AGENDA
IRVINE RANCH WATER DISTRICT
ENGINEERING AND OPERATIONS COMMITTEE
TUESDAY, DECEMBER 8, 2020

Due to COVID-19, this meeting will be conducted as a teleconference pursuant to the provisions of the Governor's Executive Orders N-25-20 and N-29-20, which suspend certain requirements of the Ralph M. Brown Act. Members of the public may not attend this meeting in person.

Participation by members of the Committee will be from remote locations. Public access and participation will only be available telephonically/electronically.

To virtually attend the meeting and to be able to view any presentations or additional materials provided at the meeting, please join online via Webex using the link and information below:

Via Web:
https://irwd.my.webex.com/irwd.my/j.php?MTID=m172fc17e3be3f8f4cee79c787f8bd3a4
Meeting Number (Access Code): 126 327 9786
Meeting Password: ubTZArKB232 (82892752 from phones and video systems)

After joining the meeting, in order to ensure all persons can participate and observe the meeting, please select the "Call in" option and use a telephone to access the audio for the meeting by using the call-in information and attendee identification number provided.

As courtesy to the other participants, please mute your phone when you are not speaking.

PLEASE NOTE: Participants joining the meeting will be placed into the Webex lobby when the Committee enters closed session. Participants who remain in the "lobby" will automatically be returned to the open session of the Committee once the closed session has concluded. Participants who join the meeting while the Committee is in closed session will receive a notice that the meeting has been locked. They will be able to join the meeting once the closed session has concluded.

CALL TO ORDER 3:00 p.m.

ATTENDANCE Committee Chair: Doug Reinhart _____
Committee Member: John Withers _____

ALSO PRESENT	Paul Cook _____	Kevin Burton _____	Wendy Chambers _____
	Jose Zepeda _____	Paul Weghorst _____	Cheryl Clary _____
	Rich Mori _____	Eric Akiyoshi _____	Richard Mykitta _____
	Kelly Lew _____	Jim Colston _____	Ken Pfister _____
	Lars Oldewage _____	Malcolm Cortez _____	Scott Toland _____
	John Dayer _____	Bruce Newell _____	Mitch Robinson _____
	Belisario Rios _____	_____ _____	_____ _____

PUBLIC COMMENT NOTICE

If you wish to address the Committee on any item, please submit a request to speak via the "chat" feature available when joining the meeting virtually. Remarks are limited to three minutes per speaker on each subject. You may also submit a public comment in advance of the meeting by emailing comments@irwd.com before 9:00 a.m. on Tuesday, December 8, 2020.

ALL VOTES SHALL BE TAKEN BY A ROLL CALL VOTE.

COMMUNICATIONS

1. Notes: Burton
2. Public Comments
3. Determine the need to discuss and/or take action on item(s) introduced that came to the attention of the District subsequent to the agenda being posted.
4. Determine which items may be approved without discussion.

ACTION

5. SYPHON RESERVOIR IMPROVEMENT PROJECT UPDATE, BUDGET INCREASE, AND CONSULTANT SELECTION – TOLAND / MORI / BURTON

   Recommendation: That the Board authorize a budget increase in the amount of $71,000,000, from $75,000,000 to $146,000,000, approve an Expenditure Authorization in the amount of $139,650,000, and authorize the General Manager to execute a Professional Services Agreement in the amount of $4,747,749 with AECOM for engineering design services for the Syphon Reservoir Improvement, Project 03808.

OTHER BUSINESS

6. Directors' Comments

7. Adjourn

Availability of agenda materials: Agenda exhibits and other writings that are disclosable public records distributed to all or a majority of the members of the above-named Committee in connection with a matter subject to discussion or consideration at an open meeting of the Committee are available for public inspection in the District's office, 15600 Sand Canyon Avenue, Irvine, California ("District Office"). If such writings are distributed to members of the Committee less than 72 hours prior to the meeting, they will be available from the District Secretary of the District Office at the same time as they are distributed to Committee Members, except that if such writings are distributed one hour prior to, or during, the meeting, they will be available electronically via the Webex meeting noted. Upon request, the District will provide for written agenda materials in appropriate alternative formats, and reasonable disability-related modification or accommodation to enable individuals with disabilities to participate in and provide comments at public meetings. Please submit a request, including your name, phone number and/or email address, and a description of the modification, accommodation, or alternative format requested at least two days before the meeting. Requests should be emailed to comments@irwd.com. Requests made by mail must be received at least two days before the meeting. Requests will be granted whenever possible and resolved in favor of accessibility.

December 8, 2020
Prepared by: S. Toland / R. Mori
Submitted by: K. Burton
Approved by: Paul A. Cook

ENGINEERING AND OPERATIONS COMMITTEE

SYPHON RESERVOIR IMPROVEMENT
PROJECT UPDATE, BUDGET INCREASE, AND CONSULTANT SELECTION

SUMMARY:

At IRWD's Strategic Planning Workshop held in July 2017, staff presented an analysis of the Syphon Reservoir Improvement Project that quantified the benefits and financial aspects of the project. Extensive progress and project development have occurred since then, providing staff the information needed to update the assumptions data used in the previous analysis, along with the identification of new data and criteria. Staff has incorporated the latest data and information into the previously completed analysis and has performed an updated project analysis, which will be presented to the Board.

Based on the results of the updated analysis, staff recommends proceeding with the design of the Syphon Reservoir Improvement Project, which will increase the storage capacity of the reservoir to approximately 5,000 acre-feet (AF). Primary project components include an enlarged engineered embankment dam and spillway, sloped inlet/outlet works, filtration facility, and disinfection facilities. Staff recommends the Board:

- Authorize a budget increase in the amount of $71,000,000, from $75,000,000 to $146,000,000;
- Approve an Expenditure Authorization in the amount of $139,650,000; and
- Authorize the General Manager to execute a Professional Services Agreement in the amount of $4,747,749 with AECOM for engineering design services for the Syphon Reservoir Improvement Project.

BACKGROUND:

The Syphon Reservoir is located within IRWD's service area on the east side of Portola Parkway between Bee Canyon Access Road and State Route 133. The existing 59-foot-tall, 535 AF capacity reservoir, which was constructed in 1949 by the Irvine Company for irrigation supply purposes, was purchased by IRWD in 2010. In 2013, IRWD constructed facilities to integrate the reservoir into its recycled water system as a relatively small seasonal storage facility. The existing facility is surrounded by sensitive upland and wetland vegetation communities that are protected under state and federal environmental and regulatory requirements.

Improvements to the Syphon Reservoir are needed to resolve challenges associated with having inadequate seasonal storage for recycled water. Each year, recycled water demands (dominated by irrigation uses) fluctuate considerably due to variations in weather patterns. IRWD's recycled water storage reservoirs allow IRWD to store surplus recycled water produced at IRWD's treatment plants during periods of low demand (generally in winter) and then use the storage during periods of high demand (generally in summer). Without adequate seasonal storage, the

excess recycled water supplies during winter are lost to ocean disposal, and IRWD must then purchase costly supplemental imported water from Metropolitan Water District to meet summer demands. Based on projected future recycled water supply and demand scenarios, staff determined that an additional 4,500 AF of recycled water seasonal storage will be needed by the year 2030. The purpose of this project is to expand the storage capacity of Syphon Reservoir to approximately 5,000 AF to meet the projected seasonal storage needs.

In 2010, IRWD contracted with GEI Consultants to perform feasibility-level studies associated with increasing the capacity of the reservoir. As part of that work, expansion of the reservoir to a maximum water surface elevation of 456 feet was the preferred option for increasing the storage capacity of the reservoir. To achieve the future capacity, GEI recommended removing the existing 59-foot dam and replacing it with a 136-foot-tall earthen embankment dam constructed to current design standards. The studies also identified that conveyance facilities would be needed to integrate an expanded reservoir into the recycled water distribution system including a pumping station, approximately 8,000 linear feet of pipeline, reservoir outlet filtration facility, and disinfection facilities. Construction of the pipelines is complete, and construction of the pump station is nearing completion. The recommended filtration and disinfection facilities will be constructed with the proposed reservoir improvements described below.

At IRWD's Strategic Planning Workshop held in July 2017, staff presented an analysis of the proposed expansion of Syphon Reservoir that quantified the financial aspects of the project relative to reduced purchases of untreated imported water from Metropolitan and reduced sewage diversions to Orange County Sanitation District (OCSD), particularly during wet weather events. The analysis demonstrated that proceeding with the expansion of the Syphon Reservoir aligned with IRWD's Strategic Objectives and that the project was economically beneficial to IRWD. Based on the analysis, the IRWD Board of Directors authorized staff to proceed with the development of environmental documentation and supporting engineering services to continue advancing the project.

Subsequent to the Strategic Planning Workshop, in September 2017 IRWD contracted with Environmental Science Associates to prepare an Environmental Impact Report (EIR) for the overall project, a Mitigated Negative Declaration (MND) for the geotechnical investigations, and jurisdictional agency permitting support services associated with both the geotechnical investigations and the overall project. The MND for the geotechnical investigations is complete, and the EIR for the overall project is anticipated to be complete in August 2021. Jurisdictional agency permitting activities are well underway and are anticipated to be complete in late 2021.

In 2018, IRWD also retained HDR to provide engineering support services as the Owner's Representative to provide resources in program management and technical expertise to support both the management and design oversight of the overall project through the final design phase. HDR's scope of work included a review of the 2010 GEI work to verify and confirm the feasibility-level concepts and to provide additional recommendations for consideration during the detailed design phase. HDR also completed additional studies regarding slope stability of the dam embankment, spillway and outlet works configurations, and potential borrow area layouts, all of which confirmed that the proposed project is feasible. HDR will continue to provide

technical support and assistance to staff during the development, implementation, and management of the project.

In 2019, IRWD contracted with AECOM Technical Services to provide a comprehensive geotechnical investigation of the site. The scope of the project included a comprehensive site characterization program to adequately document and characterize the geologic and geotechnical conditions at the site. The proposed investigation resulted in the collection of a suite of soils data and samples that were used to evaluate the proposed dam foundation, abutments, spillway, and outlet works. The data were also used to determine the appropriate excavation depths and requirements for dam seepage control measures, evaluate the characteristics of potential dam construction materials that could be extracted from borrow areas on the site, and verify the location and historical activity of the previously documented inactive Center Valley Fault that was believed to be located at the site. The geotechnical investigations confirmed that the geologic and geotechnical conditions at the site are suitable and fully support development of the proposed Syphon Reservoir Improvement project. The investigations further confirmed the location of the Center Valley Fault along the western edge of the valley, rather than through the center of the valley as previously inferred, and that the fault is inactive in accordance with California Division of Safety of Dams (DSOD) fault activity criteria.

Over the past decade, IRWD has worked closely with some of the most experienced, technically proficient, and renowned dam and reservoir consulting firms and engineers in the world including AECOM, GEI, and HDR. Through the completion of that work, IRWD and its cadre of expert consultants have confirmed the suitability, feasibility, economic viability, and safety of the proposed Syphon Reservoir Improvement Project.

Updated Project Analysis:

As indicated above, staff previously presented a comprehensive analysis of the proposed expansion of Syphon Reservoir at IRWD's Strategic Planning Workshop held in July 2017. Extensive progress and project development have occurred since then, which has resulted in the confirmation of assumptions and validation of data used in the previous analysis along with the identification of new data and criteria that were incorporated into an updated analysis of the project. Some of the key data and information that have been updated include the following:

- Sewage treatment costs at IRWD's Michelson Water Recycling Plant and at OCSD;
- OCSD capital outlay revolving fund (CORF) and equity costs;
- Orange County Water District (OCWD) Green Acres Project hydraulic criteria and costs;
- Impacts of the project on IRWD's access to potable groundwater;
- Facility replacement planning costs;
- Jurisdictional agency permitting requirements and associated environmental mitigation requirements; and
- Expanded site geotechnical and geological characterization and updated Syphon Reservoir Improvement project costs.

Staff has incorporated the latest data and information into the previously completed analysis and has performed an updated project analysis. Staff will provide a presentation of the updated analysis, provided as Exhibit "A", at the Committee meeting and at an upcoming meeting of the IRWD Board.

Consultant Selection Process:

Staff issued a Request for Proposal for engineering design services to AECOM, Black & Veatch, GEI, and Stantec. Staff received proposals from GEI and AECOM; Black & Veatch; Stantec declined to submit a proposal. Each firm presented unique project approaches and creative engineering solutions for achieving the project objectives, but AECOM's approach to completing the project exceeded those presented by the other firms. AECOM outlined a focused and detailed work plan for completing the design services and presented innovative approaches to enhancing and improving project design concepts. Several of AECOM's recommended design enhancements include the following:

- Confirmation that adequate onsite materials are available to support a more robust zoned earthfill embankment dam with a central core;
- Optimized reservoir grading that increases reservoir capacity, improves water circulation and water quality, and ensures adequate borrow material is available at the site;
- Improved inlet/outlet structure with additional intakes at multiple water levels that maximizes operational flexibility and good water quality; and
- Supplemental limited geotechnical investigation that further analyzes the seepage potential adjacent to the left abutment, the mapped landslide along the southeast ridge of the reservoir, and the site access road proposed at the intersection of Sand Canyon Avenue and Portola Parkway.

AECOM presented a superior depth and knowledge of managing and implementing complex designs for dam and reservoir projects. As part of the proposal, AECOM developed a project management plan that reduces the duration of the design by four months while maintaining all the necessary quality reviews, including independent reviews by the DSOD. AECOM's proposed project management team, which includes Michael Smith as the Project Manager and Bryan Payne as the Deputy Project Manager, have extensive experience working together, and both have managed previous projects for IRWD and other dam and reservoir projects. This management team recently delivered the design and construction of Santa Margarita Water District's Trampas Canyon Reservoir and Dam, which like Syphon Reservoir, is a 5,000 AF recycled water storage reservoir.

After reviewing the proposals, staff met with AECOM to review, discuss, and negotiate the final scope of work and overall design fee. The consultant selection matrix is provided as Exhibit "B", and AECOM's scope of work and fee proposal are provided as Exhibit "C".

Staff recommends the Board authorize the General Manager to execute a Professional Services Agreement with AECOM in the amount of $4,747,749.00 since its design approach, design schedule, and level of effort are consistent with the project goals.

Project Schedule:

The design phase will be completed in accordance with the following schedule milestones:

Notice of Award – Design (anticipated)	January 2021
Preliminary Design Report Complete	October 2021
Final Design Complete and Final Plans Approved	April 2023
Notice of Award – Construction	July 2023

FISCAL IMPACTS:

The Syphon Reservoir Improvement Project, Project 03808, is included in the FY 2020-21 Capital Budget as a flagged project and will be funded through recycled water regional funds. A budget increase is required to fund the engineering design services. Staff is also requesting an Expenditure Authorization (EA) to fund the design and associated design support services including continued public outreach, jurisdictional permitting, and environmental compliance activities as summarized in the table below.

Project No.	Current Budget	Addition <Reduction>	Total Budget	Existing EA	This EA Request	Total EA Request
03808	$75,000,000	$71,000,000	$146,000,000	$6,350,000	$139,650,000	$146,000,000

ENVIRONMENTAL COMPLIANCE:

This project is subject to the California Environmental Quality Act (CEQA). In conformance with the California Code of Regulations Title 14, Chapter 3, Section 15004, IRWD is preparing an EIR for the project.

RECOMMENDATION:

That the Board authorize a budget increase in the amount of $71,000,000, from $75,000,000 to $146,000,000, approve an Expenditure Authorization in the amount of $139,650,000, and authorize the General Manager to execute a Professional Services Agreement in the amount of $4,747,749 with AECOM for engineering design services for the Syphon Reservoir Improvement, Project 03808.

LIST OF EXHIBITS:

Exhibit "A" – Updated Syphon Reservoir Expansion Analysis Presentation
Exhibit "B" – Consultant Selection Matrix
Exhibit "C" – AECOM Scope of Work and Fee Proposal

Note: This page is intentionally left blank.

Engineering and Operations Committee

Updated Syphon Reservoir Expansion Analysis

December 8, 2020

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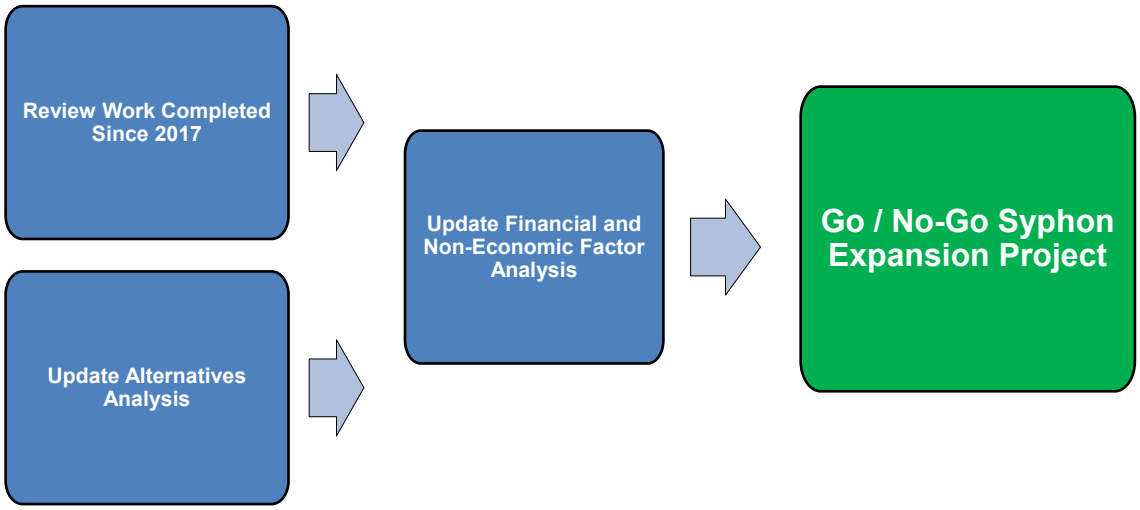
Updated Syphon Reservoir Expansion Analysis

- Financial Viability
- Strategic Alignment
- Future Looking

2

Irvine Ranch WATER DISTRICT

Approach for Today's Workshop



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Work Completed Since 2017

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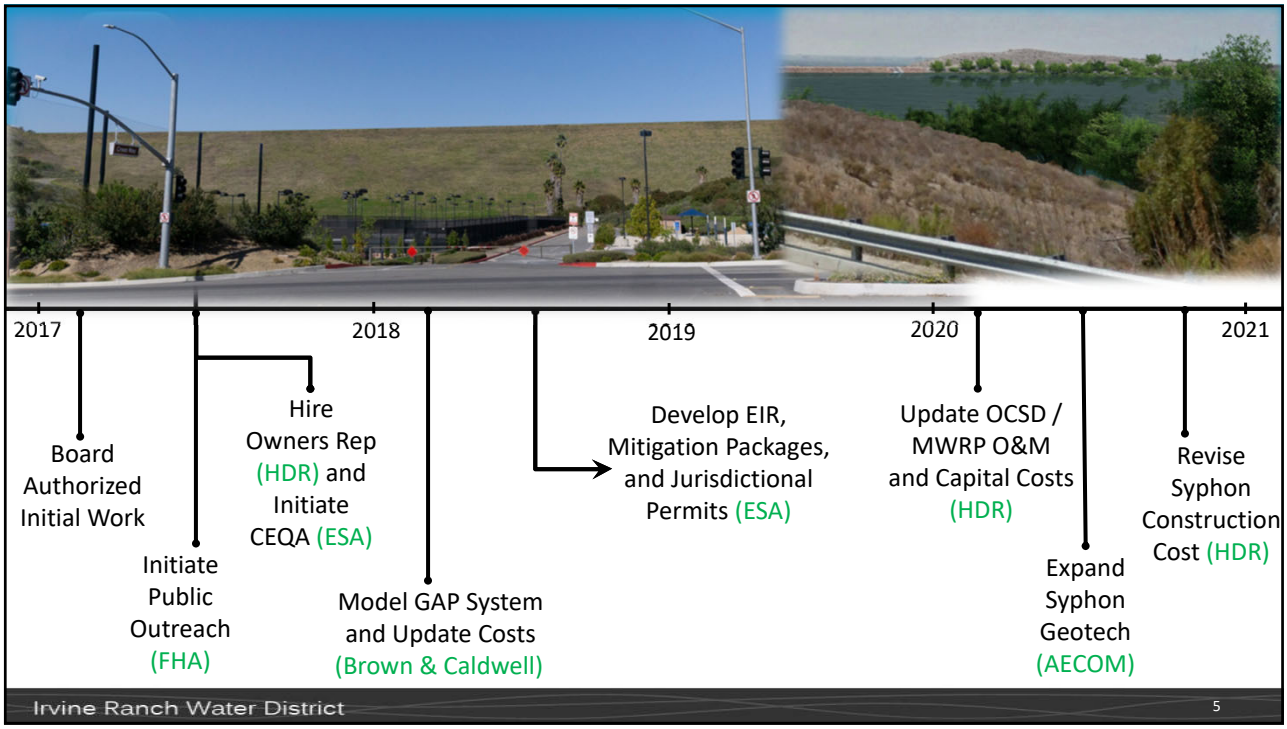
Irvine Ranch WATER DISTRICT



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Updates to Key Evaluation Components: 2017 to 2020

Project Component	2017	2020
OCSD and MWRP O&M Costs	Interdepartmental Analysis	**HDR update**
OCSD Capital Outlay Revolving Fund and Equity Costs	OCSD input in 2017	**Updated w/ OCSD input in 2019**
Jurisdictional Permits / Mitigation Costs	Feasibility Level Study	**Clear direction from agencies and mitigation ratios / packages**
Geotechnical Exploration / Dam Costs	Feasibility Level Study	**Expansive geotech work, Confirmed site suitability, and updated costs**
Green Acres Project (GAP) Expansion Hydraulic Modeling and Costs	Interdepartmental Analysis	**Modeling, OCWD Input, and updated capital cost by Brown & Caldwell**
Replacement Expenditures	Not Included	**Districtwide Replacement Expenditure Update**

Irvine Ranch Water District 6

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Concepts for the Analysis

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Concepts for the Analysis

- IRWD Optimizes Use of Recycled Water
- RW Penalty Continues
- Enhanced Expanded Green Acres Project (GAP) Alternative
- MWRP Flow at 28 mgd
- Updated Sewage and RW Demand Projections
- No Grant Funding for Project

This approach incorporates the latest information reviewed and adopted by the Board of Directors and addresses questions raised in the CEQA process

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Irvine Ranch WATER DISTRICT

Introduction to the Seasonal Storage Alternative

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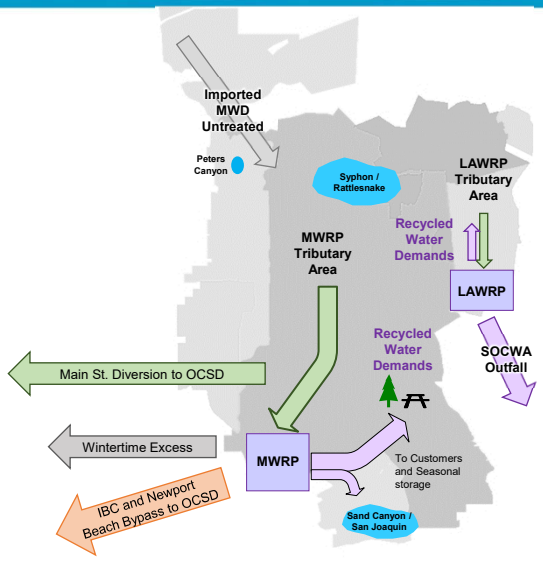
Seasonal Storage Overview

- Balances IRWD sewage flows with annual variations in Recycled Water (RW) demands
- Minimizes excess sewage disposal at OCSD and South Orange County Water Authority (SOCWA) outfall
- Minimizes purchasing Metropolitan Water District untreated water during peak summer season
- IRWD has existing seasonal storage, but needs more to meet the balance



Irvine Ranch Water District 10

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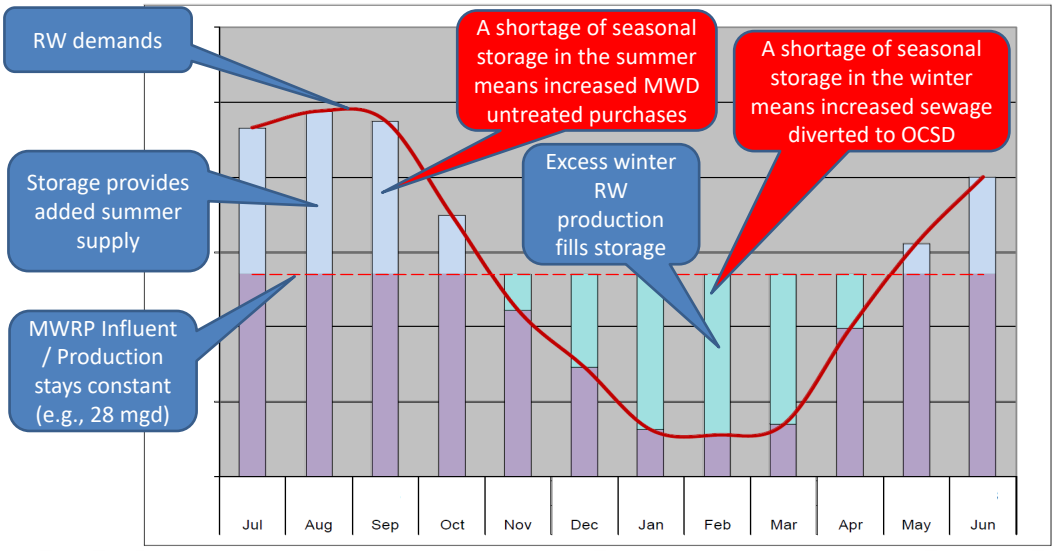
Seasonal Storage Overview



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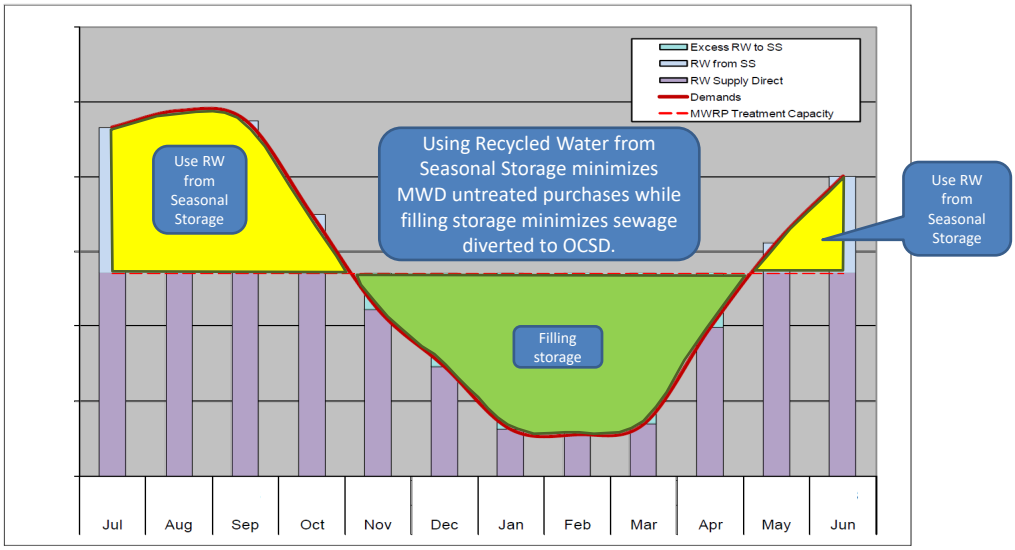
Balancing Recycled Water Demands and Seasonal Storage



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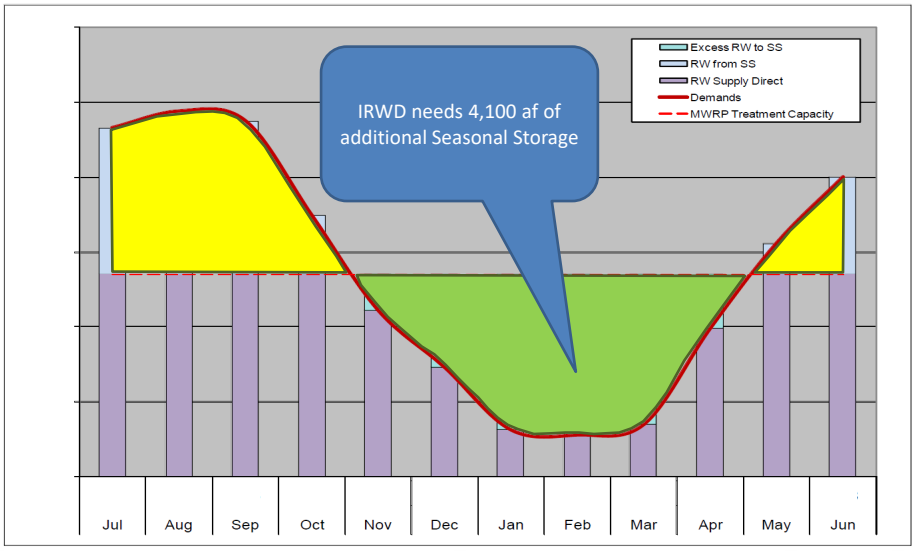
Balancing Recycled Water Demands and Seasonal Storage



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Green Acres Project Expansion Alternative

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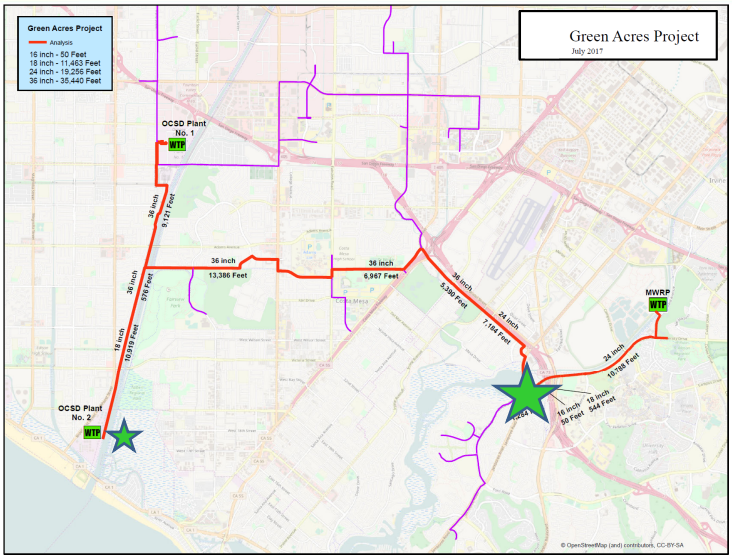
Irvine Ranch WATER DISTRICT

Alternative: OCWD Green Acres Project (GAP) Overview

- Established in 1991 and provides RW to Mile Square Park, Golf Courses, Costa Mesa Country Club, Mt. Olive Memorial Park, and others
- Consists of 7.5 mgd Tertiary Treatment Plant and 37 total miles of RW pipelines
- Connections to IRWD and Orange County Sanitation District's (OCSD) Plant #2



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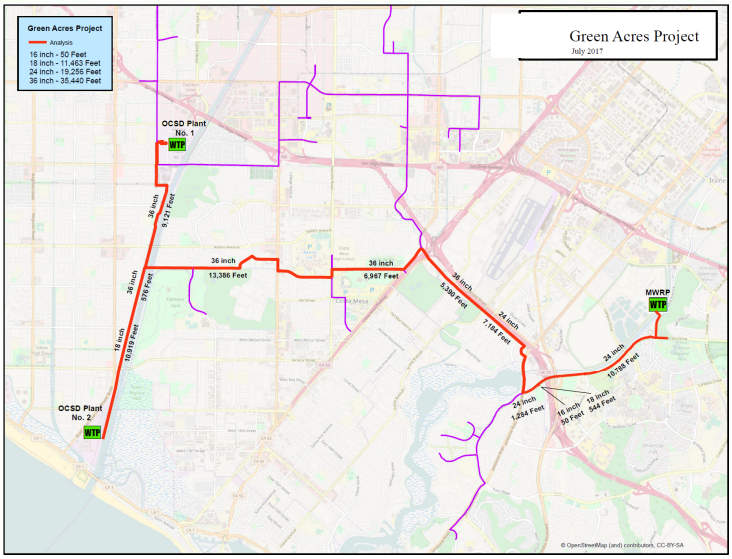
Alternative: Expanded GAP Conveyance System Overview

- Expand GAP Conveyance System to send excess IRWD RW to GAP Customers and Groundwater Replenishment System
- Extensive IRWD / Orange County Water District (OCWD) coordination
- Expanded GAP Conveyance upsized to 28 mgd
- Conducted hydraulic modeling of GAP system
- Upsize 10.5 miles of pipeline to 42-inch (of 37 total miles)



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Irvine Ranch WATER DISTRICT

Financial Analysis

Syphon Reservoir Expansion
GAP Conveyance System Expansion

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Updated Financial Analysis

Layered Building Blocks for Financial Analysis

- OCSD O&M/ Capital and MWRP O&M — HDR
- Syphon and GAP Capital — HDR/AECOM/ESA; Brown & Caldwell
- Impact to Cost of Water — HDR
- GAP Expansion Revenue

All costs escalated and discounted for Net Present Value analysis

Irvine Ranch Water District 18

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Irvine Ranch WATER DISTRICT

Updated Financial Analysis

- **OCSD O&M/ Capital and MWRP O&M** — HDR
- **Syphon and GAP Capital** — HDR/AECOM/ESA; Brown & Caldwell
- **Impact to Cost of Water** — HDR
- **GAP Expansion Revenue**

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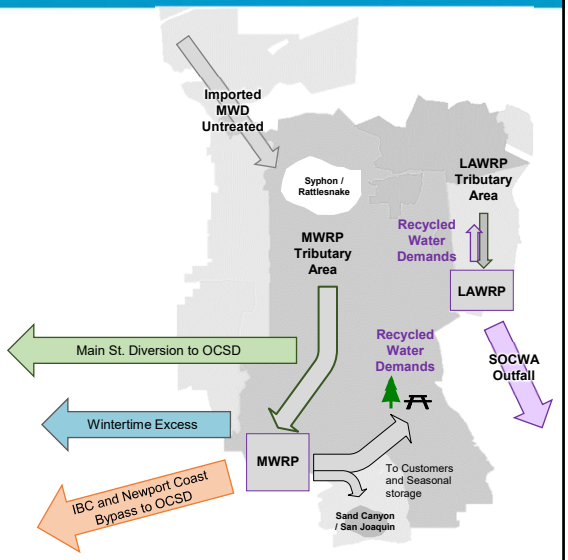
Sewage Treatment Costs - Excess Sewage Diversions

- Main Street Diversion to OCSD is primarily used when sewage influent exceeds MWRP treatment capacity
- Wintertime excess diversion occurs when seasonal storage is full and MWRP tertiary flow exceed demands
- SOCWA Outfall is used when LAWRP tertiary flow is not needed
- MWRP Biosolids Facilities require at least 10 mgd to maintain operations



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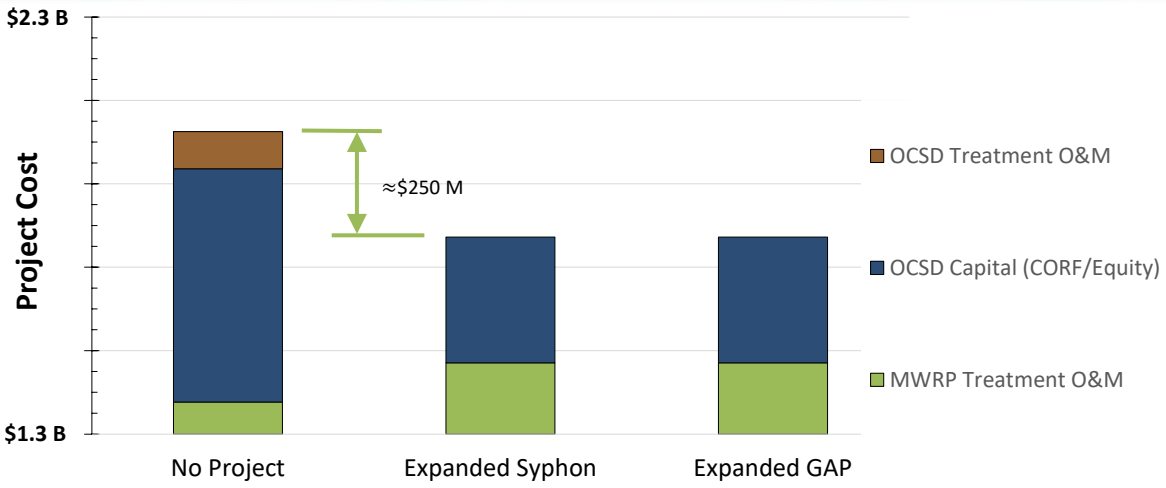
Irvine Ranch WATER DISTRICT

OCSD / MWRP Sewage Treatment Costs (50-Year Period)



EA1

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Updated Financial Analysis

- OCSD O&M/ Capital and MWRP O&M — HDR
- **Syphon and GAP Capital** — HDR/AECOM/ESA; Brown & Caldwell
- Impact to Cost of Water — HDR
- GAP Expansion Revenue

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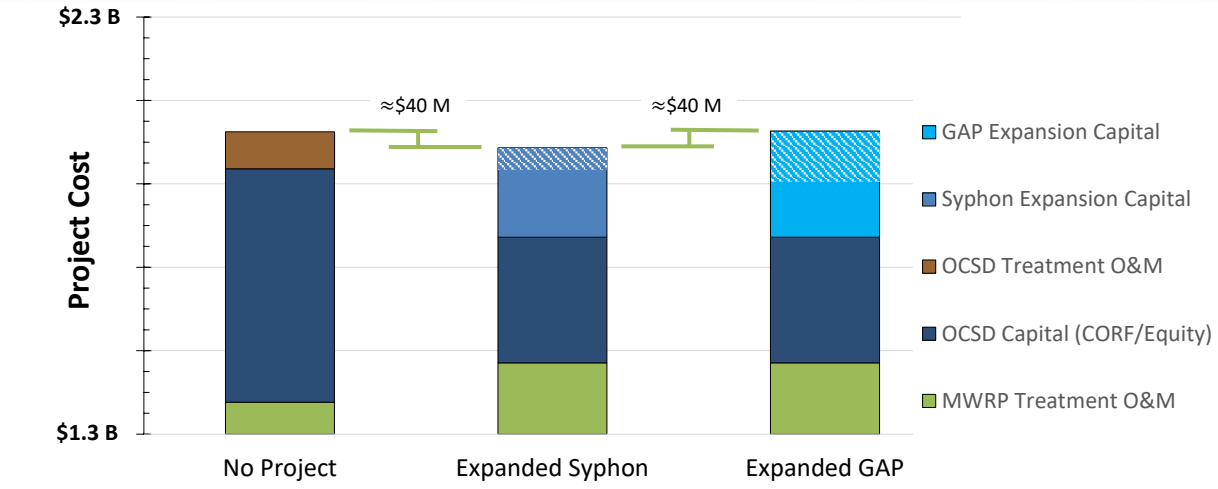
Irvine Ranch WATER DISTRICT

Syphon Expansion and Expanded GAP Capital Costs

- Updated Syphon Expansion capital costs are ≈$146 M
  - AECOM geotechnical findings confirmed site suitability and soil criteria
  - ESA engaged with regulatory agencies
  - HDR updated 2017 quantities and costs
- Updated GAP Expansion capital costs are ≈$110 M
  - Met with OCWD staff to confirm operational criteria
  - Brown and Caldwell conducted hydraulic modeling analysis
  - Confirmed pipe routing and sizing to deliver 28 mgd through GAP system

Updated Syphon and GAP Capital (50-Year Period)



Cross-hatched areas indicate replacement costs

Updated Financial Analysis

- OCSD O&M/ Capital and MWRP O&M — HDR
- Syphon and GAP Capital — HDR/AECOM/ESA, Brown & Caldwell
- **Impact to Cost of Water — HDR**
- GAP Expansion Revenue

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Impact of Seasonal Storage on Imported Water Purchases

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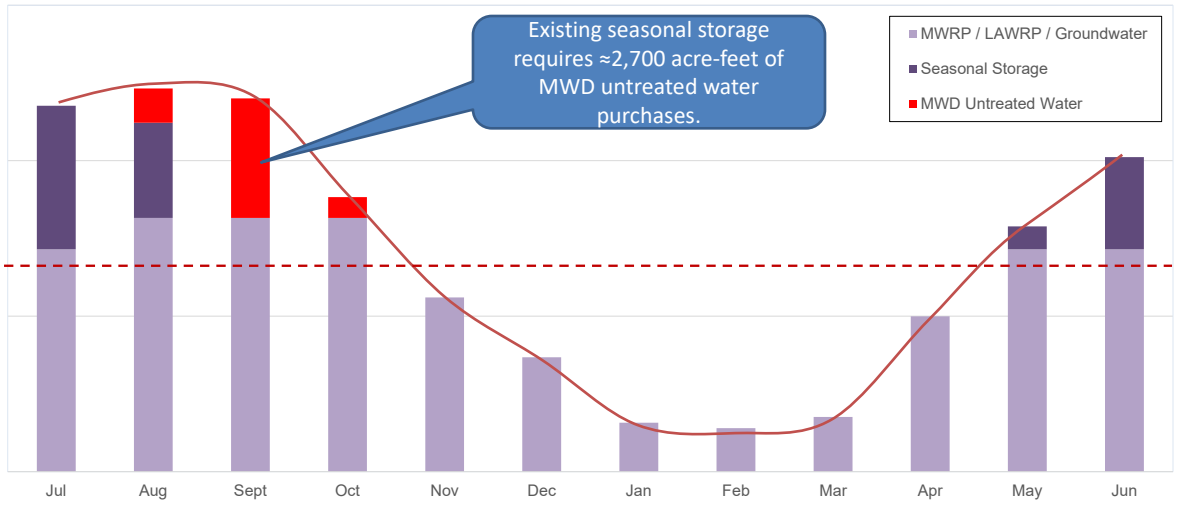
Irvine Ranch WATER DISTRICT

Seasonal Storage – Reduction in MWD Imported Needs



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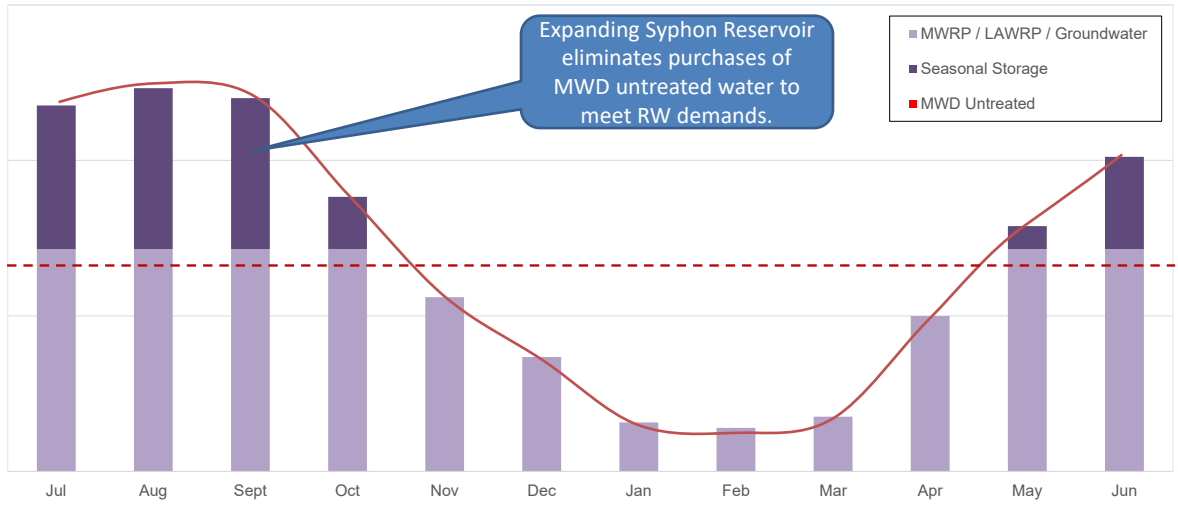
Seasonal Storage – Reduction in MWD Imported Needs



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Impact of Seasonal Storage on Groundwater Pumping

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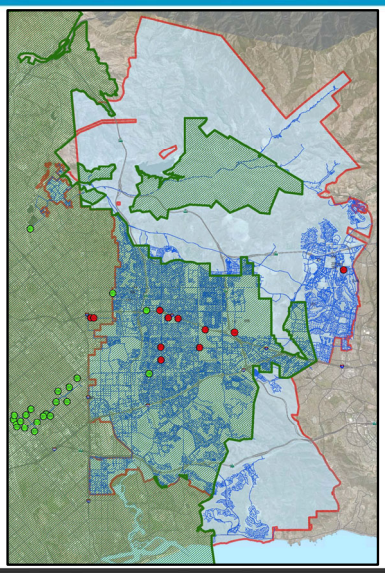
Groundwater Production Concepts

- **Orange County Water District (OCWD):** OCWD helps manage Orange County's groundwater basin in a sustainable and reliable manner
  - Groundwater Replenishment System
  - Infiltration basins
  - Local governance for groundwater producers
- **Basin Production Percentage (BPP)**: The percent of total water usage an agency can pump from the groundwater basin without incurring extra fees.
- **Basin Equity Assessment (BEA):** OCWD's added fee that equalizes the cost of pumping groundwater (pumped in excess of the BPP) with the cost of importing treated MWD water



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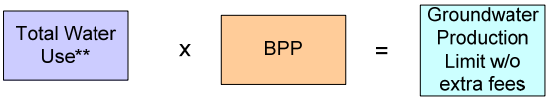
Irvine Ranch WATER DISTRICT

Basin Production Percentage (BPP) Calculation

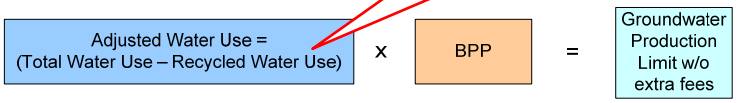
BPP = the percent of total water usage an agency can pump from the groundwater basin without incurring the Basin Equity Assessment (BEA)

BPP Basic Calculation



This is the "Recycled Water Penalty"

If Agency produces Recycled Water



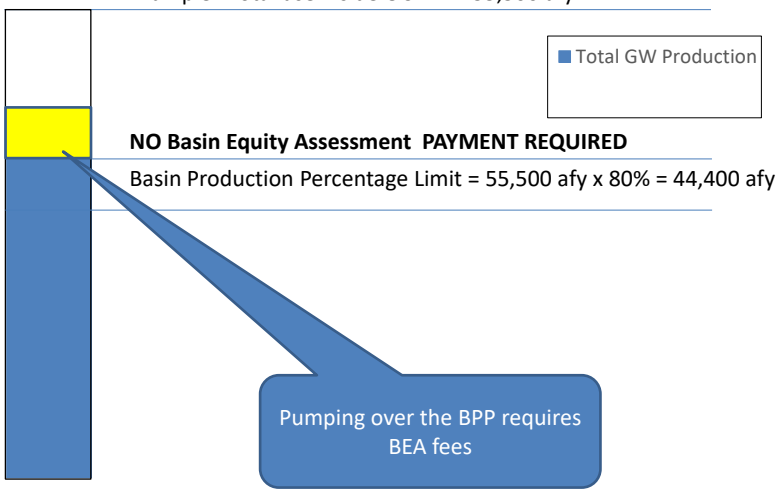
** Total Water Use within the OCWD annexed area (aka boundary). Note that the OCWD Watershed is a larger area.

Basin Equity Assessment Calculation

- Conceptually, the Basin Equity Assessment (BEA) is meant to bring the cost of Groundwater (GW) up to the cost of imported treated MWD water.
  - **In accordance with the OCWD Act the BEA is meant to equalize the cost of water for all the GW producers**
- The BEA for FY 2019-20 was ≈ $540 per af

Basin Production Percentage and Basin Equity Assessment

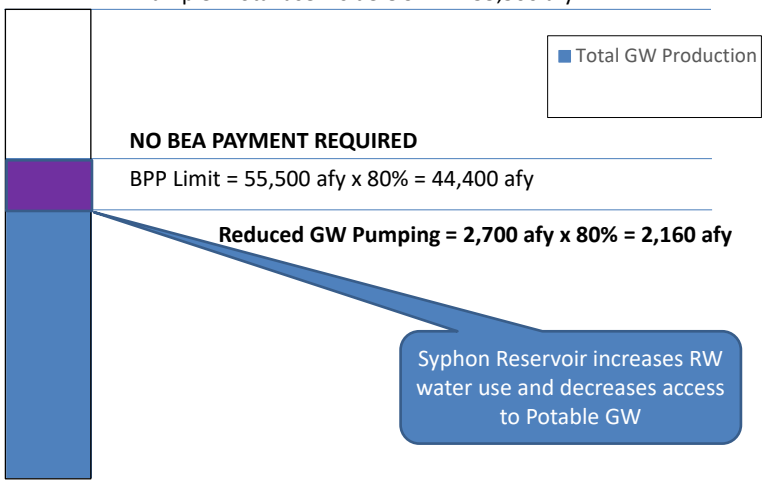
Example: Total use inside OCWD = 55,500 afy



33

Seasonal Storage – Reduced Access to Potable Groundwater

Example: Total use inside OCWD = 55,500 afy

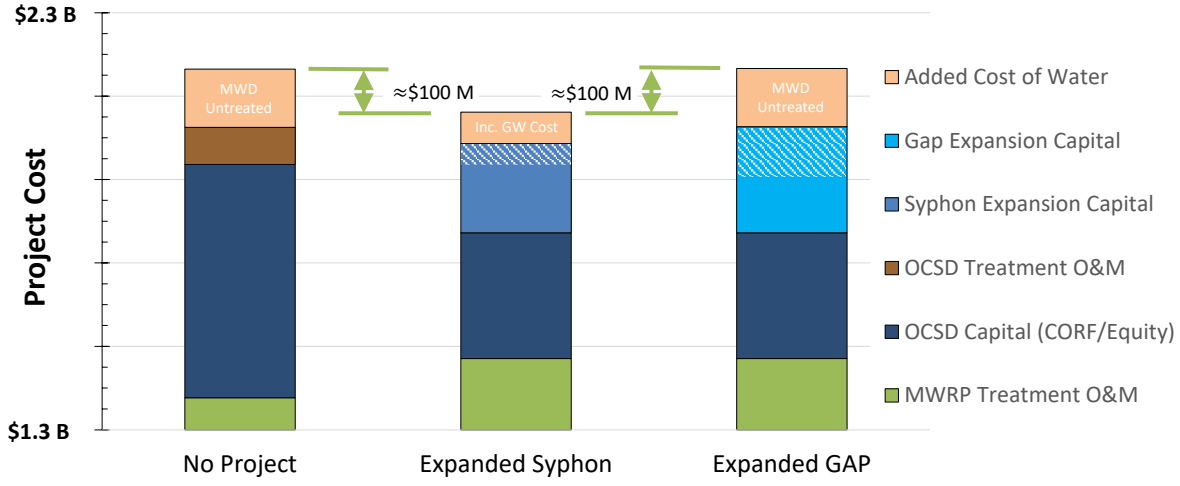


34

Financial Analysis:
Increased Costs of Imported Water and Groundwater Production

35

Added Cost of Water (50-Year Period)



Irvine Ranch Water District 36

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Updated Financial Analysis

- OCSD O&M/ Capital and MWRP O&M — HDR
- Syphon and GAP Capital — HDR/AECOM/ESA; Brown & Caldwell
- Impact to Cost of Water — HDR
- GAP Expansion Revenue

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OCWD GAP Expansion Revenue Feasibility

a) OCWD and OCSD are mutually obligated to accept and supply secondary effluent for GWRS

b) GWRS has more than adequate supply sources from OCSD and multiple contingency plans

c) Water Quality of OCSD effluent is perfectly suitable for GWRS and GAP

d) Reliance on IRWD is not acceptable to OCWD Board

e) OCSD has a policy to recycle all reclaimable sewage flows

f) State of California committed to expanding RW and minimizing ocean discharges

Conclusion: OCWD will not pay IRWD for its recycled water

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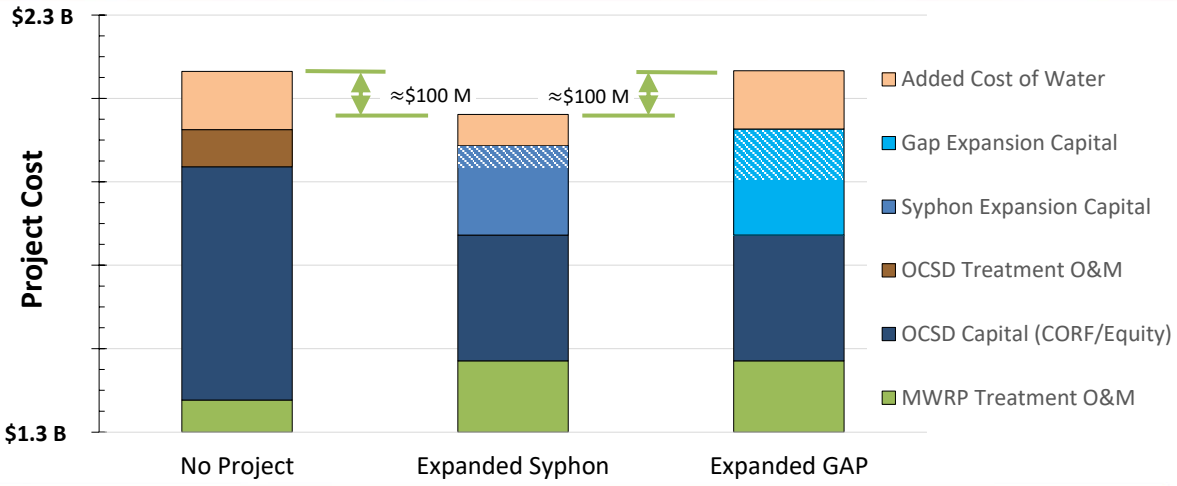
Irvine Ranch WATER DISTRICT

Financial Analysis Summary



Expanding Syphon Reservoir Saves IRWD ≈$100M

IRWD Goals and Target Activities
Unquantified Benefits

IRWD Goals and Target Activities

2. Evaluate and invest in projects and programs that will enhance future long-term water supply reliability

6. Develop water recycling facilities and applications for optimal benefit

10. Ensure financial and rate stability

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IRWD Goals and Target Activities

2. Evaluate and invest in projects and programs that will enhance future long-term water supply reliability

Project Objectives:

Improves local water supply reliability by reducing the need to purchase imported water from MWD by storing and using additional recycled water when needed during high demand periods

	Syphon Expansion	GAP Expansion
	☑	☐

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Irvine Ranch WATER DISTRICT

IRWD Goals and Target Activities

6. Develop water recycling facilities and applications for optimal benefit

Project Objectives:	**Syphon Expansion**	**GAP Expansion**
Maximizes the use of recycled water produced by IRWD for the benefit of IRWD customers	☑	☐
Reduces recycled water discharges to the ocean	☑	☐

IRWD Goals and Target Activities

10. Ensure financial and rate stability

Project Objectives:	**Syphon Expansion**	**GAP Expansion**
Reduces diversions of sewage to OCSD	☑	☑
Reduces MWD untreated water purchases	☑	☐
Increases Access to Potable Groundwater	☐	☑

Unquantified Benefits

Project Advantages:	**Syphon Expansion**	**GAP Expansion**
Provides Source water for IRWD potable reuse	☑	☐
Provides excess wintertime RW option (Minimizes discharges to SD Creek)	☑	☐
Provides regional opportunities	☑	☑

Syphon Reservoir Expansion

- Financial Viability ✓
- Strategic Alignment ✓
- Future Looking ✓

Consultant Selection for Engineering Design Services

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Consultant Selection – Engineering Design Services

- Request for Proposals distributed August 25,2020
  - AECOM
  - Black & Veatch
  - GEI
  - Stantec
- Proposals received October 1, 2020 from AECOM and GEI
- Both teams presented outstanding proposals

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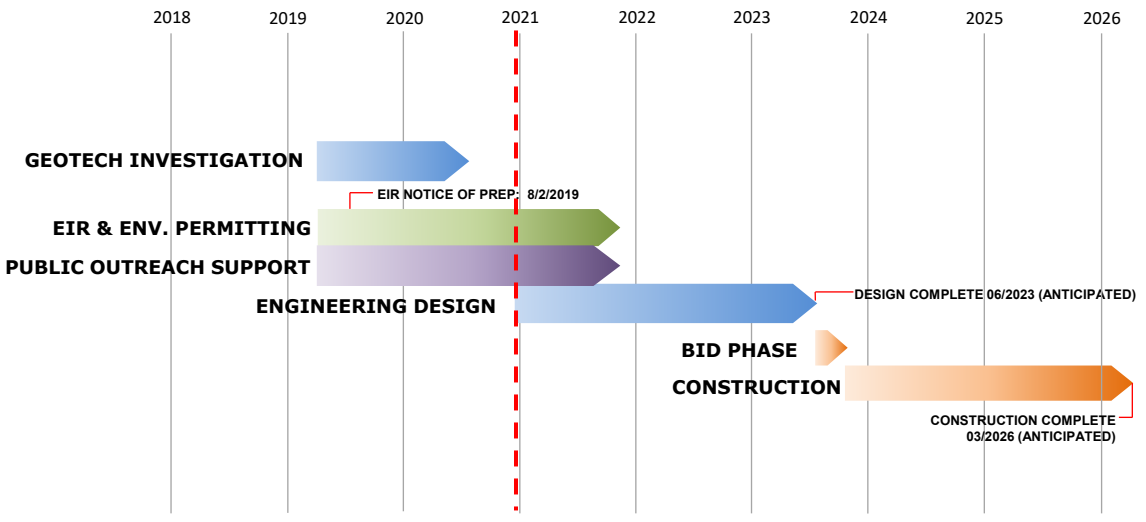
Irvine Ranch WATER DISTRICT

Consultant Selection – Engineering Design Services

- AECOM proposal highlights
  - Proven expertise in designing modern and safe dams
  - Impressive understanding of the project and its requirements
  - Substantial experience with DSOD and Risk Informed Decision Making
  - Same team that successfully completed SMWD's Trampas Reservoir

Project Schedule



Recommendation

- Authorize a budget increase in the amount of $71,000,000, from $75,000,000 to $146,000,000
- Authorize an Expenditure Authorization in the amount of $139,650,000
- Authorize the GM to execute a Professional Services Agreement with AECOM in the amount of $4,747,749

EXHIBIT "B"

CONSULTANT SELECTION MATRIX

Syphon Reservoir Improvement Project - Engineering Design Services						
Item	Description	Weights	AECOM		GEI Consultants	
A	TECHNICAL APPROACH					
1	Project Understanding	30%	1		2	
2	Project Approach	40%	1		2	
3	Project Team	30%	1		2	
	Weighted Score		1.0		2.0	
	Ranking of Consultants		**1**		**2**	
B	SCOPE OF WORK					
TASK			Task Hours	FEE	Task Hours	FEE
1	Project Management		2,839	$616,640	2,229	$407,070
2	Data Review, Survey, Geotechnical Services		605	$167,760	772	$162,915
3	Preliminary Design (30 Percent)		5,850	$1,152,686	10,397	$1,943,033
4	Final Design (60 Percent)		5,580	$811,900	7,896	$1,296,556
5	Final Design (90 Percent)		3,235	$458,250	6,792	$1,134,970
6	Final Design (100 Percent)		1,296	$182,820	2,192	$413,507
7	Miscellaneous Tasks		4,134	$833,222	2,580	$602,187
8	Bid Phase Services		208	$38,870	202	$38,588
	Subtotal - Base Scope		23,747	$4,262,148	33,060	$5,998,826
	OPTIONAL TASKS					
2.5	Supplemental Geotechnical Investigation		672	$236,916	None Proposed	
3.4	CFD Modeling to Optimize Water Quality		308	$49,960		
4.5	Noise Model Baseline		32	$5,005		
4.6	Detailed Construction Noise Study		80	$9,960		
6.3a	Initial Reservoir Fill Plan		122	$20,700		
6.3b	Maintenance and Operations Plan		170	$26,100		
7.9	Riparian Habitat Mitigation Design		1,154	$136,960		
	Subtotal - Optional Tasks		2,538	$485,601	0	$0
	Total Hours and Fee		**26,285**	**$4,747,749**	**33,060**	**$5,998,826**
C	OTHER					
	Number of Drawings		327		383	
	Engineering Design Services Fee per Drawing*		$7,599		$9,001	
	Subconsultants					
	Filtration and Chemical Systems Design		In-house		Carollo	
	Survey/Utility Search		Fuscoe/T2 Utility Engineers		Psomas	
	Geotechnical Services		In-house and GMU		None Proposed	
	Intersection Design		In-house		Psomas	
	Water Quality / CFD Modeling		In-house		Water Quality Solutions	
	Construction Cost/Schedule Estimates		In-house		Engineering Solutions	
	Risk-Informed Decision Making		In-house		In-house and Halpin Consulting	
	Seismology and Faulting		Dr. Tom Rockwell		In-house	
	Project Controls		In-house		Management Solutions LLC	
	Exceptions taken to IRWD Standard Contract		NO		NO	
	DIR Numbers Provided		YES		YES	
	Insurance (Professional & General Liability)		Meets Requirements		Meets Requirements	

*Calculated using the total of Tasks 4, 5, 6, and 7 (including optional tasks)

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SECTION 1

SCOPE

1

SECTION 1

SCOPE

Our approach is centered on establishing a comprehensive scope of work that reflects all the efforts needed to complete the Project.

1.1 Project Understanding

Irvine Ranch Water District (IRWD) is planning to construct a recycled water reservoir to provide seasonal and operational storage for its existing recycled water system. The potential supply of recycled water from the Michelson and Los Alisos Water Recycling Plants exceeds demand during the cool, rainy season, but demand exceeds supply in the hot, dry season. Currently, excess supply is stored in IRWD's San Joaquin, Rattlesnake, Sand Canyon and Syphon Reservoirs during the rainy season and is drawn upon in the dry season. With continued new construction in its service area (City of Irvine and parts of five adjacent cities), IRWD has projected a need for an additional 4,500 acre-feet (AF) of recycled water storage capacity by 2030. To meet this need, IRWD proposes to replace its existing Syphon Canyon earthfill dam and reservoir—which has a nominal storage capacity of 535 AF—with a new earthfill dam creating a reservoir with a potential storage capacity of approximately 5,000 AF.

IRWD purchased Syphon Canyon Dam from The Irvine Company in 2010. In 2013, IRWD constructed facilities to integrate the reservoir into IRWD's recycled water system as a relatively small seasonal storage facility. In 2012 GEI performed a feasibility study to assess the potential of constructing a larger reservoir on the Syphon property. GEI concluded that the property could support a reservoir of almost 5,000 AF by means of a new 136-foot tall earthfill dam at approximately the same location as the existing dam (the downstream toe of the new and old dams would be nearly identical). GEI also concluded that the alluvium at the dam site is potentially liquefiable in a design earthquake, so the alluvium and existing dam would have to be removed within the footprint of a new dam. GEI's site exploration and laboratory testing were relatively modest and constrained by environmental considerations. In 2019-2020 AECOM performed significant additional exploration and laboratory testing under a program developed by IRWD and HDR. The AECOM program resulted in the production of a Geotechnical Data Report (GDR), a Preliminary Geotechnical Interpretive Report (GIR), a report on the fault believed to pass under dam in the alluvium in the center of the valley, a seismic parameters report with deterministic and probabilistic design information, and an analytic laboratory test report for samples of the reservoir sediments. The final pre-construction stage in the program to increase storage at the Syphon property—preliminary and final design and bid-phase services—is the subject of this proposal.

AECOM has reviewed the various reports and technical memoranda furnished by IRWD. In considering the Feasibility Design (GEI, 2012) in conjunction with the other documents, we have developed a number of ideas for improved design. The more significant of these ideas are illustrated on the site map, **Exhibit 1-1** and discussed below.

1 The first design improvement is implementing additional safety elements into the dam design and what will likely be our initial model for 30% design evaluations. This is further discussed under Task 3.2.2, Embankment Dam Design TM (Technical Memorandum).

2 The second design improvement includes optimization of reservoir grading. The grading serves a number of purposes—provision of borrow material to build the dam, increasing the reservoir capacity, improvement of water circulation and water quality, and the initial dead pool that acts as a repository for reservoir sediment. The grading is also subject to several constraints—sufficient quantities of suitable materials must be provided, the desired


Steep Borrow Area Cut Slopes at Trampas Canyon Reservoir

reservoir capacity must be achieved, environmental impacts must be minimized, permanent cut slopes must be stable, and impacts on the adjacent toll road property must be nil or found to be acceptable. Some of the constraints may be in conflict. The second design improvement is further discussed under Task 3.2.4, Borrow Development and Handling TM.

3 The third design improvement addresses optimization of the number and location of intake valves at the Inlet/Outlet structure. It seems clear to AECOM that the Feasibility Design, with only three intakes at elevations 340, 380 and 420 feet, is inadequate to provide good water quality and operational flexibility. This is further discussed under Task 3.2.5, Inlet/Outlet Works Design TM).

4 The fourth design element includes identifying the best option for the main construction entrance for deliveries of materials (e.g., concrete, riprap) and heavy equipment. This design element is further discussed under Task 3.2.6, Construction Access, Contractor Staging, and Temporary Utilities TM, and Task 7.4, Construction Documents for the Portola/Sand Canyon Intersection.

5 The fifth design element addresses the water treatment facility. The facility should be designed for automation and minimal operator intervention and attention. Furthermore, the facility should be designed to allow for additional future processes (e.g. DAF and mechanical mixers) should the water quality deteriorate and stratification is difficult to manage. Planning includes physical space and electrical. This is further discussed under Task 3.2.8 Chlorination and Dechlorination Storage and Feed Design TM and 3.2.9 Reservoir Algae Filtration TM.

6 The sixth design element includes designing the spillway, which is adjacent to the dam embankment for safety. A hydrology and hydraulic analysis will be completed to properly design the spillway to provide adequate freeboard within the reservoir and spillway channel. The spillway itself will be founded on rock and discharge energy will be dissipated prior to release downstream. This is further discussed under Task 3.2.3, Spillway Design TM.

7 The seventh design element includes evaluating the need for a seepage barrier on the southeast ridge near the spillway crest. AECOM is recommending that this be further investigated as discussed under Task 2.5, Supplemental Geotechnical Investigations (Optional Task). Reduction of seepage could be accomplished by curtain grouting, construction of a cutoff wall, or by expanding the embankment fill of the proposed new dam to completely fill in the area adjacent to the thin rim.

8 The eighth design element includes the faults that pass through the dam foundation and cross the Inlet/Outlet pipe. Although the conclusion by AECOM that these faults are inactive has been accepted by DSOD, it may be necessary to communicate the facts about faulting in the dam foundation to the public. If needed, AECOM geologist (Chris Goetz) and Seismic Specialist (Dr. Tom Rockwell), who collaborated to perform the Local Fault Investigations will support IRWD with Public Outreach meetings to allay any concerns that surface fault rupture may present a safety hazard to the dam and appurtenant facilities. Also, an analysis of the potential for triggered slip on these faults will be part of the Inlet/Outlet Works design. This is further discussed under Task 3.2.5, Inlet/Outlet Works Design TM.

9 The ninth design element is reservoir water quality. Due to the increased depth of the reservoir there will be the potential for increased thermal stratification. Selection and placement of the in-reservoir water quality management system will be important to maximize mixing and minimize adverse water quality effects (algae blooms and eutrophication). This is further discussed under Task 3.2.10, Reservoir Water Quality Management System.

10 The tenth design consideration is the cost of environmental mitigation. AECOM's intent is to cut borrow slopes steeper to reduce the environmental impact by not encroaching on environmentally sensitive areas above the high-water elevation. The extent of borrow on the reservoir slopes will be largely controlled by the maximum slope inclination that is expected to be stable. By cutting slopes steeper there will be less acreage that will be impacted by site grading. Steep borrow area cut slopes were successfully constructed for the Trampas Canyon Reservoir Project. This is further discussed under Task 3.2.4, Borrow Development and Handling TM.

Exhibit 1-1. Understanding of Key Project Elements will Provide Solutions to Benefit IRWD

1 Dam Safety: Ensure a robust, economical, and safe design

SOLUTION Our team brings extensive knowledge of this site and local experts with a proven track record of successfully completing other large dam design and construction projects in Southern California and with IRWD. *See Task 3.2.2 and Exhibit 1-7.*

☑ BENEFITS TO IRWD

- Allows confidence in delivering this project on time and within budget
- Demonstrated ability to obtain required DSOD approvals
- Provides a safe facility that the community can trust

2 Grading: Balance earthwork to optimize dam and reservoir construction

SOLUTION Our team has prepared zoned embankment details and material handling concepts specifically for this project and identified multiple opportunities for innovation. *See Task 3.2.4 and Exhibit 1-9.*

☑ BENEFITS TO IRWD

- Design schedule can be accelerated
- Reduces construction cost with smaller dam and reservoir footprint
- Minimizes environmental impacts

3 Inlet/Outlet Works: Appropriate number, location, and type of intake valves

SOLUTION Our team has developed a modified intake layout concept to better serve the specific functionality requirements of this project. *See Task 3.2.5 and Exhibit 1-10.*

☑ BENEFITS TO IRWD

- Enhances operational flexibility
- Improves water circulation and quality
- Increases system reliability

4 Construction Access: Early intersection improvements to facilitate reservoir construction

SOLUTION Using our in-house local experts, we prepared intersection improvement design concepts specifically for this project. *See Task 3.2.6, Task 7.4 and Exhibits 1-11 and 1-12.*

☑ BENEFITS TO IRWD

- Improves pedestrian safety
- Streamlines public traffic flow with access for construction traffic
- Early construction works can be accelerated

5 Water Treatment Facility: Implement effective treatment facilities

SOLUTION Our team brings in-house technical expertise with the latest water treatment technologies and is prepared to implement the method basis of design. *See Tasks 3.2.8 and 3.2.9.*

☑ BENEFITS TO IRWD

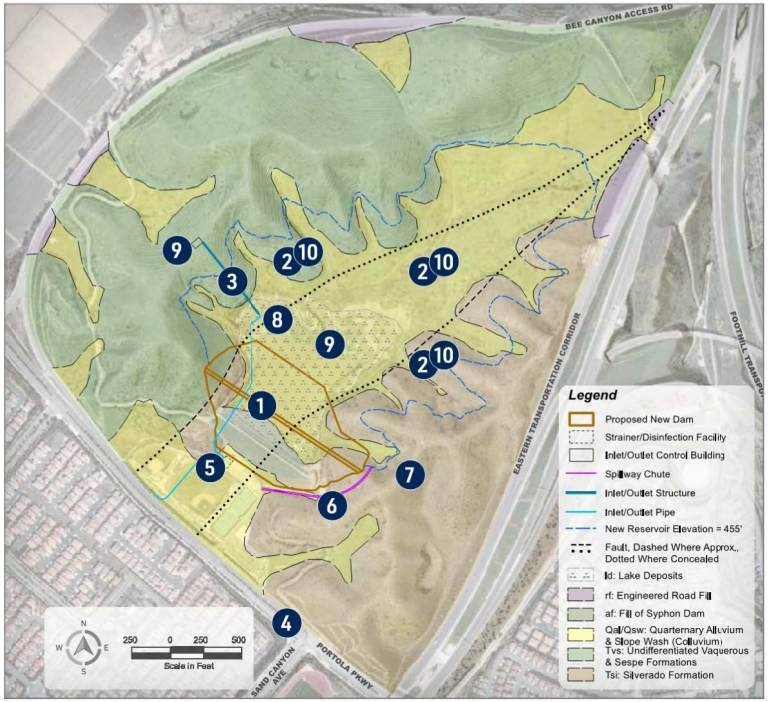
- Provide an automated facility for more economical operation and maintenance
- Allow for future process expansion

6 Spillway Safety: Application of most current design methods

SOLUTION Our team will apply knowledge gained from other recent spillway projects and has prepared a conceptual layout of the planned facilities specifically for this project. *See Task 3.2.3 and Exhibit 1-8.*

☑ BENEFITS TO IRWD

- Design schedule can be accelerated
- CFD modeling to confirm safe design that is permittable by DSOD
- Implementation of latest DSOD spillway Design Details learned from Oroville.



7 Rim Seepage: Evaluation near the spillway crest

SOLUTION Our team is proposing supplemental investigation to further evaluate seepage potential in the southeast portion of the site – *see Exhibits 1-4 and 1-5.*

☑ BENEFITS TO IRWD

- Focused and proactive attention on key geotechnical/geologic items
- Early identification of mitigation measures
- Eliminates potential schedule delays

8 Faulting: DSOD concurrence of low rupture hazard

SOLUTION The findings of our fault rupture hazard investigation indicate low hazard and have been accepted by DSOD.

☑ BENEFITS TO IRWD

- Eliminates cost of additional evaluation
- Avoids schedule delays from further investigation
- Provides synergy should additional public outreach be required

9 Water Quality: Maintain water quality in deeper reservoir and deliver high water quality to recycled water users with a facility that is easy to maintain and operate

SOLUTION Selection of appropriate in-reservoir water quality management system technology and strategy. Design that favors simplicity and automation for minimal operator intervention and attention.

☑ BENEFITS TO IRWD

- Maintain quality of water in the reservoir - control algae bloom
- Provide adequate disinfection
- Minimize operator intervention

10 Environmental Mitigation: Minimize environmental impacts

SOLUTION Our team's conceptual design reduces the dam and reservoir footprint by utilizing steeper embankment and reservoir slopes.

☑ BENEFITS TO IRWD

- Excavations for borrow material avoid environmentally sensitive areas
- Reduces environmental mitigation costs

Task 1 - Project Management

Task 1.1 –Project Management

AECOM will conduct effective project management that adheres to the scope, schedule, and budget; provide efficient and frequent communication with IRWD and other project stakeholders; and implement AECOM's Quality Management System in order to provide effective quality assurance/quality control (QA/QC).

AECOM has more than 30 years of experience helping clients prepare for, respond to, and recover from complex challenges of all kinds. In light of the COVID-19 pandemic and its impact on longer-term, post pandemic processes and protocols, we are committed to maintaining team safety, continuity and collaboration without losing sight of project quality, cost, and schedule. Mike Smith and our team can draw on multiple technology platforms to support IRWD's unique needs. For each project, our approach is driven by our clients' preferences and project requirements. We will employ a range of technology and tools to promote open, virtual communication and share project information and files with the IRWD.

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, 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
- Quality Management System (QMS) protocol
- Risk management issues
- Safety, Health, and Environment (SH&E) procedures and training needs
- Subconsultants roles and budgets

Using AECOM's proprietary software, the PM can quickly view dashboard reports designed to show current fiscal and schedule status at-a-glance.

Our processes are set to monitor budget and schedule frequently. AECOM's powerful management tools improves our Project Manager's efficiency. Senior Managers meet with project managers monthly to identify any trends that can be adjusted early to stay on schedule and within budget.

Our Project Manager, Mike Smith, 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.

Mike Smith and Joe Ehasz at Trampas Dam Foundation

VALUE ADDED

The Right Project Manager with Proven Project Delivery. We understand that it is Imperative to manage the design team to meet the schedule and each deliverable deadline.

Our subconsultants were selected for their delivery track record with AECOM and experience on similar projects. Our delivery team has a strong working relationship with each proposed subconsultant. Mike will manage and direct our subconsultants to make sure all participants know their assigned roles and responsibilities as we work toward a set of scheduled deliverables. AECOM will conduct regular team meetings using the latest communication technologies, such as Teams teleconferencing, to keep all informed and to coordinate all activities.

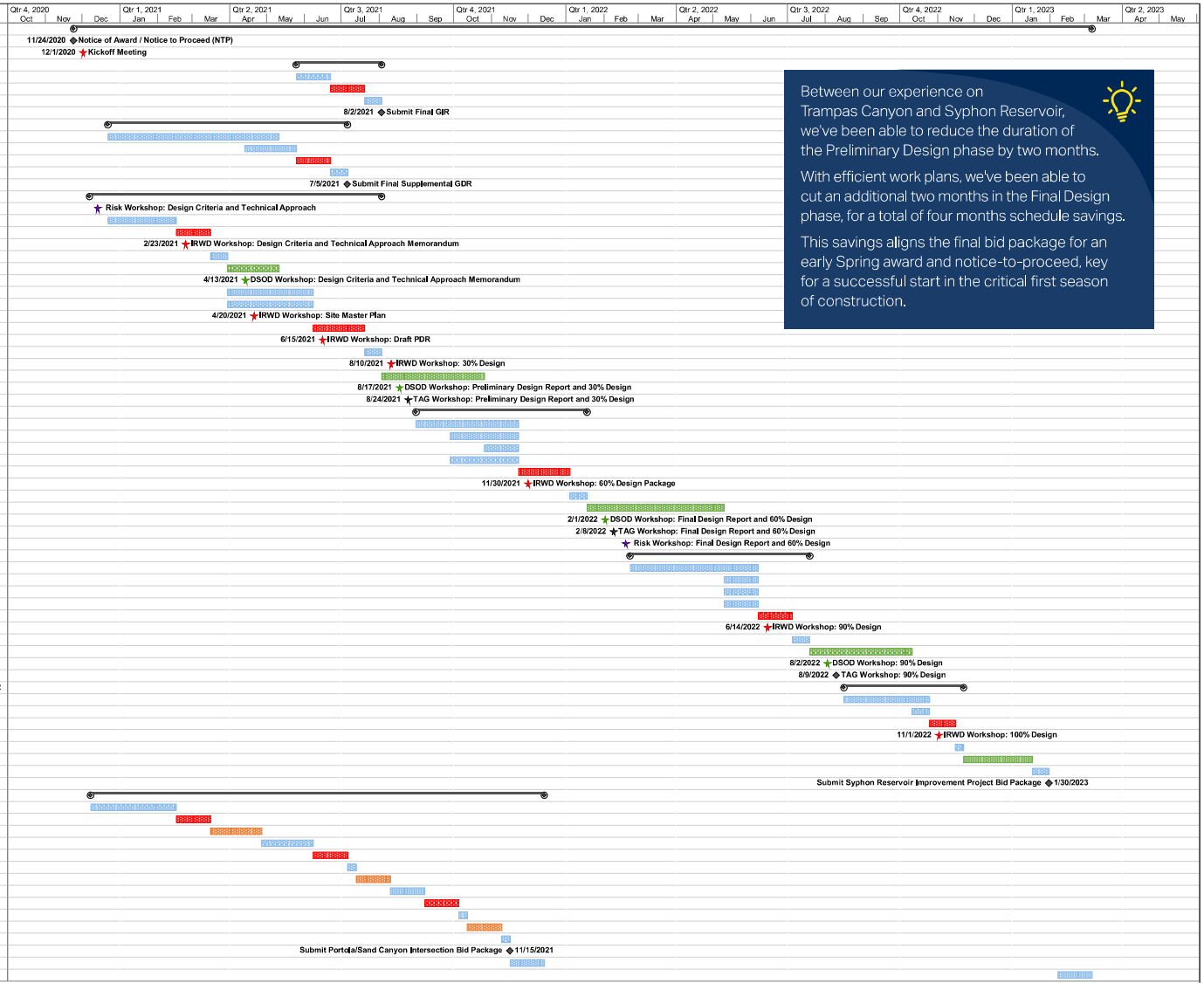
Task 1.2 – Project Schedule

AECOM will develop and maintain a Microsoft Project schedule that establishes the sequential logic and durations of all tasks and milestones. Our Project Manager Mike Smith will monitor compliance with the schedule, update it monthly as necessary, and distribute it at monthly progress meetings and with monthly reports. The schedule will include all primary work elements defined in the scope of work, key milestones defined herein, deliverables, and IRWD and DSOD review periods. If any issues arise that may cause delays, Mike will develop proactive actions to maintain and recover (if necessary) the schedule. Schedule updates will be shared regularly during coordination meetings with the entire Design team, including key subconsultants.

We have developed a detailed schedule for design from Award through Bid Phase Services. Note that the design schedule meets or exceeds all the milestones provided in the RFP and is presented in **Exhibit 1-2**. AECOM is proposing to reduce the duration of the design by four months while maintaining all the necessary quality reviews, including reviews by IRWD and DSOD. These schedule savings will have the project constructed

Exhibit 1-2. Schedule

ID	Task Name	Duration	Start	Finish
1	**Syphon Reservoir Improvement Project (SRIP) Engineering Services**	**595 days**	**Tue 11/24/20**	**Mon 3/6/23**
2	**Notice of Award / Notice to Proceed (NTP)**	**0 days**	**Tue 11/24/20**	**Tue 11/24/20**
3	**Kickoff Meeting**	**0 days**	**Tue 12/1/20**	**Tue 12/1/20**
4	**Task 2.4 - Final Geotechnical Interpretive Report (GIR)**	**50 days**	**Tue 5/25/21**	**Mon 8/2/21**
5	Prepare Draft Final GIR	20 days	Tue 5/25/21	Mon 6/21/21
6	IRWD Review of Draft Final GIR	20 days	Tue 6/22/21	Mon 7/19/21
7	Revise Final GIR	10 days	Tue 7/20/21	Mon 8/2/21
8	Submit Final GIR	0 days	Mon 8/2/21	Mon 8/2/21
9	**Task 2.5 - Supplemental Geotechnical Investigations**	**140 days**	**Tue 12/22/20**	**Mon 7/5/21**
10	Geotechnical Investigation (GIWP, Field Work, Laboratory Testing)	100 days	Tue 12/22/20	Mon 5/10/21
11	Supplemental Geotechnical Data Report (GDR)	30 days	Tue 4/13/21	Mon 5/24/21
12	IRWD Review of Draft Supplemental GDR	20 days	Tue 5/25/21	Mon 6/21/21
13	Revise Supplemental GDR	10 days	Tue 6/22/21	Mon 7/5/21
14	Submit Final Supplemental GDR	0 days	Mon 7/5/21	Mon 7/5/21
15	**Task 3 - Preliminary Design (30 Percent)**	**171 days**	**Mon 12/7/20**	**Mon 8/2/21**
16	Risk Workshop: Design Criteria and Technical Approach	5 days	Mon 12/7/20	Mon 12/14/20
17	3.1 Design Criteria and Technical Approach Memorandum	40 days	Tue 12/22/20	Mon 2/15/21
18	IRWD Review of Draft Design Criteria and Technical Approach Memorandum	20 days	Tue 2/16/21	Mon 3/15/21
19	IRWD Workshop: Design Criteria and Technical Approach Memorandum	0 days	Tue 2/23/21	Tue 2/23/21
20	Revise Design Criteria and Technical Approach Memorandum	10 days	Tue 3/16/21	Mon 3/29/21
21	DSOD Review of Final Design Criteria and Technical Approach Memorandum	30 days	Tue 3/30/21	Mon 5/10/21
22	DSOD Workshop: Design Criteria and Technical Approach Memorandum	0 days	Tue 4/13/21	Tue 4/13/21
23	3.2 Preliminary Design Report (PDR)	50 days	Tue 3/30/21	Mon 6/7/21
24	3.3 30% Design Package	50 days	Tue 3/30/21	Mon 6/7/21
25	IRWD Workshop: Site Master Plan	0 days	Tue 4/20/21	Tue 4/20/21
26	IRWD Review of Draft PDR and 30% Design Package	30 days	Tue 6/8/21	Mon 7/19/21
27	IRWD Workshop: Draft PDR	0 days	Tue 6/15/21	Tue 6/15/21
28	Revise PDR and 30% Design Package	10 days	Tue 7/20/21	Mon 8/2/21
29	IRWD Workshop: 30% Design	0 days	Tue 8/10/21	Tue 8/10/21
30	DSOD Review of Revised Draft PDR and 30% Design Package	60 days	Tue 8/3/21	Mon 10/25/21
31	DSOD Workshop: Preliminary Design Report and 30% Design	0 days	Tue 8/17/21	Tue 8/17/21
32	TAG Workshop: Preliminary Design Report and 30% Design	0 days	Tue 8/24/21	Tue 8/24/21
33	**Task 4 - Final Design (60 Percent)**	**100 days**	**Tue 8/31/21**	**Mon 1/17/22**
34	4.1 Final Design Report (FDR)	60 days	Tue 8/31/21	Mon 11/22/21
35	4.2 60% Design Package	40 days	Tue 9/28/21	Mon 11/22/21
36	4.3 Construction Schedule and Sequencing Plan TM (Draft)	20 days	Tue 10/26/21	Mon 11/22/21
37	4.4 Noise Model and Evaluation TM (Draft)	40 days	Tue 9/28/21	Mon 11/22/21
38	IRWD Review of Draft FDR and 60% Design Package	30 days	Tue 11/23/21	Mon 1/3/22
39	IRWD Workshop: 60% Design Package	0 days	Tue 11/30/21	Tue 11/30/21
40	Revise FDR and 60% Design Package	10 days	Tue 1/4/22	Mon 1/17/22
41	DSOD Review of FDR and 60% Design Package	80 days	Tue 1/18/22	Mon 5/9/22
42	DSOD Workshop: Final Design Report and 60% Design	0 days	Tue 2/1/22	Tue 2/1/22
43	TAG Workshop: Final Design Report and 60% Design	0 days	Tue 2/8/22	Tue 2/8/22
44	Risk Workshop: Final Design Report and 60% Design	5 days	Mon 2/14/22	Fri 2/18/22
45	**Task 5 - Final Design (90 Percent)**	**105 days**	**Tue 2/22/22**	**Mon 7/18/22**
46	5.1 90% Design Package	75 days	Tue 2/22/22	Mon 6/6/22
47	5.2 Construction Schedule and Sequencing Plan TM (Final)	20 days	Tue 5/10/22	Mon 6/6/22
48	5.3 Noise Model and Evaluation TM (Final)	20 days	Tue 5/10/22	Mon 6/6/22
49	5.4 Geotechnical Baseline Report (GBR) (Draft)	20 days	Tue 5/10/22	Mon 6/6/22
50	IRWD Review of 90% Design Package	20 days	Tue 6/7/22	Mon 7/4/22
51	IRWD Workshop: 90% Design	0 days	Tue 6/14/22	Tue 6/14/22
52	Revise 90% Design Package	10 days	Tue 7/5/22	Mon 7/18/22
53	DSOD Review of 90% Design Package	60 days	Tue 7/19/22	Mon 10/10/22
54	DSOD Workshop: 90% Design	0 days	Tue 8/2/22	Tue 8/2/22
55	TAG Workshop: 90% Design	0 days	Tue 8/9/22	Tue 8/9/22
56	**Task 6 - Final Design (100 Percent)**	**70 days**	**Tue 8/16/22**	**Mon 11/21/22**
57	6.1 100% Design Package	50 days	Tue 8/16/22	Mon 10/24/22
58	6.2 Geotechnical Baseline Report (GBR) (Final)	10 days	Tue 10/11/22	Mon 10/24/22
59	IRWD Review of 100% Design Package	15 days	Tue 10/25/22	Mon 11/14/22
60	IRWD Workshop: 100% Design	0 days	Tue 11/1/22	Tue 11/1/22
61	Revise 100% Design Package	5 days	Tue 11/15/22	Mon 11/21/22
62	DSOD Review of 100% Design Package	40 days	Tue 11/22/22	Mon 1/16/23
63	Revise 100% Design Package (if needed)	10 days	Tue 1/17/23	Mon 1/30/23
64	Submit Syphon Reservoir Improvement Project Bid Package	0 days	Mon 1/30/23	Mon 1/30/23
65	**Task 7.4 - Construction Documents for Portola/Sand Canyon Intersection**	**265 days**	**Tue 12/8/20**	**Mon 12/13/21**
66	60% Design Package	50 days	Tue 12/8/20	Mon 2/15/21
67	IRWD Review of 60% Design Package	20 days	Tue 2/16/21	Mon 3/15/21
68	City Review of 60% Design Package	30 days	Tue 3/16/21	Mon 4/26/21
69	90% Design Package	30 days	Tue 4/27/21	Mon 6/7/21
70	IRWD Review of 90% Design Package	20 days	Tue 6/8/21	Mon 7/5/21
71	Revise 90% Design Package	5 days	Tue 7/6/21	Mon 7/12/21
72	City Review of 90% Design Package	20 days	Tue 7/13/21	Mon 8/9/21
73	100% Design Package	20 days	Tue 8/10/21	Mon 9/6/21
74	IRWD Review of 100% Design Package	20 days	Tue 9/7/21	Mon 10/4/21
75	Revise 100% Design Package	5 days	Tue 10/5/21	Mon 10/11/21
76	City Review of 100% Design Package	20 days	Tue 10/12/21	Mon 11/8/21
77	Revise 100% Design Package (if needed)	5 days	Tue 11/9/21	Mon 11/15/21
78	Submit Portola/Sand Canyon Intersection Bid Package	0 days	Mon 11/15/21	Mon 11/15/21
79	Bidding Support Services	20 days	Tue 11/16/21	Mon 12/13/21
80	**Task 8 - Bid Phase Services**	**20 days**	**Tue 2/7/23**	**Mon 3/6/23**



Between our experience on Trampas Canyon and Syphon Reservoir, we've been able to reduce the duration of the Preliminary Design phase by two months.

With efficient work plans, we've been able to cut an additional two months in the Final Design phase, for a total of four months schedule savings.

This savings aligns the final bid package for an early Spring award and notice-to-proceed, key for a successful start in the critical first season of construction.

Syphon Reservoir Improvement Project
AECOM Proposal

Task | Summary | DSOD Review | IRWD Meeting/Workshop | TAG Workshop
Milestone | IRWD Review | City Review | DSOD Workshop | Risk Workshop

Page 1

earlier, delivering value to IRWD, its customers, and the reservoir's neighbors. We can accelerate the design based on our thorough understanding of scope requirements and geotechnical conditions, and a streamlined delivery model. A key factor is providing additional time for the 60 percent design, which will be the most production-heavy task and the subject of the most critical DSOD review. The design schedule is organized to match the scope, making tracking of deliverables simple and IRWD review and approval of schedule updates straightforward, as well as color-coded for review periods by IRWD (in red) and DSOD (in green). The design schedule includes adequate review periods for IRWD and DSOD, based on years of experience and includes time for revisions and resubmittals.

VALUE ADDED

AECOM is proposing to reduce the duration of the design by four months while maintaining all the necessary quality reviews, including reviews by IRWD and DSOD. These schedule savings will have the project constructed earlier, delivering value to IRWD, its customers, and the reservoir's neighbors.

AECOM will prepare weekly and monthly project status reports for IRWD's management team. The weekly status reports will consist of a brief (one to two paragraphs) email summarizing work activities completed the previous week, along with activities planned for the upcoming week and critical decisions that need to be made to stay on schedule. Monthly status reports will provide more detail and summarize work for the previous and upcoming month. The monthly reports will include an updated project schedule (Microsoft Project Gantt Chart), a summary of budget expenditures to date per task, and budget remaining. The monthly reports will also indicate percent complete for all tasks, allowing IRWD to manage earned value throughout the design phase.

In addition to the status reports, AECOM's Project Manager Mike Smith will maintain strong lines of communication with IRWD via email and telephone.

Task 1.3 – Meetings and Workshops

AECOM will schedule and lead meetings with IRWD, jurisdictional agencies and project stakeholders to ensure that all design, operational and maintenance issues are being addressed. AECOM will provide agendas of upcoming project coordination meetings five working days in advance of the meetings and prepare meeting minutes with 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.

Meetings will be attended in person at IRWD's HQ or at the project site, as appropriate. We understand that may not always be possible given the restrictions of the pandemic, but every effort will be made to meet in person. If in person meetings are not possible we have become well versed in web based meetings such as Webex and Teams.

For the purposes of budgeting, the following meetings with IRWD are anticipated for the project:

Meeting/Workshop	Description
Kick-off Meeting with IRWD	1 two-hour meeting
Monthly design development meetings with IRWD	28 two-hour meetings
Bi-monthly project management meetings with IRWD	14 one-hour meetings
Site visits	8 two-hour meetings
Coordination with jurisdictional agencies and project stakeholders including, but not limited to, City of Irvine, Southern California Edison, and Orange County Fire Authority	8 two-hour meetings
Present Dam Appurtenant Structures Design Criteria and Technical Approach Memorandum to IRWD	1 two-hour meeting
Site Master Plan Workshop with IRWD	1 two-hour meeting
Present Draft PDR to IRWD	1 four-hour meeting
Present 30% design package to IRWD, discuss IRWD's comments, and discuss how the outstanding items were addressed	1 four-hour meeting
Present 60% design package to IRWD, discuss IRWD's comments, and discuss how the outstanding items were addressed	1 four-hour meeting
Present 90% design package to IRWD, discuss IRWD's comments, and discuss how the outstanding items were addressed	1 four-hour meeting
Present 100% design package to IRWD, discuss IRWD's comments, and discuss how the outstanding items were addressed	1 four-hour meeting

Task 1.4 – Quality Assurance and Quality Control

At AECOM, all deliverables go through a prescribed review process prior to submittal to our clients. AECOM has developed a Quality Management System (QMS) that is International Organization for Standardization (ISO) 9001:2008-certified. Unique to the engineering consulting industry, our ISO 9001-certified QMS directly interacts with our project managers for timely reviews. This system also provides guidance and uniformity for document and electronic file control and ensures that all deliverables undergo a thorough quality review by prequalified experts.

Initiating Quality: Quality begins with our understanding of your project goals and objectives, emphasizing communication with IRWD and a thorough review of project inputs. Our initial planning and scheduling will include defining project work tasks and quality reviews.

Producing Quality: AECOM will prepare a Project Work Plan that includes a QA/QC Plan and will define processes and procedures to guide the project team. The plan will be discussed at the project team kickoff meeting and updated as needed to include:

- Proper application of codes, standards and design criteria
- Oversight and supervision for accuracy and completeness
- In-progress quality reviews
- Coordination among disciplines
- Resolving and closing in-progress review comments

Confirming Quality: While it is important to build quality into the work as it is performed, formal checking and review are critical QMS activities. Quality checking activities will include:

- Calculations to verify correctness and completeness of mathematics, methodology, selection of software, application of standards and codes, and general approach
- Drawings within each discipline to confirm design layout, dimensions and details, and potential interferences
- Specifications within each discipline for consistency with drawings and design intent, and coordination across disciplines for conformity
- Cost estimates for reasonableness based on bids of projects with similar scope
- Studies and reports for content, logic, clarity, and recommendations for soundness and reasonableness, as well as grammar, punctuation, and format

Delivering Quality: All deliverables will undergo a final verification check before they are submitted. An independent reviewer evaluates the deliverable for completeness and consistency, adherence to quality requirements, and resolution of comments. The reviewer will then sign a Deliverable Release Record and transmits it to our project manager, who is then responsible for the final overlook, approval, and submittal. The final verification must include verifying that the electronic and paper versions are the same and that PDF files are searchable (not scans without OCR) and have intact bookmarks. Verification must occur after all changes are made and before transmittal.

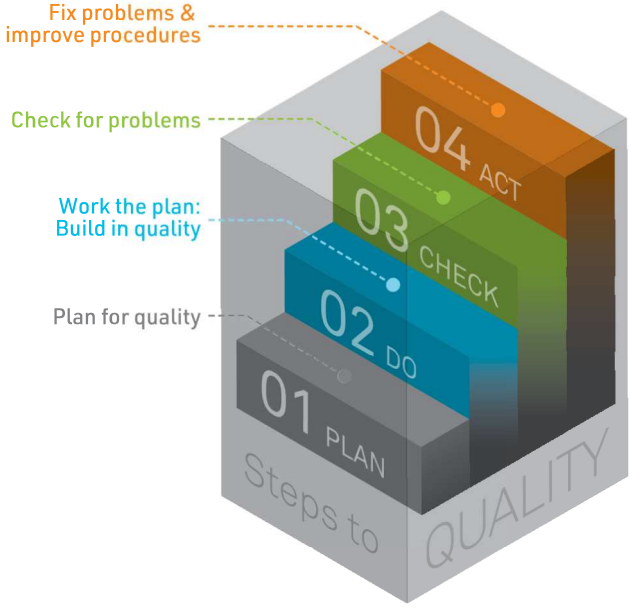
Quality driven results
AECOM is ISO 9001 certified

Improving Quality: A key component of our quality program and ISO 9001 is continuous improvement. We learn from our experiences and apply those lessons to future work through a formal, iterative process.

For this project, Bryan Paine, PE, will lead an independent quality control team. Mr. Paine is one of AECOM's most experienced design engineers and understands the AECOM quality process and IRWD's requirements. His role is to clearly communicate requirements and documentation of reviews conforming to our ISO-certified QC program.

Deliverables

AECOM will submit the project schedule monthly. Electronic copies of the draft meeting minutes in Microsoft Word and Adobe Systems Incorporated® Portable Document Format™ (PDF) will be submitted for review. Upon resolution and incorporation of review comments, we will submit one electronic PDF file of the final meeting minutes. For the QA/QC Plan, we will submit five printed copies and one PDF file of the draft plan for review. Upon resolution and incorporation of review comments, we will submit three printed copies and one PDF file of the final QA/QC plan.



Task 2 - Data Review, Surveying Services, and Geotechnical Services

Task 2.1 – Technical Review of Background Information

The initial task of the project design will be a review of previous project documentation. There have been a substantial number of studies related to various aspects of the Syphon Reservoir Improvement Project (SRIP), including:

- Preliminary feasibility and geotechnical studies for the SRIP by GEI,
- Technical memorandums for the SRIP by HDR,
- Topographic/bathymetric surveys and unmanned aerial vehicle survey by GEI/Stantec and Fuscoe,
- Environmental studies for the SRIP by Dudek and ESA, and
- Geotechnical and seismic studies by AECOM.

Additionally, there are other investigations, reports and construction plans for projects at the site that have been completed such as the Syphon Reservoir Interim Facilities Project (URS 2012, Preliminary Design Report) and the Syphon Reservoir Pipelines Improvement Project (Hunsaker & Associates 2012 Construction Plans). AECOM will review these existing reports and use that information to advance the development of the design. Because many of these reports were either written by, or previously reviewed by AECOM for inclusion in the Geotechnical Data Report, the technical review of previous studies task will be quickly and economically accomplished. As part of the data review, AECOM will visit DSOD's office to review their project files for the Syphon Canyon Dam.

Task 2.2 – Surveying Services and Topographic Mapping

AECOM will subcontract with Fuscoe Engineering (Fuscoe) to provide topographic surveying for the project. A new aerial survey will be conducted to obtain topography and aerial imagery of the reservoir site. The limits of the aerial survey are provided in **Exhibit 1-3**. A ground survey will also be conducted to identify spot elevations of key surficial features. Fuscoe will establish ground control for the aerial and ground surveys. 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. The survey scope will include the following:

- Establish survey ground control for aerial mapping using NAD83 coordinates and NAVD88 county benchmark elevations.
- Provide contour mapping at 40 scale, one-foot contour intervals, in all areas of proposed work.

Exhibit 1-3. Limits of Survey Map

VALUE ADDED

AECOM discussed with Fuscoe Engineering, Inc. the possibility of reusing previous topography. We both concluded the best approach for successful project implementation is to provide a new high-quality survey for the design phase, which is AECOM's recommendation.

- Field locate and add obscured surface features for all areas of proposed work.

Deliverables

Topographic Mapping (survey data with control and utility information, base map drawing, aerial imagery)

Task 2.3 – Utility Research

AECOM will research and identify the location of existing underground and aboveground utilities and/or other physical features within and adjacent to the project site. T2 Utility Engineers (T2) will serve as our subconsultant to provide the utility engineering services. T2, who are a recognized expert in the industry of utility infrastructure, is currently teamed with AECOM to provide utility engineering services at USACE's Whittier Narrows Dam. Their engineers, geophysicists, surveyors, and field technicians will produce accurate, reliable drawings of the underground infrastructure. T2's report will identify horizontal and vertical locations, and will include information regarding type, pressure zone, material, and size. For cost estimating we have budgeted to pothole 10 existing utilities within IRWD's property to a maximum depth of 20 feet and to survey the pothole locations of all anticipated tie-in locations of existing services for northing/easting and depth.

Deliverables:

Utility Maps and Reports

Task 2.4 – Final Geotechnical Interpretive Report

Earlier this year AECOM completed a Preliminary Geotechnical Interpretive Report (GIR) for the project that summarizes initial interpretations from the geotechnical exploration and testing program that are not captured in AECOM's Geotechnical Data Report. The Preliminary GIR provided a discussion of the geologic materials encountered, geologic hazards, surface and subsurface geologic conditions including groundwater, and preliminary geotechnical interpretations of the data. The Preliminary GIR included a project geologic map/site exploration plan and 12 geologic cross sections that depicted interpretations of the subsurface stratigraphy, groundwater levels, the locations of faults, and the thickness of alluvium (depth to bedrock). The Preliminary GIR also included AECOM's interpretations of anticipated stripping depths, bedrock and alluvium hydraulic conductivities, corrosion potential and the index and engineering properties of potential borrow materials.

Building on that effort, AECOM will produce a Final GIR that will present final interpretations of site geologic conditions. The Final GIR will include updated geologic interpretations based on Supplemental Geotechnical Investigations (if done) and will refine the geotechnical interpretations as the project advances towards final design. The final geotechnical interpretations will focus on factors that affect seepage in the dam foundation and localized relatively thin rim areas, stability of permanent slopes in the reservoir, and thickness and characteristics of potential alluvial borrow.

AECOM will be responsible for those interpretations as Engineer of Record for the Project.

Deliverables

- ☑ Final Geotechnical Interpretive Report (Draft)
- ☑ Final Geotechnical Interpretive Report (Final)

Optional Task - 2.5

Supplemental Geotechnical Investigations

Preliminary (GEI) and Comprehensive (AECOM) geotechnical investigations have been completed to support the project design. The data from these have been summarized in the 2020 Geotechnical Data Report (GDR) prepared by AECOM. AECOM recommends that three supplemental investigations be done to further support the design.

The locations of these investigations are shown on Exhibit 1-4.

Recommended Supplemental Investigations

These supplemental investigations should be done to investigate the following areas of the project:

1. The thin rim on the left side of the reservoir adjacent to the proposed new dam that may be prone to seepage.
2. The landslide that was mapped by the California Geological Survey along the southeast ridge of the reservoir adjacent to the toll road (SR-133).
3. The area of the construction/permanent access road into the site from the intersection of Portola Parkway and Sand Canyon Avenue where cut slopes and retaining walls will likely be constructed.

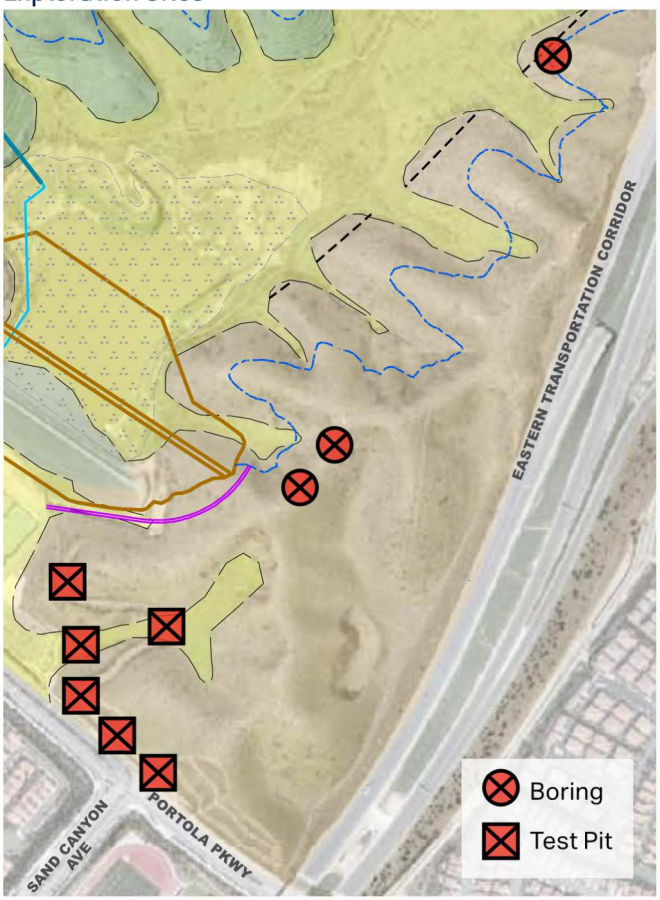
Potential for Seepage Through the Thin Rim Adjacent to Left Abutment of the Proposed Dam

It has been suspected that the thin bedrock rim that is adjacent to the left abutment of the proposed new dam might be prone to seepage of reservoir water that could daylight in the adjacent drainage that is outside the reservoir. The outlet of this drainage is blocked (dammed) by a large road fill for the toll road. Therefore, excessive seepage could pose a problem for the project such as surface water ponding in that drainage and saturating the base of the road fill.

AECOM drilled boring B-23 into the thin bedrock ridge to investigate the potential for seepage of reservoir water through the thin rim. Boring B-23 did encounter conditions that suggest excessive seepage could potentially occur through the thin rim. Some rock with very high hydraulic conductivity (>100 lugeons) was encountered at a depth of 46 to 61 feet below ground surface. Furthermore, packer testing could not be performed in this boring below a depth of 76 feet because the drill rods could not be filled with water. Evidently, water was flowing out the bottom of the boring as quickly as it could be pumped into the hole. Therefore water never reached the top of the drill rods. The drilling fluid circulation was reported as 50% return for most of the boring down to about 90 feet bgs, and from 90 feet to 100 feet there was no fluid circulation. There was no obvious explanation for the high hydraulic conductivities at the bottom of B-23.

Rendering showing full reservoir at thin rim near the left abutment where there is the potential for seepage

Exhibit 1-4. Proposed Boring and Test Pit Exploration Sites



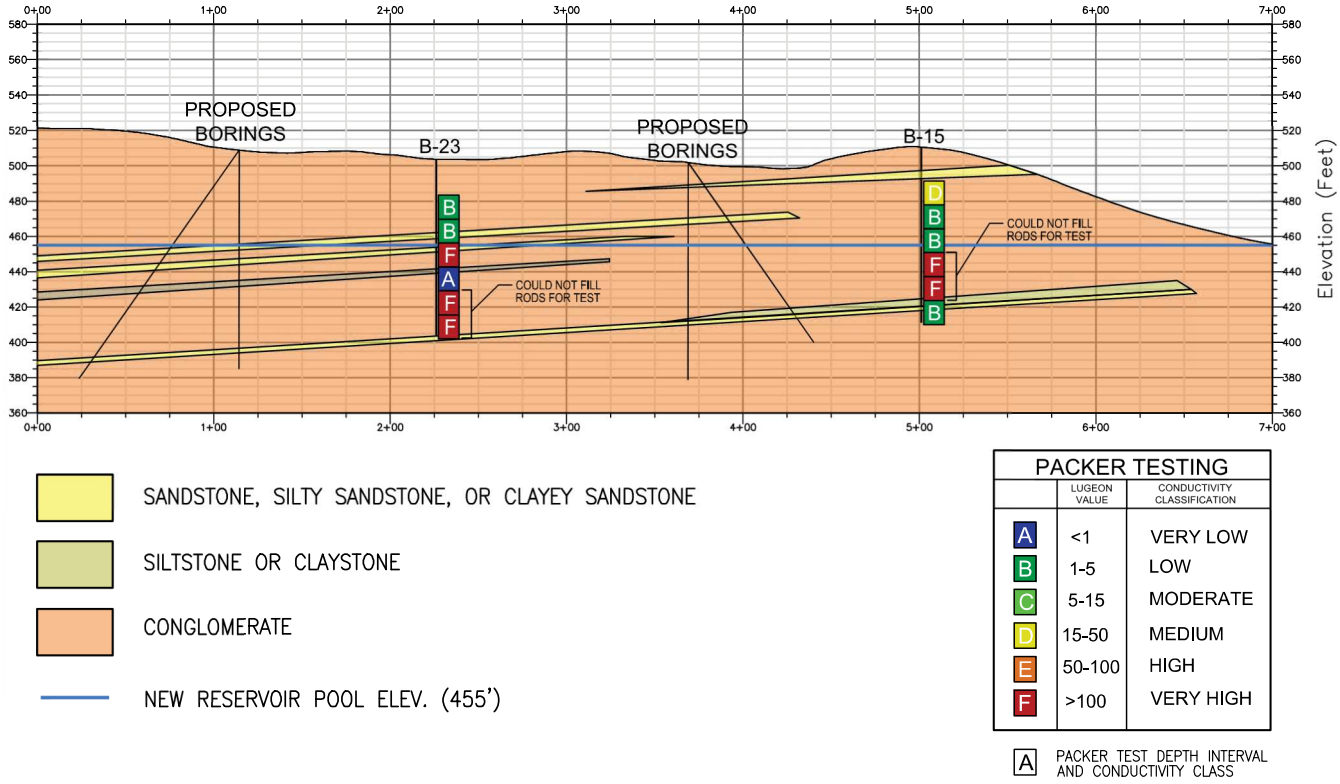
Most of the core was very good quality (RQD values 91 to 100%) and there were no highly fractured zones observed in the optical televiewer survey that was done.

Nearby boring B-15, which was drilled at the left abutment of the proposed new dam, also encountered a very high hydraulic conductivity interval at approximately the same depth below ground surface and elevation as the highly permeable rock encountered in boring B-23 (See **Exhibit 1-5**). Packer testing could not be performed in two test intervals between a depth of 60 to 85 feet bgs because the drill rods could not be filled with water, and at a depth of 69 to 85 feet below ground surface there was no drilling fluid circulation. Correlation of this permeable zone in boring B-15 with the zone encountered in boring B-23 suggests that there might be a horizontal to shallow dipping stratigraphic layer, perhaps a permeable conglomerate, that might explain the formation's inability to hold water.

Based on the findings of borings B-23 and B-15, it is apparent that seepage through the thin rim will need to be controlled (reduced or eliminated) in some manner. This could be accomplished by curtain grouting, construction of a cutoff wall, or by expanding the embankment fill of the proposed new dam to completely fill in the area adjacent to the thin rim. Further characterization of the subsurface geology at the rim will help the design team determine the most effective and economical method of controlling seepage.

AECOM recommends that additional drilling, packer testing, and optical/acoustic televiewer surveys be completed in the thin rim. As shown on **Exhibit 1-5**

Exhibit 1-5. Geologic Cross Section Along Thin Rim Showing Locations of Existing and Proposed Borings



(Geologic Cross Section) two additional helicopter boring sites are proposed along the thin rim approximately mid-way between borings B-23 and B-15 and approximately 100 feet to the northeast of boring B-23. AECOM recommends that both a vertical and an angled boring (approximately 40 degrees from vertical) be done at each helicopter drill site, as shown on **Exhibit 1-5**. Completing an angled boring from the same site as a vertical boring involves the simple (quick) task of lowering the drill mast angle. Considering that a sizeable portion of the cost of these boring is the mobilization, it would be cost effective to complete two borings from each mobilization. Assuming that the seepage zone is associated with a stratigraphic layer, completing both a vertical and inclined boring at each drill site will provide double the inspections of the zone, which would substantially strengthen the geologic characterization. AECOM will reunite the same team that successfully completed the drilling, packer testing, and downhole geophysical surveys during the geotechnical investigations of 2019/2020.

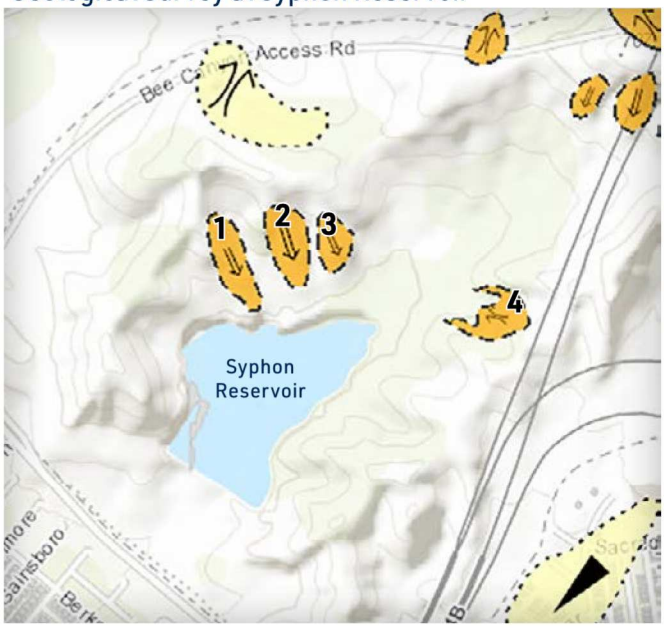
AECOM notes that the proposed drilling is above the high-water level of the proposed reservoir and that there may be environmental constraints that prohibit or discourage drilling from these locations. The area of disturbance will be limited to two approximately 15-foot wide by 20-foot long drill pads that will be cleared of brush by laborers using hand tools. Because the proposed drill sites are on flat ground at the top of the ridge, there will be no ground excavation. Thus, the area and extent of the disturbance will be minimal. However, If drilling from these locations is prohibited, AECOM will discuss with IRWD alternative drill sites that are at or below the high-water line.

Investigation of the Landslide Interpreted by the California Geological Survey

In the Preliminary Geotechnical Interpretive Report, AECOM noted that the California Geological Survey (CGS, 2001) had interpreted the presence of four dormant landslides in the reservoir valley based on a geomorphic assessment of aerial photographs (see **Exhibit 1-6**). If present, these landslides would be partially inundated by the proposed reservoir. Three of those landslides (labeled 1 through 3) are interpreted to be shallow (thin) debris slides that would not have enough mass to pose a threat to the Project. The landslide that is labeled No. 4 is interpreted by the CGS to be a dormant landslide that could be up to 50 feet thick. If present, a landslide of this thickness could pose a hazard to either the project or adjacent infrastructure (i.e. the SR-133 toll road) were it to reactivate upon filling of the expanded reservoir.

AECOM considers the geomorphic evidence suggestive of landslide No. 4 to be subtle and has questioned whether the interpretation of the landslide is correct. AECOM believes that a non-invasive investigation will be able to discover evidence that either supports or refutes the presence of the landslide. AECOM is proposing to inspect historic aerial photographs and high-resolution digital elevation maps generated from publicly available airborne LiDAR data to asses geomorphic evidence of landsliding. AECOM will also seek permission from the Transportation Corridor Agencies (TCA) to perform geologic mapping of roadcut exposures along the toll road. The as-built geologic mapping that was done for the toll road suggests that there is exposure of bedrock where the landslide was interpreted by the CGS.

Exhibit 1-6. Landslides Interpreted by the California Geological Survey at Syphon Reservoir



Upon completion of the aerial photo/ LiDAR analysis and geologic mapping AECOM will reach out to the CGS geologists to discuss what evidence they believe is suggestive of landsliding. Upon completion of this non-invasive investigation, AECOM will prepare a technical memorandum that summarizes the findings and provides an opinion regarding the existence of the landslide. If evidence is found refuting the presence of the landslide no further investigation will be done. If evidence is found supporting the existence of the landslide, the slope will need to be analyzed and designed to be stable under anticipated conditions during operation of the reservoir. This would require a drilling investigation to define the subsurface geometry of the landslide. A tentative location of a helicopter mobilization boring would be as shown on **Exhibit 1-4**. A geotechnical testing program consisting of unconfined compressive strength (ASTM D7012) and point load testing (ASTM D5731) of core samples and direct shear (ASTM D3080) and/or ring shear (ASTM D6467) testing of the basal shear surface will be done to support engineering analyses.

As requested in the RFP, AECOM will prepare a Supplemental Geotechnical Data Report rather than including the supplemental data in an expanded revision of the 2020 GDR.

Construction Access Road

The Project includes the construction of an access road into the site from the intersection of Portola and Sand Canyon (see Task 3.2.6 for additional details). This road must be capable of supporting two-way traffic for construction equipment and at the completion of construction, the access road will be re-purposed as IRWD's permanent access to the site. Due to the steep terrain adjacent to the intersection, construction of this two-way road will likely require a retaining wall, excavations into the slope, or both. AECOM is proposing that a geotechnical field investigation and laboratory program be completed to support the road design including the temporary construction cut and the retaining wall. AECOM is proposing that approximately 5 to 6 test pits be performed along the road alignment (1 day of test pitting) as shown on **Exhibit 1-4**. A geotechnical testing program consisting of R-Value (ASTM D2844), water content (ASTM D2216), compaction, testing (ASTM D1577), Atterberg limits (ASTM D4318) and sieve analyses (ASTM D6913) will be done to support geotechnical analyses.

Deliverables

- ☑ Supplemental Geotechnical Investigation Work Plan (Draft)
- ☑ Supplemental Geotechnical Investigation Work Plan (Final)
- ☑ Supplemental Geotechnical Data Report (Draft)
- ☑ Supplemental Geotechnical Data Report (Final)

Task 3 – Preliminary Design (30 Percent)

Task 3.1 – Dam and Appurtenant Structures Design Criteria and Technical Approach Memorandum

It is our understanding that IRWD will hold the first five-day risk workshop prior to the development of the Dam and Appurtenant Structures Design Criteria and Technical Approach Memorandum (Criteria and Approaches Memorandum). Although IRWD has not explicitly communicated the objectives of this first risk workshop, based on the timing we anticipate it is to provide input to the design criteria and technical approaches that will be used for the embankment and critical appurtenant structures. AECOM's lead designer, engineering geologist and/or lead engineers/designers appropriate to the subject matter will participate in this multiday meeting, providing our input and interacting with IRWD and the risk assessment team. The decisions and guidance provided, as agreed upon in discussions between IRWD and AECOM, will naturally provide a foundation for the Criteria and Approaches Memorandum.

VALUE ADDED

AECOM's familiarity with risk informed decision making will result in the efficient incorporation of workshop conclusions into a design memorandum that facilitates approvals.

To commence Preliminary Design, AECOM will prepare the Criteria and Approaches Memorandum defining the basic criteria and guidance that will be used during design of the dam and appurtenant structures. It will include design criteria and loading conditions; to the extent possible it will draw upon criteria and guidelines from approved nationally recognized sources such as DSOD, USBR, USACE, ACI, and CBC. In addition to criteria, the Criteria and Approaches Memorandum will describe the manner in which key engineering analyses will be conducted, the approach and software that will be used to complete those analyses, and a description of when those analyses will be completed, e.g., in preliminary design or final design.

AECOM will draw upon design criteria documents it has prepared for dam projects for a variety of California clients in the recent past, such as for Sites Reservoir (Sites Project Authority), Trampas Canyon Reservoir & Dam (Santa Margarita Water District), Calaveras Dam Replacement Project (San Francisco Public Utilities Commission), and Metropolitan Water District of Southern California's entire portfolio of dams and appurtenances.

The Criteria and Approaches Memorandum will cover the criteria and approach for hydrology and hydraulics, seismic hazards, the embankment dam, the spillway and the outlet works, at a minimum.

AECOM will submit the Design Criteria and Approaches Memorandum in draft form before advancing the 30% design. We understand that IRWD will submit the memorandum to DSOD for review and concurrence. AECOM will update the memorandum as the design progresses to the 30% level.

The following are examples of criteria included for Seismic Hazards and Embankment Dam Design.

Seismic Hazards Criteria and Approach

Criteria will include:

- Selection of the Project design earthquake(s)—recommendation for using the Maximum Credible Earthquake (MCE) and/or an appropriate probabilistic recurrence interval (e.g., a return period of 5,000, 10,000 or 25,000 years)

The approach section will cover:

- Sympathetic fault displacements and approach for determining values to be used during final design (consistent with design earthquake recurrence)

VALUE ADDED

This team has detailed knowledge of the site conditions having completed the previous geotechnical/geologic/seismic studies, allowing acceleration of the design schedule.

Embankment Dam Criteria and Approach

Drawing upon our extensive recent experience with design criteria for embankment dams in California, AECOM will prepare design criteria tailored to this dam. The dam criteria will cover analysis methods and non-analytic aspects of design. The approach section will address all the normal aspects of dam embankment design and the software that will be used. Topics will include:

- Foundation characteristics
- Foundation treatment—which zones to treat, types of treatment, handling of faults in foundation
- Geologic mapping of foundation
- Seepage analysis—analysis software; for non-linear analysis, method of accounting for pore pressure generation during shaking
- Stability—loading cases to consider (e.g., which slopes (upstream and/or downstream) require analysis; rapid drawdown cases, etc.), required factors of safety for each case; analysis software and method (e.g., Spenser's method)
- Seismic deformation— purpose, cases, and analysis software
- Settlement—purpose, cases, and analysis software
- Filter criteria—criteria and source
- Freeboard criteria—criteria and source
- Sizing of riprap on upstream slope—criteria and source
- Embankment dimensioning—minimum dimensions, e.g., minimum crest width, minimum width of core at every level, minimum widths of chimney drain filters, benches (number and width)
- Camber—general requirements
- Possible local modifications of dam section at the main fault between the Silverado Formation (Tsi) and undifferentiated Vaqueros and Sespe Formations (Tvs) and possible other significant faults
- Miscellaneous crest features—roadway, parapet wall, curbs, guard rails, lighting, signage, turn-arounds (all as applicable)
- Vegetation—Requirements for vegetation on or near the dam embankment

Deliverables

- ☑ Dam and Appurtenant Structures Design Criteria and Technical Approach Memorandum (Draft)
- ☑ Dam and Appurtenant Structures Design Criteria and Technical Approach Memorandum (Final)

Task 3.2 – Preliminary Design Report

Building on the design criteria and the technical approaches developed in Task 3.1, and with concurrence from DSOD, AECOM will prepare a Preliminary Design Report (PDR) that will concisely describe the overall project and document key design features, criteria and decisions leading to the proposed design. The PDR will define the technical requirements and parameters for the Project. The PDR will be based in large measure on analyses reported in a series of technical memoranda (TM) described below, which will be appended to the PDR. The criteria and approaches formalized in the Criteria and Approaches Memorandum (Task 3.1) will form a basis for the TMs described in Tasks 3.2.1 through 3.2.16. We understand that IRWD will submit the PDR to DSOD and the TAG for review.

Prior to the development of the PDR we will prepare a table of contents (TOC) for IRWD consideration. The TOC will be configured for easy modification and expansion as the design evolves. The TOC will be the blueprint for the completion of the PDR and subsequent FDR. IRWD, TAG and DSOD review comments will be listed separately in a table format with columns provided for responses, back check and final resolution of each comment. The PDR will be finalized incorporating the resolution of each comment received.

Deliverables

- ☑ Preliminary Design Report (Draft)
- ☑ Preliminary Design Report (Revised Draft)

Task 3.2.1 – Hydrology and Hydraulics TM

The 2012 GEI Syphon Reservoir Expansion Feasibility Study summarized a hydrological study that routed the Probable Maximum Flood (PMF) resulting from the Probable Maximum Precipitation (PMP) within the watershed through the proposed Syphon Reservoir. The existing Syphon Reservoir is classified as an Extremely High Hazard dam; therefore, it is anticipated that DSOD will require the proposed dam—which has greater height and provides nine to ten times the storage—be designed for the PMF.

AECOM will need to perform additional hydrologic studies to estimate the design flows into the reservoir and required capacity of the spillway. After review of the available data, AECOM will calculate the PMP for Syphon Reservoir using procedures outlined in NOAA Hydrometeorological Report 58/59 to calculate the rainfall depth of the PMP. The PMP rainfall depth will be calculated for both the local 6-hour storm and the general 72-hour storm. These rainfall depths and volumes will be compared with the proposed dam stage-storage curve to determine the amount of freeboard during an extreme rainfall event.

AECOM will use high-resolution topographic data and record drawings of the existing storm drain system to validate the watershed area of the reservoir. A point of emphasis will be the overland flow drainage basin that

routes runoff under SR-133 and SR-241 through a culvert collection system and 48-inch diameter storm drain pipe below SR-133. AECOM proposes to utilize a 2D hydrologic model to determine the peak run off through the existing system and verify whether the entire drainage basin runoff is conveyed by this storm drain system. The PMF hydrograph will be routed through the reservoir to determine the required crest elevation and spillway length for the replacement dam. Based on recent dam project experience, AECOM recommends an ogee weir with an open trapezoidal channel for the proposed spillway design.

AECOM has completed a preliminary hydraulic analysis and has determined that backflow from the City of Irvine storm drain system would not impact the size of the spillway channel. AECOM will evaluate two different alternatives at the terminus of the spillway: (1) connecting to the existing 48-inch underground storm drain and allowing overflow from the proposed plunge pool energy dissipator, and (2) design of new storm drain that can convey spillway flows directly to the City of Irvine storm drain system.

Deliverables

- ☑ Hydrology and Hydraulics TM (Draft)
- ☑ Hydrology and Hydraulics TM (Revised Draft)

Task 3.2.2 – Embankment Dam Design TM

During Preliminary Design, AECOM will complete all analyses required to support design of the embankment dam, prepare recommendations for final design of the dam embankment, and summarize these in the Embankment Dam Design TM. Preliminary Design commences with an initial model and proceeds successively through a series of improved designs. While the embankment envisioned in the Feasibility Study (GEI, 2012) might be taken as that starting point, we have envisioned several design modifications that we believe would form a more suitable initial model. Our proposed initial model is shown on **Exhibit 1-7** ; the changes are discussed in the following paragraphs.

Initial Model

First, we noticed that the Feasibility Design failed to meet DSOD's minimum height-based requirement for freeboard. We would increase the freeboard from 10.0 feet to at least 11.5 feet to meet DSOD's minimum freeboard criterion.

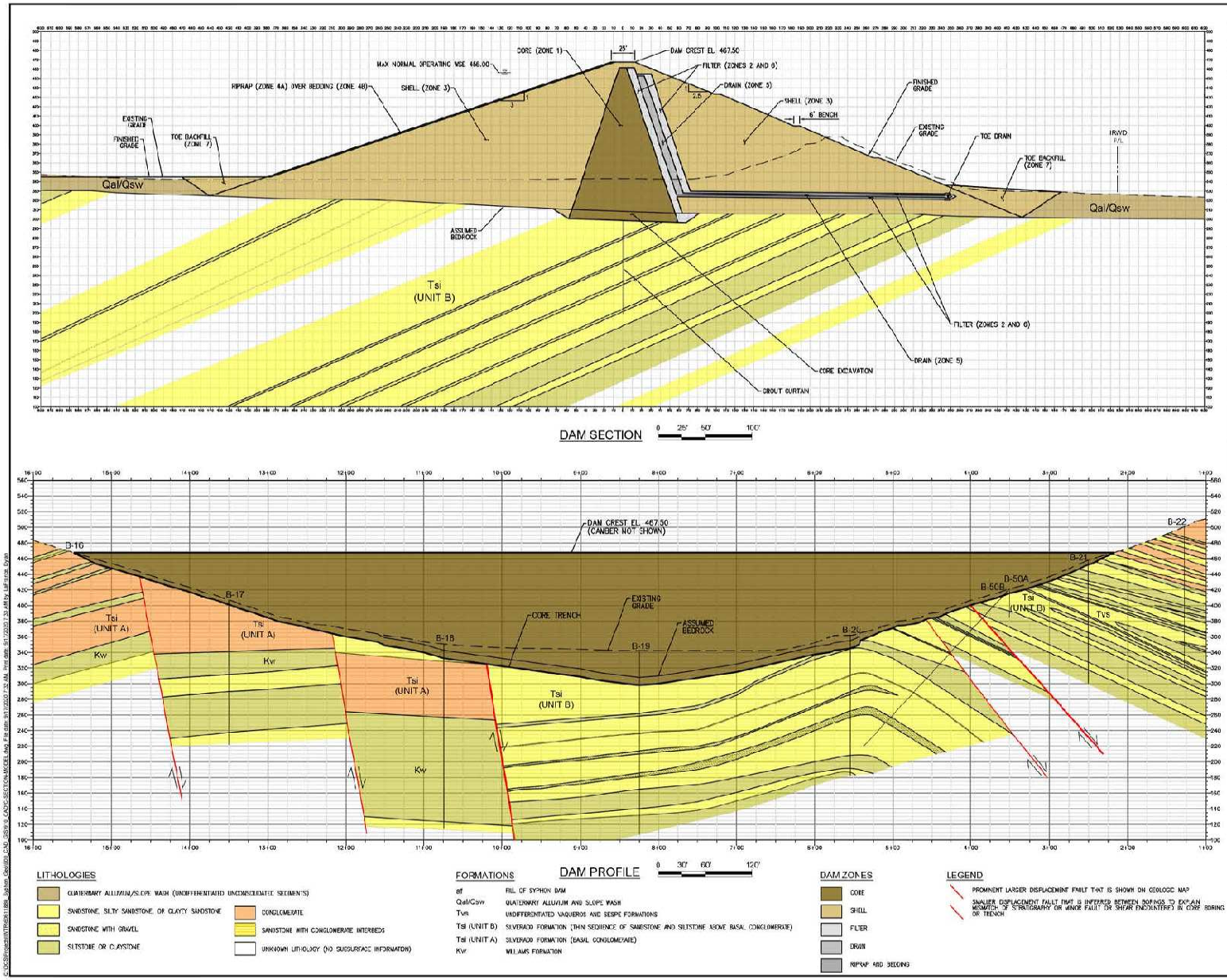
Although it was concluded in the Feasibility Design that a grout curtain was not needed, this conclusion was based on too few data. Packer test data from the 2019-2020 geotechnical program revealed some very high Lugeon values, particularly on the abutments, and even attempted test intervals where the borehole would not retain the water needed to perform a packer test. We would provide a grout curtain, which would likely be nominal in the valley bottom where relatively low water takes were registered and more extensive on the abutments, where packer test results were unfavorable.

AECOM recently designed the second highest dam in Orange County (Trampas Canyon, second only to IRWD's San Joaquin Dam) and the highest constructed in Orange County in the last 50 years. This demonstrates we have the local expertise that IRWD can rely on to get the job done.

The Feasibility Design envisioned a homogeneous dam. We would consider a zoned earthfill with a central core. Material for the core would be taken from the deposits that are more consistently fine-grained, while coarse-grained materials and deposits that are less consistently fine-grained would be placed in the shells.

Filters, which prevent internal erosion of the embankment, and drains, which control pore-water pressures in the downstream shell and prevent seepage from daylighting downstream, are among the most important defensive features. We envision extending the blanket drain laterally to collect seepage not only in the center valley but also on the abutments. In the valley bottom, we would lower the blanket drain as much as possible while still maintaining adequate flow from the collector pipe to the discharge point at Portola Parkway. An alternative, not illustrated on **Exhibit 1-7**, would be to lower the blanket drain and its filters to the foundation if there is a potential for piping to develop due to particle transport from the foundation into the embankment or vice versa (this protection could also be achieved without moving the blanket drain to the foundation by adding an additional filter zone on the foundation). We also recommend partitioning the blanket drain to provide more detailed data concerning seepage sources. For example, a partition at the base of each abutment would provide the flow amount coming from each abutment and the valley bottom. The more partitions that are provided, the more information is available concerning source of seepage and the less likely that a developing seepage problem will be masked by the overall seepage amount.

Exhibit 1-7. Dam Design (Task 3.2.2)



DAM DESIGN ELEMENTS		
ELEMENT	**SOLUTION**	**BENEFIT**
Freeboard	Increase freeboard to 11.5 feet to meet DSOD minimum freeboard criteria	DSOD approval will be secured
Foundation Seepage	Provide grout curtain	Control seepage and piping potential
Homogeneous Embankment	Zone the dam to provide a central core	Improved seepage and stability performance
Limited Drainage Blanket	Extend the blanket drain laterally	Controls seepage and internal erosion potential on abutments
Drain Performance	In the valley bottom, lower the blanket drains as much as possible	Keeps more of the downstream shell dry, and captures more seepage
Seepage Source	Partition the blanket drain	Improved seepage monitoring and helps identify source area of any concentrated seepage
Drain Capacity And Contamination	Provide a three-zone chimney comprising a drain sandwiched between filter zones	Reduces the potential from drain contamination from core or downstream shell and provides greater robustness in seismic event
Seismic Deformation	Increase width/ thickness of filter and drain zones relative to feasibility study	Allows for some filter/ drain displacement without significant impact to system, and provides greater robustness in seismic event
Limited Borrow Material And Available Area	Steepen the upstream dam slope from 4:1 to 3:1	Reduces material and area needed for reservoir, reduces cost of constructing the embankment, and reduces environmental impacts
Limited Space For Downstream Structures	Steepen the downstream dam slope from 3:1 to 2.5:1	Increases space for buildings and other infrastructure at downstream toe, reduces material and area needed for reservoir, reduces cost of constructing the embankment, and reduces environmental impact
Periodic Monitoring Safety	Provide three benches on the downstream slope	Allows better access for dam inspections
Dam Access	Provide a permanent access road on the right groin and downstream dam slope to the left end of the crest	Road grade is much flatter than for access roads on groins and can also serve as a place to perform exploration in case issues are raised in the future
Foundation Seepage	Provide appropriate treatment of the multiple known and not-yet-identified inactive faults crossing the dam foundation	Reduce foundation seepage and the potential for piping of fault zone materials
Dam Geometry	Increase the crest width to 25 feet	Provides more space to fit the three-zone chimney and core, provides better working space for maintenance. Repairs, and emergencies, enhances seismic performance
Instrumentation Reading Liability	Provide piezometers and seepage measurement devices with remote, automated reading capabilities	Makes more frequent instrument readings more reliable by eliminating operator error, and enhances worker safety by reducing potential for serious injury

AECOM

IRVINE RANCH WATER DISTRICT
15600 SAND CANYON AVENUE
IRVINE, CA 92618

DAM DESIGN

Proj. No.: | Date: SEPTEMBER 2020
Project: SYPHON RESERVOIR IMPROVEMENT PROJECT | Figure:

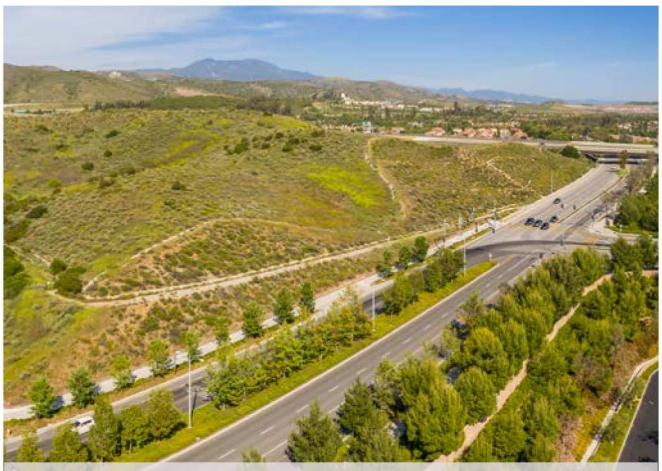
Regarding the chimney drain, the Feasibility Design provided a 5-foot wide single-zone combination filter and drain. Considering the height of this embankment and the hazard it poses, we would recommend replacing that design with a three-zone chimney comprising a drain sandwiched between filter zones, as illustrated on **Exhibit 1-7.** In, addition, we would increase the width of the chimney relative to the Feasibility Design.

The upstream and downstream slopes in the Feasibility Design appear to be flatter than necessary to meet DSOD design criteria. Based on limited preliminary analyses, we think the slopes of the initial dam model can be steepened from 4:1 upstream to 3:1, and from 3:1 downstream to 2.5:1.

The Feasibility Design did not provide any benches on the slopes. We recommend providing three benches on the downstream slope to enable access on foot for inspection and access to instrumentation. If desired, one or more of the benches could be made wider to enable access for maintenance or repair equipment; a wider bench could also provide access for subsurface exploration equipment should it be necessary to reevaluate the dam in the distant future.

The Feasibility Design planned a primary access to the crest of the new dam via Bee Canyon Access Road, also passing the Inlet/Outlet Control Structure. The RFP materials suggest access roads going up both the right and left abutments, which are very steep above the elevation of the crest of the existing dam. This concept is presented on Exhibit 1-11. As an alternative to one or both of these groin access roads we recommend considering an access road from the downstream toe of the dam that climbs the downstream slope of the dam as sown on Exhibit 1-12. This access road would connect to the crest road, which would be extended to the Inlet/Outlet Control Structure. This alternative has several benefits as listed on Exhibit 1-12. These alternatives are considered further at Task 3.2.6, Construction Access, Contractor Staging, and Temporary Utilities.

The Feasibility Study assumed that the fault(s) at the dam site would be inactive and anticipated that localized overexcavation of the fault zone and replacement with compacted embankment fill might be needed. We believe that appropriate treatment of the multiple known and not-yet-identified inactive faults crossing the dam footprint, particularly the core and its downstream filter, is necessary. Because the bottom of excavation will be in bedrock, we would not backfill the overexcavation for the fault with compacted embankment fill as the Feasibility Design suggests, due to the difference in material properties (bedrock vs embankment fill) and the potential for arching, which could lead to piping. We would backfill with dental concrete. Additional measures—such as stitch grouting—may be appropriate but are best decided when the faults are uncovered during construction. If the fault zone contains pipeable material, a cutoff shaft or wall may be appropriate.



Construction Access: Early intersection improvements to facilitate reservoir construction - improves pedestrian safety.

The Feasibility Design shows the outlet conduit being placed in an excavation on the right abutment and being backfilled with compacted embankment fill. To mitigate potential for transverse cracking of the dam embankment we recommend using concrete encasement in a smaller trench excavation in bedrock.

For a dam of this height, we recommend increasing the crest width to at least 25 feet.

For enhanced dam safety and technician safety and convenience, we recommend providing piezometers and seepage measurement devices with remote and automated reading capabilities.

Analysis Approach

With an initial model selected, AECOM will perform a series of analyses, beginning with simpler analyses to refine the model, progressing to more advanced analyses as the model is refined. The analyses may include but not be limited to, the following.

- Seepage analyses and filter/drain design
- Slope stability
- Seismic response modeling
- Settlement
- Foundation Treatment Requirements
- Filter and drain gradations
- Erosion protection
- Evaluation of potential failure modes
- Construction materials requirements
- Excavation stability and dewatering needs

The analyses will guide the selection of slope geometry, crest camber, fill material requirements, material zone placement and dimensions, foundation excavation limits and treatment, seepage control measures, erosion protection and other design features, as appropriate.

Earlier this year AECOM completed a seismic hazards task for the Project and issued an engineering report that summarized the seismic sources capable of eliciting significant ground motion at the site and the seismic parameters of these faults, relevant site parameters needed to analyze seismic hazard at the site, a deterministic seismic hazard analysis (DSHA) and a probabilistic seismic hazard analysis (PSHA). It also included spectrally matched acceleration-time histories for the 84th percentile deterministic target and for the 10,000-year return period Uniform Hazard Spectrum (UHS) target. Additional information was provided for return periods of 1,000, 5,000 and 25,000 years.

Building on that effort and the experience gained thereby, AECOM will consider DSOD's requirements for new earthfill dams and IRWD's own internal criteria and risk posture (as expressed by the end of the first risk workshop) to recommend one or more design earthquakes for this Project. Considering the significant downstream population and property and DSOD's current design standards, it is certain that the embankment will need to perform acceptably for a selection of deterministic 84th percentile earthquakes. Since this level of earthquake is one that DSOD is familiar with, it should be included in documentation submitted to them for review. Nevertheless, there may be reason to consider a less likely, more powerful event, which would be explored in discussion with IRWD at and following the first risk workshop.

Design earthquakes will also be needed for other project features, including the inlet/outlet works, spillway, and treatment facilities. As for the embankment, AECOM will propose design criteria based on regulatory agency requirements (DSOD or other) and on internal IRWD criteria.

Seepage analysis will be performed using two-dimensional finite-difference or finite-element methods to evaluate pore-water pressures for stability and deformation analysis and seepage control and monitoring measures for the embankment and its abutments. Seepage analysis may be completed with SEEP/W, whose pore-water pressure results can be directly imported to SLOPE/W, and/or FLAC, whose pore-water pressure results can be directly used by FLAC for static and dynamic analysis.

For the seismic loading evaluation, two-dimensional finite-difference code (e.g., FLAC) or finite-element tools will be used, using fully non-linear methods. Other software, including equivalent-linear finite-element programs such as QUAD4 may be used in conjunction with fully non-linear methods. The modeling will consider the seven acceleration-time histories provided in the 2020 AECOM seismic hazards report and will include a sufficient number of dam sections to evaluate the various conditions and potential response of the embankment. The modeling will incorporate the use of constitutive models that appropriately capture seismic-induced liquefaction behavior. The models will include appropriate phreatic conditions (pore-water pressures) for the loading conditions being evaluated.

The analyses will consider long-term static settlement of the embankment, seismic-induced embankment settlement, and settlement during construction. The last of these analyses evaluates the additional material quantities needed as a result of settlement that occurs as fill is being placed and for estimating camber.

Filter and drain gradations will be analyzed in accordance with the USBR Design Standards No. 13 (*Embankment Dams*) Chapter 5, *Protective Filters.*

Over the course of this task the embankment designer will be considering potential failure modes and incorporating larger and smaller modifications to the design to reduce the probability that the design will not function as intended with the ultimate objective of lowering the probability of consequences (e.g., downstream property damage). Probabilities will not be formally evaluated, though we anticipate this may be done at the second risk workshop near the conclusion of 60% design.

In addition to the deliverables below, AECOM will provide the raw model files and all intermediate calculation files for review as a separate transmittal.

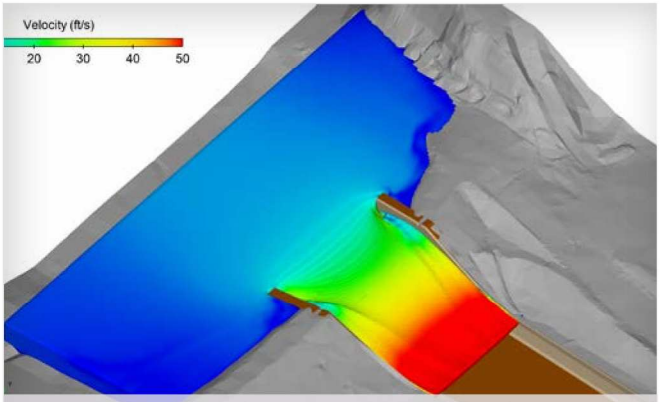
Deliverables

- ☑ Embankment Dam Design TM (Draft)
- ☑ Embankment Dam Design TM (Revised Draft)

Task 3.2.3 – Spillway Design TM

AECOM will prepare a Spillway Design TM for the Project, which will include all hydraulic, geotechnical, structural, and civil evaluations required for preliminary design of the spillway. The analysis and recommendations in the TM will be used to develop the final design of the spillway.

The Spillway Design TM will summarize the design of the spillway crest, channel, energy dissipator, and storm drain connection to the existing Portola Parkway storm drain. The memorandum will summarize the types of hydraulic analyses (i.e. one-dimensional and CFD) that will be completed during the different phases of the Project. During preliminary design, a one-dimensional hydraulic model and spreadsheet calculations will be used to complete the preliminary layout and size of the emergency spillway and channel. A CFD (Computational Fluid Dynamics) model will be developed to validate that the preliminary spillway design can safely convey the design flow. The CFD model results will be used to validate the preliminary design of the spillway and check that the spillway provides sufficient freeboard within the reservoir and spillway channel. The image below shows a CFD model recently developed for the Santa Anita Debris Basin spillway to design seismic improvements without reducing the capacity of the spillway.



CFD modeling will validate our design: as completed for Santa Anita Debris Dam

Exhibit 1-8 shows a preliminary layout for the spillway. AECOM preliminary spillway layout includes an inline ogee weir that conveys the PMF while providing sufficient residual freeboard within the reservoir. The spillway channel will consist of a concrete trapezoidal channel that would be more resistant to erosion compared to the existing unlined channel. An open channel spillway is preferred by DSOD because it is easier to inspect and maintain compared to an underground pipeline, which may be susceptible to clogging from debris. A new storm drain is planned for a direct connection to the existing Portola Parkway box culvert.

Structural analyses for design of the spillway weir and channel will be included in accordance with USBR Design Standards and USACE Engineering Manuals. Structural analysis will include seismic analysis, structural stability analysis, and sliding and flotation factors of safety.

During the detailed analysis structural models of the spillway will be analyzed under static and dynamic loads using commercial structural analysis software programs.

Structural detailing of the spillway will be in accordance with current best practices from USBR Design Standards No. 14, Appurtenant Structures for Dams (Spillways and Outlet Works) Design Standard. In addition, the following references will be utilized for structural design of the spillway:

- Structural analysis of the spillway will be performed in general conformance with EM 1110-2-2400, *Structural Design and Evaluation of Outlet Works* (USACE, June 2, 2003).
- Seismic analysis of the spillway will be performed in accordance with EM 1110-2-2400 and ER 1110-2-1806, *Earthquake Design and Evaluation for Civil Works Projects* (USACE, May 31, 2016).
- Sliding and flotation factors of safety will be calculated in accordance with EM 1110-2-2100, *Stability Analysis of Concrete Structures* (USACE, December 1, 2005).
- Reinforced concrete design will be performed in accordance with EM 1110-2-2104, *Strength Design of Concrete Hydraulic Structures* (USACE, November 30, 2016).

VALUE ADDED

We will use the most current best practices in spillway design recently adopted by DSOD and the dam design community since the Oroville spillway incident, establishing a safe and permittable design.

Deliverables

- ☑ Spillway Design TM (Draft)
- ☑ Spillway Design TM (Revised Draft)

Task 3.2.4 – Borrow Development and Handling TM

Onsite materials produced by the required dam foundation excavation and the reservoir grading will be used to construct the dam embankment except for the filter, drain, riprap and riprap bedding zones, which require high-quality granular materials with soundness and durability characteristics similar to those required for concrete aggregates. These materials will be imported from offsite sources.

Groundwater

Groundwater levels at the project site are approximately known from nine piezometers installed in eight selected borings (B-9, B-16, B-17, B-21, B-34, B-42, B-47, and B-49) during the geotechnical investigation, from observations during drilling of some of the borings, and from the observation of an oxidation boundary that is recognized in some of the core samples.

Groundwater beneath the project site appears to include perched groundwater that is mostly developed within the overburden sediment (alluvium and lake deposits) and a deeper, regional groundwater table that is developed in bedrock. The deeper regional groundwater table would likely not be encountered in bedrock borrow area excavations. The groundwater levels of both the perched groundwater and the regional bedrock groundwater can be expected to rise during periods of rainfall and subside during summer months, drought years, and when the reservoir is empty.

Reservoir Grading

Borrow materials are expected to be produced by the excavation required to remove the existing dam and reach foundation level for the new dam. Additional borrow needed to complete the embankment will be obtained by grading the reservoir; some grading may be desirable to improve circulation in the reservoir and improve water quality, other grading may be necessary simply to furnish an adequate supply of material. We estimate the proposed reservoir side slopes will be predominately cut at a 3:1 (H:V) ratio, as illustrated on **Exhibit 1-9** . The reservoir bottom will drain southwest towards the inlet/outlet structure at approximately 3% grade.

Exhibit 1-8. Spillway (Task 3.2.3)

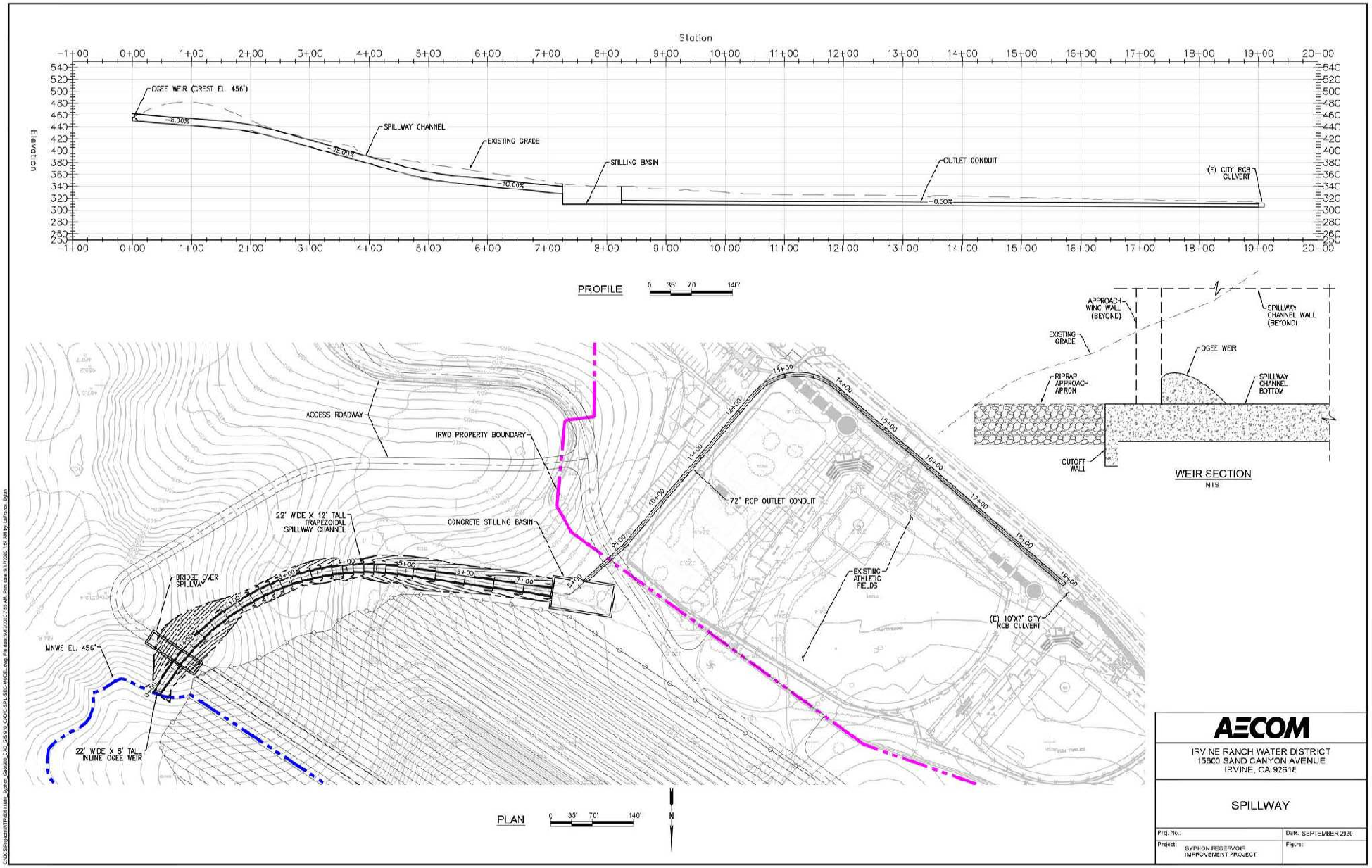
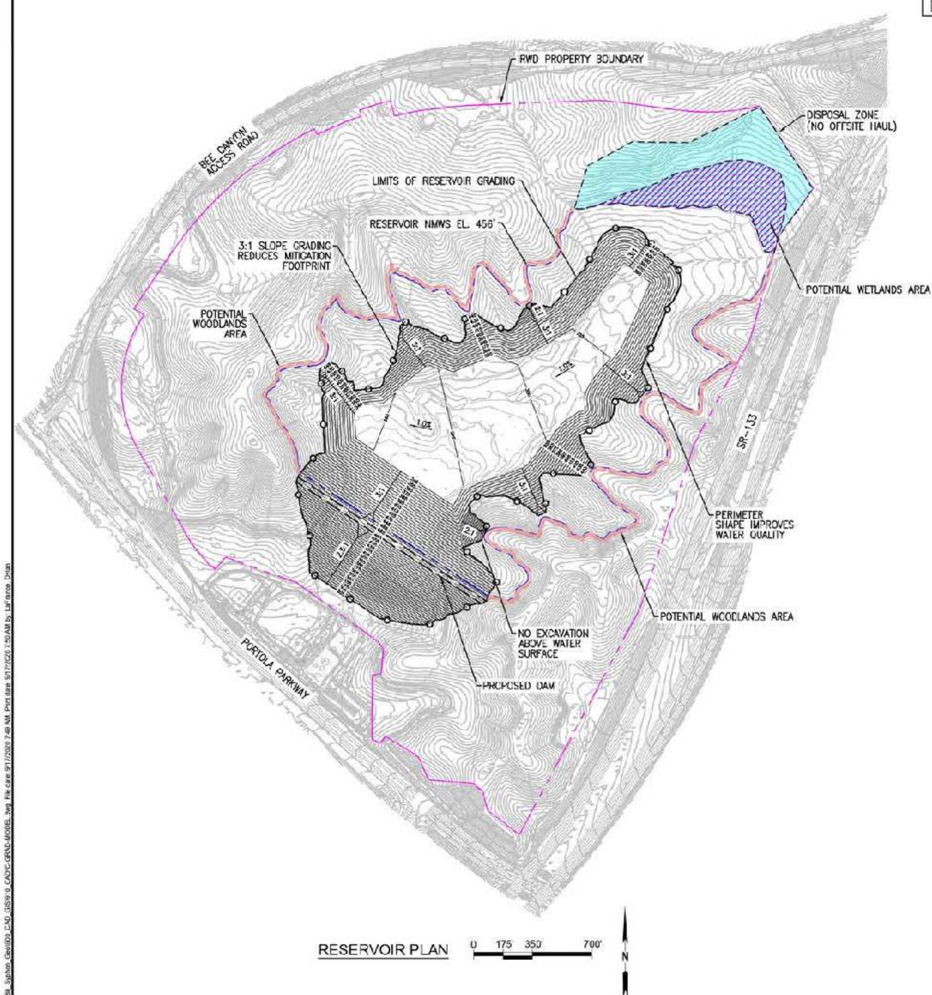
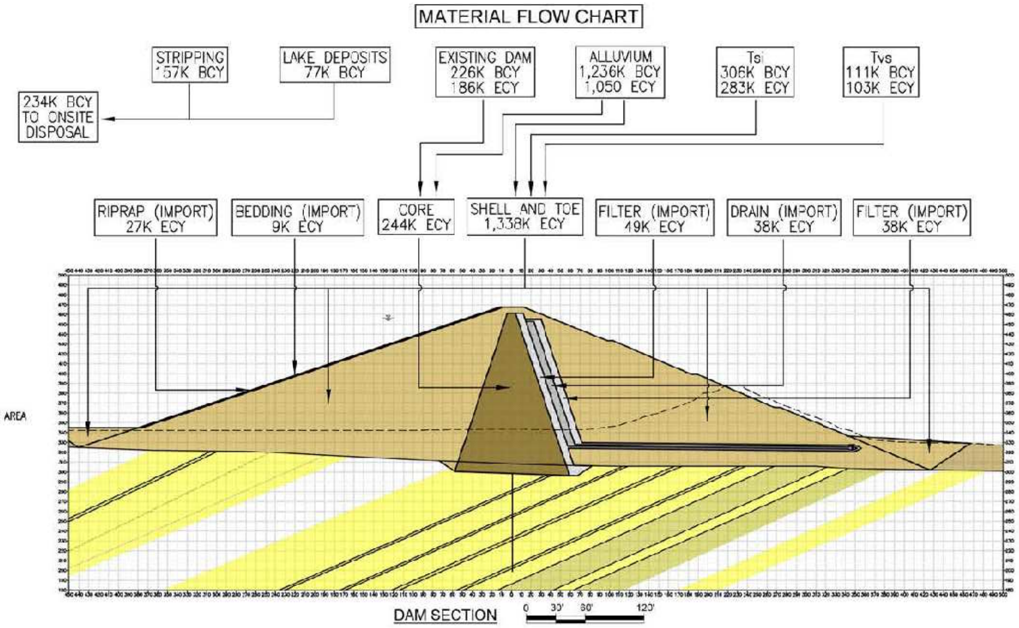


Exhibit 1-9. Reservoir Grading and Borrow (Task 3.2.4)





RESERVOIR GRADING DESIGN ELEMENTS		
ELEMENT	**SOLUTION**	**BENEFIT**
Mitigation	Grade reservoir to avoid excavations above the normal maximum water surface (nmws)	Reduces mitigation cost
Water Quality	Grade reservoir with 3:1 slopes to develop a wide open reservoir	Improves water quality by reducing stagnation
Borrow Material Source	Grade reservoir with 3:1 slopes to achieve storage capacity with a smaller reservoir footprint	Leaves area on the north side for additional borrow source
Lake Sediments	High organic material can be hauled to the disposal/wetlands area	Good material source for wetlands, and avoids putting lake sediments in the dam embankment or reservoir

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RESERVOIR GRADING

Proj. No.: Date: SEPTEMBER 2020
Project: SYPHON RESERVOIR IMPROVEMENT PROJECT Figure:

Borrow Materials

Materials considered for borrow include:

- Existing dam embankment
- Alluvium/colluvium
- Bedrock (Silverado Formation and undifferentiated Vaqueros and Sespe Formations)

Materials that will be encountered but not considered as borrow include lake deposits and organic-laden soil, such as topsoil or clearing, grubing and stripping. The following paragraphs characterize the potential borrow materials. We estimate that an average of 2 feet of material will be stripped from all areas of excavation due to the organic content of surface deposits and will not be used in the embankment.

Based on the proposed grading, it is estimated that most of the borrow material (60 to 65 percent) will come from the valley alluvium and colluvium. The material is expected to consist predominately of clayey sands with some sandy lean clays.

The existing dam is expected to produce approximately 10 to 15 percent of the borrow material. The material is expected to consist predominately of clayey sands and sandy lean clays.

The Silverado formation is expected to produce approximately 15 to 20 percent of the borrow material. The material encountered during the field explorations broke down to clayey and silty sands, clays, gravels, and silt, with sands being the most prominent type on the site and silt being the least common.

The undifferentiated Vaqueros and Sespe Formations (Tvs) are expected to produce 5 to 10 percent of the borrow material. The Vaqueros/Sespe sandstone broke down predominately to clayey and silty sands. The Vaqueros-Sespe sandstone appears to have a higher fines content than the Silverado sandstone.

Zonation

Zonation for the embankment was planned based on the estimated quantities of borrow materials and their average index properties. The core and inner part of the dam will come from the existing embankment and the undifferentiated alluvium and colluvium. These materials are expected to have relatively consistently higher fines content than the bedrock formations. The Vaqueros/Sespe formations and the Silverado formation will be used for the shells, with the Silverado formation, which is expected to have the coarser sand and the gravel materials, being used for the outermost shell material. AECOM understands the distribution of materials and their potential use intimately as a result of conducting the latest field exploration and laboratory testing, including composite samples.

Material Development and Handling

The sources and uses as described above, will facilitate construction by relating material source to embankment zone. The material is expected to be stockpiled and blended in designated areas. This will allow for a more consistent material. The formation materials are expected to be excavated with conventional heavy earthmoving equipment.

Material Balance

Based on the proposed grading and preliminary analysis, it is estimated that the borrow materials will be sufficient to construct the proposed embankment. The analysis assumed shrinkage and losses on the order of 15 percent. Should additional material be necessary, the proposed grading allows for the alluvium excavation to move further north, or the side slopes to be steeper than currently proposed.

Disposal Area

We anticipate that stripped material and lakebed sediments will contain too much organic matter to be used in engineered fills. Some may be used on surfaces such as the downstream slope of the dam or access road side slopes to promote vegetation. Additional waste material may be used to create the planned wetlands at the north end of the planned reservoir; this will be evaluated by another of IRWD's consultants. More detailed analyses are needed to evaluate whether and how much additional waste material might need to be disposed of elsewhere.

The proposed reservoir grading will reduce the disturbance footprint relative to the plan previously proposed in the Feasibility Design. This will reduce the amount of disposal material by reducing the stripping while allowing for more area to be used within the site limits for a disposal area.

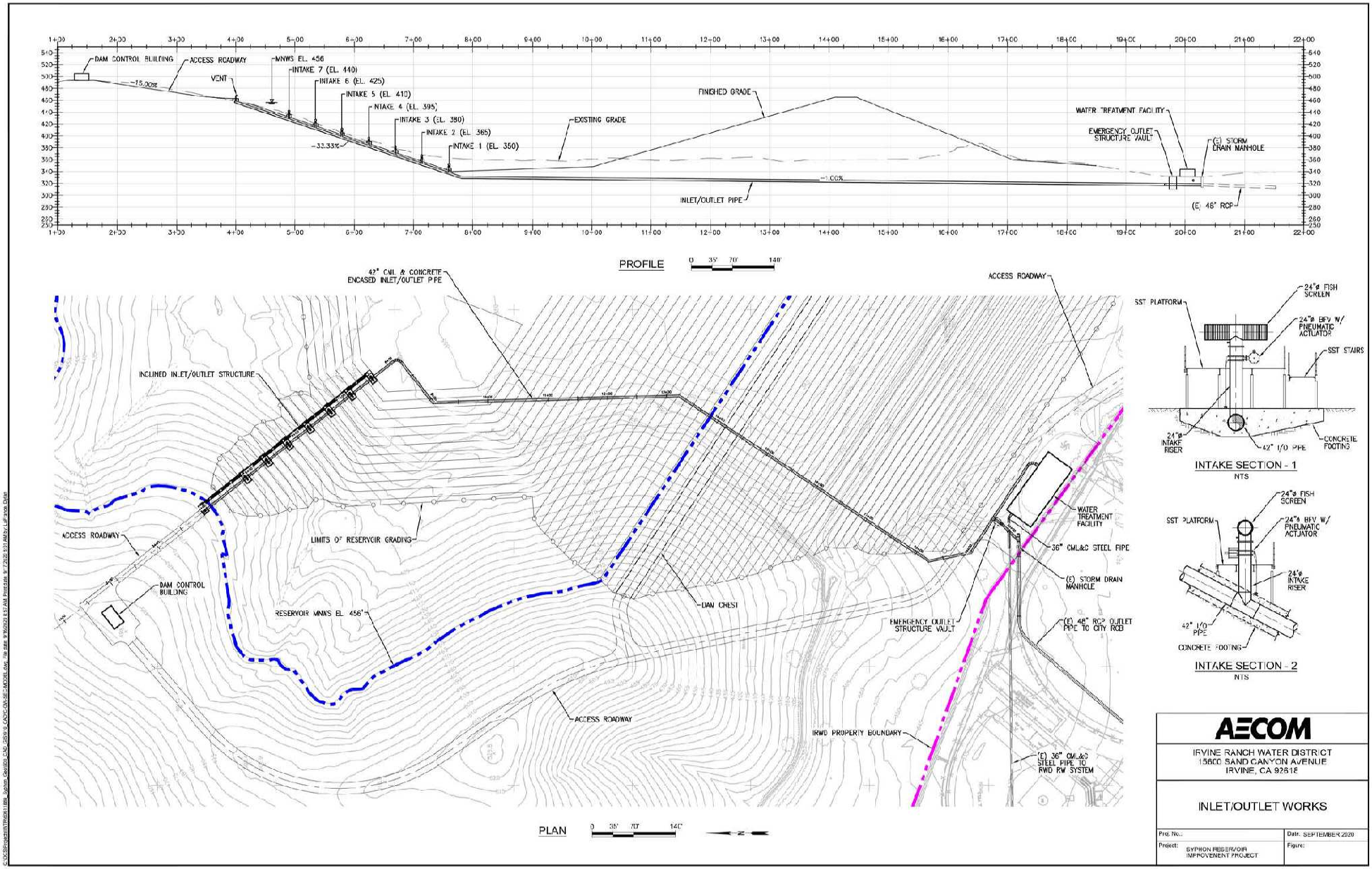
Deliverables

- ☑ Borrow Development and Handling TM (Draft)
- ☑ Borrow Development and Handling TM (Revised Draft)

Task 3.2.5 – Inlet/Outlet Works Design TM

AECOM will prepare an Inlet/Outlet Works Design TM for the Project, which will include all hydraulic, geotechnical, structural, civil, mechanical, instrumentation and electrical evaluations required for preliminary design of the inlet/outlet works system. The analysis and recommendations in the TM will be used to develop the final design of the inlet/outlet works system. This inlet/outlet works system includes a sloping inlet/outlet structure, multiple inlet/outlet structure ports with fish screens and isolation valves, a valve actuation system, low-level inlet/outlet piping, and an energy dissipation structure at the downstream discharge location. **Exhibit 1-10** illustrates our current concept for the inlet/outlet works layout.

Exhibit 1-10. Inlet/Outlet Works (Task 3.2.5)



The TM will include an analysis of the location and configuration for the sloped inlet/outlet structure. The current state of the practice for sloped inlet/outlet structures is to construct them of welded steel pipe encased in reinforced concrete that is entrenched and anchored into the bedrock surface of a dam abutment or reservoir slope. The sloping inlet/outlet arrangement is favored over a free-standing tower for seismic performance.

A stainless steel cylindrical fish screen with hydraulically actuated butterfly valve at Trampas Reservoir.

We will conduct a hydraulic analysis of the inlet/outlet works system using Bentley PondPack software. The analysis will allow us optimize inlet/outlet port sizes, fish screens size, sloped inlet/outlet structure size, low-level piping diameter, and energy-dissipater type and configuration. The inlet/outlet ports on the sloped structure will be spaced at regular vertical intervals every 10- to 15-feet in depth so that water can be drawn and discharged to the reservoir at elevations that are ideal for water circulation and quality. Our hydraulic analysis will also evaluate emergency reservoir drain time to ensure that the outlet works system is compliant with current DSOD dewatering regulations (i.e. 10% of hydraulic head drawdown in 7 days and full reservoir drawdown in 90 days for reservoirs over 5,000 AF).

AECOM will evaluate a variety of materials, piping sizes, valve types, actuators (electric, pneumatic, hydraulic), intake screens, ancillary equipment, and emergency and permanent power supplies for the new sloped inlet/outlet structure. Our in-house Corrosion Engineer will develop a cathodic protection system for the sloped inlet/outlet structure, inlet/outlet piping, and all metallic appurtenances. We will also evaluate an exterior stairway, platform and guard rail system that will allow operators to safely access each of the valve actuators and screens.

Deliverables

- ☑ Inlet/Outlet Works Design TM (Draft)
- ☑ Inlet/Outlet Works Design TM (Revised Draft)

VALUE ADDED

Our modified intake layout concept (Exhibit 1-10) will provide projects benefits including: improved operational flexibility, water qualify, and system reliability.

Accommodation for Fault Displacement Across Outlet Pipe

An estimate of sympathetic fault displacement that could occur at the project site will be developed and considered for the design of the outlet pipe. Site-specific fault investigations performed by AECOM demonstrated that the fault that crosses the project site (previously referred to as Center Valley fault) is inactive in accordance with DSOD Criteria. HDR (April 29, 2019-Technical Review and Validation of Feasibility Study Documents) recommended that the potential for sympathetic movements on this fault be estimated even if this fault is determined to be inactive. AECOM notes that displacement on secondary faults typically occur on faults that are located within a few hundred meters to a kilometer of the main strand of an active fault. These secondary faults are connected to the main fault (at depth) and move sympathetically with it. However, there are no active faults in proximity of the project site. Therefore, triggered fault slip[1] where the secondary faulting is further away, and probably not directly related to the main fault, is a more appropriate geologic phenomenon to consider for the faults that are at the project site.

AECOM will estimate the fault displacement parameters based on a comparison with case studies where triggered slip has occurred during historic earthquakes. There are numerous examples of triggered slip documented in the published literature. AECOM will compile and present the case studies of triggered slip that are comparable to the geologic setting and style of faulting of the project site. Based on comparison with these examples AECOM will develop an estimate of the maximum slip that could reasonably occur on the fault at the project site from maximum earthquakes occurring on regional seismic sources in the project area.

AECOM will also estimate the maximum slip that could occur on the fault based on an estimate of its length and surface rupture area. This fault has been mapped on published regional maps as concealed for much off its length below Quaternary alluvium, so its length is unknown. AECOM will estimate its maximum possible length and down dip width. These estimated values will be input into the empirical regression equations of Wells and Coppersmith (1994) and Leonard (2010) to estimate average and maximum slip that could occur on the fault,

1 Triggered fault slip involves the slipping of a fault located in the same region as, but not directly associated with, a fault that ruptures in a major earthquake. Most likely, the shaking of the ground during the earthquake causes minor slippage of the triggered fault.

presuming it is active. The finding of the empirical relationship studies will be considered collectively, and AECOM will make a recommendation of slip parameters to be considered for design.

If a more rigorous (semi-quantitative) analysis of the fault displacement hazard is desired, AECOM can perform a Probabilistic Fault Displacement Hazard Analyses (PFDHA). The PFDHA can assign the likelihood of various magnitudes of displacement associated with less likely, more powerful earthquake events. Most of the current PFDHA models include equations to characterize the sympathetic displacement hazard on secondary faults that are typically associated with the main fault strand. Triggered slip from more distant faults will be more difficult to characterize, as the current databases that collect data for PFDHA do not include such triggered slip. This type of slip has frequently been observed but has not been documented consistently until the advent of remote sensing techniques such as LiDAR and InSAR. Therefore, this task will include a significant effort in collecting and analyzing this data from the literature and building an empirical model. Also, since the secondary slip is not necessarily related to slip rates on the main fault, development of the PFDHA will need to find constraints on the slip rate for the secondary structures at the project site, for instance from slip deficits (difference between geodetic and seismically observed rates) in the current models.

Deliverables

- ☑ Inlet/Outlet Works Design TM (Draft)
- ☑ Inlet/Outlet Works Design TM (Revised Draft)

Task 3.2.6 – Construction Access, Contractor Staging, and Temporary Utilities TM

This is an important task because it affects the efficiency of construction and the permanent operations of the facility. During construction, access to the site is a key not only for import of the filter and drain materials (which will be on the order of 125,000 cubic yards), but also for worker access and other material deliveries throughout construction. Upon completion of construction, this entrance and road will become the permanent access to the site. **Exhibit 1-11** shows our current concept for the access road to the toe of the dam, which will later become the permanent site access for O&M staff, chemical deliveries, and fire-fighting and other emergency equipment. **Exhibit 1-11** also illustrates potential O&M access roads on the right and left downstream abutments, providing access to both ends of the dam crest and to the inlet/outlet control building; these road locations were suggested in the RFP materials.

As discussed at Task 3.2.2, Embankment Dam Design TM, the locations shown on **Exhibit 1-11** for the access roads from the downstream toe to the dam crest and control building are extremely steep; they are also likely to come at an environmental cost. **Exhibit 1-12** illustrates an

The design team will coordinate with IRWD staff to develop a staging plan that accounts for current, interim, and permanent conditions as the Project is developed.

alternative to one or both abutment access roads wherein one or both access roads start from the downstream toe of the dam and climbs the downstream slope of the dam. This access road would connect to the crest road, which would be extended to the Inlet/Outlet Control Building. This alternative has several benefits listed on **Exhibit 1-12**.

The proposed entrance is at the Portola Parkway/Sand Canyon Avenue intersection and this intersection will be modified to accommodate the new entrance. Task 7.4 describes details for the improvements necessary to the intersection to achieve the proper entrance. It is also noted that the intersection will be developed as an early package for this Project. With this, the team will carefully coordinate early-on to capture both the temporary uses needed during construction and those of the permanent operations since the intersection improvements and entrance will be one of the first orders of work.

The haul road function of the access road will be considered and designed to withstand the loads imposed during construction. The imported material will be delivered using street-legal loads and the entrance into the facility will be designed accordingly. It is important to note that most of the dam fill material will be mined from onsite borrow sites and transported across an internal network of roads potentially using heavier than street-legal trucks. The access road to accommodate outside haul trucks will be designed to 30 feet wide to provide for efficient and safe travel during each stage and use of the road. The balance between efficient travel for the haul trucks, an effective entrance to the facility that serves security and operational needs, and disturbance to environmental habitat will be considered.

Retaining walls along the initial grade from the Portola Parkway entrance to the first turn near the Crean Lutheran athletic facilities will be required to reduce the impacts to the Coastal Sage Scrub (CSS) in this area. Potential alignments of the access road cross CSS, non-native CSS, and disturbed areas. Walls will be utilized to reduce impacts to the CSS and non-native CSS areas.

Exhibit 1-11. Access Roads (Task 3.2.6)

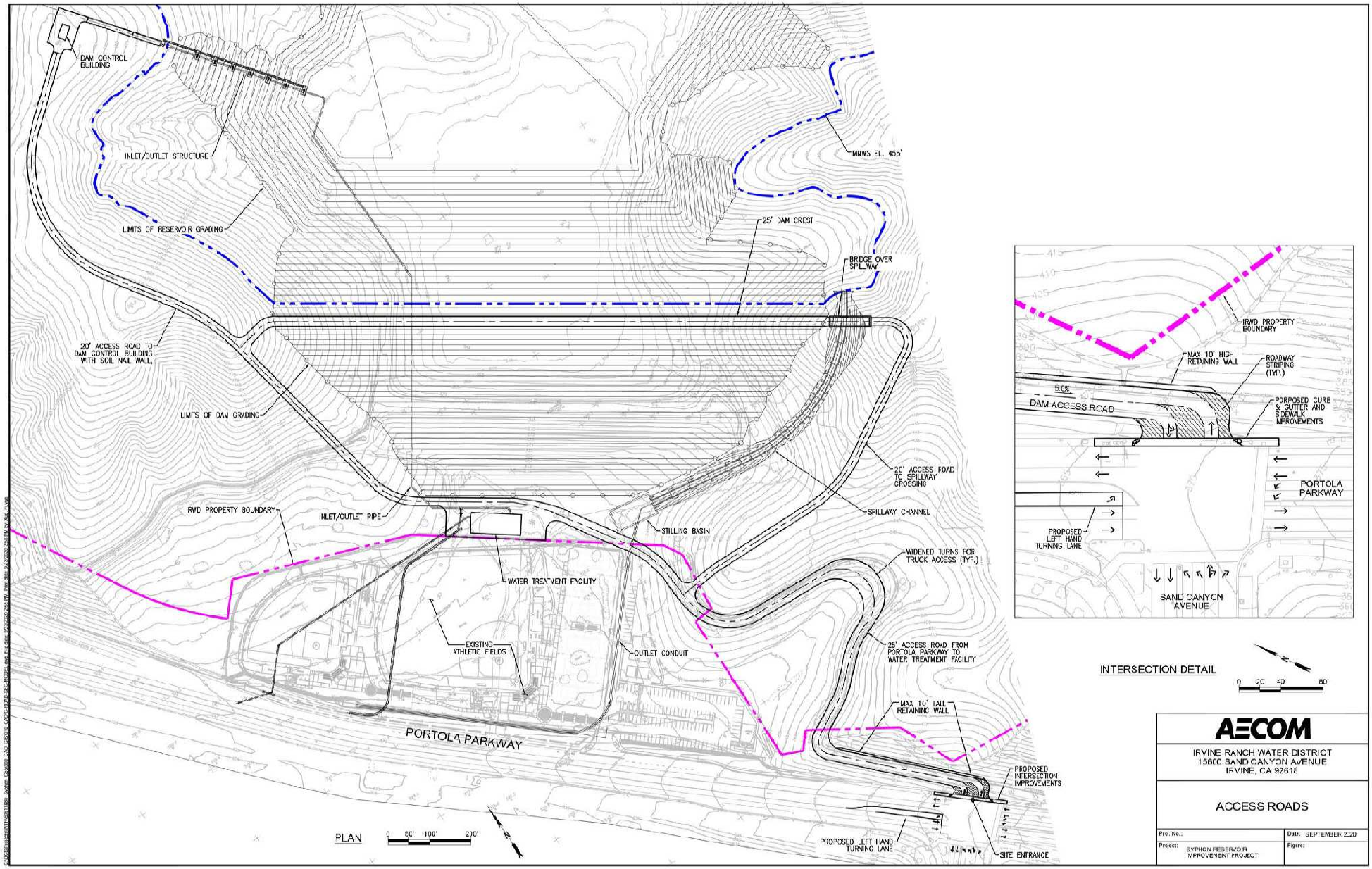
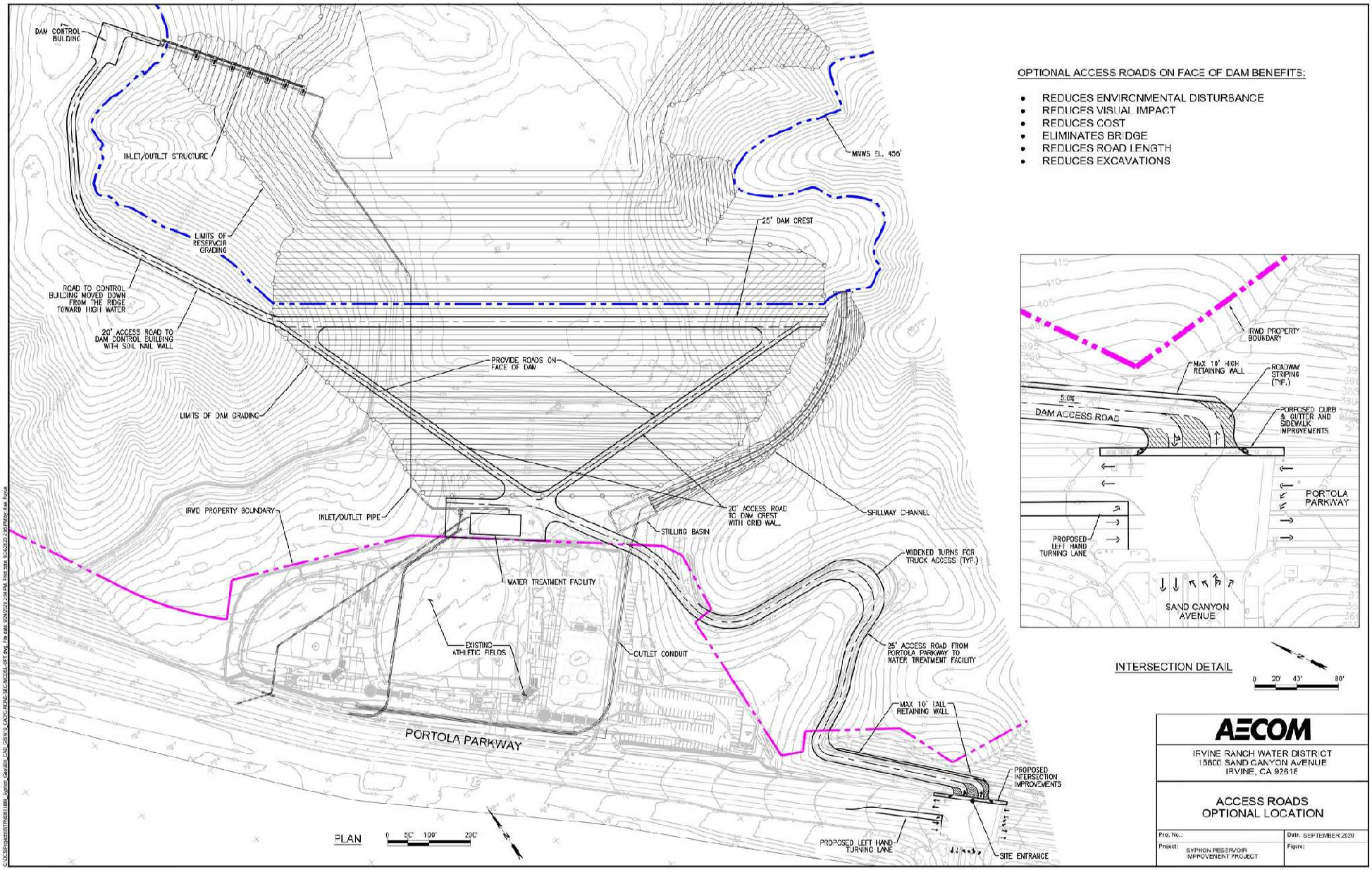


Exhibit 1-12. Access Roads Optional Location (Task 3.2.6)



The entrance from the Portola Parkway intersection will designed to accommodate a motorized security gate and will require a tight radius from the intersection to the access road in order to reduce large cuts or high retaining walls near this location. The location of a security gate will be such that vehicles—including large delivery trucks accessing the site during permanent operations—are able to pull far enough along the access road to clear out of the intersection while waiting to enter the site at a gate. We will study the preferred gate location and coordinate with the operations staff so that practical issues such as emergency vehicle access and turnaround space for vehicles not intending to enter the site have room to negotiate a U-turn without significant disruption.

We will develop recommendations for the surface of the haul road and permanent access road. Initially a deep section of aggregate base could be used as the structural section for the haul road so that the permanent surface is not damaged during construction. Another option is to place an aggregate base/asphalt concrete combination section and design it so that the final asphalt concrete course is not placed until after construction. Geosynthetics may be incorporated in the pavement section design for an improved design at lower cost.

Onsite haul routes will be developed to enable the movement of fill material from the borrow areas to processing areas to the final embankment at the dam. Again, efficiency of material movement will be balanced with environmental constraints and resource permit requirements. In addition, utilities that are required during construction will be evaluated and staged to coordinate the needs throughout the Project. Relocation of the processing facilities located near the toe of the existing dam will occur during the Project and service utilities will also be coordinated to enable the work to progress efficiently.

The design team will coordinate with IRWD staff to develop a staging plan that accounts for current, interim, and permanent conditions as the Project is developed. Relocation of utilities and temporary services can pose a risk to the construction schedule and early and frequent contact with utility owners is key to mitigating this risk.

Deliverables

- ☑ Construction Access, Contractor Staging, and Temporary Utilities TM (Draft)
- ☑ Construction Access, Contractor Staging, and Temporary Utilities TM (Revised Draft)

Task 3.2.7 – Site Master Plan and Site Grading TM

The overall site layout alternatives will be developed through an iterative process in conjunction with the verification of all key engineering/space requirements for the Project. Up to two alternative layouts will be prepared. The alternative layouts will include a combination of the best options for key features of the Project, as follows:

- The alignment and overall geometry of the dam embankment (crest and side slope characteristics) and spillway will be developed as indicated under Tasks 2.2.2 and 2.3.3. The overall site layout alternatives will be developed based on the optimum location(s) of these two structures.
- Multiple alternatives will be considered to route the access road from the entrance to the site (Portola Parkway and Sand Canyon Avenue) to the top of the dam at the left and right abutments. Routing the access road up the downstream face of the dam (east west and/or west east directions) will be considered in some of these alternatives, as discussed further at Task 3.2.6, Construction Access, Contractor Staging, and Temporary Utilities TM. These alternatives will be evaluated together with space requirements for treatment and electro-mechanical facilities, including access and parking, at the toe of the dam.
- Surface drainage at the downstream side of the dam will be a key consideration of the layout plan. Drainage design will depend on the alignment of the access road from the site entrance to the crest of the dam. It will also incorporate the routing of surface runoff, including runoff that is currently intercepted by and conveyed in the Highland Canal.
- Security requirements, including fencing around the site, will be incorporated into the layout plan alternatives.
- The maintenance road location around the rim of the reservoir will be determined after verification of the limits of the reservoir slope excavations and wetland and woodland riparian habitat mitigation areas. In turn, the limits of the reservoir slope excavations are dependent on stability analysis and benching requirements for surface drainage. A key consideration will be O&M requirements for the water supply and power service for the irrigation system as well as the location of the reservoir inlet/outlet structure and Control Building.
- Development and completion of the layout alternatives will require a close review of as-built drawings and potential additional surveying and exploration work to locate all existing above and below ground structures and features. This information will be used to prepare tie-ins and demolition plans.

Development of the site layout alternatives will require close coordination with IRWD project management, engineering, and O&M teams. Our goal is to prepare the optimum alternatives considering technical, financial and functional viewpoints. After the preferred alternative is selected by IRWD, we will continue its development to completion. Any potential change to the selected alternative will be brought to the attention of IRWD prior to implementation.

Deliverables

- ☑ Site Master Plan and Site Grading TM (Draft)
- ☑ Site Master Plan and Site Grading TM (Revised Draft)

Tasks 3.2.8 to 3.2.11 – Siting of New Facilities for Chlorination and Dechlorination Storage and Feed, Reservoir Algae Filtration, and Reservoir Water Quality Management System

We propose hosting the new algae filtration system, chemical addition (Chlorination and Dechlorination) system, and auxiliary equipment for the in-reservoir water quality management system, electrical and control room in a combined facility located at the toe of the dam near the property fence (see **Exhibit 1.13, 1.14,** and **1.15** for proposed siting). This location is easily accessible for inspection and maintenance crews, and chemical delivery trucks. It is also near the SCE transformer (located on the property near the tennis fields) and the 8-inch sanitary sewer (there is a manhole next to the existing strainer facility that will have to be relocated to make room for the new dam toe). As shown in **Exhibit 1.13**, **1.14,** and **1.15**, the new building will be a split-faced masonry block building with a sloped or gable roof constructed of fire-resistant material as indicated in the RFP.

The proposed arrangement of the facility on the site and the different systems within the facility has been developed following these criteria:

- **Ease of truck traffic circulation.** Particularly, ease of access for the chemical delivery trucks for filling the hypochlorite and sodium bisulfite chemical tanks.
- **Adequate space** around equipment and large openings to easily access equipment (filters, valves, blowers, and electrical panels) for routine maintenance and future replacement (skylights could be added to further facilitate access to equipment if desired).
- Isolation of the blowers supplying area to the in-reservoir aeration system in a separate room for **noise reduction**.
- Common slab and common wall construction for **cost savings**.
- Modular design with the option to place filtration area, blowers, and chemical feed under a canopy instead of inside a building for **cost savings**. If this option is selected, a smaller building will be designed to host electrical/ control room/bathroom/storage.
- Electrical and control room airtight and with separate air circulation form the rest of the building to **prevent corrosive chemical fumes** (chlorine) from damaging the electrical equipment – an alternative is a separate building for the chemical facilities (or outdoor under a canopy).

A smaller Dam Outlet Control Building (**Exhibit 1.16**) is proposed to host the controls (pneumatic air supply and purification) for the dam butterfly valves. We suggest placing the Dam Outlet Control Building in the proximity of the outlet to minimize the length of stainless-steel piping used to control the butterfly valves. Aesthetic criteria will be also applied to this building to minimize visual impact.

Task 3.2.8 – Chlorination and Dechlorination Storage and Feed Facilities Design TM

We propose placing the chemical feed system (sodium hypochlorite for chlorination and sodium bisulfite for dechlorination) in a corner of the new Combined Algae Filtration / Chemical Feed / Reservoir Quality Management Facility with ease of access for delivery trucks. The hypochlorite storage facility will include two tanks (a third tank could be provided depending on the average flow to be treated) providing storage for approximately 30-day supply under for average outflow conditions (this is critical as sodium hypochlorite decays and storage beyond 3 to 4 weeks is not recommended). Sodium bisulfite will be stored in two tanks providing 30 days storage under

Exhibit 1-13. Siting of the Combined Chemical Addition / Algae Filtration / Reservoir Quality Management Facility – Site Plan

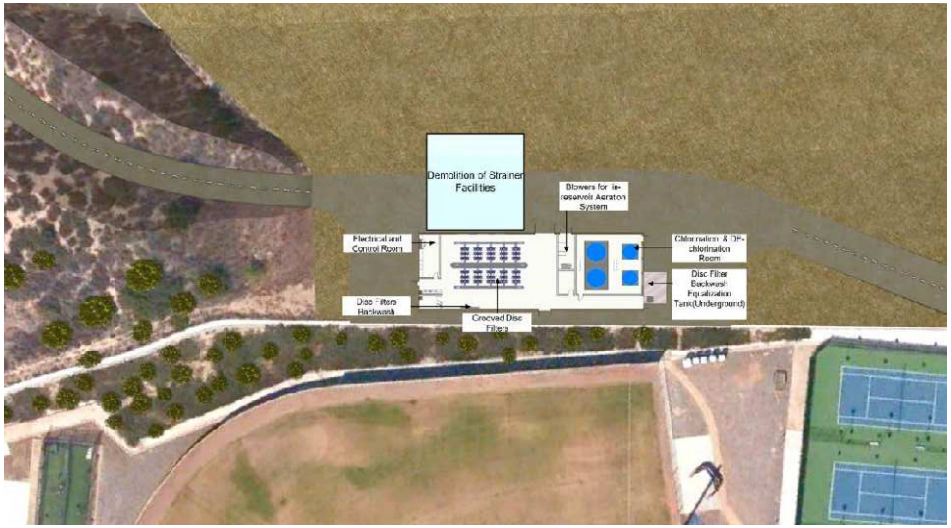


Exhibit 1-14. Combined Chemical Addition / Algae Filtration / Reservoir Quality Management Facility – Site Isometric Perspective - View a

Exhibit 1-15. Combined Chemical Addition / Algae Filtration / Reservoir Quality Management Facility – Site Isometric Perspective - View b

Exhibit 1-16. Dam Outlet Control Building and Combined Chemical Addition / Algae Filtration / Reservoir Quality Management Facility – Isometric View

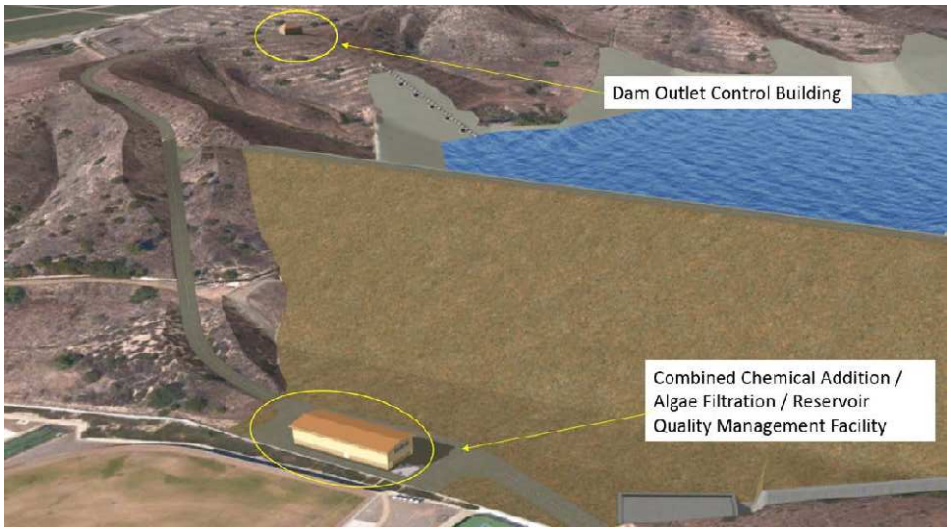
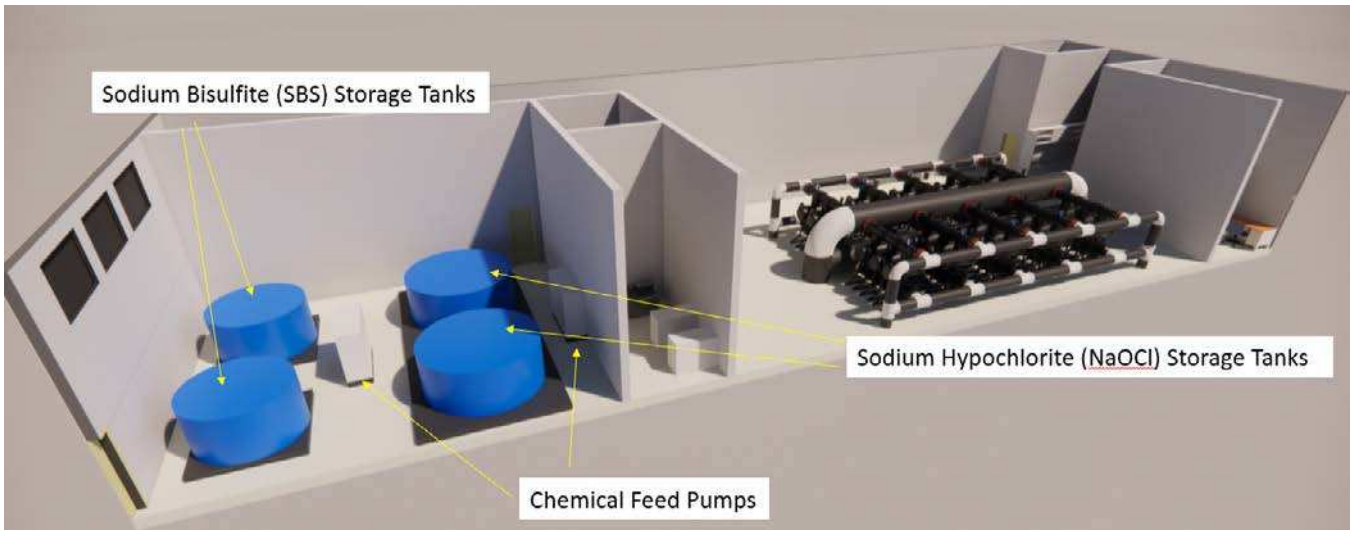


Exhibit 1-17. Chemical Storage and Feed Facilities – Isometric View



average inflow conditions. The feed pump skids will be placed in proximity of the tanks and will have the capacity to handle the full range of low to high inflows and outflows. The tanks will be placed on a pedestal and the pumps will have a flooded suction to utilize the full tank volume. The hypochlorite piping system will be designed to prevent and relieve gas buildup using degassing valves connected placed at high point in the system and vented back to the storage tank. The piping will be double walled for leak prevention and collection. **Exhibit 1-17** provides an isometric view of the preliminary layout of the chemical storage and feed facilities.

The chemicals storage tanks and pumps will be set within a chemical containment area with drains to the sewer. A valve to control the flow of the chemical to the sewer in case of a spill will be placed outside of the containment area to minimize operator exposure to the chemical. We will discuss all the aspects of the chemical feed system with IRWD during the Water Quality and Treatment Facilities Workshop before we submit the draft TM.

Deliverables

- ☑ Water Quality and Treatment Facilities Workshop Notes and Decision Log
- ☑ Chlorination and Dechlorination Storage and Feed Facilities Design Draft TM
- ☑ Chlorination and Dechlorination Storage and Feed Facilities Design Final TM

Task 3.2.9 – Reservoir Algae Filtration TM

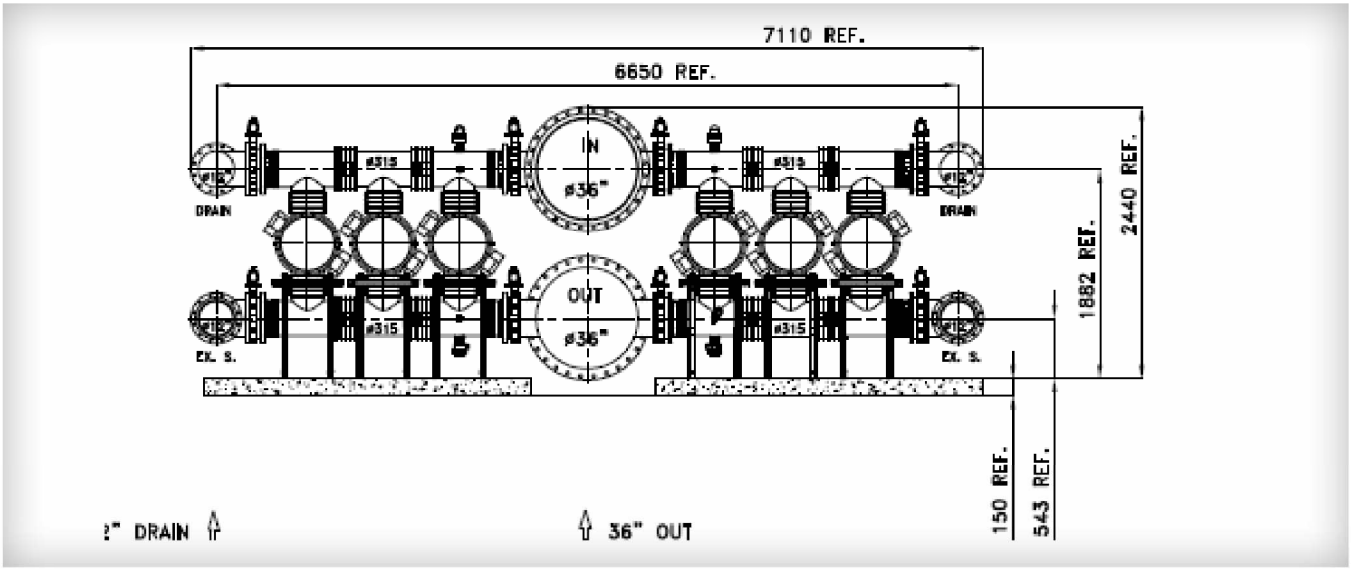
The filtration system will be using the Amiad's 70-micron grooved disc (Super Galaxy) filtration system per RFP. We have discussed the Syphon Reservoir Project with the vendor and Amiad confirms that the 70-micron filtration degree is recommended based on the pilot testing at the San Joaquin Reservoir. For the Syphon Reservoir Amiad recommend using ten 10" Super Galaxy Horizontal units with three modules each (**Exhibits 1-18 and 1-19)** to meet the flow range of 2,500 to 22,000 gpm (18,000 gpm maximum sustained average flow), minimize capital cost, and reduce backwash flow requirements.

Exhibit 1-18. Amiad Grooved Disc Filtration System – Isometric view, Courtesy of Amiad

3 Model Unit

The filter units automatically backwash when a set pressure differential is reached. For units with three modules a minimum backwash flow rate of approximately 2,400 gpm and 5,400 gpm per backwash cycle will be needed (per Amiad recommendation). Assuming worst case scenario (35 ppm suspended solids in the influent) one backwash per hour per unit may be needed. Filtered water is used to backwash and to satisfy this demand when the facility is operating under low flow conditions (2,500 gpm), a backwash supply tank may be required. Spent backwash water should not be returned to the reservoir for the inevitable buildup of algae a nutrient over time. The existing 8"sewer connection (see **Exhibit 1.20**) can be used to discharge the backwash water (the existing

Exhibit 1-19. Amiad Grooved Disc Filtration System Preliminary Arrangement Prepared for the Syphon Reservoir Project – Section View, Courtesy of Amiad



manhole will have to be relocated once the toe of the dam is expanded). However, the instantaneous flows appears to be too high to be handled by the exiting 8" sewer connection and an underground spent backwash equalization tank may be required.

Depending on water quality periodic (approximately one per month) cleaning with chlorine may be required to remove organics accumulated on the filter surface.

Exhibit 1.21 illustrates the preliminary layout of the combined algae filtration, chemical feed, and reservoir water quality management facility based on a configuration ten units (a total of thirty filters) arranged in pairs on both sides of a central feed and collection system. **Exhibit 1.22** shows an isometric view of the electrical and control room (with room for a desk), bathroom, and workbench that operators can use for sampling and wet chemistry testing.

In summary, the critical aspects of the reservoir algae filtration system to be considered during the design include ease of access to the equipment for inspection and maintenance, power supply, on-site and remote controls, backwash supply, and backwash disposal.

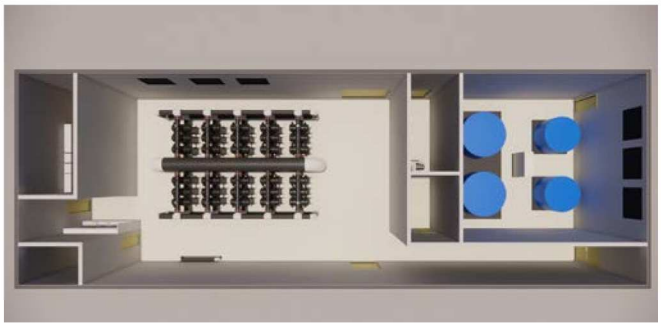
We will discuss all the aspects of the algae filtration system with IRWD the Water Quality and Treatment Facilities Workshop before we submit the draft TM.

Deliverables

- ☑ Water Quality and Treatment Facilities Workshop Notes and Decision Log
- ☑ Algae Filtration System Design Draft TM
- ☑ Algae Filtration System Design Final TM

Exhibit 1-20. Syphon Reservoir Strainer Facility Existing Connection to the Sanitary Sewer

Exhibit 1-21. Combined Algae Filtration, Chemical Feed and Reservoir Water Quality Management Facility – Section View



Task 3.2.10 Reservoir Water Quality Management System Design TM

Thermal stratification and its negative consequences on water quality will be exacerbated by the increased depth of the Syphon reservoir. The typical depth of the epilimnion (top layer) in reservoirs in Southern California is approximately 30 ft thick. With the raising of the dam, water depth will be over 100 ft in parts of the Syphon reservoir; thus, the strength of stratification may increase causing more intense anoxic conditions in the hypolimnion (bottom layer). Anoxia can lead to severe water quality issues including elevated concentrations of trace metals, odor-producing compounds, and nutrients that fuel algae growth. Further, anoxia is detrimental to aquatic life and can cause fish kills. The new in-reservoir water quality management system will have to address the issue of anoxia through artificial aeration, oxygenation and/or mixing systems to maintain acceptable water quality.

The main options to manage the in-reservoir water quality are:

- Bubble Plume Aeration
- Mechanical Mixing
- Airlift Aerator (Air)
- Side-Stream Oxygenation
- Combination of the Above Methods

Bubble plume aeration has been successfully used in many reservoirs across the United States and Southern California. Membrane diffuser domes have been typically used, but they have some drawbacks as they can clog, and they have limited mixing ranges. An alternative system to be considered is a flotation line diffuser with high enough airflow to prevent stratification. The drawback of this system is the requirement for anchoring on the bottom of the reservoir which, in turn, makes this system difficult to extract for maintenance and inspections. A different system that we have recently designed for the Trampas Canyon Reservoir (Santa Margarita Water District) consists of submerged modules of simple construction (essentially coiled hose) (see **Exhibit 1-23**). These modules can be installed at the bottom of the reservoir with buoys (see **Exhibit 1-24**) to allow annual inspection and replacement of the hose if needed. This system provides efficient mixing. ADS has installed many of these systems through North America and in California. Examples include the San Dieguito Reservoir (near San Diego) and the Trampas Canyon Reservoir designed by AECOM. The air supply can be provided by a compressor for deep applications where an air blower may not be sufficient. A configuration with two compressors, one in service and one on standby, is typically recommended. The selection of the compressor will focus on low maintenance for a typically unmanned installation.

Exhibit 1-22. Combined Algae Filtration, Chemical Feed and Reservoir Water Quality Management Facility – Isometric View Showing Electrical and Control Rooms, Bathroom, and Workbench

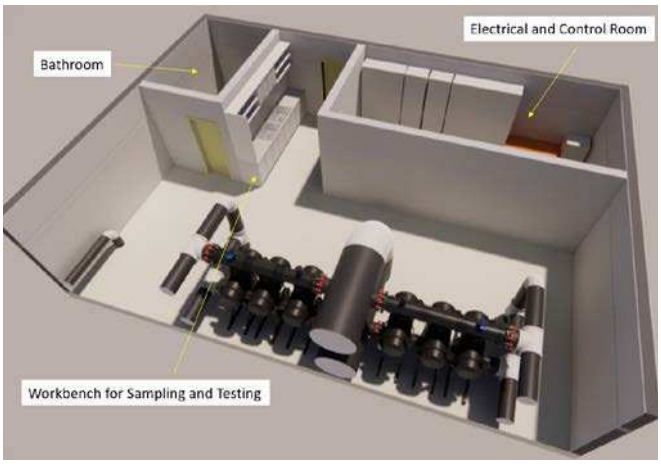


Exhibit 1-23. Aeration Disk Modules - Courtesy of ADS

Exhibit 1-24. Installation of Aeration Modules with Buoys – San Dieguito Reservoir, Courtesy of ADS

A preliminary screening of in-reservoir water quality management options is provided below:

In-Reservoir Water Quality Management Options			
Method	**Advantages**	**Disadvantages**	**Initial Comments and Findings**
Bubble plume	Effective DO transfer Low capital cost Low maintenance	May result in a uniform temperature profile and the overall warming of the reservoir	The design must account for reservoir geometry to maximize benefits of this technology
Axial flow pump mixing system	Lowest capital cost	Least effective DO transfer High O&M	High energy requirements and complex installation
Speece Cone oxygenation system	Effective DO transfer	Highest Capital cost Underwater maintenance	Requires large underwater installation and structure
Pure Oxygen diffuser system	Most effective DO transfer	High Capital cost High O&M	Requires onsite oxygen generator/ concentrator or external oxygen supply (e.g., Liquid Oxygen [LOX])

While the above approaches may be effective to address anoxia, they may not sufficiently address issues with algae blooms. Water transferred to the reservoir will have excessive nutrient levels that could promote algal blooms even in the absence of internal nutrient loading due to anoxia and with habitat disruption (i.e., mixing). Other technologies to address high nutrient levels and reduce the risk of harmful algal blooms can be evaluated, if desired.

Emerging Technologies: Examples of other emerging reservoir management systems that may be investigated include:

Ultrasonic Treatment: Ultrasonic treatment of algae in reservoirs (**Exhibit 1.25**) has limited success. It prevents growth by transmitting ultrasonic waves that target gas vesicles in the algae, causing them to become less buoyant and sink to the bottom of the reservoir. Once they sink to the bottom, algae cannot photosynthesize without sufficient light and eventually die. However, algae can adapt during seasons within the same reservoir and the ultrasonic frequencies must be regularly adjusted for successful long-term algal control. The disadvantage of ultrasound algae control in that it must cover the entire surface of the lake. Each spatial spot must be treated for a minimum duration to achieve full efficiency. This technology would have to be piloted in another reservoir before being implemented.

Nanobubbles Treatment: Nanobubbles (range from 80 – 200 nm in diameter) have some unique properties that provide advantages over conventional aeration and other air/oxygen injection technologies. Nanobubbles provide high oxygen transfer to the entire water column and can do so without breaking thermal stratification; this can support improved ecosystem health, reduced internal nutrient cycling, and promote aerobic sediment decomposition, all supporting algae reductions. Nanobubbles themselves regardless of using air or oxygen will provide chemical-free oxidation in the water that can directly impact algae and treatment of other

Exhibit 1-25. Solar Powered LG Sound Ultrasonic Algae Control System - Courtesy of LG Sound

oxidizable compounds via hydroxyl radical and reactive oxygen species formation. The technology functions by a fluid running through the systems at a specific flow rate (individual units ranging in size from 25 to 1000 GPM). A gas under pressure is injected into the flowing water to make nanobubbles (compressed air or high purity oxygen source). The equipment is installed onshore with pumps to pull water from the reservoirs and returning nanobubble rich water, and with onboard air compression or oxygen concentration units. **Exhibit 1-26** illustrates an example of a nanobubbles generator unit.

A disadvantage of the nanobubble system is the need for a pump to pull and return water from and to the reservoir compared to conventional aeration that only needs to move air. Once introduced into the system, nanobubbles themselves will spread within a reservoir, however, the technology is not promoting hydraulic mixing so if there is a specific goal to destratify a water body, this would not be achieved easily with nanobubbles unless the water is pulled and returned from different stratified layers to attempt to disrupt the thermal levels of each layer locally. The technology has been used by the US Fish and Wildlife, and the US Department of Agriculture. Currently, this technology is under review by the CA State Water Board for a project being conducted at Lake Temescal by the East Bay Regional Park District. Piloting may be required before implementation.

Exhibit 1-26. Nanobubbles Generator Unit - Courtesy of Moleaer

Chemical Treatment: Chemical treatment is the last resort to contain algae blooms that involve treating the water with various chemical additives including coagulants such as alum, lanthanum, or any other products that precipitate or sequester the ionized orthophosphates or algaecides often copper-based compounds (e.g. copper sulfate, copper chelate communes, chemical Endothall). Chemical treatment is advantageous only if an extensive portion of the reservoir is treated. Algaecides are expensive and need frequent dosing. They must be used with care, as they can cause algal cell rupture. This triggers the release of toxins into the water. Rapid decay of harmful algal blooms can contaminate water with high concentrations of algal toxins.

AECOM will select three relevant technologies for detailed evaluation based on previous work completed for the GEI Engineering Summary Report, AECOM's experience with these and other technologies. The evaluation will consider, life cycle costs (including considerations for energy, labor, and capital), likelihood to achieve desired water quality, ease of operation, and IRWD experience and preferences. A preliminary design will be completed for the preferred option, to include sizing and system configuration needs based on modeling results, manufacturer specifications or other relevant documentation, identification of power requirements, equipment layout and associated controls philosophy. The technology evaluation will also take into consideration the capability of the new filtration system.

Overall, we complete Reservoir Water Quality Management System selection and design will require the following three steps:

1. Review and screen candidate technologies
2. Conduct detailed alternative analysis of three relevant technologies and select recommended technology
3. Design based on recommended technology

We suggest conducting a workshop to discuss the review and complete the selection of technologies before the Technical Memorandum is produced.

Deliverables

- ☑ Reservoir Water Quality Management System Workshop Notes and Decision Log
- ☑ Reservoir Water Quality Management Design Draft TM
- ☑ Reservoir Water Quality Management Design Final TM

Task 3.2.11 – Architectural Renderings TM

We will develop architectural rendering for Combined Chemical Addition / Algae Filtration / Reservoir Quality Management and the Dam Outlet Valve Control Buildings. The renderings will be developed in conformity to IRWD architectural standards and will be used to ensure that the new buildings have a low visual impact on the neighbor.

Deliverables

- ☑ Architectural Renderings TM (Draft)
- ☑ Architectural Renderings TM (Revised Draft)

Task 3.2.12 – Control of Water During Construction TM

Water management during construction will be the Contractor's responsibility. In consultation with IRWD we will develop a list of performance requirements to be included in the technical specifications. Those requirements will emphasize the responsibility of the Contractor to protect the work and project site throughout the construction period. Performance requirements might include minimum type of protection structures needed to control inflow water from the drainage culvert under the tollway. Similarly, minimum type of structure required to prevent site runoff from damaging the work might also be specified, if considered necessary. The performance requirements will also include water quality monitoring and sampling for off-site discharges. Water quality requirements will be consistent with jurisdictional permits and the SWPPP developed under Task 7.8.

AECOM will evaluate site conditions to determine the optimum timeline for lowering the reservoir and dewatering the site. This evaluation will be based on the hydrology information gathered during Task 3.2.1, operational requirements and estimated time required for the dewatering of the valley soils. The timeline for dewatering of the valley soils will be estimated based on alternative dewatering approaches and the characteristics and permeability of the soils. However, the actual means and methods for dewatering and handling of the valley soils will be the Contractor's responsibility. The dewatering timeline will be valuable information for IRWD project planning purposes.

Deliverables

- ☑ Control of Water During Construction TM (Draft)
- ☑ Control of Water During Construction TM (Revised Draft)

Task 3.2.13 – Site Electrical Service TM

We will develop a list of electrical load requirements for the Project. Proposed loads will be compared to the existing service to determine needed upgrades. Upgrades will be coordinated with SCE to develop the preliminary service plan. We will provide support, as needed to develop the final, SCE-approved service plan during the final design. We will coordinate with IRWD the evaluation of permanent backup power generation equipment. However, the design should be limited to provide manual transfer switches.

Deliverables

- ☑ Site Electrical Service TM (Draft)
- ☑ Site Electrical Service TM (Revised Draft)

Task 3.2.14 – Water Quality Management Plan Requirements TM

Syphon Reservoir is located within the boundary of the Santa Ana Regional Water Quality Control Board. .AECOM will utilize the Model Water Quality Management Plan and Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs) to recommend post-construction Best Management Practices (BMPs) to address urban runoff and stormwater pollution from the Project.

Syphon Canyon Reservoir is located within the Newport Bay – Newport Coastal Streams watershed area. A review of the TGD showed that the Reservoir is within an area designated as having potential for erosion, habitat, and physical structure susceptibility. AECOM will develop low impact development and hydrologic source control onsite BMPs to treat pollutants of concern (e.g. copper, indicator bacteria) as well as mitigate for increases in peak flow to reduce potential for hydromodification impact.

A review of soils within the project area showed that soils consisted of hydrologic soil groups B and C, which are soils having moderate to slow infiltration rates. Infiltration tests will be performed at locations that would be suitable for infiltration BMPs. Example BMPs include bioretention facilities and impervious area dispersion (e.g. roof top disconnection). Final BMPs and development strategies will be reviewed and agreed upon by IRWD. Suitable BMPs and strategies will be incorporated into the site civil design improvements. Per the RFP, preparation of a complete WQMP is not required.

Deliverables

- ☑ Water Quality Management Plan Requirements TM (Draft)
- ☑ Water Quality Management Plan Requirements TM (Revised Draft)

Task 3.2.15 – Additional Facility Evaluations

AECOM will be prepared to evaluate additional facilities and alternatives, supplemental investigations or analyses as requested and authorized by IRWD under this task and implement outcomes into the 30% design package.

Deliverables

- ☑ TBD TM (Draft)
- ☑ TBD TM (Revised Draft)

Optional Task - 3.2.16

Bee Canyon Access Road Crossing

This is an optional task but if this task is activated by IRWD, AECOM will develop concepts for a pedestrian crossing of the Bee Canyon Access Road. A budget allowance has been established however specific details would be developed in collaboration with IRWD. The anticipated scope of work would include the conceptual development of alternatives for a pedestrian crossing over or a culvert under the Bee Canyon Access Road.

Constraints that affect crossings include a variety of features, but ADA access and grades for either type of crossing are important. Crossings over the road can be more difficult to accommodate with ramps since there is typically more vertical change to accommodate. Elevators are an option and we developed concepts for a pedestrian bridge near the intersection of Michelson and Jamboree in the City of Irvine that included elevators.

Another variable to consider is architectural treatment and what level of treatment may be requested. There is less opportunity to display architectural treatment on an undercrossing, but either way it is a consideration.

An allowance of $50,000 is included in the budget for this optional task. Work under this task shall proceed only as authorized by IRWD and the scope will be refined as the crossing is defined in the future.

Deliverables

- ☑ Bee Canyon Access Road Crossing Concepts (Draft)
- ☑ Bee Canyon Access Road Crossing Concepts (Revised Draft)

VALUE ADDED

We are experienced with implementing the latest water quality requirements. At IRWD's Eastwood RW Pump Stations we specified CONTECH StormFilters which benefited the project by discharging clean storm water and meeting the requirements of the General Permit.

Task 3.3 – 30% Design Package

AECOM will prepare a 30% design package consisting of a partial set of construction plans, a complete table of contents for the Project Manual, and an opinion of probable construction cost that conforms to AACE Class 4 requirements. The plans will show the size, type and location of all key project features in plan view and typical section, including the embankment dam, dam foundation excavation, inlet/outlet works, spillway configuration, and water treatment facilities.

The 30% Design Package will include the basic organization sheets in enough detail to show the basic layout of facilities, process instrumentation and control diagrams, and single-line power diagrams. The plans will provide horizontal and vertical control for proposed facilities.

In preparing the 30% Design Package, as well as all subsequent design packages, AECOM will adhere to the requirements stipulated on page 18 of 28 of the RFP concerning the preparation and content of construction plans and the Project Manual.

We anticipate that IRWD will provide the 30% Design Package to DSOD and the TAG. AECOM will respond to and address IRWD comments and submit a revised package to be transmitted to DSOD and TAG.

Deliverables

- ☑ 30% Construction Plans (Draft)
- ☑ 30% Construction Plans (Final)
- ☑ Project Manual Table of Contents (Draft)
- ☑ Project Manual Table of Contents (Final)
- ☑ Opinion of Probable Construction Cost (AACE Class 4) (Draft)
- ☑ Opinion of Probable Construction Cost (AACE Class 4) (Final)

VALUE ADDED

AECOM's experienced Limnologist and hydraulic modelers will implement measures to control odors and optimize circulation and aeration of the reservoir.

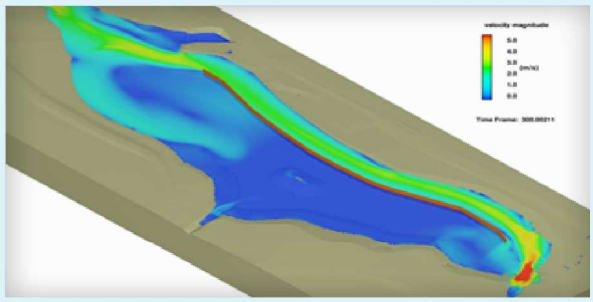
Optional Task - 3.4

CFD Modeling to Optimize Water Quality System

CFD Modeling for Syphon Reservoir to Assist with the Selection of the Aeration and/or Mixing System

As an optional task, AECOM proposes to offer a three-dimensional Computational Fluid Dynamics modeling of the reservoir, in addition to the general task of CFD modeling for the dam and spillway, to evaluate the hydraulic characteristics inside the reservoir, under various reservoir operation conditions. This task would help identify the flow patterns and stagnation zones that may be critical to reservoir management and further identify measures to mitigate the adverse hydraulic conditions identified – i.e. assisting with the selection of the optimal aeration and/or mixing system. Thermodynamics in the reservoir could also be model using the same CFD computer program.

AECOM would use the same CFD program for modeling the reservoir as for the spillway, which is based on FLOW-3D, a well-tested, reliable CFD computer program developed and supported by Flow Science, Inc. of Santa Fe, New Mexico, USA. FLOW-3D is a program that has been tested and used in water and environmental applications, such as spillway, inlet and outlets, dock and sluices, diversion, rivers, and reservoirs around the world. The program has been designed for the treatment of time-dependent (transient) problems in one, two and three dimensions, and is based on a finite difference solution of the complete Navier-Stokes equations. Because the program is based on the fundamental laws of mass, momentum, and energy conservation, it can be applied to almost any type of flow process.



Task 4 – Final Design (60 Percent)

Task 4.1 – Final Design Report

With comments by IRWD, the TAG, and DSOD on the PDR and 30% Design Package, AECOM will prepare a Final Design Report (FDR) that will define the final technical requirements and parameters, including all underlying technical memoranda, representing a thorough basis of design for all project features. Final design will immediately proceed following the submittal of the Revised Draft PDR to the District, reducing the overall time needed to advance the design to the 60% level. All comments received from DSOD's review of the PDR will be addressed prior to submittal of the Draft FDR. The FDR will update and expand upon the analyses summarized in the technical memoranda

prepared in the PDR. The FDR will include all detailed final analyses that form the design basis for the Project, will include any needed revisions to the PDR, and will incorporate appropriate responses to all PDR review comments. Each technical memorandum included in the FDR will be stamped by a California-registered Professional Engineer. It is our understanding that IRWD will submit the FDR to DSOD and the TAG for review.

Instrumentation

In addition to the content of the PDR, we plan to integrate a thorough discussion of geotechnical instrumentation in the FDM's Embankment Dam Design TM. Instrumentation and well-planned instrumentation monitoring are extremely valuable for dam safety. Without instrumentation, the dam owner has to rely on what is observed at the ground surface, at which time, the dam conditions may be significantly out of the range of stability design assumptions.

Instrumentation can provide:

- An early warning of problems. Instrumentation allows the collection of quantitative data. The data can help in the detection of subtle trends in deformation, seepage, and dam embankment or foundation pore pressures that may develop over time.

For example, changes in normal pattern of seepage flow, that may not be noticeable by visual inspections. Increase in phreatic surface in the downstream shell that may impact the stability of the dam.

- Verification of expected behavior. Instrumentation is often designed to have expected behavior. Settlement points are placed on the crest and monitor to verify that consolidation settlement is within the expected ranges. Piezometers above the drainage blanket are designed to always return a dry status. Instrumentation can provide verify design assumptions and provide peace of mind that the dam is performing as designed.

AECOM (and its legacy companies) has designed instrumentation for multiple dams across the country. Some of the local dams include Trampas Canyon Dam, Los Vaqueros Dam, Calaveras Dam, Los Angeles Dam, and Santa Anita Debris Dam.

Geotechnical instrumentation for monitoring the performance of the proposed Syphon Dam is an important component of the design. New monitoring instrumentation will consist of the following types:

- Survey monuments
- Inclinometer
- Seepage weir(s)
- Piezometers
- Reservoir level sensor
- Strong-motion accelerographs
- Weather station

VALUE ADDED

This team will bring our lessons learned from recently completed projects (Trampas Reservoir and Calaveras Dam) to deliver a comprehensive set of plans and specifications and minimize construction issues.

The instrument types and their function in monitoring Syphon Dam are described in the following paragraphs.

Survey Monuments

These monuments will be located at multiple locations on the new embankment, including the crest. Survey monuments will measure deformation, including consolidation settlement of the embankment. The monument data will provide a check on whether the embankment settlement conforms to design expectations. Survey monuments will provide consistent, identifiable points that will be manually measured by surveyors in successive campaigns to measure the shape of the dam embankment in three dimensions (four, counting time).

Inclinometer

An inclinometer casing will be placed along the maximum section of the new embankment. An inclinometer probe will be used to manually survey the casing. The probe will measure lateral deformation from the ground surface to the inclinometer tip elevation. Surveying of the casing top will be included as part of the surveying program.

Seepage Weir(s)

One or more v-notch seepage weirs will be installed downstream of the dam to measure the embankment and foundation seepage. Seepage can be segregated by partitions within the embankment drain zones and measured by individual seepage weirs. This allows for monitoring of specific sections within the embankment. Due to the two formation types in the dam foundation, having two seepage weirs may be helpful for a more informative system. The exact number of seepage weirs will be determined during design based on discussions with IRWD. The weir(s) will be instrumented with vibrating wire buoyant weight transducers.

Piezometers

This instrument type will monitor the hydrostatic (water) levels in the embankment, foundation and downstream of the embankment. Water levels and how they change with time are important geotechnical data that provide a check on whether the as-built structures conform to design expectations. Water levels within an embankment dam are affected by changes in the reservoir water surface elevation (seasonal) as well as earthquake shaking. Piezometers will be of the Casagrande Open Standpipe

Instrumentation is a key element in safe operation of the dam and reservoir. Our designs include the latest technology approved by DSOD.

type where a defined interval of slotted plastic pipe is set in a sand pack with a seal above the interval and the remainder of the plastic pipe is blank (no slots). Electronic pressure transducers suspended inside the piezometer casings will provide the ability to measure the water levels automatically.

Reservoir Level Sensor and Staff Gages

Monitoring the reservoir water elevation is one of the most important geotechnical measurements. The reservoir elevation drives the embankment water levels, an important determinant of the performance of the dam. The reservoir level sensor will consist of a pressure transducer placed in the reservoir. Reservoir level staff gages will be mounted on the upstream embankment slope. The staff gages will be a backup to the pressure transducer and will allow for visual observation of the reservoir level from the dam crest.

Strong Motion Accelerographs

These instruments measure and record the accelerations in three components (X-Y-Z) that the embankment undergoes during earthquakes. The accelerographs are typically placed near the maximum section at the crest and at an abutment. The strong motion accelerographs will be self-contained units containing sensors and a standalone recording system that is triggered at the onset of earthquakes.

Weather Station

Weather stations have become highly accurate and affordably priced and provide significant value to dam monitoring. The weather station can monitor temperature, wind speed and direction, and rainfall. Monitoring of atmospheric values is important because they can help evaluate instrumentation response to atmospheric changes. We note that IRWD currently has a weather station at all five of its DSOD-jurisdictional dams; we could review the capabilities and condition of the unit installed at Syphon Canyon Dam and provide an opinion on the advisability of replacing it.

Automated Data Acquisition System (ADAS)

The incorporation of ADAS systems in the design of new instrumentation system is typical practice. They allow for automatic monitoring, which can trigger alarms if set thresholds are exceeded. The piezometers, reservoir level sensor, seepage weirs, and accelerographs will all be monitored by specialized field computers that will provide remote access to collected data and real-time readings. The survey monuments and the inclinometer will be the only manually monitored geotechnical instruments.

The instrumentation systems described above are not only required by DSOD but are likely to be appreciated by downstream residents in that they know the dam is thoroughly monitored for safety.

Instrumentation is only as valuable as the monitoring and maintenance plan in place. Instrumentation should be maintained to ensure reliable data. AECOM not only has designed instrumentation for the various dams but has also performed multiple instrumentation condition assessments for agencies. The assessments often find lapse in maintenance, not only reducing the life of the instrument, but causing unreliable instrumentation data. AECOM is committed to not only designing the proper instrumentation, which can reduce the reliance in maintenance, but providing guidelines on monitoring and maintenance.

Deliverables

- ☑ Final Design Report (Draft)
- ☑ Final Design Report (Final)

Task 4.2 – 60% Design Package

With comments by IRWD, the TAG, and DSOD on the PDR and the 30% Design Package, AECOM will prepare construction plans commensurate with the 60% design level (nearly all plan sheets except a few detail sheets), a draft Project Manual based on the table of contents provided with the 30% design package, and an opinion of probable construction cost (OPCC) that meets the definition of AACE Class 3 cost estimate. 60% design will immediately proceed following the submittal of the Final 30% design package to the District, reducing the overall time needed to advance the plans, specs and construction cost estimate to the 60% level. All comments received from DSOD's review of the Final 30% design package will be addressed prior to submittal of the Draft 60% design package. This results in a four-months schedule savings for this design milestone compared to the RFP.

We will prepare the 60% Design Package to meet the content and format requirements described under Task 4.2 on RFP page 19 of 28.

It is our understanding that IRWD will hold the second risk workshop after completion of the 60% design package in order to analyze and evaluate key potential failure modes and associated risks. It is our understanding that IRWD will prepare a formal presentation, meeting agenda, and meeting minutes for each workshop. AECOM's lead designer, engineering geologist and/or lead engineers/ designers appropriate to the subject matter will participate in this multiday meeting, providing our input and interacting with the IRWD and the risk assessment team.

AECOM will respond to and address IRWD comments and submit a revised package to be transmitted to DSOD and TAG.

Deliverables

- ☑ 60% Construction Plans (Draft)
- ☑ 60% Construction Plans (Final)
- ☑ Project Manual (Draft)
- ☑ Project Manual (Final)
- ☑ Opinion of Probable Construction Cost (AACE Class 3) (Draft)
- ☑ Opinion of Probable Construction Cost (AACE Class 3) (Final)

Task 4.3 – Construction Schedule and Sequencing Plan TM

AECOM will prepare a detailed construction schedule in Microsoft Project based on the 60% Construction Plans, including all phases of work from mobilization and staging to commissioning and testing, including all key milestones and critical sequencing considerations. A conceptual-level construction schedule will be developed to assess the total estimated construction duration. The schedule will show the main construction activities for the dam and appurtenant works.

Duration estimates for the various construction operations will be based on experience on other projects and, where applicable, on the estimates used to develop construction costs. Factors that would affect the actual duration of the project include the actual timing of Notice to Proceed (NTP) and the start of construction, adverse weather, the reservoir stage at the time of NTP, and working hour restrictions.

The schedule will provide a description of the main elements of work assessed to constitute the critical path for construction together with major elements of the work that are not on the critical path. The schedule will show the interrelationship between work activities and can be used to assess construction logistics and to identify potential constraints on construction.

Deliverables

- ☑ Construction Schedule and Sequencing Plan (Draft)

Task 4.4 – Noise Model and Evaluation TM

AECOM will review relevant available preliminary Project documents and develop a detailed data needs and assumptions list for the engineering teams. We will also check for updates of State, county, and municipal (City of Irvine) laws, ordinances, regulations, standards (LORS), and guidance that may influence the assessment of noise impacts.

Using 3-D predictive modeling, AECOM will predict noise emissions from the Project resulting from operation of the proposed Project facilities which will include all major noise-generating features associated with the replacement strainer facility, replacement disinfection facility, new dechlorination facility, and replacement reservoir aeration system. Facility noise modeling will predict the operation of both outdoor and housed (i.e., considering building penetrations or unit enclosures) equipment including but not limited to HVAC systems, vertical pump units, feed pumps, air compressors (motors), filtration disk backwash events, electrical systems, and any other notable noise sources identified by the engineering team.

AECOM will determine the adverse noise effects based on the applicable noise standards. If an exceedance of applicable LORS is identified, AECOM will determine conceptual mitigation measures (e.g. interior acoustical treatments, enclosures, noise barriers, etc.) that, if installed, would be expected to bring Project operations into compliance.

AECOM will prepare a draft preliminary noise technical report that incorporates the data, analysis, findings, and recommendations resulting from the performance of Tasks described above. This preliminary report will reflect available data and information associated with 60% Design of the Project facilities and will identify all noise mitigation features required to ensure compliance with applicable LORS. Presented analysis results detail will include tabulated predicted sound levels at nearest NSR locations in the surrounding community and figures featuring noise level contours superimposed on available aerial mapping imagery of the project site and surroundings.

Deliverables

- ☑ Noise Model and Evaluation (Draft). Final provided in Task 5.3.

Optional Task 4.5

Noise Model Baseline

Measure Existing (Baseline) Ambient Outdoor Sound Levels. Should IRWD anticipate opposition to the Project from adjacent land uses and/or potential noise complaints regardless of compliance, AECOM recommends the collection of baseline ambient noise levels at noise-sensitive receptor locations. AECOM will conduct unattended long-term (48-hour period) sound level monitoring at or in proximity to up to three (3) nearest noise-sensitive receptors (NSR) or property lines in the vicinity of the proposed Project facilities to help characterize the outdoor ambient sound environment and document the associated environmental conditions (e.g., weather, observed or perceived audible sound sources or activities, etc.)

Optional Task 4.6

Detailed Construction Noise Study

Measure Existing (Baseline) Ambient Outdoor Predict Project Construction Noise. The Project is expected to require multiple years of continuous construction of varying intensity. The City of Irvine Code of Ordinances allows construction to occur during certain daytime periods and without quantified noise level limits during such times. Therefore, construction noise is rarely an issue for typical IRWD construction projects in the City. However, due to the potential for long-term exposure to construction noise during what may be ongoing work-from-home conditions for many residents in the adjacent residential development, AECOM recommends that a construction noise analysis is conducted. This analysis would utilize 3-D modeling of the existing reservoir site to analyze noise generated by up to four (4) of the worst-case construction phases and predict the potential noise levels received at nearby noise-sensitive land uses. Due to the size, scope, and terrain in the existing project area, mitigation in the form of temporary noise barriers may not be feasible. Thus, this analysis will be relegated to identifying critical construction noise-intensive phases for informational purposes and recommendations of conceptual approaches to reducing construction noise and/or negative responses from the surrounding community. The results of the analysis and conceptual recommendations will be provided in a concise technical memorandum.

Task 5 – Final Design (90 Percent)

Task 5.1 – 90% Design Package

With IRWD, TAG, DSOD, and risk assessment team comments on the 60% design package, AECOM will prepare construction plans commensurate with the 90% design level (all plan sheets, including all details), a complete Project Manual, and an opinion of probable construction cost (OPCC) that meets the definition of AACE Class 2 cost estimate. 90% design will immediately proceed following the submittal of the Final 60% design package to the District, reducing the overall time needed to advance the design to the 90% level. All comments received from DSOD's review of the 60% design package will be addressed prior to submittal of the Draft 90% design package. This results in a four-months schedule savings for this design milestone compared to the RFP.

We will prepare the 90% Design Package to meet the content and format requirements described under Task 5.1 on RFP page 20 of 28.

AECOM will respond to and address IRWD comments and submit a revised package to be transmitted to DSOD and TAG.

Deliverables

- ☑ 90% Construction Plans (Draft)
- ☑ 90% Construction Plans (Final)
- ☑ Project Manual (Draft)
- ☑ Project Manual (Final)
- ☑ Opinion of Probable Construction Cost (AACE Class 2) (Draft)
- ☑ Opinion of Probable Construction Cost (AACE Class 2) (Final)

Task 5.2 – Final Construction Schedule and Sequencing Plan TM

The 60% construction sequencing plan will be further developed based on the final construction drawings. The sequence plan with incorporate engineering requirements and permit considerations for the Project. Engineering requirements will include safe excavation practices (stability of temporary and final slopes), dewatering approaches (dewatering timeline), optimization of the handling and managing of site soils (minimize double handling of soils), lead time for critical components (valves and control systems), availability and delivery of materials (e.g. filter, drain and riprap), whether constraints and water management during construction, productivity during construction, optimize the size of construction areas to minimize erosion, and other requirements. Permit considerations will include permit constraints and timing of construction, water quality requirements, permit limits, noise and air quality requirements.

VALUE ADDED

Our team has successfully completed four recent noise studies for IRWD and is very familiar with the noise regulations in Irvine.

The construction sequence will be developed using 3D surfaces to identify potential stability or conflict issues. The construction sequence will illustrate the progression of the work from the start of the project through completion. The construction sequence will be developed in close coordination with IRWD. When completed the construction sequence will be used to prepare the construction schedule for the project. The construction schedule will be prepared using Microsoft Project software.

Deliverables

☑ Construction Schedule and Sequencing Plan (Final)

Task 5.3 – Final Noise Model and Evaluation TM

Using the latest site designs, equipment schedule, and comments received by IRWD and other parties on the 60% design noise technical report, we will update the 60% predictive noise model to evaluate final operational noise levels. By way of revisions to the draft 60% noise report submitted for Task 5.2, we will update the noise technical report to include the results of the final noise modeling, including but not limited to final noise mitigation requirements, tabulated results, and noise contours maps.

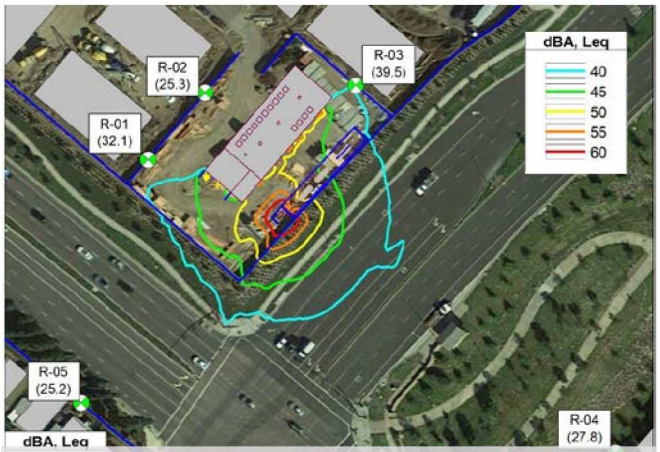
AECOM noise specialists will assist the engineering team in the development of concise Contract Documents to ensure compliance with the applicable LORS (e.g., Irvine Code of Ordinances).

Deliverables

☑ Noise Model and Evaluation (Final)

Task 5.4 – Geotechnical Baseline Report

As part of the 90% design AECOM will prepare a Draft Geotechnical Baseline Report (GBR). The GBR will be an interpretive report that will establish anticipated (or to be assumed) geotechnical conditions for all project major features—dam embankment, spillway structure, Inlet/Outlet structure, outlet conduit, treatment facilities, planned access roads, and environmental mitigation areas. The GBR will include contractual statements, referred to as baselines, that are clear, concise, and quantifiable. The baselines will serve as the basis for bidding and constructing the Project and for resolution of disputes related to differing site conditions (usually



Noise Study from IRWD Eastwood RW Pump Stations

conditions that are more adverse than those described, but sometimes more favorable conditions give rise to changed conditions claims).

The principal purpose of the GBR will be to establish realistic baselines to provide all contractors with a single contractual interpretation that can be relied upon for preparation of their bids. The GBR will also inform the contractor of the geotechnical considerations that formed the basis of the design and enhance their understanding of Project constraints. Furthermore, the GBR will provide guidance to IRWD and its Construction Management team in administering the contract and monitoring contractor performance.

Typical baselines provided in the GBR will be regarding the bedrock rippability, amount of stripping required, depth of alluvium, groundwater levels and seepage quantities in Project excavations, borrow material characterizations and quantities. The GBR will be more than a collection of baselines. The report will present a comprehensive geologic/geotechnical interpretation that will be discussed in adequate detail to communicate these conditions to the bidders. The GBR will refer to the geotechnical data presented in the Geotechnical Data Report and will provide the rationale for the baselines. The GBR will contain a thorough explanatory text and a full suite of geologic figures (e.g., geologic maps and geologic cross sections), and summary tables to provide a comprehensive overview of the conditions. With this background the bidding contractors and the selected contractor will have a better understanding of the key Project constraints, and important requirements in the contract plans and specifications that need to be identified and addressed during bid preparation and construction.

Deliverables

☑ Geotechnical Baseline Report (Draft)

We will submit copies of each deliverable in the format and number specified on RFP page 21 of 28.

Task 6 – Final Design (100 Percent)

At the 100% stage AECOM will perform engineering analyses and calculations and prepare design documents required for the 100% design. The 100% design documents will include the final GBR and the 100% design level construction plans, Project Manual, and opinion of probable construction cost.

Task 6.1 – 100% Design Package

With IRWD, TAG, and DSOD comments on the 90% design package, AECOM will prepare construction plans commensurate with the 100% design level (all plan sheets, including all details), a complete Project Manual, and an opinion of probable construction cost (OPCC) that meets the definition of AACE Class 1 cost estimate. 100% design will immediately proceed following the submittal of the Final 90% design package to the District, reducing the overall time needed to advance the design to the 100% level. All comments received from DSOD's review of the 90% design package will be addressed prior to submittal of the Draft 90% design package. This results in a four-months schedule savings for this design milestone compared to the RFP.

We will prepare the 100% Design Package to meet the content and format requirements described under Task 6.1 on RFP page 21 of 28.

AECOM will respond to and address IRWD comments and submit a revised package to be transmitted to DSOD and TAG.

Deliverables

- ☑ 100% Construction Plans (Draft)
- ☑ 100% Construction Plans (Final)
- ☑ Project Manual (Draft)
- ☑ Project Manual (Final)
- ☑ Opinion of Probable Construction Cost (AACE Class 1) (Draft)
- ☑ Opinion of Probable Construction Cost (AACE Class 1) (Final)
- ☑ Final Reproducible Bid Set (1 copy)

Task 6.2 – Geotechnical Baseline Report

Following review of the Draft GBR (Task 5.4) by IRWD and the TAG, the design team will prepare the Final GBR, which will establish a contractual understanding (interpretation) of the geologic/geotechnical site conditions. The review of the Draft GBR should focus on verifying that statements in the GBR are compatible with the elements and provisions of other Contract Documents.

Deliverables

- ☑ Geotechnical Baseline Report (Final)

We will submit copies of each deliverable in the format and number specified on RFP pages 21 of 28.

Optional Task 6.3a

Initial Reservoir Fill Plan

The objective of this optional Task is to develop an Initial Reservoir Fill Plan to guide monitoring and filling procedures for the initial filling of the Syphon Reservoir. The Plan will be a stand-alone document that will be a companion to the Syphon Reservoir Emergency Action Plan (EAP) and the proposed M&O plan (M&O). The Initial Reservoir Fill Plan will cover filling sequence, timeline for filling, restrictions (target hold elevations), visual inspections, instrument monitoring as well as data collection and reporting protocols. Three target hold elevations are anticipated at this time: 1/3, 2/3 and full elevations. At each of these target hold elevations fill will be paused to assess the performance of the dam.

Inspection procedures and frequencies of inspections during the initial filling of the reservoir will be included as well as inspection lists for each of the different features and structures (dam, spillway, mechanical equipment, etc.) of the project. Maintenance and operation procedures that are specific to the initial filling period will also be included in the Plan.

The Plan will facilitate the correlation and evaluation of monitoring data with performed filling activities and reservoir levels. Pre-determined expected threshold values for key monitoring parameters (piezometer levels, settlement, etc.) will be included in the Plan to help with the evaluation of the data. The Plan will provide IRWD with the tools to develop a well-documented baseline response to the filling of the reservoir. This in turn will help evaluate/validate design assumptions; long term performance of the dam; and adjust maintenance and operation procedures, as needed. The proposed preliminary Table of Content for the Initial Filling Plan is as follows,

1. Introduction
2. Organizational Roles and Responsibilities
3. Description of the Dam and Appurtenant Structures
4. Reservoir Filling and Restrictions
5. Visual Inspections
6. Instrument Monitoring
7. Expected Data Readings and Dam Performance
8. Data Evaluation and Reporting
9. References

Optional Task 6.3b

Maintenance and Operation Plan

This optional task consists of the preparation of the Maintenance and Operational Plan (M&O) for the project. The M&O Plan will outline maintenance and operation requirements to efficiently operate and maintain the facility for the intended use and to maximize the life project structures and systems. Safety of the dam will be given the highest priority throughout the plan to minimize the risk of failure. The Plan will be coordinated with the Emergency Action Plan to provide guidance for the identification and reporting of conditions that may adversely affect the operation, maintenance or safety of the dam.

The O&M Plan will cover the post filling maintenance and operation of the reservoir, dam, I/O works (conduits/valves), spillway, water treatment plant, instrumentation, power and control system and site civil works. The M&O Plan will be stand alone document that will include catalogs and specific O&M manuals provided by the manufacturers of the installed equipment.

The dam and the spillway will be designed to operate without human intervention. However, both structures will require periodic inspections. Maintenance will include remedying erosion, removing vegetation, filling animal holes and addressing other embankment and structural disturbances. Inspection lists will be prepared to facilitate identification of sloughs, slumps, bulges, depressions, cracks, settlement, seepage or other irregularities.

The plan will discuss essential overall (integrated) inlet/outlet works operation, shutdown and flooding. This overall discussion will be followed by more detail discussions of the individual components of the inlet/outlet works covering start-up, operation, exercising, inspection, maintenance, and troubleshooting of the I/O structure and control house; and I/O conduits, valves and controls. Manufacturer O&M manuals for the major and specialized equipment (e.g., valves, gate motor operators, power, instrumentation and controls) will be provided under a separate volume.

The M&O plan will be coordinated with the water treatment plant O&M manual to address the integrated operation of the I/O works and the water treatment plant. The water treatment plant O&M manual will be a standalone document attached to the M&O plan.

Maintenance, operation and troubleshooting of the data acquisition and supervisory control; and the dam instrumentation systems will be discussed in detail to ensure the proper operation and reliability of both systems. Monitoring frequency of the dam instrumentation system will be specified to monitor the dam for signs of potential issues.

The proposed preliminary table of contents for the M&O plan is presented below. This table of contents will be refined and updated during the design and construction phases of the projects.

Volume 1- Maintenance and Operation Plan

1. Introduction and Project Description
2. Organization and Responsibilities
3. Operation, Inspection and Maintenance
   a. Dam
   b. Spillway, stilling basin and outflow conduit
   c. I/O Structure and Control House
   d. I/O Conduits, valves and Controls
   e. Water Treatment Plant
   f. Supervisory Control and Data Acquisition
4. Dam Observation and Instrumentation
5. Documentation and Reporting
6. References

Volume 2 – Manufacturer Maintenance and Operation Manuals

Pump Install at Trampas

Task 7 – Miscellaneous Tasks

Task 7.1 – Technical Advisory Group Workshop Participation

It is our understanding that IRWD will assemble a Technical Advisory Group (TAG) to review key design deliverables and discuss key technical issues. IRWD plans to convene the TAG at three key points in the design process to review and discuss (1) the Preliminary Design Report and 30% design deliverables, (2) the Final Design Report and 60% design deliverables, and (3) the 90% design deliverables. Each TAG review workshop will last 2 days.

AECOM's design leads will play key roles at the three 2-day TAG review workshops, presenting and discussing the design documents developed at that time. Preliminarily we plan for the design lead to attend each workshop in its entirety. The lead engineering geologist for the Project and/or feature design leads would attend appropriate sessions according to the subject matter.

After each workshop AECOM will provide workshop minutes. AECOM will incorporate feedback and comments from the TAG—as agreed upon between AECOM and IRWD in separate discussions—into the 60%, 90% and 100% design.

Workshop	Description
Present and discuss PDR and 30% Design with TAG	Two-day workshop
Present and discuss FDR and 60% Design with TAG	Two-day workshop
Present and discuss 90% Design with TAG	Two-day workshop

Deliverables

- ☑ TAG Workshop presentations and meeting notes with action items

Task 7.2 – California Division of Safety of Dams (DSOD) Coordination

AECOM has found that the best way to work with DSOD is to communicate regularly and openly. AECOM suggests IRWD provide DSOD with the design schedule early in the design phase, identifying when deliverables will be transmitted for DSOD's review. The key to maintaining the overall schedule will be adhering to this schedule. AECOM's design schedule is color-coded to simplify this communication with DSOD, so they can easily see how their reviews fit into the overall Project schedule. Additionally, sending reminder emails to DSOD that a deliverable is forthcoming and scheduling an in-briefing call after the deliverable is received will kickstart their review. Another key is determining if DSOD has any initial questions or if they require supplemental documents or references to support their review. Regular check-ins (polite emails or quick phone calls) throughout the DSOD review period will help keep the deliverable near the top of their work pile. Our proven approach to interfacing with DSOD promotes timely and cost-effective completion of the Project's design and construction. The following table outlines our scheduled meetings and presentations with DSOD. Preliminarily, we plan for the design lead, one of the feature design leads, as appropriate for the subject matter, to attend the DSOD workshops, in **Exhibit 1-27**.

Deliverables

- ☑ DSOD Workshop presentations and meeting notes with action items

VALUE ADDED

Adhering to the design schedule and frequent communication is key to obtaining DSOD approvals on time.

Exhibit 1-27. Scheduled Meetings and Presentations with DSOD

Meeting	Purpose and Benefits
Design Criteria and Approach review meeting	Enables DSOD to provide input on basis of design, design criteria, and proposed analysis methods before detailed engineering begins Minimizes potential for having to "re-do" work
PDR and 30% Design deliverables review meeting	Enables DSOD and the Project team to have a common understanding of items in advance of DSOD plans and specifications review
FDR and 60% Design deliverables review meeting	Minimizes time required for DSOD review of final design and the potential for additional "re-do" work
90% Design deliverables review meeting	Minimizes time required for DSOD review of final design and the potential for additional "re-do" work

Task 7.3 – Risk Workshop Participation

We understand a risk-informed design approach does not replace the need for traditional deterministic analysis and criteria, but rather informs where more- or less-stringent criteria may be warranted and to guide components of the design that are not adequately informed with traditional design standards-based criteria. Our experience in applying risk analyses to design and our appreciation of its benefits from the designer's perspective, will enable the AECOM team to be a proficient partner to IRWD in implementing RIDM into the design of the Syphon Reservoir Project. We will leverage our experience in performing design-stage risk analyses to develop a design analysis plan that facilitates a risk-informed approach that goes beyond traditional analyses. This will include performing analyses from a probabilistic framework to develop design fragility (system response) curves over a full range of loading to inform design-phase risk analyses. We will also use the results of the probabilistic-based design analyses to better portray and understand how uncertainties may influence the overall risk of the structure. Through this, risk-informed decisions can be made to either reduce the uncertainty or design to address the uncertainty. In addition to our team participating in the two planned risk workshops conducted by IRWD, the following list includes examples of analyses and approaches that our team will implement in relation to applying RIDM into the design of the Syphon Reservoir Project:

- Probabilistic fault displacement analysis
- Probabilistic seismic shaking levels for events at varying return periods including time histories
- FLAC and QUAD4 seismic displacement analysis for seismic events with a range of return periods
- Hydrology and hydraulics analyses evaluating flood and pool levels with varying combinations of return periods
- Sensitivity analyses for strength parameters and safety factors
- Filter and drain design to lower the risk of piping under normal, flood and seismic conditions
- Evaluation of alternatives for design that consider risks of failure in addition to deterministic standards

VALUE ADDED

Incorporating RIDM into Design – Reduces Risk and Improves Safety.

It is our understanding that IRWD has adopted a risk-based approach to the Project and will implement the concept of Risk-Informed Decision Making into the design. IRWD will assemble a risk assessment team and conduct and facilitate two 5-day risk workshops during the design phase. The first workshop is anticipated to be held prior to the development of the Dam and Appurtenant Structures Design Criteria and Technical Approach Memorandum. The second workshop is anticipated to be held after completion of the 60% design package such that key potential failure modes and associated risks can be analyzed and evaluated. AECOM will participate in both workshops and our lead designer, engineering geologist and/or lead engineers/designers appropriate to the subject matter will participate in this multiday meeting, providing our input and interacting with the IRWD and the risk assessment team. In general, we anticipate having two representatives in attendance over the course of the 5-day workshops.

Workshop	Description
Risk Workshop prior to development of Design Criteria and Technical Approach Memorandum	Five-day workshop
Risk Workshop following development of FDR and 60% Design	Five-day workshop

Task 7.4 – Construction Documents for the Portola/Sand Canyon Intersection

AECOM will develop a stand-alone construction package for the modifications to the Portola Parkway and Sand Canyon Avenue intersection. The modifications will provide a fourth leg to the existing tee intersection and provide a new entrance to the Syphon Canyon Dam site. The existing street intersection elevation is lower than the existing access road leading into the dam site, so grading and retaining walls will be required to provide a usable entrance. It is assumed that this construction package will include modifications needed to add the fourth intersection leg as well as construct approximately 300 feet of the new access road and tie into the existing road. See **Exhibit 1-11** at Task 3.2.6, Construction Access, Contractor Staging, and Temporary Utilities TM, for a plan view of the intersection and access road.

In addition to the construction bid documents, AECOM will also prepare a Project Manual for the intersection work, and an opinion of probable cost for the modifications for each submittal.

The specific improvements to be included consist of:

- Add or replace signal poles and mast arms on the southeast and southwest corners facing eastbound Portola Parkway traffic and southbound Sand Canyon traffic respectively;
- Add pedestrian crossing to western leg of intersection including curb ramps, striping, and pedestrian crossing equipment to signals;
- Modify signal equipment such as signal heads, detectors, controller;
- Add left turn pocket to eastbound Portola Parkway;

- Grade entrance location and provide retaining walls to join existing intersection grades with access road;
- Establish new 30-foot access road and join existing access road approximately 300 feet from east portion of intersection;
- Modify drainage components in order to tie-in to existing systems along the new access road and for the new leg of the intersection;
- New curb returns and sidewalk modifications on new leg; and,
- Modify striping and signage.

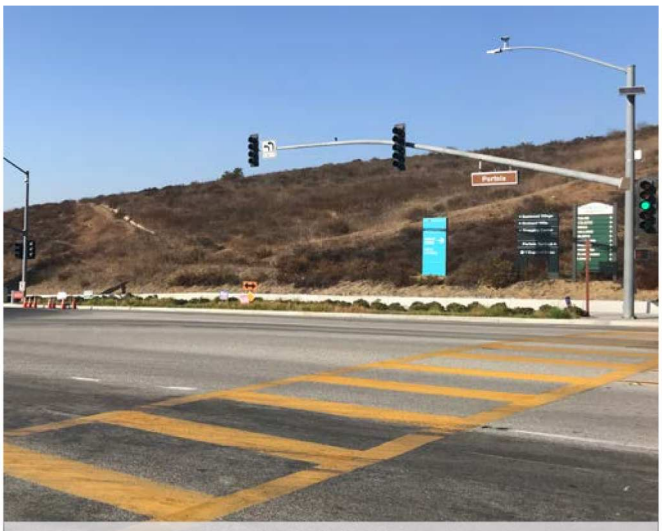
The proposed modifications will be reviewed and approved by the City of Irvine Public Works department staff. Approved plans and permits are scheduled for December 2021 in order to advance this work and have the new entrance completed and usable for the dam construction. This project is one of the first orders of work and we recognize the importance of staying proactive and obtaining approvals. We will follow City of Irvine design standards and assume that IRWD is contracting out the project, so IRWD standards and procedures will be implemented.

There are several key elements that will influence the design of the project. These include:

- A high volume of trash hauling and other trucks on northbound Sand Canyon Avenue to westbound Portola parkway
- There will be a high volume of haul trucks utilizing the new entrance to the dam site during construction of the dam
- Pedestrian traffic uses this intersection and crosses from Crean Lutheran on the southeast quadrant to the athletic fields along Portola Parkway northwest of the intersection

Our team will provide a SYNCHRO analysis of the intersection to determine operational characteristics of the existing condition, future condition (after the dam construction), and during construction of the dam. The data listed as key issued will be utilized and accounted for in the analyses. This information will help us determine the effects of the new leg, the effect of shifting N-S pedestrian traffic from the east side of the intersection to the west leg to reduce pedestrian/haul truck conflicts, and the length of turn pockets.

It is anticipated that an 8-phase operation of the intersection will allow for N-S pedestrians to be shifted to the west leg during construction of the dam thereby reducing ped/truck conflicts. However, the large volume of left turns from northbound Sand Canyon to westbound Portola combined with a pedestrian phase also crossing that leg of the intersection will need to be carefully analyzed since there will be competition for green time across that leg. After dam construction is complete, volumes to and from the new entrance will be low and the pedestrian crossing on the west leg could be removed and shifted back to the east leg. That is something we will explore during design.



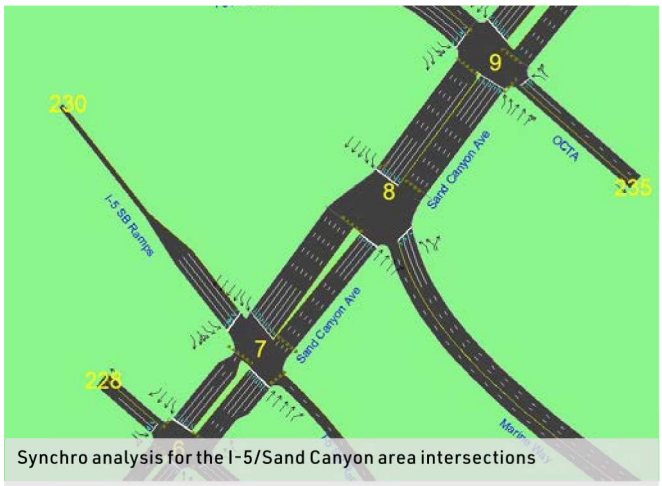
Using our in-house local experts, we prepared intersection improvement design concepts specifically for this project.

City of Irvine approvals are critical to this task and we will schedule a kick-off meeting with City staff immediately upon NTP. Our team will also engage the utility companies early on to determine the extent of existing utilities and whether any conflicts exist. We reviewed the intersection and developed an early layout of the fourth leg and access road alignment and believe the major utilities in the intersection can be avoided. Some of the drainage facilities will be modified so until the utility base maps are obtained and plotted, the status of conflicts is speculative.

Installation of a left turn pocket for eastbound Portola Parkway motorists to enter the site will involve modifying the center median to accommodate the lane. Adequate width exists in the median for the turn pocket but truck turning templates are required to confirm that trucks are able to negotiate the turn. The left turn into the dam site is essentially a 180-degree change in direction from Portola Parkway to the access road so careful study is required.

Pedestrians and bicyclists will have to be accommodated during construction of the intersection, the dam, and during subsequent permanent operations. During our field review we noted cyclists and pedestrians in the area. Accommodating all users of the intersection and adjacent facilities is very important and we will account for pedestrians, bicyclists, and motorists during all stages of the intersection construction and dam construction.

Trucks entering and exiting the site from the access road will have a tight radius from the access road into the intersection. The grading will be evaluated and retaining walls are planned to provide the room needed for opposing traffic to negotiate the access road and intersection from the various directions, and to accommodate grade differences that exist at the intersection between the access road and the streets.



Synchro analysis for the I-5/Sand Canyon area intersections

We will review the construction timeline and consider whether advanced purchase of the signal poles is worthwhile since pole procurement can be time consuming and may be the critical path for this first portion of work.

Approvals from the City of Irvine will be critical and coordinating with staff early is key. Having a 90% and 100% submittal reduces the duration of review times, but we will hold progress meetings with staff during design to vet the design and reduce the chances for delays during the formal plan reviews.

Activities planned for this task include the following:

- SYNCHRO analysis of the intersection for existing condition, after dam construction, and during dam construction
- Drainage calculations for the connection of the ditches along the existing access road. An overall analysis of the trunk lines or hydrology analysis of the basin is not included. A letter format with a brief discussion of the findings will be included.
- WQMP/stormwater analysis of project area
- Prepare plans and specifications to City of Irvine standards. 90% and 100% packages will be submitted to the City. Review times for each package are assumed to be 4 weeks.
- See Plan Sheet list for the specific sheets included
- Develop Traffic Control plans for the project
- Develop detour plans for pedestrians and bicyclists
- Prepare technical specifications
- Prepare Project Manual
- Obtain City of Irvine encroachment permit; permits from Resource agencies are not included.
- Prepare utility base map; identify utility conflicts with improvements; no utility relocations or designs are assumed

Other Assumptions:

- Pavement studies are not included but could be added to the scope and budget if needed
- Public meetings or hearings are not required for this work
- The entire signal for the intersection will not require replacement or upgrade
- Only curb ramps directly affected by the construction will be replaced and included in plans
- Existing pavement within and approaching the intersection includes some distress. Pavement studies are not included. With a high volume of haul trucks, a pavement study or inventory may be warranted, and AECOM can assist if needed, however it is currently not included.
- It is assumed that environmental clearance of this is included in environmental document for the dam reconstruction and a separate environmental clearance is not required.

Deliverables

- ☑ 60% Construction Plans (Draft)
- ☑ 60% Project Manual (Draft)
- ☑ 60% Opinion of Probable Constuction Cost (AACE Class 2) (Draft)
- ☑ 90% Construction Plans (Draft)
- ☑ 90% Project Manual (Draft)
- ☑ Opinion of Probable Construction Cost (AACE Class 2) (Draft)
- ☑ 100% Construction Plans (Draft)
- ☑ 100% Project Manual (Draft)
- ☑ 100% Construction Plans (Final)
- ☑ 100% Project Manual (Final)
- ☑ Opinion of Probable Construction Cost (AACE Class 2) (Final)

Task 7.5 – Environmental Mitigation Coordination

Early coordination with the environmental mitigation consultant will be a priority at the start of the Project. The environmental mitigation features and requirements impact grading and temporary and permanent access throughout the site. In addition, provisions need to be incorporated for water supply, power and O&M requirements for these areas. Understanding the woodland riparian habitat requirements is important as rough grading of these areas should be performed prior to starting excavation of the side slopes (Side slope excavations should proceed from the top down). Similarly, the overall layout and grading of the wetland habitat area needs to be understood early in the design as they will impact the management of stockpiles and sequence of construction. Provisions for surface drainage of the woodland riparian habitat areas needs to be incorporated into the overall drainage of the site to safely convey runoff to lower elevations without impacting the finished side slopes. On the other hand, the wetland habitat areas require the incorporation of dikes and other features to prevent the draining of those areas during low reservoir levels. Understanding the environmental mitigation requirements from the start of the Project will avoid costly re-dos later in the design and help the team incorporate those requirements in the most cost-effective manner.

Early and close coordination of the work will also help the environmental mitigation consultant secure the required jurisdictional approvals for their design.

Task 7.6 – Environmental and Permitting Coordination

The Project must be designed, constructed and operated in full compliance with environmental and jurisdictional permits. To facilitate compliance a register of permit conditions and requirements will be developed for the Project. The register will be based on our review of the Project environmental documentation and permits. The register will be provided to IRWD's permitting team for your review and feedback and it will be distributed to the AECOM design team for use during the design. We plan to coordinate closely with IRWD' permitting team for updates on the permits and update the register accordingly. Similarly, we will provide technical support the permitting team for the permitting effort, as needed and authorized by IRWD. Permit information such as permit limits and conditions as well as EIR mitigation measures will be incorporated into the design and construction documents. In coordination with IRWD Project Management we will propose contractor penalties for non-compliance with the permit requirements. The register of permit conditions will facilitate IRWD review of the design for compliance with environmental permits and will document required design updates due to changes in permit conditions/requirements.

Task 7.7 – Public Outreach Coordination

AECOM will provide as-needed support with IRWD's public outreach efforts for the Project. We anticipate that support will include preparation of graphics and exhibits, review of outreach materials developed by others, and attendance at community meetings and/or public briefings.

Task 7.8 – NPDES Permit

AECOM will conduct groundwater discharge and land disposal discharge permitting services in accordance with the applicable for NPDES orders, including soil and water sampling. AECOM will prepare documents and drawings as required by the application processes for groundwater and soil waste discharge on behalf of the District. These include, but are not limited to, the Notice of Intent (NOI) packages and sampling and analytical services as required by the Orders. AECOM will collect and deliver water samples to an analytical laboratory for testing in order to comply with the sampling requirements of each Order. It is assumed the annual fee and NOI/NOT fees will be paid directly to the respective governing bodies by the District as the Legally Responsible Party (LRP).

Deliverables

- ☑ NPDES Permit Application Materials (Draft)
- ☑ NPDES Permit Application Materials (Final)
- ☑ Stormwater Pollution Prevention Plan (SWPPP) (Draft)
- ☑ Stormwater Pollution Prevention Plan (SWPPP) (Final)

Optional Task 7.9

Riparian Woodland and Wetland Mitigation Design

The development of the mitigation construction documents will be guided by a close review of the project site, its geotechnical and soil conditions, existing vegetation, hydrology, climatic conditions, slope aspects, and ecological functions. The mitigation design will focus on the restoration of ecological processes and functions on the banks of Syphon Reservoir by placing native, locally sourced native plants, pole cuttings and seed in the most appropriate microhabitats of the site, allowing them to thrive and expediently provide key riparian functions essential for compliance with agency imposed performance standards such as vegetation cover, shaded riverine habitat, wetland development, erosion protection, bank stabilization, nutrient cycling and production, habitat creation, water retention and many others.

The mitigation plans, specifications and construction cost estimate (PS&E) will include planting and seeding plans, legends and details; irrigation plans, legends, flow rate and pipe sizing calculations and details; cross-sections of typical soil profiles and proposed topography indicating pervious and impervious soil layers, slopes, berms and dikes and their dimensions based on engineering grading plans project needs. Plans will be drawn in the AutoCad format with engineering plans referenced in the background. AECOM will prepare a set of detailed specifications addressing each mitigation item, as well as develop a detailed landscape construction schedule closely aligned with the overall project schedule. The mitigation design work will be phased the same as the main project and will consist of the following phases – Project Data Review, Preliminary Design - 30%, Final Design - 60%, Final Design - 90%, and Final Design 100%. Each phase deliverable will first be provided as a draft for the District's review and then updated based on the District's comments and re-submitted to the District and submitted to DSOD.

During the 30%, 60% and 90% phases, AECOM will prepare and/or update a Mitigation Design Technical Memorandum that will present the approach to riparian and wetland habitat restoration, basis of design for this element and will include up to two coordination teleconferences with IRWD, ESA and the resource agencies if necessary.

Optional Task 7.9 *cont.*

Planting Plans

The riparian plants that will constitute the proposed planting zones will be selected from easy-to-establish, native plants that grow naturally both at the project site and in its vicinity. They will be grouped into three planting zones based on their water needs and vertical distance from the ground water table. The probability of plants growing under different wetland conditions has been extensively scientifically studied and is well documented by the plant species wetland status (USACE 2016) and water demands (WUCOLS IV - Regents of UC 2016). Another important environmental component of the plant selection will be their capacity to withstand some degree of summer drought conditions.

The revegetation design will utilize planting zones rather than the numerous riparian and wetland vegetation plant communities. The proposed planting zones will loosely correspond to lower, middle, and upper riparian zones. The existing upland coastal scrub vegetation zone will form the project boundary in several areas and upland native vegetation will be planted in these ecotone areas. Each planting zone will have the potential to contain multiple plant communities with the same water requirements.

Lower Riparian Zone

TThe lower riparian planting zone is the zone closest to the reservoir water surface. The plant species proposed for this zone will be well adapted to coarse, cobbly substrate and extended inundation. Willows, sedges and rushes typically grow at or below the Ordinary High Water Mark. The lower riparian planting zone will provide important ecosystem benefits. Growing close to the water's edge, this vegetation will shade the reservoir edges and reduce water temperatures in shallow bank areas, reducing the potential for algae growth. It will also contribute to improved bank stability, provide organic debris recruitment, and serve as a major source of nutrients. Dense willow thickets can develop root mats and have the potential to provide increased habitat complexity. Sedges and rushes have strong and extensive root systems and over time will stabilize the surrounding soil. In order to create suitable wetland and riparian woodland conditions along the reservoir rim, it will be essential to install an impervious compacted layer of clay or a clay liner covered by a minimum of 2' of loose soil with less than 80% compaction. The grading, reservoir water level management and irrigation schedule will have to be set up so that riparian vegetation does not get flooded for extended periods (beyond two weeks) and similarly not dry up for too long.

Middle Riparian Zone

The middle riparian planting zone will be approximately delineated by the top and bottom of the sloping berms. These berms will be occasionally flooded, so vegetation in this zone will have to withstand a flooding regime that is less frequent than that in the lower planting zone. Soils in the berm planting zone will be several feet of salvaged native topsoil installed over a clay core of the berm. These soils may be coarse and cobbly near the surface with finer sand, silt and some clay deeper down to provide nutrients for bank vegetation and to allow for the plants' good anchorage. Trees planted in this zone may come from pole cuttings and will develop strong root systems in the uncompacted surface soil. The understory will be seeded with a riparian seed mixture.

Upper Riparian Zone

The upper edges of this zone will act as an ecotone between the upland coastal scrub and riparian communities. This vegetation zone will be planted in a mosaic pattern with facultative riparian vegetation, also incorporating some upland vegetation along the highest edges, based on site contours and slope aspect. Ecotones are transitional areas between two distinct habitats, in this case the upland and riparian. Salvaged topsoil from the project area as well as chipped and/or composted native plant material may be used to enhance the topsoil qualities in this area before planting.

Planting Palette

As typically required by agency mandated performance criteria, the wetlands and riparian habitats along Syphon Reservoir will be revegetated with a variety of locally native plant species that will be selected based on botanical surveys results. The upper riparian planting zone will be planted with facultative and upland vegetation. The two upper planting zones will consist of a diverse mix of facultative and facultative wetland trees, shrubs, and herbaceous species that typically colonize riparian banks in this area. They will be installed by direct planting of clean, field-collected plant divisions, such as pole cuttings, rhizome segments, and rooted side shoots, and by seeding of herbaceous perennials and annuals. Because of recent serious issues with several aggressive species of the invasive introduced watermold of the genus Phytophthora spreading from nursery-grown plants on many restoration projects, and the resulting high morbidity of native vegetation infected with these species, and associated liability, we will strive to not introduce any nursery-grown plants and require the contractor to keep all collected plant divisions in a protective enclosure at the project site or very close to it. If

Optional Task 7.9 *cont.*

necessary, native plant divisions will be kept in sterilized or new containers on elevated benches, not allowed to share overflow irrigation water. The lower riparian planting zone will consist of facultative wetland and obligate wetland species well adapted to inundation and high ground water table. The three plant types most appropriate for this area are rushes (Juncus), sedges (Carex), and willows (Salix).

Irrigation Plans

Intensive irrigation of the wetland and riparian mitigation areas will be critical to the success of the project. The wetland and riparian plants proposed for the mitigation areas of the project area will greatly benefit from any summer season irrigation they will receive. Unlike California native upland plants that are adapted to the summer dry Mediterranean climate, and often decline due to water-borne diseases with too much summer water, the native wetland and riparian plants really thrive with ample summer irrigation, being relics of a pre-historic hot and humid climate in California. Additionally, unlike the native upland vegetation, riparian plants are also well adapted to, and thrive with overhead precipitation throughout the year. Irrigation should be provided on a daily basis for the newly installed vegetation during the first dry season beginning in early April and ending in early November. Based on the preliminary evaluation of different irrigation options for the project, a combination of an overhead sprinkler system and a reservoir overflow/flooding system would be ideal for the maintenance of of the mitigation sites. The soil permeability and percolation rate will be critical for the long-term sustenance of the wetland and riparian habitats.

The irrigation design for the habitat mitigation areas will be based on and connect into a 6" irrigation main line around the perimeter of the reservoir and to the proposed wetland habitat areas that will be designed by the engineers. The water main will be designed to provide a water pressure and flow rate needed for mitigation design by the engineers. AECOM landscape architects will design the irrigation system downstream of the water main. An irrigation controller will be adequately sized for the required number of irrigation valves connected to the irrigation main. The controller will either be provided with an electrical connection as designed by AECOM engineers, or be solar or ambient light powered and will allow for flexible schedule setting of each individual irrigation valve. The irrigation control valves will be remotely and manually operable and will be used to independently irrigate areas with different watering needs and slope aspects. South and west facing areas will typically require higher amounts of irrigation than areas with north and east aspect. Similarly, different planting zones will require different frequency of irrigation. Lateral (non-pressurized) lines will be installed below-ground, downstream of the control valves. While the initial cost of the piping system will be slightly higher because of the cost of burying the supply pipes, most of the system will be well protected from vandalism, and UV damage and more aesthetically pleasing.

Task 8 - Bid Phase Services

Task 8.1 – Addenda Preparation and Pre-Bid Meeting

During the bidding period, AECOM 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 in providing information and clarification of the bid documents as needed. AECOM will consult with IRWD to address concerns or answer their questions in support of administering the bid process. AECOM has budgeted for three (3) addenda to the construction plans and/or Project Manual for prospective bidders, as determined necessary by IRWD. Bid phase services will include:

- **Plan Revisions:** AECOM has budgeted eighty (80) hours of staff time for plan revisions.
- **Specification Revisions:** AECOM has budgeted forty (40) hours of staff time for revisions to the Project Manual.
- **Bidder Questions:** AECOM has budgeted eighty (80) hours of staff time to address and respond to bidder questions.
- **Pre-Bid Meeting:** Two senior AECOM staff will attend one (1) two-hour pre-bid meeting, conducted by IRWD, along with a site visit with potential bidders, if required.

Deliverables

- ☑ Pre-Bid Meeting presentation and meeting notes and action items
- ☑ Addenda 1 package
- ☑ Addenda 2 package
- ☑ Addenda 3 package

SECTION 2

TEAM

2

SECTION 2

TEAM

Work for this contract will be based out of our Orange Office, just minutes from the project site and IRWD offices. Our team's strong local presence, combined with its world class dam expertise, will result in efficient and successful Project delivery on time.

IRWD recognizes how critical a thorough geotechnical exploration and testing investigation program is to establishing the basis for a quality design—and selected AECOM to do this. This Project requires a team that has the expertise in both geotechnical and geologic investigations and engineering, as well as an understanding of the design process for embankment dams. AECOM is that team! With more than 85 years in the industry, we are experts in dam and reservoir engineering and have worked on hundreds of dams and water resources projects in California and around the globe. Our experience spans every facet of dam engineering—from planning and feasibility studies through design and construction, commissioning, operation, on-going dam safety monitoring, maintenance, and rehabilitation. Our core team members are based in Orange, geographically positioned to quickly respond to your needs, provide local resources, and meet the Project schedule. The AECOM offices that will be performing the work are home to our legacy dams, water treatment and water quality, and transportation centers of excellence in California. The practitioners here have a history with IRWD, and our teaming partners have a long-standing working relationship with AECOM.

170+
170+ California-based Dam and Reservoir Staff (35 in Southern California)

900+
900+ National Dam and Reservoir Staff

1,200+
1,200+ PEs in California

100%
Project Management and Design Leads 100% Committed to the Success of Syphon Reservoir

#1
No. 1 Ranking in ENR California's 2020 Top Design Firm

300+
We have a deep bench or resources with has over 300 water, wastewater, recycled water, treatment design professional based in California, 3,300 in northern America and 6,600 worldwide

#1
No. 1 Ranking in ENR Transportation Nationally

#1
No. 1 Ranking in ENR Top 200 Environmental Firm Overall

Organization Chart

AECOM has assembled a highly qualified and dedicated group of experienced personnel who will work closely together to expediently complete the services described in this proposal. As evident in previous projects performed for IRWD and throughout Southern California, the AECOM Team will maintain a high degree of communication, clarity, and professionalism to ensure that work products meet IRWD's quality and schedule standards.

AECOM IS A PROVEN, DEDICATED, COLLABORATIVE TEAM OF PROFESSIONALS THAT WILL DELIVER.

The AECOM team's history of successfully partnering with IRWD on the Syphon Reservoir Improvement Project will save time and money, support effective engagement of your internal experts and external stakeholders, and reduce the Project's overall schedule risk. We are poised to maintain momentum on your Project. **Exhibits 2-1** and **2-3** graphically illustrates the leadership, technical capabilities, and depth of resources offered by the AECOM team. **Exhibit 2-2** shows the progression of the design measured by hours per month along the entire schedule and includes the planned monthly contribution by all design team members.

WHAT OUR CLIENTS ARE SAYING

QUALITY: AECOM is continually providing high quality engineering analyses; providing engineering analyses quickly; makes time to brief and educate the government staff with respect to all contract designs, reviews, and RFI evaluations.

SCHEDULE: AECOM meets schedules even when schedules get changed and issues are fast tracked, working nights and weekends as needed. This is helping the Government make quicker and better decisions.

COST CONTROL: AECOM provides USACE with advanced notification if/when increased scope would warrant additional funding and provides recommendations for eliminating tasks.

MANAGEMENT: AECOM's assigned manager is always available and fully understand the needs of USACE. He or his assignee participates in all meetings including office and field. The assigned manager is proactive in determining when additional field support is warranted. AECOM management is very knowledgeable, thorough, and easy to communicate with. Management is willing to perform research on difficult and important issues whenever asked and present their knowledge and expert opinions to USACE as well as the construction contractor.

ADDITIONAL/OTHER: AECOM has done an outstanding job to support this critical and complex BNSF bridge scour protection project on the Lower Santa Ana River, Reach 9. AECOM's management and technical staff have given high priority, timely attention, and competent engineering support to this project. Keep up the great work!

RECOMMENDATION: Given what I know today about the contractor's ability to perform in accordance with this contract or order's most significant requirements, I would recommend them for similar requirements in the future."

~ Jim Farley, Supervisory Civil Engineer - Corps of Engineers, Los Angeles District

Exhibit 2-1. Organization Chart

Legend

GV = GeoVision
GMU = GMU Geotechnical, Inc.
ISG = Innovative Services Group
F = Fuscoe Engineering, Inc.
RUEN = Ruen Drillers, Inc.
TR = Dr. Tom Rockwell
T2 = T2 Utility Engineers

**Registered in state other than California*

ROLES AND RESPONSIBILITIES

Project Manager

Mike Smith, PE, GE will be our main point of contact and work closely with IRWD on technical issues and will direct and coordinate internally the key personnel – serve assigned leads engineers and other specialty support personnel. He will maintain control of the schedule and work progress and provide technical guidance to team as well as technical oversight supervision of all team members including subconsultants.

Deputy Project Manager

Bryan Paine, PE, EnvSP, QSP will serve as Mike's Deputy and next in line for technical coordination.

Principal in Charge

Sujan Punyamurthula, PhD, PE will be responsible for monitoring performance of the team; legally obligating AECOM; and committing corporate resources.

Discipline Design Leads

Our Discipline Design Leads will work cooperatively under the direction of the Project Manager and Deputy Project Manager in their area of expertise for task integration and efficiency. Discipline-specific lead engineers, will be dedicated to this project on an as-needed basis. The AECOM team also offers IRWD access to several project support personnel in specific specialty disciplines.

Senior Technical Advisors

Joe Ehasz, PE, Rich Millet, PE, GE, and Dave Schug, PG, CEG, CHg are the appointed Technical Advisors whose role will be to establish and identify, early-on in the project, the guiding criteria, the potential shortcomings, the institutional and policy matters, regulatory and compliance requirements, and other items that may affect the project during the initial workshop. They will be available for consultation throughout the life of the project as well.

VALUE ADDED

We are Doers. Our staff from the PM to drafting have successfully designed dams here in Southern California. We have been through every phase of work from siting, feasibility, concept, preliminary, final design, permitting, bidding, construction, monitoring, and inspection. We have rolled up our sleeves and done the hard work. While other firms may have reviewed others' designs or done evaluations of existing dams, few have experience in every aspect of a dam's life that our team has. This translates to safe, high-quality, efficient, and cost-effective design.

The AECOM team is poised to maintain project momentum.

Staff Experience and Capabilities

Our team members were carefully chosen based on their commitment to the Syphon Reservoir Improvement Project, years of experience, licenses and certifications, their availability, and past performance on projects of similar scope and size to IRWD's Syphon Reservoir Improvement Project. Our chosen personnel are subject matter experts in their fields of engineering, and many have helped develop the Syphon Project to date. Brief biographies for a few key individuals are provided below.

The AECOM offices that will be performing the work are home to our legacy dams and geotechnical practices in California. The practitioners here have a history with IRWD, and our teaming partners have a long-standing working relationship with AECOM. We have a very good relationship working with HDR as well.

The AECOM Team is organized with a single goal in mind: to expeditiously work with IRWD to meet the schedule and deliver a constructible and biddable Project. Our Team clearly understands that the success of this Project is dependent on how well the interdependent project components—facilities planning and design, operations, and environmental—are integrated.

The professional highlights of AECOM's Project Manager and other key personnel are briefly presented as follows. The related project experience and percent commitment of the key personnel and supporting team members are summarized in **Exhibit 2-X** and **Exhibit 2-X**, respectively. Resumes for all team members listed on our Organization Chart in **Exhibit 2-x** are included in Appendix A.

100% Commitment

Our Project Management and Engineering Leads are 100% Invested in the Syphon Reservoir Improvement Project. We have partnered with you on the IRWD Syphon Geotechnical Investigation. We are proud of our team's involvement in this project and we want to carry it forward to completion.

The AECOM Team is organized with a single goal in mind: to expeditiously work with IRWD to meet the schedule and deliver a constructible and biddable Project. Our Team clearly understands that the success of this Project is dependent on how well the interdependent project components—facilities planning and design, operations, and environmental—are integrated.

Mike Smith, PE, GE

Project Manager/Dam Design

Total Years of Experience: 35

Home Office: Orange, CA

Why Mike?

- ☑ Managed complex, multidisciplinary office and field teams locally and throughout California
- ☑ Managed or supported 20+ dam/ reservoir engineering design projects in California
- ☑ Worked with all key staff on our recent relevant dam projects
- ☑ Up-to-date knowledge of DSOD dam design criteria
- ☑ Extensive knowledge about Syphon Dam – Project Manager for the Geotechnical Investigation

An engaged and collaborative Project Manager who will deliver quality results on budget and on time.

Mike will be the day-to-day contact with IRWD and ensure that the AECOM team maintains a safe working environment that minimizes impacts to the environment and local community. He will be responsible for the overall performance of the work, communication with IRWD, coordination of the subconsultants, quality assurance, and interactions with DSOD. Under his leadership, the AECOM team will deliver high-quality, responsive design that above all will meet the Districts schedule.

Mike was selected as Project Manager based on his expertise in geotechnical engineering, depth of experience in dam and reservoir design, and his reputation among his clients as an outstanding Project Manager and communicator. His 35-year professional career involves extensive involvement in the design and construction of 20+ dams and reservoirs. As a seasoned Project Manager, Mike will apply his collaborative nature and team-oriented management style to make sure IRWD is clear on Project milestones, challenges and needs at each step of the Project.

A Career Focused on Dam Design, Project Management and Design

Assigned to our local office in Orange, California, Mike has spent his entire career in Orange County and understands the local geology and geotechnical issues particular to Orange County dams. For instance, Mike is the Project Manager, Lead Geotechnical Engineer and Dam Designer for the Trampas Canyon Dam – Recycled Water Reservoir Project currently in construction for the Santa Margarita Water District. The Trampas Project has several similarities to Syphon Reservoir in terms of geology, materials, dam type, size, and purpose. Mike has provided reviews on current designs for Vail Dam, Lee Lake Dam and Tinemaha Dam.

What Mike's Clients Say

"Mike Smith was responsive to requests of the District during execution and completion of the project. The District team valued the service provided by Mike and his support crew of experts. We look upon [AECOM] as a trusted advisor and consultant to the District and recommend its services."

– Dan Ferons, General Manager, Santa Margarita Water District, Trampas Canyon Dam – Recycled Water Reservoir Project

"...Exceptional in managing and coordinating activities, designs, specs and other information...committed to meeting schedules and helping to move forward to completion."

– USACE, Santa Ana River Reach 9 Phase IIA (CPARS evaluation for Exceptional Management Performance)

Mike's career also includes leading and supporting the iconic $2.1B Diamond Valley Lake planning, design, and construction project for the Metropolitan Water District of Southern California (MWD), involving the investigation of earthfill and rockfill borrow and foundation characterization for three dams. Diamond Valley Lake was the largest earth/rockfill dam project in US history. He also participated in the historic third set of locks project for the Panama Canal, in which he investigated borrow for the dams, performed test fills, and authored the Geotechnical Baseline Reports for the new locks.

Mike has been a partner and leader to many of the large water purveyors in Southern California, such as the Santa Margarita Water District, US Army Corps of Engineers-Los Angeles District, Los Angeles Department of Water and Power, and Los Angeles County. He recently completed the development of a dam and reservoir assessment criteria document for MWD to use for its portfolio of dams. Other representative assignments include:

- IRWD Syphon Canyon Dam Geotechnical Investigation,
- Los Angeles County Dams, County of Los Angeles: Geotechnical investigations of four dams
- Los Vaqueros Reservoir Expansion, Contra Costa Water District: Plans and specifications for dam embankment, borrow and foundation
- Calaveras Dam, San Francisco Public Utilities Commission: Plans and specifications for dam embankment, borrow and foundation

In addition to his project history and successful project management capabilities, Mike has an excellent relationship and reputation with DSOD. He has prepared many geotechnical programs for dam analysis and design under DSOD jurisdiction, and completely understands the data needs of both DSOD and dam designers. He has made numerous presentations to DSOD, both in Sacramento and on jobsites.

PM Attribute and Advantage	Benefit to IRWD
Locally Based – Mike Lives and Works in Orange County **ADVANTAGE** • Minutes from Syphon Reservoir and IRWD offices • Familiar with the local geotechnical and seismic issues	**RESPONSIVE** • Establishes and uses excellent communication methods throughout the project • Provides flexibility and ready-response to changes in field conditions • Ensures open, collaborative and continuous communication with IRWD **QUALITY** • Evaluates the unique local geologic and seismic conditions by applying the appropriate exploration and testing methods
Experienced Dam Designer **ADVANTAGE** • Completed numerous dam designs • Knows the analysis methodology and design requirements • Understands the entire process of dam engineering from siting to geotechnical investigations, testing, design analyses, PS&E, O&M, inspection, and condition assessment	**QUALITY** • Develops correct data directly useful to the design engineer's analyses, design, plans and specifications **COST AND SCHEDULE** • Focuses on the most impactful information that reduces risk • Ensures no wasted time or effort • Addresses key issues to design and construction challenges
Experienced Geotechnical Engineer in Dam and Reservoir Investigations **ADVANTAGE** • Knows and has performed all of the exploration and testing methods for dam and reservoir design • Has led large investigation and testing programs	**SAFETY** • Tailors a Health and Safety plan to the site • Assigns experienced and safety-trained staff **QUALITY** • Maximizes the usefulness of the data **COST AND SCHEDULE** • Maintains a do-it-right-the-first-time attitude • Allows IRWD to receive the biggest bang for the buck • Uses efficient and effective communication methods and AECOM project management tools
Safety and Quality Focused **ADVANTAGE** • Leader in AECOM safety and quality programs and culture	**SAFETY** • Strives for zero incidents • Commits to the safety of IRWD staff, the public, AECOM team, and subconsultant personnel **QUALITY** • Implements field methods using recognized standards • Provides calibrations and checks to ensure quality data
Environmentally Sensitive **ADVANTAGE** • Delivered numerous projects with environmental sensitivity and constraints	**COST AND SCHEDULE** • Focuses on lower impact, which translates to less mitigation and expedited work **ENVIRONMENTAL MITIGATION** • Uses methods that minimize impact to the environment • Actively reduces impacts
DSOD Coordination and Approval Experience **ADVANTAGE** • Trusted partner to DSOD for the past 30+ years, having completed many dam investigation and design projects	**COST AND SCHEDULE** • Coordinates closely with DSOD, resulting in quick approval **QUALITY** • Performs tasks to DSOD standards and guidelines using approved methods

Bryan Paine, PE, EnvSP, QSP

Deputy Project Manager/Civil Design/NPDES/SWPPP

Total Years of Experience: 22

Home Office: Orange, CA

Why Bryan?

- ☑ Project Manager on Syphon Reservoir Interim Facilities Project and Santiago Creek Dam Outlet Tower Replacement involving DSOD coordination and review
- ☑ Completed 12 projects for IRWD, he is familiar with IRWD operations and procedures
- ☑ Quality Control Reviewer, Project Manager and Design Engineer roles for 20+ Southern California water projects

A long-term, successful partner to IRWD on your water supply projects, Bryan is well qualified to be Mike's Deputy Project Manager for this project based on his familiarity with the Syphon Reservoir and track record for delivering consistent, detail-oriented and on-time results.

Bryan recently served as Deputy Project Manager for the Trampas Canyon Dam – Recycled Water Reservoir Project for the Santa Margarita Water District (SMWD). This project, which is very similar to the work proposed for IRWD's Syphon Reservoir, involves design and construction of a 5,300-acre- foot recycled water storage reservoir that will provide seasonal storage for the SMWD's existing and proposed recycled water system.

With a 10-year+ history of successfully working with IRWD, Bryan is very familiar with your facilities planning, design, and construction processes and procedures. His current and most recent assignments for IRWD include managing the Eastwood Recycled Water Pump Station project and serving as Deputy Project Manager/Project Engineer for the Syphon Reservoir Interim Outlet Strainer System and Orange Park Acres Well No. 1 and Wellhead Facilities. His understanding and background working with IRWD will help facilitate timely quality reviews of all project deliverables and completion of the geotechnical investigation that will translate into a technically sound design phase.

Bryan is a Senior Dam Engineer having led or worked on 15+ dam projects including Trampas Canyon Dam, Vail Dam, Santiago Creek Dam Outlet Tower, Los Vaqueros Dam, Lake Mathews Dam, Lake Skinner Dam, Santa Anita Dam, and the Santa Anita Debris Dam Seismic Strengthening project for LACPW. Bryan has over 22 years of civil engineering experience specializing in the planning, design, and construction support services for water, wastewater, recycled water, and storm water infrastructure projects. Bryan has experience in a wide range of projects in his field, including pump stations, groundwater wells, pipelines, steel and concrete reservoirs, dams, levees, hydrology and hydraulic studies, civil site improvements, and permitting.

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October 1, 2020

Scott Toland, PE, Senior Engineer
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

Via Email - toland@irwd.com and mori@irwd.com

RE: Budget Proposal for Engineering Services for the Syphon Reservoir Improvement Project

Dear Mr. Toland and Members of the Selection Committee:

AECOM is pleased to submit the enclosed budget proposal to provide Engineering Services for the Syphon Reservoir Improvement Project. Our technical proposal, including our qualifications and scope of work, is submitted under separate cover and was prepared in response to the Irvine Ranch Water District's Request for Proposal (RFP) dated August 25, 2020.

The enclosed fee estimate is based on the Scope of Services outlined in AECOM's Technical Proposal, and our understanding of the level of effort required to complete this work. Our detailed Budget Proposal includes our fee schedule, labor hours, and a breakdown of the fees by task and subtask for AECOM and our subconsultants. A separate sheet is shown for optional tasks.

The following table summarizes the base contract fee estimate:

TASK NO./DESCRIPTION	TOTAL HOURS	LABOR COSTS	SUB-CONTRACTOR COSTS	DIRECT COSTS & MATERIALS	TOTAL
Task 1 - Project Management	2,839	$ 609,150	$ 0	$ 7,490	$ 616,640
Task 2 - Data Review, Surveying Services, and Geotechnical Services	605	$ 86,990	$ 80,750	$ 20	$ 167,760
Task 3 - Preliminary Design (30%)	5,850	$ 909,810	$ 92,576	$ 300	$ 1,152,686
Task 4 - Final Design (60%)	5,580	$ 811,550	$ 0	$ 350	$ 811,900
Task 5 - Final Design (90%)	3,235	$ 458,060	$ 0	$ 190	$ 458,250
Task 6 - Final Design (100%)	1,296	$ 182,500	$ 0	$ 320	$ 182,820
Task 7 - Miscellaneous Tasks	4,134	$ 699,600	$ 11,402	$ 12,220	$ 833,222
Task 8 - Bid Phase Services	208	$ 38,400	$ 0	$ 470	$ 38,870
Totals	**23,747**	**$ 3,796,060**	**$ 184,728**	**$ 21,360**	**$ 4,262,148***

*Total Fee includes $260,000 in allowances as described in RFP.

The following table summarizes the fee estimate for optional tasks:

OPTIONAL TASK NO./DESCRIPTION	TOTAL HOURS	LABOR COSTS	SUB-CONTRACTOR COSTS	DIRECT COSTS & MATERIALS	TOTAL
2.5 - Supplemental Geotechnical Investigation	672	$ 93,840	$ 134,702	$ 8,374	$ 236,916
3.4 - CFD Modeling to Optimize Water Quality System	308	$ 49,960	$ 0	$ 0	$ 49,960
4.5 - Noise Model Baseline	32	$ 3,860	$ 0	$ 1,145	$ 5,005
4.6 - Detailed Construction Noise Study	80	$ 9,920	$ 0	$ 40	$ 9,960
6.3a - Initial Reservoir Fill Plan	122	$ 20,680	$ 0	$ 20	$ 20,700
6.3b - Maintenance and Operation Plan	170	$ 26,080	$ 0	$ 20	$ 26,100
7.9 - Riparian Habitat Mitigation Design	1,154	$ 133,860	$ 0	$ 3,100	$ 136,960
Totals	**2,538**	**$ 338,200**	**$ 134,702**	**$ 12,699**	**$ 485,601**

Base contract fee estimate plus optional tasks result in grand total of: $4,747,749.

If you have any questions regarding our Budget Proposal, please contact Mike Smith by telephone at (714) 697-5239, or email at michael.g.smith@aecom.com.

Sincerely,

Michael G. Smith, PE, GE
Project Manager
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