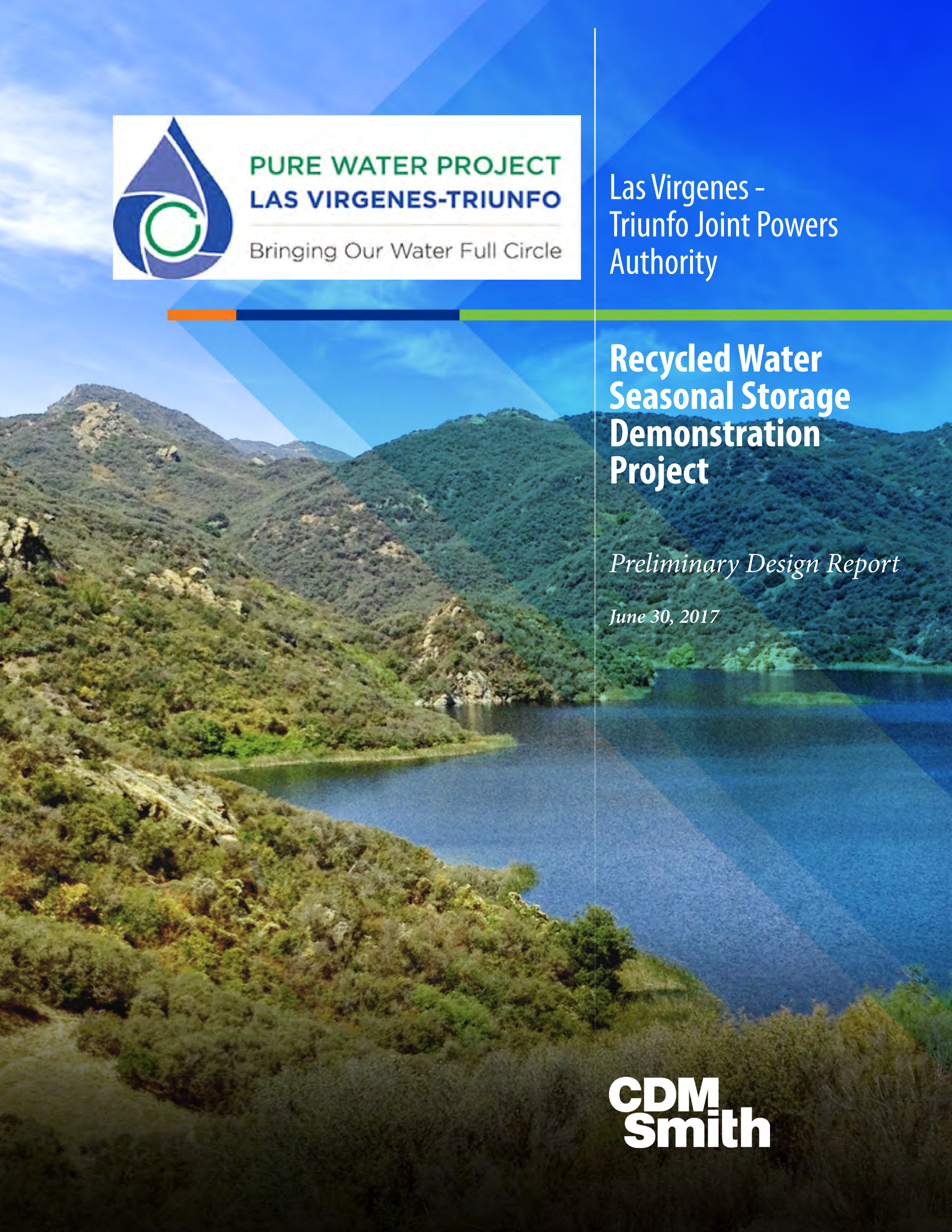

PURE WATER PROJECT
LAS VIRGENES-TRIUNFO
Bringing Our Water Full Circle

Las Virgenes - Triunfo Joint Powers Authority

Recycled Water Seasonal Storage Demonstration Project

Preliminary Design Report

June 30, 2017

CDM Smith

Pure Water Project - Las Virgenes – Triunfo Joint Powers Authority Demonstration Project

Acknowledgements

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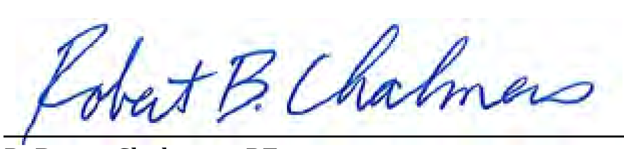

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Acronyms

ADA	Americans with Disabilities Act
AFY	Acre-feet per year
AOP	advanced oxidation processes
CEQA	California Environmental Quality Act
CIP	clean-in-place
CMWD	Calleguas Municipal Water District
DB	Design/Build
DBB	Design/Bid/Build
DDW	Division of Drinking Water
Delta	Sacramento-San Joaquin River Delta
gfd	gallons/ft/day
gpm	gallons per minute
GRS	Galvanized rigid steel
IPR	Indirect potable reuse
JPA	Las Virgenes-Triunfo Joint Powers Authority
LVMWD	Las Virgenes Municipal Water District
MF	microfiltration
mg/L	milligrams per liter
MWD	Metropolitan Water District of Southern California
NDMA	N-Nitrosodimethylamine
ng/L	Nanograms per liter
PDR	Preliminary Design Report
RO	reverse osmosis
SWP	California State Water Project
TDS	total dissolved solids

TMDL	Total Maximum Daily Load
TSD	Triunfo Sanitation District
TSS	Total Suspended Solids
USBR	United States Bureau of Reclamation
US EPA	United States Environmental Protection Agency
UV	Ultraviolet disinfection
VFD	variable frequency drive
WRF	Water Reclamation Facility

Section 1

Project Description

Section 1 of the Preliminary Design Report (PDR) includes project background about work has been done to date for the Pure Water Project and highlights what information is included in the other Sections of the PDR.

1.1 Project Background

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). The General Manager of LVMWD acts as the Administering Agent/General Manager of the JPA. Under the direction of the Administering Agent/General Manager LVMWD staff administers, manages, operates and maintains JPA facilities.

Formed in 1958, LVMWD is a municipal water district organized and operating pursuant to California Water Code Sections 71000 et seq. A board of five directors, elected by district for 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 approximately 30,100 people and provides wastewater collection and treatment (via JPA facilities) and supplies recycled water. A board of five directors, elected at large for four-year terms, governs TSD. 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 other areas within TSD's service area. The JPA's service area of approximately 100,000 people is shown in **Figure 1-1**. LVMWD serves as the JPA's Administering Agent.

Figure 1-1
Boundary of JPA Service Area (Recycled Water Seasonal Storage Basis of Design Report, MWH/Stantec, 2016)

The JPA has no natural water supplies within its watershed and boundaries. There is no groundwater of sufficient quantity or quality for municipal use. The JPA's member agencies are 100 percent dependent upon imported water from the California State Water Project (SWP) delivered by the Metropolitan Water District of Southern California (MWD). The JPA built an extensive recycled water distribution system beginning the 1970s and currently reuses 60 percent of its Title 22 recycled water from the Tapia Water Reclamation Facility (WRF) for irrigation use. However, recycled water demands drop significantly in the cooler winter months while wastewater flows remain relative constant. Lacking seasonal storage for the excess recycled water, the JPA releases the valuable resource to Malibu Creek, which drains to the Pacific Ocean after passing through Malibu Lagoon.

Discharge of the WRF's recycled water to Malibu Creek is not a sustainable practice. The JPA wishes to find a more beneficial use for this valuable, local resource and increasingly stringent regulatory standards for water body impairments, particularly for nutrients, are now requiring advanced treatment of recycled water. The "2013 US EPA Malibu Creek and Lagoon Total Maximum Daily Load (TMDL) for Sedimentation and Nutrients to Address Benthic Community Impairments" established new in-stream limits of 1.0 milligrams per liter (mg/L) total nitrogen and 0.1 mg/L total phosphorous for Malibu Creek. These nutrient standards cannot be met with conventional wastewater treatment, even when producing Title 22 tertiary-treated recycled water. Advanced treatment is required to meet the standards. As such, discharge of the excess recycled water from the WRF to Malibu Creek is no longer a viable option absent treatment to drinking water standards. The JPA is investigating the Pure Water Project Las Virgenes – Triunfo to beneficially reuses the surplus recycled water and reduce discharges to Malibu Creek. See **Figure 1-2**.

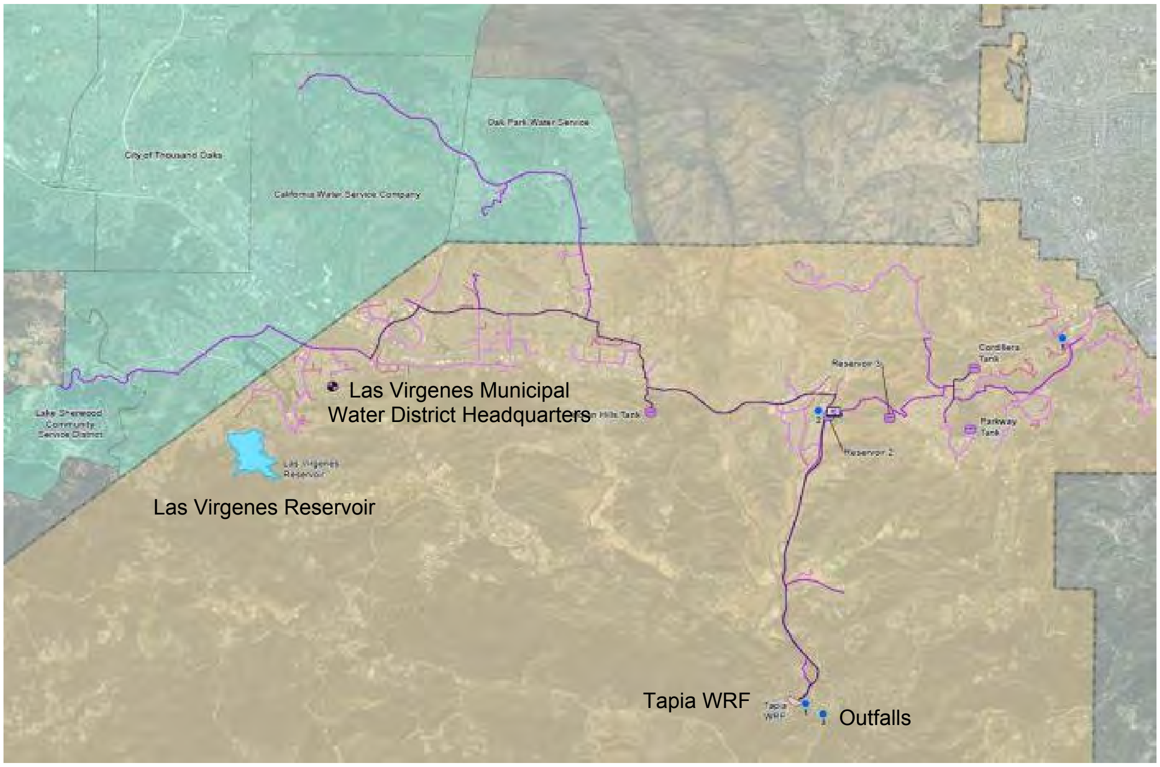

Figure 1-2
Existing Recycled Water Pipeline System (Recycled Water Seasonal Storage Basis of Design Report, MWH/Stantec, 2016)

Also, the state-wide drought has illustrated the challenges of relying on imported water, with uncertain long-term reliability associated with drought shortages, climate change, seismic events, environmental flow restrictions in the Sacramento-San Joaquin River Delta (Delta), which is the area of pumping origin for the SWP, and salinity of Colorado River supplies. Due to the significant investments being made by MWD to improve supply and system reliability, LVMWD's imported water costs are expected to increase significantly into the foreseeable future. Every acre-foot of recycled water that is beneficially used offsets an acre-foot of imported water from the SWP. Importing SWP water to the service area is very energy intensive, as compared to locally purified recycled water, and places additional strains on the sensitive Delta, which is also the pumping location for the Bureau of Reclamation's Central Valley Project (CVP).

1.2 Pure Water IPR Project

The JPA is studying the Pure Water Project Las Virgenes – Triunfo, an indirect potable reuse (IPR) surface water augmentation project that would ultimately produce up to 5,151 acre-feet per year (AFY) of new, local, drought-resilient water supply. The JPA produces recycled water at its Tapia

WRF by treating wastewater flows from its service area, with surplus recycled water discharged to Malibu Creek, which is an impaired water body that drains to Santa Monica Bay.

The Pure Water Project Las Virgenes – Triunfo would involve the seasonal advanced treatment of discharges from the Tapia Water WRF when existing recycled water demands are low. This advanced treated water would be conveyed to the 9,800 acre-foot Las Virgenes Reservoir where it would mix and be stored with imported supplies.

Figure 1-3 shows a photo of the Las Virgenes Reservoir. This project is unique in that it will be one of the first seasonally-operated IPR facilities as well as one of the first surface water augmentation projects in California.

Figure 1-3
Las Virgenes Reservoir

1.3 Demonstration Project Definition

The JPA has determined that a Demonstration Project is needed to:

1. provide opportunities for public education, acceptance, and public outreach to its customers;
2. test design criteria and operational procedures to inform and improve the full-scale design and provide experience to operators; and
3. 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.

LVMWD has requested and has been approved for outside funding from the United States Bureau of Reclamation (USBR) for a Demonstration Project through the USBR's WaterSmart Grant Program. A copy of the WaterSmart Grant application is included in **Appendix A**. The Demonstration Project will provide information to decision makers to streamline the planning process and provide a basis for the design of the full-scale advanced treatment facility.

The Demonstration Project will be a nominal 100 gallons per minute (gpm) facility that tests full advanced treatment processes of microfiltration (MF), reverse osmosis (RO), ultraviolet disinfection (UV), and advanced oxidation processes (AOP) on the tertiary treated recycled water produced by the JPA's Tapia WRF and local dry weather flows. It is proposed that the treatment process equipment, chemicals, and testing laboratory will be housed in the former LVMWD administration building located adjacent to the current headquarters building. The outside of the former administration building is shown in **Figure 1-4**.

Initial thoughts are that no significant new construction should be necessary to convert the vacant building to be able to house the Demonstration Facility and only minor refurbishment of the building is expected to permit public use. The funding will support the procurement and installation of the Demonstration Facility's equipment, testing, and public education facilities, and

the associated laboratory testing and research.

Figure 1-4
The Future Demonstration Facility Building (former LVMWD Administration Building)

1.4 Preliminary Design Report Organization

This PDR provides a vision for the Demonstration Project, as well as a summary of the regulatory environment, process requirements, procurement alternatives, and project costs. An overview of the organization of this PDR is provided below:

- **Section 1 – Project Description** provides background on the Pure Water Project to be implemented by the Las Virgenes – Triunfo JPA and summarizes the information that is presented in the rest of the PDR.
- **Section 2 – Vision and Architectural Development** describes the overall vision and objectives for the Demonstration Project, provides an overview of the existing facilities and the modifications that are needed to implement the project, and an outline of the preliminary Architectural Programming.
- **Section 3 – Regulatory Environment and Process Selection** discusses the applicable regulations for potential reservoir augmentation projects and their impacts on the process selection.
- **Section 4 – Preliminary Design Criteria** presents the design criteria for each of the processes that will be tested at the Demonstration Project.
- **Section 5 – Procurement Options and Schedule** identifies the primary alternatives that could be utilized for the procurement of the Demonstration Project process systems.
- **Section 6 – Cost Estimate** provides the capital cost estimates for the Demonstration Project.
- **Section 7 – Environmental Documentation** summarizes the California Environmental Quality Act (CEQA) requirements.
- **Section 8 – Preliminary Drawings** presents the site, process, electrical and flow diagrams for the Demonstration Project.
- **Section 9 – Sources** identifies references used in report.
- **Appendices –** Appendices provide a copy of the 2017 WaterSmart Grant application and vendor information used to prepare the PDR.

Section 2

Vision and Architectural Development

The Demonstration Project will be installed inside the former LVMWD headquarters building and will incorporate testing facilities, supplemental research capabilities, public education and tour opportunities. The public education features will include explanations of the safety, benefits, and successful implementation of IPR across the globe, both implemented and anticipated like the JPA's Pure Water Project. The vision for the Demonstration Project will be discussed below, followed by a description of the condition of the existing building and the modifications required to facilitate the implementation of the Demonstration Project facilities.

2.1 Vision

The Demonstration Project is envisioned as an opportunity to test and prove processes for the IPR of effluent from the Tapia WRF. This is another step towards the District's goal of providing IPR through reservoir augmentation. Concurrently, and equally significant, the Demonstration Project will provide a focal point to develop public awareness of the entire Pure Water Program and build understanding and acceptance of IPR as a safe and desirable component of the local water supply portfolio.

Implementation of IPR provides significant benefits for the JPA (LVMWD and TSD), their customers, their communities, and the local environment, including:

- The ability to offset imported water supplies that currently comprise a high percentage of the local water portfolio and which are becoming less reliable and increasingly expensive.
- Local control and beneficial use of effluent from the Tapia WRF, that has gone through advanced water purification treatment.
- An alternative to avoid the capital and operating expense required to avoid discharges of nutrients in the tertiary treated effluent from the Tapia WRF to Malibu Creek, particularly during the shoulder spring and autumn months.

2.1.1 Purpose

Continuing their commitment to beneficial reuse, the JPA proposes to install a water purification demonstration facility in the currently unused former LVMWD headquarters building. Demonstration Project is envisioned to have a clean, industrial look that supports visitors' sense that the process is safe and technologically sound. The former headquarters previously used for cubicles by administrative staff has been cleared out and will provide ample space to install the treatment systems needed to purify water. The space also is sufficient for installation of interpretive tour components, to show and explain the multiple steps to consistently produce safe, pure water.

In keeping with the adage "seeing is believing", visitors should be able to walk through the operating demonstration facility, seeing and hearing the processes in operation. Other areas of the former headquarters building should be configured and designed to extend the tour experience, with explanations of the process for water purification, why the project is needed, benefits within the context of the local water picture, and demonstration of water purification as a safe and reliable water supply alternative.

The Demonstration Project should have the capability to test several approaches to purification as well as providing engineering data to guide selection of the most effective protocols for purifying the effluent water from the Tapia WRF. The Demonstration Project must be able to provide the JPA staff an in-depth understanding of the process operation while developing skills related to the purification processes. The Demonstration Project will serve as a precursor to operating the future full-scale facility. The Demonstration Project should also provide data to secure regulatory approval, inform diverse audiences about the safety and benefits of IPR, and instill a sense of security in indirect potable reuse.

2.1.2 Public Outreach

One of the critical roles of the Demonstration Project will be to introduce people to the concept of water recycling, particularly for human consumption. Research findings and the experience of other water utilities indicate that understanding the technology of water recycling, the supporting science, the safeguards against failure, the environmental and social benefit of potable reuse, and being able to see the water purification process are key drivers in transforming disgust and skepticism to acceptance and even support for IPR. The Demonstration Project and information from successful water purification plants can prove that "seeing is believing".

Demonstration facility tours, messaging, design elements and other information-related features at the facility should be integrated with the many other forms of public outreach collateral and activities related to the Pure Water Project. Among the key design and architectural considerations are:

- Creating an environment that is clean, uncluttered, orderly, and modern, leading to a sense of confidence in the processes and the people who operate it
- Ample space for a comfortable experience, both in the Learning Center (former board room) and through the tour of the Demonstration Project
- Exhibits and presentations at a Learning Center prior to the tour, to provide a basic understanding of the process steps and science behind IPR, as well as an area for questions and close-out of each tour
- Color and design palates that are simple, compatible with the other JPA partners, and adaptable to multiple media.
- Displays and exhibits to draw visitors' attention, build interest, and provide background about the safety, benefits, and worldwide use of IPR
- Clear, attractive signage throughout the facility site (inside and out) that seamlessly guides people to the right spot or in the right direction.

2.1.3 Demonstration Project Location and Systems

The Demonstration Project is planned for installation inside the former LVMWD headquarters building, and is expected to operate until the full-scale plant is built. The facility is proximate to the current LVMWD headquarters and maintenance yard, with close access to outreach and maintenance staff. This provides convenience in opening and closing the facility, plant operation, restocking areas, performing minor maintenance, and other details of operation. The site is close to the Las Virgenes/Malibu Canyon exit of the 101 freeway, providing convenience and easy direction for visitors.

Interior installation of the Demonstration Project offers multiple advantages in terms of convenience and safety. Weather proof installations of pilot and Demonstration Projects are unusual. This Demonstration Project installation will operate in a clean and consistently dry environment allowing operation throughout the year, regardless of the weather or time of day. The indoor environment also simplifies development of interpretive tour components, enabling use of a broader range of materials without consideration of inclement weather and sun-proofing. On the other hand, interior installation will require attention to climate control systems, necessary to offset the impacts of the long hallway with floor to ceiling windows, heat emanating from process pumps, heat from compressors, and climate impacts of the raised ceiling areas along the tour route.

2.2 Existing Facilities and Required Improvements

The former LVMWD headquarters building is located on LVMWD property at 4232 Las Virgenes Road in Calabasas, California. The building was originally constructed to house the District's administrative offices. Constructed in 1967, the building was remodeled or expanded in 1978, 1986, and most recently in 1994. The building has been vacant since 2011 when the tenants vacated the building. The old headquarters building underwent asbestos abatement in 2012.

The layout and room sizes within the former LVMWD headquarters are well matched to demonstrating advanced water treatment. It provides dedicated space for the process systems as well as tours and other forms of public outreach. The existing portions of the building that will be used by the Demonstration Project and a summary of the required modifications are provided in **Table 2-1**. A plan of the building is shown below in **Figure 2-1**.

Table 2-1 Proposed Building Improvements

Original Use	Demo Plant Use	Required Upgrades and Improvements
Entrance	Entrance	General cleanup, addition of project signage, landscaping, minor building exterior updates
Board Room	Learning Center	Transition to a Learning Center. Repair and update ceilings, walls, floors, HVAC, lighting, audio visual system
Open Area	Process Area	Repair and update ceilings, walls, floors, HVAC, lighting, audio
Offices	Ancillary Process Facilities	Modify offices to provide a small laboratory and house demo plant process chemicals and blower equipment. Repair and update ceilings, walls, floors, HVAC, lighting, audio
Rest Rooms	Rest Rooms	Redo rest rooms to meet current building codes
North Patio	Optional Process Area	General cleanup, landscaping, minor building exterior updates
Utilities	Utilities	Utility connections for recycled water, sewer, potable water

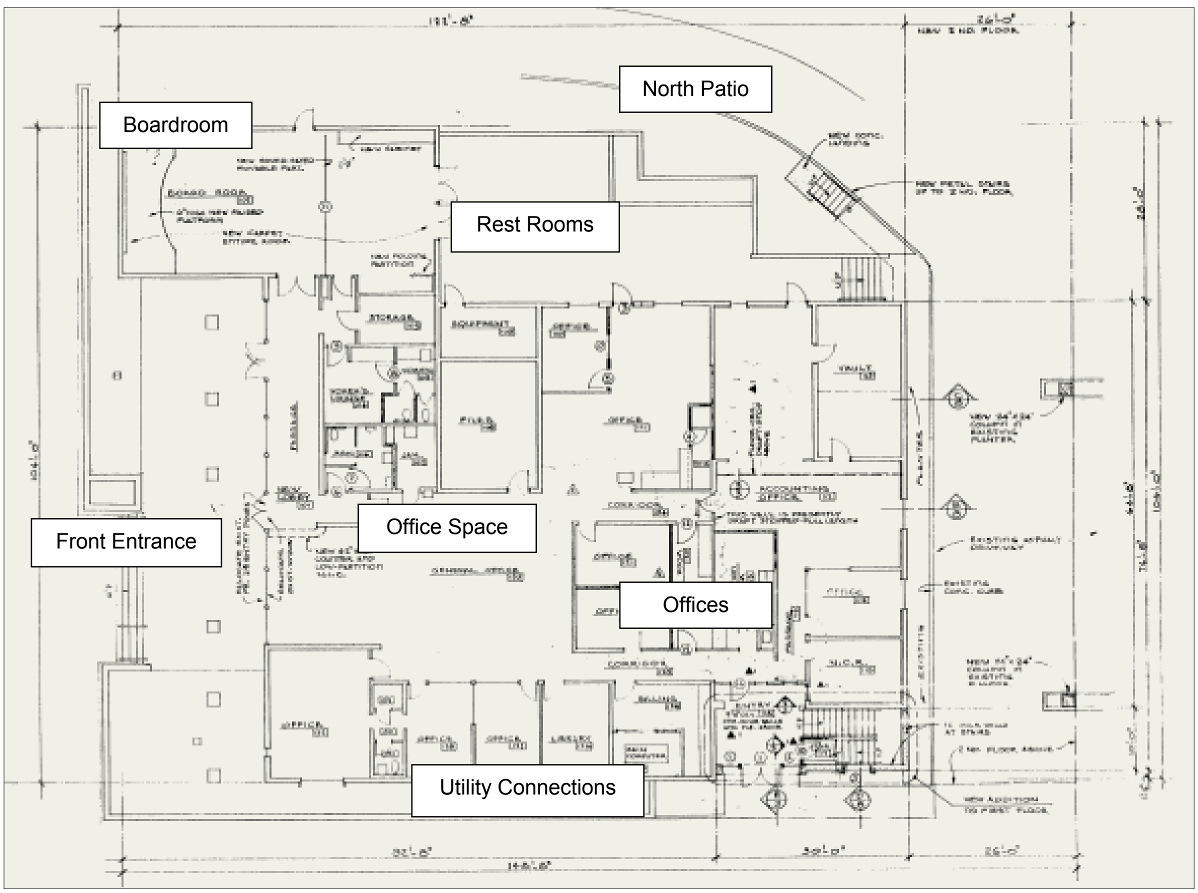

Figure 2-1
Existing Building Plan

The following provides a detailed vision of each Demonstration Project area as well as a list of the required upgrades and improvements.

2.2.1 Front Entrance

Vision for the Front Entrance

The tour should be designed so that the experience is launched with visitors' turn into the LVMWD headquarters complex. Signage reflecting the designated logo, color, and design template should direct people off Las Virgenes Road into the Demonstration Project parking lot, then to the Demonstration Project's front entrance. **Figure 2-2** shows the existing entrance to the former LVMWD administration building site and the front entrance to the building itself.

The facility name and logo should be clearly displayed on or near the low walls bordering the entry stairs, possibly etched brass or a similarly permanent material. Signage should clearly direct visitors to the entry door on the west side of the building. Careful consideration should be given to the high-visibility design and/or information posted on the hallway walls across from the entry doors. As noted above: "First Impressions Count!"

Figure 2-2
Existing Building Front Entrance (west side)

Figure 2-3 shows the hallway from the front entrance to the former Boardroom which will be modified to become a Learning Center. The existing sliding wood separator gate located just behind where the photo was taken would be closed prior to the start of a tour, preventing visitors from entering the process area. Signage on the gate and/or other nearby surfaces should clearly guide people down the hallway to the Learning Center. There is ample room to set up a sign-in station at the far end of the hallway, before people enter the board room. The storage room just outside the board room may warrant some reconfiguration to provide appropriate space to store tables, chairs, temporary signs, and other materials for tour activities.

Physical Modifications to the Front Entrance

The following summarizes the modifications needed to the front entrance to facilitate use for the Demonstration Project:

- Overall "sprucing up" of the building's front facade and entry area, including repairs and painting as required.
- Specific Demonstration Facility signage should be installed at the entrance and front of the building.
- Paved areas proximate to the entryway and landscaped areas should be cleaned or slurry sealed, with parking lines repainted.
- Landscaping should be refurbished or replaced with drought tolerant landscaping to match the rest of the site.
- Remove and replace front windows to facilitate installation of process equipment inside the building.
- New window coverings or blinds to help reduce the heat load on the HVAC.
- Consideration should be given to installing a fish tank or other water feature at the entry, similar to the one at the Tapia WRF entrance.
- See Section 2.2.4 for entrance hallway improvements.

Figure 2-3
Hallway from the Front Entrance to Board Room (looking north)

2.2.2 Learning Center (Board Room)

Vision for the Learning Center

The primary function of the Learning Center is to orient visitors to the tour experience, provide basic information about the processes of water reuse, introduce the science and safeguards of potable reuse, and other background information specific to the JPA's commitment to environmental sustainability. The current vision for the Learning Center anticipates diverse formats for displays, graphics, and interactive exhibits along the perimeter of the room. Visitors can constructively pass their time waiting for the tour to get underway. Their learning will build excitement for what they are about to experience.

The Learning Center is spacious and can be reconfigured to serve multiple purposes, including Demonstration Project tours as well as other potential community functions and meetings. **Figure 2-4** shows the Board Room as it exists today. The primary layout likely will be conference style, with chairs and tables.

Figure 2-4
Boardroom Converted to the Learning Center (looking west)

The audience would face a large, multi-screen video monitor that can be used for presentations orienting visitors to water treatment technologies and setting the stage for what they will see and experience during their facility tour. The presentation system also can be used to show animations of the treatment process, live microscope projections, and other visuals that help explain and build credibility for the treatment process.

Visitors would also congregate at the Learning Center at the close of their tour. This would be a chance to reflect on the experience, pose questions, and clarify understanding. The public outreach strategy for the Pure Water Project may recommend an interactive or closing activity using displays in the Learning Center. At minimum, visitors will have the chance to revisit some of the displays with new eyes, based on what they learned on the tour.

The walls of the hallway to the Learning Center as shown above in Figure 2-3 also provide prime area for messaging and graphics. Examples are photos that convey healthy people, diverse uses of water, environmental benefits, water conservation and water portfolio diversification are all contiguous with the Pure Water Project.

The actual Demonstration Project tour would start as visitors exit the Learning Center and walk through the hallway toward the treatment facility, as designated by the colored epoxy path on the floor. The floor of the Learning Center would be the same materials and format. This color will subsequently "dissolve" into the changing flow of colors (likely shades of blue) that will indicate the varied treatment processes.

Visuals toward the end of the hallway should help create a sense of discovery and excitement, that draws guest in to see more.

Physical Modifications for the Learning Center and Hallway

The following summarizes the modifications needed to the board room and adjacent hallway to facilitate use for the Demonstration Project:

- **Floors** – Colored epoxy application to the formerly carpeted floors, to give a sense of the facility being "so clean you could eat off the floor." A grey design is proposed for the Learning Center, outlined in blue which will be the predominant color on the floors throughout the building.
- **Walls** – Walls should be painted. The floor-to-ceiling wooden gate at the right of the entryway should be refurbished to close off the demonstration facility and guide people toward the Learning Center where the tour will start.
- **Ceilings** – Remove the tile drop ceiling in the process area and Learning Center. Paint the ceilings black. The drop ceiling tiles in the hallway between the Learning Center and the process area should be replaced with new tiles. All abandoned wires above the drop ceiling should be removed.
- **HVAC** – HVAC in the Learning Center and adjacent hallway should be checked and modified as required to make sure that all of the existing systems are working.
- **Lighting** – Provide simple lighting, to maintain focus on the tour features.
- **Audio Visual** – Install a new audio visual system consisting of a big screen TV panel and sound system.

2.2.3 Building Open Space Converted to Process Area

Vision for the Process Area

It is proposed that the demonstration process equipment be installed in the large open area formerly used to house cubicles for administrative staff. **Figure 2-5** shows the existing building open space that will be converted to the process area. The process systems should be positioned so that visitors walk the length of the skid for each process as they progress on the tour. The major process equipment (MF/RO/UV) should be positioned, painted and lighted so they stand out while the ancillary equipment pumps/tanks should be less prominent.

Figure 2-5
Existing Building Open Space (looking east from near the front entrance)

The process flow should also be designated by progressive changes in coloration in the pathway on the floor, coordinated with the same coloration on the skid, equipment or surrounding walls. Process names can be mounted in a manner that avoids direct contact on the equipment or flooring, to avoid their becoming dirty or detached over time.

Care should be taken to position wires and pipelines so they are concealed as much as possible, supporting the sense of this being an orderly, well maintained process. No pipes or conduits should cross the walking pathway to avoid damage and tripping hazards. Partitions and curtains can be used to visually set off the process equipment and maintain visitors' focus on the tour.

The suspended ceiling tiles over the Process Area should be removed, providing a more open atmosphere and a pleasant environment for visitors. See **Figure 2-6** for the typical condition of the existing ceiling. An open ceiling space enables installation of the taller process systems and provides more options for focused lighting along the tour route. The open ceiling space also will accommodate hanging banners proximate to each process step. These could include titles, graphics (as appropriate), and explanations of the process. Looking up to read the details helps visual learners and provides an alternative source of information being shared orally by the tour guide. Banners are particularly helpful for people with limited hearing or during large tours.

Figure 2-6
Typical Office Ceiling

Appropriately located wall displays, panels and curtains along the tour route can be used to reinforce messaging related to the treatment process and safe, reliable benefits of IPR. Along the tour route, visitors could have access to cutaways and samples of membranes, UV lamps, etc., for a "hands on" opportunity to build understanding and instill trust in the process. Similar opportunities should be "built in" to enable more technical visitors to "look under the hood" at process stages, view live testing, and handle filtration media.

The absence of the acoustical ceiling tiles will drive the need for the design to pay special attention to HVAC capabilities of the existing air conditioning system. Not having an acoustical ceiling will also impact the selection an audio system for tours because the sound will not be held close to the tour participants. Tour presentations will likely require more than a simple electronic megaphone or loud speaker to be effective.

The open space area will focus attention on exhibits and important components of the tour by spot-lighting these areas. Applying darker colors in unused areas that do not contribute to the overall message can enhance the effect.

Physical Modifications for the Open Space/Process Area

The following summarizes the modifications needed to the open space area to facilitate use as the process area for the Demonstration Project:

- **Floors** – Like the Learning Center, colored epoxy application should be installed on the formerly carpeted floors to give a sense of the facility being "so clean you could eat off the floor." A blue (or blue and grey) design is proposed for the process area, which will be the predominant color on the floors throughout the building and designate the tour route.
- **Walls** – Walls should be painted. Existing openings to areas not part of the visitor experience should be partitioned off to inhibit access and focus the visitors on the process equipment in front of them. Varied materials can be used, including curtains, portable barriers, and wall board.
- **Ceilings** – Remove the tile drop ceiling in the process area. Paint the ceilings black and provide simple lighting, to maintain focus on the tour features. All abandoned wires above the drop ceiling should be removed.
- **HVAC** – HVAC in the process area should be checked and modified as required to make sure that the existing systems are working. The existing insulation should be removed and replaced with an appropriate alternate material or covered up.
- **Lighting** – Provide simple lighting, to maintain focus on the tour features.
- **Drains** – Construct drains in the floors to provide a method for cleaning and removing potential water spills that may occur during operation.

2.2.4 Offices/Ancillary Facilities

Vision for the Offices/Ancillary Facilities

Three former offices along the windowed wall adjacent to the process area will be used to locate ancillary processes required by the Demonstration Project. These rooms should be inaccessible to the public and should only be used by the operators. These rooms will have some improvements, but will not have the same level of modifications as the public areas.

The vision for each of the rooms that will be used are as follows:

- A laboratory, with lab table, sink, beaker drying rack, and computer screens with visible "test results" displayed. The "lab" should be seen as a "working lab" even if no one is in there, perhaps with some beakers on the table or scrolling test results on the computer screen.

- An air compressor room that likely will require soundproofing and improvements to the HVAC
- A chemical storage room that may require special containment features, HVAC modifications, and other accommodations for storing and delivering chemicals to the process systems.

Figure 2-7 shows the entrances to the offices while F**igure 2-8** shows the inside of one of the individual offices.

Figure 2-7
Existing Building Office Space

Figure 2-8
Existing Building Office

Physical Modifications for Offices/Ancillary Facilities

The following summarizes the modifications needed to the open space area to facilitate use as the process area for the Demonstration Project:

- **Floors** – Since the offices will not be part of the tours and not accessible to the public, no significant improvements to the floors are anticipated.
- **Walls** – Walls should be painted. Existing openings to areas not part of the visitor experience should be partitioned off to inhibit access and focus the visitors on the process equipment in front of them.
- **Ceilings** – Remove the tile drop ceiling in the offices. All abandoned wires above the drop ceiling should be removed.
- **HVAC** – HVAC in the offices should be checked and modified as required to make sure that the existing systems are working. The laboratory, compressor room, and chemical storage room will require additional enhancements to allow changes to the building occupancy to suit the new intended uses. The existing insulation should be removed and replaced with an appropriate alternate material or covered up.
- **Lighting** – Provide lighting to allow safe operation of the systems.
- **Plumbing** – Add plumbing to the laboratory for laboratory sinks and appurtenances. An Emergency Eyewash Shower will be required for the chemical area.

- **Drains** – Construct drains in the floors to provide a method for cleaning, removing potential spills that may occur during operation, and water from an emergency eyewash shower.

2.2.5 Restrooms

Vision for the Restrooms

See **Figure 2-9** for a photo of one of the existing restrooms. At a minimum, general "cleanup" of the Men's and Women's restrooms is required. The modifications to the building may require that the existing rest rooms be brought up to code, including meeting Americans with Disabilities Act (ADA) requirements. A worst-case scenario might require demolition and construction of all new rest room fixtures. Consideration could be given to providing one unisex restroom instead of separate woman's and man's restrooms.

In the event that LVMWD would like to avoid refurbishment of the existing rest rooms altogether, the rest rooms in the current LVMWD headquarters building could be used, as the distance from the Demonstration Project site to the administration building is less than 500 feet.

Figure 2-9
Existing Building Restrooms

Physical Modifications to the Rest Rooms

The following summarizes the modifications needed for the rest rooms to facilitate use as the process area for the Demonstration Project:

- **Floors** – Replace the floor tiles with new ceramic or vinyl tiles.
- **Walls** – Walls should be painted and tiled as required to meet code.

CDM Smith

- **Ceilings** – The tile drop ceiling in the rest rooms should be replaced with new tiles. All abandoned wires above the drop ceiling should be removed.
- **Lighting** – Replace the existing lighting with new lighting.
- **HVAC** – HVAC in the rest rooms should be checked and modified as required to make sure that the existing systems are working.
- **Lighting** – Replace lighting as required.
- **Plumbing** – Replace fixtures, urinals, and toilets as required.

2.2.6 North Patio Area

Vision for the North Patio and Adjacent Areas

After the tour has progressed through the process area (see Section 2.2.3), LVMWD would like to give the visitors to the Demonstration Project the opportunity to taste product water from an IPR facility prior to leaving the building. Comments from other IPR facilities indicate that tasting the purified water is one of the most surprising and convincing elements of the tour experience. Experience of existing and anticipated IPR facilities indicates visitors are excited to do their own taste test.

At the end of the process area, just before the doors to exit the building into the north patio area, visitors would arrive at a "finished water tasting station" adjacent to the doorway. Design of the station should reflect common potable water uses, e.g. a bar sink or kitchen sink. The station would need to include storage and trash receptacles for small cups, towels, trash and other amenities. The tasting station also could be configured for visitors to take part in a "blind taste test" of tap water, bottled water and a "Pure Water", to see if they can tell the difference

In the north patio area itself (See **Figure 2-10**), facilities could be installed to introduce the possibility of using extended solar exposure as an alternative process step for NDMA removal, essentially demonstrating using the LVMWD Las Virgenes Reservoir as a "Process Component" of the IPR system.

From the North Patio, visitors would return to the Learning Center to bring closure to the experience. Closure can take many forms and should be discussed and a program developed as the JPA progresses with creating a comprehensive outreach strategy for introducing the Pure Water Project to the community's multiple audiences.

Visitors would exit the building by walking back through the long, windowed hallway to the same door that was used to enter the building. This exit will reinforce the impression of water's many uses and its role in our community, communicated through graphics that convey healthy people, environmental benefits, water conservation, water portfolio diversification, and other critical activities that will be advanced through the Pure Water Project.

Figure 2-10
Existing Building North Patio Area

Physical Modifications to the North Patio Area

The following summarizes the modifications needed for the water testing station and the north patio area for the Demonstration Project:

- **Floors** – Inside the building at the water testing station, the floors would be refurbished as outlined for the process area. Outside in the north patio area, no significant modifications to the existing concrete slabs is anticipated.
- **Walls** – Interior walls at the water tasting station should be painted to match the process area improvements.
- **Ceilings** – Drop ceiling modifications would be implemented with the process area improvements for the water tasting station area.
- **Lighting** – Provide lighting for the water tasting station. No additional lighting is anticipated for the north patio area.
- **HVAC** – HVAC modification for the water tasting station area would be implemented with the process area improvements.
- **Plumbing** – Plumbing and drains should be provided to construct the water tasting station.

2.2.7 Connections to Existing Utilities

Vision for the Connections to Existing Utilities

Connections will be made to existing utilities to obtain recycled water for the Demonstration Project, discharge of waste flows, and power for the process systems. Connections will be made to minimize pipe length and damage to existing facilities. **Figure 2-11** show the potential location for the connection to the non-potable reclaimed water line in the access road to the LVMWD administration building.

Figure 2-11
Existing Utility Connections South of Existing Building

Physical Modifications to Make Connections to Existing Utilities

The following summarizes the modifications needed for the connections to the existing utilities for the Demonstration Project:

- **Potable Water** – Potable water connections to the existing building water system will be required to provide water to the process area, laboratory, and water tasting area.
- **Recycled Water** – A connection is required to the existing non-potable recycled water pipe located in the access road to the LVMWD administration building.
- **Sewer** – The existing sewer connection will be used. All new floor drains and the discharge from the demonstration plant itself will be connected to the existing sewer.
- **Electrical** – The existing electrical panel on the north side of the building will be modified to power the new Demonstration Project loads.

2.3 Architectural Programming

As described above, the Demonstration Project will be designed to obtain engineering data as well as facilitate tours and learning at the site. The vision for the project is developed and defined by the architectural programming. This section provides ideas and suggestions from the Demonstration Project architect to show how the vision could be implemented as part of the final design. The architectural floor plan highlighting the modifications to the building floors is shown in **Figure 2-12**, while **Figure 2-13** shows the ceiling and exhibit plan.

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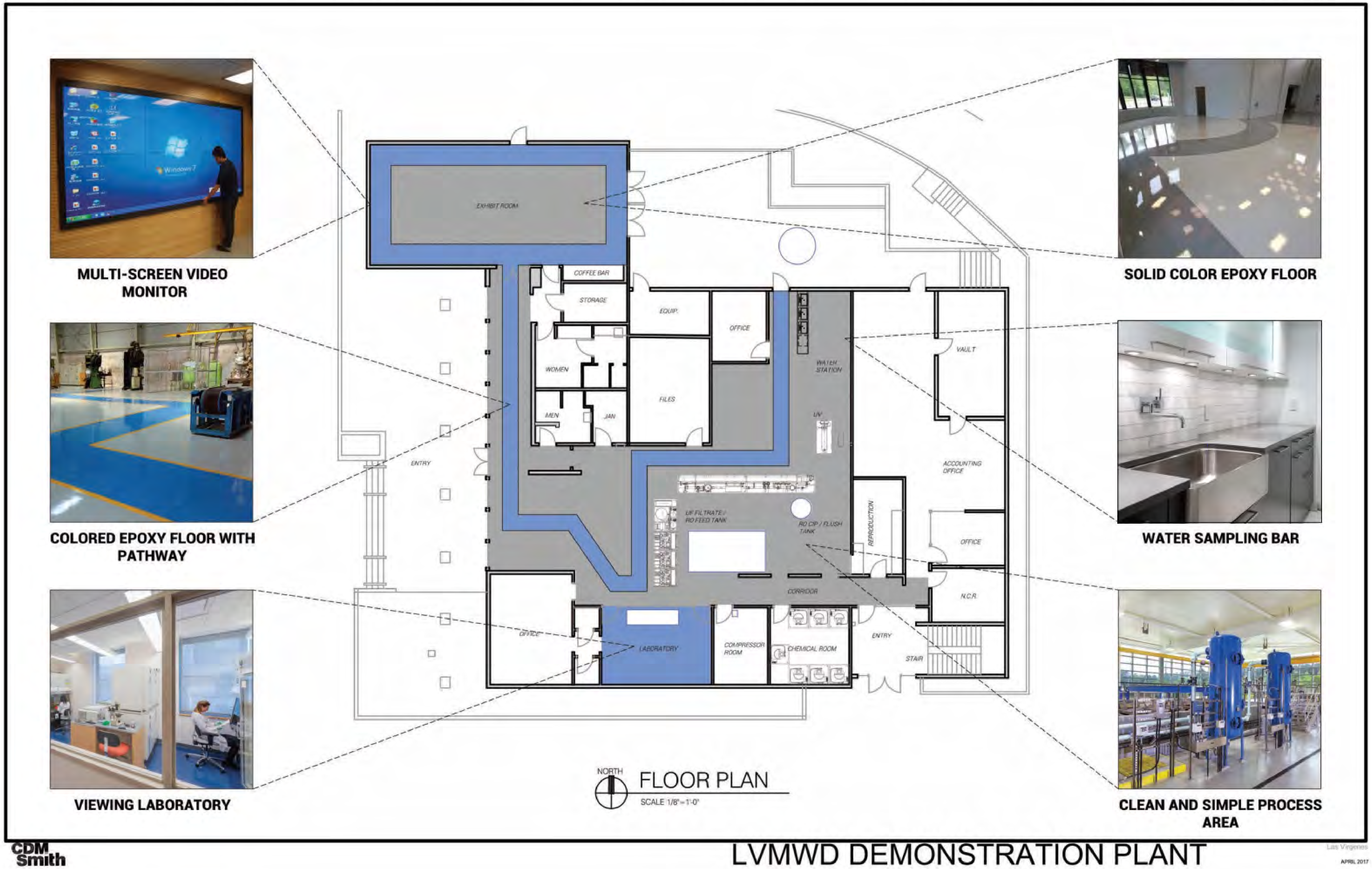

Figure 2-12
Architectural Floor Plan

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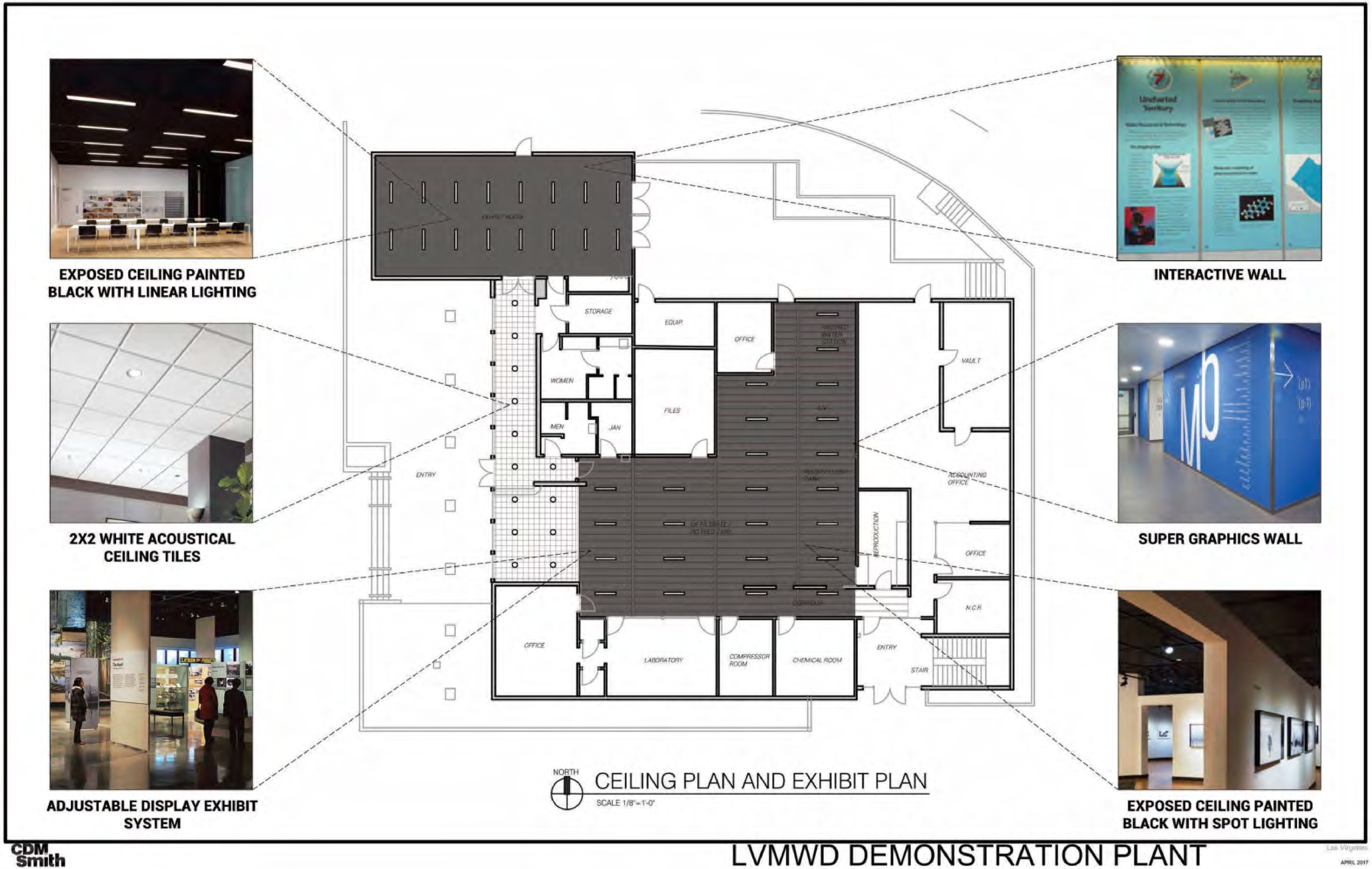

Figure 2-13
Architectural Ceiling and Exhibit Plan

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Public Outreach Demonstration Project Tours – The tour will wind through the facility to highlight major processes while avoiding chemical and other potentially hazardous areas. The tour will include a learning center, laboratory, major treatment processes, and a water tasting bar. The floor of the building will be coated with epoxy to smooth and flatten the current floor. The path of the tour, which begins and ends in the Learning Center, will be blue epoxy. Epoxy will prevent wear and/or peeling associated with other types of pathway markers. The shade of blue for the tour path will change during the tour to indicate a new process.

Learning Center – The Learning Center is designed to encourage interactive learning using exhibits, multi-screen video displays, and/or touchscreens. Interactive electronic walls, while engaging, can be costly and difficult to maintain. For this reason, a non-electronic interactive wall is recommended. Learning tools will focus on the source of the water and the treatment process and include both text and videos. The tour will then proceed down the hallway.

Laboratory – The laboratory will have a wall of windows looking out into the process area to allow for tours to look into the lab. The laboratory will contain hard-top countertops, cabinets, sinks and drains. Glassware and drying racks typical of water quality laboratory labs will be included to provide the viewer with an idea of common tools used in water treatment plant analysis. The laboratory will also have a work station with a computer monitor and chair.

Process Area – Each of the specific process systems will be discussed during the tour. Spotlights for each process will allow the tour guide to light up specific portions of the treatment system as they are being discussed. Banners will be hung from the ceiling to identify process areas. The wall behind the equipment will have a large super graphic wall that could contain text or a figure. Process area will be kept clean and simple.

Water Tasting Area – After the process area, tour participants will enter the water tasting bar. The bar can be done in a modern style or retro kitchen style. The bar will include a sink and drain and 3 taps: bottled water, purified water, and tap water. Taps will have a sloped slotted trough leading to the drain to prevent pooling of water while collecting samples. Samples will be provided in disposal cups and trash receptacle's will be provided.

Interior Walls – The interior walls of the building will be painted white. Anything at 9 feet in height and above in the process area and learning center will be painted black to allow the viewer to focus on the tour components. The ceiling in the process area and learning center will be exposed, with the drop ceiling removed as well as the phone and Ethernet cables. Duct work and lighting hangers will be painted black. Duct work with insulation will be wrapped in foil prior to painting to provide a cleaner surface. The exposed ceiling will also facilitate linear lighting and hangers for banners to aid in the identification of processes during the tour. The ceiling between the learning center and the process area will have white acoustical ceiling tiles. The building main entrance will have new white acoustical tiles. Black acoustical ceiling tiles may be used in place of a black exposed ceiling in the learning center if desired.

Chemical and Compressor Rooms – Chemicals and compressors will be kept away from the tour route for safety and to control noise during the tour. Chemical storage and pumps will be kept in the chemical room. Compressors will be installed in the compressor room. After sampling on the patio guests will return to the learning center for a debrief.

Other architectural programming ideas that should be implemented for the final design include:

- Use of darker colors in unused or immovable areas that do not contribute to the overall message, so as to focus their attention on the important components.
- Consider the use of colors (walls and process equipment) to convey the purification concept as water makes its way to the sampling area
- Establish logos explanations of process steps.
- Use of colors (walls and process equipment) to convey the purification concept as water makes its way to the sampling area.
- Use colors denoting progressive levels of treatment and purity.
- A sampling area that is inviting with integrated sinks or fountains, bottle fill station, cup dispensers, and integrated disposal receptacles.
- Install continuous online instruments that show improvement in water quality through the processes, like TDS (or provide sample taps so a tour guide can test, like we did for the watershed tour).
- Create visual aids (banners; cards) as if it was a self-guided tour.
- Consider sound transfer. Also consider an AV system linked to head sets or i-phones.
- Safety features include keeping chemicals and pumps away from the public tour route. Chemical delivery and storage away from tour and visitors
- Locate the compressor away from tour area, to reduce sound impacts.
- Consider the value of universal skids to a Demonstration Facility is the possibility of vetting different vendor's side-by-side and maintaining competitive pricing for future WTP membrane replacement
- Use banners to close off areas not in use. Banners can be black to diminish visibility. Also, can be designed to carry additional messaging.
- Use of monitor to view videos, show treatment up-close and personal, or project a series of static photos
- Provide maps of sites where IPR is in use
- Provide quotes from journal articles.

Section 3

Regulatory Environment and Process Selection

The regulatory environment has a significant impact on the Demonstration Project. This section highlights the current regulations and discusses how the treatment processes will be selected to meet the regulatory requirements.

3.1 Current Regulations

The California State Water Resource Control Board Division of Drinking water (DDW) is currently developing regulations for reservoir augmentation using recycled water. At this time, there are no formal regulations in place specific to surface water augmentation, thought the surface water augmentation regulations are currently under review. The development of these regulations has been an open and transparent process and preliminary information on the regulatory requirements has been provided by DDW at public presentations and through direct discussions with DDW staff. These new regulations are expected to build upon the existing Groundwater Replenishment Reuse Regulations, finalized in 2014.

While DDW has not yet released an expected date to promulgate the final regulations, the draft regulations are expected to be available in the second quarter of 2017. Internal drafts of the regulations were released within the 2016 Expert Panel Report on the Evaluation of the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse (September 2016). These early releases indicate that process requirements for RO and AOP and specified log reductions for pathogens will be similar to those contained in the 2014 Groundwater Recharge Reuse Regulations.

3.1.1 Pathogen Reduction

The draft regulations call for a total of 8-log reduction of *Giardia* and enteric viruses and 7-log reduction of *Cryptosporidium* prior to discharging to the reservoir. Additional pathogen credits would then be required by the surface water treatment plant pulling water from the reservoir, totaling 12-log virus, 10-log *Giardia*, and 10-log *Cryptosporidium*, between the wastewater treatment plant, advanced water treatment, and surface water treatment. Pathogen reduction provided by dilution and residence time are discussed below.

3.1.2 Dilution

Average theoretical hydraulic residence time within the reservoir must exceed 4 months and the reservoir must provide a 100 to 1 dilution to any single day flow into the reservoir. This dilution must be demonstrated through tracer testing. A smaller 10 to 1 dilution factor would also be allowed if an additional 1-log credit is provided for each pathogen. The Expert Panel also recommended that theoretical hydraulic residence times between 2 and 4 months be allowed if an additional log reduction credit is provided for each pathogen type. The maximum pathogen credit required before discharge to a reservoir would therefore be 10-log for *Giardia* and viruses and 9-log for *Cryptosporidium*, assuming no further changes to the draft regulations.

3.1.3 Residence Time

Another key component of the surface water augmentation regulations will be the residence time required in order to utilize a similar treatment train to the UF-RO-UV/AOP employed in groundwater replenishment projects.

At this point, DDW staff has indicated that a 4-month average residence time will be required, accounting for all influent into the reservoir, including both recycled water and natural and imported water supplies. Reservoirs with average residence time between 2 and 4 months will require an additional level of treatment for pathogen reduction, as is expected to be required for San Diego's Pure Water program. In addition, reservoirs with a daily dilution factor less than 1 to 100, but greater than 1 to 10 will require an additional 1-log reduction for each pathogen time.

Given the size of the Las Virgenes Reservoir (9,800 acre-feet), and the historic inflows, the residence time provided by this reservoir will likely be greater than the 2-month minimum and provide more than the 10 to 1 dilution, but it is not yet clear if they will exceed the 4-month residence time and 100 to 1 dilution needed to avoid additional pathogen removal. This question will need to be evaluated through the reservoir modeling that is being performed separately.

3.1.4 Pathogen Reduction Assumptions

It should therefore be assumed that the maximum removal requirements in the draft regulations will be required, specifically 10-log virus, 10-log *Giardia*, and 9-log *Cryptosporidium*. An additional 4-log virus, 2-log *Giardia*, and 3-log *Cryptosporidium* would be provided by the surface water treatment plant after storage in the reservoir.

3.2 Treatment Processes Selection

The high quality of the Tapia WRF effluent and the expected residence time in the Las Virgenes Reservoir (exceeding 4 months), could allow a high degree of flexibility in the treatment processes that are employed. The Demonstration Project should therefore focus on optimizing the primary treatment steps, MF/UF and RO, while evaluating alternative AOPs that are less costly than the standard UV/hydrogen peroxide used for most groundwater replenishment projects. **Figure 3-1** shows the proposed process stream for the Demonstration Project and future potable reuse approach.

Figure 3-1
Demonstration Project Process Flow Graphic

3.2.1 Core Treatment Processes

Beyond the core treatment processes of RO and AOP, MF or UF is generally provided as pretreatment for the RO and as an additional pathogen barrier. With technologies in advanced water treatment continuing to evolve, it is important that the full-scale facility design provide flexibility to take advantage of continuing developments in the industry. The use of a semi-universal membrane skid will provide an opportunity to directly test alternative MF/UF membranes side-by-side, facilitating pre-approval of acceptable membranes for use in the future full-scale facility

Part of the Demonstration Project's technical effort will focus on options for reducing brine quantity through higher RO recovery rates. Brine generation is an important consideration for the full-scale design due to the distance it would be conveyed to the disposal point and the potential requirements that will be imposed on the brine water quality by Calleguas Municipal Water District (CMWD), the discharge permittee. Since the cost of brine disposal is a significant cost, reducing the amount of brine produced by the Pure Water Project is essential to implement a cost-effective solution.

3.2.2 Disinfection/Advanced Oxidation

The low ammonia levels in the nitrified and denitrified source water provide an opportunity to use breakpoint chlorination for an additional level of virus inactivation and to trial UV/chlorine in place of UV/hydrogen peroxide. Utilizing a UV/chlorine approach at the Demonstration Project could allow for a reduction in UV unit sizing at a full-scale plant, reducing both the capital and operating cost of the facility. Disinfection using ozone is also a possibility as discussed below.

3.3 CEC Reduction

Preliminary bench testing or water quality testing to be performed during operation of the Demonstration Project will aid in the selection of a proposed process train for the full-scale Pure Water Project. Testing should include:

- NDMA and other nitrosamine formation potential benchtop testing;
- Spiking of 1,4-dioxane to assess and optimize AOP performance; and
- Simulated reservoir degradation of NDMA and other nitrosamines through natural sunlight.

3.3.1 Ozone

Ozone should also be evaluated as a means of reducing CECs, while serving as a barrier for viruses and *Giardia*. *Cryptosporidium* reduction can also be achieved with ozone, but requires extended contact times and higher ozone doses, which will add to the cost and could make UV treatment a more appealing alternative. Whether or not additional *Cryptosporidium* reduction is required, beyond what is achieved at Tapia WRF, MF, and RO, will depend on results of ongoing reservoir modeling and the final requirements of the reservoir augmentation regulations.

3.3.2 Nitrosodimethylamine (NDMA)

With source water potentially coming from the Tapia WRF downstream of existing storage tanks, there is a concern that elevated levels of N-Nitrosodimethylamine (NDMA), a disinfection by-product, will be present. NDMA has a notification level of 10 nanograms per liter (ng/L) and is often present at levels ranging from 30 to 1,000 ng/L in Southern California recycled water distribution systems. NDMA can be controlled by reducing the chloramine contact time, however, this alternative is generally not available to plants fed from an existing distribution network. When NDMA formation cannot be controlled, it must be removed using high doses of UV after the RO.

A unique opportunity for NDMA control at the JPA's full-scale facility is to consider the residence time of the water in the Las Virgenes Reservoir, where extended exposure to sunlight should be expected to naturally degrade residual NDMA in the water. While no existing facilities have been given credit for natural degradation of NDMA, testing was conducted by OCWD after startup of the Groundwater Replenishment System, storing treated water in open basins. The results demonstrated a relatively rapid breakdown of NDMA from sunlight (Plumee and Reinhard, 2007). Conducting similar testing at the Demonstration Project would be beneficial in providing baseline data for future regulatory approval of NDMA reduction credits within the Las Virgenes Reservoir. Such approval could allow for a reduced UV dose or the use of post-RO ozone, resulting in significant savings in both capital and operating costs for the future full-scale facility. Such an approach has not yet been approved by DDW, so it will be critical to include any novel means of NDMA reduction and any alternative AOP approach in the Demonstration Project testing.

3.4 Impacts from Seasonal Operation

The Demonstration Project will provide information for the full-scale Pure Water Project as well as research ways to make the Project more efficient and economical. If the Pure Water Project Las Virgenes-Triunfo were to use only tertiary treated recycled water from the Tapia WRF as the source water, its advanced treated water would only be available during the winter months (when the Tapia WRF has excess supply). The Demonstration Project should also investigate options for treating dry weather flows from the local stormwater municipal discharge (MS4) permittees.

The CMWD operates the Salinity Management Pipeline, which discharges saline water from groundwater desalination facilities and excess recycled water in the region to the Pacific Ocean. CMWD is concerned about exceeding the discharge permit water quality limits if the source of the brine includes urban runoff. If the Demonstration Project identified a feasible treatment method for the dry weather flows, the yield of potable water supply from the full-scale advanced water treatment plant could increase beyond 5,151 AFY. While it would likely not be feasible to collect and treat this water at the Demonstration Project, the project could include a study sampling and quantifying dry weather flows to evaluate their potential impact on the operations of the Advanced Treatment Facility.

In light of the above, the Demonstration Project's research efforts should focus on the following seven primary areas:

1. Evaluation and quantification of the natural degradation of NDMA and other constituents of emerging concern in an open-air reservoir subject to direct sunlight.

2. Direct testing of high recovery RO, achieving recoveries above 93 percent to reduce the brine flows requiring transmission and disposal.

3. Long-term demonstration of the benefits of operating RO membranes at elevated flux to improve contaminant rejection and product water quality.

4. 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.

5. Characterization of the brine to determine its compatibility for discharge to CMWD's Salinity Management Pipeline.

6. Evaluation of post-RO ozonation as an alternative to UV/AOP.

7. Characterization of dry weather urban run-off and consideration as a supplemental source to the advanced treatment facility.

In addition, it is expected that full RO treatment will be required, along with AOP sufficient to achieve 0.5-log reduction of 1,4-dioxane, or other approved surrogate compounds. **Table 3-1** below presents a potential process train and level of pathogen credits to achieve the expected requirements of the Surface Water Augmentation Regulations. These credits are based on those granted in the permitting of similar IPR projects. It should be noted that this approach does not rely on any pathogen credits from travel time within the reservoir.

Table 3-1 Potential Pathogen Credits for AWT Process Train

Pathogen	WWTP	MF	RO	Free Cl2	UV	Total	Maximum Requirement
Cryptosporidium	1	4	2	0	6	13	9
Giardia	2	4	2	0	6	14	10
Virus	2	0	2	6	6	16	10

3.5 Building Codes and Permitting

The following building codes may be applicable to this project:

- Americans with Disabilities Act
- 2016 California Building Code
- 2016 California Mechanical Code
- 2016 California Energy Code
- 2016 California Plumbing Code

- 2016 California Green Building Standards Code
- 2013 California Fire Code
- 2016 California Environmental Quality Act
- National Electrical Safety Code
- National Fire Protection Agency
- Federal Occupational Safety and Health Administration
- Cal/OSHA General Industry Safety Orders
- California Health and Safety Code
- ANSI Z358.1: Emergency Eyewash and Shower Equipment, 1981

The following building permits may be required for the proposed modifications:

- Building Permit
  - City of Calabasas Building Permit(s)
  - County of Los Angeles Building Permit(s)

Section 4

Preliminary Design Criteria

The Demonstration Project will include multiple unit processes for treatment and testing of the water, including UF, RO, advanced oxidation with UV and free chlorine, an alternative advanced oxidation system using ozone, and product water stabilization using calcium chloride and caustic soda. The overall process flow diagram is shown in **Figure 4-1**. This section includes a description of the various systems that are part of the Demonstration Project. Vendor information used in the preparation of the preliminary design criteria and drawings (Section 8) is included in **Appendix B**.

Table 4-1 summarizes recoveries, waste flows, and treatment process capacities for primary treatment systems.

Table 4-1 Demonstration Project Process Design Capacities

Parameter	Unit	Criteria
UF recovery	%	90
RO recovery with Brine Reduction System	%	92.5
Influent to AWTF	gpm	107
UF filtrate water capacity	gpm	96.1
UF backwash waste	gpd	19,600
RO Feed Flow	gpm	96.1
RO Product Flow	gpm	88.9
RO brine	gpm	7.2

4.1 Ultrafiltration System

The membrane filtration system provides pretreatment for the RO system to reduce the particulate and biological fouling of the RO membranes. The membrane filtration system will effectively remove inert particulates, organic particulates, colloidal particulates, pathogenic organisms, bacteria and other particles by the size-exclusion sieve action of the membranes. **Table 4-2** presents design criteria for the membrane filtration system, with system components described briefly below.

Table 4-2 Preliminary Design Criteria (UF)

Parameter	Unit	Value
Max Feed Flow	gpm	107
Minimum Recovery	%	90
Element Area	ft^2	650 - 900
No. Membranes	-	6
Independently monitored systems		3
Flux	gallons/ft/day (gfd)	30-40
Backwash rate (each system)	gpm	50-75
Filtrate Storage	min	30
	gallons	2880

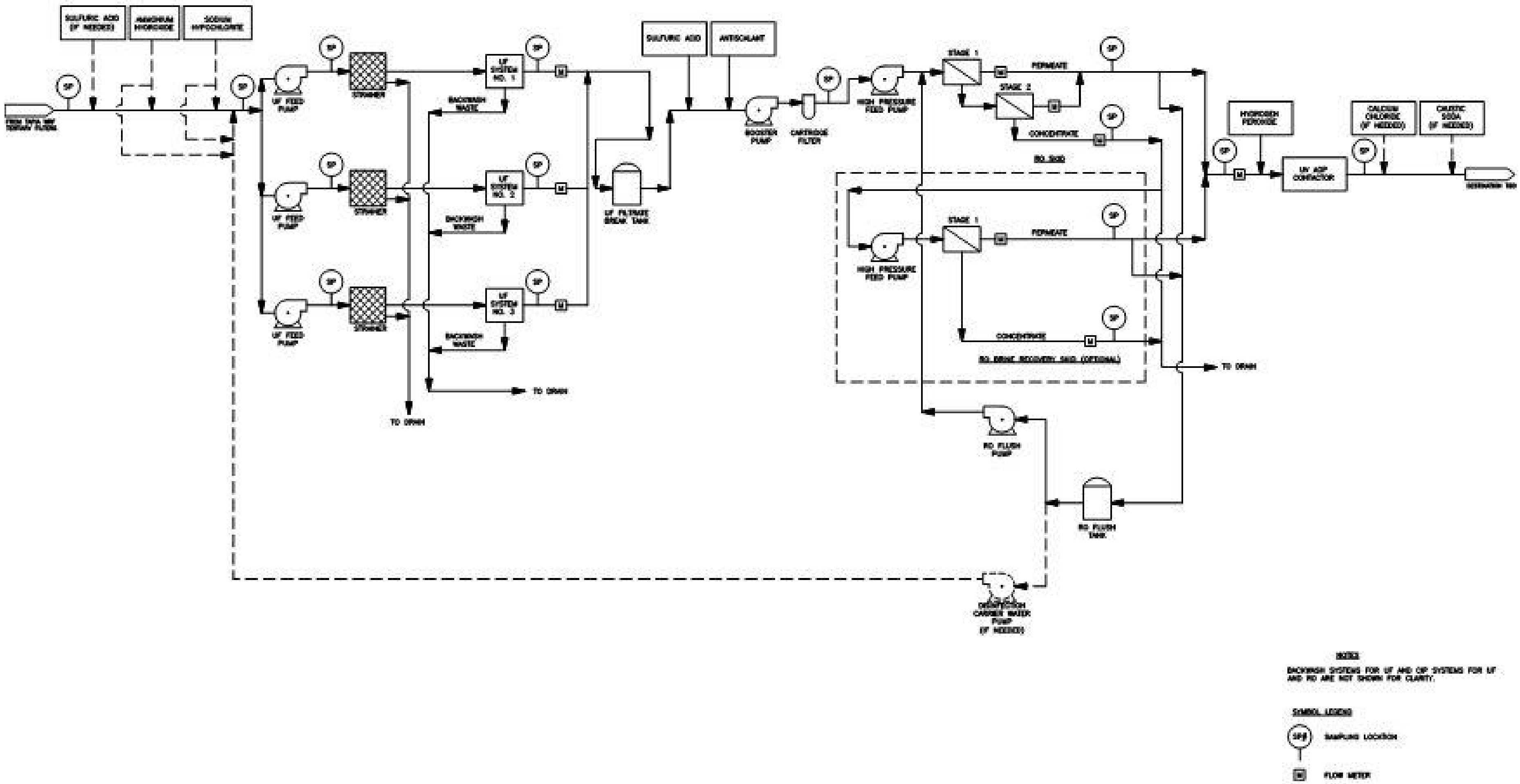

Figure 4-1
Demonstration Plant Process Flow Diagram

4.1.1 Pre-Treatment Chemical Addition

Ammonium hydroxide and sodium hypochlorite will be added downstream of the membrane feed pumps and upstream of the membrane filtration 200-micron inlet strainers for chloramination to control biological fouling of the UF membranes. The target combined chlorine concentration (chloramines) will be 3 to 5 mg/L.

4.1.2 Membrane Filtration Pre-Filters

The membrane filtration inlet strainers protect the membrane filtration membranes from damage and/or fouling due to larger particles. Automatic self-cleaning inlet strainers are typically provided by the membrane manufacturers as part of a complete membrane filtration system package and are required by the membrane filtration system warranty.

4.1.3 Membrane Filtration System

Since the membrane flux is a major element in determining how much membrane equipment is required for both the MF/UF and the RO systems, optimizing the flux rate across each is a critical outcome of the demonstration project. For the MF/UF, utilizing a universal skid design will allow multiple vendor's membranes to be tested at different flux rates side-by-side. The system should accommodate a minimum of three alternative membrane types, operating as independent systems with separate flow monitoring, integrity testing, backwashing, and membrane cleaning to allow a direct comparison of membrane performance between the three systems. Membrane integrity will be confirmed using online turbidimeters and by daily pressure decay tests. The system will be fully automated for flow control, backwashing, daily maintenance cleans, and periodic chemical cleans in place.

4.1.4 Membrane Filtration Break Tank

The membrane filtration break tank will serve as a flow equalization reservoir for the membrane filtration product prior to being pumped to the RO system. The membrane filtration filtrate will be conveyed to the membrane filtration break tank with residual pressure from the membrane filtration system. The membrane filtration break tank will mitigate the impact of the variations in the membrane filtration filtrate flow (resulting from backwashes, cleanings, and integrity tests) by providing equalization volume equivalent to approximately 30 minutes of the maximum RO feed flow between the membrane filtration and RO processes. The membrane filtration filtrate flow varies due to the membrane filtration backwashes, which will occur every 25 to 30 minutes. Overflow from the break tank will be directed to the sanitary sewer.

4.2 Reverse Osmosis System

While RO is used for purification and desalination in water treatment, it also has an extensive history of being effectively utilized in wastewater treatment processes for removal of a wide array of dissolved constituents, including trace organic compounds that are not removed through a tertiary filtration process. RO has proven to be effective at removing the refractory organics and volatile organic fractions of dissolved organic constituents. It can also remove complex organic constituents such as taste and odor causing compounds. RO is generally recognized as the best available treatment for reducing total dissolved solids (TDS) and many constituents of emerging concern in wastewater effluent intended for groundwater replenishment.

The RO facility will include the following processes:

- RO pre-treatment chemical addition (antiscalant and sulfuric acid for scale control)
- RO primary feed pump
- Two-Stage primary RO system
- Secondary RO feed pump
- One-stage secondary RO system
- RO flush tank and flush pump

4.2.1 Pre-Treatment Chemical Addition

Antiscalant will be added upstream of the RO membranes to control scaling. Sulfuric acid will also be added upstream of the RO membranes to lower the pH of the RO feed water to prevent calcium carbonate, calcium phosphate, barium and strontium from limiting the RO recovery.

4.2.2 Reverse Osmosis Feed Pump

The RO feed pump will pump membrane filtrate from the membrane filtration break tank to the RO system. he required RO feed pump pressure is a function of the headloss in the upstream associated piping, and the required feed pressure into the RO system. The required discharge pressure for the RO feed pump will vary as the RO operating pressure changes due to water quality changes and RO membrane fouling. Therefore, a variable frequency drive (VFD) will be used for the RO feed pump to adjust to varying pressure requirements. The rated design point for the pump will be selected from within this range such that the pump will operate near best efficiency for the most common operating conditions.

4.2.3 Reverse Osmosis System

A two-stage primary RO and single-stage secondary RO configuration will be provided to increase recovery and reduce brine flow. The RO trains will have 8-inch elements, which are the most common size in the IPR industry to date. One primary RO system will be used to treat the flow with a 2-stage design operating at approximately 85 percent recovery. The concentrate from the two primary RO systems will be combined and pumped through a single-stage secondary RO system which will increase overall RO recovery to approximately 92.5 percent. The two systems will share a common chemical cleaning system. Membrane integrity will be monitored continuously through conductivity and intermittently through weekly sampling for sulfate. Assessment of the RO flux rate requires longer term operation and cannot be as easily varied during a demonstration test. Based on experience with similar source waters, a primary RO flux rate of 14 gfd has been assumed for the RO skid design.

4.2.4 Reverse Osmosis Flush Tank and Pump

An RO flush tank and pump will be provided for membrane cleanings. The RO flush tank will be fed with RO permeate.

Design criteria for the RO system are summarized in **Table 4-3.**

Table 4-3 Preliminary Design Criteria (RO)

System		Parameter	Unit	Value
Primary RO		Membrane Diameter	in	8
		Membrane Area	ft^2	400
		No. Membranes/ Vessel	-	7
		No. Vessels	-	3
		Configuration	-	Two Stage
		Feed Flow	gpm	96.1
		Overall Recovery	%	85
		Permeate Flow	gpm	81.7
	1st Stage	No. Membranes	-	14
		No. Vessels	-	2
		Permeate Flow	gpm	54.4
		Recovery	%	57%
		Flux	gfd	14
	2nd Stage	No. Membranes	-	7
		No. Vessels	-	1
		Permeate Flow	gpm	27.2
		Recovery	%	65%
		Flux	gfd	14
Brine Recovery RO System		Configuration	-	One Stage
		Feed Flow	gpm	9.4
		Recovery	%	50
		Permeate Flow	gpm	4.7
		Membrane Diameter	in	4
		Membrane Area	ft^2	81
		No. Membranes	-	7
		No. Vessels	-	2 (1 duty, 1 standby)
		Flux	gfd	10 - 12
Primary RO + Brine Recovery		Overall Recovery	%	90
		Permeate Production	gpm	86.4

4.3 UV/Advanced Oxidation System

The final advanced water purification process is disinfection and advanced oxidation, which is required for projects to comply with the 2014 Groundwater Recharge Reuse Regulations. A disinfection process is needed to meet the pathogenic microorganism reduction requirements included in the regulations. Advanced oxidation is required for the full advanced treatment, achieving a minimum 0.5-log reduction of 1,4-dioxane.

The UV reactors serve two purposes: disinfection and, with addition of hydrogen peroxide or chlorine upstream, advanced oxidation. The UV disinfection process will provide 6-log enteric virus reduction (towards the overall requirement of 12-log removal), 6-log *Giardia cyst* reduction (towards the overall requirement of 10-log removal), and 6-log *Cryptosporidium oocyst* reduction (towards the overall requirement of 10-log removal).

Advanced oxidation is considered the best available technology to address the destruction of trace organic compounds that are not fully removed by the RO membranes, notably NDMA, flame retardants, and 1,4-dioxane. UV coupled with an oxidant, such as hydrogen peroxide, chlorine or ozone, destroys trace organic compounds through two simultaneous mechanisms:

- Through UV photolysis (exposure to UV light) where UV photons break the bonds of certain chemicals if the bond energy is less than the photon energy.
- Through UV light reacting with the oxidant to generate hydroxyl radicals. A typical hydrogen peroxide added to the RO permeate upstream of the UV process at a dose of approximately 3.0 mg/L.

Advanced oxidation with UV/hydrogen peroxide systems are the most common advanced oxidation technology for IPR, and have been used extensively for the removal of trace organic compounds found in treated water. However, recent studies have investigated the benefits of using other oxidants, such as chlorine or ozone, for AOP in IPR. Preliminary testing of UV/chlorine has shown that it has the potential to provide similar reductions in 1,4-Dioxane to UV/hydrogen peroxide. Use of chlorine for AOP has the benefits of sodium hypochlorite being is a relatively inexpensive chemical and it being commonly used in water and wastewater treatment. The system will be designed to allow for the injection of either hydrogen peroxide or chlorine upstream of the UV. Ozone is another AOP oxidant that may be tested during this study.

The UV/hydrogen peroxide system has been designed to meet the 2014 Groundwater Recharge Reuse Regulations, providing a minimum 0.5-log reduction of 1,4-dioxane, which serves as an indicator compound for other trace organic compounds. The UV system design criteria are listed in **Table 4-4**.

Table 4-4 Preliminary Design Criteria (UV)

Parameter	Unit	Value
Design Flow	gpm	90
UV Transmittance	%	>96
1,4-Dioxane Removal Target	-	0.5 log
NDMA Removal Target	-	<10 ng/L
Lamp Technology		LP-HO

4.4 Chemical Addition Systems

Chemicals will be added at various stages of the treatment process to improve water quality, prevent fouling of the membranes, and provide chemical cleaning for the membranes.

4.4.1 Membrane Filtration Pre-Treatment

Sodium hypochlorite and ammonium hydroxide will be added to the membrane filtration feed water. Sodium hypochlorite will be added before the membrane filtration system to prevent biogrowth on the membranes, reducing the risk of fouling. Ammonium hydroxide will be added before the membrane filtration system to combine with the sodium hypochlorite and create a chloramine residual, which will not damage the RO membranes. Without ammonia, free chlorine could cause severe damage to the oxidant sensitive membranes. A target chlorine to ammonia ratio of 4:1 will be used to provide excess ammonia and prevent the formation of dichloramine.

4.4.2 Reverse Osmosis Pre-Treatment

Sulfuric acid and antiscalant will be added the membrane filtration filtrate before entering the RO system. Sulfuric acid will be added before the RO system to prevent scaling in the RO membranes. System will target an RO feed water pH of 6.5. Antiscalant will be added before the RO system to prevent scaling in the RO membranes.

4.4.3 Reverse Osmosis Post-Treatment

The RO post-treatment strategy will include the addition of calcium chloride to increase hardness and the addition of caustic soda to increase pH. This strategy allows operators to control hardness and pH independently, producing stable product water that can be matched to any desired combination of pH, hardness, and alkalinity. Hydrogen peroxide or chlorine will be added before the UV system to promote advanced oxidation and removal of any trace organic compounds present in the RO permeate.

4.4.4 Clean-In-Place Systems

The membrane filtration and RO systems will include clean-in-place (CIP) systems that will utilize chemical cleaning to remove fouling from the membranes. Chemicals that will be used for MF/UF CIP include sodium hypochlorite, citric acid, and caustic soda. Chemicals that will be used for RO CIP include citric acid, caustic soda, and proprietary cleaning chemicals.

Table 4-5 presents the design criteria for the chemical addition systems.

4.5 Water Quality

Projections of water quality are based on the historic effluent quality from the Tapia WRF. **Table 4-6** presents a summary of these data.

Table 4-5 Preliminary Design Criteria (Chemicals)

Chemical	Dosing Location	Frequency of Use	Dose (mg/L)
Sodium Hypochlorite	UF Feed	Continuous	3 to 5[1]
	RO Permeate (alternative AOP testing)	Continuous	2 to 4
	UF MW/ CIP	Intermittent	To achieve free chlorine residual target
Ammonia	UF Feed	Continuous	1[1]
Sulfuric Acid	RO Feed	Continuous	80[2]
	Dosing Location (Alternative)	Brine Recovery Feed	150[2]
Antiscalant	RO Feed	Continuous	4
Hydrogen Peroxide	RO Permeate	Continuous	Up to 4
Calcium Chloride	RO Permeate	Continuous	15[3]
Caustic Soda	RO Permeate	Continuous	15[3]
	UF CIP	Intermittent	To achieve desired %wt concentration
	RO CIP	Intermittent	To achieve desired %wt concentration
Citric Acid	UF MW/ CIP	Intermittent	To achieve desired %wt concentration
	RO CIP	Intermittent	To achieve desired %wt concentration

Notes:
1. To be refined based on Title 22 feed water analysis
2. To be refined based on Title 22 feed water analysis and RO projections
3. To be refined based on RO projections and RTW modelling

Table 4-6 Anticipated Source Water Quality for the Demonstration Project

Parameter	Units	Taipa WRF Effluent[1]	
		Avg	Max
Ammonia – N	µg/L	97	440
BOD (5 day, 20° C)	mg/L	1.7	4.6
Boron	mg/L	0.39	0.48
Chloride	mg/L	160	182
Copper (Total Recoverable	µg/L	97	440
Cyanide	µg/L	1.82	10
Nickel (Total Recoverable)	µg/L	3.5	5
Nitrate + Nitrite – N	mg/L	7	9.9
Orthophosphate – P	mg/L	2.3	3.4
Sulfate	mg/L	192	281
Total Dissolved Solids (TDS)	mg/L	744	860
Total Suspended Solids (TSS)	mg/L	1.69	9.9
Turbidity	NTU	<1	7

Note:
1. Based on Joint Powers Authority LVMWD Triunfo Sanitation District Basis of Design Report (MWH, 2016). Data summarizes effluent water quality between November 2010 and December 2014.

4.6 Structural

A structural assessment was conducted for the equipment scheduled to be mounted to the existing Headquarters Building. The new equipment will be supported on the first-floor concrete slab on grade. The following structural design criteria were used:

- Building Code: 2016 California Building Code
- Building Risk Category II
- Dead Loads include weight of all materials of construction
- Earthquake Design Data:
  - Spectral Response Accelerations:
    - $S_S = 1.919\ g$
    - $S_1 = 0.681\ g$
- Site Class D (assumed)
- Earthquake Spectral Response Acceleration Parameters
  - S_{DS} = 1.279 g
  - S_{D1} = 0.681 g
- Long-Period Transition Period TL = 8 seconds
- Seismic Design Category D
- Seismic Importance Factor Ie = 1.00
- Component Importance Factor IP = 1.00

The existing concrete slab on grade is 4" thick with #4@24" each way. Therefore, the slab is a soil supported slab and not reinforced to allow it to act as a structural slab on grade.

Each major piece of equipment was assessed for the effect of its operating weight and operating weight plus earthquake effects on the concrete floor. When the structural analysis indicates that the equipment would overturn during a seismic event, then uplift, anchorage will be provided. Since the existing concrete floor can accommodate only a small amount of uplift, separate equipment pads will be provided to provide the needed structural support. The following are the key findings from this assessment.

- MF Process Skid – The MF Skid is skid mounted equipment with an operating weight of 7,500 lbs. This skid will need anchorage to resist sliding and uplift. The skid will be mounted on a concrete equipment pad to elevate the equipment to provide drainage away from the skid and adequate concrete thickness for the anchor bolts.

- MF Break Tank – The MF Break Tank is a 2,500-gal tank with an operating weight of 21,230 lbs. This tank will need anchorage to resist sliding. The existing slab should be adequate. The height of the tank and the per square foot loading could cause potential settlement.
- RO Skid – The RO skid is skid mounted equipment with an operating weight of 6,750 lbs. This skid will need anchorage to resist sliding and uplift. The skid will be mounted on a concrete equipment pad to elevate the equipment to provide drainage away from the skid and adequate concrete thickness for anchor bolts.
- Chemical Skid – The chemical storage tanks will consist of 55 gal. drums with an operating weight of approximately 500 lbs. will require anchorage for sliding. The existing slab should be adequate.
- Metering Pumps – The metering pumps with an operating weight of approximately 800 lbs. The standard rack system will need to be modified to allow the pumps to be mounted directly on the existing concrete floor. If the rack cannot be modified, an equipment pad will be provided.

4.7 Electrical

This section summarizes general electrical design criteria for the Demonstration Project. The applicable codes and standards for the electrical design of the facility include the following:

- NFPA 70 – National Electrical Code (NEC) 2017
- California Building Code
- California Fire Code
- American National Standards Institute (ANSI) Standards
- National Electrical Manufacturers Association (NEMA) Standards

4.7.1 Design Criteria

Table 4-7 through **Table 4-9** contain the general electrical design criteria for the system.

Table 4-7 General Electrical Design Criteria

Category	Design Criteria
Electrical Equipment Sizing	As a minimum, the electrical equipment will be sized in accordance with the NEC for the following: ▪ Protective devices, conductors, and conduits shall be sized in accordance with the NEC.
Overcurrent and Short Circuit Protection	All 120/240V power circuits will be protected by fuse or circuit breaker. Protective devices will be fully rated for the short circuit duty at the point of application. Bus and equipment short circuit ratings will exceed worst case fault current available at each location.
Identification	Identification plates will be provided for the conduits. Wire markers will be provided for all power conductors.

Table 4-8 Conductors Design Criteria

Category	Design Criteria
Minimum Size Conductors	Power circuits (240 Volts): #12 AWG
600 Volt cable/wiring	Copper conductors 120v power and lighting circuits and control wiring: THWN/THHN-2 insulation 480V power circuits: XHHW-2 insulation

Table 4-9 Conduit Design Criteria

Category	Design Criteria
Wiring	All wiring will be run in conduit. Minimum ¾-inch trade size conduit for exposed runs.
Conduit Usage	Exposed: ▪ Clean, dry unfinished, non-process areas: Galvanized rigid steel (GRS) and liquid-tight flexible metal conduit (unless otherwise noted below.) ▪ Process areas designated DAMP or WET: GRS and liquid-tight flexible metal conduit (unless otherwise noted below.) ▪ Corrosive areas: PVC coated rigid steel ▪ Exposed outdoor areas: PVC coated rigid steel ▪ Hazardous areas: GRS or PVC coated GRS depending on exposure Embedded in concrete walls, floors, or ceilings: Schedule 40 PVC Connections to all motors and transformers: Liquid tight flexible metal conduit.

4.7.2 Power Distribution System

The existing electrical distribution system consists of Switchboard P, which is fed from the utility. Switchboard P is currently not in use. The new power distribution system will utilize the existing Switchboard P with its current circuit breakers to feed the new loads. See Section 7 for the required electrical single-line diagram.

4.8 HVAC

The HVAC system for the existing building requires modifications for it to function with the with the Demonstration Project layout. The air handling unit and ductwork date from the original building construction in 1968. While the system might still function, it is approaching 50 years old and is at the end of its service life. It is recommended that a full evaluation of the existing HVAC unit be completed during the design phase by a reputable HVAC contractor to determine whether it should be replaced as part of this project, or if it can be reused.

The existing HVAC equipment also does not meet current energy codes. Any modifications will be required to meet the current energy code. This includes modifications to the windows, walls, roof, lighting as well as the HVAC and ductwork systems.

At a minimum, the HAVC system will require rebalancing because of the changed usage of the exhibit room, process area, laboratory, compressor room and chemical room. The existing ductwork, if it is reused will require sealing and re-insulating. A new HVAC control system is also required.

Specific requirements for each room are provided as follows:

4.8.1 Process Room

The heat gain from the process equipment is not yet known. It is anticipated that the existing HVAC system will have adequate capacity for the heat if it is still operational. Diffusers may need to be moved to provide the cooling where it is required.

4.8.2 Laboratory

The building code requires no ventilation air from laboratories be returned to the building air conditioning system. This would require an exhaust fan to purge the air from the building. A final determination on whether the air from this room needs to be exhausted can be made once the testing protocols and the chemicals involved have been established

4.8.3 Compressor Room

The heat generated by the new compressor may exceed the design capacity of the HVAC provided to this room. A supplemental air conditioning unit like a mini-split air conditioner can be added to this room to remove the additional heat from the compressor. Also, additional wall insulation and layers of wallboard may be required to keep the compressor noise from being objectionably loud in the public spaces.

4.8.4 Chemical Storage Room

Chemical storage for this facility could be indoors or outside, depending on chemicals and design considerations. Outdoor storage of chemicals, while less complex in terms of HVAC design, often requires longer chemical lines and places chemicals in areas that may be more prone to vandalism. Chemical storage indoors, while more complex for permitting and HVAC design, allows for the chemicals to be stored in a secure, temperature-controlled location. For these reasons, chemicals will be stored inside the building in a chemical storage room. The chemical storage room requires 1 cfm/sq. ft. of exhaust ventilation, approximately 125 cfm. The new exhaust fan can penetrate the roof. The existing air handling unit will need to be rebalanced to accommodate the increased building exhaust. Any penetrations through the walls will need to be fire rated.

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Section 5

Procurement Options & Schedule

Three primary alternatives could be utilized for the procurement of the equipment used in the Demonstration Testing. These include:

- Leasing
- Design/Bid/Build (DBB)
- Design/Build (DB)

These alternatives are discussed briefly below. A table summarizing advantages and drawbacks to each is included as **Table 5-1**. Regardless of the procurement method selected, a pre-qualification process is recommended, and is discussed further at the end of this section.

Table 5-1 Procurement Alternatives: Advantages/ Disadvantages

Procurement Type	Advantages	Disadvantages
Leasing	Potential for lower cost Vendors provide maintenance responsibility Simplified decommissioning	Limitations in available equipment May be higher cost if extending operations period Desired operation period of project (>3 years) is greater than typical length of leasing projects
Design-Bid-Build	Highest level of control over design conditions	Longer schedule Potential for conflicts between design, construction, and operations contract
Design-Build	Faster schedule Single point of responsibility Simpler to modify plant during operation	Less control during design

5.1 Leasing

For the leasing option, the process systems used would be rented or leased from specific vendors, whether proprietary or not. Leasing is advantageous for short pilot or demonstration programs. It allows equipment to be changed out during the testing, if needed, maintains equipment maintenance responsibility with the suppliers, and does not require effort to sell off equipment once it is no longer needed. Because the leasing relies on readily available equipment packages, the equipment options may limit the scope of what can be tested, and the potential for cost savings decrease substantially as the duration of the testing is extended. Assuming the demonstration plant trial will last 12 months, the difference between purchasing and leasing is estimated to be $403,000, however, if the rental period is extended to 18 months, the savings we be only $46,600. If the rental period extends beyond 18 months, it could become more costly than purchasing the equipment. A breakdown of costs for both options is presented in Section 6 Cost Estimates.

5.2 Design/Bid/Build

Using a DBB procurement method for the demonstration plant would require that the JPA retain a design firm to take the results of the demonstration plant preliminary design and complete the final design. The design firm would then assist the JPA with the procurement of a contractor to build the demonstration plant. The design firm and contractor work directly with the Owner, there is no contractual relation between the design firm and contractor. Operation could be by the design consultant, the contractor, or a separate operations consultant, depending on JPA preferences. **Table 5-2** presents an estimated schedule for a DBB contracting approach.

Advantages of DBB project delivery include:

- Owner has control with the design firm responsible for design and the contractor responsible for construction as per design.
- Owner has more input into the design compared with a DB contract.

Drawbacks of DBB project delivery include:

- Owner assumes significant risk for the overall project. Design risk is with the designer and construction and start-up risk is borne by the Contractor.
- Pursuing separate contracts for the engineering and construction services can lengthen the project schedule compared with a DB contract.
- Conflicts can arise between the design firm and contractor as a result of the separate contracts.

Table 5-2 Design-Bid-Build Schedule

Action/ Item	Duration (months)
30% Design Submittal	3
Bid for the Design Firm	
Award the Design Contract	
Complete Design Documents	3
Bid for the Construction Contract	3
Evaluation of Proposal Submissions	
Award the Construction Contract	
Materials and Equipment Procurement	2
Construction	3
Commissioning and Start-up	1
Handover to Operations	12
Project Duration	27

5.3 Design/Build

DB combines the design and construction into one contract. The DB team can be led by a design firm or contractor which may be separate firms or a single integrated firm. A 30 percent procurement “bridging” document, possibly based on the preliminary design prepared for this project, would be used to define the DB contractor’s responsibilities. The DB contractor would have the ability, as allowed by the bridging documents, to select which vendors to use for the demonstration project. The DB contracting approach has seen increasing use in municipal water treatment projects over the last 10 to 20 years, and it provides unique advantages for a demonstration project, where ideal operating conditions are not necessarily fixed and continued changes to design and construction may be desired during plant operation. For a DB project, the owner would contract with a single entity, avoiding the risks of conflicts between the designer and contractor scope, and this firm could remain under contract during plant operations, covering plant maintenance, facility modifications, and possibly operation of the plant, as desired. **Table 5-3** presents an estimated schedule for a DB contracting approach.

Advantages of the DB project delivery approach include:

- Compared with DBB schedules, DB project schedules are often shorter due to the elimination of separate procurement contracts for the design firm and constructor. This also tends to lead to reduced costs.
- Owner assumes less risk for the design compared with a DBB project.
- Unlike a DBB project, with DB there is a single point of responsibility for the owner to manage.
- Professional relationship exists between the design firm and contractor.
- Unified recommendations are presented to the owner.
- Constructability reviews during design promote innovation.

Disadvantages of DB project delivery include:

- DB contractor generally has to assume more risk depending on the prescriptive nature of the bidding documents.
- Owner generally has less control of design.

Table 5-3 Design-Build Schedule

Action/ Item	Duration (months)
30% Design Submittal	3
Develop Design-Build Documents	
Bid for the Design-Build Contractor	
Evaluation of Proposal Submissions	
Award Design-Build Contract	
Complete Design Documents	3
Materials and Equipment Procurement	2
Construction	3
Commissioning and Start-up	1
Operations	12
Project Duration	24

5.4 Vendor Prequalification and Selection Processes

While pre-qualification is recommended for both DBB and DB projects, it is only one part of the procurement process. Even after pre-qualifying vendors through the demonstration testing, there will still be differences between the qualified vendors that will impact the size, layout and ancillary facilities needed. Determining which proprietary membrane filtration systems to include in the full-scale design for example, requires specialized procurement methods to maintain competition between the qualified vendors and provide the necessary information to complete the design as discussed above.

The typical vendor selection processes are outlined in **Table 5-4**. Implemented successfully, all three options provide a means for project owners to obtain a firm price for the proprietary equipment and eliminate schedule delay.

Table 5-4 Vendor Selection Processes: Advantages/ Disadvantages

Procurement Type	Advantages	Disadvantages
Negotiated	Single system design Matches existing system	No competition to determine price
Owner Pre-purchase	Single system design Life-cycle cost	Owner has schedule/ operation risk
Pre-selection and Assignment	Maintains competition Single system design Life-cycle cost	Upfront contract to provide shop drawings

Section 6

Cost Estimate

This section provides the capital cost estimates for the Demonstration Project. LVMWD has the option of either purchasing or leasing the treatment process equipment. The Demonstration Plant is estimated to be operational until the full scale Pure Water Project comes is implemented. This period is estimated to be approximately 4-5 years after construction of the Demonstration Project. There would be some minor savings from leasing the equipment compared to purchasing; however, a leasing option would reduce the opportunity to continue utilizing the equipment for an extended period of time after the leasing agreement has ended. It is therefore recommended to purchase the equipment, providing greater flexibility for future plant operation.

6.1 Ancillary Facilities

The capital cost of the ancillary facilities for the Demonstration Project is summarized in **Table 6-1.** Ancillary costs are identical for both the purchase and lease options. Costs for the architectural/structural/HVAC items are estimates and the actual scope of work should be refined during the final design.

Table 6-1 Ancillary Facilities Breakdown

No.	Description	Burdened Actual Cost	Detail of Assumptions
1	Site Work	$35,000	Yard piping, dumpster, maintenance, utility connections
2	Demolition	$15,000	
3	Piping	$20,000	Interior piping, drains, supports, painting
4	Laboratory Furnishing	$10,000	
5	Miscellaneous Items	$135,000	Tools, signs, safety equip., materials, etc.
6	Architectural/Structural/HVAC[1]	$750,000	Allowance to: refurbish walls, ADA requirements, rest rooms, floor repairs, AC Units and Ducts, water testing station
	Subtotal	**$965,000**	

Notes:

1. Exhibits, banners and other public outreach specific items are not included in this item.

6.2 Purchase Option

The capital cost to purchase equipment for the Demonstration Project is summarized in **Table 6-2**.

Table 6-2 Purchase Option Cost Estimate Breakdown for Design-Build and Design-Bid-Build

No.	Description	Burdened Actual Cost
1	UF Skid (Equipment, shipping, startup)	$265,000
2	RO Skid (Equipment, shipping, startup)	$260,000
3	UV Skid (Equipment, shipping, startup)	$120,000
4	Chemical System (Chemicals, dosing pumps)	$30,000
5	Air Compressor	$2,000
6	Ancillary Facilities (See Table 6-1)	$965,000
7	Electrical and Instrumentation (Wiring, equipment)	$100,000
8	Labor and Equipment (Contractor labor and equipment installation)	$325,000
	Subtotal	**$2,067,000**
7	Contractor OH&P (10%)	$206,000
8	Permit Allowance (1%)	$20,000
9	Sales Tax (8%)	$165,000
	Subtotal	**$2,458,000**
10	General Liability Insurance (1%)	$25,000
11	Builder's Risk Insurance (0.4%)	$10,000
	Construction Subtotal	**$2,493,000**
12	Engineering (10%)	$249,000
	Project Subtotal	**$2,742,000**
13	Construction Contingency (30%)	$822,000
	Grand Total	**$3,564,000**

6.3 Lease Option

The capital cost to lease equipment for the Demonstration Project is summarized in **Table 6-3.** Leasing costs are based on 12-month and 18-month rentals of major process equipment, which is the longest period where leasing could be considered favorable over purchasing of equipment. Since this project will likely last more than 18-months (up to fiveyears), leasing is not considered a favorable option for implementation. Ancillary facilities costs are assumed to be the same as those presented in Table 6-1. Contractor markups, project development costs, and contingencies are based on the same percentages presented previously in Table 6-2.

Table 6-3 Cost Estimate Breakdown (Lease Option)

	Description	Cost for 12-month Rental Period [1]	Cost for 18-month Rental Period [1]
1	UF Skid (Equipment, shipping, startup)	$135,000	$203,000
2	RO Skid (Equipment, shipping, startup)	$230,000	$345,000
3	UV Skid (Equipment, shipping, startup)	$48,000	$72,000
4	Ancillary Facilities (See Table 6-1)	$965,000	$965,000
5	Electrical and Instrumentation (Wiring, equipment)	$100,000	$100,000
6	Labor and Equipment (Contractor labor and equipment installation)	$325,000	$325,000
	Subtotal	**$1,803,000**	**$2,010,000**
7	Contractor OH&P (10%)	$180,000	$201,000
8	Permit Allowance (1%)	$18,000	$20,000
9	Sales Tax (8%)	$144,000	$161,000
	Subtotal	**$2,145,000**	**$2,392,000**
10	General Liability Insurance (1%)	$21,000	$24,000
11	Builder's Risk Insurance (0.4%)	$9,000	$10,000
	Construction Subtotal	**$2,175,000**	**$2,426,000**
12	Engineering (10%)	$218,000	$243,000
	Project Subtotal	**$2,393,000**	**$2,669,000**
13	Construction Contingency (30%)	$718,000	$801,000
	Grand Total	**$3,111,000**	**$3,470,000**

Notes:
1. The lease option is for less time (12-18 months vs 4-5 years) than currently proposed for the purchase option.

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Section 7
Environmental Documentation

The CEQA was enacted in 1970 to provide decision-makers and the public with information regarding environmental effects of proposed projects; identifying means of avoiding environmental damage; and disclosing to the public the reasons behind a project's approval even if it leads to environmental damage. CEQA applies only to discretionary government activities, referred to as "projects." Under CEQA, a "project" is defined as the whole of an action, which has the potential for resulting in either direct physical change in the environment or a reasonable foreseeable indirect physical change in the environment. Once a determination has been made that a "project" exists, there are three basic levels of environmental documentation:

- Exemption;
- Negative Declaration (includes those with or without mitigation); and,
- Environmental Impact Report.

As the proposed Pure Water Las Virgenes-Triunfo Demonstration Project (proposed project) involves activities/actions which have the potential for resulting in either direct physical change in the environment or a reasonable foreseeable indirect physical change in the environment, the project is subject to CEQA.

LVWD as the Lead Agency under CEQA (the Lead Agency is the public agency which has the principal responsibility for carrying out or approving the project) has determined that the proposed project falls within categories of activities that are recognized under CEQA as generally having no significant effect on the environment pursuant to Article 19 of the State CEQA Guidelines (i.e., Categorical Exemptions).

As the proposed project would

1. be a nominal 100 gpm facility that tests full advanced treatment processes of MF, RO, UV, and AOP on the tertiary treated recycled water produced by JPA's Tapia WRF and local dry weather flows, and
2. the project's treatment process equipment, chemicals, and testing laboratory would be housed in the vacant former LVWD building (located at 4232 Las Virgenes Road, Calabasas, California, which is on the same site as the new/existing headquarters, reclaimed water reservoir and pump station), and
3. no significant new construction will be necessary, only minor refurbishment of the building (mostly within the interior of the building) and tie into existing systems is expected.

In accordance with the State CEQA Guidelines Section 15301 (a) and (b), the proposed project is the minor alteration of an existing public utility structure/facility involving negligible use beyond existing. The proposed project includes minor interior and exterior alterations of the existing structure/facility. A Notice of Exemption should be filed with the Los Angeles Registrar-Recorder/County Clerk.

As the proposed project is not anticipated to affect federal lands or require federal funding, no compliance under the National Environmental Policy Act is required.

Section 8

Preliminary Drawings

The following preliminary Demonstration Project drawings are provided:

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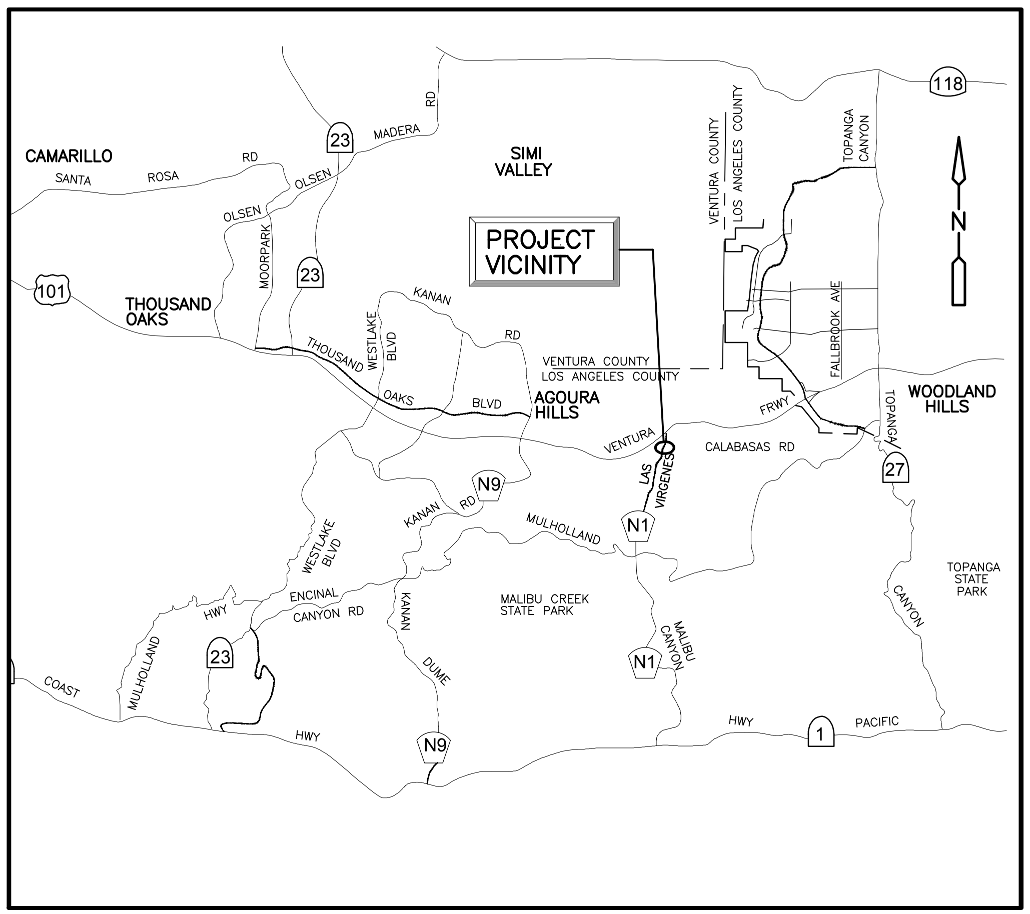
LAS VIRGENES – TRIUNFO JOINT POWERS AUTHORITY

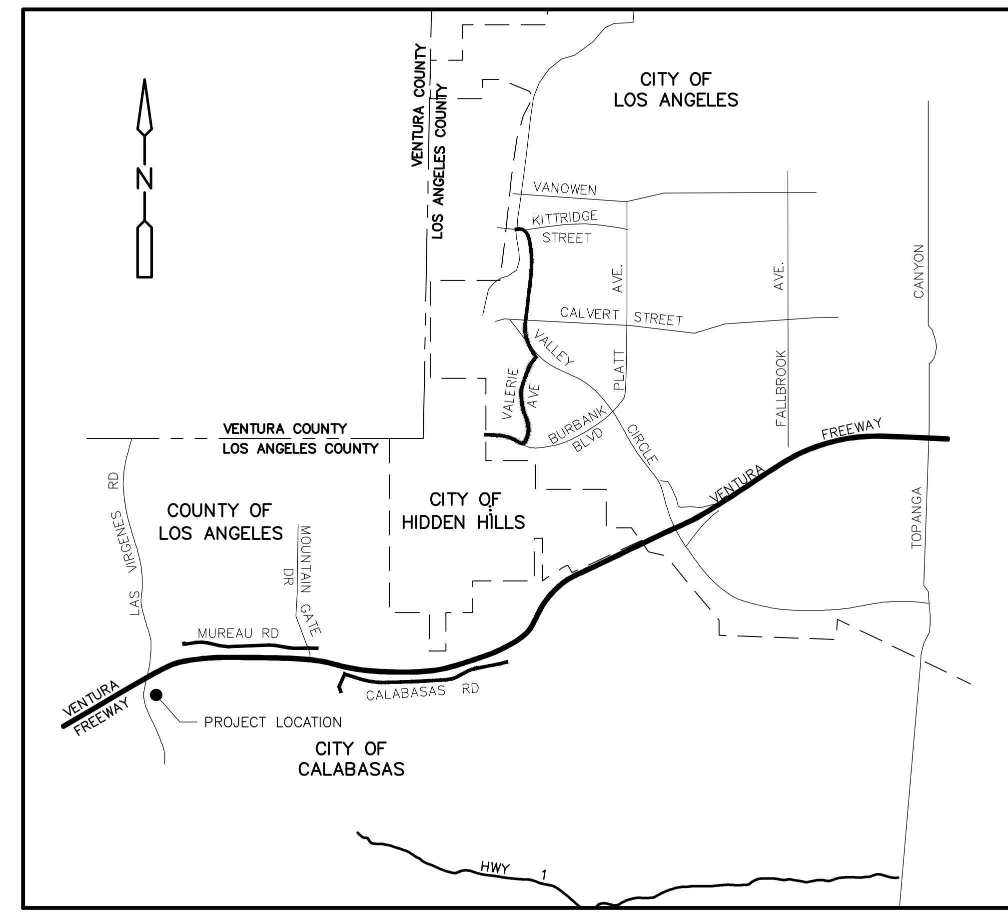
RECYCLED WATER SEASONAL STORAGE DEMONSTRATION PROJECT



VICINITY MAP

NTS

PURE WATER PROJECT
LAS VIRGENES-TRIUNFO
Bringing Our Water Full Circle



LOCATION MAP

NTS

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. YOSHIMURA
DRAWN BY: M. PEREZ
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JUNE 2017

CDM Smith
703 Palomar Airport Road, Suite 300
Carlsbad, CA 92011
Tel: (760) 438-7755

LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

COVER SHEET

PROJECT NO. 10976-215736
FILE NAME: T001COVR.DWG
SHEET NO.
T-1

DRAFT - NOT FOR CONSTRUCTION

XREFs: [CDMS_2234] Images: []
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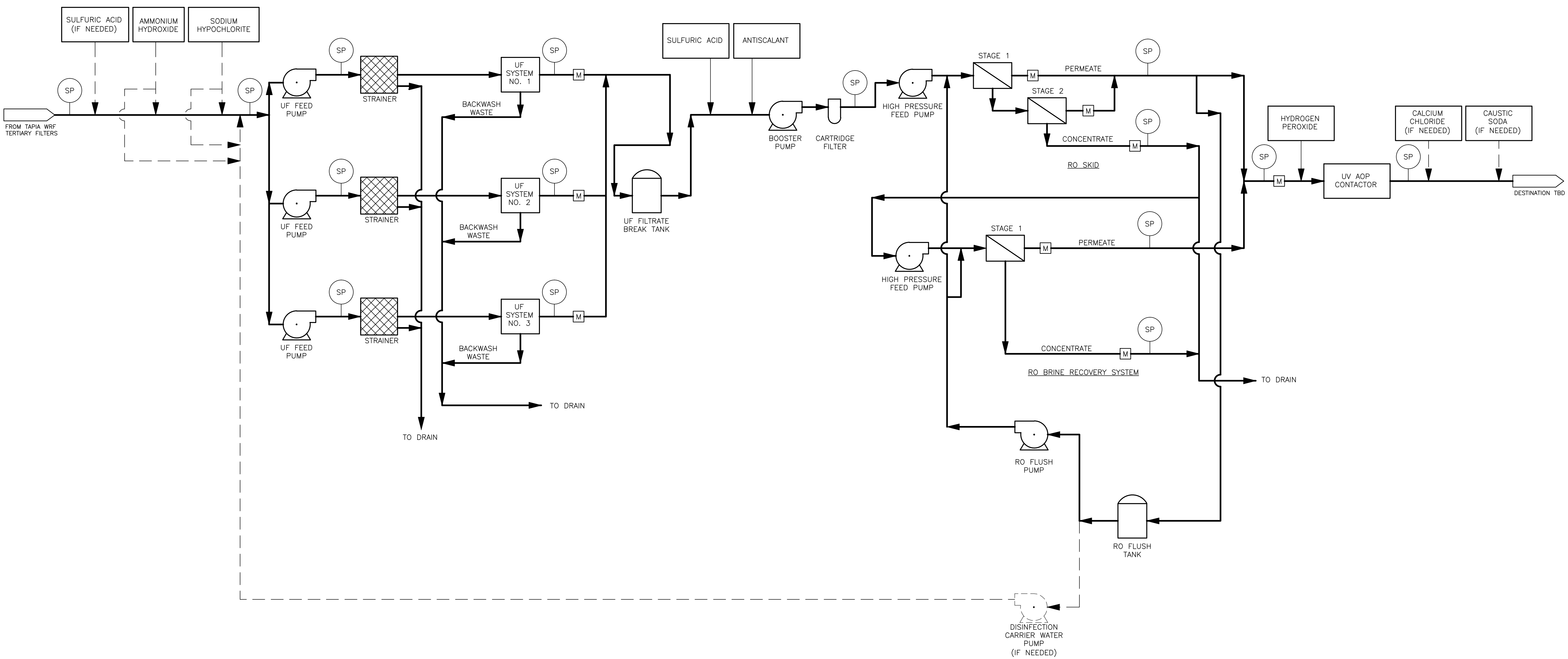

NOTES

BACKWASH SYSTEMS FOR UF AND CIP SYSTEMS FOR UF AND RO ARE NOT SHOWN FOR CLARITY.

SYMBOL LEGEND

SP# SAMPLING LOCATION

M FLOW METER

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: C. SANDERS
DRAWN BY: M. PEREZ
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JUNE 2017

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Carlsbad, CA 92011
Tel: (760) 438-7755

LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

PROCESS FLOW DIAGRAM

PROJECT NO. 10976-215736
FILE NAME: G001NFPF.DWG
SHEET NO. G-1

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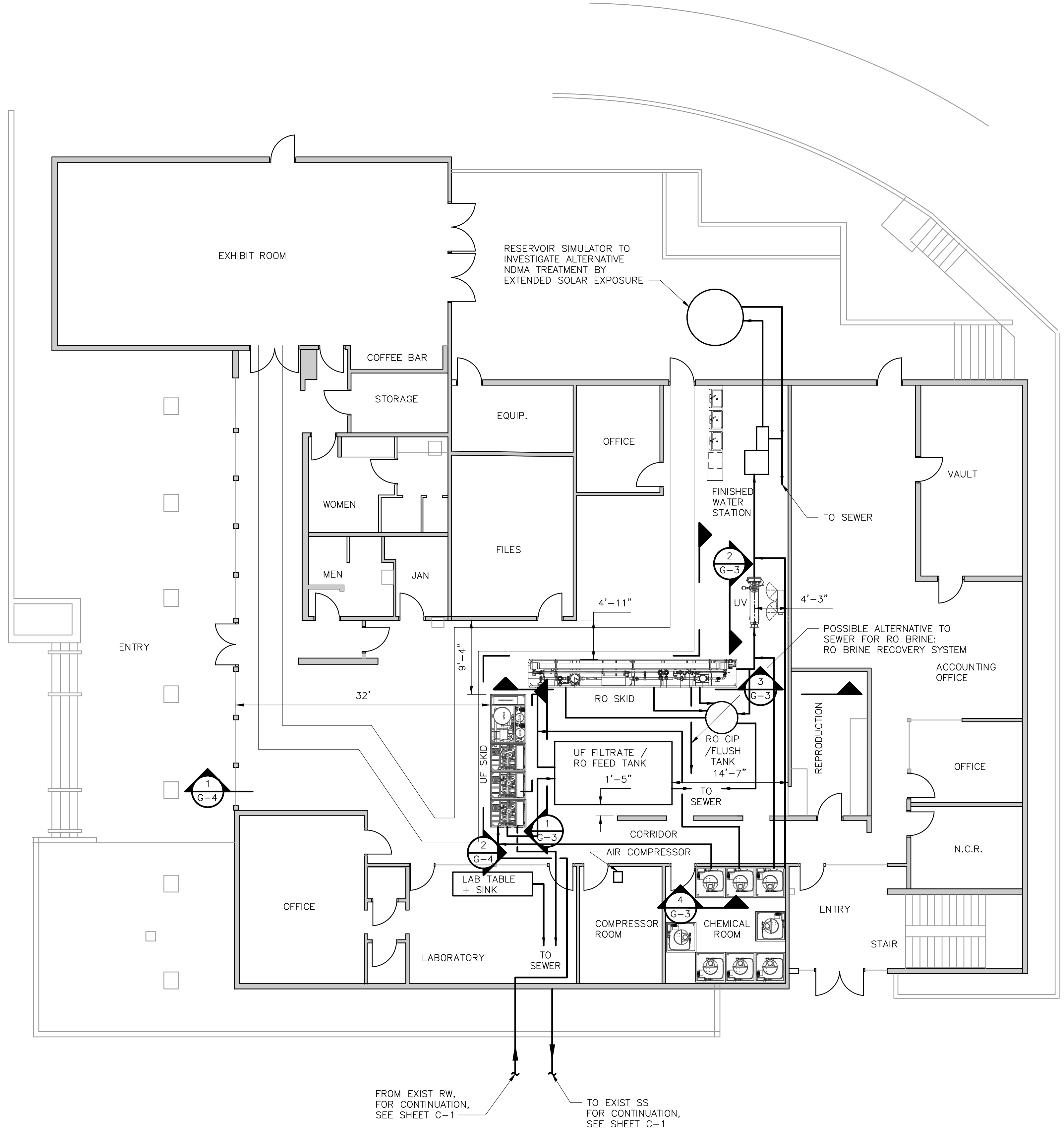
UNITS TABLE		
UNITS	LENGTH (FT–INCHES)	DEPTH (FT–INCHES)
RO SKID	26'–2"	3'–6"
MF SKID	4'–6"	4'–6"
UV REACTOR	2'–1"	2'–1"
UF FILTRATE/ RO FEED TANK	7'–11"	7'–11"
RO FLUSH TANK	4'–7"	4'–7"



PLAN
1/8" = 1'–0"

1/8" = 1'– 0"
4 2 0 4 8

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: C. SANDERS
DRAWN BY: M. PEREZ
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JUNE 2017

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LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

DEMONSTRATION PLANT
PRELIMINARY LAYOUT

PROJECT NO. 10976–215736
FILE NAME: G002STPL.DWG
SHEET NO.
G-2

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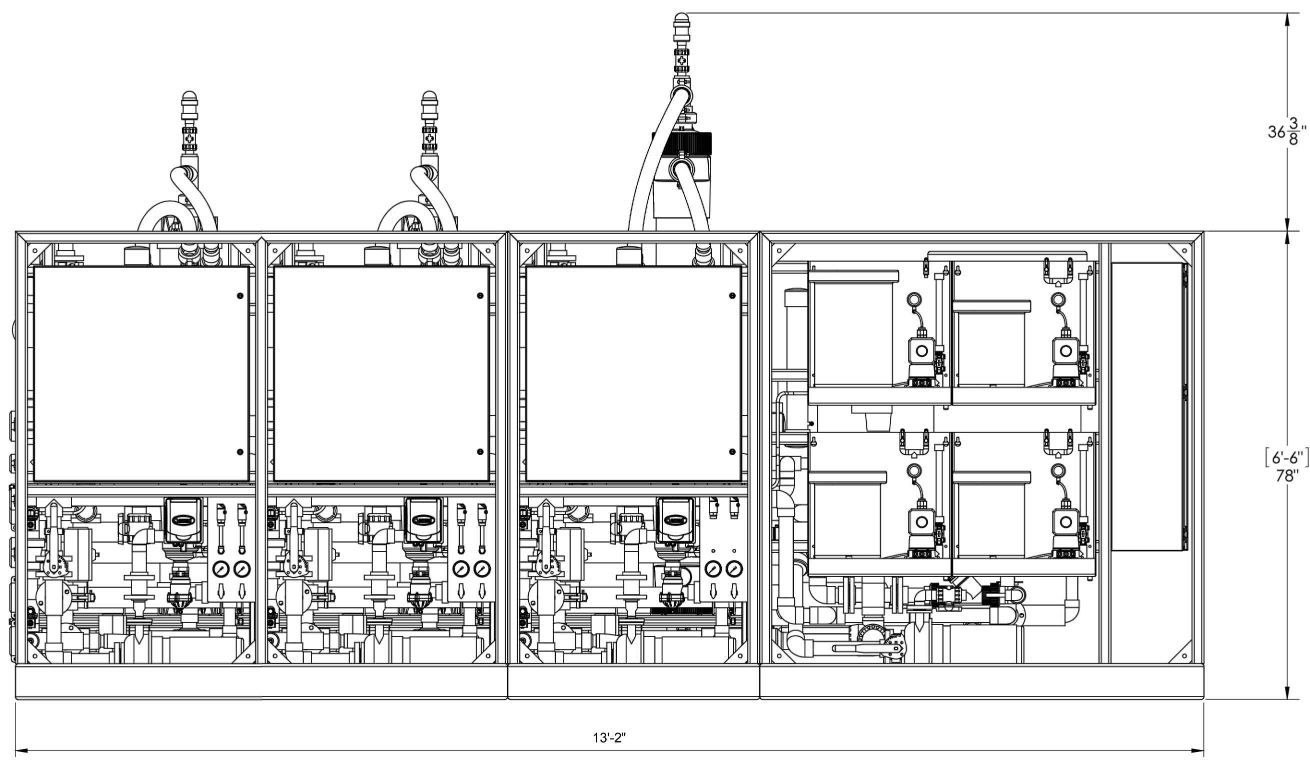
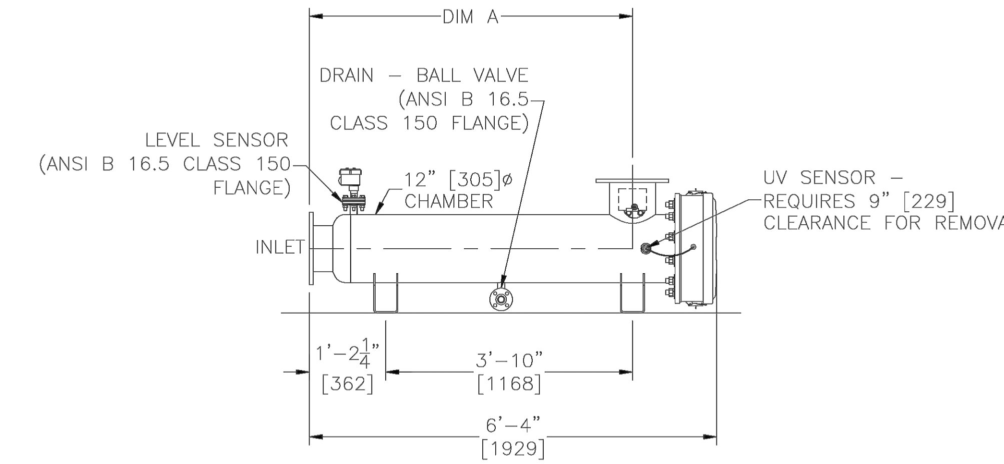
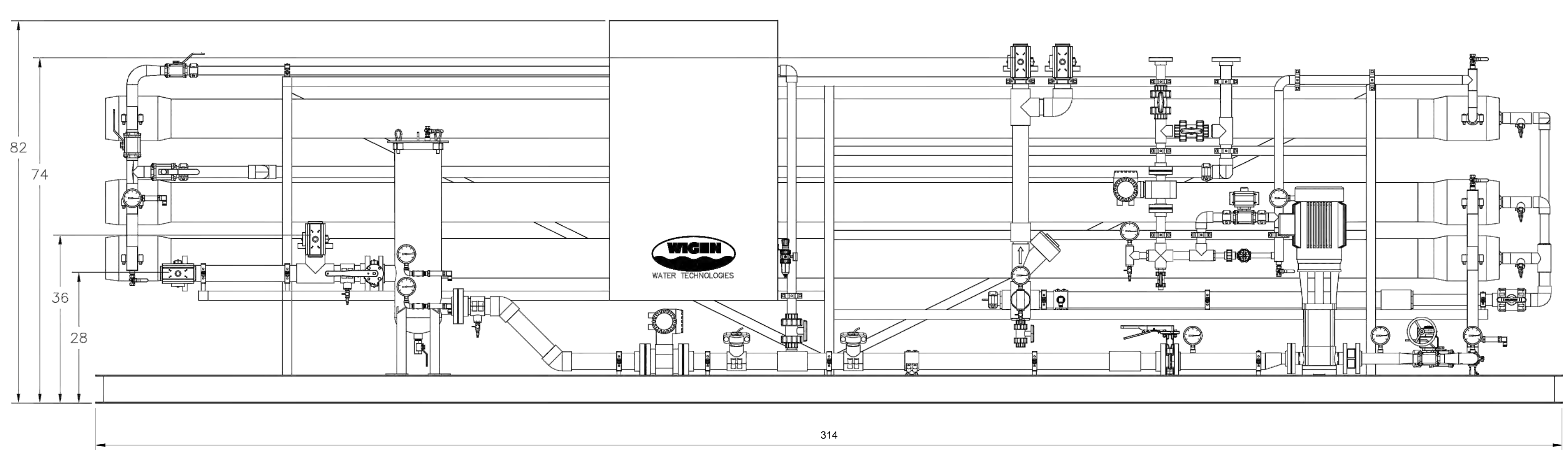


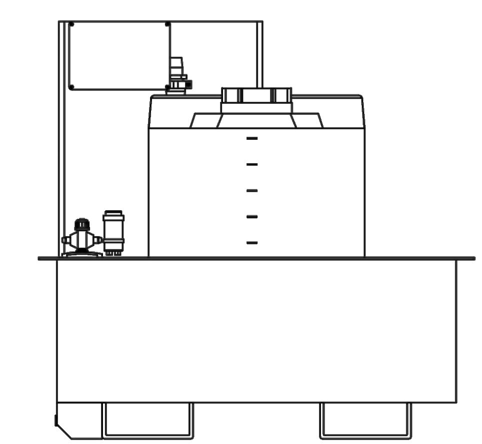
UF SKID
SECTION 1 G-2
NTS



UV REACTOR
SECTION 2 G-2
NTS



RO SKID
SECTION 3 G-2
NTS



TYPICAL CHEMICAL FEED SKID
SECTION 4 G-2
NTS

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. YOSHIMURA
DRAWN BY: M. PEREZ
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JUNE 2017

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LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

DEMONSTRATION PLANT
PRELIMINARY SECTIONS

PROJECT NO. 10976-215736
FILE NAME: G003STSC.DWG
SHEET NO.
G-3

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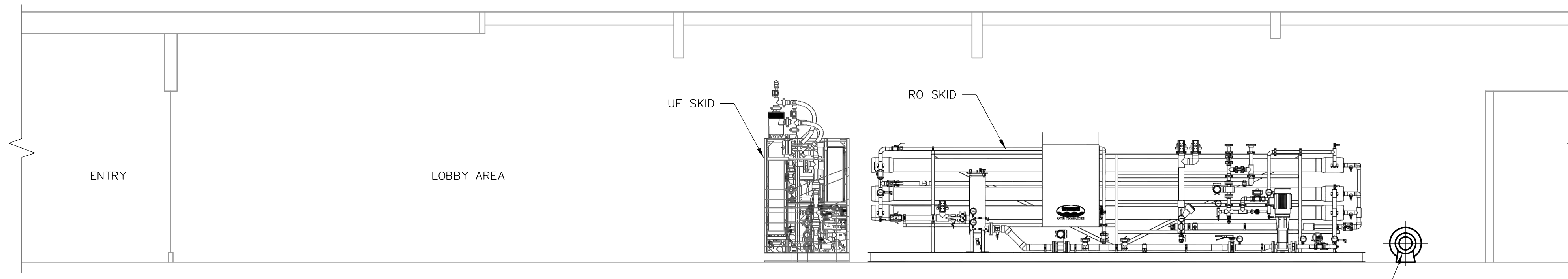
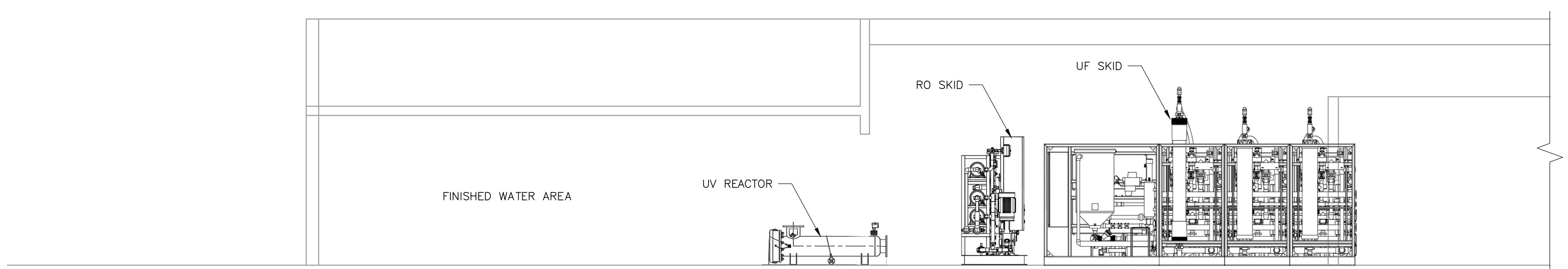


SECTION THROUGH PROCESS AREA LOOKING NORTH

SECTION 1 (G-2)
1/4" = 1'-0"



SECTION THROUGH PROCESS AREA LOOKING EAST

SECTION 2 (G-2)
1/4" = 1'-0"

1/4" = 1'- 0"
2 1 0 2 4

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: C. SANDERS
DRAWN BY: M. PEREZ
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JUNE 2017

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LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

DEMONSTRATION PLANT
PRELIMINARY BUILDING SECTIONS

PROJECT NO. 10976-215736
FILE NAME: G004STSC.DWG
SHEET NO.
G-4

DRAFT - NOT FOR CONSTRUCTION

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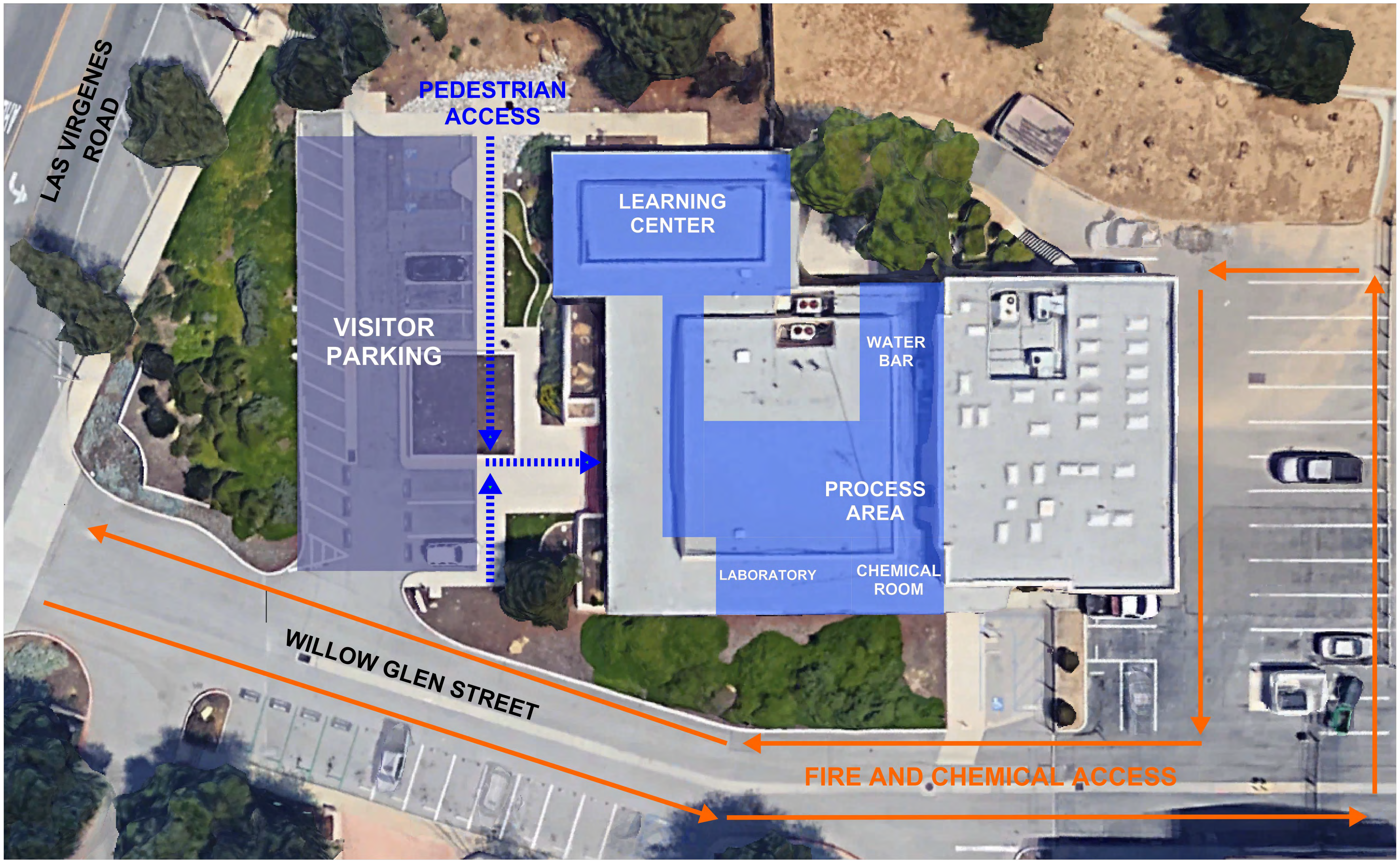

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: K. DOWDELL
DRAWN BY: M. PEREZ
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JUNE 2017

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LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

PARKING AND ACCESS PLAN

PROJECT NO. 10976-215736
FILE NAME: G005STPL.DWG
SHEET NO.
G-5

DRAFT - NOT FOR CONSTRUCTION

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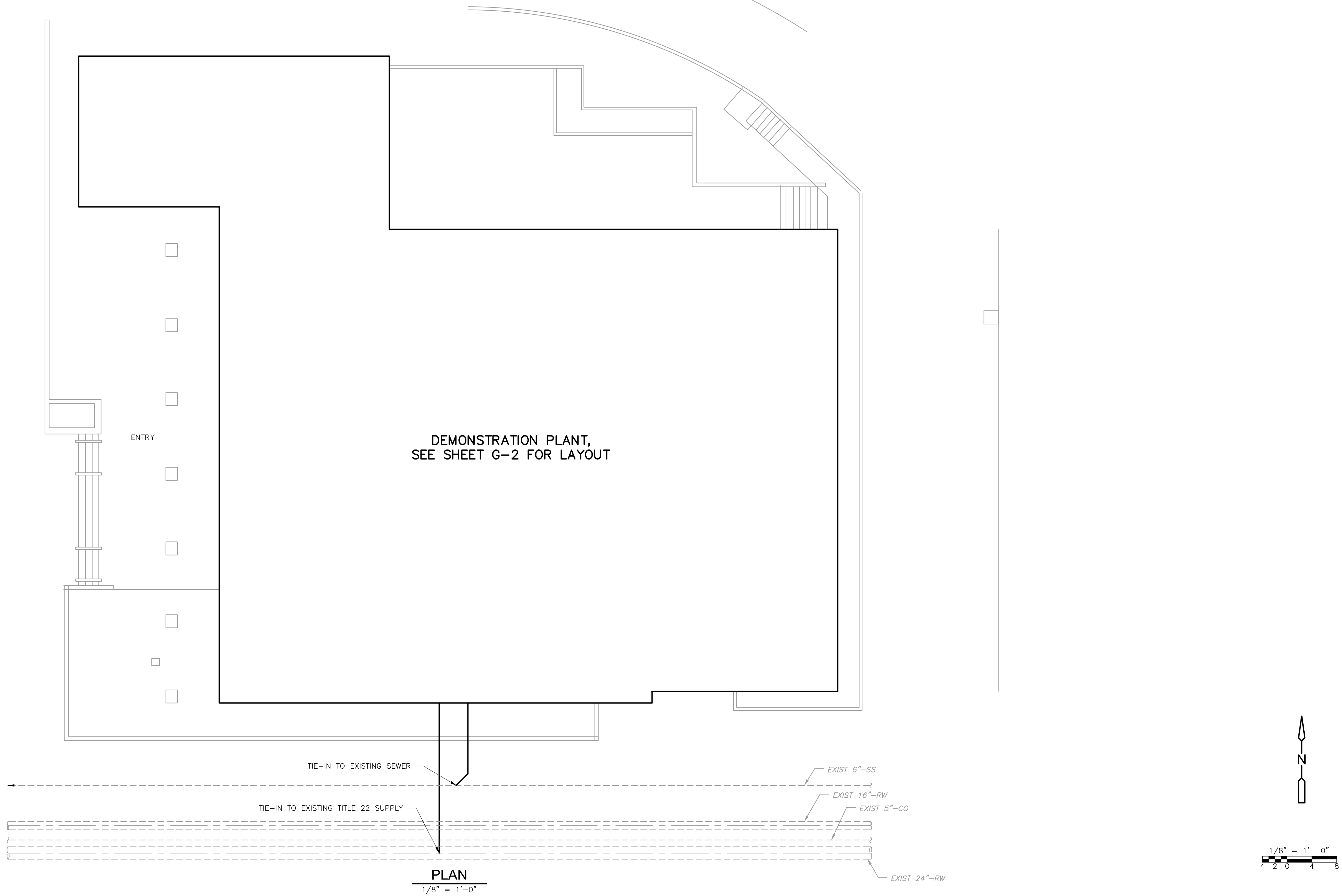

PLAN
1/8" = 1'-0"

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. YOSHIMURA
DRAWN BY: M. PEREZ
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JUNE 2017

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LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

DEMONSTRATION PLANT
UTILITY CONNECTIONS

PROJECT NO. 10976-215736
FILE NAME: C001STPL.DWG
SHEET NO.
C-1

DRAFT - NOT FOR CONSTRUCTION

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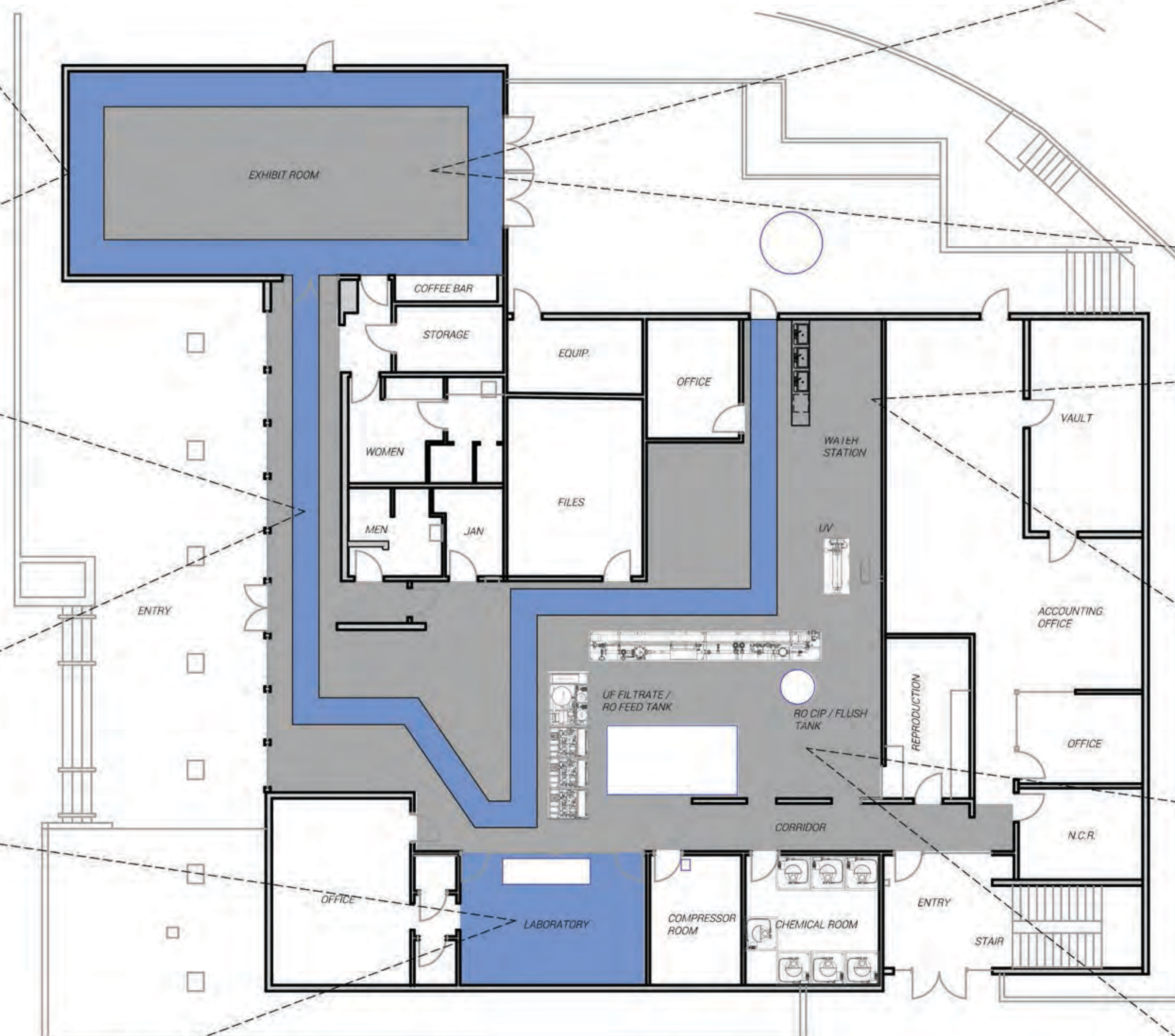
LVMWD DEMONSTRATION PLANT

MULTI-SCREEN VIDEO MONITOR

COLORED EPOXY FLOOR WITH PATHWAY

VIEWING LABORATORY



NORTH

FLOOR PLAN

SCALE 1/8"=1'-0"

SOLID COLOR EPOXY FLOOR

WATER SAMPLING BAR

CLEAN AND SIMPLE PROCESS AREA

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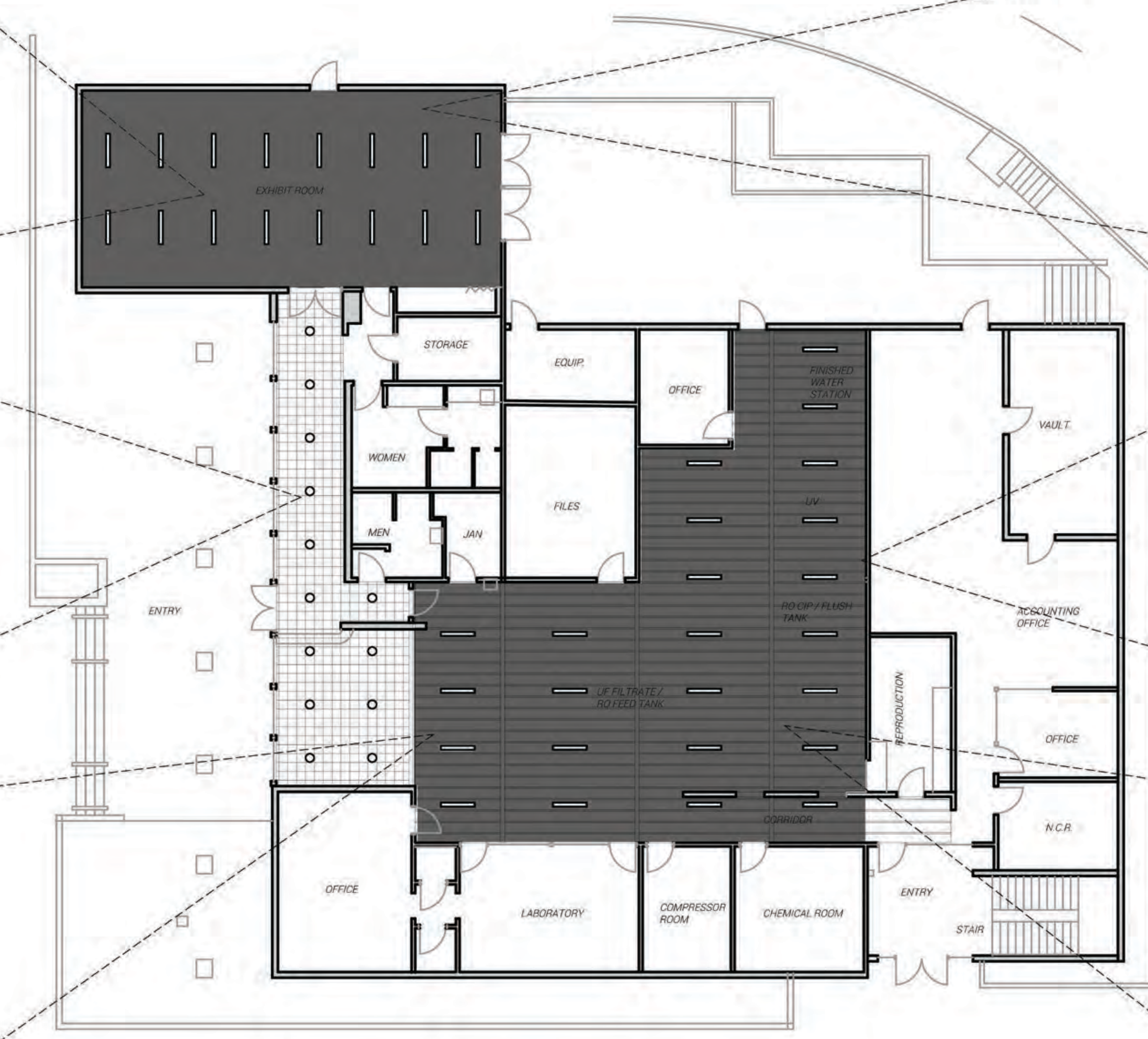
LVMWD DEMONSTRATION PLANT

EXPOSED CEILING PAINTED BLACK WITH LINEAR LIGHTING

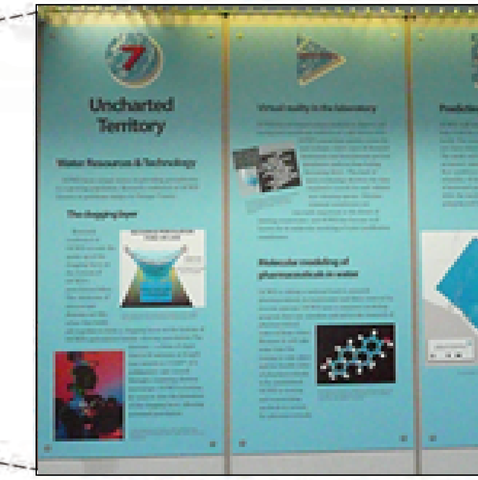
2X2 WHITE ACOUSTICAL CEILING TILES

ADJUSTABLE DISPLAY EXHIBIT SYSTEM



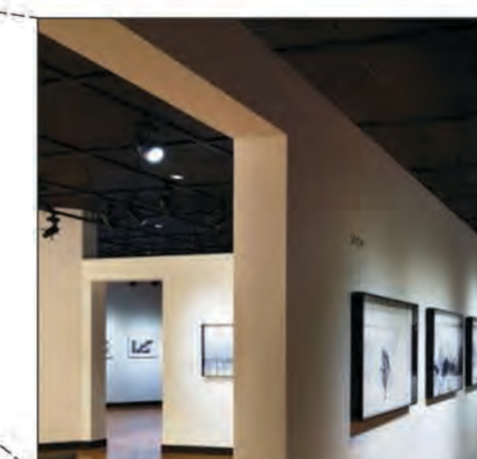
CEILING PLAN AND EXHIBIT PLAN

SCALE 1/8"=1'-0"



INTERACTIVE WALL

SUPER GRAPHICS WALL



EXPOSED CEILING PAINTED BLACK WITH SPOT LIGHTING

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Las Virgenes

APRIL 2017

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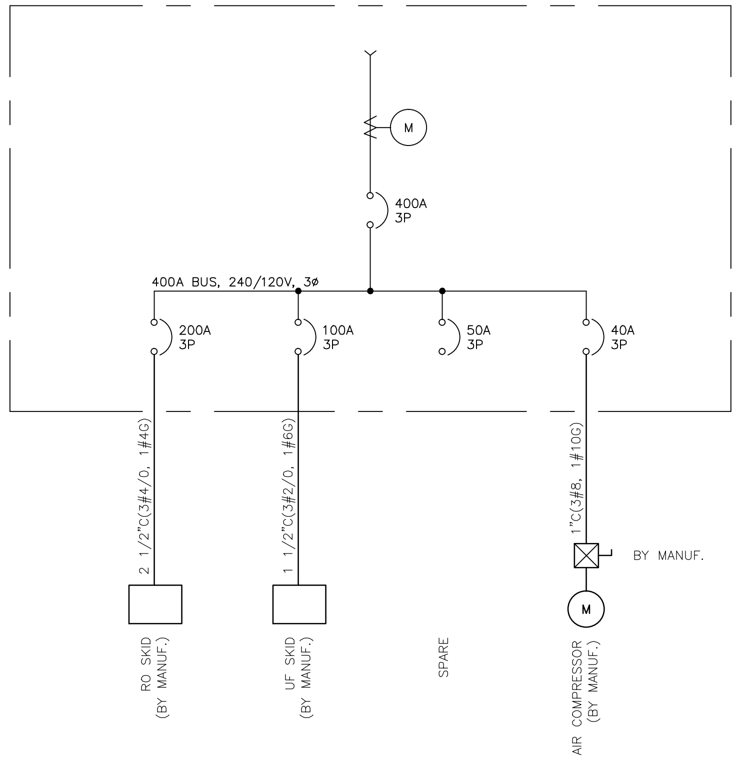

SWITCHBOARD 'P' SINGLE LINE
NO SCALE

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: F.Y
DRAWN BY: O.N
SHEET CHK'D BY: F.Y
CROSS CHK'D BY: –
APPROVED BY: –
DATE: JUNE 2017

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LAS VIRGENES - TRIUNFO JOINT POWERS AUTHORITY
PURE WATER PROJECT
RECYCLED WATER SEASONAL STORAGE
DEMONSTRATION PROJECT

SINGLE LINE DIAGRAM

PROJECT NO. 10976–215736
FILE NAME: E01.dwg
SHEET NO.
E-1

DRAFT - NOT FOR CONSTRUCTION

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Section 9

Sources

2016. *Expert Panel Report on the Evaluation of the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse*. September 2016.

MWH/Stantec, 2016. *Joint Powers Authority Las Virgenes Municipal Water District Triunfo Sanitation District Basis of Design Report.*

MWH/Stantec, 2016. *Recycled Water Seasonal Storage Basis of Design Report.*

Plumee, M. H. and M. Reinhard. *Photochemical Attenuation of N-Nitrosodimethylamine (NDMA) and other Nitrosamines in Surface Water.* Eviron. Sci. Technol. 2007, 41: 6170-6176.

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