15,000	
pport	4	24	24			24	8	84	$15,160	$5,840			
of Probable Construction Cost	4	20	120			40	2	186	$33,560	$5,180			
dule		16						16	$4,000	$4,000			
ngs	83	187	157					427	$100,650	$126,800	$21,880		$5,820
ssistance	2	20	4	12	20	40	2	100	$15,460	$15,460			$100
ables			4					-	-	-			
nts Plans (149 Sheets)	109	436	654	872	1744	1962		5777	$846,930	$344,800			$3,000
nual (includes considerations for Weir at El 796)	20	80	40	250			40	430	$77,400	$66,000			$2,000
s Final Design Phase Services								-	-	-			
SUBTOTAL PHASE 2	**312**	**1125**	**1111**	**1378**	**2044**	**2166**	**140**	**8,272**	**$1,320,520**	**$686,240**	**$21,880**	**$15,000**	**$11,120**

Task No.	Task Description	Principal Engineer	Project Manager / Senior Engineer	Senior Project Engineer / Geologist / Scientist	Project Engineer / Geologist / Scientist	Senior Staff Engineer / Geologist / Scientist	Staff Engineer / Geologist / Scientist / CAD / GIS	Project Admin	GEI TOTAL HOURS	GEI LABOR COSTS	GEI TOTAL
		$290	$250	$190	$160	$130	$110	$100			
Phase 1 - Preliminary Design											
1.	Project Management and Client Interaction	40	140						180	$46,600	$46,600
2.	Hydraulic Analysis and Erodibility Study	20	40	80		120	24	4	288	$49,640	$49,640
	a. Hydraulic Modeling (1D and 3D CFD)	40	80	200	200	80			600	$112,000	$112,000
	b. Spillway Physical Model	180	148			80	80	8	496	$109,200	$109,200
3.	Topographic Field Survey								0	$0	$0
4.	Irvine Lake Shoreline Facility Evaluation								0	$0	$0
5.	Seismic Design	4	4						8	$2,160	$2,160
6.	Geologic Exploration, Evaluation, and Design Parameters								-	-	-
	a. Develop Workplan and DSOD approval	8	4	40			8	2	62	$12,000	$12,000
	b. Develop Safe Work Plan	1	2	4		16	2	2	27	$4,050	$4,050
	c. Geologic Conditions Evaluation	16	40			40			96	$19,840	$19,840
	d. Geologic Mapping	0	36			36		0	72	$13,680	$13,680
	e. Subsurface Geotechnical Investigation	30	120			460	24	8	642	$101,940	$101,940
	f. Develop Geotechnical Parameters	12	36	50		50		12	160	$29,680	$29,680
	g. Prepare Geotechnical Data Report (GDR)	12	30	30	30	200		16	318	$49,080	$49,080
	h. Prepare Geotechnical Investigation Report (GIR)	16	40	40	64	64	64	16	304	$49,440	$49,440
7.	Outlet Works and Spillway Demolition	2	8		12		12		34	$5,820	$5,820
8.	Outlet Tower Abandonment								0	$0	$0
9.	Downstream Outlet Works Improvements								0	$0	$0
10.	Emergency Access & Power Supply Plan								0	$0	$0
11.	Foundation and Underdrain Design								-	-	-
	a. Foundation Treatment	12	50	30					92	$21,680	$21,680
	b. Anchor Design	12	72	80					164	$36,680	$36,680
	c. Foundation Acceptance Procedures	2	20	16					38	$8,620	$8,620
	d. Underdrain System Design	4	20	16					40	$9,200	$9,200
	e. Energy Dissipater Design	4	20	16					40	$9,200	$9,200
	f. Slope Stability / Erosion Mitigation Design	4	20	16					40	$9,200	$9,200
	g. Foundation Design / Stability Analysis for El 796 Weir Structure	24	40	120	120	80	60		444	$75,960	$75,960
12.	Structural Design								-	-	-
	a. Stability Analyses	48	72	240					360	$77,520	$77,520
	b. Reinforced Concrete Design	8	28	80					116	$24,520	$24,520
	c. Joints, Waterstops, and Tolerances	8	24	80					112	$23,520	$23,520
	d. Structural Design & Stability Analysis for El 796 Weir Structure	24	40	120	120	80	60		444	$75,960	$75,960
13.	Dam Embankment Stability Analysis with Permanent Reservoir at El 796	40	60	120	120	120	100		560	$95,200	$95,200
14.	Construction Duration, Constructability, and Access	4	16	8					28	$6,680	$6,680
15.	Permitting Support		8	8	32		32		80	$12,160	$12,160
16.	CEQA Documentation	4	24			40	40	5	113	$17,260	$17,260
17.	Preliminary Opinion of Probable Construction Cost	2	4				10		16	$2,680	$2,680
18.	Project Schedule	2	8						10	$2,580	$2,580
19.	Project Meetings	104	102	96					302	$73,900	$73,900
20.	Task Deliverables								-	-	-
	a. Preliminary Design Report	40	120	120	120	80	24	16	520	$98,240	$98,240
	b. 30% Preliminary Plans	16	44	66		110	110		346	$54,580	$54,580
21.	Miscellaneous Preliminary Design Phase Services								-	-	-
	SUBTOTAL PHASE 1	**743**	**1520**	**1676**	**818**	**1656**	**650**	**89**	**7,152**	**$1,340,470**	**$1,340,470**
Phase 2 - Final Design											
1.	Project Management and Client Interaction	60	140					8	208	$53,200	$53,200
2.	Outlet Pipe, Outlet Valves,Valve House, and Emergency Outlet Structure								0	$0	$0
3.	Point of Connection								0	$0	$0
4.	Pedestrian Bridge acros Spillway and Stairway to Landfill								-	-	-
	a. Pedestrian Bridge Across Spillway	8	8				8		24	$5,200	$5,200
	b. Stairway to Landfill	12	36	48	48	48	40		232	$39,920	$39,920
5.	Constructability and Access (includes considerations for Weir at El 796)	16	24	20	20		20		100	$19,840	$19,840
6.	Stormwater Pollution Prevention Plan								0	$0	$0
7.	Groundwater Dewatering and Land Disposal Permitting								0	$0	$0
8.	Permitting Support	8	8	8					24	$5,840	$5,840
9.	Final Opinion of Probable Construction Cost	2	8			20			30	$5,180	$5,180
10.	Project Schedule		16						16	$4,000	$4,000
11.	Project Meetings	136	240	144					520	$126,800	$126,800
12.	Bid Period Assistance	2	20	4	12	20	40	2	100	$15,460	$15,460
13.	Task Deliverables								-	-	-
	a. Improvements Plans (40 GEI Sheets)	80	240	240	360	660	660		2240	$344,800	$344,800
	b. Project Manual (includes considerations for Weir at El 796)	40	80	80	100			32	332	$66,000	$66,000
14.	Miscellaneous Final Design Phase Services								-	-	-
	SUBTOTAL PHASE 2	**364**	**820**	**544**	**540**	**748**	**768**	**42**	**3,826**	**$686,240**	**$686,240**

Irvine Ranch Water District and Serrano Water District
Santiago Creek Dam Outlet Tower and Spillway Improvements Project - Engineering Services
April 6, 2020

Miscellaneous Subcontractor Costs

Task No.	Subcontractor	Task Description	Quantity	Unit	Unit Cost	Total Cost
Ph 1, Task 3	Psomas	Three days of field survey for area downstream of spillway and outlet works	1	LS	$10,800.00	$10,800.00
Ph 1, Task 6e	Innovative Services Group	Dig total four (4) test pits to 5ft depth (includes three machine-dug pits and one hand-dug pit)	1	LS	$20,000.00	$20,000.00
Ph 1, Task 6e	Gregg Drilling	Phase 1a (7 borings in spillway approach and chute, 1 boring near outlet structure, 1 boring on slope across from spillway)	1	LS	$192,000.00	$192,000.00
Ph 1, Task 6e	Gregg Drilling	Phase 1b borings (3 over-water borings; 1 boring near downstream end of spillway)	1	LS	$281,000.00	$281,000.00
Ph 1, Task 6e	Innovative Services Group	Vegetation Clearing for boring near downstream end of spillway chute	1	LS	$8,000.00	$8,000.00
Ph 1, Task 6e	Belshire Environmental Services	Pick-up and dispose up to 20 drums of drill cuttings	1	LS	$6,000.00	$6,000.00
Ph 1, Task 6e	Eurofins Calscience	Chemical analysis of drummed drill cuttings.	1	LS	$400.00	$400.00
Ph 2, Task 7	Eurofins Calscience	Lab costs for NPDES groundwater sampling	1	LS	$15,000.00	$15,000.00
					Total	**$533,200.00**

AECOM Geotechnical Laboratory Costs

Task No.	Subcontractor	Task Description	Quantity	Unit	Unit Cost	Total Cost
Ph 1, Task 6e	AECOM Geotechnical Lab	Water content tests	80	EA	$16.00	$1,280.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Dry density tests	80	EA	$31.00	$2,480.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Particle-size distribution tests	40	EA	$130.00	$5,200.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Corrosivity suites	12	EA	$190.00	$2,280.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Liquid limit and plastic limit tests	32	EA	$140.00	$4,480.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Direct shear tests	24	EA	$240.00	$5,760.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Triaxial shear tests	20	EA	$325.00	$6,500.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Unconfined compressive strength tests on rock	54	EA	$100.00	$5,400.00
Ph 1, Task 6e	AECOM Geotechnical Lab	Point load strength tests on rock	88	EA	$100.00	$8,800.00
					Total	**$42,180.00**

Notes:
1. Agency permit fees for drilling are unknown at this time.
2. Assumes AECOM Geotechical Lab in Anaheim, CA will perform geotechnical laboratory testing.
3. All subcontractor and laboratory costs shown in the tables above include payment of prevailing wages. The California Department of Industrial Relations (DIR) registration numbers for all companies are as follows:
   DIR # 1000005693 AECOM Technical Services, Inc.
   DIR # 1000025634 GEI Consultants, Inc.
   DIR # 1000061085 Gregg Drilling, LLC
   DIR # 1000464682 Innovative Service Group (ISG), LLC
   DIR # 1000010904 Psomas
   DIR # 1000010287 Belshire Environmental Services, Inc.
   DIR # 1000058872 Eurofins Calscience LLC

AECOM/GEI
Schedule of Fees and Charges (Rate Table) for the IRWD Santiago Creek Dam Outlet Tower and Spillway Improvements Project

This Schedule of Fees and Charges shown in the labor classification table below will remain constant for the preliminary design, final design, and bid support phases of the project.

PERSONNEL CHARGES*

The charge for all time required in the performance of the Scope of Service, including office, field and travel time, will be at the Unit Price Hourly rates set forth below for the labor classifications:

LABOR CLASSIFICATION

Professional Staff	Hourly Rate
Staff Engineer/Scientist/Geologist	$110
Senior Staff Engineer/Scientist/Geologist	$130
Project Engineer/Scientist/Geologist	$160
Senior Engineer/Scientist/Geologist	$190
Project Manager/Senior Engineer	$250
Principal Engineer/Architect	$290
Principal-in-Charge	$300
Technical Staff	**Hourly Rate**
Drafter/GIS/Graphics	$100
Senior Drafter/GIS/Graphics	$110
Design/GIS/Estimator/Scheduler	$130
Senior Design/Estimator/Scheduler	$160
Lead Design/Estimator/Scheduler	$190
Project Support Staff	**Hourly Rate**
Office/Clerical	$80
Project Assistant	$90
Administrator/Contracts	$100
Project Admin/Contracts	$125
Sr Project Admin/Contracts	$150
Principal Project Admin/Contract	$175

Overtime (hours worked in excess of eight (8) hours per day) by exempt personnel will be charged at the above straight time rate. Overtime by non-exempt personnel will be charged at 1.5 times the above hourly rates.

OTHER PROJECT CHARGES

Subcontractors and Equipment Rental

The cost of services subcontracted by AECOM/GEI to others and other costs incurred by AECOM/GEI will be charged at cost with no mark-up.

Document Reproduction

In-house reproduction will be charged as follows:
8 ½x11 Black & White = $0.09
11x17 Black & White = $0.17
8 ½x11 Color = $0.14
11x17 Color = $0.26
Black & White plot/ square foot = $0.20
Color plot/square foot = $0.26

Vehicles and Mileage

Leased field vehicles (pick-ups, vans, trucks, etc.) used on project assignments will be charged at $85 per day. The mileage charge for personal autos will be the current mileage rate established by the Internal Revenue Service.

The above rates do not include prevailing wages as determined by the Department of Industrial Relations on Public Works projects. Prevailing wages and benefits are billed at a higher rate in comparison to the AECOM/GEI rate.

When AECOM/GEI staff, appear as expert witnesses at court trials, mediation, arbitration hearings and depositions, their time will be charged at 2.0 times the standard rate. All time spent preparing for such trials, hearings and depositions will be charged at the standard

Santiago Reservoir Improvements Consultant Selection and Project Update

IRWD/SWD Joint Committee
April 15, 2020

1

Presentation Agenda

1. Purpose
2. DSOD Update
3. Spillway Replacement Alternatives Analysis
4. Design Scope of Work and Fee
5. CEQA Update
6. Next Steps

2

Purpose of Presentation

Recommend a new Professional Services Agreement with AECOM/GEI for design of the tower and spillway improvements and to provide update on spillway replacement alternatives analysis.

3

Dec 2019

Dec: Transmitted Phase II Spillway Assessment to DSOD

Jan: AECOM/GEI initial draft of scope of work

AECOM GEI Consultants

Jan: Spillway replacement brainstorm workshop

Feb 2020

Mar: GEI completed draft alternatives analysis

Feb: Implemented Irvine Lake interim operation plan

May 2020

***May 19**: SWD Board Consultant Selection*

***Apr 27**: IRWD Board Consultant Selection*

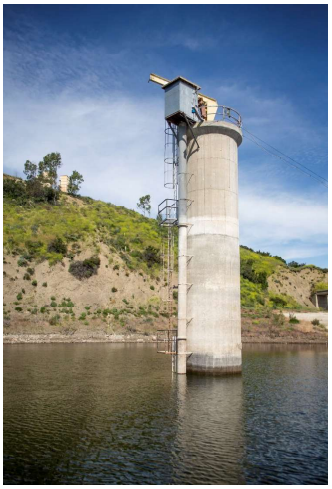
Apr 15: IRWD/SWD Joint Committee Meeting

4

Irvine Ranch WATER DISTRICT

Division of Safety of Dams Response to Spillway Assessment

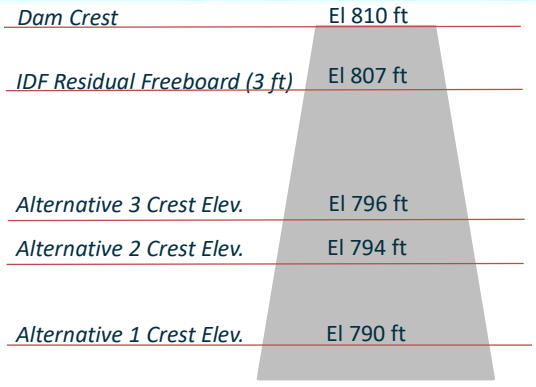
- Staff transmitted Phase II Spillway Assessment to DSOD in December 2019
- DSOD changed Santiago Creek Dam condition rating from "Satisfactory" to "Poor"
  - Outlet tower deficiency
  - Spillway deficiency
- DSOD is requiring the districts implement interim risk reduction measures and submit spillway replacement alternative by July 1



5

Considerations for Spillway Replacement Alternatives

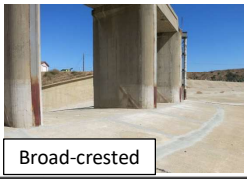
- Design for Probable Maximum Flood (PMF)
  - Existing spillway designed for 23,830 cfs
  - New PMF is approximately 47,300 cfs
- Freeboard requirements
- Spillway components
- Terrain
  - Complex geotechnical issues
  - Steep topography surrounding existing spillway
  - Spillway alignment




Labyrinth


Ogee


Glory Hole


Broad-crested

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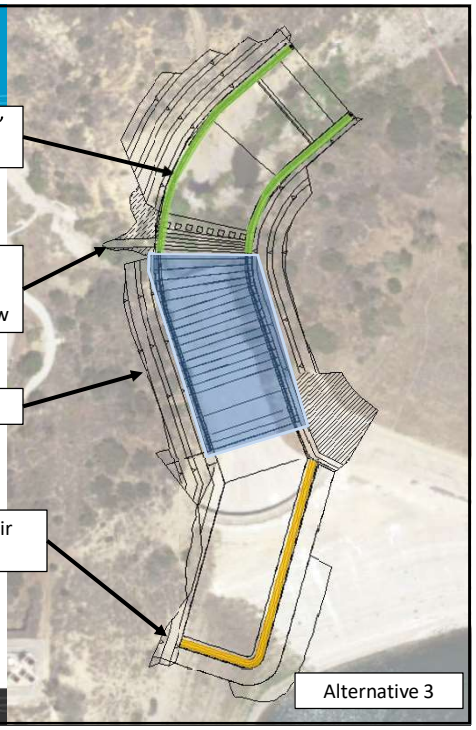
Irvine Ranch WATER DISTRICT

Spillway Replacement Alternatives

- Alternative 1 – Spillway Crest at 790-ft *(current crest elevation)*
  - No additional storage
- Alternative 2 – Spillway Crest at 794-ft *(current elevation at top of flashboards)*
  - 2,400 AF of additional storage
- Alternative 3 – Spillway Crest at 796-ft
  - 3,700 AF of additional storage



Irvine Ranch Water District

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Additional Reservoir Storage – Potential Savings

Savings in Untreated Water Purchases Over 100-year Period

Spillway Alternative	Storage Above 790-feet (AF)	Construction Cost Estimate ($Millions)*	Cumulative Savings Based on Storage Usage Frequency		
			5-Year	10-Year	20-Year
1 – Crest at 790-feet	0	$73	-		
2 – Crest at 794-feet	2,400	$76	$520 M	$287 M	$172 M
3 – Crest at 796-feet	3,700	$78	$802 M	$442 M	$266 M

*Values escalated to mid-point of construction.

Alternative 3 costs approximately $5M more than Alternative 1 and offers the highest overall value.

Irvine Ranch Water District 8

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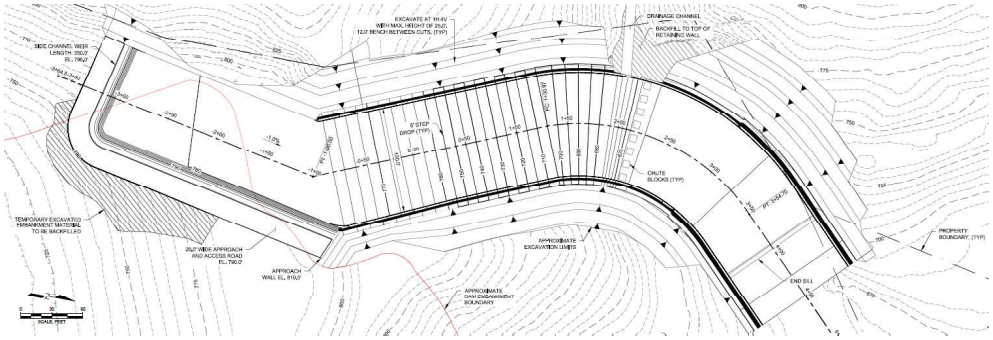
Irvine Ranch WATER DISTRICT

Spillway Replacement Recommendation

- Recommend Alternative 3, Ogee Weir Crest at 796-ft
  - Maximizes reservoir storage
  - Minimizes untreated water purchases
  - Maximizes use of the districts' water rights

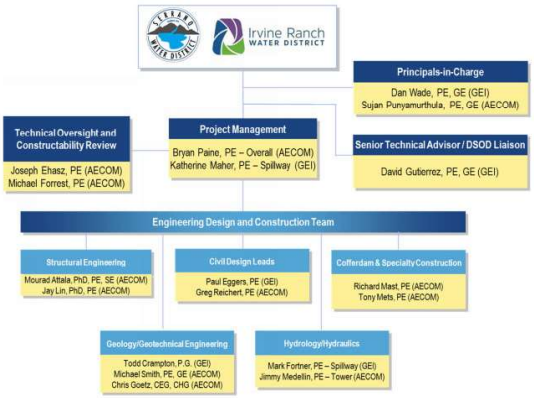


Anticipated "All-In" Project Cost

Outlet Works:	$5 M
Spillway:	$78 M
Inclined Outlet Structure:	$20 M
Approximate overall construction cost	$103 M
Soft Costs @ 35% (engineering, environmental, construction management, legal)	$36 M
Total "All-In" Project Cost	$139 M

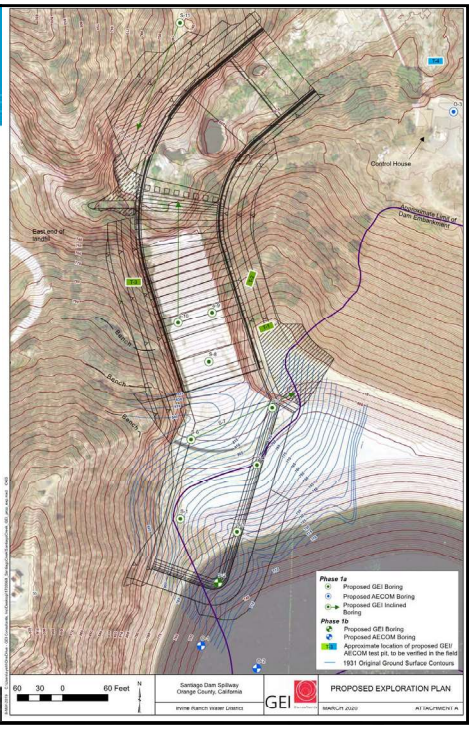
AECOM/GEI Team

- Project Team Led by AECOM and fully supported by GEI
- AECOM/GEI have established working relationship
- Proven experience with DSOD coordination and approvals
- AECOM/GEI are top design firms for dams and reservoirs in California



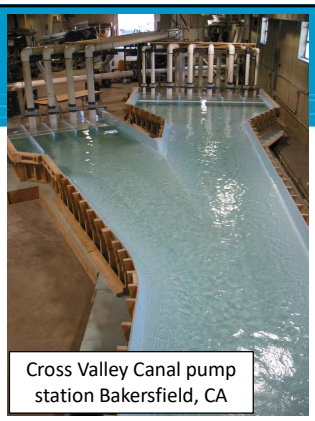
Scope of Work

- Coordination with DSOD
- Geotechnical investigation
- Erodibility study for Santiago Creek
- Hydraulic analysis using computational fluid dynamics (CFD) and physical model
- Improvements for all weather access
- Complete preliminary and final design



Scope of Work

- Physical Model
  - Spillway configuration yields complex hydraulics
  - Effective method for DSOD review and approval
  - Improved understanding of spillway hydraulics reduces uncertainty in design



Cross Valley Canal pump station Bakersfield, CA

Utah Water Research Laboratory

Design Fee & Future Contracts

- New professional services agreement with AECOM in the amount of $4,989,380
- Cancel AECOM's existing contract for the Inclined Outlet Tower design (~$535,000 remains)
- Future contract with Environmental Consultant for CEQA documentation (MND or EIR) – Start in February 2021

AECOM

GEI Consultants

Irvine Ranch WATER DISTRICT

Environmental Compliance Activities

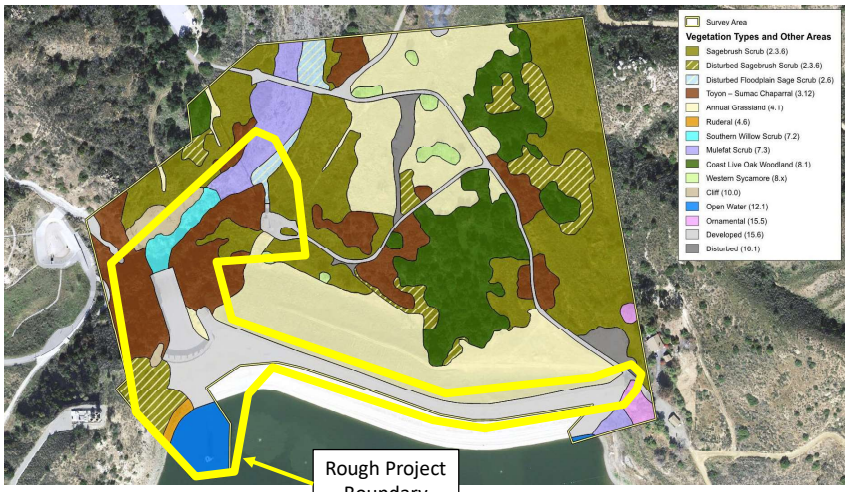
Pervasive sensitive habitat through project site

Upcoming Environmental Activities:

- Jurisdictional delineation
- Biological surveys
- Initial Study (IS)

Future Environmental Activities:

- MND or EIR
- Evaluate mitigation options



Project Schedule

• Complete Spillway Alternatives Analysis	May 2020
• Complete Preliminary Design Report	June 2021
• Complete CEQA	February 2023
• Complete Design	April 2023
• Start Construction	June 2023
• Construction Completion	June 2025

Next Steps

- Board approvals of consultant selection
- Obtain DSOD approval for preferred spillway replacement alternative
- Advance environmental compliance activities
- Proceed with geotechnical exploration
- Start preliminary design

February 24, 1969

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Questions

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Irvine Ranch WATER DISTRICT