ITEM # 18

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Pure Water Project
Las Virgenes-Triunfo Demonstration Project

JPA Presentation

July 2018

WATER
OUR FOCUS
OUR BUSINESS
OUR PASSION

carollo
Engineers...Working Wonders With Water®

ITEM #18


ITEM # 18
Welcome and
Introductions

ITEM #18

Purpose, Objectives, Approach

Workshop Purpose

ITEM # 18

Present a Conceptual Vision of the Pure Water Demonstration Project, Focused on Architectural and Engineering Components

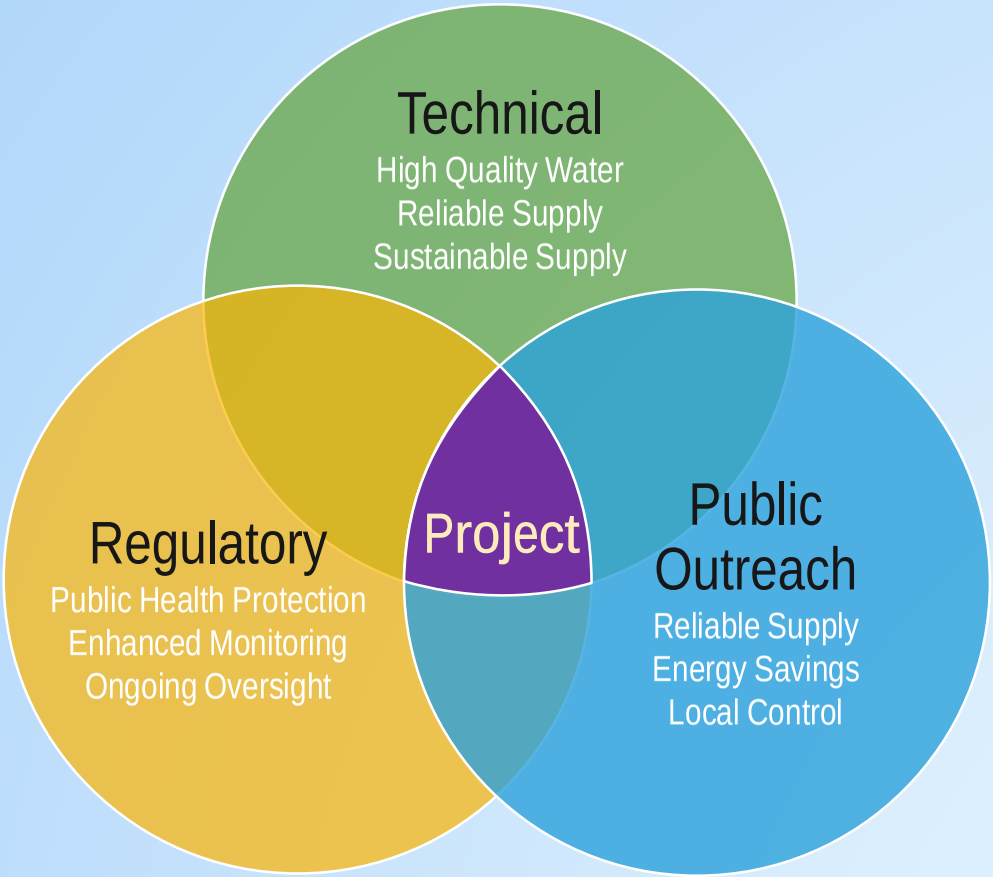
Workshop Objectives

- Cursory review of **engineering-related aspects** of the Pure Water Demonstration Project; including engineering, operations, regulatory, and research and development.
- Review and discuss potential **architectural themes**, landscaping and building improvements.
- If time allows, review and discuss **educational concepts** *within the demonstration facility.*

ITEM # 18

What is a potable reuse project?

ITEM # 18



Why Do a Demonstration Project?

ITEM # 18

A Demonstration Project Offers Broad Engineering, Regulatory, and Public Value

A demonstration project ***is not*** a science experiment

A demonstration project has sufficient depth, duration, and intensity to definitively answer important questions

Value					
Documents new approaches/efficiencies	X				
Data becomes core component of permitting process	X				
Reduces design conservatism, reduces cost		X			
Optimizes chemical use, reduces/eliminates problems at startup		X			
Train staff per forthcoming AWT requirements			X		
Define long term staffing needs and cost			X		
Provides overview of needs and benefits				X	
Showcases how advanced treatment works				X	
Demonstrates safety and reliability				X	
Opportunity to see and taste water				X	
Provides access to other educational materials				X	
Brine minimization and scaling					X
Advanced monitoring for water quality confidence					X
Potential for low cost innovation (e.g., novel UV systems, novel remineralization systems)					X

ITEM # 18

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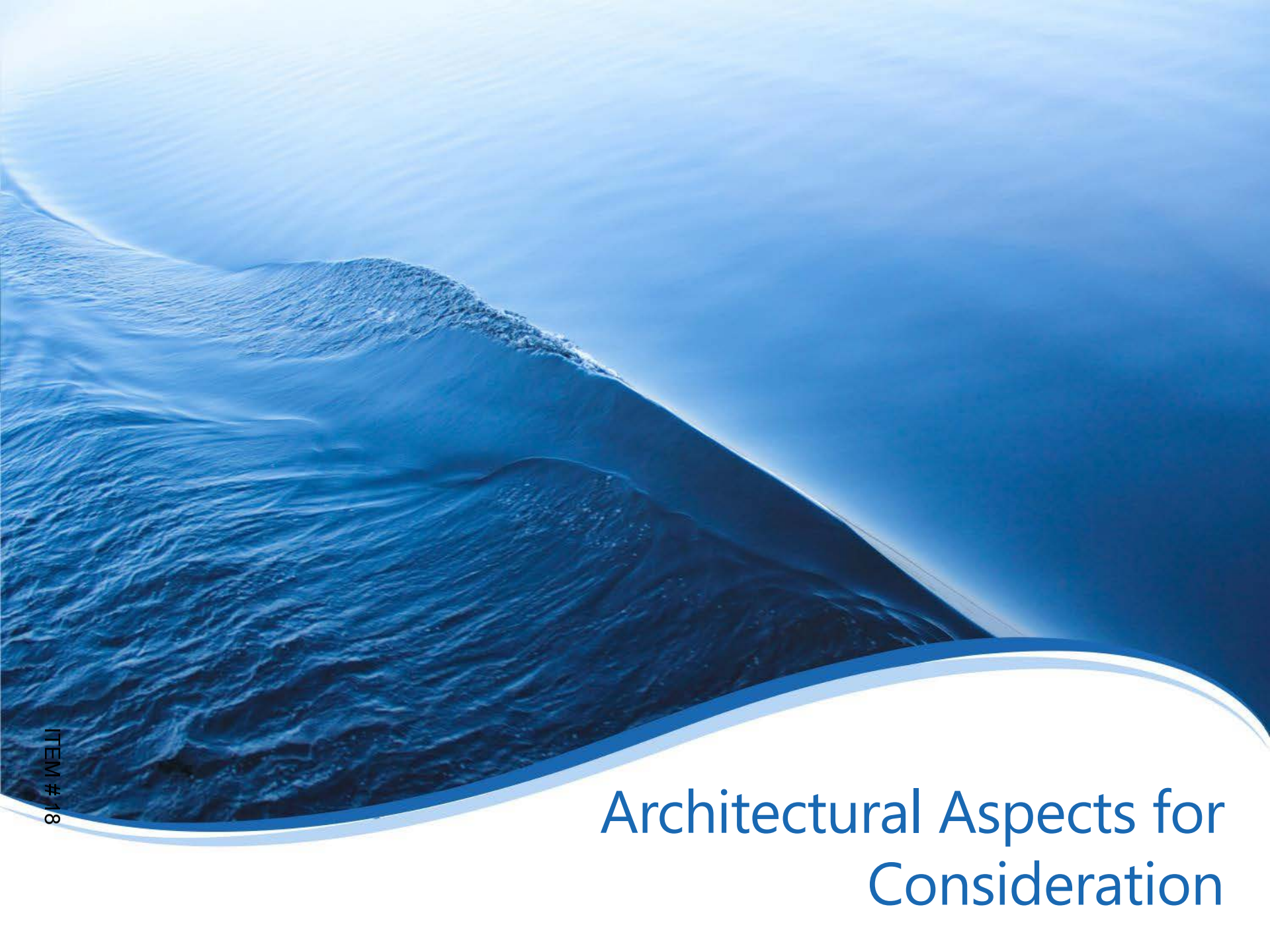
What Could This Pure Water Demonstration Facility Look Like?

A demonstration project is about more than treatment equipment



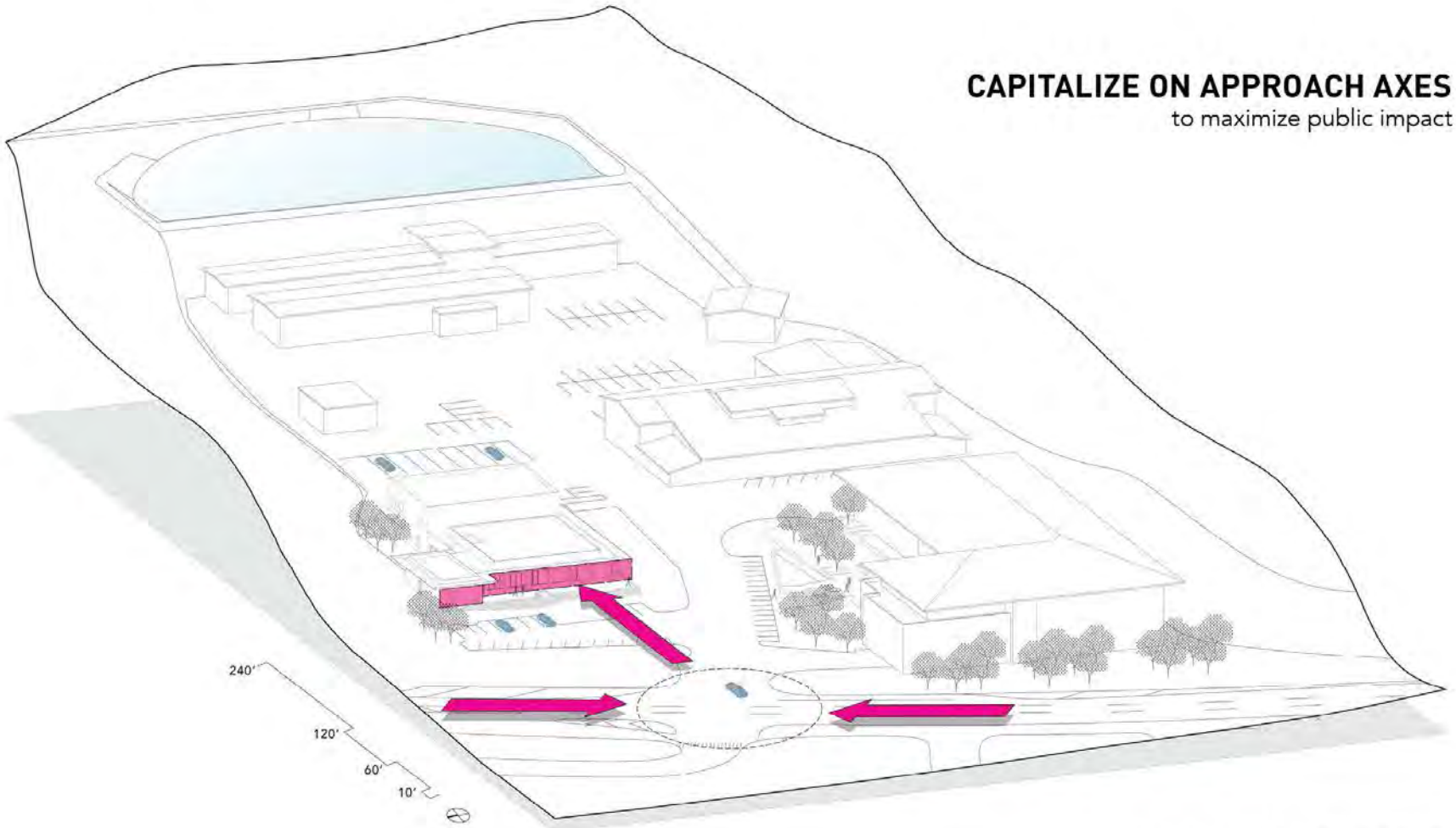
Architectural Aspects for Consideration

ITEM #18

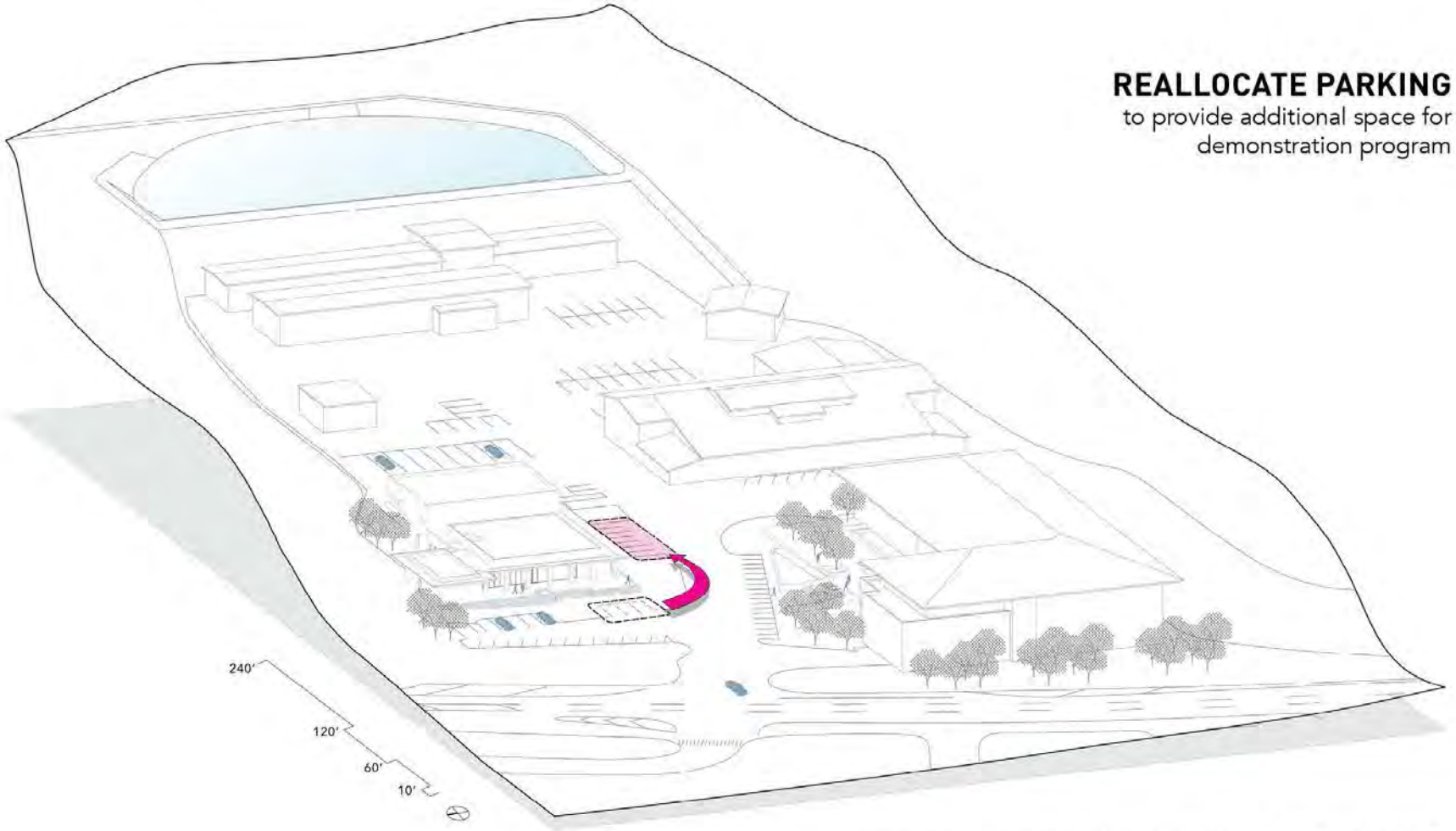
SITE STRATEGIES

CAPITALIZE ON APPROACH AXES

to maximize public impact



SITE STRATEGIES



REALLOCATE PARKING
to provide additional space for demonstration program

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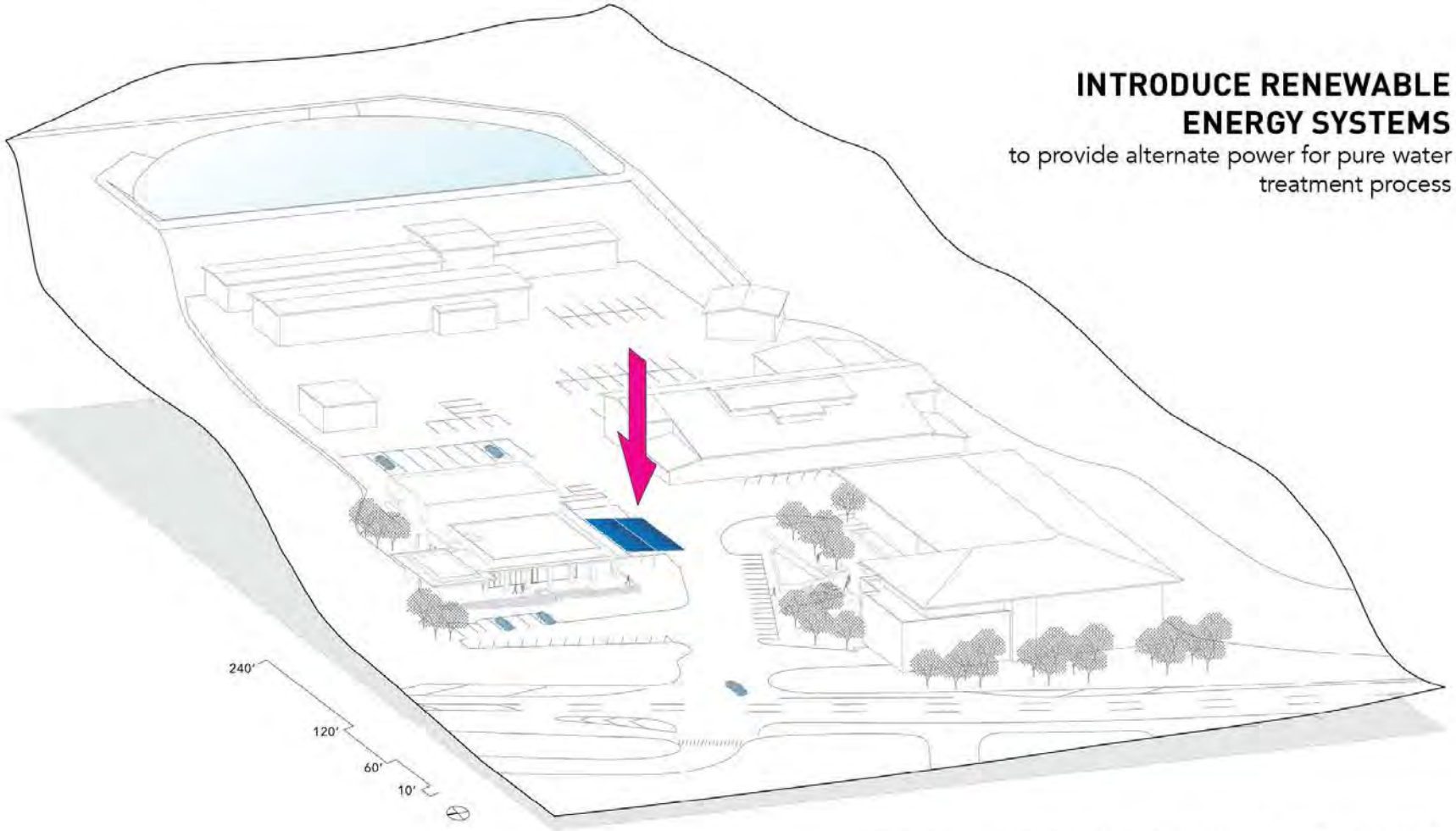
ITEM # 18

ITEM # 18

SITE STRATEGIES

INTRODUCE RENEWABLE ENERGY SYSTEMS

to provide alternate power for pure water treatment process



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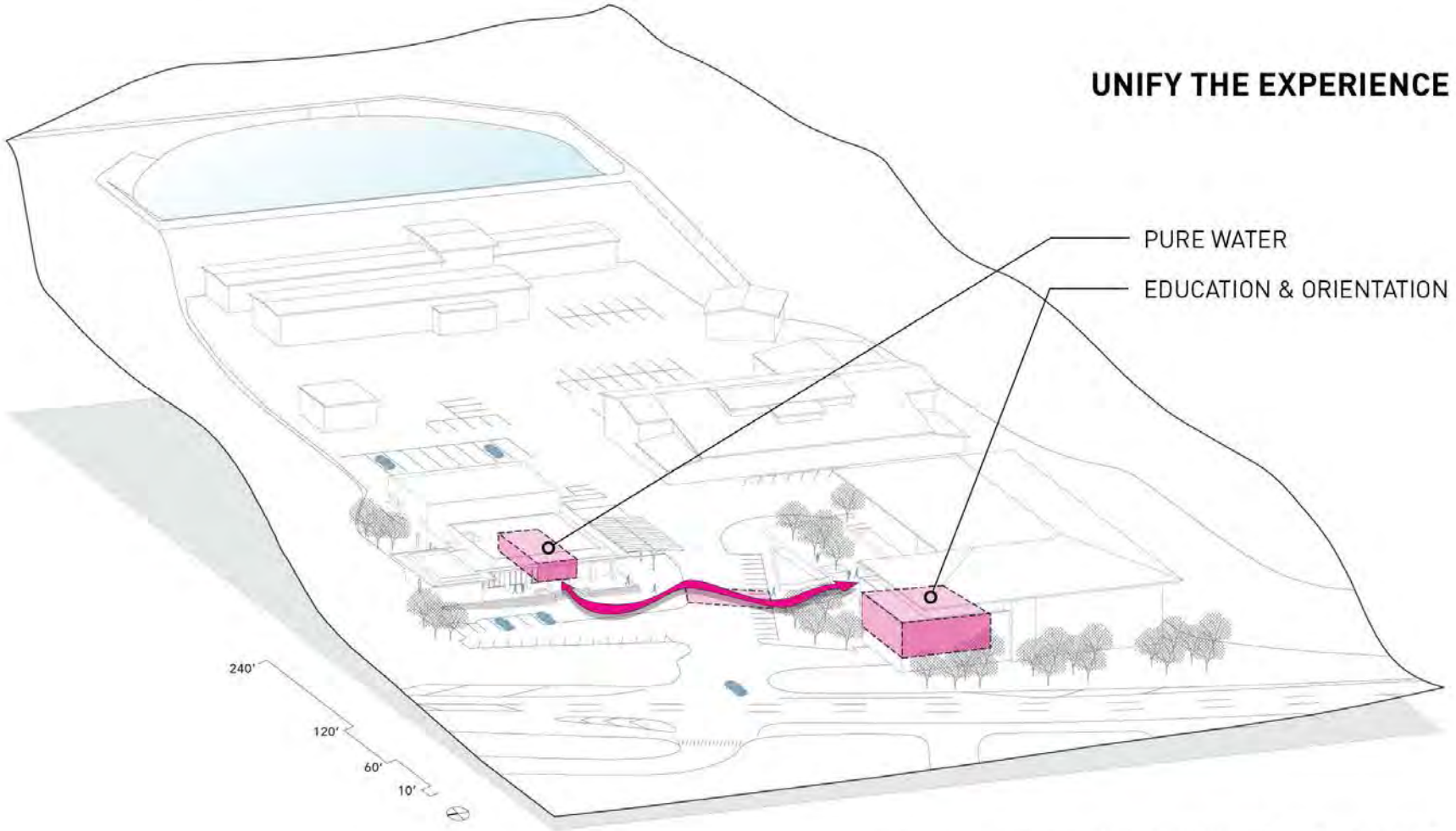
SITE STRATEGIES



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ITEM # 18

ITEM# 18

LANDSCAPE STRATEGIES

Lower California Native / Adapted Plant Diversity

LANDSCAPE STRATEGIES

Lower California Native / Adapted Plant Diversity

ITEM# 18

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LANDSCAPE STRATEGIES

Lower California Native / Adapted Plant Diversity

LANDSCAPE STRATEGIES

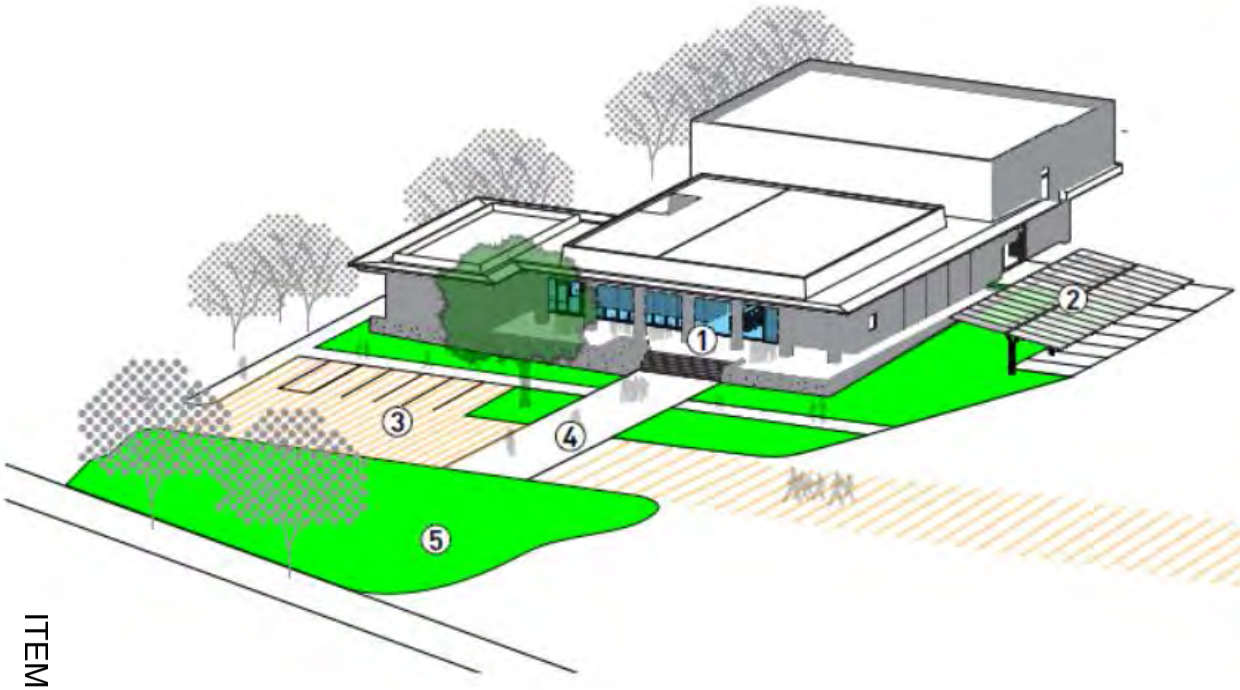
Lower California Native / Adapted Plant Diversity

ITEM # 18

PROPOSED PROGRAM

+

PROPOSED SITE ELEMENTS



FRONT PORCH:
Functional space that welcomes vistors into the building and out to the landscape.

SOLAR PARKING:
Existing parking is consolidated to the south side of the building and paired with a solar parking structure.

PARKING PLAZA:
Social space for outdoor gathering illustrating the geographic scale and movement of the current California water delivery system.

ENTRY EXPERIENCE:
Outdoor reflection of the interior exhibition space highlighting Coastal Live Oak.

NATIVE GARDENS:
Gardens showcasing drought resistant native California plants.

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FRONT PORCH

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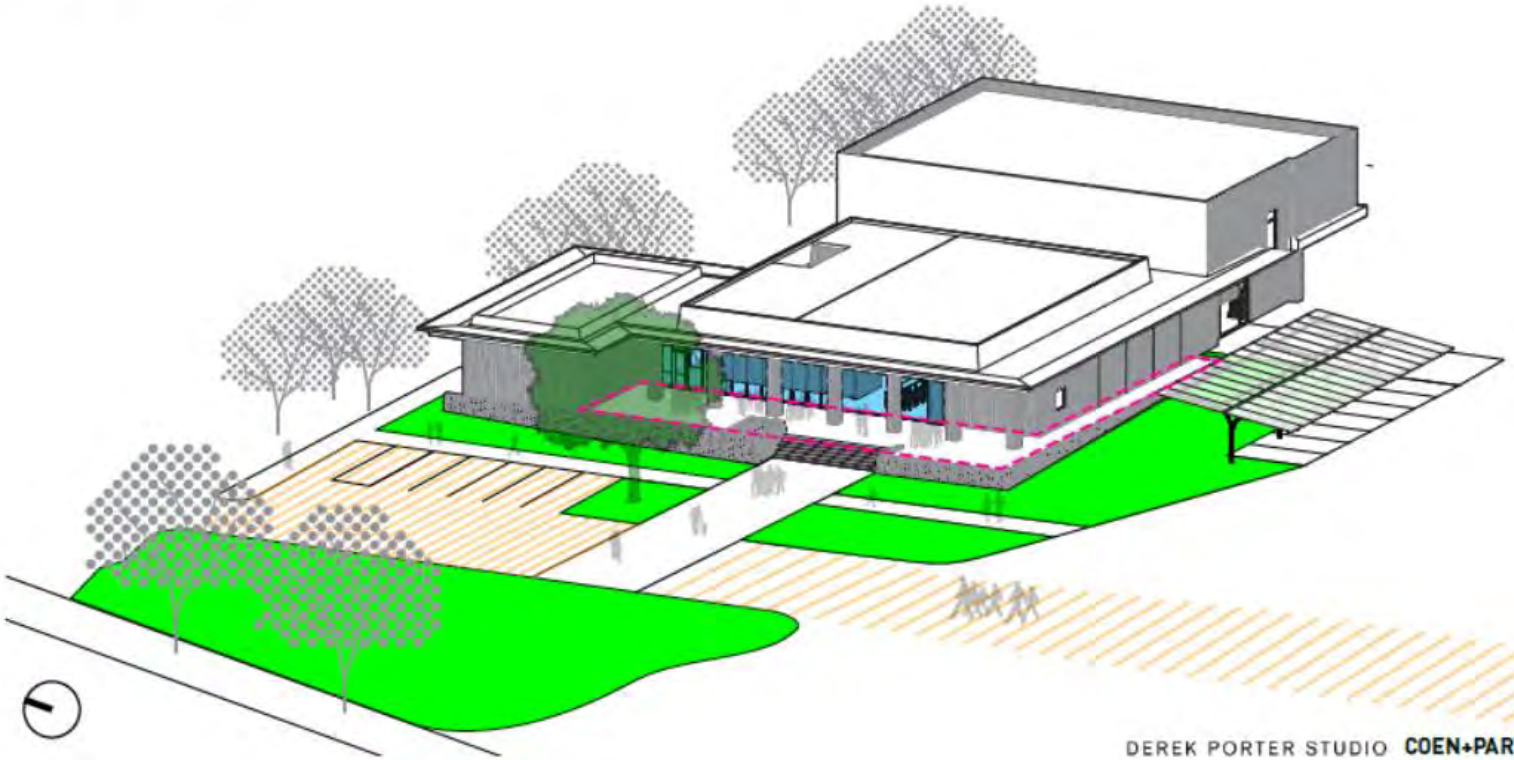
SOCIAL GATHERING SPACE



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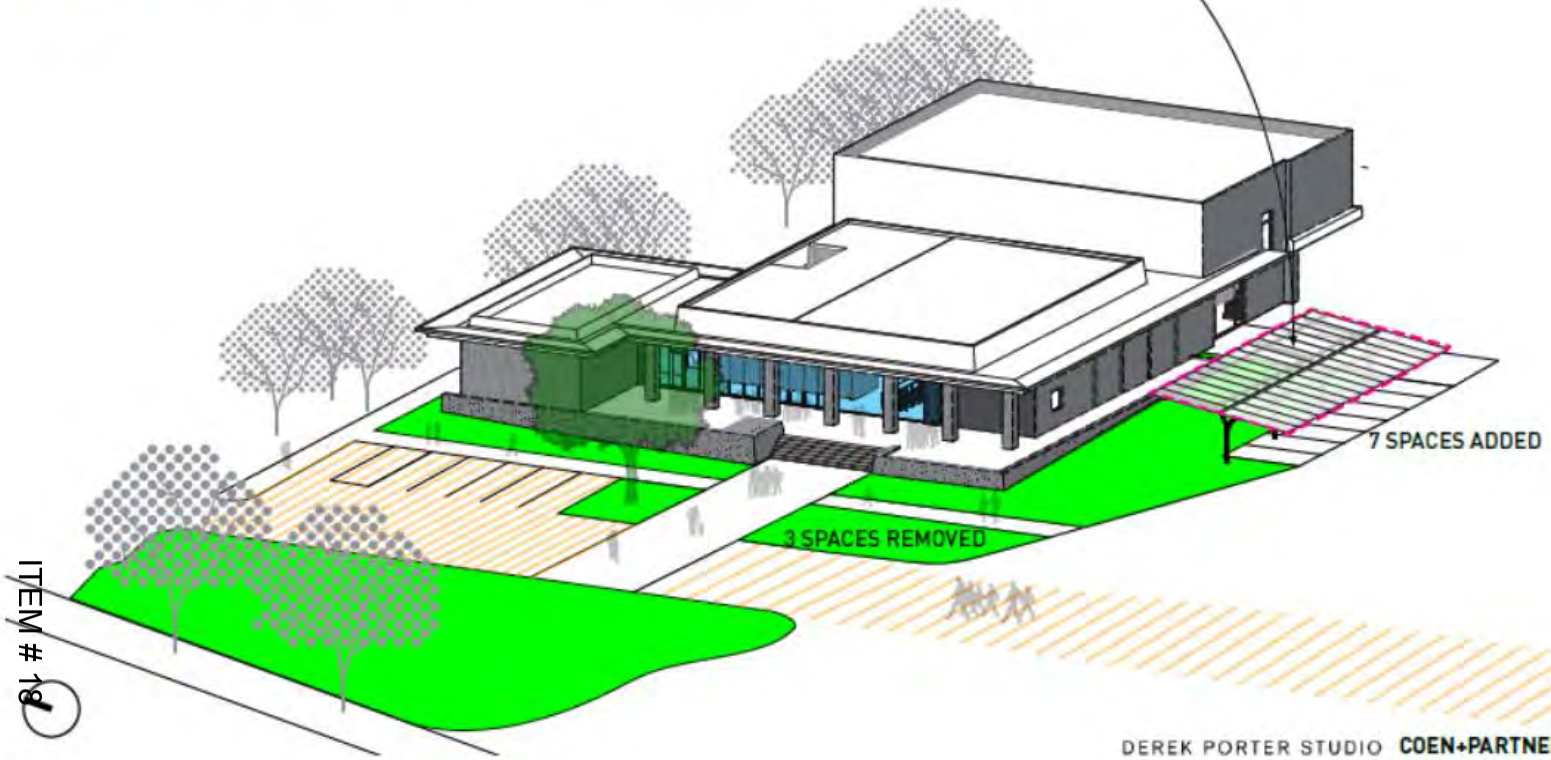
SOUTHERN SOLAR PANEL BAY

SOLAR PANELS FROM HILTON FOUNDATION

RECONFIGURED STRUCTURAL FRAME



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PARKING PLAZA

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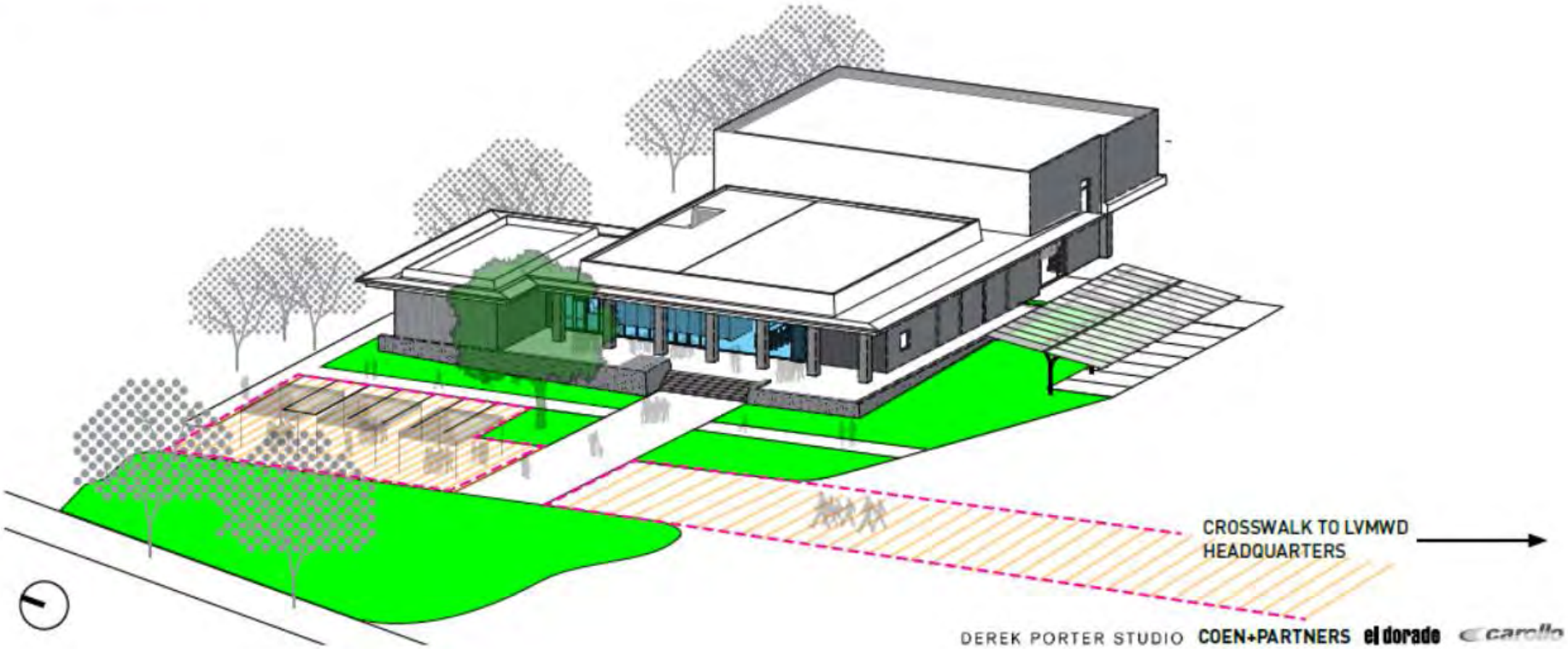
GRAPHIC PLAZA / PAVING



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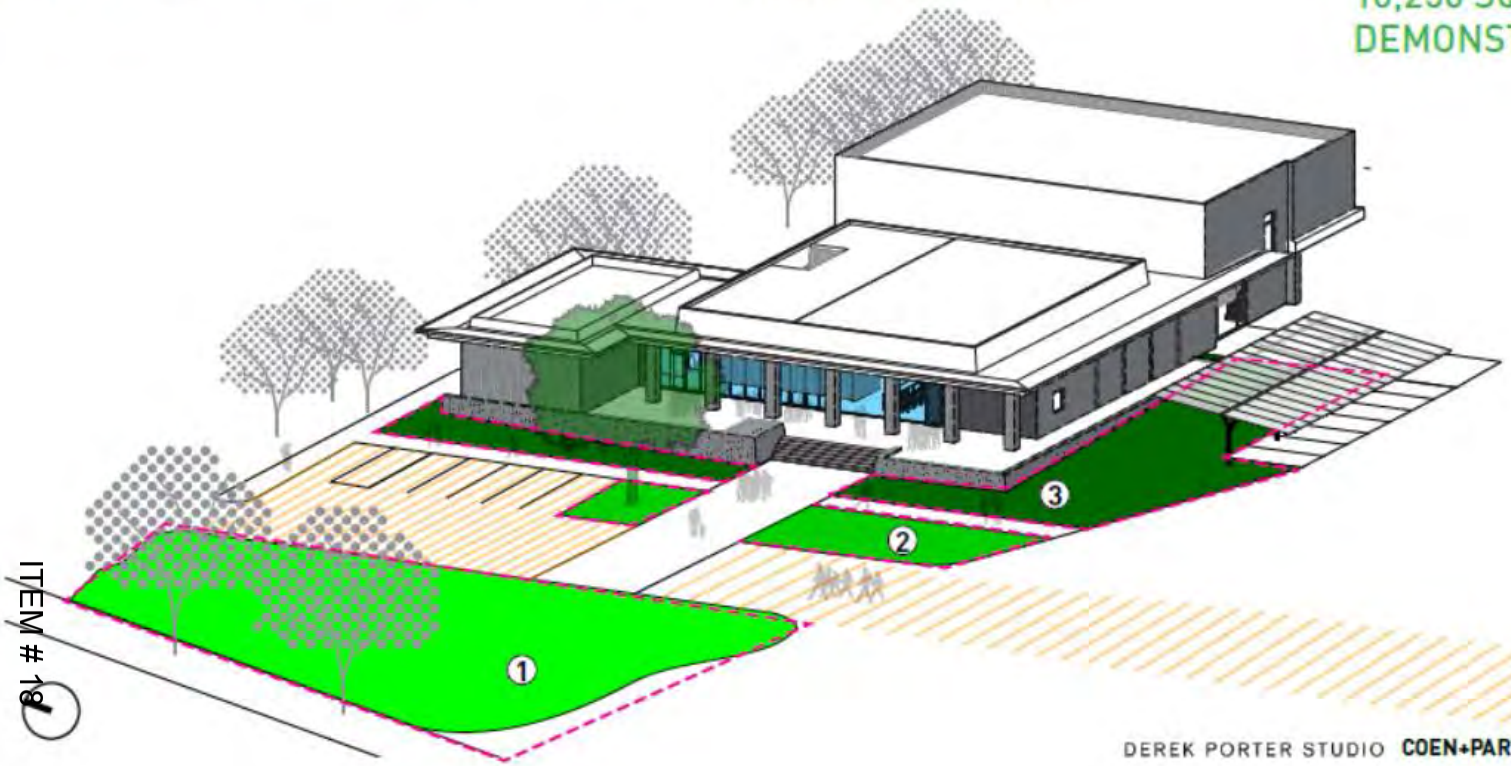
NATIVE GARDENS

SUN TOLERANT NATIVE GRASSES AND PERENNIALS

MIXED SUN/SHADE PLANTINGS

SHADE TOLERANT TEXTURAL PLANTS AND GROUNDCOVERS

10,250 SQUARE FEET OF DEMONSTRATION GARDEN



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SITE PLAN / COMPARISON

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PROPOSED SITE PLAN

A - SUN PERENNIAL GARDEN
B - PARKING PLAZA
C - COASTAL LIVE OAK
D - ENTRY PROMENADE
E - MIXED SUN/SHADE GARDEN
F - FRONT PORCH
G - PURE WATER EXHIBITION
H - SHADE SEDUM GARDEN
I - SOLAR PARKING
J - SOUTH ENTRY

40' 80'

EXISTING SITE PLAN

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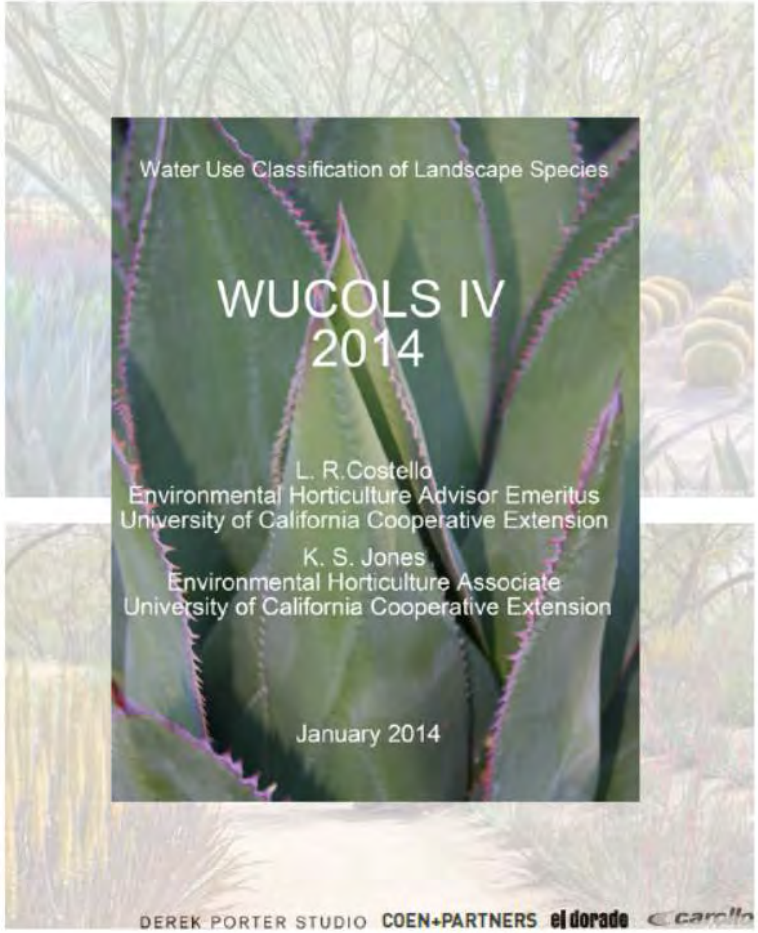
PLANTING / SELECTION

NEW WATER LAW — NEW OPPORTUNITIES

California Landscape Contractors Association

MWELO



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EXISTING BUILDING

Exterior Improvement

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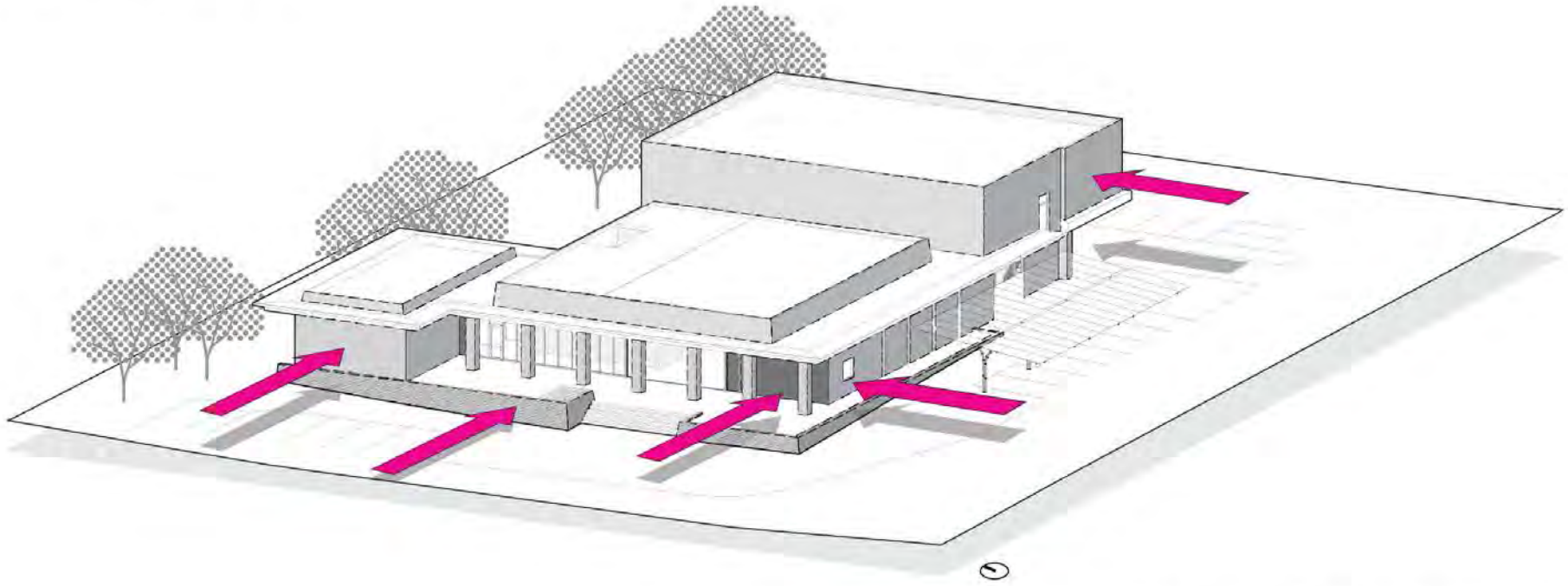
REFRESH WITH PAINT

to give the building new life



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EXISTING BUILDING

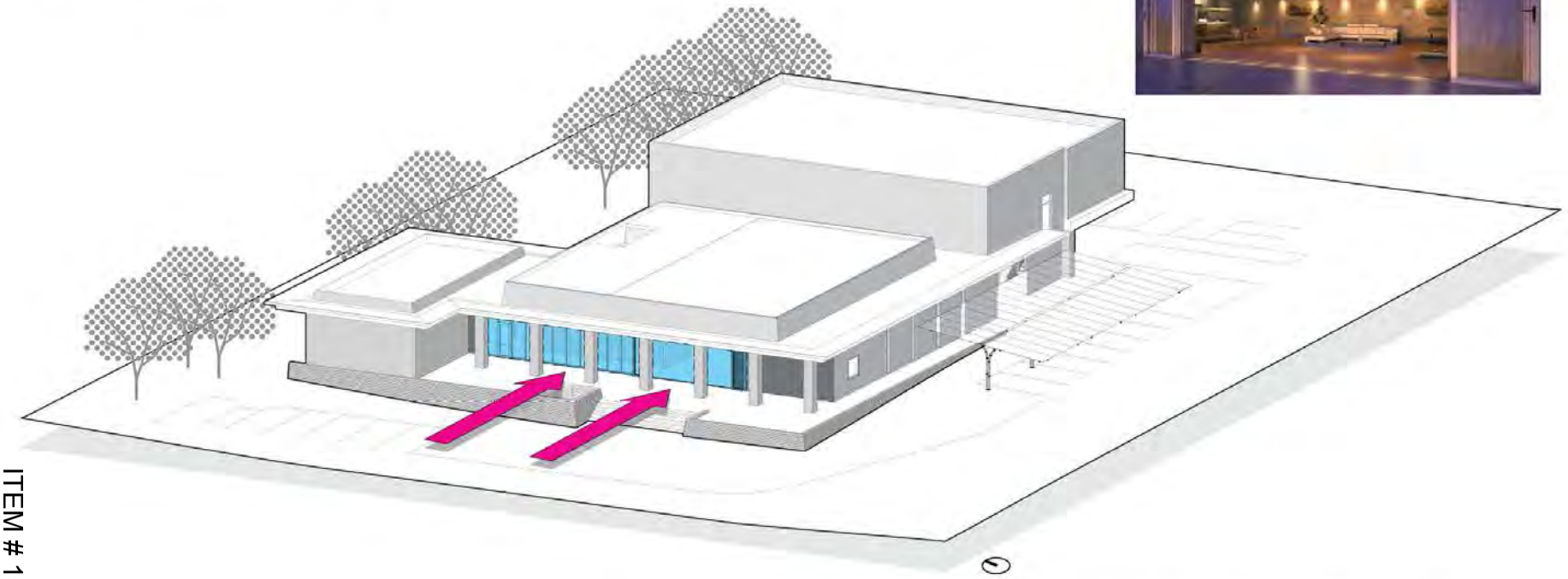
Exterior Improvement

REMOVE TILE HEADER

EMPLOY FULL HEIGHT
SLIDING GLASS WALL SYSTEM

MAXIMIZE TRANSPARENCY

to encourage welcoming presence



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ITEM # 18

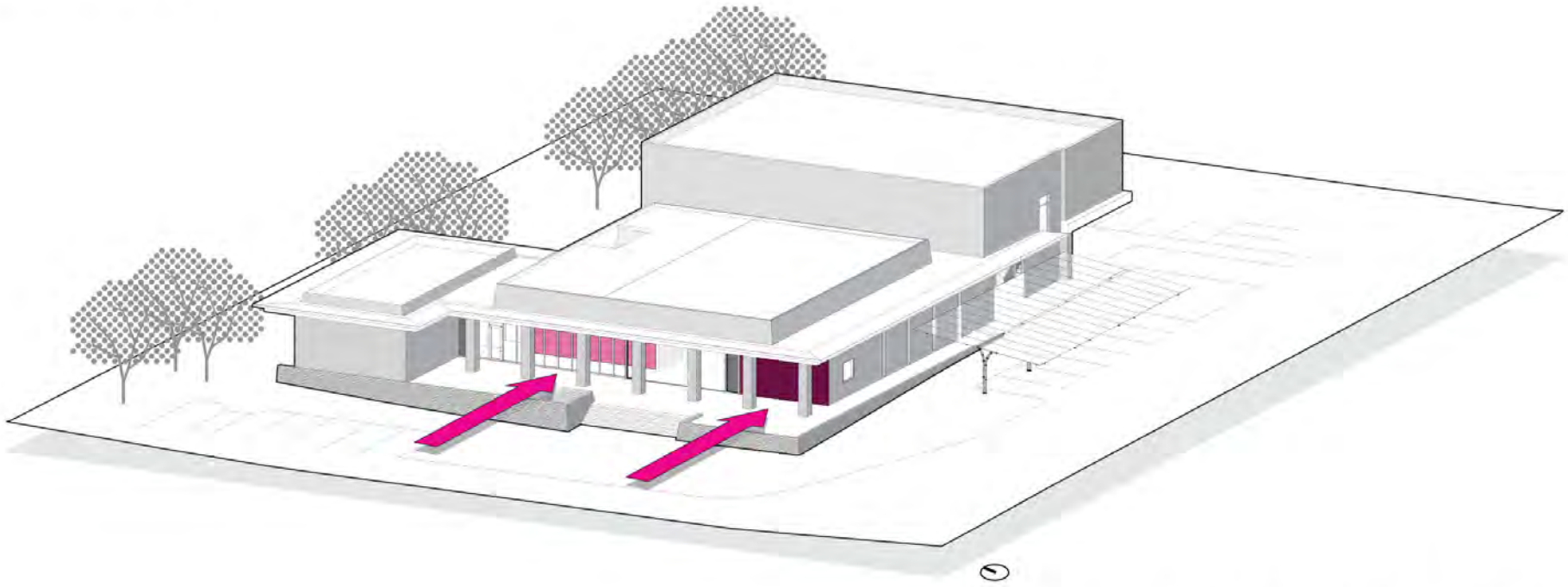
EXISTING BUILDING

Exterior Improvement

ITEM # 18

USE BOLD SIGNAGE

to announce the project



EXISTING BUILDING

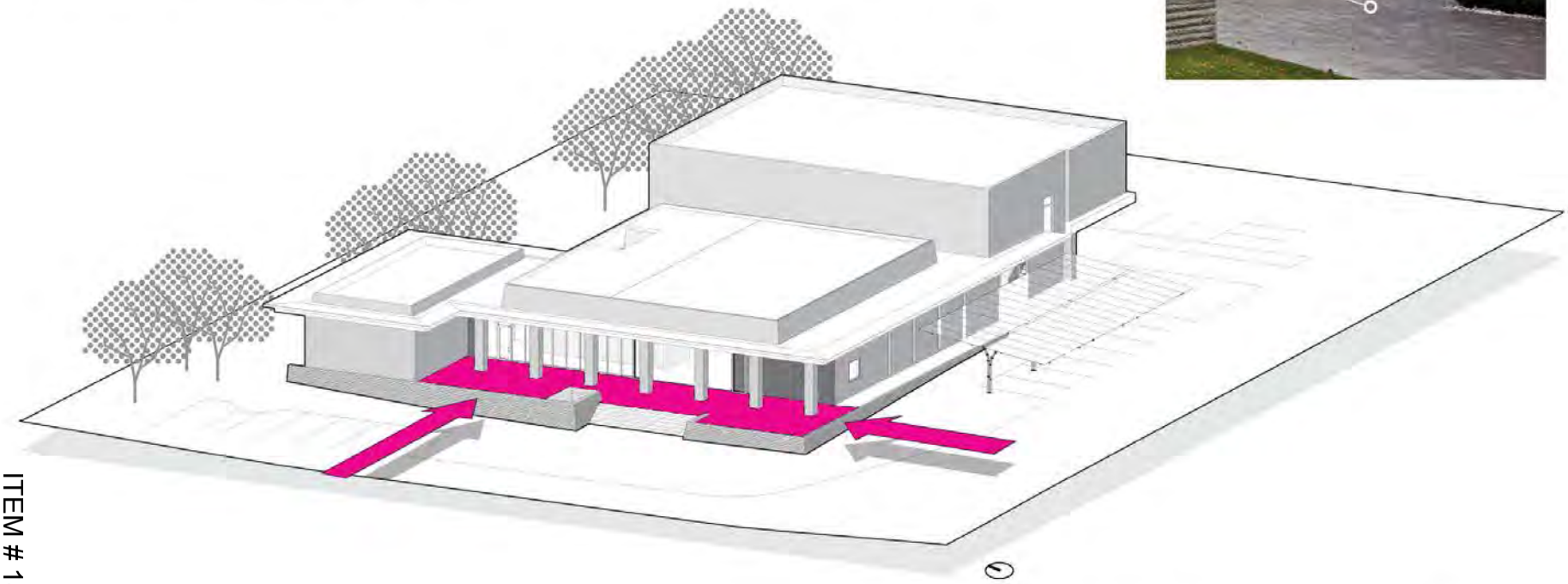
Exterior Improvement

REMOVE RED TILE

REPLACE WITH
NEUTRAL PAVERS

REVITALIZE THE PORCH

to capitalize on California's wonderful climate



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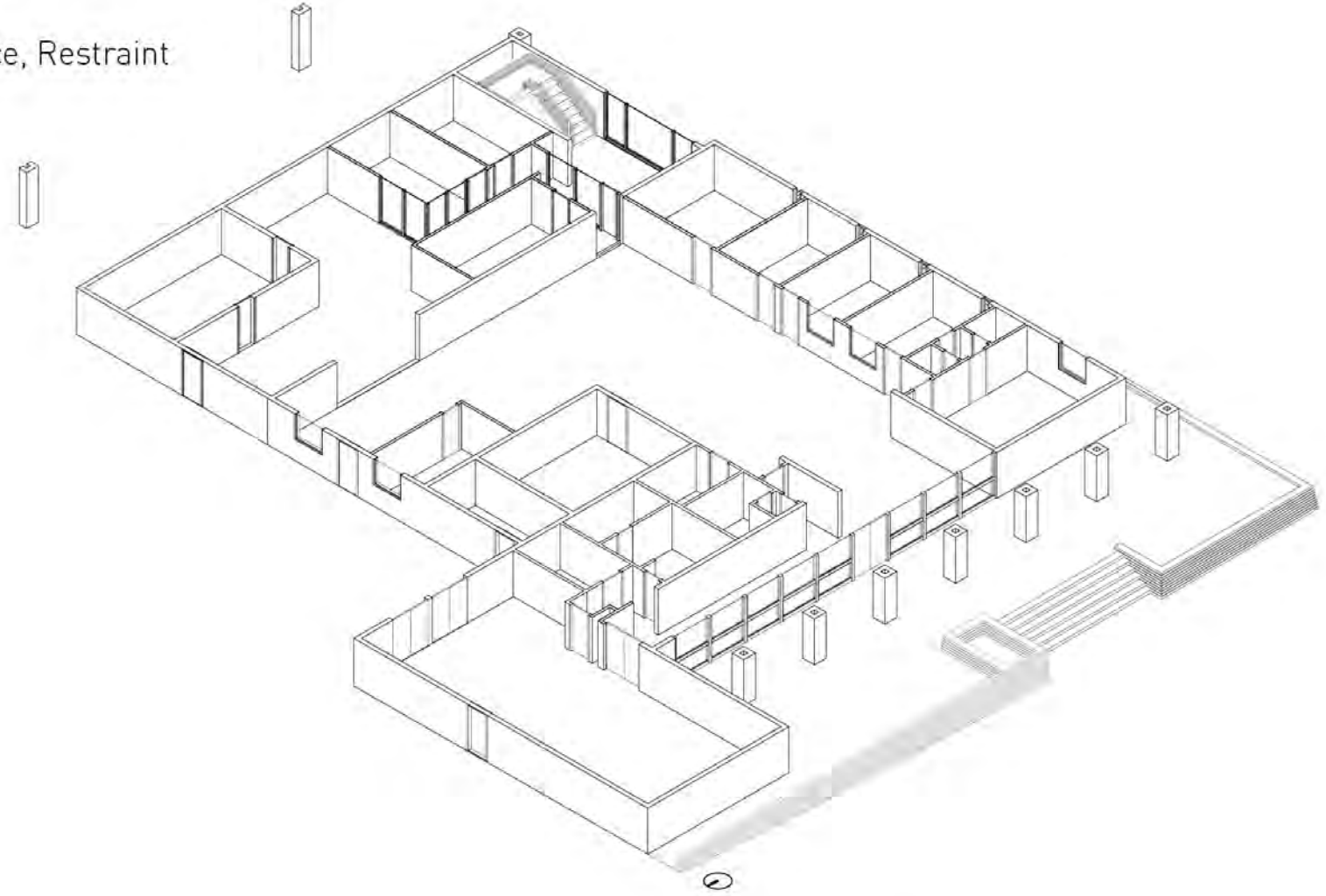
ITEM # 18

INTERIOR

Simplicity, Elegance, Restraint

ITEM # 18



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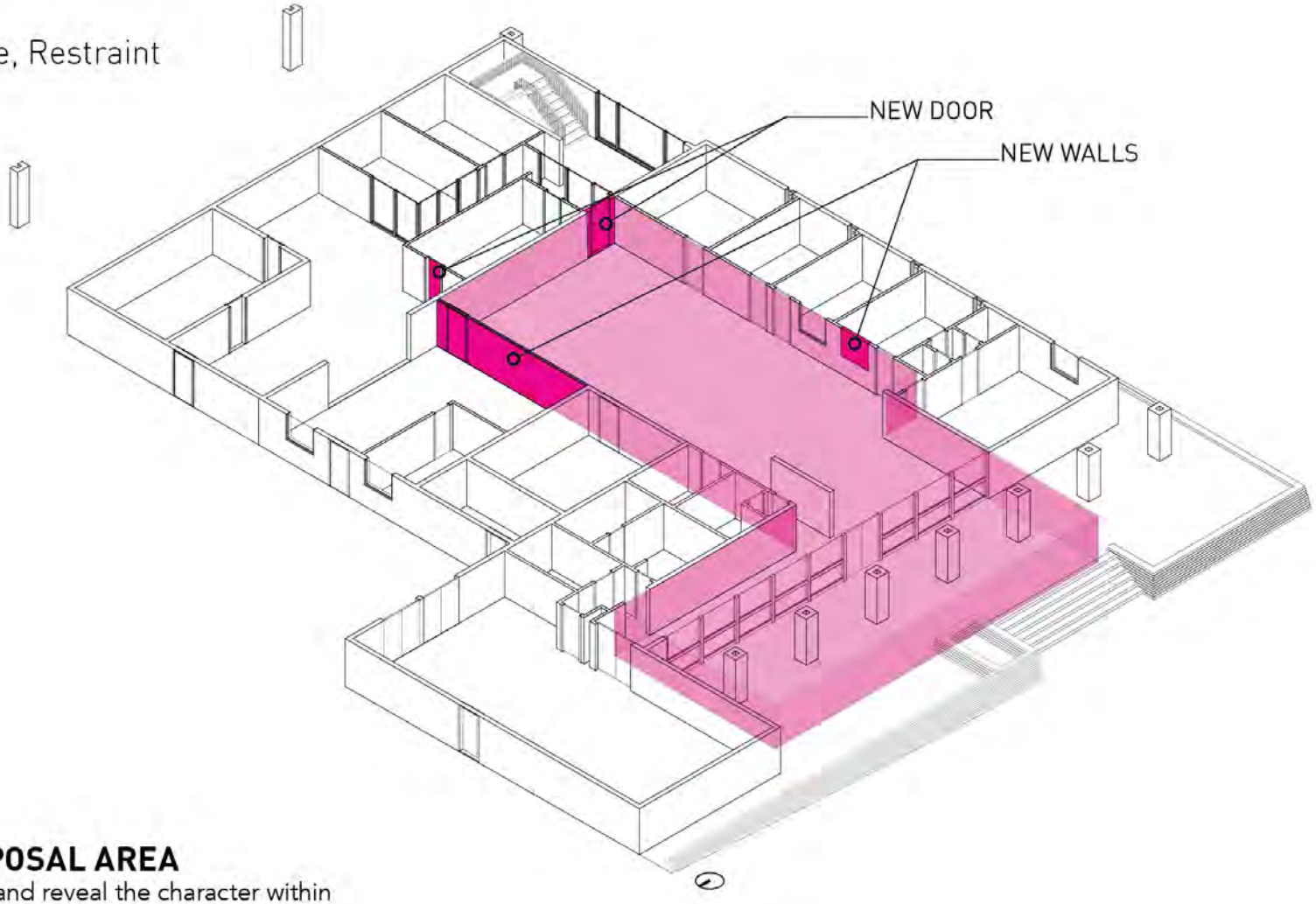
INTERIOR

Simplicity, Elegance, Restraint



DEFINE THE PROPOSAL AREA

to limit the area of work and reveal the character within

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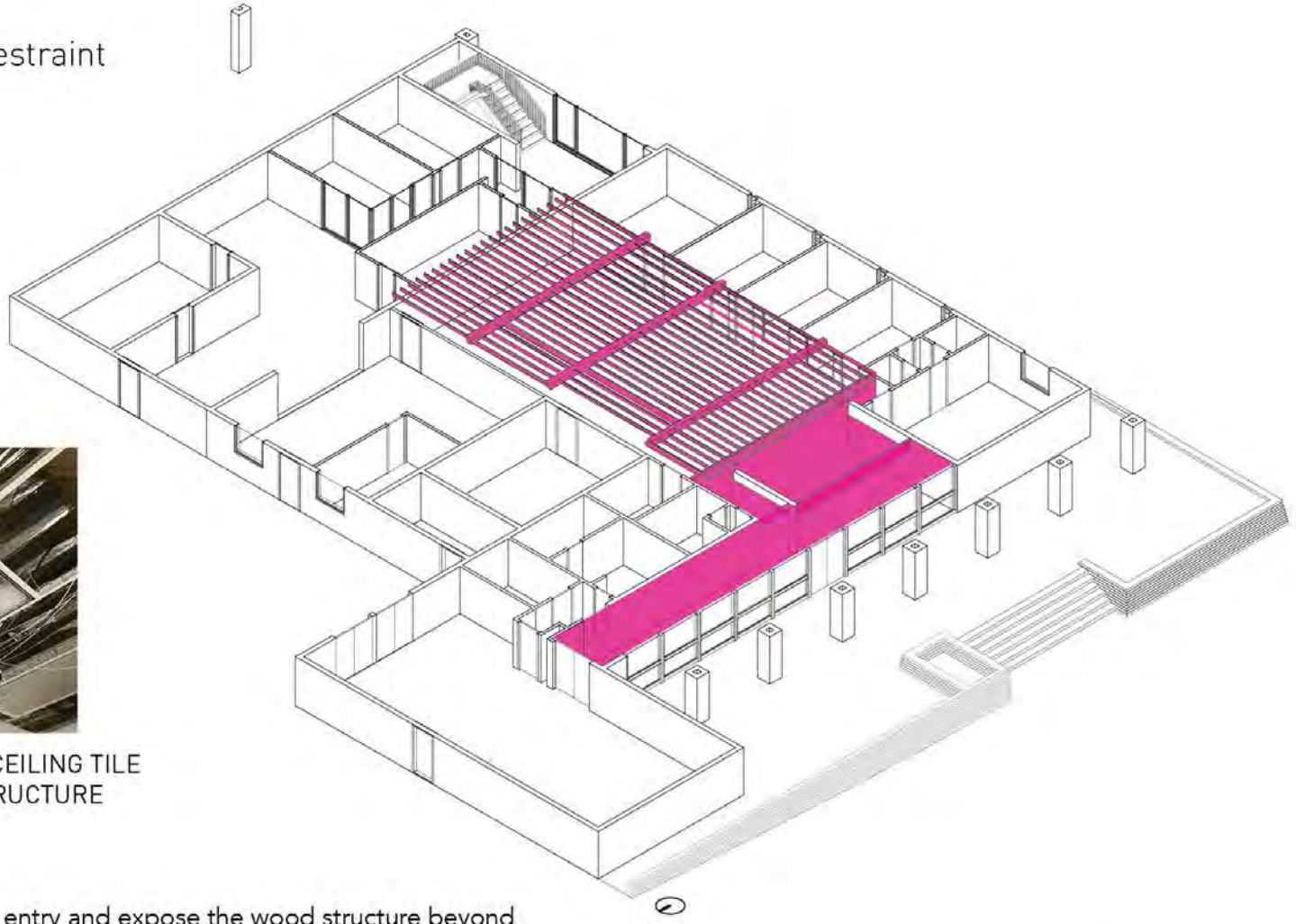
INTERIOR

Simplicity, Elegance, Restraint

ITEM # 18

REMOVE CEILING TILE
WOOD STRUCTURE

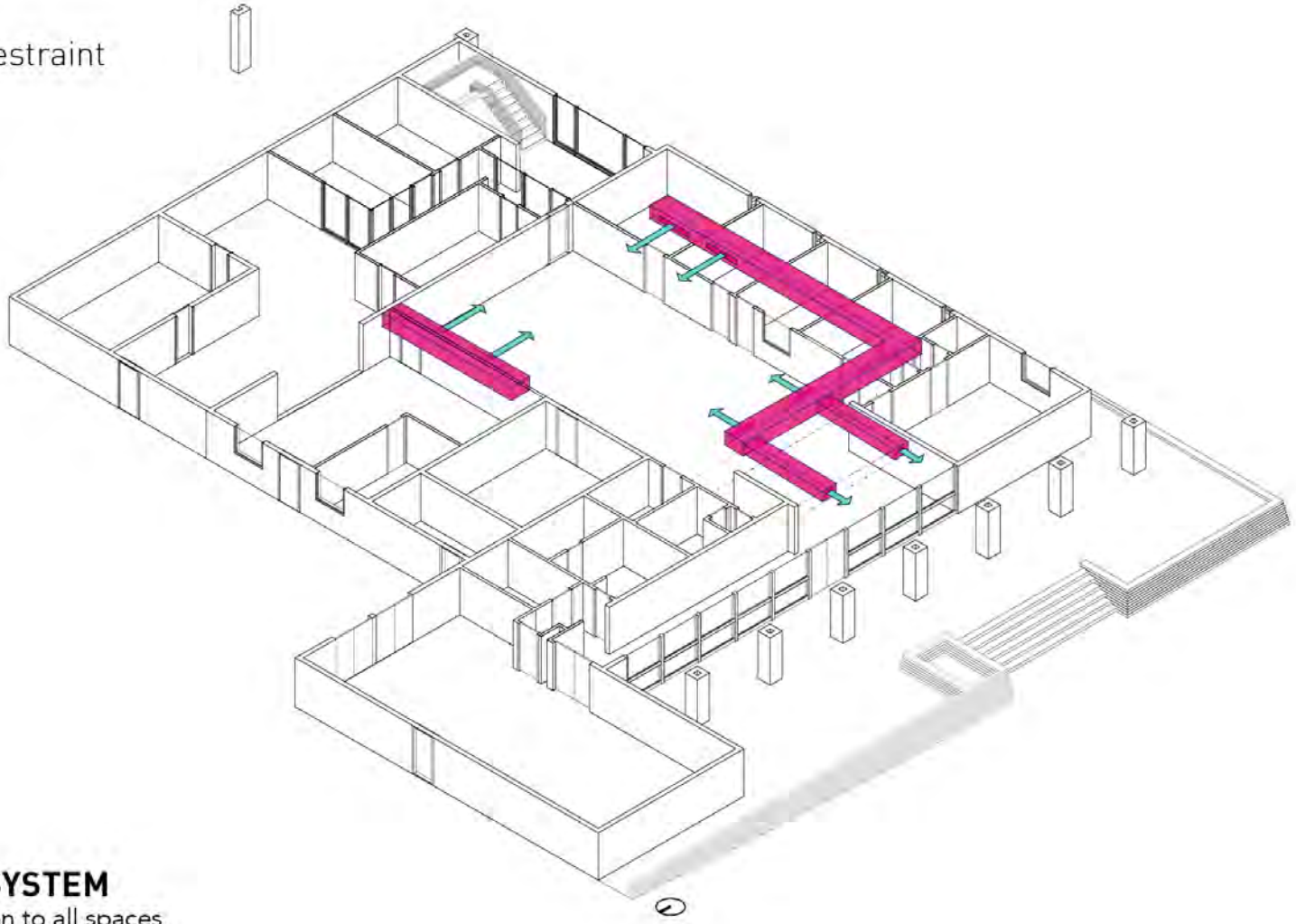


CRAFT THE VOLUME

to create clean surfaces at the entry and expose the wood structure beyond

INTERIOR

Simplicity, Elegance, Restraint



REROUTE THE HVAC SYSTEM

to provide adequate ventilation to all spaces

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INTERIOR

Simplicity, Elegance, Restraint

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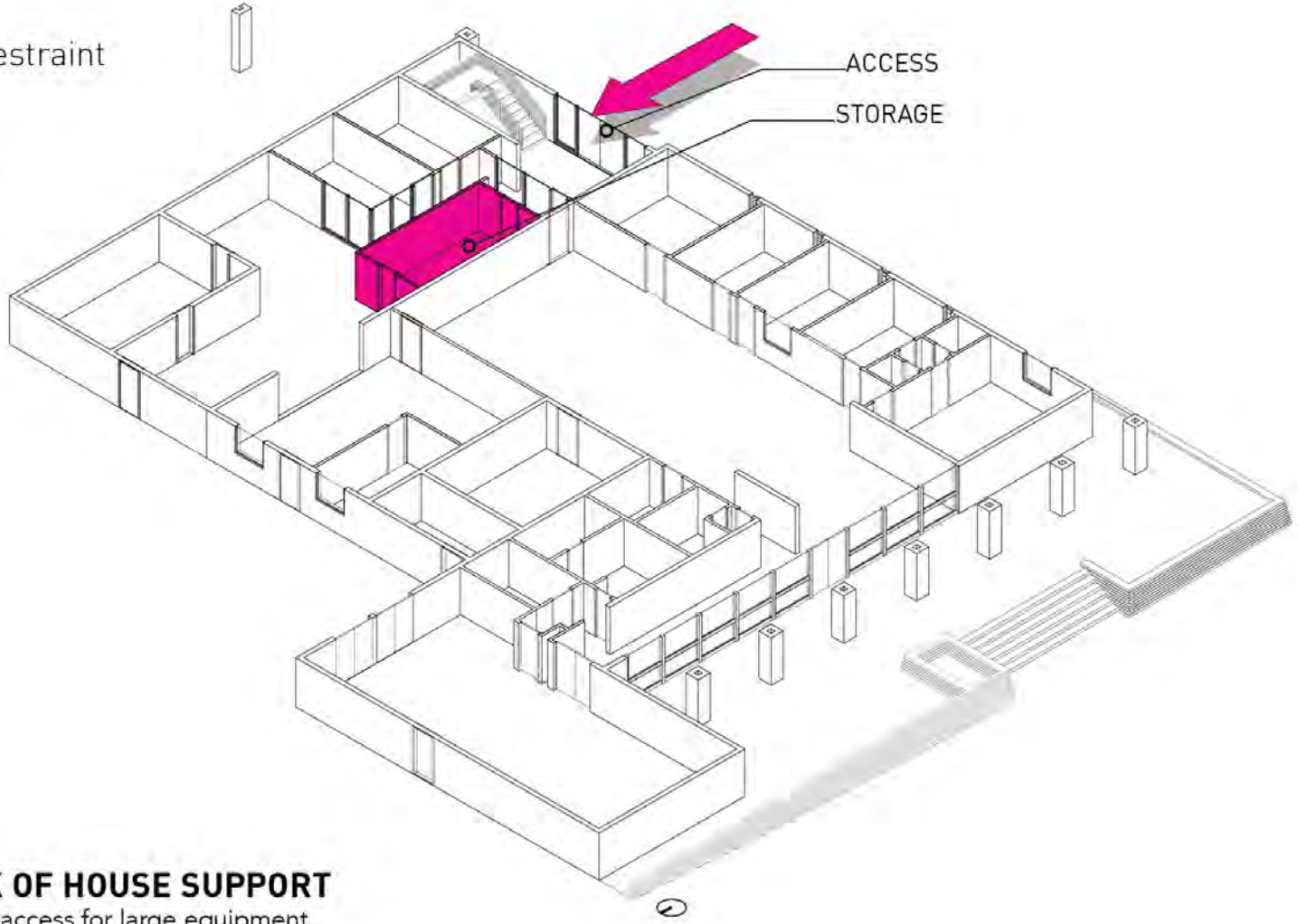
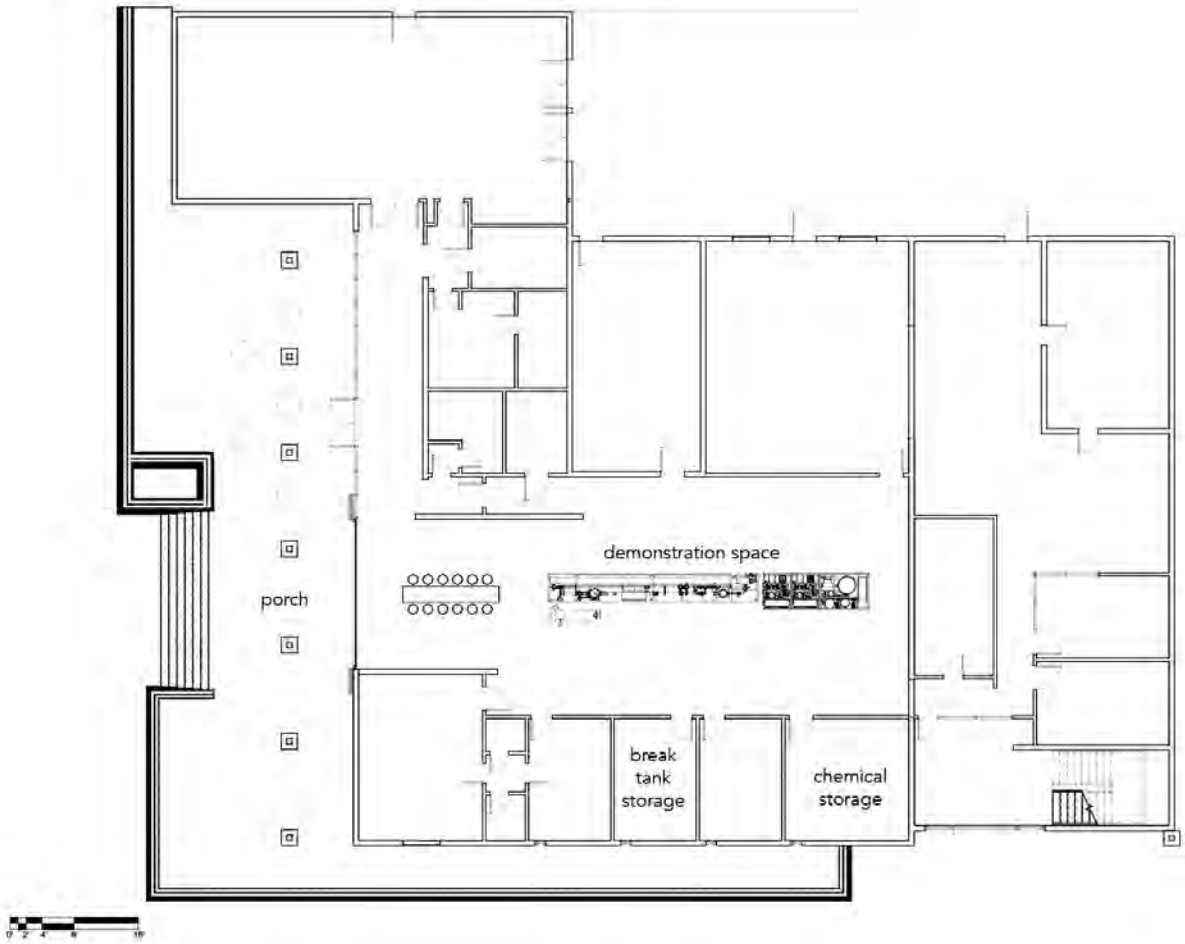


ESTABLISH THE BACK OF HOUSE SUPPORT

to locate storage and provide access for large equipment

INTERIOR

"Pure Water"



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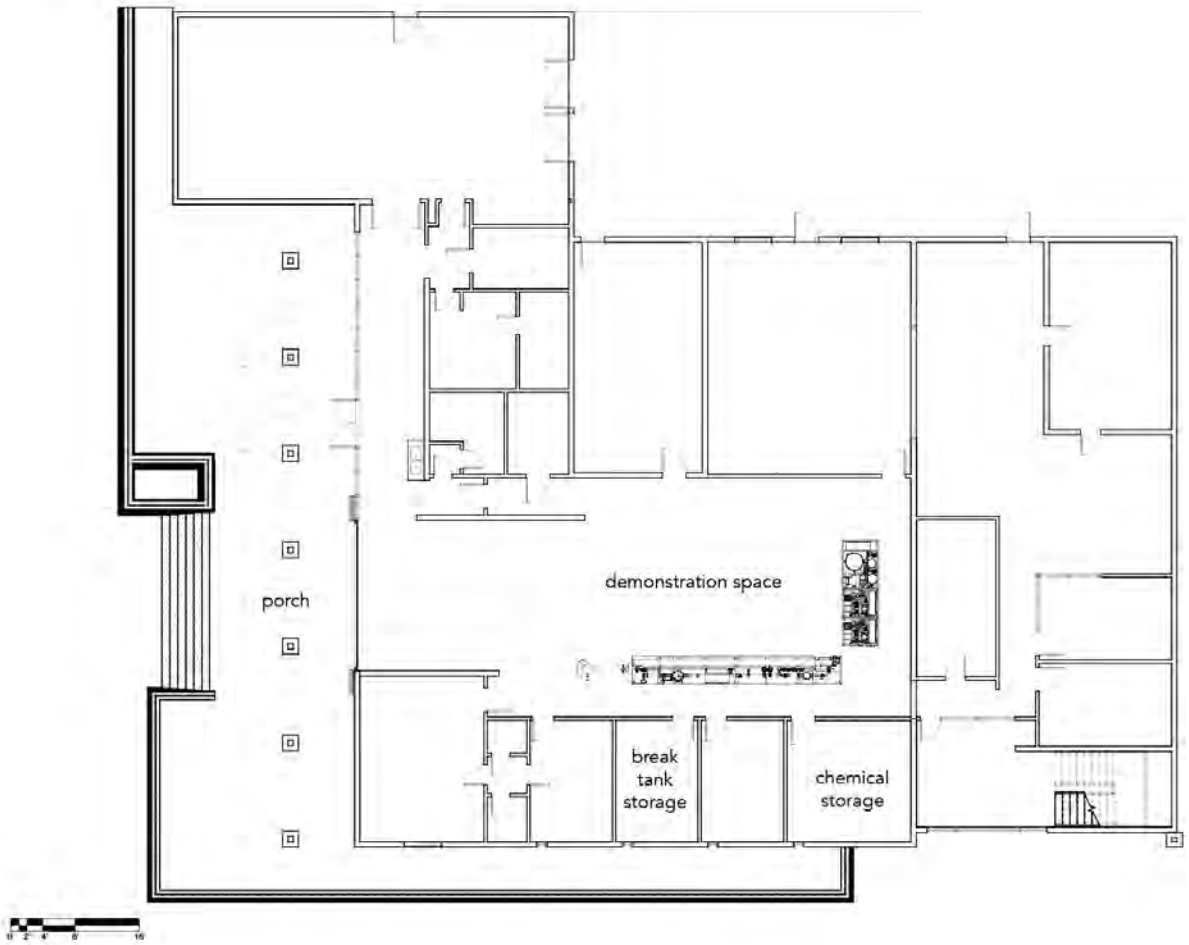
INTERIOR

"Future Water"

ITEM # 18



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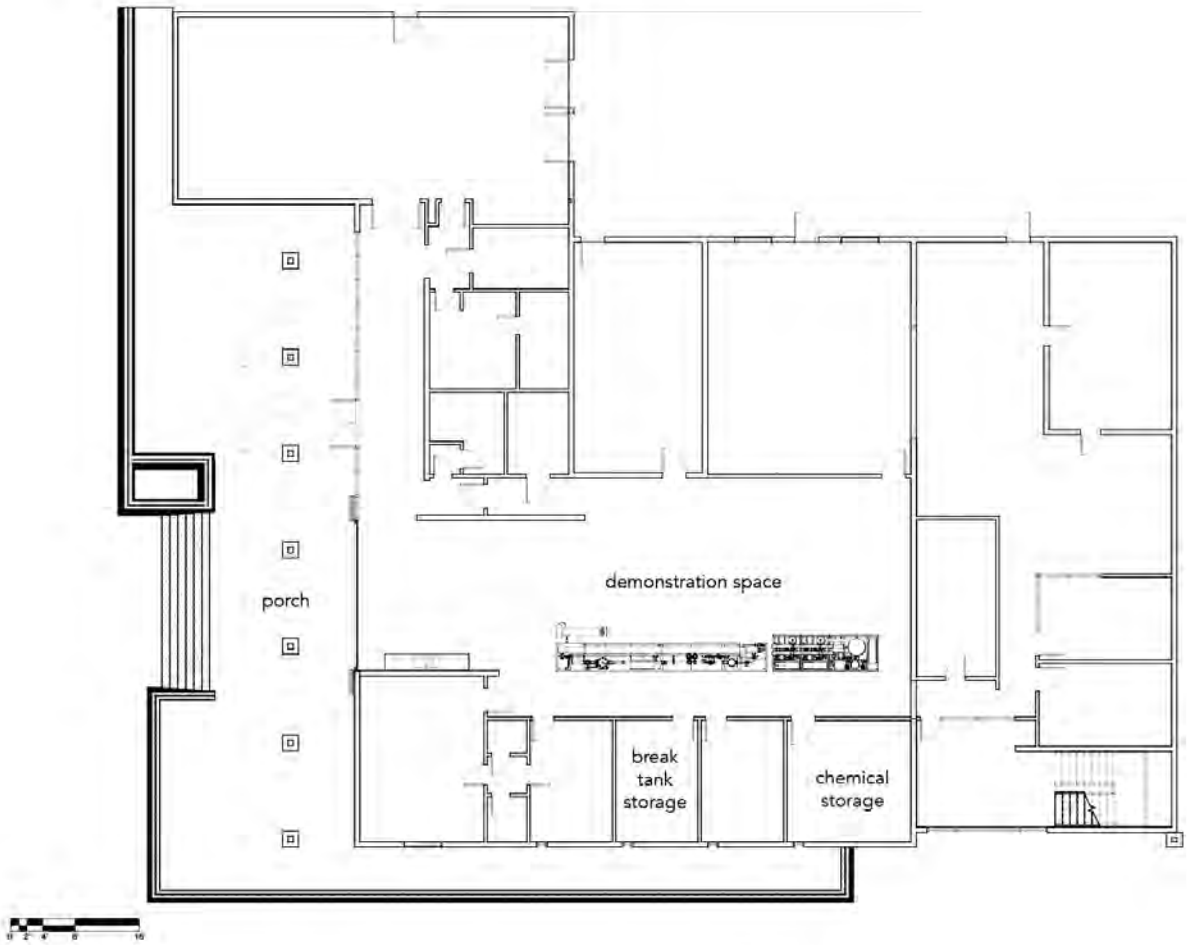
INTERIOR

"Pure Water"



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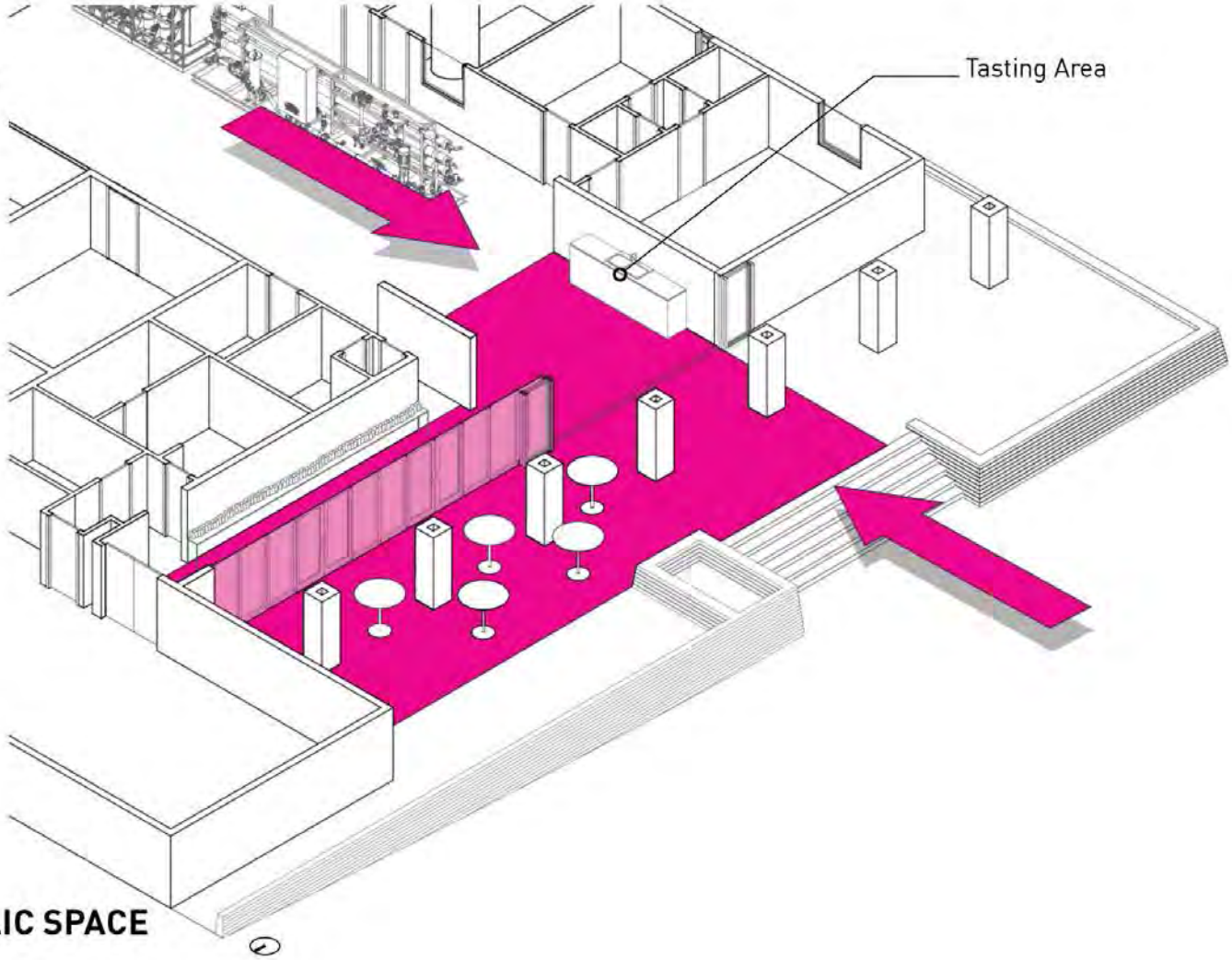
INTERIOR

Simplicity, Elegance, Restraint

ITEM # 18



CREATE A WELCOMING PUBLIC SPACE

to use and enjoy in all seasons

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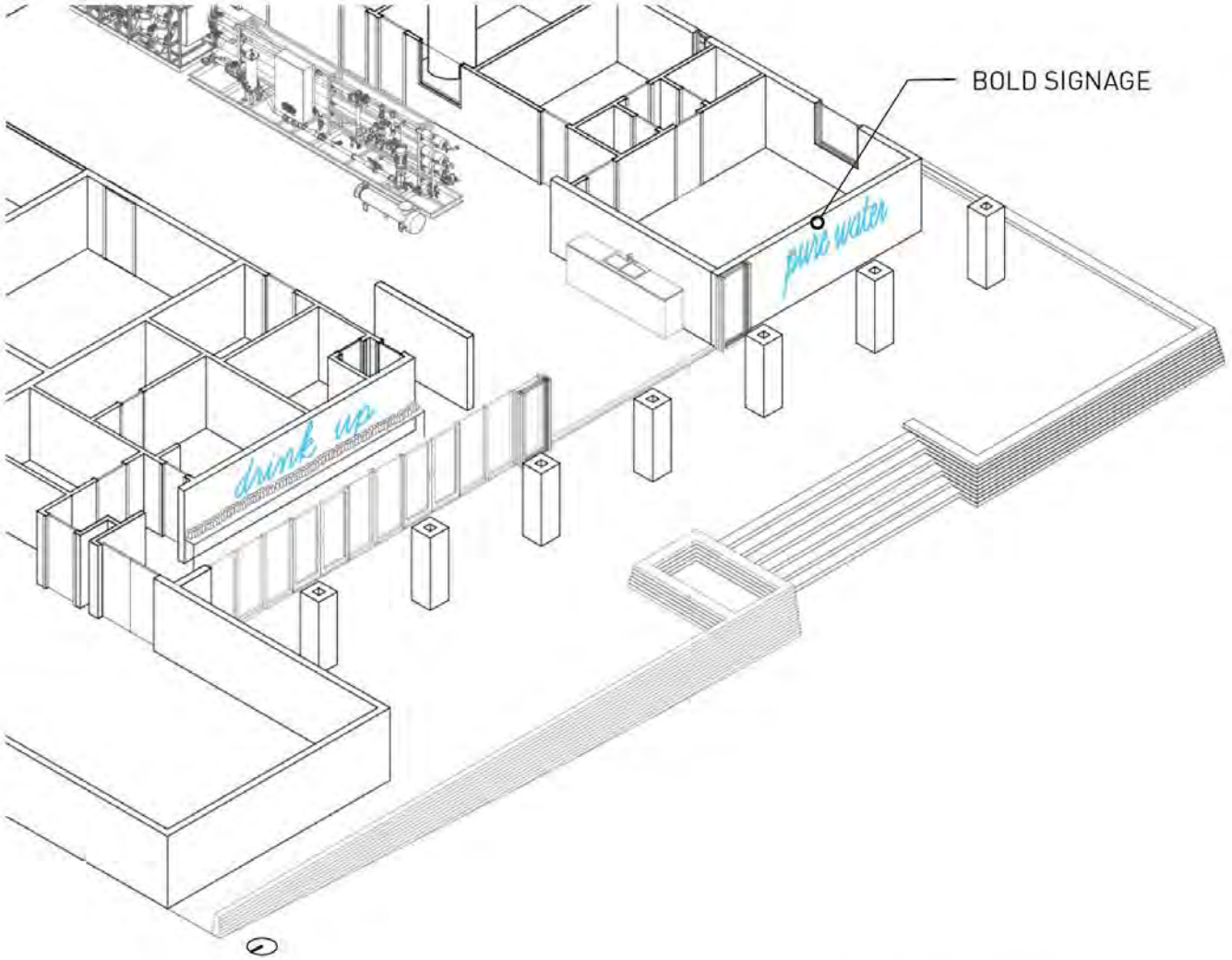
INTERIOR

Simplicity, Elegance, Restraint



USE BOLD SIGNAGE

to announce the project

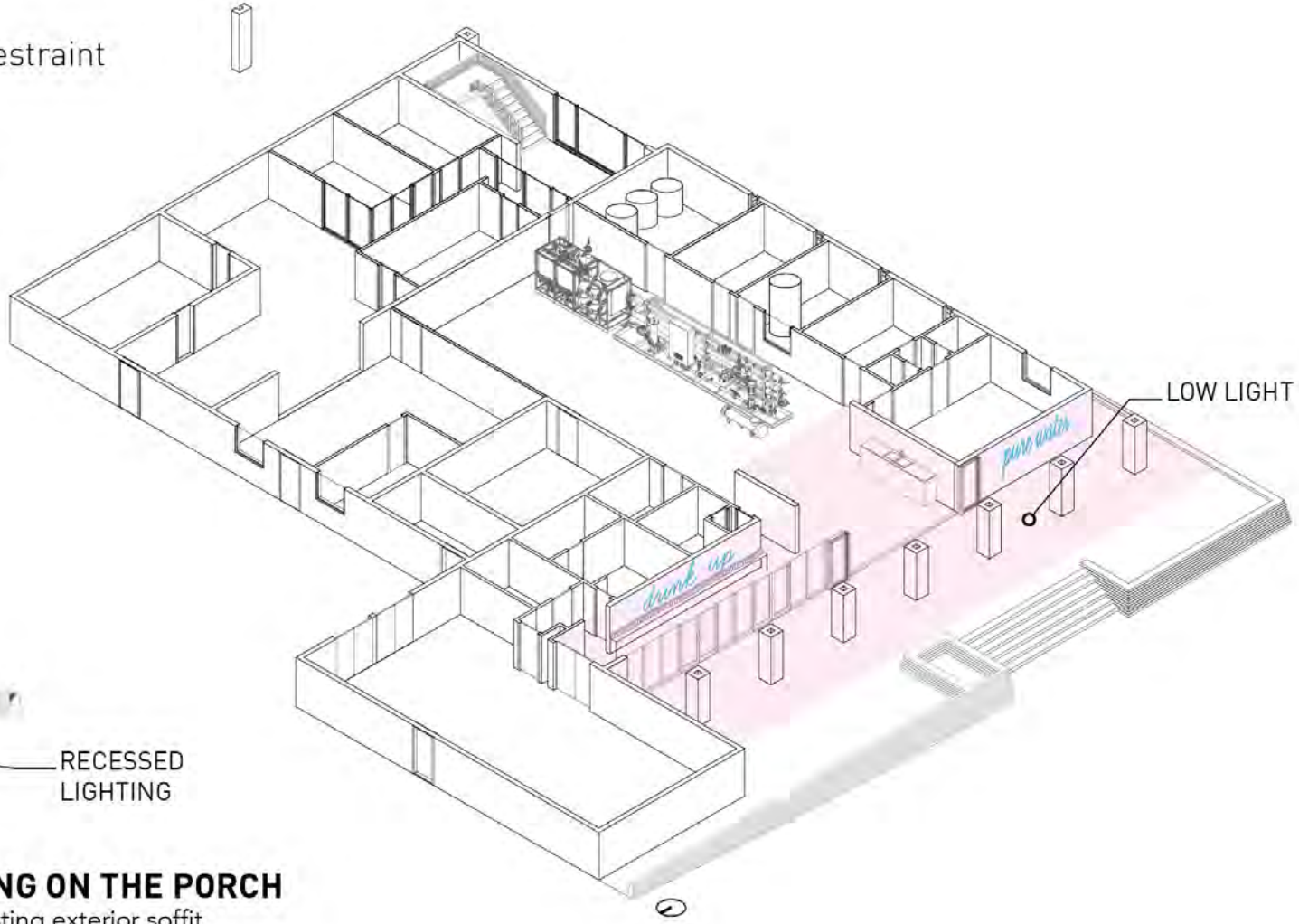
ITEM # 18

ITEM # 18

INTERIOR

Simplicity, Elegance, Restraint

RECESSED LIGHTING



PROVIDE LOW LIGHTING ON THE PORCH

with recessed lights in the existing exterior soffit

EXPERIENCE

Approach

ITEM # 18

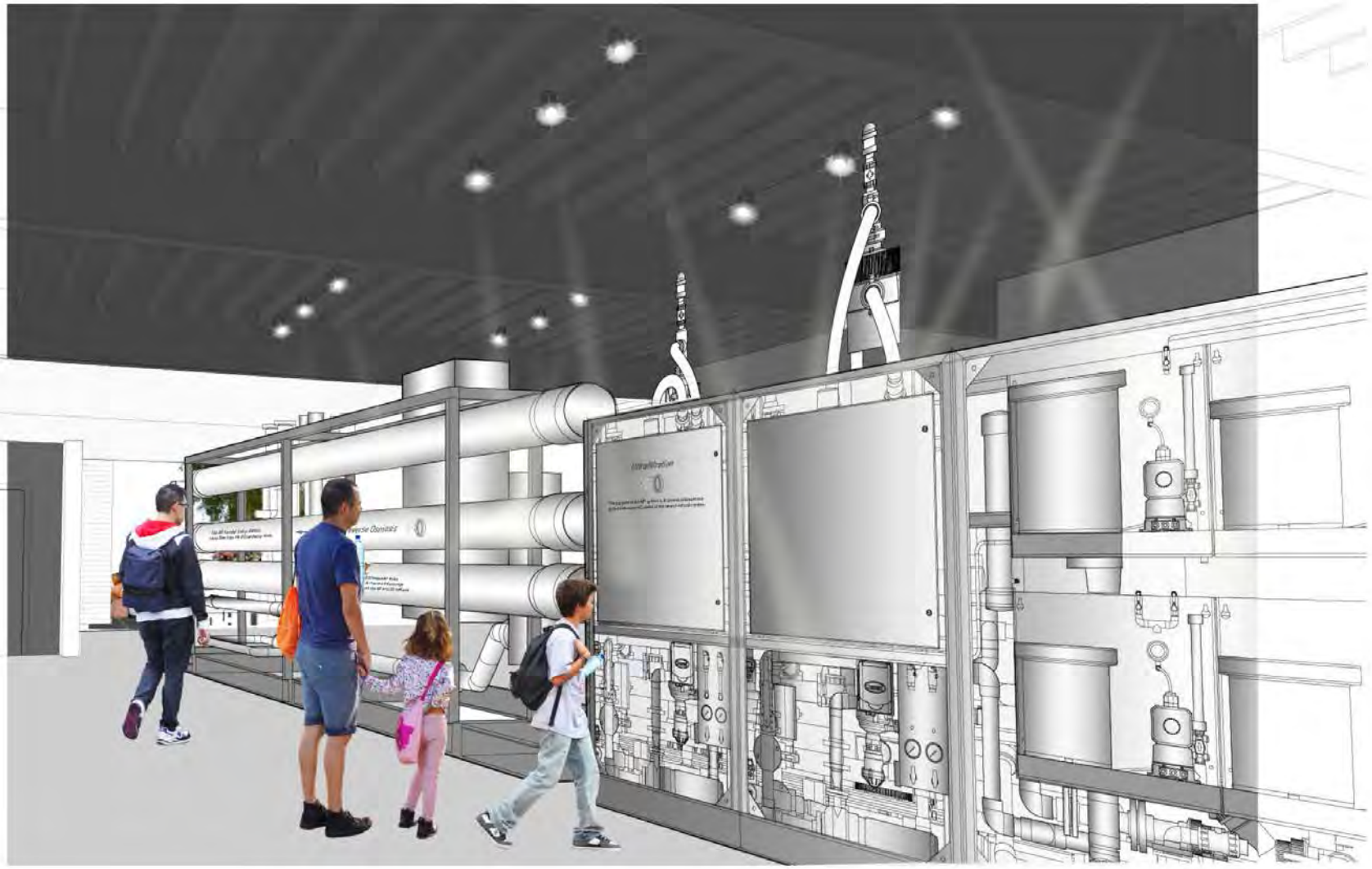
EXPERIENCE

Front Porch

ITEM # 18

EXPERIENCE

Interior



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Estimated Costs

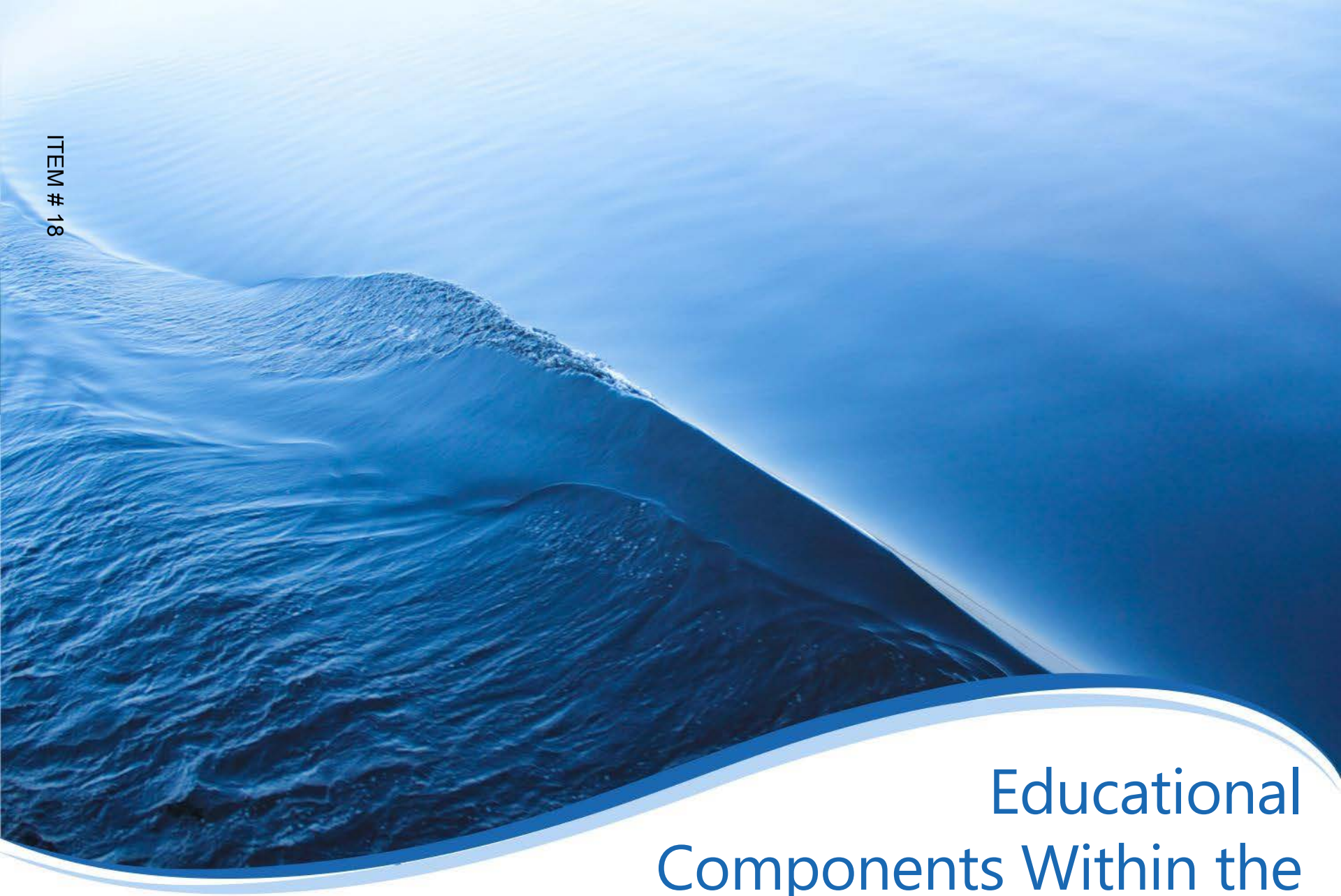
ITEM # 18

Preliminary Cost Estimate (costs under development)

Area	Cost
General Site Development	
UF System	
RO System	
UV AOP System	
Chemical Facilities	
EI&C, HVAC, Structural, and Miscellaneous Mechanical	
Architectural Improvements	
Total	

ITEM # 18

ITEM # 18



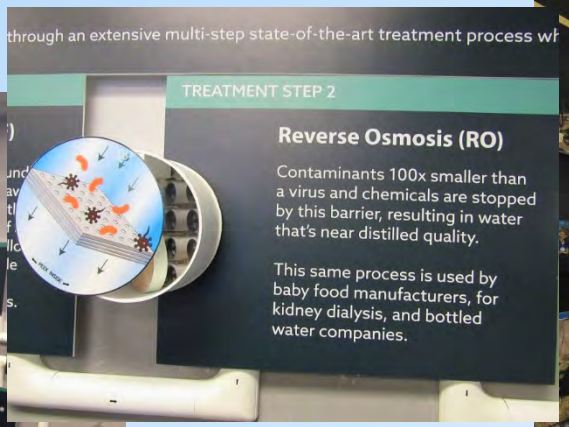
Educational Components Within the Demonstration Facility

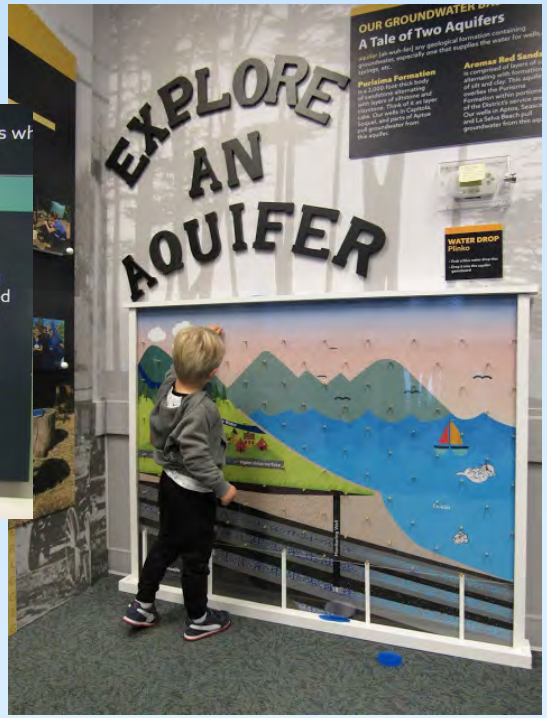
Altamonte Springs

ITEM # 18

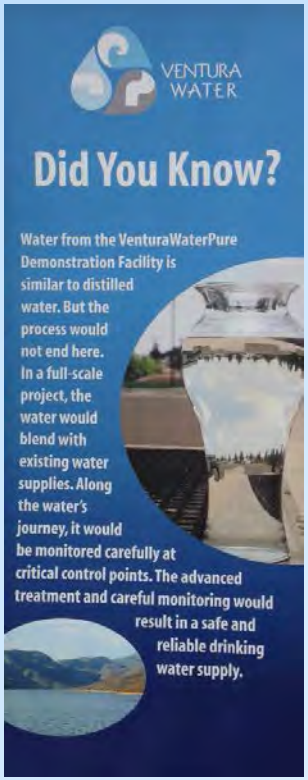
ITEM # 18

Soquel Creek Water District





Ventura Water



ITEM # 18

ITEM # 18

Monterey

Questions & Discussion

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Proposition 12 Santa Monica Bay Restoration Grants

PROPOSAL SOLICITATION AND APPLICATION

Coastal Conservancy

bay restoration commission
STEWARDS OF SANTA MONICA BAY

ITEM # 18

Santa Monica Bay Restoration Grant Program

ANNOUNCEMENT

The California State Coastal Conservancy (Conservancy) and the Santa Monica Bay Restoration Commission (SMBRC) announce the availability of grant funds for projects that advance the goals and priorities of the Santa Monica Bay Restoration Plan (BRP). Grant funding is made available by Proposition 12, the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000 (Prop 12), which allocated to the Conservancy $25 million for the restoration of Santa Monica Bay (SMB). Prop 12 provides for the Conservancy to use the SMB funds for grants to public agencies and non-profits to implement storm water and urban runoff pollution prevention programs, habitat restoration, and other priority actions specified in the BRP. The SMBRC establishes project eligibility and priority criteria.

SMBRC staff and Conservancy staff will work together on a coordinated grant award process to award the remaining Prop 12 funds for the SMB, approximately $6.9 million. Applications will be accepted and evaluated on a rolling basis. SMBRC staff will review each application. If SMBRC staff determine that the projects meets the SMBRC eligibility and priority criteria, the staff will recommend that the Conservancy award a grant. The Conservancy staff will review each application recommended by SMBRC. If the application meets the Conservancy's eligibility and priority criteria, it will recommend that the Conservancy award a grant. This process will continue until the Conservancy has awarded all remaining grant funds. Grantees must be ready and able to complete projects by March 2022. The eligibility and priority criteria and additional information about the grant award process are below. The grant application is attached.

ELIGIBILITY AND PRIORITY CRITERIA

ELIGIBLE GRANTEES

Government agencies (including federal, state, local, special districts, federally-recognized tribes) and certain nonprofit organizations are eligible for funding. To be eligible, a nonprofit organization must qualify under the provisions of Section 501(c)(3) of the Internal Revenue Code, and its articles of incorporation must demonstrate that the organization's purposes are consistent with Division 21 of the Public Resources Code, the Coastal Conservancy's enabling legislation.

PROJECT ELIGIBILITY

Projects must be consistent with the purposes of the funding source. Prop 12 provides for the Conservancy to use the SMB funds for grants to implement storm water and urban runoff pollution prevention programs, habitat restoration, and other priority actions specified in the BRP and for the SMBRC to determine project eleigibility criteria. The SMBRC has determined that eligible projects must meet one or more of the goals and objectives of the BRP.

The Coastal Conservancy may fund property acquisition and project planning, design, and/or construction in accordance with Division 21 of the Public Resources Code. Regional planning, research, monitoring, and assessments will generally be considered only when directly tied to the furtherance of on-the-ground projects. Projects should meet the goals and objectives in the

Conservancy's **Strategic Plan**. In addition, project applications should provide information that will enable consideration of any applicable criteria specified in the Project Selection Criteria and Guidelines established by the Conservancy's board.

PROJECT LOCATION

All projects must be located within and provide beneficial impacts to the water quality, natural resources, or human benefits and values of the Santa Monica Bay and its watersheds.

CONSERVANCY PROJECT SELECTION CRITERIA

The Conservancy has adopted Project Selection Criteria, last updated in October 2014, which set forth the evaluation criteria that the Conservancy uses for all of its grant programs. To be eligible for Conservancy funding, a project must meet the Conservancy's required project selection criteria:

- Promotion of the Conservancy's statutory programs and purposes (Division 21 of the Public Resources Code);
- Consistency with purposes of the funding source;
- Promotion and implementation of state plans and policies;
- Support from the public;
- Location (must benefit coastal, ocean resources);
- Need (desired project or result will not occur without Conservancy participation);
- Greater-than-local interest;
- Sea level rise vulnerability. (Consistent with Executive Order S-13-08, for new projects located in areas vulnerable to future sea level rise, planning shall consider a range of sea level rise scenarios in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise.)

ENVIRONMENTAL DOCUMENTS

The Conservancy is required to comply with the California Environmental Quality Act (CEQA). Grant applicants should consider whether their proposed project will trigger the need for an environmental impact report or negative declaration or whether a CEQA exemption applies. How CEQA applies and the status of CEQA compliance must be addressed in the grant application.

PRIORITY CRITERIA

The SMBRC establishes grant priority criteria for the Prop 12 SMB funds and has determined that multi-benefit projects that advance the goals and objectives of the BRP are priority projects for grant funding.

GRANT PROCESS

SOLICITATION PERIOD

Proposals will be accepted on a rolling basis until all available funds have been allocated. The grant application info and materials are posted on the Conservancy's website at http://scc.ca.gov/grants/smb-grants/.

GRANT AMOUNTS

There is no established minimum grant amount. The maximum will depend on the amount of available funds remaining at the time of the application. SMBRC staff and Conservancy staff will base the recommended size of the grant on each project's needs, its overall benefits, and on the extent of competing demands for available funds.
Prop 12 does not require matching funds, however, the Conservancy and SMBRC seek to leverage Prop 12 funds and therefore strongly encourage applicants to secure matching funds in the form of cash or in-kind contributions.

GRANT APPLICATION

The grant application is attached. Complete applications should be submitted via email to smbgrants@scc.ca.gov.

Email attachments, including photos and maps, should not exceed 10MB total. Relevant photos and maps should demonstrate the location, context, and proposed outcomes of the project.

If you are unable to email the application, please contact us to discuss alternate ways to submit your electronic files. Please note: all information that you submit is subject to the unqualified and unconditional right of the Conservancy to use, reproduce, publish, or display, free of charge. Please indicate if crediting is requested for any of the photos and/or maps.

PROJECT REVIEW

Grant applications will be initially reviewed for completeness and for eligibility under Prop 12, SMBRC and Conservancy eligibility criteria, as stated above. SMBRC staff will evaluate each eligible proposal based on how likely the proposed project is to advance the goals and objectives of the BRP, whether the project is a multi-benefit project, and whether the grantee is ready and able to complete the project by March 2022.

Applicants may be contacted to provide additional information during the review process. Additionally, Conservancy and SMBRC staff may request a site visit to assist in the evaluation of a project.

GRANT AWARDS

SMBRC staff will make written funding recommendations to the Conservancy. The SMBRC will base the size of the recommended grant on each project's needs, its overall benefits, and on the extent

of competing demands for available funds. A grant can only be awarded upon Conservancy approval at a public meeting.

The Conservancy typically holds five public meetings per calendar year. Each year's meeting schedule is published on the Conservancy's website. The agenda for each public meeting will be published on the Conservancy's website ten days in advance of the meeting. Conservancy staff will prepare a report for each proposed grant presented to the Conservancy at a public meeting. The staff report will describe the project and explain how the project is consistent with the Conservancy's enabling legislation, the Conservancy Program Guidelines, the Conservancy's Strategic Plan and the evaluation criteria in these Santa Monica Bay Restoration Grant Program Guidelines.

QUESTIONS

Prospective applicants are welcome to consult with SMBRC and/or Conservancy staff prior to submitting applications. Please direct questions about the grant program and application process and potential projects to the staff listed below:

SMBRC Staff

Jack Topel: (626) 232-7128 / jtopel@waterboards.ca.gov

Conservancy Staff

Kara Kemmler: (805) 252-5272 / kara.kemmler@scc.ca.gov

ADDITIONAL INFO

FUND AVAILABILITY

Project funding will not be available until a grant agreement between the Conservancy and the grantee has been executed which will generally take two to three months following Conservancy approval of the grant award. The remaining balance of approximately $6.9 million of Prop 12 funds available for SMB restoration must be encumbered in executed grant agreements by June 30, 2020 and disbursed by June 30, 2022, after which the funds will no longer be available. Any funds unencumbered by June 30, 2020 will not be granted. Additionally, all funded projects must be completed by early Spring 2022; project costs not incurred by early Spring 2022 will not be reimbursed (the early Spring deadline is the minimum time needed for the Conservancy to be able to disburse funds by June 30).

TYPICAL GRANT AGREEMENT TERMS

Once the Conservancy has approved a grant award at a public meeting, Conservancy staff will prepare a grant agreement setting forth the terms and conditions of the grant. The grantee must sign the grant agreement and comply with all of its conditions in order to receive funds. Preparation and finalization of a Grant Agreement usually takes at least three weeks. Five copies of the Grant Agreement are sent to the grantee for signatures, and all five must be sent back to the Conservancy. The Executive Officer signs each copy and one fully executed copy is sent back to the grantee.

It is important that the person administering the project for the grantee be familiar with the procedures and requirements of the Grant Agreement. There are several steps and requirements for grantees receiving Conservancy funding. To help prospective grantees understand the process, listed below are the typical requirements for receiving funds from the Conservancy. It may be useful for the grantee to arrange a meeting with the Conservancy Project Manager early in the project to review the Grant Agreement conditions.

The Grant Agreement describes these and other requirements in greater detail and will be the controlling document. If there are any questions about the Grant Agreement, discuss them with the Conservancy Project Manager. Close review of and compliance with the Grant Agreement is essential and is the grantee's responsibility.

Typical Conditions and Requirements of Conservancy Grants

- The Conservancy usually limits overhead to 15%.
- Expenses incurred before the Grant Agreement with the Conservancy is executed cannot typically be billed to the grant.
- The Conservancy typically reimburses grantees for expenses after they are incurred. This means the grantee will have to cover the costs of the project between the time the expenses are incurred and they get paid by the Conservancy. It typically takes about 6 weeks between the time an invoice is received at the Conservancy and the payment is received by the grantee.
- Grantees are typically responsible for operation, maintenance and monitoring of completed projects for 20 years.
- Grants to nonprofit organizations for work on property not owned by the nonprofit require an agreement between the landowner, the nonprofit and the Conservancy to protect the public interest in the project.

All Conservancy grantees should expect to be audited by the State of California. Grantees must maintain all necessary records to substantiate and document all payments made pursuant to a Conservancy grant. If a grantee cannot provide adequate records when they are audited, they may be required to repay grant funds.

The Conservancy requires nonprofit grantees to submit the **Nonprofit Organization Pre-Award Questionnaire** to help flag any potential issues with accounting and record keeping before the grantee begins work. Technical assistance may be available to help grantees meet all of the state's accounting requirements. The Coastal Conservancy requires that all nonprofit organizations complete a pre-award questionnaire every two years. If your organization has submitted the questionnaire within 24 months, you may indicate that in your application.

Coastal Conservancy

Santa Monica Bay Restoration Grant Application

For your reference please use this link to our Grant Application Instructions

CONTACT INFO			
Organization*	Las Virgenes Municipal Water District		
Contact Person	Dave Roberts		
Position/Title	Resource Conservation Manager		
Phone	(818) 251-2145	**Email**	DRoberts@LVMWD.com
Address	4232 Las Virgenes Rd., Calabasas, CA 91302		
Federal Tax ID #	95-2212398		

*Organization Type – If applicant qualifies as a 501(c)(3) organization, provide your IRS 501(c)(3) letter and Articles of Incorporation (AOI) as attachments to your completed Non-Profit Questionnaire. Note: Applicants who have submitted the Non-Profit Questionnaire in the past two years do not need to resubmit. Non-profits only need to submit the AOI and 501c3 letter once, unless they are updated.

PROJECT INFO			
Project Name	Pure Water Project Las Virgenes-Triunfo (Pure Water Project)		
Summary	The Pure Water Project is a multi-benefit, phased, indirect potable water reuse project for reservoir augmentation that will produce up to 6 million gallons of local, drought resistant water supply per day while improving in-stream habitat. This grant application is for the Demonstration Project only, the first phase of the Pure Water Project, which is necessary to implement before the full-scale project.		
Total Project Cost	$ 2,534,000	**Amount Requested**	$ 1,155,375
Start Date	06/2018	**End Date**	11/2020
Project Type (check all that apply)	■ Planning ☐ Acquisition ■ Implementation/Construction ☐ Access ■ Water Quality ■ Climate Change ■ Habitat Conservation/Enhancement ☐ Urban Greening		
Acres/Linear Feet	25,500 ft	**APNs** (Acquisition Only)	

LOCATION INFO			
County	Los Angeles	**Specific Location**	Calabasas
Latitude	34.136505	**Longitude**	-118.701359
What point is represented by the lat/longs (eg., parking lot, center of site, etc):	Center of existing building for Demonstration Facility		
Is project in a Disadvantaged Community ? mapping tool: https://gis.water.ca.gov/app/dacs/	☐ Yes ■ No ☐ Partially ☐ Adjacent/will benefit		

ELECTED OFFICIALS		
Districts	**Number(s)**	**Name(s)**
State Assembly	44,45, 50	Jacqui Irwin, Jesse Gabriel, Richard Bloom
State Senate	27	Henry I. Stern
Congressional	30, 33, 26, 25	Brad Sherman, Ted Lieu, Julia Brownley, Steve Knight

PROJECT DESCRIPTION

Complete each of the elements of the project description below with clear, but detailed answers.

1. **Need for the project.** Describe the specific problems, issues, or unserved needs the project will address.

   The Demonstration Project, the first phase of the full-scale Pure Water Project, will address three important needs: 1) Demonstrate the feasibility of the Pure Water Project and its ability to address the regulatory requirements of the Sediment and Nutrient TMDL for Malibu Creek and its associated regulatory permits. The in-stream limits for nutrients as required by the TMDL will essentially prohibit the discharge of recycled water into Malibu Creek and are anticipated to help improve in-stream habitat. The Pure Water Project will, instead, utilize that recycled water that would otherwise have been discharged into the creek by converting it into high quality potable water, thereby using the waste product for beneficial reuse and satisfying the in-stream nutrient requirements of the TMDL. Upon its completion, the Pure Water Project will comprise nearly 20 percent of the water demand throughout the service area by providing up to 5,141 acre-feet of locally-sourced water annually. The project will also reduce dependence on imported water and eradicate the greenhouse gas emissions associated with the electrical demand needed to transport this amount of water each year. 2) Inform and educate the public about advanced water treatment, safety of the treatment process and the need to locally-source water by diversifying our water portfolio to become better resilient to drought and the impacts of climate change. 3) Garner and analyze important information and data regarding the treatment process to optimize the development of the full-scale facility and to train operators on how to use the equipment.

2. **Goals and objectives.** The goals and objectives should clearly define the expected outcomes and benefits of the project.

   The Demonstration Project has three main goals that support the needs outlined above. 1) Inform and educate the public about the Pure Water Project and its benefits. Outreach and educational materials will be developed to explain the advanced treatment process and its different stages, the need for potable reuse for drought resilience and the environmental benefits of locally-sourced water. Educational tours of the facility will be frequent and provided to the local community, legislators, schools and industry professionals. Surveys will be conducted before and after the tours to gauge people's perceptions and comments. 2) Evaluate the performance of treatment options to optimize equipment selection for the full-scale project and to train staff on operations. Research will be conducted throughout the operation of the Demonstration Project to evaluate the efficiency and performance of treatment options and their efficiency at treating various constituents. 3) Demonstrate feasibility of the Pure Water Project and provide information and technical documentation for regulatory permitting of the full-scale project and for future regulatory requirements The results of the Demonstration Project's research will be used for the development of the full-scale project and will serve as a model for other agencies considering indirect potable reuse to augment surface water supplies.

3. **Project Description.** Describe all of the major project components (i.e., what will actually be done to address the need and achieve the goals and objectives).

   The District will construct a 100 gallon per minute advanced water treatment demonstration facility to test the microfiltration, reverse osmosis, ultraviolet light disinfection, and advanced oxidation components of the Pure Water advanced treatment facility. The demonstration facility will occupy an existing vacant building owned by the District. No new construction is needed, only minor refurbishment of the building. Interpretive signage and educational materials will explain each step of the treatment process, need for potable reuse and the environmental benefits associated with the project. Tours will be conducted for local schools, service groups, and the general public. Visitors will be provided the opportunity to taste the treated water and will fill in before and after surveys. Operation of the advanced water system will provide the opportunity to evaluate performance of equipment, optimize operational efficiency, train operators and compile information into a final report to be shared with other entities interested in pursuing potable reuse projects. Also during operation, information will be collected on operational controls, system performance and treated water quality which will be used to assist in the development of future regulatory documentation for design and completion of the larger Pure Water advanced water treatment facility.

Willing Seller: Projects that include land acquisition must have a willing seller. If the project includes land acquisition, please describe the status and expected conclusion of landowner negotiations.

The demonstration facility will be housed in an existing vacant building owned by the District. This is not a land acquisition project.

4. **Site Description.** Describe the project site or area, including site characteristics that are tied to the project objectives (i.e.: for acquisition of habitat, describe current vegetation assemblages, condition of habitats, known wildlife migration corridors, etc.). Include ownership and management information.

The location for the Demonstration Project is the former headquarters administration building of the Las Virgenes Municipal Water District and is owned by the District. The address is 4232 Las Virgenes Rd., Calabasas, CA 91302. The building frontage faces Las Virgenes Rd. and includes adequate visitor parking. The building interior includes plenty of space to provide tours, educational materials such as informative signs, interactive features, room for visitors and a large open interior space optimal for displaying each step of the advanced treatment process. Visitors will be able to sit and taste test tap water, advanced treated recycled water and bottled water to see if they can tell the differences between them. The landscaping in front of the building was planted as a water conservation demonstration garden and will be updated to display an attractive alternative to traditional front yards.

5. **Specific Tasks.** Identify the specific tasks that will be undertaken and the work that will be accomplished for each task.

#	Task Name	Description	Expected Completion Date
1	Board Approval	Governing Board approval of demonstration project	06/2018
2	Equipment Set-up	Purchase, fabrication and shipping of treatment equipment	11/2018
3	Complete Design	Completion of all design elements for project construction	12/2018
4	Call for Bids	Advertise and review bids for construction and start-up of facility	12/2018
5	Award of Contract	Award contract for construction and start up of facility	02/2019
6	Construction	Construction of facility including treatment equipment installation	08/2019
7	Performance Testing	Test and adjust the treatment equipment as necessary for operation	08/2019
8	Facility Start-up	Initiate water treatment, continue testing and implement research plan	09/2019
9	Public Tours	Begin public tours of facility and implement outreach plan	11/2019
10	Final Research Repor	Complete and summarize research completed as part of project	11/2020

6. **Work Products.** List below the specific work products or other deliverables that the project will result in:

The final products will be an advanced water treatment demonstration facility and a final research report. The Demonstration Project's results will define the complete process train, address disinfection byproduct formation, establish the design criteria that will be acceptable to the California State Water Resources Control Board Division of Drinking Water (DDW) for surface water augmentation. This work will expand the industry knowledge of successful treatment processes applied to both surface water augmentation and will contribute to increased public education on the issue of advanced treated water used in indirect and direct potable reuse. The project will also include a demonstration garden which will inform community members about climate appropriate garden design and ocean friendly gardening practices.

7. **Measuring Success.** For projects involving restoration, construction or land acquisition, describe the plan for monitoring, evaluating and reporting project effectiveness, and implementing adaptive management strategies if necessary. For planning projects, do the plans include monitoring and measuring project success? Who will be responsible for funding and implementing ongoing management and monitoring?

Given the importance of public opinion regarding potable reuse, surveys will be conducted before and after facility tours. This will be complimented by broader community surveys to gauge public acceptance and assist in focusing future outreach efforts. The surveys will be conducted early during the implementation of the Demonstration Project and within a few years after the public educational efforts have been initiated to measure the success of those initiatives. The success of facility operations will be measured as part of the project research plan and optimization of equipment operation which will measure treatment effectiveness and efficiency. The ultimate measure of success will be the facilities' ability to meet water quality standards and achieve permit compliance. The results of the research plan will be shared with other entities interested in developing potable reuse projects.

8. **Applicant Capacity.** The applicant must demonstrate that it can adequately administer the grant and manage the project, and that its entire operating budget is not dependent upon the underlying grant. The applicant should address the following organizational capacity and expertise elements, including but not limited to:
   - Capacity to manage a state grant, including fiscal system and staff dedicated to financial operations;
   - Ability to address cash flow and how the applicant will handle the process of reimbursement payments;
   - Proof of qualified staff or contractors to carry out the project activities;
   - A record of success completing similar projects and the commitment to see the project to completion.
   - If applicant qualifies as a 501(c)(3) organization, provide your IRS 501(c)(3) letter and Articles of Incorporation as attachments to your completed **Non-Profit Questionnaire**. Note: Applicants who have submitted the Non-Profit Questionnaire in the past two years do not need to resubmit.

As a local government agency, the District routinely applies federal and state grant funds to projects and new initiatives. These funds are routed through the District's financial department which has extensive experience with the management of grant funds. The department is well-staffed and is highly skilled to accept these funds which will be included in the District's annual third party financial audit. The District is an enterprise special district and consistently receives cash flow from rate payer fees and possesses adequate reserve funds for capital improvement projects, emergency operations and matching grant funding requirements. The District also plays a leadership role in the local IRWMP and has recently successfully completed large, multi-party grants received from Propositions 50 and 84. The District is adept and positioned to receive these funds and has the staff experience and financial resource to successfully implement and complete the project.

9. **Project History.** Provide a history of the project including how it was identified as a priority, organizations involved in development of the project, key steps that have already been completed, and any background information not provided in the project description. Is the project related to any previous or proposed Coastal Conservancy or SMBRC projects? If so, which ones and how are they related?

   The District established a collaborative, stakeholder-driven process involving 17 organizations with various roles throughout the Malibu Creek watershed to develop an action plan in response to the 2013 Malibu Creek TMDL for Sedimentation and Nutrients. The project was given top priority because of the costly and potentially innovative methods required to meet TMDL requirements. Individual interviews of JPA board members were conducted and stakeholders were engaged in three public workshops. The workshops resulted in six conceptual scenarios, ranging from TMDL compliance with advanced nutrient removal at the Tapia WRF to a regional Indirect Potable Reuse (IPR) project to balance the constant supply of recycled water with fluctuating demands. In 2015, the JPA board selected two of the six recommendations for further analysis: IPR and repurposing Encino reservoir for recycled water seasonal storage. The 2016 Basis of Design Report (BODR) identified IPR with surface water augmentation as the best option to meet the project objectives because it involves the best and highest beneficial use of the recycled water resource. The BODR identified the Demonstration Project as a critical step to achieve regulatory and public acceptance of the project. Three more stakeholder workshops and one Board technical workshop were held, resulting in agreement on the IPR option.

10. **Maps and Graphics.** Provide the following project graphics with your application. **Project maps and design plans should be combined into one pdf file with a maximum size of 10 MB. Project photos should be provided in jpg format.**
    - Digital file of the project footprint – Please send us a shapefile or .kmz file showing the project footprint. If you need help generating this file, please contact us.
    - Regional Map – Clearly identify the project's location in relation to prominent area features and significant natural and recreational resources, including regional trails and protected lands.
    - Site-scale map – Show the location of project elements in relation to natural and man-made features on-site or nearby. Any key features discussed in project description should be shown.
    - Design Plan – Construction projects should include one or more design drawings or graphics indicating the intended site improvements.
    - Site Photos – One or more clear photos of the project site

PRELIMINARY BUDGET AND SCHEDULE

In the budget matrix below, relist the tasks identified in #4 above and for each provide: 1) the estimated completion date for the task, 2) the estimated cost of the task, and 3) the funding sources (applicant, Conservancy, and other) for the task. The table will automatically sum the totals for each row and column. **Please do not include in-kind services or contributions in the table below.**

Task Number	Task	Coastal Conservancy	Other CA State Funds	Other Non-State Funds	Total Cost	Expected Completion Date
1	Board Approval				$ 0	06/2018
2	Equipment Setup	$ 292,500		$ 292,500	$ 585,000	11/2018
3	Complete Design			$ 292,500	$ 292,500	12/2018
4	Call for Bids				$ 0	12/2018
5	Award Contract				$ 0	02/2019
6	Construction	$ 862,875		$ 862,875	$ 1,725,750	08/2019
7	Performance Testi			$ 40,749	$ 40,749	08/2019
8	Facility Start-up			$ 99,905	$ 99,905	10/2019
9	Public Tours				$ 0	11/2019
10	Final Research Re				$ 0	11/2020
TOTAL		$ 1,155,375	$ 0	$ 1,588,529	$ 2,743,904	

Other Funds

Please list all of the sources of match funding described above. Please indicate if other funding sources have been secured or are pending (applied for but not yet awarded). **Please do not include in-kind services or contributions in the table below.**

Source	Amount ($)	Status - Secured / Applied for	State of CA Funds Y/N
U. S. Bureau of Reclamation WaterSmart Research grant	$ 300,000	Secured	N
Matching funds from Las Virgenes - Triunfo JPA	$ 1,588,529	Secured	N
			N
			N
TOTAL	$ 1,888,529		

In Kind Services

In-kind services or contributions include volunteer time and materials, bargain sales, and land donations. Describe and estimate the value of expected in-kind services.

In kind services consist of staff time associated with project and construction management, operational training, tours and grant administration as well as associated general & administrative costs. For planning and budget purposes the District uses an estimate of 4% of the project cost for staff time for projects costing between $500,000 and $5,000,000. The total project cost is $2,733,991 with estimated staff costs of $109,360. For planning and budget purposes the District uses an estimate of 7% of the project cost for general and administrative costs for projects costing between $500,000 and $5,000,000 with estimated general and administrative costs of $191,379. Total in-kind services are estimated at $300,739.

Budget Justification

Please provide a brief narrative explanation of the budget that explains and justifies the costs. The purpose of the narrative is to provide background and detail to explain the costs in the budget, including the source of the estimates. The narrative should specify whether the budget includes administrative or indirect costs, and/or contingencies and those amounts of each. If the budget is based on an engineer's cost estimate, provide a copy of the estimate and specify how complete (i.e., what percent) is the design on which the estimate is based.

The Budget is based on the Scope of Work and fee schedule prepared independently by Carollo Engineers who were hired to help design, provide construction support services and start-up the facility. The estimate includes a 25% contingency. The budget does not include administrative or indirect costs unless calculated as part of in kind services.

PROJECT INFORMATION

Questions 11-21 should be answered by all applicants. For questions 22-24, enter "not applicable" if the question does not pertain to your project.

11. **Santa Monica Bay Restoration Plan Goals and Objectives:** Please list the **Bay Restoration Plan** goals and objectives that apply to the proposed project and explain how the project will serve to advance each goal and objective.

Water Quality Goal #1: 1. Improve water quality through enhancement of current regulatory framework and collaborative, integrated watershed-wide planning and implementation.
Objective 1.1 Attain TMDL water quality goals.
Objective 1.2: Eliminate and prevent water and sediment quality impairments ... in Malibu Creek watershed.
Water Quality Goal #2: Improve water quality through pollution prevention and source control
Water Quality Goal #3: Address potential impacts of emerging contaminants
Objective 3.2: Reduce loading of contaminants in waterways
Goal #14: Conserve water and increase local supply
Objective 14.1: Increase local water supplies
Objective 14.3 Further increase wastewater recycling and reuse

12. **Multi-benefit Projects:** Please explain how the proposed project will provide multiple benefits.

The Pure Water Project will improve in-stream conditions and habitat, establish the first locally-sourced water, reduce the need for imported water, the corresponding reduction in energy demand and the greenhouse gases associated with the transport of water. As a result, the Pure Water Project will provide 5,151 AF of locally-sourced water each year which will help mitigate the region from the impacts of climate change. Additionally, over 80,000 pounds of total nitrogen and close to 20,000 pounds of total phosphorus will no longer be discharged into Malibu creek each year and 4,533 tons of CO_2 emissions will be reduced annually by not importing an equivalent amount of water. As an essential first step, the Demonstration Project will educate the public on the need to develop locally-sourced water, adapt to climate change, prioritize the need for drought resiliency and plan for potential changes in water availability. This project will also educate the community about the benefits of native and climate appropriate landscaping, watershed management, and future state regulations regarding efficient water use.

13. **Environmental Review:** Projects funded by the Conservancy must be reviewed in accordance with the California Environmental Quality Act ("CEQA"). CEQA does not apply to projects that will not result in a direct or indirect change in the environment. For all other projects, if the project is statutorily or categorically exempt under CEQA, no further review is necessary. If the proposed project is not exempt, it must be evaluated by a public agency that is issuing a permit, providing funding, or approving the project, to determine whether the activities may have a significant effect on the environment. The evaluation results in a "Negative Declaration (Neg Dec)," "Mitigated Negative Declaration (MND)," or "Environmental Impact Report." **NOTE – the Conservancy can not grant funding for construction or restoration projects without final CEQA documentation.**

The proposed project…. (select the appropriate answer):

- ☐ Is not a project under CEQA. Briefly specify why.
- ■ Is exempt under CEQA. Provide the CEQA exemption number and specify how the project meets the terms of the exemption.
- ☐ Requires Neg Dec, MND, or EIR. Specify the lead CEQA agency (the agency preparing the document) and the (expected) completion date. Please note that the Conservancy will need to review and approve any CEQA document. For more information on CEQA, visit: **http://ceres.ca.gov/topic/env_law/ceqa/flowchart/index.html**.

14. **Permits:** If this is an implementation project, please list permits the project will require and their respective status.

Name of permit(s)	Status (eg. acquired, pending, included in scope of proposal)	Date of permit, or expected date
No permits required for this project		

15. **Wetland/Riparian Area Monitoring Plan:** Does the project involve the construction or restoration of a wetland or riparian area?

☒ No ☐ Yes

If yes, and the project is awarded a Conservancy grant, please note that you will be required to conduct a baseline report utilizing the California Rapid Assessment Method (CRAM) within the year prior to the beginning of project construction, unless otherwise agreed upon in writing by the Conservancy and the grantee. (More information is available at http://www.cramwetlands.org/). You will also be required to provide a plan for Completion of Post-Construction CRAM Assessment, including a budget and timeline for the collection of at least one additional CRAM assessment following construction of the project and prior to the completion date of the grant agreement in order to document the change in wetland condition at the project site. Costs associated with CRAM assessment can be included in the proposed project budget.

16. **Consistency with State Plans:** If the proposed project will help to implement or promote the goals of any of the State Plans listed below, check that plan and specify which of the plan's goals, objectives, priority actions, etc. will be furthered by the project. Provide 1-3 sentences per relevant plan explaining how the project advances that plan.

☒ California @ 50 Million: The Environmental Goals and Policy Report

Pure Water is consistent with this report by aligning with the 5th pillar, Stewarding Natural Resources, and by aligning with the growth and management strategy to "build a resilient and sustainable water system."

☒ CA Climate Adaptation Strategy/Safeguarding California: Reducing Climate Risk Plan

By locally sourcing 5,151 AF/Yr, energy for transporting and treating recycled water will be reduced by 15.5m kWh/yr and greenhouse gas production will be reduced by 4,533 tons of CO2. Additionally, this project will provide developing "a water use plan that reduces reliance on distant, unpredictable sources." Multiple benefits

☒ California Water Action Plan

Pure Water addresses all three Plan goals: Reliable water supply, Restoration of important habitat, and Resilient, sustainably managed water resource systems. Pure Water increases use of recycled water produced in the winter and for which there is no demand, by treating it to drinking water standards and using it as an

☒ CA Wildlife Action Plan

This project addresses several of the plan's objectives for southern California, by maintaining stream hydrology to mimic historic patterns with the addition of a small amount of highly treated water that will meet NPDES requirements. This additional flow assures low flows to sustain aquatic species, and aiding the federally

☐ California Aquatic Invasive Species Management Plan

☐ California Essential Habitat Connectivity Strategy for Conserving a Connected California

☒ State and Federal Species Recovery Plans (specify the plan)

Southern California Steelhead Recovery Plan - The Pure Water project helps address one objective of the Recovery Plan: Maintain and restore suitable habitat conditions and characteristics to support all life history stages of viable populations. The Pure Water Project will continue to provide in-stream water supplies to

☐ Habitat Conservation Plans/Natural Community Conservation Plans (specify the plan)

☐ California Coastal Sediment Management Master Plan

☐ Completing the California Coastal Trail

☒ Other relevant state or regional plan(s) (specify the plan):

The EPA's Malibu Creek and Lagoon TMDL for Sedimentation and Nutrients to Address Benthic Community Impairments determined that nutrient pollution caused excess algal growth and can lead to depleted dissolved oxygen. This project drastically reduces nutrient pollution to Malibu Creek by eliminating all discharge of recycled water into Malibu Creek unless an emergency necessitates.

17. **Consistency with Conservancy's 2018-2022 Strategic Plan:** Please list up to 3 of the most applicable Conservancy strategic plan goals and objectives that this project meets.

6. Enhance biological diversity, improve water quality, habitat, and other natural resources
4. Expand environmental education efforts to improve public understanding
8. Enhance the resiliency of coastal communities and ecosystems to the impacts of climate change

18. **Support:** List the public agencies, non-profit organizations, elected officials, and other entities and individuals that support the project. Describe involvement in the development of the project by communities impacted or benefited by the project. **Please do not include support letters.**

The District developed a collaborative, stakeholder-driven process involving 17 organizations with various roles in the Malibu Creek watershed to develop a plan of action in response to the 2013 Malibu Creek TMDL. Direct Potable reuse of recycled water was the preferred option selected by the group. The demonstration Project is the first step in implementing one of the first surface water augmentation potable reuse projects in the state. As a result of the identified need for potable reuse projects, this project has broad bi-partisan and community support.Supported By: State Assembly: Richard Bloom, Jesse Gabriel - State Senate: Henry Stern - U.S. Congress: Ted Lieu, Julia Brownley, Steve Knight - Cities: Calabasas, Hidden Hills and Aguora Hills

19. **Need:** What would happen to the project if no funds were available from the Conservancy? What project opportunities or benefits could be lost and why if the project is not implemented in the near future?

The success of indirect potable reuse water projects is largely dependent on robust public education and acceptance. Failure to properly inform the community about the benefits of potable reuse and the safety of treatment technologies could result in significant public backlash that could potentially delay implementation of the Pure Water Project. Without funding provided by this grant, it is possible that the scale of the project would have to be reduced which, in turn, could reduce the effectiveness of community outreach and education efforts. This project is part of a larger effort by the region and the district to immediately become more resilient and prepared for the impacts of climate change through the implementation of the Pure Water Project by providing long-term water reliability and recognizing the significance of a healthy, robust and protected Malibu Creek Watershed.

20. **Regional Significance:** Describe the regional significance of the project with respect to recreation (regional trails and parks, staging areas, environmental education facilities, etc.), agricultural resources, and/or natural resources (including listed species, identified high priority habitat, wildlife corridors, watersheds, and agricultural soils).

The Demonstration Project will serve as a regional education center for advanced water treatment. Besides drop-in visitors, 5th graders from school districts in the service area will likely visit as part of their water education program. Educational programming has not yet been developed, but both local and distant visitors will be welcomed. As one of the first surface water augmentation potable reuse projects in the state, the demonstration project provides the opportunity to educate the public on the need for and benefit of these types of projects as California faces future water supply and reliability issues. Additionally, implementation of all phases of the Pure Water Project will benefit Malibu Creek and Lagoon's threatened and endangered species including the Federally protected Southern California Steelhead Distinct Population Segment, and California'

21. **Sea Level Rise Vulnerability:** If the project involves a site that is close to a shoreline (i.e. potentially flooded or eroded due to climate change), please identify vulnerabilities of the site in relation to flooding, erosion, and sea level rise/storm surges for the years 2050 and 2100 (assume 16 inches and 55 inches of sea level rise respectively). For reference, see the **State of California's Sea Level Rise Task Force Interim Guidance Document**. Describe any adaptive management approaches you have considered for addressing Sea Level Rise. Specify the expected lifespan or duration of the project.

Not applicable. The project is not close to a shoreline.

ONLY AS APPLICABLE:

22. **Innovation:** Describe how the project is innovative. [Many kinds of innovation are possible - technical, environmental, design, economic, etc.]

The Pure Water Project will be one of the first indirect potable reuse projects to utilize surface water augmentation in the state. State regulations allowing for surface water augmentation were just approved in 2017. Given that this project will be one of the first projects of this type, the innovative research and system optimization work that will be completed as part of this project will be directly applicable to other agencies wanting to pursue surface water augmentation for indirect potable reuse. The district envisions the Pure Water Project to be a flagship initiative that utilizes state-of-the-art technology to produce locally-sourced water, beneficially reuse a waste product, blend it with state water project water through augmentation of the district reservoir, reduce greenhouse gas emissions by not importing as much water and improve water quality in Malibu Creek.

23. **Vulnerability from Climate Change Impacts Other than Sea Level Rise**: Describe how the project objectives or project may be vulnerable to climate change impacts (fire, drought, species and habitat loss, etc.) other than sea level rise, coastal erosion or flooding. Identify design, siting, or other measures incorporated into the project to reduce these vulnerabilities.

The Pure Water Project will convert recycled wastewater effluent into high quality potable water. Recycled water that would otherwise be discharged into Malibu Creek will be routed to an advanced water treatment facility that will provide a local source of drought resistant potable water. Once operational, the facility will produce up to six million gallons of water per day (5,151 AF per year) that will provide up to twenty percent of potable water for local customers and reduce the need for imported water. By locally sourcing water, the local community will need to import less water which will greatly reduce electricity use needed to import water and the associated green house gas emissions.

24. **Greenhouse Gas Emissions/Climate Change:** If the proposed project will result in production of greenhouse gas emissions (including construction impacts and vehicle miles travelled as part of a public access component), describe the measures the project includes to reduce, minimize or avoid greenhouse gas emissions through project design, implementation construction, or maintenance. What, if any, are the possible sources or sinks of greenhouse gases for the project, such as carbon sequestration from habitats at the site? If one of the project goals is to sequester carbon (reduce greenhouse gas concentrations), how do you intend to ensure continued long-term sequestration while achieving project objectives? Do you have any plans to seek carbon credits for the carbon sequestration activities on the project site?

Implementation of the Pure Water Project will result in a net decrease in green house gas emissions. By implementing indirect potable reuse, the district will produce 5,151 acre-feet of water locally. As a result, a corresponding amount of water will not need to be imported from northern California which will save 10,508 megawatt-hours of electricity annually. Based upon industry estimates, this amount of electricity production releases 4,533 tons of CO2 emissions annually.

GRANT APPLICATION CHECKLIST

A complete application will consist of the following files:

- ☐ Grant Application form
- ☐ Project maps and design plans (in one pdf file, 10 MB maximum size)
- ☐ Project photos (in jpg format)
- ☐ For Nonprofit Organizations, please submit a completed **Nonprofit Organization Pre-Award Questionnaire**, and the organization's 501(c)(3) letter and Articles of Incorporation. Note: Applicants who have submitted these documents in the past two years do not need to resubmit.

Complete applications should be submitted via email to **smbgrants@scc.ca.gov**.

Email attachments, including photos and maps, should not exceed 10MB total per email or the email may not be received. Relevant photos and maps should demonstrate the location, context, and proposed outcomes of the project.

If you are unable to email the application, please contact us to discuss alternate ways to submit your electronic files. Please note: all information that you submit is subject to the unqualified and unconditional right of the Conservancy to use, reproduce, publish, or display, free of charge. Please indicate if crediting is requested for any of the photos and/or maps.

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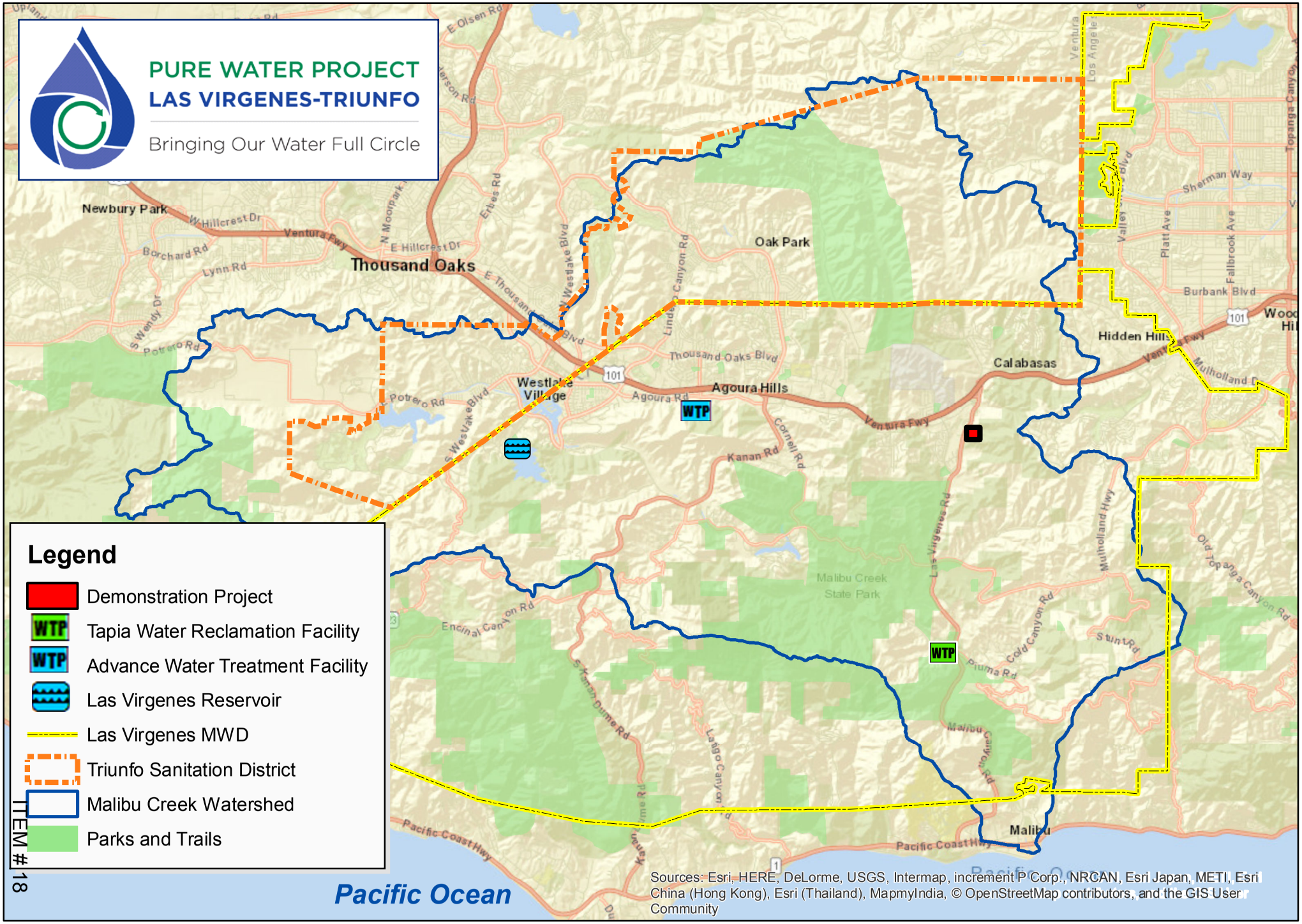

Pure Water Demonstration Project Regional Map

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Pure Water Demonstration Project Site Map

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LAS VIRGENES MUNICIPAL WATER DISTRICT
EST. 1958

Dedicated to Providing High-Quality Water Service in a Cost-Effective and Environmentally Sensitive Manner

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MEMBER AGENCY OF THE
METROPOLITAN WATER
DISTRICT
OF SOUTHERN CALIFORNIA

August 31, 2018

Mr. Warren Teitz
Funding Program Manager
Metropolitan Water District of Southern California
700 North Alameda Street
Los Angeles, CA 90012-2944

RE: Proposal for Future Supply Actions Funding Program:
Application of Artificial Intelligence/Machine Learning to Advanced Water Treatment Facilities for Indirect Potable Reuse

Dear Mr. Teitz:

The Las Virgenes Municipal Water District, a Metropolitan Water District member agency, is pleased to submit the attached proposal for the 2018 Future Supply Actions Funding Program. Our proposed project focuses on the development of recycled water for potable water supply via surface water augmentation using an advanced water treatment facility (AWTF); the first phase of this project is a demonstration project.

The Las Virgenes – Triunfo Joint Powers Authority (JPA) was formed between Las Virgenes and Triunfo in 1964 to construct, operate, and maintain a joint wastewater treatment system for their respective service areas, primarily within the Malibu Creek Watershed. The JPA has gone through a stakeholder driven process to consider options for regulatory compliance and the beneficial reuse of excess recycled water and selected indirect potable reuse utilizing the existing Las Virgenes Potable Water Reservoir via surface water augmentation as the preferred solution, known as "Pure Water Project Las Virgenes – Triunfo."

As outlined in our proposal, we are requesting grant funding to implement and test artificial intelligence (AI)/machine learning (ML) control algorithms as part of the demonstration plant master control systems. The goal of this project is to determine if AI/ML could provide intelligent system control that would increase resilience and reliability of the new AWTF through additional virtual barrier, thus further protecting public health, and reducing operational costs and operator duties. This exciting new technology has yet to be applied in the field of water reuse and could have some profound impacts on the efficiency and effectiveness of existing and future full scale AWTFs for Metropolitan Water District and its member agencies.

We look forward to undertaking this work and sharing information with the Metropolitan Water District and corresponding member agencies. I am informed and believe that the information contained in this proposal is true and that the supporting data is accurate and complete.

Please contact David Lippman, Director of Facilities and Operations at dlippman@lvmwd.com or 818-251-2221 with any questions. Our Federal Tax ID number is 95-2212398, our address is 4232 Las Virgenes Road, Calabasas CA 91302, and our website is www.LVMWD.com.

Thank you for the opportunity to submit this proposal.

Sincerely,

David W. Pedersen, P.E.
General Manager

PARTICIPATING ENTITIES

The project and proposal were developed through the Joint Powers Authority (JPA) of the Las Virgenes Municipal Water District (District) and the Triunfo Sanitation District. This JPA is funding the design, construction, and operation of the Pure Water Demonstration Project.

KEY INDIVIDUALS

This section highlights the responsibilities of key individuals and illustrates the lines of authority. In addition, our key team members' background and relevant experience is also summarized below.

David Pederson, P.E. - Las Virgenes General Manager

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David Pederson, P.E.
General Manager
4232 Las Virgenes Road
Calabasas, CA 91302
P: 818-251-2100
F: 818-251-2109
DPedersen@lvmwd.com

As the District's chief executive officer, the General Manager implements policies adopted by the elected Board of Directors and oversees the business of the District. David Pederson provides leadership in the administration of District programs; ensures that District services meet the needs of customers; coordinates the effective use of facilities, finances, and personnel to achieve District goals and objectives in the strategic plan; and keeps the Board fully informed. Three departments report directly to the General Manager: 1) Facilities and Operations, 2) Finance and Administration, and 3) Resource Conservation and Public Outreach. David will be overseeing the Pure Water Demonstration Project and acting as Board liaison.

David Lippman, P.E. - JPA Pure Water Demonstration Project Manager

Contact Information:

David Lippman, P.E.
Director of Facilities and Operations
4232 Las Virgenes Road
Calabasas, CA 91302
P: 818-251-2100
F: 818-251-2109
dlippman@lvmwd.com

The Facilities and Operations Department is responsible for the day-to-day operation, maintenance, regulatory compliance, and replacement needs of the District's potable water, recycled water, and sanitation facilities. The department is also responsible for the planning, engineering and construction of new facilities to serve current and future customers. David Lippman is the Pure Water Demonstration Project Manager and contract administrator. He will be working with the consulting engineer (Carollo Engineers, Inc.) to ensure the success of the project.

Adam Zacheis, Ph.D., P.E. - Pure Water Demonstration Operation Project Manager

Contact Information:

G. Adam Zacheis, Ph.D., P.E.
Vice President
707 Wilshire Boulevard, Suite 3920
Los Angeles, CA 90017
P: 213-489-1587
F: 213-572-0361
azacheis@carollo.com

Adam Zacheis, a Vice-President with Carollo Engineers, Inc., (Carollo) has worked on numerous reuse projects, including studies, full-scale treatment plant designs, and piloting/demonstration projects in various aspects of analysis, design, construction, and project management. Relevant project experience includes work on the Metropolitan Water District Advanced Water Treatment Facility (AWTF) Demonstration Facility, the Los Angeles Department of Sanitation (LASAN) Hyperion Membrane Bioreactor (MBR) Demonstration AWTF project, City of Ventura Water Pure Project, LASAN Terminal Island Advanced Water Purification Facility expansion to 12 mgd, and City of San Diego Pure Water full-scale facility. Currently, Adam is the project manager of the Pure Water demonstration design and operation.

Vincent Roquebert, P.E. - Carollo Practice Lead for Intelligent Controls

Contact Information:

Vincent Roquebert, P.E.
3150 Bristol Street, Suite 500
Costa Mesa, CA 92626
P: 714-593-5100
F: 714-593-5101
vroquebert@carollo.com

Vincent Roquebert has over 27 years of experience specializing in water and wastewater treatment plant (WWTP) design, pump stations, and conveyance systems. In addition to engineering design, he brings hands-on project management experience and expertise in procurement, installation, start-up, and operations troubleshooting. Recent projects include the Groundwater Reliability Improvement Project (GRIP) Advanced Water Treatment Plant (WTP) Progressive Design-Build effort for the Water Replenishment District of Southern California (WRD) and the City of Los Angeles Advanced Water Purification Facility at the Terminal Island Water Reclamation Plant. For this project, Vincent would be assisting with establishing the objectives for the combined instrumentation, data, and process management effort, coordinating with the intelligent platform suppliers, coordinating with the project data scientist, and monitoring the benefits in terms of increased resilience and reliability for the new AWTF.

Hannah Ford, P.E. - Pure Water Demonstration Project Engineer

Contact Information:

Hannah Ford, P.E.
Senior Engineer
707 Wilshire Boulevard, Suite 3920
Los Angeles, CA 90017
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hford@carollo.com

Hannah Ford is a senior environmental engineer and Carollo's Southern California water reuse lead, specializing in water treatment and potable reuse design, operations, and permitting. Her project experience ranges in size from demonstration to full scale and breadth from Greenfield to complicated retrofits. She is currently the senior process engineer for the JPA Pure Water Demonstration Project and is leading the design of the microfiltration (MF), reverse osmosis (RO), and ultraviolet advance oxidation process (UV AOP) processes for the treatment of tertiary effluent for potable reuse via surface water augmentation.

Chirag Patel, Ph.D. - Data Scientist

Contact Information:

Dr. Chirag Patel, Ph.D.
Assistant Professor of
Biomedical Informatics,
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F: 617-432-0275
chirag@hms.harvard.edu

Dr. Chirag Patel is an assistant professor in the department of biomedical informatics at Harvard Medical School and Harvard University (Harvard). Dr. Patel's long-term research goal is to address problems in human health and disease by developing computational and machine learning methods to reason over high-throughput information spanning molecules to populations. Specifically, Dr. Patel's group focuses on computational strategies to efficiently and reproducibly uncover the complex interaction between the environment, genetics, and phenotype towards development of new tools for disease diagnosis and therapy, supported by the NIH, including NIEHS (K99/R00), NIAID, the National Science Foundation, the PhRMA Foundation, doc.ai, Agilent Technologies, Sanofi Aventis, and Johnson and Johnson. He trained in biomedical informatics and epidemiology at Stanford University. Prior to graduate work, Dr. Patel was a software engineer in the biotechnology industry at Applied Biosystems (now a division of Thermo-Scientific). He teaches introductory courses in data science and machine learning and is a mentor to three post-doctoral associates and advises three PhD students. He will be leveraging his data management knowledge from the biomedical industry assisting with collecting, understanding, preparing, and modeling the historian data for this project.

PROPOSAL DESCRIPTION

Through the demonstration project, the JPA desires to gain public acceptance and buy-in for advanced treatment of existing Title 22 recycled water for additional potable water supplies and provide operator training. In addition, a critical component of this project is to use the demonstration platform as means to optimize design criteria in an effort to enhance resilience and reliability, and reduce costs of a future, full-scale AWTF.

Artificial intelligence (AI), or machine learning (ML), is a promising new area of technology that is beginning to be applied to more areas in modern life and may result in significant costs savings across various industrial sectors. Simple adaptive and predictive controls, such as that found in the simple Nest thermostat controller, will eventually see a broadened base of applications.

Model Predictive Control (MPC; also called Advanced Predictive Control) combined with analytics is the evolution of instrumentation, control, and automation that is currently applied in advanced WWTP design. To get the full benefit of MPC, much more data will need to be captured, validated, processed, integrated, and analyzed very quickly so that the process can, not only, be controlled by "what's happening now" (hindsight) but also be adapted to "what could happen in the future" (foresight). This processing of large volumes of data at increasing velocities is the data analytics that will need to be developed. MPC and analytics is a large part of what has been termed in our industry as "Smart Water" or the "Intelligent Water System."

Data management in our industry is not a new concept. However, most of the efforts related to data analysis have been focused on historical data ("what happened in the past") for "back room" issues such as customer support, planning, asset evaluation, and business intelligence/decision support for capital improvement projects. Very few systems are using advanced analytics of "real-time" data in a

meaningful way to identify "what is happening now" to make process control decisions or affect plant operations. Ultimately, as analytic methods in our industry mature, we will be able to develop predictive models to tell us "what might happen in the future" so that the process can be adjusted accordingly.

The goal of this project is to apply a newly developed, industrial intelligent platform to the AWTF demonstration process, which is currently under design for the JPA. Given that model control has not been attempted for a potable water reuse project before, its application on a demonstration scale could allow the industry to prove the efficacy of MPC prior to moving to a full scale. Ultimately, MPC combined with analytics has the potential to optimize AWTF operations, reducing operating (power, chemical, labor) costs, in addition to enhancing the protection of public health through optimization of AWTF operation and reducing risks of process damage and upsets (i.e., increasing AWTF resilience and reliability).

REDUCES BARRIERS TO FUTURE PRODUCTION

Given the limitations in fresh water available to municipalities and water districts, many agencies have been forced to turn to impaired water sources, such as brackish groundwater, or the treatment of wastewater for future potable water production. One of the major impediments to potable water reuse, excluding public acceptance, is the cost associated with advanced treatment processes and the daunting prospect of training operations staff to operate a treatment process that is typically more complicated than what many agencies operate currently.

Through the implementation, testing, and optimization of intelligent controls and algorithms, the following goals may be realized through the Pure Water Demonstration Project:

1. Reduced Power Consumption
2. Reduced Chemical Consumption
3. Enhanced Water Quality
4. Reduced Operator Intervention
5. Increase System Resilience and Reliability

The following sections detail the principles behind ML and the power of data analysis in order to optimize the operation of advanced treatment processes.

Resource Implementation and Planning

Through the establishment of a more robust treatment process through combined instrumentation, data, and process optimization, the use of these advanced treatment processes would be less daunting to water supplying agencies. Furthermore, since AWTFs are highly dependent upon advanced process monitoring to verify log reduction values (LRV) for regulatory approval and permit to operate, the application of advanced controls could be beneficial for acceptance of the project with the State of California Regional Water Quality Control Board (RWQCB) and the Division of Drinking Water (DDW). As part of the Pure Water Demonstration project, the trial of this technology will be coordinated with these regulatory agencies. Expedited permitting of AWTFs by the RWQCB and DDW may be possible if advanced controls are implemented, given that there may be greater confidence in AWTF product water quality and enhanced public health protection.

Advancing Water Resource Field of Knowledge Through a Unique and Innovative Approach

Implementation of MPC and analytics in water reuse would be new to the field. Currently, the use of analytical online instruments and controls utilize typical proportional–integral–derivative (PID) controller type of programmable logic controller (PLC) controls that are common throughout water and wastewater treatment.

Control Systems - PID Versus ML Algorithms

Typical PID control relies on a multi-step process that involves using a control loop feedback mechanism and requires continuously modulated control. Per Figure 1, the PID controller continuously calculates an error value, which is the difference between the desired setpoint (SP) and the measured process variable (PV). The controller then applies a correction to the SP based on proportional, integral, and derivative terms (P, I, and D).

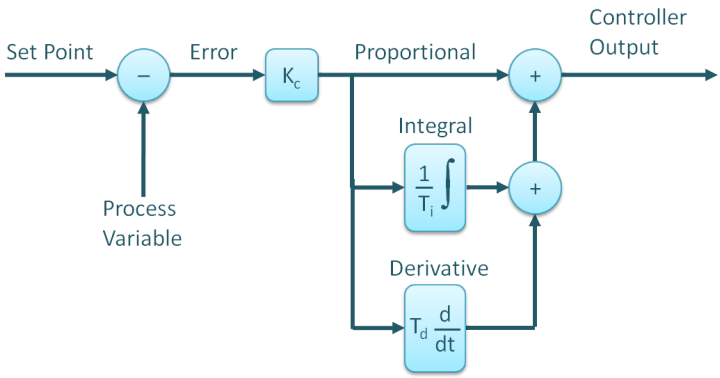

Figure 1 Typical PID Control

As can be seen in Figure 2, the nature of PID control means that swings in setpoints are common.

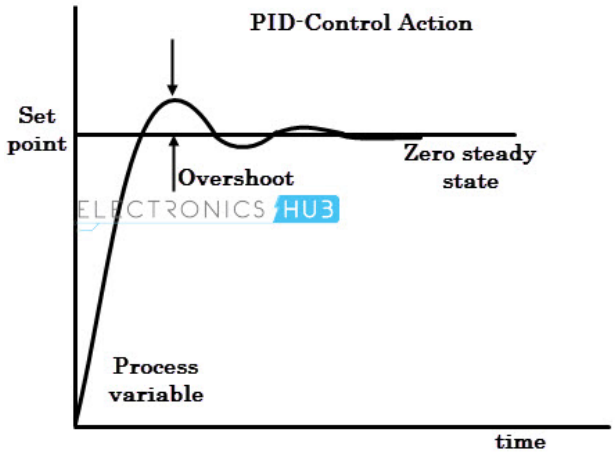

Figure 2 PID Control Changes

During the start-up and commissioning of AWTFs (or any advanced facility, for that matter), the integrator, working with the process engineer, must "tune loops" to ensure that fluctuations in setpoints are minimized. However, tuning can often only be taken so far, and multiple process variables can affect each other, resulting in constant changes to the system. These constant changes prevent the overall process from operating under truly steady-state conditions. This can lead to excessive power consumption and, for membrane systems, changes that are not ideal for stable

performance. The following are examples of setpoint variability that can result in an AWTF control system to change setpoints constantly:

1. Variability in chemical feed pump setpoints, which changes the chloramine concentration in UF system feed water and may lead to gradual increases in fouling potential.
2. Ultrafiltration (UF) feed or filtrate flow control valve modulation, which leads to constant changes in instant UF flux rate.
3. RO concentrate flow control valve modulation, which affects the RO feed pump and vice-versa. These modulations also impact permeate electro-conductivity and introduce variability in RO system LRV calculations.
4. Free chlorine chemical metering pump fluctuations, which affect hydroxyl radical generation in the UV AOP reactor and results in dose fluctuations.

Control Systems - Machine Learning

In contrast to PID-type controls, the use of ML algorithms attempts to "learn" what the typical optimized control setpoints are for an advanced treatment process and to hold setpoints constant throughout operation. Our team has already implemented a similar approach to get lower and more-steady dissolved oxygen (DO) control at several WWTP aeration basins.

Currently, several companies are looking at various ML algorithms for enhanced control. Our team has already held discussions with the following companies, to name a few:

1. Hach - At WEFTEC 2017, Hach unveiled their Claros™ data management platform. This platform combines Hach's water information management system (WIMS) and their instrument management system, and uses the data to make real-time control changes to the facilities wastewater process. The system can also use external data (e.g., weather reports) to alert the facility staff to possible operating changes. While the platform is new, Hach should be able to develop it very quickly into a stable platform.
2. Veolia/Kruger - Also at WEFTEC 2017, Veolia/Kruger presented their data management and control platform called AquaVista™. During WEFTEC they demonstrated a live fully functional system (the WWTP was in Denmark). This platform is an extension of their industrial control systems that have been expanding for over a decade. The new system includes cloud-based data storage, remote access and real-time monitoring and control. Kruger says that they have written application programming interfaces (APIs) for any instrument reading and can quickly and easily add this data to their database. They have also hired a PhD student to improve the data analytics and begin building algorithms for predictive control.
3. Schneider Electric - Schneider Electric is trying to expand their industrial and electric utility predictive automation and control expertise into the water/wastewater industry. They are marketing SimSci APC, an advanced process control software from SimSci, the software connects and communicates directly to a wide variety of automation systems and uses both real-time and historical data to analyze, identify, and model the significant cause-and-effect relationships in a process. The SimSci software provides a toolkit of advanced process control approaches including neural networks, model predictive control, and other adaptive control algorithms for utilization on the user's processes. The software license includes extensive capabilities including the ability to perform modeling, response testing, simulation, and training. The product has been on the market for about 30 years and was originally developed by the University of Manchester and then acquired by Foxboro who was acquired by Invensys who was acquired by Schneider Electric in 2014. Schneider Electric has been in discussions with

Carollo to identify a facility that would be interested in MPC and have them provide data for a return -on-investment evaluation. The goal would be to fully implement and test the MPC technology for a water/wastewater process and collaborate with the Client and Schneider to write an industry paper/presentation.

These platforms typically use various control algorithm techniques to optimize system performance:

1. Classification - the goal of classification is to predict what category set of data or variables will fall under.
2. Regression - this analysis aims to predict a numeric value for a variable based on data analysis.
3. Cluster Analysis - the goal of this category is to organize similar items into groups.
4. Association Analysis - the goal of this category is to find rules to capture associations between items.

Hach Claros™ Platform

Ultimately, after several preliminary discussions and meetings with various companies, it was determined that the Hach Corporation has developed a platform that is more advanced and ready for testing. As such, our team has received quote for the Claros™ platform to use on this project. To date, Hach has developed (and is continually developing) control code packages for common treatment processes such as microfiltration and reverse osmosis.

The Hach Claros™ platform includes three modules each divided in several functions:

- Instrumentation Management:
  - Predictive Diagnostics: This function identifies outliers and faulty instruments and analyzers.
  - Asset maintenance indicators that assist operators in scheduling cleaning and calibration.
  - The module can accept non-Hach filed instruments and analyzers.
- Data Management:
  - Collect data
  - Aggregate data
  - Standardize data
  - Allow user to visualize data
- Process Management:
  - Real-Time Control (RTC) = Model Predictive Control (MPC)
  - Compliance
  - Energy
  - Chemicals
  - Allows user to implement existing RTC models that have already been developed. The promise is that the model will be scaled to the new site within the three-month start-up (dial-in) period.
  - New RTC model could be developed on-demand through collaboration with Hach data scientists.

The platform has been developed to address some security considerations, and, as a result, a non-cloud data processing option is available at the cost of reduced functionality. In general, cloud processing is preferred, as greater computing power and reliability may be accessed via the cloud due to the ability of the Claros™ system to utilize multiple, remote parallel computer CPUs.

The platform may be procured through a procurement contract that provides access to the platform, and each module can be procured separately; each module is developed to the level of detail required by the user.

In addition, given the complex nature of data analyses to be undertaken, additional support will be provided through the laboratory of Dr. Patel at the Harvard School of Medicine.

Data Analyses

In addition to selecting a vendor to provide advanced control packages, our team is interested in analyzing large datasets from the Pure Water demonstration facility and in contracting with a data scientist to discover unseen correlations between various process variables in order to gain further insight in process control modifications. For this project, our team will be working with Dr. Patel, a data scientist who routinely creates data analysis algorithms for the evaluation of large datasets of medical data in order to determine relationships/causation between environmental health factors and disease. Figure 3 illustrates just one type of data analyses that Dr. Patel uses to find correlations between large numbers of variables.

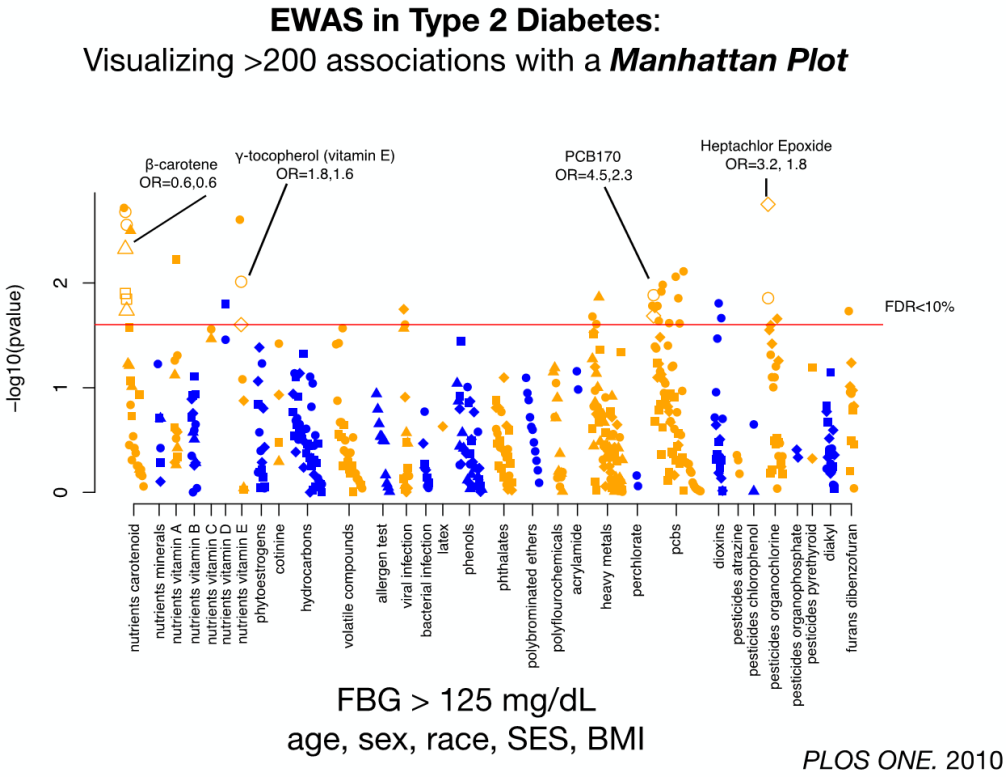

Figure 3 Advanced Analysis Algorithms

In the case of Figure 3, Dr. Patel's laboratory built a logistic regression predictor of diabetes as a function of multiple exposures (~200). Then, the research group corrected for multiple tests using a method called the "false discovery rate" to filter the signal (those that are higher on the plot). Even though this type of analysis has been completed for biological data, these methods can equally be used for large sets of process data for water and wastewater treatment.

In a huge dataset of sensors (i.e., water quality instrument data, process data, etc.) that is deployed for the treatment process we are utilizing, we want to dynamically find the variables that predict some

outcome of interest (i.e., low turbidity, low total dissolved solids (TDS), N-nitrosodimethylamine (NDMA) reduction, etc.) and tell us how much they contribute to the overall prediction (and visualize on a plot).

As will be described in the Work Plan section of this proposal, the intent is to implement ML programs onto the control system master PLC while collecting data, both during a baseline period (no ML control) and after ML implementation. Dr. Patel will then analyze the large set of data gathered by the historian in order to evaluate this date for unforeseen trends and correlations. Results from these evaluations may then be used to adjust ML code and algorithms with the ML vendor.

Literature

Though examples of ML and MPC applications for AWTF control have not been found in the literature, the Water Research Foundation (WRF) has produced reports on data management topics, including:

1. Designing Sensor Networks and Locations on an Urban Sewershed Scale
2. Leveraging Other Industries - Big Data Management (Phase I)
3. From Collection Systems to Tap: Resilience of Treatment Process for Direct Potable Reuse

WRF has a project called LIFT for Management. This project is meant to address "business processes"; human resources (HR), procurement, capital improvement programs (CIPs), but also treatment plant data.

LOOKING FORWARD

Ultimately, the results from this study may be used for all types of existing treatment facilities with the goal of reducing costs, enhancing resilience and reliability, and providing an additional level of safety for public health. In fact, any effective control platform would be recommended for use in the JPA's planned full -scale facility in the near future.

Increasing Local Supply Potential

Advanced control systems have the potential to make AWTF more economically viable through the acceptance of virtual barrier, and provide a new local supply for potable water. However, one large advantage could be the benefit to public health through enhanced critical control point (CCP) monitoring and stabilized process control.

Critical Control Point Monitoring

An AWTF must address hazards that pose both acute and chronic risks. Acute risks have the potential for immediate health consequences, such as pathogens and nitrate. Chronic risks are those based on a lifetime (typically 30 years) of exposure. Acute risks must be controlled with a real-time approach to measurement and response, whereas chronic risks can be controlled by achieving an acceptable average performance over time, which requires monitoring much less frequently. The AWTF's monitoring program will have two main components: online, or rapid-response surrogate monitoring, coupled with periodic sampling for parameters of concern.

The Hazard Analysis and Critical Control Point (HACCP) framework was originally developed to protect astronauts from the risk of foodborne illness and adapted for use in potable reuse. The purpose of a HACCP analysis is to develop a framework under which reductions in water quality can be detected and mitigated at the earliest possible point in the process. The focus in a HACCP-oriented

monitoring program is on monitoring and maintaining each individual treatment barrier rather than measurement of water quality after the fact (also known as "end of pipe testing"). The advantage of an HACCP-based approach is that deviations in water quality are detected earlier, and off-specification water can be diverted before it leaves the advanced treatment facility. The Hazard Analysis component of the HACCP approach was completed and generalized for all potable reuse projects by Walker et al (2016), who identified the hazards in potable reuse as pathogens and chemical constituents. The remaining analysis focused on the CCPs at which those hazards can be controlled and mitigated, along with their associated monitoring requirements and action triggers.

Before defining CCPs, a distinction must be made between CCPs and Critical Operating Points (COPs). COPs are important for monitoring the overall effectiveness of treatment, whereas CCPs are limited to only a handful of parameters requiring significant action (e.g., shutting down the facility). Furthermore, excursions in COP monitoring may trigger responses at the operational level, but they do not directly affect hazard mitigation or regulatory compliance.

Figure 4 illustrates the numerous process steps, sampling points, and chemical addition points for the City of Los Angeles' Terminal Island Advanced Water Purification Facility (TI AWPF). As shown, numerous processes for this indirect potable resource (IPR) facility results in complicated controls and complex inter-relations between water chemistry and controls from one process to another.

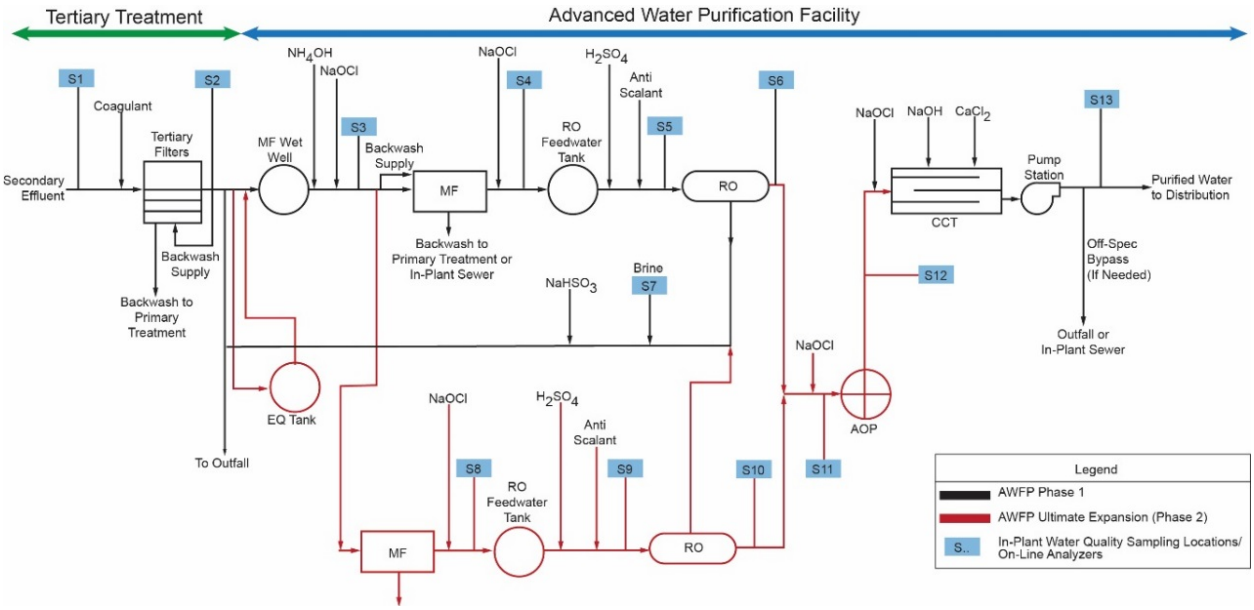

Figure 4 TI Process Flow Diagram

Likewise, Figure 5 is a summary of the tertiary influent (TI) sampling, monitoring, and CCPs associated with the TI AWPF.

Sample Station	Design Water	Parameter[1]	Type of Sample	Sampling Frequency	Alarm	Critical Limit	Typical Control Actions
S1	SE	BOD	24-Hr-Composite	Quarterly			Confirm results; adjust secondary process
		TSS	24-Hr-Composite				
		TOC	24-Hr-Composite				
		Inorganic Minerals	24-Hr-Composite				
S2	TE	Turbidity	Continuous	Continuous	NTU > 2	NTU > 5	Confirm results; adjust secondary and tertiary processes
		BOD	24-Hr-Composite	Quarterly			
		TOC	24-Hr-Composite				
		TSS	24-Hr-Composite				
S3	MF Feedwater	Turbidity	Continuous	Continuous	Total Cl_2 > 1 mg/L Total Cl_2 < 3 mg/L	Total Cl_2 > 3 mg/L	Confirm results; adjust chemical addition, failover to stand-by pump
		Total Chlorine	Continuous	Continuous			
		Temperature	Continuous	Continuous			
		ORP	Continuous	Continuous			
S4 S8	Phase 1 MF Product Water Phase 2 MF Product Water	Pressure Decay Test (PDT)	Continuous	1/day	LRV[2] 4.3 results in warning alarm	LRV[2] 4.0 results in shutdown and alarm	Confirm results; perform sonic test to assess any leaking; isolate/repair/ replace as appropriate
S5 S9	Phase 1 RO Feedwater Phase 2 RO Feedwater	Turbidity	Continuous	Continuous	NTU > 0.3 pH < 5.5 pH > 7.4	NTU > 0.5 pH < 4.0 pH > 7.4	Confirm results & review AWPF overall process performance; adjust chemical addition; failover to stand-by pump
		pH	Continuous	Continuous			
		Temperature	Continuous	Continuous			
		TOC	Continuous	Continuous			
		Conductivity	Continuous	Continuous			
		NH_3-N	24-Hr-Composite	Weekly			
		Inorganic Minerals	24-Hr-Composite	Weekly			
S6 S10	Phase 1 RO Product Water Phase 2 RO Product Water	Turbidity	Continuous	Continuous	NTU > 0.15 EC > 250 µS/cm	NTU > 0.20 EC > 350 µS/cm	Confirm results & review AWPF overall process performance; adjust chemical addition; failover to stand-by pump
		pH	Continuous	Continuous			
		Temperature	Continuous	Continuous			
		TOC[3]	Continuous	Continuous			
		Conductivity	Continuous	Continuous			
		NH_3-N	24-Hr-Composite	Weekly			
S7	RO Brine	TSS	24-Hr-Composite	Monthly	NPDES Permit Requirements		Contact LACDPW, Regional Board (as needed)
		Total Chlorine	Continuous	Continuous			
S11	AOP Feedwater	Free Chlorine (monitoring)	Continuous	Continuous	Free Cl_2 < 2 mg/L Free Cl_2 > 4 mg/L	Free Cl_2 < 2 mg/L Free Cl_2 > 4 mg/L	Confirm results and review AWPF overall process performance; adjust chemical addition; failover to stand-by pump
		Total Chlorine (control)	Continuous	Continuous	Total Cl_2 < 2 mg/L Total Cl_2 > 4 mg/L	Total Cl_2 < 2 mg/L Total Cl_2 > 4 mg/L	
		UV transmittance (UVT)[4]	Continuous	Continuous	UVT < 96%	UVT <96%	
		pH (monitoring)	Continuous	Continuous	pH < 5.0 pH > 6.5	pH < 5.0 pH > 6.5	
		Calculated UV Dose(control)	Continuous	Continuous	< 920 mJ/cm²	<920 mJ/cm²	
S12	AOP Product Water	Total Chlorine (monitoring/validation)	Continuous	Continuous	Total Cl_2 > 4 mg/L	Total Cl_2 > 4 mg/L	
S13	AWPF Product Water (Purified Water)	Turbidity	Continuous	Continuous	WDRs/WRRs Permit Requirements		Contact LACDPW, DDW, Regional Board, recycled water users, downgradient potable well owners, cease distribution (as needed)
		Total Chlorine	Continuous	Continuous			
		pH	Continuous	Continuous			
		TOC	24-Hr-Composite	Monthly			
		Total Coliforms	Grab	Daily			

Notes:
(1) Adopted from Table 14-1 of the Engineering Report.
(2) Log Removal Value (LRV); for MF, MEMCOR® MEMBRANE Integrity testing per Membrane Filtration Guidance Manual EPA 815-R-06-009 (2005) based on PDT.
(3) Confirmed with weekly grab sample.
(4) UVT measurement upstream of NaOCl addition for monitoring. UVT measurement downstream of NaOCl addition for control.

Figure 5 TI Monitoring Points and CCPs

As with a full -scale facility, the Pure Water Demonstration Project will have just as many process variables and instrument data. As such, it is critical to have the capability to analyze large data sets from the historian in order to determine where process optimization may occur. Overall optimization may help to improve average water quality, through the reduction or elimination of process upsets and fluctuations that would, in effect, increase process resilience and reliability while enhancing the protection of public health.

REGIONAL BENEFIT AND APPLICABILITY

Through the implementation, testing, and optimization of MPC and analytics, the following goals may be realized through the Pure Water Demonstration Project:

1. Reduced Power Consumption: The operation of an AWTF under optimized conditions means that plant operation under fouled (membrane) conditions will result in power savings. Furthermore, the identification of correlations between various treatment process operational parameters means that optimized system performance may be obtained to lower baseline power consumption. For example, optimization of upstream UF chloramines (or no chloramines) will reduce the fouling potential of the membranes and reduce operating pressures; the same holds true for RO.
2. Reduced Chemical Consumption: The optimization of chemical pre-treatment (i.e., pH adjustment, chloramines, anti-scalants) and cleaning (i.e., acids, bases, proprietary cleaners) will result in reduced chemical consumption overall.
3. Enhanced Water Quality: By operating a treatment process at optimal conditions, it may be possible to limit operating excursions that could reduce the effectiveness of the treatment process. Process optimization, through the monitoring of CCPs, could help to increase the level of resilience and reliability and enhance the protection of public health.
4. Reduced Operator Intervention: Optimized performance has the added benefit of decreasing the time that operations staff needs to dedicate to the monitoring and adjustments to the

overall treatment process. This would free up operator time to provide preventative maintenance of analyzers and actuators and ensure proper analytical instrument calibration and proper actuator operation.

All of these economic savings would be beneficial to Metropolitan member agencies interested in potable water reuse applications. In addition, these savings could prove to be extremely valuable to Metropolitan itself, as these controls could be applied to the future Regional Recycled Water Advanced Purification Center in Carson, California. Given the potential size of this particular project, 150 mgd of IPR water, even small gains in efficiency, power savings, and chemical savings, can scale up to large, overall cost savings. Furthermore, potential regulatory acceptance of virtual barriers could save significant cost in process mechanical equipment redundancy. Findings from this study may be made available to all Metropolitan, Metropolitan member agencies, and stakeholders.

Impact on Operations

On-line data tracking helps the operators make better decisions about when maintenance is required. It removes the burden of data collection and data entry from the operator to SCADA, where alarms can help inform the operator when probe cleaning or other maintenance may be required. The trick to effective on-line monitoring and associated decision-making is having the on-line monitoring available in the proper locations. However, monitoring data may be variable based on process control changes and drift of analytical instruments. Through the application of ML techniques such as K-means clustering and artificial neural network, meter faults (i.e., outliers) can be detected and operator informed of instrument drift. Thus, it is hoped that further optimization of the treatment process will further reduce the burden to operations staff as, ideally, more stable operation will lead to less "wear and tear" on equipment and will lead to less process upsets and operator focusing more on proactive maintenance and less on implementing corrective actions to respond to emergencies.

Work Plan and Schedule

The proposed work plan for this project involved the installation of MPC and analytics controls on to the demonstration project master PLC, operation of the system, analysis of the data, and modifications to the control system. The sequence of work is best illustrated in Figure 6.

As shown in Figure 6, after the selection of the intelligent platform vendor and successful demonstration plant commissioning, the team will operate the demonstration system for at least two months in order to establish a baseline of performance. This is a critical step in that all following control modifications will be compared to this initial set of data. Following the baseline run of the system, MPC and analytics will be implemented (installed during the baseline period) and the system will be run for one month before all historian data is sent to the platform vendor and the Harvard lab in order to look for correlations and trends prior to ML control modifications. Once the new, modified controls are uploaded to the PLC, the demonstration plant will run again and the entire process will be repeated - up to three times. The following sections detail the scope of work associated with these steps.

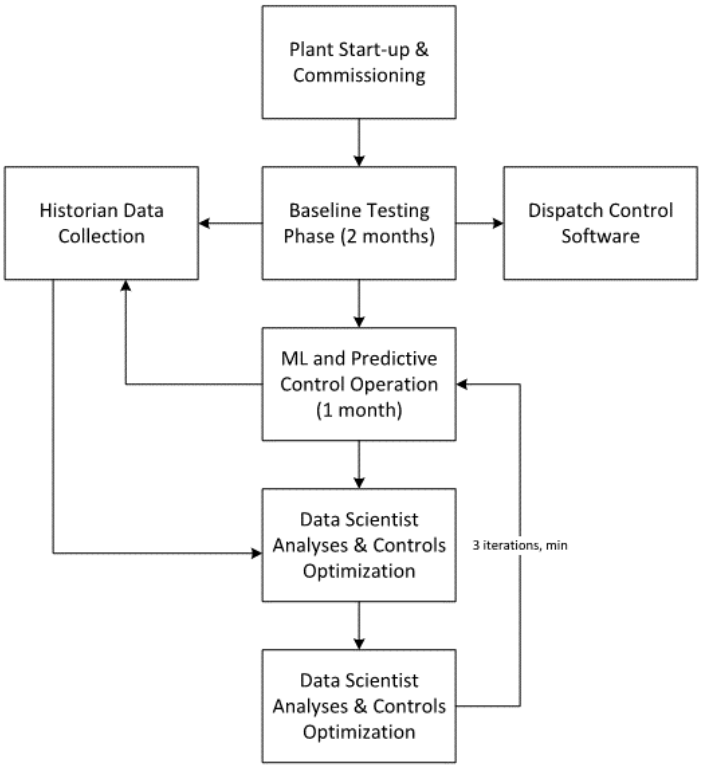

Figure 6 Sequence of Work

Intelligent Platform Vendor Coordination and Selection

Although upfront coordination with platform vendors has already occurred and Hach is the preferred, the team will continue to meet with Hach to refine the scope of supply and services for the testing period. As will be summarized in the budget section of this proposal, our team has already received a cost proposal from Hach. As further detailed in our project schedule, this work is ongoing and more detailed information will be required from Hach once the demonstration equipment has been procured. Issues to be addressed during this phase include:

1. Compatibility of Hach Claros™ with proposed master PLC
2. Available process input/output and integration between process PLCs and master PLC
3. Determination if cloud-based computation is acceptable to the District
4. Discussions with equipment suppliers regarding active control of unit processes via the Claros™ system, which will reside on the master PLC
5. Workflow during plant operations, including turn-around time for control modifications
6. Coordination between Harvard lab and overall project team

This phase of the work constitutes the largest share of grant monies ($17,900) as the initial purchase of the software will be required. Potential challenges during this phase of the project include the need for equipment vendors to modify their field instruments, and/or control code to allow for active ML control of their units. Given that the engineering design team will be working on final design and

construction issues during this phase, it is not anticipated that there will be issues with engineering availability to complete this work.

Baseline Testing

Baseline testing will involve simple operation of the demonstration process in a fully automated control mode. District staff will be in charge of operating the facility with input and monitoring from the engineering team. The sole purpose of this phase is to collect data when the system is run on typical PLC controls - similar to all full-scale treatment facilities for water and wastewater treatment. This phase will last two months, minimum, in order to provide data for a point of comparison to data obtained during ML operation. During baseline operation, the engineering team will coordinate with Hach for the installation of the Claros™ software. The level of effort during this phase is limited to engineering monitoring and is projected to cost $2,000. No challenges are expected during this phase of operation.

ML and Predictive Control Operation - Multiphase

The heart of the project, ML and MPC operation will determine if operating advantages may be obtained through the operation of the demonstration system under ML and MPC control. As with the baseline phase, the system shall run for a minimum amount of time in order to produce data for subsequent analyses (one month minimum). After one month, historian data will be downloaded and sent to Hach and Harvard for analysis. At this step, the Harvard data scientist will analyze the data for correlations and potential trends that may suggest control modifications to improve performance. Potential correlations could include the following:

1. Valve and pump modulation impacts on various water quality parameters
2. Treatment chemical levels impact on system performance (i.e., chlorine levels and UF fouling and/or cleaning cycles)
3. Impact of RO flux rate on electroconductivity (rejection)
4. RO process parameters on UV transmission (UVT) and corresponding UV system dose

Ultimately, the team will meet to discuss data analysis results and potential changes to the control system. At this point, Hach will implement those changes and the updated algorithms will be loaded to the master PLC. This process will be repeated two more times throughout the testing program. The anticipated effort for each step of ML control operation is $29,250. Engineering staff is available during these phases, as staff has already been assigned to monitor the process throughout demonstration testing.

While it is relatively simple to suggest potential correlations between various operational parameters, it is uncertain that these correlations and trends will be present, or detectable, in the data set. The following are potential challenges that our team may encounter and potential solutions:

1. Testing Plan Changes: Table 1 summarized preliminary testing activities that will occur in order to meet overall project goals. It is possible that changes resulting from the testing plan will reduce "clarity" within the data set.
   Potential Solutions: More closely align the testing plan changes with changes to the ML controls.
2. Imperceptible Correlations and Trends: The project team may find that the data does not show trends or correlations, making the deployment of process control changes difficult.

Potential Solutions: Impart larger process deviations manually, such as increasing chemical setpoints or adjusting membrane flux rates to higher than desired levels in order to test system responsiveness. These tests would have the advantage of testing the controls under unexpected process upsets.

Table 1 summarizes the major testing objectives in the current, draft test plan.

Table 1 Quarterly Sampling Schedule

	Q1	Q2	Q3	Q4
Chloramines	No Chloramines	No Chloramines	Chloramines	Optimized Chloramine Dose
RO System	Brine Toxicity Testing	Biocide Dosing Brine Toxicity Testing	Brine Toxicity Testing	O-Ring Failure & Membrane Breach Testing
UV AOP System	UV Validation UV/NaOCl Testing		Assess Difference in Required AOP Dose	UV Lamp and Ballast Failure Testing
Intelligent Control System	Data Collection	Optimized Controls	Optimized Controls	Optimized Controls/Reporting
Ongoing Testing	UF Flux and Cleaning Frequency Optimization Water Quality Monitoring NDMA Reservoir Degradation			

As shown in Table 1, several process changes will be altered to meet the requirements of the demonstration project. Therefore, it will be important to coordinate efforts associated with the test plan and ML controls.

Reporting Phase

The reporting phase of the project will consist of final, complete data analysis to determine if the ML control system was able to improve the operation of the system. The following improvements (over baseline conditions) would be searched for in the testing data:

1. Reduced electrical consumption
2. Reduced chemical consumption
3. Reduced clean-in-place cycles for UF and RO systems
4. More stable valve position settings and flow rates
5. More stable water quality data

This phase would require additional meetings with Harvard and Hach in order to process the large set of data that will accumulate after a year of operation. A draft report will be produced by the project engineering team and circulated among District staff and Metropolitan for comments. Ultimately, a final report will be produced after incorporation of comments for issuance to Metropolitan and member agencies. The anticipated level of effort for this phase is $20,000, and the report will be prepared by the Carollo project manager and project engineer, who both have availability.

Schedule

The project schedule details the various phases of ML controls testing and data analyses as shown in Figure 7. Currently, discussions are underway with Hach and Dr. Patel's laboratory to become involved in this potential project.

Table 2 Cost Table

Cost Category		Non-Metropolitan Share (Funding Match)		Requested Metropolitan Funding	Total
		Source	Amount		
(a)	Intelligent Platform Vendor Coordination and Selection	JPA	$8,950	$8,950	$17,900
(b)	Baseline Testing	JPA	$1,000	$1,000	$2,000
(c1)	ML and Predictive Control Operation - Hach/Carollo	JPA	$7,125	$7,125	$14,250
(c2)	ML and Predictive Control Operation - Harvard	JPA	$7,500	$7,500	$15,000
(d)	Reporting Phase	JPA	$10,000	$10,000	$20,000
	Grand Total	--	--	--	**$69,150**

The JPA has budgeted and committed the $34,575 in matching funds for this project.

Figure 7 Project Schedule

Las Virgenes – Triunfo Joint Powers Authority
4232 Las Virgenes Road, Calabasas, CA 91302
818.251.2100

August 31, 2018

Mr. Warren Teitz
Funding Program Manager
Metropolitan Water District of Southern California
700 North Alameda Street
Los Angeles, CA 90012-2944

RE: Support for Proposal for Future Supply Actions Funding Program: Application of Artificial Intelligence/Machine Learning to Advanced Water Treatment Facilities for Indirect Potable Reuse

Dear Mr. Teitz:

The Las Virgenes – Triunfo Joint Powers Authority (JPA) operates a joint wastewater treatment system for their respective service areas, primarily within the Malibu Creek Watershed. The JPA has gone through a stakeholder driven process to consider options for regulatory compliance and to beneficially reuse excess recycled water that is currently being discharged to Malibu Creek. The JPA selected indirect potable reuse utilizing Las Virgenes Reservoir for surface water augmentation as the preferred solution, known as "Pure Water Project Las Virgenes – Triunfo." A new advanced water treatment facility (AWTF) will produce purified water that will augment the supply in Las Virgenes Reservoir.

The JPA supports the proposal and request for grant funding to implement and test artificial intelligence (AI)/machine learning (ML) control algorithms as part of the demonstration plant master control systems associated with the Pure Water Project. The goal of this project is to determine if AI/ML could provide intelligent system control that would increase resilience and reliability of the new AWTF through additional virtual barriers, thus further protecting public health, and reducing operational costs and operator duties. This exciting new technology has yet to be applied in the field of water reuse and could have some profound impacts on the efficiency and effectiveness of existing and future full scale AWTFs for Metropolitan Water District and its member agencies.

Sincerely,

Glen Petersen
Chair, Las Virgenes – Triunfo Joint Powers Authority

Glen Peterson
Chair, Las Virgenes-Triunfo
Joint Powers Authority
President, Las Virgenes Municipal Water District
Board of Directors

Michael Paule
Vice Chair, Las Virgenes-Triunfo
Joint Powers Authority
Chair, Triunfo Sanitation District
Board of Directors

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
P. O. Box 944212, Sacramento, CA 94244-2120

WATER RECYCLING FUNDING PROGRAM PILOT PROJECT GRANT APPLICATION

I. APPLICANT INFORMATION

Agency Name: Las Virgenes Municipal Water District

Agency Type: ☑ Public – Local ☐ Other: Specify

Charter City/County: ☐ Yes ☑ No

Street Address: 4232 Las Virgenes Road, Calabasas, CA 91302

Mailing Address: 4232 Las Virgenes Road, Calabasas, CA 91302

Congressional District(s): 33	State Senate District(s): 27
State Assembly District(s): 45	County (or Counties): Los Angeles County

Regional Water Board where the project will take place: ☐ 1 (North Coast) ☐ 2 (San Francisco Bay) ☐ 3 (Central Coast) ☑ 4 (Los Angeles) ☐ 5 (Central Valley) ☐ 6 (Lahontan) ☐ 7 (Colorado River) ☐ 8 (Santa Ana) ☐ 9 (San Diego)

Federal ID No.: 95-2212398

Authorized Representative Name, Title: David W. Pedersen, General Manager

Phone No.: (818) 251-2122	Email Address: dpedersen@lvmwd.com

General Contact Person Name, Title: David Lippman, Director Facilities and Operations

Phone No.: (818) 251-2221	Email Address: dlippman@lvmwd.com

II. PROJECT INFORMATION

Project Title: Pure Water Project Las Virgenes-Triunfo: Demonstration Project

Total Project Cost: $ 2,949,040

Grant Amount Requested: $ 893,249

Note: The maximum grant is 35 percent of the total eligible construction cost up to a maximum grant of $1,000,000

Estimated Project Schedule	Construction start date	Construction completion date	Final Report Submittal
	09/06/2018	08/20/2019	02/20/2020

Note: Construction expenses incurred prior to July 1, 2018 are not eligible

Funds for Cash Flow: The Agency is expected to have funds available to handle cash flow of the entire project cost, pending receipt of grant disbursements.
Does the Agency have local funds on hand to cover the entire Project cost? ☑ Yes ☐ No

Describe any other loans, grants, or other financial assistance provided to the grant applicant to assist in this Project:

U.S. Bureau of Reclamation WaterSMART: Water Reclamation Research under the Title XVI Water Reclamation and Reuse Program for Fiscal Year 2016 for $300,000

State Use Only	
WRFP Project #	
Project Manager	
Date Received	

III. ENVIRONMENTAL COMPLIANCE

Environmental compliance should be complete at time application is submitted. Proof of complete environmental documentation shall be provided during application review period.

☑ Categorical Exemption ☐ MND, IS/MND or EIR Notice of Exemption attached.

IV. WATER RIGHTS

Is the entity a water diverter and subject to section 5103 of the Water Code? ☑ YES ☐ NO

V. REGULATORY INFORMATION

NPDES Permit and/or WDR Order No.: R4-2017-0124

VI. DISCUSSION OF MATERIAL EVENTS AND MATERIAL OBLIGATION CONDITIONS

Identify any current, prior or pending material events such as bankruptcy, defaults, litigation, grand jury findings, unscheduled draws on reserve funds, substitution of insurers or their failure to perform, actions taken in anticipation of filing Chapter 9, and relevant conditions in material obligations.

None

VII. ATTACHMENT CHECKLIST

Check the box next to each item attached to your application.

Technical Attachments:

☑ 1. Work Plan

☑ 2. Certification for Compliance with Water Metering Form

☑ 3. Proof of Urban Water Management Plan compliance (if applicable)

Financial Attachments:

☑ 4. Authorizing Resolution (Draft or Final)

☑ 5. Audited Financial Statements

☑ 6. Relevant Service, Management, Operating, or Joint Power Agreement (if applicable)

CERTIFICATION AND SIGNATURE OF AUTHORIZED REPRESENTATIVE

To the best of my knowledge and belief, I certify that I am authorized to submit this application; the information provided in this application is true and correct; the documentation has been duly authorized by the governing body of the applicant; and the entity possesses the legal authority to apply for the financing and enter into a financing agreement with the State Water Resources Control Board and to finance and construct the proposed facilities.

Name of Authorized Representative: David W. Pedersen Title: General Manager

Signature of Authorized Representative: David W. Pedersen Date: November 15, 2018

Notice of Exemption

Form D

To: Office of Planning and Research
P.O. Box 3044, Room 212
Sacramento, CA 95812-3044

County Clerk
County of Los Angeles
12400 Imperial Highway
Norwalk, CA 90650

From: (Public Agency) Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 91302
(A

2017 255679
FILED
Sep 11 2017
Dean C. Logan, Registrar – Recorder/County Clerk
Electronically signed by SHERON SMITH

Project Title: Pure Water Project Las Virgenes-Triunfo: Demonstration Project

Project Location - Specific:

Las Virgenes Municipal Water District, 4232 Las Virgenes Road, Calabasas, CA 91302

Project Location – City: Calabasas Project Location – County: Los Angeles

Description of Nature, Purpose and Beneficiaries of Project:

The Pure Water Demonstration Project will be a nominal 100 gallon per minute (gpm) facility that will test fully advanced treatment processes of microfiltration (MF), reverse osmosis (RO), ultraviolet disinfection (UV) and advanced oxidation (AOP) on the JPA's tertiary treated recycled water to produce purified water suitable for surface water augmentation.

Name of Public Agency Approving Project: Las Virgenes Municipal Water District

Name of Person or Agency Carrying Out Project: Las Virgenes Municipal Water District

Exempt Status: **(check one)**

- ☐ Ministerial (Sec. 21080(b)(1); 15268);
- ☐ Declared Emergency (Sec. 21080(b)(3); 15269(a));
- ☐ Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
- ☒ Categorical Exemption. State type and section number: Existing Facilities: Section 15301.b and 15306
- ☐ Statutory Exemptions. State code number:

Reasons why project is exempt:

The proposed project is a minor alteration of an existing public utility structure/facility involving negligible use beyond its existing use. This is a categorical exemption and requires a Board determination and filing of a Notice of Exemption.

Lead Agency Contact Person: David R. Lippman, P.E. Area Code/Telephone/Extension: 818-251-2221

If filed by applicant:

1. Attach certified document of exemption finding.
2. Has a Notice of Exemption been filed by the public agency approving the project? ☐ Yes ☐ No

Signature: Date: 9/5/2017 Title: Director of Facilities and Operations

☒ Signed by Lead Agency

☐ Signed by Applicant

Date received for filing at OPR:

THIS NOTICE WAS POSTED
ON September 11 2017
UNTIL October 11 2017
ITEM # 18
REGISTRAR – RECORDER/COUNTY CLERK

ATTACHMENT 1

Work Plan

Work Plan for Pure Water Project
Las Virgenes-Triunfo: Demonstration Project

Application for Water Recycling
Funding Program Pilot Project Grant

November 15, 2018

Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 90266

ITEM # 18

State Water Resource Control Board
Water Recycling Funding Program - Pilot Project Grant Application
Pure Water Project Las Virgenes – Triunfo: Demonstration Project

WORKPLAN

Executive Summary

The Las Virgenes – Triunfo Joint Powers Authority (JPA) was formed in 1964 to construct, operate and maintain a joint sewer system and wastewater treatment facilities to serve the Malibu Creek Watershed. The Board of the JPA consists of the Boards of the Las Virgenes Municipal Water District (LVMWD) and the Triunfo Sanitation District (TSD).

Formed in 1958, LVMWD is a municipal water district organized and operating pursuant to California Water Code Section 71000 et seq. A board of five directors, elected by division to serve four-year terms, governs LVMWD. LVMWD provides potable water, wastewater treatment, recycled water and biosolids composting to more than 70,000 residents in the cities of Agoura Hills, Calabasas, Hidden Hills, Westlake Village, and unincorporated areas of western Los Angeles County.

Pursuant to California Health and Safety Code Division 5, Part 3, Chapter 3, Section 4700, TSD was formed in 1963 as a special district to provide sanitation services for the southeast portion of Ventura County. Covering approximately 50 square miles, TSD serves about 30,100 people and provides wastewater collection and treatment (via JPA facilities) and supplies recycled water to customers. A board of five directors, elected at large to serve four-year terms, governs TSD. TSD contracts with Ventura Regional Sanitation District for administration, operation, and management services. The Oak Park Water Company is a branch of TSD and provides potable water service to about 4,600 service connections in the 4.1-square-mile community of Oak Park. Other public and private water purveyors serve the remaining areas of TSD's service area.

The JPA produces tertiary treated recycled water at the Tapia Water Reclamation Facility (Tapia) by treating wastewater flows from the joint service areas of LVMWD and TSD. The recycled water is beneficially reused for the irrigation of parks, schools, golf courses and common area landscapes, a practice that began in 1972. However, there is a high level of seasonal variability in recycled water demand, which are typically low in the winter and sharply escalate in the summer. The supply of recycled water generally remains constant throughout the year, creating excess recycled water in the winter and a shortage of recycled water in the summer. In the summer, the deficient supply is managed by supplementing the recycled water system with local groundwater and potable water. In wintertime, the excess recycled water is discharged to Malibu Creek. The JPA discharges to Malibu Creek pursuant to National Pollutant Discharge Elimination Permit No. CA0056014, Order No. R4-2017-0124 issued by the Los Angeles Regional Water Quality Control Board (LARWQCB). In order to meet regulatory requirements and achieve the highest and best use of the recycled water that is currently discharged to Malibu Creek, or disposed of using other methods, the JPA is planning to use the water for indirect potable reuse.

On July 2, 2013, the United States Environmental Protection Agency (EPA), Region IX, established the *Malibu Creek and Lagoon Maximum Daily Loads for Sedimentation and Nutrients to Address Benthic Community Impairments* (2013 TMDL). On December 8, 2016, the LARWQCB adopted an Implementation Plan for the 2013 TMDL and, on September 22, 2017, the California State Water Resource Control Board approved the Implementation Plan.[1] The 2013 TMDL waste load allocations (WLA) to be implemented for Tapia's discharge are as follows:

Implementation Schedule	Total Nitrogen Summer WLA	Total Nitrogen Winter WLA	Total Phosphorus Summer WLA	Total Phosphorus Winter WLA
Upon effective date of Implementation Plan	Current performance	Current performance	Current performance	Current performance
5 years from the effective date	1.0 mg/L	Current performance	0.1 mg/L	Current performance
13.5 years from the effective date	1.0 mg/L	4.0 mg/L	0.10 mg/L	0.20 mg/L

To meet these discharge requirements at existing facilities, reserve osmosis based treatment processes are needed at an estimated cost exceeding $100 million, only to discharge the highly purified water to Malibu Creek.[2] Rather than incurring this cost to discharge highly treated water, the JPA initiated and lead a stakeholder driven process in 2015 to evaluate options to discharging to Malibu Creek. The stakeholder process resulted in six alternatives considered in a Plan of Action document and eventually two alternatives evaluated in a Basis of Design Report. On August 1, 2016, the JPA Board selected Indirect Potable Reuse using Surface Water Augmentation as the preferred alternative, subsequently renamed as the Pure Water Project Las Virgenes – Triunfo (Pure Water Project)

The Pure Water Project will convey the excess recycled water produced at Tapia to a new Advanced Water Treatment (AWT) facility that will further treat the water using micro-filtration, reverse osmosis and ultraviolet light disinfection/advanced oxidation. The purified water will then be conveyed to the existing Las Virgenes Reservoir, which stores potable water for the region, for indirect potable reuse via surface water augmentation. After the requisite detention time, mixing and dilution, the purified water will be available as additional source water in the reservoir. The water will then be treated at the existing Westlake Filtration Plant and conveyed to the LVMWD's service area in Los Angeles County and TSD's service area in Ventura County to meet potable water demands. The brine from the AWT plant will be conveyed to the Calleguas Municipal Water District (CMWD) Salinity Management Pipeline (SMP) in Ventura County.

The Pure Water Project takes advantage of a variety of existing infrastructure, including recycled water conveyance facilities Las Virgenes Reservoir, Westlake Filtration Plant and the potable water distribution systems of LVMWD, TSD and CMWD. New proposed facilities will include an AWT plant, an extension of

[1] The Implementation Plan also included a 2003 EPA established Malibu Creek Watershed TMDL for Nutrients. The JPA complied with the waste load allocations in this TMDL via a Time Schedule Order in its 2005 NPDES Discharge Permit.

[2] Nutrient Reduction Measures for Low Total Nitrogen and Phosphorus – UPDATE 2013

the existing recycled water transmission system, a new purified water pipeline to Las Virgenes Reservoir, mixing facilities at Las Virgenes Reservoir and a brine disposal pipeline to the CMWD SMP.

The total combined potable water demand for LVMWD and TSD in 2015 was 21,566 acre-feet[3]. The 2016 Basis of Design Report determined a near-term low and high range of purified water produced at the AWT plant of 680 to 2,637 acre-feet. This would represent 3% to 12% of the 2015 potable water demand. The projected combined potable water demand in 2035 is 26,274 acre-feet[4]. The 2016 Basis of Design Report projected a low and high range of purified water produced at the AWT plant of 3,681 to 5,151 acre-feet in 2035. The water produced by the Pure Water Project would represent 14% to 20% of the potable water demand in 2035.

In February 2009, the California State Water Resource Control Board (SWRCB) adopted Resolution 2009-0011, an updated water recycling policy, which included the goal of increasing the use of recycled water in the state over 2002 levels by at least 1,000,000 acre-feet per year by 2020 and by at least 2,000,000 acre-feet per year by 2030. The Resolution also included a requirement to adopt uniform water recycling criteria for surface water augmentation by December 31, 2016. The SWRCB used an expert and advisory panel to develop recommended uniform water recycling criteria for surface water augmentation. The SWRCB adopted the regulations in March 2018, which were approved by the Office of Administrative Law on August 7, 2018.

The surface water augmentation regulations rely on treatment performance measured as "log removal" for the various treatment trains. Log removal relates to the percentage of microorganisms physically removed or inactivated by a given process. For reference, current regulations for a conventional surface water filtration plant require 4-log (99.99%) removal and/or inactivation of enteric viruses and 3-log (99.9%) removal and/or inactivation of Giardia lamblia cysts. The proposed surface water augmentation regulations require 12-log removal for enteric viruses, 10-log removal for Giardia cysts and 10-log removal for cryptosporidium oocysts. The required log reduction is often referred to as 12-10-10 log reduction requirements. The treatment trains involved include microfiltration, reverse osmosis and ultraviolet light disinfection with advanced oxidation. The treatment trains used to achieve these reductions must be demonstrated to meet the log reduction standards using SWRCB Division of Drinking Water approved performance testing procedures.

The JPA has worked closely with the SWRCB and its expert and advisory panels during the development of the uniform water recycling criteria for surface water augmentation. This water reuse process requires innovative approaches, so the JPA commissioned a demonstration project and a mixing and dilution study.

The demonstration facility will serves four main purposes:

1. Public Outreach & Acceptance. The demonstration facility will provide an opportunity for the public to see and learn about the processes used for indirect potable reuse.
2. Operator Training. The demonstration facility will provide operator training on the processes used for indirect potable reuse.

[3] From LVMWD and TSD 2015 Urban Water Management Plans
[4] From LVMWD and TSD 2015 Urban Water Management Plans

3. Regulatory Compliance. The demonstration facility will help to validate the effectiveness of the treatment trains proposed for the Pure Water Project and illustrate compliance with regulations for surface water augmentation.
4. Provide research in five focused areas, as follows:

    a. Evaluation and quantification of the natural degradation of NDMA and other constituents of emerging concern in an open-air reservoir subject to direct sunlight.
    b. Direct testing of high recovery RO, achieving recoveries above 93 percent to reduce the brine flows that require transmission and disposal.
    c. Long-term demonstration of the benefits of operating RO membranes at elevated flux to improve contaminant rejection and product water quality.
    d. Evaluation of the benefits of RO membrane flushing to extend operating periods between chemical cleanings, reducing chemical usage, energy consumption, and high salinity waste flows.
    e. Characterization of the brine to determine its compatibility for discharge to Calleguas Municipal Water District's Salinity Management Pipeline.

Although there are several indirect potable reuse groundwater recharge projects operational in California, there are currently no permitted surface water augmentation projects. Only two other agencies in California are actively pursuing surface water augmentation projects, the City of San Diego and Padre Dam Municipal Water District. However, a significant distinction for the proposed Pure Water Project as compared to the two others is that it will need to be operated seasonally. The application of various treatment processes to achieve 12-10-10 log reduction and being one of the first projects to apply the new surface water augmentation regulations with a seasonal mode of operation makes the Pure Water Project groundbreaking and innovative.

Section 1 – Goals and Objectives

a. A clear statement of what question(s) is being asked by the Pilot Project and why it is relevant to the recycled water industry:

The Pure Water Project Las Virgenes – Triunfo: Demonstration Project will answer two major questions that are very relevant to the recycled water industry:

1. What are the design criteria and operational procedures that will optimize the future advanced water treatment plants used for potable reuse via surface water augmentation?

2. How can a demonstration project be designed to best educate the public on the basics of potable reuse and multiple barriers to protect public health? And, how effective is a demonstration project in influencing public perception on potable reuse?

The first area of research (Question No. 1) will focus on design criteria and operational procedures to optimize the future Pure Water Project Las Virgenes-Triunfo, which will be directly relevant to other agencies proposing similar advanced water treatment facilities.

Following are the criteria and procedures to be tested: contrasting the use of UV/chloride and UV/peroxide for advanced oxidation; the use of a semi-universal UF/MF skid to test several different UF/MF products under differing operating conditions; the natural degradation of NDMA using sunlight; the treatment of urban run-off and other non-traditional source waters; direct testing of high recovery RO and the application of artificial intelligence/machine learning to the plant control system. The results of these areas of testing and research will provide information that will lead to optimization during the design of full-scale plants, supporting cost-savings and improved water quality.

The second area of research (Question No. 2) will be focused on public outreach and public perception of potable reuse. The Pure Water Demonstration Project will include a structured visitor experience using focused messaging on the water cycle, water resources management and potable reuse. The objective will be to illustrate the importance of potable reuse as a water management strategy in California, recognizing that all water is recycled. Careful thought will be placed on designing the project to best educate the public on the basics of potable reuse and the multiple barriers to protect public health. Information on the rationale for decisions related to the visitor experience will be summarized and shared with other agencies contemplating potable reuse projects. In addition, pre- and post-tour surveys of visitors will be used to measure the effectiveness of the demonstration project to influence public perception on potable reuse. Statistical information will be collected and analyzed to correlate specific messaging and visitor experience elements that we most effective in communicate with the public, allowing other agencies to focus their efforts accordingly.

b. What body of knowledge relating to potable reuse does the proposed Pilot Project address?

The first area of research, design criteria and operational procedures, will increase the body of knowledge available to designers when selecting processes and control scenarios to support optimization of full-scale projects. As wastewater flows continue to decline due to indoor water use efficiency, the supply of source water available for potable reuse will also diminish. The demonstration project will increase the body of knowledge available on the potential for use of non-traditional water sources, such as urban run-off, as a source of supply for potable reuse.

The second area of research, public outreach and public perception of potable reuse, will increase the knowledge of owners and elected officials related to public support for potable reuse projects. In addition, it will directly address and measure the effectiveness of investing in a demonstration project on influencing public perception. Gaining public support and developing a positive perception of potable reuse is necessary for the success of all potable reuse project.

Section 2 – Project Benefits

- **a.** ***How will the project improve water supply reliability, provide water quality and ecosystems benefits related to decreased reliance on surface water and/or;***
- **b.** ***Provide Public Health benefits from improved drinking water quality or supply;***
- **c.** ***The project impacts on cost effectiveness; and***
- **d.** ***Energy efficiency and greenhouse gas emissions impacts.***

The following discussion relates to section 2, items a, b and d.

The Pure Water Demonstration Project is a critical element of the full-scale Pure Water Project that will provide water supply reliability, ecosystem benefits related to reduced reliance on imported water and reduction of discharges to receiving waters, improved drinking water supply, and reduced greenhouse gas emissions.

Reduced Reliance on Imported Surface Water

Las Virgenes Municipal Water District (LVMWD) and Triunfo Sanitation District (TSD) rely solely on imported water from the Metropolitan Water District of Southern California (MWDSC) for their potable water supply. About 30 percent of Southern California's water comes from the State Water Project (SWP), the largest state-built water and power system in the nation. The project runs from Lake Oroville in Northern California to Southern California, passing through the Sacramento-San Joaquin Bay Delta along the way. The SWP serves a population of nearly 25 million Californians from the Bay Area to San Diego, as well as providing irrigation for some of the nation's most productive farmland in the Central Valley. The State Water Project is operated and maintained by the California Department of Water Resources and includes 34 storage facilities, reservoirs and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power plants; and about 700 miles of open canals and pipelines. Water from the State Water Project is delivered through the California Aqueduct, a 444 mile-long canal, beginning at the south Delta and ending at Lake Perris in Riverside County. It varies in width from 50 to 110 feet and 19 to 32 feet in depth.

MWDSC is the largest contractor on the State Water Project system, receiving about 50% of the SWP's supplies, roughly 1.2 million acre-feet (MAF) in an average year. MWDSC's SWP allocation varies depending on water supply conditions in the Western Sierra Nevada Mountains and environmental conditions in the Sacramento-San Joaquin Bay Delta, which can restrict water deliveries.

As Southern California's population and economy continues to grow, the need for additional water to meet new demands grows with it. Local resource programs such as conservation, water recycling, desalination, potable reuse and groundwater recovery and storage are important programs in the region that contribute to a diverse local resources portfolio. These programs also bring greater water supply reliability to Southern California and help to reduce reliance on imported water supplies.

The Pure Water Project will replace up to 2,600 acre-feet of imported water supply in the near-term and up to 5,100 acre-feet of imported water in the long-term. These reductions represent 12% of the combined potable water demand in the near-term and 20% of the combined potable water demand in the long-term. Every acre-foot of water produced by the Pure Water Project reduces the need for imported water by the same amount.

Increased Reliability with Drought Resilient Water Supply

The Pure Water Project is a local, drought resilient water supply, increasing the reliability of the JPA's drinking water supplies by reducing reliance on strained imported water sources. Droughts are a recurring feature of California's climate and likely to become more frequent and severe due to the impacts of climate change. Over the last century, significant statewide droughts have occurred in 1929-1934, 1976-1977 and 1987-1992, and a less severe drought occurred in 2007-2009. From 2012 to 2016, California experienced an extreme drought emergency that significantly affecting the amount of

imported water available to Southern California. Being 100% reliant upon imported water, LVMWD and TSD do not currently have local supplies of drinking water and are very susceptible to shortages in regional and state supplies. The Pure Water Project will produces a local, drought resilient supply of water that will meet up to 20% of the combined potable water demands in the joint service areas of LVMWD and TSD. The project will diversify the region's water supply portfolio, increase local resilience and support adaptation to the potential adverse effects of climate change.

Water Quality and Ecosystem Benefits

The Pure Water Project will provide water quality and ecosystem benefits in two ways. First, the project will effectively eliminate the discharge of treated wastewater to Malibu Creek, Malibu Lagoon and the Santa Monica Bay. Based on the U.S. EPA's 2013 *Malibu Creek and Lagoon Maximum Daily Loads for Sedimentation and Nutrients to Address Benthic Community Impairments*, discharges of treated wastewater from the Tapia Water Reclamation Facility contribute to nutrient loading for downstream receiving waters. The nutrient loading is believed to be supporting algal growth, eutrophication that impair the health of benthic macroinvertebrate communities in Malibu Creek and Lagoon. The benthic communities in these receiving waters serve as a broader indicator of the overall ecosystem health. The effective elimination of Tapia's discharges to Malibu Creek, instead supply the flows to the proposed AWT plant, will significantly reduce nutrient loading to the receiving waters, improve the quantity and variety of benthic macroinvertebrates, and enhance the overall ecosystem health.

Second, the Pure Water Project will significantly reduce the region's reliance on surface water imported by MWDSC from the Sacramento-San Joaquin Bay Delta via the State Water Project. Currently, the region is entirely dependent on imported surface water that primarily originates in the Bay Delta. The Bay Delta ecosystem is suffering from a significant decline and its 1,100 miles of levees are increasingly vulnerable to earthquakes, flooding, seawater intrusion, climate change and further environmental degradation. Pumps for the State Water Project pull water in the south Delta in an unnatural direction, creating reverse flows in the Old and Middle Rivers, which can draw fish away from their migratory paths and even entrain them in the pumps. By reducing the region's demand for imported water from the Bay Delta, the Pure Water Project will in turn support improvement of ecosystem health in the Bay Delta. The reduction of demands from the Bay Delta will allow more natural flows to pass through the Delta, supporting improvement of the affected fisheries.

Public Health Benefits from Improved Drinking Water Supply and Quality

The Pure Water Project will also provide public health benefits through improved drinking water quality and enhanced water supply reliability. Water produced by the proposed AWT plant will be of the highest quality in the region. The multi-barrier treatment system will be protective of public health and produce water that is absent of pre-cursor compounds that produce total trihalomethanes following disinfection. The enhancement of water supply reliability in significant in the event of a major disaster such as an earthquake when the region would be vulnerable to interruptions that may occur in the imported water delivery system. The Pure Water Project will supply essential supplies for public health and safety during emergencies or natural disasters.

Energy Savings and Reduced Greenhouse Gas Emissions

According to the California Energy Commission, 19 percent of the State's electricity, more than 30 percent of the natural gas use (aside from that consumed by power plants), and 88 million gallons annually of diesel fuel are associated with water use and wastewater treatment.[5] The SWP is the single largest energy user in the State, consuming 5 billion kilowatt-hours per year, accounting for 2 to 3 percent of all electricity consumed in California.[6]

The JPA purchases 100 percent of its potable water from MWDSC. The water for the region is treated at the Joseph Jensen Water Treatment Plant in Granada Hills, which is supplied with imported water from the State Water Project. For each acre-foot of water transported to and treated at Jensen, 4.09 megawatt-hours (MWh) of electricity is consumed. For each MWh of electricity produced, an average of 0.433 tons of carbon dioxide (CO_2) is emitted, so for each acre-foot of water delivered to the JPA's service area, 1.77 tons of CO_2 is emitted.[7] The transmission, distribution, and advanced treatment of an acre-foot of recycled water consumes an average of 2.05 MWh of electricity, resulting in 0.89 tons of CO_2 emitted. For every acre-foot of advanced treated recycled water that replaces imported water, a reduction of 2.04 MWh of electricity and 0.88 tons of CO_2 emissions are realized. As a result, the production of 5,151 AF of water through the Pure Water Project will result in an annual reduction of 10,508 MWh of electricity and 4,533 tons of CO_2 emissions.

Every acre-foot of water produced by the Pure Water Project reduces the need to import an acre-foot of water from the SWP. The reduction in imported water results in increased water supply reliability, environmental benefits and reduced energy consumption and greenhouse gas emissions.

The following discussion relates to section 2 item c.

The Pure Water Project is cost effective and expected to produce water at a lower rate than the projected cost to import surface water via the State Water Project within 20 years. As a result, the project will have a positive net present worth over the long-term. The initial unit cost of water produced through the Pure Water Project is estimated to be $1,724, which is economically favorable as compared to alternative water supply sources. In addition, the cost of limited imported water supplies has traditionally increased by 7% per annum, which is likely to continue in the future. The Basis of Design Report for the Pure Water Project indicates that the project will result in a $40.4 million savings when considering the present worth of annual operations over a 30-year period. The savings increases to $80.7 million when considering the present worth of annual operations over a 30-year period including growth within the service area that would produce more wastewater for treatment.

[5] California Energy Commission. 2005. *Integrated Energy Policy Report.* CEC-100-2005-007-CMF. November 2005.
[6] Natural Resources Defense Council. 2004. *Energy Down the Drain: The Hidden Costs of California's Water Supply.* August 2004.
[7] Calleguas Municipal Water District. 2007. *CO_2 Emissions and Imported State Project Water to Ventura County*. January 25, 2007.

Section 3 – Project Description

a. ***The project scope;***

The Demonstration Project will include the following three critical purification processes:

1. **Ultrafiltration (UF)**: one open platform train that will produce approximately 100 gpm of filtered effluent using three different UF membranes (and thus three modules) to undergo simultaneous testing
2. **Reverse Osmosis (RO)**: one train that will operate at 85 percent recovery in the following two modes of operation:
    a. **Two-Stage**: 2:1 array with seven 4-inch elements per vessel and an inter-stage booster pump between stages to produce 12 gpm.
    b. **Three-Stage**: 4:2:1 array with six 4-inch elements per vessel and an inter-stage booster pumps between stages 2 and 3 to produce 25 gpm.
3. **Ultraviolet Light Disinfection (UV) and Advanced Oxidation Process (AOP)**: one reactor capable of treating up to 20 gpm[8] with a dose up to 600 mJ/cm^2 for N-nitrosodimethylamine (NDMA) destruction coupled with an upstream dose of sodium hypochlorite for a minimum removal of 0.5-log of 1,4-dioxane. Lower flows will be run through the system to generate high dose values sufficient for NDMA destruction and to best understand future AWPF design criteria.

In addition to the three treatment systems (UF, RO, UV AOP), this Demonstration Project includes:

1. **Online Monitoring Systems**: each of the three processes will be monitored online (both in real time and periodically) over the demonstration period by the instrumentation summarized in Table 1. In addition:
    a. The UF system will continuously monitor normalized flux, turbidity removal, and transmembrane pressure (TMP). It will also conduct daily pressure decay tests (PDTs).
    b. The RO system will continuously monitor normalized flux, conductivity removal, and TMP. It may include dosing and measuring a fluorescent dye (Trasar) continuously for a period of testing.
    c. The UV system will continuously monitor dose. UV intensity (UVI) sensors within the UV reactor will report UVI continuously.
    d. All online meters will be calibrated weekly or monthly using either bench-scale calibrated devices or through laboratory analysis.
2. **Artificial Intelligence (AI):** The system will be programmed to continuously track performance of each treatment process as well as the combined performance to meet DDW requirements for a new water supply. Analysis will include data trends, off-spec determinations, and quantification of total time out of compliance.
3. **Equipment for Supporting Studies:** In adjacent rooms to the UF, RO, and UV AOP, the project team will potentially study NDMA reformation and corrosion through pipe loop studies.

[8] Uncertainty in dose prediction accuracy and hydroxyl radical scavenging by the proposed UV system require flexibility by this team as to the production flow (gpm) of the proposed unit. These details will be made clear during the Demonstration Project.

b. ***Location of the project***
The demonstration project will be constructed at the existing LVMWD Headquarters campus in Calabasas, California. A portion of a vacant office building, which served as LVMWD's original headquarters building, will be renovated to accommodate the project.

c. ***How the proposed construction will be incorporated into the existing treatment facility***
Recycled water from the Tapia Water Reclamation Plant (Tapia) is currently pumped to the headquarters campus, stored in an adjacent reservoir and then pumped east and west in the distribution system. The main recycled water line at the campus will be tapped to provide influent flows to the demonstration project. Brine and effluent from the demonstration project will be discharged to sanitary sewer and returned to Tapia.

d. ***Equipment/operations to be examined***

The Demonstration Project includes evaluation of several novel challenges:

1. **Seasonal Operation:** The JPA is committed to maintaining its current successful non-potable water reuse program. Thus, the future pure water potable reuse project may run seasonally, with pure water conveyed to the Las Virgenes Reservoir in the wet weather months only. Accordingly, this Test Plan must evaluate the approach and impact of membrane storage during the traditional summer non-potable recycled water season, when all of the treated water is required for non-potable purposes.
2. **Feed Water Quality:** The feed to the future system will be tertiary recycled water treated with filtration and chloramination. The future system will not pull water from secondary or filtered/non-disinfected locations. Chloramination is employed for Tapia's effluent to meet Title 22 disinfection criteria and minimize conventional disinfection byproducts (DBPs) [e.g., trihalomethanes (THMs)], but will result in N-nitrosodimethylamine (NDMA) formation ahead of purification. Understanding the value and variability of chloramine residual and NDMA concentrations, and the subsequent impact on treatment performance and efficiency, will be an important component of the Demonstration Project.
3. **High Run Time:** Increasingly stringent water quality requirements are making seasonal discharge to Malibu Creek very challenging and would trigger a significant investment in treatment at the Tapia Water Reclamation Facility. Therefore, the JPA has gone through a stakeholder driven process to consider options for regulatory compliance and selected indirect potable reuse utilizing Las Virgenes Reservoir as the preferred scenario/option. With that understood, no treatment process will run effectively 100% of the time. Accordingly, this project must include development of a clear understanding of the reliability of the treatment performance to Division of Drinking Water standards and conclude on the levels of redundancy of treatment and monitoring systems to attain a target Water Production Reliability Goal (value TBD).
4. **Stabilization:** The new purified water will ideally match or surpass the quality of the existing finished potable water supply that is fed into Las Virgenes Reservoir. This includes an understanding of purified water and existing raw water supply concentrations of regulated and unregulated pollutants, toxicity, and chlorine/chloramine residual. To that end, this Demonstration Project will include stabilization of the purified water and may include quenching of chlorine/chloramine.

5. **RO Concentrate:** A primary goal of the demonstration project and full-scale facility will be to maximize RO recovery. However, increased RO recovery results in a more concentrated brine with scaling potential that can result in brine line scaling, significantly impacting operations. As such, this project must determine which brine concentrations will lead to scaling issues and determine if brine stability can be increased.

The project will include a targeted visitor experience focused on educating the public on potable reuse, water supply and conservation actions. The visitor experience will include a California-friendly, native plant demonstration garden, signage and videos explaining the various treatment processes, and a purified water tasting station.

Pre- and post-tour surveys will be conducted to evaluate the public's perception and measure changes in perception of potable reuse that will be correlated to the messaging, allowing other agencies to best focus their public outreach efforts. All data associated with the public outreach and impact on public perception will be shared with others, so they may determine the value of a similar demonstration project.

e. ***Any significant issues that may impact the project***

There are no significant issues that may impact the project or the JPA's commitment to move forward.

Section 4 Study Design and Methods

a. How will the research questions be answered or addressed
b. Data analysis procedures and quality assurance methods
c. Facility process flow diagram/design parameters; and
d. Failure exit parameters if determined at some point the project is going fail.

Please see the Pure Water Demonstration Test Plan related to the methods employed to develop design criteria and operational procedures to optimize the future advanced water treatment plant, which is the first arear of research (Question No. 1 in Section No. 1)

For the second area of research (Question No. 2 in Section No. 1), pre- and post-tour surveys of visitors will be used to measure the effectiveness of the demonstration project to influence public perception on potable reuse. Statistical information will be collected and analyzed to correlate specific messaging and visitor experience elements that we most effective in communicate with the public, allowing other agencies to focus their efforts accordingly.

d: Failure exit parameters if determined at some point that the project is going to fail

Although it is very unlikely that the project will fail, if it does, the data collected to that point will be analyzed and reported out.

Section 5 Construction/Implementation

Please see the attached Project Schedule, which highlights the construction/implementation activities in green.

Section 6 Monitoring/Performance

For the first area of research, design criteria and operational procedures, the project effectiveness will be monitored by thorough sampling and analyses as described in the Pure Water Demonstration Test Plan.

For the second area of research, public perception of potable reuse, the project effectiveness will be monitored by preforming a statistical analysis of data obtain from the pre- and post-tour surveys.

Section 7 Data Analysis/Report Preparation

For the first area of research, design criteria and operational procedures, periodic progress reports and a final report will be prepared based on the Pure Water Demonstration Test Plan. In addition, a final report will be prepared for the U.S. Bureau of Reclamation to satisfy its grant requirements.

For the second area of research, public perception of potable reuse, the pre- and post-tour surveys will be analyzed to identify trends, changes in public perception of potable reuse and the effectiveness of the messaging. The analysis will be documented and shared in a final report.

Section 8 Education and Outreach

In addition to tours that will be performed of the demonstration project, LVMWD will be conducting a broader public education and outreach program surrounding potable reuse and the Pure Water Project Las Virgenes – Triunfo. The program will include an explanation of the need for investment in local, drought-resilient water supplies, the basics of potable reuse and the fact that all water is recycled. Specifics on the proposed Pure Water Project Las Virgenes – Triunfo will be provided and individuals will be encouraged to participate in a tour of the demonstration project. The information will be shared through individual presentations to service clubs, community organizations, city councils, and distributed via social media and print advertisement. The public education and outreach materials will be made available to other organizations seeking to implement a potable reuse project.

Section 9 Project Costs

Please see attached Detailed Application Budget Summary.

Section 10 Project Schedule

Please see attached Project Schedule.

Section 11 Research Program Partner Involvement

Research partners include Carollo Engineers (demonstration design and operation assistance), Astound & NewWater Resources (visitor experience design) and Katz & Associates (survey design).

Las Virgenes – Triunfo Joint Powers Authority
Pure Water Demonstration Project

Technical Memorandum
PURE WATER DEMONSTRATION TEST PLAN

DRAFT | October 2018

ITEM # 18

Contents

Appendices

Tables

Figures

Abbreviations

AC	acre
AFY	acre-feet per year
ADD	average day demand
Carollo	Carollo Engineers, Inc.
cf	cubic feet
cfs	cubic feet per second
F	Fahrenheit
ft	feet
gpcd	gallons per capita day
gpd/ac	gallons per day per acre
µg/L	micrograms per liter
MDD	maximum day demand
MG	million gallons
µg/L	micrograms per liter
mg/L	milligrams per liter
mgd	million gallons per day
MinDD	minimum day demand
MinMD	minimum month demand
MMD	maximum month demand
msl	mean sea level
PHD	peak hour demand
PS	pump station
psi	pounds per square inch
RO	reverse osmosis
SCADA	supervisory control and data acquisition
WRF	water reclamation facility
WWTP	wastewater treatment plant
WTP	water treatment plant

Technical Memorandum

PURE WATER DEMONSTRATION TEST PLAN

The Las Virgenes – Triunfo Joint Powers Authority (JPA) Pure Water Demonstration Project (Demonstration Project) is a potable water reuse demonstration project. This demonstration project will develop the necessary information to successfully implement a future full scale potable reuse Advanced Water Purification Facility (AWPF) that would produce up to 5,151 acre-feet per year (AFY) for surface water augmentation to the Las Virgenes Reservoir. The existing Tapia Water Reclamation Facility (WRF) recycles wastewater through primary sedimentation, conventional activated sludge, media filtration, and chloramine disinfection, and will provide the influent for the Demonstration Project and AWPF. At this time, planned future AWPF operation will be done seasonally when existing recycled water demands are low, a concept to be mimicked with this Demonstration Project. JPA has identified the following as goals of the Demonstration Project:

- Provide opportunities for public education, acceptance, and public outreach to the JPA's customers;
- Develop design criteria and operational procedures to inform and improve the full scale design and provide experience to operators; and
- Provide technical documentation and support for permitting the project by the State of California's Division of Drinking Water (DDW) as a surface water augmentation project.

This Test Plan provides a detailed test plan for the 12-month duration of the Demonstration Project.

Proposed Treatment Train

The Demonstration Project will include the following three critical purification processes:

1. **Ultrafiltration (UF)**: one open platform train that will produce approximately 100 gpm of filtered effluent using three different UF membranes (and thus three modules) to undergo simultaneous testing
2. **Reverse Osmosis (RO)**: one train that will operate at 85 percent recovery in the following two modes of operation:
    a. **Two-Stage**: 2:1 array with seven 4-inch elements per vessel and an inter-stage booster pump between stages to produce 12 gpm.
    b. **Three-Stage**: 4:2:1 array with six 4-inch elements per vessel and an inter-stage booster pumps between stages 2 and 3 to produce 25 gpm.
3. **Ultraviolet (UV) Advanced Oxidation Process (AOP)**: one reactor capable of treating up to 20 gpm[1] with a dose up to 600 mJ/cm^2 for N-nitrosodimethylamine (NDMA) destruction coupled with an upstream dose of sodium hypochlorite for a minimum

[1] Uncertainty in dose prediction accuracy and hydroxyl radical scavenging by the proposed UV system require flexibility by this team as to the production flow (gpm) of the proposed unit. These details will be made clear during the Demonstration Project.

removal of 0.5-log of 1,4-dioxane. Lower flows will be run through the system to generate high dose values sufficient for NDMA destruction and to best understand future AWPF design criteria.

Figure 1 provides an overview of the process train and corresponding chemicals and flow rates. Appendix A contains the process flow diagrams that provide additional information on supporting systems.

Ancillary Systems and Components

In addition to the three treatment systems (UF, RO, UV AOP), this Demonstration Project includes:

1. **Online Monitoring Systems**: each of the three processes will be monitored online (both in real time and periodically) over the demonstration period by the instrumentation summarized in Table 1. In addition:
    a. The UF system will continuously monitor normalized flux, turbidity removal, and transmembrane pressure (TMP). It will also conduct daily pressure decay tests (PDTs).
    b. The RO system will continuously monitor normalized flux, conductivity removal, and TMP. It may include dosing and measuring a fluorescent dye (Trasar) continuously for a period of testing.
    c. The UV system will continuously monitor dose. UV intensity (UVI) sensors within the UV reactor will report UVI continuously.
    d. All online meters will be calibrated weekly or monthly using either bench-scale calibrated devices or through laboratory analysis.
2. **Artificial Intelligence (AI):** The system will be programmed to continuously track performance of each treatment process as well as the combined performance to meet DDW requirements for a new water supply. Analysis will include data trends, off-spec determinations, and quantification of total time out of compliance.
3. **Equipment for Supporting Studies:** In adjacent rooms to the UF, RO, and UV AOP, the project team will potentially study NDMA reformation and corrosion through pipe loop studies.

Table 1 Online Water Quality Monitoring

Parameter	Tertiary Effluent	UF Filtrate	RO Permeate	UV AOP Effluent	RO Concentrate
pH	●	●	●	●	
Turbidity	●	●(1)			
Temperature		●			
Conductivity		●	●(2)		●
TOC		●	●		
ORP		●			
UVT			●	●	

carollo
ITEM # 18

Parameter	Tertiary Effluent	UF Filtrate	RO Permeate	UV AOP Effluent	RO Concentrate
Free Chlorine		●	●	●	
Total Chlorine		●	●	●	
Ammonia		●			

Notes:
(1) On filtrate from each UF module.
(2) On permeate from each RO stage.

Challenges

This Demonstration Project includes evaluation of several novel challenges:

1. **Seasonal Operation:** The JPA is committed to maintaining its current successful non-potable water reuse program. Thus, a future pure water potable reuse project may run seasonally, with pure water to the Las Virgenes Reservoir being in the wet weather months only. Accordingly, this Test Plan must evaluate the approach and impact of membrane storage during the non-potable reclaimed water season.
2. **Feed Water Quality:** The feed to the future system will be tertiary recycled water treated with filtration and chloramination. The future system will not pull water from secondary or filtered/non-disinfected locations. The chloramination is employed to meet Title 22 disinfection criteria and to minimize conventional disinfection byproducts (DBPs) [e.g., trihalomethanes (THMs)] but will result in N-nitrosodimethylamine (NDMA) formation ahead of purification. Understanding the value and variability of chloramine residual and NDMA concentrations and the subsequent impact on treatment performance and efficiency will be an important component of the Demonstration Project.
3. **High Run Time:** Increasingly stringent water quality requirements are making seasonal discharge to Malibu Creek very challenging and would trigger a significant investment in treatment at the Tapia Water Reclamation Facility. Therefore, the JPA has gone through a stakeholder driven process to consider options for regulatory compliance and selected indirect potable reuse utilizing Las Virgenes Reservoir as a preferred scenario. With that understood, no treatment process will run effectively for 100% of the time. Accordingly, this project must develop a clear understanding of reliability of treatment performance to DDW standards and conclude on the levels of redundancy of treatment and monitoring systems to attain a target Water Production Reliability Goal (value TBD).
4. **Stabilization:** The new purified water will ideally match or surpass the quality of the existing finished potable water supply that is fed into Las Virgenes Reservoir. This includes an understanding of purified water and existing raw water supply concentrations of regulated and unregulated pollutants, toxicity, and chlorine/chloramine residual. To that end, this Demonstration Project will include stabilization of the purified water and may include quenching of chlorine/chloramine.
5. **RO Concentrate:** A primary goal of the demonstration project and full scale facility will be to maximize RO recovery. However, increased RO recovery results in more concentrated brine with scaling potential that can result in brine line scaling, significantly impacting operations. As such, this project must determine which brine

concentrations will lead to scaling issues and determine if brine stability can be increased.

Test Plan

Table 2 summarizes the four phases of the test plan, which will each last approximately three months, and includes a description of the purpose of each proposed testing.

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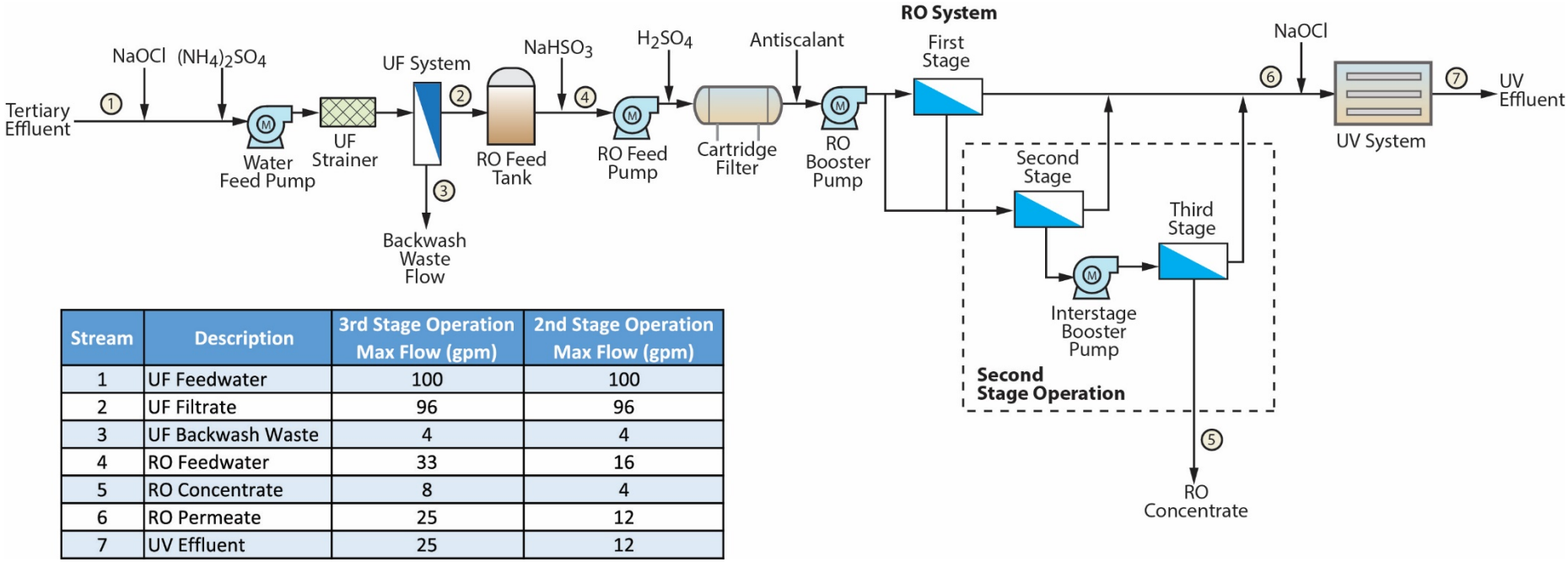
ITEM # 18



Stream	Description	3rd Stage Operation Max Flow (gpm)	2nd Stage Operation Max Flow (gpm)
1	UF Feedwater	100	100
2	UF Filtrate	96	96
3	UF Backwash Waste	4	4
4	RO Feedwater	33	16
5	RO Concentrate	8	4
6	RO Permeate	25	12
7	UV Effluent	25	12

Figure 1 Process Train Overview

Table 2 Quarterly Operating Schedule

System	Q1	Q2	Q3	Q4	Purpose	Description
Pretreatment	No Added Chloramines[1]	No Added Chloramines[1]	Supplemental Chloramination	Optimized Chloramine Dose	To establish the optimal dose of upstream chloramine addition (if any) required to prevent membrane biofouling and reduce NDMA formation	• Establish if chloramines are necessary by starting testing with no upstream chloramine dose and monitoring corresponding membrane fouling. • Compare no chloramine operation to chloramine operation with respect to membrane performance and NDMA formation. • Determine an optimized dose for Q4 testing.
UF	Flux and Cleaning Frequency Optimization				To determine the optimal UF system flux rate and cleaning frequency with varying levels of chloramine pretreatment.	• Incrementally vary flux rate similarly each quarter as detailed in Table 8. • Monitor required chemical cleaning interval at various design conditions.
	UF Challenge Testing				To establish pathogen log removal	• Evaluate removal of indigenous PMMoV, seeded MS2, and indigenous *Bacillus spores*. Consider potential use of real time qPCR monitoring of virus removal by UF.
RO[3]	No Biocide	No Biocide	Dose Biocide	Quench Filtrate Chloramines & Dose Biocide[3]	To assess if biocide effectively reduces RO fouling. To examine the potential improvement in UVT due to biocide use (compared to chloramination).	• Dose biocide upstream of RO system in Q3 and monitor corresponding TMP and CIP interval. • Dose again in Q4 if results are promising. • Dose sodium bisulfite upstream of the RO system to reduce free chlorine during Q4, if biocide is being dosed.
	Baseline Acid & Anti-scalant	Baseline Acid & Anti-scalant	Lower Acid Dose	Lower Acid & Anti-scalant Dose	To determine optimum anti-scalant and sulfuric acid dosage to inhibit scale from membranes	• Test baseline conditions of anti-scalant and sulfuric acid dosing in Q1 and Q2 for 2-stage and 3-stage RO. • Adjust sulfuric acid dosage down in Q3. • Keep same low sulfuric acid dose as Q3. Adjust anti-scalant dosage down in Q4.
	2-Stage RO Operation	3-Stage RO Operation	Number of Stages Per Q1 and Q2 Results	Number of Stages Per Q1 and Q2 Results	To determine the optimal number of stages for optimal operating of the full scale AWPF RO system	• Monitor normalized flux rate, transmembrane pressure, and conductivity removal of the two systems. • Operate Q3 and Q4 with either 2-stage or 3-stage, based on which system performs better during Q1 and Q2.
	RO Challenge Testing	RO Challenge Testing		RO Challenge Testing	To establish pathogen log removal and identify sensitivity to challenge testing	• In Q1 and Q2, establish baseline conditions for 2-stage and 3-stage operation by evaluating removal of seeded MS2 as well as Trasar (TBD), UVA, EC, TOC, strontium, and sucralose as surrogates for removal of constituents. • Challenge test O-ring failure and membrane breach conditions during Q4 with Trasar (TBD), UVA, EC, TOC, sucralose, and seeded MS2 measurements.
	Concentrate Toxicity Testing	Concentrate Toxicity Testing	Concentrate Toxicity Testing	Concentrate Toxicity Testing	To measure level of acute and chronic concentrate toxicity; understand effect of varying levels of chemical pretreatment; and establish mitigation measures (dilution and/or pH adjustment).	• Perform acute and chronic toxicity tests at varying dilutions with most sensitive species per Tapia WRF's NPDES permit each quarter once pretreatment levels have been established.
				Concentrate Scaling Testing	To determine if RO concentrate is stable enough to travel from the full scale AWPF to the Calleguas brine line without adverse precipitating scale	• Send water quality data to AWC for scaling potential analysis. • Potentially perform additional benchtop testing if needed. Testing would monitor over time if residual anti-scalants remain active by placing a fixed volume of brine on the benchtop and monitoring it daily for turbidity, particle size distribution, and pH. Adjust pH of samples and add additional anti-scalant to determine the impact of chemical addition on brine stability.
UV AOP	UV Validation		UV Validation		To determine design pathogen and NDMA destruction dose	• Adjust power setting and flow to result in a range of dose values: 0, 200, 400, 600, 1,200 mJ/cm^2. • No oxidant will be dosed during this testing. • Measure for corresponding seeded *A. brasiliensis*[4] and NDMA removal. (Seed NDMA if necessary.) • Re-assess UV dose during Q3 when chloramines, known scavengers, are included as membrane pretreatment.

System	Q1	Q2	Q3	Q4	Purpose	Description
	UV/NaOCl Testing		UV/NaOCl Testing		To confirm 0.5-log removal of 1,4-dioxane at design dose	• Couple UV doses of 0, 200, 400, 600, 1,200 mJ/cm^2 with sodium hypochlorite doses of 0, 1, 2, and 4 mg/L. • Conduct an upfront bioassay and measure for corresponding NDMA, seeded 1,4-dioxane, CECs, TOC, nitrite, chloramines, and free chlorine removal. • Re-assess oxidant dose during Q3 when additional chloramines, known scavengers, are included as membrane pretreatment.
	UV Challenge Testing				To identify sensitivity to challenge testing	• Adjust power setting and flow to result in a range of dose values: 0, 200, 400, 600, 1,200 mJ/cm^2. Test lamp and ballast failure. • Evaluate removal of seeded 1,4-Dioxane surrogate. • Measure for corresponding *A. brasiliensis*(4) and NDMA removal.
Product Water			Product Water Stabilization		To establish required post treatment chemical addition for future project	• Confirm quantity of additional chemical required to stabilize product water at benchtop. • Potentially test post treatment chemicals on product water at the pilot scale in the future.
				Blending Analysis	To determine impact of varying blends of product water on downstream surface water treatment plant.	• Blend stabilized product water with 0%, 25%, 50%, 75%, and 100% blends of reservoir water at the benchtop. Use design dosages determined by Q3 product water stabilization. • Conducting jar tests representative of the existing conditions at the downstream surface water treatment plant. • Determine impacts to TOC removal, impacts to DBP formation, and if varying pretreatment conditions need to be assessed.
			Simulated Distribution System (SDS) Testing		To confirm regrowth of NDMA and other DBPs that could form while in transit to the reservoir.	• Dose product water with varying levels of chlorine (1 mg/L increments from 0 mg/L to 5 mg/L) at benchtop. • Age chlorinated water for the same duration as the product water pipeline would be from the AWPF to the reservoir. • Measure residual chlorine, NDMA, THMs, and haloacetic acids (HAAs).
Intelligent Controls	Data Collection	Data Collection	Optimized Controls	Optimized Controls	To potentially improve operational efficacy through machine learning	• Collect historian data during Q1 and Q2. • Identify correlations and trends with aid of Harvard data analyst. • Implement ML control modifications up to two times (once during Q3 and once during Q4).
Reservoir	UV Photometers	UV Photometers	UV Photometers	Bench Scale UV Testing	To determine NDMA attenuation in reservoirs	• Place UV photometers at reservoir to define incidental UV light at surface of reservoir. • Test different blends (5% increments from 0% to 100%) of reservoir and demonstration product water with bench scale UV system using the same intensity as measured at the reservoir. Measure corresponding NDMA removal.

Notes:
(1) Using existing chloraminated water to determine if supplementary chloramines are needed.
(2) During each quarter, the RO system will operate half of the time (1.5 months) with two-stages and the other half of the time with three-stages.
(3) Only dose biocide if Q3 results are promising.
(4) Though MS2 coliphage has historically been used in UV validation, previous studies have shown that the maximum UV dose that can be predicted with MS2 is limited to 300 mJ/cm^2. Recent work at Altamonte Springs has shown that *A. brasiliensis* can predict a UV dose of up to 800 mJ/cm^2, due to the high resistance of this organism to UV light (approximately 200 mJ/cm^2 for 90% reduction). This alternative test organism allows an estimation of dose, which can then be correlated to a specific log reduction of a broad range of pathogens, including virus.

Water Quality Monitoring

Process Train Analysis

Grab sample locations (with appropriate ID numbers) at the Demonstration Plant are as follows and as identified on the process flow diagrams in Appendix A:

- Point 1: Tertiary Effluent
- Point 2: UF Filtrate
- Point 3: RO Permeate
- Point 4: UV AOP Effluent
- Point 5: RO Concentrate

Two additional sample points, henceforth designated as Point A (raw wastewater) and Point B (filtered but undisinfected secondary effluent), would be located at Tapia WRF to monitor pathogen removal by the WRF.

Table 3 summarizes the monitored chemicals, responsible laboratory, and appropriate analytical method for each of the planned process train grab sample events. The location and frequency for the sampling remains to be determined due to the high cost of analytical testing. However, Table 3 presents one potential grab sampling program.

Planned grab samples will be collected and compared against industry standards and results from other potable water reuse efforts. These results will be used to compare pollutant levels with the advanced analytics outcomes. Missed sampling cycles due to unforeseen events will be carried out on the following day or next business day possible.

Table 3 Process Train Grab Sampling

Group	Parameter	Sample Point A: Raw Wastewater	Sample Point B: Filtered (non-disinfected) Secondary Effluent	Sample Point 1: Tertiary Effluent	Sample Point 2: UF Filtrate	Sample Point 3: RO Permeate	Sample Point 4: UV AOP Effluent	Sample Point 5: RO Concentrate	Responsible Lab	Analytical Method
Calibration Chemicals	pH			1 x Week[(1)]	1 x Week	1 x Week	1 x Week[(1)]	2 x Month[(1)]	Onsite	EPA 150.2
	Turbidity			1 x Week	1 x Week				Onsite	SM 2130 B
	Temperature				1 x Week				Onsite	
	Conductivity				1 x Week	1 x Week		1 x Week	Onsite	EPA 2510B
	TOC			2 x Month[(1)]	1 x Week	1 x Week			Weck	SM310C
	ORP				1 x Week				Onsite	
	UVT			1 x Week[(1)]	1 x Week[(1)]	1 x Week	1 x Week		Onsite	
	Free Chlorine			2 x Month[(1)]	1 x Week	1 x Week	1 x Week		Onsite	Hach 8167
	Total Chlorine			2 x Month[(1)]	1 x Week	1 x Week	1 x Week		Onsite	Hach 8167
	Ammonia			1 x Week [(1)]	1 x Week	1 x Week [(1)]			Onsite	EPA 350.1
Surrogate Chemicals	Strontium				1 x Monthly	1 x Monthly			Weck	EPA 200.7
	Sucralose				1 x Week	1 x Week			Weck	
Process Monitoring	BOD	2 x Month							Onsite	SM 5210 B
	TSS	2 x Month							Onsite	SM 2540 D
	TDS				1 x Quarter	1 x Quarter			Weck	SM 2540 C
	Alkalinity			1 x Week			1 x Week		Onsite	
	Dissolved Organic Carbon (DOC)			1 x Week					Weck	
	Total Nitrogen			1 x Week	1 x Week	1 x Week	1 x Week		Onsite	EPA 351.2
	Dissolved Oxygen (DO)			1 x Week					Onsite	
	Silica			1 x Week	1 x Week	1 x Week			Weck	
	Iron (total)			1 x Week	1 x Week				Weck	
	Aluminum (total)			1 x Week	1 x Week				Weck	
	Manganese (total)			1 x Week	1 x Week				Weck	
	Silt Density Index (SDI)			2 x Week	2 x Week	2 x Week			Onsite	ASTM D4189
	Bromide					1 x Week	1 x Week		Weck	
	Bromate					1 x Week	1 x Week		Weck	
Indigenous Chemicals	Primary MCLs	1 x Quarter		1 x Quarter		1 x Quarter	1 x Quarter		Weck	EPA 200.8, 100.2, 218.6, 245.1, 300, 524.2, 504.1, 505, 515.4, 525.2, 531.2, 547, 548.1, 549.2, 1613B, SM4500CN-F, SRL 524M-TCPs
	Secondary MCLs	1 x Quarter		1 x Quarter		1 x Quarter	1 x Quarter		Weck	EPA 200.8, 524.2, 525.1, 300, SM5540C, SM2540C, SM210B
	NLs	1 x Quarter		1 x Quarter		1 x Quarter	1 x Quarter		Weck	EPA 200.8, 524.2, 525.2, 521, 300, 522m, 556, 524-SIM

Group	Parameter	Sample Point A: Raw Wastewater	Sample Point B: Filtered (non-disinfected) Secondary Effluent	Sample Point 1: Tertiary Effluent	Sample Point 2: UF Filtrate	Sample Point 3: RO Permeate	Sample Point 4: UV AOP Effluent	Sample Point 5: RO Concentrate	Responsible Lab	Analytical Method
	Contaminants of Emerging Concern (CECs)			1 x Quarter		1 x Quarter	1 x Quarter		Weck	LC/MS
	DBPs			1 x Quarter	1 x Quarter	1 x Quarter	1 x Quarter		Weck	EPA 542.2, 317, 300.0, SM6251B
	NDMA			2 x Month	2 x Month	2 x Month	2 x Month		Weck	EPA 521
	NMOR			2 x Month	2 x Month	2 x Month	2 x Month		Weck	EPA 521
Spiked Chemicals	1,4-Dioxane					1 x Q1, Q3 UV/NaOCl Test 1 x Q1 UV Challenge Test	1 x Q1, Q3 UV/NaOCl Test 1 x Q1 UV Challenge Test		Weck	EPA 524.2
Bacteria	Total Coliform					1 x Month	1 x Month		Weck	25t
Protozoa	*Cryptosporidium* and *Giardia*(2)	1 x Month	1 x Month						BioVir	Method 1623; EPA 815-R-05-002
Virus by Gene Copy	Adenovirus and Norovirus	1 x Quarterly	1 x Quarterly						BioVir	EPA 600/R-95/178 - Modified
	Enteric Virus	1 x Quarterly	1 x Quarterly						BioVir	
	PMMoV	1 x Quarterly	1 x Quarterly		2 x Month	2 x Month			University of Arizona	
Virus by Culture	Total Culturable Virus	1 x Month	1 x Month						BioVir	
	Adenovirus	1 x Month	1 x Month						BioVir	
	MS2 coliphage	1 x Month	1 x Month						BioVir	Various
Pathogen Challenge Test	MS2 coliphage			1 x Q1 UF Challenge Test	1 x Q1 UF Challenge Test 1 x Q1, Q2, Q4 RO Challenge Test	1 x Q1, Q2, Q4 RO Challenge Test			BioVir	Various
	Aspergillus brasiliensis					1 x Q1, Q3 UV Validation Test 1 x Q1 UV Challenge Test	1 x Q1, Q3 UV Challenge Test 1 x Q1 UV Challenge Test		BioVir	Various

Notes:
(1) No corresponding online instrumentation.
(2) Colorseed will be spiked into raw wastewater and filtered effluent tests three times for Giardia and Cryptosporidium over the course of the test period, with results used to adjust measured concentrations.

Monitored Contaminants of Emerging Concern (CECs) for this project include the following:

- Pharmaceuticals and Personal Care Products (PPCPs):
  - Acetaminophen
  - Atenolol
  - Caffeine
  - Carbamazepine
  - DEET
  - Fluoxetine
  - Gemfibrozil
  - Ibuprofen
  - Meprobamate
  - Naproxen
  - Primidone
  - Sucralose
  - Sulfamethoxazole
  - TCEP
  - Triclocarban
  - Triclosan
  - Trimethoprim
  - 17 beta estradiol
  - 17 alpha estradiol
  - Iopromide
- Per/polyfluoroalkyl Substances (PFAS):
  - Perfluorobutyrate (PFBA)
  - Perfluoropentanoic acid (PFPeA)
  - Perfluorohexanoic acid (PFHxA)
  - Perfluoroheptanoic acid (PFHpA)
  - Perfluorooctanoic acid (PFOA)
  - Perfluorononanoic acid (PFNA)
  - Perfluoro-n-decanoic acid (PFDA)
  - Perfluoroundecanoate (PFUdA)
  - Perfluorododecanoate (PFDoA)
  - Perfluorobutane sulfonate (PFBS)
  - Perfluorohexylsulfonate (PFHxS)
  - perfluorosulfonic acid (PFOS)
  - Perfluorodecylsulfonate (PFDS)

RO Concentrate Analysis

RO concentrate presents three potential challenges: (1) high concentrate of permitted constituents, (2) toxicity, and (3) scaling, as detailed below.

Concentrate Chemical Constituent and Toxicity Testing

RO concentrate will ultimately need to comply with the Calleguas Municipal Water District (CMWD) Salinity Management Pipeline (SMP) NPDES permit water quality requirements for disposal, which requires both chemical constituent compliance and toxicity compliance.

Toxicity testing for ocean discharge as seen in the Calleguas SMP NPDES permit uses the most sensitive of the following organisms:

1. Topsmelt (Atherinops affinis - survival and growth),
2. Purple sea urchin (Strongylocentrotus purpuratus - growth and fertilization),
3. Sand dollar (Dendraster excentricus - growth and fertilization),
4. Red abalone (Haliotis rufescens - shell development), and
5. Giant kelp (Macrocystis pyrifera - germination and growth).

Topsmelt has been determined to be the most sensitive to RO concentrate based upon recent RO concentrate work in Pismo Beach, California and will be used in this experiment. A passing toxicity test demonstrates less than a XX percent reduction in growth, fertilization, reproduction, or other response measure, using 100 percent concentrate.

Table 4 summarizes the proposed RO concentrate chemical constituent and toxicity testing. The sample frequency of each parameter listed in Table 4 is eight:

Q1: Once on each of the sensitive species (total of 5 tests).
Q2: Once on the most sensitive species based on Q1 testing (total of 1 test).
Q3: Once on the most sensitive species based on Q1 testing (total of 1 test).
Q4: Once on the most sensitive species based on Q1 testing (total of 1 test).

Toxicity testing will be performed over a range of dilution. Dilution water will be lab grade water or saline water to simulate the combined discharge of RO concentrate and its diluent, the sum of which is required to meet the toxicity requirement.

Table 4 Concentrate Testing

Parameter	Responsible Lab	Analytical Method
Alkalinity		
Aluminum		
Ammonia		
Antimony		
Arsenic		EPA200.7
BOD		SM5210 B.
Benzidine		EPA 625
Bis(2-chloroethyl) ether		EPA 625
Beryllium		
Cadmium		
Calcium		
Chloride		
Total Chlorine Residual		SM4500-CTG
Chlordane		EPA 608
Chromium		
Chromium III		

carollo
ITEM # 18

Parameter	Responsible Lab	Analytical Method
Chromium VI		
Copper		EPA200.7
3,3-Dichlorobenzidine		EPA 625
Dichlorobromomethane		EPA 624
Fluoride		
Hexachlorobenzene		EPA 625
Iron		
Lead		
Magnesium		
Manganese		
Mercury		
Nickel		EPA200.7
PAHs		EPA 625
PCBs		EPA 608
pH		
Phosphate		
Potassium		
Selenium		
Silica		
Silver		
Sodium		
Strontium		
Sulfate		
TCDD Equivalents		Dioxins
TDS		
Toxaphene		EPA 608
TSS		SM2540 D.
Thallium		
Total Cyanide		
Total Hardness		
Zinc		
Gross Beta		SM7100 B
Acute Toxicity		

Parameter	Responsible Lab	Analytical Method
Chronic Toxicity(1)		

Notes:
(1) If the sample fails the toxicity test, it will be repeated again at a different dilution. Dilution water will be either lab grade water or WRF tertiary effluent to simulate the combined discharge of RO concentrate and WWTP effluent, the sum of which is required to meet the toxicity requirement.

Concentrate Scaling Testing

RO brine water quality data will be analyzed using water quality modeling tools to determine if it is sufficiently stable to travel from a full scale AWPF to the Calleguas brine line without precipitating scale within the brine line. In addition, water quality data will be sent to AWC for scaling potential analysis. Based on these results, additional benchtop testing may be completed such as the monitoring over time to determine if residual anti-scalants remain active. This would be accomplished by placing a fixed volume of brine on the benchtop and monitoring it daily for turbidity, running particle size distribution tests, and monitoring pH. The goal is to determine if crystallization is occurring over time. Furthermore, the pH of samples may be adjusted and additional anti-scalant added to determine the impact of chemical addition on brine stability. Pipe loop testing using HDPE piping, which is recommended for full scale brine line, may be completed.

Finished Water Quality Analysis

Carollo will undertake several additional analyses, beyond regulated constituents and CECs, with respect to finished water quality. These additional tests are detailed below.

Reservoir Degradation Testing

Table 5 summarizes the grab sampling required for the reservoir degradation testing. The number of samples in Table 5 represent the number required for each blend of reservoir and product water (0 to 100 in 5 percent increments) before and after UV treatment at the average intensity measured in the reservoir during Q1 through Q3.

Table 5 Reservoir Degradation Grab Sample Water Quality Monitoring

Parameter	Pre-Treatment	Post-Treatment	Responsible Lab	Analytical Method
NDMA	21(1) x Q4	21(1) x Q4	Weck	EPA 521
UVT	21(1) x Q4	-	Grab	N/A

Notes:
(1) Number required for each blend of reservoir and product water (0 to 100 in 5 percent increments) before and after UV treatment at the average intensity measured in the reservoir during Q1 through Q3.

These samples will be tested under controlled conditions within a known unit volume of water exposed to sunlight to ascertain NDMA removal in the reservoir.

Product Water Stabilization

Water quality results from UV/AOP effluent will be analyzed using commonly available water quality models (i.e. MINEQL+, RTW) to determine the level of chemical treatment required to stabilize the water for positive Langelier Saturation Index (LSI) and Calcium Carbonate Precipitation Potential (CCPP) in order to decrease the corrosivity of the final product water. The JPA may decide to test the desktop calculated stabilization doses at the bench and/or with a pilot post-treatment system at a later date.

carollo
ITEM # 18

Blending Analysis

Additional modeling will be undertaken to determine if mixing of raw reservoir water and stabilized UV/AOP effluent will result in potential water quality issues for the existing surface water treatment plant. Data for this desktop analysis will come from available water quality data and new grab samples:

1. Presence/Absence Coliform (from existing data)
2. TTHM on a quarterly basis (from existing data)
3. 1,2,3-Trichloropropane (sampled this year).
4. pH, temp, color, odor, turbidity, TOC, coliform, ammonia, manganese and iron (from existing data)
5. Chlorine residual, alkalinity, sulfate, calcium, and chloride (grab samples as part of pilot testing)

Following the desktop analysis, the JPA may decide to conduct a series of jar tests to evaluate the impact of varying blends of stabilized product water and reservoir water on the downstream surface water treatment plant.

Simulated Distribution System Testing

Work in progress

Daily Operational Data

All data collected during rounds, data logged by the programmable logic controller (PLC), and laboratory analyses will be merged into a comprehensive database and backed up on a network fileserver. All data will correspond to uniform sample identification (IDs) from operations sheets and laboratories to ease the analysis of this large data set. ***Sample ports will be labeled with matching IDs.***

Log data will be scanned and sent to hford@carollo.com and azacheis@carollo.com at the end of each week, and Carollo will analyze data every two weeks.

Quality Assurance/Quality Control

Quality Assurance and Quality Control (QA/QC) are necessary aspects of any project, and particularly so for this project as it pertains to the protection of public health. The project team will work closely with certified laboratories running accepted standard methods to ensure data precision and accuracy (defined below). Method Detection limits (MDLs) will be used to determine the statistical significance of any detectable response. Certified laboratories will be performing the analysis in this project and will be responsible for internal QA/QC for each sampling parameter.

Sample Replicates

The Demonstration Project will run for 12 months, with online monitoring of a range of parameters, daily inspection of online equipment, and monthly or more frequent sampling for a wide range of offline laboratory parameters.

Sample replicates will be conducted for 5% of all samples, with a minimum of one replicate for each MCL, NL, or CEC.

Precision

The precision of duplicate samples is assessed by calculating the relative percent difference (RPD) according to:

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100\%$$

where,
S = Sample concentration and
D = Duplicate sample concentration.

If calculated from three or more replicates, the precision is determined using the relative standard deviation (RSD):

$$RSD = \frac{SD}{Average} \times 100\%$$

where,
SD = Standard deviation for the replicate samples.

Accuracy

For measurements where matrix spikes (constituent seeding) are used, accuracy is evaluated by calculating the percent recovery (R):

$$R(\%) = \frac{S - U}{C_{SA}} \times 100\%$$

where,
S = Measured concentration in spiked sample,
U = Measured concentration in unspiked sample, and
C_{SA} = Calculated concentration of spike in sample.

When a standard reference material (SRM) is used, the Recovery is determined by:

$$R(\%) \frac{C_m}{C_{SRM}} \times 100\%$$

where,
C_m = Measured concentration of SRM, and
C_{SRM} = Actual concentration of SRM.

Method Detection Limit

To determine the MDL, at least seven replicates of a laboratory fortified blank at a concentration of three to five times the estimated instrument detection limit is analyzed through the entire analytical method. The MDL for each constituent tested will be determined by the laboratory in accordance with the standard method listed for each constituent. It is important to show that the detection limit for each chemical parameter is sensitive enough such that it can measure below the regulatory limit and show appropriate removal of each compound in question. The MDL is calculated using the following equation:

$$MDL = (t) \times (SD)$$

where,
t = t value for 99 percent (t for 7 replicates= 3.14), and

carollo
ITEM # 18

SD = Standard deviation for the replicates samples.

Comparability

On-site online monitors and field kits will analyze much of the critical data, and outside laboratory analysis will be used for remaining analyses. It is important to prove consistency between laboratories and have a common practice to ensure QC across various laboratories. Comparability is the degree of consistency between a data set obtained at one laboratory and data sets from another. It is achieved by use of consistent methods and materials (i.e., standards). Comparability of data will be promoted by adherence to the standard and certified analytical methods decided by each outside laboratory.

Sample Transport

Sampling will be performed by JPA staff. Operators will package the samples in coolers/shipping boxes and provide shipping information. Samples should be in coolers with fresh ice (or freezer bricks) and a chain of custody (COC). Due to hold time and preservation concerns, the samples should be shipped FedEx "Priority Overnight" to outside labs. The samples should be shipped only Monday through Wednesday as some of the labs are closed on Friday. The cases should be insured for a minimum of $700 in case of loss or damages due to shipper error and note no signature needed upon arrival.

Two to five weeks is the industry standard for report turnaround times from labs. If the results are needed sooner, surcharges may be applied.

External Laboratory Samples

Lab-prepared sample bottles will be sent from each lab (BioVir, Weck, and University of Arizona) to the WRF, who will then take the bottles and coolers to the test site. Sampling will be performed by Carollo. Before sampling, approximately one to two (1-2) liters (L) of water will be flushed from the sample port to minimize potential contamination from sample lines. Each sample bottle will be filled with minimum bubbling, without external agents touching and disturbing the internal integrity of the inside of the bottle. All bottles will be immediately capped post sampling, placed in a cooler with the date and sample ID, and sent to the lab within the allowable holding time provided by the lab for each parameter to be measured. All coolers will contain a COC (log of samples), and will be clearly marked with identification tags before shipment. Samples will be shipped priority overnight unless otherwise directed to respective labs by Carollo, and follow up communication and tracking will take place after each shipment to confirm receipt of all samples.

Process Monitoring, Optimization, and Cleaning

During the yearlong demonstration testing, operators will complete the daily performance log contained in Appendix B. The grab samples included in these logs represent weekly or more frequent grabs only. A sample schedule that includes all samples, including those less frequent than weekly, will be developed upon approval of this test plan.

Ultrafiltration

The UF system will operate with flux rates, backwash intervals, and chemical cleaning intervals per the supplier's instructions and as described in Table 6. Each quarter of testing will follow the steps listed in Table 6. After the completion of each quarter of testing, the UF membranes will either be replaced or cleaned in a rigorous recovery clean (RC).

Table 6 UF System Quarterly Experimental Matrix

Stage	Description
Week 1: Module Break-In Period	Operate for 3-5 days at a flux of 20 gallons per square foot per day (gfd) and 95% recovery. Conduct an RC.
Weeks 1-2: Initial Experimentation	Operate at a flux of 40 gfd and 95% recovery to determine membrane fouling response.
• If membrane permeability does not drop below 50% of baseline permeability in 3.5 days	• Perform a hypochlorite Maintenance Cleaning (MC) and increase flux to 45 gfd. Increase the flux by 5 gfd in consecutive experiments until a 50% permeability decline in 3 days is observed.
• If permeability drops by more than 50% in 3 days in initial experiments	• Perform an MC and decrease flux until it takes at least 3 days before 50% permeability decline is measured.
Weeks 3 - 7: Demonstration Phase 1	30 days of continuous operation. No change in set point. Perform weekly integrity tests.
• If RC criteria (max Transmembrane Pressure (TMP)) are triggered before end of 30 days	• Perform RC. With unused time in this period, adjust backwash, MC, and flux as necessary to define conditions for next test period.
• If RC criteria are met (30-day operation without reaching TMP)	• Adjust flux, MC, and backwash criteria to reduce cost. Depending on results this could be flux increase, recovery increase, or MC frequency decrease.
Weeks 8 - 12: Demonstration Phase 2	30 days of continuous operations at constant operating conditions, followed by RC.

Performance Monitoring

Online turbidimeters will monitor the influent and effluent water quality and the performance of the UF unit. Daily PDTs will determine the integrity of the UF membranes. If the PDT fails, the test will be repeated, and if it fails again then the UF system supplier will be notified.

Cleaning Protocols

The initial cleaning strategy is presented in Table 7. These parameters will be adjusted as necessary. Cleaning sequences, chemical type, chemical doses, cleaning sequence duration, and temperature may all be adjusted to maximize RC permeability recovery.

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ITEM # 18

Table 7 UF Initial Cleaning Protocols

Cleaning Strategy	Parameter	Value
Maintenance Cleaning (MC)	**NaOCl**	
	Interval (hours)	84
	Chemical Contact Duration (minutes)	30
	Target pH(1)	< 10
	Maximum Free Chlorine Residual (mg/L) (2)	300
Clean in Place (CIP)	**NaOCl**	
	Interval (days)	30
	Chemical Contact Duration (minutes)	120
	Heated Water Temperature (F)	95
	Target pH(1)	< 10
	Minimum Free Chlorine Residual (mg/L) (2)	1,000
	Citric Acid	
	Interval (days)	30
	Chemical Contact Duration (minutes)	120
	Heated Water Temperature (F)	95
	Target pH(3)	2 - 3
	Minimum Dose (mg/L)	5,000

Notes:
(1) Sodium hydroxide will be dosed to achieve the target pH.
(2) Sodium hypochlorite will be dosed to achieve free chlorine residual target.
(3) Sulfuric acid will be dosed to achieve the target pH.

Reverse Osmosis

The RO system will run at an average of 10.7 gfd in three-stage operation and at 10.3 gfd in two-stage operation. The interstage booster pump will balance flux rates between the second and third stage; the first stage has a bypass so that the interstage booster pump can similarly balance flux rates in two-stage mode. Its product water setpoint will be set to recover 85 percent of the influent. These parameters will be adjusted as needed during each phase of testing. Table 8 summarizes the key RO operating parameters in two- and three-stage modes. During each quarter of testing, the RO system will operate for half of the time (approximately 1.5 months) in two-stage mode and the other half of the time in three-stage mode.

Table 8 RO Operating Parameters

Parameter	Units	Two-Stage	Three-Stage
Vessel Array	No.	2:1	4:2:1
Number of Elements per Presser Vessel	No.	7	6
Flux Rate	gfd	10.3	10.7
Recovery Rate	%	85	85
Product Water Flow Rate	gpm	12	25

Performance Monitoring

Online conductivity meters, temperature gauge, flow meters, and pressure gauges on the combined feed and on each stage of permeate will monitor the performance of the RO unit. From these instruments, the RO system PLC will track temperature corrected specific fluxes for each stage. TOC analyzers on the combined feed and combined permeate will serve as a

surrogate for pathogen log removal to gain higher accuracy than conductivity. The ORP meter on the feed of the RO system will alarm upon high reading and shutdown the RO feed pump to protect the membranes from oxidation.

Cleaning Protocols

The RO membrane modules require cleaning if one or more of the following parameters are applicable:

(1) Normalized permeate flow drops 10%.
(2) Normalized salt passage increases 5%.
(3) Normalize pressure drop increases (feed - concentrate) 10 -15%.

Chemical cleaning strategies depend on the target foulant, as shown in Table 9.

Table 9 RO Initial Cleaning Protocols

Target Foulant	Cleaning Chemical	Cleaning Solution pH	Cleaning Solution Temperature (°F)
Inorganic Salts	0.3% H_2SO_4	1-2	77
Metal Oxides	1.0% $Na_2S_2O_4$	5	77
Inorganic Colloids Biofilms Organics	0.1% NaOH	12	95

During a CIP, RO membranes will soak in the cleaning solution for approximately one hour. Extending the soak time to 10 to 15 hours (overnight) can help mitigate heavy fouling. The RO CIP system pump will recirculate the cleaning solution in the concentrate stream of the membrane module at a flow rate of 13 gpm per vessel for 30 to 50 minutes. At the end of a CIP, the RO membranes should be flushed with potable water. This system does not include RO flush pumps and instead includes valved connection to the utility water system, which will provide adequate flow and pressure to flush the membranes when necessary.

UV AOP

The UV AOP system will operate to meet the required 0.5 log removal of 1,4-dioxane and removal of NDMA to below the DDW notification level of 10 ng/L. Table 11 summarizes the UV AOP operating parameters, which will be adjusted as necessary to meet the treatment goals. Dose modulation can be done with power modulation or by changing the flow to the UV reactor.

Table 11 UV AOP Operating Parameters

Parameter	Units	Value
UV Dose	mJ/cm^2	600
UV Reactor Power	%	50 - 100
Minimum UVT	%	96

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Performance Monitoring

The UV system will continuously monitor UV intensity (UVI) and flow (Q), providing a simplistic surrogate for UV dose, UVI/Q. Online UVT analyzers also serve to verify influent UVT and track potential change in UVT across the reactor.

Because chlorine generates hydroxyl radicals in the UV AOP more effectively at low pH (less than 6.5 when its speciation is mostly in the form of hydrochlorous acid), the online pH analyzer informs the system if the RO permeate pH is in the correct range. Because chloramines scavenge hydroxyl radicals, the total and free chlorine analyzers on the influent of the UV reactor identify how much chlorine is combined versus free. Total and free chlorine analyzers on the effluent track the chlorine reduction across the UV reactor.

Disinfection byproducts will be monitored across UV AOP, with dose modulated to maintain regulatory performance targets while minimizing DBP formation.

Cleaning Protocols

The UV reactor does not include wipers or a hard piped chemical cleaning system. Though not anticipated due to the high quality and low fouling potential of RO permeate, the UV reactor could be cleaned with citric acid or similar chemical per the supplier's instructions, if necessary.

Appendix A

PROCESS FLOW DIAGRAMS

ITEM # 18

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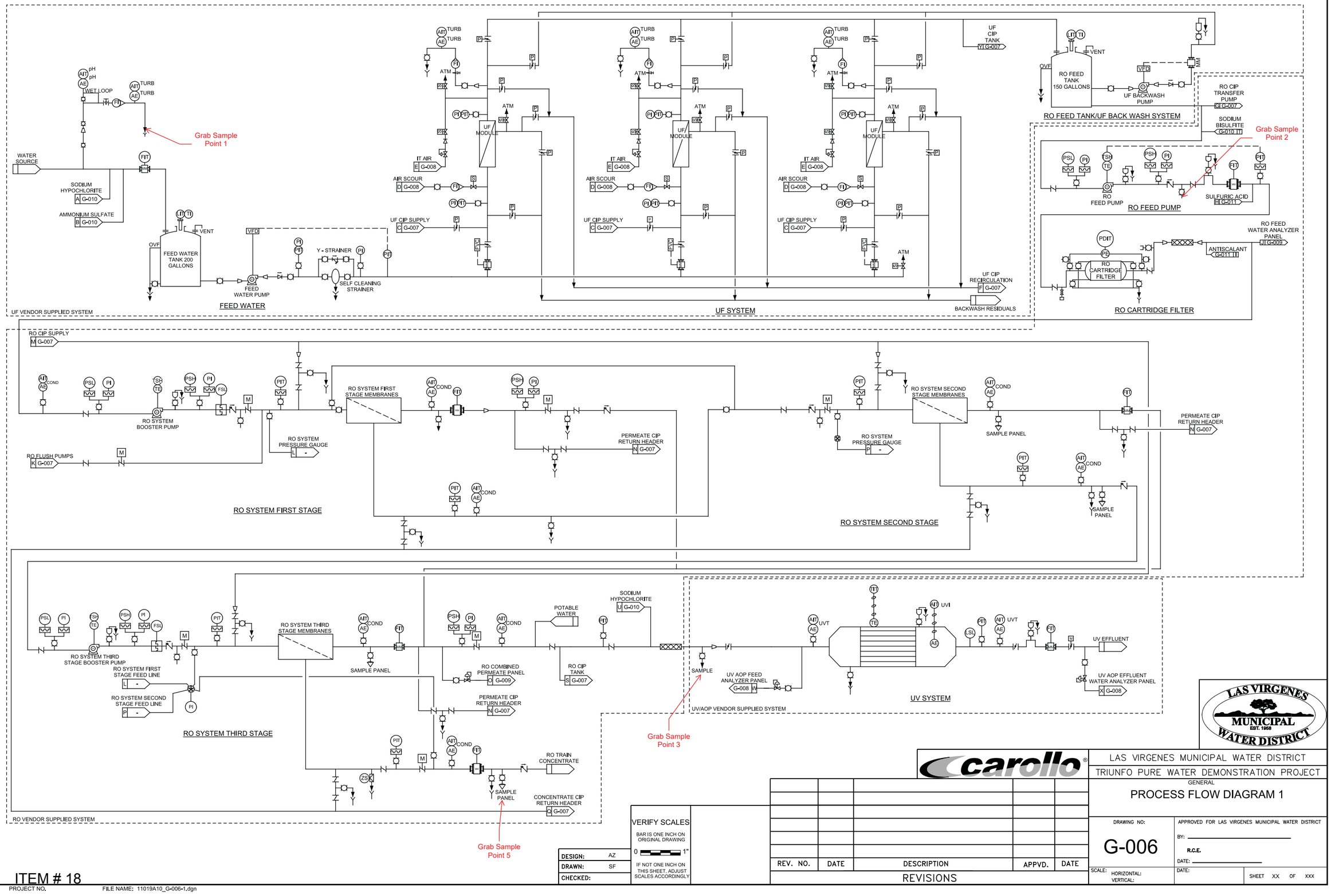

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TRIUNFO PURE WATER DEMONSTRATION PROJECT
GENERAL
PROCESS FLOW DIAGRAM 1

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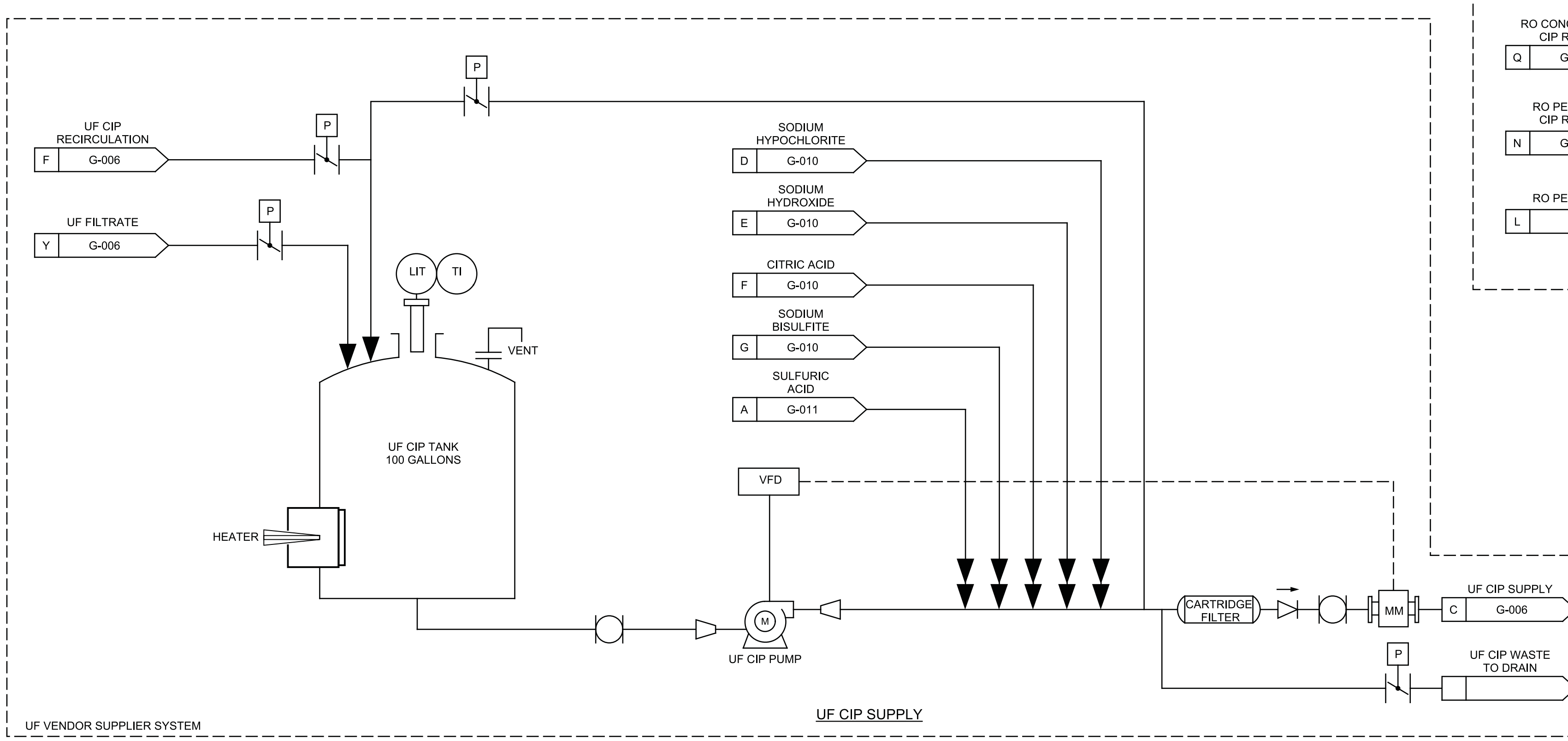

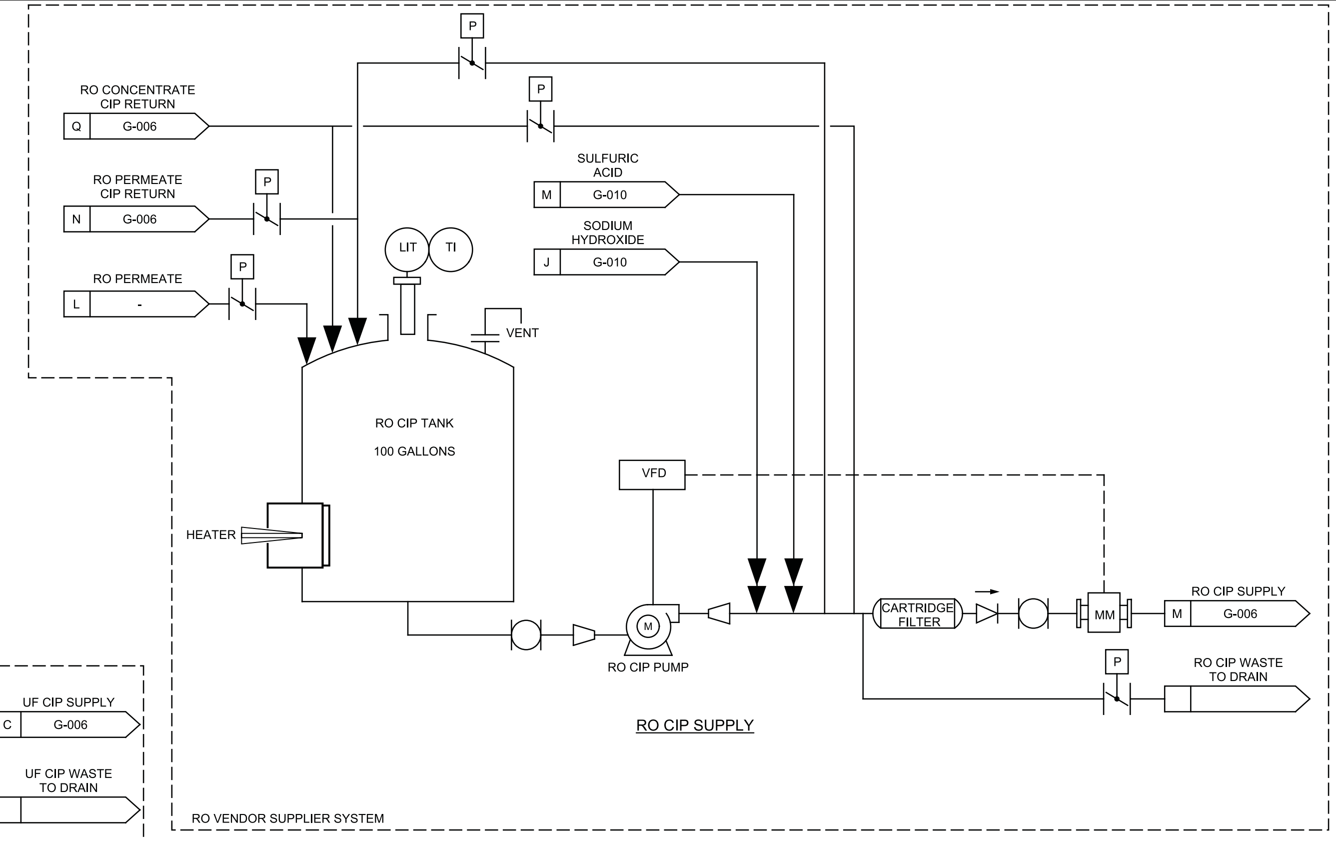

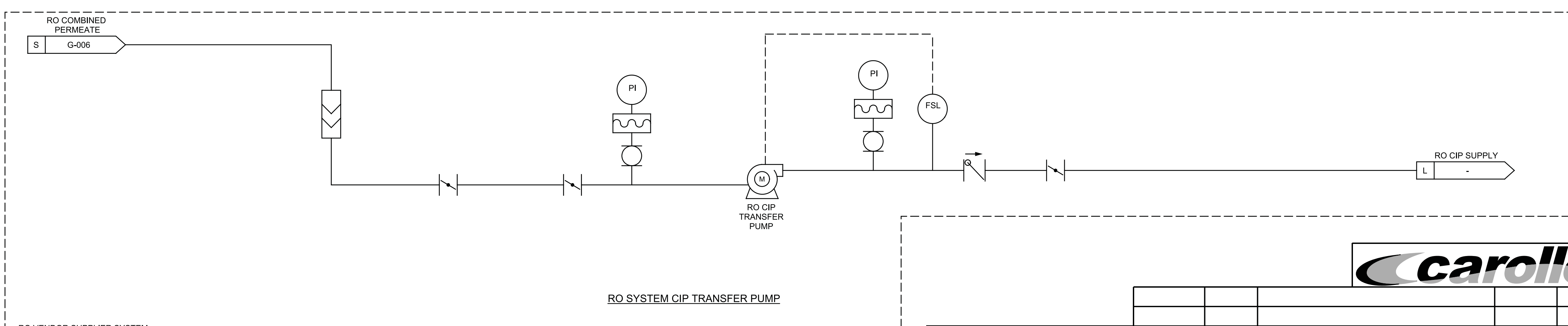

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PROCESS FLOW DIAGRAMS 2

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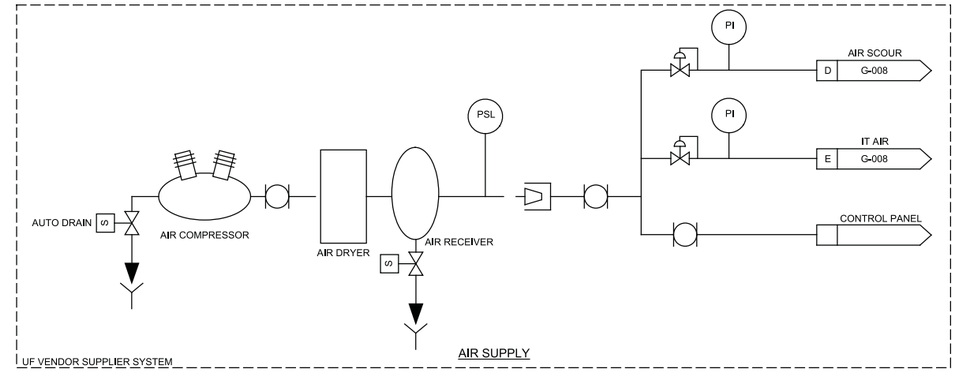

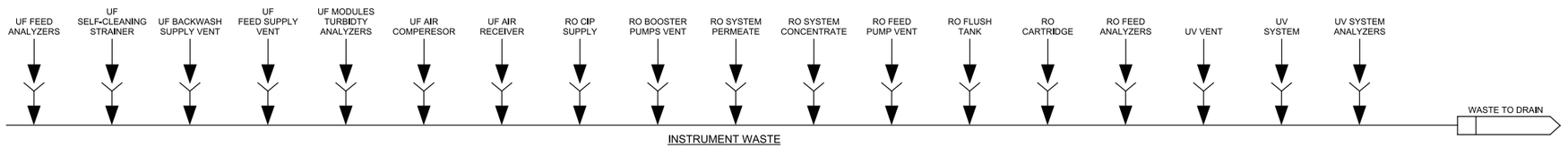

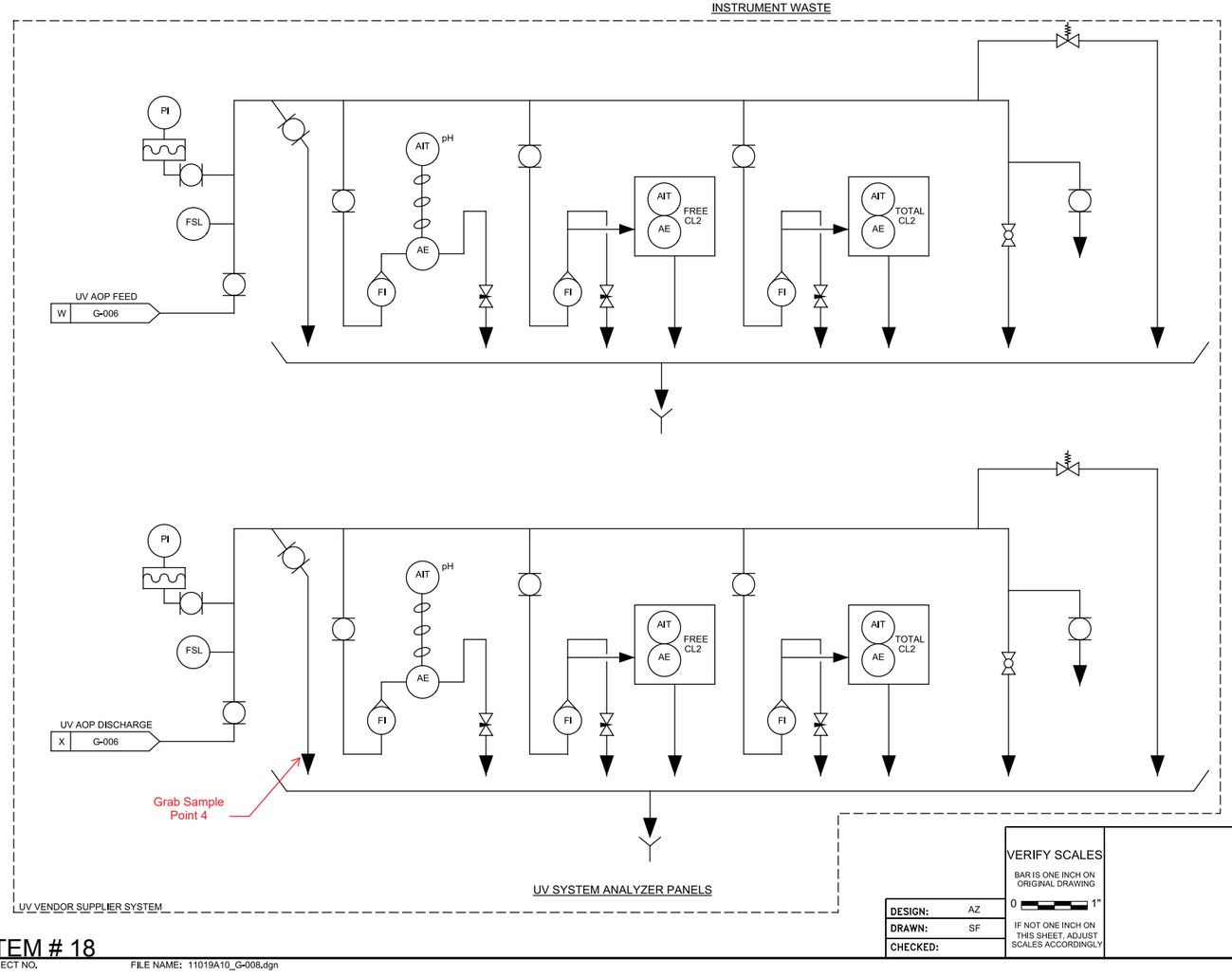

ITEM # 18

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PROCESS FLOW DIAGRAMS 3

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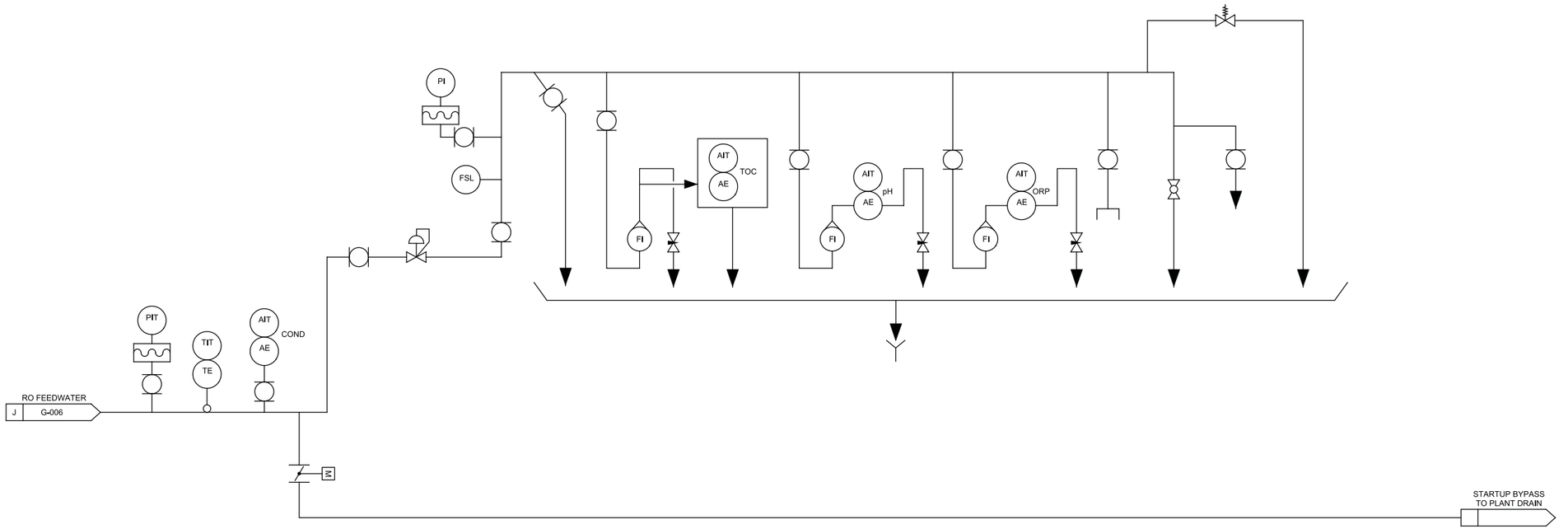
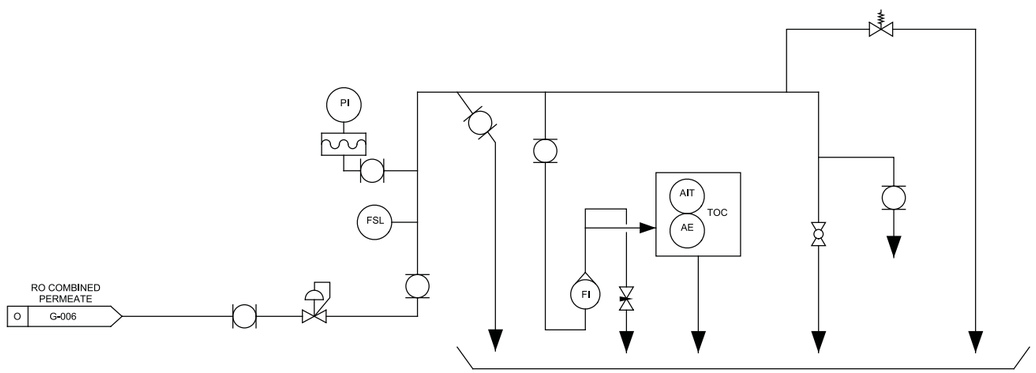


RO SYSTEM FEED WATER ANALYZER PANEL



RO FINAL PERMEATE ANALYZER PANEL

RO VENDOR SUPPLIER SYSTEM

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PROCESS FLOW DIAGRAMS 4

DRAWING NO: G-009

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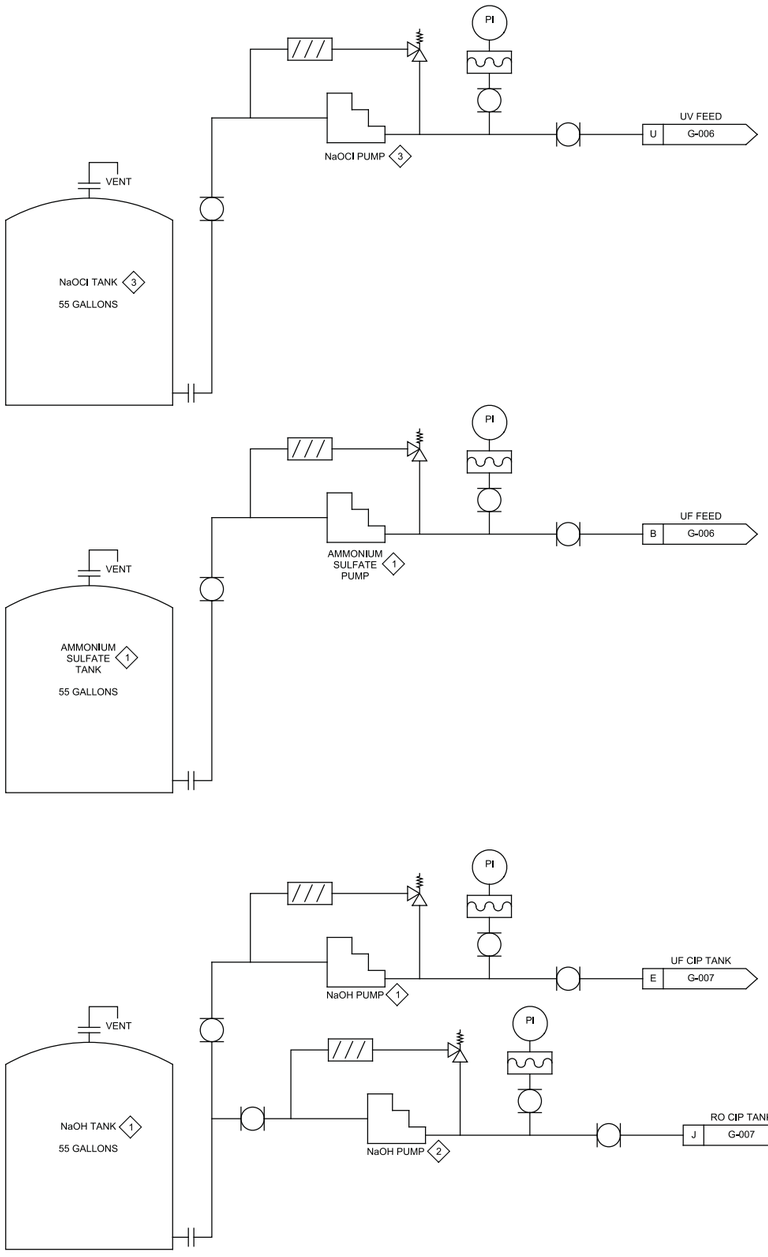
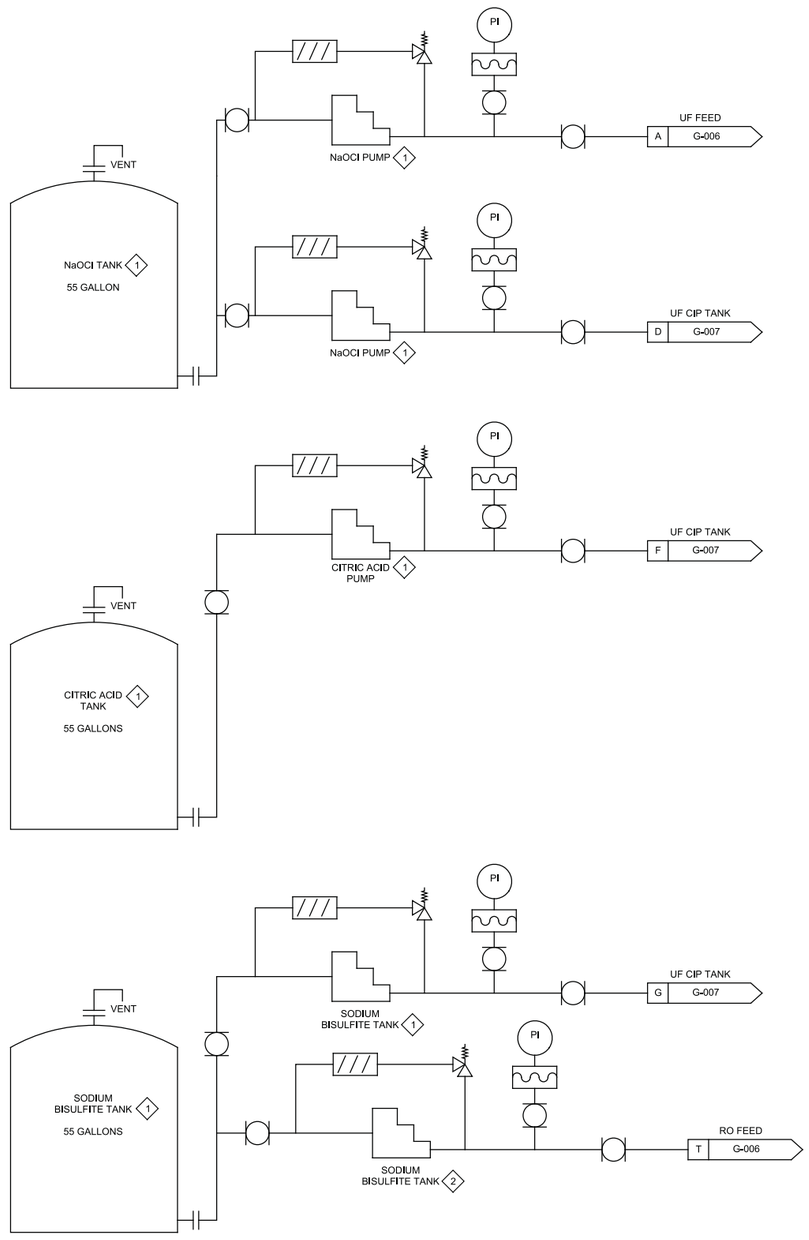
2. FURNISHED BY RO SYSTEM SUPPLIER.
3. FURNISHED BY UV SYSTEM SUPPLIER.





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PROCESS FLOW DIAGRAMS 5

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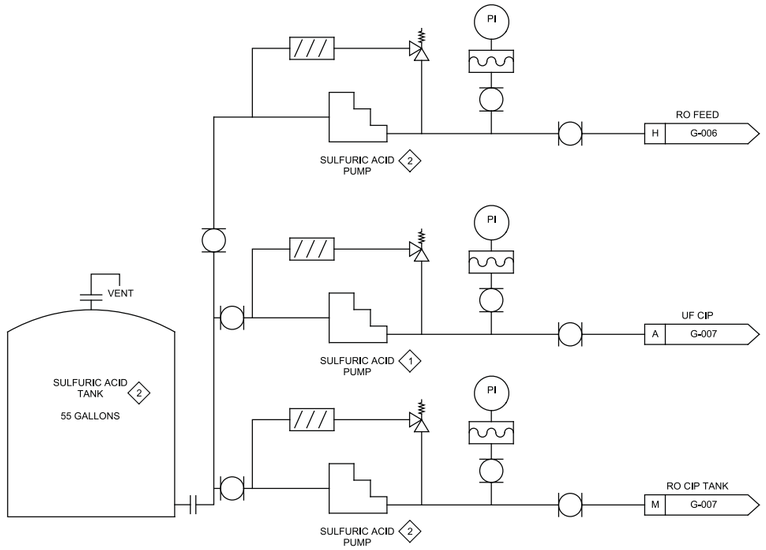

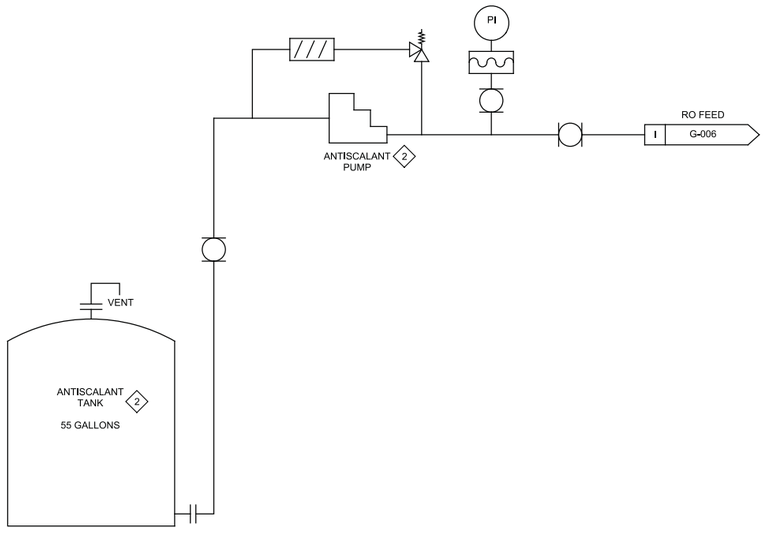

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PROCESS FLOW DIAGRAMS 6

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Appendix B

DAILY PERFORMANCE LOGS

UF Daily Performance Log		
Operator:		
Date		
Time:		
Test Quarter:	Q1 / Q2 / Q3 / Q4	
Pilot Plant Operational?	Y / N	
Alarms:		
Leaks?	Y / N	Where?
Chemical Tanks	Low / Medium / High	
Total Volume Treated		
Time before Backwash		
Time before Air Scour		
Time before MC		
Pressure Decay Test (psi/min)	Module 1: Module 2: Module 3:	
	Feed Water	**Filtrate Water**
HMI		
pH		N/A
Temperature (◦C)		N/A
Turbidity (NTU)		Module 1: Module 2: Module 3:
Target flow rate (gpm)	Module 1: Module 2: Module 3:	N/A
Pressure (psi)	Module 1: Module 2: Module 3:	Module 1: Module 2: Module 3:

Weekly Grab Sample		
pH		N/A
Temperature (◦C)		N/A
Turbidity (NTU)		
Ammonia (mg/L)		
Total Nitrogen (mg/L)		
Total Chlorine (mg/L)		
Free Chlorine (mg/L)		
TSS (mg/L)		N/A
BOD (mg/L)		N/A
Conductivity (µS/cm)	N/A	
Alkalinity as $CaCO_3$ (mg/L)		N/A
TOC (mg/L)		
DOC (mg/L)		N/A
Strontium (mg/L)	N/A	
UVT		
ORP (mV)	N/A	
DO (mg/L)		N/A
Silica (mg/L)		
Iron (total) (mg/L)		
Aluminum (total) (mg/L)		
Manganese (total) (mg/L)		
Twice Weekly Grab Sample		
SDI		
Notes:		

RO Daily Performance Log		
Operator:		
Date		
Time:		
Test Quarter:	Q1 / Q2 / Q3 / Q4	
Pilot Plant Operational?	Y / N	
Number of Operational Stages	Two-Stage / Three-Stage	
Alarms:		
Leaks?	Y / N	Where?
	Value	**Notes**
Equipment HMI		
Feed Flow		
Stage 1 Permeate Flow		
Stage 1 Concentrate / Stage 2 Feed Flow		
Stage 2 Permeate Flow		
Stage 2 Concentrate / Stage 3 Feed Flow		
Stage 3 Permeate Flow		
Total Permeate Flow		
Feed Pressure		
Stage 1 Concentrate Pressure		
Stage 2 Concentrate Pressure		
Stage 3 Concentrate Pressure		
Stage 1 Permeate Pressure		
Stage 2 Permeate Pressure		
Stage 3 Permeate Pressure		
ΔP Stage 1		
ΔP Stage 2		
ΔP Stage 3		

	Feed	Permeate	Concentrate
HMI			
pH		N/A	N/A
Temperature (◦C)		N/A	N/A
ORP (mV)		N/A	N/A
TOC (mg/L)			N/A
Total Chlorine (mg/L)		N/A	N/A
Free Chlorine (mg/L)		N/A	N/A
Ammonia (mg/L)		N/A	N/A
Conductivity (µS/cm)		Stage 1: Stage 2: Stage 3:	
Weekly Grab Sample			
pH		N/A	
Temperature (◦C)		N/A	N/A
ORP (mV)		N/A	N/A
TOC (mg/L)			N/A
Conductivity (µS/cm)		Stage 1: Stage 2: Stage 3:	
Total Chlorine (mg/L)		N/A	N/A
Free Chlorine (mg/L)		N/A	N/A
Ammonia (mg/L)			N/A
Total Nitrogen (mg/L)			N/A
Twice Weekly Grab Sample			
SDI			N/A

UV Daily Performance Log			
Operator:			
Date			
Time:			
Test Quarter:	Q1 / Q2 / Q3 / Q4		
Pilot Plant Operational?	Y / N		
Alarms:			
Leaks?	Y / N	Where?	
	Feed Water	**Finished Water**	**Reactor**
Equipment HMI			
UVI	N/A	N/A	
UV Dose	N/A	N/A	
Total Chlorine			N/A
Free Chlorine			N/A
UVT			N/A
pH		N/A	N/A
Weekly Grab Sample			
Total Chlorine			N/A
Free Chlorine			N/A
UVT			N/A
pH			N/A
UVA			N/A
Total Nitrogen (mg/L)	N/A		N/A
Notes:			

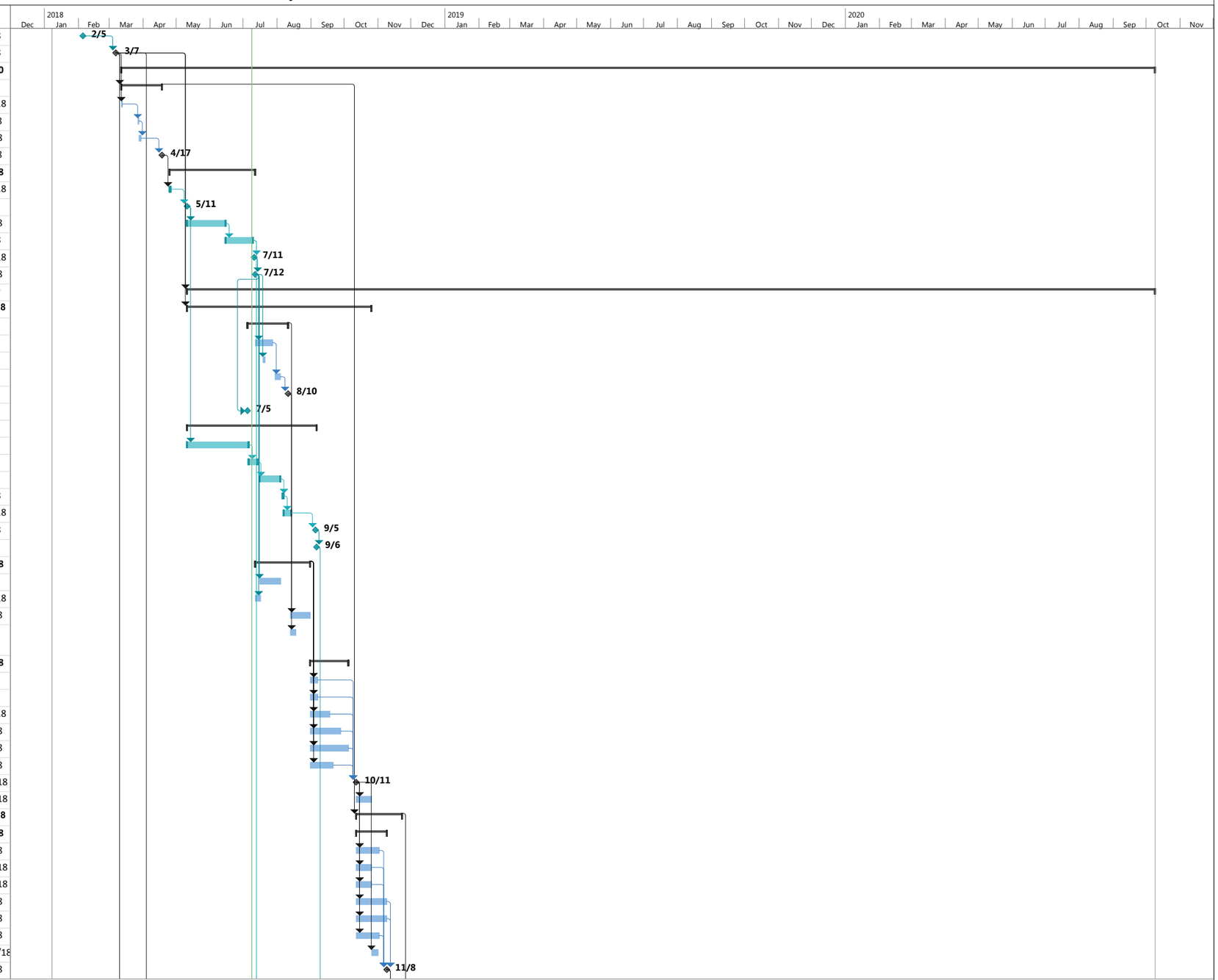
Weekly Chemical Checks-up				
NaOCl Tank	Refill?	Y / N	Level:	%
Aqueous Ammonia Tank	Refill?	Y / N	Level:	%
NaOH Tank	Refill?	Y / N	Level:	%
Citric Acid Tank	Refill?	Y / N	Level:	%
Sodium Bisulfite Tank	Refill?	Y / N	Level:	%
Sulfuric Acid Tank	Refill?	Y / N	Level:	%
Antiscalant Tank	Refill?	Y / N	Level:	%

Notes:

Please note any leaks, overflowing or tank damage.

Pure Water Demonstration Project
Las Virgenes-Triunfo
Project Schedule

ID	Task Mode	Task Name	Duration	Start	Finish
1		NTP	0 days	Mon 2/5/18	Mon 2/5/18
2		Kick-off Meeting	0 days	Wed 3/7/18	Wed 3/7/18
3		**Task 1 - Demonstration System Design**	**674 days**	**Mon 3/12/18**	**Thu 10/8/20**
4		***JPA Workshop***	**27 days**	**Mon 3/12/18**	**Tue 4/17/18**
5		Develop Questionnaire and Distribute to Board Members	1 day	Mon 3/12/18	Mon 3/12/18
6		Review Questionnaire Responses	1 day	Tue 3/27/18	Tue 3/27/18
7		Develop JPA Workshop Presentation and Materials	2 days	Wed 3/28/18	Thu 3/29/18
8		Hold Workshop Meeting	0 days	Tue 4/17/18	Tue 4/17/18
9		**Develop Architectural Concepts**	**56 days**	**Wed 4/25/18**	**Thu 7/12/18**
10		Internal Meeting - After Board Meeting	1 day	Wed 4/25/18	Wed 4/25/18
11		Site Visit To Discuss Preliminary Ideas	0 days	Fri 5/11/18	Fri 5/11/18
12		Prepare Second Board Meeting Slides	25 days	Fri 5/11/18	Thu 6/14/18
13		Refine Slides and Prepare Cost Estimate	17 days	Fri 6/15/18	Mon 7/9/18
14		Second Board Meeting	0 days	Wed 7/11/18	Wed 7/11/18
15		Design NTP	0 days	Thu 7/12/18	Thu 7/12/18
16		***Develop Plans and Specifications***	**630 days**	**Fri 5/11/18**	**Thu 10/8/20**
17		**60% Design Effort**	**120 days**	**Fri 5/11/18**	**Thu 10/25/18**
18		**Perform Field Visit to Collect Information**	**27 days**	**Thu 7/5/18**	**Fri 8/10/18**
19		Verify Available Power	12 days	Thu 7/12/18	Fri 7/27/18
20		Coordinate with Architect	2 days	Thu 7/19/18	Fri 7/20/18
21		Determine Available Utilities for Tie-ins and Source Water	5 days	Mon 7/30/18	Fri 8/3/18
22		Meet with Operators for Feedback on Design Issues	0 days	Fri 8/10/18	Fri 8/10/18
23		HVAC Field Meeting	0 days	Thu 7/5/18	Thu 7/5/18
24		**Equipment Procurement**	**84 days**	**Fri 5/11/18**	**Thu 9/6/18**
25		Develop PFD/P&IDs and Specs	40 days	Fri 5/11/18	Thu 7/5/18
26		Contact Vendors	6 days	Fri 7/6/18	Fri 7/13/18
27		Vendor Communication	15 days	Mon 7/16/18	Fri 8/3/18
28		Review Bids	1 day	Mon 8/6/18	Mon 8/6/18
29		Purchase Order Documents	5 days	Tue 8/7/18	Mon 8/13/18
30		JPA Board Meeting	0 days	Wed 9/5/18	Wed 9/5/18
31		Vendor NTP	0 days	Thu 9/6/18	Thu 9/6/18
32		**Develop Initial Design Parameters**	**36 days**	**Thu 7/12/18**	**Thu 8/30/18**
33		Develop System Layout	15 days	Mon 7/16/18	Fri 8/3/18
34		Develop Load Lists	3 days	Thu 7/12/18	Mon 7/16/18
35		Coordinate with Architect for Concepts	14 days	Mon 8/13/18	Thu 8/30/18
36		Determine Controls Philosophy and Remote Monitoring Requirements	5 days	Mon 8/13/18	Fri 8/17/18
37		**Detailed Design**	**25 days**	**Fri 8/31/18**	**Thu 10/4/18**
38		Develop Civil Tie-in Detail Sheets	5 days	Fri 8/31/18	Thu 9/6/18
39		Develop General Sheets	5 days	Fri 8/31/18	Thu 9/6/18
40		Develop Structural Sheets	12 days	Fri 8/31/18	Mon 9/17/18
41		Develop Mechanical Sheets	20 days	Fri 8/31/18	Thu 9/27/18
42		Develop EI&C Sheets	25 days	Fri 8/31/18	Thu 10/4/18
43		Draft Specification Development	15 days	Fri 8/31/18	Thu 9/20/18
44		Submit 60% Design Package	0 days	Thu 10/11/18	Thu 10/11/18
45		JPA Review Period	10 days	Fri 10/12/18	Thu 10/25/18
46		**90% Design Effort**	**30 days**	**Fri 10/12/18**	**Thu 11/22/18**
47		**Detailed Design**	**20 days**	**Fri 10/12/18**	**Thu 11/8/18**
48		Civil Sheets	15 days	Fri 10/12/18	Thu 11/1/18
49		General Sheets	10 days	Fri 10/12/18	Thu 10/25/18
50		Structural Sheets	10 days	Fri 10/12/18	Thu 10/25/18
51		Mechanical Sheets	20 days	Fri 10/12/18	Thu 11/8/18
52		EI&C Sheets	20 days	Fri 10/12/18	Thu 11/8/18
53		Specification Refinement	15 days	Fri 10/12/18	Thu 11/1/18
54		Contact Contractors about Project	4 days	Fri 10/26/18	Wed 10/31/18
55		Submit 90% Design Package	0 days	Thu 11/8/18	Thu 11/8/18



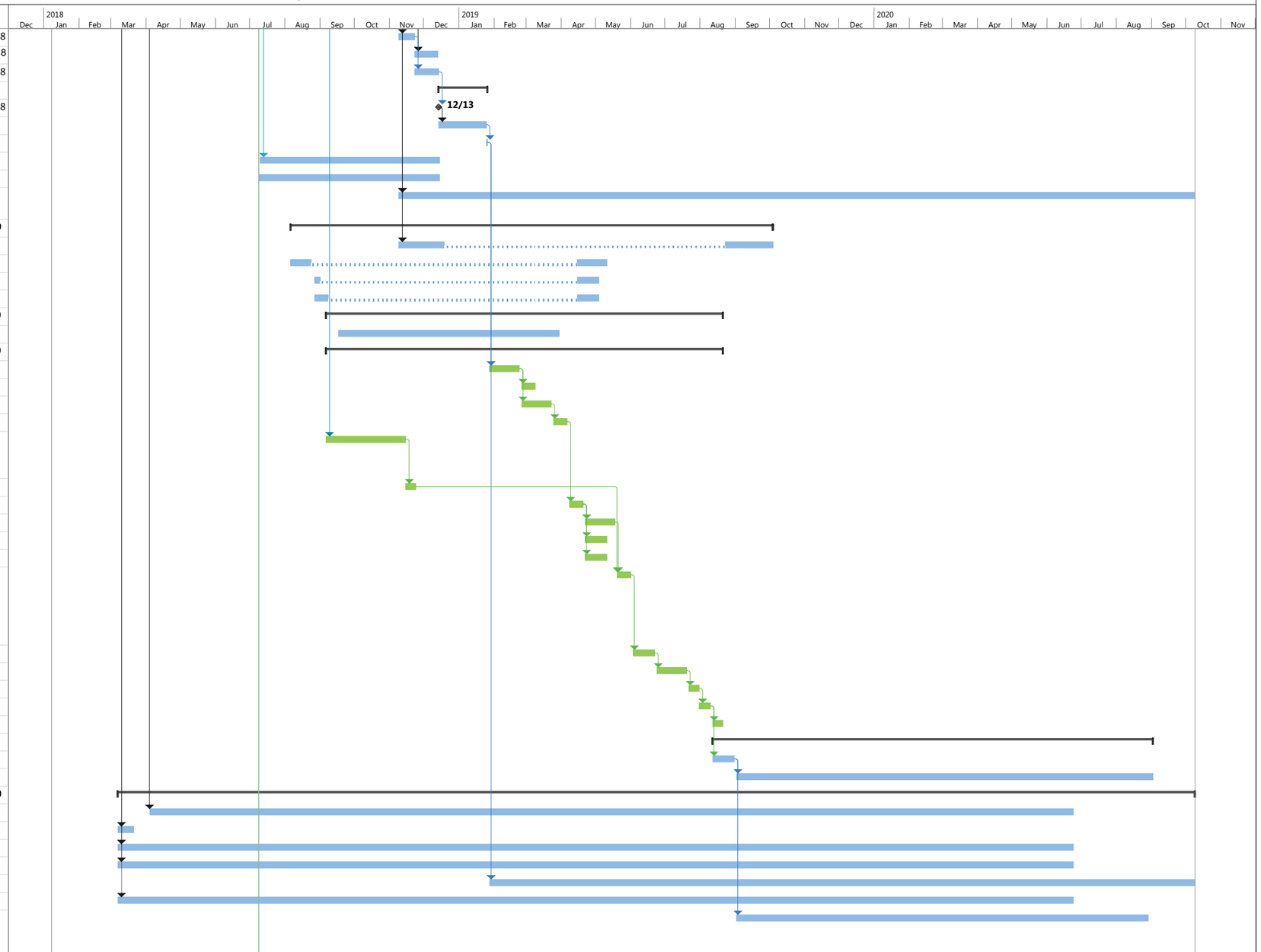
Project: Project Schedule
Date: Mon 7/9/18

Task | Milestone | Project Summary | Inactive Milestone | Manual Task | Manual Summary Rollup | Start-only | External Tasks | Deadline | Manual Progress
Split | Summary | Inactive Task | Inactive Summary | Duration-only | Manual Summary | Finish-only | External Milestone | Progress

ITEM # 18

Pure Water Demonstration Project
Las Virgenes-Triunfo
Project Schedule

ID	Task Mode	Task Name	Duration	Start	Finish
56		JPA Review Period	10 days	Fri 11/9/18	Thu 11/22/18
57		100% Design Effort	14 days	Fri 11/23/18	Wed 12/12/18
58		Incorporate JPA Comments	15 days	Fri 11/23/18	Thu 12/13/18
59		**Bid Phase**	**31 days**	**Thu 12/13/18**	**Fri 1/25/19**
60		Issue for Bid	0 days	Thu 12/13/18	Thu 12/13/18
61		Bid Assistance	30 days	Fri 12/14/18	Thu 1/24/19
62		Review Bid Results	1 day	Fri 1/25/19	Fri 1/25/19
63		***Refine Project Schedule and Cost Estimate***	114 days	Tue 7/10/18	Fri 12/14/18
64		***Assist with Permitting***	115 days	Mon 7/9/18	Fri 12/14/18
65		***Meetings with RWQCB and DDW***	500 days	Fri 11/9/18	Thu 10/8/20
66		**Task 2 - Operations, Testing, and Research Assistance**	**304 days**	**Mon 8/6/18**	**Thu 10/3/19**
67		***Develop Operations and Testing Plans***	58 days	Fri 11/9/18	Thu 10/3/19
68		***Develop Research Protocol***	34 days	Mon 8/6/18	Fri 5/10/19
69		***Develop Transitional Operations Plan***	20 days	Mon 8/27/18	Fri 5/3/19
70		***Develop Procurement Documents for Transitional Operations***	25 days	Mon 8/27/18	Fri 5/3/19
71		**Task 3 - Services During Construction**	**249 days**	**Thu 9/6/18**	**Tue 8/20/19**
72		***Review Submittals and RFIs***	140 days	Mon 9/17/18	Fri 3/29/19
73		**Construction of the Demo Facility**	**249 days**	**Thu 9/6/18**	**Tue 8/20/19**
74		Contract Negotiation	20 days	Mon 1/28/19	Fri 2/22/19
75		Mobilization	10 days	Mon 2/25/19	Fri 3/8/19
76		Submittal Preparation	20 days	Mon 2/25/19	Fri 3/22/19
77		Submittal Review by the Engineer	10 days	Mon 3/25/19	Fri 4/5/19
78		Equipment Fabrication	50 days	Thu 9/6/18	Wed 11/14/18
79		Equipment Shipping	7 days	Thu 11/15/18	Fri 11/23/18
80		Building Demolition and Preparation	10 days	Mon 4/8/19	Fri 4/19/19
81		Structural Slab Modifications (Form/Pour/Cure/Strip)	20 days	Mon 4/22/19	Fri 5/17/19
82		Building Access (Door) Modifications	15 days	Mon 4/22/19	Fri 5/10/19
83		HVAC Modifications	15 days	Mon 4/22/19	Fri 5/10/19
84		Setting and Anchoring Equipment and Tanks	10 days	Mon 5/20/19	Fri 5/31/19
85		Mechanical Piping	15 days	Mon 6/3/19	Fri 6/21/19
86		Electrical Conduits and Wiring	20 days	Mon 6/24/19	Fri 7/19/19
87		PLC Installation and Loop Testing	7 days	Mon 7/22/19	Tue 7/30/19
88		Functional and Wet Testing	8 days	Wed 7/31/19	Fri 8/9/19
89		Performance Testing	7 days	Mon 8/12/19	Tue 8/20/19
90		**Task 4 - Start-up and Transitional Operation Assistance**	**277 days**	**Mon 8/12/19**	**Tue 9/1/20**
91		***a: Assist with Facility Start-up***	15 days	Mon 8/12/19	Fri 8/30/19
92		***b: Assist in Implementing Transitional Operations***	262 days	Mon 9/2/19	Tue 9/1/20
93		**Task 5 - Tasks Applicable to all Areas**	**677 days**	**Wed 3/7/18**	**Thu 10/8/20**
94		***JPA Workshops***	580 days	Wed 4/4/18	Tue 6/23/20
95		***Review Materials***	10 days	Wed 3/7/18	Tue 3/20/18
96		***Perform Site Visits***	600 days	Wed 3/7/18	Tue 6/23/20
97		***Attend JPA Board Meetings***	600 days	Wed 3/7/18	Tue 6/23/20
98		***Interface with Regulatory Agencies***	444 days	Mon 1/28/19	Thu 10/8/20
99		***Other Tasks***	600 days	Wed 3/7/18	Tue 6/23/20
100		***USBR Grant Reporting (assuming 1 year of operation)***	260 days	Mon 9/2/19	Fri 8/28/20



Project: Project Schedule
Date: Mon 7/9/18

Task | Milestone | Project Summary | Inactive Milestone | Manual Task | Manual Summary Rollup | Start-only | External Tasks | Deadline | Manual Progress
Split | Summary | Inactive Task | Inactive Summary | Duration-only | Manual Summary | Finish-only | External Milestone | Progress

ITEM # 18

PILOT PROJECT GRANT
DETAILED APPLICATION BUDGET SUMMARY

Applicant: Las Virgenes Municipal Water District **FAAST PIN: 43607**

Project Title: Pure Water Project Las Virgenes-Triunfo: Demonstration Project

(Note: the maximum grant is 35 percent of the eligible construction cost line items up to a total maximum of $1,000,000)

	Requested Grant	Local Match	Other Funding	Total	% Grant
Eligible Project Cost Activities					
1. Construction/ Implementation	**$843,709**	**$1,566,887**	**$0**	**$2,410,596**	**35%**
Contractor (1)	$600,513	$1,115,238		$1,715,750	
Agency Staff Labor for construction					
Manufacturer					
Equipment (2)	$243,196	$451,650		$694,846	
2. Construction Management	**$49,540**	**$92,004**	**$0**	**$141,544**	**35%**
Start-up Assistance (3)	$34,967	$64,938		$99,905	
Services during construction (3)	$14,574	$27,065		$41,639	
Ineligible Project Cost Activities					
3. Project Administration Costs	**N/A**	**$0**	**$0**	**$0**	**N/A**
4. Planning/ Design/ Engineering/ Environmental	**N/A**	**$0**	**$292,590**	**$292,590**	**N/A**
Design (3)		$0		$292,590	
Bureau of Reclamation Grant			$292,590		
5. Monitoring/ Performance	**N/A**	**$33,346**	**$7,410**	**$40,756**	**N/A**
Operation, testing & reseach Assistance (3)		$33,346		$40,756	
Bureau of Reclamation Grant			$7,410		
5. Data Analysis/ Report Preparation	**N/A**	**$0**	**$0**	**$0**	**N/A**
6. Education/ Outreach	**N/A**	**$63,554**	**$0**	**$63,554**	**N/A**
Visitor Experience Design (4)		$63,554		$63,554	
Grand Total:	**$893,249**	**$1,755,791**	**$300,000**	**$2,949,040**	**30%**

List Other Funding Sources:

Note: CHECK YOUR NUMBERS! Do NOT assume this Excel spreadsheet is correct. Add/ delete rows as necessary. Please refer to the READ ME tab.

ATTACHMENT 2

Certification for Compliance with Water Metering Form

CERTIFICATION FOR COMPLIANCE WITH WATER METERING
REQUIREMENTS FOR FUNDING APPLICATIONS

Funding Agency Name: State Water Resources Control Board
Funding Program Name: Water Recycling Funding Program
Applicant (Agency Name): Las Virgenes Municipal Water District

Please check one of the boxes below and sign and date this form.

☐ As the authorized representative for the applicant agency, I certify under penalty of perjury that the agency is not an urban water supplier, as that term is understood pursuant to the provisions of section 529.5 of the Water Code.

■ As the authorized representative for the applicant agency, I certify under penalty of perjury that the applicant agency has fully complied with the provisions of Division 1, Chapter 8, Article 3.5 of the California Water Code (sections 525 through 529.7 inclusive) and that the ordinances, rules, or regulations submitted with this certification as listed below have been duly adopted and are in effect as of this date.

I understand that the Funding Agency will rely on this signed certification in order to approve funding and that false and/or inaccurate representations in this Certification Statement may result in loss of all funds awarded to the applicant for its project. Additionally, for the aforementioned reasons, the Funding Agency may withhold disbursement of project funds, and/or pursue any other applicable legal remedy.

David W. Pedersen	General Manager
Name of Authorized Representative (Please print)	Title
David W. Pedersen	11/15/2018
Signature of Authorized Representative	Date

ATTACHMENT 3

Proof of Urban Water Management Plan Compliance

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY
EDMUND G. BROWN JR., Governor

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

June 30, 2016

Mr. John Zhao
Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, California 91302

Dear Mr. Zhao:

This is to inform you that the Department of Water Resources (DWR) received the 2015 Urban Water Management Plan for the Las Virgenes Municipal Water District on June 21, 2016. DWR reviews plans as quickly as possible and in the order they are received.

Please feel free to contact Gwen Huff at (916) 651-9672 if you have any questions or would like to discuss the review of 2015 Urban Water Management Plans. Contact Ms. Huff also if you require an expedited review.

Sincerely,

Vicki Lake
Unit Chief
Urban Water Use Efficiency
(916) 651-0740

ATTACHMENT 4

Authorizing Resolution/Ordinance

RESOLUTION NO. 2545

A RESOLUTION OF THE BOARD OF DIRECTORS OF LAS VIRGENES MUNICIPAL WATER DISTRICT AUTHORIZING THE GENERAL MANAGER TO SIGN AND FILE A FINANCIAL ASSISTANCE APPLICATION FOR A PILOT PROJECT GRANT FROM THE STATE WATER RESOURCES CONTROL BOARD, WATER RECYCLING FUNDING PROGRAM FOR THE PURE WATER PROJECT LAS VIRGENES-TRIUNFO: DEMONSTRATION PROJECT

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF LAS VIRGENES MUNICIPAL WATER DISTRICT as follows:

1. The General Manager (the "Authorized Representative") or his designee is hereby authorized and directed to sign and file, for and on behalf of the Las Virgenes Municipal Water District (the "Entity"), a Financial Assistance Application for a pilot project grant from the State Water Resources Control Board, Water Recycling Funding Program for the Pure Water Demonstration Project (the "Project");

2. The Authorized Representative, or his designee, is designated to provide the assurances, certifications, and commitments required for the financial assistance application, including executing a financial assistance agreement from the State Water Resources Control Board and any amendments or changes thereto; and

3. The Authorized Representative, or his designee, is designated to represent the Entity in carrying out the Entity's responsibilities under the grant agreement, including certifying disbursement requests on behalf of the Entity and compliance with applicable state and federal laws.

PASSED, APPROVED AND ADOPTED this 4th day of December, 2018.

_____
Glen Peterson, President

ATTEST:

_____
Jay Lewitt, Secretary

(SEAL)

APPROVED AS TO FORM:

_____

W. Keith Lemieux, District Counsel

ATTACHMENT 5

Audited Financial Statements

THE PUN GROUP
ACCOUNTANTS & ADVISORS

INDEPENDENT AUDITORS' REPORT

To the Board of Directors
of the Las Virgenes Municipal Water District
Calabasas, California

Report on Financial Statements

We have audited the accompanying financial statements of the business-type activities and the discretely presented component unit of the Las Virgenes Municipal Water District, California (the "District"), as of and for the year ended June 30, 2018, and the related notes to the financial statements, which collectively comprise the District's basic financial statements as listed in the table of contents.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express opinions on these financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinions.

Opinions

In our opinion, the financial statements referred to above present fairly, in all material respects, the respective financial position of the business-type activities and the discretely presented component unit of the District, as of June 30, 2018, and the respective changes in financial position, and where applicable, cash flows thereof for the year then ended in accordance with accounting principles generally accepted in the United States of America.

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www.pungroup.com

Emphasis of Matter

Change in Accounting Principle

As discussed in Note 11 to the financial statements, in 2018, the District adopted new accounting guidance, GASB Statement No. 75, *Accounting and Financial Reporting for Postemployment Benefits Other Than Pensions*. The adoption of this statement requires retrospective application of previously reported net position at July1, 2017 as described in Note 12 to the basic financial statements. In addition, Total OPEB Liability is reported in the Statement of Net Position in the amount of $19,183,096 as of June 30, 2017, the measurement date. This Total OPEB Liability is calculated by actuaries using estimates and actuarial techniques from an actuarial valuation as of June 30, 2018. Our opinion is not modified with respect to this matter.

Other Matters

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the Management's Discussion and Analysis, the Schedule of Changes in Net Pension Liability and Related Ratios – CalPERS Pension Plan, the Schedule of Contributions – CalPERS Pension Plan, the Schedule of Changes in OPEB Liability and Related Ratios – Other Post-Employment Benefits Plan, and the Schedule of Contributions –Other Post-Employment Benefits Plan on pages 5 through 12 and 51 through 53, be presented to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Other Information

Our audits were conducted for the purpose of forming opinions on the financial statements that collectively comprise the District's basic financial statements. The Introductory and Statistical Sections are presented for purposes of additional analysis and are not a required part of the basic financial statements. The Introductory and Statistical Sections have not been subjected to the auditing procedures applied in the audit of the basic financial statements, and accordingly, we do not express an opinion or provide any assurance on them.

Other Reporting Required by *Government Auditing Standards*

In accordance with *Government Auditing Standards*, we have also issued our report dated November 6, 2018 on our consideration of the District's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the District's internal control over financial reporting and compliance.

The Pun Group, LLP

Santa Ana, California
November 6, 2018

Kenneth H. Pun, CPA, CGMA
CPA Number: 88316

THE PUN GROUP
ACCOUNTANTS & ADVISORS

INDEPENDENT AUDITORS' REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING AND ON COMPLIANCE AND OTHER MATTERS BASED ON AN AUDIT OF FINANCIAL STATEMENTS PERFORMED IN ACCORDANCE WITH *GOVERNMENT AUDITING STANDARDS*

Independent Report

To the Board of Directors
of the Las Virgenes Municipal Water District
Calabasas, California

We have audited, in accordance with the auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards* issued by the Comptroller General of the United States, the financial statements of the business-type activities and the discretely presented component unit of the Las Virgenes Municipal Water District, California (the "District"), as of and for the year ended June 30, 2018, and the related notes to the financial statements, which collectively comprise the District's basic financial statements, and have issued our report thereon dated November 6, 2018.

Internal Control over Financial Reporting

In planning and performing our audit of the financial statements, we considered the District's internal control over financial reporting ("internal control") to determine the audit procedures that are appropriate in the circumstances for the purpose of expressing our opinions on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the District's internal control. Accordingly, we do not express an opinion on the effectiveness of the District's internal control.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

Compliance and Other Matters

As part of obtaining reasonable assurance about whether the District's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards*.

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www.pungroup.com

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's internal control or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the entity's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.

The Pun Group, LLP

Santa Ana, California
November 6, 2018

Kenneth H. Pun, CPA, CGMA
CPA Number: 88316

LAS VIRGENES MUNICIPAL WATER DISTRICT

MANAGEMENT'S DISCUSSION AND ANALYSIS

JUNE 30, 2018

This section of the District's annual financial report presents management's analysis of the District's financial performance during the Fiscal Year that ended on June 30, 2018. Please read it in conjunction with the Financial Statements, which follow this section.

FINANCIAL HIGHLIGHTS

- The District's 2018 net position increased by $13.9 million to $218.3 million.
- During FY 2018, the District's revenues increased by 12.22% to $68.9 million, expenses increased by 5.43% to $57.5 million.
- In FY 2018, capital contributions to the District increased to $2.6 million or 313.8% more than FY 2017.

OVERVIEW OF THE FINANCIAL STATEMENTS

The discussion and analysis serves as an introduction to Las Virgenes Municipal Water District's basic financial statements. The District's basic financial statements are comprised of two components: Financial Statements and Notes to the Financial Statements. This report also contains other supplementary information in addition to the basic financial statements themselves.

CHANGES TO THE FINANCIAL STATEMENTS

Governmental Accounting Standards Board (GASB) Statement 75

GASB 75, dated June 2015, was issued to improve accounting and financial reporting by state and local governments for postemployment benefits other than pensions (other postemployment benefits or OPEB). GASB 75 defines how the District will present OPEB liability and contributions, and is reflected in Note 11. GASB 75 also requires adding the District's Net OPEB liabilities to the Financial Statements beginning on page 14. The District's reported Net OPEB liability is $19.2 million at June 30, 2018.

BASIC FINANCIAL STATEMENTS

Because the District is comprised of three business type enterprises, potable water, recycled water, and sanitation, the Financial Statements of the District report information about the District using accounting methods similar to those used by private sector companies. These statements offer short- and long-term financial information about its activities. The Statement of Net Position includes all of the District's assets, deferred outflow of resources, liabilities and provides information about the nature and amounts of investments in resources (assets) and the obligations to District creditors (liabilities). It also provides the basis for computing rate of return, evaluating the capital structure of the District and assessing the liquidity and financial flexibility of the District.

All of the current year's revenues and expenses are accounted for in the Statements of Revenues, Expenses and Changes in Net Position. This statement measures the success of the District's operations over the past year and can be used to determine the District's credit worthiness and whether the District has successfully recovered all its costs through its user fees and other charges.

The final required Financial Statement is the Statement of Cash Flows. The primary purpose of this statement is to provide information about the District's cash receipts and cash payments during the reporting period. The statement reports cash receipts, cash payments, and net changes in cash resulting from operations and investments. It also provides answers to such questions as where did cash come from, what was cash used for, and what was the change in cash balance during the reporting period.

FINANCIAL ANALYSIS OF THE DISTRICT

The Financial Statements provide information on whether the District, as a whole, is in a stronger or weaker financial position compared to the last year. The Statement of Net Position and the Statement of Revenues, Expenses, and Changes in Net Position provide a means to measure the District's financial health or financial position. Over time, increases or decreases in the District's net position are one indicator of whether its financial health is improving or deteriorating. However, you will need to consider other non-financial factors such as changes in economic conditions, population growth, weather, and new or changed government legislation.

During Fiscal Year 2017-18 the District saw continued increased water sales as a rebound from the multi-year drought continued. The District's potable water-budget based rate structure supports a conservation philosophy through increasing tier structure and an annual incremental increase in the percentage of fixed cost recovered through fixed fees, which over time will reduce dependence on fluctuating water sales to meet revenue needs. The sanitation and recycled water enterprises continued to build additional reserves as the District prepares to construct its Pure Water project that will take surplus recycled water and process it through an advanced treatment facility; then store it at Las Virgenes Reservoir for later use as drinking water. The District is well positioned to meet demands of a changing climate to meet its customer's water and sanitation needs.

Las Virgenes Municipal Water District operates a Joint Powers Authority (JPA) with Triunfo Sanitation District for the transmission and treatment of sanitation. In conformance with GASB 61, the JPA is presented in the District's Financial Statements as a Discretely Presented Component Unit. The JPA annually issues an Independent Auditors' Report and Financial Statements that includes a Management Discussion and Analysis. It is recommended to review this document for additional information on the financial condition of the JPA.

NET POSITION

Table 1 shows a comparative analysis of the District's Net Position. As shown below, net position increased by $13.9 million to $218.3 million in FY 2017. The implementation of GASB 75 restated the net position at June 30, 2018 by $18.1 million.

TABLE 1
Condensed Statements of Net Position
(in thousands of dollars)

	FY 2018	FY 2017 (restated)
Current and Other Assets	$ 96,369	$ 82,884
Capital Assets	124,526	125,810
Investment in JPA	62,521	62,556
Total Assets	**283,416**	**271,250**
Deferred Outflow of Resources	9,065	9,158
Long-Term Debt Outstanding	15,596	14,670
Net Pension Liability	20,493	19,563
Net OPEB Liability	19,183	18,064
Other Liabilities	16,592	18,956
Total Liabilities	**71,864**	**71,253**
Deferred Inflows of Resources	2,274	4,707
Net Position:		
Net Investment in Capital Asset,	109,794	108,930
Restricted	2,683	2,654
Unrestricted	105,866	92,864
Total Net Position	**$ 218,343**	**$ 204,448**

REVENUES, EXPENSES AND CHANGES IN NET POSITION

While the Statement of Net Position shows the change in financial position, the Statement of Revenues, Expenses and Changes in Net Position provides information concerning the nature and source of these changes. As shown in Table 2 below, the income before capital contributions was $11.3 million. The income plus capital contributions lead to the overall increase in net position of $13.9 million, when compared to last year's CAFR.

Water sales, the District's primary revenue source, were higher as the drought restrictions were lifted and customers adjusted to their water budgets. Wasteful water use penalties impose increasing fines on customers who exceed their water budgets by 200%, which has helped limit the increase.

Operating expenses were higher by 5.4% year-over-year primarily due to salary and benefits increase and increased maintenance costs.

Capital contributions are irregular, as the District does not experience many large-scale projects. In July 2017, the District adopted a new capacity fee structure that focuses contributions on maintenance and upgrading of existing infrastructure.

TABLE 2
Condensed Statements of Revenues, Expenses and Changes in Net Position

	FY 2018	FY 2017 (restated)
Operating Revenues:		
Water Sales	$ 45,257	$ 39,963
Sanitation and Other	21,461	19,832
Non-operating Revenues:		
Taxes and Penalties	946	953
Interest Income and Other	1,212	625
Total Revenues	**68,876**	**61,373**
Depreciation Expense	3,943	4,076
Other Operating Expenses	709	36,500
Share of JPA Net Expenses	13,718	13,139
Non-Operating Expenses	715	867
Total Expenses	**19,085**	**54,582**
Income (Loss) Before Capital Contributions	11,329	6,791
Capital Contributions	2,566	620
Change in Net Position	13,895	7,411
Net Position - Beginning of Year	204,448	215,101
Net Position - End of Year	**$ 218,343**	**$ 204,448**

CAPITAL ASSETS

At the end of FY 2018, the District had invested $237.3 million in a broad range of infrastructure including water and sewer lines, wastewater facilities, reservoirs, tanks, distribution facilities, compost facility, maintenance and administration facilities, vehicles and equipment and an investment in Joint Venture of $62.5 million as shown in Table 3. This amount represents a net decrease (including additions, deletions, and depreciation) of $1.3 million from last year. The decrease is predominantly due to fewer projects added as the District prepares for Las Virgenes Triunfo Pure Water Project that is planned to treat sanitation effluent into potable water.

More information about the District's Capital Assets Depreciation policy is presented in Note 2 of the Basic Financial Statements. A more detailed summary of Capital Assets is presented in Note 7 to the Basic Financial Statements.

TABLE 3
Capital Assets
(In thousands of dollars)

	FY 2018	FY 2017	Dollar Change	Total Percent Change
Land	$ 6,915	$ 6,915	$ -	0.00%
Buildings and Improvements	22,094	22,023	71	0.32%
Machinery and Equipment	11,416	11,173	243	2.13%
Infrastructure	195,570	188,638	6,932	3.54%
Construction in Progress	1,290	6,108	(4,818)	-373.49%
Subtotal	**237,285**	**234,857**	**2,428**	**1.02%**
Less Accumulated Depreciation	112,760	109,048	3,712	3.29%
Net Property, Plant and Equipment	**124,525**	**125,809**	**(1,284)**	**-1.03%**
Investment in Joint Venture	**62,521**	**62,556**	**(35)**	**-0.06%**
Total Capital Assets	**$ 187,046**	**$ 188,365**	**$ (1,319)**	**-0.71%**

The following is a summary of some of the major improvements to the system during FY 2018.

TABLE 4
Major Capital Improvement Projects
(In thousands of dollars)

	FY 2018
Westlake Filtration Plant Expansion	$ 4,636
Jed Smith Pipeline Replacement	714
Raise Air Vacuum Valves	536
Building 7 & 8 Lighting Efficiency Upgrades	200
Total	**$ 6,086**

	FY 2017
Westlake Pump Station Upgrade	$ 4,236
Westlake Filtration Plant Expansion	3,838
Centrate Equalization Tank	1,785
Tapia Primary Tanks No. 2-5 Rehabilitation	874
Jed Smith Pipeline Replacement	643
Tapia Sluice Gates and Drives Replacement	437
Twin Lakes Tank Site Drainage Project	274
Recycled Water Seasonal Storage Study	224
Total	**$ 12,311**

LONG TERM DEBT

At year-end, the District had total long-term debt of $15.5 million, down from $17.9 million in FY 2017. The majority of this, $15.5 million is for the 2009 Sanitation Refunding Revenue Bond and Unamortized Premium, which had a FY 2018 year-end balance of $14.7 million. This debt is solely the obligation of the Sanitation Enterprise. More detailed information about the District's long-term liabilities is presented in Note 9 to the Basic Financial Statements. No new debt was incurred in FY 2018.

The District maintains an "AA" rating from Standard & Poor's for the refunding revenue bonds. One area that demonstrates the District's financial strength and future borrowing capability is seen in its debt coverage ratio. Current bond covenants require that the debt coverage ratio must be greater than 1.10. The debt coverage ratio for FY 2018 was 2.69%.

TABLE 5
Debt Coverage Ratio - Sanitation
(In thousands of dollars)

	FY 2018	FY 2017	Total Percent Change
Sanitation:			
Total Operating Revenues	18,818	18,613	1.10%
Total Operating Expenses (less depreciation)	11,421	10,614	7.60%
Net Earnings	**7,397**	**7,999**	**-7.53%**
Maximum Annual Debt Service	2,752	2,756	-0.15%
Debt Coverage Ratio	**2.69**	**2.90**	**-7.39%**

The District has outstanding refunding revenue bonds issued in December 2009. The District's current average cost of capital were 3.66% and 3.93% at June 30, 2018 and 2017, respectively, as shown on Table 6.

TABLE 6
Cost of Capital
(In thousands of dollars)

	Debt Balace	Average Coupon Rate
Refunding Revenue Bonds at June 30 ,2018	14,670	3.66%
Refunding Revenue Bonds at June 30, 2017	16,795	3.93%

CONTACTING THE DISTRICT'S FINANCIAL MANAGER

This financial report is designed to provide our residents, customers, investors, and creditors with a general overview of the District's finances and to demonstrate the District's accountability for the money it receives. If you have questions about this report or need additional financial information, contact the Las Virgenes Municipal Water District, Department of Finance and Administration, 4232 Las Virgenes Road, Calabasas, California, 91302; or visit our website at www.lvmwd.com.

BASIC FINANCIAL STATEMENTS

Las Virgenes Municipal Water District
Statement of Net Position
June 30, 2018

	Primary Government	Discretely Presented Component Unit - JPA
ASSETS		
Current assets:		
Cash and cash equivalents (Note 3)	$ 27,811,040	$ 4,282,084
Investments (Note 3)	47,206,546	972,870
Receivables:		
Sales and services, net of allowance for uncollectible (Note 4)	7,468,124	1,112,207
Due from Joint Powers Authority (Note 6)	2,830,105	-
Interest	332,150	19,350
Interest receivable - designated for capital projects	830	-
Taxes	212,654	-
Other	436,325	-
Inventories (Note 5)	7,036,431	171,555
Prepaid items	268,024	52,427
Total current assets	93,602,229	6,610,493
Noncurrent assets:		
Restricted cash and cash equivalents (Note 3)	2,766,678	-
Investments in Joint Powers Authority (Note 6)	62,520,957	-
Capital assets (Note 7):		
Nondepreciable	8,204,902	19,322,622
Depreciable, net of accumulated depreciation	116,320,804	71,852,004
Capital assets, net	124,525,706	91,174,626
Total noncurrent assets	189,813,341	91,174,626
Total assets	283,415,570	97,785,119
DEFERRED OUTFLOWS OF RESOURCES		
Deferred amount on debt refunding	864,464	-
Pension related deferred outflows of resources (Note 10)	6,568,390	-
OPEB related deferred outflows of resources (Note 11)	1,632,555	-
Total deferred outflows of resources	9,065,409	-

See accompanying Notes to the Basic Financial Statements.

Las Virgenes Municipal Water District
Statement of Net Position (Continued)
June 30, 2018

	Primary Government	Discretely Presented Component Unit - JPA
LIABILITIES		
Current liabilities:		
Accounts and contracts payable and accrued expenses	4,934,135	1,325,214
Interest payable	95,729	-
Unearned capacity and developer fees	9,124,718	-
Due to primary government (Note 6)	-	2,830,105
Due to other government	-	2,455,174
Deposits and other	284,764	-
Compensated absences - due within one year (Note 8)	938,425	-
Long-term debt - due within one year (Note 9)	2,233,076	-
Total current liabilities	17,610,847	6,610,493
Noncurrent liabilities:		
Compensated absences (Note 8)	1,213,575	-
Long-term debt - due in more than one year (Note 9)	13,363,149	-
Net pension liabilities (Note 10)	20,493,355	-
Net OPEB liabilities (Note 11)	19,183,096	-
Total noncurrent liabilities	54,253,175	-
Total liabilities	71,864,022	6,610,493
DEFERRED INFLOWS OF RESOURCES		
Pension related deferred inflows of resources (Note 10)	2,273,619	-
Total deferred inflows of resources	2,273,619	-
NET POSITION (Note 12)		
Primary government's net investment in capital assets	109,793,945	60,563,415
Other government's net investment in capital assets	-	30,611,211
Restricted for:		
Debt services	2,683,039	-
Unrestricted	105,866,354	-
Total net position	$ 218,343,338	$ 91,174,626

See accompanying Notes to the Basic Financial Statements.

Las Virgenes Municipal Water District
Statement of Revenues, Expenses, and Changes in Net Position
For the Year Ended June 30, 2018

	Primary Government	Discretely Presented Component Unit - JPA
Operating Revenues:		
Water sales and service fees	$ 45,256,520	$ -
Sanitation service fees	18,818,242	-
Wholesale recycle water sales	-	2,281,256
Other income	2,642,349	64,477
Total operating revenues	66,717,111	2,345,733
Operating Expenses:		
Water expenses:		
Source of supply	25,574,893	-
Pumping	1,668,779	-
Transmission and distribution	2,834,052	-
Meter	734,851	-
Water conservation	265,324	-
Rental	7,303	-
General and administrative	6,208,338	-
Total water expenses	37,293,540	-
Sanitation expenses:		
Other sewage treatment	447,386	-
Lifting	197,785	-
General and administrative	1,230,521	-
Total sanitation expenses	1,875,692	-
JPA expenses:		
Operating expenses	-	8,282,475
General and administrative	-	7,396,735
Total JPA expenses	-	15,679,210
Depreciation	3,943,121	5,695,161
Total operating expenses	43,112,353	21,374,371
Billings to primary government	-	8,954,213
Billings to other government	-	4,309,990
Total JPA billings	-	13,264,203
Net Operating Income (Loss)	23,604,758	(5,764,435)

See accompanying Notes to the Basic Financial Statements.

Las Virgenes Municipal Water District
Statement of Revenues, Expenses, and Changes in Net Position (Continued)
For the Year Ended June 30, 2018

	Primary Government	Discretely Presented Component Unit - JPA
Nonoperating Revenues (Expenses):		
Taxes and penalties	945,976	-
Interest income	451,792	69,274
Facilities charge	351,673	-
Interest expense and fiscal charges	(642,341)	-
Share of Joint Powers Authority (expense)	(13,718,223)	-
Gain (loss) on disposal of capital asset	(72,917)	(215)
Other revenues/(expenses)	408,364	(237,471)
Total nonoperating revenues (expenses)	(12,275,676)	(168,412)
Capital Contributions:		
Capital contributions from others	2,566,438	-
Capital contributions from primary government	-	4,305,114
Capital contributions from other government	-	1,792,782
Total capital contributions	2,566,438	6,097,896
Changes in Net Position	13,895,520	165,049
Net Position:		
Beginning of year, as restated (Note 12)	204,447,818	91,009,577
End of year	$ 218,343,338	$ 91,174,626

See accompanying Notes to the Basic Financial Statements.

Las Virgenes Municipal Water District
Statement of Cash Flows
For the Year Ended June 30, 2018

	Primary Government
Cash Flows From Operating Activities:	
Cash received from customers	$ 63,763,330
Cash payments to suppliers for operations	(30,326,726)
Cash received from Joint Powers Authority	1,267,600
Cash payments for general and administrative expenses	(7,842,722)
Cash received from others	2,394,182
Net cash provided by operating activities	29,255,664
Cash Flows From Noncapital Financing Activities:	
Receipt from facilities charges	351,673
Receipt from other revenues	408,364
Property taxes and fee collected	941,050
Net cash provided by noncapital financing activities	1,701,087
Cash Flows From Capital and Related Financing Activities:	
Acquisition of capital assets	(2,783,810)
Proceeds from sale of assets	51,629
Capital contribution	2,566,438
Repayment of bonds payable and capital leases	(2,146,467)
Interest payment	(659,751)
Capital facilities and developer fees received	2,766,299
Capital facilities and developer fees refunded and developer fees used	(1,725,927)
Net cash (used in) capital and related financing activities	(1,931,589)
Cash Flows From Investing Activities:	
Interest received	943,219
Contributions to Joint Power Authority	(13,683,030)
Investments matured	8,673,426
Purchase of investments	(20,112,490)
Net cash (used in) investing activities	(24,178,875)
Net Change in Cash and Cash Equivalents	4,846,287
Cash and Cash Equivalents:	
Beginning of year	25,731,431
End of year	$ 30,577,718
Financial Statement Presentation:	
Cash and cash equivalents	$ 27,811,040
Restricted cash and cash equivalents	2,766,678
Total cash and cash equivalents	$ 30,577,718
Noncash investing activities:	
Change in fair value of investments	$ (959,686)

See accompanying Notes to the Basic Financial Statements.

Las Virgenes Municipal Water District
Statement of Cash Flows (Continued)
For the Year Ended June 30, 2018

	Primary Government
Reconciliation of Net Operating Income to Net Cash Provided By Operating Activities:	
Net operating income	$ 23,604,758
Adjustments to reconcile operating income to net cash provided by operating activities	
Depreciation	3,943,121
Changes in operating assets and liabilities	
(Increase) decrease in accounts and other receivables	(604,010)
(Increase) decrease in due from Joint Powers Authority	1,267,600
(Increase) decrease in inventories	1,565,619
(Increase) decrease in prepaid items	(24,920)
(Increase) decrease in deferred outflows or resources - pension	1,565,891
(Increase) decrease in deferred outflows or resources - OPEB	(1,632,555)
Increase (decrease) in accounts and contracts payable and accrued expenses	(118,389)
Increase (decrease) in compensated absences	28,649
Increase (decrease) in deposits and other	44,411
Increase (decrease) in net pension liability	930,320
Increase (decrease) in net OPEB liability	1,118,701
Increase (decrease) in deferred inflows or resources - pension	(2,433,532)
Net cash provided by Operating Activities	$ 29,255,664

Disclosure of Noncash Transactions:

1 Projects funded by water and sewer capacity fees/connection fees and meter installation fees were completed during the fiscal year. As a result, capital contributions in the amount of $1,477,147 from capacity fees and $60,942 from meters installed were reclassified from deferred capacity and developer fees to contributed capital for the year ended June 30, 2018.

See accompanying Notes to the Basic Financial Statements.

ITEM # 18

Note 1 – Reporting Entity

Las Virgenes Municipal Water District (the "District") is organized under the Municipal Water District Act of 1911 (California Water Code 71000). A five-member board of directors, who are elected by geographic divisions, provide governance. The District was formed to secure a high quality, reliable source of water for areas which include the cities of Agoura Hills, Calabasas, Hidden Hills and Westlake Village, plus surrounding unincorporated portions of western Los Angeles County.

Discretely Presented Component Unit

The *Las Virgenes-Triunfo Joint Powers Authority* ("JPA") was created on October 12, 1964 between the District and Triunfo Sanitation District ("TSD") for the purpose of constructing, operating, maintaining and providing for the replacement of a joint sewage system to serve the Malibu Canyon drainage area. The JPA consists of ten board members where five of them are the board members of the District and the other five are the board members of TSD. The JPA is fiscally dependent in that the JPA could not issue bonded debt without approval from the District. There is a financial benefit and burden relationship between the District and the JPA. The JPA issues a separate financial report that is available upon request from the District. The financial statements of the JPA are included as a discretely presented component of the District's financial statements.

Note 2 – Summary of Significant Accounting Policies

Basis of Presentation

Financial statement presentation follows the recommendations promulgated by the Governmental Accounting Standards Board ("GASB") commonly referred to as accounting principles generally accepted in the United States of America ("U.S. GAAP"). GASB is the accepted standard-setting body for establishing governmental accounting and financial reporting standards.

Measurement Focus, Basis of Accounting, and Financial Statement Presentation

The financial statements (i.e., the statement of net position, the statement of revenues, expenses and changes in net position, and statement of cash flows) report information on all of the activities of the District.

The financial statements are reported using the *"economic resources"* measurement focus and the accrual basis of accounting. Revenues are recorded when earned and expenses are recorded when a liability is incurred, regardless of the timing of related cash flows. Grants and similar items are recognized as revenue as all eligibility requirements have been met. Interest associated with the current fiscal period is considered to be susceptible to accrual and so has been recognized as revenue of the current fiscal period.

The Statement of Net Position reports separate sections for Deferred Outflows of Resources, and Deferred Inflows of Resources, when applicable.

> **Deferred Outflows of Resources** represent outflows of resources (consumption of net position) that apply to future periods and that, therefore, will not be recognized as an expense until that time.
>
> **Deferred Inflows of Resources** represent inflows of resources (acquisition of net position) that apply to future periods and that, therefore, are not recognized as a revenue until that time.

Note 2 – Summary of Significant Accounting Policies (Continued)

Measurement Focus, Basis of Accounting, and Financial Statement Presentation (Continued)

Operating revenues are those revenues that are generated from the primary operations of the District. The District reports a measure of operations by presenting the change in net assets from operations as "operating income" in the statement of revenues, expenses, and changes in net assets. Operating activities are defined by the District as all activities other than financing and investing activities (interest expense and investment income), grants and subsidies, settlement receivable allowance, and other infrequently occurring transaction of a non-operating nature. Operating expenses are those expenses that are essential to the primary operations of the District. All other expenses are reported as non-operating expenses.

Cash, Cash Equivalents, and Investments

Cash and cash equivalents include all highly liquid investments with original maturities of 90 days or less and are carried at cost, which approximates fair value.

The District participates in an investment pool managed by the State of California titled Local Agency Investment Fund ("LAIF"), which has invested a portion of the pool funds in structured notes and asset-backed securities. LAIF's investments are subject to credit risk with the full faith and credit of the State of California collateralizing these investments. In addition, these structured notes and assets-backed securities are subject to market risk and to change in interest rates. The reported value of the pool is the same as the fair value of the pool shares.

Certain disclosure requirements, if applicable for deposit and investment risk, are specified for the following areas:

- Interest Rate Risk
- Credit Risk
  - Overall
  - Custodial Credit Risk
  - Concentration of Credit Risk
- Foreign Currency Risk

Restricted Cash and Investments

Cash and investments with fiscal agents are restricted due to limitations on their use by bond covenants or donor limitations. Fiscal agents acting on behalf of the District hold investment funds arising from the proceeds of long-term debt issuances. The funds may be used for specific capital outlays or for the payment of certain bonds, and have been invested only as permitted by specific State statutes or applicable District ordinance, resolution or bond indenture.

Fair Value Measurements

U.S. GAAP defines fair value, establishes a framework for measuring fair value and establishes disclosures about fair value measurement. Investments, unless otherwise specified, recorded at fair value in the Statements of Net Position, are categorized based upon the level of judgment associated with the inputs used to measure their fair value. Levels of inputs are as follows:

Level 1 — Inputs are unadjusted, quoted prices for identical assets and liabilities in active markets at the measurement date.

Level 2 — Inputs, other than quoted prices included in Level 1, that are observable for the asset or liability through corroboration with market data at the measurement date.

Level 3 — Unobservable inputs that reflect management's best estimate of what market participants would use in pricing the asset or liability at the measurement date.

Note 2 – Summary of Significant Accounting Policies (Continued)

Receivables and Unbilled Revenues

Customer accounts receivable consist of amounts owed by private individuals and organizations for services rendered in the regular course of business operations. Receivables are shown net of allowances for doubtful accounts, if any. The District also accrues an estimated amount for services that have been provided, but not yet billed. Federal and State grants accrued as revenue when all eligibility requirements have been met. Amount earned but outstanding at year end are reported as due from other governments.

Inventories

Inventories consist of expendable materials, supplies, and water in storage and are stated at average cost.

Prepaid Items

Payments made to vendors for services that will benefit periods beyond the fiscal year ended are recorded as prepaid items.

Capital Assets

Capital assets are valued at historical cost, or estimated historical cost, if actual historical cost was not available. Donated capital assets are valued at their acquisition value on the date donated. The District policy has set the capitalization threshold for reporting capital assets at $5,000, all of which must have an estimated useful life in excess of one year. Depreciation is recorded on a straight-line basis over estimated useful lives of the assets as follows:

Primary Government		
Water Plant	Source of supply (primarily water tanks)	10 - 100 Years
	Plant	10 - 75 Years
	Structures	25 - 35 Years
Sanitation Plant	Plant	10 - 100 Years
	Machinery and equipment	3 - 25 Years
General Utility Plant	Building and improvements	10 - 50 Years
	Machinery and equipment	3 - 25 Years
Discretely Presented Component Unit - JPA		
Recycle Water Plants	Plant	10 - 100 Years
	Machinery and equipment	3 - 25 Years

Major outlays for capital assets are capitalized as projects, once constructed, and repairs and maintenance costs are expensed. Interest accrued during capital assets construction, if any, is capitalized as part of the asset cost, net of interest income on construction bond proceeds.

Note 2 – Summary of Significant Accounting Policies (Continued)

Capital Contributions

Prepayments of water and sewer capacity fees/connection fees assessed by the District are reported as unearned revenues until construction of the related projects has commenced and the District is reasonably certain they will be completed. Upon completion, the applicable amounts are recognized as capital contributions.

Compensated Absences

District's policy permits its employees to accumulate not more than 288 hours of their current annual vacation for the miscellaneous general and office units and not more than 311 hours for the supervisor, professional, confidential and management units. General Managers are compensated 5 days into accrued sick leave bank at onset of employment and 8 hours per month thereafter up to 96 hours per year with a maximum of 311 hours accrual. Non-Represented employees are compensated 8 hours per month. The annual accrual of sick leave has no maximum accrual. The combined unused vacation and sick pay will be paid to employee or his/her beneficiary upon leaving the District's employment. The amount due will be determined using salary/wage rate in effect at the time of separation and vesting period.

All vested vacation and compensatory leave time is recognized as an expense and as a liability at the time the benefit vests. The liability for compensated absences is included as part of compensated absences payable from unrestricted current assets.

Long-Term Debt

Debt premiums and discounts are amortized over the life of the debt using the straight-line method. Long-term debt is reported net of the applicable unamortized bond premium or discount. Debt issuance costs are expensed when incurred.

Arbitrage Rebate Requirement

The District is subject to the Internal Revenue Code ("IRC") Section 148(f), related to its tax exempt revenue bonds. The IRC requires that investment earnings on gross proceeds of any revenue bonds that are in excess of the amount prescribed will be surrendered to the Internal Revenue Service. The District had no rebate liability for arbitrage as of June 30, 2018..

Pension

For purposes of measuring the net pension liability, deferred outflows of resources and deferred inflows of resources related to pensions, and pension expense, information about the fiduciary net position of the plans and additions to/deductions from the plans' fiduciary net position have been determined on the same basis as they are reported by the plans (Note 10). For this purpose, benefit payments (including refunds of employee contributions) are recognized when due and payable in accordance with benefit terms. Investments are reported at fair value.

The following timeframes are used for pension reporting:

For the Year Ended	June 30, 2018
Valuation Date	June 30, 2016
Measurement Date	June 30, 2017
Measurement Period	July 1, 2016 to June 30, 2017

Note 2 – Summary of Significant Accounting Policies (Continued)

Pension (Continued)

Gains and losses related to changes in total pension liability and fiduciary net position are recognized in pension expense systematically over time. The first amortized amounts are recognized in pension expense for the year the gain or loss occurs. The remaining amounts are categorized as deferred outflows and deferred inflows of resources related to pensions and are to be recognized in future pension expense. The amortization period differs depending on the source of the gain or loss. The difference between projected and actual earnings is amortized straight-line over 5 years. All other amounts are amortized straight-line over the average expected remaining service lives of all members that are provided with benefits (active, inactive, and retired) as of the beginning of the measurement period.

Other Postemployment Benefits ("OPEB")

For purposes of measuring the net OPEB liability, deferred outflows of resources and deferred inflows of resources related to OPEB, and OPEB expense, information about the fiduciary net position of the District Retiree Benefits Plan ("OPEB Plan") and additions to/deductions from OPEB Plan's fiduciary net position have been determined on the same basis as they are reported by the Plan. For this purpose, the OPEB Plan recognizes benefit payments when due and payable in accordance with the benefit terms. Investments are reported at fair value, except for money market investments, which are reported at amortized cost.

The following timeframes are used for pension reporting:

For the Year Ended	June 30, 2018
Valuation Date	June 30, 2017
Measurement Date	June 30, 2017
Measurement Period	July 1, 2016 to June 30, 2017

Net Position

Net position represents the difference between all other elements in the statement of net position and should be displayed in the following three components:

Net Investment in Capital Assets – This component of net position consists of capital assets, net of accumulated depreciation, reduced by the outstanding balances of debt and deferred inflows and outflows of resources that are attributable to the acquisition, construction, or improvement of those assets.

Restricted – This component of net position consists of restricted assets and related deferred outflows of resources reduced by liabilities and deferred inflows of resources related to those assets.

Unrestricted – This component of net position is the amount of the assets, deferred outflows of resources, liabilities, and deferred inflows of resources that are not included in the determination of net investment in capital assets or the restricted component of net position.

When both restricted and unrestricted resources are available for use, it is the District's policy to use restricted resources first, then unrestricted resources as they are needed.

Note 2 – Summary of Significant Accounting Policies (Continued)

Property Taxes

Property taxes are levied on March 1 and are payable in two installments: November 1 and February 1 of each year. Property taxes become delinquent on December 10 and April 10, for the first and second installments, respectively. The lien date is March 1. The County of Los Angeles, California ("County") bills and collects property taxes and remits them to the District according to a payment schedule established by the County.

The County is permitted by State law to levy on properties at 1% of full market value (at time of purchase) and can increase the property tax rate at no more than 2% per year. The District receives a share of this basic tax levy proportionate to what it received during the years 1976-1978.

Property taxes are recognized in the fiscal year for which the taxes have been levied.

No allowance for doubtful accounts was considered necessary.

Use of Estimates

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect certain reported amounts and disclosure. Accordingly, actual results could differ from those estimates.

Accounting Changes

GASB Statement No. 75, *Accounting and Financial Reporting for Postemployment Benefits Other Than Pensions.* This statement applies to government employers who provide OPEB to their employees and for governments that finance OPEB for employees of other governments. This statement basically parallels GASB Statement 68 and replaces GASB Statement 45. Application of this statement is effective for the District's fiscal year ended June 30, 2018.

GASB Statement No. 81, *Irrevocable Split-Interest Agreements.* This Statement requires that a government that receives resources pursuant to an irrevocable split-interest agreement recognize assets, liabilities, and deferred inflows of resources at the inception of the agreement. Furthermore, this Statement requires that a government recognize assets representing its beneficial interests in irrevocable split-interest agreements that are administered by a third party, if the government controls the present service capacity of the beneficial interests. This Statement requires that a government recognize revenue when the resources become applicable to the reporting period. Application of this statement did not have a significant effect on the District's fiscal year ending June 30, 2018.

GASB Statement No. 85, *Omnibus 2017.* This Statement addresses practice issues that have been identified during implementation and application of certain GASB Statements. This Statement also addresses a variety of topics including issues related to blending component units, goodwill, fair value measurement and application, and postemployment benefits (pensions and other postemployment benefits [OPEB]). Application of this statement did not have a significant effect on the District's fiscal year ending June 30, 2018.

GASB Statement No. 86, *Certain Debt Extinguishment Issues.* This Statement improves consistency in accounting and financial reporting for in-substance defeasance of debt by providing guidance for transactions in which cash and other monetary assets acquired with only existing resources—resources other than the proceeds of refunding debt—are placed in an irrevocable trust for the sole purpose of extinguishing debt. This Statement also improves accounting and financial reporting for prepaid insurance on debt that is extinguished and notes to financial statements for debt that is defeased in substance. Application of this statement did not have a significant effect on the District's fiscal year ending June 30, 2018.

Note 3 – Cash and Investments

At June 30, 2018, cash and investments are classified in the accompanying statements of net position as follow:

	Primary Government	Discretely Presented Component Unit - JPA	Total
Unrestricted Assets:			
Cash and cash equivalents	$ 27,811,040	$ 4,282,084	$ 32,093,124
Investments	47,206,546	972,870	48,179,416
Restricted Assets:			
Cash and cash equivalents	2,766,678	-	2,766,678
Total cash and investments	$ 77,784,264	$ 5,254,954	$ 83,039,218

At June 30, 2018, cash and investments consisted of the following:

	Primary Government	Discretely Presented Component Unit - JPA	Total
Deposits:			
Demand Deposits	$ 9,679	$ 692,269	$ 701,948
Petty Cash	2,200	-	2,200
Total deposits	11,879	692,269	704,148
Investments:			
Municipal Bonds	9,722,457	-	9,722,457
U.S. Government Sponsored Agency Security	33,403,680	972,870	34,376,550
Certificate of Deposit	4,080,409	-	4,080,409
California Local Agency Investment Fund	27,799,161	3,589,815	31,388,976
Total investments	75,005,707	4,562,685	79,568,392
Investments with Fiscal Agents:			
California Local Agency Investment Fund	2,766,678	-	2,766,678
Total investments with fiscal agents	2,766,678	-	2,766,678
Total cash and investments	$ 77,784,264	$ 5,254,954	$ 83,039,218

The statements of cash flows for the year ended June 30, 2018 have been prepared by considering the following deposits and investment instruments to be cash and cash equivalents:

	Primary Government	Discretely Presented Component Unit - JPA	Total
Demand Deposits	$ 9,679	$ 692,269	$ 701,948
Petty Cash	2,200	-	2,200
California Local Agency Investment Fund	30,565,839	3,589,815	34,155,654
Total cash and cash and cash equivalents	$ 30,577,718	$ 4,282,084	$ 34,859,802

Note 3 – Cash and Investments (Continued)

Fair Value Measurement

At June 30, 2018, investments are reported at fair value. The following table presents the fair value measurement of investments on a recurring basis and the levels within GASB 72 fair value hierarchy in which the fair value measurements fall at June 30, 2018:

	Significant Other Observable Input (Level 2)	Uncategorized	Total
Municipal Bonds	$ 9,722,457	$ -	$ 9,722,457
Federal Agricultural Mortgage Corporation	969,390	-	969,390
Federal Farm Credit Bank	6,886,480	-	6,886,480
Federal Home Loan Bank	7,847,450	-	7,847,450
Federal Home Loan Mortgage Corporation	12,795,210	-	12,795,210
Federal Nation Mortgage Association	5,878,020	-	5,878,020
Certificate of Deposit	4,080,409	-	4,080,409
Local Agency Investment Fund	-	31,388,976	31,388,976
Investment with fiscal agents:			
Local Agency Investment Fund	-	2,766,678	2,766,678
Total investments	$ 48,179,416	$ 34,155,654	$ 82,335,070

Demand Deposits

Demand deposits are held in pool by the District. The carrying amounts of cash deposits were $701,948 at June 30, 2018. Bank balance at June 30, 2018 was $932,664, which were fully insured and/or collateralized with securities held by the pledging financial institutions in the District's name as discussed below.

The California Government Code requires California banks and savings and loan associations to secure the District's cash deposits by pledging securities as collateral. This Code states that collateral pledged in this manner shall have the effect of perfecting a security interest in such collateral superior to those of a general creditor. Thus, collateral for cash deposits is considered to be held in the District's name.

The fair value of pledged securities must equal at least 110% of the District's cash deposits. California law also allows institutions to secure the District's deposits by pledging first trust deed mortgage notes having a value of 150% of the District's total cash deposits. The District may waive collateral requirements for cash deposits, which are fully insured up to $250,000 by the Federal Deposit Insurance Corporation. The District, however, has not waived the collateralization requirements.

Note 3 – Cash and Investments (Continued)

California Local Agency Investment Funds

The District is a voluntary participant in the California Local Agency Investment Fund ("LAIF") that is regulated by California Government Code Section 18429 under the oversight of the Treasurer of the State of California. LAIF is overseen by the Local Agency Investment Advisory Board, which consists of five members, in accordance with State statute. The District's investments with LAIF include a portion of the pool funds invested in Structured Notes and Asset-Backed Securities. These investments include the following:

- **Structured Notes** – debt securities (other than asset-backed securities) whose cash flow characteristics (coupon rate, redemption amount, or stated maturity) depend upon one or more indices and/or that have embedded forwards or options.

- **Asset-Backed Securities** – the bulk of which are mortgage-backed securities, entitle their purchasers to receive a share of the cash flows from a pool of assets such as principal and interest repayments from a pool of mortgages (such as CMO's) or credit card receivables.

JPA's investment in LAIF was pooled with the District. As of June 30, 2018, the District had $34,155,654 invested in LAIF, which had invested 2.67% of the pool investment funds in Structured Notes and Asset-Backed Securities, respectively. The value of the investment in this pool is reported in the accompanying financial statements at amounts based upon the District's pro-rata share of the fair value provided by LAIF for the entire portfolio (in relation to the amortized cost of that portfolio). The balance available for withdrawal is based on the accounting records maintained by LAIF, which are reported at net asset value.

Investments Authorized by the California Code and The District's Investment Policy

The table below identifies the investment types that are authorized for the District by the California Government Code (or the District's investment policy, where more restrictive). The table also identifies certain provisions of the California Government Code (or the District's investment policy, where more restrictive) that address interest rate risk, credit risk, and concentration of credit risk.

This table does not address investments of debt proceeds held by bond trustees that are governed by the provisions of debt agreements of the District, rather than the general provisions of the California Government Code or the District's investment policy.

Authorized Investment Type	Maximum Maturity	Percentage of Portfolio	Maximum Investment in One Issuer
United States Treasury Bills, Bonds and Notes	5 years	None	None
United States Government Sponsored Agency Securities	5 years	None	None
Time Deposits	1 year	25%	None
Repurchase Agreements/Reverse Repurchase Agreement	30 days	25%/10%	None
California Local Agency Investment Fund (LAIF)	None	25%	$65,000,000
Bonds Issue by Local Agencies or States	5 years	None	None
Certificates of Deposits	5 years	25%	$250,000

Note 3 – Cash and Investments (Continued)

Investments Authorized by Debt Agreements

Investments of debt proceeds held by bond trustees are governed by provisions of the debt agreements, rather than the general provisions of the California Government Code or the District's investment policy. The table below identifies the investment types that are authorized for investments held by bond trustees. The table also identifies certain provisions of these debt agreements that address interest rate risk and concentration of risk.

Authorized Investment Type	Maximum Maturity	Percentage of Portfolio	Maximum Investment in One Issuer
United States Treasury Obligations	None	None	None
United States Government Sponsored Agency Securities	3 years	None	None
Time Deposits	360 days	None	None
Banker's Acceptances	360 days	None	None
Money Market Mutual Fund	None	None	None
Local Agency Fund	None	None	None
Commercial Paper	270 days	None	None
Investment Agreement	None	None	None
Other investments approved by bond insurer	None	None	None

Disclosures Relating to Interest Rate Risk

Interest rate risk is the risk that changes in market interest rates will adversely affect the fair value of an investment. Generally, the longer the maturity of an investment, the greater the sensitivity of its fair value to changes in market interest rates. One of the ways that the District manages its exposure to interest rate risk is by purchasing a combination of shorter term and longer term investments and by timing cash flows from maturities so that a portion of the portfolio is maturing or coming close to maturity as necessary to provide the cash flow and liquidity needed for operations.

Information about the sensitivity of the fair values of the District's investments (including investments held by bond trustee) to market interest rate fluctuations is provided by the following table that shows the distribution of the District's investments by maturity as of June 30, 2018.

	Remaining Maturity (in Years)					
Investment Type	Less Than 1 Year	1 to 2 Years	2 to 3 Years	3 to 4 Years	4 to 5 Years	Fair Value Total
Municipal Bonds	$ 903,725	$ 985,410	$ 4,854,263	$ 1,562,228	$ 1,416,831	$ 9,722,457
Federal Agricultural Mortgage Corporation	-	-	-	-	969,390	969,390
Federal Farm Credit Bank	1,985,140	1,976,330	-	-	2,925,010	6,886,480
Federal Home Loan Bank	1,992,430	-	977,960	1,941,740	2,935,320	7,847,450
Federal Home Loan Mortgage Corporation	-	1,969,650	1,963,310	3,894,830	4,967,420	12,795,210
Federal Nation Mortgage Association	-	3,931,850	1,946,170	-	-	5,878,020
Certificate of Deposit	488,870	971,389	717,654	709,635	1,192,861	4,080,409
Local Agency Investment Fund	31,388,976	-	-	-	-	31,388,976
Investment with fiscal agents:						
Local Agency Investment Fund	2,766,678	-	-	-	-	2,766,678
	$39,525,819	$ 9,834,629	$ 10,459,357	$ 8,108,433	$ 14,406,832	$ 82,335,070

Note 3 – Cash and Investments (Continued)

Disclosures Relating to Credit Risk

Generally, credit risk is the risk that an issuer of an investment will not fulfill its obligation to the holder of the investment. State law limits investments in commercial paper and corporate bonds to the top two ratings issued by nationally recognized statistical rating organizations (NRSROs). It is the District's policy to limit its investments in these investment types to the top rating issued by NRSROs, including raters Standard and Poor's, and Moody's Investors Service. Presented in the following table are the Standard and Poor's credit ratings for the Districts investments as of June 30, 2018.

Investment	Total As of June 30, 2018	Minimum Legal Requirement	AAA	AA+/-	A+	Unrated
Municipal Bonds	9,722,457	AA-	$ 1,969,820	$ 7,207,991	$ 544,646	$ -
Federal Agricultural Mortgage Corporation	969,390	None	-	-	-	969,390
Federal Farm Credit Bank	6,886,480	None	-	4,915,140	-	1,971,340
Federal Home Loan Bank	7,847,450	None	-	3,934,270	-	3,913,180
Federal Home Loan Mortgage Corporation	12,795,210	None	-	6,891,130	-	5,904,080
Federal Nation Mortgage Association	5,878,020	None	987,730	1,954,740	-	2,935,550
Certificate of Deposit	4,080,409	None	-	-	-	4,080,409
Local Agency Investment Fund	31,388,976	None	-	-	-	31,388,976
Investment with fiscal agents:						
Local Agency Investment Fund	2,766,678	None	-	-	-	2,766,678
	$ 82,335,070		$ 2,957,550	$ 24,903,271	$ 544,646	$ 53,929,603

Disclosures Relating to Concentration of Credit Risk

Investments in any one issuer that represents 5% or more of total District's investments (excluding cash with fiscal agents) are as follows:

Issuer	Investment Type	Reported Amount	Percentage of Investments
Federal Farm Credit Bank	United States Government Sponsored Agency Securities	$ 6,886,480	8.65%
Federal Home Loan Bank	United States Government Sponsored Agency Securities	7,847,450	9.86%
Federal Home Loan Mortgage Corporation	United States Government Sponsored Agency Securities	12,795,210	16.08%
Federal National Mortgage Association	United States Government Sponsored Agency Securities	5,878,020	7.39%

Note 3 – Cash and Investments (Continued)

Disclosures Relating to Custodial Credit Risk

The custodial credit risk for investments is the risk that, in the event of the failure of the counterparty (e.g., broker-dealer) to a transaction, a government will not be able to recover the value of its investment or collateral securities that are in the possession of another party. The California Government Code and the District's investment policy do not contain legal or policy requirements that would limit the exposure to custodial credit risk for investments. With respect to investments, custodial credit risk generally applies only to direct investments in marketable securities. Custodial credit risk does not apply to a local government's indirect investment in securities through the use of mutual funds or government investment pools (such as LAIF).

Note 4 – Accounts Receivable

Accounts receivable primarily consist of sales and services fees as well as the District's allocation of property taxes collected but not remitted by the Los Angeles County. As of June 30, 2018, sales and services receivable, net of allowance for uncollectible accounts, was in the amount of $7,468,124 for the District and $1,112,207 for the JPA, respectively.

Note 5 – Inventories

Inventories consisted of the following as of June 30, 2018:

Primary Government		
Material and supplies	$	875,683
Water in storage		6,160,748
Total	$	7,036,431
Discretely Presented Component Unit - JPA		
Material and supplies	$	171,555

Water in storage was calculated by taking the volume of the reservoir and tanks times the average cost per acre foot.

Note 6 – Investment in Joint Powers Authority

The District was the designated administering agent for the Las Virgenes-Triunfo Joint Powers Authority ("JPA"). Costs and capital contributions are generally shared by the two districts in accordance with capacity rights reserved in each component of the joint system. Maintenance and operating costs are pro-rated to the districts in accordance with the average monthly flows contributed by each to the system. The allocation of construction costs related to projects in process is based upon engineering estimates of the capacity rights and is subject to increase or decrease when final costs are determined.

Note 6 – Investment in Joint Powers Authority (Continued)

Summary of changes in investment in Joint Powers Authority is as follows:

Beginning of year	$	62,556,150
Contributions		13,683,030
Share in income (loss):		
Sanitation expenses		(9,545,571)
Depreciation expenses		(4,172,500)
Loss on disposal of capital assets		(152)
End of year	$	62,520,957

Investment in Joint Powers Authority includes capitalized interests for the debt issued for the JPA's facilities held under the District's name as follows:

Primary government's net investment in JPA's capital assets	$	60,563,415
Capitalized interest, net		1,957,542
Investment in JPA	$	62,520,957

Condensed financial statement of the JPA as of and for the year ended June 30, 2018 including the participants' approximate percentage shares as follows:

	Amount	Las Virgenes Municipal Water District	Triunfo Sanitation District
Total assets	$ 97,785,119	66%	34%
Total liabilities	6,310,491	67%	33%
Total equity	91,174,625	66%	34%
Billings to participants	13,264,203	68%	32%
Depreciation	5,695,161	70%	30%
Construction cost	6,097,896	71%	29%

The amount due from the JPA at June 30, 2018 consisted of the following:

Beginning of year	$	4,097,705
Additions (Deletions)		(1,267,600)
End of year	$	2,830,105

Note 7 – Capital Assets

Primary Government

Summary of changes in capital assets for the year ended June 30, 2018 is as follows:

	Balance July 1, 2017	Additions	Deletions	Reclassification	Balance June 30, 2018
Capital assets, not depreciated					
Land and land rights:					
Water plant	$ 6,804,099	$ 12	$ -	$ -	$ 6,804,111
Sanitation plant	111,235	-	-	-	111,235
Construction in progress	6,108,328	1,733,846	(39,554)	(6,513,064)	1,289,556
Total capital assets, not depreciated	13,023,662	1,733,858	(39,554)	(6,513,064)	8,204,902
Capital assets, being depreciated					
Water plant:					
Source of supply	41,737,630	-	-	-	41,737,630
Plant	118,986,331	987,670	(127,117)	5,912,188	125,759,072
Structure	20,512,668	14,679	(1,868)	146,975	20,672,454
Sanitation plant:					
Plant	7,472,620	-	-		7,472,620
Machinery and equipment	17,318	-	-		17,318
General utility plant					
Building and improvements	22,023,030	-	(129,165)	200,478	22,094,343
Machinery and equipment	11,084,233	47,603	(58,211)	253,422	11,327,047
Total capital assets, being depreciated	221,833,830	1,049,952	(316,361)	6,513,063	229,080,484
Less accumulated depreciation					
Water plant:					
Source of supply	(10,442,596)	(906,051)	-	-	(11,348,647)
Plant	(54,918,909)	(1,824,542)	83,041	-	(56,660,410)
Structure	(17,586,292)	(192,560)	1,869	-	(17,776,983)
Sanitation plant:					
Plant	(3,766,851)	(147,851)	-	-	(3,914,702)
Machinery and equipment	(16,454)	(866)	-	-	(17,320)
General utility plant					
Building and improvements	(12,454,599)	(520,175)	88,252	-	(12,886,522)
Machinery and equipment	(9,862,231)	(351,076)	58,211	-	(10,155,096)
Total accumulated depreciation	(109,047,932)	(3,943,121)	231,373	-	(112,759,680)
Total capital assets, being depreciated, net	112,785,898	(2,893,169)	(84,988)	6,513,063	116,320,804
Total capital assets, net	$ 125,809,560	$ (1,159,311)	$ (124,542)	$ -	$ 124,525,706

Note 7 – Capital Assets (Continued)

Discretely Presented Component Unit – JPA

Summary of changes in capital assets for the year ended June 30, 2018 is as follows:

	Balance July 1, 2017	Additions	Deletions	Reclassification	Balance June 30, 2018
Capital assets, not depreciated					
Land and land rights	$ 12,258,791	$ -	$ -	$ 2,109,359	$ 14,368,150
Construction in progress	3,039,783	5,860,424	-	(3,945,735)	4,954,472
Total capital assets, not depreciated	15,298,574	5,860,424	-	(1,836,376)	19,322,622
Capital assets, being depreciated					
Sewer and treatment plant	120,681,832	-	(6,215)	419,159	121,094,776
Compost plant and farm	71,196,292	-	(9,278)	595,872	71,782,886
Recycled water system	34,013,089	-	(15,030)	821,345	34,819,404
Total capital assets, being depreciated	225,891,213	-	(30,523)	1,836,376	227,697,066
Less accumulated depreciation					
Sewer and treatment plant	(81,808,847)	(2,821,922)	6,215	-	(84,624,554)
Compost plant and farm	(48,236,081)	(1,888,398)	9,278	-	(50,115,201)
Recycled water system	(20,135,282)	(984,841)	14,816	-	(21,105,307)
Total accumulated depreciation	(150,180,210)	(5,695,161)	30,309	-	(155,845,062)
Total capital assets, being depreciated, net	75,711,003	(5,695,161)	(214)	1,836,376	71,852,004
Total capital assets, net	$ 91,009,577	$ 165,263	$ (214)	$ -	$ 91,174,626

Note 8 – Compensated Absences

Summary of changes in compensated absences for the year ended June 30, 2018 is as follows:

Balance July 1, 2017	Additions	Deletions	Balance June 30, 2018	Due within One Year	Due in More than One Year
$ 2,123,351	$ 895,961	$ (867,312)	$ 2,152,000	$ 938,425	$ 1,213,575

Note 9 – Long-Term Debt

Summary of changes in long-term debt for the year ended June 30, 2018 is as follows:

	Balance July 1, 2017	Additions	Deletions	Balance June 30, 2018	Due within One Year	Due in More Than One Year
2009 Sanitation Refunding Revenue Bonds	$ 16,795,000	$ -	$ (2,125,000)	$ 14,670,000	$ 2,210,000	$ 12,460,000
Add: Unamortized Premium	1,022,141	-	(159,295)	862,846	-	862,846
Capital Lease	84,846	-	(21,467)	63,379	23,076	40,303
Total long-term debt	$ 17,901,987	$ -	$ (2,305,762)	$ 15,596,225	$ 2,233,076	$ 13,363,149

Note 9 – Long-Term Debt (Continued)

2009 Sanitation Refunding Revenue Bonds

The District issued sanitation refunding revenue bonds ("2009 bonds") dated December 1, 2009, totaling $29,415,000. The purpose of the 2009 bonds was to advance refund 1998 Installment Purchase Refunding Revenue Bonds.

The 2009 bonds mature through November 1, 2023, and bear interest at rates ranging from 1.00% to 5.00%. Interest is payable semiannually on May 1 and November 1, beginning May 1, 2010. The 2009 bonds are subject to optional early redemption provisions. The 2009 bonds fully mature on November 1, 2023.

The District completed the refunding to reduce its debt service over the next 14 years by approximately $7,604,000 and to obtain an economic gain (difference between the present values of the old and new debt service payments) of approximately $4,796,000.

Total balance outstanding as of June 30, 2018, net of unamortized premium was as follows:

Principal outstanding	$ 14,670,000
Add unamortized premium	862,846
Net bonds outstanding	$ 15,532,846

The annual debt service requirements at June 30, 2018 are as follows:

Year Ending June 30,	Principal	Interest	Total
2019	$ 2,210,000	$ 541,225	$ 2,751,225
2020	2,305,000	450,450	2,755,450
2021	2,400,000	353,825	2,753,825
2022	2,480,000	272,975	2,752,975
2023	2,580,000	174,075	2,754,075
2024	2,695,000	58,513	2,753,513
Total	$ 14,670,000	$ 1,851,063	$ 16,521,063

Capital Leases

The District entered into various leases agreement for the copiers at interest rates range from 2% to 6.72%. These leases are classified as capital leases and have been recorded at the present value of the future minimum lease payments at the inception date of the leases. The assets acquired through capital leases are included in the District's capital assets in the amount of $128,377, net of accumulated depreciation in the amount of $58,817.

Year Ended June 30,	
2019	23,076
2020	24,815
2021	15,488
Subtotal	63,379
Less amount representing interest	6,376
Present value of future minimum lease payments	$ 69,755

Note 10 – Pension Plan – Defined Benefit Plan

The Net pension liabilities and the related deferred outflows of resources and deferred inflows of resources at June 30, 2018 are as follows:

Deferred outflows of resources:		
Pension contribution after measurement date	$	2,063,540
Projected earning on pension plan investments in excess of actual earnings on pension plan investments		919,804
Changes of assumption		3,585,046
Total deferred outflows of resources	$	6,568,390
Net pension liabilities:		
Net pension liabilities	$	20,493,355
Total net pension liabilities	$	20,493,355
Deferred inflows of resources:		
Difference between expected and actual experiences	$	2,098,046
Changes of assumption		175,573
Total deferred inflows of resources	$	2,273,619

General Information about the Pension Plan

Plan Description

The District contributes to the California Public Employees' Retirement System ("CalPERS"), an agent multiple-employer public employee defined benefit pension plan. CalPERS acts as a common investment and administrative agent for participating public entities within the State of California. Benefit provisions and all other requirements are established by state statute. A full description of the pension plan regarding number of employees covered, benefit provisions, assumptions (for funding, but not accounting purposes), and membership information are listed in the June 30, 2016 Annual Actuarial Valuation Report. This report and CalPERS' audited financial statements are publicly available reports that can be obtained at CalPERS' website under Forms and Publications.

Benefits Provided

CalPERS provides retirement and disability benefits, annual cost-of-living adjustments, and death benefits to plan members and beneficiaries. A classic CalPERS member becomes eligible for service retirement upon attainment of age 55 with at least 5 years of credited service. PEPRA miscellaneous members become eligible for service retirement upon attainment of age 62 with at least 5 years of service. The service retirement benefit is a monthly allowance equal to the product of the benefit factor, years of service, and final compensation. The final compensation is the monthly average of the member's highest 36 or 12 consecutive months' full-time equivalent monthly pay. Retirement benefits for classic miscellaneous employees are calculated as 2% of the average final 12 months compensation. Retirement benefits for PEPRA miscellaneous employees are calculated as 2% of the average final 36 months compensation.

Note 10 – Pension Plan – Defined Benefit Plan (Continued)

General Information about the Pension Plan (Continued)

Benefits Provided (Continued)

Participant is eligible for non-industrial disability retirement if becomes disabled and has at least 5 years of credited service. There is no special age requirement. The standard non-industrial disability retirement benefit is a monthly allowance equal to 1.8 percent of final compensation, multiplied by service. Industrial disability benefits are not offered. Upon the death of a retiree, a one-time lump sum payment of $500 will be made to the retiree's designated survivor(s), or to the retiree's estate.

Benefit terms provide for annual cost-of-living adjustments to each employee's retirement allowance. Beginning the second calendar year after the year of retirement, retirement and survivor allowances will be annually adjusted on a compound basis by 3 percent.

Employees Covered by Benefit Terms

At June 30, 2016 valuation date, the members covered by the benefit terms are as follow:

Active employees	111
Transferred and terminated employees	74
Retired employees and beneficiaries	141
	326

Contributions

Section 20814(c) of the California Public Employees' Retirement Law ("PERL") requires that the employer contribution rates for all public employers be determined on an annual basis by the actuary and shall be effective on the July 1 following notice of a change in the rate. The total plan contributions are determined through CalPERS' annual actuarial valuation process. The actuarially determined rate is the estimated amount necessary to finance the costs of benefits earned by employees during the year, with an additional amount to finance any unfunded accrued liability. The employer is required to contribute the difference between the actuarially determined rate and the contribution rate of employees. For the measurement period ended June 30, 2017, the employees' contribution rate was 6.990% of annual pay, and the employer's contribution rate was 17.351% of employee annual payroll, respectively.

Note 10 – Pension Plan – Defined Benefit Plan (Continued)

Net Pension Liability

Actuarial Methods and Assumptions Used to Determine Total Pension Liability

For the measurement periods ended June 30, 2017, the total pension liability was determined by rolling forward the June 30, 2016 total pension liability, respectively. The June 30, 2017 total pension liabilities were based on the following actuarial methods and assumptions:

Actuarial Cost Method	Entry Age Normal
Actuarial Assumptions:	
Discount Rate	7.15%
Inflation	2.75%
Salary Increases	Varies by Entry Age and Service
Investment Rate of Return	7.65%
Mortality Rate Table	Derived using CalPERS' Membership Data for all Funds. The mortality table used was developed based on CalPERS' specific data. The table includes 20 years of mortality improvements using Society of Actuaries Scale BB.
Post Retirement Benefit Increase	Contract COLA up to 2.75% until Purchasing Power Protection Allowance Floor on Purchasing Power applies, 2.75% thereafter

All other actuarial assumptions used in the June 30, 2016 valuation was based on the results of an actuarial experience study for the period from 1997 to 2011, including updates to salary increase, mortality and retirement rates. The Experience Study report can be obtained at CalPERS' website under Forms and Publications.

Discount Rate

The discount rate used to measure the June 30, 2017 total pension liability was 7.15 percent. To determine whether the municipal bond rate should be used in the calculation of the discount rate for each plan, CalPERS stress tested plans that would most likely result In a discount rate that would be different from the actuarially assumed discount rate. The tests revealed the assets would not run out. Therefore, the current 7.15 percent discount rate is appropriate and the use of the municipal bond rate calculation is not deemed necessary. The long-term expected discount rate of 7.15 percent is applied to all plans in the Public Employees' Retirement Fund ("PERF"). The cash flows used in the testing were developed assuming that both members and employers will make their required contributions on time and as scheduled In all future years. The stress test results are presented In a detailed report called "GASB Crossover Testing Report" that can be obtained at CalPERS website under the GASB 68 section.

The long-term expected rate of return on pension plan Investments was determined using a building-block method In which expected future real rates of return (expected returns, net of pension plan Investment expense and Inflation) are developed for each major asset class

Note 10 – Pension Plan – Defined Benefit Plan (Continued)

Net Pension Liability (Continued)

Discount Rate (Continued)

In determining the long-term expected rate of return, CalPERS took into account both short-term and long-term market return expectations as well as the expected pension fund (PERF) cash flows. Taking Into account historical returns of all the Public Employees Retirement Funds' asset classes (which Includes the agent plan and two cost-sharing plans or PERF A, B, and C funds), expected compound (geometric) returns were calculated over the short-term (first 10 years) and the long-term (11-60 years) using a building-block approach. Using the expected nominal returns for both short-term and long-term, the present value of benefits was calculated for each PERF fund. The expected rate of return was set by calculating the single equivalent expected return that arrived at the same present value of benefits for cash flows as the one calculated using both short-term and long-term returns. The expected rate of return was then set equal to the single equivalent rate calculated above and rounded down to the nearest one quarter of one percent.

The table below reflects long-term expected real rate of return by asset class. The rate of return was calculated using the capital market assumptions applied to determine the discount rate and asset allocation. Tile target allocation shown was adopted by the Board effective on July 1, 2016.

Asset Class	New Strategic Allocation	Real Return Years 1 - 10[1]	Real Return Years 11+[2]
Global Equity	47.00%	4.90%	5.38%
Global Fixed Income	19.00%	0.80%	2.27%
Inflation Sensitive	6.00%	0.60%	1.39%
Private Equity	12.00%	6.60%	6.63%
Real Estate	11.00%	2.80%	5.21%
Infrastructure and Forestland	3.00%	3.90%	5.36%
Liquidity	2.00%	-0.40%	-0.90%
	100.00%		

[1] An expected inflation of 2.5% used

[2] An expected inflation of 3.0% used

Note 10 – Pension Plan – Defined Benefit Plan (Continued)

Changes in the Net Pension Liability

The following table shows the changes in net pension liability recognized over the measurement period of July 1, 2016 to June 30, 2017.

	Increase (Decrease)		
	Total Pension Liability (a)	Plan Fiduciary Net Position (b)	Net Pension Liability/(Asset) (c) = (a) - (b)
Balance at June 30, 2015 (Valuation Date)	$ 88,299,511	$ 68,736,476	$ 19,563,035
Changes Recognized for the Measurement Period:			
Service cost	1,813,978	-	1,813,978
Interest on the total pension liability	6,456,858	-	6,456,858
Changes of benefit terms	-	-	-
Difference between expected and actual experience	(2,211,229)	-	(2,211,229)
Changes of assumptions	5,214,612	-	5,214,612
Contributions from the employer	-	1,992,743	(1,992,743)
Contributions from employees	-	741,264	(741,264)
Net investment income, net of administrative expense	-	7,711,377	(7,711,377)
Benefit payments, including refunds of employee contributions	(3,808,359)	(3,808,359)	-
Administrative expense	-	(101,485)	101,485
Net Changes during July 1, 2015 to June 30, 2016	7,465,860	6,535,540	930,320
Balance at June 30, 2016 (Measurement Date)	$ 95,765,371	$ 75,272,016	$ 20,493,355

Sensitivity of the Net Pension Liability to Changes in the Discount Rate

The following presents the net pension liability of the Plan as of the measurement date, calculated using the discount rate of 7.15%, as well as what the net pension liability would be if it were calculated using a discount rate that is 1 percentage-point lower (6.15%) or 1 percentage-point higher (8.15%) than the current rate:

	Plan's Net Pension Liability/(Asset)		
	Discount Rate - 1% (6.15%)	Current Discount Rate (7.15%)	Discount Rate + 1% (8.15%)
June 30, 2017 Measurement Date	$ 33,105,020	$ 20,493,355	$ 9,989,785

Note 10 – Pension Plan – Defined Benefit Plan (Continued)

Changes in the Net Pension Liability (Continued)

Pension Plan Fiduciary Net Position

Detailed information about the plan's fiduciary net position is available in the separately issued CalPERS financial report.

For the measurement periods ended June 30, 2017, the District incurred a pension expense of $2,126,219.

As of measurement date of June 30, 2017, the District has deferred outflows and deferred inflows of resources related to pensions as follows:

	Deferred outflows of Resources	Deferred inflows of Resources
Pension contribution made after the measurement period	$ 2,063,540	$ -
Difference between expected and actual experience	-	(2,098,046)
Changes of assumptions	3,585,046	(175,573)
Net difference between projected and actual earning on pension plan investments	919,804	-
Total	$ 6,568,390	$ (2,273,619)

The amounts above are net of outflows and inflows recognized in the 2016-17 measurement period.

The expected average remaining service lifetime (EARSL) is calculated by dividing the total future service years by the total number of plan participants (active, inactive, and retired). The EARSL for the Plan for the 2016-17 measurement periods is 3.2 years, which was obtained by dividing the total service years of 1,042 (the sum of remaining service lifetimes of the active employees) by 324 (the total number of participants: active, inactive, and retired).

Pension Expense and Deferred Outflows and Deferred Inflows of Resources Related to Pensions

$2,063,540 reported as deferred outflows of resources related to pension resulting from the District's contributions subsequent to the measurement date during the year ended June 30, 2017 is recognized as a reduction of the net pension liability in the years ended June 30, 2018. Other amounts reported as deferred outflows and deferred inflows of resources related to pensions will be recognized in future pension expense as follows:

Year Ended June 30,	Deferred Outflows/(Inflows) of Resources
2019	$ 148,069
2020	2,049,262
2021	604,017
2022	(570,117)
	$ 2,231,231

Note 11 – Other Post-Employment Benefits

Aggregate net OPEB liability and deferred outflows of resources are reported in the accompanying Statement of Net Position as follows:

Deferred outflows of resources:		
OPEB contribution after measurement date	$	1,632,555
Total deferred outflows of resources	$	1,632,555
Net OPEB liabilities:		
Net OPEB liabilities	$	19,183,096
Total net OPEB liabilities	$	19,183,096

General Information about the OPEB Plan

Plan Description

The District contributes to a multi-employer defined benefit plan to provide post-employment medical benefits. Specifically, the District provides postretirement medical benefits to all employees who retire from the District. The level of benefit and vesting time varies based on the entry date and employee bargaining unit. Benefits range from 100% coverage for employee plus one dependent after 5 years of service to 75% of lowest cost plan for employee only after 10 years of service. The plan does not provide a publicly available financial report.

The District has elected to join the *California Employers' Retiree Benefit Trust* (the "Trust") in accordance with GASB Statement No. 75, which provides a means to fund the annual OPEB costs, referred to as the *Actuarially Determined Contribution* (ADC). The ADC includes the normal cost (current accrual for benefits being earned) plus an amortization of the unfunded accrued liability or net OPEB liability over 15 years on level-percentage of pay basis. The ADC for fiscal year ended 2018 was $1,553,193.

Eligibility

Employees of the District are eligible for retiree health benefits if they retire from the District and commence pension benefits under PERS (typically on or after age 50 with at least five years of PERS eligible service). Membership in the plan consisted of the following at June 30, 2017, the date of the latest actuarial valuation

Active employees	109
Retired employees and beneficiaries	85
	194

Note 11 – Other Post-Employment Benefits (Continued)

Net OPEB Liability

Actuarial Assumptions

The net OPEB liability in the June 30, 2017 actuarial valuation was determined using the following actuarial assumptions, applied to all periods included in the measurement, unless otherwise specified:

Actuarial Cost Method	Entry Age Normal
Actuarial Assumptions:	
Discount Rate	6.00%
Inflation	2.75%
Salary Increases	Varies by Entry Age and Service
Investment Rate of Return	6.00%
Mortality Rate Table	2014 CalPERS Active Mortality for Miscellaneous Employees
Retirement Rates	Hired before 2013: 2009 CalPERS 2.0%@55 Rates for Miscellaneous Employees. Hired after 2012: 2009 CalPERS Retirement Rates for Miscellaneous Employees 2%@60 adjusted to minimum retirement age of 52

The actuarial assumptions used in the June 30, 2017 valuation were based on the results of an actuarial experience study for the period July 1, 2016 to June 30, 2017

Discount Rate

The discount rate used to measure the net OPEB liability was 7.0%. This discount rate assumes the District continues to fully fund for its retiree health benefits through the California Employers' Retiree Benefit Trust (CERBT) under its investment allocation strategy 1. The rate reflects the CERBT published median interest rate for strategy 1 of 7.28% with an additional margin for adverse deviation.

The table below reflects long-term expected real rate of return by asset class. The rate of return was calculated using the capital market assumptions applied to determine the discount rate and asset allocation. These geometric rates of return are net of administrative expenses.

Asset Class	Percentage of Portfolio	Real Return[1]
US Large Cap	24.00%	7.795%
Long-Term Corporate Bonds	34.00%	5.295%
Long-Term Government Bonds	8.00%	4.500%
US Small Cap	8.00%	7.795%
Treasury Inflation Protected Securities (TIPS)	15.00%	7.795%
US Real Estate	8.00%	7.795%
All Commodities	3.00%	7.795%
	100.00%	

Note 11 – Other Post-Employment Benefits (Continued)

Change in the Net OPEB Liability

	Increase (Decrease)		
	Total OPEB Liability (a)	Plan Fiduciary Net Position (b)	Net OPEB Liability/(Asset) (c) = (a) - (b)
Balance at June 30, 2016 (Valuation Date)	$ 23,976,480	$ 4,254,341	$ 19,722,139
Changes Recognized for the Measurement Period:			
Service cost	174,032	-	174,032
Interest on the total OPEB liability	1,412,981	-	1,412,981
Contributions from the employer	-	1,657,742	(1,657,742)
Net investment income, net of administrative expense	-	472,252	(472,252)
Benefit payments, including refunds of employee contributions	(1,022,844)	(1,022,844)	-
Administrative expense	-	(3,938)	3,938
Net Changes during July 1, 2016 to June 30, 2017	564,169	1,103,212	(539,043)
Balance at June 30, 2017 (Measurement Date)	$ 24,540,649	$ 5,357,553	$ 19,183,096

Sensitivity of the Net OPEB Liability to Changes in the Discount Rate

The following presents the net OPEB liability of the District, as well as what the District's net OPEB liability would be if it were calculated using a discount rate 1-percentage point lower (5.00%) or 1-percentage point higher (7.00%) than the current discount rate:

	Plan's OPEB Liability/(Asset)		
	Discount Rate - 1% (5.00%)	Current Discount Rate (6.00%)	Discount Rate + 1% (7.00%)
June 30, 2017 Measurement Date	$ 22,667,120	$ 19,183,096	$ 16,364,870

OPEB Liabilities, OPEB Expense and Deferred Outflows/Inflows of Resources to OPEB

Under GASB 74 and 75, OPEB expense includes service cost, interest cost, change in Total OPEB Liability ("TOL") due to plan changes; all adjusted for deferred inflows and outflows. The District determined that it was not reasonable to rerun prior valuations under GASB 75. Therefore, we used the transition approach provided in GASB 75, Paragraph 244 where in circumstances in which OPEB is provided through OPEB plans that are not administered through trusts, no other beginning balances for deferred outflows of resources and deferred inflows of resources related to OPEB should be reported. If restatement of all prior periods presented is not practical, the cumulative effect, if any, of applying this Statement should be reported as a restatement of beginning net position (or fund balance or fund net position, as applicable) for the earliest period restated. That means that there are no deferred inflows/outflows in the first year (with the possible exception of contributions after the measurement date).The OPEB expense shown below is considered to be preliminary because there can be employer specific deferred items (e.g., contributions made after the measurement date, and active employee contributions toward the OPEB plan).

Note 11 – Other Post-Employment Benefits (Continued)

OPEB Liabilities, OPEB Expense and Deferred Outflows/Inflows of Resources to OPEB (Continued)

Certain types of TOL changes are subject to deferral, as are investment gains/losses. To qualify for deferral, gains and losses must be based on GASB 74/75 compliant valuations. Since the District's prior valuation was performed in accordance with GASB 43/45, it is not practical to calculate compliant deferred outflows and inflows as stated in GASB 75 Appendix E, Paragraph 244. Therefore, valuation-based deferred items will not begin until the next valuation. However, there could be employer-specific deferred items that need to be reflected, as mentioned earlier.

For the year ended June 30, 2018, the City recognized OPEB expense of $1,118,700 for the District Plan. At June 30, 2018, the City reported deferred outflows of resources and deferred inflows of resources related to OPEB from the following sources:

	Deferred outflows of Resources	Deferred inflows of Resources
OPEB contribution made after the measurement period	$ 1,632,555	$ -
Total	$ 1,632,555	$ -

Note 12 – Net Position

Net position represents the difference between assets, deferred outflows of resources, liabilities and deferred inflows of resources. Designations of unrestricted net position represent the District management's intentions for the use of resources. The net position amounts were as follows:

	Debt Service
Restricted Assets:	
Restricted cash and investments	$ 2,766,678
Restricted receivables	
Interest	12,090
Total restricted assets	2,778,768
Current Liabilities Payable from Restricted Assets:	
Interest payable	(95,729)
Total current liabilities payable from restricted assets	(95,729)
Total restricted net position	2,683,039
Total net position (deficit)	$ 2,683,039

Note 12 – Net Position (Continued)

As of June 30, 2018, the restricted net position for the District consisted of the following:

	Primary Government	Discretely Presented Component Unit - JPA
Net investments in capital assets:		
Capital assets, net of accumulated depreciation	$ 124,525,706	$ 91,174,626
Less:		
Capital lease obligations	(63,379)	-
2009 Sanitation refunding revenue bond, net	(14,668,382)	-
Total investment in capital assets, net of related debt	109,793,945	91,174,626
Restricted for:		
Debt Service	2,683,039	-
Total restricted	2,683,039	-
Unrestricted:		
Designated for:		
Investment in JPA	62,520,957	-
Rate stabilization	7,750,000	-
Insurance	7,554,513	-
Operating emergencies	13,466,301	-
Pure water	15,000,000	-
Undesignated	(425,417)	-
Total unrestricted	105,866,354	-
Total net position	$ 218,343,338	$ 91,174,626

Prior Period Adjustment

The District recorded the following prior period adjustments to the beginning net position in order to record beginning balances of OPEB-related items as part of GASB Statement 75 implementation.

Net position at July 1, 2017, as previously reported	$ 222,512,214
To implement GASB 75 for the net OPEB liability	(18,064,396)
Net position at July 1, 2017, as restated	$ 204,447,818

Note 13 – Risk Management

The District retained Tolman & Wiker Insurance Services, LLC, for general liability, property, inverse condemnation, auto and physical damage. In addition, reinsurance support for the program is provided by Swiss Reinsurance of America and Travelers Reinsurance. The coverage for the general liability provides $11 million per occurrence and $61 million in the aggregate with a $50,000 self insured retention limit per occurrence. The coverage for the property provides $61 million of coverage with a deductible of $50,000 per occurrence. The District paid premiums of $835,844 for the year ended June 30, 2018.

Effective August 1, 2012, the District retained the Association of California Water Agencies Joint Powers Insurance Authority (ACWA/APIA) for its workers' compensation insurance coverage. The District paid premiums of $284,687the year ended June 30, 2018.

Note 14 – Construction and Other Significant Commitments

Lawsuits

The District is a defendant in various lawsuits. Although the outcome of these lawsuits is not presently determinable, it is the option of the District's legal counsel and the District's management that resolution of these matters will not have a material adverse effect on the financial condition of the District.

Contract Commitments

As of June 30, 2018, the District had no material construction commitments evidenced by contractual commitments with contractors.

As of June 30, 2018, the JPA had five material construction commitments evidenced by contractual commitments with contractors in the amount of $171,713.

Project Name	Contractual Commitment
Pure Water Project Demonstration	$ 171,713
	171,713

ATTACHMENT 6

Relevant Service, Management, Operating, or Joint Powers Agreements

JOINT EXERCISE OF POWERS AGREEMENT

This Agreement is entered into this 26th day of January 2009 by and between LAS VIRGENES MUNICIPAL WATER DISTRICT, a California municipal water district formed pursuant to Water Code Section 71000, hereinafter referred to as "Las Virgenes," and TRIUNFO SANITATION DISTRICT, a California sanitation district formed pursuant to Health and Safety Code Section 4700, hereinafter referred to as "Triunfo."

RECITALS

A. The parties entered into a Joint Exercise of Powers Agreement dated July 1, 1982. The Agreement was amended on June 1, 1987 and March 26, 2003. The Agreement provides for the construction, operation and maintenance of a sewage collection, treatment and disposal system, recycled water system, and related ancillary facilities.

B. The parties to this Agreement wish to revise the Joint Exercise of Powers Agreement, as amended, and provide further clarification for the exercise of powers between the parties.

C. The purpose of this Agreement is to provide for the collection, treatment and disposal of sewage generated within the respective territorial limits of the parties. This Agreement replaces the prior Joint Exercise of Powers Agreement between the parties, and amendments thereto.

NOW, THEREFORE, it is agreed as follows:

ARTICLE ONE: GENERAL

1. Purpose. The purpose of this Article is to provide introductory terms applicable to the entire Agreement.

2. Definitions. The following terms are defined for the purposes of this Agreement:

   a. "Administering Agent" means Las Virgenes Municipal Water District.

   b. "Authority" means the separate entity created by this Agreement.

   c. "Board" means the governing body of the Authority.

d. "Joint System" means jointly owned facilities in Los Angeles and Ventura Counties presently as described in Exhibits A, B and C. Subsequently acquired joint facilities shall be identified in exhibits attached hereto.

3. Responsibilities.

Each party must adopt and enforce regulations to comply with regulations adopted by State and Federal agencies, including, but not limited to, pretreatment regulations. Currently, a pretreatment program, a suitable revenue program, and a system of equitable user charges are required because the Authority has received Federal assistance for the so-called Clean Water Act grant projects.

4. Authority Meetings. Meetings of the Authority shall be held at times and places as determined by the Board. The Chairs of the two (2) parties' governing boards will alternate annually as Chair and Vice-Chair, respectively, of the meetings.

5. Exercise of Power. The Board of the Authority consists of the board of directors of each party. The decisions of the Authority shall be made at meetings of the Board. The quorum for such meeting shall consist of at least three (3) members of the board of directors of each party. Action by the Authority requires the affirmative vote of not less than three (3) members of each party's board of directors, acting as the governing Board of the Authority.

6. Duty of Administering Agent. The Administering Agent shall provide, arrange and contract for the operation and maintenance of the Joint System. The Administering Agent shall administer the Authority and execute agreements as the agent for the Authority. At meetings of the Board, the Administering Agent shall report on the status of agreements or actions taken on behalf of the Authority. The Administering Agent shall use its best efforts to keep the parties and their staff informed of actions taken on behalf of the Authority.

7. Term. The term of this Agreement shall be ten (10) years commencing on the date first above written and shall automatically renew for additional ten-year (10-year) terms unless terminated earlier as provided herein. The Agreement shall be reviewed by a

committee of the General Manager, General Counsel, and two (2) directors from the board of each party.

8. Ownership of Property.

a. Real property necessary for the Joint System located in Ventura County shall be acquired by the joint partner and title shall be held in the name of Triunfo for the benefit of the Authority. Real property necessary for the Joint System and located in Los Angeles County shall be acquired by Las Virgenes and title shall be held in the name of Las Virgenes for the benefit of the Authority.

b. Personal property necessary for the Joint System and the operation of the Authority shall be acquired and held in the name of the Administering Agent.

ARTICLE TWO: BUDGET AND FINANCE

9. Purpose. This Article sets forth the procedures for adoption of an annual budget and how the finances of the Authority shall be handled.

10. Budget Process.

a. By February 10th of each year, each party may submit proposals to the Administering Agent for inclusion in the annual budget. The Administering Agent shall include proposals from both Districts in the proposed budget, covering the fiscal year commencing the next following July 1st. At a meeting in May of each year, the Administering Agent shall present such proposed budget directly to the Board at a meeting called and noticed for that purpose. The Chair and Vice Chair shall determine if more meetings are necessary prior to July 1st of each year.

b. The proposed budget will include expected revenue and expense for administration, operations and maintenance, and works of improvement in sufficient detail to enable the Board to determine whether each budget item or proposal is reasonably necessary to fulfill the mission of the Authority. Proposals to expand or upgrade a facility shall be included in the budget process.

c. If the budget has not been approved by the Board by July 1st of each year, the Administering Agent may expend monies for administration, operation, and

maintenance purposes. The expenditures for specific administration, operation and maintenance categories cannot be more than one hundred ten percent (110%) of the prior year's expenditures for the same category. The expenditures for capital projects approved during the prior year's budgets are also permitted.

11. Expenditures.

a. Budgeted.

(i) The Administering Agent shall expend money in accordance with the budget and with requirements of all applicable laws.

(ii) The Administering Agent shall present to the Authority a quarterly written report of budget expenditures with corresponding explanations as appropriate.

(iii) The Administering Agent shall process budgeted works of improvement as follows:

(a) Work estimated to cost less than Twenty-Five Thousand Dollars ($25,000) may be undertaken by the Administering Agent without further Authority approval.

(b) Work estimated to cost more than Twenty-Five Thousand Dollars ($25,000) shall be presented to the Board for approval. No further Authority action will be required after a preliminary design report is accepted by the Authority and the Authority approves proceeding with the work described in the preliminary design report.

b. Unbudgeted.

The Administering Agent may not construct works of improvement to expand or enlarge the Joint System unless authorized in the approved budget or by subsequent action of the Authority. However, the Administering Agent may spend money during an emergency. The Administering Agent shall report such emergency or action and proposed response in writing immediately to the Board as soon as the situation has stabilized. An emergency means a sudden, unexpected occurrence that poses a clear and imminent danger, requiring

immediate action to prevent or mitigate the loss or impairment of life, health, property, or essential public services, and further includes orders of a regulatory agency requiring immediate action or response and events requiring immediate response to avoid or to minimize the consequences of being in violation of a regulation.

12. Funds.

a. Operations Fund. An operations fund is established to provide for operation and replacement of the Joint System. Deposits to this fund shall be made by each party to provide for a three-month (3-month) working capital reserve. The Administering Agent shall provide monthly statements to the parties describing the amounts required for deposit in the fund to cover ongoing operating costs. Such amounts shall be submitted by the parties to the Administering Agent within thirty (30) days of the date of the statement.

b. Construction Fund. A construction fund is established to provide for the expansion of the Joint System to meet new customer demands. Each party shall submit money for their respective share of estimated project costs. If the bids for the work indicate the deposits are insufficient, the Administering Agent shall notify the parties. The parties shall submit additional money so that the Administering Agent will have sufficient project funding to complete the work.

13. Allocation of Costs.

a. Variable operation and maintenance costs shall be prorated between the parties based upon the average monthly sewage flow contributed to the Joint System by each party. As used herein, "variable operation and maintenance costs" means costs for sewage collection and treatment, solids and effluent disposal, which are a function of the amount of sewage entering the Joint System.

b. Fixed operation and maintenance costs shall be prorated between the parties, based on the parties' respective capacity rights in the facility. As used herein, "fixed operation and maintenance costs" means costs for sewage collection and treatment, solids and effluent disposal costs, which are not a function of the amount of sewage entering the Joint System.

c. Capital costs shall be prorated between the parties based upon the parties' respective capacity rights in the facility. As used herein, "capital costs" means costs of facilities or equipment to replace or augment existing capital improvements.

d. Annual audit costs shall be shared equally.

e. General and administrative costs shall be based upon the actual cost of labor. As used herein, "general and administrative costs" means accounting, personnel and general management expenses of the Administering Agent, and similar costs of each party approved in the annual budget.

f. Land acquisition costs shall be shared based upon the capacity rights in the project for which the land is acquired. As used herein, "land acquisition costs" or "land costs" means costs associated with acquisition of land, including interests in land and any professional services necessary for land acquisition.

14. Income.

a. The proceeds from the sale by the Authority or a commodity, including; but not limited to, compost/sludge, recycled water, or agricultural products, shall be credited to each party based upon the party's capacity rights in the facility or facilities producing the commodity.

b. The price for the sale of such commodity shall be approved by the Authority. In determining the price, the Authority shall consider such expense as debt service, replacement service, capital recovery, operation and maintenance costs, cost of the commodity production, the cost of supplemental water, and the value of the product.

c. Monies on deposit will be invested. Interest will be periodically credited to each party in proportion to each party's average monthly balance.

15. Surplus Property. The Authority may sell surplus real and personal property if the Board declares the property surplus. After other requirements of law concerning the disposal of surplus property are satisfied, the property shall be offered for sale to the highest bidder. Either party may purchase the property for the minimum price prior to the public sale. The Administering Agent shall remit the proceeds of the sale to each

party in proportion to each party's contribution to the initial purchase, or acquisition and replacement costs, if any.

16. Financial Records. The Administering Agent shall render an accounting of all funds and report on all receipts and expenditures for the review and audit of the parties. Annually the Administering Agent shall engage a certified public accountant, with the approval of the Authority, to perform an annual audit of the accounts and records for the operation and maintenance of the Joint System in accordance with generally accepted auditing principles and procedures. A copy of the Authority's annual audit shall be filed with the governing Boards of the parties within six (6) months of the end of the fiscal year under examination.

ARTICLE THREE: CAPACITY RIGHTS

17. Purpose. This Article allocates capacity between the parties for the use of the Joint System.

18. Capacity Rights. Each party may use a portion of the existing System. As of January 1, 2005, the Joint System, except for the sewer collection system, is apportioned between the parties with Las Virgenes having 70.6% and Triunfo having 29.4%. The joint sewer collection system capacity is apportioned between the parties as set forth in Exhibit A. If additional future collection, treatment or disposal facilities are constructed pursuant to this Agreement, the right to utilize capacity in those facilities shall be based upon the respective parties' contributions to the construction costs of the particular facility.

19. Use of Excess Capacity.

a. A party may use the other party's unused capacity on a month-to-month basis provided:

(i) The party using the other party's capacity shall pay: variable operation and maintenance costs based upon the amount of excess sewage contributed and the fair rental value of the part of the facility used.

(ii) Such excess capacity shall be transferred in minimal increments of 0.25 MGD, average dry weather flow.

(iii) The party providing the excess capacity may terminate the other party's use upon the giving of thirty (30) days' prior written notice that capacity is no longer surplus.

(iv) Upon termination of the temporary capacity rights, the party using the temporary capacity must reduce its flow to within its permanent capacity limits, or shall fully indemnify the other party for all costs, liabilities, damages and expenses incurred as a result of the usage of the other party's capacity.

b. Capacity rights shall not be assigned, conveyed or transferred by either party without the express written consent of the other party. Capacity rights may be permanently transferred from one party to the other party upon mutually agreeable terms and conditions.

20. Importation of Sewage. Sewage shall not be accepted from additional areas outside the service boundaries of the parties without the prior written approval of the other party, which approval shall not be unreasonably withheld. The areas served outside the boundaries of the Districts are shown on Exhibit D attached hereto. A party responsible for the importation of such sewage shall be solely liable for any financial or legal liabilities arising by reason of the importation of such sewage.

21. Single-User Facility.

a. The parties will make every effort to expand Authority facilities to meet new demands represented by additional sewage flow generated within the service areas of the parties by more stringent regulatory requirements. The preference of the parties is to construct new Authority facilities to meet the new demands. However, the parties might not agree on precisely how to meet emerging demands. When this occurs, a party may construct a "single-user facility" as set forth in this section.

b. The parties may construct, operate and maintain a single-user facility if: (1) the single-user facility does not interfere with the operation of the Authority facilities; (2) the single-user facility does not increase the cost of the existing Authority facilities; and (3) the proposed single-user facility does not increase a party's

share of the burden of the existing Authority facilities. In determining whether a proposed single-user facility will interfere with the operations and maintenance of the Authority facilities, the parties shall consider the current and future uses of the Authority facilities in relation to the single-user facility. In determining whether the single-user facility will increase the cost of the existing Authority facilities, the parties shall consider capital costs, operation and maintenance costs, and the value of the property. In determining whether a proposed single-user facility increases a party's share of the burden of the existing Authority facilities, the parties shall consider shared responsibilities such as the capacity, environmental impact, liability, and permits.

c. The parties are unable to describe every possible future single-user facility. However, the parties can establish the following procedure for evaluating a proposed single-user facility:

(i) Parties are expected to recommend the construction of Authority facilities for consideration by the Board of Directors of each party. A party which has suggested a facility rejected by the other party may then cause the project to be evaluated as a single-user facility.

(ii) The Administering Agent shall prepare a report describing whether the proposed single-user facility will impact the Authority facilities, whether it is possible to apportion the costs of a single-user facility in a way which does not impact the Authority facilities, and the impact on shared burden. The report shall be provided to the joint partner in a reasonable period of time prior to consideration by the Boards of Directors of Las Virgenes and Triunfo, but in no event, no less than thirty (30) days' advance notice.

(iii) The Boards of Directors of the Districts shall consider the report on the single-user facility at a joint meeting. The Boards shall also consider such other information as a party wishes to submit. The Boards shall decide whether a single-user facility can be constructed, operated and maintained in accordance with this provision and what, if any, arrangements must be made concerning apportionment of costs and capacity.

22. Allocation Upon Partial or Total Termination.

a. If the parties mutually agree to terminate the use of a portion of the Joint System or equipment, the Administering Agent may be directed to dispose of the property. The proceeds from the sale, if to a third party, shall be distributed to the parties in a proportion which reflects each party's contribution to the cost of the Joint System or the equipment being sold. The Joint System or equipment shall not be sold without making provision for repayment of any outstanding obligations on the Joint System or equipment.

b. If there is a total termination of the Joint System, or if there is a dispute between the parties as to the value of the property to be disposed, the value of a party's interest in the property shall be determined by appraisal as follows:

(i) Within five (5) days after the event requiring appraisal, the parties shall jointly appoint an appraiser for that purpose, or failing this joint action, each shall separately designate an appraiser, and within fifteen (15) days after their appointment, the two (2) designated appraisers shall jointly designate a third appraiser. The failure of either party to appoint an appraiser within the time allowed shall be deemed equivalent to appointing the appraiser appointed by the other party. No persons shall be appointed or designated an appraiser unless he is an M.A.I., S.R.A. appraiser or registered engineer having expertise in costing these types of facilities.

(ii) Within thirty (30) days after the appointment of all appraisers, a majority of the appraisers concur on the value of the interest being appraised, the appraisal shall be binding and conclusive. If a majority of the appraisers does not concur within that period, the determination of the appraiser whose appraisal is neither the highest nor the lowest shall be binding and conclusive.

(iii) The parties will share the appraisal expenses equally.

ARTICLE FOUR: EFFLUENT DISPOSAL

23. Purpose. This Article describes how the Authority will dispose of treated effluent or raw sewage. Disposal methods include: discharge to a public watercourse, distribution as recycled water, spray irrigation or injection on public and private lands, or transfer to another agency.

24. Ownership of Treated Effluent. The minimum each party is entitled to receive from the Joint System is the amount of treated effluent equivalent to the sewage contribution from its county. If demand for treated effluent exceeds the available supply, costs for supplementing the treated effluent supply with potable water shall be charged to the retail water agency exceeding the party's entitlement. If a party's demand for treated effluent is less than the available supply, either party may use the other party's unused entitlement and pay the appropriate operation and maintenance costs.

25. System Alteration or Expansion.

a. Nothing contained herein is intended to limit or govern the rights of either party to regulate the extent or method of treated effluent distribution or sale of the party to others in its own territory.

b. A party may construct and, thereafter, shall solely own a recycled water distribution system extension without the participation of the other party if the other party is offered the option to participate in the extension on the same basis as the party's then-current capacity to distribute water to land from the treatment plant(s) from which the effluent is generated, in which event, the addition shall become a part of the Joint System. If a party elects not to participate in the extension, that party shall sell recycled water to the party proposing the extension at the recycled water rate described herein, in which event, the extension shall not be part of the Joint System.

c. All parties must participate in the expansion of the treated effluent disposal facilities required to maintain pressure and flow for effluent disposal.

d. The parties shall meet and confer in good faith if a party wishes to divert a significant portion of its untreated influent. For purposes of this Agreement,

significant portion shall mean ten percent (10%) or more of that party's contributed flow of raw sewage into the collection system.

ARTICLE FIVE: MISCELLANEOUS

26. Dispute Resolution.

a. Disputes can be best avoided by full, fair and complete communication. The parties will do everything reasonably possible to undertake and foster such communication. Directors and staff of both parties are permitted and encouraged to address one another during regular business hours and during meetings. The procedures in this section may be invoked when disputes arise despite the best efforts of the parties, their officers, agents and employees. This provision anticipates disputes will be divided into two categories. A "budget dispute" arises when (1) a party wishes to contest expenditures for administration, operation or maintenance in the absence of a budget, or when (2) a party disputes whether a project may be constructed as a "single user facility." A "general dispute" arises when a party disputes any other decision of the governing body, or Administering Agent, or interpretation of this agreement. This provision provides a different alternate dispute resolution process depending on whether a budget dispute or a general dispute has arisen.

b. A party may invoke dispute resolution for a budget dispute by serving a written statement on the chairs of the two districts. The statement shall identify the issues to be resolved, the position of the petitioner, the apparent position of the respondent, and a summary of anticipated evidence. The districts are required to use dispute resolution strictly in the following order: (1) through mediation with a neutral mediator or fact-finder; and (2) if still needed, by binding arbitration. If arbitration becomes necessary, each district will select a neutral arbitrator (a neutral arbitrator, technically qualified for the specific issue, if possible), and the two arbitrators so selected shall select a third neutral arbitrator (also technically qualified, if possible) to chair the three-person arbitration. The arbitrators shall conduct the arbitration as expeditiously as possible according to the appropriate

laws and rules regarding arbitrations in California. The arbitration panel shall limit its award to a determination of reasonableness and need, and to a determination of whether the petition of the petitioner or the respondent is most appropriate for projects that one district refuses to approve. Each party shall pay its own attorneys fees and costs of dispute resolution, but the prevailing party as determined by the arbitrator shall be entitled to recover attorneys fees and costs.

c. A party may invoke this subsection to deal with a general dispute by filing a written request with the president of the board of the other party. At the next regular meeting occurring at least four days after the filing of the request, the governing board of each district shall appoint two of its members to serve on a committee. The committee members shall meet forthwith to receive and consider the reports of each district on the subject matter of the dispute. The committee will report its findings at the next scheduled meeting of the joint districts to occur at least thirty (30) days after the appointments of the committees.

If the dispute is not resolved after the committees have met and conferred, either party may press the appointment of a mediator. If the parties are unable to select a mutually agreeable mediator, the mediator shall be selected by using the procedures specified for the appointment of a mediator by a court.

If the dispute is not resolved as a result of mediation, a party may request advisory arbitration. If the parties cannot select an arbitrator by mutual agreement, the process for selecting an arbitrator in a court proceeding shall be followed. After appointment of an arbitrator, either party may obtain copies of records in the possession of the other party at no cost by written request. Witnesses may be deposed, but the record of the deposition shall be a videotape record. The record of the arbitration shall also be videotaped. The decision of the arbitration shall be written and transmitted simultaneously to the president of each board.

27. Supplemental Operational Agreements. The parties recognize that certain technical and detailed operational agreements in the form of memorandums of understanding will need to be negotiated by the General Managers. The General Managers shall meet and

confer in good faith in developing those memorandums of understanding which will become addendums to this Agreement.

28. Insurance. The Administering Agent shall maintain, during the life of this Agreement, property damage and liability insurance to protect parties from claims for damages or personal injury, death, as well as from claims for accidental property damage, which may arise from its operation under this Agreement, whether such operations shall be by the Administering Agent or by any contractor or subcontractor or by anyone directly or indirectly employed by the Administering Agent. The amount of such insurance shall be as from time to time determined by the parties.

29. Inurement. The provisions of this Agreement shall inure to the benefit of, and be binding upon, each of the parties and their successors and assigns.

30. Prior Agreements. This Agreement supersedes the prior agreements of the parties and is a substitute therefor; provided, however, that all apportionment of costs, expenses or liability heretofore made or incurred shall not be affected by terms hereof.

31. Mutual Consent. This Agreement shall continue in full force and effect until terminated by the mutual consent of the parties hereto.

IN WITNESS WHEREOF, the parties have executed this Agreement or caused it to be executed as of the date first written.

LAS VIRGENES MUNICIPAL WATER DISTRICT

By _____
Chair

ATTEST:

By _____
Secretary

(SEAL)

TSD\Agreements\Revised FEP Agreement14

Approved as to Form:

Legal Counsel for Las Virgenes

TRIUNFO SANITATION DISTRICT

By _____
1-26-2009
Chair

ATTEST:

By _____
Clerk of the Board

(SEAL)

Approved as to Form:

Legal Counsel for Triunfo

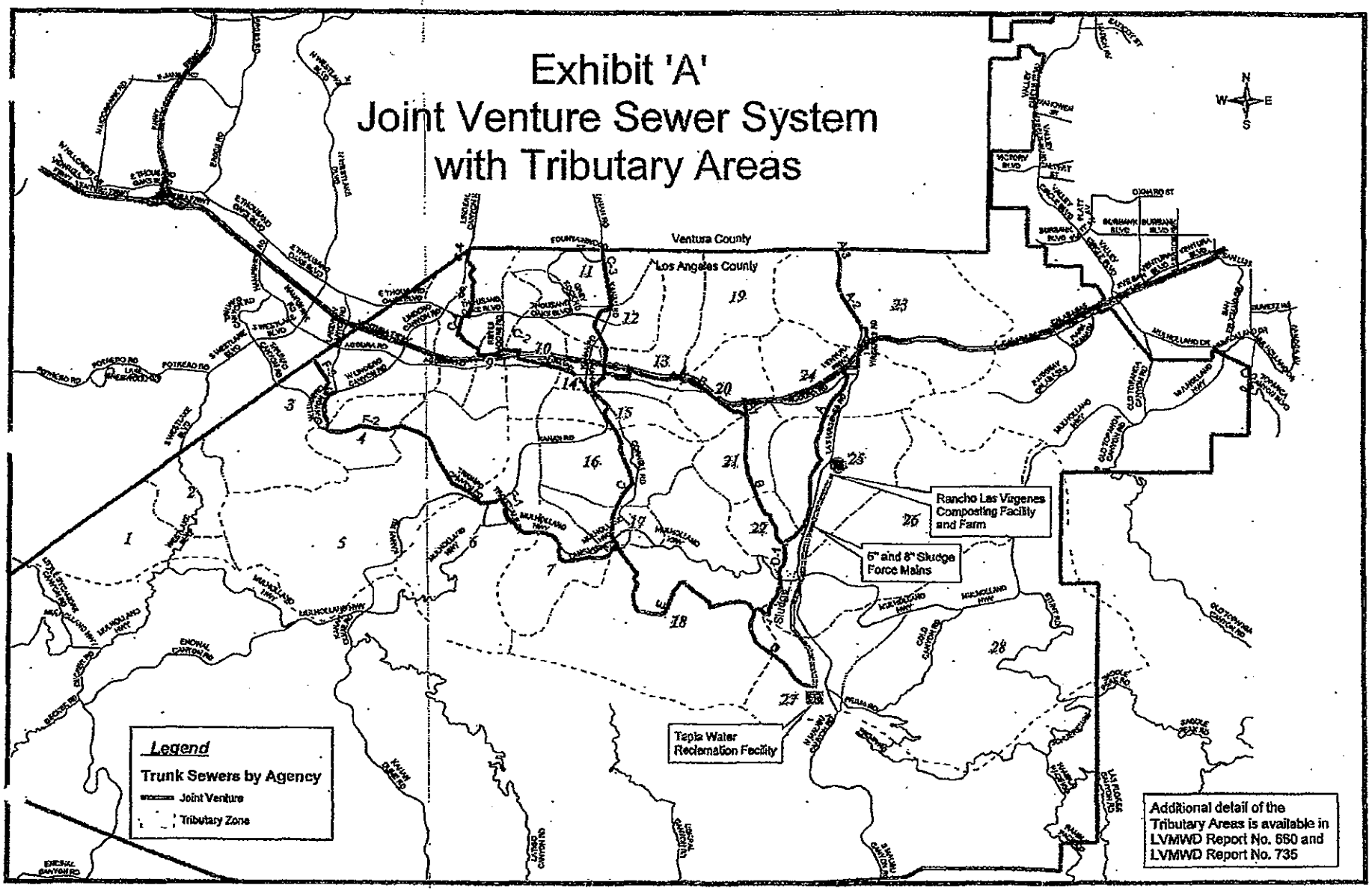


Exhibit 'A'
Joint Venture Sewer System
with Tributary Areas
Ventura County
Los Angeles County
Rancho Las Virgenes Composting Facility and Farm
6" and 8" Sludge Force Mains
Tapia Water Reclamation Facility
Legend
Trunk Sewers by Agency
Joint Venture
Tributary Zone
Additional detail of the Tributary Areas is available in LVMWD Report No. 660 and LVMWD Report No. 735

ITEM # 18

ITEM # 18

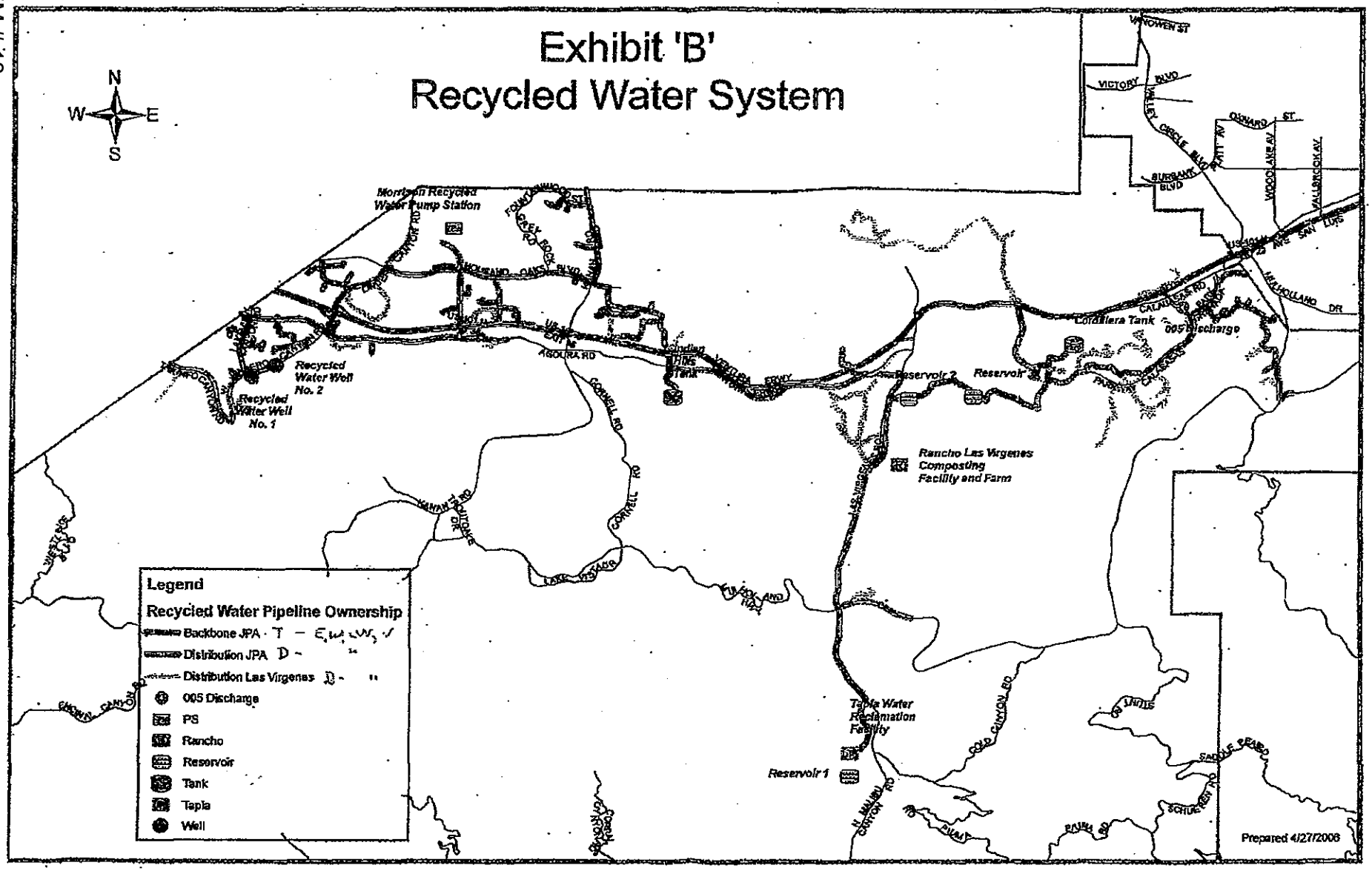
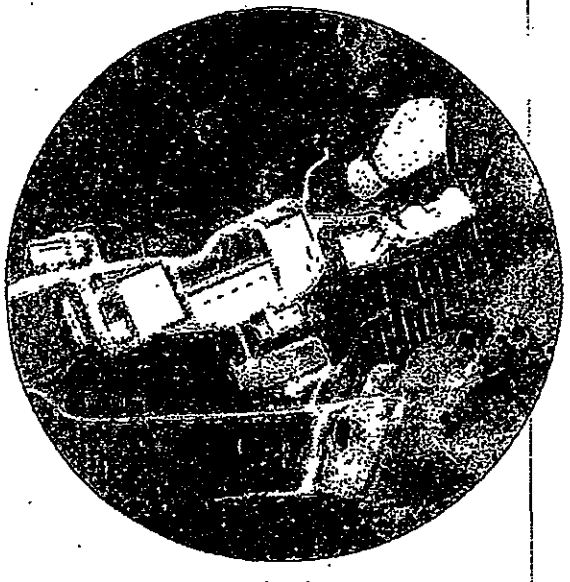
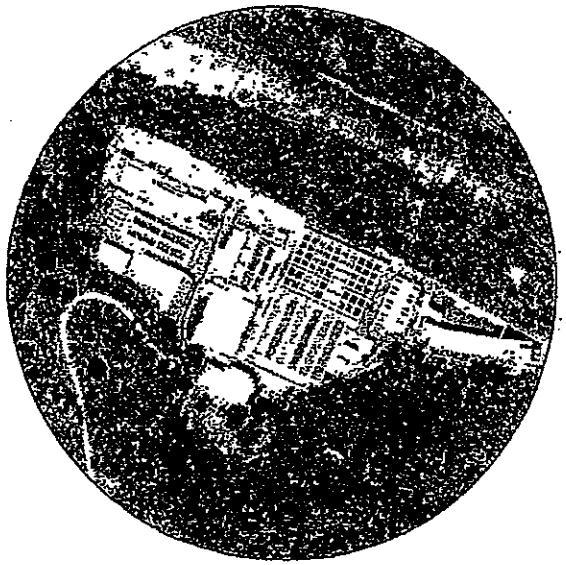


Exhibit 'B'
Recycled Water System
N
W
E
S
Morrison Recycled Water Pump Station
Recycled Water Well No. 2
Recycled Water Well No. 1
Reservoir 2
Reservoir
Caldwell Tank
005 Discharge
Rancho Las Virgenes Composting Facility and Farm
Tapia Water Reclamation Facility
Reservoir 1
Legend
Recycled Water Pipeline Ownership
Backbone JPA
Distribution JPA
Distribution Las Virgenes
005 Discharge
PS
Rancho
Reservoir
Tank
Tapia
Well
Prepared 4/27/2006

Exhibit 'C'
Plant Facilities



Rancho Las Virgenes
Composting Facility
3700 Las Virgenes Rd



Tapia
Water Reclamation Facility
731 Malibu Canyon Rd

ITEM # 18

ITEM # 18

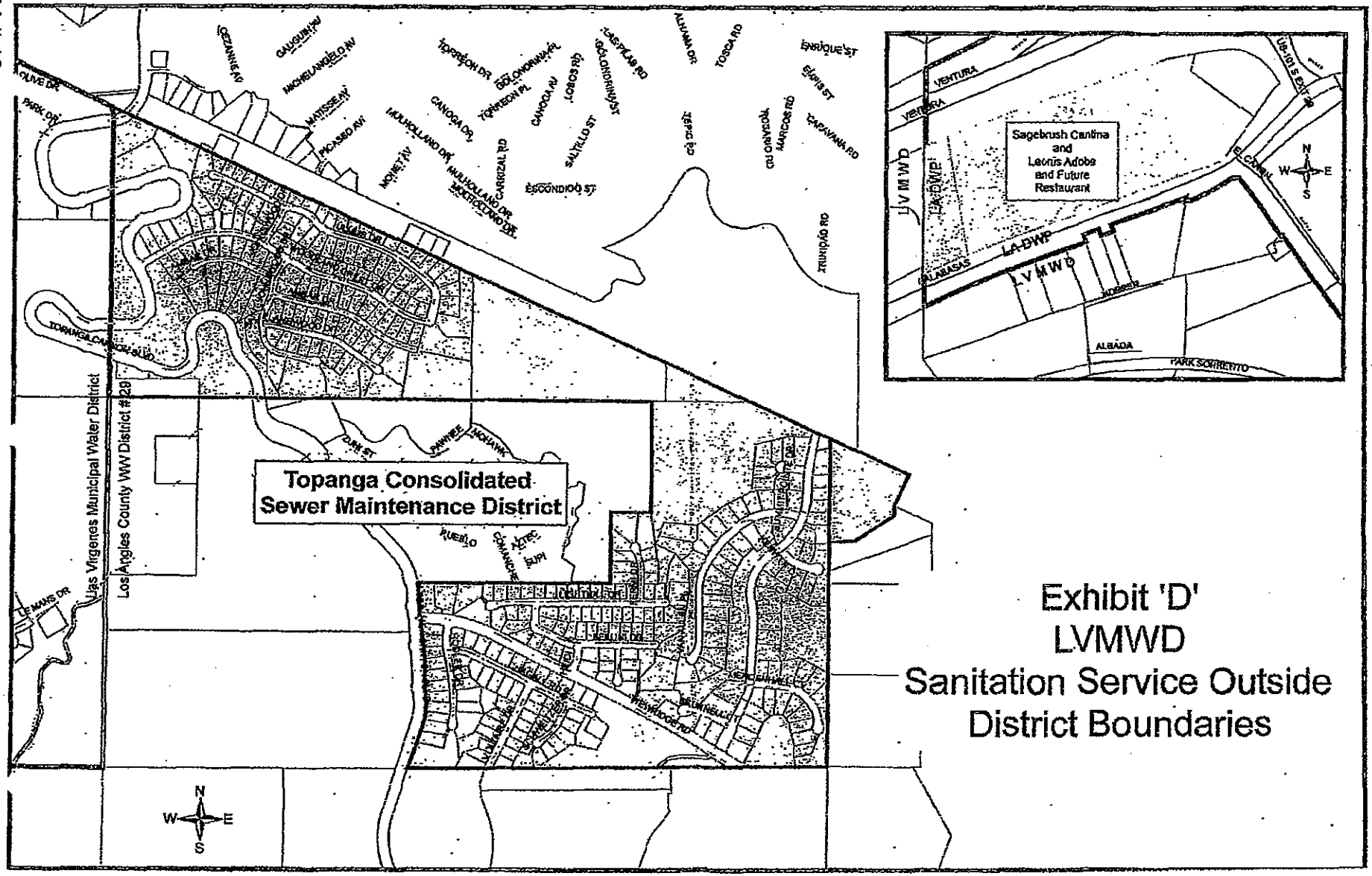
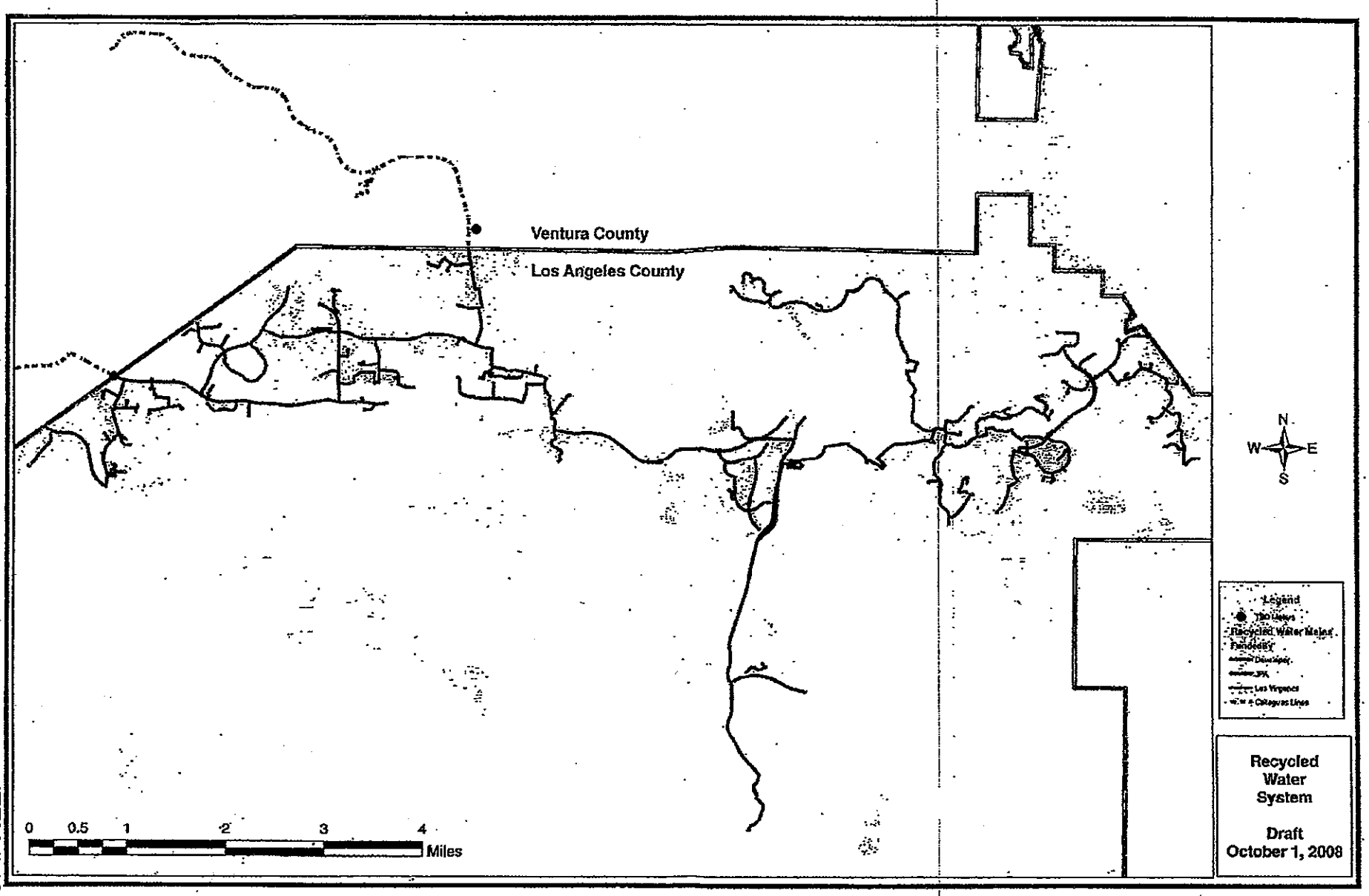


Exhibit 'D'
LVMWD
Sanitation Service Outside District Boundaries


Ventura County
Los Angeles County
N
W
E
S
Legend
0 0.5 1 2 3 4
Miles
Recycled Water System
Draft
October 1, 2008

ITEM # 18

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