LA Sanitation & Environment
Pure Water Los Angeles Program
Implementation Plan for Hyperion

PROGRAM IMPLEMENTATION PLAN

FINAL | October 2024

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Abbreviations

µg/L	micrograms per liter
µm	microns
AAF	annual average flow
APC	air pollution control
AQMD	Air Quality Management District
aSRT	aerobic solids retention time
AWPF	advanced water purification facility
AWT	advanced water treatment
BAC	biologically activated carbon
BACT	best available control technology
BEF	Bio-Energy Facility
BF	baffling factor
BNR	biological nitrogen removal
BOD	biochemical oxygen demand
BTF	biotrickling filter
BWW	backwash waste
$CaCO_3$	calcium carbonate
CCP	critical control point
CDR	Conceptual Design Report
CEQA	California Environmental Quality Act
cfm	cubic feet per minute
CIP	clean-in-place
City	City of Los Angeles
CO_2	carbon dioxide
CSTR	continuous-stirred tank reactor
CT	contact time
DBP	disinfection byproducts
DDW	Division of Drinking Water
degrees C	degrees Celsius
degrees F	degrees Fahrenheit
DGUP	Digester Gas Utilization Project
Dm	minimum probable initial dilution
DPR	direct potable reuse

EBCT	empty-bed contact time
ECLWRF	Edward C. Little Water Recycling Facility
EIR	Environmental Impact Report
EPL	employee parking lot
EPP	effluent pumping plant
EQ	equalization
ESF	emergency storage facility
FBD	fine bubble diffuser
ffCOD	flocculated/filtered chemical oxygen demand
ft^2	square feet
ft^3	cubic feet
GAC	granular activated carbon
gal/ft^2	gallons per square foot
gfd	gallons per square foot per day
gpd	gallons per day
gpd/ft^2	gallons per day per square foot
gph	gallons per hour
gpm	gallons per minute
gpm/ft^2	gallons per minute per square foot
H_2S	hydrogen sulfide
HAWPF	Hyperion Advanced Water Purification Facility
HLR	hydraulic loading rate
hp	horsepower
HPE	high-pressure effluent
HPO	high-purity oxygen
HPOAS	high-purity oxygen activated sludge
HRT	hydraulic retention time
HWRP	Hyperion Water Reclamation Plant
IPR	indirect potable reuse
IPS	intermediate pump station
kg/h	kilograms per hour
kV	kilovolt
kVA	kilovolt-ampere
kWh/100 scf	kilowatt-hour per 100 standard cubic feet

LADBS	Los Angeles Department of Building & Safety
LADWP	Los Angeles Department of Water & Power
LASAN	LA Sanitation & Environment
LAWA	Los Angeles World Airport
LDC	lamp drive cabinet
LOX	liquid oxygen
LRV	log reduction value
LSI	Langelier Saturation Indexs
MBR	membrane bioreactor
MCL	maximum contaminant level
MF	microfiltration
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
mgN/L	milligrams nitrogen per liter
mgP/L	milligrams phosphorus per liter
mJ/cm^2	millijoules per square centimeter
ML	mixed liquor
MLR	mixed liquor recycle
MLSS	mixed liquor suspended solids
MMF	maximum month flow
MTE	mass transfer efficiency
MVA	megavolt-amperes
MW	megawatt
N/A	not applicable
NA	not available
ND	non-detect
NDMA	N-Nitrosodimethylamine
NEC	National Electrical Code
NEPA	National Environmental Policy Act
NH_3 N	ammonia nitrogen
NL	notification level
nm	nanometers
NMHC	non-methane hydrocarbon
NO_2-N	nitrite
NO_3-N	nitrate
NPDES	National Pollutant Discharge Elimination System;
NPOC	non-precursor organic compound

NTU	nephelometric turbidity unit
O&M	operations and maintenance
OCP	operational control point
OGF	oxygen generation facility
OPCC	opinion of probable construction cost
PDC	power distribution center
PE	primary effluent
PFAS	per- and polyfluoroalkyl substances
PIP	Program Implementation Plan
PO-4P	phosphate phosphorus
POC	precursor organic compound
ppb	parts per billion
ppbv	parts per billion by volume.
ppd	pounds per day
ppm	parts per million
ppmv	parts per million by volume
Program	Pure Water Los Angeles Program
psi	pounds per square inch
psid	pressure per square inch differential
psig	pounds per square inch gauge
PVDF	polyvinylidene difluoride
PWWF	peak wet weather flow
RAS	return activated sludge
RO	reverse osmosis
RSC	reduced sulfur compound
RWA	raw water augmentation
RWQCB	Regional Water Quality Control Board
scfm	standard cubic feet per minute
scfm/ft^2	standard cubic feet per minute per square foot
SE	secondary effluent
sMCL	secondary maximum contaminant level
SRT	solids retention time
SSI	sidestream injection
SWF	Service Water Facility

TDH	total dynamic head
TDS	total dissolved solids
TM	technical memorandum
TOC	total organic carbon
tpd	tonnes per day
TSF	Technical Services Facility
tSRT	total solids retention time
TSS	total suspended solids
TWA	treated water augmentation
UCF	Utility Compressor Facility
UF	ultrafiltration
UV-AOP	ultraviolet advanced oxidation process
UVT	ultraviolet transmittance
VFD	variable frequency drive
VOC	volatile organic compound
VPSA	vacuum pressure swing absorption
W x L	width by length
WAS	waste activated sludge
WDR	waste discharge requirements
West Basin	West Basin Municipal Water District
WRP	Water Reclamation Plant
WRR	water recycling requirements
wt%	weight percentage
WWTP	wastewater treatment plants
ZID	zone of initial dilution

EXECUTIVE SUMMARY

ES.1 Program Overview

The Pure Water Los Angeles Program (Program) embodies LA Sanitation & Environment's (LASAN) vision for transforming the City of Los Angeles' (City) largest wastewater treatment plant (WWTP) into a world-class recycled water purification facility for beneficial reuse. Maximizing reuse of wastewater effluent from the Hyperion Water Reclamation Plant (HWRP) will create a new and sustainable local water supply. The long-term goal is to increase and optimize the City's local supplies and support the transition to seventy percent local water. By providing a sustainable, resilient local water supply, the program will further diversify the City's water supply portfolio while mitigating risks associated with climate change.

ES.2 Program Implementation Plan Overview

The purpose of the Pure Water Los Angeles Program Implementation Plan (PIP) for the HWRP is to develop a conceptual design basis for the wastewater and advanced water treatment (AWT) facilities needed to achieve maximum recycling of HWRP effluent for potable reuse. The conceptual design basis is conservative in that it streamlines program implementation by siting all necessary treatment processes and support systems at a centralized location, the HWRP. This is the basis for the PIP's approach for program implementation.

However, the final program definition in terms of ownership of the AWT facilities, quality of water, demand quantity, demand location, and associated timeframe remains to be determined upon completion of Los Angeles Department of Water & Power's (LADWP) Master Plan for Pure Water Los Angeles, coordination with regional agencies, and environmental review in accordance with California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) requirements.

Accordingly, LASAN is closely collaborating with LADWP and regional partnering agencies to further advance, solidify, and unify the various endeavors associated with the implementation of HWRP effluent reuse.

ES.3 Findings and Recommendations for Chapter 1 - Program Summary

This section provides a summary of the HWRP improvements proposed under the program based on information presented in PIP Chapter 1 - Program Summary.

Figure ES.1 presents the proposed configuration of the wastewater and AWT facilities to be implemented under Pure Water Los Angeles. The intended process improvements at the HWRP are as follows:

- **Wastewater Treatment:** To facilitate water reuse, the secondary treatment process will be upgraded from high-purity oxygen activated sludge (HPOAS) to membrane bioreactors (MBRs) capable of producing a higher quality product water upstream of the AWT.
- **AWT:** Two separate treatment trains are provided for production of two different potable water qualities: direct potable reuse (DPR) and indirect potable reuse (IPR). Each meets the water quality requirements commensurate with the planned reuse application.

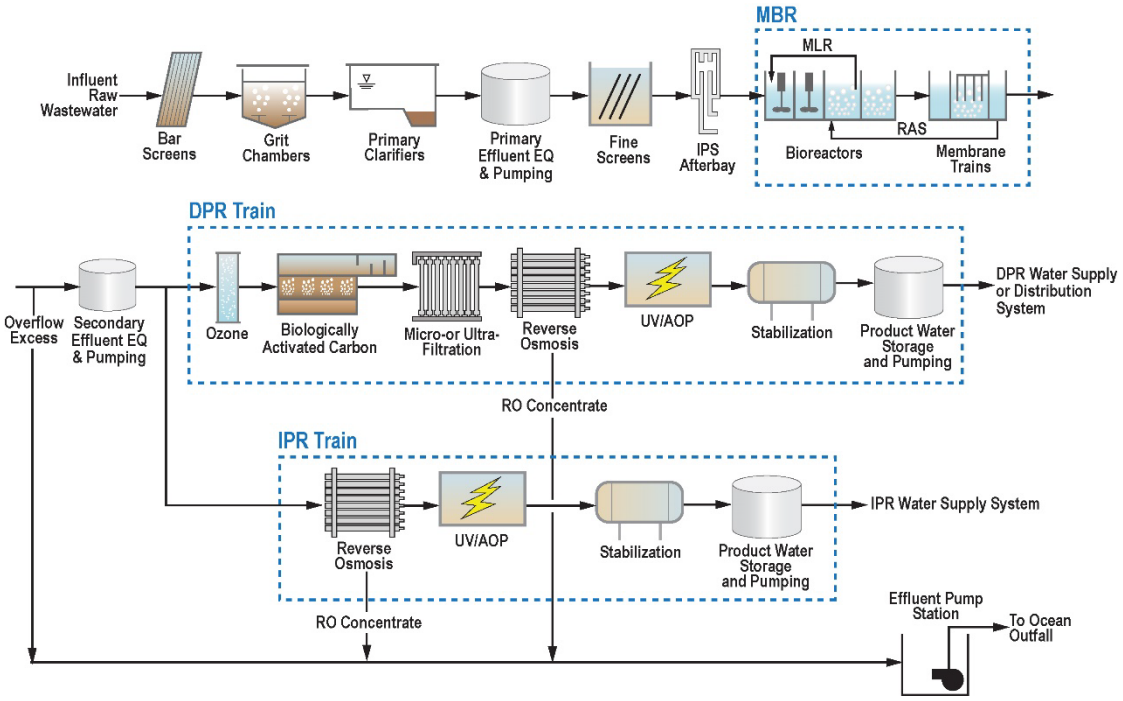


Figure ES.1 Proposed Wastewater and AWT Configuration

ES.3.1 Site Overview

The following conclusions pertain to the evaluations of the existing site utilization:

- **Current Site:** The existing Hyperion site is effectively "built-out," with limited open space available for new construction. Any future improvements of significant magnitude will need to sequence work and create space by some combination of process modifications and demolition or relocation of existing facilities.
- **Process Conversion:** Reflected in existing site plan, secondary treatment is significantly more space-intensive than preliminary and primary treatment as well as solids handling. As a result, the southern half of the plant occupied by the existing secondary treatment facilities provides best opportunities for siting new processes and facilities, following the conversion to MBR.

ES.3.2 Program-Level Design Criteria

- **Basis of Design Flows:** The Pure Water Los Angeles Program will be designed based on the projected conditions including the annual average flow (AAF) of 272 million gallons per day (mgd), the maximum month flow (MMF) of 318 mgd, and the attenuated peak wet weather flow (PWWF) of 638 mgd. The facilities being designed for this current program will provide provisions to facilitate future expansion(s) to attain the Ultimate Build-Out capacities, which are the AAF of 420 mgd, the MMF of 450 mgd, and the attenuated PWWF of 740 mgd.
- **Secondary Process:** To facilitate potable water reuse, the existing secondary treatment process will be upgraded from HPOAS to MBR. The MBR process replaces existing systems providing both efficient space utilization and pretreatment for AWT.
- **Odor Control:** Based on close proximity to the El Segundo residences to the east, effective odor control is considered a key driver and consideration in HWRP improvements.
- **AWT Configuration:** Two separate treatment trains (IPR and DPR) will be provided to meet a wide range of potable reuse water needs.

ES.3.3 Primary Effluent Management

- **Diurnal Flow Equalization (EQ):** A volume of up to 30.5 million gallons (MG) is needed to fully equalize (constant flow over the course of a day) influent flows at the design AAF of 272 mgd.
- **PWWF Attenuation:** Based on an analysis of historical peak wet weather influent flows, a volume of 36.4 MG is needed to provide peak flow attenuation from 740 mgd to 638 mgd.
- **Flow EQ:** Three flow EQ facilities will be provided for a total storage of 36.4 MG. They include a basin called the Module 10 EQ, which would be converted to Module 10 Bioreactor in the future.
- **Intermediate Pump Station (IPS):** The implementation of MBR including the need for a fine screening process substantially modifies the hydraulic grade line, necessitating replacement of the existing IPS with a new pump station. The existing IPS afterbay will be modified and incorporated into new facilities. Increasing the hydraulic head also allows for an increase in use of existing bioreactor volume.

ES.3.4 Secondary Treatment

- **MBR Configuration:** The proposed MBR configuration is a four-stage biological nitrogen removal (BNR) process with swing zones. With MBR membrane separation systems, secondary clarification is no longer needed.
- **Bioreactors:** The existing nine HPOAS reactor modules will be retained and retrofitted for use as BNR basins utilizing air activated sludge. They will be incorporated into two MBR batteries: A and B.
- **Oxygen Dissolution:** Fine bubble diffusers will be utilized for aeration/oxygen dissolution within the bioreactors. Two new dedicated buildings will house the blowers, one for each MBR battery. The blower buildings will be constructed on land that is currently part of the hillside, east of the modules. New retaining walls will be constructed into the hillside to make level space for these buildings.
- **Membrane Type:** The MBR membrane systems will utilize submerged hollow-fiber membranes in an outside-in flow pattern, the configuration selected for full-scale MBR pilot testing to be performed at HWRP. Membrane technology continually evolves, increasing packing density and replacing older models with more optimized versions. To ensure procurement of the best and most current membrane technology, a comprehensive evaluation of the available membrane technologies should be conducted before retaining the progressive design-build entity.
- **Membrane Tanks:** Each membrane train will consist of up to 26 membrane tanks, configured in 2 banks of 13 membrane tanks. The three membrane manufacturers selected for the pilot testing are being considered, and their conceptual sizing is based on meeting the target instantaneous wet weather flux of ≤30 gallons per day per square foot (gpd/ft^2).

ES.3.5 Advanced Water Treatment

- **AWT Capacity:** The IPR train will be sized for a 90-mgd production. The DPR train will be sized for a 120-mgd production. These goals are based on the current program AAF of 272 mgd. No future expansion beyond the current program flows is planned for the AWT facilities.
- **IPR Train:** Following MBR, treatment for IPR applications will include reverse osmosis (RO), ultraviolet advanced oxidation process (UV-AOP), and post treatment for stabilization following MBR.
- **DPR Train:** Following MBR, treatment for DPR applications will include ozone, biological activated carbon (BAC), microfiltration (MF), RO, UV-AOP, post treatment for stabilization, and potentially blending infrastructure.
- **DPR Blending Infrastructure:** The California DPR regulations require provisions to achieve a 10:1 dilution of a chemical contaminant spike in the influent. It is highly desirable to identify and consider the dilution capacity of any existing offsite LADWP facilities that may receive any DPR production water. If the 10:1 dilution requirement must be met exclusively within the HWRP, additional blending infrastructure of 20.5 to 22.4 MG would be needed for a 120-mgd DPR train.

ES.3.6 Sidestream Treatment

- **Sidestream Treatment:** A standalone project will construct a full-scale sidestream treatment facility for HWRP's dewatering centrate stream for a more effective nitrogen removal.
- **Treatment Process:** Deammonification process is selected for implementation. Multiple technologies are under consideration for pilot testing and validation prior to full-scale implementation.

ES.3.7 Support Facilities

- **Odor Control:** The recommended odor control technology is based on the two-stage best available control technology (BACT) consisting of biotrickling filters (BTFs) and carbon filters. It provides robust treatment capability for hydrogen sulfide (H_2S) and other potential foul air constituents of concern.
- **Chemical Storage:** Two new chemical facilities are proposed for providing bulk storage of the various chemicals needed for the MBR and AWT processes. Referred to as the South Chemical Facility, a main facility for storage and distribution of eight chemicals will be located at the south end of the site.
- **Electrical Demand:** New or modified facilities at the HWRP under Pure Water Los Angeles will result in a peak duty connected load of 156 megavolt-amperes (MVA). Of these, the demand attributable to the AWT facilities is 53 percent or 83 MVA. Considering existing and recent modifications, HWRP's peak connected loads will be approximately 203 MVA following Program completion, which is substantially higher than existing levels.
- **HWRP Electrical Service:** A new or additional electrical service from LADWP will be required. The approach of providing a second service to augment the existing appears highly beneficial, resulting in a minimal impact on LADWP's power supply infrastructure and facilitate leveraging the existing service to the maximum extent. However, the selection of the appropriate approach is strictly within LADWP's purview, and the overall electrical service size required will depend on the production capacity and water quality for the AWT facilities, which are also within LADWP's purview.
- **Standby Power:** The PIP is developed based on an assumption that standby power will be provided to the wastewater treatment facilities but not the AWT. This approach is to be further evaluated in consideration of LADWP's goals.

ES.3.8 Plant Hydraulics

- **Recycle Streams:** In general, major recycle streams have been accounted for in the sizing of liquid treatment processes.
- **PWWF Management:** Five scenarios have been evaluated to address a wide range of operational configurations under PWWF conditions. The scenarios address the current and ultimate build-out configurations as well as during construction of Pure Water Los Angeles facilities.
- **5-Mile Outfall:** The 5-mile outfall will be managed such that the discharge flows consistently exceed the minimum flow needed to achieve minimum initial dilution and to prevent seawater intrusion (~50 mgd). The waste streams to be discharged in this manner include several miscellaneous cooling water and backwash water (BWW) streams from the secondary and AWT facilities, RO concentrate, and flows in excess of

the AWT production. This approach avoids making modifications to the 5-mile outfall that will reduce its conveyance capacity.

ES.4 Findings and Recommendations for Chapter 2 - Program Implementation

This section provides a synopsis of the analyses conducted to determine the optimal strategy to implementing the proposed HWRP improvements based on information presented in PIP Chapter 2 - Program Implementation. As such, this chapter provides a recommended phasing and packaging approach for an efficient and effective program delivery. It also describes major challenges and risks that need to be further considered while the program advances into next phases.

ES.4.1 Construction Phasing

- **Program Phasing:** As currently envisioned, Pure Water Los Angeles at the HWRP will be implemented in three distinct phases and via five construction packages. The first phase is being planned to be a combination of three subphases (Phases 1A and 1B, and sidestream treatment). The proposed phasing approach is summarized in Table ES.1.

Table ES.1 Conceptual Construction Phasing Summary[1]

Phase	1A	1B[2]	Sidestream Treatment[2]	2	3
Description	Recycled Water Foundational Infrastructure	50-mgd IPR (MBR Battery A1)	Sidestream Treatment	40-mgd IPR (MBR Battery A2)	MBR Battery B and 120-mgd DPR
Dry Weather MBR Permeate Production[3]	0	78	78	155	272
IPR Production Capacity[4]	0	50	50	90	90
DPR Production Capacity[4]	0	0	0	0	120
Anticipated Completion	2032	2036	2036	2039	To Be Determined

Notes:
Abbreviations: HAWPF - Hyperion Advanced Water Purification Facility.
(1) Based on an AWT design approach of providing separate IPR and DPR trains.
(2) Construction of the Sidestream Treatment Facility will be performed concurrently with that of Phase 2, to achieve concurrent project completions.
(3) Based on an AAF of 272 mgd and excluding recycle flows.
(4) Excludes the flows associated with the HAWPF.

- **Phased Implementation of MBR and AWT:** The MBR conversion will begin in Phase 1B and continue through the remainder of the program. IPR facilities will be built in two consecutive phases for a total capacity of 90 mgd, to be completed by the end of Phase 2. The entirety of the DPR facilities will be constructed in Phase 3 for a 120-mgd capacity.
- **Sidestream Treatment:** As a standalone project, a new full-scale sidestream treatment facility will be constructed. Driven by secondary process benefits, its construction will be performed concurrently with that of Phase 1B, the initial MBR construction.

ES.4.2 Preliminary Construction Sequencing Plan

- **Key Construction Sequencing Constraints for Pure Water Los Angeles:**
  - **Maintain Function of Existing Facilities:** Existing functioning facilities may be demolished only after new facilities are constructed to replace their function.
  - **Maintain Plant Capacity:** Maintain a PWWF of 740 mgd throughout construction. This is to be incorporated into a permit condition in the 2028 National Pollutant Discharge Elimination System (NPDES) permit for HWRP. During Phase 1A, at least seven modules must be in service to meet this capacity. Following Phase 1A, at least six modules must be in service; Since two modules will be offline at a time for rehabilitation, a third module may be taken offline for maintenance.
  - **Odor Control:** Odor control must be available for immediate operation to serve new or modified wastewater treatment facilities as each of them comes online.
  - **Electrical Facilities:** Similar to odor control, new wastewater treatment facilities must have both electrical utility service and standby power capabilities at startup and commissioning.
  - **Minimum Outfall Flow:** A minimum flow of ~50 mgd must be maintained in the 5-mile outfall at all times to maintain minimum dilution and prevent seawater intrusion.

ES.4.3 Major Program Risks

- **Area of Major Constructability Concerns:**
  - **Space Constraints:** Due to space constraints, new construction will need to be sequenced, following demolition or relocation of existing facilities.
  - **Groundwater and Deep Excavations:** The Program will involve multiple, large excavations that may also extend below the mean sea water level. As a result, they will necessitate significant shoring and construction dewatering operations with potential settlement concerns.
- **Seismic Risk and Resiliency:** Several existing structures are to be altered or repurposed as part of the program. Such structures must be assessed and improved for seismic code compliance in order to extend their service life while reducing long-term seismic risk.

- **Coordination with Other HWRP Improvements:** Although outside of the program scope, there are other planned plant upgrades and modifications that may impact, or be impacted by, the overall program in a substantive manner. As a result, it is important to understand their interdependencies in order to mitigate adverse impacts and promote mutually beneficial outcomes. Example projects include:
  - **Effluent Pumping Plant (EPP) Improvements.**
  - **Existing Cryogenic Facility Maintenance.**
  - **Electrical Systems Evaluation.**
- **Permitting and Regulatory Challenges:** Based on the size and complexity of the envisioned construction, the program will require a number of challenging permitting and regulatory approvals. They include:
  - **Peak Wet Weather Treatment Capacity:** Consistent with the current planning efforts for the Program, HWRP's 2028 NPDES permit from the Regional Water Quality Control Board (RWQCB) needs to establish a PWWF capacity of 740 mgd.
  - **NPDES Permit Compliance:** Prior to commencement of potable reuse water production, it is recommended that LASAN approach the RWQCB for incorporating the tiered dilution approach into one of the future NPDES permits for compliance with the California Ocean Plan. Based on an analysis of secondary effluent water quality data from the past five years, the constituent estimated to come closest to exceeding the water quality objective was copper. If the tiered dilution structure is based on copper, all other constituents would also comply.
  - **California Environmental Quality Act/Environmental Impact Report (EIR) Approval:** Construction activities outside of the HWRP are expected to have large and complex impacts on the environment and the communities as well as increased risks of finding unknown features or sensitive receptors. As such, the preparation of the EIR pertaining to non-HWRP improvements will be significantly onerous and time-consuming.
  - **City of El Segundo Jurisdiction:** Due to the City boundary between Los Angeles and El Segundo, select new facilities proposed on the eastern side of the HWRP will fall in the City of El Segundo's jurisdiction.
  - **LADWP Right-of-Way:** New construction proposed on the east side of the HWRP will require close coordination with, and potential approval from, LADWP due to close proximity to its high-voltage power transmission infrastructure owned and operated by LADWP.

ES.4.4 Interagency Collaboration

- **Regional Partnership:** In addition to exploring a wide-range of reuse water delivery alternatives within the City of Los Angeles, LASAN and LADWP should also consider long-term partnerships with external entities. As other entities are brought in as program partners, implementation cost and schedule are expected to improve.
- **Other Infrastructure Needs:** To fully support Pure Water Los Angeles, LADWP will need to complete several key infrastructure projects outside of the HWRP boundaries. They include bringing a new electrical service to the plant as well as IPR and DPR product water conveyance facilities.

Chapter 1

PROGRAM SUMMARY

1.1 Purpose

The goal of the Pure Water Los Angeles PIP for the HWRP is to develop a conceptual design basis for transforming the HWRP to an advanced water purification facility (AWPF) providing 100 percent wastewater recycling for potable reuse. The reuse targets are in accordance with the Mayoral direction given to the relevant city departments to implement 100 percent water recycling in the City to achieve a goal of 70 percent of drinking water being sourced locally. [LA Sustainability Plan, revision 2]. The conceptual design basis is conservative in that it maximizes the production of recycled water by locating all necessary advanced water purification steps at the HWRP. The final program definition in terms of capacity and advanced water purification processes remains to be determined upon completion of LADWP's Pure Water Los Angeles Master Plan, coordination with regional agencies, and environmental review in accordance with CEQA/NEPA requirements.

The purpose of this chapter is to summarize the proposed HWRP improvements to be completed under the Pure Water Los Angeles Program while providing a conceptual design basis for the upgrades. Chapter 2 "Program Implementation" describes, among others, the major infrastructure improvements that are necessary outside of the HWRP in order to support the intended water reuse.

1.2 Background

The Pure Water Los Angeles Program is a multi-billion-dollar investment that will transform the City's largest WWTP into a world-class recycled water purification facility producing potable water. The City has established the following goals:

- Sourcing 70 percent of the City's drinking water locally.
- Maximize recycling of all wastewater for beneficial reuse.

Purification and reuse of water from the City's wastewater facilities, including the HWRP, is a critical supply component in meeting these water supply objectives. The magnitude of the multi-package construction effort envisioned, all taking place within the confines of an operating facility, combined with the advanced technologies of planned treatment systems that will be integrated with existing, as well as the different delivery methods likely to be employed, all result in a complex undertaking.

1.3 Facility Overview

The HWRP has been in operation since the 1890s and is the City's oldest and largest water reclamation plant (WRP). The plant is located on a 144-acre site near the Los Angeles World Airport (LAWA) and Dockweiler State Beach. The plant is bounded by Imperial Highway on the north, Vista Del Mar on the west, the Scattergood Power Plant on the south, and the City of El Segundo on the east. The plant address is 12000 Vista Del Mar, Playa Del Rey, California

90293. The HWRP treats wastewater from a tributary area of approximately 515 square miles that includes 29 contract agencies as well as sludge from the Donald C. Tillman WRP and Los Angeles-Glendale WRP.

The original plant provided minimal treatment before discharge into Santa Monica Bay but was upgraded in 1950 to provide advanced primary/partial secondary treatment. It was upgraded again in 1998 to provide full secondary treatment. Shortly thereafter, the City entered into a contractual partnership with the West Basin Municipal Water District (West Basin) to send a portion of the HWRP effluent to West Basin's Edward C. Little Water Recycling Facility (ECLWRF). The ECLWRF provides advanced treatment of HWRP SE producing various qualities of recycled water supplied to customers (potable and non-potable) in the south bay and west Los Angeles area as well as parts of Los Angeles Harbor. Figure 1.1 depicts the overall configuration of the existing wastewater treatment facilities at the HWRP.

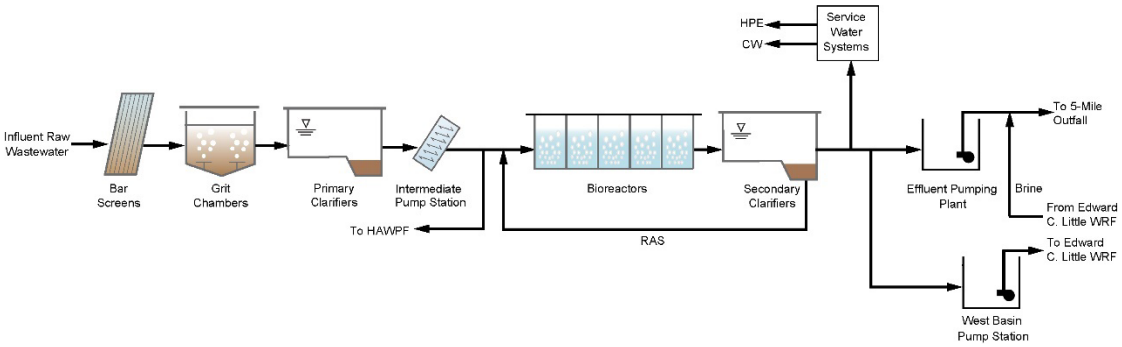


Figure 1.1 Existing Overall Wastewater Treatment Configuration

Currently, HWRP is operated as a full secondary treatment facility utilizing a HPOAS process with the majority of its effluent discharged to Santa Monica Bay through a 5-mile outfall terminating at a depth of 200 feet. The plant has state-of-the-art solids processing units centered on anaerobic digestion and the production of biogas and treated solids for reuse. LASAN operates the Hyperion Bio-Energy Facility (BEF) to utilize the HWRP's digester biogas for renewable energy generation.

1.4 Site Overview

Figure 1.2 provides an existing site plan based on an aerial photo taken in 2024. The site is approximately 1,800-feet wide in the east-west direction and 4,600-feet long in the north-south direction. Site topography is generally flat, varying from elevation 32 to 34 per the National Geodetic Vertical Datum of 1929. Along the east and south boundaries of the site, existing retaining walls separate the flat, usable space from the steep hillside to the east and south. Figure 1.2 also shows the property line for the HWRP as well as the boundary between the city of Los Angeles and the city of El Segundo. As shown on Figure 1.2, limited areas of the plant in the east fall within the city of El Segundo.

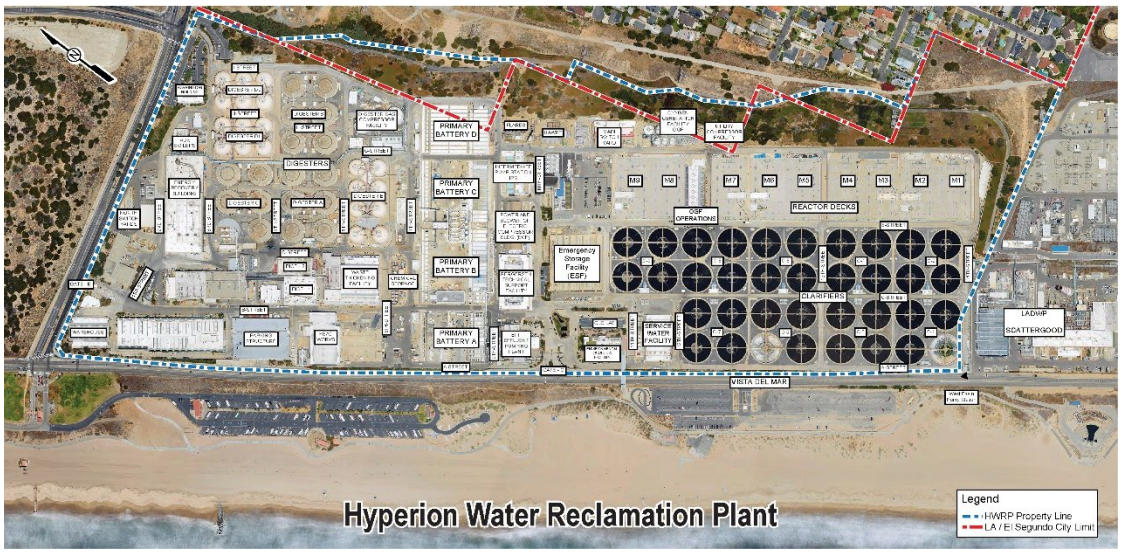


Figure 1.2 Existing Site Plan

The primary treatment and solids-handling facilities are generally located within the northern half of the plant, while the secondary treatment facilities predominantly occupy the southern half. Figure 1.3 categorizes existing structures and facilities based on their specific use within the overall operation of the plant. As illustrated on Figure 1.3, secondary treatment is significantly more space-intensive when compared to preliminary and primary treatment as well as solids handling. Space requirements for secondary treatment reflect, to a great degree, the area required for secondary clarification. In addition, the site is effectively "built-out," having little-to-no open space available for new construction. Any future improvements of significant magnitude will need to sequence work and create space by way of demolition or relocation of existing facilities.

Figure 1.3 Current Space Utilization

1.4.1 Secondary Treatment Facilities

As noted previously, the existing secondary treatment facilities were constructed in the 1990s as part of an expansion to provide full secondary treatment. These facilities are mainly comprised of:

- Nine HPOAS reactor modules with dedicated influent channels and each module consisting of three parallel aeration basins.
- High purity oxygen (HPO) cryogenic generation facility and associated compressor building.
- Thirty-six circular secondary clarifiers, each four dedicated to a specific HPOAS reactor module.
- Eighteen return activated sludge (RAS)/waste activated sludge (WAS) pumping systems, each dedicated to a pair of secondary clarifiers.

In general, these facilities were configured to operate as nine separate treatment "trains," with limited hydraulic or process interconnections between the parallel trains. Flows in an individual treatment train remain separate from the other trains until treated flows are combined downstream of secondary treatment.

1.4.2 Decommissioned or Unoccupied Facilities

At the HWRP, several existing facilities are currently unoccupied or previously decommissioned. Listed below, these facilities represent areas that may be made available for either new construction or temporary facilities needed during construction. Figure 1.4 locates these facilities on a current site plan.

- Power and Blower Building.
- Conventional Digesters (also known as pancake digesters).
- Old Laboratory.
- Carver Greenfield Building.
- Service Water Pump Station.

Figure 1.4 Decommissioned or Unoccupied Facilities

1.5 Program-Level Design Criteria

This section presents the foundational design criteria that are used as a basis to develop the scope of the HWRP improvements on a program-wide level.

1.5.1 Flow Characterization

Table 1.1 provides a summary of design flow rates for the current Program as well as for a future ultimate build-out scenario. These flow rates were established based on multiple discussions with LASAN that considered existing treatment infrastructure, influent flow projections, necessary improvements and feasibility, hydraulic impacts, and other factors.

Table 1.1 Design Flows

Scenario	Unit	Current Program (Pure Water Los Angeles)	Future Program (Ultimate Build-Out)
Plant Influent PWWF	mgd	740(1)	740(1)
Secondary Plant PWWF	mgd	638(2,3)	740(4)
AAF	mgd	272(5)	420(6)
MMF	mgd	318(7)	450(8)

Notes:
Abbreviations: PE - primary effluent.
(1) Matches HWRP's peak wet weather capacity of 740 mgd per NPDES Permit No. CA0109991, CI-1492 dated 3/17/2023. For reference, 740 mgd corresponds to a conservative peak flow capacity of the existing secondary plant if 28 of the 36 secondary clarifiers are in service, which is equivalent to seven of the nine modules being in service.
(2) PE EQ is intended to provide peak flow shaving for the downstream secondary plant.
(3) Secondary Plant PWWF of 638 mgd corresponds to a conservative peak flow capacity of the existing secondary plant if six of the nine modules are in service. This capacity is to be maintained for the MBR plant in the current program.
(4) Established for future planning purposes.
(5) Established by the March 2020 *Toxicity Reduction Work Plan Study* and validated by the December 2023 *Hyperion Flow Projections Update Study*.
(6) Matches HWRP's dry weather capacity of 420 mgd from the 1994 NPDES Permit.
(7) Based on an evaluation of 10-year influent flow data between 2010 and 2019 conducted as part of the June 2020 *100 percent Reuse Spatial Feasibility Study*. The study also established a MMF to AAF peaking factor of 1.17.
(8) Matches HWRP's secondary treatment capacity of 450 mgd per NPDES Permit No. CA0109991, CI-1492 dated 3/17/2023.

Figure 1.5 displays the typical diurnal influent flow patterns (normalized) observed under normal dry-weather conditions. It demonstrates a higher and more sustained dry weather peaking factor for weekend (Saturday and Sunday) days than weekdays (Monday to Friday).

Table 1.2 summarizes the simulated PE constituent concentrations used in a BioWin dynamic treatment process model that integrates biological, chemical, and physical processes into a comprehensive plant simulation of the HWRP. It also compares the simulated values with the measured, showing good agreement between them.

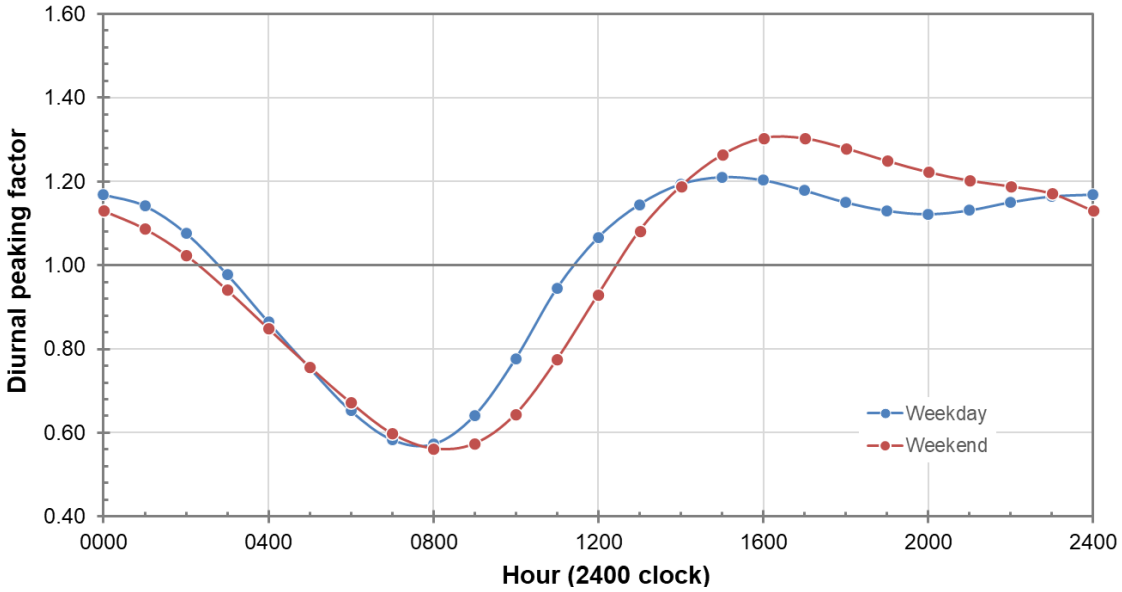


Figure 1.5 Dry-Weather Diurnal Peaking Factors

Table 1.2 Simulated vs. Measured PE Constituent Concentrations

Constituent	Units	Concentration in Simulated PE	Concentration in Measured PE(1)	
			Average	Range
TSS	mg/L	225	277	191 - 535
Volatile Suspended Solids Fraction		0.91	0.91	0.82 - 0.93
Chemical Oxygen Demand	mg/L	540	540	508 - 582
Soluble Chemical Oxygen Demand	mg/L	214	224	197 - 251
ffCOD	mg/L	173	203	180 - 225
BOD	mg/L	212	198	175 - 211
Total Kjeldahl Nitrogen	mgN/L	55.5(2)	67.0	63.4 - 72.0
NH_3-N	mgN/L	39.7(2)	48.9	46.6 - 51.0
Total Phosphorus	mgP/L	7.95	7.96	7.83 - 8.07
PO4-P	mgP/L	6.01	6.12	5.89 - 6.51
pH	Standard Units	7.8	7.78	7.71 - 7.88
Alkalinity	mg/L as $CaCO_3$	360	360	350 - 369

Notes:
Abbreviations: BOD - biochemical oxygen demand; $CaCO_3$ - calcium carbonate; ffCOD - flocculated/filtered chemical oxygen demand; mg/L - milligrams per liter; mgN/L - milligrams nitrogen per liter; mgP/L - milligrams phosphorus per liter; NH_3N - ammonia nitrogen; PO-4P - phosphate phosphorus; TSS - total suspended solids.
(1) Arithmetic average of IPS east and IPS west composite samples collected March 12-18, 2019.
(2) Concentration reduced to reflect nitrogen removal by a full-scale sidestream treatment of dewatering centrate. Refer to Section 1.6.5.

Further, a wastewater temperature of 26.0 degrees Celsius (degrees C) was used to simulate average conditions based on historical HWRP effluent data shown on Figure 1.6. A wastewater temperature of 22.0 degrees C was used to simulate maximum month conditions for secondary treatment.

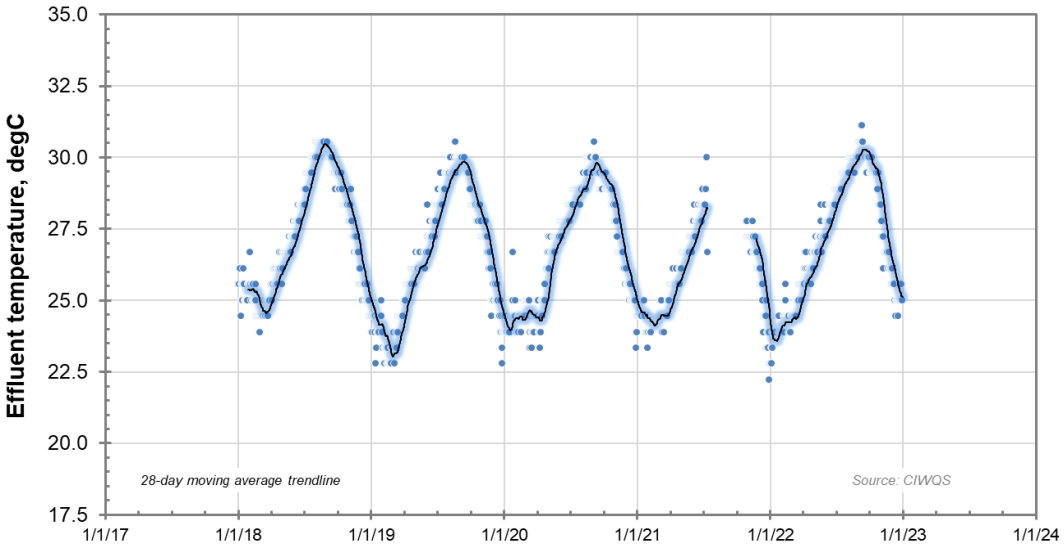


Figure 1.6 HWRP Effluent Temperature, 2018 - 2022

1.5.2 Effluent Water Quality

This section establishes the target effluent quality for the proposed wastewater and advanced water treatment facilities depicted in Figure 1.7. To be further described in Section 1.6 and to facilitate potable water reuse, the existing secondary treatment process will be upgraded from HPOAS to MBRs.

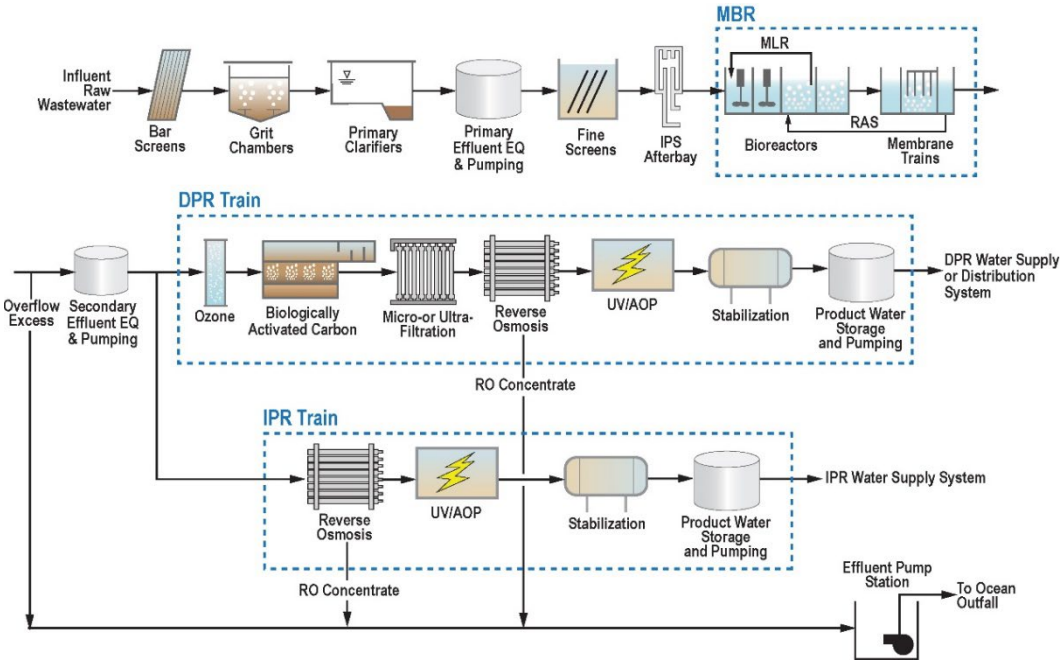


Figure 1.7 Conceptual Liquid Treatment Configuration

1.5.2.1 MBR

Table 1.3 provides the anticipated effluent water quality from MBR operation, predicted from BioWin process modeling and subject to confirmation from the planned full-scale pilot testing.

Table 1.3 Anticipated Effluent Water Quality for MBR

Constituent	Unit	Value[1]
TSS	mg/L	<2.0
BOD	mg/L	<1.0
NH_3-N	mg/L	<0.5
NO_2-N	mg/L	<0.5[2]
NO_3-N	mg/L	<10[2]
Turbidity	NTU	≤0.2

Notes:
Abbreviations: NO_2-N - nitrite; NO_3-N - nitrate; NTU - nephelometric turbidity unit.
(1) Based on implementing partial EQ of PE.
(2) Provide a NO_x (NO_3-N + NO_2-N) concentration of less than 10 mg/L.

1.5.2.2 Advanced Water Treatment

Table 1.4 provides the anticipated product water quality and treatment requirements from the proposed AWT facilities. Where necessary, water quality requirements are differentiated between IPR and DPR trains.

Table 1.4 Treatment and Water Quality Requirements for IPR and DPR

Parameter	IPR - Groundwater Recharge	IPR - Surface Water Augmentation	DPR
Pathogen Control			
Enteric virus LRV	12	8[1]	20
Giardia LRV	10	7[1]	14
Cryptosporidium LRV	10	8[1]	15
Number of Processes Required	3	2-3	4
Removal Mechanism Requirements	N/A	N/A	1-log removal of each pathogen via: physical removal, chemical inactivation, and UV inactivation
Chemical Control			
Treatment Train Requirement	RO + AOP[2]	RO + AOP	Ozone+BAC+RO+AOP
Process Performance Criteria	AOP[2]: 0.5-log 1,4 dioxane reduction	AOP: 0.5-log 1,4 dioxane reduction	Ozone: 1-log carbamazepine and sulfamethoxazole reduction BAC: 1-log formaldehyde and acetone reduction AOP: 0.5-log 1,4 dioxane reduction

Parameter	IPR - Groundwater Recharge	IPR - Surface Water Augmentation	DPR
TOC	<0.5 mg/L <0.25 mg/L for first 20 weeks(3)	<0.25 mg/L for first 20 weeks(3)	<0.1 mg/L, <0.15 mg/L, <0.5 mg/L(4) <0.25 mg/L for first 20 weeks(3)
Water Quality Sampling(5)			
Sampling Locations	Prior to application	Prior to discharge	SE Post-AOP Prior to distribution
MCLs, NLs, Priority Toxic Pollutants Sampling Frequency	Quarterly	Quarterly	Monthly (at all three locations)
Solvents(6) Sampling Frequency	N/A	N/A	Monthly (at all three locations)
NO_3-N/NO_2-N, Perchlorate, Lead Sampling Frequency	N/A	N/A	Weekly (prior to distribution)
Other Sampling Required	State Board-specified compounds	State Board-specified compounds	Treatment byproducts and precursors, business or household chemicals, pharmaceuticals, personal care products (monthly at all three locations)
Basin Plan Objectives	Varies by Basin	Varies by Basin	N/A unless utilizing an aquifer or reservoir with <2-month retention time

Notes:
Abbreviations: BAC - biologically activated carbon; LRV - log reduction value; MCL - maximum contaminant level; N/A - not applicable; NL - notification level; sMCL - secondary maximum contaminant level; TOC - total organic carbon.
(1) Additional pathogen LRV may be required depending on the amount of dilution and retention time in the surface water reservoir.
(2) RO and AOP not required for surface spreading.
(3) RO permeate TOC must remain below 0.25 mg/L at the 95th percentile for the first 20 weeks of operation
(4) If RO permeate TOC is >0.1 mg/L continuously for 24 hours, a 5 day trihalomethane formation potential study must be conducted. If RO permeate TOC is >0.15 mg/L continuously for more than 120 hours, investigate RO integrity and take corrective action. If finished water TOC is >0.5 mg/L at any time, water must be diverted.
(5) Table is not exhaustive of sampling requirements and does not include sampling required in monitoring wells or reservoir.
(6) Specifically, acetone, N,N-dimethylacetamide, methanol and methyl ethyl ketone.

In general, DPR treatment and water quality requirements are greater than what is required for IPR. While both IPR and DPR require that the final water quality meet regulated limits (i.e., MCLs, ALs, NLs), DPR requires more frequent sampling and requires sampling at multiple locations within the treatment train. DPR also requires sampling for many contaminants that do not have specified public health limits. Additionally, the treatment requirements for DPR are greater with much higher LRV goals and additional processes required for chemical control.

While not included in Table 1.4, consideration should be given to how product water is stabilized to ensure compatibility with distribution piping. Typically, stabilization for IPR is driven by protection of pipeline assets from corrosion, while minimizing overall alkalinity to limit cost and potential plugging of wells. However, with DPR, it is pertinent to consider stabilization not only

for asset protection but specifically for the case of treated water augmentation (TWA), compatibility, and similarity to the existing drinking water quality. Concentration gradients within the distribution system, driven by introduction of a highly different purified water matrix to an existing surface water may trigger undesirable release of contaminants that were otherwise stable in biofilms or otherwise immobilized on distribution pipes. Consequently, in addition to the parameters outlined in Table 1.4, it is important to revisit drivers for stabilization including water quality, asset protection and economics once project definitions are finalized.

1.5.3 Odor Limits

Table 1.5 summarizes the various odor related requirements for existing facilities that are currently specified in HWRP's permits to operate or permits to construct/operate issued by the South Coast Air Quality Management District (AQMD). Based on the close proximity to the El Segundo residences to the east, effective odor control is considered a key consideration in designing the Program's wastewater treatment facilities.

The following sections provide an analysis of odor control parameters that are currently regulated or may become regulated within the timeline for Program implementation.

1.5.3.1 Hydrogen Sulfide

Historically, H_2S has been a primary constituent of concern for wastewater treatment facilities from an odor control standpoint. Accordingly, the California State Ambient Air Quality Standards as well as the permitting agencies (i.e., South Coast AQMD in the case of the HWRP) routinely reference within their permits the California Air Resources Board 1969 adoption of a not-to-exceed ground level concentration of 30 parts per billion by volume (ppbv) over a one-hour average for H_2S. Subsequently validated by a California Department of Public Health review in 1981, the CARB has consistently maintained the position that the current standard is adequate. With regards to the HWRP and as indicated in Table 1.5, the pertinent requirements of the existing permits generally fall under two categories. In some cases, they require a stack (chimney for elevated emissions release and dispersion) limit of 1 part per million by volume (ppmv) while others mandate both the 1-part-per-million (ppm) stack limit and a property boundary limit of 30 ppbv as measured over a one-hour average.

Stack limits of the type discussed herein are typically informed by dispersion modeling results that consider a given stack airflow, velocity, height, and concentration within a geographic model containing historical wind data to calculate ground-level concentrations at the fence line. As a result, future odor control systems may require more stringent performance standards than 1 ppmv at the stack depending on stack proximity to the fence line and how the dispersion model predicts fence-line ground level concentrations.

However, any regulatory changes or dispersion modeling advancements necessitating lower H_2S concentrations are not expected to impact odor control technology selection or sizing. Current systems in use at HWRP represent the BACT consisting of chemical scrubbers, biofilters/BTFs, and carbon adsorbers and would continue to be successfully employed for odor and emission control on new systems.

Table 1.5 Summary of Existing AQMD Permits for HWRP Facilities

Facility	Permit No.	Description	Permit PDF Page	Condition No.	Relevant Information	Rule
APC System No. 1 Liquid Scrubber	F38896	Two scrubbers (one standby), two exhaust blowers (one standby)	23	9	The concentration of sulfur compounds, measured as H_2S at the carbon adsorber exhaust shall not exceed 1.0 ppmv.	402
APC System No. 2, Liquid Scrubber - HPO Reactor	G15556	Two scrubbers (one standby), two exhaust blowers (one standby)	24	6	The concentration of sulfur compounds, measured as H_2S in the scrubber exhaust shall not exceed 1.0 ppmv, daily average.	402
APC System No. 3, Liquid Scrubber - HPO Reactor	G15557	Two scrubbers (one standby), two exhaust blowers (one standby)	26	6	The concentration of sulfur compounds, measured as H_2S in the scrubber exhaust shall not exceed 1.0 ppmv, daily average.	402
Primary Batteries (A, B, C and D), Primary Influent/Effluent Channels, Primary Sludge Wet Wells, and Intermediate Pumping Station.	G22329	Six caustic scrubbers and twelve carbon vessels used for the primary batteries	57	4	The concentration of sulfur compounds measured as H_2S at the exhaust shall not exceed 1.0 ppmv.	402
Odor Scrubbers - Sludge Truck Loading	G48630	Two sets of two-stage Chemical Scrubbers in parallel, 12-foot diameter with 10-foot packing depth	90	4	The concentration of sulfur compounds measured as H_2S in the exhaust of this equipment shall not exceed 1.0 ppmv, daily average.	402
Odor Control System - Influent and Headworks	G48627	Six blowers (three standby). Four BTFs, eight carbon adsorbers, eight exhaust stacks, eight temporary carbon adsorbers	101	6	Maximum H_2S concentration at the downwind property boundary shall not exceed 30 ppb over one-hour average or any revised State Ambient Air Quality Standards which may become effective during the operation of this equipment	204
			101	8	Maximum H_2S concentration measured at each system exhaust stack outlet to the atmosphere shall not exceed 1.0 ppmv, daily average.	402

Facility	Permit No.	Description	PDF Page	Condition No.	Relevant Information	Rule
Odor Control System - IPS	G48628	Four BTFs, four foul air blowers (one standby), four carbon adsorbers, eight exhaust stacks	158	6	Maximum H_2S concentration at the downwind property boundary shall not exceed 30 ppb over one-hour average or any revised State Ambient Air Quality Standards which may become effective during the operation of this equipment	204
			158	8	Maximum H_2S concentration measured at each system exhaust stack outlet to the atmosphere shall not exceed 1.0 ppmv, daily average.	402
WWTP	G48629	Primary, secondary, and biosolids digestion, thickening, dewatering, and handling system	166,167, 168	7, 9, 10, 12, 17, 21	The primary treatment system, headworks facility, IPS, sludge digestion system, thickening system, dewatering system, and digester screening facility shall not operate without venting to an APC system, except when APC is undergoing maintenance and repair, not to exceed 24 hours per event or 72 hours per year.	402
			167	11	The ground level H_2S concentration at the property boundary line shall not exceed 30 ppb or any revised State Ambient Air Quality Standards which may become effective during operation of wastewater treatment system.	402

Notes:
Abbreviations: APC - air pollution control; ppb - parts per billion.
Source: AQMD Facility Permit Public - 8 27 2019 - Revision# 12.

1.5.3.2 Reduced Sulfur Compounds

Although currently unregulated, some reduced sulfur compounds (RSCs) may be specified in future permits if limiting odor complaints calls for a greater effort to reduce RSCs. The aforementioned chemical scrubbers, biofilters/BTFs, and carbon adsorbers can each reduce RSC concentrations to varying degrees (30 to 90 percent depending on individual compounds). Combining these control technologies, as currently done for the existing Headworks and IPS odor control facilities, will enhance their overall effectiveness.

Understanding the potential regulations involving RSCs prior to design finalization, it may be prudent to investigate RSCs contributions to off-site odors and assess the BACTs effectiveness for reduction. However, because RSC compounds are often found in low concentrations, it can be challenging to accurately test them using handheld devices. Facilities may consider sampling using Tedlar bags or summa canister to detect RSCs as shown on Figure 1.8, however, it is recommended to avoid this sampling as part of permit-required monitoring under normal operation as it requires an onerous level of effort and cost.

Figure 1.8 Sampling Methodologies for RSC Compounds

1.5.3.3 Volatile Organic Compound

In general, the aforementioned odor control technologies do not consistently reduce volatile organic compounds (VOCs). Depending on the specific VOC compounds and the technology employed, removal of some compounds range from moderate removal (e.g., ~50 to 75 percent for ethanol, isopropyl alcohol) to having little or no impact (e.g., 0 to 30 percent removal for methane, acetone, methylene chloride, and chloroform). The typical VOC sampling gathered into a Tedlar Bag or Silonite Canister is lab tested using mass spectroscopy and focuses on the Environmental Protection Agency's TO-15 list of 75 VOC compounds.

For enhanced air emission control, there have been efforts outside of the South Coast AQMD to incorporate VOC reduction into odor control permits. For example, the Bay Area AQMD's non-precursor organic compound (NPOC) list recently became a permit requirement for Silicon Valley Clean Water Facility with the following conditions:

1. Combined limit of 10 ppmv for precursor organic compounds (POCs) and NPOCs, measured as methane; or, combined POC and NPOC emission rate of 0.75 pounds per hour.
2. Owner/operator shall monitor organic compounds, such as methane, with a portable flame ionization detector, or other approved instrument.

Following the initial permit issuance, it was determined that methane was not removed by the facility's BTF/carbon absorber systems, and that methane concentrations alone exceeded the 10-ppmv limit. Ultimately, this issue was addressed by a correction on subsequent permits, replacing POC and NPOCs with non-methane hydrocarbons (NMHCs) as the revised target.

For future consideration, any forthcoming standards set by the South Coast AQMD to reduce VOCs will likely follow the Bay Area AQMD as an example and will limit VOCs solely to NMHC, which typically exist at levels far below the specified 10-ppm limit. However, any VOC abatement conditions that the South Coast AQMD may or may not impose on future projects will need to meet the standards for BACT, which are those that are both (1) technologically feasible and cost-effective and (2) achieved in practice.

1.6 Summary of Program Elements

This section describes all major facilities, systems, and infrastructure that will be required to achieve maximum water reuse within the HWRP under Pure Water Los Angeles. More specifically, it addresses the secondary process conversion to MBR, the addition of new AWT facilities, and the incorporation of associated support systems and infrastructure serving new systems.

Figure 1.9 provides a liquid flow schematic for Pure Water Los Angeles. Of the facilities shown, the preliminary and primary treatment facilities, as well as the EPP, are considered outside of the program boundaries. All other facilities will be of new construction, except IPS Afterbay, Bioreactors, and IPR Product Water Pumping. Consequently, the Program will primarily affect the existing liquid treatment facilities downstream of primary clarification and upstream of the EPP.

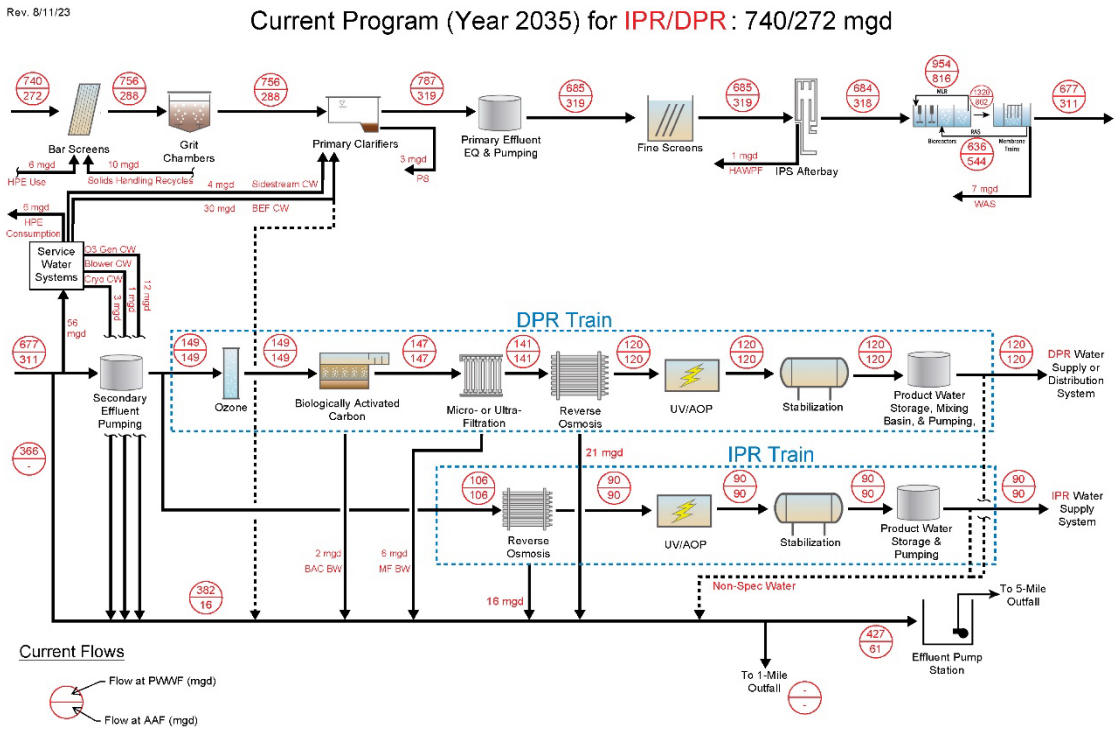


Figure 1.9 Overall Liquid Flow Schematic

Figure 1.10 shows an overall site plan reflecting a post-construction configuration of the HWRP. New facilities will predominantly utilize the space vacated by demolishing existing secondary clarifiers that would be no longer necessary in MBR operation (approximately 22 acres cumulative following 36-clarifier demolition).

As numerated in Table 1.1, the Program's secondary treatment facilities are designed for current program flows, with provisions to facilitate future expansion(s) to build-out conditions. In the following sections, conceptual design criteria for the wastewater treatment facilities are provided for both the current program and a future program representing the ultimate build-out of the HWRP.

1.6.1 Primary Effluent Management

Prompted by the secondary process conversion to MBR and the addition of AWT, improvements and modifications to the existing PE management facilities will be necessary. The improvements will primarily consist of new flow equalization facilities, replacement of the existing IPS, and the addition of fine screens.

Under dry weather conditions, flow storage and pumping upstream of MBR will achieve diurnal flow equalization required for the optimal design and operation of the downstream AWT processes while providing storage for emergency. In wet weather, these facilities will be used to attenuate and moderate the PWWF. Further, with the proposed conversion to MBR, fine screens are required upstream to protect the membranes. The addition of the fine screens and the MBR process requires a higher hydraulic grade line than can be provided by the existing IPS. Consequently, the existing IPS (utilizing Archimedes screw pumps) will be replaced with a new pump station with suitable flow and head characteristics.

1.6.1.1 Flow Equalization Basins

Based on the diurnal flow patterns shown in Figure 1.5, the volume requirements for flow equalization differ significantly between weekdays and weekends. At the design AAF of 272 mgd, the equalization volume required will be 25.3 MG for a weekday and 30.5 MG for a weekend day.

To take full advantage of the large storage capacity, the EQ basins will be used under wet weather conditions for a peak flow attenuation that will effectively reduce the magnitude of the design PWWF experienced by the MBRs. This attenuation of peak PE flows effectively reduces the required MBR peak hydraulic capacity, resulting in lower construction cost and smaller footprint. An analysis of historical peak wet weather influent flow data established that the storage volume for PWWF attenuation from 740 mgd to 638 mgd in accordance with Table 1.1 is 36.4 MG.

Figure 1.10 Pure Water Los Angeles Hyperion Overall Site Plan

Shown in Figure 1.11, the PE equalization basins will operate in a sidestream configuration, where the majority of PE would flow from the PE channels to the IPS. Only a portion of the flow would be diverted to effluent flow equalization basins during times of higher influent flows and subsequently returned to the main process stream from the flow equalization basins during times of lower influent flows. Sidestream equalization requires separate pumps to return equalized flow back to the main process stream.

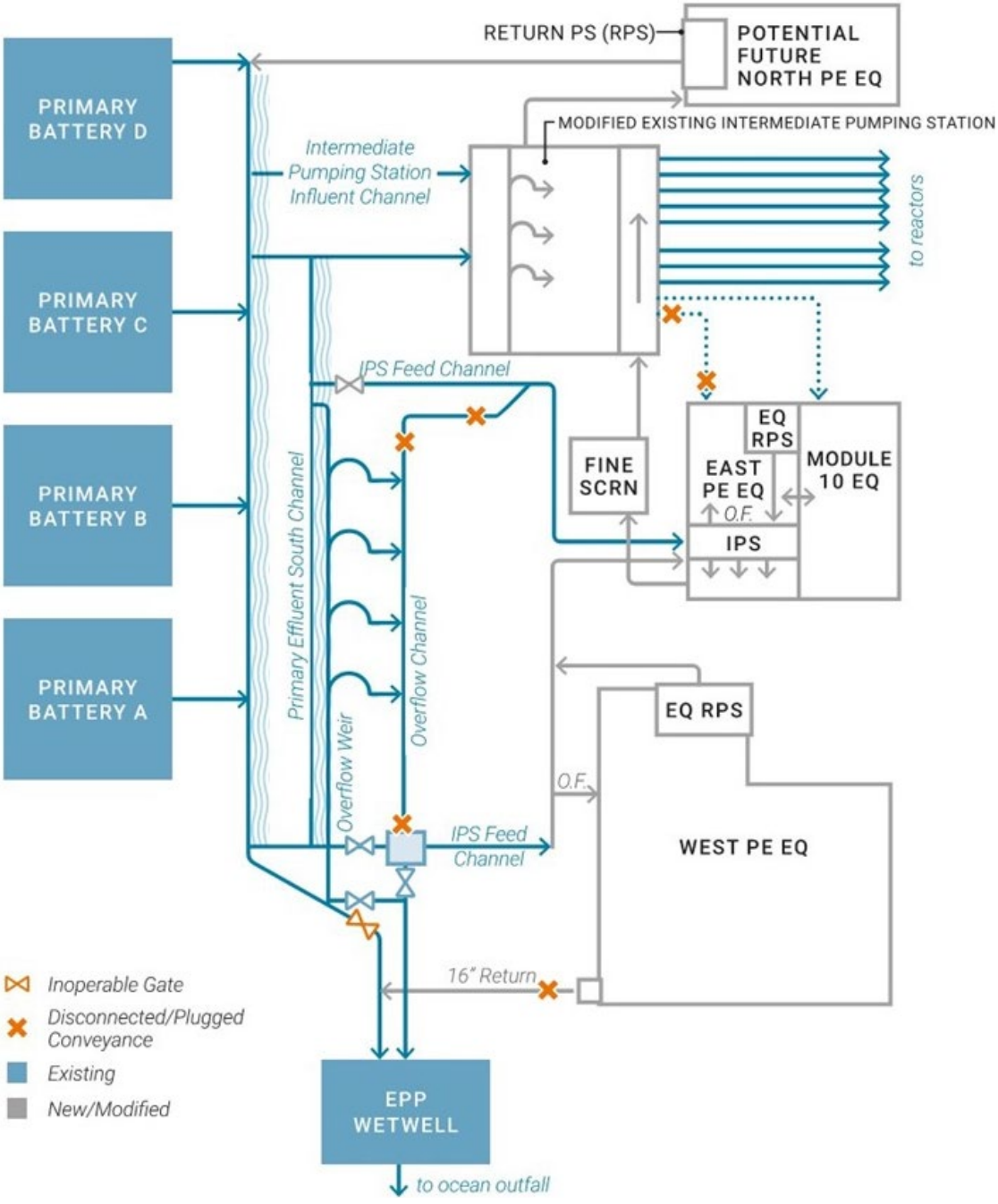


Figure 1.11 PE EQ Facilities

Table 1.6 summarizes the conceptual design parameters for the proposed three PE flow EQ basins. In particular, the Module 10 EQ Basin will be constructed at the location of the future Module 10 as a structural shell. It will be hydraulically connected to the East PE EQ so that they may operate a single hydraulic system. If and when Module 10 is needed as part of a future program, an additional EQ basin will be constructed to replace the associated storage volume (9.7 MG), and the Module 10 EQ will be converted to a bioreactor module.

For day-to-day operations, the PE equalization basins will be used for diurnal flow equalization. Augmented by 5.3-MG SE EQ basins (i.e., downstream of MBR and upstream of AWT), they will also fulfill emergency storage needs.

Table 1.6 Design Parameters for PE Flow EQ Basins

Parameter	East PE EQ (at Existing EPL)	West PE EQ (at Existing ESF)	Module 10 EQ (at Future Module 10)
Approximate Area (ft^2)	24,000	81,000	50,790
Basin Bottom Slab Elevation	-3.0	-3.0	-3.0
EQ Return Pump Station Invert Elevation(1)	-13.0	-13.0	N/A(2)
Maximum Water Surface Elevation(3)	26.3	26.3	37.3
Working Depth (feet)	29.3	29.3	40.3
Working Volume (MG)(4)	5.0	16.8	14.5

Notes:
Abbreviations: EPL - employee parking lot; ESF - emergency storage facility; ft^2 - square feet.
(1) Invert elevation of the EQ return pump station is calculated by subtracting the pump minimum submergence and the minimum clearance from the inlet bell to the pump station floor from the equalization bottom slab elevation.
(2) Module 10 would drain to the East PE EQ by gravity and therefore shares its EQ return pump station.
(3) Based on the PWWF condition of 787 mgd.
(4) For a total volume of 36.4 MG.

1.6.1.2 Intermediate Pump Station

Table 1.7 shows the conceptual design criteria for the new IPS. Based on discussions with LASAN, a high degree of redundancy will be provided for the new pump station. Figure 1.12 and Figure 1.13 show a conceptual plan and a corresponding section for the new IPS, respectively. The new IPS wet well will be centrally located among the three PE EQ basins for efficient flow conveyance.

Table 1.7 Conceptual Design Criteria for New IPS

Parameter	Unit	Current Program	Ultimate Build-Out
Total Reliable Pumping Capacity	mgd	685(1)	790(2)
Type of Pump	-	Vertical Mixed-Flow	Vertical Mixed-Flow
Number of Pumps (Duty + Standby)	each	6 + 3	7 + 2
TDH	feet	25	25
Motor Size, each	hp	800	800
Speed Control	-	Variable	Variable

Notes:
Abbreviations: hp - horsepower; TDH - total dynamic head.
(1) Consists of 638 mgd influent PWWF plus recycle flows.
(2) Consist of 740 mgd influent PWWF plus recycle flows.

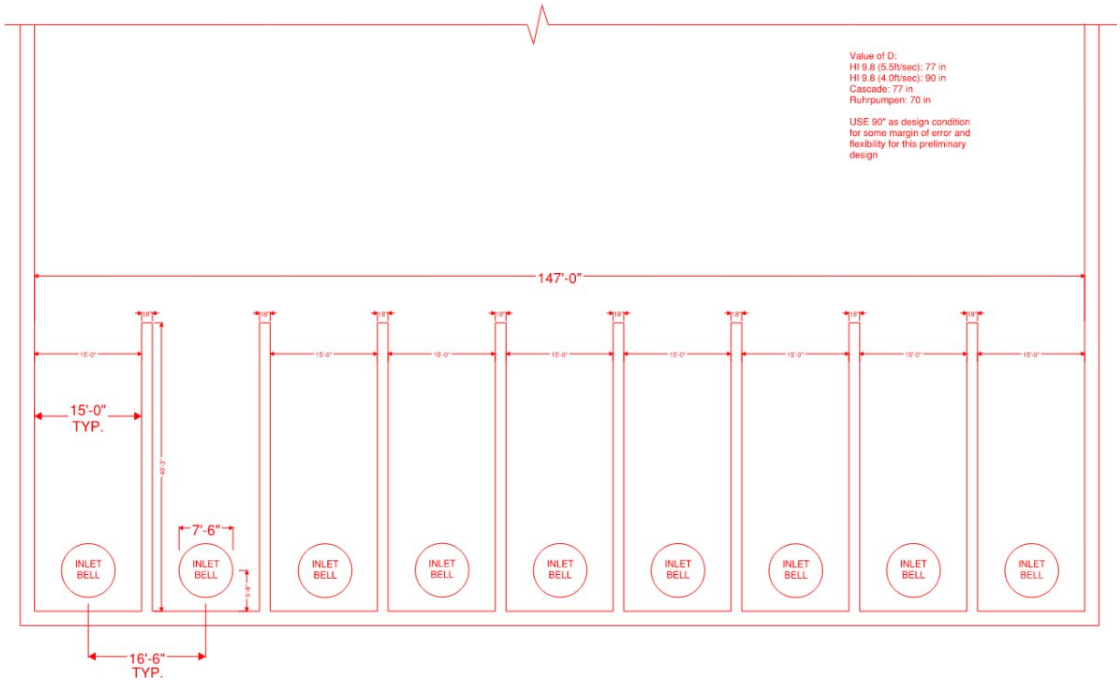


Figure 1.12 Conceptual Plan for New IPS

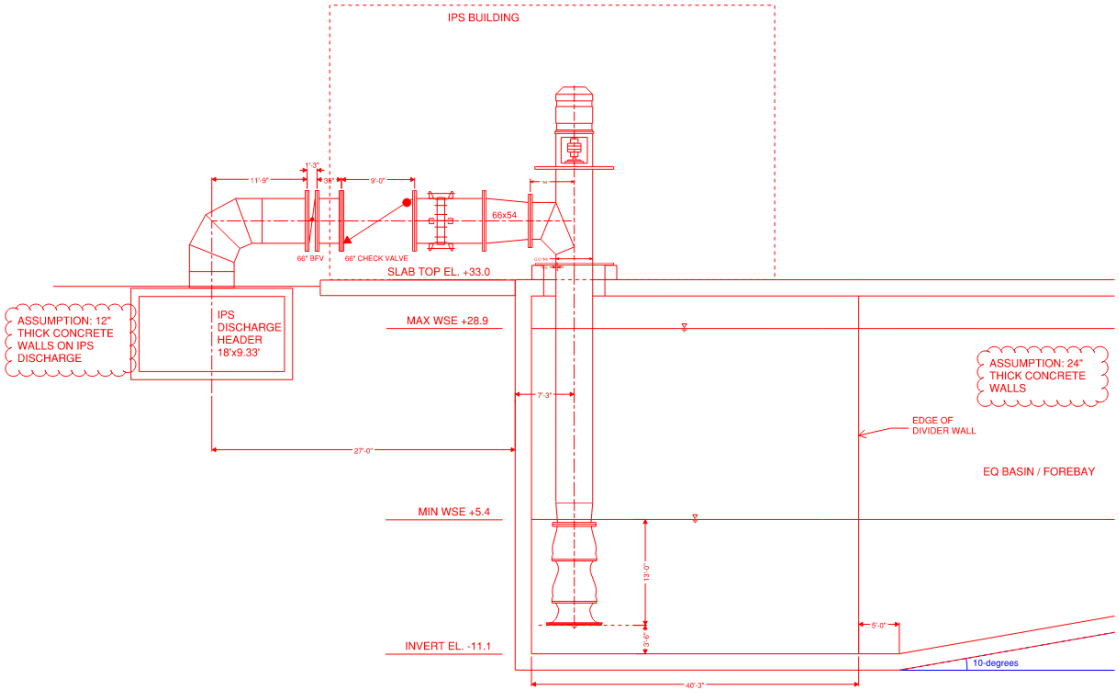


Figure 1.13 Conceptual Section for New IPS

1.6.1.3 Fine Screen Facility

Shown in Table 1.8, two fine screen technologies are under consideration - band screens and in-channel drum screens. Both technologies will be equipped with perforated plates with 2-mm openings, in order to protect the downstream MBRs in accordance with membrane manufacturer requirements. The fine screen facility will be located west of the existing IPS. Figure 1.14 and Figure 1.15 show conceptual plans for the fine screen facility based on the two technologies.

Table 1.8 Conceptual Design Criteria for Fine Screen

Parameter	Current Program (685 mgd)			Ultimate Build-Out (790 mgd)		
	Great White Center Flow Screen[(1)]	CF 200 Band Screens[(2)]	Drum Screens	Great White Center Flow Screen[(1)]	CF 200 Band Screens[(2)]	Drum Screens
Type of Screen	Center-Flow Band Screen	Center-Flow Band Screen	Single Entry Drum Screen	Center-Flow Band Screen	Center-Flow Band Screen	Single Entry Drum Screen
Number of Screens (Duty + Standby)	8 + 2	9 + 3	3 + 1	9 + 1	11 + 1	3 + 1
Flow Capacity, each (mgd)	85.6	76	264	85.6	76	264

Notes:
(1) Design criteria shown are based on band screens proposed by Hydro-Dyne Engineering.
(2) Design criteria shown are based on band screens proposed by Ovivo.

To understand the strengths and weaknesses of each system and select a final screening technology, a phone survey of reference installations that employed the technologies in similar applications will be conducted in the next phase of the Program, to be followed by site visits to gain an informed perspective regarding long-term performance, reliability, and operations and maintenance (O&M) requirements from operating facilities. Additionally, it may be prudent to complete screenings characterization testing at the MBR Pilot Facility (as part of the MBR pilot testing) or HAWPF to determine the typical solids loading present in the PE. This testing may help with selection of screening technology and help further define screen sizing and overall channel dimensions. Alternatively, one of the fine screen vendors may be contracted to perform a screenings characterization test as part of a standalone pilot test.

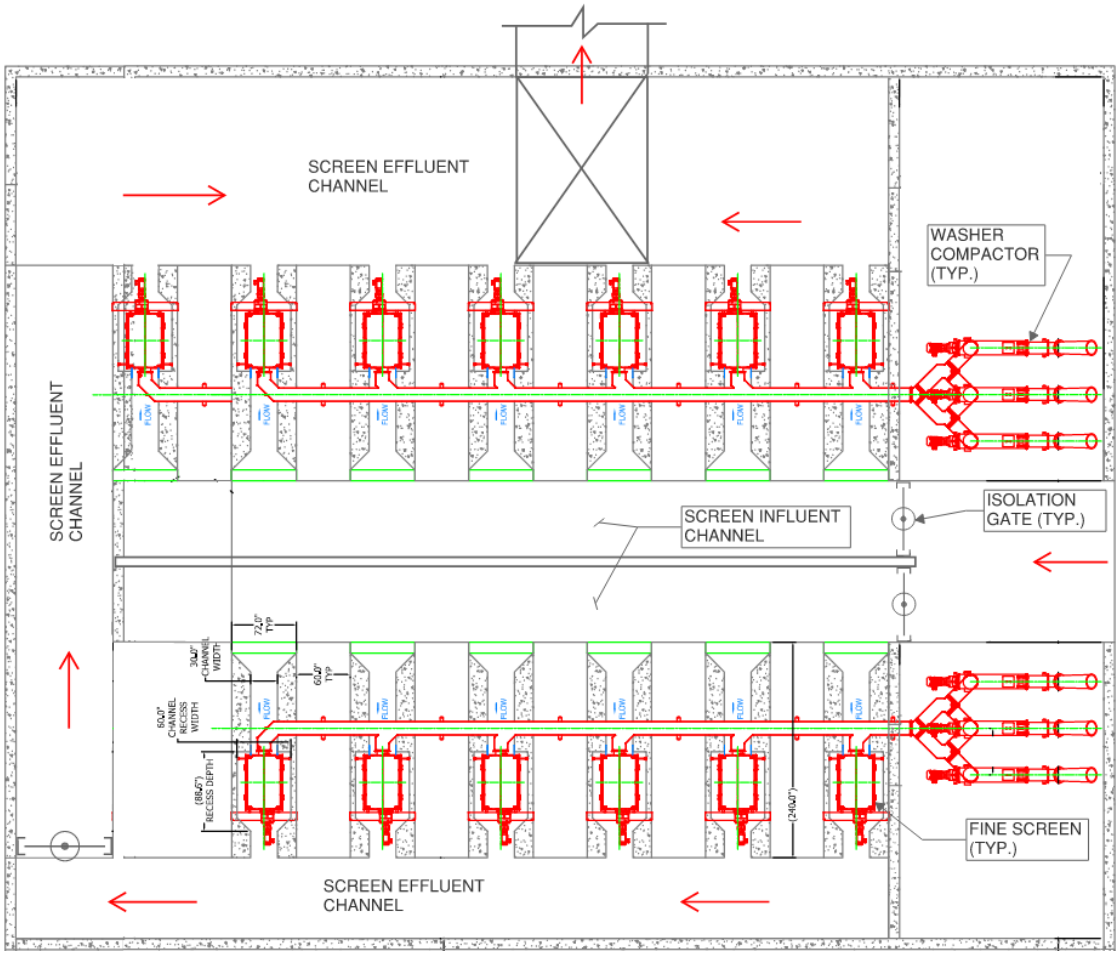


Figure 1.14 Conceptual Plan for Fine Screen Facility with Band Screens

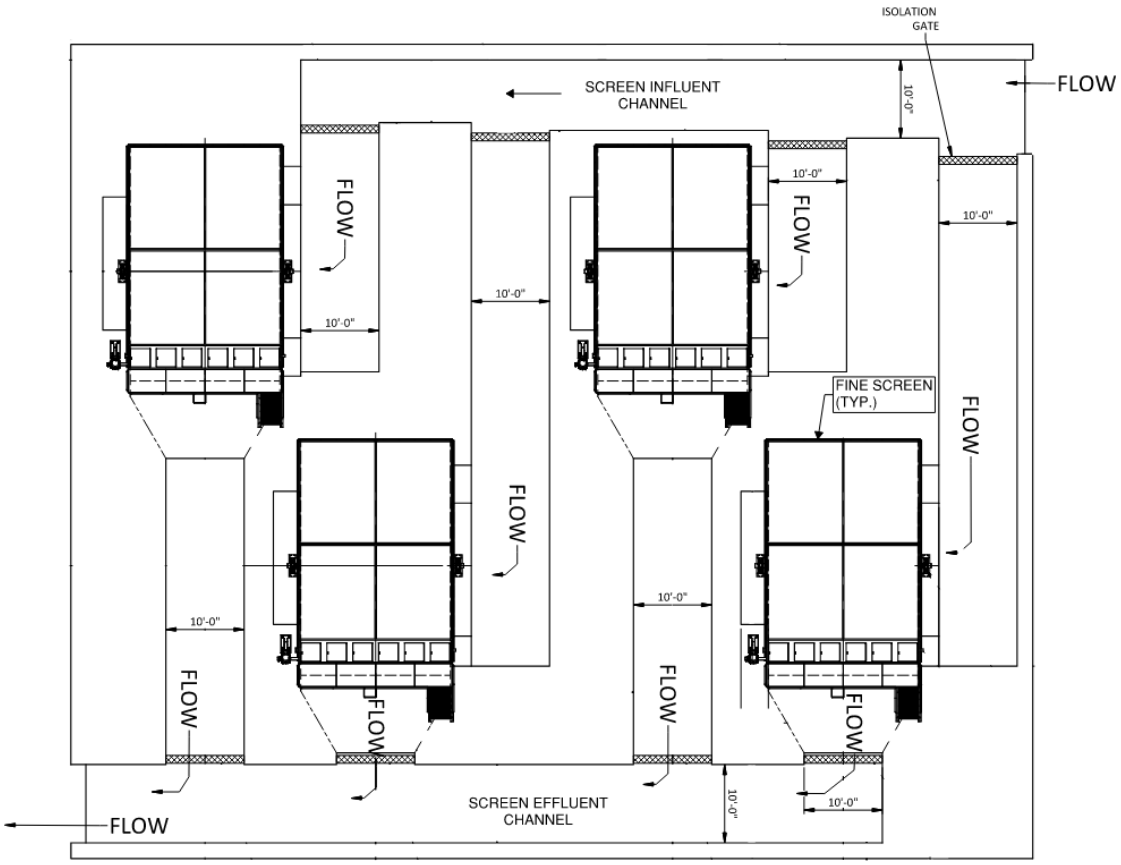


Figure 1.15 Conceptual Plan for Fine Screen Facility with Drum Screens

1.6.2 Secondary Treatment

Under Pure Water Los Angeles, the MBR process will be implemented to produce high quality tertiary effluent that will be suitable as a feed water for AWT facilities. The proposed MBR configuration is a four-stage BNR process shown on Figure 1.16.

The MBR process provides biological carbonaceous BOD and nitrogen removal as well as solids separation using membrane filtration. As such, it replaces the functionality of the HPOAS, secondary clarifiers, and tertiary filters.

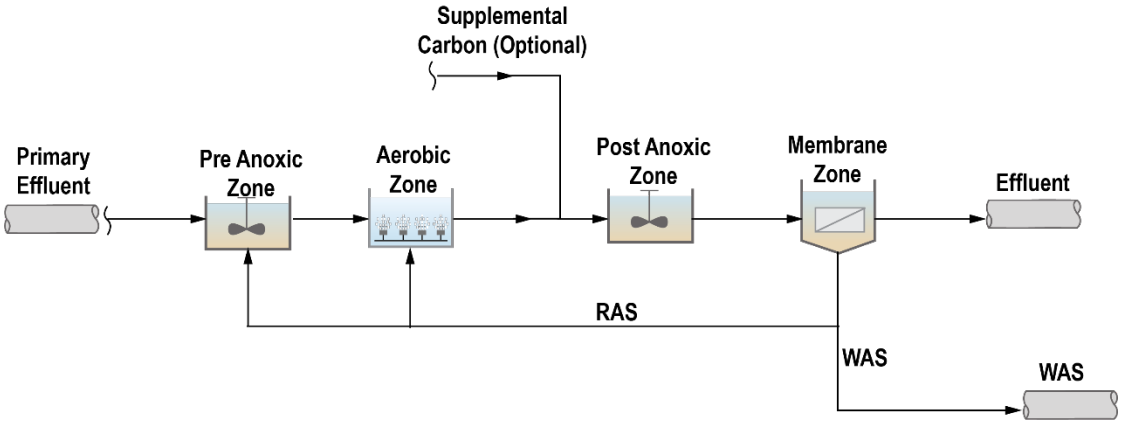


Figure 1.16 Schematic of a Four-Stage BNR Process With MBR

1.6.2.1 MBR Overview

Table 1.9 and Table 1.10 present the conceptual design criteria for the proposed MBR process for the current program and for the Ultimate Build-Out, respectively. The mixed liquor suspended solids (MLSS) concentrations shown in the tables are based on the worst-case operating conditions (highest concentrations) reflecting the minimum required bioreactors being in service. During normal operation, it is recommended that all available bioreactors be in service to reduce the MLSS concentrations and thereby gain the benefits associated with lower MLSS operation as summarized below.

- Bioreactors required for the hydraulic conveyance of the PWWF are in place.
- Provides additional aeration basins for increased process redundancy and operational flexibility, compared to conventional MBR.
- Provides operating process buffer for diurnal peaks if partial PE EQ is available.
- Reduces RAS rates from three times the influent flow rate (Q) or 4Q to 2Q or less, significantly reducing capital/O&M costs, minimizing plant hydraulic impacts, and optimizing RAS conveyance sizing.
- Improves oxygen transfer efficiency due to low MLSS concentrations, allowing the use of conventional fine-bubble diffusers (FBDs) and providing significant energy savings.
- Better accommodates increases in influent flows due to future growths (reserved capacity).

Table 1.9 Conceptual Design Criteria for MBR - Current Program

Constituent	Unit	AAF	MMF	PWWF
Influent Flow Rate	mgd	272	318	638
Number of Bioreactors In-Service[(1)]	-	20	24	24
aSRT[(2)]	days	6.6	6.6	6.6
tSRT[(2)]	days	9.0	9.0	9.0
Bioreactor MLSS	mg/L	5,600	6,360	6,280
Membrane Train MLSS	mg/L	8,350	9,480	12,530
Instantaneous Membrane Flux	gfd	13.1	12.8	≤30
RAS Rate	-	2Q[(3)]	2Q[(3)]	1Q[(3)]
MLR Rate	-	3Q[(3)]	3Q[(3)]	1.5Q[(3)]

Notes:
Abbreviations: aSRT - aerobic solids retention time; gfd - gallons per square foot per day; MLR - mixed liquor recycle; SRT - solids retention time; tSRT - total solids retention time.
(1) Total number of bioreactors is 27, based on 9 existing modules. During normal operation, it is recommended that all available bioreactors be in service to benefit from lower MLSS operation.
(2) SRTs may be refined based on results of the full-scale MBR pilot testing, currently in startup at HWRP.
(3) Q = influent flow rate.

Table 1.10 Conceptual Design Criteria for MBR - Ultimate Build-Out

Constituent	Unit	AAF	MMF	PWWF
Influent Flow Rate	mgd	420	450	740
Number of Bioreactors In-Service[1]	-	27	30	30
aSRT[2]	days	5.3	5.3	5.3
tSRT[2]	days	7.3	7.3	7.3
Bioreactor MLSS	mg/L	5,455	6,105	6,075
Membrane Train MLSS	mg/L	8,130	9,100	11,015
Instantaneous Membrane Flux	gfd	15	14.5	≤30
RAS Rate	-	2Q[3]	2Q[3]	1.22Q[3]
MLR Rate	-	3Q[3]	3Q[3]	1.82Q[3]

Notes:
(1) Total number of bioreactors is 30, based on 10 modules (9 existing plus 1 new). During normal operation, it is recommended that all available bioreactors be in service to benefit from lower MLSS operation.
(2) SRTs may be refined based on results of the full-scale MBR pilot testing, currently in startup at HWRP.
(3) Q = influent flow rate.

The proposed secondary treatment facilities will be configured in two batteries, as shown on Figure 1.17. Battery A will consist of four modules, a common mixed liquor(ML) channel, and two membrane trains. Battery B will consist of five modules, a common ML channel, and two and a half membrane trains. Each battery will have a dedicated aeration air blower building to support fine air diffusion in the BNR basins. Each membrane train will include two RAS pumps stations, one WAS pump station, and one scour air blower building.

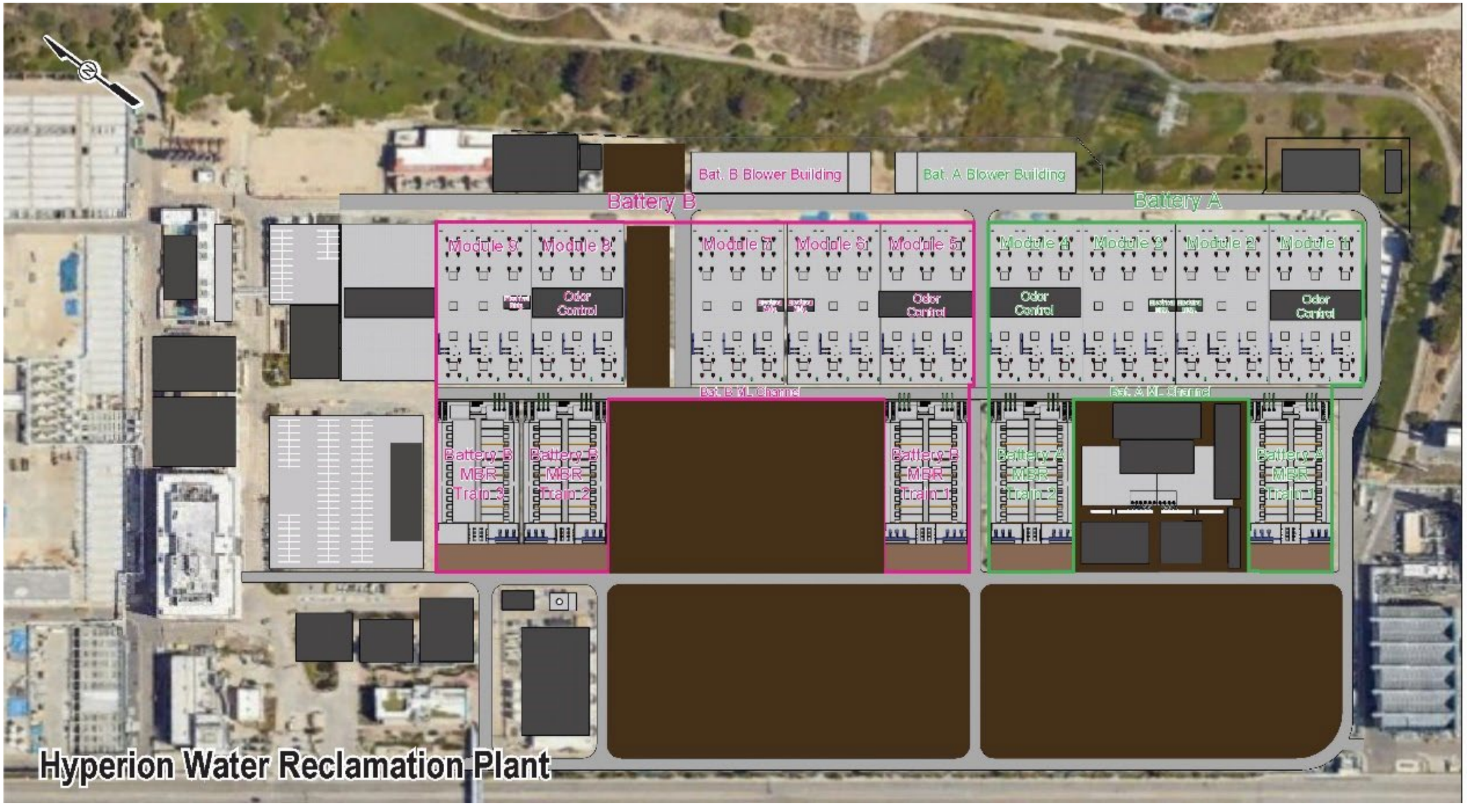


Figure 1.17 Proposed Secondary Plant Configuration

1.6.2.2 HPOAS Reactor Conversion

As part of the conversion to the MBR process, each of the existing nine HPOAS modules will be retrofitted for use as BNR basins utilizing air activated sludge. Shown on Figure 1.18, this retrofit will include the following elements:

- Aeration air distribution piping and valving.
- Installation of FBDs in both aerobic and swing zones in BNR basins.
- Installation of mixers in both anoxic and swing zones in BNR basins.
- Interior partition walls delineating different zones within BNR basins.
- MLR pumps and piping.
- RAS discharge piping.

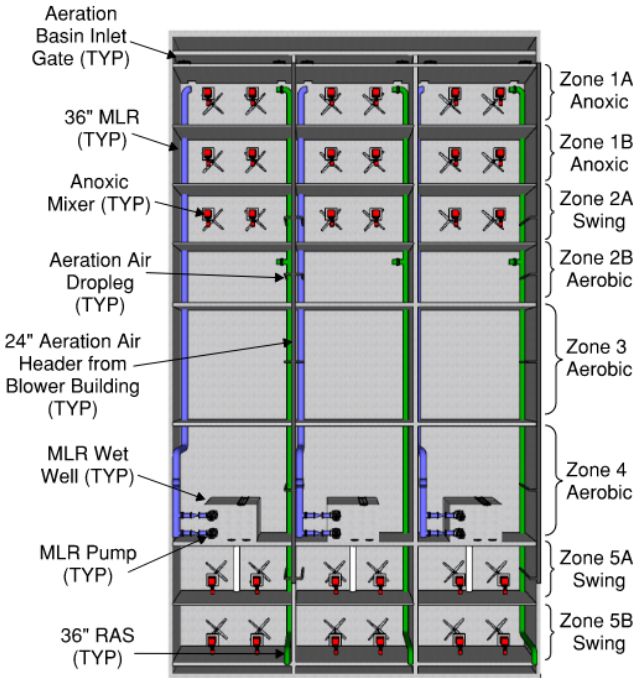


Figure 1.18 HPOAS Reactor Conversion

Internal Mixed Liquor Recycle Pumps

Each BNR basin in a bioreactor module will be equipped with MLR pumps that are intended to pump ML from the end of the reactor's aeration zones and discharge to the beginning of the BNR basin. Since the post-anoxic zones (5A and 5B) are proposed to be swing zones, with the dual capability to operate as either anoxic or aerobic, a wet well will be provided with gates to selectively receive flow from one of zone 4 (aerobic), zone 5A (swing), and zone 5B (swing), as shown on Figure 1.18. Table 1.11 provides the conceptual design criteria for the MLR pumps.

Table 1.11 Conceptual Design Criteria - MLR Pumps

Description	Unit	Current Program	Ultimate Build-Out
Type of Pump	-	Vertical Turbine	Vertical Turbine
Number of Pumps per BNR Basin	-	2 Duty	2 Duty
Recycle Rate	-	3Q(1)	3Q(2)
Capacity, each	mgd	23.9	25
Motor Size	hp	15	20
Drive Type	-	VFD	VFD
Discharge Header Diameter	inch	36	42

Notes:
Abbreviations: VFD - variable frequency drive.
(1) Q = Influent flow rate. The return rate of 3Q will be maintained up to the proposed MMF of 318 mgd.
(2) Q = Influent flow rate. The return rate of 3Q will be maintained up to the proposed MMF of 450 mgd.

Anoxic Mixers

All zones in the BNR basins that may operate as anoxic zones will be equipped with mixers to facilitate mixing and minimize settlements. Table 1.12 provides the conceptual design criteria for the mixers.

Table 1.12 Conceptual Design Criteria - Anoxic Mixers

Description	Unit	Current Program and Ultimate Build-Out
Type of Mixers	-	Platform-mounted propeller mixers
Number of Mixers	-	2 per anoxic or swing zone
Uniformity	%	90
Motor Size	hp	3
Drive Type	-	Constant speed

1.6.2.3 Blower Buildings

In the aerobic and swing zones, FBDs will be utilized, and process air to the diffusers will be supplied by a new aeration air blower system. Flexible membrane FBDs will be used for ML aeration. Aeration air demands were simulated assuming a conservative DO set point of 2.0 mg/L and average a value of 0.50, where a is the ratio of process water oxygen mass transfer to that in clean water.

Two new aeration air blower buildings, one for each battery, will house the aeration air blowers and support fine air diffusion in the BNR basins. The blower buildings will be located on the hillside, south of the existing oxygen generation facility (OGF), as shown in Figure 1.10 and Figure 1.17. Conceptual layouts of the two blower buildings are provided in Figure 1.19 and Figure 1.20.

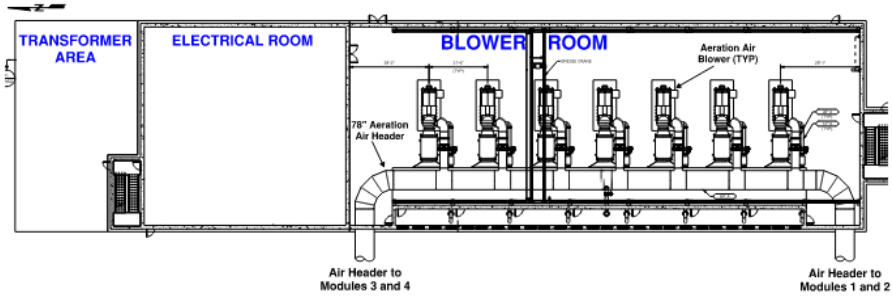


Figure 1.19 Conceptual Layout of Battery A Aeration Air Blower Building

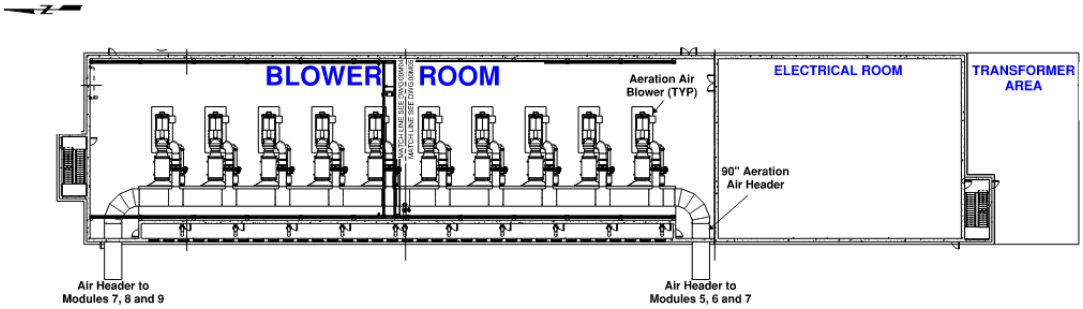


Figure 1.20 Conceptual Layout of Battery B Aeration Air Blower Building

Table 1.13 provides the conceptual design criteria for the aeration air blowers.

Table 1.13 Conceptual Design Criteria - Aeration Air Blower System

Description	Unit	Current Program		Ultimate Build-Out	
		Battery A	Battery B	Battery A	Battery B
Number of Blower Buildings	-	1	1	1	1
Modules Served	-	1-4	5-9	1-4	5-10
Number of Blowers	-	6 Duty + 1 Standby	8 Duty + 2 Standby	6 Duty + 1 Standby	8 Duty + 2 Standby
Type	-	High Efficiency Single-Stage Centrifugal		High Efficiency Single-Stage Centrifugal	
Capacity, each	scfm	23,600(1)		34,300(2)	
Discharge Pressure	psig	13.2		13.2	
Motor Size	hp	1,500		2,500	
Drive Type	-	Soft Starter		Soft Starter	
Discharge Header	inch	78	90	90	108
Discharge Header, per BNR Basin	inch	24	24	26	26

Notes:
Abbreviations: psig - pounds per square inch gauge; scfm - standard cubic feet per minute.
(1) For reference, anticipated total aeration air demands are 212,600 scfm under average conditions and 318,900 scfm under peak conditions.
(2) For reference, anticipated total aeration air demands are 319,800 scfm under average conditions and 479,700 scfm under peak conditions.

1.6.2.4 Membrane Filtration Facilities

In line with the two-battery configuration of the proposed secondary treatment facilities shown on Figure 1.16, the membrane filtration facilities are arranged in two batteries. Battery A includes two membrane trains and Battery B includes two and a half membrane trains with the ability to build-out the second half of the membrane train for Ultimate Build-Out. In general, each full membrane train provides two banks of membrane tanks and associated support systems in symmetry, as shown in Figure 1.21. The membrane trains will provide the following:

- Individual tanks in which submerged membrane cartridges or cassettes provide liquid-solids separation.
- Permeate pumps and other equipment and piping in underground equipment galleries (to be connected to existing tunnels).
- Scour air blowers in blower buildings.
- RAS/WAS pump stations.

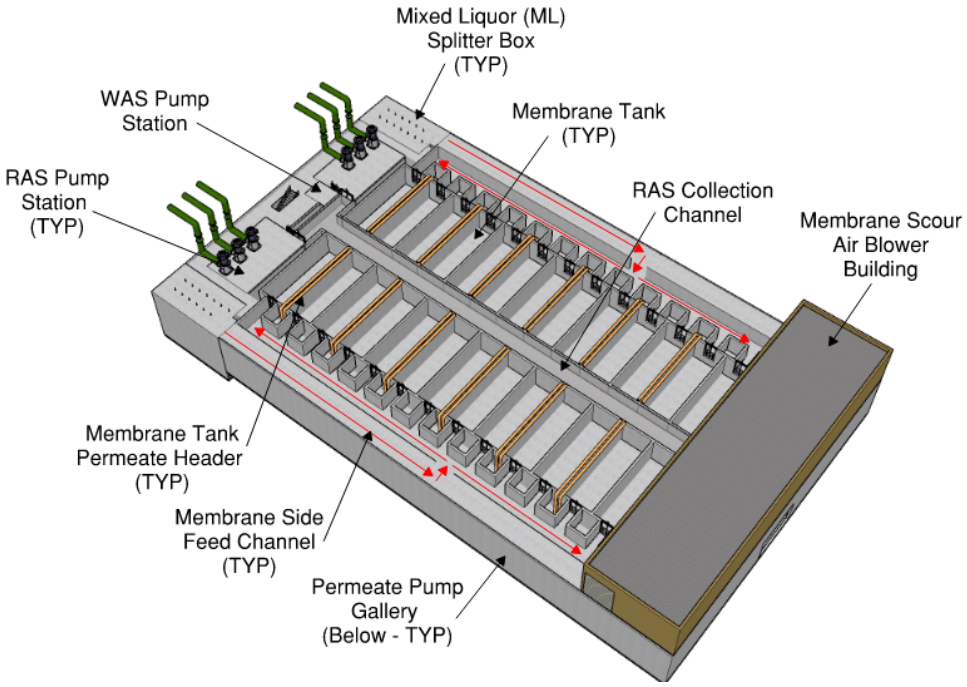


Figure 1.21 Conceptual Layout of Representative Membrane Train

Membrane Tanks

Cast-in-place concrete tanks will be constructed to hold submerged membrane racks or cassettes to provide separation of solids from the ML. The hollow-fiber membrane configuration will be used since they provide the most efficient use of the available footprint and are being tested in the MBR pilot facility at HWRP. Three manufacturers are being considered and their membranes serve as the basis for conceptual sizing. The preliminary design is based on meeting the target instantaneous wet weather flux of ≤30 gfd.

As shown in Table 1.14, both DuPont and Veolia produce a new membrane module boasting a larger membrane surface area compared to modules predominantly utilized over the past decade (approximately 530 versus 430 ft^2 - approximately 25 percent increase). The increased surface area translates to a reduced footprint for the membrane filtration facility. However, given the recent introduction of these new membrane modules by DuPont and Veolia, and their limited usage thus far, the layout for the membrane filtration facilities takes into account both module options.

Table 1.14 Conceptual Design Criteria - Membrane Modules

Description	Unit	Veolia (Zenon)(1)		DuPont (Memcor)		Kovalus
Membrane Module	-	500D	500EV	B40N	B50N	LE44
Membrane Surface Area per Module	ft^2	430	530	430	538	468
Number of Tanks per Membrane Train	-	22	18	24	26	24
Membrane Tank Dimensions	feet (W x L)	19 x 45	19 x 41.7	13.5 x 50	13.5 x 41	20 x 45
Membrane Filtration Facility Dimensions	feet (W x L)	290 x 140	261 x 140	245 x 150	266 x 130	322 x 150

Notes:
Abbreviations: W x L - width by length.
(1) Formerly under Suez Environment, Inc.

Membrane technology continually evolves, building upon past successes and replacing older models with improved versions. At the time of this report, both new and old membrane modules are being considered in the layout of the membrane filtration facilities. However, construction of the first membrane filtration facility is not anticipated to start until July 2030. By then, the new membrane module may be widely adopted, rendering the lower surface area modules obsolete. Furthermore, a more advanced membrane module might be introduced that could further optimize the layout and design of the membrane filtration facilities. A comprehensive evaluation of the available membrane technologies should be conducted during Phase 1B, when the first membrane train will be constructed.

Membrane Scour Air Blower Building

Submerged MBR membranes require continuous coarse bubble aeration to reduce solids fouling associated with the accumulation of material on membrane surfaces. Low-pressure air is typically supplied to the bottom of the membrane cassettes or cartridges for discharging coarse bubbles that travel vertically up through the space between membranes, thereby providing a shearing effect.

Each bank of membrane tanks in a membrane train has a dedicated scour air blower system. The two scour air blower systems in a membrane train are housed in a common building at grade elevation that also includes an electrical room and is integrated into the membrane train structure. Figure 1.22 provides a conceptual layout of the scour air blower building.

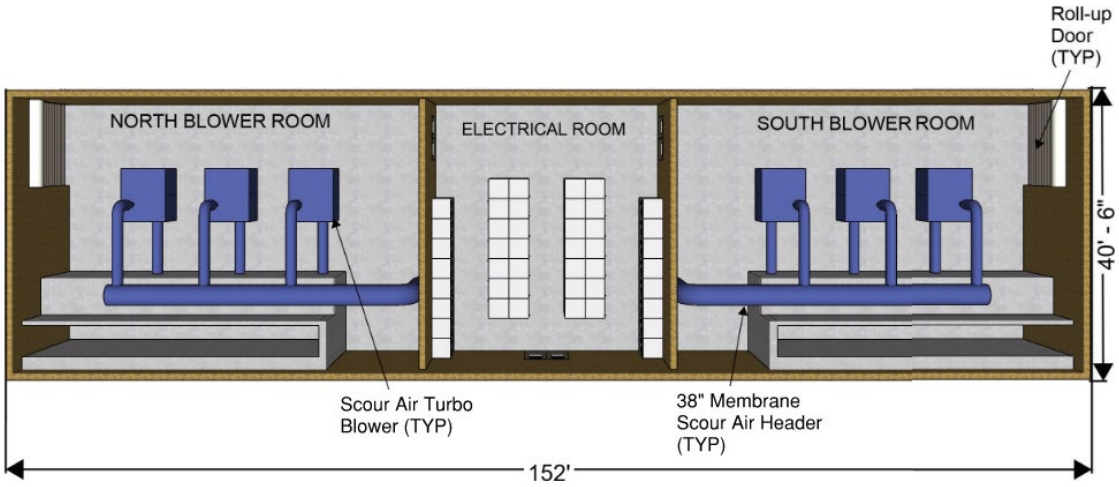


Figure 1.22 Conceptual Layout of Scour Air Blower Building

The scour air blowers for each bank of membrane trains share a common discharge header. These headers will be located in a gallery underneath the RAS center collection channel. Table 1.15 provides the conceptual design criteria for the membrane scour air systems.

Table 1.15 Conceptual Design Criteria - Membrane Scour Air Systems

Description	Unit	Current Program and Ultimate Build-Out
Number of Blower Systems per Membrane Train	-	2
Number of Blowers per System	-	2 Duty + 1 Standby
Type of Blower	-	Turbo
Capacity, each	scfm	17,000
Discharge Pressure	psig	5.2
Motor Size	hp	500
Driver Type	-	VFD
Discharge Header, per System	inch	38
Discharge Header, per Tank	inch	10

1.6.2.5 RAS/WAS Pumping

Liquid-solids separation is achieved in the membrane tanks, where the permeate, devoid of solids, is pumped from inside the membranes to downstream treatment facilities. Unable to pass through the membranes, the solids are effectively concentrated in the membrane tanks and then routed to a common channel. The sludge, thus collected, is either returned to the bioreactors as RAS or discharged to the solids handling facilities as WAS.

RAS Collection Channel

At the center of each membrane train, a common channel receives the unfiltered portions of the ML that exit the membrane tanks via overflow weirs and conveys them to two identical RAS wet wells as shown on Figure 1.23.

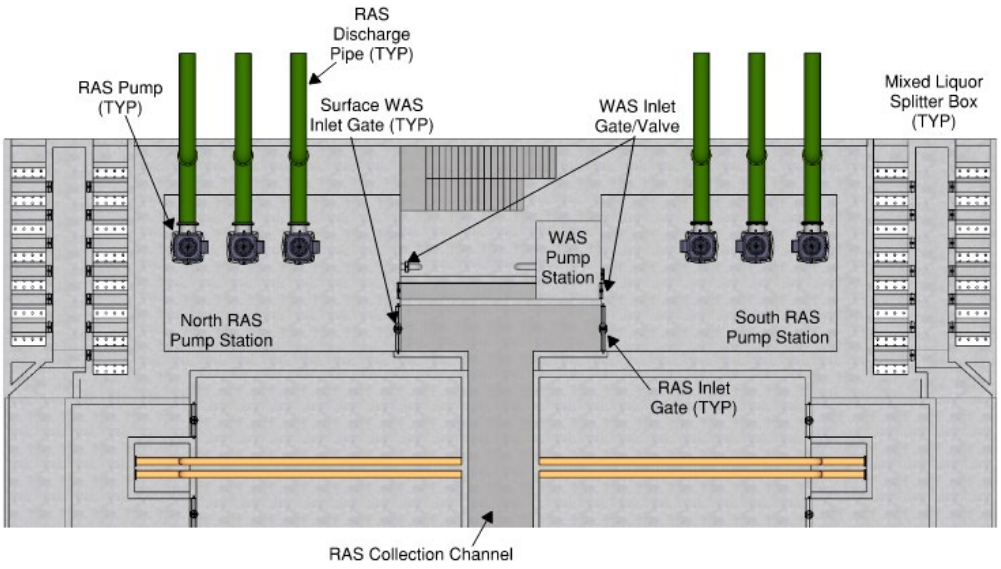


Figure 1.23 Conceptual Layout of RAS/WAS Pump Station

RAS Pumping

The sludge flow downstream of the membrane tanks is conveyed to two RAS pumping stations located at the east end of the membrane train. The pump station is approximately 34 feet long by 24 feet wide with an average side water depth of 13 feet, sized in accordance with Hydraulic Institute standards. Table 1.16 provides the conceptual design criteria for the RAS pumps.

Table 1.16 Conceptual Design Criteria - RAS Pumping

Description	Unit	Current Program		Ultimate Build-Out	
		Battery A	Battery B	Battery A	Battery B
Number of Systems	-	4	5	4	6
Modules Served	-	1-4	5-9	1-4	5-10
Number of Pumps per System	-	2 Duty + 1 Standby		3 Duty + 1 Standby	
Type	-	Vertical Turbine		Vertical Turbine	
Return Rate	-	2Q(1)		2Q(2)	
Capacity, each	mgd	35.3		35.3	
Drive Type	-	VFD		VFD	
Motor Size	hp	300		300	
Discharge Headers	inch	60(3)		60(3)	

Notes:
(1) Q = Influent flow rate. The return rate of 2Q will be maintained up to the proposed MMF of 318 mgd.
(2) Q = Influent flow rate. The return rate of 2Q will be maintained up to the proposed MMF of 450 mgd.
(3) Two 60-inch discharge headers will be provided for each battery.

Pump discharges from all the RAS pump stations in a secondary treatment battery will be conveyed in two 60-inch discharge headers that serve all bioreactors within the battery. The two headers will be routed in a new RAS gallery to be constructed on top of the new ML channel.

Both headers will be connected to all of the bioreactors to allow taking a header out of service for maintenance. Figure 1.23 provides a conceptual layout of the RAS/WAS pump station.

WAS Pumping

Adjacent to the two RAS pump stations is a WAS pumping station, which receives flow from the two RAS pump stations such that the three pump stations are hydraulically connected and may be operated using a common set of level instruments under normal operating conditions.

The WAS wet well will have two inlets from each of the two RAS wet wells, one to convey waste sludge under normal operation and another to convey scum, foam, and other floatables to avoid a buildup of these materials as required. Pump discharges from each WAS pump station will be directed to in a common header to the existing thickening centrifuge facility via tunnels. Table 1.17 provides the conceptual design criteria for the WAS pumps.

Table 1.17 Conceptual Design Criteria - WAS Pumping

Description	Unit	Current Program and Ultimate Build-Out
Number of Systems per Membrane Train	-	1
Total Number of Systems	-	5
Number of Pumps per System	-	2 Duty + 1 Standby
Type of Pump	-	End Suction Centrifugal or Submersible
Capacity, each	gpm	620
Drive Type	-	VFD
Motor Size	hp	20
Discharge Header Diameter	inch	10

Notes:
Abbreviations: gpm - gallons per minute.

1.6.3 Advanced Water Treatment

As shown in Figure 1.9, the Program is currently based on implementing a conservative approach to the AWT facility design, which is to provide two separate treatment trains for DPR and IPR that each meet the water quality requirements commensurate with the application. Following the MBRs, treatment for DPR applications will include ozone, BAC, MF or ultrafiltration (UF), RO, UV-AOP, post treatment for stabilization, and blending infrastructure to meet chemical dilution regulatory requirements. For IPR applications, treatment will include RO, UV-AOP, and post treatment for stabilization following MBR. For both trains, provisions for diurnal flow EQ will be provided, and all associated AWT treatment facilities will be situated within HWRP with a possible exception of blending infrastructure for DPR product water downstream of post treatment. Figure 1.24 shows a conceptual site plan of the AWT facilities.

Based on input received from LASAN and LADWP, the AWT facilities will be designed for the current program AAF of 272 mgd plus recycle flows, and a future expansion beyond the current program flows will not be considered. This design flow along with other key design criteria is under further review and will be refined based on the final program direction that will be developed collaboratively by LASAN and LADWP upon the completion of LADWP's Pure Water Los Angeles Master Plan (anticipated December 2024).

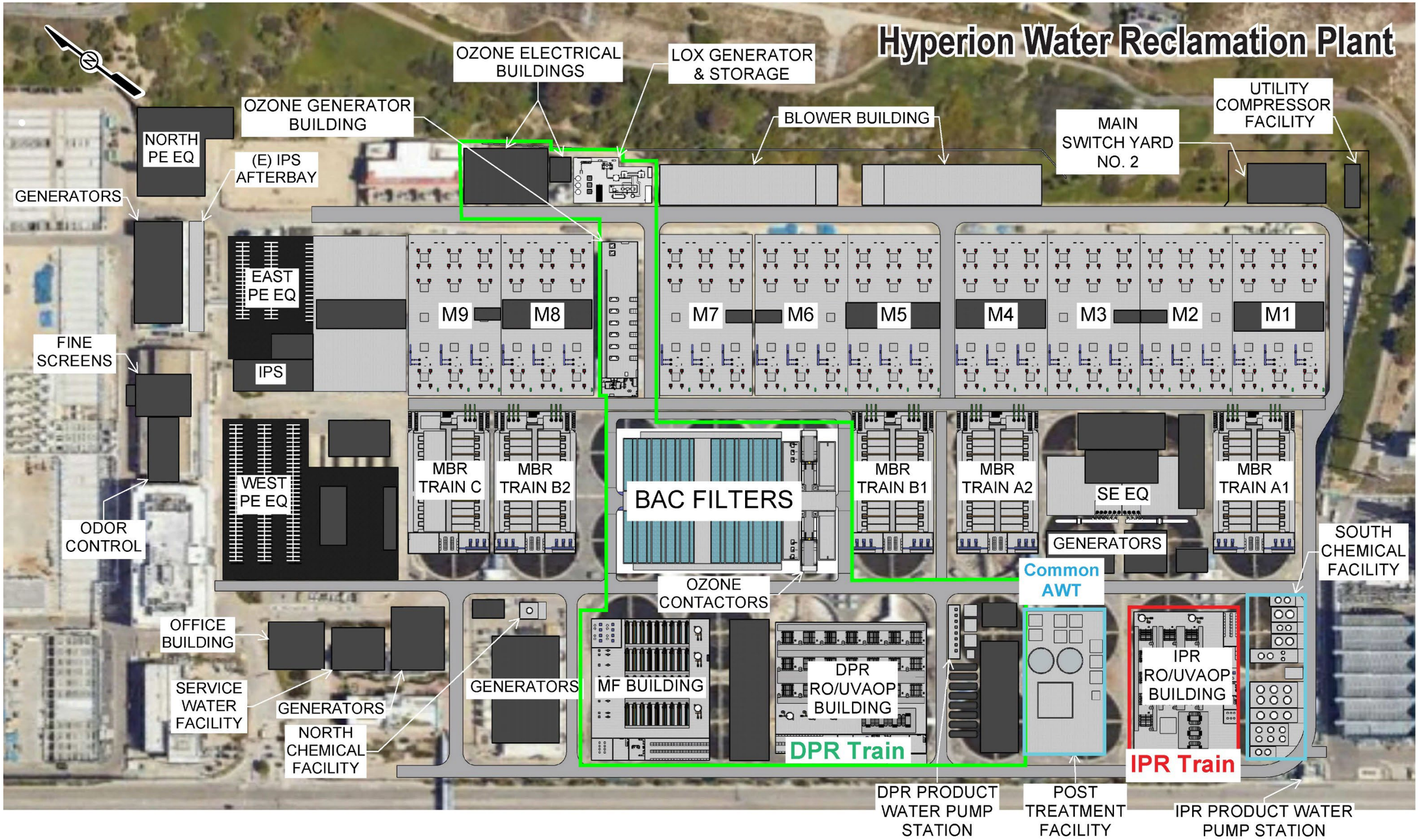


Figure 1.24 Conceptual Site Plan - AWT Facilities

1.6.3.1 Secondary Effluent EQ and Pumping

Downstream of the MBR membrane filtration facilities, an additional EQ facility will be provided and equipped with a pump station that functions as an AWT influent pump station. This SE EQ facility, in conjunction with PE EQ facilities, is intended to normalize diurnal flow fluctuations to enable operating the downstream AWT facilities at a constant flow, which is desirable for those processes while providing additional operational flexibility.

Secondary Effluent EQ Basins

Shown on Figure 1.25, a common secondary EQ facility is proposed and is located in the membrane train areas for hydraulic efficiency. For redundancy, the EQ facility consists of two identical basins of equal volume, separated by an interior partition wall. Under normal operation, the two basins are intended to operate (i.e., fill and draw) as one hydraulic system. Table 1.18 provides the conceptual design criteria for the SE EQ facility.

Table 1.18 Conceptual Design Criteria - SE EQ Facility

Parameter	Value
Location	Existing Clarifiers 2C, 2D, 4A, and 4B
Inside Width (feet)	280
Inside Length (feet)	110
Bottom Floor Elevation	4.0
Maximum Water Surface Elevation	29.5
Working Depth (feet)	24
Working Volume (MG)	5.53(1)

Notes:
(1) For reference, the PE EQ basins will provide a total volume of 36.4 MG.

Secondary Effluent EQ Pump Stations

The SE EQ facility includes an integral pump station equipped with vertical turbine pumps to draw down the level in the associated EQ basins and convey the equalized flow to the two AWT treatment trains (IPR and DPR) using two separate pump systems. The pump station will be located on the west side of the basins. The pump station is approximately 28 feet long by 90 feet wide, sized in accordance with Hydraulic Institute standards. Figure 1.25 provides a plan view of the pump station. In order to maintain minimum submergence for the pumps, the pump station bottom floor is recessed relative to the EQ basins they serve, as illustrated on Figure 1.26. Table 1.19 presents key dimensions and elevations used to size the pump station.

Table 1.19 SE EQ Pump Station - Key Dimensions and Elevations

Parameter	Value
Low Water Surface Elevation (feet)	5.5
Minimum Submergence (feet)(1)	8.0
Minimum Clearance (feet)(2)	2.0
Pump Station Floor Elevation (feet)	-4.5

Notes:
(1) Minimum distance from water surface elevation to pump inlet.
(2) Minimum distance from pump inlet to the floor.

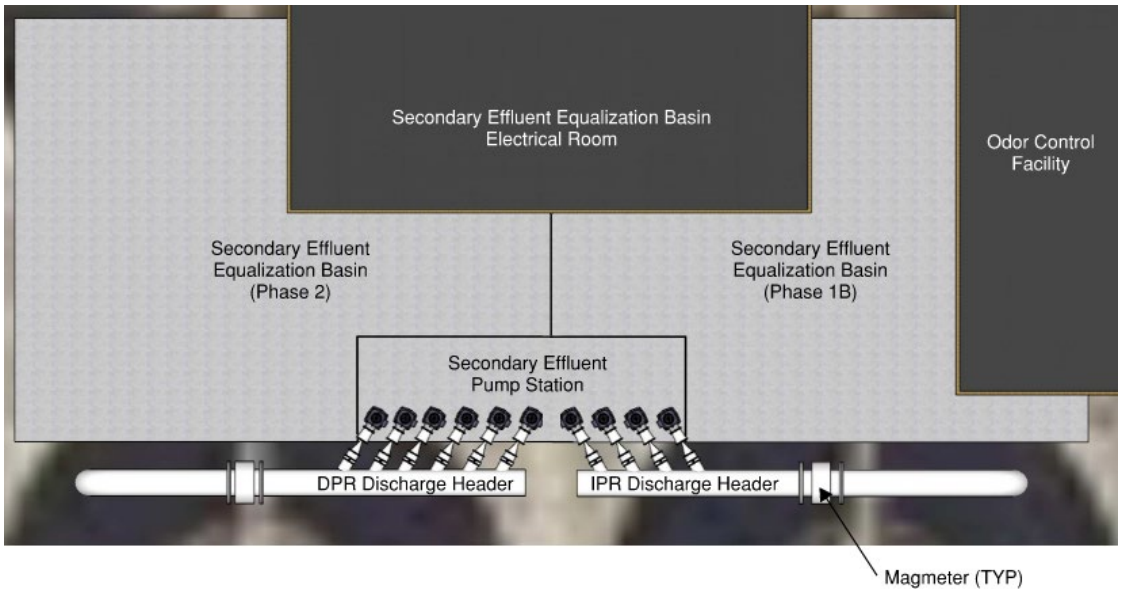


Figure 1.25 SE EQ Pump Station

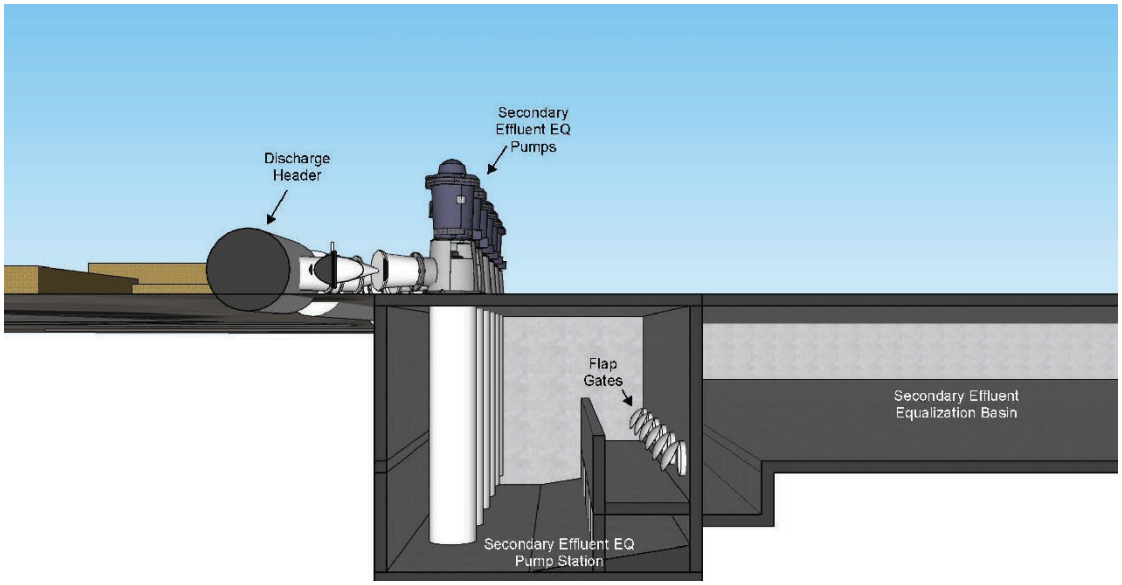


Figure 1.26 SE EQ Pump Station - Section View

Table 1.20 provides the conceptual design criteria for the SE EQ pump stations.

Table 1.20 Conceptual Design Criteria - SE EQ Pump Station

Description	Unit	IPR Supply	DPR Supply
Number of Pumps	-	3 Duty + 1 Standby	4 Duty + 2 Standby
Type of Pump	-	Vertical Turbine	Vertical Turbine
Total Duty Capacity(1,2)	mgd	106	149
Capacity, each	mgd	35.3	37.3
Drive Type	-	VFD	VFD
Motor Size	hp	350	350

Notes:
(1) Excludes standby units.
(2) The two pump systems provide a combined duty capacity of 282.5 mgd based on using similarly sized pumps.

1.6.3.2 DPR Train

The DPR treatment train consists of ozone/BAC, MF, RO, UV-AOP, post-treatment, and blending infrastructure to meet chemical dilution regulatory requirements, all located downstream of MBR secondary treatment. The DPR quality water produced at HWRP will be delivered to the end users by LADWP's conveyance infrastructure, with a target DPR production of 120 mgd. The conceptual siting and sizing of AWT facilities for the DPR train are summarized in the following sections.

Ozone Area Overview

Ozonation of wastewater provides a disinfection barrier that provides inactivation credits for virus, *Cryptosporidium,* and *Giardia*. In addition to pathogen inactivation, the ozonation process oxidizes many soluble organic compounds in the SE. Because the half-life of ozone gas is short, ozone must be generated at the point of use and cannot be purchased like most other treatment chemicals.

Depending on the ozone generation technology used, the gas product is typically in the range of 1 percent to 20 percent ozone by weight. At small scale it is cost-effective to generate ozone using dry air as the feed gas, which results in a low-concentration ozone gas. At larger scale, it becomes more cost-effective to use HPO (>90 percent) as the feed gas, which allows the ozone generators to make a higher concentration of ozone. In large scale municipal applications, HPO is typically used to generate ozone gas in the range of 8 to 12 percent by weight. Given the need for HPO, and on-site generation of ozone, the ozone process consists of the following major areas:

1. Oxygen Concentration and Storage.
2. Ozone Generation.
3. Ozone Dissolution.
4. Ozone Contact Tanks.

Each of these four major areas have multiple technology options available that can be the most suitable approach in different applications. In the case of the Program's ozonation process, pilot data is highly recommended to identify the typical and maximum ozone dose that will be required to reliably achieve the disinfection requirement. Without optimizing this design criteria with site-specific pilot data, a definitive technology recommendation cannot be made in all cases. Therefore, the following sections describe the alternatives available for each of these

areas, assess the space requirements, present pros and cons, and quantify approximate life-cycle costs. Technology selection for ozonation will occur during detailed design once all high-level design criteria have been finalized.

For the purpose of this assessment the following water quality and ozone demand have been assumed and summarized in Table 1.21. These assumptions are conservative and pilot testing should provide slightly reduced ozone dose criteria which will reduce equipment sizing, footprint, power consumption, etc.

Table 1.21 Ozone Dose Design Criteria

Parameter	Value	Unit	Comments
Maximum NO2-N	0.14	mg/L	From MBR process modeling data in Hyperion MBR Pilot CDR.
Maximum Ozone: TOC + NO_2-N Ratio Required	1.25		Literature value to achieve CT needed for minimum 1-log *Cryptosporidium* inactivation.
Minimum Ozone: TOC + NO_2-N Ratio	1.0		An alternate ratio may be used if demonstrated to meet chemical surrogate removal requirements.
Chemical Surrogate Removal Requirements	1.0	LRV	1.0-log reduction of carbamazepine and sulfamethoxazole required across ozone
Maximum SE TOC	10	mg/L	Conservative high value for MBR process.
Typical SE TOC	8	mg/L	
Design Minimum Transfer Efficiency	90	percent	Conservative low MTE assumed due to high dose.
Typical Applied Ozone Dose	11.6	mg/L	Calculated value.
Maximum Applied Ozone Dose	14.4	mg/L	Calculated value.

Notes:
Abbreviations: CDR - Conceptual Design Report; CT - contact time; MTE - mass transfer efficiency.

Oxygen Supply

Conceptual design criteria for a vacuum pressure swing absorption (VPSA) system that may be suitable for onsite generation of HPO are shown in Table 1.22.

A conceptual layout for a VPSA system with liquid oxygen (LOX) backup is shown on Figure 1.27. The VPSA equipment would be housed in an acoustical building, which is not shown on Figure 1.27.

Table 1.23 presents the conceptual design criteria used for laying out the ozone area. As mentioned above, after pilot testing, the final selected maximum ozone dose may differ from what is assumed in this concept design. The conceptual design dose is intended to be conservative so that the future detailed designer will not need to increase the size of the ozone area and will likely decrease it.

Table 1.22 VPSA Design Criteria

Parameter	DPR	Unit	Comment
Maximum Oxygen Demand	75	tpd	Assuming maximum dose at 12wt% ozone
Average Oxygen Demand	55	tpd	Assuming average dose at 10wt% ozone
Number of VPSA Units	2	No.	Duty/Assist
Feed Blower Motor Power (each)	1,000	hp	
Product Compressor Motor Power (each)	100	hp	
Oxygen Purity	93 ± 1%	%	
Production Efficiency	0.90 ± 5%	kWh/100 scf	At 93% purity
Dew Point	-60	degrees C	Maximum
Days of LOX Backup	7	days	Assuming average dose at 12wt% ozone
Number of LOX Tanks	4	No.	Vertically mounted
Tank Volume (each)	22,000	gallons	Selected for common tank size
Number of Vaporizers	3	No.	Duty/Thaw/Standby
Average LOX Deliveries per Day (only when required)	2.3	per day	Assuming average dose at 12wt% ozone

Notes:
Abbreviations: kWh/100 scf - kilowatt-hour per 100 standard cubic feet; tpd - tonnes per day; wt% - weight percentage.

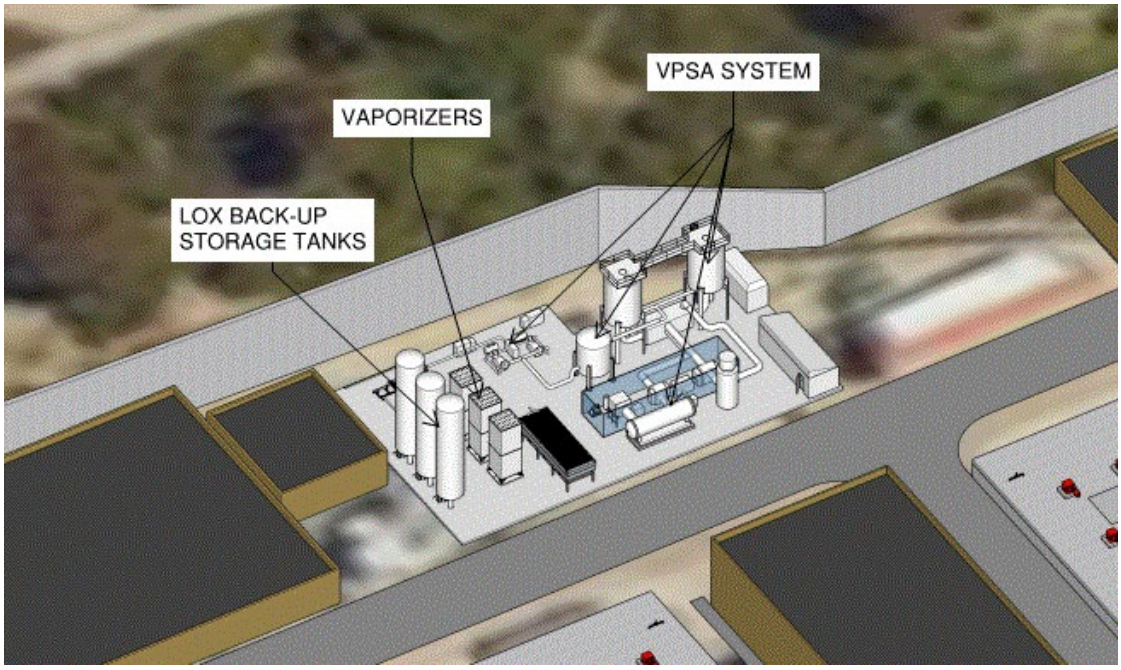


Figure 1.27 Conceptual Layout of VSPA Facility with LOX Backup

Table 1.23 Ozone Generation Design Criteria

Parameter	DPR	Unit	Notes
Ozone Dose Required			
Average Applied Ozone Dose	11.6	mg/L	
Maximum Applied Ozone Dose	14.4	mg/L	
Ozone Production			
Average Ozone Mass Flow	11,026	ppd	
Maximum Ozone Mass Flow	17,935	ppd	
Number of Duty Ozone Generators	4	No.	
Number of Standby Ozone Generators	1	No.	
Total Number of Ozone Generators	5	No.	
Individual Ozone Generator Capacity	4,484	ppd	
Ozone Production Efficiency	<4.5	kilowatt hours per pounds	At 90 degrees F cooling water temperature and 10wt%
Ozone Concentration at Average Dose	10%	wt%	Operational range 8 to 12wt%
Ozone Concentration at Maximum Dose	12%	wt%	
Open Loop Cooling Water Temperature	70 to 90	degrees F	Operational range 21 to 32 degrees C. 22 to 30 degrees C typical

Notes:
Abbreviations: degrees F - degrees Fahrenheit; ppd - pounds per day.

A conceptual layout for the ozone generator room is presented on Figure 1.28. This layout utilizes the space currently occupied by the existing HPOAS's compressor room that will become available for construction in Phase 3. This area is located directly opposite the proposed Oxygen Area making oxygen supply to the ozone generators convenient. The equipment shown below is based on the Xylem PDOevo 4500 with external transformers. However, the transformers could be located indoors or outdoors (as shown below) depending on the ultimate ozone generator specification. The proposed layout shows a predominantly single-level building except for a second level satellite control room on the west side. However, if additional space is required in the area the second level could be extended east. Additionally, if internal transformers are used, the south wall could be shifted closer to the road to provide additional indoor space.

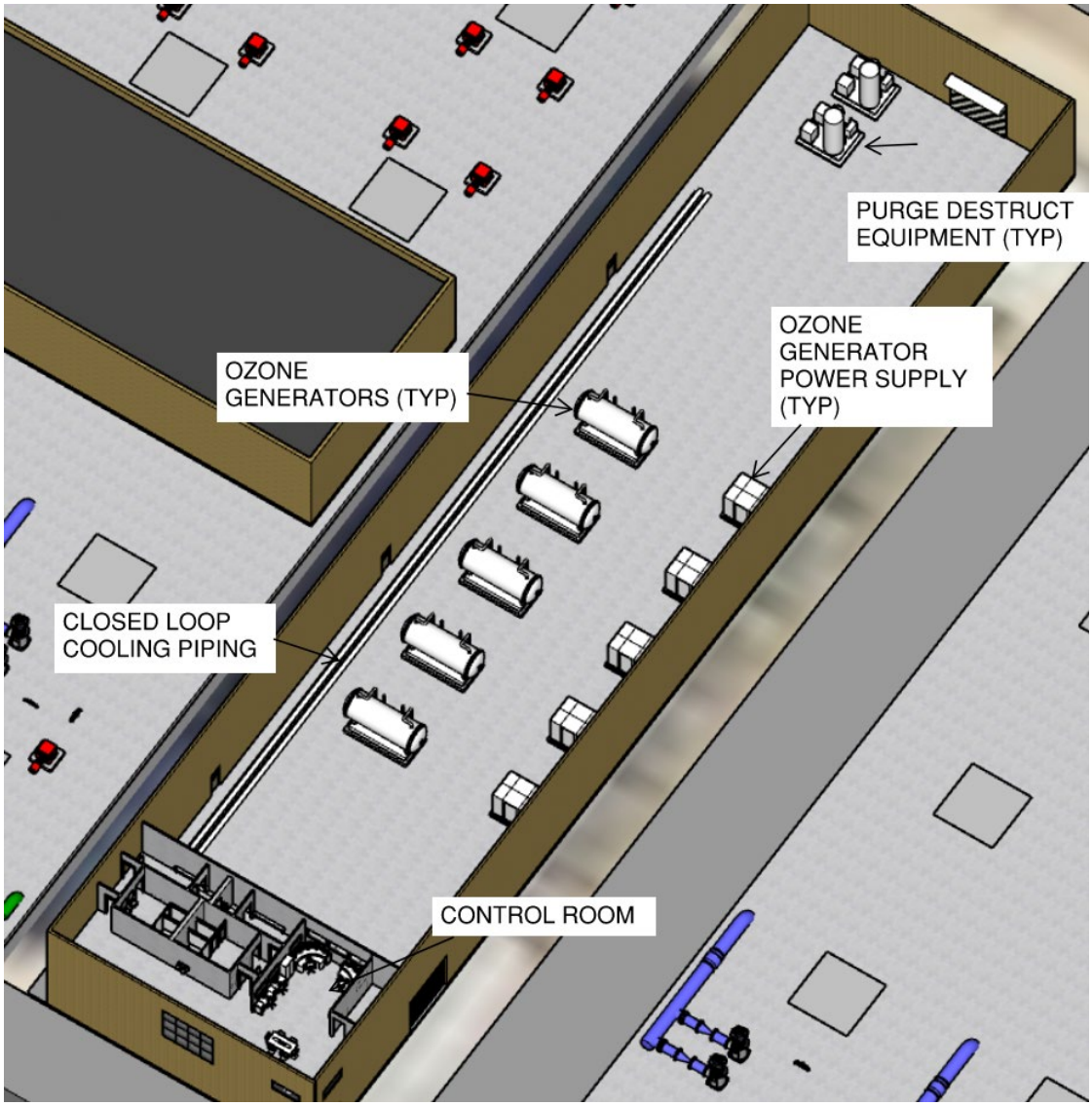


Figure 1.28 Conceptual Layout of Ozone Generator Room

In addition to the ozone generators, the ozone room will also house the closed-loop cooling equipment (located underneath the control room) and the purge-destruct equipment (located at the east end). Product gas will be piped approximately 800 feet to the ozone injection equipment located with the ozone contactors.

Ozone Dissolution

The design of the gas injection and dissolution system is a critical part of the process as it determines the MTE of the ozone gas, which is required for sizing the ozone and oxygen facilities. There are two approaches to ozone injection that are commonly applied at this scale:

- FBDs.
- Sidestream Injection (SSI).

An FBD design typically uses the first one to three chambers of the ozone contactor to introduce ozone gas through a ceramic diffuser grid secured to the floor. The ozone gas then moves upward through the water in either a counter-current or co-current manner, before being removed as off-gas. Because the diffuser equipment is located inside the contact tank, it is important to have a routine maintenance task to drain the contactors and inspect the diffusers for leaks or damage. To facilitate this inspection inside a confined space, robust access methods are necessary to promote worker safety.

An SSI design uses venturi eductors to inject the ozone gas into a sidestream of process water. The sidestream fraction varies with the gas flow but can be as high as 35 percent in high-dose designs. The sidestream flow is then introduced to the bulk flow through a secondary mixing device such as a static mixer or pipeline flash reactor. Because the pumped sidestream fraction can be high, the electricity cost of sidestream systems can become significant.

For the purpose of this conceptual layout, it is assumed that a high-flow SSI design will be used. However, a low flow sidestream approach or a diffuser system would likely lead to life-cycle cost savings. For that reason, it is recommended that a diffuser fouling pilot be conducted to identify the expected maintenance interval on the MBR effluent. If the extent and frequency of maintenance is acceptable to LASAN, a diffuser approach could be pursued in detailed design.

Ozone Contact Tanks

The ozone contact tanks serve a dual purpose by providing a suitable location for the ozone off-gas to be safely removed, as well as providing the hydraulic residence time required for the ozone reactions to take place. It is typically desirable for an ozone contact tank to have a high baffling factor (BF), to limit short circuiting. This is particularly true when a dissolved ozone CT must be achieved, since the BF is included in the calculation. The conceptual design is based on four ozone contact tanks with the ability to take one tank offline without impacting hydraulic capacity. The contact tanks are arranged in a four-pass stacked serpentine to provide a high BF and approximately match the adjacent BAC structure size. The four tanks are mirrored to provide a central equipment gallery which will house the stainless-steel influent pipes, isolation valves, flowmeters, SSI equipment, static mixer/s, and water quality analyzers. The hydraulic retention time (HRT) (and therefore size) of the ozone contact tanks has been selected to allow for normal operation in ozone CT mode to achieve 1-log *Cryptosporidium* LRV. If the ozone system design did not need to achieve a measure dissolved ozone CT (for example if virus or chemical destruction were the operational target) then the contact tanks could be approximately half this size and the online instrumentation would be simplified.

Table 1.24 summarizes the ozone contact tanks design criteria.

Table 1.24 Ozone Contact Tanks Design Criteria

Parameter	DPR	Unit	Notes
Type	Four Pass Serpentine		
Number of Duty Ozone Contactors	3	No.	
Number of Standby Contactors	1	No.	
Total Number of Contactors	4	No.	
Contactor Capacity (each) (N-1)	50	mgd	Typically operates N-0

Parameter	DPR	Unit	Notes
Contactor Feed Pipe Diameter	54	inches	Stainless-steel
Contactor Pass Width	11	feet	
Contactor Pass Depth	11	feet	
Contactor Pass Length (each)	82	feet	
Total Contactor Volume (each)	297,000	gallons	
Contact Zone HRT (N-0)	10	minutes	
Quench Zone HRT (N-0)	1.5	minutes	
Total HRT (N-0)	11.5	minutes	
t_{10} BF	0.70	ratio	Minimum

Figure 1.29 shows a conceptual layout of the four contact tanks at the south end of the BAC structure. The top deck of the contact tanks will be used to house the off-gas destruct equipment, electrical room, and a small satellite control facility.

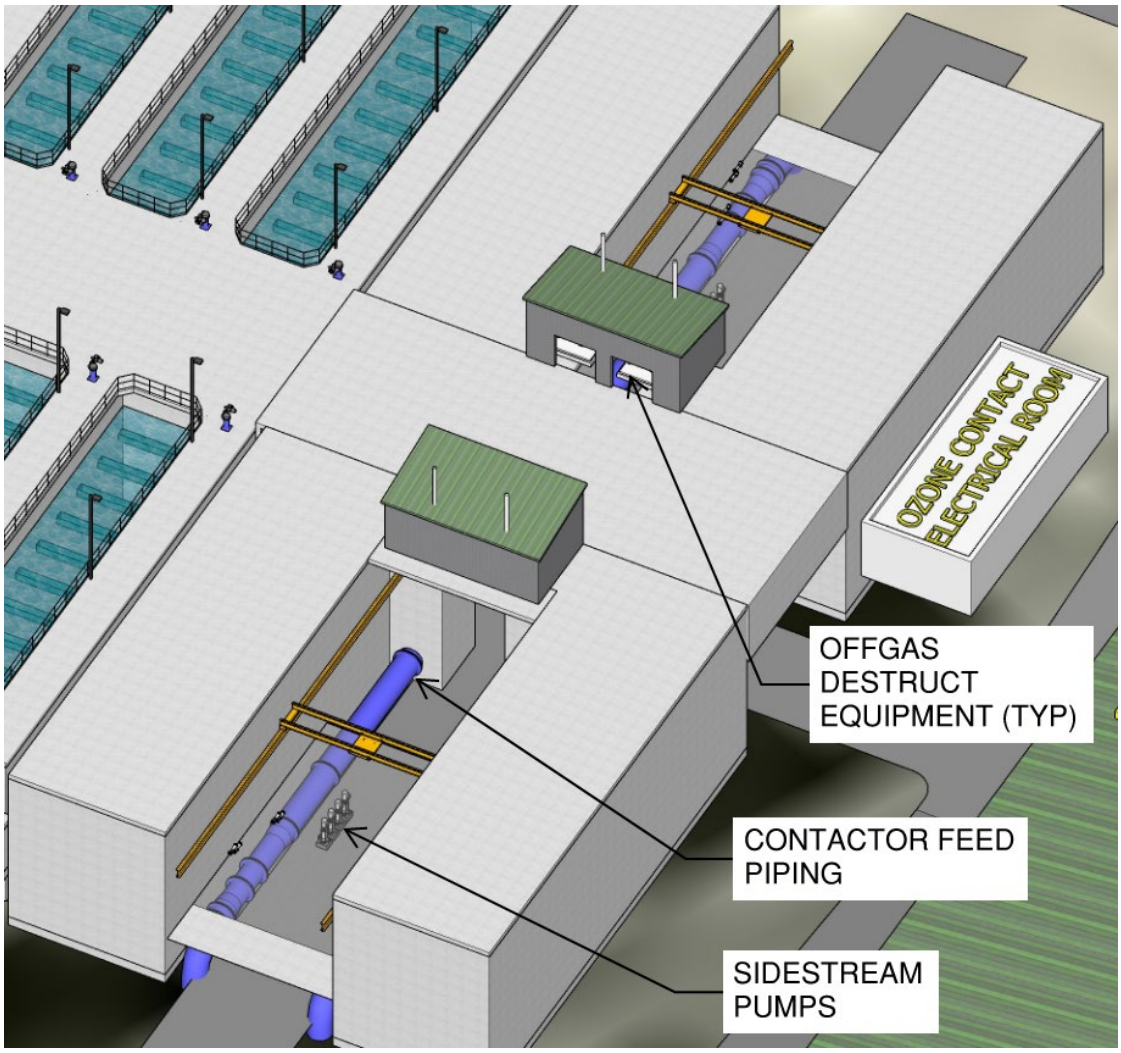


Figure 1.29 Four Pass Serpentine Ozone Tanks

The final pass of each ozone contact tank shall include provisions for ozone residual quenching if an excess dose was applied. Effluent from the ozone contact tanks will overflow an effluent weir and enter the common BAC influent channel running from south to north overtop of the filter gallery.

Each contact tank will be fitted with four sample points for the measurement of dissolved ozone residual. Ozone residual will be measured continuously online and used to calculate the first order decay coefficients and allow the calculation of the achieved ozone CT. The calculated CT is used to calculate the claimed pathogen LRVs.

BAC Contact

A biologically active filtration process is used following ozonation to metabolize lower molecular weight and aliphatic organic compounds produced by the ozonation process. The fixed-film biological layer that provides this treatment can be supported by filter mediums such as extruded plastic shapes, plastic beads, expanded shale, or traditional granular filter media like sand, anthracite, or granular activated carbon (GAC). However, after demonstrating robust performance over many studies, GAC has been adopted as the standard filter medium for potable reuse applications and is specifically required by the Final DPR regulations. While a minimum empty-bed contact time (EBCT) of 15 minutes is required by the regulations, there are no specific requirements on the hydraulic loading rate (HLR), GAC type, GAC grain size, or bed depth is stated. As such, the designer is free to specify these items in the way that makes the most sense for the individual project. Of these items, the GAC type can have a significant impact on the treatment efficiency of the BAC process. It is typically recommended to specify domestically produced GAC from a bituminous or semi-bituminous coal to promote better quality control and ensure performance matches what has been demonstrated in literature. If a different GAC material is being considered at the detailed design phase, it is recommended that pilot testing for both performance and durability be conducted.

Regarding the AWT facilities, the feedwater will already be membrane filtered through the secondary MBR process and contain negligible TSS. As such, head loss accumulation across the BAC process will be caused exclusively by biological growth on the GAC media and not by suspended solids removal. Because head loss accumulation due to biological growth is much slower than head loss accumulation due to suspended solids removal, the frequency of backwashing is significantly reduced, and the hydraulic efficiency of the BAC process is increased. Pilot testing of the MBR/ozone/BAC process train will accurately quantify the head loss accumulation rate and the required backwash frequency. However, for the Hyperion conceptual design criteria, the San Diego North City Pure Water demonstration pilot serves as a representative basis of design since the feedwater to the ozone/BAC process was a high-quality granular media filtered tertiary effluent. Since the MBR treated effluent will be even lower in TSS than the San Diego Pure Water project, this design criteria reference will be slightly conservative. Table 1.25 provides the proposed conceptual design criteria for the BAC process.

The BAC system has been sized to provide the required volumetric capacity with two contactors temporarily offline for backwash or degas, and one contactor down for maintenance. Since these contactors are biological, all available cells should be operated at all times to keep the biology alive and acclimated. Typically, only one backwash would occur at a time due to the expected long run times as a result of the low TSS feedwater.

Table 1.25 BAC Design Criteria

BAC Contactors	DPR	Units	Comment
Gross Capacity	149.0	mgd	Assuming (N-4) contactors in service.
Net Capacity	147.5	mgd	
Minimum Volumetric Recovery	99.0	percent	Assuming each contactor backwashes twice per week.
Total Number of BAC Contactors	18	No.	
BAC Contactors in Backwash or Degas	2	No.	One contactor per bank.
BAC Contactors Offline for Maintenance	1	No.	
Duty BAC Contactors	16	No.	
BAC Contactor Length	88	feet	
BAC Contactor Width	16	feet	
Filtration Area (per contactor)	1,408	ft^2	
Filtration Area (duty)	21,120	ft^2	
Filtration Area (total)	25,344	ft^2	
HLR (duty area)	4.9	gpm/ft^2	
HLR (total area)	4.1	gpm/ft^2	
GAC Bed Depth	10	feet	
GAC Grain Size	8 x 16	mesh	
Minimum EBCT	15	minutes	An alternate EBCT may be used if demonstrated to meet chemical surrogate removal requirements
Removal Acetone and Formaldehyde across BAC	1.0	LRV	Regulatory removal requirement across the BAC filters
EBCT (duty area)	15.3	minutes	
EBCT (total area)	19.1	minutes	

Notes:
Abbreviations: gpm/ft^2 - gallons per minute per square foot.

Shown on Figure 1.30, the BAC contactors will be laid out in a central pipe gallery arrangement. Due to the large surface area of each filter, a side gullet configuration has been assumed to facilitate good backwash flow distribution across such a long structure. Access will be provided to the filter gallery by means of a vehicle ramp. The filter gallery and ozone gallery will be segregated due to the need for a dedicated ozone area heating, ventilation, and air conditioning system. However, a normally locked access door will connect the two areas when required. A means of egress shall be provided at the south end of the BAC structure.

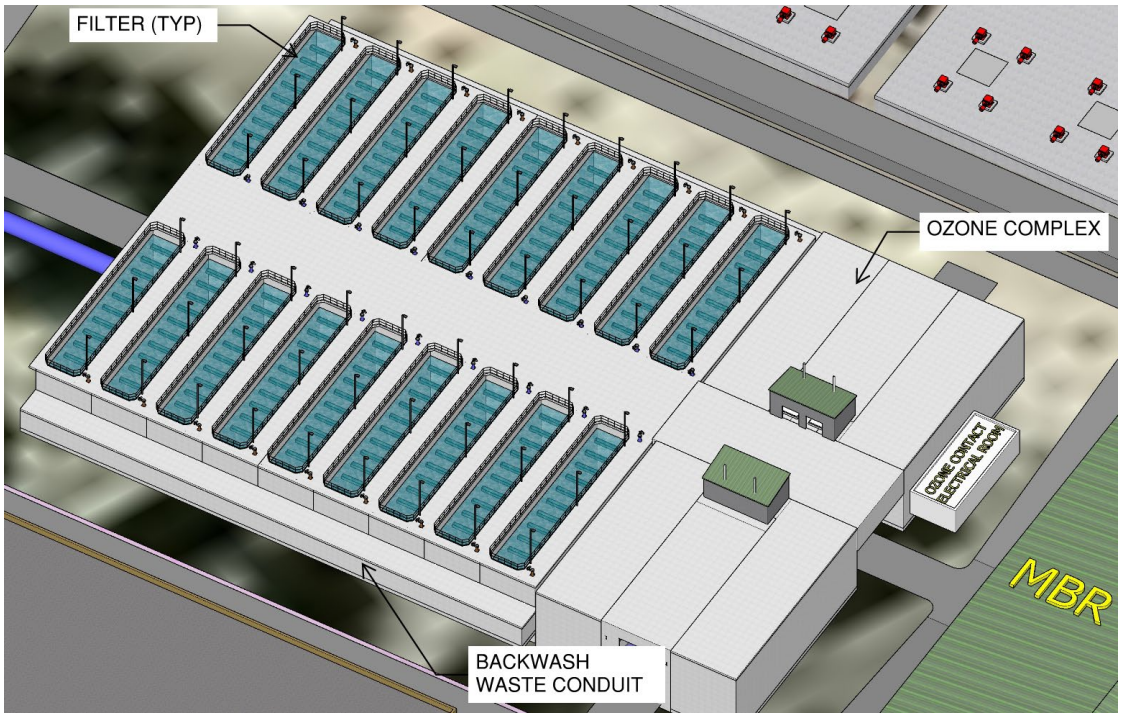


Figure 1.30 BAC Area Conceptual Layout

Backwash supply pumps will be located on the MF feed tank and pump water stored in that tank to backwash the BAC. Full flow pressure relief shall be provided to protect the contactor underdrains using either the constant head overflow tank or the standpipe approach. Air scour blowers will be located on the BAC deck level. BWW will be conveyed to the BWW EQ basin located under the MF building, adjacent to the MF feed tank. The BWW EQ pumps will be located on the BWW EQ basin and will return BAC BWW to the primary treatment process. Design criteria for the BAC ancillary equipment is provided in Table 1.26.

Table 1.26 BAC Ancillary Equipment Design Criteria

BAC Backwashing	DPR	Units	Comment
Backwash Supply			
Maximum Backwash Rate	25	gpm/ft^2	
Backwash Flow	35,200	gpm	
Unit Backwash Volume	250	gal/ft^2	
Backwash Volume	0.35	MG	
Number of Backwash Systems	2	No.	Allowing concurrent backwashing from each bank.
Number Backwash Pumps per System	2 + 1	No.	Duty + Standby.
Backwash Pump Power	350	hp	Assumes 50-feet TDH and 70 percent efficiency.

BAC Backwashing	DPR	Units	Comment
Air Scour			
Maximum Air Scour Rate	4	scfm/ft^2	
Total Air Scour Flow Rate	5,630	scfm	
Number of Air Scour Blowers	2 + 1	No.	Duty + Standby.
Blower Motor Power	250	hp	Assuming two duty, high humidity, high temperature, 10-psig discharge.
BWW			
Maximum Backwashes Per Day	10	No.	
Time to Empty Backwash EQ Tank	4	hours	
Number of BWW Pumps	2 + 1	No.	Duty + Standby.
BWW Pump Capacity (each)	1,500	gpm	
BWW Pump Motor Power (each)	75	hp	

Notes:
Abbreviations: gal/ft^2 - gallons per square foot; scfm/ft^2 - standard cubic feet per minute per square foot.

MF

MF is a critical unit operation in the DPR treatment train, located between the ozone/BAC and RO processes. MF is included: (1) to provide additional *Cryptosporidium* and *Giardia* LRV credits using a validated method and (2) to remove particulate matter that may slough from the BAC and foul the RO. MF is a well-established and effective RO pretreatment technology that is accepted by Division of Drinking Water for pathogen LRV credits and is thus included for the DPR base train.

The anticipated MF feed water quality is summarized in Table 1.27 and reflects the BAC effluent water quality with the addition of ammonium hydroxide and sodium hydroxide to form chloramines for biofouling protection. Further discussion of the MF system follows.

Table 1.27 Anticipated MF Feed Water Quality

Parameter	Unit	Value
Temperature	degrees F	70 - 90
Ammonia	mg/L as nitrogen	0.1 - 0.6
BOD	mg/L	ND
Chloramines	mg/L as chlorine	≤3.0
pH	Standard	7.0
TOC	mg/L	<6
TSS	mg/L	ND - 0.1
Turbidity	NTU	0.1

Notes:
Abbreviations: ND - non-detect.

The MF process is shown in Figure 1.31 and features a feed tank, feed pumps, automatic feed strainers, pressurized MF membrane process units, backwash pumps, an EQ tank for the combined backwash flows from the MF and BAC systems, a compressed air and blower system, and a clean-in-place (CIP) system.

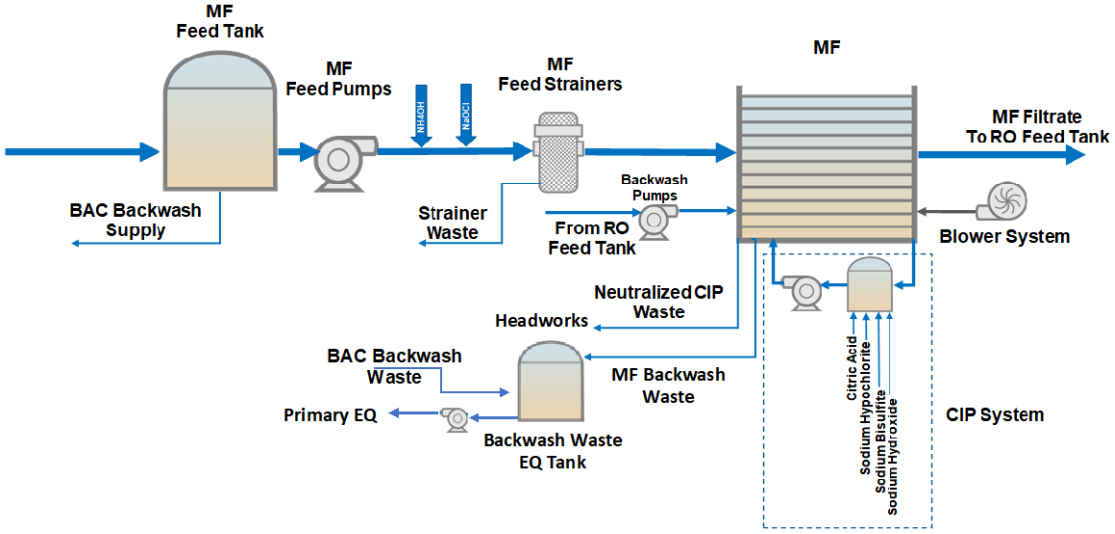


Figure 1.31 MF Process Flow Diagram

The MF feed tank is designed to accommodate 15 minutes of HRT, plus additional capacity for the BAC backwash supply. The high feedwater quality provided by the upstream MBR, ozone, and BAC processes is expected to allow for operation of MF at higher fluxes (e.g., 80 to 100 gfd) relative to lower typical fluxes (e.g., 20 to 40 gfd) downstream of tertiary filtration. Higher flux rates allow for less membrane modules and a lower overall footprint relative to lower flux rates. Also, the high-quality feed water should result in less organic fouling and less chemical cleaning than a lower quality water with less upstream treatment. A design flux rate of 80 gfd was selected for the conceptual MF system for purposes of equipment sizing and layout. Pilot testing will be required to assess the optimal flux relative to transmembrane pressure and cleaning regiments.

The MF system selected as the basis of design for DPR at HWRP is based on open platform skids from Biwater and H2O Innovation using polyvinylidene difluoride (PVDF) UF membrane modules manufactured by Toray. Key design parameters for the MF system are presented in Table 1.28. The selected PVDF membrane, HFUG-2020AN, is a relatively new update of the HFU-2020AN module with smaller fiber diameters that offer greater surface area per module, which is expected to provide relatively high flux based on drinking water installations where this product is being implemented. Pilot testing is recommended to compare membrane types and confirm the overall performance, as well as the optimal flux and recovery relative to transmembrane pressure and cleaning regiments for all tested modules. It is significant to note that MF systems are typically supplied by vendors in standard sized racks with a maximum flow capacity and are shipped pre-assembled to minimize installation requirements on site. Considering the high flow rates and corresponding numbers of MF racks needed, custom design and/or construction of MF racks with higher flow capacity should be evaluated in the future to optimize MF cost, layout, constructability, and operability.

Table 1.28 Design Criteria 120-mgd MF System for DPR

Parameter	Unit	DPR Train
Process Flow		
Feed Flow Rate	mgd	148
Permeate Flow Rate	mgd	141
MF Feed Tank		
Design HRT	minutes	15
Operational Capacity	gallons	1,541,000
BAC Backwash Supply	gallons	600,000
Total Capacity	gallons	2,141,000
MF Feed Pumps		
Number of Pumps (Duty + Standby)	No.	8 + 2
Design Operating Point per Pump (Flow)	gpm	12,840
Motor Size	hp	700
MF Strainer		
Type	-	Auto-backwash
Number of Units (Duty + Standby)	No.	8 + 2
Capacity (per strainer)	mgd	25.3
Nominal Pore Size	µm	300
Membrane Module		
Membrane Type	-	Hollow Fiber PVDF
Membrane Manufacturer and Module(2)	-	Toray HFUG-2020AN
Nominal Pore Size	µm	0.01
Train Configuration		
Number of Clusters(2)	No.	4
Trains per Cluster(2)	No.	8
Redundancy per Cluster	-	N - 2
Production Capacity per Train (2)	mgd	5.87
Modules per Train(2)	No.	78
Spaces per Train(2)	No.	10
Membrane Area per Module(2)	ft^2	969
Number of Installed Modules(2)	No.	2,496
Total Membrane Area Installed(2)	ft^2	2,418,624
Maximum Instantaneous Flux Rate	gfd	80
Recovery(2)	percent	97
Backwash System		
Number of Pumps (Duty + Standby)	No.	8 + 4
Design Operating Point per Pump (Flow)	gpm	4,224
Motor Size	hp	150

Parameter	Unit	DPR Train
Backwash Interval[3]	minutes	35
Backwash Duration[3]	minutes	0.5
Compressed Air and Blower System for Backwashes and Membrane Integrity Testing		
Number of Air Compressors (Duty + Standby)	No.	5
Air Compressor Motor Size	hp	25
Test Frequency (per train)	number per day	1
Test Duration (per train)	minutes	10
Air Scour Blower Type	-	Positive displacement
Number of Air Scour Blowers (Duty + Standby)	No.	8 + 4
Blower Motor Size	hp	25
Air Scouring Flow Rate	scfm	3.5
MF BWW Pumps		
Number of Pumps (Duty + Standby)	No.	2 + 1
Design Operating Point per Pump (Flow)	gpm	2,200
Motor Size	hp	75
MF and BAC BWW EQ Tank		
Total Capacity	gallons	600,000
CIP System		
Number of Pumps (Duty + Standby)	No.	8 + 4
Design Operating Point per Pump (Flow)	gpm	1,141
Motor Size	hp	10
Maintenance Clean Frequency[3]	number per week	4
CIP Cleaning Frequency[3]	number per year	12
Chemical Use		
Sodium Hypochlorite 12.5 Percent		
Design Dose for Chloramines	mg/L as chlorine	3
Design Dose for Maintenance Cleans[3]	mg/L as chlorine	300
Design Dose for CIP[3]	mg/L as chlorine	3,000
Total Design Daily Usage	gpd	3,031
Ammonium Hydroxide 18 Percent		
Design Dose for Chloramines	mg/L	0.6
Design Daily Usage	gpd	530
Sodium Bisulfite 25 Percent		
Design Dose for Maintenance Cleans	mg/L	290
Dose for CIP[3]	mg/L	2,900
Design Daily Usage	gpd	42

Parameter	Unit	DPR Train
Citric Acid 50 Percent		
Design Dose for CIP(3)	mg/L	5,000
Design Daily Usage	gpd	11
Sodium Hydroxide 25 Percent		
Design Dose for CIP Neutralization(3)	mg/L	5,000
Design Daily Usage	gpd	20

Notes:
Abbreviations: gpd - gallons per day; µm - microns.
(1) Tank dimensions based on preliminary layouts and estimated volume requirements; subject to change with refinement of AWT design.
(2) Preliminary design information provided by Biwater and H_2O Innovation.
(3) Estimate from vendor; final number to be confirmed via pilot testing.

Chloramines will be added to the MF feed to provide biofouling control through both the MF and RO systems. A target dose of 3 mg/L as chlorine (5:1 ratio of chlorine:nitrogen) is assumed as a conservative upper estimate for the preliminary design, based on experience with advanced treatment downstream of ozone/BAC; considering the combined MBR and ozone/BAC pretreatment, this dose should be optimized through pilot testing, along with evaluation of the impact on fouling, as well as the downstream formation of N-Nitrosodimethylamine (NDMA) and disinfection byproducts (DBPs). Another design assumption is that sodium hypochlorite and ammonium hydroxide are added directly to the MF feed; however, the use of preformed chloramines has been found to be effective for controlling the formation of the combined chlorine species and the subsequent formation of NDMA.

To increase modularity and redundancy while minimizing pipe sizes, the MF design was organized into clusters of MF trains. Clusters of eight MF racks were selected for 120-mgd DPR. Each cluster has dedicated common header piping including dedicated common ancillary equipment (feed pumps, strainers, compressor and blower system, backwash pumps, CIP systems). Each cluster has one dedicated CIP tank with two CIP pumps (each serving half of the MF trains), and one standby CIP pump that provides redundancy for the full cluster. A clearance of 6 feet is allotted between trains and on either side of each cluster to allow for a walkway. Common header piping runs were located above or below the walkway.

Given space constraints, several of the MF system components are located below grade beneath the MF building. The below-grade equipment includes the MF feed tank, the BAC backwash pumps (which draw from the MF feed tank), and the BWW EQ tank. The layouts for the MF Building are presented in Figure 1.32 (above grade) and Figure 1.33 (below grade).

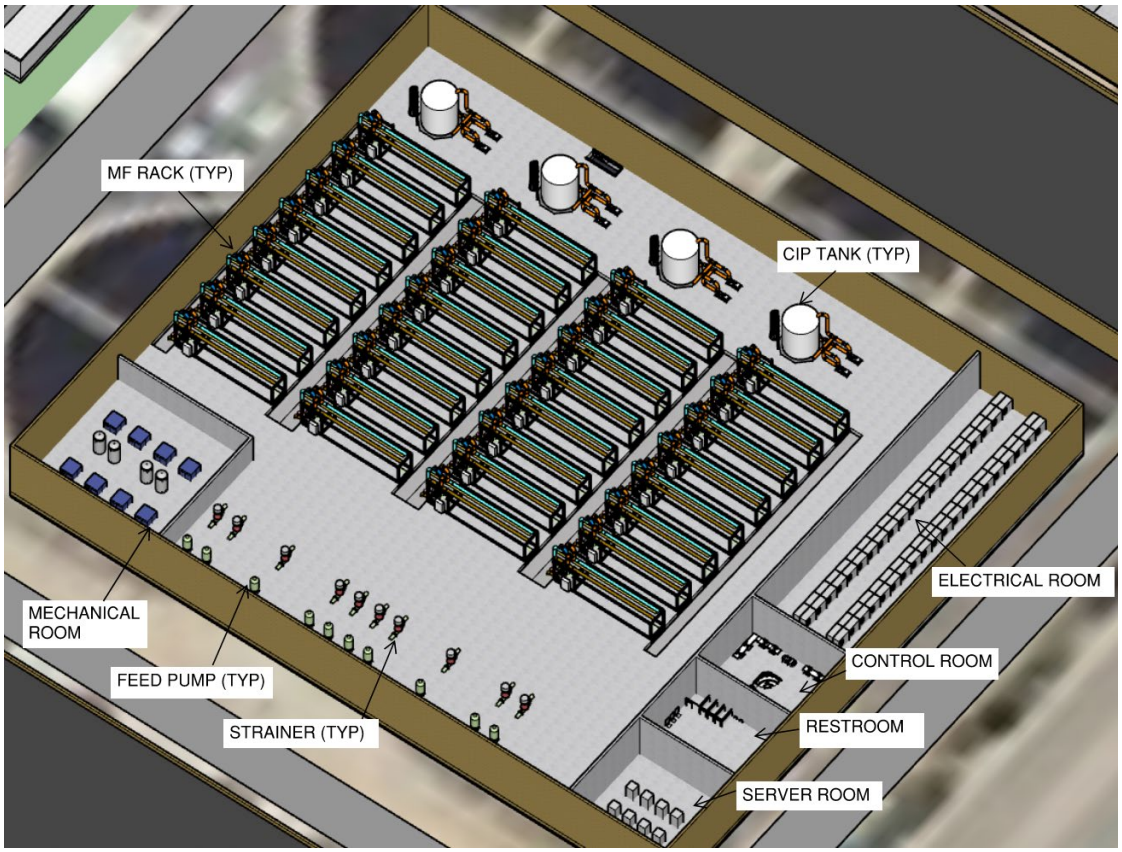


Figure 1.32 MF Building Above Grade Layout for 120-mgd DPR

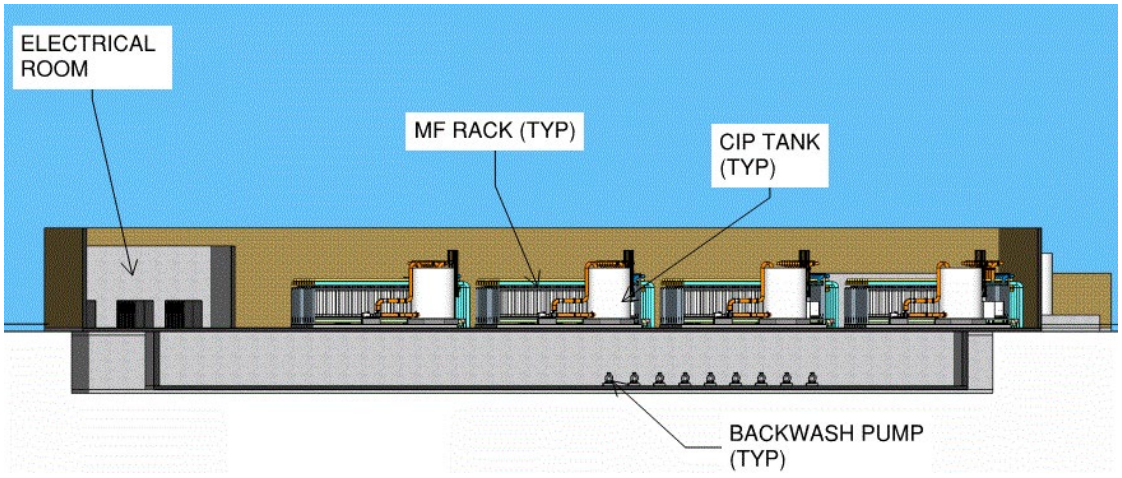


Figure 1.33 MF Building Below Grade Layout for 120-mgd DPR

RO

The RO system is a central treatment component of any potable reuse treatment train, as it provides removal of dissolved constituents - including inorganic salts, TOC, and trace organic contaminants - while also serving as a barrier for pathogens with removal requirements defined in the DPR regulations. The RO process yields two different water streams, (1) the purified RO permeate and (2) the reject stream, or concentrate, containing high concentrations of the dissolved solutes. Overall water recovery of the RO system can be improved by passing this concentrate through subsequent RO stages and combining the permeate from each stage. The water quality of the RO permeate is largely a function of the feed water quality and the design of the RO system.

The anticipated feed water quality for the RO system is summarized in Table 1.29. The water quality was compiled from a number of sources, including previous documentation capturing MBR modeling results as well as historical water quality representative of RO feed from HWRP. Parameters impacted by upstream treatment (e.g., nitrate, ammonia, alkalinity) were based on previous MBR modeling as cited in the footnotes to Table 1.29.

Table 1.29 Anticipated RO Feed Water Quality Used for Basis of Design

Parameter	Unit	Median	90th Percentile
Alkalinity[1]	mg/L as $CaCO_3$	80	NA
Aluminum[2,3]	µg/L	130	230
Ammonia[4,5,6]	mg/L as nitrogen	0.32	0.59
Barium[2,3]	µg/L	26	35
Boron[2,5]	mg/L	0.44	0.45
Bromide[2]	mg/L	1.0	1.2
Calcium[2,3,6]	mg/L	45	50
Chloride[2,3]	mg/L	350	420
Fluoride[2,5,6]	mg/L	0.68	1.0
Iron[5]	mg/L	0.1	0.1
Magnesium[2,5,6]	mg/L	34	49
Manganese[2,3]	µg/L	62	71
NO_3-N[4,5,6]	mg/L as nitrogen	8	16
pH[2,5,6]	-	7.2	7.3
Phosphate[4,5,7]	mg/L as phosphorus	2.0	3.5
Potassium[2,3]	mg/L	21	25
Silica[2,3]	mg/L	15	21
Sodium[2,3]	mg/L	200	220
Strontium[2,3]	mg/L	0.33	0.35
Sulfate[2,3]	mg/L	110	120

Parameter	Unit	Median	90th Percentile
Temperature(2,3)	degrees C	26	27
TDS(2,5,6,8)	mg/L	1,000	1,400
TOC(5)	mg/L	<7	NA

Notes:
Abbreviations: µg/L - micrograms per liter; NA - not available; TDS - total dissolved solids.
(1) Typical MBR permeate value per subject matter expert (60 to 100 mg/L alkalinity range).
(2) PE (IPS West) value from Final *Hyperion AWPF BODR* (revised), 2020. PE does not account for expected removal of certain constituents across MBR/ozone/BAC.
(3) PE value from *Hyperion MBR Pilot Test Plan*, 2021. PE does not account for expected removal of certain constituents across MBR/ozone/BAC.
(4) Based on GPS-X modeling results from MBR from Hyperion Alternatives Analysis, 2021.
(5) Hyperion MBR CDR (revised final), 2019.
(6) RO feed water value from *H2OI RO Membrane Projections*, 2020.
(7) SE value from 'WW Characterization Spreadsheet' for Hyperion MBR Pilot, 2019.
(8) RO feed water value used for Hyperion MBR pilot design work.

The RO process is shown in Figure 1.34 and features a feed tank, feed pumps, chemical pretreatment, cartridge filters, three-stage membrane trains, a CIP system, an air gap structure which doubles as a flush tank, and flush pumps.

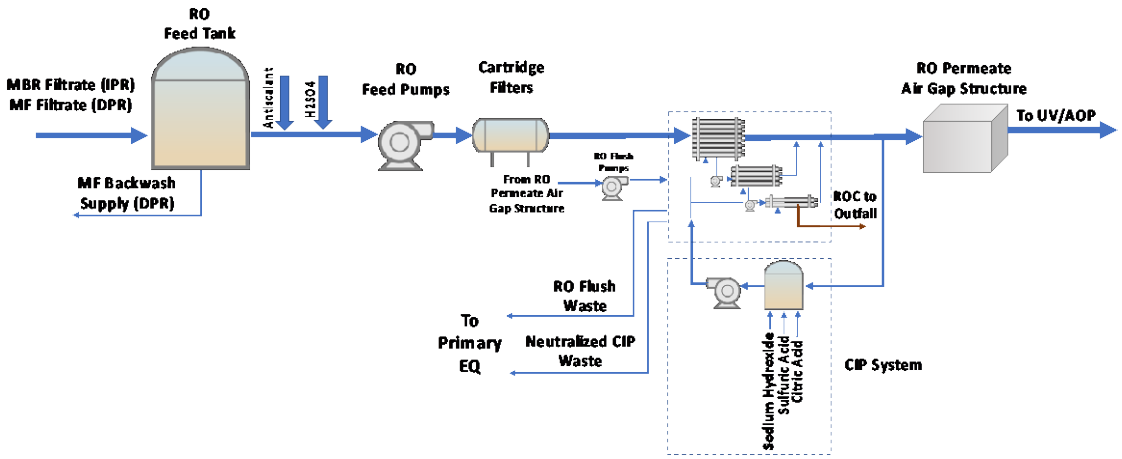


Figure 1.34 RO Process Flow Diagram for Hyperion DPR and IPR Treatment Trains

The RO feed tank collects and stores MF permeate which serves as the RO feed water and MF backwash supply water. The RO feed water is conveyed from the RO feed tank directly to each RO train via a high-pressure RO feed pump and cartridge filter. Antiscalant and sulfuric acid, necessary to control scaling of the RO elements, are injected between the RO feed tank and RO feed pumps.

The RO train selected as the basis of design is configured as a three-stage system with a pressure vessel array of 120:60:30. Each pressure vessel is sized to house seven RO elements. This approach results in the smallest number of trains. Each train is sized to produce 7.6 mgd of RO permeate with a recovery of 85 percent and flux rate of 12 gfd. Each RO train includes an RO feed pump, cartridge filter, second-stage booster pumps, and third-stage energy recovery turbo motor-assisted booster pumps.

RO permeate is collected from the RO permeate header piping under the trains and conveyed up through a pipe gooseneck above the top of the RO trains and then back under the trains to the RO Permeate Air Gap Structure located at the same floor grade as the RO trains. This

configuration prevents draining of the RO trains. The RO Permeate Air Gap Structure provides a water volume sufficient to flush 40 percent of the RO trains at a given time. In the event of an emergency shutdown with loss of power, a backup dechlorinated potable water supply could supplement the RO Permeate Air Gap Structure water volume to support flushing all the RO trains. The wastewater from the flushing process is returned to the PE EQ basins. The RO Permeate Air Gap Structure has an air gap weir over which water passes and is conveyed to the UV-AOP process. The air gap prevents back flow of water containing free chlorine used by the UV-AOP process, and hence protects the RO membranes.

Fouling of the RO elements is addressed by periodic chemical cleanings using a CIP system equipped to conduct a low-pH or high-pH cleaning, as needed. For the conceptual design, CIP cleanings are conservatively estimated to occur once every 30 days and are assumed to consist of a high pH clean followed by a low pH clean. However, due to the high quality of feed water from MBR, ozone, BAC, and MF pretreatment, pilot-scale testing is expected to demonstrate that less frequent CIP cleans will be required. If necessary, with two redundant RO trains, two CIP cleans could occur per day without reducing production capacity. Upon completion of a CIP, the wastewater is neutralized in the CIP system and returned to the PE EQ basins.

The RO concentrate from the third RO stage with each train will be sent to the effluent pumping plant for ocean discharge.

Key design parameters for the 120-mgd RO system in the DPR train are presented in Table 1.30.

Table 1.30 Design Criteria 120-mgd RO System for DPR

Parameter	Unit	DPR Train
Design Feed Flow	mgd	141
Design Recovery	percent	85
Design Permeate Flow	mgd	120
Number of Trains (Duty + Standby) [1]	No.	16 + 2
Permeate Capacity per Train[1]	mgd	7.57
Number of Stages per Train[1]	No.	3
Pressure Vessel Configuration per Train[1]	No.	120:60:30
Pressure Vessel Diameter[1]	inches	8
Elements per Pressure Vessel[1]	No.	7
Maximum Average Flux[1]	gfd	12
RO Feed Tank		
Design HRT	minutes	15
Operational Capacity	gallons	1,471,000
Cartridge Filters		
Cartridge Filter Enclosures per Train	No.	1
Cartridge Filters per Enclosure	No.	25
Material	-	Polypropylene
Manufacturer	-	Fil-trek
Height	inches	30

Parameter	Unit	DPR Train
Retention Rating	µm	5
Maximum Differential Pressure	psid	50
Change-Out Pressure	psid	35
RO Feed Pumps		
Number of Pumps (Duty + Standby)	No.	16 + 2
Operating Flow per Duty Pump	gpm	6,127
Motor Size	hp	1,250
RO Permeate Air Gap Structure		
Operational Capacity	gallons	94,500
RO Flush Pumps		
Number of RO Flush Pumps	No.	5
Flow per Pump	gpm	500
Motor Size	hp	10
RO CIP System		
Number of CIP Tanks	No.	3
Tank Material	-	FRP
Tank Capacity (per tank)	gallons	10,700
Total Tank Capacity	gallons	32,100
High pH CIP Frequency[2]	days	30
Low pH CIP Frequency[2]	days	30
Number of CIP Pumps	No.	6
Flow per Pump	gpm	2,250
Motor Size	hp	125
Chemical Use		
Sulfuric Acid 93 Percent		
RO Feed Design Dose[2]	mg/L	20
RO Feed Design Daily Usage	gpd	1,650
Antiscalant 100 Percent		
RO Feed Design Dose[2]	mg/L	5
RO Feed Design Daily Usage	gpd	710
Citric Acid 50 Percent		
Design Chemical Dose for Cleaning[2]	mg/L	20,000
Design Dose for High pH Neutralization[2,3]	mg/L	1,600
Total Design Daily Usage	gpd	320

Parameter	Unit	DPR Train
Sodium Hydroxide 25 Percent		
Design Chemical Dose for Cleaning(2)	mg/L	1,000
Design Chemical Dose for Low pH Neutralization(2)	mg/L	12,492
Total Design Daily Usage	gpd	385

Notes:
Abbreviations: psid - pressure per square inch differential.
(1) Preliminary design information provided by Biwater.
(2) Estimate from vendor or RO modeling; final number to be confirmed via pilot testing.
(3) High pH neutralization may also be carried out using sulfuric acid. Citric acid used in basis of design to minimize use of sulfuric acid, which requires additional safety considerations.

The RO system for DPR is located in the DPR RO/UV-AOP Building. For increased modularity and redundancy to the RO design while minimizing pipe sizes, the RO design was organized into clusters of RO trains. Each cluster has dedicated common header piping including dedicated common ancillary equipment (flush system, CIP system). Three clusters of six RO trains were selected for the DPR RO/UV-AOP Building. Space of 12.5 feet is allocated on the long sides of each cluster for the purposes of a walkway, clearance, access, and common header piping runs (located above or below the walkway). The layouts for the DPR RO/UV-AOP Building are presented in Figure 1.35 (above grade) and Figure 1.36 (below grade).

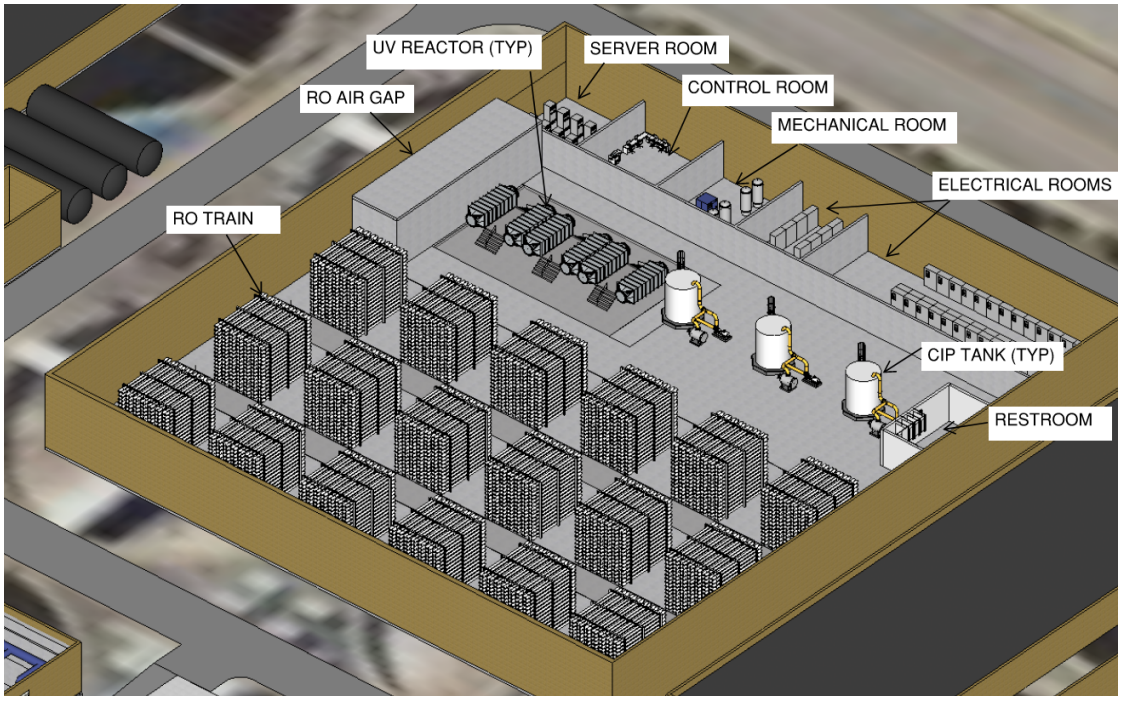


Figure 1.35 DPR RO/UV-AOP Building Aboveground-Layout for 120-mgd DPR

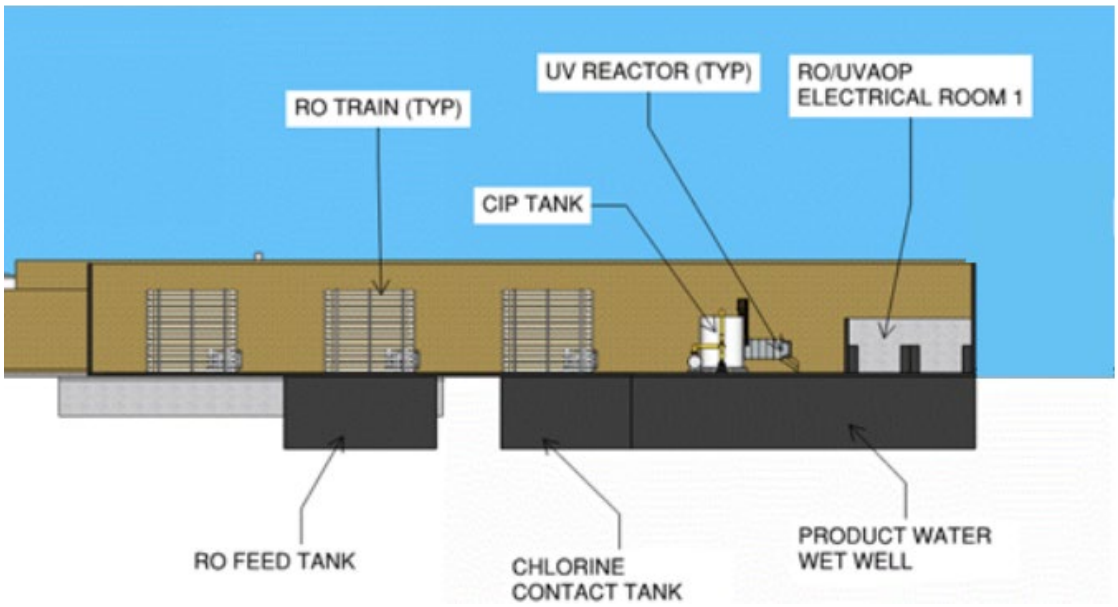


Figure 1.36 DPR RO /UV-AOP Building Belowground Layout for 120-mgd DPR

UV-AOP

The UV-AOP system will be used to reduce NDMA and other nitrosamines by photolysis, remove trace organics including 1,4-dioxane by advanced oxidation, and provide 6-log inactivation of pathogens. The UV-AOP system performance depends on the feed water quality, including the presence of compounds known to be scavengers of hydroxyl radicals, scalants that can foul the UV lamps, and parameters that lower the ultraviolet transmittance (UVT) at 254 nanometers (nm). The anticipated feed water quality for the UV-AOP system is summarized in Table 1.31. These water quality values will be further refined with data collected as part of MBR piloting.

Table 1.31 Anticipated UV-AOP Feed Water Quality Used for Basis of Design

Parameter	Unit	Value
Temperature	degrees F	70-90
TOC	mg/L	<0.50
pH	-	5.5-6.0
Chloramines	mg/L as chlorine	≤3.0
Ammonia (excluding chloramines)	mg/L as nitrogen	≤0.3
NO_3-N	mg/L as nitrogen	≤5.0
NO_2-N	mg/L as nitrogen	≤0.05
Alkalinity	mg/L as $CaCO_3$	≤18
UVT at 254 nm	percent	≥96

The UV-AOP system is fed with RO permeate supplied by the RO Permeate Air Gap Structure. Residual head from the pressurized RO trains is sufficient to allow the RO permeate to flow by gravity through the air gap structure, over a weir, through the UV reactors, and into an inlet box ahead of the chlorine contact tank and the product water wet well. Because the RO permeate is exposed to the atmosphere via the RO Permeate Air Gap Structure, the pH is expected to

increase and can be adjusted as necessary to the feed water target via sulfuric acid addition upstream of the UV-AOP. Free chlorine is injected upstream of the reactor and serves as the oxidant for the system.

The process flow diagram for the UV-AOP system is shown in Figure 1.37.

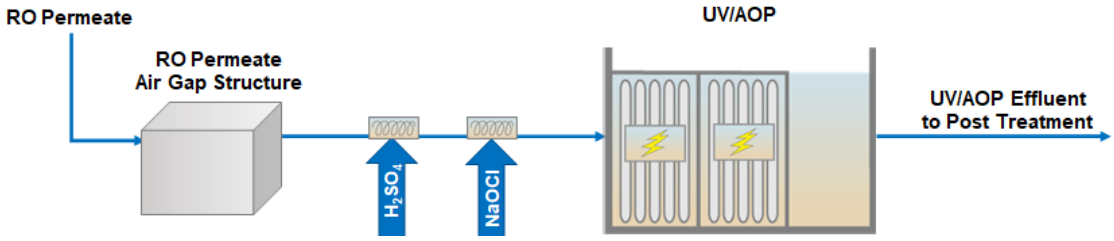


Figure 1.37 UV-AOP System Process Flow Diagram for Hyperion IPR and DPR Treatment Trains

The UV-AOP system is designed to meet a 0.5-log reduction of 1,4-dioxane at 96 percent UVT. The UV dose required to achieve the 0.5-log 1,4-dioxane reduction requirement will result in a 2.4-log reduction of NDMA. Each UV train consists of a single UV reactor based on the Trojan UVFlex 200 with 8 banks, 48 UV lamps per bank, and 384 lamps per reactor housed inside quartz sleeves. The lamps are low-pressure, high-output lamps that have an input power of 1,000 watts each and emit UV light concentrated at a wavelength of 254 nm. The ballasts supply power to the lamps (two lamps per ballast) and have an operation range of 30 to 100 percent.

The UVFlex 200 reactor is a large UV chamber configured with multiple banks or rows of lamps in series to provide the required UV dose. The UV system monitors and reports UV dose delivery as a function of the flow through the reactor, UVT of the water, and lamp output as indicated by UV sensor readings. To deliver the required dose with minimal overdosing, banks of lamps can be turned on and off and lamp power can be adjusted in real time to account for changing water quality conditions and age of lamps. Since UV-AOP systems typically operate at UVTs around 98 percent with lamps that are not at the end of lamp life, the UV system will operate at reduced power with a reduced number of banks on. The design UVT of 96 percent is the worst-case, permitted condition to primarily account for operators periodically needing to potentially increase chloramine levels upstream for biofouling control of the MF and RO systems. The high quality of ozone/BAC pretreatment should allow operators to consistently run with lower chloramine levels resulting in an RO permeate with a UVT of approximately 98 percent. For example, only six of the eight banks of lamps per reactor need to be on when running at the typical anticipated operating condition of 98 percent UVT. This allows the banks that are off to be in standby mode if one of the duty banks has a lamp or ballast failure. Furthermore, these redundant banks provide up to n+2 mechanical redundancy per reactor with respect to lamps and ballasts, which have the highest frequency of failure of all UV reactor components.

Key design parameters for the 120-mgd UV-AOP system for the DPR train are presented in Table 1.32.

Table 1.32 Design Criteria for 120-mgd UV-AOP System for DPR Train

Parameter	Unit	DPR Train
Design Flow	mgd	120
Number of Trains (Reactors) (1)	No.	6
Design UVT (due to maximum anticipated chloramine levels in RO permeate)	percent	96
Number of Banks Used per Reactor at Design UVT(1)	No.	8 (out of 8 available)
Operating UVT (due to typical anticipated chloramine levels in RO permeate)(2)	percent	98
Number of Banks Used Per Reactor at Operating UVT(1)	No.	6 (out of 8 available)
Oxidant	-	Sodium hypochlorite
Target Free Chlorine Residual Entering Reactor(2)	mg/L as chlorine	2
Design UV NDMA Reduction Equivalent Dose(1)	mJ/cm^2	2,500
UV Reactor		
Number of Trains(1)	No.	6
Flow per Train(1)	mgd	20
Reactors per Train(1)	No.	1
Reactor Model(1)	-	Trojan UVFlex 200
Reactor Lamp Type	-	Low pressure, high output
Pressure Drop through Reactor(1)	inches	<6.9
UV Lamps		
Banks per Reactor(1)	No.	8
Lamps per Bank(1)	No.	48
Maximum Power per Lamp(1)	watts	1,000
Lamps per Ballast(1)	No.	2
Maximum Power per Reactor(1)	kilowatts	4,121
Power Turndown per Reactor(1)	percent	30-100
End of Lamp Life(1)	percent	86
Lamp Fouling Factor(1)	-	0.95
Power and Control Enclosures		
Double PDCs per Reactor(1)	No.	4
LDCs per Reactor(1)	No.	1
Total SCCs (All Reactors) (1)	No.	1
Chemical Use		
Sulfuric Acid 93 Percent		
UV-AOP Feed Design Dose	mg/L	5
UV-AOP Feed Design Daily Usage	gpd	351

Parameter	Unit	DPR Train
Sodium Hypochlorite 12.5 Percent		
UV-AOP Feed Design Dose(2)	mg/L	4
UV-AOP Feed Design Daily Usage	gpd	3,174

Notes:
Abbreviations: LDC - lamp drive cabinet; mJ/cm^2 - millijoules per square centimeter; PDC - power distribution center.
(1) Preliminary design information provided by Trojan.
(2) Estimate from vendor; final number to be confirmed via pilot testing.

The UV-AOP system for DPR is located in the DPR RO/UV-AOP Building and consists of six trains (reactors). Each UV reactor has a footprint of 21.4 feet by 8.4 feet and is equipped with four double PDCs and one LDC. The layout for the UV-AOP system is provided in Figure 1.38.

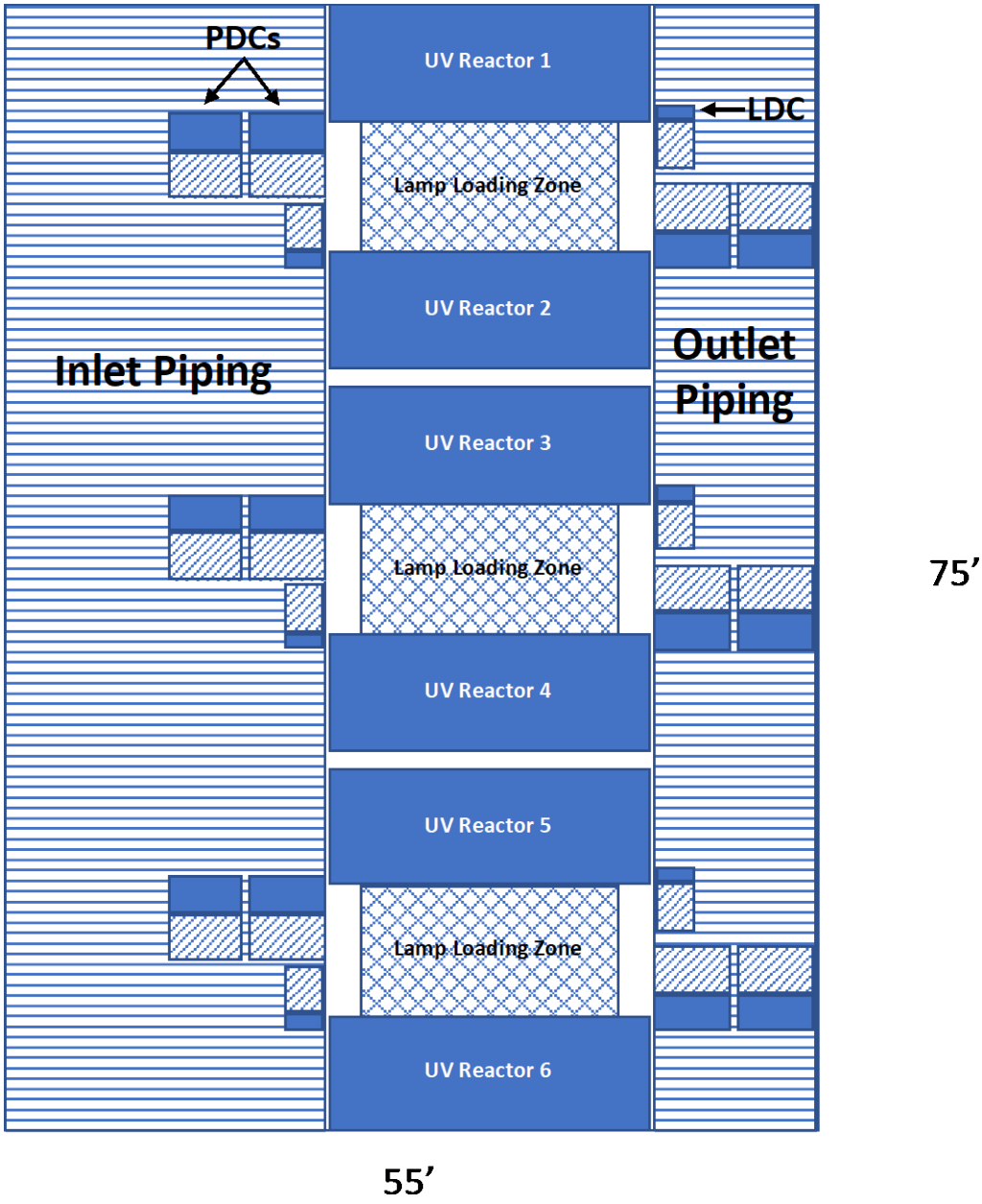


Figure 1.38 UV-AOP System Layout for 120-mgd DPR Located in DPR RO/UV-AOP Building

Post Treatment

The product water stabilization, or post treatment, will be located between the UV-AOP process and the free chlorination process.

The low alkalinity, low concentrations of calcium, and relatively low pH levels of RO permeate leave it with an imbalance for ions and bicarbonate buffering capacity. This chemical disequilibrium makes RO permeate corrosive, which is problematic for downstream piping and the overall water quality at the end of the pipeline. Therefore, the advanced treated water must be stabilized, or re-mineralized, before it can enter the distribution system.

Water corrosiveness is typically evaluated using the Langelier Saturation Index (LSI), which measures the water's ability to dissolve or deposit $CaCO_3$ onto the pipeline or surface of contact. Negative LSI values represent corrosiveness, while positive values signify deposition of $CaCO_3$ in the pipeline. An LSI of zero indicates equilibrium. In order to calculate the LSI, the following parameters must be known, or at least estimated: pH, temperature, alkalinity, calcium hardness, and TDS. RO permeate and UV-AOP effluent are extremely corrosive, i.e., their LSI values are usually below -0.5, and, therefore, the water must be stabilized in order to achieve a slightly positive LSI value such as between 0 and 0.5.

The post treatment design is based on the UV-AOP effluent water quality and the final purified water quality goals. The UV-AOP effluent water quality is expected to be very similar to RO permeate, with respect to the water quality parameters relevant for post treatment (alkalinity, calcium content, etc., as previously discussed), and has been estimated from RO modeling software. The drivers for the chemical dosing will be dependent on the water quality goals. The post-treatment water quality goals are presented in Table 1.33.

Table 1.33 Post-Treatment Water Quality Goals for DPR

Parameter	Unit	DPR	Notes
Alkalinity	mg/L as $CaCO_3$	80	Flexible while meeting LSI and pH and reducing costs
pH	-	6.5 - 8.5	Flexible range while meeting LSI>0
LSI	-	0.0 - 0.5	Flexible range while reducing chemical dosing
Turbidity	NTU	<0.5	Difficult to predict from chemical dosing alone

There are currently a few approaches in practice to adjust advanced treated water (i.e., UV-AOP effluent) for potable reuse applications. In general, post-treatment involves increasing alkalinity and LSI of the water. Lime addition is the most common approach since it provides both alkalinity and calcium hardness. Other approaches include: (1) the combination of sodium hydroxide and calcium chloride to provide alkalinity and calcium hardness, respectively; and (2) acidifying the water and exposing it to a calcite contactor; where alkalinity and calcium hardness are added through dissolution of the calcite media. An evaluation was completed to compare these three post-treatment approaches, considering costs, footprint, as well as advantages and disadvantages learned from potable reuse applications.

After a detailed evaluation of the three options, lime was selected, in the form of lime water with saturators and acid. A process flow diagram for this post treatment system is presented in Figure 1.39.

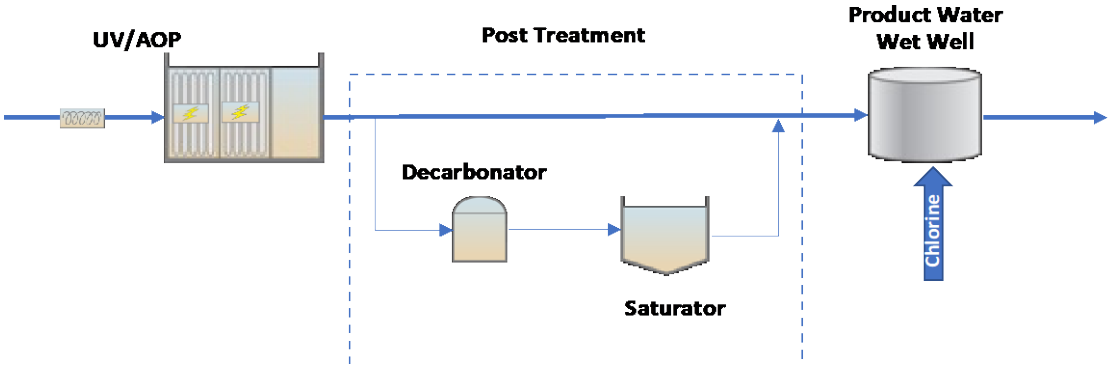


Figure 1.39 Lime Saturator Post-Treatment System Process Flow Diagram for DPR and IPR

Design criteria for the lime water with saturator and acid option for 120-mgd DPR are summarized in Table 1.34.

Table 1.34 Design Criteria 120-mgd Post-Treatment System (Lime Water, Saturator, Acid) for DPR

Parameter	Unit	DPR Train
Process Design Feed Flow	mgd	120
Quick Lime Dose	mg/L	42.0
"Pure" Quick Lime Dose	mg/L	46.7
Quick Lime Purity	percent	10
Silos/Slakers for Lime Slurry Production		
Lime Slurry Concentration	percent	10
Number of Silos/Slakers	-	4
Silo Capacity	tons	85
Quick Lime Consumption	tpd	33.9
Quick Lime Consumption	tons per month	1,018
Decarbonation System		
Design Feed Flow	percent of main flow	5
Number of Decarbonators	-	2
Capacity of Decarbonators	gpm	4,000
Sulfuric Acid		
Acid Dose	mg/L	7.9
Acid Concentration	percent	93
Acid Feed Flow	gph	2.03
Acid Consumption	gpd	49
Acid Consumption	gallons per month	1,462
Cationic Polymer		
Polymer Dose	mg/L	0.6
Polymer Concentration	percent	20
Polymer Feed Flow	gph	0.65

Parameter	Unit	DPR Train
Polymer Consumption	gpd	15.7
Polymer Consumption	gallons per month	470
Lime Water Production in Saturators		
Lime Water Concentration	percent	0.2
Lime Water Consumption	mgd	5.38
Saturators		
Number of Saturators	-	2
Volume per Saturator	ft^3	17,884
Saturator Depth	feet	15
Saturator Diameter	feet	47
Saturator HRT	minutes	5
Lime Water Day/Mixing Tank		
Lime Water Day/Mixing Tank Volume	ft^3	66,798
Lime Water Day/Mixing Tank HRT	minutes	120
Lime Water Day/Mixing Tank Depth	feet	15
Lime Water Day/Mixing Tank Width	feet	63
Lime Water Day/Mixing Tank Length	feet	63
CO_2 System		
CO_2 Dose	mg/L	48
CO_2 Feed Rate	kg/h	1,206
CO_2 Flow Rate Capacity per System	kg/h	2,722
CO_2 Storage Capacity per System	tons	100
Number of CO_2 Systems Required	-	2 + 1
CO_2 Consumption	tpd	36.2
CO_2 Consumption	tonnes/month	869
CO_2 Mixing Tank		
Carrier Water Feed Flow	gpm	3,000
CO_2 Mixing Tank HRT	minutes	3
CO_2 Mixing Tank Height	feet	10
CO_2 Mixing Tank Length	feet	15
CO_2 Mixing Tank Width	feet	16

Notes:
Abbreviations: CO_2 - carbon dioxide; ft^3 - cubic feet; gph - gallons per hour; kg/h - kilograms per hour.

The post-treatment area is located outside and consists of two decarbonators, four silos for lime slurry production, two lime water saturators, three CO_2 systems, one CO_2 mixing tank, and one lime water EQ tank. The equipment in this area serves both the DPR and IPR trains. The layout for the post-treatment facility is presented in Figure 1.40.

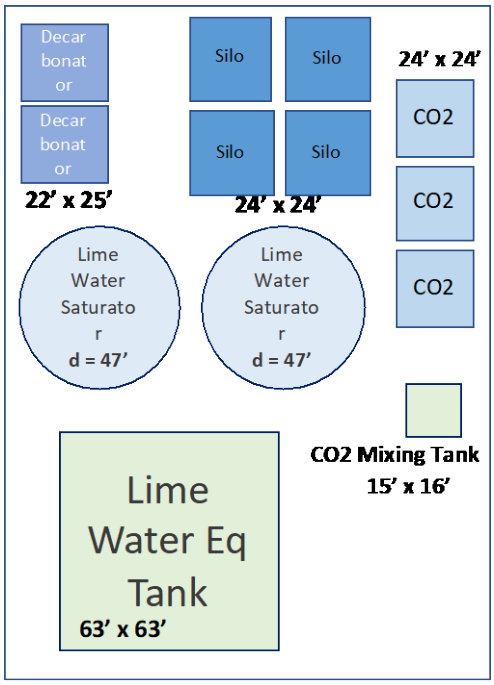


Figure 1.40 Post-Treatment Facility Layout

Chemicals

Nine chemicals are dosed at various points in the DPR train: sodium hypochlorite, citric acid, ammonium hydroxide, sodium bisulfite, sulfuric acid, sodium hydroxide (25 percent), antiscalant, cationic polymer, and lime slurry. Each chemical addition point requires a set of chemical metering pumps drawing from the storage vessels located in the chemical storage facility on the south side of the plant. Due to the relatively long distances that the chemicals have to travel from the chemical storage facility to their respective dosing points, the chemical pumps are oversized to account for pressure and head differentials.

Two types of chemical pumps are proposed for advanced water treatment at HWRP: hose and gear. Like peristaltic pumps, hose pumps are a type of rotary positive displacement pumps that allows for higher pressures and increased turndown capabilities without sacrificing pump integrity or accuracy. Gear pumps are another type of rotary positive displacement pumps that work better in transfer applications. In this design, hose pumps are used for general chemical metering applications, while gear pumps are stationed at the CIP skids.

The number of required pumps depends on the application. If the chemical is dosed into a common flow, then only one duty pump and one standby pump are required. If the chemical is dosed into separated flows (i.e., at the CIP skids), then each flow will require its own duty and standby pump combination. Additionally, some chemicals are used for multiple applications at the same CIP skid, so to simplify the design, only one pair of pumps are prescribed.

Table 1.35 shows the capacity, number, and type of chemical metering pumps required for the chemical application points in the DPR train.

Table 1.35 DPR Chemical Metering Pumps

Chemical Application(s)	Pump Type	Pump Capacity (gph)	Number Required (Duty + Standby)
Sodium Hypochlorite 12.5 Percent			
MF Feed Chloramination	Hose	175	1 + 1
MF Maintenance Cleans + CIPs	Gear	5	4 + 4
UV-AOP Oxidation	Hose	200	1 + 1
Product Water Tank Chlorination	Hose	150	1 + 1
Citric Acid 50 Percent			
MF CIPs	Gear	0.25	4 + 4
RO CIPs + CIP Neutralization	Gear	10	4 + 4
Ammonium Hydroxide 18 Percent			
MF Feed Chloramination	Hose	40	1 + 1
Sodium Bisulfite 25 Percent			
MF TMC Waste Neutralization + CIP Waste Neutralization	Gear	1	4 + 4
Sulfuric Acid 93 Percent			
RO Feed Conditioning	Hose	100	1 + 1
UV-AOP Stabilization	Hose	25	1 + 1
Lime Water Acidification	Hose	2	1 + 1
Sodium Hydroxide 25 Percent			
MF CIP Waste Neutralization	Gear	0.5	4 + 4
RO CIPs + CIP Neutralization	Gear	10	4 + 4
Antiscalant 100 Percent			
RO Feed Scaling Prevention	Hose	45	1 + 1
Cationic Polymer 20 Percent			
Lime Water Saturation	Hose	1.5	1 + 1
Lime Slurry			
Lime Water Lime Addition	Hose	4,500	1 + 1

Blending Infrastructure

For a DPR project, finished recycled water could be placed into a system of pipelines or aqueducts that deliver raw water supply to a water treatment plant, which is defined as raw water augmentation (RWA). Alternatively, it could be introduced directly into a drinking water distribution system, including finished water reservoirs, termed as TWA. At present, there has not been a final decision of the type of DPR (i.e., RWA vs. TWA) that the Program will pursue and the entry point for finished recycled water to be introduced into a public water system.

Both RWA and TWA DPR projects are required to attenuate a one-hour chemical contaminant spike by a factor of 10 as per the California DPR regulations. In the case of RWA, any concentration of a contaminant would be reduced when the finished recycled water is blended with the surface water source or treated drinking water at a certain ratio. In the case of TWA,

when finished recycled water is conveyed to a finished water reservoir, dilution could also be achieved given the large volumes present in the reservoir. For example, leveraging the surface water supply or treated drinking water (such as the Los Angeles Reservoir with a variable capacity of 2,750 to 3,030 MG) or the existing finished water reservoirs (such as Headworks East and the Headworks West Reservoirs for a combined capacity of 110 MG) could reduce or eliminate the needs for additional mixing facilities at the HWRP in order to meet the dilution requirement. However, a conservative analysis was conducted to determine the needed mixing facilities in the event that existing offsite facilities owned and operated by LADWP are not used in the manner described to augment the dilution capabilities of the proposed facilities at the HWRP. Table 1.36 summarizes the results of this analysis. It shows that 20.5 to 22.4 MG of additional blending infrastructure will be needed for a 120-mgd DPR train if the 10:1 dilution requirement must be met exclusively within the HWRP. Consequently, it is highly desirable to identify and consider the dilution capacity of any existing LADWP facilities that may receive any DPR production water in LADWP's Pure Water Los Angeles Master Plan.

Table 1.36 Additional Volume Needed With Complete Mixing for Diluting 120-mgd DPR Water

Scenarios	CSTR			DPR Production (mgd)	Dedicated Volume Needed with Complete Mixing for Contaminant Dilution (MG)
	PE EQ (MG)	MBR (MG)	SE EQ (MG)		
Scenario 1[(1)]	0	91.8	0	120	22.1
Scenario 2[(2)]	36.4	91.8	0	120	19.9
Scenario 3[(3)]	0	91.8	5.5	120	21.7
Scenario 4[(4)]	36.4	91.8	5.5	120	19.5

Notes:
Abbreviations: CSTR - continuous-stirred tank reactor.
(1) Based on all MBR facilities functioning as CSTRs.
(2) Based on all PE EQ and MBR facilities functioning as CSTRs. Addition mixing equipment or extended operation of mixing equipment may be needed for PE EQ facilities to function as CSTRs.
(3) Based on all MBR and SE EQ facilities functioning as CSTRs. Addition mixing equipment or extended operation of mixing equipment may be needed for SE EQ facilities to function as CSTRs.
(4) Based on all PE EQ, MBR and SE EQ facilities functioning as CSTRs. Addition mixing equipment or extended operation of mixing equipment may be needed for PE and SE EQ facilities to function as CSTRs.

1.6.3.3 IPR Train

The IPR treatment train consists of RO, UV-AOP, and post-treatment, all located downstream of MBR secondary treatment. The IPR train is to produce 90 mgd of IPR quality water. The existing West Basin water conveyance infrastructure could be repurposed for IPR product water. The conceptual siting and sizing of AWT facilities for the IPR train are summarized in the following sections.

RO

The RO train sizing for the 90-mgd IPR train is the same as the 120-mgd DPR train for the purposes of this conceptual design. It is anticipated that differences in feed water quality due to ozone/BAC/MF pretreatment, especially a reduction in TOC with DPR relative to IPR, will impact the RO train sizing and performance, but are not anticipated to be significant. The anticipated RO feed water quality is presented in Table 1.29. The RO system is located between the MBR and UV-AOP processes in the IPR treatment train.

The base RO process is the same for both IPR and DPR and described in Section 1.6.3.2. Since there are two different types of reuse (IPR and DPR), each with its own treatment requirements, the source waters for IPR and DPR must be separated after secondary EQ. Therefore, the only difference in the RO system process flow diagram for the IPR treatment train is that the feed water is MBR permeate (Figure 1.34).

Either the SE EQ basins or an RO feed tank (sized for a 15-minute HRT at the design flow of the train) will provide the feed water. Sodium hypochlorite and ammonium hydroxide are added into the feed water to form chloramines that are used to control biofouling throughout the RO system. Preformed chloramines should be considered for pilot testing as they are more effective for controlling the formation of chloramines and minimizing DBP formation. The RO system components are otherwise the same for both DPR and IPR treatment trains, as described in the previous section.

For RO systems, it is assumed that the same vendor and type of membranes are selected for both treatment trains. This will allow the operators to gain familiarity with a single RO system as the phased expansion proceeds from IPR (i.e., 50 mgd to 90 mgd of RO permeate) through DPR. Key design parameters for the IPR train RO system are presented in Table 1.37.

Table 1.37 Design Criteria for 90-mgd RO System for IPR

Parameter	Unit	IPR Train (90-mgd)
Design Feed Flow	mgd	106
Design Recovery	percent	85
Design Permeate Flow	mgd	90
Number of Trains (Duty + Standby) [1]	No.	12 + 1
Permeate Capacity per Train[1]	mgd	7.57
Number of Stages per Train[1]	No.	3
Pressure Vessel Configuration per Train[1]	No.	120:60:30
Pressure Vessel Diameter[1]	inches	8
Elements per Pressure Vessel[1]	No.	7
Maximum Average Flux[1]	gfd	12
RO Feed Tank		
Design Hydraulic Residence Time	minutes	15
Operational Capacity	gallons	1,105,000
Cartridge Filters		
Cartridge Filter Enclosures per Train	No.	1
Cartridge Filters per Enclosure	No.	25
Material	-	Polypropylene
Manufacturer	-	Fil-trek
Height	inches	30
Retention Rating	µm	5
Maximum Differential Pressure	psid	50
Change-Out Pressure	psid	35

Parameter	Unit	IPR Train (90-mgd)
RO Feed Pumps		
Number of Pumps (Duty + Standby)	No.	12 + 1
Operating Flow per Duty Pump	gpm	6,127
Motor Size	hp	1,250
RO Permeate Air Gap Structure		
Operational Capacity	gallons	68,250
RO Flush Pumps		
Number of RO Flush Pumps	No.	3
Flow per Pump	gpm	500
Motor Size	hp	10
RO CIP System		
Number of CIP Tanks	No.	2
Tank Material	-	FRP
Tank Capacity (per tank)	gallons	10,700
Total Tank Capacity	gallons	21,400
High pH CIP Frequency[3]	days	30
Low pH CIP Frequency[3]	days	30
Number of Mixers per Tank	No.	2
Number of CIP Pumps	No.	4
Flow per Pump	gpm	2,250
Pump Head	feet	140
Motor Size	hp	125
Chemical Use		
Sodium Hypochlorite 12.5 Percent		
RO Feed Design Dose for Chloramines[3]	mg/L	3
RO Feed Design Daily Usage	gpd	2,100
Ammonium Hydroxide 18 Percent		
RO Feed Design Dose for Chloramines[3]	mg/L	0.6
RO Feed Design Daily Usage	gpd	380
Sulfuric Acid 93 Percent		
RO Feed Design Dose[3]	mg/L	20
RO Feed Design Daily Usage	gpd	1,240
Antiscalant 100 Percent		
RO Feed Design Dose[3]	mg/L	5
RO Feed Design Daily Usage	gpd	530

Parameter	Unit	IPR Train (90-mgd)
Citric Acid 50 Percent		
Design Chemical Dose for Cleaning(3)	mg/L	20,000
Design Dose for High pH Neutralization(3,4)	mg/L	1,600
Total Design Daily Usage	gpd	230
Sodium Hydroxide 25 Percent		
Design Chemical Dose for Cleaning(3)	mg/L	1,000
Design Chemical Dose for Low pH Neutralization(3)	mg/L	12,492
Total Design Daily Usage	gpd	278

Notes:
(1) Preliminary design information provided by Biwater.
(2) Estimate from vendor or RO modeling; final number to be confirmed via pilot testing.
(3) High pH neutralization may also be carried out using sulfuric acid. Citric acid used in basis of design to minimize use of sulfuric acid, which requires additional safety considerations.

The RO system for IPR is located in the IPR RO/UV-AOP Building. Eight RO trains will be installed initially for 50-mgd IPR production and will share one RO CIP system. When production expands to 90-mgd IPR, additional five RO trains will be added to the building with its associated CIP system. The area below grade contains the RO feed tank (if provided) and the product water wet well, both sized for 90-mgd IPR flow. The aboveground and belowground layouts for the IPR RO/UV-AOP Building are presented in Figure 1.41 and Figure 1.42.

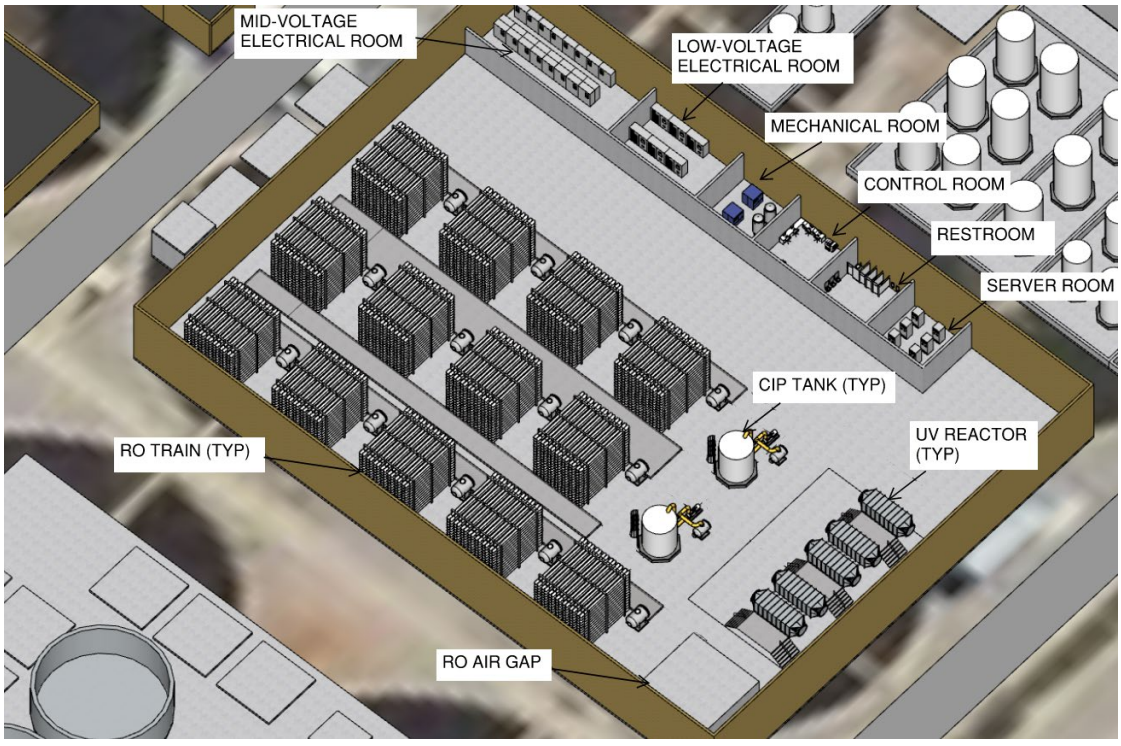


Figure 1.41 IPR RO/UV-AOP Building Aboveground Layout

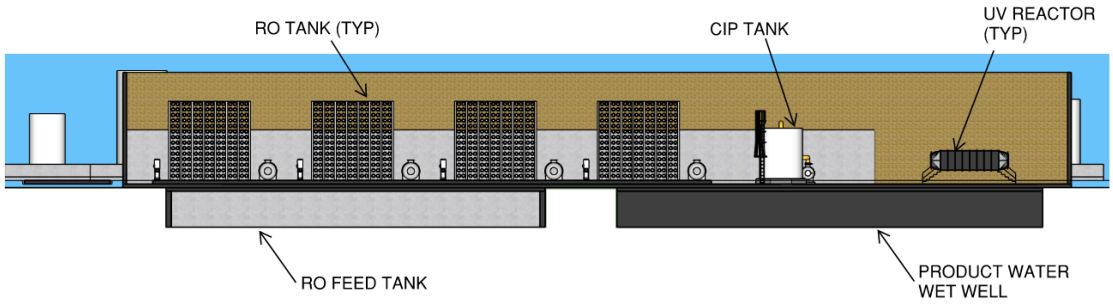


Figure 1.42 IPR RO/UV-AOP Building Belowground Layout

UV-AOP

The base process for the UV-AOP system is the same for IPR and DPR and is described in Section 1.6.3.2. With ozone/BAC/MF ahead of RO in the DPR train, higher quality feedwater to the UV-AOP system is expected for the DPR train compared to the IPR train, especially with regard to some scavengers and UVT. While these differences impact the UV-AOP design and operating costs, identical reactor sizes were used for simplicity for both IPR and DPR in the absence of essential pilot-scale data. The end use of the product water should also be evaluated to determine if it is subject to the California Toxics Rule NDMA limit of 0.69 nanograms per liter, as this will impact the required NDMA log reduction and UV dose requirement.

Key design parameters for the IPR UV-AOP system are presented in Table 1.38.

Table 1.38 Conceptual Design Criteria 90-mgd UV-AOP System for IPR

Parameter	Unit	IPR Train
Design Flow	mgd	90
Number of Trains (Reactors)(1)	No.	5
Design UVT (due to maximum anticipated chloramine levels in RO permeate)	percent	96
Number of Banks Used per Reactor at Design UVT(1)	No.	8 (out of 8 available)
Operating UVT (due to typical anticipated chloramine levels in RO permeate) (2)	percent	98
Number of Banks Used Per Reactor at Operating UVT(1)	No.	6 (out of 8 available)
Oxidant	-	Sodium hypochlorite
Target Free Chlorine Residual Entering Reactor(2)	mg/L as chlorine	2
Design UV NDMA Reduction Equivalent Dose(1)	mJ/cm^2	2,500

Parameter	Unit	IPR Train
UV Reactor		
Number of Trains(1)	No.	5
Flow per Train(1)	mgd	18
Reactors per Train(1)	No.	1
Reactor Model(1)	-	Trojan UVFlex 200
Reactor Lamp Type	-	Low pressure, high output
Pressure Drop through Reactor(1)	inches	<6.9
UV Lamps		
Banks per Reactor(1)	No.	8
Lamps per Bank(1)	No.	48
Maximum Power per Lamp(1)	watts	1,000
Lamps per Ballast(1)	No.	2
Maximum Power per Reactor(1)	kilowatts	4,121
Power Turndown per Reactor(1)	percent	30-100
End of Lamp Life(1)	percent	86
Lamp Fouling Factor(1)	-	0.95
Power and Control Enclosures		
Double PDCs per Reactor(1)	No.	4
LDCs per Reactor(1)	No.	1
Total SCCs (All Reactors) (1)	No.	1
Chemical Use		
Sulfuric Acid 93 Percent		
UV-AOP Feed Design Dose	mg/L	5
UV-AOP Feed Design Daily Usage	gpd	263
Sodium Hypochlorite 12.5 Percent		
UV-AOP Feed Design Dose(2)	mg/L	4
UV-AOP Feed Design Daily Usage	gpd	2,380

Notes:
(1) Preliminary design information provided by Trojan.
(2) Estimate from vendor; final number to be confirmed via pilot testing.

The UV-AOP system for IPR is located in the IPR RO/UV-AOP Building. Three UV trains will be installed initially for 50-mgd IPR flow and two additional trains will be added for the full 90-mgd IPR flow. The layout for the UV-AOP system is provided in Figure 1.43.

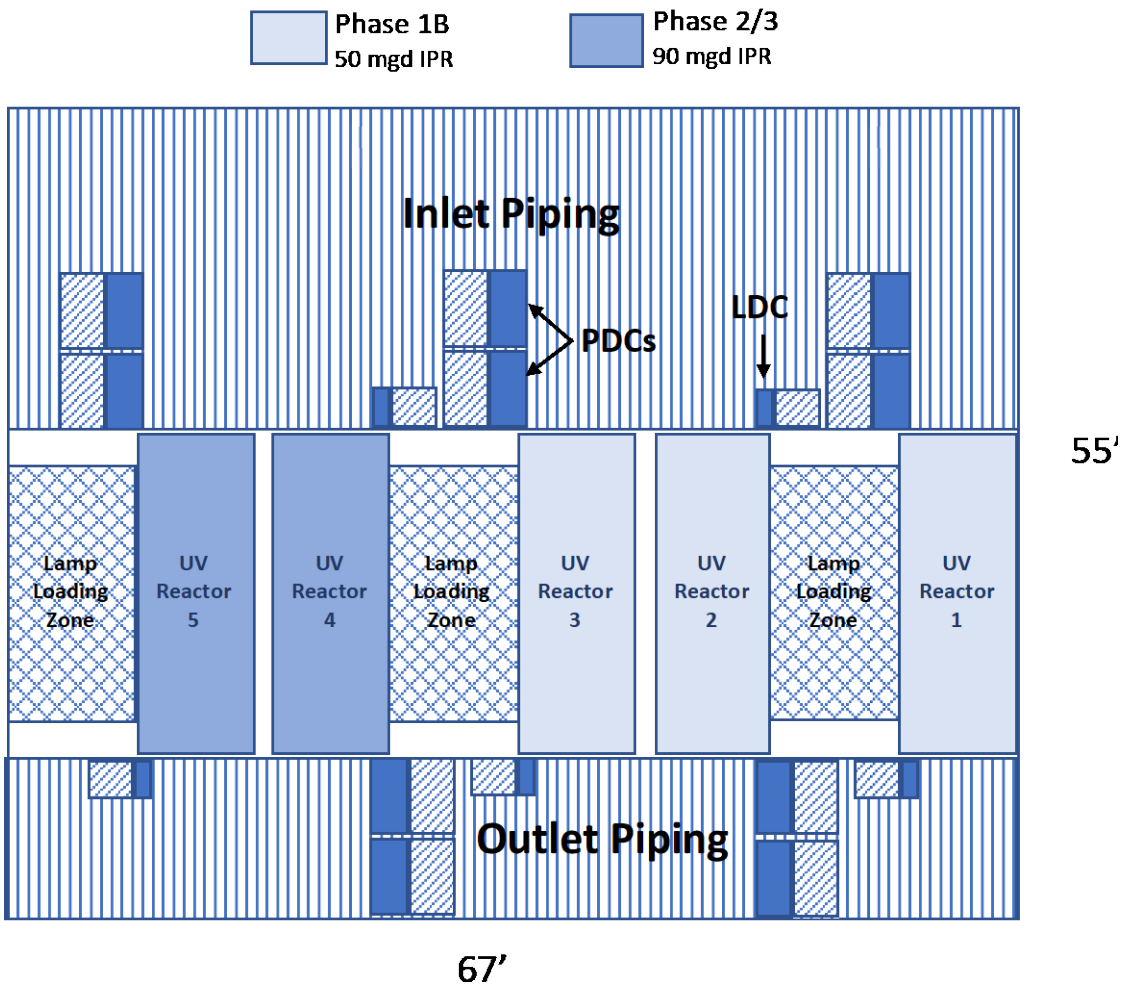


Figure 1.43 UV-AOP System Layout for 90-mgd IPR Located in IPR RO/UV-AOP Building

Post Treatment

For IPR, the product water is expected to be used for groundwater replenishment, which requires more stringent final turbidity goals. The post-treatment water quality goals for IPR are summarized in Table 1.39.

Table 1.39 Post-Treatment Water Quality Goals for IPR

Parameter	Unit	IPR	Notes
Alkalinity	mg/L as $CaCO_3$	50	Flexible while meeting LSI and pH and reducing costs
pH	-	6.5 - 8.5	Flexible range while meeting LSI>0
LSI	-	0.0 - 0.5	Flexible range while reducing chemical dosing
Turbidity	NTU	<0.2	Difficult to predict from chemical dosing alone

Due to the phased approach envisioned for construction, available footprint is an important consideration as the IPR facilities are completed before the DPR facilities. A separate, temporary post-treatment option for IPR product water will be implemented until the permanent post-treatment equipment is installed for use by both the IPR and DPR trains.

Prior to construction of the DPR facilities, post-treatment for the IPR train will be achieved through addition of sodium hydroxide and calcium chloride on an interim basis. This chemical addition approach addresses the final water quality goals for the IPR product water, including the low turbidity goal, as well as site space constraints. Sodium hydroxide and calcium chloride will be directly injected into the main flow of UV-AOP effluent in the pipeline. A small sidestream flow will be diverted to serve as the carrier water for CO_2 dissolution into water in a mixing tank, and the CO_2 water will be injected into the main pipeline to reduce the final pH. A process flow diagram for the interim IPR post-treatment system is shown in Figure 1.44.

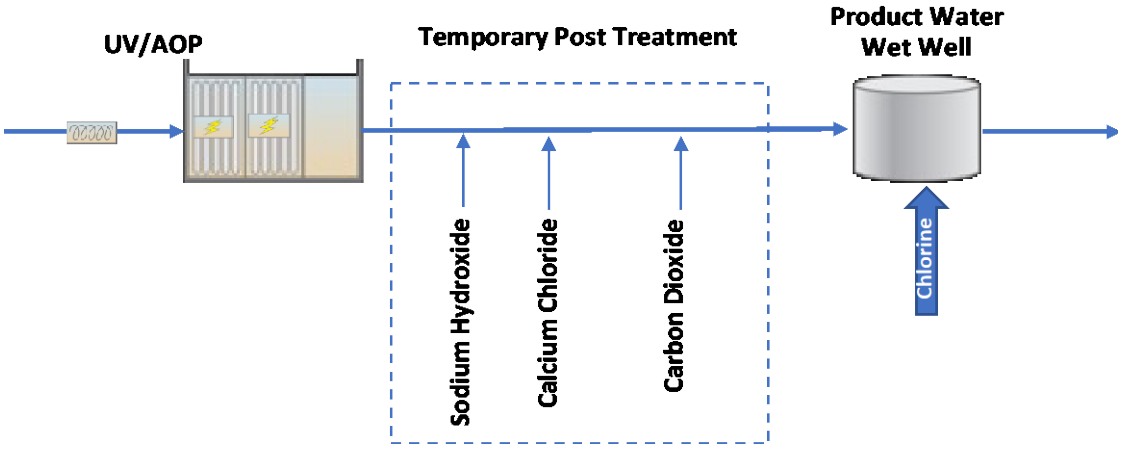


Figure 1.44 Sodium Hydroxide/Calcium Chloride Post-Treatment System Process Flow Diagram for IPR

Design criteria for the interim IPR post-treatment system are summarized in Table 1.40.

Table 1.40 Design Criteria 90-mgd Interim IPR Post-Treatment System (Sodium Hydroxide, Calcium Chloride) for IPR

Parameter	Unit	IPR Train
IPR Process Design Feed Flow	mgd	90
Sodium Hydroxide		
Sodium Hydroxide Dose	mg/L	35.6
Sodium Hydroxide Concentration	percent	50
Sodium Hydroxide Feed Flow	gph	176
Sodium Hydroxide Consumption	gpd	4,216
Sodium Hydroxide Consumption	gallons per month	126,474
Calcium Chloride		
Calcium Chloride Dose	mg/L	39.4
Calcium Chloride Concentration	percent	35
Calcium Chloride Feed Flow	gph	335
Calcium Chloride Consumption	gpd	8,041
Calcium Chloride Consumption	gallons per month	241,224

Parameter	Unit	IPR Train
CO_2		
CO_2 Dose	mg/L	20.9
CO2 Feed Rate	kg/h	297
CO2 Flow Rate Capacity per System	kg/h	2,722
CO2 Storage Capacity per System	tons	91
Number of CO2 Systems Required	-	1 + 1
CO2 Consumption	tons/day	7.1
CO2 Consumption	tons/month	213.6

Once the DPR facilities are complete, the lime saturator post-treatment system described in Section 1.6.3.2 will be used for the IPR train as well. The same equipment in the post-treatment area (e.g., decarbonation system, silos/slakers, saturators) to produce the lime water used to treat both the IPR and DPR trains, but the lime dose and the CO_2 dose (for pH adjustment) will differ for each train. Selecting a dose tailored for each reuse type allows for lower chemical consumption and smaller footprint. This post-treatment approach will meet the turbidity requirements of IPR while minimizing costs. This approach also has the advantage of simplicity, with only one treatment solution for both product waters. The design criteria for post-treatment with lime water, saturators, and acid for IPR are shown in Table 1.41.

Table 1.41 Design Criteria 90-mgd Final Post-Treatment System (Lime Water, Saturators, Acid) for IPR

Parameter	Unit	IPR Train
Process Design Feed Flow	mgd	90
Quick Lime Dose	mg/L	33.5
"Pure" Quick Lime Dose	mg/L	37.2
Quick Lime Purity	percent	10
Silos/Slakers for Lime Slurry Production		
Lime Slurry Concentration	percent	10
Number of Silos/Slakers	-	4
Silo Capacity	tons	85
Quick Lime Consumption	tpd	33.9
Quick Lime Consumption	tons per month	1,018
Decarbonation System		
Design Feed Flow	percent of main flow	5
Number of Decarbonators	-	2
Capacity of Decarbonators	gpm	4,000
Sulfuric Acid		
Acid Dose	mg/L	7.9
Acid Concentration	percent	93
Acid Feed Flow	gph	2.03
Acid Consumption	gpd	49
Acid Consumption	gallons per month	1,462

Parameter	Unit	IPR Train
Cationic Polymer		
Polymer Dose	mg/L	0.6
Polymer Concentration	percent	20
Polymer Feed Flow	gph	0.65
Polymer Consumption	gpd	15.7
Polymer Consumption	gallons per month	470
Lime Water Production in Saturators		
Lime Water Concentration	percent	0.2
Lime Water Consumption	mgd	5.38
Saturators		
Number of Saturators	-	2
Volume per Saturator	ft^3	17,884
Saturator Depth	feet	15
Saturator Diameter	feet	47
Saturator HRT	minutes	5
Lime Water Day/Mixing Tank		
Lime Water Day/Mixing Tank Volume	ft^3	18,646
Lime Water Day/Mixing Tank HRT	minutes	120
Lime Water Day/Mixing Tank Depth	feet	15
Lime Water Day/Mixing Tank Width	feet	63
Lime Water Day/Mixing Tank Length	feet	63
CO_2 System		
CO_2 Dose	mg/L	21
CO_2 Feed Rate	kg/h	298
CO_2 Flow Rate Capacity per System	kg/h	2,722
CO_2 Storage Capacity per System	tons	100
Number of CO_2 Systems Required	-	2 + 1
CO_2 Consumption	tpd	7.1
CO_2 Consumption	tonnes/month	215
CO_2 Mixing Tank		
Carrier Water Feed Flow	gpm	3,000
CO_2 Mixing Tank HRT	minutes	3
CO_2 Mixing Tank Height	feet	10
CO_2 Mixing Tank Length	feet	15
CO_2 Mixing Tank Width	feet	16

Chemicals

Ten chemicals are dosed at various points in the IPR train: sodium hypochlorite, citric acid, ammonium hydroxide, sulfuric acid, sodium hydroxide (50 percent), sodium hydroxide (25 percent), calcium chloride, antiscalant, cationic polymer, and lime slurry. Once the DPR train is installed, the IPR train will switch its post treatment from a calcium chloride and sodium hydroxide (50 percent) addition to a lime water addition via the lime saturators. Before the switch (pre-DPR at HWRP), sulfuric acid, cationic polymer, and lime slurry will not be used. After the switch (concurrent with introduction of DPR at HWRP), calcium chloride and sodium hydroxide (50 percent) will not be used for IPR post treatment.

The same assumptions for the chemical metering pumps described in Section 1.6.3.2 apply to the IPR train. Table 1.42 shows the capacity, number, and type of chemical pumps required for the chemical application points in the IPR train.

Table 1.42 IPR Chemical Metering Pumps

Chemical Application(s)	Pump Type	Pump Capacity (gph)	Number Required (Duty + Standby)
Sodium Hypochlorite 12.5 Percent			
RO Feed Chloramination	Hose	125	1 + 1
UV-AOP Oxidation	Hose	150	1 + 1
Product Water Tank Chlorination	Hose	125	1 + 1
Citric Acid 50 Percent			
RO CIPs + CIP Neutralization	Gear	10	2 + 2
Ammonium Hydroxide 18 Percent			
RO Feed Chloramination	Hose	25	1 + 1
Sulfuric Acid 93 Percent(2)			
RO Feed Conditioning	Hose	75	1 + 1
UV-AOP Stabilization	Hose	20	1 + 1
Lime Water Acidification	Hose	1.5	1 + 1
Sodium Hydroxide 50 Percent(1)			
Post Treatment Stabilization	Hose	250	1 + 1
Sodium Hydroxide 25 Percent			
RO CIPs + CIP Neutralization	Gear	15	2 + 2
Calcium Chloride 35 Percent(1)			
Post Treatment Stabilization	Hose	500	1 + 1
Antiscalant 100 Percent			
RO Feed Scaling Prevention	Hose	40	1 + 1
Cationic Polymer 20 Percent(2)			
Lime Water Saturation	Hose	1	1 + 1
Lime Slurry(2)			
Lime Water Lime Addition	Hose	2000	1 + 1

Notes:
(1) To be used for post treatment until the DPR train and lime saturators are built.
(2) To be used to make lime water for post treatment upon the installation of the lime saturators.

1.6.4 Product Water Storage and Pumping

This section describes the facilities that are required at the HWRP to convey product water to offsite facilities for beneficial reuse. Accordingly, these facilities must closely align with LADWP's Pure Water Los Angeles Master Plan relative to reuse water distribution requirements. Although some coordination has taken place, the information contained in this section is preliminary in nature and is subject to further refinement based on program direction.

1.6.4.1 DPR Product Water

The DPR treatment train has a production capacity of 120 mgd. Based on preliminary coordination, LADWP's mechanical design team has developed initial requirements for a DPR product water storage and pump station at the HWRP. More specifically, the storage facility will be based on one hour of HRT with chlorination taking place either within the storage facility or inline downstream of the pump station. The pump station will feature a configuration of seven constant-speed soft-start pumps (five duty plus two standby) with future conversion to VFD duty pumps. This will enable better flow control and power efficiency during start-up and shutdown sequences.

According to initial planning, this onsite pump station plus four offsite pump stations may be necessary for conveyance over a distance of 40.7 miles and an elevation gain of 1,140 feet tentatively to the Van Norman Complex. Additional storage basins would be needed between offsite pump stations to assist in maintaining stable pressures and system reliability.

The onsite storage facility will be located underneath the DPR RO/UV AOP building, while the pump station will be situated directly south of the building. The pump station will discharge into a new conveyance pipeline to be constructed by LADWP. Table 1.43 summarizes the aforementioned facilities for DPR that will be located within the HWRP.

Table 1.43 DPR Product Water Storage and Pumping Facilities

Parameter	DPR Train
Pumping Rate	120 mgd
Storage Requirement	1 hour
Storage Volume	5.0 MG
Effective Storage Dimensions	21.9 feet x 250 feet x 142 feet
Pump TDH	500 feet
Pump Type	Vertical Turbine Pumps
Pump Configuration	5 duty + 2 standby
Pump hp	3,000 hp
Discharge Header Diameter	78 inches
Total Surge Tank Volume Required	101,000 gallons
Number of Surge Tanks Required	3

1.6.4.2 IPR Product Water

As shown in Figure 1.1, West Basin owns and operates a pump station located within the HWRP that is used to convey SE to ECLWRF for further treatment and reuse. The pump station and the associated 60-inch conveyance pipeline have a peak design capacity of 90 mgd, which matches the proposed IPR production capacity. For this reason, the program currently assumes that this infrastructure may be retrofitted to address existing deficiencies and meet the new conveyance requirements. For example, the existing pump station lacks a reliable power supply and will necessitate upgrades to the existing power supply in order for the pump station to be utilized in this manner.

Table 1.44 shows design criteria for the existing West Basin Pump Station. Table 1.45 describes an IPR product water storage facility that would meet LADWP's design requirements. As shown on Figure 1.42, the IPR product water storage facility will be located below the IPR RO/UV-AOP Building.

Table 1.44 Design Criteria for Existing West Basin Pump Station

Description	Unit	Value[1]
Pumps - Original Construction	-	Two 800-hp, 21-mgd pumps Two 500-hp, 15-mgd pumps
Firm Pumping Capacity - Original Construction	mgd	51[2,4]
Pumps - Expansion	-	Three 800-hp, 20-mgd pumps
Firm Pumping Capacity - Expansion	mgd	40[3,4]

Notes:
(1) Source: Presentation material to West Basin Board of Directors dated October 25, 2021.
(2) Based on one 21-mgd pump out of service.
(3) Based on one 20-mgd pump out of service.
(4) The total pump station and conveyance capacity may be considered approximately 90 mgd, limited by existing power infrastructure constraints and the 60-inch force main capacity.

Table 1.45 IPR Product Water Storage Facility

Description	IPR Train
Pumping Rate	90 mgd
Storage Requirement	1 hour
Storage Volume	3.8 MG
Effective Storage Dimensions	13 feet x 257 feet x 150 feet

Since the pump station and the pipeline are owned by West Basin, the proposed approach will be coordinated and confirmed with the agency. If the approach is deemed unacceptable by West Basin, LADWP will likely be designated as a lead entity for providing a new pump station and conveyance system. This work needs to be coordinated with the intended IPR product water delivery locations, which are to be determined by LADWP. With either approach (retrofit or new), an equivalent pumping and conveyance capacity must be made available by the associated timelines to enable beneficial reuse of recycled wastewater.

1.6.4.3 Performance Monitoring, Critical Control Points, and Bypassing

Water quality monitoring at HWRP will encompass both compliance monitoring, to adhere to regulatory limits, and performance monitoring. Performance monitoring aims to establish pathogen LRVs and assess treatment effectiveness. The HWRP will monitor various parameters such as MCLs, NLs, sMCLs, contaminants of emerging concern, Basin Plan Water Quality Objectives, Ocean Plan Limits, and RWQCB NPDES permit requirements at different treatment stages as defined by regulations. Critical control points (CCPs) within the treatment process will be prioritized for monitoring to ensure they effectively mitigate health hazards. Surrogate constituents will be continuously monitored at CCPs to validate treatment process efficacy, with monitoring systems and analyzers in place for this purpose. CCPs are distinct from operational control points (OCPs) in that CCPs address immediate health hazards, whereas OCPs monitor process efficiency without immediate health risks if values exceed design limits. In the event of a CCP being exceeded, potentially resulting in a critical alarm or a drop in pathogen LRVs below potable reuse requirements, flow diversion may be necessary. Because of the robust treatment and redundancy of the proposed AWT at HWRP, such contingencies are expected to be rare. During diversion or non-compliance events, off-spec water may be directed to disposal via the ocean outfalls, bypassing AWT processes, or flow to the AWT may be halted until the issue is rectified.

1.6.5 Sidestream Treatment

As indicated in Table 1.4, nitrogen is one of the key water quality parameters in potable reuse water production, and effective nitrogen removal in wastewater treatment processes is critical to achieving the goal. While only representing 1 to 2 percent of the plant influent flows, the return flow from dewatering anaerobically digested sludge typically includes a substantial portion of the overall nitrogen load for a WWTP (20 to 30 percent in the form of ammonia). Treating this ammonia-rich sidestream for nitrogen removal has the potential to significantly improve the overall process efficiency when compared to mainstream nitrogen treatment. More specifically, the potential benefits are:

- Reduced power demand for process aeration for ammonia oxidation.
- Reduced supplemental carbon dosing to the activated sludge process for biological denitrification (total nitrogen removal) to achieve the desired treatment goals.
- Reduced biosolids generation, treatment, and disposal due to reduced biomass growth associated with reduced supplemental carbon.
- Increased stability of secondary treatment.

1.6.5.1 Sidestream Treatment Overview

Of the various nitrogen removal processes available, deammonification is selected for implementation. The following deammonification technologies will be considered for pilot testing and validation prior to full-scale implementation:

- **Tomorrow Water AMX™**: two-stage system that separates the partial nitrification tanks from the anammox tank and includes intermediate pumping step.
- **Ovivo/Paques AnammoPAQ® system**: Continuously fed process based on granular biomass, with a single tank system where both ammonia-oxidizing bacteria and anammox are enriched in the same tank.

- **Veolia/Kruger ANITA™ Mox**: Continuously fed process that utilizes plastic media for biofilm attachment.
- **World Water Works DEMON®:** Continuously fed process with aerated EQ tank and single-stage treatment system with anammox granules.

1.6.5.2 Conceptual Design

To be implemented as a standalone project, a full-scale sidestream treatment facility will be constructed in the area of four abandoned pancake digesters at Battery C as shown in Figure 1.45. Figure 1.46 shows a conceptual process flow diagram for the existing solids handling facilities with sidestream deammonification treatment (highlighted in yellow). The existing anaerobic digestion process operate in a thermophilic mode. This results in a higher temperature stream with a greater solids concentration and variability, which need to be accounted for in the design of the sidestream treatment facility.

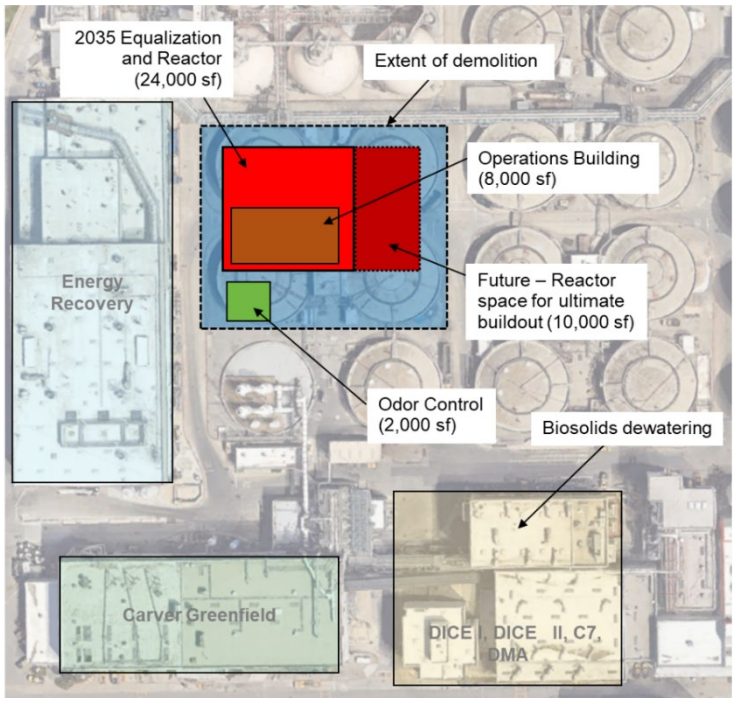


Figure 1.45 Conceptual Sidestream Treatment Facilities Layout

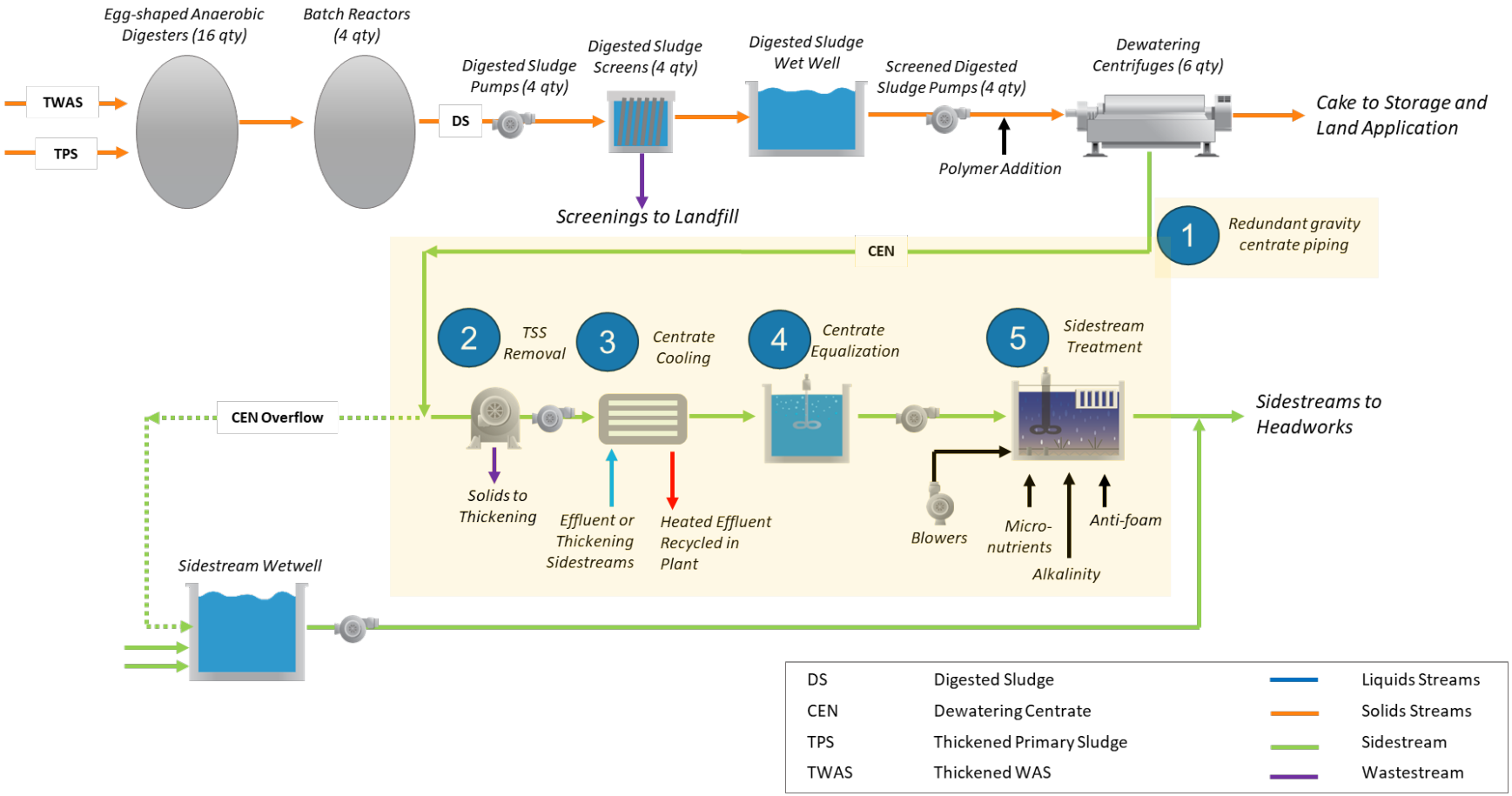


Figure 1.46 Process Flow Diagram of the Conceptual Design

Accordingly, several supporting systems are envisioned as follows:

- **EQ Tank**: Six hours of EQ storage, given historical data showing outage and variability in operation of the dewatering facility.
- **Conveyance**: Redundant gravity centrate piping from dewatering facility to new sidestream treatment, to mitigate potential clogging issues due to struvite.
- **TSS treatment**: Pretreatment for TSS removal, to avoid spikes in TSS that may reduce treatment efficacy of the deammonification system.
- **Centrate cooling**: To cool temperature of the centrate from approximately 50 degrees C to 35 degrees C, which is the preferred temperature for deammonification.
- **Odor Control**: Dedicated odor system via BTF system, and final polishing through activated carbon towers.

1.6.5.3 Next Steps

The results of the analysis demonstrate sidestream treatment as a technologically and economically viable option to reduce the cost of nitrogen treatment under Pure Water Los Angeles. The following next steps are recommended to help refine and optimize the conceptual sidestream design for project implementation.

- Increase centrate water quality testing to increase the limited historical data.
- Complete biosolids master planning to determine the preferred approach to digestion to allow sidestream treatment improvements to be configured appropriately.
- Investigate existing dewatering infrastructure seeking opportunities to improve consistency of dewatering, polymer addition, and TSS removal.
- MBR piloting (currently in commissioning phase) including optimizing aeration to provide for effluent low influent carbon to nitrogen ratio treatment to achieve HWRP's water quality goals.
- Plan the approach to further vendor investigation and analysis, including short-listing and selection, for pilot testing and demonstration purposes.
- Review of existing geotechnical information in Digester Complex C and collect and analyze additional samples if needed.

1.6.6 Support Facilities

This section describes the proposed ancillary and utility facilities that are necessary to support the operation of the aforementioned wastewater and advanced water treatment facilities. They include facilities for foul air treatment, chemical storage, water, air, and electrical utilities, and plant operation and administration.

1.6.6.1 Odor Control Facilities

To meet air quality regulations and avoid negatively impacting nearby residents, effective odor control at the HWRP is essential. In the areas of secondary treatment, a two-stage odor control system consisting of BTFs followed by carbon adsorbers currently treats foul air from the IPS. New construction for the Program will require the removal of this existing system and the installation of a new system that serves the new IPS, fine screens, and PE EQ basins. In addition, the new secondary treatment facilities will replace existing vent gas scrubber systems associated with HPOAS process and provide odor containment and treatment using the two-stage odor control system described above. Figure 1.47 highlights the various PE management and secondary treatment facilities that will be provided with odor control, including the bioreactors and membrane trains.

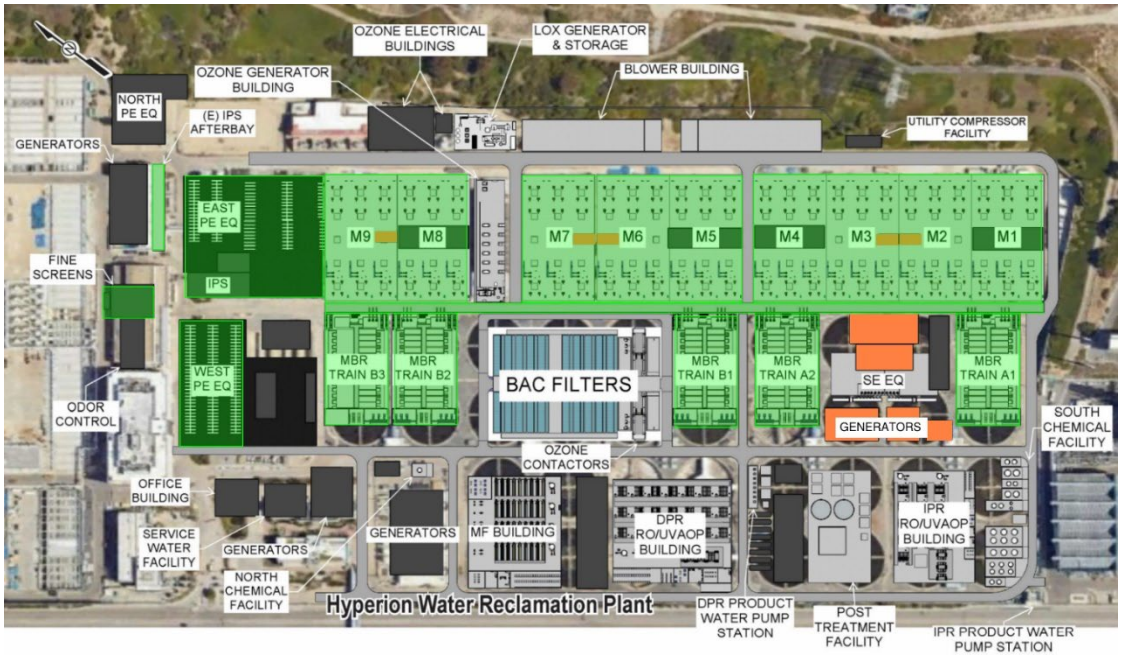


Figure 1.47 Process Areas (Green Shading) to be Provided with Odor Control

As mentioned in Section 1.5.3, the recommended odor control technology is based on the two-stage BACT, consisting of BTFs and carbon filters, that collectively provides robust treatment capability for H_2S and other potential foul air constituents of concern. The foul air first moves through the BTFs and then into demisters (Figure 1.48) and finally through the carbon filters (Figure 1.49) prior to its release. For planning purposes, this approach provides conservative sizing in terms of spatial and budget allocation.

The sizing for odor control equipment is primarily governed by the foul air flow rate. The foul air flow rates are in turn based on WEF Guidelines which require: (1) the headspace volume in a water-bearing structure at a specific air change rate or; (2) the process air flow rate supplied to the structure. Accordingly, the air flow rates for the PE EQ basins, IPS, and fine screens are dictated by the maximum volume of headspace in the individual basins, whereas those for the bioreactors and MBR trains are determined based on the maximum aeration rates.

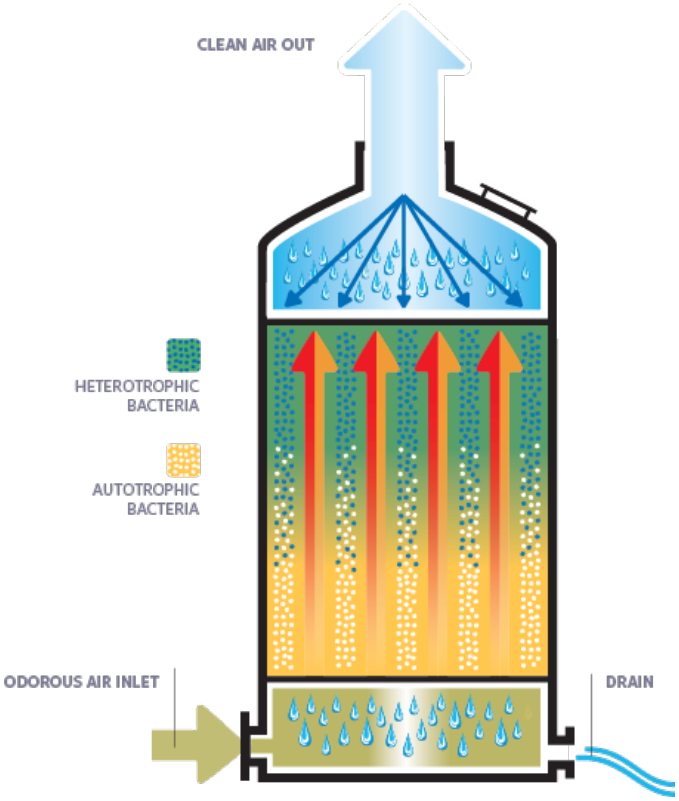


Figure 1.48 BioAir Solutions' EcoFilter BTF

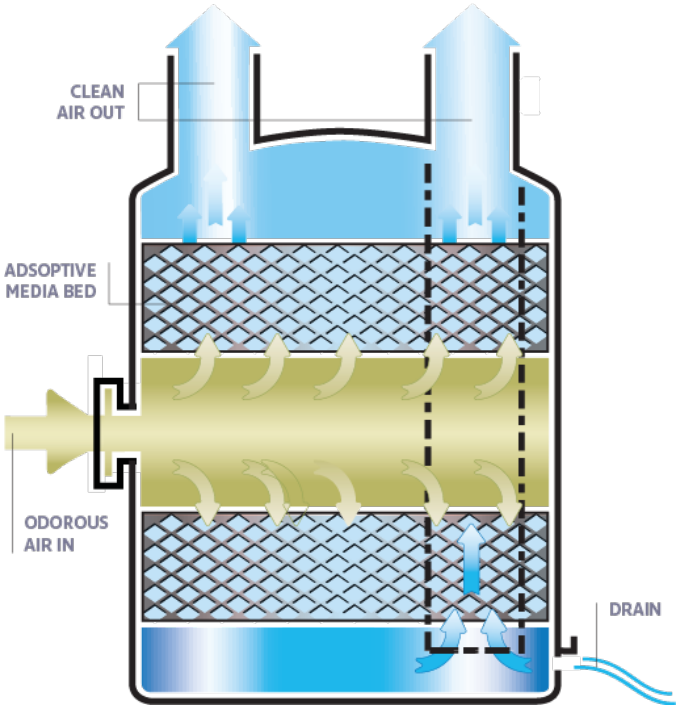


Figure 1.49 BioAir Solutions' EcoCarb Carbon Filter

Table 1.46 summarizes the various odor control systems that are anticipated for Pure Water Los Angeles at HWRP. Figure 1.50 shows the proposed locations and spatial allocations for the seven systems described in Table 1.46.

Table 1.46 Conceptual Design Criteria for Odor Control Systems

System	Odor Source	Airflow (cfm)	Duct Size (inches)	Estimated Footprint	Equipment Selection
1	Primary Equalization, IPS, Fine Screens	195,000	TBD	275′ x 95′	9x BTFs + 11x Carbon
2	Bioreactor Modules M1 and M2, 1/2 ML Channel A	80,000	78	168' x 55'	4x BTFs + 5x Carbon
3	Bioreactor Modules M3 and M4, 1/2 ML Channel A	80,000	78	168' x 55'	4x BTFs + 5x Carbon
4	Bioreactor Modules M5, M6, M7, and 2/3 ML Channel B	135,000	108	177′ x 49′	6x BTFs + 8x Carbon
5	Bioreactor Modules M8 and M9, 2/3 ML Channel B	80,000	78	168' x 55'	4x BTFs+ 5x Carbon
6	Bioreactor Modules M10, MBR Train B2 and B3	135,000	108	177′ x 49′	6x BTFs + 8x Carbon
7	MBR Train A1, A2, and B1	135,000	108	177′ x 49′	6x BTFs + 8x Carbon

Notes:
Abbreviations: cfm - cubic feet per minute.

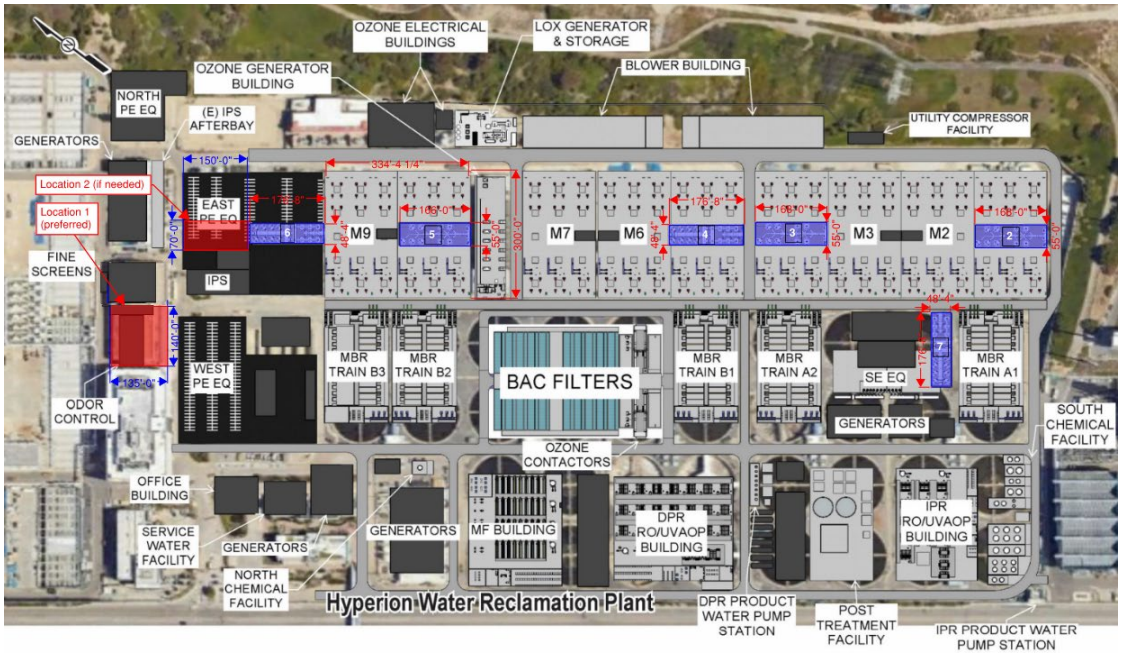


Figure 1.50 Preferred Odor Control System Site Layout

1.6.6.2 Chemical Facilities

Two new chemical facilities are proposed for providing bulk storage of the various chemicals needed for the MBR and AWT processes. As requested by LASAN and referred to as the South Chemical Facility, a main chemical facility will be located at the south end of the site. This facility will provide storage of eight chemicals: sodium hypochlorite, sodium hydroxide (caustic), calcium chloride, sodium bisulfate (or aqueous ammonia), sodium bicarbonate, sulfuric acid, citric acid, and antiscalant. Multiple chemical truck unloading areas will be provided to facilitate chemical delivery and minimize wait time for truck drivers. Figure 1.51 shows a conceptual layout for the South Chemical Facility.

In addition, a smaller chemical facility (to be located between the service water facility (SWF) and C Street) is proposed for storing citric acid only. This facility will be used in conjunction with an existing sodium hypochlorite facility associated with the SWF to support some of the MBR and AWT facilities that are situated far from the South Chemical Facility.

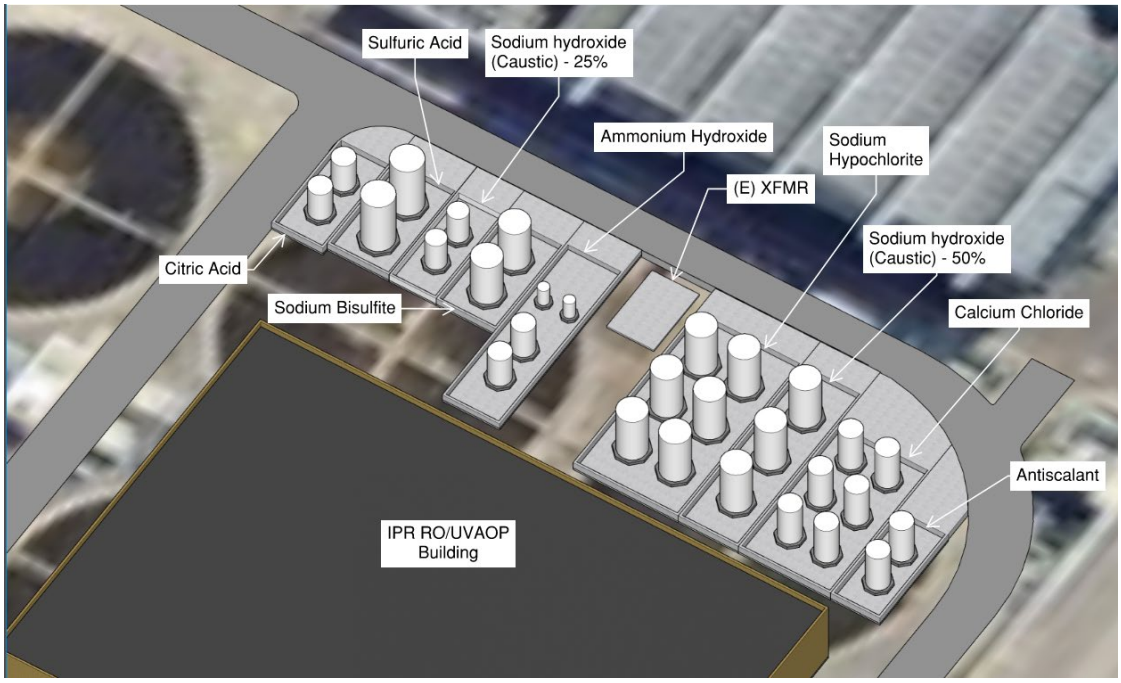


Figure 1.51 Conceptual Layout of South Chemical Facility

1.6.6.3 Non-Electrical Utilities

Table 1.47 provides a summary of existing non-electrical utility systems at the HWRP with current and projected demands based on the HWRP improvements described in the PIP.

Table 1.47 Non-Electrical Utilities

Utility	Origination Facility	Existing Equipment	Total Reliable Capacity(1)	Current Usage(2)	Projected Usage
Instrument Air	Utility Compressor Facility	4 - 60 hp air compressors	180 hp air	240 hp air(3)	790 hp air
BEF (DGUP) Cooling Water	SWF (CW1)	5 Pumps(4), each at 10,000 gpm at 70-feet TDH	57.6 mgd(4)	30 mgd(5)	30 mgd
Cryo(6) Cooling Water	SWF (CW2)	3 Pumps(4), each at 5,000 gpm at 70-feet TDH	14.4 mgd(4)	7.3 mgd	3 mgd
Plant Water (HPE)	SWF HPE	5 Pumps(4), each at 3,500 gpm at 243-feet TDH	10.4 mgd(4)	7.1 mgd	6 mgd
Sidestream Treatment(7) Cooling Water	SWF				5 mgd
Ozone Generation(7) Cooling Water	SWF	-	-	-	12 mgd
Aeration Blower(7) Cooling Water	SWF	-	-	-	1 mgd

Notes:
Abbreviations: DGUP - Digester Gas Utilization Project; HPE - high-pressure effluent.
(1) Based on one unit out of service.
(2) Source: June 2022 Maximum Flow Plant Data unless noted otherwise.
(3) Source: Operations Interview. All air compressors operate without redundancy.
(4) Source: Element 113: Chlorination and Service Water Facilities Drawings.
(5) Source: BEF Cooling Water System Description (2016) - Peak Demand.
(6) Existing cryogenic facility is to be demolished. A new cryogenic facility may be constructed to produce oxygen needed for a new ozone generation facility.
(7) New facilities to be constructed under Pure Water Los Angeles at HWRP.

Instrument Air

Instrument air is primarily produced at the Utility Compressor Facility (UCF). This facility houses four air compressors and five nitrogen compressors. In addition, supplementary compressors situated on the north side of HWRP are available to enhance the instrument air supply as needed.

As indicated in Table 1.47, the instrument air demand is projected to rise substantially from 1,000 scfm (240 hp) to 3,200 scfm (790 hp). To support the new capacity, a new UCF will be constructed to replace the existing and will provide five 200-hp compressors in a four duty + one standby configuration. Similarly, one to two more instrument air receiver tanks will be added to augment the instrument air receiver system. Due to space constraints, the existing receivers will need to be relocated to the area of the new UCF. In addition, leaks in the instrument air distribution piping will be addressed.

The fate of the five existing nitrogen compressors is to be determined based on condition assessment. More specifically, if the nitrogen compressors are found to be near the end of their useful life when the new UCF will be constructed (Phase 1B as indicated in Chapter 2), then they will be replaced in kind. If they still have service life left, then they will be relocated.

SWF

With the proposed conversion of the existing secondary treatment process from HPOAS to MBR, MBR permeate will be used as a feed water to the service water system. The level of treatment provided by the MBR - with non-detectable TSS - will eliminate the need for tertiary filtration (AquaDisk) in the existing SWF. This higher quality feedwater will be suitable for use in all applications including cooling water for BEF and other facilities, and only requires chlorination before it can be used as HPE water. Therefore, the existing AquaDisk filters will be removed, and the various pumping systems will be consolidated into a smaller, more-efficient facility.

The new SWF will be located north of the existing Old Laboratory as shown in Figure 1.10. This location is near the existing SE channel for long-term permanent connection to multi-train MBR effluent. It is also adjacent to the C Street tunnel where piping connections for cryogenic oxygen production system cooling water as well as ozone generator cooling water and HPE water can be made.

The new SWF will include a new chlorine contact basin utilizing the same volume as existing and a new pump station that meets the Hydraulic Institute Pump Intake design standards.
A conceptual layout of the new SWF is shown on Figure 1.52. Figure 1.53 is a corresponding section view.

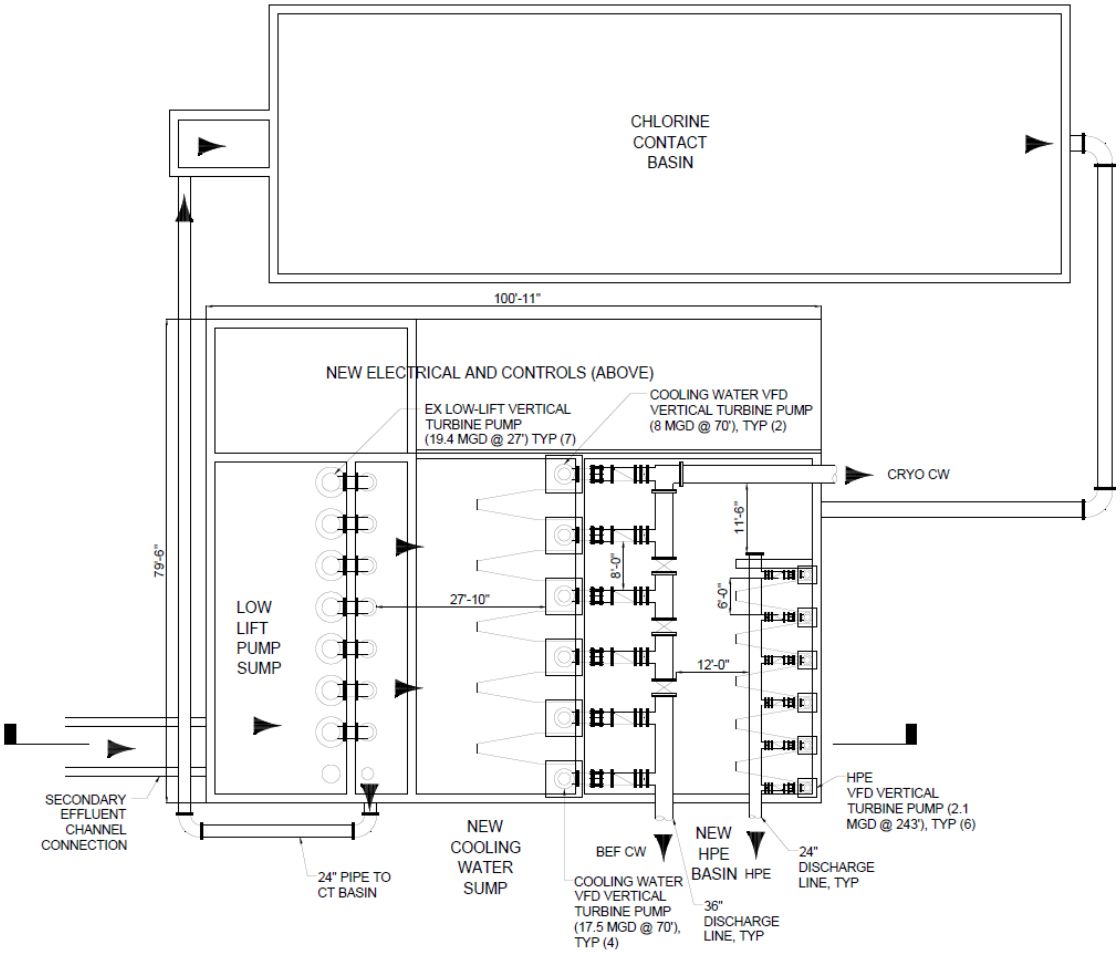


Figure 1.52 Conceptual Layout for New SWF

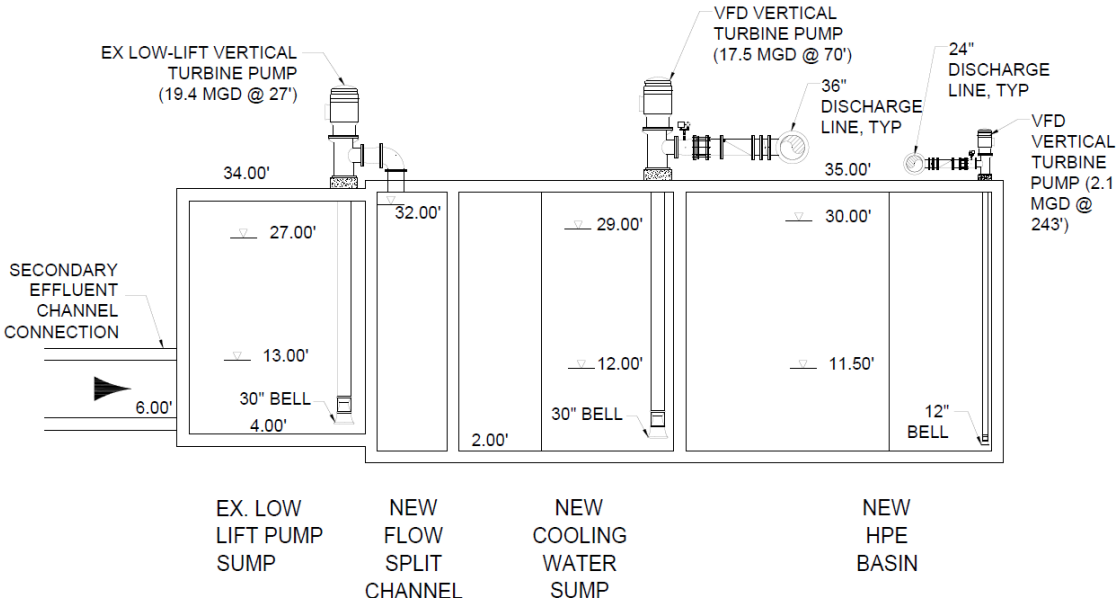


Figure 1.53 Conceptual Section for New SWF

Table 1.48 provides conceptual design criteria for the proposed SWF.

Table 1.48 Conceptual Design Criteria for New SWF

Parameter	Low-Lift Sump	Cooling Water Sump	HPE Sump	Chlorine Contact Basin
Invert Elevation	6.0 feet	10.0 feet	10.0 feet	19.5 feet
Minimum (Maximum) Water Elevation	13.0 feet (27.0 feet)	13.0 feet (29.0 feet)	11.5 feet (30.0 feet)	19.5 feet (31.9 feet)
Effective Volume	16,400 ft^3	24,400 ft^3	37,960 ft^3	70,930 ft^3
Pumps	Seven 13,500-gpm pumps	**Cryo:** (Two Duty) 5,500-gpm pumps (One Standby) 12,200-gpm pump **BEF:** Two Duty + One Standby) 12,200-gpm pumps	Six 1,500-gpm pumps	Two Rapid Mixers

1.6.6.4 Technical Support Facility No. 2

The HWRP will undergo substantial plant improvements for the production of potable reuse water associated with the Pure Water Los Angeles Program. With the additional planned treatment capabilities at the HWRP, a significant increase in the number of plant personnel is anticipated. As a result, the existing office and support spaces will be insufficient for the projected staffing needs.

Table 1.49 summarizes the plant staff projections for Pure Water Los Angeles at HWRP and associated needs for office space. Requirements for future office space factored in common areas such as reception, conference rooms, and bathrooms, and that not all staff require offices.

Table 1.49 Plant Staff Projections Requiring Office Space Following Pure Water Los Angeles

Divisions	Long-Term Staff Projection	Staff Requiring Office Space
Water Recycling Implementation Division	54	54
Process Engineering	35	35
Environmental Engineering Division and Bureau of Contract Administration	124	124
Environmental Monitoring Division	103	103
Information and Control Systems Division	69	69
Operation	136	5(1)
Maintenance	285	5(1)
Total	**806**	**395**

Notes:
(1) Additional spaces for O&M allocated in the new office space.

The total number of existing office spaces/cubicles available between the existing Technical Services Facility (TSF) (248 office spaces) and Harrington Building (50 office spaces) is 298. Comparing this to the projected 395 office spaces results in a deficit of 147 office spaces/cubicles. To satisfy the needed spaces, construction of a new, four-story TSF No. 2 is planned in the area north of the Old Laboratory, as shown in Figure 1.54, possibly maintaining some of the wetlands pond.

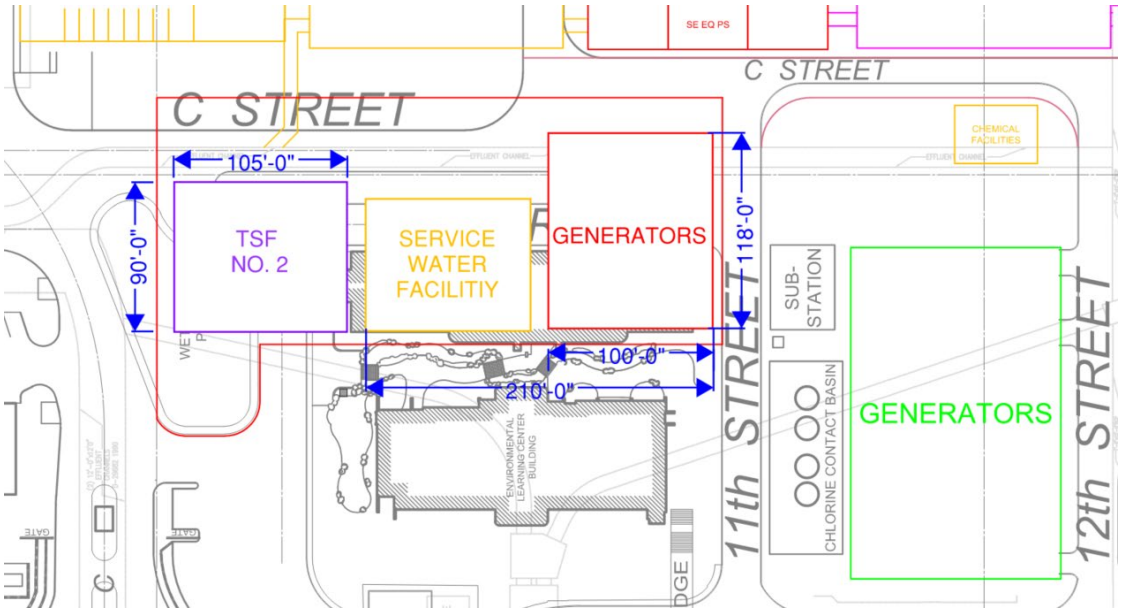


Figure 1.54 TSF No. 2 Near Old Laboratory

If the proposed location is deemed undesirable or unavailable, increasing the density of the existing TSF may be considered to accommodate the projected increase in staff. In either approach, upgrading existing office spaces at TSF may be beneficial for improving working conditions, including bathroom; heating, ventilation, and air conditioning system; electrical, backup system; and elevator upgrades.

1.6.6.5 Electrical Systems

Considering the magnitude of flows to be treated and the power demands of processes required, the Pure Water Los Angeles program will require very large and reliable power supplies. This section provides estimates of the required electrical infrastructure capacities anticipated for the Program at the HWRP.

Provided by LADWP, the existing electrical service at the HWRP consists of two 34.5-kilovolt (kV) redundant feeds that are rated for 90 MVA continuously and 100 MVA in emergency. The two feeds are not intended to operate simultaneously.

LASAN's electrical service entrance equipment at the HWRP is located at its Main Switch Yard. The equipment is rated at 154 MVA and was designed to be fully redundant. Hence, the current power supply is limited by LADWP's service transformer rating of 90 MVA continuous and 100 MVA in emergency.

In normal operation, the HWRP sustains its operation with the power generated by its cogeneration facility at the BEF. In fact, the plant typically operates in a small export mode with

the utility service, making the entire existing service capacity available for the Program-related facilities.

Program Connected Loads

Table 1.50 summarizes the electrical capacities for which the new electrical distribution system will be designed as part of Pure Water Los Angeles at HWRP. It is important to understand that these load values are not estimates of the anticipated power consumption. Rather, they are a total of all "duty" motors within a treatment process as if they were running at full nameplate load and concurrently. Required by the National Electrical Code (NEC), this method of calculation provides a conservative sizing of electrical distribution system and related components.

The reality of all wastewater plants with a large diversity of loads is that not all duty motors run concurrently and most equipment typically runs at less than their respective full nameplate ratings. Collectively, each plant has a unique "demand factor." The demand factor relates to the actual maximum load that operates at the plant as a ratio of the total peak connected load calculated in Table 1.50. Plant power factor for existing loads was assumed to be 92.4 percent and is based on metering data provided by LASAN.

Table 1.50 Peak Connected Loads by Process

Treatment	Process	Peak Loads, kVA
Wastewater	Miscellaneous Wastewater	14,094
	IPS	5,177
	MBR	52,760
	Other	970
IPR/DPR	RO	36,304
	UV-AOP	6,810
	Product Water	14,049
DPR Only	Ozone/BAC	13,015
	MF	12,355
Total	-	**155,534**

Notes:
Abbreviations: kVA - kilovolt-ampere.

Plant-Wide Connected Loads and Service Sizing

The total planned peak load for the HWRP is summarized in Table 1.51. It accounts for existing loads that will be unaffected by the Program, additional loads being implemented by the Program, and existing loads that will be demolished under the Program.

Table 1.51 Plant-Wide Peak Duty Loads

Summarized Load Information	kVA Peak	Kilowatt Peak
Total New or Modified Processes	155,533	143,712
Total New or Modified Processes With 20 Percent Extra	186,639	172,455
Cogeneration Production	0	0
Demolished Load	9,524	8,800
2017 Plant Load	24,600	22,300
Recent HAWPF Additions	1,250	1,000
Total Peak Plant Connected Load at Pure Water Los Angeles Program Completion	202,966	186,955

Notes:
(1) Per input from LASAN and for conservatism, the cogeneration facility is assumed to be out of service and not contributing power for the purpose of this analysis.

The above totals, similar to the loads described in Table 1.50, represent peak connected loads based on the Pure Water Los Angeles program, substantially increasing beyond the existing levels. This load table is being communicated to LADWP as part of revisions to the service application and will be used in the electrical calculations for sizing the electrical distribution system per NEC requirements. Because the estimates of new loads are part of a conceptual design and the estimates of loads remain preliminary, a 20 percent factor was provided to account for loads currently not identified. Per the initial review meeting with LASAN and LADWP, the impact of cogeneration was not included in these calculations but is shown for reference. Cogeneration will impact power usage and amount imported beyond that generated at the plant, but not the required electrical infrastructure.

These load values will ultimately dictate the sizing of power distribution equipment within Hyperion as well as equipment owned by LADWP. At LASAN/Hyperion property, equipment will need to be sized in accordance with NEC requirements. LADWP property and the 34.5-kV equipment ahead of the Main Switchyard is not governed by NEC requirements and is sized according to LADWP requirements. Our understanding is that LADWP's 90-MVA operating/100-MVA emergency rating is based on demand load (as opposed to connected or peak load). Due to the exceptionally large scale and the preliminary nature of the current assessments, it is not practical to estimate anticipated operating loads with a reasonable level of certainty.

Service Modifications

According to preliminary discussions with LADWP, if the existing service cannot handle the new loads, then any new service over 80 MVA will require a transmission-level substation. The Program's electrical requirement at the HWRP is expected to exceed this limit by a large margin prior to completion (refer to Table 1.51), so a new transmission-level substation will likely be required for a later phase of the Program. However, key decisions that will significantly impact the magnitude of the electrical requirements at the HWRP remain, including the production capacity, water quality (IPR vs. DPR), and siting of the AWT facilities. When the Program progresses further with greater definition with respect to the AWT facilities, LADWP will make the final determination following their internal assessment of the connected load and procedures for determining the rating of their service.

For reference, LADWP provided a sample transmission-level substation that would meet LADWP standards, and it is shown on Figure 1.55. The rating of the substation is ~120 MVA, which is about 60 percent of the size of the planned expansion loads. The physical space required by the 120-MVA substation is very substantial and roughly 850 feet by 350 feet or 7 acres. The footprint needed to accommodate the required capacity is unavailable at the HWRP and will need to be provided offsite by LADWP as their design progresses.

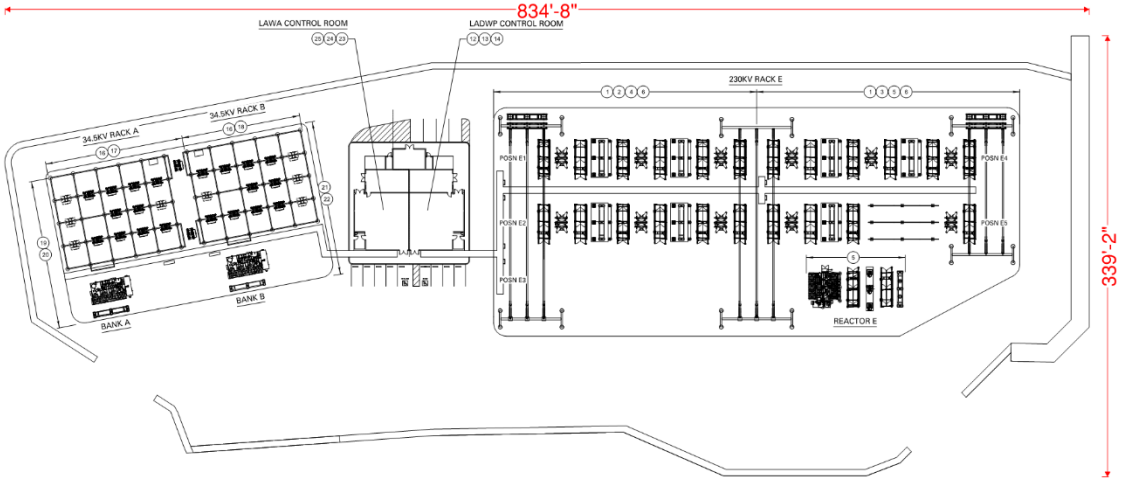


Figure 1.55 120-MVA Transmission-Level Substation Example From LADWP

The reuse of the existing service gear is desired by LASAN to the extent possible, so as to eliminate the need for a transmission-level substation. Due to the rating of the existing service entrance gear of 154 MVA, the upstream service transformer and cabling rated at 100 MVA, and the expected plant load being close to 202 MVA, it is not possible to power the new loads from the existing service. However, it may be beneficial to retain the existing electrical service and provide an additional service (as a second independent service) to augment the existing instead of a completely new service. This approach may result in a minimal impact on LADWP's power supply infrastructure and facilitate leveraging the existing service to the maximum extent.

Standby Power

Table 1.52 describes the proposed approach to providing backup power that would sustain treatment operation in the event of a utility power outage. Based on input provided by LADWP, this approach will be further evaluated for potentially providing standby power capability to the AWT facilities similar to what has been proposed for the wastewater treatment facilities.

Table 1.52 Standby Generation Approach

Proposed Approach	Description
MBR/IPS Standby Scenario 638/740 mgd (25 Generators)	• Provides standby power to all proposed wastewater treatment facilities up to the PWWF. • Significantly higher level of standby power capability compared to existing. • Does not provide standby power to AWT facilities.

Table 1.53 provides the conceptual design criteria for the proposed standby generation system in accordance with the standby generation approach described above. For the purposes of this analysis, diesel fuel generators with Tier IV emission controls that meet the current AQMD emission standards are deemed most appropriate and have been selected as a basis of design. Further, a modular approach of using individual standard diesel generator product offerings is used to conservatively account for space and cost in the evaluation. More specifically, 3-megawatt (MW) diesel machines, which are standard product offerings from multiple manufacturers, is used as the basis. By using standard product offerings, equipment procurement would be competitive while parts are readily available. Using these smaller machines is also more conservative in the site space requirements and ensures that adequate space is reserved on site for standby generation. In areas where the 4,160-volt systems do not require standby power, 480-volt generators will be used.

Table 1.53 Conceptual Design Criteria for Standby Generation

Description	Quantity
MBR/IPS Standby Scenario 740/638 mgd	
Standby Load	62,116 kVA
Number of Generators	25
Generator Technology	Diesel Engine Driven
Generator Capacity, each	3 MW

All manufacturers consulted have 4.16-kV alternators with similar dimensions and offer Tier IV solutions. A total of four generator facilities is anticipated and located strategically around the site to feed their associated loads in an efficient manner. Paralleling switchgear will be used to connect multiple generators together where needed to meet the power requirements for the areas they serve. The generator outputs will be synchronized and connected to the switchgear for distribution to the required loads as needed.

1.6.7 Site Improvements

This section summarizes the major site improvements that are envisioned for the Pure Water Los Angeles Program. These improvements are intended to facilitate construction of new facilities, improve access, and enhance plant O&M activities.

1.6.7.1 Earth Retaining Walls

In order to construct new blower buildings and potentially other facilities, the existing retaining wall on the east side of the plant will be demolished in two segments, and the hillside behind them will be further cut in. This will require constructing two new retaining walls as shown in Figure 1.56. A profile view of the new retaining walls in conjunction with the existing wall is shown on Figure 1.57. As shown on Figure 1.57, the new walls will be as high as 62 feet above finished grade. For comparison, the existing retaining wall has a maximum height of approximately 40 feet.

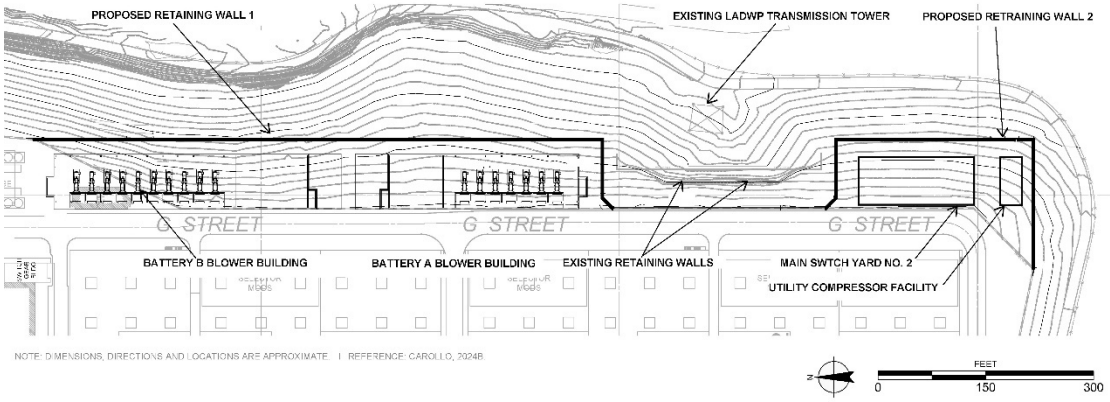


Figure 1.56 New Retaining Walls on Eastern Boundary

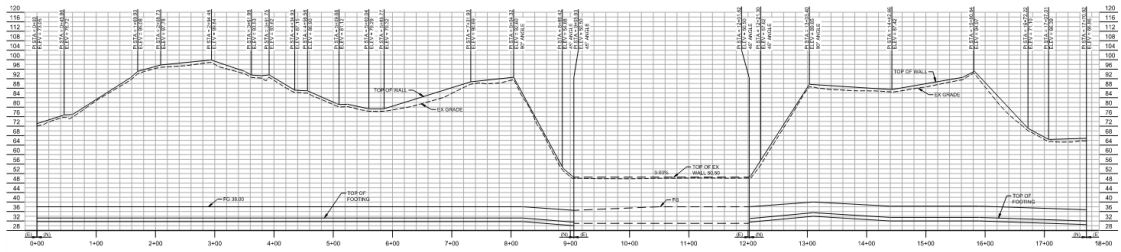


Figure 1.57 Retaining Wall Profile

1.6.7.2 Tunnel System

The existing secondary treatment facilities are supported by a network of underground tunnels shown on Figure 1.58. The tunnel system is used to route process piping, utilities, electrical conduits, and control wires.

Two main tunnels, Tunnels C and E, run in the north-south direction and are located below C Street and E Street, respectively. These tunnels will remain in place and serve as main utility corridors for the planned facilities. In addition, new ML channels and RAS galleries will be constructed on top of existing Tunnel E. The new ML channels will convey flows from the bioreactor modules to the downstream membrane trains. The RAS galleries will house large RAS discharge headers and foul air conveyance ducts.

Five tunnels run in the east-west direction between the existing secondary clarifiers and are connected to Tunnels C and E. These tunnels will be demolished and generally replaced with new underground galleries that serve new facilities.

Lastly, three tunnels run in the east-west direction between the modules. Specifically, Tunnel 2/3, Tunnel 6/7, and Tunnel 9/10 each are located between the two adjacent modules that they are named after. These tunnels will remain in place.

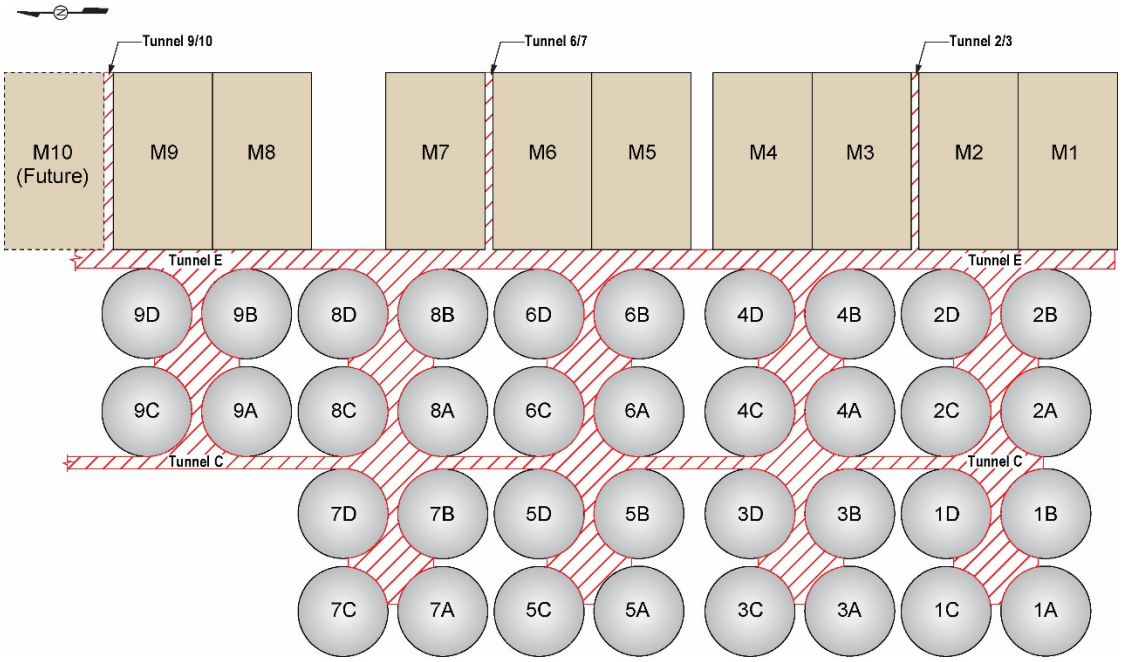


Figure 1.58 Existing Tunnel System in the Areas of Secondary Treatment Facilities

1.6.7.3 Site Entrance Improvements

Several potential options to improve the existing site entrance configuration were considered to accommodate the new site layout and increased traffic. Among the proposed improvements are modifications to the alignment of C Street at 10th Street. Specifically, modifications to the plant entrance through Gate C up to the intersection of 10th Street and C Street are currently envisioned to improve vehicular circulation to the south side and accommodate an increase in both permanent and construction-related staffing.

Figure 1.59 illustrates the proposed configuration of the intersection of C Street and 10th Street. Furthermore, an additional vehicular entrance gate will be considered at the southern end of the plant. Such a gate will facilitate construction traffic as well as post-construction deliveries of chemicals and diesel fuel. Chemical deliveries are primarily to be made to the South Chemical Facility proposed at the southwestern part of the plant in accordance with LASAN's request. Potential options are at the intersection of A Street and 13th Street or through the Scattergood Power Plant.

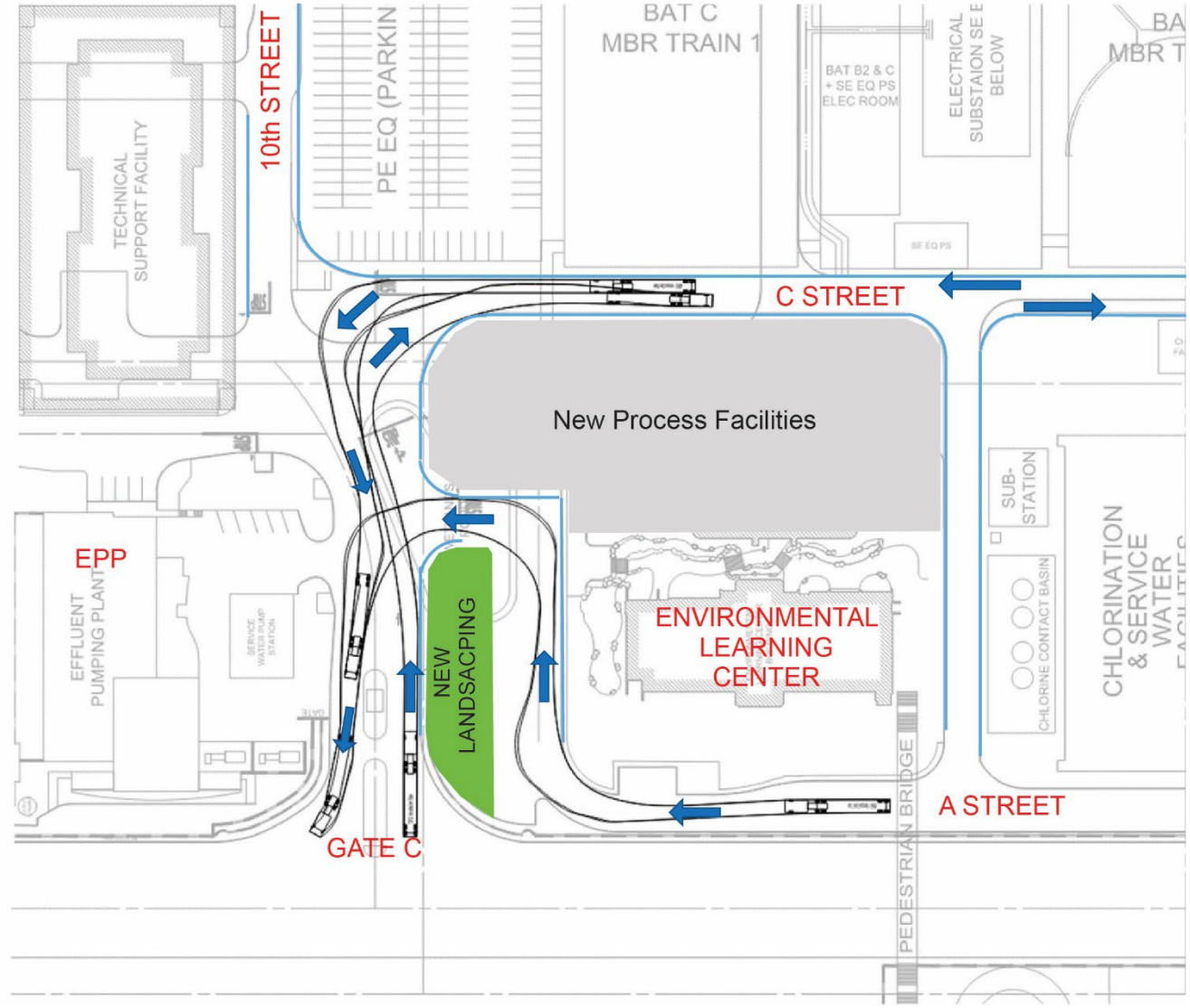


Figure 1.59 Proposed Configuration of C Street and 10th Street (with large truck circulation)

1.7 Plant Hydraulics

This section describes a conceptual basis for the overall plant hydraulic and conveyance systems associated with the proposed wastewater and AWT facilities under the Pure Water Los Angeles Program. It also presents critical scenarios for managing peak flows during and following the construction of the proposed facilities.

1.7.1 Recycle Streams and Flows

Recycle streams are sidestream flows that separate from mainstream flows as a result of liquid treatment or solids handling processes. They are generally discharged to an appropriate location in the liquid treatment processes for necessary treatment and as such can impact downstream process sizing and plant hydraulics, depending on flow rate and constituents.

The following provides a list of major recycle streams that are anticipated for the Program and their estimated flow contributions.

- AWT:
  - Backwash from BAC filters: 2 mgd peak (intermittent - DPR only).
  - Backwash from MF/UF: 6 mgd peak (DPR only).
  - Concentrate from RO: 37 mgd peak (both DPR and IPR).
- SWF:
  - Cooling water for the BEF: 30 mgd ultimate.
  - Cooling water for new aeration blowers: 1 mgd peak.
  - Cooling water for new sidestream treatment facility: 4 mgd average, 5 mgd ultimate peak.
  - Cooling water for new ozone generation: 12 mgd peak.
  - Cooling water for new potential cryogenic OGF: 3 mgd peak.
  - Onsite use of HPE: 6 mgd average.

Figure 1.9 provides a simplified liquid flow schematic with flow rates for the current Program that accounts for the anticipated recycle stream flows and their intended discharge locations. Figure 1.60 provides a similar schematic for the ultimate build-out scenario. As shown on the figures, two separate AWT trains are under consideration to meet a wide range of potable reuse water needs.

As shown in the figures, the maximum MBR permeate production is estimated to be 677 mgd, to be comprised of 638 mgd of PWWF; 50 mgd of contributing recycle streams; and minus 11 mgd of primary sludge, HAWPF, and WAS flows. Similarly, the maximum potable reuse water production is estimated to be 210 mgd for the two AWT trains consisting of 90-mgd IPR and 120-mgd DPR.

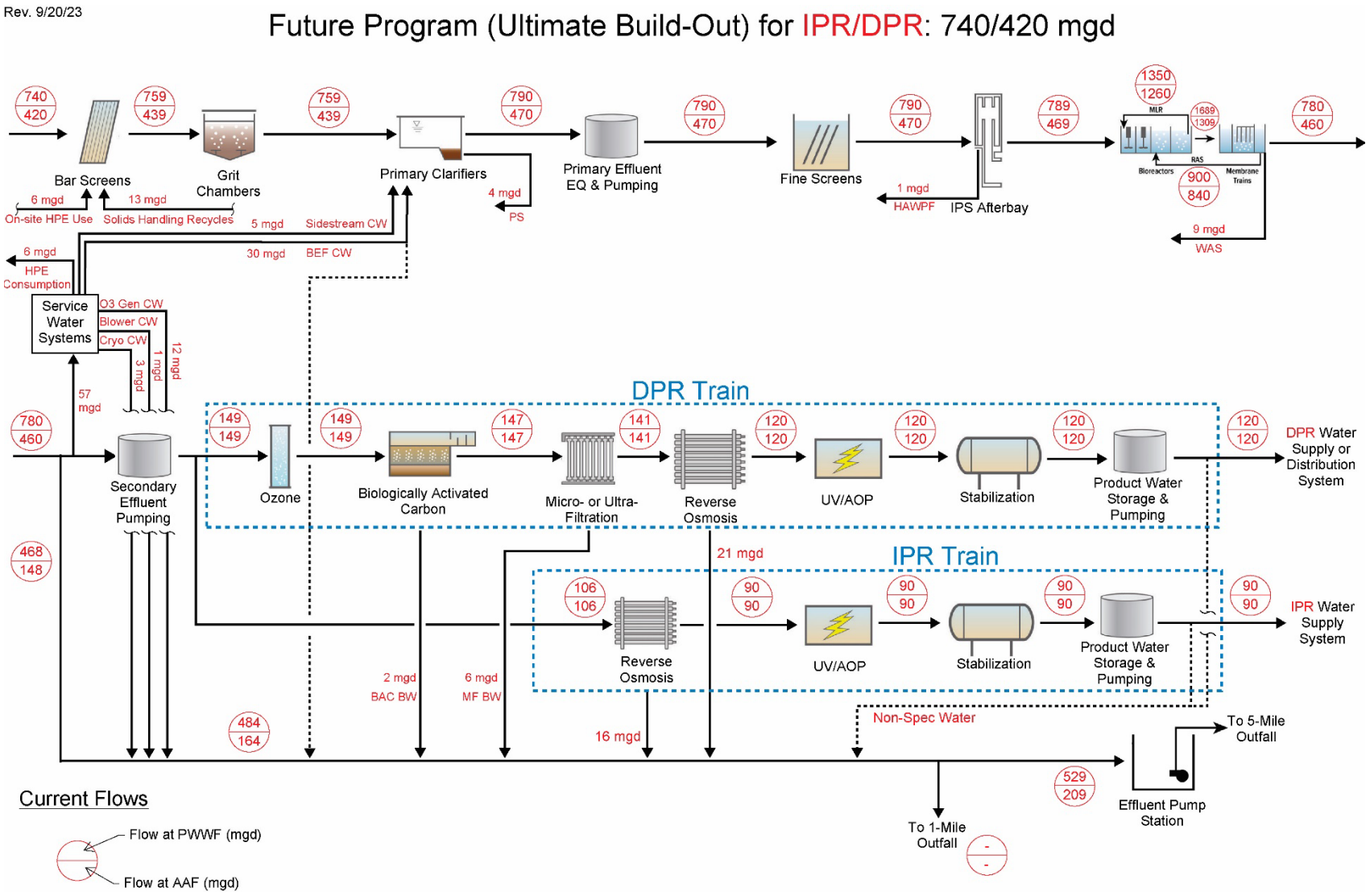


Figure 1.60 Simplified Liquid Flow Schematic - Future Build-Out

1.7.2 Ocean Outfall Modifications

Under the concept of "100-percent reuse" of plant effluent, following the current Program and under normal dry weather conditions, the majority of the plant effluent would be conveyed offsite as potable reuse water, with the existing 5-mile outfall only discharging the concentrate from the RO facilities to the ocean.

At an AAF of 272 mgd, the RO concentrate of approximately 42 mgd would be discharged in this manner, which will represent an 85 percent reduction in the outfall flows. An analysis into the existing outfall hydraulics concluded that some port modifications would be necessary to prevent seawater intrusion at this flow, considering that the minimum required to prevent modifications is approximately 50 mgd. Two port modification options were identified:

- Retrofitting duckbill nozzles over the existing ports.
- Retrofitting nozzle inserts into the existing ports.

Each option listed would result in additional head loss and thereby increase the system head, which in turn reduces the outfall capacity in both gravity and EPP-assisted flow modes while also potentially increasing maintenance requirements on the outfall.

Under the current approach of "maximum reuse", after construction of Pure Water Los Angeles is completed, the existing 5-mile outfall will be utilized for discharge of several miscellaneous cooling water and backwash water streams from the secondary and AWT facilities, RO concentrate, and flows in excess of the AWT capacity. This approach would enable producing up to 210 mgd of product water, while increasing the minimum flow through the outfall to 62 mgd, exceeding the minimum flow needed to achieve minimum initial dilution to prevent seawater intrusion. As a result, under the current approach, modifications to the 5-mile outfall will not be necessary.

1.7.3 Hydraulic Operation Scenarios

Table 1.54 presents the various peak flow management scenarios evaluated as part of the conceptual plant hydraulic evaluations. The scenarios address conditions that are anticipated both during and after construction of the Pure Water Los Angeles Program as well as for the current and future build-out programs. To provide redundancy and operational flexibility, all scenarios were analyzed based on 3 of the 27 bioreactors being out of service, except for Scenario 1B, in which 6 of the 27 bioreactors are assumed to be out of service due to shutdowns associated with the conversion to MBR.

Table 1.54 Peak Hydraulic Evaluation Operational Scenarios

Scenario No.	Scenario Title	PWWF (mgd)	Total MBR Flows (mgd)	Number of Modules and Membrane Trains in Service	AWT Feed (mgd)	Ocean Outfall Flow (mgd)	Product Water Flow (mgd)
1A	Full MBR, Post Construction, Current Program	740	638 + Recycles[1]	9 modules + 4.5 membrane trains	0	637	+1[2]
1B	Full MBR During Construction	740	638 + Recycles	7 modules + 3.5 membrane trains[3]	0	637	+1[2]

Scenario No.	Scenario Title	PWWF (mgd)	Total MBR Flows (mgd)	Number of Modules and Membrane Trains in Service	AWT Feed (mgd)	Ocean Outfall Flow (mgd)	Product Water Flow (mgd)
2A	Full MBR + AWT, Current Program	740	638 + Recycles(1)	9 modules + 4.5 membrane trains	272 + Recycles	427(4)	210+1(2)
2B	Full MBR + AWT, Ultimate Build-Out	740	740 + Recycles(5)	10 modules + 5 membrane trains(6)	272 + Recycles	529(4)	210+1(2)
3	Full MBR, Ultimate Build-Out	740	740 + Recycles(5)	10 modules + 5 membrane trains(6)	0	739	+1(2)

Notes:
Abbreviations: TM - technical memorandum.
(1) MBR recycles include 636 mgd for RAS and 954 mgd for MLR, based on current program design.
(2) "+1" denotes 1 mgd of product water to be produced by the HAWPF. The HAWPF is in the process of being commissioned and will provide approximately 1 mgd of product water to LAWA.
(3) One membrane train will be constructed at a time. Up to three and a half membrane trains will be available during construction. Refer to TM 2 - Secondary Process Integration for a detailed description of PWWF operating condition during construction.
(4) Includes up to 37 mgd of RO concentrate.
(5) MBR recycles at Ultimate Build-Out include 900 mgd for RAS and 1,350 mgd for MLR.
(6) A future program for Ultimate Build-Out will construct a tenth module and complete the fifth membrane train.

The following sections further describe Scenarios 1A, 1B, and 2A, as they are most representative of the different operational scenarios under the current Program.

1.7.3.1 Scenario 1A: Full MBR, Post Construction, Current Program

Scenario 1A represents a PWWF event occurring after successful implementation of MBR, however either before the AWT facilities have gone online or they are unavailable. Hence, the entirety of the PWWF, excluding the 1-mgd production from the HAWPF, is discharged through the ocean outfall system. Figure 1.61 shows the conceptual hydraulic profile for Scenario 1A.

As shown in Figure 1.61, all weirs and launders are free-discharging, and the freeboard in the IPS afterbay, bioreactor modules, ML channels, and membrane trains exceeds the 2-foot minimum, as measured from the top of concrete.

1.7.3.2 Scenario 1B: Full MBR During Construction

Scenario 1B represents a PWWF event occurring during Pure Water Los Angeles construction, more specifically, when three and a half of the four and a half MBR trains are constructed and operational. It also assumes that the AWT facilities are not online. Hence, it is similar to Scenario 1A, except that seven modules and three and a half MBR trains are operational.

During earlier phases of MBR construction, fewer MBR trains would be available. However, an equivalent number of secondary clarifiers would be available to suitably handle the PWWF in conjunction with new MBR trains. Thus, the hydraulics between modules does not significantly change between construction phases, so one hydraulic analysis was performed for the entire construction phase during the "worst-case" scenario. Figure 1.62 shows the conceptual hydraulic profile for Scenario 1B.

Due to the decreased number of operational facilities, the flow through each module and MBR train is significantly higher than in Scenario 1A. Hydraulic conditions for this scenario can be characterized as follows:

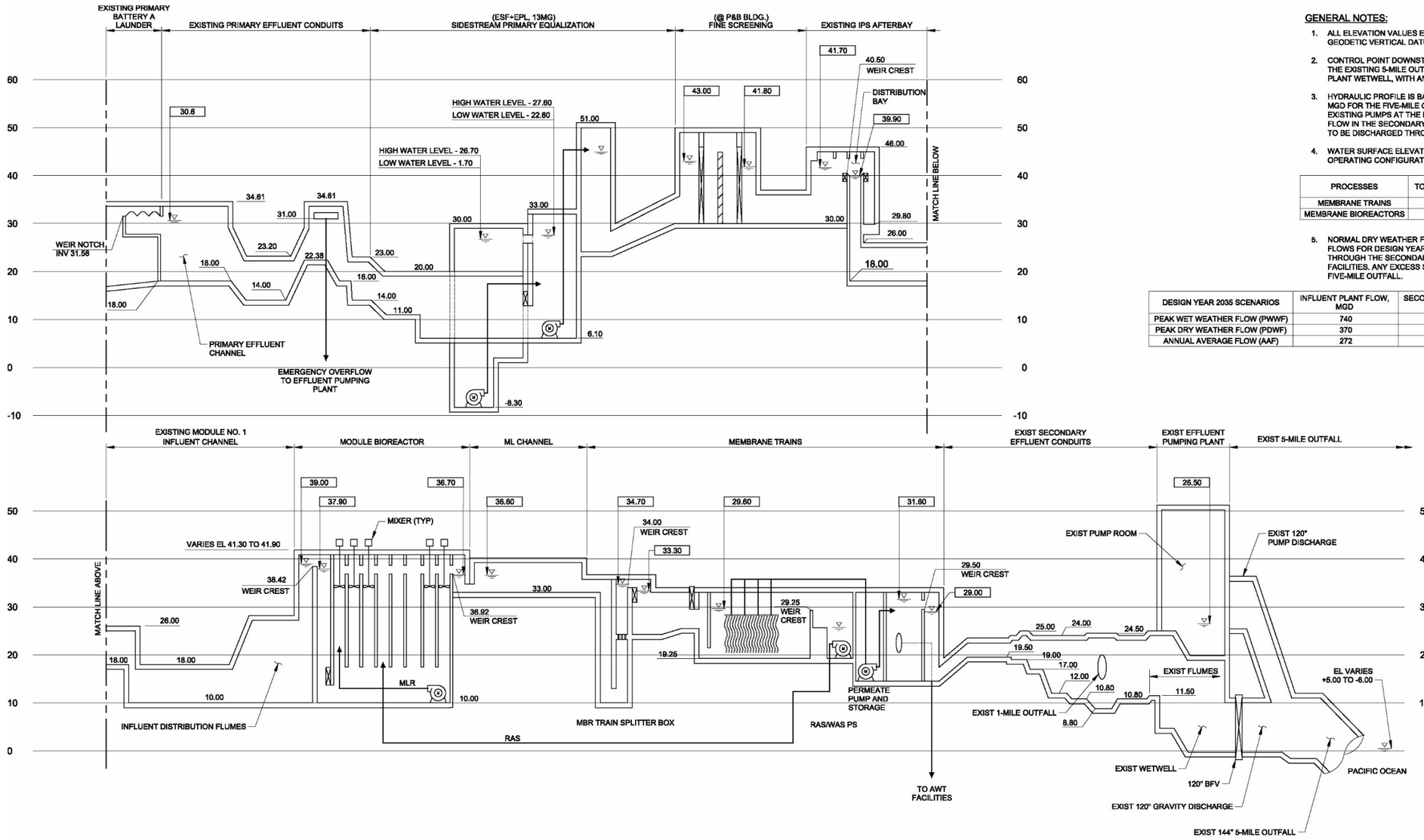
- The IPS afterbay weir gates are free discharging, therefore maintaining good flow split between the modules.
- Similarly, the module bioreactor influent weirs are free discharging, therefore maintaining good flow split between the three bioreactors in a single module.
- The module bioreactor effluent weirs as well as the ML splitter box launders are submerged. The submergence of the bioreactor effluent weirs should not affect flow distribution among the bioreactors in service. The submergence of the ML splitter box launders may lead to slightly uneven flow distribution among the membrane trains within a battery, but due to the symmetry that exists within a battery, it should not be to a significant degree. More importantly, it should not impede the plant's ability to pass and treat the PWWF.
- The freeboard in the IPS afterbay, bioreactor modules, ML channels, and membrane trains exceeds the 2-foot minimum.

Per discussions with LASAN, modifications to avoid the weir/launder submergence in this scenario are unnecessary since this scenario is for temporary consideration and would result in increased pumping costs during the operational lifetime of these facilities.

1.7.3.3 Scenario 2A: Full MBR + AWT, Current Program

Scenario 2A is similar to Scenario 1A, except that the AWT facilities are fully operational. Hence, it represents the plant configuration upon completion of the Pure Water Los Angeles Program. With the AWT facilities taking in approximately 255 mgd of MBR permeate, the flow being discharged to the ocean is significantly reduced, with the entirety of that flow (approximately 383 mgd) being discharged through the 5-mile outfall during PWWF. This flow includes approximately 45 mgd of RO concentrate and backwash for various AWT facilities. Figure 1.63 shows the conceptual hydraulic profile for Scenario 2A.

As shown on the hydraulic profile, all launders and weirs are free discharging, maintaining good flow split at all locations. The freeboard in all water-bearing structures exceeds the 2-foot minimum.



CONCEPTUAL HYDRAULIC PROFILE - FULL MBR

GENERAL NOTES:

1. ALL ELEVATION VALUES EXPRESSED RELATIVE TO NORTH GEODETIC VERTICAL DATUM OF 1929.
2. CONTROL POINT DOWNSTREAM OF MEMBRANE TRAINS THROUGH THE EXISTING 5-MILE OUTFALL IS THE EXISTING EFFLUENT PUMPING PLANT WETWELL, WITH AN ELEVATION OF 25.00.
3. HYDRAULIC PROFILE IS BASED ON A MAXIMUM CAPACITY OF 780 MGD FOR THE FIVE-MILE OUTFALL PER THE PUMP CURVE OF THE EXISTING PUMPS AT THE EFFLUENT PUMPING PLANT. ANY EXCESS FLOW IN THE SECONDARY EFFLUENT CHANNELS OVER 780 MGD ARE TO BE DISCHARGED THROUGH THE ONE-MILE OUTFALL.
4. WATER SURFACE ELEVATIONS REFLECT THE FOLLOWING OPERATING CONFIGURATIONS:

PROCESSES	TOTAL NUMBER OF UNITS	NUMBER OF UNITS IN SERVICE
		PWWF
MEMBRANE TRAINS	4.5	4.5
MEMBRANE BIOREACTORS	27	24

5. NORMAL DRY WEATHER FLOWS INCLUDING ASSOCIATED DIURNAL FLOWS FOR DESIGN YEAR 2035 AAF OF 272 MGD WILL CONTINUE THROUGH THE SECONDARY EFFLUENT EQUALIZATION AND AWT FACILITIES. ANY EXCESS STORM FLOWS WILL BE ROUTED TO THE FIVE-MILE OUTFALL.

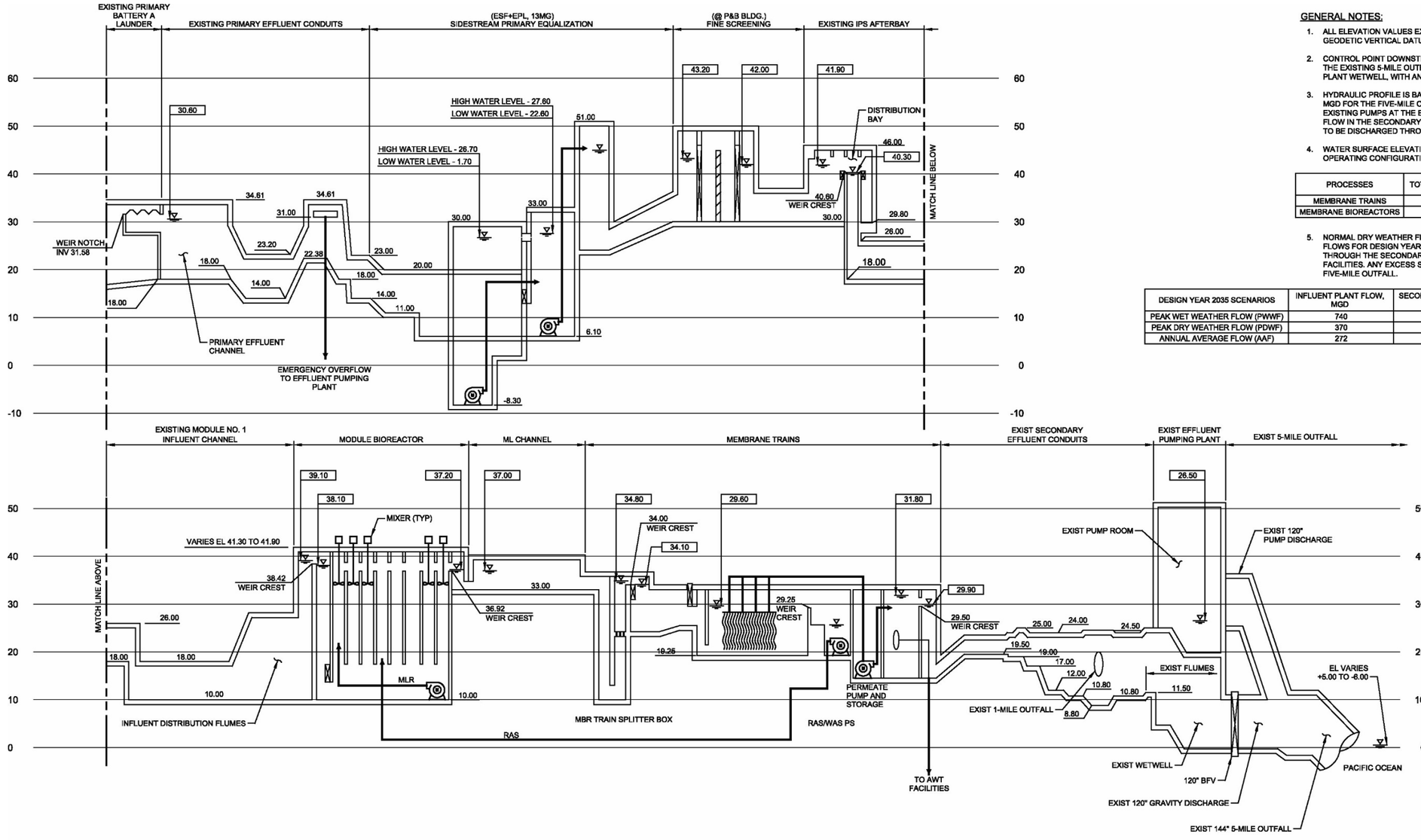
DESIGN YEAR 2035 SCENARIOS	INFLUENT PLANT FLOW, MGD	SECONDARY PLANT FLOW, MGD	RAS, MGD	MLR, MGD
PEAK WET WEATHER FLOW (PWWF)	740	638	638	954
PEAK DRY WEATHER FLOW (PDWF)	370	370	636	954
ANNUAL AVERAGE FLOW (AAF)	272	272	544	816

LEGEND:

XX.XX WSE @ PWWF

WATER SURFACE

Figure 1.61 Scenario 1A - Conceptual Plant Hydraulic Profile



CONCEPTUAL HYDRAULIC PROFILE - FULL MBR

GENERAL NOTES:

1. ALL ELEVATION VALUES EXPRESSED RELATIVE TO NORTH GEODETIC VERTICAL DATUM OF 1929.
2. CONTROL POINT DOWNSTREAM OF MEMBRANE TRAINS THROUGH THE EXISTING 5-MILE OUTFALL IS THE EXISTING EFFLUENT PUMPING PLANT WETWELL, WITH AN ELEVATION OF 25.00.
3. HYDRAULIC PROFILE IS BASED ON A MAXIMUM CAPACITY OF 780 MGD FOR THE FIVE-MILE OUTFALL PER THE PUMP CURVE OF THE EXISTING PUMPS AT THE EFFLUENT PUMPING PLANT. ANY EXCESS FLOW IN THE SECONDARY EFFLUENT CHANNELS OVER 780 MGD ARE TO BE DISCHARGED THROUGH THE ONE-MILE OUTFALL.
4. WATER SURFACE ELEVATIONS REFLECT THE FOLLOWING OPERATING CONFIGURATIONS:

PROCESSES	TOTAL NUMBER OF UNITS	NUMBER OF UNITS IN SERVICE
		PWWF
MEMBRANE TRAINS	4.5	3.5
MEMBRANE BIOREACTORS	27	21

5. NORMAL DRY WEATHER FLOWS INCLUDING ASSOCIATED DIURNAL FLOWS FOR DESIGN YEAR 2035 AAF OF 272 MGD WILL CONTINUE THROUGH THE SECONDARY EFFLUENT EQUALIZATION AND AWT FACILITIES. ANY EXCESS STORM FLOWS WILL BE ROUTED TO THE FIVE-MILE OUTFALL.

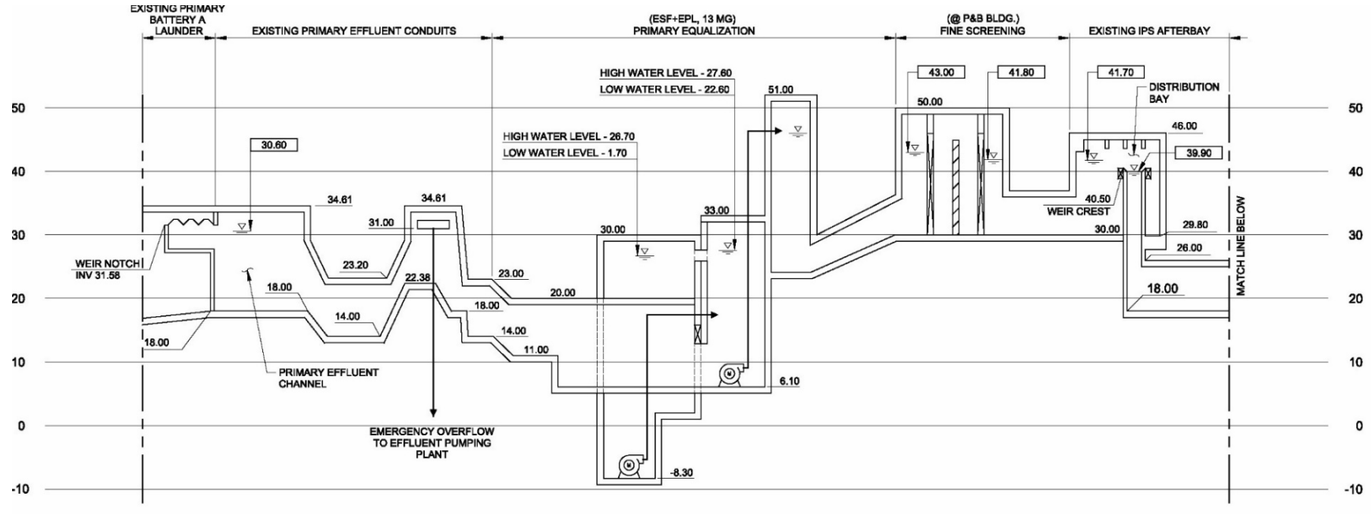
DESIGN YEAR 2035 SCENARIOS	INFLUENT PLANT FLOW, MGD	SECONDARY PLANT FLOW, MGD	RAS, MGD	MLR, MGD
PEAK WET WEATHER FLOW (PWWF)	740	638	636	954
PEAK DRY WEATHER FLOW (PDWF)	370	370	636	954
ANNUAL AVERAGE FLOW (AAF)	272	272	544	816

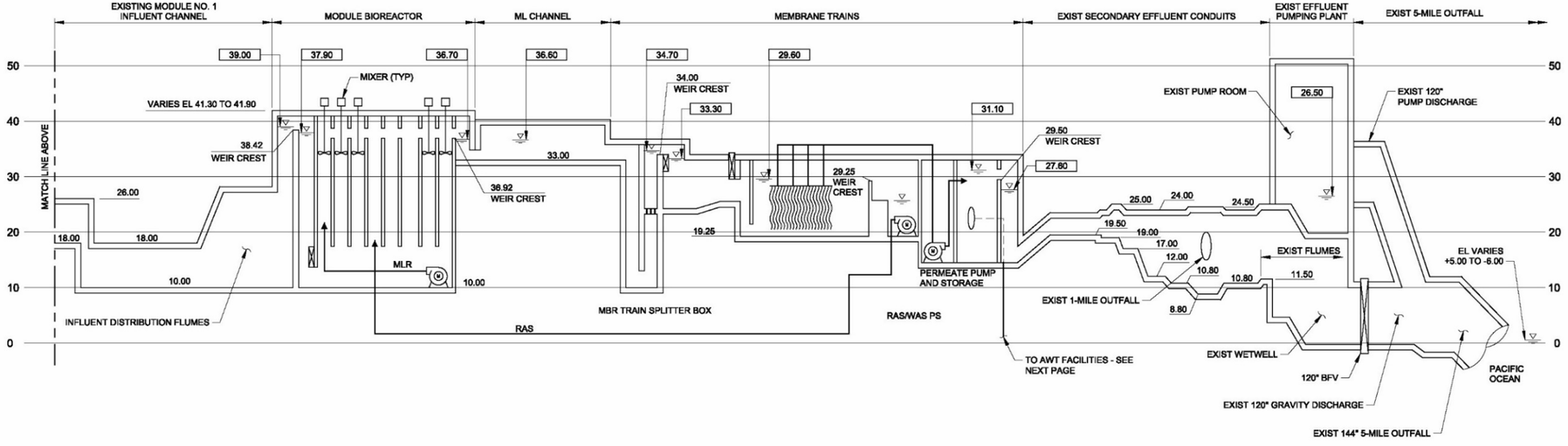
LEGEND:

WSE PWWF @ 850 MGD INFLUENT FLOW

WATER SURFACE

Figure 1.62 Scenario 1B - Conceptual Plant Hydraulic Profile





CONCEPTUAL HYDRAULIC PROFILE - FULL MBR + AWT

GENERAL NOTES:

1. ALL ELEVATION VALUES EXPRESSED RELATIVE TO NORTH GEODETIC VERTICAL DATUM OF 1929.
2. CONTROL POINT DOWNSTREAM OF MEMBRANE TRAINS THROUGH THE EXISTING 5-MILE OUTFALL IS THE EXISTING EFFLUENT PUMPING PLANT WETWELL, WITH AN ELEVATION OF 25.00.
3. HYDRAULIC PROFILE IS BASED ON A MAXIMUM CAPACITY OF 780 MGD FOR THE FIVE-MILE OUTFALL PER THE PUMP CURVE OF THE EXISTING PUMPS AT THE EFFLUENT PUMPING PLANT. ANY EXCESS FLOW IN THE SECONDARY EFFLUENT CHANNELS OVER 780 MGD ARE TO BE DISCHARGED THROUGH THE ONE-MILE OUTFALL.
4. WATER SURFACE ELEVATIONS REFLECT THE FOLLOWING OPERATING CONFIGURATIONS:

PROCESSES	TOTAL NUMBER OF UNITS	NUMBER OF UNITS IN SERVICE
		PWWF
MEMBRANE TRAINS	4.5	4.5
MEMBRANE BIOREACTORS	27	24

5. NORMAL DRY WEATHER FLOWS INCLUDING ASSOCIATED DIURNAL FLOWS FOR DESIGN YEAR 2035 AAF OF 272 MGD WILL CONTINUE THROUGH THE SECONDARY EFFLUENT EQUALIZATION AND AWT FACILITIES. ANY EXCESS STORM FLOWS WILL BE ROUTED TO THE FIVE-MILE OUTFALL.

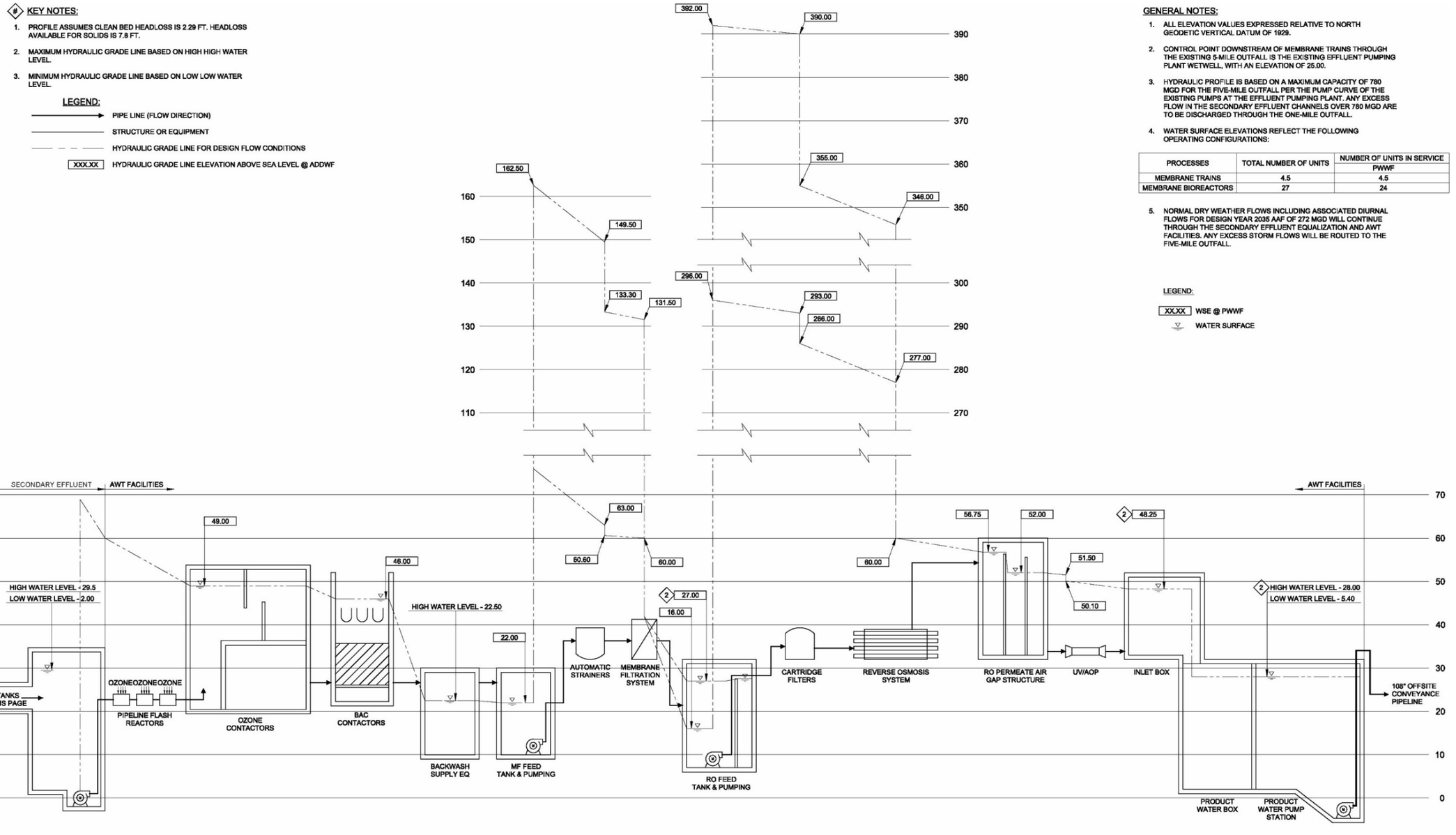
DESIGN YEAR 2035 SCENARIOS	INFLUENT PLANT FLOW, MGD	SECONDARY PLANT FLOW, MGD	RAS, MGD	MLR, MGD
PEAK WET WEATHER FLOW (PWWF)	740	638	636	954
PEAK DRY WEATHER FLOW (PDWF)	370	370	636	954
ANNUAL AVERAGE FLOW (AAF)	272	272	544	816

LEGEND:

XX.XX WSE @ PWWF

WATER SURFACE

Figure 1.63 Scenario 2A - Conceptual Plant Hydraulic Profile



GENERAL NOTES:

1. ALL ELEVATION VALUES EXPRESSED RELATIVE TO NORTH GEODETIC VERTICAL DATUM OF 1929.
2. CONTROL POINT DOWNSTREAM OF MEMBRANE TRAINS THROUGH THE EXISTING 5-MILE OUTFALL IS THE EXISTING EFFLUENT PUMPING PLANT WETWELL, WITH AN ELEVATION OF 25.00.
3. HYDRAULIC PROFILE IS BASED ON A MAXIMUM CAPACITY OF 780 MGD FOR THE FIVE-MILE OUTFALL PER THE PUMP CURVE OF THE EXISTING PUMPS AT THE EFFLUENT PUMPING PLANT. ANY EXCESS FLOW IN THE SECONDARY EFFLUENT CHANNELS OVER 780 MGD ARE TO BE DISCHARGED THROUGH THE ONE-MILE OUTFALL.
4. WATER SURFACE ELEVATIONS REFLECT THE FOLLOWING OPERATING CONFIGURATIONS:

PROCESSES	TOTAL NUMBER OF UNITS	NUMBER OF UNITS IN SERVICE
		PWWF
MEMBRANE TRAINS	4.5	4.5
MEMBRANE BIOREACTORS	27	24

5. NORMAL DRY WEATHER FLOWS INCLUDING ASSOCIATED DIURNAL FLOWS FOR DESIGN YEAR 2035 AAF OF 272 MGD WILL CONTINUE THROUGH THE SECONDARY EFFLUENT EQUALIZATION AND AWT FACILITIES. ANY EXCESS STORM FLOWS WILL BE ROUTED TO THE FIVE-MILE OUTFALL.

LEGEND:

XX.XX WSE @ PWWF

WATER SURFACE

CONCEPTUAL HYDRAULIC PROFILE - FULL MBR + AWT

Figure 1.63 Scenario 2A - Conceptual Plant Hydraulic Profile (continued)

1.8 Findings and Recommendations Summary

This section provides a summary of the major findings and recommendations for implementing the HWRP improvements proposed under Pure Water Los Angeles based on information presented in this chapter of the PIP.

1.8.1 Site Overview

The following conclusions pertain to the evaluations of the existing site utilization:

- **Current Site:** The existing Hyperion site is effectively "built-out," with little to no open space available for new construction. Any future improvements of significant magnitude will need to sequence work and create space by some combination of process modifications and demolition or relocation of existing facilities.
- **Process Conversion:** Reflected in existing site plan, secondary treatment is significantly more space-intensive than preliminary and primary treatment as well as solids handling. As a result, the southern half of the plant occupied by the existing secondary treatment facilities provides best opportunities for siting new processes and facilities, following the conversion to MBR.

1.8.2 Program-Level Design Criteria

- **Basis of Design Flows:** The Pure Water Los Angeles Program will be designed based on the projected conditions including the AAF of 272 mgd, the MMF of 318 mgd, and the attenuated PWWF of 638 mgd. The facilities being designed for this current program will provide provisions to facilitate future expansion(s) to attain the Ultimate Build-Out capacities, which are the AAF of 420 mgd, the MMF of 450 mgd, and the attenuated PWWF of 740 mgd.
- **Secondary Process**: To facilitate potable water reuse, the existing secondary treatment process will be upgraded from HPOAS to MBR.
- **Odor Control**: Based on close proximity to the El Segundo residences to the east, effective odor control is considered a key driver and consideration in HWRP improvements.
- **AWT Configuration**: Two separate treatment trains (IPR and DPR) will be provided to meet a wide range of potable reuse water needs.

1.8.3 Primary Effluent Management

- **Diurnal Flow Equalization**: A volume of up to 30.5 MG is needed to fully equalize influent flows at the design AAF of 272 mgd.
- **PWWF Attenuation:** Based on an analysis of historical peak wet weather influent flows, a volume of 36.4 MG is needed to provide peak flow attenuation from 740 mgd to 638 mgd.
- **Flow Equalization:** Three flow equalization facilities will be provided for a total storage of 36.4 MG. They include a basin called the Module 10 EQ, which would be converted to Module 10 Bioreactor in the future.
- **IPS**: The implementation of MBR including the need for a fine screening process substantially modifies the hydraulic grade line, necessitating replacement of the existing IPS with a new pump station. The existing IPS afterbay will be modified and incorporated into new facilities.

1.8.4 Secondary Treatment

- **MBR Configuration:** The proposed MBR configuration is a four-stage BNR process with swing zones. With MBR membrane separation systems, secondary clarification is no longer needed.
- **Bioreactors:** The existing nine HPOAS reactor modules will be retained and retrofitted for use as BNR basins utilizing air activated sludge. They will be incorporated into two MBR batteries: A and B.
- **Oxygen Dissolution:** FBDs will be utilized for aeration/oxygen dissolution within the bioreactors. Two new dedicated buildings will house the blowers, one for each MBR battery. The blower buildings will be constructed on the hillside, east of the modules. New retaining walls will be constructed into the hillside to make space for these buildings.
- **Membrane Type:** The MBR membrane systems will utilize submerged hollow-fiber membranes in an outside-in flow pattern, the configuration selected for full-scale MBR pilot testing to be performed at HWRP. Membrane technology continually evolves, increasing packing density and replacing older models with more optimized versions. A comprehensive evaluation of the available membrane technologies should be conducted during a program phase when the first membrane system will be constructed.
- **Membrane Tanks:** Each membrane train will consist of up to 26 membrane tanks, configured in 2 banks of 13 membrane tanks. The three membrane manufacturers selected for the pilot testing are being considered, and their conceptual sizing is based on meeting the target instantaneous wet weather flux of ≤30 gfd.

1.8.5 AWT

- **AWT Capacity:** The IPR train will be sized for a 90-mgd production. The DPR train will be sized for a 120-mgd production. These goals are based on the current program AAF of 272 mgd, and a future expansion beyond the current program flows will not be considered for the AWT facilities.
- **IPR Train:** For IPR applications, treatment will include RO, UV-AOP, and post treatment for stabilization following MBR.
- **DPR Train:** Following MBR, treatment for DPR applications will include ozone, BAC, MF, RO, UV-AOP, post treatment for stabilization, and potentially blending infrastructure.
- **DPR Blending Infrastructure:** The California DPR regulations require provisions to achieve a 10:1 dilution of a chemical contaminant spike in the influent. It is highly desirable to identify and consider the dilution capacity of any existing offsite LADWP facilities that may receive any DPR production water. If the 10:1 dilution requirement must be met exclusively within the HWRP, additional blending infrastructure of 20.5 to 22.4 MG would be needed for a 120-mgd DPR train.

1.8.6 Sidestream Treatment

- **Sidestream Treatment:** A standalone project will construct a full-scale sidestream treatment facility for HWRP's dewatering centrate stream for a more effective nitrogen removal.
- **Treatment Process**: Deammonification process is selected for implementation. Multiple technologies are under consideration for pilot testing and validation prior to full-scale implementation.

1.8.7 Support Facilities

- **Odor Control:** The recommended odor control technology is based on the two-stage BACT consisting of BTFs and carbon filters. It provides robust treatment capability for H_2S and other potential foul air constituents of concern.
- **Chemical Storage:** Two new chemical facilities are proposed for providing bulk storage of the various chemicals needed for the MBR and AWT processes. Referred to as the South Chemical Facility, a main facility for eight chemicals will be located at the south end of the site.
- **Electrical Demand:** New or modified facilities under Pure Water Los Angeles will result in a peak duty connected load of 156 MVA. Of these, the demand attributable to the AWT facilities is 53 percent or 83 MVA. Considering existing and recent modifications, HWRP's peak connected loads will be approximately 203 MVA following Program completion, which is substantially higher than existing levels. This assessment is subject to a further update based on LADWP's final determination of the desirable production capacity, quality of water, and siting of the AWT facilities.
- **HWRP Electrical Service**: A new or additional electrical service from LADWP will be required. The approach of providing a second service to augment the existing appears highly beneficial, resulting in a minimal impact on LADWP's power supply infrastructure and facilitate leveraging the existing service to the maximum extent.
- **Standby Power:** The PIP is developed based on an assumption that standby power will be provided to the wastewater treatment facilities but not the AWT. This approach is to be further evaluated in consideration of LADWP's goals.

1.8.8 Plant Hydraulics

- **Recycle Streams:** In general, major recycle streams have been accounted for in the sizing of liquid treatment processes.
- **PWWF Management:** Five scenarios have been evaluated to address a wide range of operational configurations under PWWF conditions. The scenarios address the current and ultimate build-out configurations as well as during construction of Pure Water Los Angeles facilities.
- **5-Mile Outfall:** The 5-mile outfall will be managed such that the discharge flows consistently exceed the minimum flow needed to achieve minimum initial dilution and to prevent seawater intrusion (~50 mgd). The waste streams to be discharged in this manner include several miscellaneous cooling water and backwash water streams from the secondary and AWT facilities, RO concentrate, and flows in excess of the AWT production. This approach avoids making modifications to the 5-mile outfall that will reduce its conveyance capacity.

Chapter 2

PROGRAM IMPLEMENTATION

2.1 Purpose

The goal of the Pure Water Los Angeles PIP for the HWRP is to develop a conceptual design basis for transforming the HWRP to an AWPF providing 100-percent wastewater recycling for potable reuse. The reuse targets are in accordance with the Mayoral direction given to the relevant city departments to implement 100-percent water recycling in the City to achieve a goal of 70 percent of drinking water being sourced locally. [LA Sustainability Plan, revision 2]. The conceptual design basis is conservative in that it maximizes the production of recycled water by locating all necessary advanced water purification steps at the HWRP. The final program definition in terms of capacity and advanced water purification processes remains to be determined upon completion of LADWP Pure Water Los Angeles Master Plan, coordination with regional agencies, and environmental review in accordance with California Environmental Quality Act/NEPA requirements.

The purpose of this chapter is to present how the Pure Water Los Angeles Program may be implemented at the HWRP in order to achieve the intended goals and maximize benefits. As such, it provides a recommended phasing and packaging approach for an efficient and effective program delivery. It also describes major challenges and risks that need to be further considered while the program matures and advances into next phases. Chapter 1 – Program Summary, among others, describes the individual elements (i.e., HWRP improvements) associated with the Pure Water Los Angeles Program.

2.2 Background

The Pure Water Los Angeles Program is a multi-billion-dollar investment that will transform City's largest WWTP into a world-class recycled water purification facility producing potable water. The City has established the following goals:

- Sourcing 70 percent of the City's drinking water locally.
- Maximize recycling of all wastewater for beneficial reuse.

Purification and reuse of water from the City's wastewater facilities, including the HWRP, is a critical supply component in meeting these water supply objectives. The magnitude of the multi-package construction effort envisioned, all taking place within the confines of an operating facility, combined with the advanced technologies of planned treatment systems that will be integrated with existing, as well as the different delivery methods likely to be employed, all result in a complex undertaking.

2.3 Treatment Process Overview

Figure 2.1 depicts the overall configuration of the existing wastewater treatment facilities at the HWRP. Currently, HWRP is operated as a full secondary treatment facility utilizing a HPOAS process with the majority of its effluent discharged to Santa Monica Bay through a 5-mile outfall.

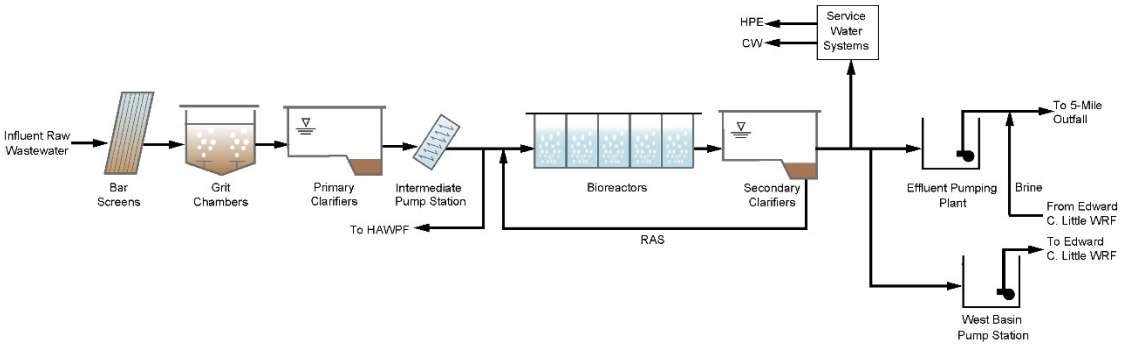


Figure 2.1 Existing Overall Wastewater Treatment Configuration

For comparison, Figure 2.2 presents the proposed configuration of the wastewater and advanced water treatment facilities to be implemented under Pure Water Los Angeles. By and large, the intended process improvements at the HWRP may be summarized as follows:

- Wastewater Treatment: The secondary treatment process will be upgraded from HPOAS to MBR to facilitate water reuse.
- AWT: Two separate treatment trains for DPR and IPR that each meet the water quality requirements commensurate with the application will be provided.

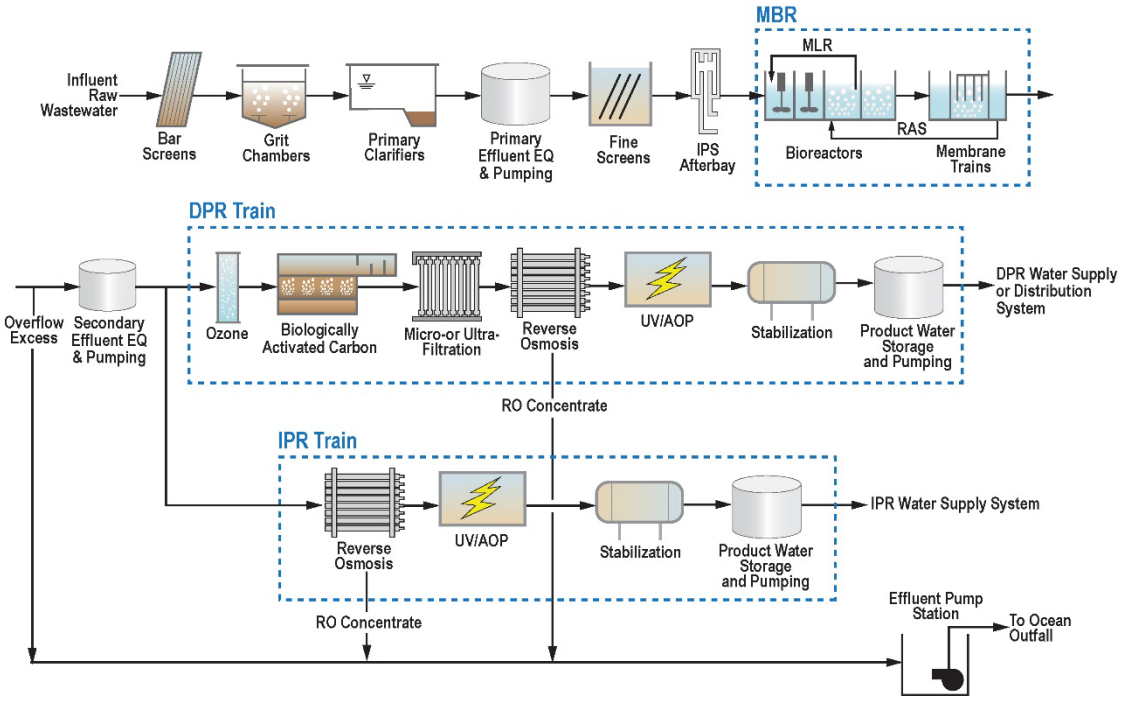


Figure 2.2 Proposed Wastewater and Advanced Water Treatment Configuration

In addition, the MBR facilities will be configured as two batteries, A and B, as shown in Figure 2.3. Each battery primarily consists of modules, membrane trains, and a dedicated blower building. The proposed configuration provides several benefits as follows:

- Provides symmetry and consistency in site layout.
- Provides more consistent performance and effluent quality by reducing the number of independent "plants" and combining mixed liquor from multiple modules.
- Provides greater overall reliability and operational flexibility by consolidating parallel trains.
- Facilitates implementation and construction phasing by defining grouping of facilities that are to be demolished, constructed, and commissioned together in a logical manner.
- Provides ability for an MBR facility expansion for Ultimate Build-Out when needed, as described in Chapter 1 – Program Summary.

2.4 Construction Phasing

Subject to further refinement, it is currently envisioned that at the HWRP, the Pure Water Los Angeles Program will be implemented in three distinct phases and via five construction packages. Factors that will affect LASAN and LADWP's considerations for the final program packaging and phasing may include projected demand for potable reuse water, construction cost and funding availability, schedule requirements, risk, and other feasibility assessment.

The following summarizes the conceptual implementation schedule for the program with key milestones:

- Phase 1 (inclusive of subphases 1A, 1B, and sidestream treatment):
  - Start of Design: June 2026.
  - Start of Construction: December 2028.
  - Construction Substantial Completion: December 2036.
- Phase 2:
  - Start of Design: July 2031.
  - Start of Construction: June 2036.
  - Construction Substantial Completion: November 2039.
- Phase 3:
  - Start of Design: May 2034.
  - Start of Construction: June 2039.
  - Construction Substantial Completion: To be determined at a later time.

Appendix A provides a more detailed schedule for the Program based on the scope of work described in Section 2.4. It should be noted that the schedule presented in the appendix is preliminary in nature and represents an optimistic scenario. As the program matures and its elements become better defined, the schedule would be refined to incorporate permitting, interagency coordination, and other requirements.

In concert with the PIP schedule development, an opinion of probable construction cost (OPCC) was prepared for each of the five construction packages. Appendix C presents a summary of each project's OPCC value while outlining the methodology, unit cost development, and assumptions used in their formulation.

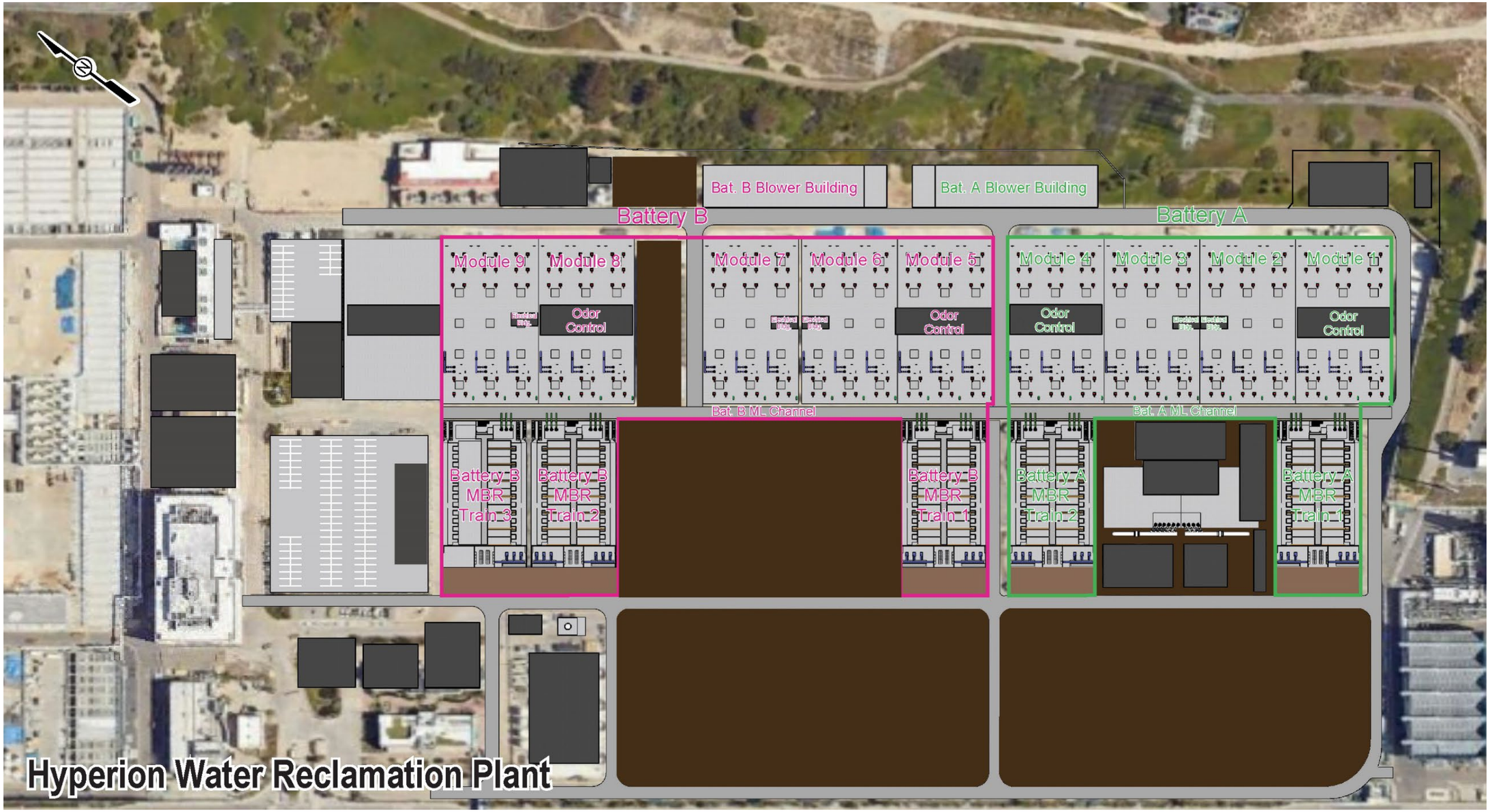


Figure 2.3 Proposed Secondary Plant Configuration

2.4.1 Phasing Overview

Table 2.1 summarizes the proposed construction phasing approach, by presenting how the treated water production capacities for the HPOAS, MBR, IPR, and DPR facilities will vary over the course of program implementation. As shown in the table and as currently envisioned, approximately 50 mgd of IPR product water will be produced by the end of Phase 1 estimated to be year 2036. Phase 2 will increase the IPR production capacity by 40 mgd. The entirety of the DPR facilities will be constructed in Phase 3, for a production capacity of 120 mgd. This information is graphically presented on Figure 2.4.

Table 2.1 Conceptual Construction Phasing[1]

Phase	Phase 1			Phase 2 40-mgd IPR (MBR Battery A2)	Phase 3 MBR Battery B and 120-mgd DPR
	1A Recycled Water Foundational Infrastructure	1B 50-mgd IPR (MBR Battery A1)	Sidestream Treatment[2] Facility		
Dry Weather HPOAS SE Production[3]	272	194	194	117	0
Dry Weather MBR Permeate Production[3,4]	0	78	78	155	272
IPR Production Capacity[4]	0	50	50	90	90
DPR Production Capacity[4]	0	0	0	0	120
Anticipated Completion[5]	2032	2036	2036	2039	To be determined

Notes:
(1) Based on an AWT design approach of providing separate IPR and DPR trains within HWRP.
(2) The Sidestream Treatment Facility Project is planned to be completed concurrently with Phase 1B.
(3) Based on an average annual flow of 272 mgd and excluding recycle flows.
(4) Excludes flows associated with the HAWPF.
(5) Estimated and subject to further refinement.

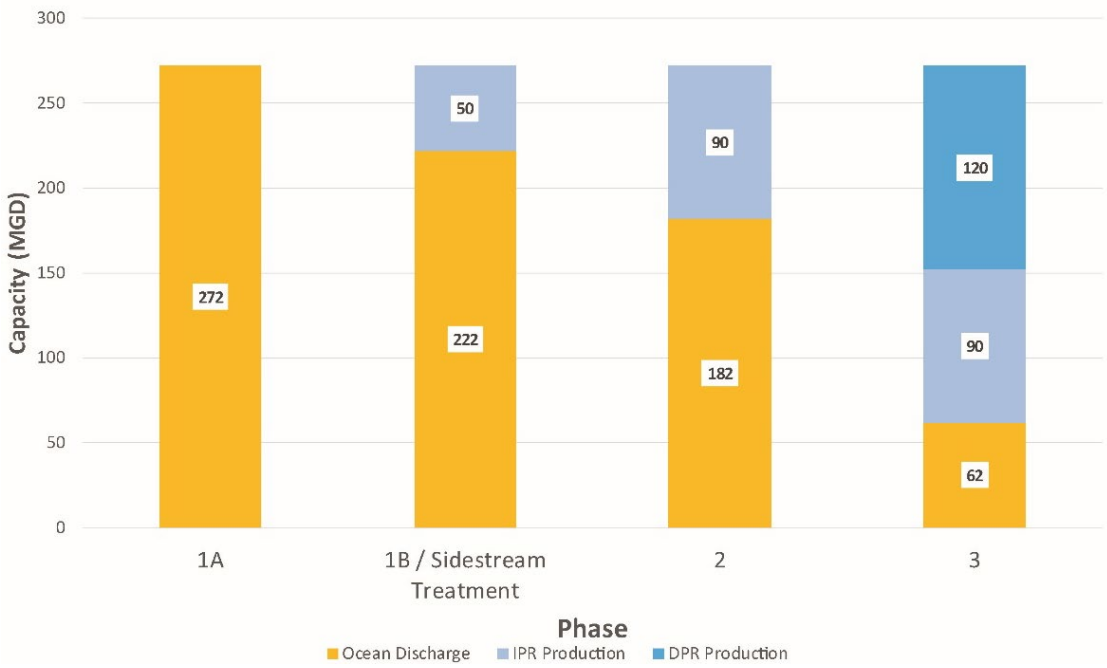


Figure 2.4 Dry Weather Ocean Discharge Versus Potable Water Reuse Over Program Implementation Duration

2.4.2 Phase 1A - Recycled Water Foundational Infrastructure

2.4.2.1 Objectives

Phase 1A is intended to expedite key support infrastructure in order to streamline the overall implementation of the Program. It primarily addresses PE EQ basins, IPS, fine screening, and associated support facilities.

2.4.2.2 Scope

Construction is concentrated around the areas of the existing IPS, the EPL, and the ESF. Once constructed, the PE EQ basins – with a 36.4-MG total storage – provide for a peak wet weather flow attenuation such that the downstream secondary treatment facilities can be sized to a maximum flow of 638 mgd, rather than 740 mgd. The secondary process will continue operation as an HPOAS system. Table 2.2 summarizes the major elements for Phase 1A. Figure 2.5 and Figure 2.6 show the conceptual site plans for Phase 1A.

Table 2.2 Major Elements for Phase 1A

Facility	Rehabilitate/ Retrofit	Demolition	New Construction	Remarks
IPS	✓ (Afterbay Only)	✓ (All Excluding Afterbay)	✓	A new IPS will replace existing. The existing afterbay will be retrofitted to continue functioning as a flow splitter box.
PE EQ Basin - East			✓	To be attached to the new IPS and providing 6.4-MG storage. Includes a return pump station.
Module 10 EQ			✓	Provides 9.7-MG storage. May operate as a single hydraulic system with the PE EQ Basin - East.
PE EQ Basin - West			✓	Provides 14.4-MG storage. Includes a return pump station.
Fine Screening Facility			✓	
Odor Control Facility		✓	✓	Relocation of existing odor scrubbers at the EPL to the new odor control facility is being considered.
Electrical Substation 1			✓	
Standby Generator Facility IPS			✓	
Abandoned Conventional Digesters		✓		Total of 11 digesters will be demolished: 1A through 6A at Battery A and 1C through 5C at Battery C
Carver Greenfield Building		✓		Abandoned
EPL		✓		Located north of Module 9
ESF		✓		Located west of EPL
Power and Blower Building		✓		Abandoned
Old Laboratory		✓		Abandoned

2.4.2.3 Implementation

Construction is anticipated to start in December 2028 and complete by June 2032.

Figure 2.5 Conceptual Site Plan - Phase 1A

Figure 2.6 Conceptual Site Plan - Phase 1A Southern Half

2.4.3 Phase 1B - 50-mgd IPR (MBR Battery A1)

2.4.3.1 Objectives

Phase 1B is intended to construct the southern half of Secondary Treatment Battery A to initiate the MBR conversion and to construct approximately half of the IPR treatment facilities to expedite the production of IPR product water. It represents the first of the three packages intended for the MBR conversion.

2.4.3.2 Scope

Figure 2.7 and Figure 2.8 show the conceptual site plans for Phase 1B. Construction is primarily concentrated around the areas vacated by the demolition of Secondary Clarifiers 1A-2D. Additional space will be made available along the east side of the plant by demolishing the existing retaining wall and cutting into the hillside between the plant and the residential communities in El Segundo.

Table 2.3 shows the major facilities that are included in the scope of Phase 1B.

Table 2.3 Major Elements for Phase 1B

Facility	Rehabilitate/ Retrofit	Demolition	New Construction	Temporary Facility	Remarks
Battery A Aeration Blower Building[(1)]			✓		The building is intended to house all blowers for MBR Battery A. The building will be constructed in this phase, but only the equipment for MBR Train A1 will be installed. Requires constructing a new retaining wall.
Battery A Electrical Building 1[(1)]			✓		
Battery A Membrane Train 1[(1)]			✓		
Battery A ML Channel (southern half)[(1)]			✓		
Battery A Odor Control Facility 1[(1)]			✓		Located on top of Module 1.
SE EQ (southern half)			✓		
Electrical Substation 2			✓		Located on top of SE EQ.

Facility	Rehabilitate/ Retrofit	Demolition	New Construction	Temporary Facility	Remarks
Battery A Standby Generator Facility			✓		
UCF			✓		Requires constructing a new retaining wall.
South Chemical Facility			✓		Provides storage for 8 chemicals. Supports both MBR and AWT facilities.
IPR RO/UV-AOP Building			✓		A common building will house RO and UV-AOP equipment for Phase 1B and Phase 2.
TSF No. 2			✓		Located in the area of Old Laboratory
Modules 1 and 2	✓				
West Basin Pump Station	✓				To be retrofitted to serve as the IPR product water pump station.
Electrical Building for Modules 1 and 2		✓			
Secondary Clarifiers 1A through 2D		✓			Creates approximately 5 acres of space for new construction.
Vent Scrubber System for Modules 3-4				✓	Existing equipment may be relocated from Module 2 to either Module 3 or 4.
IPR Post Treatment				✓	Temporary post treatment is necessary until a permanent post treatment facility is constructed.
Oxygen for Modules 5-9[(2)]				✓	For Post-Phase 1B: Modules 3-4 would be out of service for MBR conversion in Phase 2.

Notes:

(1) When completed, Battery A will consist of Modules 1-4, Membrane Trains A1 & A2, a blower building, and associated support facilities.

(2) Once Modules 3 and 4 are taken offline for conversion, a temporary oxygen generation facility may be required to meet the needs of the remaining HPOAS modules. An alternative solution is to purchase oxygen from Phase 1B to the decommissioning of the final HPOAS module in Phase 3. See Section 2.5.3 for more information.

Figure 2.7 Conceptual Site Plan - Phase 1B (with Sidestream Treatment Facility)

Figure 2.8 Conceptual Site Plan - Phase 1B Southern Half

2.4.3.3 Implementation

Construction is anticipated to start in December 2031 and complete by December 2036. Following this phase, the MBR permeate production will increase up to approximately 78 mgd under normal dry weather conditions, which will be sufficient for supporting the initial 50-mgd IPR production.

2.4.4 Sidestream Treatment Facility

2.4.4.1 Objectives

A sidestream treatment of dewatering centrate is found to provide significant technical and economic benefits to the HWRP. The proposed sidestream treatment will materially reduce the ammonia and total nitrogen loads in the secondary process. Consequently, the sidestream treatment is expected to reduce process air demand at the biological nutrient removal basins and provide a potential for meeting more stringent effluent nitrate requirement in the future. In addition, primary treatment performance may also improve due to the reduced influent total suspended solids and reduction in the active mass biomass present in the primary clarifiers.

2.4.4.2 Scope and Implementation

Shown on Figure 2.9, a new sidestream treatment facility is proposed and will be situated in the area of existing abandoned Conventional Digester Battery C. To facilitate this work and to leverage Phase 1A construction that will include demolition of 7 adjacent digesters, the demolition of 4 Battery C Digesters associated with the sidestream treatment facility siting will be performed in Phase 1A. All six Battery B Digesters will be demolished under a separate project, CIP 2528, to prepare for the construction of a new flare facility within the area.

Table 2.4 shows the major elements for a stand-alone project that will construct the sidestream facility.

Table 2.4 Major Elements for Sidestream Treatment Facility

Facility	Rehabilitate/ Retrofit	Demolition	New Construction	Temporary Facility	Remarks
Sidestream Treatment Facility			✓		A sidestream treatment pilot will test two or three manufacturers side by side to document performance and define comparable design criteria for the full-scale facility.
Sidestream Treatment Odor Control			✓		

Although currently envisioned as separate contractual packages, the construction of the sidestream treatment facility is expected to be performed concurrently with that of Phase 1B, allowing the startup of the sidestream treatment facility to be completed concurrently or prior to that of the first MBR train in Phase 1B in 2035-2036. In support of this approach, the proposed three-step process consisting of technology screening, pilot testing, and progressive design build project for a full-scale facility indicates an implementation schedule of approximately 9 years for a December 2033 completion.

Currently, the first project is underway to collect data from short-listed vendors and develop design criteria for the full-scale facility including optimization of O&M parameters. Construction and testing of the pilot facility will follow and is anticipated to take place from July 2026 to March 2029.

Following the pilot testing, the full-scale facility will be designed and constructed via a progressive design-build approach. Anticipated milestones include conceptual design completion by August 2029; bidding and award of the progressive design-builder entity by August 2030; design by December 2031; and construction and startup by December 2033.

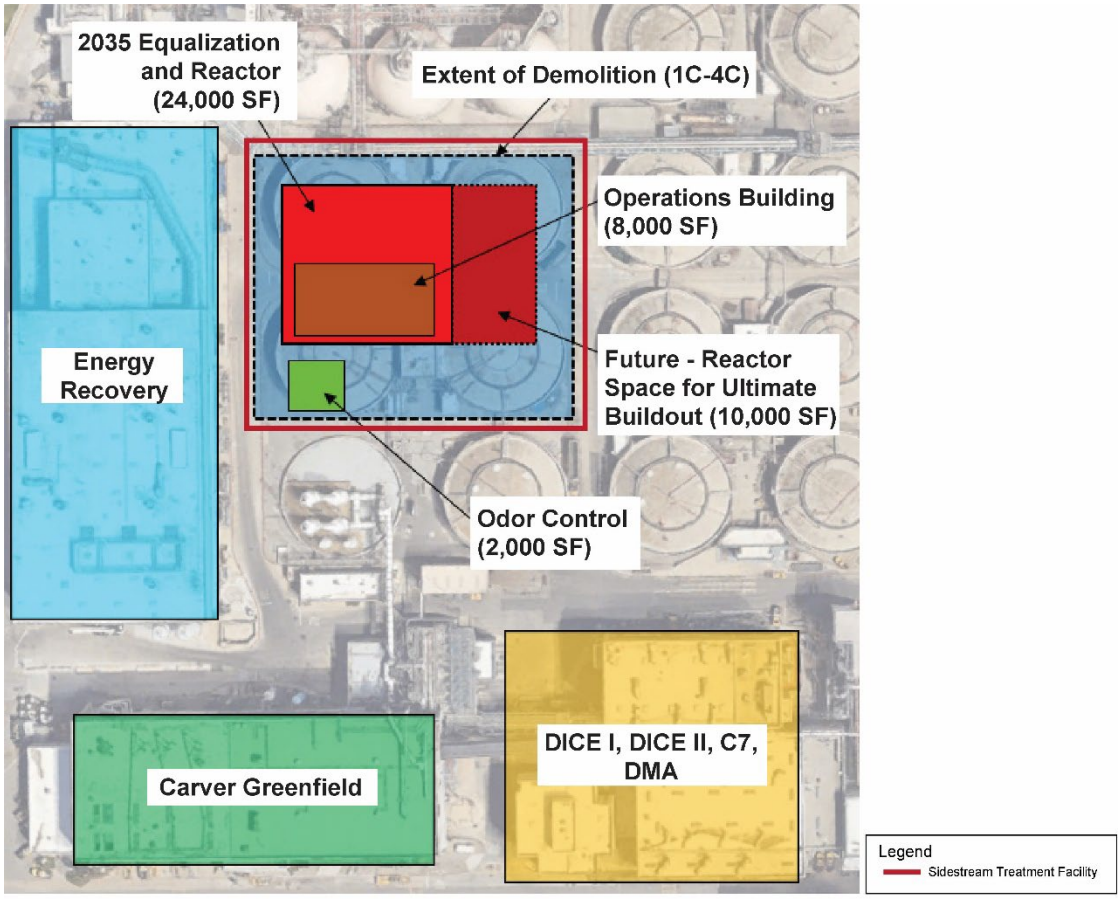


Figure 2.9 Sidestream Treatment Facility

2.4.5 Phase 2 - 40-mgd IPR (MBR Battery A2)

2.4.5.1 Objectives

Phase 2 is intended to construct the northern half of Secondary Treatment Battery A to increase the MBR permeate production and to complete the remaining IPR treatment train. It marks the fourth of the five overall packages and is the second package intended for the MBR conversion. The IPR train expansion will provide an additional 40-mgd capacity, for a 90-mgd total production capacity.

2.4.5.2 Scope

Figure 2.10 and Figure 2.11 show the conceptual site plans for Phase 2. Construction is primarily concentrated around the areas vacated by the demolition of Secondary Clarifiers 3A-4D.

Table 2.5 shows the major facilities in the scope of Phase 2.

Table 2.5 Major Elements for Phase 2

Facility	Rehabilitate/ Retrofit	Demolition	New Construction	Temporary Facility	Remarks
Blower System for Modules 3 and 4			✓		Installed in Battery A Blower Building constructed in Phase 1B.
Battery A Electrical Building 2			✓		
Battery A Membrane Train 2			✓		
Battery A ML Channel (northern half)			✓		
Battery A Odor Control Facility 2			✓		Located on top of Module 4.
SE EQ (northern half)			✓		
Battery A Odor Control Facility 3			✓		Serves Membrane Trains A1 and A2.
Additional IPR RO/UV-AOP trains			✓		Located in IPR RO/UV-AOP Building constructed in Phase 1B.
Electrical Substation RO/UV-AOP South			✓		
Post Treatment Facility			✓		Initially to serve IPR train only.
Modules 3 and 4	✓				
Electrical Building for Modules 3 and 4		✓			
Secondary Clarifiers 3A through 4D		✓			Creates approximately 5 acres of space for new construction.
Oxygen for Modules 5-9(1)				✓	Modules 3-4 would be out of service for MBR conversion in Phase 2.

Notes:
(1) Once Modules 3 and 4 are taken offline for construction, a temporary oxygen generation facility may be required to meet the needs of the remaining HPOAS modules. An alternative solution is to purchase oxygen from Phase 1B to the decommissioning of the final HPOAS module in Phase 3. See Section 2.5.3 for additional information.

Figure 2.10 Conceptual Site Plan - Phase 2

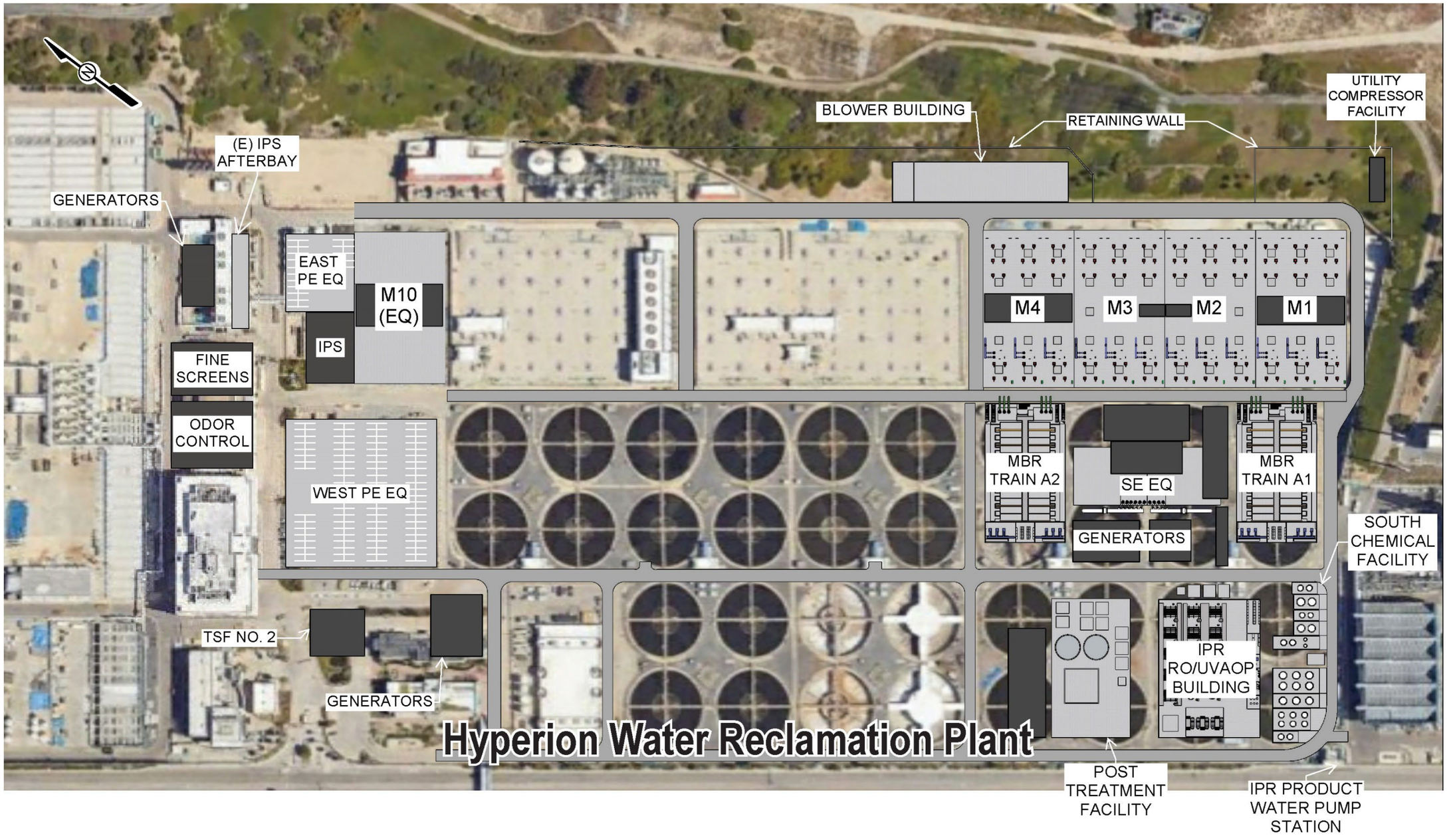


Figure 2.11 Conceptual Site Plan - Phase 2 Southern Half

2.4.5.3 Implementation

Construction is anticipated to start in June 2036 and be completed by November 2039. Following this phase, the MBR permeate production will increase up to approximately 155 mgd under normal dry weather conditions, and the IPR production capacity will increase to its intended maximum of 90 mgd.

2.4.6 Phase 3 - MBR Battery B and 120-mgd DPR

2.4.6.1 Objectives

Phase 3 is intended to construct the entirety of Secondary Treatment Battery B and the DPR train. As a final construction phase, it represents the last step in completing the MBR conversion.

2.4.6.2 Scope

Figure 2.12 and Figure 2.13 show the conceptual site plans for Phase 3. Construction is primarily concentrated around the areas vacated by the demolition of Secondary Clarifiers 5A-9D. Table 2.6 shows the major elements of Phase 3.

Table 2.6 Major Elements for Phase 3

Facility	Rehabilitate/ Retrofit	Demolition	New Construction	Temporary Facility	Remarks
Battery B Blower Building[(1)]			✓		
Battery B Electrical Buildings 1 and 2[(1)]			✓		
Battery B Membrane Trains 1, 2, and 3[(1)]			✓		
Battery B ML Channel[(1)]			✓		
Battery B Odor Control Facilities 1 and 2[(1)]			✓		
Standby Generator Facility North			✓		Located at the Old Laboratory area.
Ozone Contactors			✓		Required for DPR
Ozone Generation Building			✓		Required for DPR
LOX Generation and Storage			✓		Required for DPR
BAC Filters			✓		Required for DPR
MF Facility and Building			✓		Required for DPR
DPR RO/UV-AOP Building			✓		Required for DPR
Post Treatment Systems			✓		DPR equipment to be installed at the Post Treatment Facility constructed in Phase 2. Supports both IPR and DPR facilities

Facility	Rehabilitate/ Retrofit	Demolition	New Construction	Temporary Facility	Remarks
DPR Product Water Storage, Blending Infrastructure, and Pump Station(2)			✓		Required for DPR
Electrical Substation RO/UV-AOP North			✓		
SWF			✓		
Modules 5-9	✓				The conversion of the modules will take place in three distinct steps, with no more than 2 modules being out of service at a time.
Main Switch Yard	✓				Tentative and pending condition assessment results from TOS SN-152, HWRP Electrical Systems Evaluation
Main Switch Yard No.2			✓		If needed for receiving a second electrical service from LADWP
Electrical Building for Modules 5 and 6		✓			
Electrical Building for Modules 7 and 8		✓			
Secondary Clarifiers 5A through 9D		✓			Creates approximately 12 acres of space for new construction.
OGF and associated Compressor Building		✓			
SWF, SWF Substation, and SWF Standby Generator		✓			
Purchase oxygen for any remaining HPOAS Modules(3)				✓	
Odor control to Module 7				✓	

Notes:
(1) Battery B will consist of Modules 5-9, Membrane Trains B1, B2, & B3, a blower building, and associated support facilities.
(2) The requirements and functionality of the blending infrastructure may be more effectively provided by existing offsite LADWP facilities (i.e., raw water or treated water reservoirs) that would receive any DPR product water. Refer to Chapter 1, Section 1.6.3, for additional information.
(3) Once Modules 3 and 4 are taken offline for conversion, a temporary oxygen generation facility may be required to meet the needs of the remaining HPOAS modules. An alternative solution is to purchase oxygen from Phase 1B to the decommissioning of the final HPOAS module in Phase 3. See Section 2.5.3 for more information.

Figure 2.12 Conceptual Site Plan - Phase 3

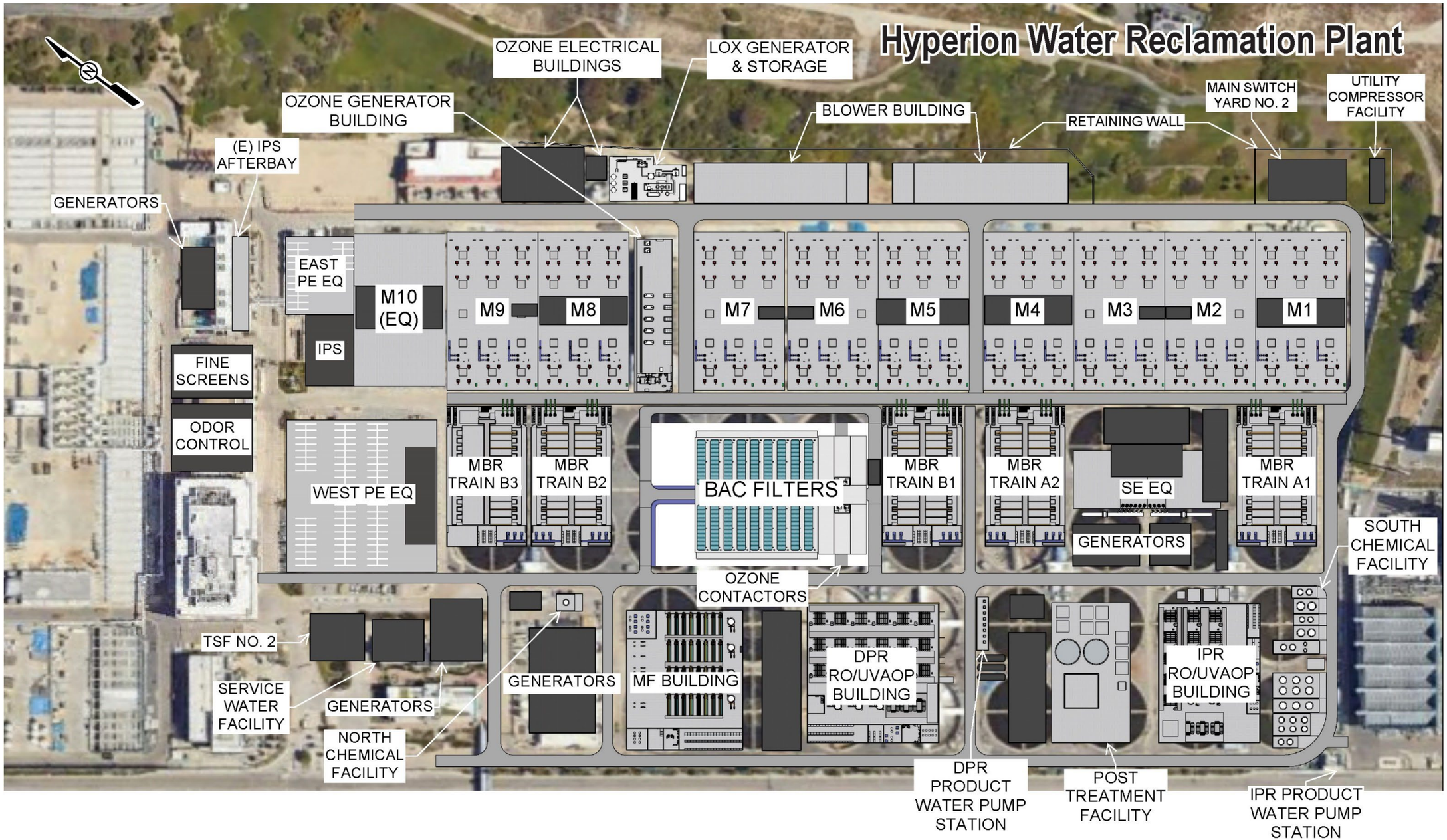


Figure 2.13 Conceptual Site Plan - Phase 3 Southern Half

2.4.6.3 Implementation

Construction is anticipated to start in June 2039. New construction in this phase is significantly more expansive than in the previous stages due to the DPR facilities, so the estimated construction duration is forecasted to be over 12 years. Phase 3 marks the end of the Program and will result in a final MBR production capacity of 272 mgd under AAF conditions, an IPR production capacity of 90 mgd, and a DPR production capacity of 120 mgd. Due to the magnitude of the project, the anticipated timeline for substantial completion will be determined at a later time.

2.5 Preliminary Construction Sequencing Plan

This section provides a potential, high-level sequence of construction envisioned for each construction package. The sequence of construction is intended to provide a logical order of construction that consolidates associated activities, improves construction efficiency, facilitates testing and startup, and optimizes construction duration. The section also describes various factors and interdependencies that affect construction sequencing concepts.

2.5.1 Major Construction Sequencing Constraints

Based on an initial analysis, several conditions and requirements at the HWRP constrain the sequence of the Pure Water Los Angeles construction as follows:

- **Maintain Function:** Existing facilities cannot be demolished until new facilities are constructed to replace the function of existing facilities. For example, the existing IPS cannot be demolished until the new IPS is constructed, tested, and made fully operational.
- **Maintain Plant Capacity:** The current NPDES permit for HWRP (No. CA0109991 issued on March 17, 2023) alludes that the plant would need to meet a peak wet weather flow of 740 mgd from the onset of Pure Water Los Angeles construction. Subject to confirmation with the RWQCB and to be incorporated into the 2028 permit as part of the permit renewal process, this peak wet weather capacity must be maintained throughout each project. During the conversion from HPOAS to MBR, the plant will lose the capacity associated with the modules to be taken out of service. A maximum of two modules are planned to be shut down and rehabilitated at a time to maintain the 740-mgd capacity, leaving up to seven modules in service. Once completed in Phase 1A, the PE EQ basins will effectively reduce the required peak wet weather capacity for the downstream secondary process from 740 to 638 mgd by attenuating peak storm flows. This further allows handling 740-mgd influent flows by allowing a third module to be out of service if needed due to maintenance (i.e., with six modules in service).
- **Chemical Facilities**: Various membrane systems in the MBR and AWT facilities require periodic chemical cleaning for maintenance purposes. As a result, when starting up membrane systems, the associated chemical storage and feed systems must be made operational concurrently.
- **Instrument Air System**: Numerous valves in the MBR and AWT facilities are pneumatically actuated to achieve fast actuation and to reduce capital and operational cost. These pneumatically actuated valves necessitate a reliable and robust instrument air supply. As a result, before starting up MBR and AWT systems, the capacity and reliability of the plant instrument air system must be adequately addressed.

- **Odor Control:** Odor control must be available for immediate operation to serve new or modified wastewater treatment facilities. When the permanent odor control for a facility has not been constructed prior to the facility's planned startup and commissioning, temporary odor control must be provided until permanent odor control is established.
- **Electrical Facilities:** Similar to odor control, new wastewater treatment facilities must have both electrical utility service and standby power capabilities at startup and commissioning. Provisions for temporary service and/or standby generators must be provided if the permanent electrical facilities are not yet available when a facility is completed.
- **Minimum Outfall Flow:** A minimum flow of ~50 mgd must be maintained in the five-mile outfall at all times to maintain minimum dilution and prevent seawater intrusion. With the proposed reuse of HWRP's effluent, the flows being conveyed through the outfall for ocean disposal will decrease in a step-wise fashion as the program progresses. RO concentrate, miscellaneous cooling and backwash water, and SE in excess of the AWT treatment capacity will be discharged in this manner to help meet the minimum flow requirement.

2.5.2 Overall Construction Sequence

This section outlines a potential construction sequence for each of the five construction packages. The information contained in this section is considered preliminary in nature and will be subject to further refinement as the program progresses and the relationships between different elements with an individual project scope become better defined. Appendix D also contains the preliminary construction sequences for each phase as discussed in the next sections.

2.5.2.1 Phase 1A – Recycled Water Foundational Infrastructure

Figure 2.14 shows a preliminary overall sequence for constructing the Phase 1A facilities. The following summarizes key conclusions from developing the proposed sequence of construction:

- In general, due to site constraints, existing facilities will be demolished early in order to create space for contractor staging and laydown areas as well as for new construction.
- The demolition of the abandoned digesters and the construction of the PE EQ basins appear highly interconnected and rather synergistic for the following reasons.
  - The construction of the PE EQ basins, in particular the East and Module 10 EQ's will result in a significant soil surplus whereas the digester demolition will require a large soil volume for backfill.
  - The demo of the digesters will generate a significant volume of recyclable concrete, which may be used as a base material for subsurface preparation prior to EQ bottom slab construction. This will be the case whether the digesters are demolished in their entireties or demolished in a manner that abandons the existing foundation in place.
- Appropriate grouping of new process facilities will streamline startup and commissioning.
  - A prime example is concurrent startup of East PE EQ, Mod 10 EQ, IPS, Fine Screening, and Odor Control.
- The West PE EQ will be constructed after the East PE EQ so that the existing ESF can remain in place until the East PE EQ is completed and made operational.

- The existing IPS forebay will be demolished after the new IPS is constructed and made operational.
- The Standby Generator Facility will be constructed last after the existing IPS forebay is demolished.

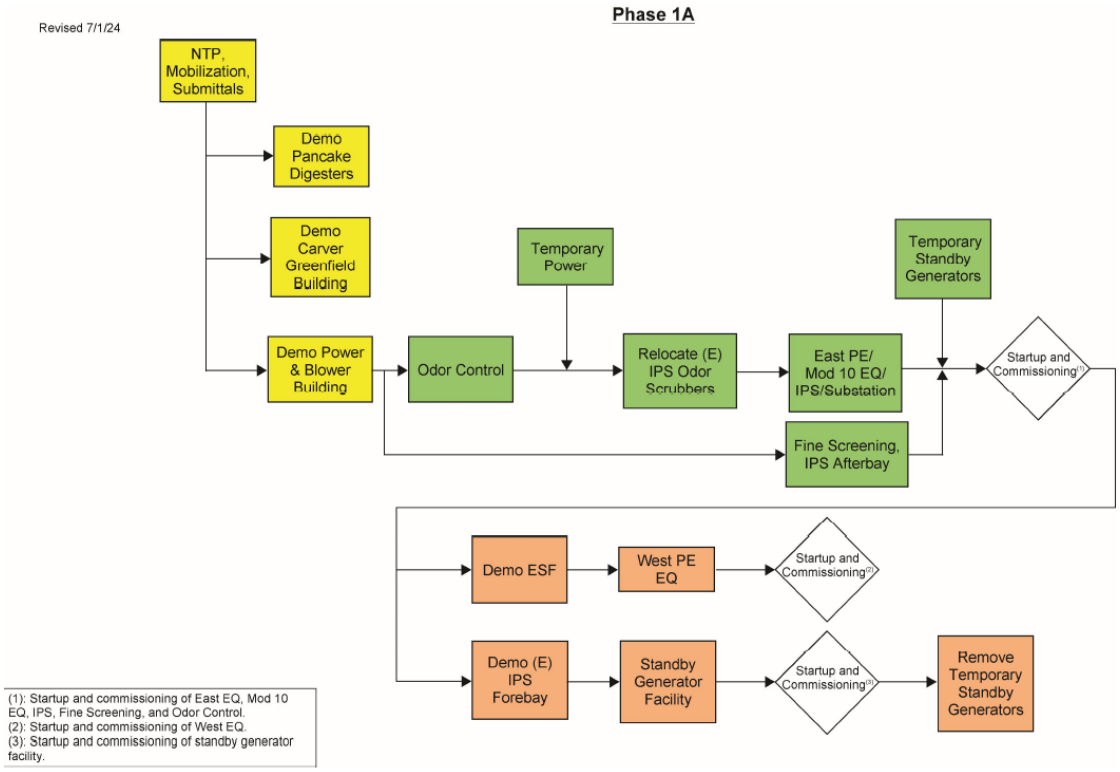


Figure 2.14 Phase 1A Preliminary Overall Construction Sequence

2.5.2.2 Phase 1B – 50-mgd IPR (MBR Battery A1)

Figure 2.15 shows a preliminary overall construction sequence for Phase 1B. The following summarizes key conclusions from developing this sequence of construction:

- Secondary Clarifiers 1A-2D will be demolished early in order to create space for new construction.
- The demolition of the secondary clarifiers and cutting into the hillside for new retaining walls and appear highly interconnected and rather synergistic for the following reasons:
  - Cutting into the hillside for new retaining walls will result in a significant soil surplus whereas the clarifier demolition will require a large soil volume for backfill.
  - The demo of the retaining walls will generate a fair amount of recyclable concrete, which may be used as a base material for subsurface preparation prior to bottom slab construction for new construction including Membrane Train A1.

- Appropriate grouping of new and rehabilitated process facilities will streamline startup and commissioning.
  - A prime example is concurrent startup of Modules 1 & 2, MBR Train A1, Battery A Blower Building, odor control, and South Chemical Facility.
  - SE EQ, IPR RO/UV-AOP Building, IPR post treatment, and IPR product water pump station (i.e., West Basin Pump Station) should also be started up together.
- The construction of the IPR train should follow that of the MBR train. Demolition of Old Laboratory may be expedited for providing additional areas for contractor staging and laydown purposes.

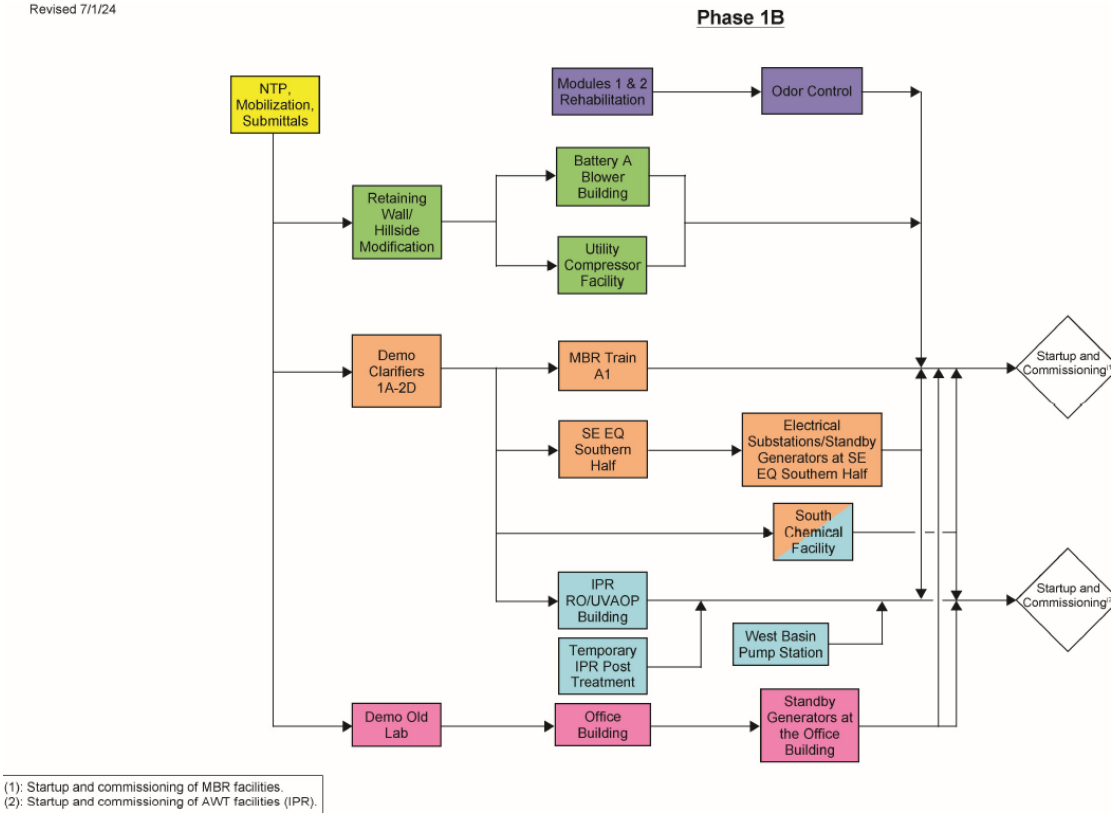


Figure 2.15 Phase 1B Preliminary Overall Construction Sequence

2.5.2.3 Sidestream Treatment

Figure 2.16 shows a preliminary overall construction sequence for the sidestream treatment facility. The following summarizes key conclusions from developing the proposed sequence of construction:

- Battery C Digesters will be demolished early in order to create space for new construction.
- All new process facilities should be started up concurrently for streamlined commissioning. They include sidestream EQ tank, sidestream treatment building, odor control, and chemical systems.

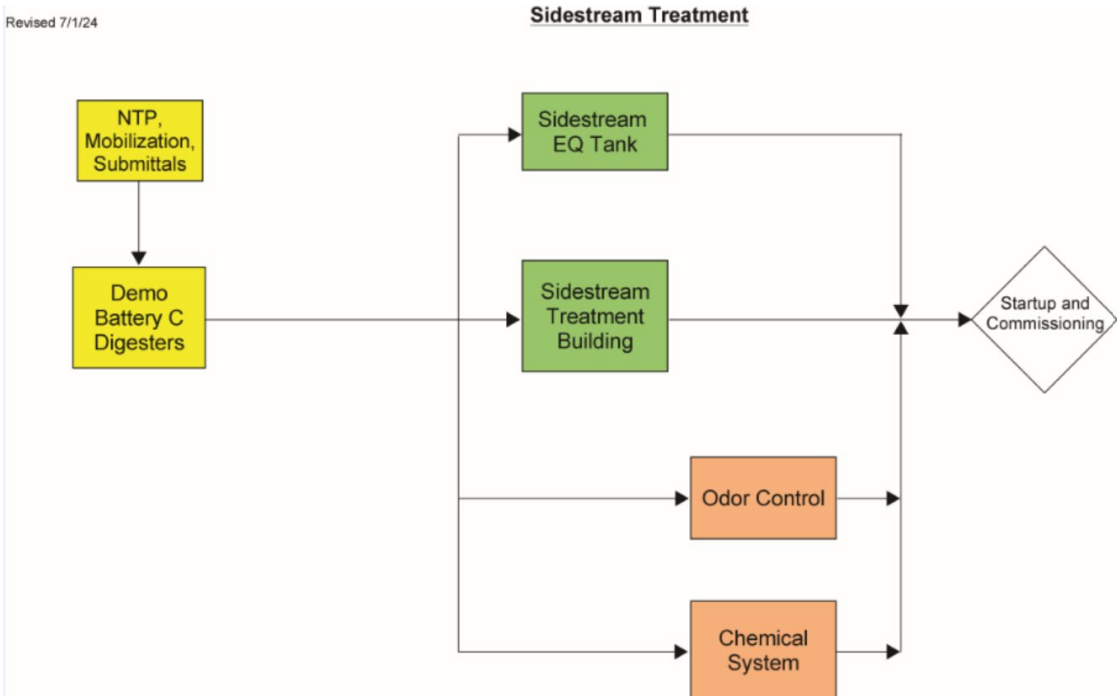


Figure 2.16 Sidestream Treatment Preliminary Overall Construction Sequence

2.5.2.4 Phase 2 – 40-mgd IPR (MBR Battery A2)

Figure 2.17 shows a preliminary overall construction sequence for Phase 2. The following summarizes key conclusions from developing this sequence of construction:

- Secondary Clarifiers 3A-4D will be demolished early in order to create space for new construction.
- Appropriate grouping of new and rehabilitated process facilities will streamline startup and commissioning.
  - A prime example is concurrent startup of Modules 3 & 4, MBR Train A2, odor control, and additional blowers.
  - SE EQ expansion, IPR RO/UV-AOP equipment, and IPR post treatment should also be started up together.
  - The startup of the IPR train should follow that of the MBR train.

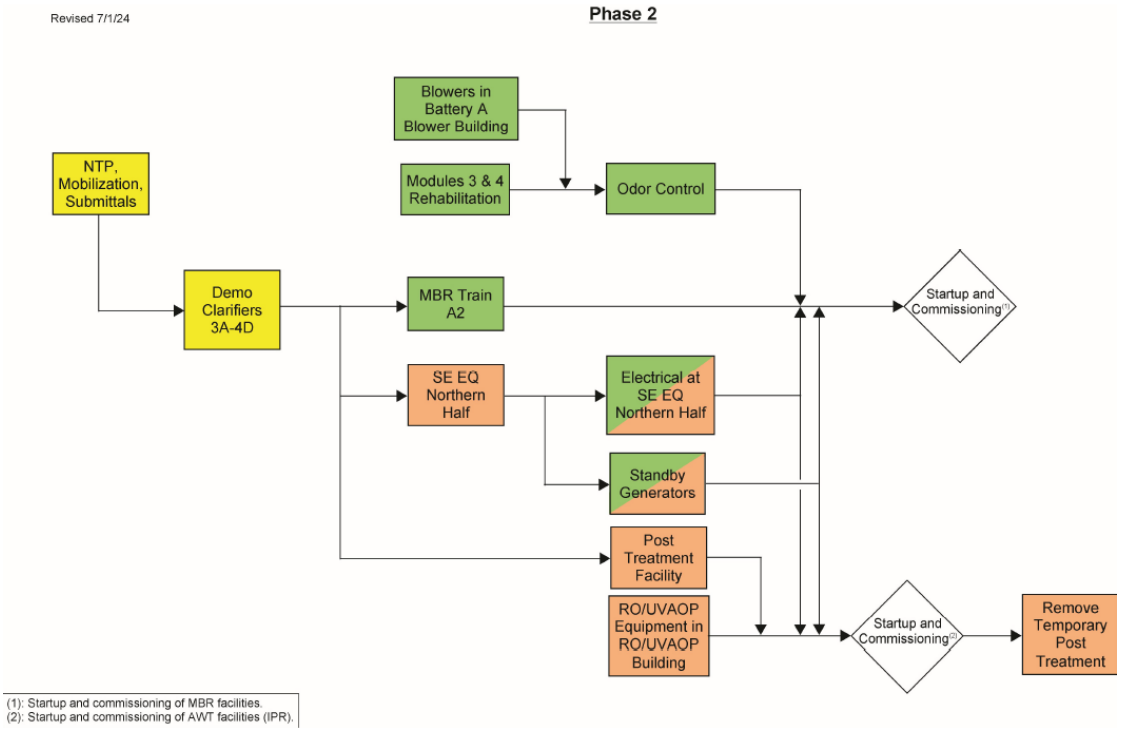


Figure 2.17 Phase 2 Preliminary Overall Construction Sequence

2.5.2.5 Phase 3 – MBR Battery B and 120-mgd DPR

Figure 2.18 shows a preliminary construction sequence for Phase 3. The following summarizes key conclusions from developing this sequence of construction:

- Rehabilitation of Modules 5-9 will be completed in three steps in order to limit the shutdown to no more than 2 modules at a time.
- The three steps will likely follow the configuration of the existing electrical infrastructure as shown on Figure 2.19 and will be as follows. Demolition of Secondary Clarifiers 5A-9D will be coordinated with the module rehabilitations such that those modules and clarifiers that are powered by a common electrical building will be taken out of service concurrently. This approach will avoid providing temporary power for existing facilities are slated to be demolished and are no longer needed from an interim treatment capacity standpoint.
  - Modules 5-6 & Secondary Clarifiers 5A-6D (all powered by an electrical building on top of Module 6), followed by
  - Modules 8-9 & Secondary Clarifiers 9A-9D (all powered by an electrical building on top of Module 9), followed by
  - Modules 7 & Secondary Clarifiers 7A-8D (all powered by an electrical building on top of Module 7).

- Appropriate grouping of new and rehabilitated process facilities will streamline startup and commissioning.
  - Modules 5 & 6, MBR Train B1, odor control, and Battery B Blower Building should be started up together.
  - Modules 9, MBR Train B3, odor control, and additional Battery B blowers should be started up together.
  - Modules 7 & 8, MBR Train B2, odor control, and additional Battery B blowers should be started up together.
  - All treatment facilities associated with the DPR train should be started up within a common test period. They consist of ozone, BAC, MF, RO, UV-AOP, post treatment, and product water pumping.
  - In general, the startup of the DPR train should follow those of the MBR trains.
- The startup of the SWF should follow that of the MBR trains.

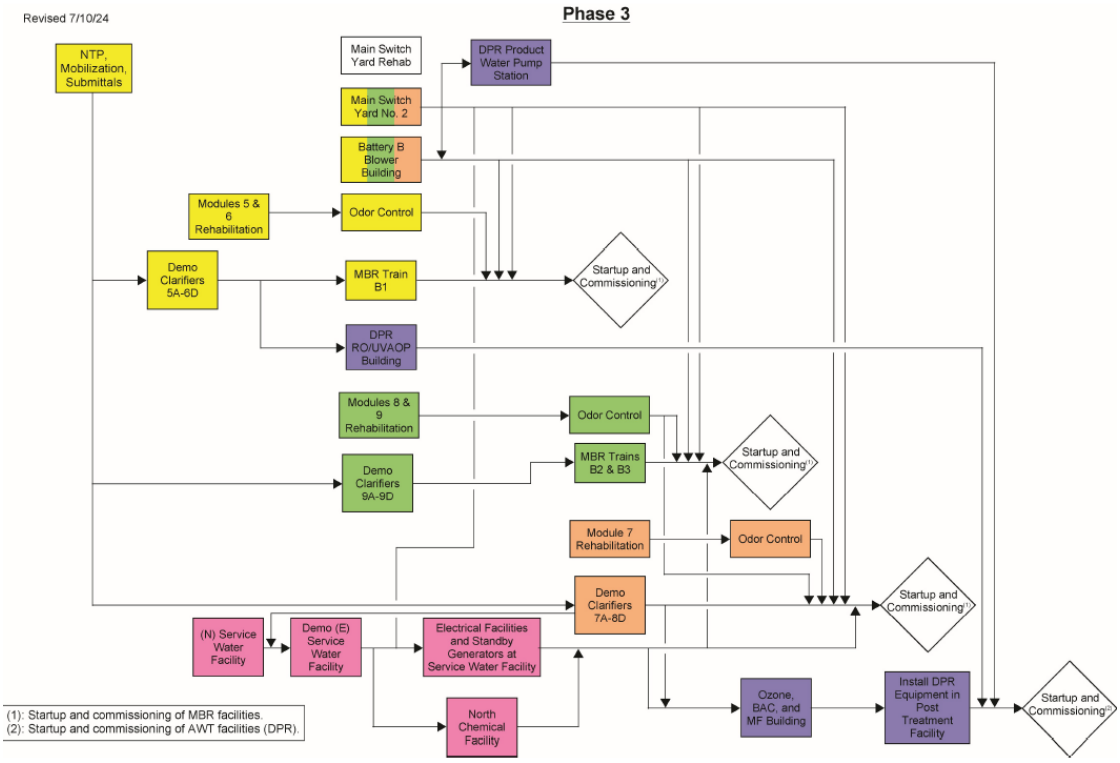


Figure 2.18 Phase 3 Preliminary Overall Proposed Construction Sequence

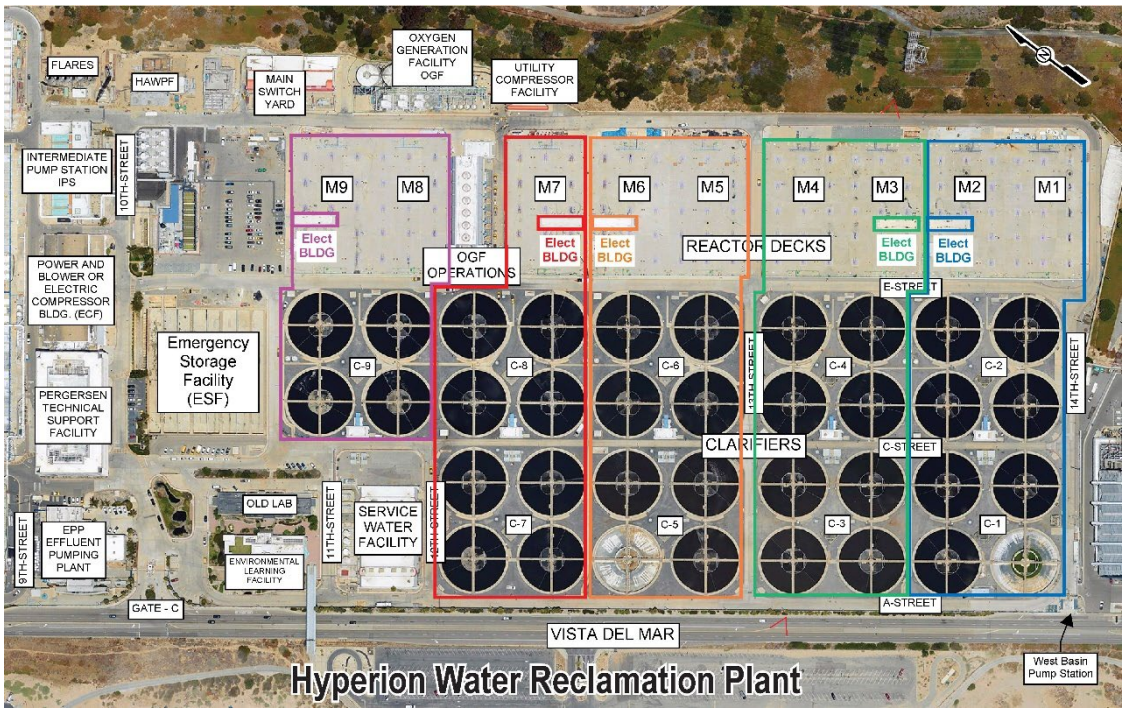


Figure 2.19 Existing Electrical System Configurations for Mod 1-9 and Associated Clarifiers

2.5.3 Temporary Facilities

During the course of the program, due to various constraints such as space availability and existing infrastructure limitations, several existing and new facilities are expected to require temporary systems in order to maintain operability of the plant. A preliminary list of temporary facilities is provided below:

- **Standby Generators in Phase 1A:**
  - During Phase 1A, once the existing IPS forebay is demolished, the area will be utilized to situate a standby generator facility that supports all Phase 1A facilities, including the new IPS. However, the new IPS must be constructed and made fully operational prior to demolishing the existing IPS forebay. Consequently, the new IPS and other Phase 1 facilities necessitate temporary standby generators until the permanent standby generator facility is constructed. The temporary generators may be located in the space occupied by the existing flare facility. Located immediately east of the existing IPS, the flare facility is slated to be demolished by CIP 2520 HWRP Flare Replacement Project in 2029, several years before the temporary standby generator facility will be needed.
- **Odor Control in Phases 1B and 3:**
  - During Phase 1B, Modules 1 and 2 will be removed from service for conversion into MBR-service bioreactors. Shown in Figure 2.20, a common vent scrubber building for Modules 1 through 4 is located on top of Module 2. Hence, when Module 2 is under rehabilitation, Modules 3 and 4 will lose this service. While Modules 3 and 4 remain in HPOAS service (i.e., until they are removed out of service in Phase 2), temporary vent scrubbers will be required.

  - Similarly, in Phase 3, when the existing vent scrubber building on top of Module 6 is removed, temporary odor control will be needed for Module 7 until the latter is taken out of HPOAS service. Also a similar situation will occur when the existing vent scrubber building on top of Module 9 is removed. At this point in time, temporary odor control will be needed for Module 8 until it is taken out of HPOAS service.
- **HPO Production:**
  - For HPOAS process, HPO is generated onsite at the existing cryogenic facility east of Module 8 (labelled Oxygen Generation Facility on Figure 2.19). During the course of the program as the modules are converted from HPOAS to air-activated sludge, there will be a declining demand for HPO. Table 2.7 shows the projected HPO consumption during each phase of the MBR conversion. After Phase 1B, the average HPO demand will be equal to or less than the minimum production capacity of the existing cryogenic facility when 29 percent of the SE will be MBR permeate. At this point, unless offsite use is identified for excess HPO generated onsite, the existing cryogenic facility may no longer adequately support the remaining HPOAS modules, and oxygen would need to be purchased instead. This would continue from Phase 1B until the final HPOAS module is taken offline in Phase 3.
- **Post Treatment System for IPR:**
  - A common permanent post treatment facility is planned for both IPR and DPR trains. As shown in Figure 2.10, this facility will be located at the location of Secondary Clarifiers 3A-3D, which will be made available in Phase 2. Hence, the initial 50-mgd IPR train to be constructed in Phase 1B will require a temporary post treatment. As further described in Chapter 1, Section 1.6.3, the temporary post treatment system will utilize sodium hydroxide and calcium chloride. The permanent facility will utilize lime addition in the form of lime water with saturators and acid. Figure 2.21 shows the two post treatment systems.

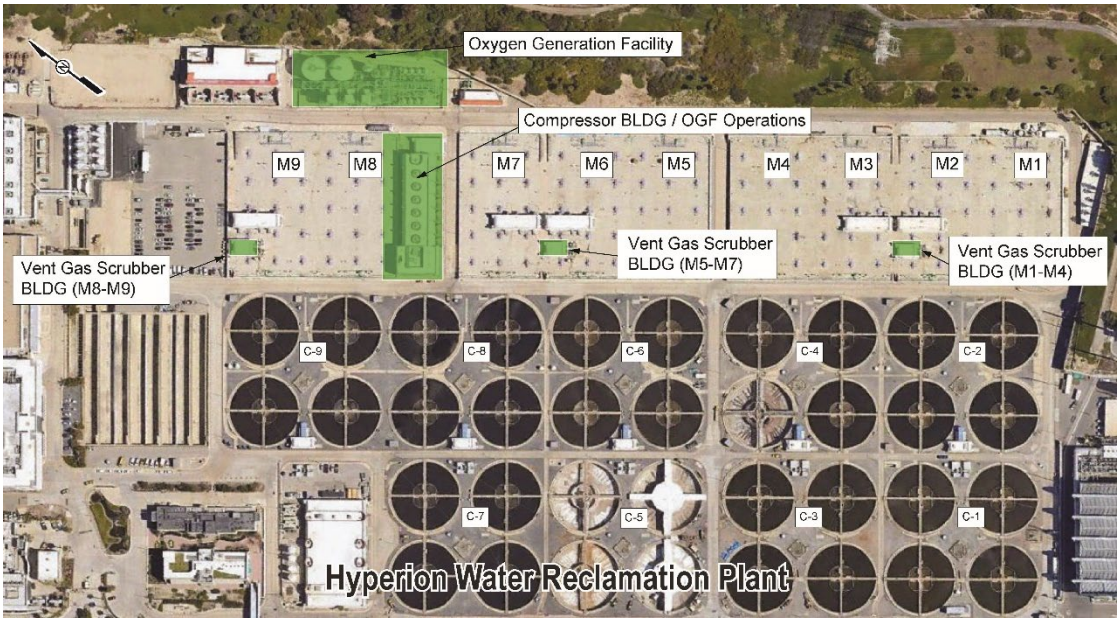
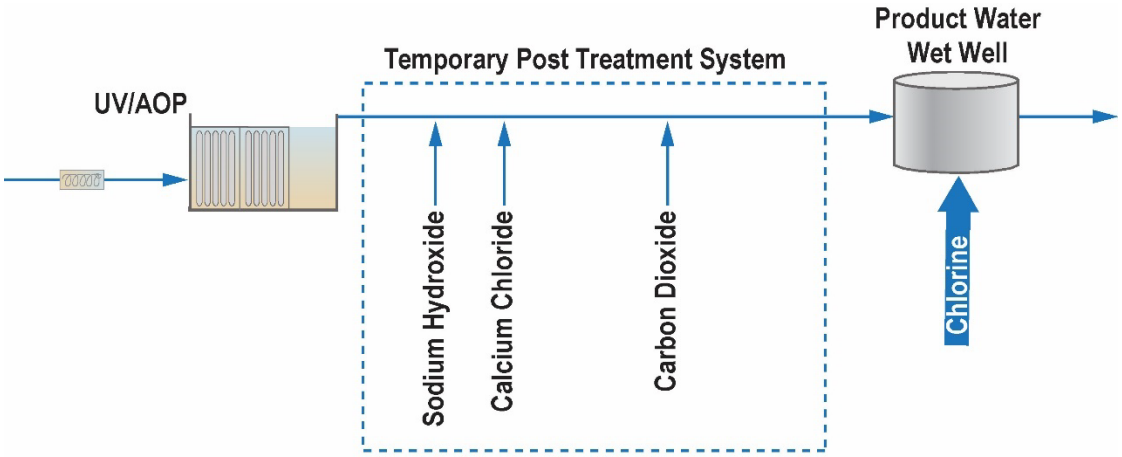


Figure 2.20 Vent Scrubber Buildings Serving HPOAS Modules

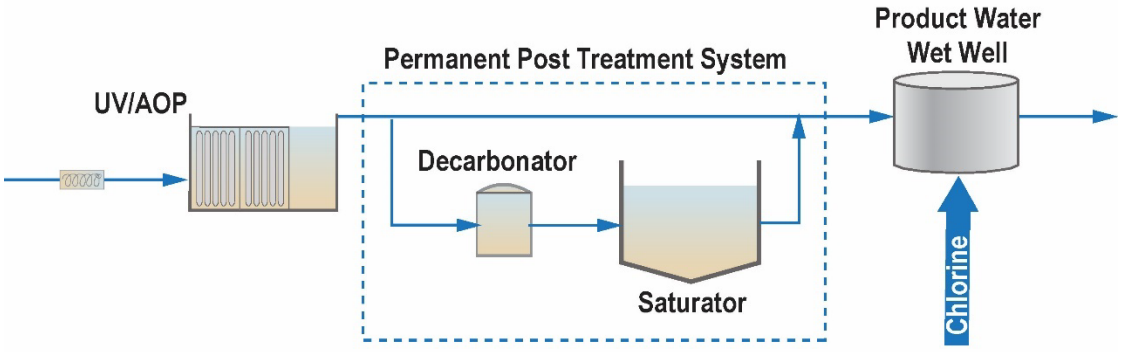
Table 2.7 Projected Average HPO Consumption During MBR Conversion

Parameters	Phase			
	1A	1B	2	3
Module Conversion to MBR	-	1 and 2	3 and 4	5 through 9
HPOAS SE Production[(1)], mgd	272	194	116	0
Dry Weather MBR Permeate Production[(1)], mgd	0	78	155	272
HPOAS SE Production of Total	100%	71%	43%	0%
Average Daily HPO Consumed[(2)], tpd	234	167	100	0
Anticipated Completion[(3)]	2032	2036	2039	To be determined

Notes:
(1) Based on an AAF of 272 mgd and excluding recycle flows.
(2) Based on an average oxygen consumption of 234 tpd for the existing HPOAS facilities, observed from a 10-year duration from January 2009 to August 2019.
(3) Estimated and subject to further refinement.



Sodium Hydroxide/Calcium Chloride Post-Treatment System Process Flow Diagram for IPR



Lime Saturator Post-Treatment System Process Flow Diagram for DPR and IPR

Figure 2.21 Temporary vs. Permanent IPR Post Treatment Systems

2.6 Major Program Risks

This section highlights significant program risks and challenges identified to date as well as the corresponding initial mitigation measures. Based on the approach outlined in the PIP, all wastewater and advanced water treatment facilities will be located within HWRP. Accordingly, this section primarily focuses implementation challenges associated with completing the proposed improvements at HWRP and with realizing the intended water reuse goals.

2.6.1 Constructability Concerns

The anticipated major constructability issues associated with the Pure Water Los Angeles program are discussed in this section.

2.6.1.1 Space Constraints

The existing HWRP site is effectively "built-out," having little-to-no open space available for construction. All future improvements of significant magnitude will need to sequence work and create space by way of demolition or relocation of existing facilities.

An analysis was performed to estimate approximate land areas at the site that are either currently available or may become available in the future for Pure Water Los Angeles utilization. Figure 2.22 provides an estimation of nine different areas potentially available at the HWRP for new construction and contractor staging and laydown. Collectively, they provide approximately 47 acres in size. The largest areas are created by demolishing the existing abandoned conventional digesters and the existing secondary clarifiers, where the latter will be no longer necessary in MBR operation. In general, to facilitate sequencing, demolition of abandoned facilities will be expediated within each construction phase as described in Section 2.5.2.

Figure 2.22 Areas Available for New Construction or Temporary Staging

2.6.1.2 Groundwater and Deep Excavation/Construction

Pure Water Los Angeles will involve multiple, large excavations that may also extend below the groundwater and mean sea water levels and, as a result, necessitate significant construction dewatering operations. Table 2.8 provides a summary of the deepest structures to be constructed and their anticipated excavation elevations.

Table 2.8 New Facilities with Deep Excavation

Facility	Phase	Type of Construction	Bottom Slab Elevation(1,2,3)	Bottom of Overall Excavation Elevation(1,2,4)
East PE EQ	1A	Cast-in-Place Concrete & Water-Bearing	-3.0	-8.0
West PE EQ	1A	Cast-in-Place Concrete & Water-Bearing	-3.0	-8.0
Module 10 EQ	1A	Cast-in-Place Concrete & Water-Bearing	-3.0	-8.0
PE EQ Return Pump Stations	1A	Cast-in-Place Concrete & Water-bearing	-12.5	-17.5
Membrane Trains	1B, 2, 3	Cast-in-Place Concrete & Water-Bearing	14.5	9.5
Secondary EQ	1B, 2	Cast-in-Place Concrete & Water-Bearing	4.0	-1.0
Secondary EQ Pump Station	1B, 2	Cast-in-Place Concrete & Water-Bearing	-4.5	-9.5

Notes:
(1) Elevations are based on the National Geodetic Vertical Datum of 1929.
(2) Anticipated finished grade elevations vary from 30 to 34.
(3) Estimated and represents the top of concrete elevation for the bottom slab.
(4) Assumes 5 feet below the bottom slab elevation.

Groundwater Variability

Regional maps of the HWRP indicate that the historic high depth to groundwater at the project site ranges from approximately 10 to 20 feet below the ground surface based on limited available data. Also, during an exploratory drilling performed in November 2023 and documented in Supplemental TM02 – Geotechnical Evaluation, groundwater was recently observed at depths ranging between 28 to 30.5 feet below the ground surface and is not considered stabilized. Fluctuations in the groundwater level may occur as a result of variations in seasonal precipitation, irrigation practices, groundwater pumping and other factors. Reliable, long-term groundwater data will significantly aid in the progressive design builder's ability to effectively design dewatering systems and significantly reduce risk during construction.

As a result, a number of groundwater monitoring wells will be constructed within the vicinity of the East and West PE EQ prior to Phase 1A procurement. To facilitate data collection, they will be equipped with level instruments and data loggers. During Phase 1A construction, these groundwater monitoring wells may be used by the design-builder to measure draw-downs achieved by the dewatering operation.

In addition, a groundwater pumping well will be installed in the vicinity of the monitoring wells to conduct a draw-down test. As part of the progressive design builder procurement, groundwater data and draw-down test results will be provided as reference information to prospective design-builder entities.

Construction Dewatering and Temporary Shoring

Where excavations extend below groundwater and where temporary slopes are not feasible due to space constraints, the shoring system should be designed to act as a cofferdam to cutoff groundwater flow from outside of the excavations and dewatering should be performed from inside the excavations to reduce the potential for ground settlement. Shoring should be provided to stabilize the excavation sidewalls during construction. Depending on the depth of the excavations, some of the shoring systems may need to be braced with tieback anchors. Additionally, the amount of construction dewatering can be reduced if the shoring systems cut off groundwater flow into the excavations. Temporary shoring should be provided in accordance with OSHA regulations where sloped excavations are not practical.

Potential Settlement

Settlement of the ground surface may occur behind shored excavations. The amount of settlement depends heavily on the type of shoring system, the contractor's workmanship and soil conditions. To reduce the potential for distress to adjacent improvements, the shoring system should be designed to limit the ground settlement behind the shoring system to 1/2-inch or less. Possible causes of settlement that should be addressed include settlement during installation of the shoring elements, excavation for structure construction, construction vibrations, and removal of the support system. The shoring installation should be evaluated carefully by the contractor prior to construction and ground vibration and settlement monitoring should be performed.

2.6.1.3 Retaining Wall

Along the east boundary of the site, an existing retaining wall separates the flat, usable space from the steep hill side to the east. It has a maximum height of approximately 40 feet in the area of the work. As part of Pure Water Los Angeles, this east retaining wall will be partially demolished, and the hillside will be further cut in to create space for new construction. The new retaining wall will be as high as 62 feet above finished grade and closer to LADWP's high-voltage transmission towers and the residential communities in El Segundo, as shown in Figure 2.23.

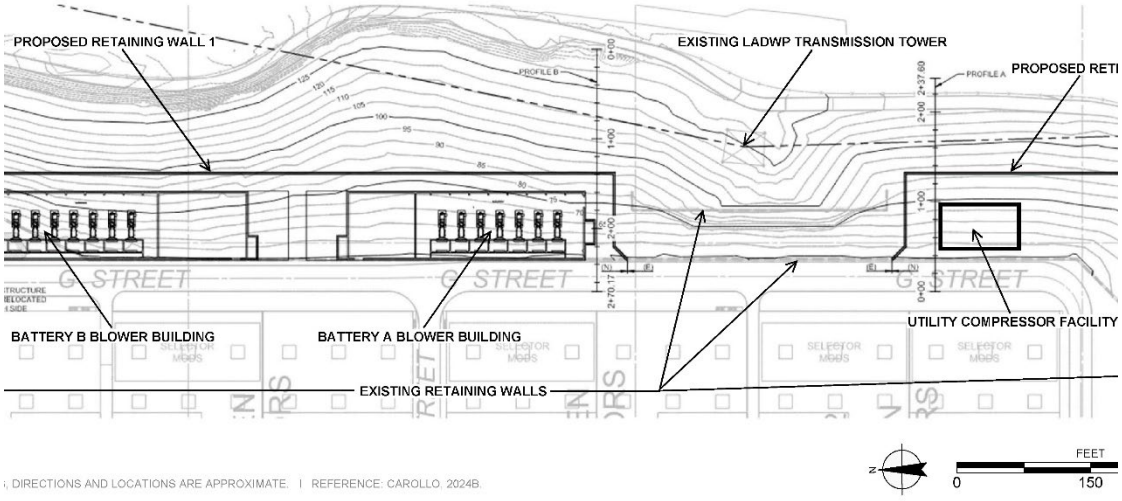


Figure 2.23 Conceptual Layout of New Retaining Wall

Further described in Supplemental TM 2 – Geotechnical Evaluation, a slope stability analysis was completed to evaluate the ground stability of the new proposed east retaining wall. In order to protect against potential ground instability around LADWP's transmission towers or the residential communities in El Segundo, the new retaining wall will be supported by a soldier pile retaining wall system braced with tiebacks, in order to provide both short- and long-term stability of the slope behind the proposed retaining wall. Additionally, the wall will be designed to support the surcharge loads of the existing LADWP transmission towers in addition to the earth pressures exerted by the retained soils.

Construction sequencing, shoring and protection of existing improvements should be further evaluated by the progressive design builder during the design phase. As further described in Section 2.6.4, coordination with LADWP will be needed to delineate LADWP's right-of-way areas in the hillside and define permissible construction activities in and around them. To mitigate against ground settlement and to avoid impacting the transmission tower stability, a ground level monitoring plan with instrumentation will be appropriate during construction. Additionally, supplemental borings along the perimeter road should be performed to evaluate the stability of the proposed retaining walls in greater detail. Figure 2.24 shows LADWP's power transmission infrastructure in the hillside.

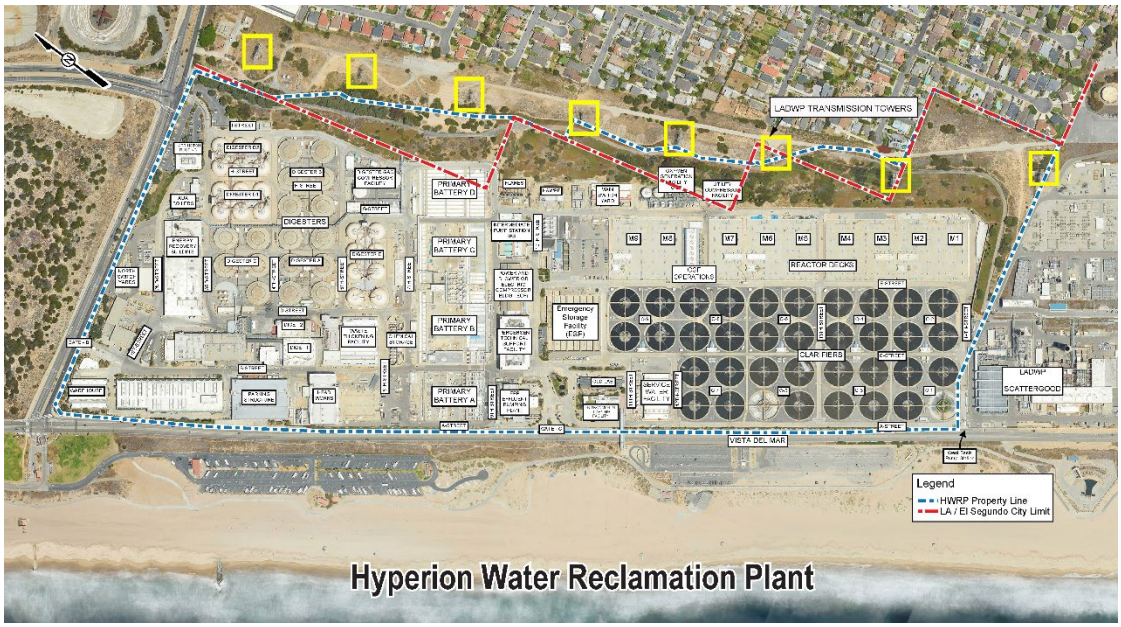


Figure 2.24 LADWP Infrastructure in Hillside

2.6.2 Seismic Risk and Resiliency

Pure Water Los Angeles is shifting the function of the HWRP from the treatment and disposal of wastewater to treating wastewater to become a reliable drinking water source for the City. Facilities that serve to produce potable water are generally designed with an equal or greater degree of importance compared to that of wastewater treatment facilities. Consequently, the design of the new facilities should consider applying elevated seismic criteria to help ensure that the new facilities are seismically resilient, that is they can withstand design-level earthquakes while limiting damage and maintaining operations to a large degree.

2.6.2.1 Building Code Requirements

Pure Water Los Angeles will not only involve replacing existing facilities with new ones, but it will also involve altering, repurposing, or maintaining existing facilities to support the operations of the improved plant. Figure 2.25 shows a site plan of the existing facilities and structures at the HWRP that will be retrofitted, repurposed, or otherwise maintained as an integral component of the improved plant. In addition, some of the existing tunnels and channels will also be rehabilitated. To address both code compliance issues and improvements in seismic resiliency of existing structures, the recommended seismic criteria that includes the evaluation type, hazard, and performance requirements are outlined in Table 2.9.

Figure 2.25 Existing Aboveground Facilities to be Rehabilitated or Retrofitted

Table 2.9 Recommended Seismic Evaluation Criteria

Structure	Seismic Evaluation Required	Original Risk Category	Recommended Risk Category	Seismic Hazard
IPS Afterbay	Code-required	II	III	BSE-1N
Module Influent Channels	Voluntary	II	III	BSE-1N
Modules 1-9	Code-required	II	III	BSE-1N
Tunnel E	Code-required	II	III	BSE-1N
Tunnel C	Code-required	II	III	BSE-1N
SE Channels	Voluntary	II	III	BSE-1N
West Basin Pump Station(1)	None	III	III	None
Truck Loading Facility	Code-required	II	III	BSE-1N
Main Switchyard	Voluntary	IV	IV	BSE-1N
Employee Parking Structure(2)	To be Determined	II	To be Determined	To be Determined

Notes:
(1) Owned and operated by West Basin.
(2) A separate project (CIP-2535) is currently underway by the Environmental Engineering Division to provide seismic upgrades and other improvements to the existing Employee Parking Structure.

The seismic resilience of the existing facilities may potentially be less than that of the new facilities depending on the year of construction and the original design criteria. Additionally, existing facilities may have corrosion, damage, or deterioration that will further reduce seismic resiliency. Therefore, to help ensure that the Pure Water Los Angeles facilities, as a whole, are seismically resilient, in addition to meeting current building code requirements for the design of new facilities and portions thereof, Supplemental TM 3 – Seismic Assessment Requirements, outlined a roadmap to establish criteria to address the seismic resiliency of existing facilities. Figure 2.26 provides a graphic representation of the seismic evaluation and mitigation workflow for existing structures.

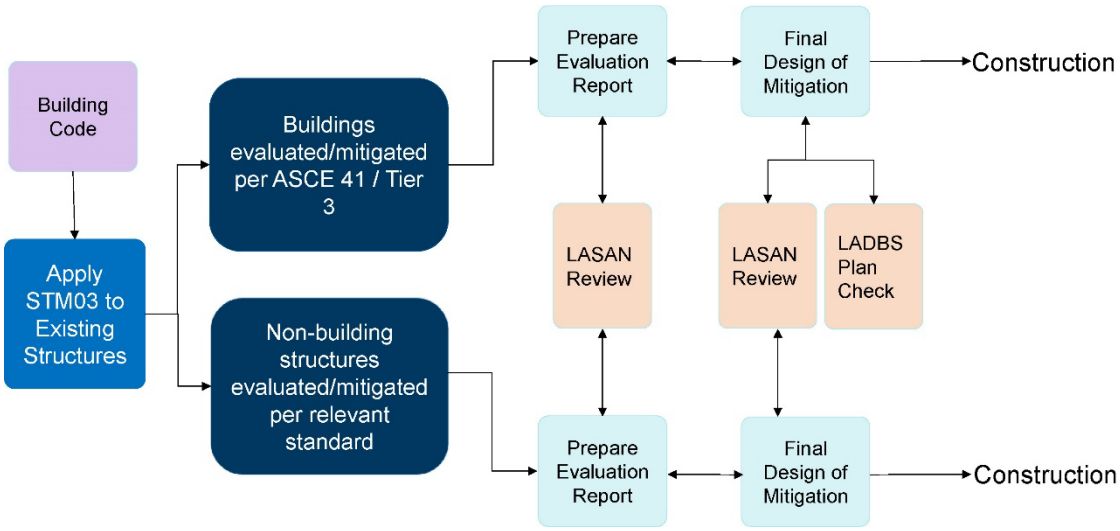


Figure 2.26 Workflow for Seismic Evaluations by Progressive Design Builder

Final mitigation design documents shall be submitted to LASAN. Additionally, final mitigation design documents for buildings shall be submitted to the Los Angeles Department of Building and Safety (LADBS) for plan check.

Because the workflow includes the preparation of seismic evaluations and associated reports with reviews by LASAN, the evaluation work is anticipated to take additional time. To prevent delays in project delivery, the seismic evaluations should be completed prior to the final design stage so that the final design of any seismic mitigation can be performed on the same schedule as the balance of the design improvements.

2.6.3 Coordination with Other HWRP Improvements

This section introduces additional projects that require further analysis and coordination with Pure Water Los Angeles. They include planned plant upgrades and modifications that are currently outside of the program scope but may impact, or be impacted by, the overall program in a substantive manner. As a result, it is important to understand such interdependencies and to execute work in a manner that mitigates adverse impacts and promotes mutually beneficial outcomes.

The following projects are presented in this section:

- EPP Improvements: As currently envisioned, the improvements to the EPP will be completed as a standalone project by LASAN. The project intends to either refurbish or replace the existing equipment in kind to maintain the total reliable capacity of 720 mgd with one pump out of service. Although highly critical, the project is not directly related to the Program. However, further coordination with the Program is recommended regarding (1) plant hydraulics and (2) design of new electrical infrastructure.

- Existing Cryogenic Facility Maintenance: Unless offsite use is identified for excess HPO generated onsite, at the beginning of Phase 1B startup and commissioning (December 2035), the existing cryogenic facility may no longer adequately support the HPOAS modules due to a turndown limitation. Some improvements are expected in order to sustain the operation of the aging cryogenic facility till this time. It is advised that this work be completed as a standalone project by LASAN or Bureau of Engineering. Project scope and delivery schedule should be developed based on a condition assessment. Oxygen may need to be purchased if the cryogenic facility cannot adequately support any remaining HPOAS modules until their conversion to MBR.
- Electrical Systems Evaluation (TOS SN-152): Currently in progress, this study is performing a comprehensive condition assessment of the existing power distribution infrastructure at HWRP as well as conducting an arc flash hazard evaluation. The intent of the study is to identify the upgrades and improvements needed to restore overall electrical system reliability and resiliency. Findings from the study will be used to develop improvement scope items that will be included in the Program. If urgent rehabilitation needs are identified, such work may need to be expedited in advance of Pure Water Los Angeles.
- Emergency Biosolids Storage Facility: A new project is under consideration for constructing a new biosolids storage facility in the area of the existing solids handling facilities. Its proposed location is the existing Carver Greenfield Building, which is also being slated for use as contractor laydown and staging for Pure Water Los Angeles. Although LASAN is interested in ultimately using this location for biosolids storage, the construction of the new facility will not be in near term. As a result, this space will be made available for contractor staging and laydown purposes until a new project is developed to this end.

2.6.4 Permitting and Regulatory Challenges

The implementation of planned new infrastructure for Pure Water Los Angeles will necessitate the procurement of a large number of clearances, reviews, approvals, authorizations and permits prior to construction initiation. This section describes potential challenges in obtaining various permitting and regulatory approvals for the Pure Water Los Angeles program.

2.6.4.1 Peak Wet Weather Treatment Capacity

HWRP currently holds a permitted peak wet weather treatment capacity of 850 mgd. In accordance with the approach outlined in Chapter 1 – Program Summary, HWRP's NPDES permit under *paragraph 3.7 – Planned Changes* acknowledges that the plant will be designed for a peak wet weather flow of 740 mgd from the onset of Pure Water Los Angeles construction. Therefore, the 740-mgd capacity is not a permit condition yet, and it must be incorporated into one as part of the next permit renewal application due in October 2027 (for a 2028 renewal).

However, the extreme flow events that occurred during February 4-6, 2024 resulted in a peak hourly flow of approximately 830 mgd. Influenced by intensification of weather phenomenon, the RWQCB may reconsider reducing the maximum hydraulic capacity to 740 mgd in the next permit renewal. To quantify the benefits of the process conversion to MBR and of the proposed 740-mgd capacity, an analysis was conducted comparing the current HPOAS operation with a hypothetical MBR operation consistent with Pure Water Los Angeles plans. More specifically, based on the flows and water quality recorded during the February 2024 storm events, the 740-mgd MBR plant (even with approximately 56 mgd of PE being discharged) would achieve approximately 95 percent reduction in each of the TSS and BOD loads discharged to Santa Monica Bay compared to the HPOAS plant that can provide full secondary treatment. Based on these findings, it is recommended that LASAN seek the 740-mgd peak wet weather capacity as a permit condition in the 2028 NPDES permit. Refer to Supplemental TM No. 1 – Influent Flow and Equalization for additional information.

2.6.4.2 NPDES Permit Compliance

As part of the implementation of the Pure Water Los Angeles program, the discharge to the ocean will undergo a significant change in both magnitude and concentration. Once implemented, the waste streams would consist of backwash waste from the BAC and MF processes, the RO concentrate, and any excess MBR filtrate. RO is an efficient process in removing various constituents from wastewater, including dissolved solids, but consequently, it generates a brine stream with concentrated constituents. At HWRP, the planned recovery for RO is 85 percent, resulting in a concentration factor of 6.7 (meaning a constituent in the RO concentrate could be as much as ~6.7 times higher than in the MBR filtrate, depending on rejection efficacy through RO).

Due to this concentration factor, as well as the change in overall flows being discharged to the ocean when compared to current operations, a study was performed to investigate future discharge compliance. The study evaluated whether HWRP's comingled discharge into the ocean would comply with the California Ocean Plan and future NPDES permit.

California Ocean Plan

The California Ocean Plan sets forth numeric and narrative water quality objectives for ocean waters with the intent of protecting the ocean's beneficial uses. These uses include recreation, aesthetics, navigation, fishing, mariculture, areas of special biological significance, rare and endangered species, habitat, fish migration, fish spawning, and shellfish harvesting (State Water Resources Control Board, 2019). Municipal wastewater effluent, being low in salinity – or total dissolved solids – is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water. The mixing that occurs in the rising plume is affected by the buoyancy and momentum of the discharge, a process referred to as 'initial dilution' (National Research Council, 1993).

The 'initial dilution' occurs in an area known as the zone of initial dilution (ZID), and the Ocean Plan objectives are to be met at the edge of the ZID. The extent of dilution in the ZID is quantified as the minimum probable initial dilution (Dm). The water quality objectives established in the Ocean Plan are typically adjusted by the Dm to derive NPDES permit limits that are applied to a wastewater discharge prior to ocean dilution. Figure 2.27 is a schematic showing these key terms from the Ocean Plan.

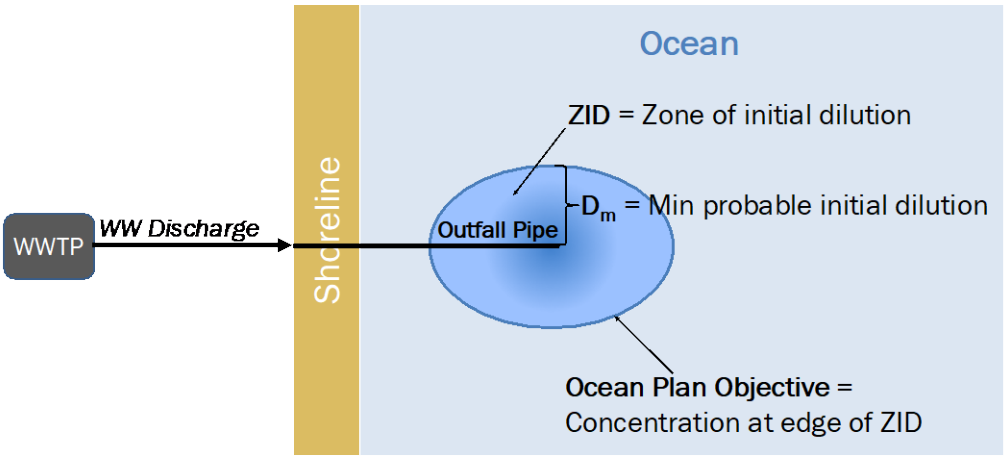


Figure 2.27 Schematic Showing Key Terms in the Ocean Plan

Compliance Assessment

To assess projected future compliance of the Program's ocean discharge with the California Ocean Plan, a study was conducted in two parts. First, ocean dilution modeling was performed utilizing a conservative RO concentrate flow of 41 mgd and varying flows of SE. Second, SE water quality data from the past five years were analyzed, to identify, using the ocean dilution model results, any constituents that may be challenging for Ocean Plan compliance assessment. As a result of this analysis, the constituent estimated to come closest to exceeding the water quality objective was determined to be copper.

Given that copper is the controlling constituent for discharge compliance, the preliminary permitting approach was developed such that the discharge would always be compliant with the water quality objective for copper. With this approach, all other constituents would also comply. Typically, one Dm value is adopted in an NPDES permit that is representative of the worst-case (or lowest) dilution achieved for all discharge flow scenarios. This typical approach does not consider the significant changes in discharge flow that will result with the implementation of Pure Water Los Angeles. An alternative approach where multiple Dm values would be adopted was developed that considers the variation in discharge flows. Copper was used to select potential new Dm values for this new discharge in a tiered ("stair-step") approach. The tiered dilution approach with the proposed two dilution values is shown in Figure 2.28 (blue series) along with the Dm values determined by the modeling (black series) and Dm values necessary to comply with the copper Ocean Plan limits (red and orange series).

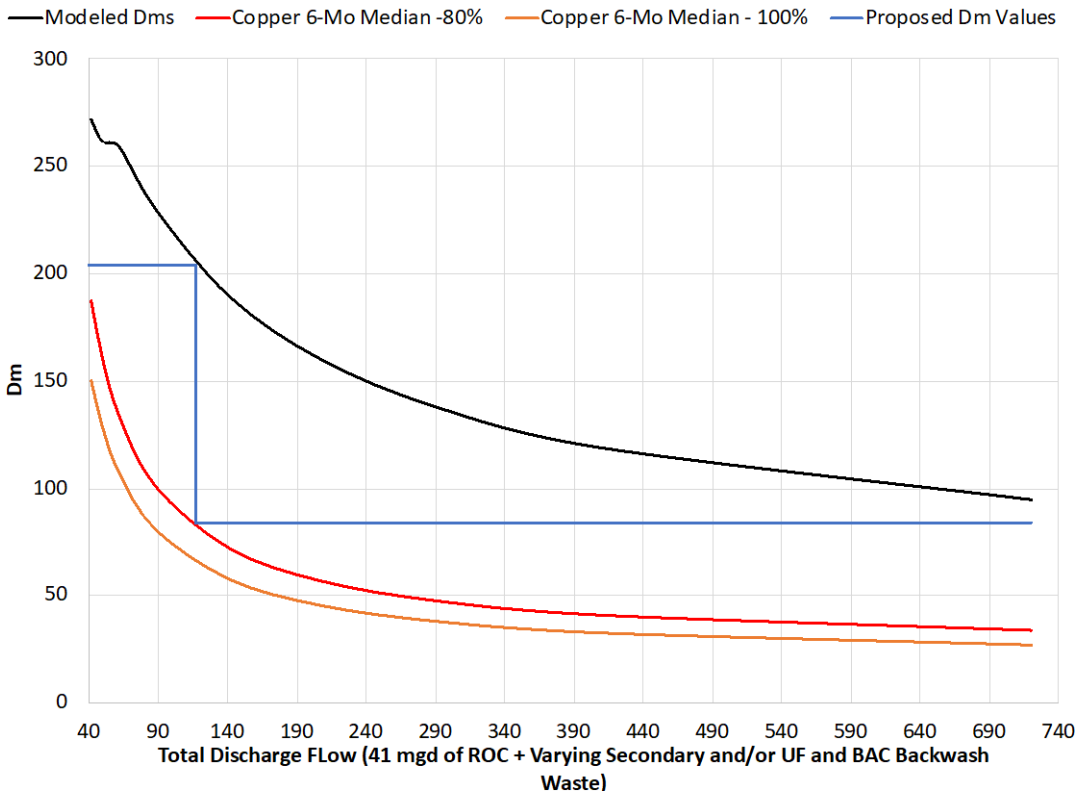


Figure 2.28 Proposed Dm Values (Blue Line) Based on Copper

More details on the ocean dilution modeling, Ocean Plan compliance assessment and the tiered dilution can be found in TM 1A – Ocean Dilution Modeling and Compliance Assessment.

Permitting Approach

The preliminary Ocean Plan compliance assessment conducted in TM 1A comprised the first in a series of steps to obtain an NPDES permit for a new waste discharge representative of Pure Water Los Angeles. Building on the tiered dilution approach developed as part of TM1A, TM1B provided an NPDES compliance framework for obtaining RWQCB approval for the tiered dilution approach. A preliminary timeline with the proposed steps is summarized in Figure 2.29.

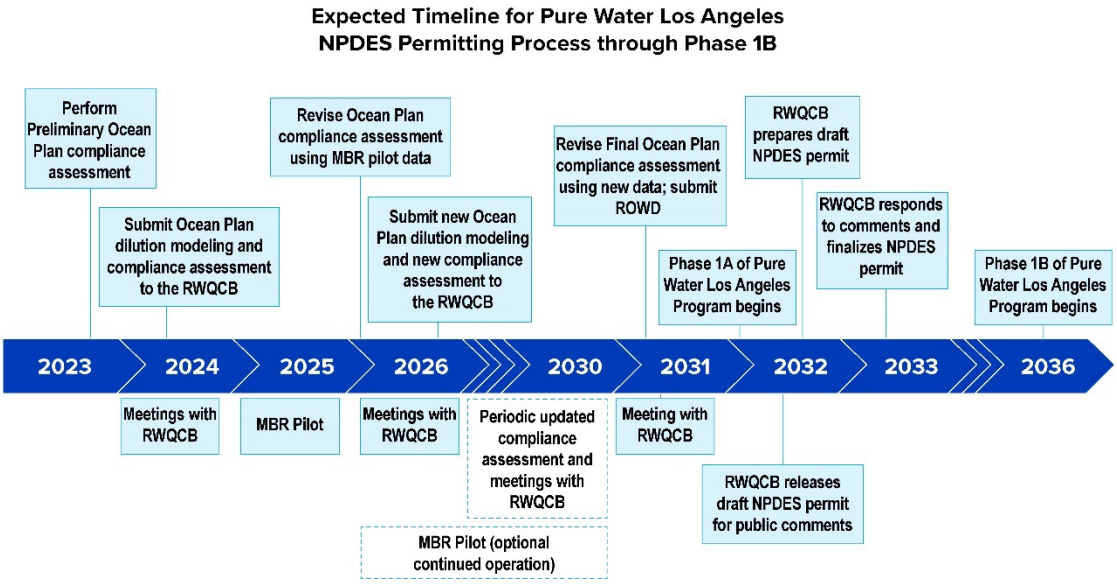


Figure 2.29 Expected Timeline for Pure Water Los Angeles NPDES Permitting Process through Phase 1B

The next step in the NPDES permitting process is to engage the RWQCB on the proposed strategy. A meeting introducing the tiered dilution approach and concept to the RWQCB is recommended. The analysis from TM1A would be presented to the RWQCB to explain the rationale, the intended approach and related assumptions, and the modeling and compliance assessment results. Feedback from the RWQCB would be requested to improve the approach, which may involve further assessment of the modeling and compliance assessment results, as well as additional monitoring of analytes as part of the MBR pilot (e.g., per- and polyfluoroalkyl substances (PFAS)). In addition, the RWQCB will be briefed on the proposed steps and project timing. After the initial meeting and depending on feedback obtained from the RWQCB, a TM summarizing the ocean dilution modeling and Ocean Plan compliance assessment may be submitted to the RWQCB (e.g., TM 1A).

Engaging other stakeholders (e.g., institutions such as Heal the Bay and Surfrider Foundation, among others) and sharing the proposed tiered dilution approach and compliance assessment can also be considered.

Continuing Compliance Testing and Regulatory Engagement

Once the MBR pilot is operational, samples will be collected throughout the piloting year and analyzed for all constituents in the Ocean Plan and current NPDES permit. The current test plan for the MBR pilot includes samples from both the MBR permeate and the RO concentrate, which will be the ultimate comingled discharge to the ocean for the future HWRP under the most conservative scenario. The results from this sampling effort will give a more representative understanding of the future water quality resulting from the Pure Water Los Angeles Program and should be used for a new Ocean Plan compliance assessment. Once the results from the pilot are available, the TM1A compliance assessment should be updated and shared with the RWQCB.

Once the initial phase of the MBR pilot is complete, the MBR pilot may continue to operate, depending on the initial results and any additional subsequent studies. While the MBR pilot is operational, it is recommended to continue to sample for Ocean Plan objectives periodically. This would provide additional data to improve the confidence of the compliance assessment and provide stakeholders with increased confidence with environmental compliance. It is recommended to periodically update the RWQCB of the Ocean Plan compliance assessment and findings from the pilot.

To obtain a water recycling requirements/waste discharge requirements (WRR/WDR) permit for the potable reuse project, a California Division of Drinking Water (DDW) approved Title 22 Engineering Report is required. This approval will be prepared in the form of a Conditional Acceptance letter from DDW, stipulating the details required for the compliance of the potable reuse program. Once it is clear that the DDW will eventually provide this approval, a report of waste discharge should be submitted to the RWQCB. Using DDW's Conditional Acceptance Letter requirements, the RWQCB will then issue the WRR/WDR for the potable reuse program. This permit is intended for compliance of the purified water, not the ocean discharge.

The ocean discharge is permitted under the existing NPDES permit, which was most recently issued in 2023 and is issued at 5-year renewal cycles. It is likely that the RWQCB will prefer the tiered dilution approach be incorporated in one of the normal permit renewal cycles. To incorporate this approach prior to commencement of the potable reuse program, this would mean the tiered dilution approach is incorporated into the 2033 NPDES permit renewal. However, given the three phases and the gradual buildout of potable reuse capacity, it is possible that the tiered dilution approach may not be necessary for compliance until later phases of the program. This potential approach should be discussed with the RWQCB to determine their preferred approach and potentially reassessed as part of the revised compliance assessment efforts, as variations on this permitting approach are possible. Figure 2.30 shows the permit cycles along with the current construction schedule and anticipated ocean discharge flows.

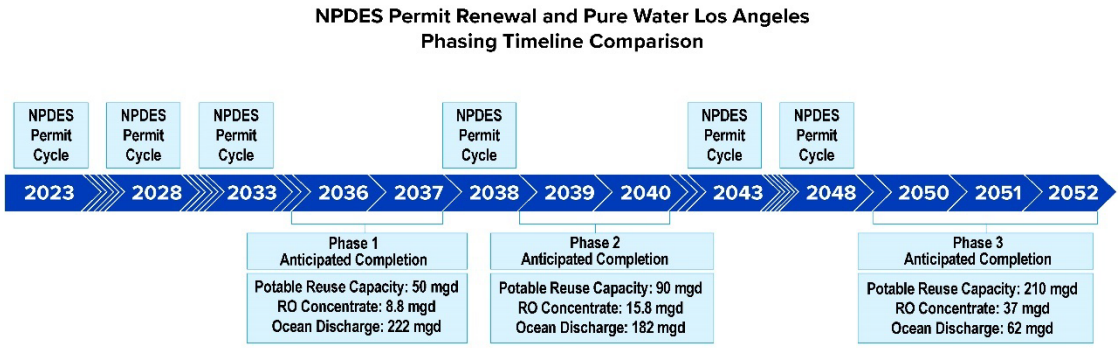


Figure 2.30 NPDES Permit Renewal and Pure Water Los Angeles Phasing Timeline Comparison

2.6.4.3 CEQA/EIR Approval

This section describes the challenges associated with procurement of environmental clearance, specifically those associated with the CEQA.

CEQA generally requires state and local government agencies to inform decision makers and the public about the potential environmental impacts of proposed projects, and to reduce those environmental impacts to the extent feasible. A "project" is defined as a "whole action" subject to a public agency's discretionary funding or approval that has the potential to either:

1. Cause a direct physical change in the environment or
2. Cause a reasonably foreseeable indirect physical change in the environment.

Under this definition, Pure Water Los Angeles is a "project" and as such requires a formal environmental review and approval consistent with CEQA.

The preparations, review, and approval of a single Program EIR covering all elements of the Pure Water Los Angeles Program (inclusive of those outside of the HWRP) will be required. This EIR will be developed to include a programmatic description of the effort and the associated impacts along with mitigation strategies. It will also assess a number of project-specific packages at detailed assessment levels. In many cases the certified EIR will be required to move forward with other aspects of program implementation.

Preparation of the EIR relative to HWRP improvements are expected to be more straight-forward as HWRP is a known, developed site in terms of large project environmental impacts. However, infrastructure construction outside of the HWRP will have a vast sphere of influence and is expected to have large and complex impacts on the environment and the communities as well as increased risks of finding unknown features or sensitive receptors. As such, the preparation of the EIR relative to non-HWRP improvements will be significantly more onerous and time-consuming.

2.6.4.4 Methane Zone Regulations

In the City of Los Angeles, there are two types of methane hazard zones. They are methane zones and methane buffer zones as defined by LADBS. In general, these zones are a result of naturally surfacing tar and crude oil or otherwise proximity to a subsurface natural gas source. According to the Los Angeles Methane Zone Map published by the LADBS, the HWRP is located in a methane zone. Development projects in a methane zone or a methane buffer zone require a methane mitigation system that addresses fire and explosion risks arising from gas accumulation unless a methane soil gas testing data suggests otherwise.

The purpose for a methane soil gas test is to determine a site-specific mitigation level based on measured data, and it can help avoid implementing the most stringent and costly mitigation components that may be unnecessary. City Ordinance No. 175790 stipulates citywide methane mitigation requirements and provides construction standards to control methane intrusion into buildings and structures.

In anticipation of Phase 1A construction, a preliminary methane survey was conducted in the proposed Phase 1A construction areas in June 2024. When available, the results along with the mitigation recommendations will be documented in a geotechnical report being prepared for Phase 1A.

2.6.4.5 City of El Segundo Jurisdiction

Described in Chapter 1 – Program Summary, two new blower buildings will be constructed to house process aeration blowers needed to support the new BNR basins. The blower buildings will be located immediately south of the existing cryogenic facility and will require building a new retaining wall against the hillside on the east boundary of the plant. The proposed location of the blower buildings and the new retaining wall will be within both the City of Los Angeles and the City of El Segundo's jurisdiction, shown in Figure 2.31, and will require both entities' approval for construction.

Figure 2.31 New Blower Buildings

Due to the proximity of the new blower buildings to the El Segundo residents on the hillside, noise emitted from the blowers may be of particular interest to the City of El Segundo.

Consequently, a noise assessment was conducted to evaluate the anticipated noise levels of the new blower buildings. The findings of this assessment can be found in Appendix B. It should be noted that the blower buildings will be insulated and specifically designed to attenuate noise emissions to the east. Further, an existing ridge along the eastern boundary of the plant serves as a noise buffer for the El Segundo residential neighborhood and provides substantial noise reduction based on past modeling endeavors.

2.6.4.6 AQMD, Odor Control, and Engine Emissions

Any equipment that emits or controls air contaminants requires permits from the regulatory agency with jurisdiction, which is South Coast AQMD for HWRP.

The South Coast AQMD's permitting program has been established to implement the requirements of the federal and state Clean Air Act, the Air Quality Management Plan, and air quality rules and regulations by specifying operating and compliance requirements for stationary sources that emit air contaminants. Prior to installation of new or relocated equipment, or prior to modification of existing equipment, the operator of the equipment is required to obtain a Permit to Construct from the South Coast AQMD. Once a piece of equipment is installed, modified and/or operated, South Coast AQMD processes the application for a Permit to Operate.

Engine Emissions

Based on preliminary discussions with the AQMD, there may be updated regulations and increased restrictions on fossil fuel technologies used for standby power generation in the future. However, there have been no specific changes and acceptable alternatives to fossil fuel that have been publicly announced. As a result and as a basis of design, standby power generation for the HWRP will use diesel fuel generators with Tier IV emission controls to meet the current standards for the AQMD. As AQMD restrictions are further defined in the future, the standby power system can be revised to include alternative sources of energy including natural gas, renewables, or other technologies as defined by the AQMD.

Odor Control

The HWRP is located less than 500 feet from the residential neighborhood of El Segundo. To meet air quality regulations and avoid impacting nearby residents, odor control for wastewater treatment facilities is essential. HWRP holds multiple South Coast AQMD permits that regulate odor. In general, the permits limit the concentration of sulfur compounds measured as H_2S at the outlet of carbon adsorption system to 1 ppmv. In addition, specific permits (e.g., IPS odor control system) limit the maximum H_2S concentration at the downwind property boundary to 30 ppb over one-hour average. With the construction of new odor control facilities as part of the Pure Water Los Angeles program, new permits will need to be acquired during each phase of construction.

2.6.4.7 LADWP Right-of-Way in Hillside Construction

Phase 1B of the Pure Water Los Angeles program will involve the following developments planned in close proximity to LADWP's transmission towers and associated lines on the eastern boundary of the HWRP:

1. Demolition of a portion of the existing retaining wall on the east boundary of the plant.
2. Construction of new retaining walls along the hillside, requiring burying long tieback anchors to provide stability.

3. Construction of new Battery A Blower Building and Utility Compressor Facility at the base of the retaining walls.
4. Grading and drainage work to accommodate the new structures, sloping away from the transmission towers and lines.

The planned developments require coordination and potential approval from LADWP's Real Estate Services due to the proximity to LADWP's easement or Right-of-Way. Construction of these new Phase 1B facilities will need to meet clearance requirements from the transmission towers and the transmission line Right-of-Way as defined by LADWP.

As a next step in the process, a request for information regarding the requirements for new construction near LADWP easement will be submitted to LADWP's Real Estate Services. Upon confirmation of requirements, a package will be subsequently prepared and formally submitted requesting approval for the construction activities listed above that may temporarily affect LADWP's Right-of-Way.

2.7 Interagency Collaboration

With a potable water production goal of 210 mgd, Pure Water Los Angeles has the potential to not only reconfigure the City's potable water supply portfolio but also improve long-term regional water supply through partnership with other municipalities. Further, the program will require large and expansive infrastructure to be constructed outside of the plant boundaries for flow conveyance and power supply purposes. This section describes interagency collaboration opportunities that may be essential from a program implementation perspective as well as those that may enhance the program's economic feasibility by widening reuse water demand.

2.7.1 Water Reuse Participation

At the current juncture where reuse water production feasibility has been established, it is essential for the program to invest additional efforts to identify the most suitable and economical reuse water demand locations for further advancing the program. To this end, under the Pure Water Los Angeles Master Plan, LADWP is currently exploring a wide-range of delivery alternatives that also consider various external entities and their anticipated needs in terms of water quality (IPR vs. DPR) and flows. In order to garner reliable information from other agencies for potential partnership, memoranda of understanding will be ultimately needed to establish the goals, interests, and mutual benefits for the involved parties. As other entities are brought in as program partners, program implementation cost and schedule are expected to be optimized.

For example, West Basin may elect to continue receiving flow from Hyperion in the form of either IPR product water or MBR permeate. Under this scenario, the existing conveyance infrastructure between the HWRP and West Basin's ECLWRF will be used, enabling expedited delivery of the desired water in a highly cost-effective manner.

2.7.2 Infrastructure Requirements

This section summarizes the major infrastructure improvements that are necessary outside of the HWRP boundaries in support of Pure Water Los Angeles. The infrastructure described herein will be within the sole jurisdiction of LADWP. As a result, LADWP will serve as a lead agency in the planning, permitting, design, and construction of the said improvements.

2.7.2.1 Electrical Service

Rated at 90 MVA for continuous service, the existing electrical service to HWPR is provided by LADWP. Considering the magnitude of flows and types of process involved, the Pure Water Los Angeles Program will substantially increase the overall power requirements for the plant. Based on preliminary discussions with LADWP Power Division, it appears two options exist for delivering the requisite power for the program. One option is to replace the existing service with a new, larger capacity service when it is no longer adequate, which is forecasted to be the last phase of the overall implementation (Phase 3 as indicated in Table 2.1). A second option is to retain the existing service and, when needed (again Phase 3), augment it with an additional service sized to address the capacity shortfall. Under this approach, the existing service may be rehabilitated to maintain long-term operability and reliability.

As the utility of jurisdiction, LADWP has the sole authority to evaluate, access, and determine the appropriate approach with respect to plant power supply. However, based on LADWP's criterion for exceeding 80 megawatts, the first option will require an exceptionally large substation categorically referred to as 'transmission-level substation.' Shown in Figure 2.32, a transmission-level substation will be a major infrastructure addition with complex planning and permitting requirements that likely necessitate a substantial implementation schedule of its own. Alternatively, the second option will likely require a relatively smaller substation that may be below the threshold for triggering a transmission-level substation. Under this approach, substantial cost savings and expedited delivery of the requisite electrical service will be achieved, providing significant advantages over the first option.

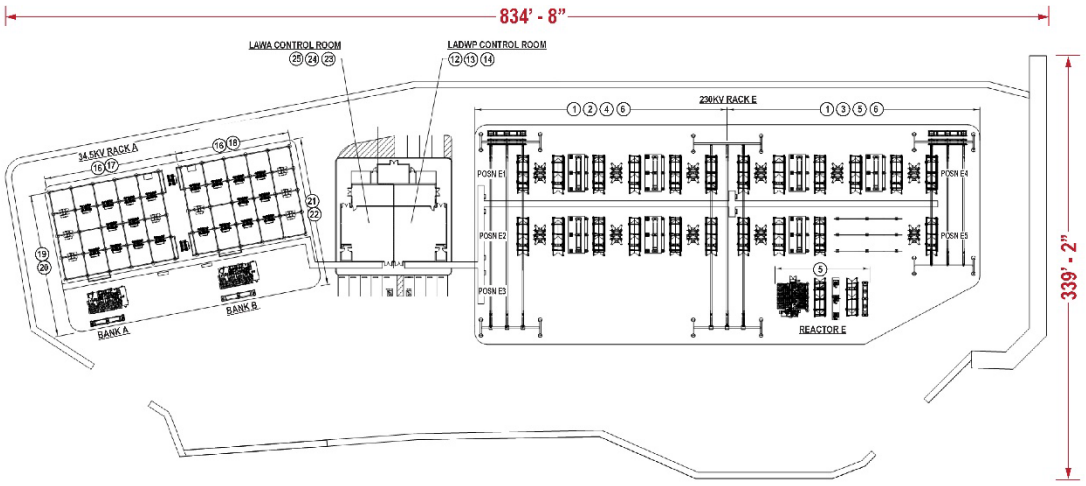


Figure 2.32 120-MVA Transmission-Level Substation Example From LADWP

It should be noted that key decisions that will significantly impact the magnitude of the electrical requirements at the HWRP remain, including the production capacity, water quality (IPR vs. DPR) and siting of the AWT facilities. When the Program progresses further with greater definition with respect to the AWT facilities, LADWP will make the final determination relative to the size and configuration of the plant power supply.

2.7.2.2 IPR Product Water Conveyance

With IPR production commencing in Phase 1B, a pumping station and conveyance system will be needed to transport the water to its destination. As currently envisioned, the West Basin Pump

Station and its associated 60-inch force main to the ECLWRF, shown on Figure 2.33, will be repurposed for conveying IPR product water. The existing West Basin Pump Station and force main were originally designed for a maximum 90-mgd capacity, which matches the proposed IPR production capacity. For this reason, the program assumes that this infrastructure may be retrofitted to address existing deficiencies and meet the new discharge requirements.

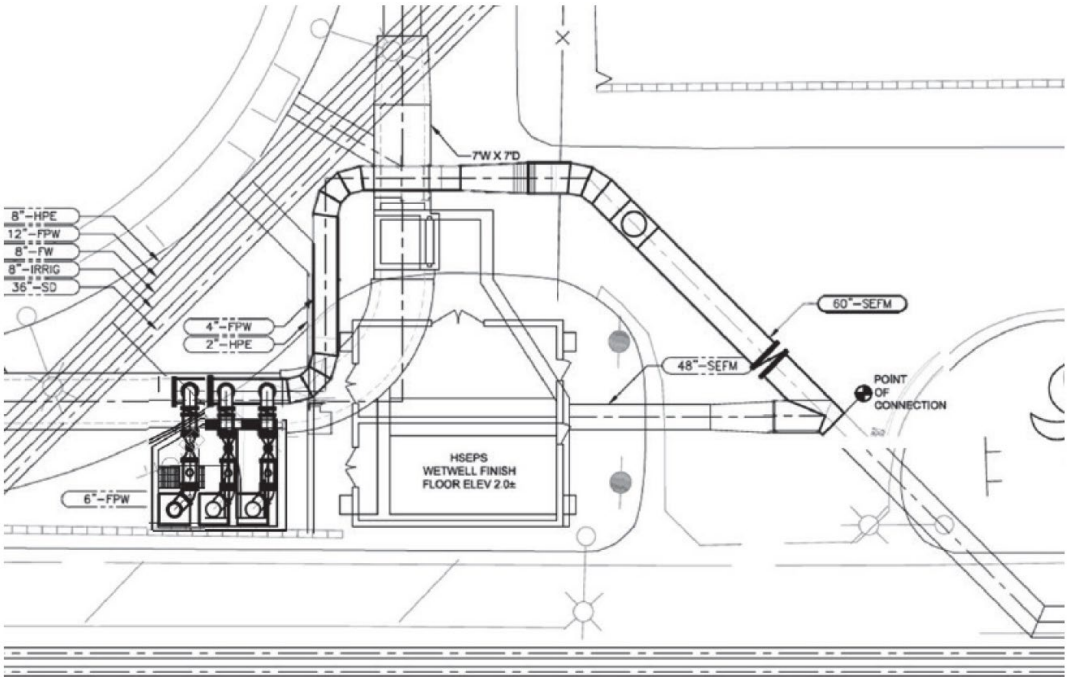


Figure 2.33 West Basin Pump Station (IPR Product Water Pump Station) and Conveyance

Since it is owned and operated by West Basin, the proposed approach will be coordinated and confirmed with the agency. If the approach is deemed unacceptable by West Basin, LADWP will likely be designated as a lead entity for providing a new pump station and conveyance system. This work needs to be coordinated with the intended IPR product water delivery locations, which are to be determined by LADWP.

IPR production is anticipated to be 50 mgd following Phase 1B and to subsequently increase to 90 mgd in Phase 2. With either approach (retrofit or new), an equivalent pumping and conveyance capacity must be made available by the associated timelines to enable beneficial reuse of recycled wastewater.

2.7.2.3 DPR Product Water Conveyance

With DPR production in Phase 3, an associated pumping station and conveyance system will be needed to transport the water to its destination. A 120-mgd capacity is needed in accordance with the DPR production capacity.

To be located onsite at Hyperion, the design of the DPR product water pump station will be largely dictated by LADWP's Pure Water Los Angeles Master Plan relative to reuse water distribution requirements. The pump station will discharge into a large conveyance pipeline that will likely be constructed along the adjacent public road – Vista Del Mar. The anticipated routing for the DPR pipeline is northbound on Vista Del Mar as shown in Figure 2.34.

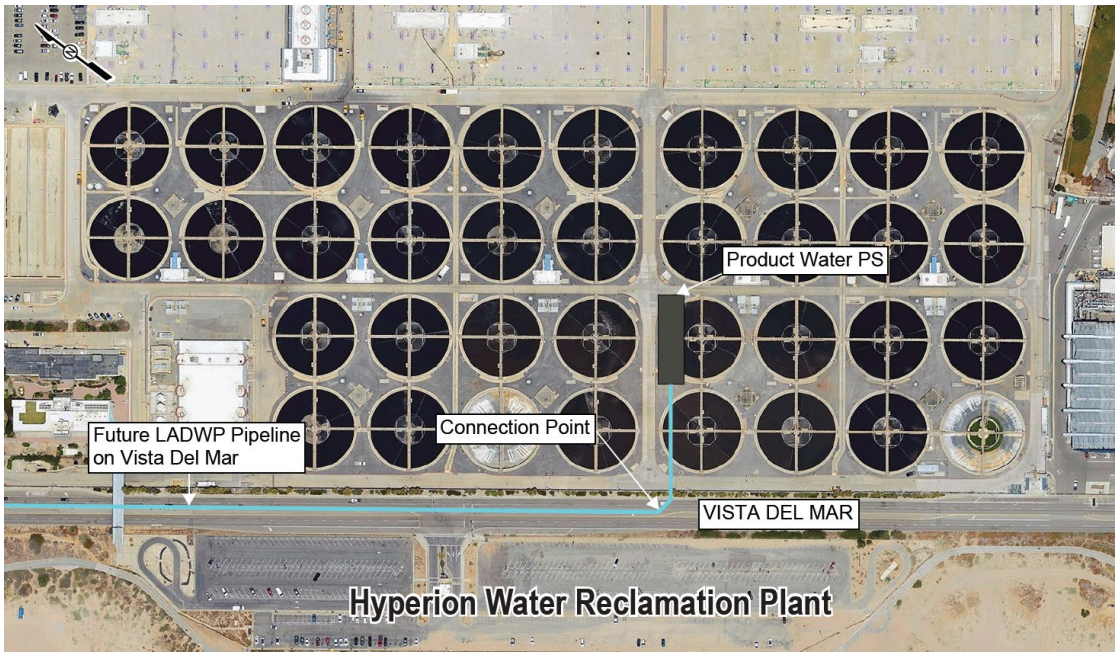


Figure 2.34 DPR Product Water Conveyance Pipeline

According to initial planning, this onsite pump station plus four offsite pump stations may be necessary for conveyance over a distance of 40.7 miles and an elevation gain of 1,140 feet tentatively to the San Fernando Valley Spreading Grounds. Additional storage basins would be needed between offsite pump stations to assist in maintaining stable pressures and system reliability.

As the lead agency, LADWP will execute multiple projects to plan, design, and construct the DPR product water conveyance and storage facilities as well as any necessary downstream facilities in accordance with its reuse objectives. These facilities are to be outside of the HWRP boundaries, and they must be constructed and online prior to the start-up and commissioning of the Phase 3 facilities in 2050, when DPR water will be first produced.

2.8 Findings and Recommendations

This section provides a summary of the major findings and recommendations for implementing the HWRP improvements proposed under Pure Water Los Angeles based on information presented in this chapter of the PIP.

2.8.1 Construction Phasing

- **Program Phasing:** As currently envisioned, the Pure Water Los Angeles Program at the HWRP will be implemented in three distinct phases and via five construction packages. The first phase is being planned to be a combination of three subphases (Phases 1A and 1B, and sidestream treatment). The proposed phasing approach may be summarized as tabulated in Table 2.10.

Table 2.10 Conceptual Construction Phasing Summary[1]

Phase	1A	1B[2]	Sidestream Treatment[2]	2	3
Description	Recycled Water Foundational Infrastructure	50-mgd IPR (MBR Battery A1)	Sidestream Treatment	40-mgd IPR (MBR Battery A2)	MBR Battery B and 120-mgd DPR
Dry Weather MBR Permeate Production[3]	0	78	78	155	272
IPR Production Capacity[4]	0	50	50	90	90
DPR Production Capacity[4]	0	0	0	0	120
Anticipated Completion	2032	2036	2036	2039	To be determined

Notes:
(1) Based on an AWT design approach of providing separate IPR and DPR trains.
(2) Construction of the Sidestream Treatment Facility will be performed concurrently with that of Phase 2, to achieve concurrent project completions.
(3) Based on an AAF of 272 mgd and excluding recycle flows.
(4) Excludes the flows associated with the HAWPF.

- **Phased Implementation of MBR and AWT:** The MBR conversion will begin in Phase 1B and continue through the remainder of the program. IPR facilities will be built in two consecutive phases for a total capacity of 90 mgd, to be completed by the end of Phase 2. The entirety of the DPR facilities will be constructed in Phase 3 for a 120-mgd capacity.
- **Sidestream Treatment:** As a standalone project, a new full-scale sidestream treatment facility will be constructed. Driven by secondary process benefits, its construction will be performed concurrently with that of Phase 1B, the initial MBR construction.

2.8.2 Preliminary Construction Sequencing Plan

- **Key Construction Sequencing Constraints for Pure Water Los Angeles:**
  - **Maintain Function of Existing Facilities:** Existing functioning facilities may be demolished only after new facilities are constructed to replace their function.
  - **Maintain Plant Capacity:** Maintain a peak wet weather flow of 740 mgd throughout construction. This is to be incorporated into a permit condition in the 2028 NPDES permit for HWRP. During Phase 1A, at least seven modules must be in service to meet this capacity. Following Phase 1A, at least six modules must be in service; Since two modules will be offline at a time for rehabilitation, a third module may be taken offline for maintenance.
  - **Odor Control:** Odor control must be available for immediate operation to serve new or modified wastewater treatment facilities when they come online.

  - **Electrical Facilities:** Similar to odor control, new wastewater treatment facilities must have both electrical utility service and standby power capabilities at startup and commissioning.
  - **Minimum Outfall Flow:** A minimum flow of ~50 mgd must be maintained in the five-mile outfall at all times to maintain minimum dilution and prevent seawater intrusion.

2.8.3 Major Program Risks

- **Area of Major Constructability Concerns:**
  - **Space Constraints:** Due to space constraints, new construction will need to be sequenced, following demolition or relocation of existing facilities.
  - **Groundwater and Deep Excavations:** The Program will involve multiple, large excavations that may also extend below the mean sea water level. As a result, they will necessitate significant shoring and construction dewatering operations with potential settlement concerns.
- **Seismic Risk and Resiliency:** Several existing structures are to be altered or repurposed as part of the program. Such structures must be assessed and improved for seismic code compliance in order to extend their service life while reducing long-term seismic risk.
- **Coordination with Other HRP Improvements:** Although outside of the program scope, there are other planned plant upgrades and modifications that may impact, or be impacted by, the overall program in a substantive manner. As a result, it is important to understand their interdependencies in order to mitigate adverse impacts and promote mutually beneficial outcomes. Example projects include:
  - **EPP Improvements.**
  - **Existing Cryogenic Facility Maintenance.**
  - **Electrical Systems Evaluation.**
- **Permitting and Regulatory Challenges:** Based on the size and complexity of the envisioned construction, the program will require a number of challenging permitting and regulatory approvals. They include:
  - **Peak Wet Weather Treatment Capacity:** Consistent with the current planning efforts for the Program, HWRP's 2028 NPDES permit from the Regional Water Quality Control Board needs to establish a peak wet weather flow capacity of 740 mgd.
  - **NPDES Permit Compliance:** Prior to commencement of potable reuse water production, it is recommended that LASAN approach the RWQCB for incorporating the tiered dilution approach into one of the future NPDES permits for compliance with the California Ocean Plan. Based on an analysis of SE water quality data from the past five years, the constituent estimated to come closest to exceeding the water quality objective was copper. If the tiered dilution structure is based on copper, all other constituents would also comply.
  - **CEQA/EIR Approval:** Construction activities outside of the HWRP are expected to have large and complex impacts on the environment and the communities as well as increased risks of finding unknown features or sensitive receptors. As such, the preparation of the EIR pertaining to non-HWRP improvements will be significantly onerous and time-consuming.

- **City of El Segundo Jurisdiction:** Due to the City boundary between Los Angeles and El Segundo, select new facilities proposed on the eastern side of the HWRP will fall in the City of El Segundo's jurisdiction.
- **LADWP Right-of-Way:** New construction proposed on the eastside of the HWRP will require close coordinate with, and potential approval from, LADWP due to close proximity to its high-voltage power transmission infrastructure.

2.8.4 Interagency Collaboration

- **Regional Partnership:** In addition to exploring a wide-range of reuse water delivery alternatives within the City of Los Angeles, LASAN and LADWP should also consider long-term partnerships with external entities. As other entities are brought in as program partners, implementation cost and schedule are expected to improve.
- **Other Infrastructure Needs:** To fully support Pure Water Los Angeles, LADWP will need to complete several key infrastructure projects outside of the HWRP boundaries. They include bringing a new electrical service to the plant as well as IPR and DPR product water conveyance facilities.

Appendix A

CONCEPTUAL CONSTRUCTION PHASING SCHEDULE

Hyperion 2035 Program- (Bell Curve Labor) 2024 06

DRAFT IPR / DPR (740 MGD - Multiple Phase 1 Projects)

Project ID:R8-IPR/DPR-740 24 06

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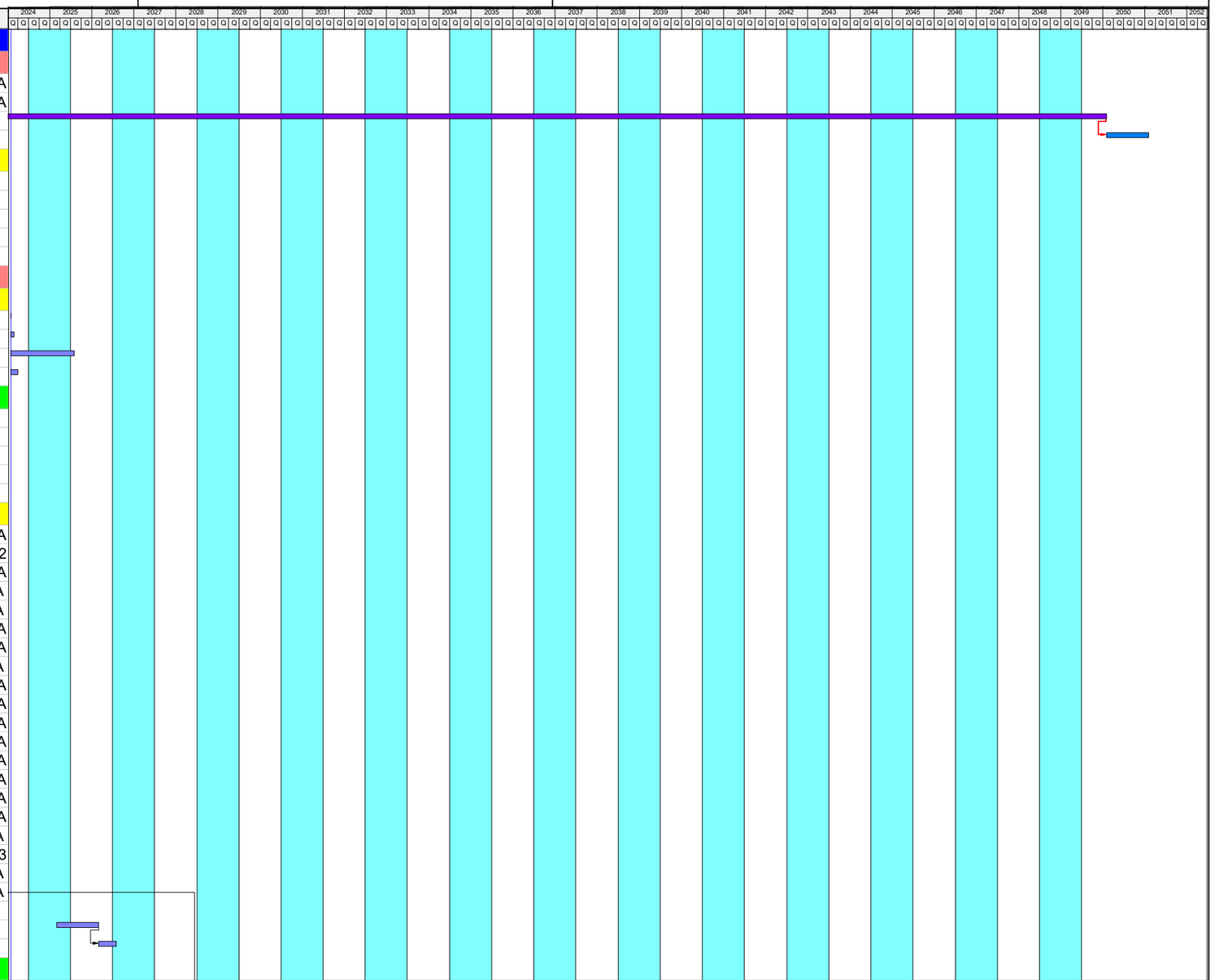
Activity ID	Activity Name	Original Duration	Start	Finish
Hyperion 2035 Program- (Bell Curve Labor) 2024 06		8967	02-Jan-17 A	15-May-52
PMO		7639	21-Oct-21 A	31-Jan-51
A1430	Program Planning	94	21-Oct-21 A	01-Mar-22 A
A1440	Program Initiation	218	02-Mar-22 A	30-Dec-22 A
A1450	Program Execution	6809	02-Jan-23 A	01-Feb-50
A1460	Program Closeout	260	02-Feb-50	31-Jan-51
Funding Activities		469	01-Feb-24	18-Nov-25
A1470	Funding Strategy TM	107	01-Feb-24*	28-Jun-24
A1785	LADWP/LASAN Develop Funding Agreement in Concept	120	01-Jul-24	13-Dec-24
A1790	LADWP/LASAN Finalize Funding Agreement in Concept	40	01-Jan-25	25-Feb-25
A1800	LADWP/LASAN MOU Development	130	26-Feb-25	26-Aug-25
A1810	LADWP/LASAN MOU Approvals	60	27-Aug-25	18-Nov-25
Informing Studies		1773	21-Oct-20 A	06-Aug-27
Programmatic Studies		1643	21-Apr-21 A	06-Aug-27
A1000	Study 1.11: Phasing-Packaging-Schedule ($75k)	0	01-Feb-24*	01-Feb-24
A1510	Project Delivery Selection Study	22	01-Feb-24*	01-Mar-24
A1530	Initial High-Level Program Planning (TD31)	391	01-Feb-24*	31-Jul-25
A1020	Project Packaging Analysis (TD48 Task 5) ($100k)	44	01-Feb-24*	02-Apr-24
Regulatory/CEQA/Permitting		1643	21-Apr-21 A	06-Aug-27
A2340	Hyperion AWPF/MBR Air Permit	856	21-Apr-21 A	28-Jun-24
A1640	DDW Support	132	01-Feb-24*	02-Aug-24
A1650	Permitting Plan	132	01-Feb-24*	02-Aug-24
A1070	Programmatic EIR/CEQA ($400k)	393	02-Sep-24*	04-Mar-26
A2270	Engineering Report Review and Approval	264	04-Aug-26	06-Aug-27
Technical Studies		1509	21-Oct-20 A	03-Aug-26
A1030	Process Alternative Study ($225k)	181	21-Oct-20 A	30-Jun-21 A
A1010	Distributed EQ, Packaging, Secondary Process Integratio	347	01-Jan-21 A	02-May-22
A1060	EPS 2.2: Power Supply - Management - Distribution ($110	276	03-Jan-22 A	23-Jan-23 A
A1250	Study 1.2: Secondary Process Integration ($110k)	206	03-Jan-22 A	17-Oct-22 A
A1040	Study 1.8: Plant Hydraulics/Major Conveyance Facilities ($	185	15-Feb-22 A	31-Oct-22 A
A1050	Study 1.1: Outfall Management ($185k)	222	15-Feb-22 A	21-Dec-22 A
A1520	Study 1.4: RO Concentrate Management ($210k)	217	15-Feb-22 A	14-Dec-22 A
A1540	Study 1.6: Secondary Clarifier Performance Enhancement	180	15-Feb-22 A	24-Oct-22 A
A1560	Study 1.5: Sidestream Treatment ($260k)	196	15-Feb-22 A	15-Nov-22 A
A1260	EPS 2.1: Conveyance and Preliminary Treatment ($260k)	239	15-Feb-22 A	13-Jan-23 A
A1270	Study 1.7: Site Plan (Treatment Conveyance) ($160k)	207	15-Feb-22 A	30-Nov-22 A
A1410	EPS 2.8: Product Water Distribution ($160k)	228	15-Feb-22 A	29-Dec-22 A
A1580	EPS 2.5: Process Modification – HPOAS Conversion to A	201	15-Feb-22 A	22-Nov-22 A
A1590	EPS 2.3: Critical Support Utilities ($110k)	234	15-Feb-22 A	06-Jan-23 A
A2240	Study 1.3: Provisions for DPR Addition ($235k)	212	15-Feb-22 A	07-Dec-22 A
A2250	EPS 2.4: Employee and Contractor Parking ($310k)	286	15-Feb-22 A	21-Mar-23 A
A1500	EPS 2.7: Secondary Clarifier Unification and Interim Impro	168	22-Aug-22 A	12-Apr-23 A
A2220	Study 1.10: Secondary Process 3D CAD Modeling ($410k	178	29-Aug-22 A	03-May-23
A2230	Study 1.9: CFD Modeling ($260k)	173	29-Aug-22 A	26-Apr-23 A
A1570	EPS 2.6: Process Modification – Sidestream Treatment ($:	157	13-Sep-22 A	20-Apr-23 A
A1680	Revise TMs (wet weather reduction)	175	03-Jul-23 A	01-Mar-24
A1230	MBR Pilot Operation and Data Collection ($1.742M)	260	04-Mar-25	02-Mar-26
A1400	MBR Pilot Report Development ($500k)	110	03-Mar-26	03-Aug-26
Program Implementation Plan/Master Plan		254	01-Feb-24 A	28-Jun-24



Program Planning
Program Initiation
Program Execution
Program Closeout
Conceptual Design
Bidding & Award
Design
Construction
Startup and Commissioning
Post-Construction
Outreach
Studies
As- Built
Field Exploration

Date	Revision	Checked	Approved

Hyperion 2035 Program- (Bell Curve Labor) 2024 06

DRAFT IPR / DPR (740 MGD - Multiple Phase 1 Projects)

Project ID:R8-IPR/DPR-740 24 06

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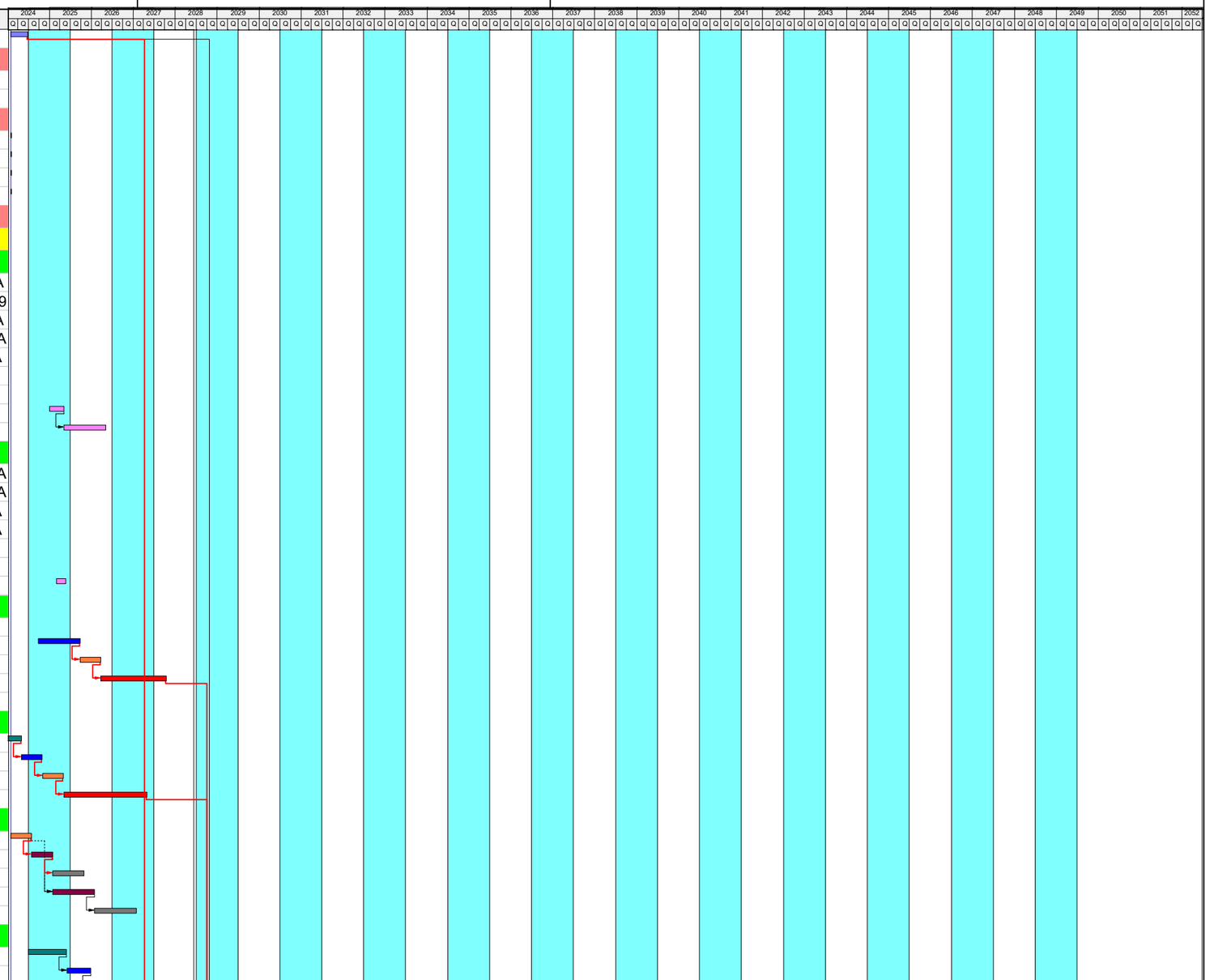
Activity ID	Activity Name	Original Duration	Start	Finish
A1550	PIP 3.0: Program Implemenation Plan ($1.06M)	254	01-Feb-24 A	28-Jun-24
LADWP Activities		543	01-Aug-23 A	02-Mar-26
A2640	Operation Next Master Plan	370	01-Aug-23 A	31-Dec-24
A2630	Prgrammatic EIR	390	03-Sep-24*	02-Mar-26
Outreach		5	01-Feb-24	07-Feb-24
A1600	Technical Advisory Group	5	01-Feb-24*	07-Feb-24
A1610	Community Advisory Group	5	01-Feb-24*	07-Feb-24
A1620	Informational Materials	5	01-Feb-24*	07-Feb-24
A1630	General Public Outreach Material Development	5	01-Feb-24*	07-Feb-24
Capital Projects		8967	02-Jan-17 A	15-May-52
Preliminary Projects		2794	02-Jan-17 A	15-Sep-28
HAWPF (Progressive DB)		2177	02-Jan-17 A	06-May-26
A1080	Pre-Design & Procuement Planning ($1M)	336	02-Jan-17 A	27-Apr-18 A
A1090	Bidding & Award	283	27-Apr-18 A	31-May-19
A1100	Design ($6M)	500	03-Jun-19 A	30-Apr-21 A
A1240	Site Preparation ($5M)	266	19-Jun-19 A	26-Jun-20 A
A1110	Construction ($70M)	439	20-Apr-21 A	31-Jul-23 A
A1111	Permitting Hold	240	01-Aug-23 A	28-Jun-24
A1115	Startup & Commissioning	133	01-Jul-24	01-Jan-25
A1120	Post-Construction	90	02-Jan-25	07-May-25
A1390	Performance Validation	260	08-May-25	06-May-26
MBR Pilot (DBB)		1731	08-Oct-18 A	26-May-25
A1180	Pre-Design ($500k)	245	08-Oct-18 A	18-Sep-19 A
A1190	Design ($1M)	122	19-Sep-19 A	06-Mar-20 A
A1200	Bidding & Award	83	09-Mar-20 A	01-Jul-20 A
A1210	Construction ($15M)	226	20-Apr-21 A	31-Jul-23 A
A1211	Permitting Hold	240	01-Aug-23 A	28-Jun-24
A1215	Startup & Commissioning	176	01-Jul-24	03-Mar-25
A1220	Post-Construction	60	04-Mar-25	26-May-25
IPS Gate Improvements (CIP 2517)		936	02-Jan-24 A	14-Apr-28
A2415	Pre-Design ($500k)	152	02-Jan-24 A	27-Sep-24
A2420	Design ($650k)	258	30-Sep-24	24-Sep-25
A2430	On-Call Contractor Procurement	129	25-Sep-25	24-Mar-26
A2440	Construction ($6.678M)	408	25-Mar-26	15-Oct-27
A2620	Post-Construction	130	18-Oct-27	14-Apr-28
Employee Parking Improvements (CIP 2535)		892	01-Jul-23 A	03-May-27
A2450	Pre-Design ($150k)	129	01-Jul-23 A	03-May-24
A2460	Design ($1.3M)	130	06-May-24	01-Nov-24
A2470	Bidding & Award	131	04-Nov-24	05-May-25
A2480	Construction ($13M)	520	06-May-25	03-May-27
Utility and Substructure Mapping		781	01-Feb-24	28-Jan-27
A2380	Professional Services Procurement	129	01-Feb-24*	30-Jul-24
A2390	Field Exploration (Phase 1)	130	31-Jul-24	28-Jan-25
A2400	As-Built Updates (Phase 1)	195	29-Jan-25	28-Oct-25
A2490	Field Exploration (Phase 2)	261	29-Jan-25	28-Jan-26
A2500	As-Built Updates (Phase 2)	261	29-Jan-26	28-Jan-27
Sidestream Treatment Pilot		1100	01-Jul-24	15-Sep-28
A2570	Pre-Design ($50k)	240	01-Jul-24*	30-May-25
A2580	Design ($450k)	150	02-Jun-25	26-Dec-25



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Hyperion 2035 Program- (Bell Curve Labor) 2024 06

DRAFT IPR / DPR (740 MGD - Multiple Phase 1 Projects)

Project ID:R8-IPR/DPR-740 24 06

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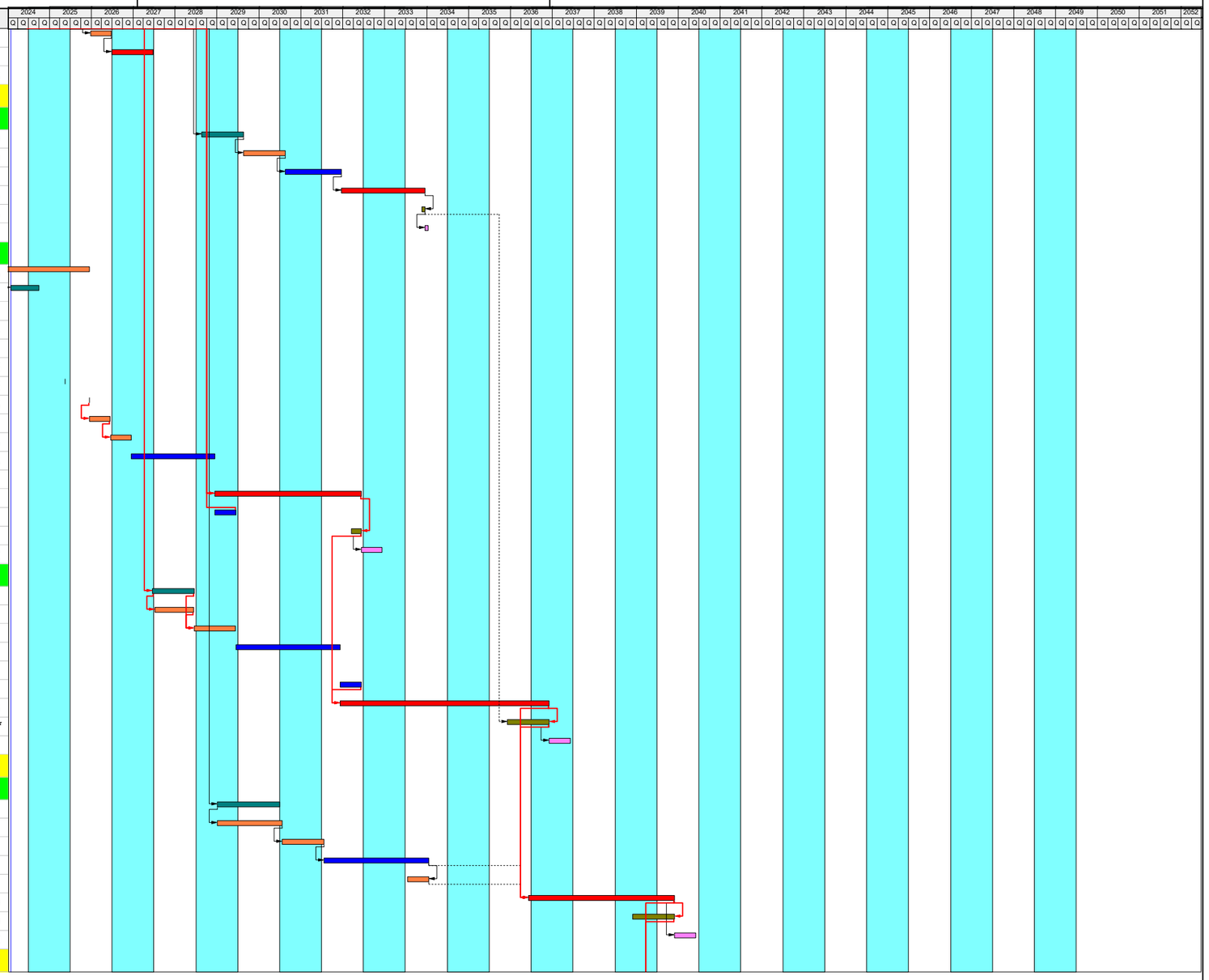
	Activity Name	Original Duration	Start	Finish
A2590	Bidding & Award	130	29-Dec-25	26-Jun-26
A2600	Construction ($4.5M)	260	29-Jun-26	25-Jun-27
A2610	Pilot Testing/Reporting	320	28-Jun-27	15-Sep-28
Phase 1 Projects		3480	02-Oct-23 A	03-Jun-37
Sidestream Treatment		1410	21-Aug-28	13-Jan-34
A1660	Conceptual Design ($1.1M)	260	21-Aug-28	17-Aug-29
Procur 20	Bidding & Award	260	20-Aug-29*	16-Aug-30
A1670	Design ($11.4M)	350	19-Aug-30	19-Dec-31
A1690	Construction ($113.5M) - Modules	520	22-Dec-31	16-Dec-33
A1700	Startup and Commissioning	20	21-Nov-33	16-Dec-33
A1710	Post-Construction	20	19-Dec-33	13-Jan-34
Phase 1A - Primary Effluent Modernization & Resiliency		2310	02-Oct-23 A	08-Dec-32
Procur 40	RFQ/RFP Development & Approval	238	02-Oct-23 A	16-Dec-25
A1720	Conceptual Design ($5.3M)	175	01-Feb-24*	02-Oct-24
A2350	RFP Review (Legal/BCA/CCU)	80	01-Jul-24	18-Oct-24
Procur 30130	RFQ Review (Legal/BCA/CCU)	20	02-Sep-24	27-Sep-24
Procur 30140	RFQ Approval to Issue	20	30-Sep-24	25-Oct-24
Procur 30110	Industry Outreach	60	26-Feb-25	20-May-25
Procur 30150	RFQ Issued	0		20-May-25
Procur 30200	RFP Issued	0		16-Dec-25
Procur 30220	Proposal Preparation	130	17-Dec-25	16-Jun-26
Procur 30240	Negotiation/Contracting	130	17-Jun-26	15-Dec-26
A1730	Design ($53.2M)	522	16-Dec-26	14-Dec-28
A2560	Final Design and Permitting	260	15-Jun-28	13-Jun-29
A1750	Construction ($665M)	910	14-Dec-28	09-Jun-32
A1780	Final Permitting	129	15-Dec-28	13-Jun-29
A1760	Startup and Commissioning	60	18-Mar-32	09-Jun-32
A1770	Post-Construction	130	10-Jun-32	08-Dec-32
Phase 1B - 50 MGD IPR (MBR Battery A1)		2600	17-Jun-27	03-Jun-37
A2150	Conceptual Design ($5.5M)	260	17-Jun-27	14-Jun-28
A2310	RFQ/RFP Development ($1M)	241	13-Jul-27	13-Jun-28
A2320	Proposal/Selection	260	14-Jun-28	12-Jun-29
A2170	Design ($54.9M)	649	13-Jun-29	08-Dec-31
A2550	Final Design and Permitting	260	12-Jun-31	09-Jun-32
A2330	Final Permitting	132	09-Dec-31	09-Jun-32
A2180	Construction ($687M)	1300	11-Dec-31	03-Dec-36
A2190	Startup and Commissioning	260	06-Dec-35	03-Dec-36*
A2200	Post Construction	130	04-Dec-36	03-Jun-37
Phase 2 Projects		2978	01-Jan-29	30-May-40
40 MGD IPR (MBR Battery A2)		2978	01-Jan-29	30-May-40
A1290	Conceptual Design ($6.1M)	390	01-Jan-29	28-Jun-30
A1302	RFQ/RFP Development ($1M)	408	01-Jan-29	24-Jul-30
A1303	Proposal/Selection	260	25-Jul-30*	23-Jul-31
A1310	Design ($61.1M)	650	23-Jul-31	18-Jan-34
A1315	GMP Negotiation	130	20-Jul-33	18-Jan-34
A1320	Construction ($764M)	910	05-Jun-36	30-Nov-39
A1480	Startup and Commissioning	260	02-Dec-38	30-Nov-39
A1330	Post Construction	130	01-Dec-39	30-May-40
Phase 3 Projects		5358	03-Nov-31	15-May-52



Program Planning
Program Initiation
Program Execution
Program Closeout
Conceptual Design
Bidding & Award
Design
Construction
Startup and Commissioning
Post-Construction
Outreach
Studies
As- Built
Field Exploration

Date	Revision	Checked	Approved

Hyperion 2035 Program- (Bell Curve Labor) 2024 06

DRAFT IPR / DPR (740 MGD - Multiple Phase 1 Projects)

Project ID:R8-IPR/DPR-740 24 06

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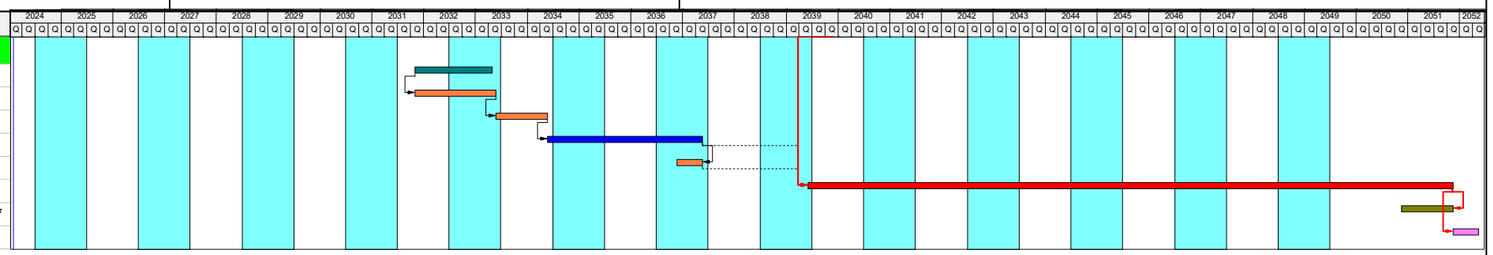
Activity ID	Activity Name	Original Duration	Start	Finish
MBR Battery B & 140 MGD DPR		5358	03-Nov-31	15-May-52
A1340	Conceptual Design ($18.8M)	390	03-Nov-31*	29-Apr-33
A1362	RFQ/RFP Development ($1M)	408	03-Nov-31	25-May-33
A1352	Proposal/Selection	260	26-May-33*	24-May-34
A1360	Design ($188M)	780	25-May-34	20-May-37
A1365	GMP Negotiation	130	20-Nov-36	20-May-37
A1370	Construction ($2.34B)	3250	02-Jun-39	15-Nov-51
A1490	Startup and Commissioning	260	17-Nov-50	15-Nov-51*
A1380	Post-Construction	130	16-Nov-51	15-May-52



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Appendix B

BLOWER NOISE ASSESSMENT

PROJECT MEMORANDUM

PURE WATER LOS ANGELES PROGRAM IMPLEMENTATION PLAN

LA Sanitation & Environment

Date: October 21, 2024
Project No.: 200945-00

Prepared By:	Kinsey Ryan, PE
Reviewed By:	Han Kang, PE
Subject:	Blower Noise Assessment

Purpose

Under the Pure Water Los Angeles Program, two new aeration air blower buildings, one for each membrane bioreactor (MBR) battery, will be located on the hillside along the eastern boundary of the Hyperion Water Reclamation Plant (HWRP), south of the existing Oxygen Generation Facility (OGF). LA Sanitation & Environment (LASAN) expressed concerns about the anticipated noise levels inside the new blower buildings due to staff exposure to elevated noise levels while working inside the buildings. Similarly, there are noise concerns outside the buildings due to the proximity to the El Segundo residents on the hillside above. The purpose of this project memorandum is to quantify the anticipated noise levels inside and outside of the new blower buildings by comparing noise data collected from operating facilities.

Denver Metro Blower Building

Serving 2.2 million people in greater Denver area in Colorado, the Metro Wastewater Reclamation District's (MWRD) Robert W. Hite Treatment Facility replaced a high-purity oxygen activated sludge process with a biological nitrogen removal facility in 2017. This conversion included the construction of a blower building that was designed by Carollo and houses five high-efficiency single-stage centrifugal blowers in a single building. Shown in Table 1, the blowers at MWRD are slightly larger in capacity and motor size than those proposed at Hyperion.

Table 1 Design Criteria – MWRD vs. Hyperion

	Unit	MWRD	Pure Water Los Angeles Program Battery A Blower Building	Pure Water Los Angeles Program Battery B Blower Building
No. of Blowers	-	4 Duty + 1 Standby	6 Duty + 1 Standby	8 Duty + 2 Standby
Type of Blowers	-	High Efficiency Single Stage Centrifugal	High Efficiency Single Stage Centrifugal	High Efficiency Single Stage Centrifugal
Capacity, each	scfm	29,260	23,600	23,600
Motor Size	hp	2,000	1,500	1,500
Drive Type	-	Soft Starter	Soft Starter	Soft Starter

The blower building at MWRD utilizes acoustic panels on the roof and walls inside of the building, as shown in Figure 1, which assist in mitigating noise levels and reducing reverberation. Additionally, the blower discharge piping is insulated to absorb and dampen noise vibrations to provide sound blocking and noise control.

Figure 1 Acoustic Wall and Ceiling Panels at MWRD Blower Building

To quantify the noise levels in and outside of the MWRD blower building, a noise assessment was performed on November 7, 2023. During the assessment, Blowers No. 1 and 3 were online. Average noise measurements were taken at the locations shown in Figure 2, at distances of 5-feet and 20-feet outside of the building as well as immediately adjacent to online Blower No. 3.

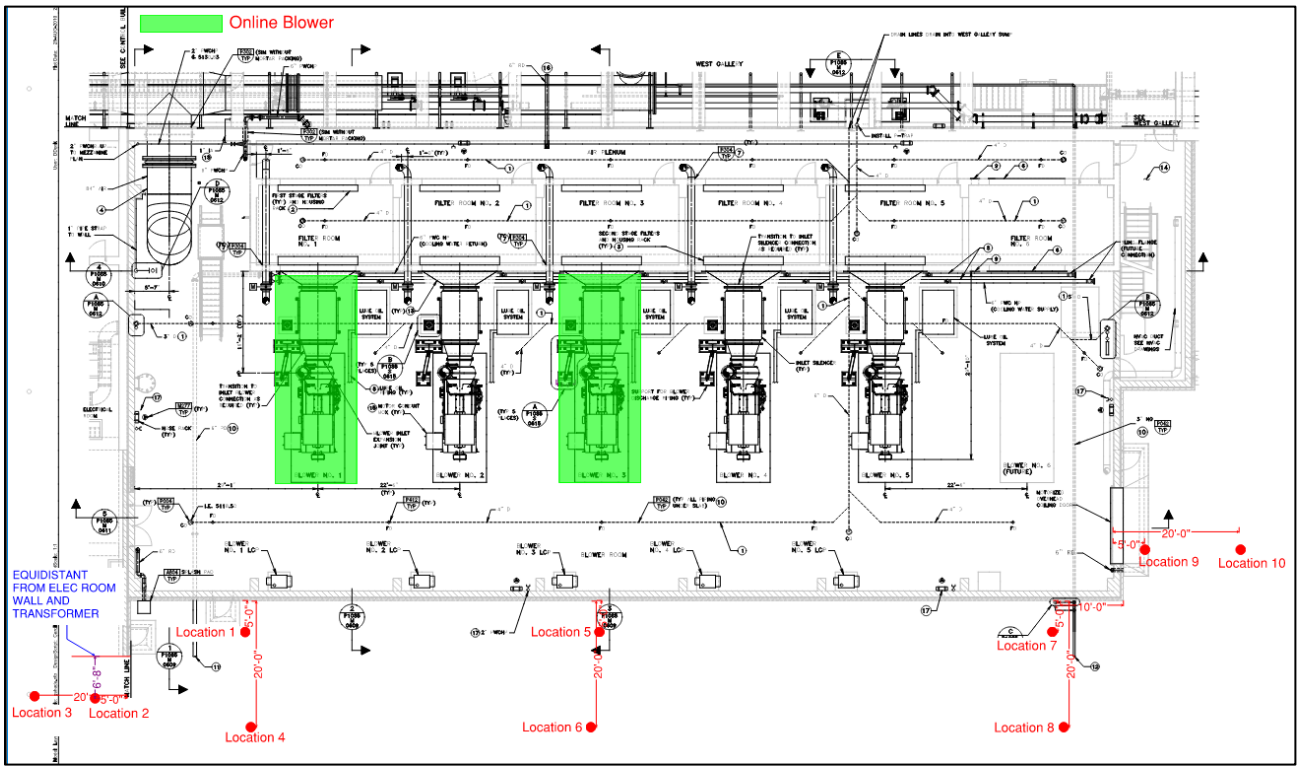

Figure 2 MWRD Blower Building – Noise Measurement Locations

Table 2 summarizes the measured noise levels at each location.

Table 2 MWRD Blower Building – Noise Data

Location No.	Noise Level (dBA)(1)(2)	Description
1	55.6	5 feet outside doorway with doors closed
5	61.5	5 feet from corner of Electrical Room, equally spaced between electrical room wall and transformer with doors closed
6	60.5	20 feet from corner of Electrical Room, equally spaced between electrical room wall and transformers with doors closed
7	50.8	20 feet outside doorway with doors closed
8	50.7	5 feet from Blower Building west wall with doors closed
9	50.1	20 feet from Blower Building west wall with doors closed
10	51.3	5 feet from Blower Building west wall, 10 feet from Blower Building south wall with doors closed
11	49.4	20 feet from Blower Building west wall, 10 feet from Blower Building south wall with doors closed
12	56.9	5 feet from Blower Building south wall roll up door with doors closed
13	55.0	20 ft from Blower Building south wall roll up door with doors closed
Adjacent to Blower No. 3	98.3	3 feet from the online blower

Notes:
(1) Noise measurements were taken on an iPhone with the app 'DecibalX'.
(2) Three noise measurements were taken at each location for a duration of one minute each. The noise level recorded is the highest average reading of the three measurements.

As shown in the table, the highest noise level recorded outside of the building was at location 5, with a noise level of 61.5 decibels (dBA), which is equivalent to the sound produced during normal conversation. Compared to the noise level adjacent to Blower No. 3, the noise level was substantially reduced outside of the building by at least 36.8 dBA. The measurement inside the building exceeded 85 dBA, a level most jurisdictions require hearing protection.

Oxygen Generation Facility Compressor Building at Hyperion

To compare the relative noise levels measured at the MWRD, a similar analysis was performed at an operating facility at Hyperion that is known to emit elevated noise levels. The existing OGF Compressor Building, located between Modules 7 and 8, was selected due to 1) high noise levels associated with five process air compressors and 2) its proximity to the hillside. The existing air compressors have a motor size of 4,500 HP, which is three times larger than the proposed motor size of the new aeration air blowers.

To quantify the noise level both inside and outside of the facility, noise data was collected inside of the OGF Compressor Building on December 18, 2023, when one compressor (No. 4) was online. Figure 3 shows the various locations surrounding the online compressor where the measurements were taken. In general, measurements were taken at distances of 5 feet from the compressor on both the compressor building floor and on top of the platform surrounding the compressor.

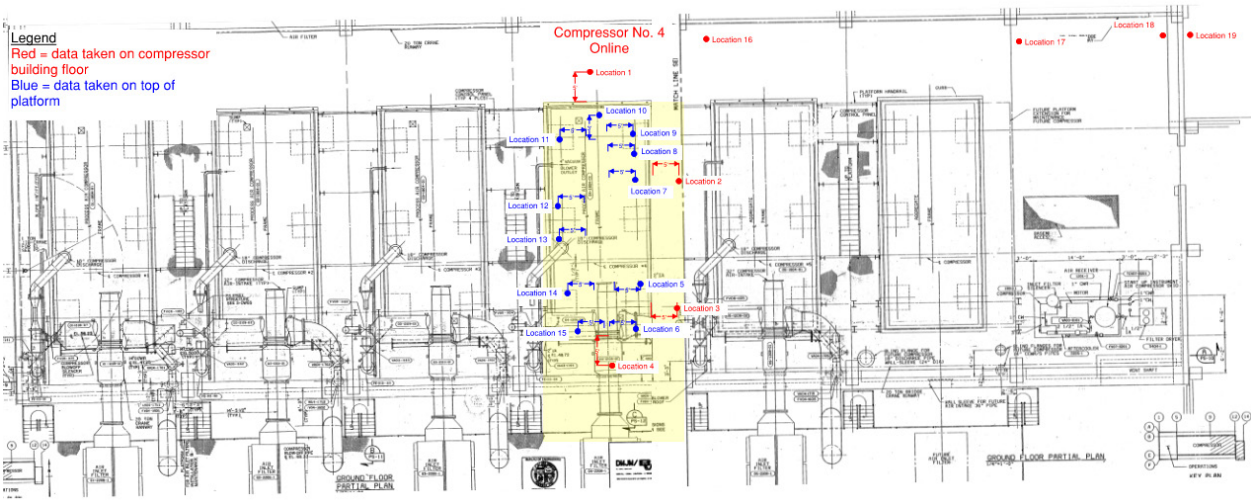

Figure 3 OGF Compressor Building – Noise Measurement Locations

Table 3 summarizes the average measured noise levels at each location shown in the figure above. Additionally, noise measurements were also taken at farther distances from the online compressor, which correspond to locations 16 through 18, and directly outside of the building at location 19.

Table 3 OGF Compressor Building – Noise Data

Location No.	Noise Level (dBA)[(1),(2)]	Location No.	Noise Level (dBA)[(1))2)]
1	92.3	11	95.0
2	96.7	12	99.5
3	99.5	13	101.5
4	100.4	14	103.2
5	99.1	15	103.1
6	100.2	16	89.6
7	98.2	17	85.5
8	97.7	18	84.7
9	96.5	19	70.8
10	93.6		

Notes:
(1) Noise measurements were taken with Reed Instruments Sound Level Meter.

As illustrated in the table, the loudest noise level recorded was closest to the compressor volute on the mezzanine level at location 14, shown in Figure 4. The noise level at this location was 103.2 dBA. All measurements made inside the building were at or above 85 dBA, a level which generally requires hearing protection. Comparatively, the noise level outside of the building was 70.8 dBA measured at location 19, indicating a reduction of approximately 32.4 dBA.

Figure 4 Location 14 – OGF Compressor Building

Findings and Recommendations

The following conclusions pertain to the completed noise assessments at the two operating facilities:

- **Blower Building** at **MWRD** – The blowers in operation at this facility are of the same type that will be installed in the HWRP aeration air blower buildings and are similar in motor size and capacity. Through implementing various noise mitigation measures into the design such as acoustical wall and ceiling panels and discharge piping insulation, a minimum noise reduction of 36.8 dBA outside of the building was observed, with the highest recorded noise level of 61.5 dBA.
- **OGF Compressor Building at Hyperion** – The loudest noise measurement recorded inside of the facility was next to the compressor volute. The noise levels inside of this facility require staff to wear ear protection when inside the building. The same is to be expected for the new aeration air blower buildings at Hyperion. Additionally, there was a significant reduction in noise outside of the building, decreasing from a maximum of 103.2 dBA to 70.8 dBA. Based on the outside noise levels measured at the two buildings (61.5 dBA at MWRD and 70.8 dBA at OGF Compressor Building) and because the motor size in the proposed blower buildings will be significantly smaller than that of the process air compressors in the OGF Compressor Building, it is expected that the noise levels outside of the new blower buildings will be lower than what was measured outside of the existing OGF Compressor Building.

Based on the results of the noise assessments performed at operating facilities, the following noise mitigation methods will be incorporated into the conceptual design of the new aeration air blower buildings:

1. The cast-in-place concrete construction of the new blower buildings will help reduce noise level transmitted to outside of the buildings.
2. Similar wall and ceiling acoustical panels that were used in the MWRD blower building will be provided in the new Hyperion blower buildings.
3. The blower layout in each new blower building to facilitate maintenance access will achieve reduced reverberation inside of the building.
4. The blower discharge piping will be insulated to help with sound attenuation, similar to the MWRD blower building.
5. When inside of the new blower building, staff will be required to wear earplugs, similar to what is required at the existing OGF Compressor Building.

Appendix C

OPINION OF PROBABLE CONSTRUCTION COST

LA Sanitation & Environment
Pure Water Los Angeles Program
Implementation Plan for Hyperion WRP

OPINION OF PROBABLE CONSTRUCTION COST

FINAL | October 2024

LA Sanitation & Environment
Pure Water Los Angeles Program Implementation Plan for Hyperion WRP

OPINION OF PROBABLE CONSTRUCTION COST

FINAL | October 2024

Digitally signed by Han Gil Kang
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Date: 2024.11.15 14:21:09-08'00'

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Abbreviations

ABC	aggregate base concrete
BAC	biological activated carbon
Carollo	Carollo Engineers
CCI	Construction Complexity Index
DPR	direct potable reuse
EI&C	electrical, instrumentation, and controls
EQ	equalization
ESF	Emergency Storage Facility
HWRP	Hyperion Water Reclamation Plant
IPR	indirect potable reuse
IPS	intermediate pump station
LADWP	Los Angeles Department of Water & Power
MBR	membrane bioreactor
MF	microfiltration
mgd	million gallons per day
ML	mixed liquor
OPCC	opinion of probable construction cost
PE	primary effluent
PIP	Pure Water Los Angeles Program Implementation Plan
PRC	Program Review Committee
Program	Pure Water Los Angeles Program
RAS	return activated sludge
RO	reverse osmosis
SE	secondary effluent
SWF	Service Water Facility
TM	technical memorandum
UCF	Utility Compressor Facility
UV-AOP	ultraviolet advanced oxidation process
WBS	Work Breakdown Structure

Section 1

INTRODUCTION

1.1 Purpose

An opinion of probable construction cost (OPCC) has been prepared for the improvements proposed at the Hyperion Water Reclamation Plant (HWRP) as part of the Pure Water Los Angeles Program (Program). The OPCC is based on the conceptual design and phasing information provided in the Pure Water Los Angeles Program Implementation Plan (PIP) for the HWRP. This report is intended to outline the methodology, unit cost development, and assumptions used in the formulation of the construction cost estimate and to provide a summary of the cost associated with each phase of the Program.

1.2 Estimate Scope

It is currently envisioned that, at the HWRP, the Pure Water Los Angeles Program will be implemented in three distinct construction phases. However, the actual number of construction packages may vary, subject to further refinement based on a variety of factors including reuse water demand, construction cost, and funding availability. For example, Phase 1 - 50-million gallons per day (mgd) indirect potable reuse (IPR) is being conceived as a combination of three subphases (Phase 1A, Phase 1B, and Sidestream Treatment). Therefore, an OPCC estimate was prepared for each of the anticipated phases of the Program listed below:

- Phase 1A - Recycled Water Foundational Infrastructure.
- Phase 1B - 50-mgd IPR (membrane bioreactor [MBR] Battery A1).
- Sidestream Treatment Facility.
- Phase 2 - 40-mgd IPR (MBR Battery A2).
- Phase 3 - MBR Battery B and 120-mgd direct potable reuse (DPR).

1.3 Basis of Cost Estimate

The OPCC estimate for the Pure Water Los Angeles Program at the HWRP was prepared using the design criteria and preliminary layouts presented in Chapter 1 of the PIP. The estimate is considered a Class 4 estimate by the Association for the Advancement of Cost Engineering, as it was prepared based on limited information and subsequently has a fairly wide accuracy range. Class 4 estimates are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1 percent to 15 percent complete, and would comprise, at a minimum, the following:

- Plant capacity.
- Block schematics.
- Preliminary plant hydraulic profile.
- Conceptual layouts.
- Process Flow Diagrams for main process facilities.
- Preliminary engineered process and support utility systems.

The typical accuracy ranges for Class 4 estimates are -15 percent to -30 percent on the low side, and +20 percent to +50 percent on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of appropriate contingency determination.

1.3.1 Estimate Methodology

The OPCC estimate was prepared using Carollo Engineers' (Carollo) cost estimating model, which is built using quantity takeoffs and unit costs for materials and equipment. These unit costs are derived from internal databases (e.g., RSMeans and Richardson database) for materials and installation of common construction items (piping, concrete, etc.). For major process equipment and materials, vendor quotes and quotes from previous projects were used.

The estimate includes direct labor, equipment, and subcontractor costs associated with construction materials and equipment. For costs derived from the internal database, direct labor, equipment and subcontractor costs were calculated using crew listing and labor hours published by RSMeans and adjusted to reflect Los Angeles local labor and material rates. For major process equipment, an installation cost of 30 percent was applied to quotes received from vendors to account for cost of install, labor, testing and startup, and warranty.

1.3.2 Estimate Structure

The structure of the OPCC estimate for each of the program phases is broken down into the following components:

- Direct Costs - Includes all costs associated with labor, materials, and equipment necessary for the construction of each facility and process area. These are considered hard costs that have a tangible end product and are accounted for in the detailed cost estimate sheets for each facility.
- Markups - Includes all costs that are not readily seen in the end product but are costs included with the contractor's bids. Percentages of the Total Direct Cost for each markup have been coordinated with Los Angeles Department of Water & Power (LADWP) and LA Sanitation & Environment's Program Review Committee (PRC) during the development of the OPCC estimates. Markups are further discussed in detail in Section 1.3.3.

Direct costs are organized according to a Work Breakdown Structure (WBS) established for this estimate. The WBS for each phase of the Program includes an element for each facility that is to be constructed, retrofitted or demolished during that phase. Each element within a phase has its own detailed cost estimate and costs are organized into Construction Specifications Institute MasterFormat 17-division categories. For information on specific items included for each element, refer to the phase specific quantity takeoff sheets included in Attachment A.

1.3.3 Markups

Markups used in the OPCC are presented in Table 1. The values were either derived from the May 9, 2024, Cost Escalation and Markups Technical Memorandum (TM) for the Pure Water Los Angeles Master Plan as prepared by LADWP Water System's Project Management Office or were based on the PRC's long-standing practices. All markups were applied to each phase of the Program and can be found in the summary sheets for each phase included in Attachment A.

Table 1 Pure Water Los Angeles Program Markups

Markup	Percentage	Notes
Sales Tax	9.5%	Applied to the material goods portion of the direct costs, estimated to be 50%(1)
		Group 1(2)
General Conditions	10%	Source: May 9, 2024, Cost Escalation and Markups TM for Pure Water Los Angeles Master Plan prepared by LADWP
CCI	10%	Source: May 9, 2024, Cost Escalation and Markups TM for Pure Water Los Angeles Master Plan prepared by LADWP
General Liability and Builder's Risk	2%	Based on current market conditions
General Contractor Bond	1%	Source: May 9, 2024, Cost Escalation and Markups TM for Pure Water Los Angeles Master Plan prepared by LADWP
Contractor Profit	10%	Source: May 9, 2024, Cost Escalation and Markups TM for Pure Water Los Angeles Master Plan prepared by LADWP
		Group 2(3)
Mobilization	5%	Source: May 9, 2024, Cost Escalation and Markups TM for Pure Water Los Angeles Master Plan prepared by LADWP
Permits	3%	Source: May 9, 2024, Cost Escalation and Markups TM for Pure Water Los Angeles Master Plan prepared by LADWP
		Group 3(4)
Estimating Contingency	45%	Source: May 9, 2024, Cost Escalation and Markups TM for Pure Water Los Angeles Master Plan prepared by LADWP

Notes:
Abbreviations: CCI - Construction Complexity Index.
(1) Salex tax is included in the Total Direct Cost.
(2) All Group 1 markups are applied to the Total Direct Cost of the project.
(3) All Group 2 markups are applied to the sum of the Total Direct Cost and Group 1 markups.
(4) All Group 3 markups are applied to the sum of the Total Direct Cost and Group 1 and 2 markups.

1.3.3.1 Sales Tax

This is a tax on material goods that the contractor must pay according to state and local tax laws. The percentage is applied to both the material and equipment the General Contractor purchases, but not to labor. For the purposes of this estimate, it is assumed that material and equipment represent 50 percent of the direct cost. The sales tax percentage is based on the local rates in place at the time the estimate was prepared. The Total Direct Cost includes the value of sales tax.

1.3.3.2 General Conditions

General Conditions' costs are for project requirements that are not directly related to construction activities or part of quantity take-offs but are required by the specifications to execute the work. These costs include requirements such as job site offices, temporary utilities, project managers, superintendents, and safety equipment and personnel.

1.3.3.3 Construction Complexity Index

The CCI is a quantitative tool to measure the complexity of construction for building projects and associated risk and is based on the conditions of the construction site. The process of determining the appropriate CCI percentage for the project included reviewing the complexity factors shown in Table 2, analyzing the level of difficulty for the project, and then comparing it to a weight of the total index (based on importance and determined by LADWP). A value of 10 percent was determined by LADWP for all projects within the Pure Water Los Angeles Program and an assessment of the projects at HWRP also determined the 10 percent factor is appropriate.

Table 2 Determination of CCI for Pure Water Los Angeles

Complexity Factor[1]	Description	Difficulty	Factor	Weight[1]	Complexity Contribution[2]
Proximity to Residents	Distance of the project to homes.	Low[3]	0.05	5%	0.3%
Level of Difficulty to Access Urban Centers for Material and Labor	Difficulty of receiving materials at the job site and of labor traveling to the site.	Low[3]	0.05	2.5%	0.1%
Level of Soil Contamination[4]	Site conditions and required mitigations for soil containing pollutants.	Medium[5]	0.1	15%	1.5%
Limited Parking and Lay Down Space Availability	Space availability on site for worker parking and storing materials.	Medium[5]	0.1	15%	1.5%
Need to Keep Facility Operational	If construction must be completed around a facility that must remain operational.	High[6]	0.15	15%	2.3%
Construction Phasing Required	Complexity stemming from phased construction within a project.	Medium[5]	0.1	15%	1.5%
Urgency of Schedule	Level of priority to keep project on schedule.	Medium[5]	0.1	10%	1.0%
Construction Method Difficulty	Level of complexity of construction.	Medium[5]	0.1	10%	1.0%

Complexity Factor[1]	Description	Difficulty	Factor	Weight[1]	Complexity Contribution[2]
Difficulty to Access Power	Ability to obtain electricity at job site.	Low[3]	0.05	2.5%	0.1%
Amount of Coordination with Other Agencies	Increase collaboration with other agencies can lead to larger review times, increasing potential complexity.	Medium[5]	0.1	5%	0.5%
				CCI[7]	**10%**

Notes:
(1) Defined by LADWP.
(2) Determined by multiplying the factor and the weight of a complexity factor.
(3) For a factor with a low level of difficulty, a factor of 0.05 was used.
(4) For Pure Water Los Angeles projects, assumed that this factor also includes potential utility conflicts.
(5) For a factor with a medium level of difficulty, a factor of 0.10 was used.
(6) For a factor with a high level of difficulty, a factor of 0.15 was used.
(7) Determined by the sum of all complexity contributions.

1.3.3.4 General Liability and Builder's Risk

This is the insurance that the general contractor must carry in order to execute the work. Anecdotally, Builder's Risk Insurance rates have been increasing across the industry. Therefore, a rate of 2 percent is being used for these estimates.

1.3.3.5 General Contactor Bond

Bonding is the cost of the Performance and Payment bonds that the City of Los Angeles requires the General Contractor to provide to ensure satisfactory completion of the work.

1.3.3.6 Contractor Profit

This is the profit that a general contractor is typically seeking in a normal bidding environment.

1.3.3.7 Mobilization

Mobilization costs are to initiate the project after receiving Notice to Proceed. It includes mobilizing the resources to start the construction activities.

1.3.3.8 Permits

This includes the costs required to obtain the permits required for construction activities.

1.3.3.9 Estimating Contingency

The estimating contingency covers variances in the costs of individual quantity line items and other unknowns. As the design progresses, the contingency is replaced in part with known unit costs for individual equipment or material components. While the estimates prepared are better than parametric estimates, they are planning level estimates (less than 5 percent design completed), and, as such, there is a significant amount of scope detail that has not been captured in the direct costs. Therefore, a 45 percent estimating contingency was applied to each project phase, aligning with the typical Class 4 estimate accuracy range of -30 percent to +50 percent.

1.3.4 Estimate Exclusions

The following items were excluded from the OPCC estimate:

- Hazardous materials remediation and/or disposal.
- Easement procurement costs.
- O&M costs.
- Utilities modification.
- Management of ground water.

As the Program progresses, these items may be accounted for and added to the cost estimate.

1.3.5 Program-Wide Assumptions

The following program-level assumptions have been required for the formulation of this cost estimate:

1. HWRP's peak wet weather design capacity will be 740 mgd.
2. Project delivery will be progressive design-build.
3. Construction schedule will be as indicated in Appendix A of the PIP.
4. All work, unless specifically stated otherwise, will be performed in eight-hour shifts with standard working hours of 7:00 a.m. through 5:00 p.m., Monday through Friday.
5. Costs relative to design, legal, construction management, inspection, and program administration are not included in this estimate.
6. Waste materials from the demolition of the existing digesters, existing secondary clarifiers and the existing Emergency Storage Facility (ESF) will be recycled and used as aggregate base concrete (ABC) fill for new facilities. All other waste materials will be transported to landfill for disposal. A dump fee of $7.50 per cubic yard is used for demolition waste based on industry-standard rates.
7. All hauling costs for waste materials are based on 20 cubic yard dump trucks and a 40-mile round trip.
8. No piles will be required for the Program. Imported Class A soil will be used for structure backfill.
9. Shoring will be required for the construction of the Primary Effluent (PE) Equalization (EQ) and Secondary Effluent (SE) EQ facilities. This estimate assumes the use of sheet piling for excavation protection.
10. Small diameter piping, less than 12 inches in diameter, were accounted for in the allowances at this stage of the estimate.
11. 4-inches of asphalt concrete over 10-inches of ABC will be provided for paved areas.
12. Standby generators and transformers will be located outdoors and installed on a 3-foot-thick concrete pad.
13. Diesel engine driven standby generators will be provided.
14. Electrical, instrumentation, and controls (EI&C) cost for each Program phase was assumed to be 20 percent of the total construction cost minus the total electrical cost.
15. Costs for LADWP to construct new infrastructure outside of HWRP in support of Pure Water Los Angeles Program implementation are not included. Such infrastructure consists of a large electrical substation for providing a new electrical service and offsite pipelines for product water conveyance.

Section 2

COST ESTIMATES

This section presents the results of the OPCC estimate for each phase of the Pure Water Los Angeles Program at the HWRP and the associated total program cost.

2.1 Phase 1A – Recycled Water Foundational Infrastructure

Phase 1A is intended to expedite key support infrastructure to streamline the overall implementation of the Program. It primarily addresses PE EQ basins, intermediate pump station (IPS), fine screening, and associated support facilities. Figure 1 highlights the facilities included in the Phase 1A OPCC estimate.

2.1.1 Assumptions

The following is a list of major assumptions made for the development of the Phase 1A cost estimate:

1. Construction is anticipated to start in December 2028 and be completed by June 2032. The midpoint of construction will be in September 2030.
2. The PE EQ basins will provide a total storage of 36.4 million gallon
3. s.
4. Large gates will be provided between the Module 10 PE EQ basin and the East PE EQ basin such that they can be operated as a single hydraulic system.
5. New IPS will utilize vertical mixed flow type pumps.
6. Fine screening will utilize center flow band screens.
7. The cost of demolishing the existing IPS is included in the cost of the IPS Afterbay.
8. Demolition of 11 abandoned digesters will be included in Phase 1A.
9. Demolition of the Carver-Greenfield Building will be included in Phase 1A.
10. Demolition of the MBR Pilot Facility and the IPS odor control facility will be included in Phase 1A.
11. Demolition of the Old Laboratory will be included in Phase 1A.
12. Temporary facilities include the cost of six temporary standby generators that will provide standby power to the new IPS. These generators will be purchased, not rented, so that they can be repurposed for use again in a later phase.

Figure 1 Phase 1A - Conceptual Site Plan

2.1.2 Cost Summary

The summary of the OPCC estimate for Phase 1A is shown in Table 3. In the table, the Direct Cost for each facility included in the estimate is shown, along with the Total Direct Cost of the project before and after markups are applied. For additional information on the items included in each area, refer to the quantity takeoff worksheets located in Attachment A.

Table 3 Phase 1A - Cost Estimate Summary in 2024 Dollars

Area	Percentage	Direct Cost[1]
Employee Parking Lot Demolition		$288,000
System 1 Odor Control Facility		$12,327,000
East Primary EQ Basin		$26,370,000
West Primary EQ Basin		$62,291,000
Module 10 EQ Basin		$39,604,000
IPS		$27,966,000
IPS Afterbay		$4,836,000
Fine Screening Facility		$18,063,000
Electrical Substation No. 1		$3,838,000
IPS Standby Generator Demolition		$89,000
IPS Standby Generator Facility - Group 1		$24,764,000
IPS Transformers		$2,304,000
Abandoned Conventional Digesters Demolition		$18,224,000
Carver Greenfield Demolition		$8,989,000
IPS Odor Control Facility Demolition		$287,000
MBR Pilot Facility Demolition		$419,000
ESF Demolition		$4,477,000
Power and Blower Building Demolition		$8,663,000
Old Laboratory Demolition		$1,243,000
Site Work		$4,018,000
Yard Piping		$2,995,000
Temporary Facilities		$4,952,000
EI&C		$21,276,000
Sales Tax[2]	9.5%	$14,168,000
	Total Direct Cost	**$312,451,000**
CCI[3]	10%	$31,245,000
General Conditions[3]	10%	$31,245,000
General Liability and Builder's Risk[3]	2%	$6,249,000
General Contractor Bond[3]	1%	$3,125,000
Contractor Profit[3]	10%	$31,245,000
	Subtotal (1)	**$415,560,000**

Area	Percentage	Direct Cost[1]
Mobilization[4]	5%	$20,778,000
Permits[4]	3%	$12,467,000
	Subtotal (2)	**$448,805,000**
Estimating Contingency[5]	45%	$201,962,000
Total Estimated Project Construction Cost[1]		**$650,767,000**

Notes:
(1) Cost values are in June 2024 dollars.
(2) Applied to 50 percent of the direct cost of each facility.
(3) Applied to the Total Direct Cost.
(4) Applied to Subtotal (1).
(5) Applied to Subtotal (2).

2.2 Phase 1B - 50-mgd IPR (MBR Battery A1)

Phase 1B is intended to construct the southern half of Secondary Treatment Battery A to initiate the MBR conversion and to construct approximately half of the IPR treatment facilities to expedite the production of IPR product water. It represents the first of the three packages intended for the MBR conversion. Figure 2 highlights the facilities included in the Phase 1B OPCC estimate.

2.2.1 Assumptions

The following is a list of major assumptions made for the development of the Phase 1B cost estimate:

1. Construction is anticipated to start in December 2031 and be completed by December 2036. The midpoint of construction will be in June 2034.
2. The new earth retaining wall along the eastern boundary will be located 40 feet east of the existing wall.
3. The Battery A Aeration Blower Building will be structurally completed in Phase 1B. Only blowers that support Modules 1 and 2 will be installed.
4. The reverse osmosis (RO)/ultraviolet advanced oxidation process (UV-AOP) building will be constructed in its entirety during this phase. However, only equipment to support 50-mgd IPR production will be installed.
5. A new Utility Compressor Facility (UCF) will be constructed along the east side of the plant and will mimic the existing UCF facility that will be demolished in a later phase.
6. Common electrical buildings will serve facilities in Phase 1B and subsequent phases. Electrical equipment required for each phase will be added in accordingly.
7. The six temporary standby generators installed in Phase 1A will no longer be needed after Phase 1A has finished construction. In Phase 1B, these standby generators will be installed in the Phase 1B standby generator facilities.
8. Temporary facilities include the cost of temporary odor control system that will provide odor control for Modules 3 and 4 after the Module 2 Vent Scrubber Building is demolished in this phase as well as temporary post treatment system for the IPR facilities constructed in Phase 1B.

Figure 2 Phase 1B - Conceptual Site Plan (Shown with Sidestream Treatment Facility)

2.2.2 Cost Summary

The summary of the OPCC estimate for Phase 1B is shown in Table 4. In the table, the Direct Cost for each facility included in the estimate is shown, along with the Total Direct Cost of the project before and after markups are applied. For additional information on the items included in each area, refer to the quantity takeoff worksheets located in Attachment A.

Table 4 Phase 1B - Cost Estimate Summary in 2024 Dollars

Area	Percentage	Direct Cost[(1)]
New Retaining Wall		$16,220,000
Existing Retaining Wall Demolition		$3,264,000
Technical Support Facility No. 2		$15,329,000
System 2 Odor Control Facility		$7,112,000
System 7 Odor Control Facility		$11,827,000
Aeration Basin Module 1		$14,050,000
Aeration Basin Module 2		$14,050,000
Battery A ML Channel and RAS Building (Southern Half)		$13,203,000
Battery A Aeration Blower Building		$31,694,000
Membrane Train A1		$63,399,000
Secondary EQ Basin (Southern Half)		$11,161,000
South Chemical Storage Facility		$3,916,000
West Basin Municipal Water District Pump Station		$6,511,000
IPR RO/UV-AOP Building (50 mgd)		$87,723,000
UCF		$3,439,000
Electrical Substation No. 2		$2,773,000
MBR Trains A1, A2, and B1, and SE EQ Electrical Room		$6,562,000
Module 2 Electrical Building		$1,073,000
Generator Facility at Old Laboratory		$10,955,000
MBR Train A1 Standby Generator Facility - Group 5		$7,743,000
SE EQ Basin and MBR Trains A1, A2, and B1 Transformers		$2,633,000
Existing Module 2 Electrical Building Demolition		$554,000
Existing Module 2 Vent Scrubber Building Demolition		$385,000
Secondary Clarifiers 1A-1D Demolition		$8,709,000
Secondary Clarifiers 2A-2D Demolition		$7,301,000
Site Work		$6,233,000
Yard Piping		$4,188,000

Area	Percentage	Direct Cost[1]
EI&C		$32,163,000
Temporary Facilities		$4,461,000
Sales Tax[2]	9.5%	$18,920,000
	Total Direct Cost	**$417,240,000**
CCI[3]	10%	$41,723,000
General Conditions[3]	10%	$41,723,000
General Liability and Builder's Risk[3]	2%	$8,345,000
General Contractor Bond[3]	1%	$4,172,000
Contractor Profit[3]	10%	$41,723,000
	Subtotal (1)	**$554,926,000**
Mobilization[4]	5%	$27,746,000
Permits[4]	3%	$16,648,000
	Subtotal (2)	**$599,320,000**
Estimating Contingency[5]	45%	$269,694,000
Total Estimated Project Construction Cost[1]		**$869,014,000**

Notes:
Abbreviations: ML - mixed liquor; RAS - return activated sludge.
(1) Cost values are in June 2024 dollars.
(2) Applied to 50 percent of the direct cost of each facility.
(3) Applied to the Total Direct Cost.
(4) Applied to Subtotal (1).
(5) Applied to Subtotal (2).

2.3 Sidestream Treatment - Cost Estimate

This project will establish a new sidestream treatment facility intended for placement in the vicinity of the abandoned Conventional Digester Battery C. To facilitate this work and to leverage Phase 1A construction that will include demolition of seven adjacent digesters, the demolition of four Battery C Digesters associated with the sidestream treatment facility siting will be performed in Phase 1A. Figure 3 shows the conceptual layout of the sidestream treatment facility.

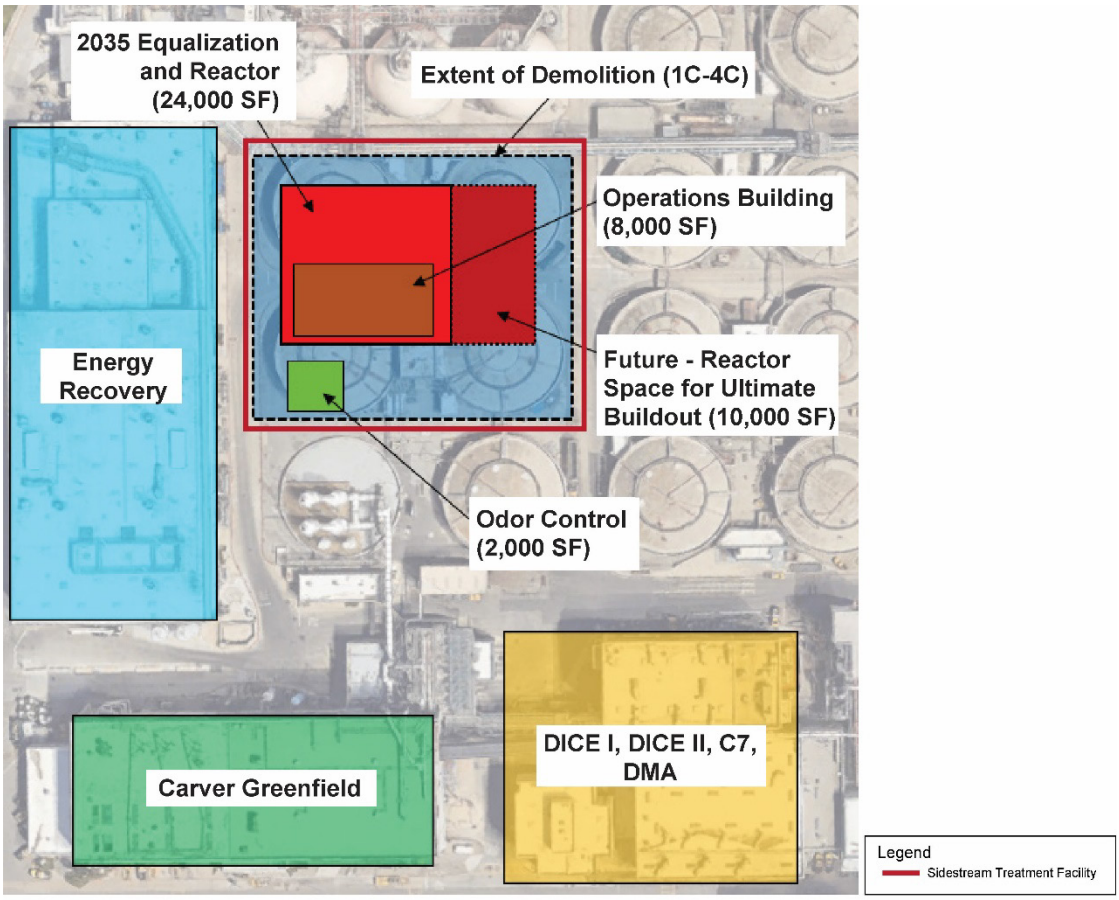

Figure 3 Sidestream Treatment Facility

2.3.1 Assumptions

The following is a list of major assumptions made for the development of the sidestream treatment cost estimate:

1. Construction is anticipated to start in December 2031 and be completed by December 2033. The midpoint of construction will be in December 2032.
2. Demolition of four abandoned digesters associated with the Sidestream Treatment project will be included in the Phase 1A project.
3. Cost to construct a sidestream pilot facility is not included.
4. The cost of the sidestream treatment facility was based on implementing the most expensive of the four sidestream treatment technologies (Tomorrow Water AMX) evaluated in TM 5 - Sidestream Treatment.

2.3.2 Cost Summary

The summary of the OPCC estimate for the Sidestream Treatment Facility is shown in Table 5. In the table, the Direct Cost for each facility included in the estimate is shown, along with the Total Direct Cost of the project before and after markups are applied. For additional information on the items included in each area, refer to the quantity takeoff worksheets located in the Appendix.

Table 5 Sidestream Treatment - Cost Estimate Summary in 2024 Dollars

Area	Percentage	Direct Cost[1]
Sidestream Treatment		$46,889,000
Site Preparation		$2,570,000
EI&C		$5,900,000
Sales Tax[2]	9.5%	$2,630,000
	Total Direct Cost	**$57,989,000**
CCI[3]	10%	$5,799,000
General Conditions[3]	10%	$5,799,000
General Liability and Builder's Risk[3]	2%	$1,160,000
General Contractor Bond[3]	1%	$580,000
Contractor Profit[3]	10%	$5,799,000
	Subtotal (1)	**$86,598,000**
Mobilization[4]	5%	$3,856,000
Permits[4]	3%	$2,314,000
	Subtotal (2)	**$83,296,000**
Estimating Contingency[5]	45%	$37,483,000
Total Estimated Project Construction Cost[1]		**$120,779,000**

Notes:
(1) Cost values are in June 2024 dollars.
(2) Applied to 50 percent of the direct cost of each facility.
(3) Applied to the Total Direct Cost.
(4) Applied to Subtotal (1).
(5) Applied to Subtotal (2).

2.4 Phase 2 - 40-mgd IPR (MBR Battery A2)

Phase 2 is intended to construct the northern half of Secondary Treatment Battery A to increase the MBR permeate production and to complete the remaining IPR treatment train. MBR Battery A2 consists of retrofitted Modules 3 and 4, a new membrane train, and new blowers to be installed in the Battery A blower building constructed in Phase 1B. For the IPR train, the secondary EQ and the RO/UV-AOP Building will each be expanded to their full capacities, utilizing the spaces vacated by Secondary Clarifiers 3 and 4. Figure 4 highlights the facilities included in the Phase 2 OPCC estimate.

Figure 4 Phase 2 - Conceptual Site Plan

2.4.1 Assumptions

The following is a list of major assumptions made for the development of the Phase 2 cost estimate:

1. Construction is anticipated to start in June 2036 and be completed by November 2039. The midpoint of construction will be in March 2038.
2. Battery A Aeration Blower Building will have been constructed in Phase 1B. In Phase 2, the blowers required to support Modules 3 and 4 will be installed.
3. The RO/UV-AOP building will have been constructed in Phase 1B. In Phase 2, equipment to support the additional 40-mgd IPR capacity will be added. Electrical equipment required for Phase 2 facilities will be added to common electrical buildings.

2.4.2 Cost Summary

The summary of the OPCC estimate for Phase 2 is shown in Table 6. In the table, the Direct Cost for each facility included in the estimate is shown, along with the Total Direct Cost of the project before and after markups are applied. For additional information on the items included in each area, refer to the quantity takeoff worksheets located in Attachment A.

Table 6 Phase 2 - Cost Estimate Summary in 2024 Dollars

Area	Percentage	Direct Cost[1]
System 3 Odor Control Facility		$6,578,000
Aeration Basin Module 3		$14,050,000
Aeration Basin Module 4		$14,050,000
Battery A ML Channel and RAS Building (Northern Half)		$10,519,000
Battery A Aeration Blower Building		$4,874,000
Membrane Train A2		$63,399,000
Secondary EQ Basin (Northern Half)		$13,299,000
IPR RO/UV-AOP Building (40 mgd)		$35,368,000
Electrical Substation No. 3		$16,160,000
MBR Trains A1, A2, and B1, and SE EQ Electrical Room		$5,554,000
Module 3 Electrical Building		$1,073,000
MBR Train A2 Standby Generator Facility - Group 4		$6,439,000
Secondary EQ Basin MBR Trains A1, A2, and B1 Transformers		$2,633,000
Existing Module 3 Electrical Building Demolition		$554,000
Secondary Clarifiers 3A-3D Demolition		$9,653,000
Secondary Clarifiers 4A-4D Demolition		$7,301,000
Site Work		$6,131,000
Yard Piping		$2,679,000
EI&C		$13,554,000
Sales Tax[2]	9.5%	$11,109,000
	Total Direct Cost	**$244,977,000**

Area	Percentage	Direct Cost[1]
CCI[3]	10%	$24,498,000
General Conditions[3]	10%	$24,498,000
General Liability and Builder's Risk[3]	2%	$4,900,000
General Contractor Bond[3]	1%	$2,450,000
Contractor Profit[3]	10%	$24,498,000
	Subtotal (1)	**$325,821,000**
Mobilization[4]	5%	$16,291 ,000
Permits[4]	3%	$9,775,000
	Subtotal (2)	**$351,887,000**
Estimating Contingency[5]	45%	$158,349,000
Total Estimated Project Construction Cost[1]		**$510,236,000**

Notes:
(1) Cost values are in June 2024 dollars.
(2) Applied to 50 percent of the direct cost of each facility.
(3) Applied to the Total Direct Cost.
(4) Applied to Subtotal (1).
(5) Applied to Subtotal (2).

2.5 Phase 3 - MBR Battery B and 120-mgd DPR

Phase 3 is intended to construct the entirety of Secondary Treatment Battery B and the DPR train. MBR Train B1 consists of retrofitted Modules 5 and 6 and a new membrane train, whereas MBR Battery B2 consists of retrofitted Modules 7 and 8 and a new membrane train. MBR Battery B3 consists of retrofitted Module 9 and a half membrane train. A dedicated blower building will serve the entire MBR Battery B. The DPR train is to be built in this phase, which consists of ozone and liquid oxygen facilities, biological activated carbon (BAC) filters, a new RO/UV-AOP Building, a new microfiltration (MF) facility, and a new Product Water Storage Basin and Pump Station. Figure 5 highlights the facilities included in the Phase 3 OPCC estimate.

Figure 5 Phase 3 - Conceptual Site Plan

2.5.1 Assumptions

The following is a list of major assumptions made for the development of the Phase 3 cost estimate:

1. Construction is anticipated to start in June 2039 and be completed by November 2051. The midpoint of construction will be in August 2045.
2. Electrical equipment required for Phase 3 facilities will be added to common electrical buildings.
3. Membrane Train B3 will be built out to accommodate two banks of membrane tanks. However, during Phase 3, only one bank of membrane tanks will be installed. The second bank will be preserved for when the Module 10 EQ basin is converted to bioreactors in a future program.
4. New equipment will be installed in the Post Treatment Facility constructed in Phase 2 and will render the temporary IPR post treatment system constructed in Phase 2 obsolete.
5. Additional blending infrastructure to achieve a 10:1 dilution of a chemical contaminant spike in the influent mandated by the California DPR regulations will be provided by offsite LADWP facilities.
6. As part of a comprehensive rehabilitation, all equipment in the Main Switch Yard will be replaced, as it will have reached its end of useful life by the time Phase 3 construction is complete.
7. Temporary facilities include the cost of temporary odor control system that will provide odor control for Module 7.

2.5.2 Cost Summary

The summary of the OPCC estimate for Phase 3 is shown in Table 7. In the table, the Direct Cost for each facility included in the estimate is shown, along with the Total Direct Cost of the project before and after markups are applied. For additional information on the items included in each area, refer to the quantity takeoff worksheets located in Attachment A.

Table 7 Phase 3 - Cost Estimate Summary in 2024 Dollars

Area	Percentage	Direct Cost[1]
System 4 Odor Control Facility		$12,693,000
System 5 Odor Control Facility		$6,998,000
System 6 Odor Control Facility		$12,693,000
Aeration Basin Module 5		$14,050,000
Aeration Basin Module 6		$14,050,000
Aeration Basin Module 7		$14,050,000
Aeration Basin Module 8		$14,050,000
Aeration Basin Module 9		$14,050,000
Battery B ML Channel and RAS Building		$23,774,000
Battery B Aeration Blower Building		$49,412,000
Membrane Train B1		$63,399,000
Membrane Train B2		$63,399,000

Area	Percentage	Direct Cost[1]
Membrane Train B3		$49,505,000
Oxygen Production		$24,721,000
Ozone Production		$18,120,000
Ozone Contact Area		$24,351,000
BAC Contact Area		$107,157,000
North Chemical Storage Facility		$91,000
Post Treatment Facility		$19,131,000
DPR Product Water Pump Station		$12,276,000
MF Building		$115,324,000
DPR RO/UV-AOP Building		$172,113,000
SWF		$26,326,000
Main Switchyard		$4,230,000
Electrical Substation No. 4		$14,500,000
Product Water Pump Station Electrical Room		$6,666,000
MBR Trains A1, A2, and B1, and SE EQ Electrical Room		$4,999,000
MBR Trains B2 and B3 Electrical Room		$9,341,000
Module 6 Electrical Building		$1,073,000
Module 7 Electrical Building		$1,073,000
Module 9 Electrical Building		$1,073,000
Ozone Electrical Buildings		$10,887,000
SWF Generator Facility - Group 2		$37,743,000
MBR Trains B2 and B3 Transformers		$4,009,000
SE EQ Basin and MBR Trains A1, A2, and B1 Transformers		$1,955,000
Oxygen Generation Facility Demolition		$1,916,000
Oxygen Generation Facility Compressor Facility Demolition		$4,787,000
Existing Module 6 Electrical Building Demolition		$554,000
Existing Module 7 Electrical Building Demolition		$554,000
Existing Module 9 Electrical Building Demolition		$554,000
Existing Module 6 Vent Scrubber Building		$385,000
Existing Module 9 Vent Scrubber Building		$385,000
Secondary Clarifiers 5A-5D Demolition		$6,806,000
Secondary Clarifiers 6A-6D Demolition		$7,153,000
Secondary Clarifiers 7A-7D Demolition		$7,731,000
Secondary Clarifiers 8A-8D Demolition		$6,965,000
Secondary Clarifiers 9A-9D Demolition		$6,497,000
SWF Demolition		$3,650,000

Area	Percentage	Direct Cost[1]
Service Water Generator Demolition		$71,000
Service Water Substation Demolition		$73,000
Existing UCF Demolition		$373,000
Site Work		$14,744,000
Yard Piping		$10,087,000
EI&C		$188,341,000
Temporary Facilities		$1,400,000
Sales Tax[2]	9.5%	$58,439,000
	Total Direct Cost	**$1,290,937,000**
CCI[3]	10%	$129,094,000
General Conditions[3]	10%	$129,094,000
General Liability and Builder's Risk[3]	2%	$25,819,000
General Contractor Bond[3]	1%	$12,909,000
Contractor Profit[3]	10%	$129,094,000
	Subtotal (1)	**$1,716,947,000**
Mobilization[4]	5%	$85,847,000
Permits[4]	3%	$51,508,000
	Subtotal (2)	**$1,854,302,000**
Estimating Contingency[5]	45%	$834,436,000
Total Estimated Project Construction Cost[1]		**$2,688,738,000**

Notes:
Abbreviations: SWF - Service Water Facility.
(1) Cost values are in June 2024 dollars.
(2) Applied to 50 percent of the direct cost of each facility.
(3) Applied to the Total Direct Cost.
(4) Applied to Subtotal (1).
(5) Applied to Subtotal (2).

2.6 Total Construction Cost Estimate for Pure Water Los Angeles Program

The total construction cost of the Pure Water Los Angeles Program at the HWRP in 2024 dollars is presented in Table 8.

Table 8 Pure Water Los Angeles Program - Cost Estimate Summary in 2024 Dollars

Project Phase	Project Construction Cost[1]
Phase 1A	$650,767,000
Phase 1B	$869,014,000
Sidestream Treatment	$120,779,000
Phase 2	$510,236,000
Phase 3	$2,688,738,000
Total Program Construction Cost	**$4,839,534,000**

Notes:
(1) Cost values are in June 2024 dollars.

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

2.7 Escalated Total Construction Cost Estimate for Pure Water Los Angeles Program

The Pure Water Los Angeles Program is anticipated to be a multi-decade initiative, thus, cost estimates for the Program will escalate and will require long-term escalation rates. The escalated total construction cost for each phase of the Program was calculated based on the anticipated increase in the total project cost between the time of the estimate and the date corresponding to the midpoint of construction. Per LADWP's Pure Water Los Angeles Master Plan documents, the following escalation rates were used in development of the escalated OPCC estimate for the Program:

- Short-Term Projects (2024 - 2027): 8 percent per year.
- Medium-Term Projects (2028 - 2033): 5.5 percent per year.
- Long-Term Projects (2034 and beyond): 3 percent per year.

The calculated escalation percentage for each phase of the project was applied to the Total Estimated Project Construction Costs presented in Table 8. Table 9 shows the anticipated midpoint of construction of each project phase, the calculated escalation percentage, and the escalated project construction cost for each phase of the Program.

Table 9 Pure Water Los Angeles Program – Escalated Cost Estimate Summary

Project Phase	Midpoint of Construction	Years to Midpoint of Construction(1)	Escalation Percentage(2)	Escalated Project Construction Cost
Phase 1A	September 2030	6.4	6.7%	$983,633,000
Phase 1B	June 2034	10.1	6.0%	$1,566,274,000
Sidestream Treatment	December 2032	8.6	6.4%	$206,429,000
Phase 2	March 2038	13.8	5.1%	$1,015,666,000
Phase 3	August 2045	21.3	4.4%	$6,736,438,000
	Total Program Escalated Construction Cost			**$10,508,440,000**

Notes:
(1) Calculated from estimate start date of May 1, 2024.
(2) Average annual percentage applied to Total Estimated Project Construction Cost for each Phase using escalation rates determined by LADWP's Pure Water Los Angeles Master Plan.

Attachment A

DETAILED COST ESTIMATES

Phase 1A - Detailed Cost Estimate

LASAN - WRID
PROJECT CONSTRUCTION COST ESTIMATE

Project Title: **Phase 1A - Recycled Water Foundational Infrastructure**

Scope: The project will provide improvements, rehabilitation and/or replacement of the existing Intermediate Pumping Station and the Primary Effluent Management Facilities and include the following components: (a) primary effluent equalization basins; (b) primary effluent return pump stations; (c) associated structural demolition or subsurface realignments; (d) fine screens for primary effluent treatment; (e) odor control; (f) upgrades to the associated electric power distribution system.

Work Order: | Client Dept.:

Project Manager: | Project Engineer:

Type of Estimate: ☐ Class "A" ☐ Class "B" ☐ Class "C" ☑ Class "O"

Estimate Date	5/1/2024
Construction Start	12/14/2028
Construction End	6/9/2032
Construction Mid Point	9/11/2030

Description	Unit	Quantity	Unit Price	Jun-24
Employee Parking Lot (EPL) Demo	LS	1	$ 287,538	288,000
System 1 Odor Control Facility	LS	1	$ 12,326,881	12,327,000
East Primary EQ Basin	LS	1	$ 26,370,434	26,370,000
West Primary EQ Basin	LS	1	$ 62,290,787	62,291,000
Module 10 EQ Basin	LS	1	$ 39,604,272	39,604,000
Intermediate Pump Station	LS	1	$ 27,966,111	27,966,000
IPS Afterbay	LS	1	$ 4,836,131	4,836,000
Fine Screening Facility	LS	1	$ 18,063,170	18,063,000
Electrical Substation No. 1	LS	1	$ 3,838,488	3,838,000
IPS Standby Generator Demo	LS	1	$ 88,692	89,000
IPS Standby Generator Facility - Group 1	LS	1	$ 24,763,575	24,764,000
IPS Transformers	LS	1	$ 2,304,182	2,304,000
Abandoned Conventional Digesters Demo	LS	1	$ 18,224,110	18,224,000
Carver Greenfield Demo	LS	1	$ 8,988,939	8,989,000
IPS Odor Control Facility Demo	LS	1	$ 287,489	287,000
MBR Pilot Facility Demo	LS	1	$ 419,164	419,000
Emergency Storance Facility Demo	LS	1	$ 4,476,591	4,477,000
Power and Blower Building Demo	LS	1	$ 8,663,040	8,663,000
Old Laboratory Demo	LS	1	$ 1,243,469	1,243,000
Site Work	LS	1	$ 4,017,697	4,018,000
Yard Piping	LS	1	$ 2,995,303	2,995,000
Temporary Facilities	LS	1	$ 4,951,800	4,952,000
Electrical and Instrumentation	LS	1	$ 21,275,955	21,276,000
Sales Tax		9.5%	$ 14,168,481	14,168,000
			Total Direct Cost	**312,451,000**
Construction Complexity Index		10.0%	$ 31,245,230	31,245,000
General Conditions		10.0%	$ 31,245,230	31,245,000
General Liability & Builder's Risk		2.0%	$ 6,249,046	6,249,000
General Contractor Bond		1.0%	$ 3,124,523	3,125,000
Contractor Profit		10.0%	$ 31,245,230	31,245,000
Subtotal (1)				**415,560,000**
Mobilization - 0% to 7% of Subtotal (1)			5%	20,778,000
Permits - 2% to 5% of Subtotal (1)			3%	12,467,000
Subtotal (2)				**448,805,000**
Estimating Contingency - 0% to 30% of Subtotal (2)			45%	201,962,000
Total Estimated Project Construction Cost (Unescalated)				**650,767,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**01 Employee Parking Lot**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	Demolition of Existing Employee Parking Lot	1	LS	$287,538.00	$287,538	
	Total					**$287,538**
	Grand Total					**$287,538**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**02 System 1 OCF**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division					
02000	Tipping Fee - Soil	3812.22	CY	$7.50	$28,592	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	3812.22	CY	$20.00	$76,244	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	124.89	CY	$58.23	$7,273	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	4320.52	CY	$15.00	$64,808	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	3812.22	CY	$3.00	$11,437	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	508.3	CY	$11.24	$5,714	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	124.89	CY	$6.16	$770	
02300	ABC Fill	2287.33	CY	$60.00	$137,240	
	Total					**$332,077**
	Division					
03300	24" Structural Flat Mat On Grade	1400	CY	$850.00	$1,190,000	
03999	Concrete Encasement Allowance	1	LS	$.00	$200,000	
	Total					**$1,390,000**
	Division					
11000	System 1 Odor Control Facility	1	LS	$8,405,916.36	$8,405,916	
	Total					**$8,405,916**
	Division					
15000	Pipe Supports	1	LS	$400,000.00	$400,000	
15814	Frp Flange, 48"	20	EA	$8,946.83	$178,937	
15814	Frp Volume Damper, 108"	4	EA	$14,016.77	$56,067	
15814	Frp Volume Damper, 48"	20	EA	$6,013.51	$120,270	
15814	Frp Tee, 108"	20	EA	$6,573.20	$131,464	
15814	90 Degree Frp Duct Elbow, 48"	27	EA	$9,400.86	$253,823	
15814	Frp Duct, 108"	496.2962963	LF	$1,500.00	$744,444	
15814	Frp Duct, 48"	200	LF	$600.00	$120,000	
15814	90 Deg Frp Duct Elbow, 108"	7	EA	$27,697.45	$193,882	
	Total					**$2,198,888**
	Grand Total					**$12,326,881**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 03 East PEQ Basin

Format: MASTER FORMAT 17
Date : May 31, 2024
By : XHK
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee - Soil	53,789.83	CY	$7.50	$403,424	
02260	Sheet Piling, 38#/Sf To 40' Deep, Driven, Left In Place (Pits & Trenches)	24,510.00	SF	$90.00	$2,205,900	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	53,789.83	CY	$20.00	$1,075,797	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	5,978.89	CY	$58.23	$348,159	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	54,623.78	CY	$15.00	$819,357	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	53,789.83	CY	$3.00	$161,369	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	833.95	CY	$11.24	$9,375	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	5,978.89	CY	$6.16	$36,856	
02300	ABC Fill	3,752.78	CY	$60.00	$225,167	
	Total					**$5,285,403**
	Division 03 - Concrete					
03000	56" STRUCTURAL FLAT MAT ON GRADE	5,918.67	CY	$897.44	$5,311,648	
03000	62" Straight Wall > 8' High	955.83	CY	$1,500.00	$1,433,745	
03000	62" Straight Wall > 8' High	2,040.43	CY	$1,500.00	$3,060,645	
03000	62" Straight Wall > 8' High	248.73	CY	$1,500.00	$373,095	
03000	62" Straight Wall > 8' High	273.61	CY	$1,500.00	$410,415	
03000	62" Straight Wall > 8' High	281.90	CY	$1,500.00	$422,850	
03000	62" Straight Wall > 8' High	82.15	CY	$1,500.00	$123,225	
03300	24" Structural Flat Mat On Grade	1,777.78	CY	$850.00	$1,511,113	
03300	30" X 30" Square Column/Pier	611.11	CY	$2,500.00	$1,527,775	
	Total					**$14,174,511**
	Division 05 - Metals					
05000	12" Diameter Soil Anchors	3,120.00	LF	$66.12	$206,302	
	Total					**$206,302**
	Division 11 - Equipment					
11000	Vertical Centrifugal Pump (30,000 gpm)	3.00	EA	$549,541.79	$1,648,625	
11000	Orifice Header Cleaning System	1.00	EA	$1,278,838.47	$1,278,838	
11000	Submersible Mixer	8.00	EA	$104,366.78	$834,934	
11000	Actuating Overflow Weir (4' H x6' L)	2.00	EA	$29,042.00	$58,084	
11000	48" Flap Gate	6.00	EA	$28,148.40	$168,890	
11294	Heavy Duty Slide Gate between East PE EQ and Module 10 EQ	6.00	EA	$452,474.35	$2,714,846	
	Total					**$6,704,219**
	Grand Total					**$26,370,434**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 04 West PEQ Basin

Format: MASTER FORMAT 17
Date : May 31, 2024
By : XHK
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee - Soil	140,122.67	CY	$7.50	$1,050,920	
02260	Sheet Piling, 38#/Sf To 40' Deep, Drive, Pull & Salvage (Trenches Only)	44232	SF	$90.00	$3,980,880	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	140,122.67	CY	$20.00	$2,802,453	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	9,770.67	CY	$58.23	$568,959	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	142,295.11	CY	$15.00	$2,134,427	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	140,122.67	CY	$3.00	$420,368	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	2,172.44	CY	$11.24	$24,421	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	9,776.00	CY	$6.16	$60,263	
02300	ABC Fill	9,776.00	CY	$60.00	$586,560	
	Total					**$11,629,251**
	Division 03 - Concrete					
03000	54" STRUCTURAL FLAT MAT ON GRADE	16,872.00	CY	$850.00	$14,341,200	
03000	62" STRAIGHT WALL >8' HIGH	3,823.33	CY	$1,500.00	$5,734,995	
03000	62" Straight Wall > 8' High	5,161.50	CY	$1,500.00	$7,742,250	
03000	62" Straight Wall > 8' High	248.57	CY	$1,500.00	$372,855	
03000	62" Straight Wall > 8' High	546.86	CY	$1,500.00	$820,290	
03000	62" Straight Wall > 8' High	563.43	CY	$1,500.00	$845,145	
03000	62" Straight Wall > 8' High	82.09	CY	$1,500.00	$123,135	
03300	24" Structural Flat Mat On Grade	6,000.00	CY	$850.00	$5,100,000	
03300	30" X 30" Square Column/Pier	1,840.74	CY	$2,500.00	$4,601,850	
	Total					**$39,681,720**
	Division 05 - Metals					
05000	12" Diameter Soil Anchors	7,980.00	LF	$66.12	$527,657	
	Total					**$527,657**
	Division 11 - Equipment					
11000	48" Flap Gate	4.00	EA	$28,148.40	$112,594	
11000	Actuating Overflow Weir (4' H x6' L)	2.00	EA	$29,042.00	$58,084	
11000	Submersible Mixer	24.00	EA	$104,366.78	$2,504,803	
11000	Orifice Header Cleaning System	1.00	EA	$4,318,155.88	$4,318,156	
11000	Vertical Centrifugal Pump (30,000 gpm)	3.00	EA	$549,541.79	$1,648,625	
11293	Slide Gate, 48" X 48"	4.00	EA	$452,474.35	$1,809,897	
	Total					**$10,452,159**
	Grand Total					**$62,290,787**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 05 Module 10 EQ Basin

Format: MASTER FORMAT 17
Date : May 31, 2024
By : XHK
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee - Soil	108,522.13	CY	$7.50	$813,916	
02260	Sheet Piling, 38#/Sf To 40' Deep, Drive, Pull & Salvage (Trenches Only)	19,350.00	SF	$90.00	$1,741,500	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	108,522.13	CY	$20.00	$2,170,443	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	9,963.56	CY	$58.23	$580,191	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	109,918.81	CY	$15.00	$1,648,782	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	108,522.13	CY	$3.00	$325,566	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	1,396.68	CY	$11.24	$15,700	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	9,963.56	CY	$6.16	$61,419	
02300	ABC Fill	6,285.07	CY	$60.00	$377,104	
	Total					**$7,734,622**
	Division 03 - Concrete					
03000	56" STRUCTURAL FLAT MAT ON GRADE	8,465.00	CY	$897.44	$7,596,825	
03000	74" STRAIGHT WALL>8' HIGH	5,086.30	CY	$1,500.00	$7,629,450	
03000	74" STRAIGHT WALL>8' HIGH	2,870.37	CY	$1,500.00	$4,305,555	
03300	30" X 30" Square Column/Pier	1,640.74	CY	$2,500.00	$4,101,850	
03300	24" Structural Flat Mat On Grade	3,762.22	CY	$850.00	$3,197,887	
	Total					**$26,831,567**
	Division 05 - Metals					
05000	12" Diameter Soil Anchors	5,460.00	LF	$66.12	$361,029	
	Total					**$361,029**
	Division 11 - Equipment					
11000	Actuating Overflow Weir (4' H x6' L)	2.00	EA	$29,042.00	$58,084	
11000	Submersible Mixer	18.00	EA	$104,366.78	$1,878,602	
11000	Orifice Header Cleaning System	1.00	EA	$2,740,368.16	$2,740,368	
	Total					**$4,677,054**
	Grand Total					**$39,604,272**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**07 IPS**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee - Soil	21239.07	CY	$7.50	$159,293	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	21239.07	CY	$20.00	$424,781	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	1080.03	CY	$58.23	$62,892	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	21653.47	CY	$15.00	$324,802	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	21239.07	CY	$3.00	$63,717	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	414.4	CY	$11.24	$4,658	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	1080.03	CY	$6.16	$6,658	
02300	ABC Fill	1847.04	CY	$112.00	$206,868	
	Total					**$1,253,670**
	Division 03 - Concrete					
03000	54" STRUCTURAL FLAT MAT ON GRADE	1080	CY	$850.00	$918,000	
03000	34" STRAIGHT WALL >8' HIGH	528.89	CY	$1,800.00	$952,002	
03300	24" Structural Flat Mat On Grade	622.22	CY	$850.00	$528,887	
03300	24" Structural Flat Mat On Grade	480	CY	$850.00	$408,000	
03300	12" Elevated Slab, 21'-26' High	237.04	CY	$2,000.00	$474,080	
03300	20" Straight Wall >8' High	622.22	CY	$2,000.00	$1,244,440	
03300	24" Straight Wall >8' High	206.81	CY	$1,800.00	$372,258	
03300	18" Straight Wall >8' High	534.67	CY	$2,000.00	$1,069,340	
	Total					**$5,967,007**
	Division 05 - Metals					
05000	12" Diameter Soil Anchors	3850	LF	$66.12	$254,571	
	Total					**$254,571**
	Division 11 - Equipment					
11000	800 HP Vertical Mixed-Flow Pumps	9	EA	$1,046,746.27	$9,420,716	
	Total					**$9,420,716**
	Division 15 - Mechanical					
15112	66" 150# Flanged Butterfly Valve, No Op	10	EA	$100,000.00	$1,000,000	
15114	66" 150# Flanged Swing Check Valve, No Op	10	EA	$350,000.00	$3,500,000	
15251	66" Flg Cldi Pipe In Open Trench	200	LF	$2,030.14	$406,027	
15251	66" 90° 125# Cldi Fxf Ell	10	EA	$55,845.44	$558,454	
	Total					**$5,464,482**
	Division 16 - Electrical					
16000	5 kV Switchgear	1.00	EA	$2,523,855.77	$2,523,856	
16000	MV VFD for 700 HP	10.00	EA	$280,255.30	$2,802,553	
16000	MCCs	1.00	EA	$279,256.25	$279,256	
	Total					**$5,605,665**
	Grand Total					**$27,966,111**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**08 IPS Afterbay**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	Demolition at Existing IPS	1	LS	$2,194,344.00	$2,194,344	
	Total					**$2,194,344**
	Division 03 - Concrete					
03300	24" Straight Wall >8' High	186.67	CY	$1,800.00	$336,006	
03300	20" Straight Wall >8' High	10.37	CY	$2,000.00	$20,740	
03300	24" Structural Flat Mat On Grade	26.67	CY	$850.00	$22,670	
	Total					**$379,416**
	Division 11 - Equipment					
11294	Heavy Duty Slide Gate - IPS Afterbay Weir Gate	33.00	EA	$68,556.72	$2,262,372	
	Total					**$2,262,372**
	Grand Total					**$4,836,131**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**09 Fine Screening**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee - Soil	1302.67	CY	$7.50	$9,770	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	1302.67	CY	$20.00	$26,053	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	184.67	CY	$58.23	$10,754	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	0	CY	$15.00	$	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	1302.67	CY	$3.00	$3,908	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	0	CY	$11.24	$	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	1118	CY	$6.16	$6,892	
02300	ABC Fill	1118	CY	$112.00	$125,216	
	Total					**$182,593**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	1104.89	CY	$850.00	$939,157	
03300	12" Elevated Slab To 20'	707.11	CY	$2,000.00	$1,414,220	
03300	30" Straight Wall >8' High	1494.44	CY	$1,800.00	$2,689,992	
03300	22" Straight Wall >8' High	217.28	CY	$2,000.00	$434,560	
03300	22" Straight Wall >8' High	108.64	CY	$2,000.00	$217,280	
	Total					**$5,695,209**
	Division 05 - Metals					
05000	Access Hatch and Other Metals Aloowance	1	LS	$200,000.00	$200,000	
	Total					**$200,000**
	Division 11 - Equipment					
11000	Great White Shark Center Flow Screen Package (sluice, compactor, etc. included)	1	LS	$6,788,567.40	$6,788,567	
11294	Heavy Duty Slide Gates for Fine Screen Channels	20	EA	$205,669.63	$4,113,393	
11294	Heavy Duty Slide Gates for Other Channels within Structure	3	EA	$294,863.42	$884,590	
	Total					**$11,786,550**
	Division 16 - Electrical					
16000	MCC	1	EA	$198,818.62	$198,819	
	Total					**$198,819**
	Grand Total					**$18,063,170**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**10 Electrical Substation No. 1**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	273.78	CY	$850.00	$232,713	
	Total					**$232,713**
	Division 16 - Electrical					
16000	38 kV Drawout Vacuum Breakers	1.00	EA	$3,605,774.80	$3,605,775	
	Total					**$3,605,775**
	Grand Total					**$3,838,488**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**11 IPS Standby Gen Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	Existing IPS Standby Generator Demo	1	LS	$88,692.00	$88,692	
	Total					**$88,692**
	Grand Total					**$88,692**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 12 IPS Standby Generator

Format: MASTER FORMAT 17
Date : May 31, 2024
By : XHK
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	2123.22	CY	$60.00	$127,393	
02000	Tipping Fee	6293.11	CY	$107.00	$673,363	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	6293.11	CY	$20.00	$125,862	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	192	CY	$58.23	$11,180	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	6764.94	CY	$15.00	$101,474	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	6293.11	CY	$3.00	$18,879	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	471.83	CY	$11.24	$5,304	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	192	CY	$6.16	$1,184	
	Total					**$1,064,640**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	1931.22	CY	$850.00	$1,641,537	
	Total					**$1,641,537**
	Division 16 - Electrical					
16000	Paralleling Switchgear	1	EA	$4,937,139.93	$4,937,140	
16000	Generator	6	EA	$2,853,376.46	$17,120,259	
	Total					**$22,057,399**
	Grand Total					**$24,763,575**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**13 IPS Transformers**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	403.33	CY	$850.00	$342,831	
	Total					**$342,831**
	Division 16 - Electrical					
16000	10 MVA Transformer	2.00	EA	$653,444.99	$1,306,890	
16000	1 MVA Transformer	2.00	EA	$91,990.53	$183,981	
16000	2.5 MVA Transformer	2.00	EA	$235,240.20	$470,480	
	Total					**$1,961,351**
	Grand Total					**$2,304,182**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 14 Digester Demo

Format: MASTER FORMAT 17
Date : May 31, 2024
By : XHK
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Battery C Digester Demo	1	LS	$6,800,000.00	$6,800,000	
02999	Complete demolition abandoned digesters A, B (11 units total)	1	LS	$11,424,110.00	$11,424,110	
	Total					**$18,224,110**
	Grand Total					**$18,224,110**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**15 Carver Greenfield Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	Demolition of Carver Greenfield Building	1	LS	$8,988,939.00	$8,988,939	
	Total					**$8,988,939**
	Grand Total					**$8,988,939**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**16 IPS Odor Control Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	Complete Demolition of IPS Odor Control Facility	1	LS	$287,489.00	$287,489	
	Total					**$287,489**
	Grand Total					**$287,489**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**17 MBR Pilot Facility Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	MBR Pilot Facility Demolition	1	LS	$419,164.00	$419,164	
	Total					**$419,164**
	Grand Total					**$419,164**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**18 ESF Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	Complete Demolition of Emergency Storage Facility	1	LS	$4,476,591.00	$4,476,591	
	Total					**$4,476,591**
	Grand Total					**$4,476,591**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**19 Power and Blower Bldg Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02999	Complete Demolition of Power and Blower Building	1	LS	$8,663,040.00	$8,663,040	
	Total					**$8,663,040**
	Grand Total					**$8,663,040**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**31 Old Lab Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demo of Old Laboratory	1	LS	$1,243,469.00	$1,243,469	
	Total					**$1,243,469**
	Grand Total					**$1,243,469**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**20 Phase 1A Site Work**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	General Conditions for Demo Items	1	LS	$375,000.00	$375,000	
02000	Construction Difficulty and Work Restrictions	1	LS	$500,000.00	$500,000	
02000	Civil Shoring Design and Construction	1	LS	$400,000.00	$400,000	
02000	Bollards	10	EA	$480.00	$4,800	
02000	Dewatering	1	LS	$1,500,000.00	$1,500,000	
02000	Traffic Control	1	LS	$750,000.00	$750,000	
02220	Remove 2"-3" Asphalt Pavement	22000	SF	$.47	$10,397	
02580	24" Dia. X 300 Lb Light Traffic Manhole Frame & Cover	5	EA	$7,500.00	$37,500	
02580	24" X 36" Precast Curb Inlet Catch Basin W/Frame & Grate	20	EA	$5,000.00	$100,000	
02742	4" Ac Paving On 10" Abc	2444.44	SY	$90.00	$220,000	
02772	4" Thick Concrete Sidewalk,	6000	SF	$20.00	$120,000	
	Total					**$4,017,697**
	Grand Total					**$4,017,697**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**21 Phase 1A Yard Piping**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	24" Structural Flat Mat On Grade	124.44	CY	$850.00	$105,774	
03300	12" Elevated Slab To 20'	62.22	CY	$2,000.00	$124,440	
03300	24" Straight Wall >8' High	177.78	CY	$1,800.00	$320,004	
03300	12" Sloped Slab On Grade (To 30%)	59.26	CY	$565.51	$33,512	
03300	12" Elevated Slab To 20'	59.26	CY	$2,000.00	$118,520	
03300	12" Straight Wall >8' High	53.33	CY	$2,000.00	$106,660	
03300	12" Sloped Slab On Grade (To 30%)	29.63	CY	$565.51	$16,756	
03300	12" Elevated Slab To 20'	29.63	CY	$2,000.00	$59,260	
03300	12" Straight Wall >8' High	26.67	CY	$2,000.00	$53,340	
03300	18" Structural Flat Mat On Grade	88.89	CY	$850.00	$75,557	
03300	12" Elevated Slab To 20'	88.89	CY	$2,000.00	$177,780	
03300	12" Straight Wall, To 8' High	51.85	CY	$2,000.00	$103,700	
03999	Concrete repair for existing channels	1	LS	$500,000.00	$500,000	
	Total					**$1,795,303**
	Division 05 - Metals					
05000	Supports for Yard Ductwork	1	LS	$250,000.00	$250,000	
	Total					**$250,000**
	Division 15 - Mechanical					
15000	Storm Drain Piping	1	LS	$500,000.00	$500,000	
15814	Frp Duct, 108"	300	LF	$1,500.00	$450,000	
	Total					**$950,000**
	Grand Total					**$2,995,303**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**22 Temporary Facilities**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 16 - Electrical					
16000	Temporary Generators	6	LS	$825,300.00	$4,951,800	
	Total					**$4,951,800**
	Grand Total					**$4,951,800**

Phase 1B - Detailed Cost Estimate

LASAN - WRID
PROJECT CONSTRUCTION COST ESTIMATE

Project Title: **Phase 1B - 50-mgd IPR (MBR Battery A1)**

Scope: Phase 1B is intended to construct the southern half of Secondary Treatment Battery A and approximately half of the IPR treatment facilities. MBR Battery A1 consists of retrofitted Modules 1 and 2, a new membrane train, and a blower facility. Other notable new facilities include a secondary effluent EQ basin, an electrical substation, a chemical facility, and an RO/UVAOP Building for IPR water production.

Work Order: | Client Dept.:

Project Manager: | Project Engineer:

Type of Estimate: ☐ Class "A" ☐ Class "B" ☐ Class "C" ☑ Class "O"

Estimate Date	5/1/2024
Construction Start	12/11/2031
Construction End	12/3/2036
Construction Mid Point	6/7/2034

Description	Unit	Quantity	Unit Price	Jun-24
New Retaining Wall	LS	1	$ 16,219,803	16,220,000
Existing Retaining Wall Demo	LS	1	$ 3,263,567	3,264,000
Technical Support Facility (TSF) No. 2	LS	1	$ 15,329,066	15,329,000
System 2 Odor Control Facility	LS	1	$ 7,111,789	7,112,000
System 7 Odor Control Facility	LS	1	$ 11,826,611	11,827,000
Aeration Basin Module 1	LS	1	$ 14,050,247	14,050,000
Aeration Basin Module 2	LS	1	$ 14,050,247	14,050,000
Battery A ML Channel and RAS Building (Southern Half)	LS	1	$ 13,202,578	13,203,000
Battery A Aeration Blower Building	LS	1	$ 31,693,818	31,694,000
Membrane Train A1	LS	1	$ 63,398,630	63,399,000
Secondary EQ Basin (Southern Half)	LS	1	$ 11,160,838	11,161,000
South Chemical Storage Facility	LS	1	$ 3,916,148	3,916,000
West Basin Pump Station	LS	1	$ 6,510,624	6,511,000
IPR RO/UVAOP Building (50 mgd)	LS	1	$ 87,723,014	87,723,000
Utility Compressor Facility	LS	1	$ 3,438,951	3,439,000
Electrical Substation No. 2	LS	1	$ 2,772,780	2,773,000
MBR Train A1, A2, B1 and SE EQ Electrical Room	LS	1	$ 6,561,620	6,562,000
Module 2 Electrical Building	LS	1	$ 1,072,767	1,073,000
Generator Facility at Old Lab	LS	1	$ 10,954,874	10,955,000
MBR Train A1 Standby Generator Facility - Group 5	LS	1	$ 7,743,157	7,743,000
SE EQ Basin and MBR Trains A1, A2 and B1 Transformers	LS	1	$ 2,632,721	2,633,000
Existing Module 2 Electrical Building Demo	LS	1	$ 553,540	554,000
Existing Module 2 Vent Scrubber Building Demo	LS	1	$ 384,534	385,000
Secondary Clarifiers 1A-1D Demo	LS	1	$ 8,708,520	8,709,000
Secondary Clarifiers 2A-2D Demo	LS	1	$ 7,300,918	7,301,000
Site Work	LS	1	$ 6,233,013	6,233,000
Yard Piping	LS	1	$ 4,187,796	4,188,000
E&IC	LS	1	$ 31,852,340	31,852,000
Temporary Facilities	LS	1	$ 4,460,502	4,461,000
Sales Tax		9.5%	$ 18,919,963	18,920,000
			Total Direct Cost	**417,240,000**
Construction Complexity Index		10.0%	$ 41,723,497	41,723,000
General Conditions		10.0%	$ 41,723,497	41,723,000
General Liability & Builder's Risk		2.0%	$ 8,344,699	8,345,000
General Contractor Bond		1.0%	$ 4,172,350	4,172,000
Contractor Profit		10.0%	$ 41,723,497	41,723,000
Subtotal (1)				**554,926,000**
Mobilization - 0% to 7% of Subtotal (1)			5%	27,746,000
Permits - 2% to 5% of Subtotal (1)			3%	16,648,000
Subtotal (2)				**599,320,000**
Estimating Contingency - 0% to 50% of Subtotal (3)			45%	269,694,000
Total Estimated Project Construction Cost (Unescalated)				**869,014,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**5A Retaining Wall**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Straight Wall >8' High	2444.44	CY	$2,000.00	$4,888,880	
03300	30" Straight Wall >8' High To 16' High	2222.22	CY	$1,800.00	$3,999,996	
	Total					**$8,888,876**
	Division 05 - Metals					
05120	Structural Steel Shapes & Plates - Sub	945000	LB	$2.23	$2,107,647	
	Total					**$2,107,647**
	Division 06 - Wood and Plastics					
06000	Timber Lagging	1	LS	$1,358,280.00	$1,358,280	
06000	Soil Anchor	1	LS	$3,865,000.00	$3,865,000	
	Total					**$5,223,280**
	Grand Total					**$16,219,803**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**5B Existing Retaining Wall Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demo of existing retaining wall	1	LS	$3,263,567.00	$3,263,567	
	Total					**$3,263,567**
	Grand Total					**$3,263,567**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**April 30, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**08 TSF No. 2**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Hardscape/Landscape Allowance	1	LS	$1,302,304.37	$1,302,304	
02000	ABC Fill	1184	CY	$60.00	$71,040	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	89.33	CY	$58.23	$5,202	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	89.33	CY	$6.16	$551	
	Total					**$1,379,097**
	Division 03 - Concrete					
03000	Concrete Slabs	1	LS	$4,503,659.48	$4,503,659	
03000	Concrete Walls	1	LS	$3,704,204.28	$3,704,204	
03000	Concrete Columns and Beams	1	LS	$820,786.38	$820,786	
	Total					**$9,028,650**
	Division 05 - Metals					
05000	Doors, Windows and Metals Allowance	1	LS	$208,629.68	$208,630	
	Total					**$208,630**
	Division 09 - Finishes					
09000	Interior Finishes	1	LS	$651,966.00	$651,966	
09000	Architectural Components	1	LS	$521,572.64	$521,573	
	Total					**$1,173,539**
	Division 13 - Special Construction					
13000	Elevators	1	LS	$260,751.14	$260,751	
	Total					**$260,751**
	Division 15 - Mechanical					
15000	Fire Sprinkler and Alarm System	1	LS	$798,007.13	$798,007	
15000	HVAC Equipment	1	LS	$1,100,000.00	$1,100,000	
15000	HVAC Ducting, Dampers and Appurtences	1	LS	$850,000.00	$850,000	
15000	Utilites	1	LS	$130,392.77	$130,393	
15000	Bathroom Fixtures	1	LS	$400,000.00	$400,000	
	Total					**$3,278,400**
	Grand Total					**$15,329,066**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**19B System 2 OCF**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade (Slab on Module)	342.22	CY	$850.00	$290,887	
03300	48" Structural Flat Mat On Grade	171.26	CY	$850.00	$145,571	
03300	12" Structural Flat Mat On Grade	53.52	CY	$850.00	$45,492	
03300	12" Structural Flat Mat On Grade	13.33	CY	$850.00	$11,331	
	Total					**$493,281**
	Division 13 - Special Construction					
13000	System 2 Odor Control Facility (4x EcoFiler EF134 + 5x EcoCarb EB14D, 1 Recirculation Pump, 3 Blowers)	1	LS	$5,978,731.24	$5,978,731	
	Total					**$5,978,731**
	Division 15 - Mechanical					
15000	Pipe Supports	1.00	LS	$336,000.00	$336,000	
15814	Frp Flange , 30"	4.00	EA	$5,278.38	$21,114	
15814	Frp Flange , 24"	5.00	EA	$4,326.17	$21,631	
15814	Frp Tee, 60"	5.00	EA	$3,454.03	$17,270	
15814	90 Degree Frp Duct Elbow, 60"	4.00	EA	$12,358.68	$49,435	
15814	45 Degree Frp Duct Elbow, 24"	1.00	EA	$2,167.87	$2,168	
15814	Frp Duct, 60"	160.00	LF	$850.00	$136,000	
15814	Frp Duct, 30"	96.00	LF	$360.00	$34,560	
15814	Frp Duct, 24"	72.00	LF	$300.00	$21,600	
	Total					**$639,777**
	Grand Total					**$7,111,789**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 34 System 7 OCF

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	1,118.33	CY	$60.00	$67,100	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	154.67	CY	$6.16	$953	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	154.67	CY	$58.23	$9,007	
	Total					**$77,060**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	963.67	CY	$850.00	$819,120	
03300	12" Structural Flat Mat On Grade	85.63	CY	$850.00	$72,786	
03300	12" Structural Flat Mat On Grade	8.89	CY	$850.00	$7,557	
03300	48" Structural Flat Mat On Grade	256.89	CY	$850.00	$218,357	
	Total					**$1,117,818**
	Division 11 - Equipment					
11000	System 7 Odor Control Facility	1	EA	$9,796,020.00	$9,796,020	
	Total					**$9,796,020**
	Division 15 - Mechanical					
15000	Pipe Supports	1.00	LS	$234,000.00	$234,000	
15814	Frp Flange, 42"	14	EA	$7,357.76	$103,009	
15814	90 Degree Frp Elbow, 42"	4	EA	$14,051.51	$56,206	
15814	Frp Volume Damper, 48"	14	EA	$6,013.51	$84,189	
15814	Frp Tee, 108"	1	EA	$6,573.20	$6,573	
15814	Frp Duct, 108"	215	LF	$1,000.00	$215,000	
15814	Frp Duct, 84"	30	LF	$850.00	$25,500	
15814	Frp Duct, 60"	18	LF	$850.00	$15,300	
15814	Frp Duct, 48"	91	LF	$600.00	$54,600	
15814	Frp Duct, 42"	70	LF	$450.00	$31,500	
15814	Frp Tee, 42"	4	EA	$2,459.03	$9,836	
	Total					**$835,713**
	Grand Total					**$11,826,611**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: Aeration Basin Module

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Module Channel Repairs	1.00	LS	$1,097,555.00	$1,097,555	
02000	Demo of Module Inlet Gate	1.00	LS	$30,000.00	$30,000	
02000	Demo of Surface Aerators	1.00	LS	$85.00	$85	
02000	Seismic Retrofit of Existing Structure	1.00	LS	$587,963.40	$587,963	
02300	Native Pipe Bed & Zone/Confined Structure Backfill, Class C Material	239.58	CY	$46.48	$11,136	
	Total					**$1,726,739**
	Division 03 - Concrete					
03000	Concrete Modifications	1.00	LS	$979,939.00	$979,939	
03300	12" Straight Wall >8' High (Zone 1A and 1B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 1B and 2A)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 2A and 2B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 5A and 5B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High	47.92	CY	$2,000.00	$95,840	
03300	12" Straight Wall >8' High	47.92	CY	$2,000.00	$95,840	
03300	12" Straight Wall >8' High	66.67	CY	$2,000.00	$133,340	
03300	12" Structural Flat Mat On Grade	46.00	CY	$850.00	$39,100	
03300	16" X 16" Square Column/Pier	79.01	CY	$1,390.43	$109,858	
03300	18" Structural Flat Mat On Grade	54.00	CY	$850.00	$45,900	
	Total					**$2,939,817**
	Division 11 - Equipment					
11000	Platform-Mounted Propeller Mixers	30	EA	$51,378.65	$1,541,359	
11000	MLR Vertical Turbine Pump	6	EA	$325,475.80	$1,952,855	
11000	Module Inlet Gate	6.00	EA	$37,700.00	$226,200	
11000	Module Outlet Gate	6.00	EA	$42,900.00	$257,400	
11000	MLR Box Gate	9.00	EA	$37,700.00	$339,300	
11000	Fine Bubble Diffusers	1.00	EA	$1,777,925.93	$1,777,926	
	Total					**$6,095,040**
	Division 15 - Mechanical					
15000	Pipe Supports	1.00	LS	$180,000.00	$180,000	
15112	Add For Motor Operator Over 20"	9.00	EA	$10,008.32	$90,075	
15112	36" 150# Fxf Awwa Butterfly Valve, No Op	9.00	EA	$35,000.00	$315,000	
15112	24" 150# Fxf Awwa Butterfly Valve, No Op	6.00	EA	$18,000.00	$108,000	
15251	36" X 36" Cldi Mj Tee Or Wye	3.00	EA	$18,345.77	$55,037	
15251	36" 90° 125# Cldi Fxf Ell	9.00	EA	$19,466.01	$175,194	
15251	36" Flg Cldi Pipe In Bldg	855.00	LF	$916.87	$783,924	
15251	36" X 24" Cldi Push-On Joint Tee (C110)	6.00	EA	$16,020.16	$96,121	
15251	36" 90° 125# Cldi Fxf Ell	9.00	EA	$19,466.01	$175,194	
15251	36" 125# Cast Iron Blind Flange	3.00	EA	$5,885.85	$17,658	
15251	36" Flg Cldi Pipe In Bldg	675.00	LF	$916.87	$618,887	
15251	24" Flg Cldi Pipe In Bldg	108.00	LF	$406.45	$43,896	
15251	42" Flg Cldi Pipe In Bldg	90.00	LF	$1,064.67	$95,820	
15252	24"A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	810.00	LF	$489.04	$396,124	
	Total					**$3,150,931**
	Division 17 - Instrumentation and Controls					
17302	36" Flow Measurement Magnetic Flow Meter	3.00	EA	$45,906.47	$137,719	
	Total					**$137,719**
	Grand Total					**$14,050,247**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 26A Battery A ML Channel and RAS

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Remove 7"-24" Non-Reinf Conc Pavement	425.68	CY	$93.81	$39,933	
	Total					**$39,933**
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	425.68	CY	$850.00	$361,828	
03300	12" Straight Wall, To 8' High	145.53	CY	$2,000.00	$291,060	
03300	12" Straight Wall, To 8' High	13.93	CY	$2,000.00	$27,860	
03300	12" Elevated Slab To 14' High	532.10	CY	$2,000.00	$1,064,200	
	Total					**$1,744,948**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	13,860.00	SF	$50.00	$693,000	
	Total					**$693,000**
	Division 05 - Metals					
05310	Steel Deck, 3" X 18 Ga.	11,493.41	SF	$50.00	$574,671	
	Total					**$574,671**
	Division 08 - Doors and Windows					
08110	3/6 X 6/8 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	7.00	EA	$2,000.00	$14,000	
	Total					**$14,000**
	Division 14 - Conveying Systems					
14631	5 Ton 75' Span Floor Operated Overhead Traveling Bridge Crane	5.00	EA	$255,256.58	$1,276,283	
	Total					**$1,276,283**
	Division 15 - Mechanical					
15000	30" Check Valve (RAS)	6.00	EA	$42,000.00	$252,000	
15000	Pipe Supports	1.00	LS	$2,100,000.00	$2,100,000	
15112	48" Dimj Awwa Butterfly Valve, No Op	2.00	EA	$80,000.00	$160,000	
15116	30" Fxf Cast Iron Plug Valve W/Handwheel Op	12.00	EA	$40,595.39	$487,145	
15116	36" Fxf Cast Iron Plug Valve W/Handwheel Op	24.00	EA	$48,271.52	$1,158,517	
15116	Add For Motor Operator 22" Through 48"	36.00	EA	$13,404.00	$482,544	
15252	36" 3/8" (Std) Wall A-234 Buttweld Straight Tee	3.00	EA	$31,001.51	$93,005	
15252	30" 1/2" (Xh) Wall A-234 Buttweld Straight Tee	6.00	EA	$25,393.09	$152,359	
15252	48" X 30" 3/8" (Std) Wall A-234 Buttwld Con Rdcr	12.00	EA	$22,396.01	$268,752	
15252	48" X 36" 1/2" (Xh) Wall A-234 Buttwld Con Rdcr	12.00	EA	$37,185.61	$446,227	
15252	36" 1/2" Wall 90° Lr Buttweld Ell	24.00	EA	$18,909.44	$453,827	
15252	30" 3/8" Wall 90° Lr Buttweld Ell	12.00	EA	$9,870.91	$118,451	
15252	48" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	693.00	LF	$1,469.56	$1,018,404	
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	720.00	LF	$807.93	$581,710	
15252	30" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	480.00	LF	$641.96	$308,139	
	Total					**$8,081,079**
	Division 17 - Instrumentation and Controls					
17302	36" Flow Measurement Magnetic Flow Meter	12.00	EA	$45,906.47	$550,878	
17302	30" Flow Measurement Magnetic Flow Meter	6.00	EA	$37,964.60	$227,788	
	Total					**$778,665**
	Grand Total					**$13,202,578**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**09 Battery A Blower Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	100 Ton Crawler Mounted Lattice Boom Crane w/ Operator and Support Crew	48	MO	$50,000.00	$2,400,000	
	Total					**$2,400,000**
	Division 02 - Site Construction					
02000	ABC Fill	3015.67	CY	$60.00	$180,940	
02000	Tipping Fee	5198.26	CY	$7.50	$38,987	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	5,198.26	CY	$20.00	$103,965	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	243.33	CY	$58.23	$14,169	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	5,868.41	CY	$15.00	$88,026	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	5,198.26	CY	$3.00	$15,595	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	670.15	CY	$11.24	$7,533	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	243.33	CY	$6.16	$1,500	
	Total					**$450,716**
	Division 03 - Concrete					
03300	24" Structural Flat Mat On Grade (Bottom Slab)	1511.48	CY	$850.00	$1,284,758	
03300	16" Straight Wall >8' High	1040.36	CY	$2,000.00	$2,080,720	
03300	16" Straight Wall >8' High	455.16	CY	$2,000.00	$910,320	
03300	12" Elevated Slab To 14' High	83.89	CY	$2,000.00	$167,780	
03300	12" Elevated Slab >20' To 26' High	219.59	CY	$2,000.00	$439,180	
03300	24" Structural Flat Mat On Grade	81.54	CY	$850.00	$69,309	
03300	12" Elevated Slab To 20'	24.89	CY	$2,000.00	$49,780	
03300	36" Structural Flat Mat On Grade	427.78	CY	$850.00	$363,613	
	Total					**$5,365,460**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	1560	SF	$50.00	$78,000	
04220	Standard Concrete Block, 12"	1820	SF	$50.00	$91,000	
04220	Standard Concrete Block, 12"	6040	SF	$50.00	$302,000	
04220	Standard Concrete Block, 12"	1920	SF	$50.00	$96,000	
04220	Standard Concrete Block, 12"	2240	SF	$50.00	$112,000	
	Total					**$679,000**
	Division 05 - Metals					
05000	Structural Steel Shapes & Plates Adder	1	LS	$958,000.00	$958,000	
05310	Steel Deck, 1-1/2" X 18 Ga.	20328	SF	$50.00	$1,016,400	
05310	Steel Deck, 2" X 18 Ga.	672	SF	$50.00	$33,600	
05500	Aluminum Stairs, Including Railing And Supports	50	RSR	$725.75	$36,288	
05500	Aluminum Osha Handrail	150	LF	$99.75	$14,963	
05500	Aluminum Grating, 1-1/2"	2250	SF	$68.65	$154,452	
	Total					**$2,213,702**
	Division 08 - Doors and Windows					
08110	Add For Panic Device, "B" Label Single Metal Door	18	EA	$430.53	$7,750	
08110	3/0 X 7/0 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	18	EA	$2,000.00	$36,000	
08110	Add For Panic Device, 1.75" "B" Label Double Metal Doors	3	PR	$1,279.77	$3,839	
08212	7/0 X 7/0 X 1.75" Double Wood Door Incl.Hardware	3	PR	$2,000.00	$6,000	
08332	Electric Door Operator For Chain Lift Roll-Up Overhead Door, No Wiring	2	EA	$2,200.49	$4,401	
08332	Bottom Weather Strip, For Roll-Up & Sectional Overhead Doors	24	LF	$8.94	$214	
08332	Top Weather Seal, For Roll-Up & Sectional Overhead Doors	24	LF	$10.05	$241	
08332	Draft Stop Molding, For Roll-Up & Sectional Overhead Doors	96	LF	$8.94	$858	

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**09 Battery A Blower Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
08332	12'-0" X 12'-0" Roll-Up Overhead Door, Chain Lift, 22 Gauge Galvanized Steel/Aluminum	2	EA	$15,000.00	$30,000	
	Total					**$89,303**
	Division 09 - Finishes					
09000	Acoustical Wall Panels	1	LS	$273,000.00	$273,000	
	Total					**$273,000**
	Division 11 - Equipment					
11000	Single-Stage Centrifugal Air Blowers and Aeration Controls System	4	EA	$1,019,735.30	$4,078,941	
	Total					**$4,078,941**
	Division 14 - Conveying Systems					
14624	10 Ton Lug Mtd 31' Lift Vs 20 Hp Elec Hoist W/Cable	1	EA	$373,548.00	$373,548	
	Total					**$373,548**
	Division 15 - Mechanical					
15000	78" A-53 Wld Steel 3/8" (Std) Wall Pipe in a Bldg	913.00	LF	$4,252.00	$3,882,076	
15000	Acoustical Louvers	1.00	LS	$126,160.00	$126,160	
15000	Air Piping Insulation	1.00	LS	$421,000.00	$421,000	
15000	Pipe Supports	1	LS	$120,000.00	$120,000	
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	72.00	LF	$807.93	$58,171	
15252	12" A-53 Welded Steel 3/8" (Std) Wall Pipe In A Bldg	64.00	LF	$248.76	$15,921	
15830	7.5 To 450 Hp, 20040-130260 Cfm Centrif.Industrial Fan, W/O Driver	4.00	EA	$62,214.65	$248,859	
15830	450Hp Fan Motor, Installed @ Fan Manuf., Add	4.00	EA	$137,636.74	$550,547	
	Total					**$5,422,733**
	Division 16 - Electrical					
16000	MCC	1.00	EA	$402,654.20	$402,654	
16000	MCC	1.00	EA	$240,462.30	$240,462	
16000	MV VFD for 1500 HP	4.00	EA	$338,000.00	$1,352,000	
16000	5 kV Switchgear	1.00	EA	$2,987,124.40	$2,987,124	
16000	20 MVA Transformer	2.00	EA	$2,471,986.40	$4,943,973	
16000	2.5 MV Transformer	2.00	EA	$210,600.00	$421,200	
	Total					**$10,347,414**
	Grand Total					**$31,693,818**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train A1

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	100 Ton Crawler Mounted Lattice Boom Crane w/ Operator and Support Crew	48.00	MO	$50,000.00	$2,400,000	
	Total					**$2,400,000**
	Division 02 - Site Construction					
02000	ABC Fill	5,004.00	CY	$60.00	$300,240	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	3,665.78	CY	$58.23	$213,463	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	3,665.78	CY	$6.16	$22,597	
	Total					**$536,301**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	4433.33	CY	$850.00	$3,768,331	
03300	24" Straight Wall >8' High	1014.74	CY	$1,800.00	$1,826,532	
03300	24" Straight Wall >8' High	572.22	CY	$1,800.00	$1,029,996	
03300	12" Straight Wall >8' High	11.47	CY	$2,000.00	$22,940	
03300	12" Straight Wall >8' High	65.56	CY	$2,000.00	$131,120	
03300	12" Straight Wall >8' High	57.22	CY	$2,000.00	$114,440	
03300	12" Straight Wall >8' High	20.03	CY	$2,000.00	$40,060	
03300	12" Straight Wall >8' High	6.56	CY	$2,000.00	$13,120	
03300	12" Elevated Slab To 20'	14.81	CY	$2,000.00	$29,620	
03300	12" Elevated Slab, 21'-26' High	7.58	CY	$2,000.00	$15,160	
03300	8" Straight Wall, To 8' High	28.00	CY	$2,000.00	$56,000	
03300	12" Elevated Slab To 20'	548.15	CY	$2,000.00	$1,096,300	
03300	12" Straight Wall, To 8' High	109.63	CY	$2,000.00	$219,260	
03300	12" Elevated Slab To 20'	45.74	CY	$2,000.00	$91,480	
03300	12" Straight Wall, To 8' High	219.56	CY	$2,000.00	$439,120	
03300	12" Straight Wall >8' High	705.74	CY	$2,000.00	$1,411,480	
03300	12" Elevated Slab To 20'	561.85	CY	$2,000.00	$1,123,700	
03300	12" Straight Wall >8' High	473.78	CY	$2,000.00	$947,560	
03300	12" Elevated Slab To 20'	68.52	CY	$2,000.00	$137,040	
03300	12" Elevated Slab To 20'	14.00	CY	$2,000.00	$28,000	
03300	12" Elevated Slab To 20'	3.80	CY	$2,000.00	$7,600	
03300	12" Straight Wall, To 8' High	24.30	CY	$2,000.00	$48,600	
03300	8" Straight Wall >8' High	47.64	CY	$2,000.00	$95,280	
03300	8" Straight Wall >8' High	53.33	CY	$2,000.00	$106,660	
03300	12" Elevated Slab, 21'-26' High	33.33	CY	$2,000.00	$66,660	
03300	12" Elevated Slab, 21'-26' High	5.78	CY	$2,000.00	$11,560	
03300	12" Straight Wall >8' High	21.33	CY	$2,000.00	$42,660	
03300	12" Straight Wall >8' High	11.56	CY	$2,000.00	$23,120	
03300	18" Straight Wall >8' High	138.67	CY	$2,000.00	$277,340	
03300	18" Straight Wall >8' High	58.67	CY	$2,000.00	$117,340	
03300	18" Straight Wall >8' High	115.56	CY	$2,000.00	$231,120	
03300	12" Structural Flat Mat On Grade	57.78	CY	$850.00	$49,113	
03300	12" Straight Wall >8' High	60.74	CY	$2,000.00	$121,480	
03300	12" Straight Wall >8' High	225.19	CY	$2,000.00	$450,380	
03300	12" Elevated Slab To 20'	230.81	CY	$2,000.00	$461,620	
	Total					**$14,651,792**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	39,900.00	SF	$50.00	$1,995,000	
05310	Steel Deck, 3" X 20 Ga.	6,232.00	SF	$50.00	$311,600	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	30.00	RSR	$725.75	$21,773	
	Total					**$2,337,082**
	Division 06 - Wood and Plastics					
06000	Weirs and Baffles	1.00	LS	$626,600.00	$626,600	
	Total					**$626,600**
	Division 11 - Equipment					
11000	Membrane Tank Inlet Gate, 60"x 60"	26.00	EA	$35,750.00	$929,500	
11000	RAS Pump	6.00	EA	$635,518.00	$3,813,108	
11000	WAS Pump	3.00	EA	$48,058.40	$144,175	
11000	RAS Inlet Gate	2.00	EA	$35,750.00	$71,500	

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train A1

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
11000	RAS/WAS Top Gate	2.00	EA	$13,175.50	$26,351	
11000	WAS Bottom Gate	1.00	EA	$13,175.50	$13,176	
11000	Membrane System (26 B50N Membrane Modules, Racks, Headers and Rack Supports; 26 Permeate Pumps;CIP Pump System; Drain Pump System;Chemical Transfer System; Controls; Commisioning and Training)	1.00	EA	$35,048,000.00	$35,048,000	
11000	Splitter Box Gate	26.00	EA	$14,105.00	$366,730	
11294	Add For Motor Operator To 96"	26.00	EA	$17,060.91	$443,584	
	Total					**$40,856,123**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	2.00	EA	$379,534.53	$759,069	
	Total					**$759,069**
	Division 15 - Mechanical					
15000	54" ST STL Permeate Header	350.00	LF	$1,995.19	$698,315	
15000	36" Air Scour Header	350.00	LF	$1,123.85	$393,348	
15000	Pipe Supports	1.00	LS	$140,000.00	$140,000	
	Total					**$1,231,663**
	Grand Total					**$63,398,630**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**38 Secondary EQ Basin**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee	11,357.63	CY	$7.50	$85,182	
02000	ABC Fill	2,247.11	CY	$60.00	$134,827	
02260	Sheet Piling, 38#/Sf To 40' Deep, Driven, Pulled & Salvaged (Pits Only)	13,230.00	SF	$90.00	$1,190,700	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	11,357.63	CY	$20.00	$227,153	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	4,796.44	CY	$58.23	$279,303	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	11,856.99	CY	$15.00	$177,855	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	11,357.63	CY	$3.00	$34,073	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	499.36	CY	$11.24	$5,613	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	4,796.44	CY	$6.16	$29,567	
	Total					**$2,164,273**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	1,711.11	CY	$850.00	$1,454,444	
03300	18" Structural Flat Mat On Grade	855.56	CY	$850.00	$727,226	
03300	30" Straight Wall >8' High	611.11	CY	$1,800.00	$1,099,998	
03300	30" Straight Wall >8' High	777.78	CY	$1,800.00	$1,400,004	
03300	30" Straight Wall >8' High	103.70	CY	$1,800.00	$186,660	
03300	30" Straight Wall >8' High	148.15	CY	$1,800.00	$266,670	
	Total					**$5,135,002**
	Division 11 - Equipment					
11000	SE EQ IPR Vertical Turbine Pump	4	EA	$646,359.12	$2,585,436	
11000	Flap Gate	4.00	EA	$32,760.00	$131,040	
	Total					**$2,716,476**
	Division 15 - Mechanical					
15000	30" Check Valve	4.00	EA	$50,000.00	$200,000	
15112	30" 150# Fxf Awwa Butterfly Valve, No Op	4.00	EA	$30,000.00	$120,000	
15252	72" C200 1/2" Wall Wld Cs Pipe In Open Trench	285	LF	$2,020.30	$575,786	
15252	30" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	40.00	LF	$641.96	$25,678	
	Total					**$921,464**
	Division 17 - Instrumentation and Controls					
17000	72" Magmeter	1	EA	$223,623.40	$223,623	
	Total					**$223,623**
	Grand Total					**$11,160,838**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**44A South Chemical Storage Facility**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	3,270.00	CY	$60.00	$196,200	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	82.89	CY	$58.23	$4,827	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	82.89	CY	$6.16	$511	
	Total					**$201,538**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	50.00	CY	$850.00	$42,500	
03300	12" Structural Flat Mat On Grade	52.15	CY	$850.00	$44,328	
03300	12" Straight Wall, To 8' High	11.11	CY	$2,000.00	$22,220	
03300	12" Straight Wall, To 8' High	4.89	CY	$2,000.00	$9,780	
03300	12" Straight Wall, To 8' High	11.11	CY	$2,000.00	$22,220	
03300	12" Straight Wall, To 8' High	4.44	CY	$2,000.00	$8,880	
03300	36" Structural Flat Mat On Grade	50.00	CY	$850.00	$42,500	
03300	12" Structural Flat Mat On Grade	47.41	CY	$850.00	$40,299	
03300	36" Structural Flat Mat On Grade	50.00	CY	$850.00	$42,500	
03300	12" Structural Flat Mat On Grade	49.78	CY	$850.00	$42,313	
03300	12" Straight Wall, To 8' High	11.11	CY	$2,000.00	$22,220	
03300	12" Straight Wall, To 8' High	4.67	CY	$2,000.00	$9,340	
03300	36" Structural Flat Mat On Grade	33.33	CY	$850.00	$28,331	
03300	24" Structural Flat Mat On Grade	14.81	CY	$850.00	$12,589	
03300	12" Structural Flat Mat On Grade	94.42	CY	$850.00	$80,257	
03300	12" Straight Wall, To 8' High	17.78	CY	$2,000.00	$35,560	
03300	12" Straight Wall, To 8' High	5.50	CY	$2,000.00	$11,000	
03300	12" Straight Wall, To 8' High	20.00	CY	$2,000.00	$40,000	
03300	12" Straight Wall, To 8' High	10.44	CY	$2,000.00	$20,880	
03300	48" Structural Flat Mat On Grade	288.00	CY	$850.00	$244,800	
03300	12" Structural Flat Mat On Grade	179.30	CY	$850.00	$152,405	
03300	48" Structural Flat Mat On Grade	144.00	CY	$850.00	$122,400	
03300	12" Structural Flat Mat On Grade	98.22	CY	$850.00	$83,487	
03300	12" Straight Wall, To 8' High	20.00	CY	$2,000.00	$40,000	
03300	12" Straight Wall, To 8' High	5.78	CY	$2,000.00	$11,560	
03300	12" Straight Wall, To 8' High	15.56	CY	$2,000.00	$31,120	
03300	12" Straight Wall, To 8' High	9.11	CY	$2,000.00	$18,220	
03300	48" Structural Flat Mat On Grade	200.00	CY	$850.00	$170,000	
03300	12" Structural Flat Mat On Grade	141.22	CY	$850.00	$120,037	
03300	36" Structural Flat Mat On Grade	56.89	CY	$850.00	$48,357	
03300	12" Structural Flat Mat On Grade	64.00	CY	$850.00	$54,400	
03300	12" Straight Wall, To 8' High	11.11	CY	$2,000.00	$22,220	
03300	12" Straight Wall, To 8' High	6.00	CY	$2,000.00	$12,000	
	Total					**$1,708,721**
	Division 05 - Metals					
05310	Steel Deck, 2" X 20 Ga.	1,100.00	SF	$6.52	$7,172	
05310	Steel Deck, 2" X 20 Ga.	1,000.00	SF	$6.52	$6,520	
05310	Steel Deck, 2" X 20 Ga.	1,050.00	SF	$6.52	$6,846	
05310	Steel Deck, 2" X 20 Ga.	1,980.00	SF	$6.52	$12,910	
05310	Steel Deck, 2" X 20 Ga.	4,230.00	SF	$6.52	$27,580	
05310	Steel Deck, 2" X 20 Ga.	2,340.00	SF	$6.52	$15,257	
05310	Steel Deck, 2" X 20 Ga.	2,870.00	SF	$6.52	$18,712	
05310	Steel Deck, 2" X 20 Ga.	1,350.00	SF	$6.52	$8,802	
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	

DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**44A South Chemical Storage Facility**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	
05500	Aluminum Stairs, Including Railing And Supports	3.00	RSR	$725.75	$2,177	
	Total					**$121,216**
	Division 11 - Equipment					
11000	Antiscalent Metering Pump (RO Feed Scaling Prevention)	2.00	EA	$42,575.00	$85,150	
11000	Scrubber Tank	2.00	EA	$74,880.00	$149,760	
11000	Ammonium Hydroxide Chemical Metering Pump (RO Feed Chloramination)	2.00	EA	$37,245.00	$74,490	
11000	Sodium Hypochlorite Chemical Metering Pump (RO Feed Chloramination)	2.00	EA	$50,108.00	$100,216	
11000	Sodium Hypochlorite Chemical Metering Pump (UVAOP Oxidation)	2.00	EA	$50,108.00	$100,216	
11000	Sodium Hypochlorite Chemical Metering Pump (Product Water Tank Chlorination)	2.00	EA	$50,108.00	$100,216	
11000	Sodium Hydroxide 50% Chemical Metering Pump (Post Treatment Stabilization)	2.00	EA	$37,700.00	$75,400	
11000	Calcium Chloride Chemical Metering Pump (Post Treatment Stabilization)	2.00	EA	$35,750.00	$71,500	
11000	Sulfiric Acid Metering Pumps (RO Feed Conditioning)	2.00	EA	$46,475.00	$92,950	
11000	Sulfiric Acid Metering Pumps (UVAOP Stabilization)	2.00	EA	$37,245.00	$74,490	
	Total					**$924,388**
	Division 13 - Special Construction					
13000	30,000 gallon FRP Tank	2.00	EA	$243,952.80	$487,906	
13206	12,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	2.00	EA	$16,866.70	$33,733	
13206	9,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	2.00	EA	$12,845.50	$25,691	
13206	12,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	2.00	EA	$16,866.70	$33,733	
13206	12,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	2.00	EA	$16,866.70	$33,733	
13206	20,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	6.00	EA	$27,143.10	$162,859	
13206	20,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	3.00	EA	$27,143.10	$81,429	
13206	12,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	6.00	EA	$16,866.70	$101,200	
	Total					**$960,285**
	Grand Total					**$3,916,148**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**15 West Basin Pump Station**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demo of existing pumps	1	LS	$1,085,104.02	$1,085,104	
	Total					**$1,085,104**
	Division 11 - Equipment					
11000	800 hp 21 mgd Pump	5	EA	$775,074.30	$3,875,372	
11000	500 hp, 15 MGD Pump	2	EA	$775,074.30	$1,550,149	
	Total					**$5,425,520**
	Grand Total					**$6,510,624**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 47A IPR ROUVAOP Building

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	100 Ton Crawler Mounted Boom Crane	48.00	MO	$50,000.00	$2,400,000	
	Total					**$2,400,000**
	Division 02 - Site Construction					
02000	ABC Fill	4,986.00	CY	$60.00	$299,160	
02000	Architectural Finishes	1.00	LS	$6,567,347.20	$6,567,347	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	1,994.00	CY	$58.23	$116,113	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	1,994.00	CY	$6.16	$12,292	
	Total					**$6,994,912**
	Division 03 - Concrete					
03000	Concrete Beams and Columns	1.00	LS	$6,156,888.00	$6,156,888	
03300	24" Structural Flat Mat On Grade	4,035.00	CY	$850.00	$3,429,750	
03300	24" Straight Wall >8' High	414.81	CY	$1,800.00	$746,658	
03300	24" Straight Wall >8' High	157.04	CY	$1,800.00	$282,672	
03300	12" Straight Wall >8' High	300.00	CY	$2,000.00	$600,000	
03300	12" Straight Wall >8' High	39.85	CY	$2,000.00	$79,700	
03300	12" Straight Wall >8' High	88.89	CY	$2,000.00	$177,780	
03300	12" Straight Wall >8' High	111.11	CY	$2,000.00	$222,220	
03300	12" Straight Wall >8' High	151.85	CY	$2,000.00	$303,700	
03300	12" Elevated Slab To 20'	2,017.50	CY	$2,000.00	$4,035,000	
03300	12" Elevated Slab To 20'	33.33	CY	$2,000.00	$66,660	
03300	24" Straight Wall >8' High	176.30	CY	$1,800.00	$317,340	
	Total					**$16,418,368**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	54,472.50	SF	$50.00	$2,723,625	
05500	Aluminum Grating, 2-1/2"	15,132.00	SF	$125.10	$1,892,987	
05500	Aluminum Grating, 2-1/2"	3,808.00	SF	$125.10	$476,374	
	Total					**$5,092,987**
	Division 11 - Equipment					
11000	UVAOP Reactor	3.00	EA	$3,445,000.00	$10,335,000	
11000	IPR 50 mgd RO System	1.00	LS	$36,799,999.60	$36,800,000	
11000	Citric Acid Pump (RO CIPs)	1.00	EA	$33,475.00	$33,475	
11000	Citric Acid Pump (RO CIP Neutralization)	1.00	EA	$33,475.00	$33,475	
11000	Sodium Hydroxide Pump (RO CIPs)	1.00	EA	$37,245.00	$37,245	
11000	Sodium Hydroxide Pump (RO CIP Neutralization)	1.00	EA	$37,245.00	$37,245	
	Total					**$47,276,440**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	4.00	EA	$379,534.53	$1,518,138	
	Total					**$1,518,138**
	Division 15 - Mechanical					
15000	Pipe Supports	1.00	LS	$300,000.00	$300,000	
	Total					**$300,000**
	Division 16 - Electrical					
16000	5 kV Switchgear	1.00	EA	$3,458,279.00	$3,458,279	
16000	LV Switchgear	2.00	EA	$573,132.30	$1,146,265	
16000	MV VFD for 1250 HP	8.00	EA	$326,300.00	$2,610,400	
16000	MCC1	2.00	EA	$253,613.00	$507,226	
	Total					**$7,722,170**
	Grand Total					**$87,723,014**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 17 UCF

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	378.22	CY	$60.00	$22,693	
02000	Tipping Fee	504.30	CY	$7.50	$3,782	
02000	Architectural Finishes	1.00	LS	$226,637.00	$226,637	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	504.30	CY	$20.00	$10,086	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	27.22	CY	$58.23	$1,585	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	588.33	CY	$15.00	$8,825	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	504.30	CY	$3.00	$1,513	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	84.04	CY	$11.24	$945	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	27.33	CY	$6.16	$168	
	Total					**$276,235**
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	98.74	CY	$850.00	$83,929	
03300	12" Straight Wall >8' High	127.41	CY	$2,000.00	$254,820	
03300	12" Straight Wall >8' High	68.89	CY	$2,000.00	$137,780	
03300	12" Straight Wall >8' High	14.81	CY	$2,000.00	$29,620	
03300	24" Structural Flat Mat On Grade	14.81	CY	$850.00	$12,589	
03300	24" Structural Flat Mat On Grade	11.11	CY	$850.00	$9,444	
03300	24" Structural Flat Mat On Grade	3.70	CY	$850.00	$3,145	
03300	12" Structural Flat Mat On Grade	26.67	CY	$850.00	$22,670	
03300	24" Structural Flat Mat On Grade	7.41	CY	$850.00	$6,299	
03300	24" Structural Flat Mat On Grade	7.41	CY	$850.00	$6,299	
	Total					**$566,593**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	2,666.00	SF	$50.00	$133,300	
	Total					**$133,300**
	Division 08 - Doors and Windows					
08110	3/0 X 7/0 X 1.75" No Label Single Hollow Metal Door W/Frame & Hdwre	2.00	EA	$2,000.00	$4,000	
08110	7/0 X 7/0 X 1.75" No Label Double Hollow Metal Door W/Frame & Hdwre	2.00	PR	$2,000.00	$4,000	
08332	10'-0" X 12'-0" Roll-Up Overhead Door, Chain Lift, 22 Gauge Galvanized Steel/Aluminum	1.00	EA	$15,000.00	$15,000	
	Total					**$23,000**
	Division 11 - Equipment					
11000	Instrument Air Reciever Tank	4.00	EA	$26,000.00	$104,000	
11000	200 hp Screw Air Compressor	5.00	EA	$286,000.00	$1,430,000	
	Total					**$1,534,000**
	Division 14 - Conveying Systems					
14631	10 Ton 50' Span Cab Operated Overhead Traveling Bridge Crane	1.00	EA	$247,777.63	$247,778	
	Total					**$247,778**
	Division 15 - Mechanical					
15000	Pipe Supports	1.00	LS	$20,000.00	$20,000	
	Total					**$20,000**
	Division 16 - Electrical					
16000	MCC	1.00	EA	$638,046.50	$638,047	
	Total					**$638,047**
	Grand Total					**$3,438,951**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**52B Electrical Substation No. 2**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	367.11	CY	$60.00	$22,027	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	93.33	CY	$58.23	$5,435	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	93.33	CY	$6.16	$575	
	Total					**$28,037**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	273.78	CY	$850.00	$232,713	
	Total					**$232,713**
	Division 16 - Electrical					
16000	38 kV Drawout Vacuum Breakers	1.00	EA	$2,512,030.30	$2,512,030	
	Total					**$2,512,030**
	Grand Total					**$2,772,780**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 54A Elec A1, A2, B1, and SE EQ

Format: MASTER FORMAT 17
Date : April 30, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	160.74	CY	$850.00	$136,629	
	Total					**$136,629**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	2800	SF	$50.00	$140,000	
04220	Standard Concrete Block, 12"	1240	SF	$50.00	$62,000	
	Total					**$202,000**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	4340	SF	$50.00	$217,000	
	Total					**$217,000**
	Division 16 - Electrical					
16000	5 kV Switchgear	1	EA	$2,357,496.70	$2,357,497	
16000	MCCs	1	EA	$655,481.00	$655,481	
16000	SE EQ LV Switchgear	1	EA	$1,007,177.00	$1,007,177	
16000	MBR Train LV Switchgear	1	EA	$558,436.00	$558,436	
16000	MV VFD for 500 HP	6	EA	$237,900.00	$1,427,400	
	Total					**$6,005,991**
	Grand Total					**$6,561,620**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**55B Module Electrical Building**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee	327.11	CY	$7.50	$2,453	
02000	ABC Fill	163.56	CY	$60.00	$9,814	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	327.11	CY	$20.00	$6,542	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	48.00	CY	$58.23	$2,795	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	363.44	CY	$15.00	$5,452	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	327.11	CY	$3.00	$981	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	36.33	CY	$11.24	$408	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	48.00	CY	$6.16	$296	
	Total					**$28,741**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	115.56	CY	$850.00	$98,226	
03300	12" Structural Flat Mat On Grade	44.44	CY	$850.00	$37,774	
	Total					**$136,000**
	Division 04 - Masonry					
04220	Concrete Block, Split Face 12" (Walls)	2,960.00	SF	$50.00	$148,000	
	Total					**$148,000**
	Division 05 - Metals					
05310	Steel Deck, 1-1/2" X 20 Ga. (Roof)	1,200.00	SF	$50.00	$60,000	
	Total					**$60,000**
	Division 16 - Electrical					
16000	0.5 MVA Transformer	2.00	EA	$69,550.00	$139,100	
16000	Module LV Switchgear	1.00	EA	$560,925.30	$560,925	
	Total					**$700,025**
	Grand Total					**$1,072,767**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**21 Generator Facility at Old Lab**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	1,446.67	CY	$60.00	$86,800	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	148.67	CY	$58.23	$8,657	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	148.67	CY	$6.16	$916	
	Total					**$96,374**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	1298	CY	$850.00	$1,103,300	
	Total					**$1,103,300**
	Division 05 - Metals					
05310	Steel Deck, 2" X 20 Ga.	6096	SF	$50.00	$304,800	
	Total					**$304,800**
	Division 16 - Electrical					
16000	Generator	1.00	EA	$2,554,500.00	$2,554,500	
16000	Paralleling Switchgear	1.00	EA	$4,420,000.00	$4,420,000	
16000	Generator (From Temporary Generators in Phase 1A)	3.00	EA	$825,300.00	$2,475,900	
	Total					**$9,450,400**
	Grand Total					**$10,954,874**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**57D Group 5 Standby Generator**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	1,280.44	CY	$60.00	$76,826	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	142.67	CY	$58.23	$8,308	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	142.67	CY	$6.16	$879	
	Total					**$86,014**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	711.11	CY	$850.00	$604,444	
	Total					**$604,444**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	3136	SF	$50.00	$156,800	
	Total					**$156,800**
	Division 16 - Electrical					
16000	Paralleing Switchgear	1.00	EA	$4,420,000.00	$4,420,000	
16000	Generator (Using Temporary Generators from Phase 1A)	3.00	EA	$825,300.00	$2,475,900	
	Total					**$6,895,900**
	Grand Total					**$7,743,157**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**April 30, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**22 SEQ and MBR A1, A2, B1 Xfrmr**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	572.72	CY	$130.00	$74,454	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	74.67	CY	$58.23	$4,348	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	74.67	CY	$6.16	$460	
	Total					**$79,262**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	501.11	CY	$850.00	$425,944	
	Total					**$425,944**
	Division 16 - Electrical					
16000	3 MVA Transformer	4	EA	$196,300.00	$785,200	
16000	10 MVA Transformer	2	EA	$585,000.00	$1,170,000	
16000	2 MVA Transformer	1	EA	$172,315.00	$172,315	
	Total					**$2,127,515**
	Grand Total					**$2,632,721**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**66B Mod 3 Electrical Bldg Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demolition of Existing Module 3 Electrical Building	1	LS	$553,540.00	$553,540	
	Total					**$553,540**
	Grand Total					**$553,540**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**25 Mod 2 Vent Scrubber Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demo of Module 2 Vent Scrubber Building	1	LS	$384,534.00	$384,534	
	Total					**$384,534**
	Grand Total					**$384,534**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**26 SC 1A-1D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demo of Secondary Clarifiers 1A-1D	1	LS	$8,708,520.00	$8,708,520	
	Total					**$8,708,520**
	Grand Total					**$8,708,520**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**27 SC 2A-2D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demo of Secondary Clarifiers 2A-2D	1	LS	$7,300,918.00	$7,300,918	
	Total					**$7,300,918**
	Grand Total					**$7,300,918**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**06 Phase 1B Site Work**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tunnel Structural Repair Cost	1.00	LS	$200,000.00	$200,000	
02000	Pipe Rack Demo and Replacement	1.00	LS	$500,000.00	$500,000	
02000	General Conditions for Demo Items	1.00	LS	$150,000.00	$150,000	
02000	Construction Difficulty and Work Restrictions	1.00	LS	$500,000.00	$500,000	
02000	Civil Shoring Design and Construction	1.00	LS	$400,000.00	$400,000	
02000	Bollards	26.00	EA	$480.00	$12,480	
02000	Dewatering	1.00	LS	$500,000.00	$500,000	
02000	Demo of large piping, channels and splitter box	1.00	LS	$500,000.00	$500,000	
02000	Traffic Control	1.00	LS	$750,000.00	$750,000	
02220	Remove 2"-3" Asphalt Pavement	144,638.00	SF	$.47	$68,356	
02580	24" Dia. X 300 Lb Light Traffic Manhole Frame & Cover	5.00	EA	$7,500.00	$37,500	
02580	24" X 36" Precast Curb Inlet Catch Basin W/Frame & Grate	20.00	EA	$5,000.00	$100,000	
02742	4" Ac Paving On 10" Abc	16,071.00	SY	$90.00	$1,446,390	
02772	4" Thick Concrete Sidewalk,	6,000.00	SF	$20.00	$120,000	
	Total					**$5,284,726**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	3,200.00	SF	$50.00	$160,000	
	Total					**$160,000**
	Division 05 - Metals					
05000	Miscellaneous Metals	1.00	LS	$100,000.00	$100,000	
05500	Aluminum Stairs, Including Railing And Supports	80.00	RSR	$725.75	$58,060	
	Total					**$158,060**
	Division 08 - Doors and Windows					
08110	3/0 X 6/8 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	4.00	EA	$2,000.00	$8,000	
	Total					**$8,000**
	Division 15 - Mechanical					
15000	Tunnel Supply Fan	6.00	EA	$39,095.00	$234,570	
15000	Tunnel Exhaust Fan	6.00	EA	$31,276.00	$187,656	
15000	Ducting in Tunnels	1.00	LS	$200,000.00	$200,000	
	Total					**$622,226**
	Grand Total					**$6,233,013**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**07 Phase 1B Yard Piping**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Sloped Slab On Grade (To 30%)	888.89	CY	$850.00	$755,557	
03300	12" Edge Forms, Flat Mat On Grade, Add	820.00	LF	$4.37	$3,581	
03300	12" Structural Flat Mat On Grade	148.15	CY	$850.00	$125,928	
03300	12" Straight Wall, To 8' High	207.41	CY	$2,000.00	$414,820	
03300	12" Elevated Slab To 20'	148.15	CY	$2,000.00	$296,300	
	Total					**$1,596,185**
	Division 15 - Mechanical					
15000	Storm Drain Piping	1.00	LS	$500,000.00	$500,000	
15252	72" C200 3/8" Wall Wld Cs Pipe In Open Trench	300.00	LF	$1,574.41	$472,323	
15252	60" C200 3/8" Wall Wld Cs Pipe In Open Trench	100.00	LF	$1,192.88	$119,288	
15814	Frp Duct, 108"	1,000.00	LF	$1,000.00	$1,500,000	
	Total					**$2,591,611**
	Grand Total					**$4,187,796**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**08 Phase 1B Temp Facilities**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	42.67	CY	$850.00	$36,270	
03300	12" Structural Flat Mat On Grade	8.89	CY	$850.00	$7,557	
03300	12" Straight Wall >8' High	11.11	CY	$2,000.00	$22,220	
03300	12" Straight Wall >8' High	11.85	CY	$2,000.00	$23,700	
03300	12" Elevated Slab To 20'	8.89	CY	$2,000.00	$17,780	
	Total					**$107,526**
	Division 11 - Equipment					
11000	CO2 System	1.00	LS	$2,814,839.96	$2,814,840	
11000	Temporary Vent Scrubbers	1.00	LS	$1,538,136.00	$1,538,136	
	Total					**$4,352,976**
	Grand Total					**$4,460,502**

Sidestream Treatment - Detailed Cost Estimate

LASAN - WRID
PROJECT CONSTRUCTION COST ESTIMATE

Project Title: **Sidestream Treatment**

Scope: This project will establish a new sidestream treatment facility intended for placement in the vicinity of the abandoned Conventional Digester Battery C. To facilitate this work and to leverage Phase 1A construction that will include demolition of 7 adjacent digesters, the demolition of 4 Battery C Digesters associated with the sidestream treatment facility siting will be performed in Phase 1A.

Work Order: | Client Dept.:

Project Manager: | Project Engineer:

Type of Estimate: ☐ Class "A" ☐ Class "B" ☐ Class "C" ☑ Class "O"

Estimate Date	5/1/2024
Construction Start	12/22/2031
Construction End	12/16/2033
Construction Mid Point	12/18/2032

Description	Unit	Quantity	Unit Price	Jun-24
Sidestream Treatment	LS	1	$ 46,889,300	46,889,000
Site Preparation	LS	1	$ 2,570,000	2,570,000
Electrical and Instrumentation	LS	1	$ 5,900,000	5,900,000
Sales Tax		9.5%	$ 2,629,567	2,630,000
			Total Direct Cost	**57,989,000**
Construction Complexity Index		10.0%	$ 5,798,887	5,799,000
General Conditions		10.0%	$ 5,798,887	5,799,000
General Liability & Builder's Risk		2.0%	$ 1,159,777	1,160,000
General Contractor Bond		1.0%	$ 579,889	580,000
Contractor Profit		10.0%	$ 5,798,887	5,799,000
Subtotal (1)				**77,126,000**
Mobilization - 0% to 7% of Subtotal (1)			5%	3,856,000
Permits - 2% to 5% of Subtotal (1)			3%	2,314,000
Subtotal (2)				**83,296,000**
Estimating Contingency - 0% to 50% of Subtotal (2)			45%	37,483,000
Total Estimated Project Construction Cost (Unescalated)				**120,779,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 01 Sidestream Treatment

Format: MASTER FORMAT 17
Date : May 31,2024
By : XHK
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03000	Concrete Deammonification Tank	1.00	LS	$5,700,000.00	$5,700,000	
03000	Concrete Equalization Tank	1,300.00	CY	$2,500.00	$3,250,000	
03000	Odor Control Concrete Pad	66.80	CY	$2,500.00	$167,000	
03000	Concrete Secondary Containment for Chemical Tanks	1.00	EA	$30,000.00	$30,000	
03000	Ancillary Facilities	1.00	LS	$4,063,000.00	$4,063,000	
	Total					**$13,210,000**
	Division 05 - Metals					
05000	Miscellaneous Metals	1.00	LS	$1,290,000.00	$1,290,000	
	Total					**$1,290,000**
	Division 09 - Finishes					
09000	Coating Allowance	1.00	LS	$730,000.00	$730,000	
	Total					**$730,000**
	Division 11 - Equipment					
11000	Deammonification Treament	1	LS	$14,020,000.00	$14,020,000	
11000	Equalization Equipment - Blowers and Influent Pumps	1	LS	$577,000.00	$577,000	
11000	TSS Removal Equipment	1	LS	$2,000,000.00	$2,000,000	
11000	Heat Exchanger	3	EA	$51,000.00	$153,000	
11000	Heat Exchangers CIP	1	EA	$33,500.00	$33,500	
11000	Booster Pump	1	EA	$64,800.00	$64,800	
11000	Odor Control Equipment	1	LS	$3,139,000.00	$3,139,000	
11000	Odor Control Chemical Pump Skid	0	EA	$35,000.00	$	
11000	Process Chemical Pump Skid	3	EA	$35,000.00	$105,000	
11000	Installation for Process Related Scope	1.00	LS	$6,900,000.00	$6,900,000	
11000	Commissioning	1.00	LS	$790,000.00	$790,000	
	Total					**$27,782,300**
	Division 13 - Special Construction					
13000	Chemical Day Tank	5	EA	$10,000.00	$50,000	
13000	Chemical Tote	1	EA	$7,500.00	$7,500	
	Total					**$57,500**
	Division 15 - Mechanical					
15000	Eyewash Station and Shower	3	EA	$2,500.00	$7,500	
15000	20" DIP centrate piping to sidestream treatment	2,200.00	LF	$600.00	$1,320,000	
15000	20" DIP treated centrate to Headworks	1,400.00	LF	$600.00	$840,000	
15000	16" DIP plant cooling water piping to heat exchangers	600.00	LF	$480.00	$288,000	
15000	16" DIP heated plant water return to Primary Clarifier	1,800.00	LF	$480.00	$864,000	
15000	36" FRP ducting for odor control piping	400.00	LF	$1,250.00	$500,000	
	Total					**$3,819,500**
	Grand Total					**$46,889,300**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	**XHK**
Element:	**03 Site Preparation**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Site Preparation	1	LS	$1,570,000.00	$1,570,000	
02000	Site Preperation Allowance	1	LS	$1,000,000.00	$1,000,000	
	Total					**$2,570,000**
	Grand Total					**$2,570,000**

Phase 2 - Detailed Cost Estimate

LASAN - WRID
PROJECT CONSTRUCTION COST ESTIMATE

Project Title: **Phase 2 - 40-mgd IPR (MBR Battery A2)**

Scope: Phase 2 is intended to construct the northern half of Secondary Treatment Battery A to increase the MBR permeate production and to complete the remaining IPR treatment train. MBR Battery A2 consists of retrofitted Modules 3 and 4, a new membrane train, and new blowers to be installed in the Battery A blower building constructed in Phase 1B. For the IPR train, the secondary EQ and the RO/UV-AOP Building will each be expanded to their full capacities, utilizing the spaces vacated by Secondary Clarifiers 3 and 4.

Work Order: | Client Dept.:

Project Manager: | Project Engineer:

Type of Estimate: ☐ Class "A" ☐ Class "B" ☐ Class "C" ☑ Class "O"

Estimate Date	5/1/2024
Construction Start	6/1/2036
Construction End	11/30/2039
Construction Mid Point	3/1/2038

Description	Unit	Quantity	Unit Price	Jun-24
System 3 Odor Control Facility	LS	1	$ 6,578,236	6,578,000
Aeration Basin Module 3	LS	1	$ 14,050,247	14,050,000
Aeration Basin Module 4	LS	1	$ 14,050,247	14,050,000
Battery A ML Channel and RAS Building (Northern Half)	LS	1	$ 10,519,231	10,519,000
Battery A Aeration Blower Building	LS	1	$ 4,873,936	4,874,000
Membrane Train A2	LS	1	$ 63,398,630	63,399,000
Secondary EQ Basin (Northern Half)	LS	1	$ 13,299,072	13,299,000
IPR RO/UVAOP Building (40 mgd)	LS	1	$ 35,367,504	35,368,000
Electrical Substation No. 3	LS	1	$ 16,160,140	16,160,000
MBR Train A1, A2, B1 and SE EQ Electrical Room	LS	1	$ 5,554,443	5,554,000
Module 3 Electrical Building	LS	1	$ 1,072,767	1,073,000
MBR Train A2 Standby Generator Facility - Group 4	LS	1	$ 6,438,647	6,439,000
Secondary EQ Basin MBR Trains A1, A2 and B1 Transformers	LS	1	$ 2,632,721	2,633,000
Existing Module 3 Electrical Building Demo	LS	1	$ 553,540	554,000
Secondary Clarifiers 3A-3D Demo	LS	1	$ 9,653,094	9,653,000
Secondary Clarifiers 4A-4D Demo	LS	1	$ 7,300,918	7,301,000
Site Work	LS	1	$ 6,131,007	6,131,000
Yard Piping	LS	1	$ 2,678,866	2,679,000
Electrical and Instrumentation	LS	1	$ 13,553,593	13,554,000
Sales Tax		9.5%	$ 11,108,675	11,109,000
			Total Direct Cost	**244,977,000**
Construction Complexity Index		10.0%	$ 24,497,551	24,498,000
General Conditions		10.0%	$ 24,497,551	24,498,000
General Liability & Builder's Risk		2.0%	$ 4,899,510	4,900,000
General Contractor Bond		1.0%	$ 2,449,755	2,450,000
Contractor Profit		10.0%	$ 24,497,551	24,498,000
Subtotal (1)				**325,821,000**

Mobilization - 0% to 7% of Subtotal (1)	5%	16,291,000
Permits - 2% to 5% of Subtotal (1)	3%	9,775,000
Subtotal (2)		**351,887,000**

Estimating Contingency - 0% to 50% of Subtotal (2)	45%	158,349,000
Total Estimated Project Construction Cost (Unescalated)		**510,236,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**19C System 3 OCF**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	48" Structural Flat Mat On Grade	171.26	CY	$850.00	$145,571	
03300	12" Edge Forms, Flat Mat On Grade, Add	446	LF	$4.37	$1,948	
03300	12" Structural Flat Mat On Grade	342.22	CY	$619.29	$211,935	
03300	12" Structural Flat Mat On Grade	53.52	CY	$619.29	$33,145	
03300	12" Structural Flat Mat On Grade	13.33	CY	$619.29	$8,255	
	Total					**$400,854**
	Division 11 - Equipment					
11000	System 3 Odor Control Facility	1	EA	$5,978,731.24	$5,978,731	
	Total					**$5,978,731**
	Division 15 - Mechanical					
15814	Frp Flange , 30"	4	EA	$5,278.38	$21,114	
15814	Frp Flange , 24"	5	EA	$4,326.17	$21,631	
15814	Frp Tee, 60"	5	EA	$3,454.03	$17,270	
15814	90 Degree Frp Duct Elbow, 60"	4	EA	$12,358.68	$49,435	
15814	45 Degree Frp Duct Elbow, 24"	1	EA	$2,167.87	$2,168	
15814	Frp Duct, 60"	160	LF	$365.34	$58,454	
15814	Frp Duct, 30"	96	LF	$210.37	$20,195	
15814	Frp Duct, 24"	72	LF	$116.45	$8,385	
	Total					**$198,651**
	Grand Total					**$6,578,236**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: Aeration Basin Module

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Module Channel Repairs	1.00	LS	$1,097,555.00	$1,097,555	
02000	Demo of Module Inlet Gate	1.00	LS	$30,000.00	$30,000	
02000	Demo of Surface Aerators	1.00	LS	$85.00	$85	
02000	Seismic Retrofit of Existing Structure	1.00	LS	$587,963.40	$587,963	
02300	Native Pipe Bed & Zone/Confined Structure Backfill, Class C Material	239.58	CY	$46.48	$11,136	
	Total					**$1,726,739**
	Division 03 - Concrete					
03000	Concrete Modifications	1.00	LS	$979,939.00	$979,939	
03300	12" Straight Wall >8' High (Zone 1A and 1B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 1B and 2A)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 2A and 2B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 5A and 5B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High	47.92	CY	$2,000.00	$95,840	
03300	12" Straight Wall >8' High	47.92	CY	$2,000.00	$95,840	
03300	12" Straight Wall >8' High	66.67	CY	$2,000.00	$133,340	
03300	12" Structural Flat Mat On Grade	46.00	CY	$850.00	$39,100	
03300	16" X 16" Square Column/Pier	79.01	CY	$1,390.43	$109,858	
03300	18" Structural Flat Mat On Grade	54.00	CY	$850.00	$45,900	
	Total					**$2,939,817**
	Division 11 - Equipment					
11000	Platform-Mounted Propeller Mixers	30	EA	$51,378.65	$1,541,359	
11000	MLR Vertical Turbine Pump	6	EA	$325,475.80	$1,952,855	
11000	Module Inlet Gate	6.00	EA	$37,700.00	$226,200	
11000	Module Outlet Gate	6.00	EA	$42,900.00	$257,400	
11000	MLR Box Gate	9.00	EA	$37,700.00	$339,300	
11000	Fine Bubble Diffusers	1.00	EA	$1,777,925.93	$1,777,926	
	Total					**$6,095,040**
	Division 15 - Mechanical					
15000	Pipe Supports	1.00	LS	$180,000.00	$180,000	
15112	Add For Motor Operator Over 20"	9.00	EA	$10,008.32	$90,075	
15112	36" 150# Fxf Awwa Butterfly Valve, No Op	9.00	EA	$35,000.00	$315,000	
15112	24" 150# Fxf Awwa Butterfly Valve, No Op	6.00	EA	$18,000.00	$108,000	
15251	36" X 36" Cldi Mj Tee Or Wye	3.00	EA	$18,345.77	$55,037	
15251	36" 90° 125# Cldi Fxf Ell	9.00	EA	$19,466.01	$175,194	
15251	36" Flg Cldi Pipe In Bldg	855.00	LF	$916.87	$783,924	
15251	36" X 24" Cldi Push-On Joint Tee (C110)	6.00	EA	$16,020.16	$96,121	
15251	36" 90° 125# Cldi Fxf Ell	9.00	EA	$19,466.01	$175,194	
15251	36" 125# Cast Iron Blind Flange	3.00	EA	$5,885.85	$17,658	
15251	36" Flg Cldi Pipe In Bldg	675.00	LF	$916.87	$618,887	
15251	24" Flg Cldi Pipe In Bldg	108.00	LF	$406.45	$43,896	
15251	42" Flg Cldi Pipe In Bldg	90.00	LF	$1,064.67	$95,820	
15252	24"A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	810.00	LF	$489.04	$396,124	
	Total					**$3,150,931**
	Division 17 - Instrumentation and Controls					
17302	36" Flow Measurement Magnetic Flow Meter	3.00	EA	$45,906.47	$137,719	
	Total					**$137,719**
	Grand Total					**$14,050,247**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 26A Battery A ML Channel

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Remove 7"-24" Non-Reinf Conc Pavement	425.68	CY	$93.81	$39,933	
	Total					**$39,933**
	Division 03 - Concrete					
03300	12" Edge Forms, Flat Mat On Grade, Add	759.34	LF	$4.37	$3,316	
03300	12" Structural Flat Mat On Grade	425.68	CY	$619.29	$263,621	
03300	12" Straight Wall, To 8' High	145.53	CY	$2,000.00	$291,060	
03300	12" Straight Wall, To 8' High	13.93	CY	$2,000.00	$27,860	
03300	12" Elevated Slab To 14' High	532.10	CY	$2,000.00	$1,064,200	
	Total					**$1,650,058**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	13,860.00	SF	$22.50	$311,829	
	Total					**$311,829**
	Division 05 - Metals					
05310	Steel Deck, 3" X 18 Ga.	11,493.41	SF	$6.52	$74,961	
	Total					**$74,961**
	Division 08 - Doors and Windows					
08110	3/6 X 6/8 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	7.00	EA	$1,236.96	$8,659	
	Total					**$8,659**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Floor Operated Overhead Traveling Bridge Crane	5.00	EA	$358,029.41	$1,790,147	
	Total					**$1,790,147**
	Division 15 - Mechanical					
15000	30" Check Valve (RAS)	6.00	EA	$34,807.06	$208,842	
15112	Add For Motor Operator Over 48"	2.00	EA	$13,404.00	$26,808	
15112	48" Dimj Awwa Butterfly Valve, No Op	2.00	EA	$30,125.48	$60,251	
15116	30" Fxf Cast Iron Plug Valve W/Handwheel Op	12.00	EA	$40,595.39	$487,145	
15116	36" Fxf Cast Iron Plug Valve W/Handwheel Op	24.00	EA	$48,271.52	$1,158,517	
15116	Add For Motor Operator 22" Through 48"	36.00	EA	$13,404.00	$482,544	
15252	36" 3/8" (Std) Wall A-234 Buttweld Straight Tee	3.00	EA	$31,001.51	$93,005	
15252	30" 1/2" (Xh) Wall A-234 Buttweld Straight Tee	6.00	EA	$25,393.09	$152,359	
15252	48" X 30" 3/8" (Std) Wall A-234 Buttwld Con Rdcr	12.00	EA	$22,396.01	$268,752	
15252	48" X 36" 1/2" (Xh) Wall A-234 Buttwld Con Rdcr	12.00	EA	$37,185.61	$446,227	
15252	36" 1/2" Wall 90° Lr Buttweld Ell	24.00	EA	$18,909.44	$453,827	
15252	30" 3/8" Wall 90° Lr Buttweld Ell	12.00	EA	$9,870.91	$118,451	
15252	48" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	693.00	LF	$1,469.56	$1,018,404	
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	720.00	LF	$807.93	$581,710	
15252	30" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	480.00	LF	$641.96	$308,139	
	Total					**$5,864,980**
	Division 17 - Instrumentation and Controls					
17302	36" Flow Measurement Magnetic Flow Meter	12.00	EA	$45,906.47	$550,878	
17302	30" Flow Measurement Magnetic Flow Meter	6.00	EA	$37,964.60	$227,788	
	Total					**$778,665**
	Grand Total					**$10,519,231**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**27A Bat A Blower Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 11 - Equipment					
11000	Aeration Air Blowers	3.00	EA	$1,139,044.31	$3,417,133	
	Total					**$3,417,133**
	Division 15 - Mechanical					
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	54.00	LF	$807.93	$43,628	
15252	12" A-53 Welded Steel 3/8" (Std) Wall Pipe In A Bldg	48.00	LF	$248.76	$11,941	
	Total					**$55,569**
	Division 16 - Electrical					
16000	MV VFD for 1500 HP Blower	3.00	EA	$377,545.99	$1,132,638	
16000	MCC (Area 27A)	1.00	EA	$268,596.39	$268,596	
	Total					**$1,401,234**
	Grand Total					**$4,873,936**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train A1

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	100 Ton Crawler Mounted Lattice Boom Crane w/ Operator and Support Crew	48.00	MO	$50,000.00	$2,400,000	
	Total					**$2,400,000**
	Division 02 - Site Construction					
02000	ABC Fill	5,004.00	CY	$60.00	$300,240	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	3,665.78	CY	$58.23	$213,463	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	3,665.78	CY	$6.16	$22,597	
	Total					**$536,301**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	4433.33	CY	$850.00	$3,768,331	
03300	24" Straight Wall >8' High	1014.74	CY	$1,800.00	$1,826,532	
03300	24" Straight Wall >8' High	572.22	CY	$1,800.00	$1,029,996	
03300	12" Straight Wall >8' High	11.47	CY	$2,000.00	$22,940	
03300	12" Straight Wall >8' High	65.56	CY	$2,000.00	$131,120	
03300	12" Straight Wall >8' High	57.22	CY	$2,000.00	$114,440	
03300	12" Straight Wall >8' High	20.03	CY	$2,000.00	$40,060	
03300	12" Straight Wall >8' High	6.56	CY	$2,000.00	$13,120	
03300	12" Elevated Slab To 20'	14.81	CY	$2,000.00	$29,620	
03300	12" Elevated Slab, 21'-26' High	7.58	CY	$2,000.00	$15,160	
03300	8" Straight Wall, To 8' High	28.00	CY	$2,000.00	$56,000	
03300	12" Elevated Slab To 20'	548.15	CY	$2,000.00	$1,096,300	
03300	12" Straight Wall, To 8' High	109.63	CY	$2,000.00	$219,260	
03300	12" Elevated Slab To 20'	45.74	CY	$2,000.00	$91,480	
03300	12" Straight Wall, To 8' High	219.56	CY	$2,000.00	$439,120	
03300	12" Straight Wall >8' High	705.74	CY	$2,000.00	$1,411,480	
03300	12" Elevated Slab To 20'	561.85	CY	$2,000.00	$1,123,700	
03300	12" Straight Wall >8' High	473.78	CY	$2,000.00	$947,560	
03300	12" Elevated Slab To 20'	68.52	CY	$2,000.00	$137,040	
03300	12" Elevated Slab To 20'	14.00	CY	$2,000.00	$28,000	
03300	12" Elevated Slab To 20'	3.80	CY	$2,000.00	$7,600	
03300	12" Straight Wall, To 8' High	24.30	CY	$2,000.00	$48,600	
03300	8" Straight Wall >8' High	47.64	CY	$2,000.00	$95,280	
03300	8" Straight Wall >8' High	53.33	CY	$2,000.00	$106,660	
03300	12" Elevated Slab, 21'-26' High	33.33	CY	$2,000.00	$66,660	
03300	12" Elevated Slab, 21'-26' High	5.78	CY	$2,000.00	$11,560	
03300	12" Straight Wall >8' High	21.33	CY	$2,000.00	$42,660	
03300	12" Straight Wall >8' High	11.56	CY	$2,000.00	$23,120	
03300	18" Straight Wall >8' High	138.67	CY	$2,000.00	$277,340	
03300	18" Straight Wall >8' High	58.67	CY	$2,000.00	$117,340	
03300	18" Straight Wall >8' High	115.56	CY	$2,000.00	$231,120	
03300	12" Structural Flat Mat On Grade	57.78	CY	$850.00	$49,113	
03300	12" Straight Wall >8' High	60.74	CY	$2,000.00	$121,480	
03300	12" Straight Wall >8' High	225.19	CY	$2,000.00	$450,380	
03300	12" Elevated Slab To 20'	230.81	CY	$2,000.00	$461,620	
	Total					**$14,651,792**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	39,900.00	SF	$50.00	$1,995,000	
05310	Steel Deck, 3" X 20 Ga.	6,232.00	SF	$50.00	$311,600	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	30.00	RSR	$725.75	$21,773	
	Total					**$2,337,082**
	Division 06 - Wood and Plastics					
06000	Weirs and Baffles	1.00	LS	$626,600.00	$626,600	
	Total					**$626,600**
	Division 11 - Equipment					
11000	Membrane Tank Inlet Gate, 60"x 60"	26.00	EA	$35,750.00	$929,500	
11000	RAS Pump	6.00	EA	$635,518.00	$3,813,108	
11000	WAS Pump	3.00	EA	$48,058.40	$144,175	
11000	RAS Inlet Gate	2.00	EA	$35,750.00	$71,500	

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train A1

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
11000	RAS/WAS Top Gate	2.00	EA	$13,175.50	$26,351	
11000	WAS Bottom Gate	1.00	EA	$13,175.50	$13,176	
11000	Membrane System (26 B50N Membrane Modules, Racks, Headers and Rack Supports; 26 Permeate Pumps;CIP Pump System; Drain Pump System;Chemical Transfer System; Controls; Commisioning and Training)	1.00	EA	$35,048,000.00	$35,048,000	
11000	Splitter Box Gate	26.00	EA	$14,105.00	$366,730	
11294	Add For Motor Operator To 96"	26.00	EA	$17,060.91	$443,584	
	Total					**$40,856,123**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	2.00	EA	$379,534.53	$759,069	
	Total					**$759,069**
	Division 15 - Mechanical					
15000	54" ST STL Permeate Header	350.00	LF	$1,995.19	$698,315	
15000	36" Air Scour Header	350.00	LF	$1,123.85	$393,348	
15000	Pipe Supports	1.00	LS	$140,000.00	$140,000	
	Total					**$1,231,663**
	Grand Total					**$63,398,630**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**11 Secondary EQ Basin**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee	11,357.63	CY	$107.00	$1,215,266	
02000	ABC Fill	2,247.11	CY	$130.00	$292,124	
02260	Sheet Piling, 38#/Sf To 40' Deep, Driven, Pulled & Salvaged (Pits Only)	8,120.00	SF	$90.00	$730,800	
02260	Sheet Piling, 38#/Sf To 40' Deep, Driven, Pulled & Salvaged (Pits Only)	5,110.00	SF	$90.00	$459,900	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	11,357.63	CY	$20.00	$227,153	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	4,796.44	CY	$58.23	$279,303	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	11,857.00	CY	$15.00	$177,855	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	11,357.63	CY	$3.00	$34,073	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	499.37	CY	$11.24	$5,614	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	4,796.44	CY	$6.16	$29,567	
	Total					**$3,451,655**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	1,711.11	CY	$850.00	$1,454,444	
03300	18" Structural Flat Mat On Grade	855.56	CY	$850.00	$727,226	
03300	30" Straight Wall >8' High	777.78	CY	$1,800.00	$1,400,004	
03300	30" Straight Wall >8' High	305.56	CY	$1,800.00	$550,008	
03300	30" Straight Wall >8' High	103.70	CY	$1,800.00	$186,660	
03300	30" Straight Wall >8' High	185.19	CY	$1,800.00	$333,342	
	Total					**$4,651,684**
	Division 11 - Equipment					
11000	SE EQ DPR Vertical Turbine Pumps	6.00	EA	$700,326.04	$4,201,956	
	Total					**$4,201,956**
	Division 15 - Mechanical					
15000	30" Check Valve	6.00	EA	$25,411.75	$152,470	
15000	Flap Gate	6.00	EA	$28,148.40	$168,890	
15000	96" Magmeter	1.00	EA	$179,837.00	$179,837	
15112	30" 150# Fxf Awwa Butterfly Valve, No Op	6.00	EA	$12,244.87	$73,469	
15252	30" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	60.00	LF	$641.96	$38,517	
15252	96" C200 1/2" Wall Wld Cs Pipe In Open Trench	140.00	LF	$2,718.52	$380,593	
	Total					**$993,777**
	Grand Total					**$13,299,072**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**47A IPR ROUVAOP Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 11 - Equipment					
11000	UVAOP Reactor	2.00	EA	$3,848,064.94	$7,696,130	
11000	IPR RO Equipment for 40 mgd (5 RO Trains)	1.00	LS	$25,691,000.07	$25,691,000	
11000	Citric Acid Chemical Pump (RO CIPs and RO CIP Neutralization)	2.00	EA	$37,391.57	$74,783	
11000	Sodium Hydroxide 25% Chemical Pump	2.00	EA	$41,602.66	$83,205	
	Total					**$33,545,118**
	Division 16 - Electrical					
16000	MV VFD for 1250 HP	5.00	EA	$364,477.09	$1,822,385	
	Total					**$1,822,385**
	Grand Total					**$35,367,504**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**52C Elec Substation No. 3**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02300	ABC Fill	1,824.00	CY	$130.00	$237,120	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	190.67	CY	$58.23	$11,103	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	190.67	CY	$6.16	$1,175	
	Total					**$249,398**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	1633.33	CY	$850.00	$1,388,331	
	Total					**$1,388,331**
	Division 16 - Electrical					
16000	Substation No. 3	1	EA	$1,143,087.30	$1,143,087	
16000	20 MVA XFMR	2	EA	$2,761,208.77	$5,522,418	
16000	25 MVA XFMR	2	EA	$3,451,510.96	$6,903,022	
16000	2 MVA Transformer	4	EA	$192,475.85	$769,903	
16000	1 MVA Transformer	2	EA	$91,990.53	$183,981	
	Total					**$14,522,411**
	Grand Total					**$16,160,140**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**April 30, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**54A MBR Train A2 Elect Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	160.74	CY	$850.00	$136,629	
	Total					**$136,629**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	2,800.00	SF	$50.00	$140,000	
04220	Standard Concrete Block, 12"	1,240.00	SF	$50.00	$62,000	
	Total					**$202,000**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	4,340.00	SF	$50.00	$217,000	
	Total					**$217,000**
	Division 16 - Electrical					
16000	LV Switchgear (MBR Train A2)	1.00	EA	$558,436.00	$558,436	
16000	5 kV Switchgear (MBR Train A2)	1.00	EA	$2,357,496.70	$2,357,497	
16000	MCC A (Area 54A)	1.00	EA	$408,835.70	$408,836	
16000	MCC BA	1.00	EA	$246,645.10	$246,645	
16000	MV VFD for 500 HP	6.00	EA	$237,900.00	$1,427,400	
	Total					**$4,998,814**
	Grand Total					**$5,554,443**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**55B Module Electrical Building**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee	327.11	CY	$7.50	$2,453	
02000	ABC Fill	163.56	CY	$60.00	$9,814	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	327.11	CY	$20.00	$6,542	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	48.00	CY	$58.23	$2,795	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	363.44	CY	$15.00	$5,452	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	327.11	CY	$3.00	$981	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	36.33	CY	$11.24	$408	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	48.00	CY	$6.16	$296	
	Total					**$28,741**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	115.56	CY	$850.00	$98,226	
03300	12" Structural Flat Mat On Grade	44.44	CY	$850.00	$37,774	
	Total					**$136,000**
	Division 04 - Masonry					
04220	Concrete Block, Split Face 12" (Walls)	2,960.00	SF	$50.00	$148,000	
	Total					**$148,000**
	Division 05 - Metals					
05310	Steel Deck, 1-1/2" X 20 Ga. (Roof)	1,200.00	SF	$50.00	$60,000	
	Total					**$60,000**
	Division 16 - Electrical					
16000	0.5 MVA Transformer	2.00	EA	$69,550.00	$139,100	
16000	Module LV Switchgear	1.00	EA	$560,925.30	$560,925	
	Total					**$700,025**
	Grand Total					**$1,072,767**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**57E Generator Facility Group 4**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	821.78	CY	$130.00	$106,831	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	110.67	CY	$58.23	$6,444	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	110.67	CY	$6.16	$682	
	Total					**$113,958**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	711.11	CY	$850.00	$604,444	
	Total					**$604,444**
	Division 05 - Metals					
05310	Steel Deck, 2" X 20 Ga.	3120	SF	$4.32	$13,492	
	Total					**$13,492**
	Division 16 - Electrical					
16000	Generator	2	EA	$2,853,376.46	$5,706,753	
	Total					**$5,706,753**
	Grand Total					**$6,438,647**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**April 30, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**58C SE EQ and MBR A2 Xfrmrs**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	572.72	CY	$130.00	$74,454	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	74.67	CY	$58.23	$4,348	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	74.67	CY	$6.16	$460	
	Total					**$79,262**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	501.11	CY	$850.00	$425,944	
	Total					**$425,944**
	Division 16 - Electrical					
16000	3 MVA Transformer	4.00	EA	$196,300.00	$785,200	
16000	10 MVA Transformer	2.00	EA	$585,000.00	$1,170,000	
16000	2 MVA Transformer	1.00	EA	$172,315.00	$172,315	
	Total					**$2,127,515**
	Grand Total					**$2,632,721**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**66B Mod 3 Electrical Bldg Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demolition of Existing Module 3 Electrical Building	1	LS	$553,540.00	$553,540	
	Total					**$553,540**
	Grand Total					**$553,540**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**67C SC 3A-3D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demolition of Secondary Clarifiers 3A-3D	1	LS	$9,653,094.00	$9,653,094	
	Total					**$9,653,094**
	Grand Total					**$9,653,094**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**67D SC 4A-4D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demolition of Secondary Clarifiers4A-4D	1	LS	$7,300,918.00	$7,300,918	
	Total					**$7,300,918**
	Grand Total					**$7,300,918**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**70A Phase 2 Site Work**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	General Conditions for Demo Items	1.00	LS	$75,000.00	$75,000	
02000	Construction Difficulty and Work Restrictions	1.00	LS	$500,000.00	$500,000	
02000	Tunnel Structural Repair Cost	1.00	LS	$200,000.00	$200,000	
02000	Pipe Rack Demo and Replacement	1.00	LS	$500,000.00	$500,000	
02000	Miscellanous Metals	1.00	LS	$100,000.00	$100,000	
02000	Civil Shoring Design and Construction	1.00	LS	$400,000.00	$400,000	
02000	Bollards	160.00	EA	$480.00	$76,800	
02000	Dewatering	1.00	LS	$500,000.00	$500,000	
02000	Demo of large piping, channels and splitter boxes near Secondary Clarifiers	1.00	LS	$500,000.00	$500,000	
02000	Traffic Control	1.00	LS	$750,000.00	$750,000	
02220	Remove 2"-3" Asphalt Pavement	144638	SF	$.47	$68,356	
02580	24" Dia. X 300 Lb Light Traffic Manhole Frame & Cover	5.00	EA	$7,500.00	$37,500	
02580	24" X 36" Precast Curb Inlet Catch Basin W/Frame & Grate	20.00	EA	$5,000.00	$100,000	
02742	4" Ac Paving On 10" Abc	16070.89	SY	$90.00	$1,446,380	
02772	4" Thick Concrete Sidewalk,	6000	SF	$20.00	$120,000	
	Total					**$5,374,036**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	3,200.00	SF	$22.50	$71,995	
	Total					**$71,995**
	Division 05 - Metals					
05500	Aluminum Stairs, Including Railing And Supports	80.00	RSR	$725.75	$58,060	
	Total					**$58,060**
	Division 08 - Doors and Windows					
08110	3/0 X 6/8 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	4.00	EA	$1,172.18	$4,689	
	Total					**$4,689**
	Division 15 - Mechanical					
15000	Ducting in Tunnels	1.00	LS	$200,000.00	$200,000	
15000	Tunnel Supply Fan	6.00	EA	$39,095.00	$234,570	
15000	Tunnel Exhaust Fan	6.00	EA	$31,276.00	$187,656	
	Total					**$622,226**
	Grand Total					**$6,131,007**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**70B Phase 2 Yard Piping**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Sloped Slab On Grade (To 30%)	1,200.00	CY	$565.51	$678,612	
03300	12" Edge Forms, Flat Mat On Grade, Add	750.00	LF	$4.37	$3,275	
03300	12" Structural Flat Mat On Grade	94.37	CY	$619.29	$58,443	
03300	12" Elevated Slab To 20'	94.37	CY	$2,000.00	$188,740	
03300	12" Straight Wall, To 8' High	139.04	CY	$2,000.00	$278,080	
	Total					**$1,207,150**
	Division 15 - Mechanical					
15000	Storm Drain Piping	1.00	LS	$500,000.00	$500,000	
15252	60" C200 3/8" Wall Wld Cs Pipe In Open Trench	100.00	LF	$1,192.88	$119,288	
15252	96" C200 3/8" Wall Wld Cs Pipe In Open Trench	400.00	LF	$2,131.07	$852,427	
	Total					**$1,471,716**
	Grand Total					**$2,678,866**

Phase 3 - Detailed Cost Estimate

LASAN - WRID
PROJECT CONSTRUCTION COST ESTIMATE

Project Title: **Phase 3 - MBR Battery B and 120-mgd DPR**

Scope: Phase 3 is intended to construct the entirety of Secondary Treatment Battery B and the DPR train. MBR Train B1 consists of retrofitted Modules 5 and 6 and a new membrane train, whereas MBR Battery B2 consists of retrofitted Modules 7 and 8 and a new membrane train. A dedicated blower building will serve the entire MBR Battery B. The entire DPR train is the be built in this phase, which consists of ozone and liquid oxygen facilities, BAC filters, a new RO/UV-AOP Building, a new MF facility and a new Product Water Storage Basin and Pump Station.

Work Order: | Client Dept.:

Project Manager: | Project Engineer:

Type of Estimate: ☐ Class "A" ☐ Class "B" ☐ Class "C" ☑ Class "O"

Estimate Date	5/1/2024
Construction Start	6/2/2039
Construction End	11/15/2051
Construction Mid Point	8/23/2045

Description	Unit	Quantity	Unit Price	Jun-24
System 4 Odor Control Facility	LS	1	$ 12,693,498	12,693,000
System 5 Odor Control Facility	LS	1	$ 6,997,676	6,998,000
System 6 Odor Control Facility	LS	1	$ 12,693,498	12,693,000
Aeration Basin Module 5	LS	1	$ 14,050,247	14,050,000
Aeration Basin Module 6	LS	1	$ 14,050,247	14,050,000
Aeration Basin Module 7	LS	1	$ 14,050,247	14,050,000
Aeration Basin Module 8	LS	1	$ 14,050,247	14,050,000
Aeration Basin Module 9	LS	1	$ 14,050,247	14,050,000
Battery B ML Channel and RAS Building	LS	1	$ 23,773,949	23,774,000
Battery B Aeration Blower Building	LS	1	$ 49,412,060	49,412,000
Membrane Train B1	LS	1	$ 63,398,630	63,399,000
Membrane Train B2	LS	1	$ 63,398,630	63,399,000
Membrane Train B3	LS	1	$ 49,504,993	49,505,000
Oxygen Production	LS	1	$ 24,721,446	24,721,000
Ozone Production	LS	1	$ 18,119,960	18,120,000
Ozone Contact Area	LS	1	$ 24,351,489	24,351,000
BAC Contact Area	LS	1	$ 107,156,606	107,157,000
North Chemical Storage Facility	LS	1	$ 90,648	91,000
Post Treatment Facility	LS	1	$ 19,130,775	19,131,000
DPR Product Water Pump Station	LS	1	$ 12,276,183	12,276,000
MF Building	LS	1	$ 115,324,476	115,324,000
DPR RO/UVAOP Building	LS	1	$ 172,112,571	172,113,000
Service Water Building	LS	1	$ 26,326,346	26,326,000
Main Switchyard	LS	1	$ 4,230,491	4,230,000
Electrical Substation No. 4	LS	1	$ 14,500,308	14,500,000
Product Water PS Electrical Room	LS	1	$ 6,665,774	6,666,000
MBR Train A1, A2, B1 and SE EQ Electrical Room	LS	1	$ 4,998,814	4,999,000
MBR Train B2 and B3 Electrical Room	LS	1	$ 9,341,241	9,341,000
Module 6 Electrical Building	LS	1	$ 1,072,767	1,073,000
Module 7 Electrical Building	LS	1	$ 1,072,767	1,073,000
Module 9 Electrical Building	LS	1	$ 1,072,767	1,073,000
Ozone Electrical Buildings	LS	1	$ 10,886,656	10,887,000
SWF Generator Facility - Group 2	LS	1	$ 37,742,836	37,743,000
MBR Trains B2 and B3 Transformers	LS	1	$ 4,099,438	4,099,000
SE EQ Basin and MBR Trains A1, A2 and B1 Transformers	LS	1	$ 1,955,200	1,955,000
Oxygen Generation Facility Demo	LS	1	$ 1,915,866	1,916,000
OGF Compressor Facility Demo	LS	1	$ 4,786,503	4,787,000
Existing Module 6 Electrical Building Demo	LS	1	$ 553,540	554,000
Existing Module 7 Electrical Building Demo	LS	1	$ 553,540	554,000
Existing Module 9 Electrical Building Demo	LS	1	$ 553,540	554,000
Existing Module 6 Vent Scrubber Building	LS	1	$ 384,534	385,000
Existing Module 9 Vent Scrubber Building	LS	1	$ 384,534	385,000
Secondary Clarifiers 5A-5D Demo	LS	1	$ 6,806,007	6,806,000
Secondary Clarifiers 6A-6D Demo	LS	1	$ 7,153,197	7,153,000
Secondary Clarifiers 7A-7D Demo	LS	1	$ 7,730,560	7,731,000
Secondary Clarifiers 8A-8D Demo	LS	1	$ 6,965,429	6,965,000
Secondary Clarifiers 9A-9D Demo	LS	1	$ 6,496,752	6,497,000
Service Water Facility Demo	LS	1	$ 3,650,491	3,650,000
Service Water Generator Demo	LS	1	$ 71,181	71,000
Service Water Substation Demo	LS	1	$ 73,181	73,000

Existing Utility Compressor Facility Demo	LS	1	$ 373,199	373,000
Site Work	LS	1	$ 14,743,941	14,744,000
Yard Piping	LS	1	$ 10,086,775	10,087,000
E&IC	LS	1	$ 188,341,175	188,341,000
Temporary Facilities	LS	1	$ 1,399,535	1,400,000
Sales Tax		9.5%	$ 58,538,867	58,539,000
			Total Direct Cost	**1,290,937,000**
Construction Complexity Index		10.0%	$ 129,093,607	129,094,000
General Conditions		10.0%	$ 129,093,607	129,094,000
General Liability & Builder's Risk		2.0%	$ 25,818,721	25,819,000
General Contractor Bond		1.0%	$ 12,909,361	12,909,000
Contractor Profit		10.0%	$ 129,093,607	129,094,000
Subtotal (1)				**1,716,947,000**

Mobilization - 0% to 7% of Subtotal (1)	5%	85,847,000
Permits - 2% to 5% of Subtotal (1)	3%	51,508,000
Subtotal (2)		**1,854,302,000**

Estimating Contingency - 0% to 50% of Subtotal (2)	45%	834,436,000
Total Estimated Project Construction Cost (Unescalated)		**2,688,738,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**01 System 4 OCF**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Edge Forms, Flat Mat On Grade, Add	452.00	LF	$4.37	$1,974	
03300	12" Structural Flat Mat On Grade	321.22	CY	$619.29	$198,930	
03300	12" Edge Forms, Flat Mat On Grade, Add	544.00	LF	$4.37	$2,376	
03300	12" Structural Flat Mat On Grade	85.63	CY	$619.29	$53,030	
03300	48" Edge Forms, Slab On Grade, Add	408.00	LF	$12.54	$5,116	
03300	48" Structural Flat Mat On Grade	256.89	CY	$581.79	$149,455	
03300	12" Edge Forms, Flat Mat On Grade, Add	108.00	LF	$4.37	$472	
03300	12" Structural Flat Mat On Grade	8.89	CY	$619.29	$5,506	
	Total					**$416,858**
	Division 11 - Equipment					
11000	System 4 Odor Control Facility	1	EA	$11,783,858.35	$11,783,858	
	Total					**$11,783,858**
	Division 15 - Mechanical					
15814	Frp Flange, 42"	14.00	EA	$7,357.76	$103,009	
15814	Frp Volume Damper, 48"	14.00	EA	$6,013.51	$84,189	
15814	Frp Tee, 42"	4.00	EA	$2,459.03	$9,836	
15814	Frp Duct, 108"	215.00	LF	$770.29	$165,612	
15814	Frp Duct, 84"	30.00	LF	$548.56	$16,457	
15814	Frp Duct, 60"	18.00	LF	$365.34	$6,576	
15814	Frp Duct, 48"	91.00	LF	$288.48	$26,251	
15814	Frp Duct, 42"	70.00	LF	$258.17	$18,072	
15814	Frp Tee, 108"	1.00	EA	$6,573.20	$6,573	
15814	90 Degree Frp Elbow, 42"	4.00	EA	$14,051.51	$56,206	
	Total					**$492,781**
	Grand Total					**$12,693,498**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**02 System 5 OCF**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	48" Edge Forms, Slab On Grade, Add	272	LF	$12.54	$3,410	
03300	48" Structural Flat Mat On Grade	171.26	CY	$581.79	$99,637	
03300	12" Edge Forms, Flat Mat On Grade, Add	446	LF	$4.37	$1,948	
03300	12" Structural Flat Mat On Grade	342.22	CY	$619.29	$211,935	
03300	12" Edge Forms, Flat Mat On Grade, Add	340	LF	$4.37	$1,485	
03300	12" Structural Flat Mat On Grade	53.52	CY	$619.29	$33,145	
03300	12" Edge Forms, Flat Mat On Grade, Add	132	LF	$4.37	$576	
03300	12" Structural Flat Mat On Grade	13.33	CY	$619.29	$8,255	
	Total					**$360,391**
	Division 11 - Equipment					
11000	System 5 Odor Control Facility	1	EA	$6,438,633.65	$6,438,634	
	Total					**$6,438,634**
	Division 15 - Mechanical					
15814	Frp Flange , 30"	4	EA	$5,278.38	$21,114	
15814	Frp Flange , 24"	5	EA	$4,326.17	$21,631	
15814	Frp Tee, 60"	5	EA	$3,454.03	$17,270	
15814	90 Degree Frp Duct Elbow, 60"	4	EA	$12,358.68	$49,435	
15814	45 Degree Frp Duct Elbow, 24"	1	EA	$2,167.87	$2,168	
15814	Frp Duct, 60"	160	LF	$365.34	$58,454	
15814	Frp Duct, 30"	96	LF	$210.37	$20,195	
15814	Frp Duct, 24"	72	LF	$116.45	$8,385	
	Total					**$198,651**
	Grand Total					**$6,997,676**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**01 System 6 OCF**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Edge Forms, Flat Mat On Grade, Add	452.00	LF	$4.37	$1,974	
03300	12" Structural Flat Mat On Grade	321.22	CY	$619.29	$198,930	
03300	12" Edge Forms, Flat Mat On Grade, Add	544.00	LF	$4.37	$2,376	
03300	12" Structural Flat Mat On Grade	85.63	CY	$619.29	$53,030	
03300	48" Edge Forms, Slab On Grade, Add	408.00	LF	$12.54	$5,116	
03300	48" Structural Flat Mat On Grade	256.89	CY	$581.79	$149,455	
03300	12" Edge Forms, Flat Mat On Grade, Add	108.00	LF	$4.37	$472	
03300	12" Structural Flat Mat On Grade	8.89	CY	$619.29	$5,506	
	Total					**$416,858**
	Division 11 - Equipment					
11000	System 4 Odor Control Facility	1	EA	$11,783,858.35	$11,783,858	
	Total					**$11,783,858**
	Division 15 - Mechanical					
15814	Frp Flange, 42"	14.00	EA	$7,357.76	$103,009	
15814	Frp Volume Damper, 48"	14.00	EA	$6,013.51	$84,189	
15814	Frp Tee, 42"	4.00	EA	$2,459.03	$9,836	
15814	Frp Duct, 108"	215.00	LF	$770.29	$165,612	
15814	Frp Duct, 84"	30.00	LF	$548.56	$16,457	
15814	Frp Duct, 60"	18.00	LF	$365.34	$6,576	
15814	Frp Duct, 48"	91.00	LF	$288.48	$26,251	
15814	Frp Duct, 42"	70.00	LF	$258.17	$18,072	
15814	Frp Tee, 108"	1.00	EA	$6,573.20	$6,573	
15814	90 Degree Frp Elbow, 42"	4.00	EA	$14,051.51	$56,206	
	Total					**$492,781**
	Grand Total					**$12,693,498**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: Aeration Basin Module

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Module Channel Repairs	1.00	LS	$1,097,555.00	$1,097,555	
02000	Demo of Module Inlet Gate	1.00	LS	$30,000.00	$30,000	
02000	Demo of Surface Aerators	1.00	LS	$85.00	$85	
02000	Seismic Retrofit of Existing Structure	1.00	LS	$587,963.40	$587,963	
02300	Native Pipe Bed & Zone/Confined Structure Backfill, Class C Material	239.58	CY	$46.48	$11,136	
	Total					**$1,726,739**
	Division 03 - Concrete					
03000	Concrete Modifications	1.00	LS	$979,939.00	$979,939	
03300	12" Straight Wall >8' High (Zone 1A and 1B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 1B and 2A)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 2A and 2B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High (Zone 5A and 5B)	180.00	CY	$2,000.00	$360,000	
03300	12" Straight Wall >8' High	47.92	CY	$2,000.00	$95,840	
03300	12" Straight Wall >8' High	47.92	CY	$2,000.00	$95,840	
03300	12" Straight Wall >8' High	66.67	CY	$2,000.00	$133,340	
03300	12" Structural Flat Mat On Grade	46.00	CY	$850.00	$39,100	
03300	16" X 16" Square Column/Pier	79.01	CY	$1,390.43	$109,858	
03300	18" Structural Flat Mat On Grade	54.00	CY	$850.00	$45,900	
	Total					**$2,939,817**
	Division 11 - Equipment					
11000	Platform-Mounted Propeller Mixers	30	EA	$51,378.65	$1,541,359	
11000	MLR Vertical Turbine Pump	6	EA	$325,475.80	$1,952,855	
11000	Module Inlet Gate	6.00	EA	$37,700.00	$226,200	
11000	Module Outlet Gate	6.00	EA	$42,900.00	$257,400	
11000	MLR Box Gate	9.00	EA	$37,700.00	$339,300	
11000	Fine Bubble Diffusers	1.00	EA	$1,777,925.93	$1,777,926	
	Total					**$6,095,040**
	Division 15 - Mechanical					
15000	Pipe Supports	1.00	LS	$180,000.00	$180,000	
15112	Add For Motor Operator Over 20"	9.00	EA	$10,008.32	$90,075	
15112	36" 150# Fxf Awwa Butterfly Valve, No Op	9.00	EA	$35,000.00	$315,000	
15112	24" 150# Fxf Awwa Butterfly Valve, No Op	6.00	EA	$18,000.00	$108,000	
15251	36" X 36" Cldi Mj Tee Or Wye	3.00	EA	$18,345.77	$55,037	
15251	36" 90° 125# Cldi Fxf Ell	9.00	EA	$19,466.01	$175,194	
15251	36" Flg Cldi Pipe In Bldg	855.00	LF	$916.87	$783,924	
15251	36" X 24" Cldi Push-On Joint Tee (C110)	6.00	EA	$16,020.16	$96,121	
15251	36" 90° 125# Cldi Fxf Ell	9.00	EA	$19,466.01	$175,194	
15251	36" 125# Cast Iron Blind Flange	3.00	EA	$5,885.85	$17,658	
15251	36" Flg Cldi Pipe In Bldg	675.00	LF	$916.87	$618,887	
15251	24" Flg Cldi Pipe In Bldg	108.00	LF	$406.45	$43,896	
15251	42" Flg Cldi Pipe In Bldg	90.00	LF	$1,064.67	$95,820	
15252	24"A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	810.00	LF	$489.04	$396,124	
	Total					**$3,150,931**
	Division 17 - Instrumentation and Controls					
17302	36" Flow Measurement Magnetic Flow Meter	3.00	EA	$45,906.47	$137,719	
	Total					**$137,719**
	Grand Total					**$14,050,247**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 03 Battery B ML Channel and RAS Bldg

Format: MASTER FORMAT 17
Date : May 31,2024
By :
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Remove 7"-24" Non-Reinf Conc Pavement	1,216.23	CY	$93.81	$114,094	
	Total					**$114,094**
	Division 03 - Concrete					
03300	12" Edge Forms, Flat Mat On Grade, Add	2,046.34	LF	$4.37	$8,937	
03300	12" Structural Flat Mat On Grade	1,216.23	CY	$619.29	$753,205	
03300	12" Straight Wall, To 8' High	415.80	CY	$1,013.55	$421,433	
03300	12" Straight Wall, To 8' High	13.93	CY	$1,013.55	$14,119	
03300	12" Elevated Slab To 14' High	1,216.23	CY	$985.51	$1,198,603	
	Total					**$2,396,297**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	39,600.00	SF	$22.50	$890,941	
	Total					**$890,941**
	Division 05 - Metals					
05310	Steel Deck, 3" X 18 Ga.	32,838.30	SF	$6.52	$214,173	
	Total					**$214,173**
	Division 08 - Doors and Windows					
08110	3/6 X 6/8 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	18.00	EA	$1,236.96	$22,265	
	Total					**$22,265**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	8.00	EA	$379,534.53	$3,036,276	
	Total					**$3,036,276**
	Division 15 - Mechanical					
15000	30" Check Valve (RAS)	15.00	EA	$34,807.06	$522,106	
15112	48" Dimj Awwa Butterfly Valve, No Op	2.00	EA	$30,125.48	$60,251	
15112	Add For Motor Operator Over 20"	2.00	EA	$10,008.32	$20,017	
15116	Add For Motor Operator 22" Through 48"	90.00	EA	$13,404.00	$1,206,360	
15116	36" Fxf Cast Iron Plug Valve W/Handwheel Op	60.00	EA	$48,271.52	$2,896,291	
15116	30" Fxf Cast Iron Plug Valve W/Handwheel Op	30.00	EA	$40,595.39	$1,217,862	
15252	36" 3/8" (Std) Wall A-234 Buttweld Straight Tee	15.00	EA	$31,001.51	$465,023	
15252	30" 1/2" (Xh) Wall A-234 Buttweld Straight Tee	30.00	EA	$25,393.09	$761,793	
15252	48" X 30" 3/8" (Std) Wall A-234 Buttwld Con Rdcr	30.00	EA	$22,396.01	$671,880	
15252	48" X 36" 1/2" (Xh) Wall A-234 Buttwld Con Rdcr	30.00	EA	$37,185.61	$1,115,568	
15252	36" 1/2" Wall 90° Lr Buttweld Ell	60.00	EA	$18,909.44	$1,134,567	
15252	30" 3/8" Wall 90° Lr Buttweld Ell	30.00	EA	$9,870.91	$296,127	
15252	48" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	2,000.00	LF	$1,280.39	$2,560,772	
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	1,800.00	LF	$807.93	$1,454,276	
15252	30" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	1,200.00	LF	$641.96	$770,347	
	Total					**$15,153,240**
	Division 17 - Instrumentation and Controls					
17302	36" Flow Measurement Magnetic Flow Meter	30.00	EA	$45,906.47	$1,377,194	
17302	30" Flow Measurement Magnetic Flow Meter	15.00	EA	$37,964.60	$569,469	
	Total					**$1,946,663**
	Grand Total					**$23,773,949**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**04 Battery B Blower Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	3,799.56	CY	$130.00	$493,943	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	182.67	CY	$58.23	$10,637	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	182.67	CY	$6.16	$1,126	
	Total					**$505,706**
	Division 03 - Concrete					
03300	24" Edge Forms, Slab On Grade, Add	540	LF	$15.03	$8,117	
03300	24" Structural Flat Mat On Grade	116.48	CY	$596.50	$69,480	
03300	16" Straight Wall >8' High	1398.96	CY	$2,000.00	$2,797,920	
03300	16" Straight Wall >8' High	455.16	CY	$2,000.00	$910,320	
03300	12" Elevated Slab, 21'-26' High	283.76	CY	$2,000.00	$567,520	
03300	12" Elevated Slab To 20'	120.28	CY	$2,000.00	$240,560	
03300	12" Elevated Slab To 20'	24.89	CY	$2,000.00	$49,780	
03300	36" Edge Forms, Slab On Grade, Add	244	LF	$10.56	$2,577	
03300	36" Structural Flat Mat On Grade	385	CY	$586.40	$225,765	
03300	24" Edge Forms, Slab On Grade, Add	864.00	LF	$15.03	$12,987	
03300	24" Structural Flat Mat On Grade	2,024.81	CY	$596.50	$1,207,796	
	Total					**$6,092,822**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	1920	SF	$22.50	$43,197	
04220	Standard Concrete Block, 12"	2240	SF	$22.50	$50,397	
04220	Standard Concrete Block, 12"	8660	SF	$22.50	$194,837	
04220	Standard Concrete Block, 12"	4330	SF	$22.50	$97,419	
04220	Standard Concrete Block, 12"	2145	SF	$22.50	$48,259	
	Total					**$434,109**
	Division 05 - Metals					
05000	Structural Steel Shapes and Plates Adder	1.00	LS	$1,596,667.00	$1,596,667	
05310	Steel Deck, 2" X 18 Ga.	672.00	SF	$5.25	$3,529	
05310	Steel Deck, 1-1/2" X 18 Ga.	27,335.00	SF	$4.49	$122,679	
05500	Aluminum Stairs, Including Railing And Supports	50.00	RSR	$725.75	$36,288	
05500	Aluminum Osha Handrail	150.00	LF	$99.75	$14,963	
05500	Aluminum Grating, 1-1/2"	2,250.00	SF	$68.65	$154,452	
	Total					**$1,928,577**
	Division 08 - Doors and Windows					
08110	Add For Panic Device, "B" Label Single Metal Door	18.00	EA	$430.53	$7,750	
08110	Add For Panic Device, 1.75" "B" Label Double Metal Doors	3.00	PR	$1,279.77	$3,839	
08110	3/0 X 7/0 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	18.00	EA	$1,188.93	$21,401	
08212	7/0 X 7/0 X 1.75" Double Wood Door Incl.Hardware	3.00	PR	$1,443.66	$4,331	
08332	Electric Door Operator For Chain Lift Roll-Up Overhead Door, No Wiring	2.00	EA	$2,200.49	$4,401	
08332	Bottom Weather Strip, For Roll-Up & Sectional Overhead Doors	24.00	LF	$8.94	$214	
08332	Top Weather Seal, For Roll-Up & Sectional Overhead Doors	24.00	LF	$10.05	$241	
08332	Draft Stop Molding, For Roll-Up & Sectional Overhead Doors	96.00	LF	$8.94	$858	
08332	12'-0" X 12'-0" Roll-Up Overhead Door, Chain Lift, 22 Gauge Galvanized Steel/Aluminum	2.00	EA	$4,099.39	$8,199	
	Total					**$51,234**
	Division 09 - Finishes					
09000	Acoustical Wall Panels	1.00	LS	$455,000.00	$455,000	
	Total					**$455,000**
	Division 11 - Equipment					
11000	Battery B Aeration Air Blowers	10.00	EA	$1,226,663.11	$12,266,631	
	Total					**$12,266,631**
	Division 14 - Conveying Systems					

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**04 Battery B Blower Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
14624	10 Ton Lug Mtd 31' Lift Vs 20 Hp Elec Hoist W/Cable	1.00	EA	$68,991.47	$68,991	
	Total					**$68,991**
	Division 15 - Mechanical					
15000	90" A-53 Wld Steel 3/8" (Std) Wall Pipe in a Bldg	1,200.00	LF	$7,819.00	$9,382,800	
15000	Acoustical Louvers	1.00	LS	$210,267.00	$210,267	
15000	Air Piping Insulation	1.00	LS	$701,667.00	$701,667	
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	180.00	LF	$807.93	$145,428	
15252	12" A-53 Welded Steel 3/8" (Std) Wall Pipe In A Bldg	160.00	LF	$248.76	$39,802	
15830	7.5 To 450 Hp, 20040-130260 Cfm Centrif.Industrial Fan, W/O Driver	4.00	EA	$62,214.65	$248,859	
15830	450Hp Fan Motor, Installed @ Fan Manuf., Add	4.00	EA	$137,636.74	$550,547	
	Total					**$11,279,369**
	Division 16 - Electrical					
16000	5 kV Switchgear - Battery B Blower Building	1.00	EA	$4,415,153.10	$4,415,153	
16000	25 MVA Transformer	2.00	EA	$3,717,011.80	$7,434,024	
16000	2 MVA Transformer	2.00	EA	$207,281.69	$414,563	
16000	MV VFD for 1500 HP	10.00	LS	$406,587.99	$4,065,880	
	Total					**$16,329,620**
	Grand Total					**$49,412,060**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	100 Ton Crawler Mounted Lattice Boom Crane w/ Operator and Support Crew	48.00	MO	$50,000.00	$2,400,000	
	Total					**$2,400,000**
	Division 02 - Site Construction					
02000	ABC Fill	5,004.00	CY	$60.00	$300,240	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	3,665.78	CY	$58.23	$213,463	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	3,665.78	CY	$6.16	$22,597	
	Total					**$536,301**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	4433.33	CY	$850.00	$3,768,331	
03300	24" Straight Wall >8' High	1014.74	CY	$1,800.00	$1,826,532	
03300	24" Straight Wall >8' High	572.22	CY	$1,800.00	$1,029,996	
03300	12" Straight Wall >8' High	11.47	CY	$2,000.00	$22,940	
03300	12" Straight Wall >8' High	65.56	CY	$2,000.00	$131,120	
03300	12" Straight Wall >8' High	57.22	CY	$2,000.00	$114,440	
03300	12" Straight Wall >8' High	20.03	CY	$2,000.00	$40,060	
03300	12" Straight Wall >8' High	6.56	CY	$2,000.00	$13,120	
03300	12" Elevated Slab To 20'	14.81	CY	$2,000.00	$29,620	
03300	12" Elevated Slab, 21'-26' High	7.58	CY	$2,000.00	$15,160	
03300	8" Straight Wall, To 8' High	28.00	CY	$2,000.00	$56,000	
03300	12" Elevated Slab To 20'	548.15	CY	$2,000.00	$1,096,300	
03300	12" Straight Wall, To 8' High	109.63	CY	$2,000.00	$219,260	
03300	12" Elevated Slab To 20'	45.74	CY	$2,000.00	$91,480	
03300	12" Straight Wall, To 8' High	219.56	CY	$2,000.00	$439,120	
03300	12" Straight Wall >8' High	705.74	CY	$2,000.00	$1,411,480	
03300	12" Elevated Slab To 20'	561.85	CY	$2,000.00	$1,123,700	
03300	12" Straight Wall >8' High	473.78	CY	$2,000.00	$947,560	
03300	12" Elevated Slab To 20'	68.52	CY	$2,000.00	$137,040	
03300	12" Elevated Slab To 20'	14.00	CY	$2,000.00	$28,000	
03300	12" Elevated Slab To 20'	3.80	CY	$2,000.00	$7,600	
03300	12" Straight Wall, To 8' High	24.30	CY	$2,000.00	$48,600	
03300	8" Straight Wall >8' High	47.64	CY	$2,000.00	$95,280	
03300	8" Straight Wall >8' High	53.33	CY	$2,000.00	$106,660	
03300	12" Elevated Slab, 21'-26' High	33.33	CY	$2,000.00	$66,660	
03300	12" Elevated Slab, 21'-26' High	5.78	CY	$2,000.00	$11,560	
03300	12" Straight Wall >8' High	21.33	CY	$2,000.00	$42,660	
03300	12" Straight Wall >8' High	11.56	CY	$2,000.00	$23,120	
03300	18" Straight Wall >8' High	138.67	CY	$2,000.00	$277,340	
03300	18" Straight Wall >8' High	58.67	CY	$2,000.00	$117,340	
03300	18" Straight Wall >8' High	115.56	CY	$2,000.00	$231,120	
03300	12" Structural Flat Mat On Grade	57.78	CY	$850.00	$49,113	
03300	12" Straight Wall >8' High	60.74	CY	$2,000.00	$121,480	
03300	12" Straight Wall >8' High	225.19	CY	$2,000.00	$450,380	
03300	12" Elevated Slab To 20'	230.81	CY	$2,000.00	$461,620	
	Total					**$14,651,792**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	39,900.00	SF	$50.00	$1,995,000	
05310	Steel Deck, 3" X 20 Ga.	6,232.00	SF	$50.00	$311,600	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	30.00	RSR	$725.75	$21,773	
	Total					**$2,337,082**
	Division 06 - Wood and Plastics					
06000	Weirs and Baffles	1.00	LS	$626,600.00	$626,600	
	Total					**$626,600**
	Division 11 - Equipment					
11000	Membrane Tank Inlet Gate, 60"x 60"	26.00	EA	$35,750.00	$929,500	
11000	RAS Pump	6.00	EA	$635,518.00	$3,813,108	
11000	WAS Pump	3.00	EA	$48,058.40	$144,175	
11000	RAS Inlet Gate	2.00	EA	$35,750.00	$71,500	

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
11000	RAS/WAS Top Gate	2.00	EA	$13,175.50	$26,351	
11000	WAS Bottom Gate	1.00	EA	$13,175.50	$13,176	
11000	Membrane System (26 B50N Membrane Modules, Racks, Headers and Rack Supports; 26 Permeate Pumps;CIP Pump System; Drain Pump System;Chemical Transfer System; Controls; Commisioning and Training)	1.00	EA	$35,048,000.00	$35,048,000	
11000	Splitter Box Gate	26.00	EA	$14,105.00	$366,730	
11294	Add For Motor Operator To 96"	26.00	EA	$17,060.91	$443,584	
	Total					**$40,856,123**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	2.00	EA	$379,534.53	$759,069	
	Total					**$759,069**
	Division 15 - Mechanical					
15000	54" ST STL Permeate Header	350.00	LF	$1,995.19	$698,315	
15000	36" Air Scour Header	350.00	LF	$1,123.85	$393,348	
15000	Pipe Supports	1.00	LS	$140,000.00	$140,000	
	Total					**$1,231,663**
	Grand Total					**$63,398,630**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train B3

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	52,959.00	CY	$130.00	$6,884,670	
02000	Tipping Fee	5,004.00	CY	$107.00	$535,428	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	52,959.00	CY	$11.03	$583,933	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	5,187.56	CY	$58.23	$302,079	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	54,071.00	CY	$15.00	$811,065	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	52,959.00	CY	$.93	$49,259	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	1,112.00	CY	$11.24	$12,500	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	5,187.56	CY	$6.16	$31,978	
	Total					**$9,210,911**
	Division 03 - Concrete					
03300	36" Edge Forms, Slab On Grade, Add	832	LF	$10.56	$8,787	
03300	36" Structural Flat Mat On Grade	4433.33	CY	$586.40	$2,599,719	
03300	24" Straight Wall >8' High	1014.74	CY	$1,800.00	$1,826,532	
03300	24" Straight Wall >8' High	572.22	CY	$1,800.00	$1,029,996	
03300	12" Straight Wall >8' High	11.47	CY	$2,000.00	$22,940	
03300	12" Straight Wall >8' High	65.56	CY	$2,000.00	$131,120	
03300	12" Straight Wall >8' High	57.22	CY	$2,000.00	$114,440	
03300	12" Straight Wall >8' High	20.03	CY	$2,000.00	$40,060	
03300	12" Straight Wall >8' High	6.56	CY	$2,000.00	$13,120	
03300	12" Elevated Slab To 20'	14.81	CY	$2,000.00	$29,620	
03300	12" Elevated Slab, 21'-26' High	7.58	CY	$2,000.00	$15,160	
03300	8" Straight Wall, To 8' High	28.00	CY	$2,000.00	$56,000	
03300	12" Elevated Slab To 20'	548.15	CY	$2,000.00	$1,096,300	
03300	12" Straight Wall, To 8' High	109.63	CY	$2,000.00	$219,260	
03300	12" Elevated Slab To 20'	45.74	CY	$2,000.00	$91,480	
03300	12" Straight Wall, To 8' High	219.56	CY	$2,000.00	$439,120	
03300	12" Straight Wall >8' High	705.74	CY	$2,000.00	$1,411,480	
03300	12" Elevated Slab To 20'	561.85	CY	$2,000.00	$1,123,700	
03300	12" Straight Wall >8' High	473.78	CY	$2,000.00	$947,560	
03300	12" Elevated Slab To 20'	68.52	CY	$2,000.00	$137,040	
03300	12" Elevated Slab To 20'	14.00	CY	$2,000.00	$28,000	
03300	12" Elevated Slab To 20'	3.80	CY	$2,000.00	$7,600	
03300	12" Straight Wall, To 8' High	24.30	CY	$2,000.00	$48,600	
03300	8" Straight Wall >8' High	47.64	CY	$2,000.00	$95,280	
03300	8" Straight Wall >8' High	53.33	CY	$2,000.00	$106,660	
03300	12" Elevated Slab, 21'-26' High	33.33	CY	$2,000.00	$66,660	
03300	12" Elevated Slab, 21'-26' High	5.78	CY	$2,000.00	$11,560	
03300	12" Straight Wall >8' High	21.33	CY	$2,000.00	$42,660	
03300	12" Straight Wall >8' High	11.56	CY	$2,000.00	$23,120	
03300	18" Straight Wall >8' High	138.67	CY	$2,000.00	$277,340	
03300	18" Straight Wall >8' High	58.67	CY	$2,000.00	$117,340	
03300	18" Straight Wall >8' High	115.56	CY	$2,000.00	$231,120	
03300	12" Edge Forms, Flat Mat On Grade, Add	832.00	LF	$4.37	$3,634	
03300	12" Structural Flat Mat On Grade	57.78	CY	$619.29	$35,783	
03300	12" Straight Wall >8' High	60.74	CY	$2,000.00	$121,480	
03300	12" Straight Wall >8' High	225.19	CY	$2,000.00	$450,380	
03300	12" Elevated Slab To 20'	230.81	CY	$2,000.00	$461,620	
	Total					**$13,482,270**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	39,900.00	SF	$5.44	$216,999	
05310	Steel Deck, 3" X 20 Ga.	6,232.00	SF	$5.44	$33,893	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	6.00	RSR	$725.75	$4,355	
05500	Aluminum Stairs, Including Railing And Supports	30.00	RSR	$725.75	$21,773	
	Total					**$281,373**
	Division 06 - Wood and Plastics					
06000	Weirs and Baffles	1.00	LS	$626,600.00	$626,600	

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 29 MBR Train B3

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Total					**$626,600**
	Division 11 - Equipment					
11000	Membrane Tank Inlet Gate, 60"x 60"	13.00	EA	$43,004.50	$559,059	
11000	RAS Pump	3.00	EA	$764,479.26	$2,293,438	
11000	WAS Pump	2.00	EA	$53,681.23	$107,362	
11000	RAS Inlet Gate	1.00	EA	$43,004.50	$43,005	
11000	RAS/WAS Top Gate	1.00	EA	$15,849.11	$15,849	
11000	WAS Bottom Gate	1.00	EA	$15,849.11	$15,849	
11000	Membrane System (13 B50N Membrane Modules, Racks, Headers and Rack Supports; 13 Permeate Pumps;CIP Pump System; Drain Pump System;Chemical Transfer System; Controls; Commisioning and Training)	1.00	EA	$21,080,023.70	$21,080,024	
11000	Splitter Box Gate	13.00	EA	$16,967.23	$220,574	
11294	Add For Motor Operator To 96"	13.00	EA	$17,060.91	$221,792	
	Total					**$24,556,951**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	2.00	EA	$379,534.53	$759,069	
	Total					**$759,069**
	Division 15 - Mechanical					
15000	54" ST STL Permeate Header	175.00	LF	$2,148.66	$376,016	
15000	36" Air Scour Header	175.00	LF	$1,210.30	$211,803	
	Total					**$587,818**
	Grand Total					**$49,504,993**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 06 Oxygen Generation

Format: MASTER FORMAT 17
Date : May 31,2024
By :
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	1,494.33	CY	$130.00	$194,263	
02000	Tipping Fee	1,992.44	CY	$107.00	$213,191	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	1,992.44	CY	$11.03	$21,969	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	69.78	CY	$58.23	$4,063	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	2,324.52	CY	$15.00	$34,868	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	1,992.44	CY	$.93	$1,853	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	332.07	CY	$11.24	$3,733	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	69.78	CY	$6.16	$430	
	Total					**$474,370**
	Division 03 - Concrete					
03300	12" Edge Forms, Flat Mat On Grade, Add	340	LF	$4.37	$1,485	
03300	12" Structural Flat Mat On Grade	267.59	CY	$619.29	$165,717	
03300	12" Edge Forms, Flat Mat On Grade, Add	264	LF	$4.37	$1,153	
03300	12" Structural Flat Mat On Grade	160.74	CY	$619.29	$99,545	
	Total					**$267,900**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	2480	SF	$22.50	$55,796	
04220	Standard Concrete Block, 12"	2800	SF	$22.50	$62,996	
	Total					**$118,792**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	4340	SF	$5.44	$23,603	
	Total					**$23,603**
	Division 11 - Equipment					
11000	VSPA System	2.00	EA	$9,829,599.86	$19,659,200	
11000	GOX Compressor	2.00	EA	$1,474,439.98	$2,948,880	
11000	Back Up LOX System	1.00	LS	$1,228,699.98	$1,228,700	
	Total					**$23,836,780**
	Grand Total					**$24,721,446**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**07 Ozone Production**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	1,547.00	CY	$130.00	$201,110	
02000	Tipping Fee	2,062.67	CY	$107.00	$220,706	
02000	Architectural Finishes	1.00	LS	$489,395.92	$489,396	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	52.89	CY	$58.23	$3,080	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	52.89	CY	$6.16	$326	
	Total					**$914,617**
	Division 03 - Concrete					
03000	Concrete Columns and Beams	1.00	LS	$458,808.67	$458,809	
03300	12" Edge Forms, Flat Mat On Grade, Add	722.00	LF	$4.37	$3,153	
03300	12" Structural Flat Mat On Grade	762.59	CY	$619.29	$472,268	
03300	12" Elevated Slab, 21'-26' High	92.04	CY	$2,000.00	$184,080	
03300	12" Straight Wall >8' High	52.59	CY	$2,000.00	$105,180	
	Total					**$1,223,490**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	5,680.00	SF	$22.50	$127,791	
04220	Standard Concrete Block, 12"	23,200.00	SF	$22.50	$521,965	
	Total					**$649,757**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	20,590.00	SF	$5.44	$111,980	
05500	Aluminum Stairs, Including Railing And Supports	40.00	RSR	$725.75	$29,030	
	Total					**$141,010**
	Division 08 - Doors and Windows					
08110	3/6 X 7/0 X 1.75" No Label Single Hollow Metal Door W/Frame & Hdwre	6.00	EA	$1,086.25	$6,518	
08332	12'-0" X 12'-0" Roll-Up Overhead Door, Chain Lift, 22 Gauge Galvanized Steel/Aluminum	3.00	EA	$4,099.39	$12,298	
	Total					**$18,816**
	Division 11 - Equipment					
11000	Ozone Generation Equipment (Includes 5 Ozone Generators and PSUs, 5 Closed Loop Cooling Pumps, 4 Destruct Units (at Ozone Contactors), 1 PDU)	1.00	LS	$14,753,335.79	$14,753,336	
	Total					**$14,753,336**
	Division 14 - Conveying Systems					
14631	15 Ton 75' Span Floor Operated Overhead Traveling Bridge Crane	1.00	EA	$318,934.41	$318,934	
	Total					**$318,934**
	Division 15 - Mechanical					
15000	Bathroom Fixtures	1.00	LS	$100,000.00	$100,000	
	Total					**$100,000**
	Grand Total					**$18,119,960**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**08 Ozone Contact Area**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	2,727.11	CY	$130.00	$354,524	
02000	Architectural Finishes	1.00	LS	$4,343,420.11	$4,343,420	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	3,101.11	CY	$58.23	$180,582	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	3,101.11	CY	$6.16	$19,116	
	Total					**$4,897,643**
	Division 03 - Concrete					
03300	30" Edge Forms, Slab On Grade, Add	632.00	LF	$9.32	$5,892	
03300	30" Structural Flat Mat On Grade	1,908.15	CY	$590.68	$1,127,110	
03300	12" Elevated Slab To 20'	417.78	CY	$2,000.00	$835,560	
03300	12" Elevated Slab, 33'-38' High	779.85	CY	$2,000.00	$1,559,700	
03300	12" Elevated Slab, 21'-26' High	134.33	CY	$2,000.00	$268,660	
03300	24" Straight Wall >8' High	2,840.89	CY	$1,800.00	$5,113,602	
03300	24" Straight Wall >8' High	604.44	CY	$1,800.00	$1,087,992	
03300	24" Straight Wall >8' High	30.00	CY	$1,800.00	$54,000	
03300	24" Straight Wall >8' High	362.67	CY	$1,800.00	$652,806	
03300	12" Edge Forms, Flat Mat On Grade, Add	160.00	LF	$4.37	$699	
03300	12" Structural Flat Mat On Grade	49.78	CY	$619.29	$30,828	
03300	36" Edge Forms, Slab On Grade, Add	172.00	LF	$10.56	$1,816	
03300	36" Structural Flat Mat On Grade	204.44	CY	$586.40	$119,884	
	Total					**$10,858,550**
	Division 04 - Masonry					
04220	Standard Concrete Block, 8"	1,440.00	SF	$19.72	$28,396	
04220	Standard Concrete Block, 8"	792.00	SF	$19.72	$15,618	
04220	Standard Concrete Block, 8"	2,240.00	SF	$19.72	$44,172	
04220	Standard Concrete Block, 8"	960.00	SF	$19.72	$18,931	
	Total					**$107,116**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	495.00	SF	$5.44	$2,692	
05310	Steel Deck, 3" X 20 Ga.	5,640.00	SF	$5.44	$30,673	
05500	304 Stainless Steel Grating, 2-1/2"	3,712.00	SF	$216.16	$802,392	
05500	Fixed Aluminum Ladder - With Safety Cage	20.00	VLF	$226.35	$4,527	
	Total					**$840,285**
	Division 11 - Equipment					
11000	Sidestream Injection Pumps and Mixer	1.00	LS	$3,127,599.95	$3,127,600	
	Total					**$3,127,600**
	Division 14 - Conveying Systems					
14631	15 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	2.00	EA	$340,439.53	$680,879	
	Total					**$680,879**
	Division 15 - Mechanical					
15000	54" ST STL Pipe	376.00	LF	$1,299.68	$488,679	
15000	54" ST STL Butterfly Valve	8.00	EA	$50,041.60	$400,333	
	Total					**$889,012**
	Division 16 - Electrical					
16000	2 MVA Transformer	4.00	EA	$207,281.69	$829,127	
16000	Ozone Contact LV Switchgear	1.00	EA	$1,335,493.00	$1,335,493	
16000	Ozone Contact MCC 1	1.00	EA	$305,077.05	$305,077	
16000	Ozone Contact MCC 2	1.00	EA	$344,278.38	$344,278	
16000	MV VFD for 150 HP	2.00	EA	$68,214.52	$136,429	
	Total					**$2,950,404**
	Grand Total					**$24,351,489**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**January 1, 2035**
Location:	**Los Angeles, CA**	**By :**	
Element:	**09 Area 43**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	100 Ton Crawler Mounted Lattice Boom Crane w/ Operator and Support Crew	1.00	LS	$240,989.00	$240,989	
	Total					**$240,989**
	Division 02 - Site Construction					
02000	ABC Fill	7,952.00	CY	$130.00	$1,033,760	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	4,952.22	CY	$58.23	$288,374	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	4,952.22	CY	$6.16	$30,527	
	Total					**$1,352,662**
	Division 03 - Concrete					
03000	BAC Facility Concrete	1.00	LS	$50,167,781.92	$50,167,782	
03000	BAC Area Controlled Desnsity Fill	1.00	LS	$398,005.95	$398,006	
	Total					**$50,565,788**
	Division 04 - Masonry					
04000	BAC Area Masonry	1.00	LS	$401,455.49	$401,455	
	Total					**$401,455**
	Division 05 - Metals					
05000	BAC Area Metals	1.00	LS	$2,322,521.06	$2,322,521	
	Total					**$2,322,521**
	Division 06 - Wood and Plastics					
06000	BAC Area FRP Grating	1.00	LS	$2,374.77	$2,375	
	Total					**$2,375**
	Division 07 - Thermal and Moisture					
07000	BAC Area Thermal and Moisture	1.00	LS	$42,738.82	$42,739	
	Total					**$42,739**
	Division 08 - Doors and Windows					
08000	BAC Area Doors	1.00	LS	$38,526.80	$38,527	
	Total					**$38,527**
	Division 09 - Finishes					
09000	BAC Area Finishes	1.00	LS	$1,259,364.00	$1,259,364	
	Total					**$1,259,364**
	Division 10 - Specialties					
10000	BAC Area Specialties	1.00	LS	$259,468.00	$259,468	
	Total					**$259,468**
	Division 11 - Equipment					
11000	BAC Area Sump Pumps	1.00	LS	$70,120.79	$70,121	
11000	BAC Flash Mix Pump	2.00	EA	$94,386.50	$188,773	
11000	GAC Filter Media	253,440.00	CF	$60.00	$15,206,400	
11000	Monolithic Filter Underdrain	25,344.00	SF	$312.76	$7,926,589	
11000	BAC Air Scour Blowers	3.00	EA	$758,442.99	$2,275,329	
	Total					**$25,667,212**
	Division 13 - Special Construction					
13000	FRP Backwash Trough	3,350.00	LF	$363.74	$1,218,529	
13000	Lower Gullet Access Hatch	18.00	EA	$9,615.81	$173,085	
	Total					**$1,391,613**
	Division 14 - Conveying Systems					
14000	BAC Area Conveying Systems	1.00	LS	$597,209.60	$597,210	
	Total					**$597,210**
	Division 15 - Mechanical					
15000	BAC Area Heating, Ventilating and Air Conditioning	1.00	LS	$120,131.78	$120,132	
15000	BAC Area Stop Logs	1.00	LS	$579,387.89	$579,388	
15000	BAC Effluent Flap Gate	2.00	EA	$40,658.80	$81,318	
15000	BAC Area Motorized Weir Gates	1.00	LS	$142,305.80	$142,306	
15000	BAC Area Slide Gates	1.00	LS	$300,165.15	$300,165	
15000	BAC Area 12" and Larger Piping	1.00	LS	$17,341,676.00	$17,341,676	
	Total					**$18,564,984**
	Division 16 - Electrical					
16000	BAC Contact Area LV MCC	1.00	EA	$1,740,096.53	$1,740,097	
16000	Bay Contact Area LV Switchgear	1.00	EA	$615,592.99	$615,593	
	Total					**$2,355,690**
	Division 17 - Instrumentation and Controls					
17000	BAC Area Instrumentation	1.00	LS	$2,094,010.00	$2,094,010	

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DETAILED COST ESTIMATE

Project:	Hyperion 2035	**Format:**	MASTER FORMAT 17
Client:	LASAN	**Date :**	January 1, 2035
Location:	Los Angeles, CA	**By :**	
Element:	09 Area 43	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Total					**$2,094,010**
	Grand Total					**$107,156,606**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**10 North Chemical Treatment Facility**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Edge Forms, Flat Mat On Grade, Add	165	LF	$4.37	$721	
03300	12" Structural Flat Mat On Grade	59.85	CY	$619.29	$37,065	
03300	36" Edge Forms, Slab On Grade, Add	48	LF	$10.56	$507	
03300	36" Structural Flat Mat On Grade	16	CY	$586.40	$9,382	
03300	12" Straight Wall, To 8' High	7.11	CY	$1,013.55	$7,206	
03300	12" Straight Wall, To 8' High	8.89	CY	$1,013.55	$9,010	
	Total					**$63,892**
	Division 05 - Metals					
05310	Steel Deck, 2" X 20 Ga.	1280	SF	$4.32	$5,535	
05500	Aluminum Stairs, Including Railing And Supports	6	RSR	$725.75	$4,355	
	Total					**$9,890**
	Division 13 - Special Construction					
13206	12,000 Gal. Frp Or Poly Vertical Aboveground Storage Tank, No Foundation	1	EA	$16,866.70	$16,867	
	Total					**$16,867**
	Grand Total					**$90,648**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**Post Treatment Facility**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	2,449.56	CY	$130.00	$318,443	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	64.67	CY	$58.23	$3,766	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	64.67	CY	$6.16	$399	
	Total					**$322,607**
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	751.85	CY	$619.29	$465,617	
03300	12" Edge Forms, Flat Mat On Grade, Add	570.00	LF	$4.37	$2,489	
03300	12" Structural Flat Mat On Grade	40.74	CY	$619.29	$25,230	
03300	12" Edge Forms, Flat Mat On Grade, Add	188.00	LF	$4.37	$821	
03300	12" Structural Flat Mat On Grade	85.33	CY	$619.29	$52,844	
03300	12" Edge Forms, Flat Mat On Grade, Add	384.00	LF	$4.37	$1,677	
03300	12" Structural Flat Mat On Grade	64.00	CY	$619.29	$39,635	
03300	12" Edge Forms, Flat Mat On Grade, Add	288.00	LF	$4.37	$1,258	
03300	12" Structural Flat Mat On Grade	8.89	CY	$619.29	$5,506	
03300	12" Edge Forms, Flat Mat On Grade, Add	62.00	LF	$4.37	$271	
03300	12" Structural Flat Mat On Grade	147.00	CY	$619.29	$91,036	
03300	12" Edge Forms, Flat Mat On Grade, Add	252.00	LF	$4.37	$1,101	
03300	12" Straight Wall >8' High	70.00	CY	$2,000.00	$140,000	
03300	12" Straight Wall >8' High	70.00	CY	$2,000.00	$140,000	
03300	12" Straight Wall >8' High	11.11	CY	$2,000.00	$22,220	
03300	12" Straight Wall >8' High	11.85	CY	$2,000.00	$23,700	
03300	12" Elevated Slab To 20'	8.89	CY	$2,000.00	$17,780	
03300	12" Elevated Slab To 20'	147.00	CY	$2,000.00	$294,000	
	Total					**$1,325,184**
	Division 11 - Equipment					
11000	Catonic Polymer Pump (Lime Water Saturation)	4.00	EA	$40,267.85	$161,071	
11000	Lime Slurry Pump (Lime Water Lime Addition)	2.00	EA	$195,475.00	$390,950	
11000	Lime Slurry Pump (Lime Water Addition DPR)	2.00	EA	$226,751.00	$453,502	
11000	Lime Silo	4.00	EA	$1,563,799.98	$6,255,200	
11000	Lime Water Saturator	2.00	EA	$3,000,000.00	$6,000,000	
11000	CO2 System	1.00	LS	$4,222,259.94	$4,222,260	
	Total					**$17,482,983**
	Grand Total					**$19,130,775**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**12 DPR Product Water PS**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	996.78	CY	$130.00	$129,581	
02000	Tipping Fee	8,838.37	CY	$107.00	$945,706	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	8,838.37	CY	$11.03	$97,453	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	3,735.11	CY	$58.23	$217,500	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	9,059.89	CY	$15.00	$135,898	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	8,838.37	CY	$.93	$8,221	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	221.51	CY	$11.24	$2,490	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	3,735.11	CY	$6.16	$23,025	
	Total					**$1,559,874**
	Division 03 - Concrete					
03300	12" Elevated Slab, 33'-38' High	79.44	CY	$2,000.00	$158,880	
03300	12" Elevated Slab To 20'	25.93	CY	$2,000.00	$51,860	
03300	36" Edge Forms, Slab On Grade, Add	196.00	LF	$10.56	$2,070	
03300	36" Structural Flat Mat On Grade	238.33	CY	$586.40	$139,758	
03300	12" Edge Forms, Flat Mat On Grade, Add	418.00	LF	$4.37	$1,826	
03300	12" Structural Flat Mat On Grade	66.67	CY	$619.29	$41,288	
03300	30" Straight Wall >8' High	321.11	CY	$1,800.00	$577,998	
03300	12" Straight Wall >8' High	133.33	CY	$2,000.00	$266,660	
03300	30" Straight Wall >8' High	207.78	CY	$1,800.00	$374,004	
03300	30" Straight Wall >8' High	409.26	CY	$1,800.00	$736,668	
03300	36" Edge Forms, Slab On Grade, Add	128.00	LF	$10.56	$1,352	
03300	36" Structural Flat Mat On Grade	77.78	CY	$586.40	$45,610	
03300	18" Straight Wall, To 8' High	27.78	CY	$2,000.00	$55,560	
03300	36" Edge Forms, Slab On Grade, Add	402.00	LF	$10.56	$4,245	
03300	36" Structural Flat Mat On Grade	220.00	CY	$586.40	$129,009	
	Total					**$2,586,788**
	Division 11 - Equipment					
11000	Product Water Surge Tank	3.00	EA	$234,570.00	$703,710	
11000	DPR Product Water Pump	7.00	EA	$874,914.81	$6,124,404	
11000	Surge Tank Compressor	2.00	EA	$39,095.00	$78,190	
	Total					**$6,906,304**
	Division 15 - Mechanical					
15000	36" Check Valve	7.00	EA	$50,041.60	$350,291	
15112	36" 150# Fxf Awwa Butterfly Valve, No Op	7.00	EA	$13,560.56	$94,924	
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	210.00	LF	$807.93	$169,666	
15252	36" 3/8" Wall 90° Lr Buttweld Ell	7.00	EA	$13,469.82	$94,289	
15252	84" C200 3/8" Wall Wld Cs Pipe In Open Trench	280.00	LF	$1,835.89	$514,048	
	Total					**$1,223,217**
	Grand Total					**$12,276,183**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: MF Building

Format: MASTER FORMAT 17
Date : May 31,2024
By :
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	7,202.00	CY	$130.00	$936,260	
02000	Architectural Finishes	1.00	LS	$6,213,340.15	$6,213,340	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	3,551.11	CY	$58.23	$206,786	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	3,551.11	CY	$6.16	$21,890	
	Total					**$7,378,276**
	Division 03 - Concrete					
03000	Concrete Columns and Beams	1.00	LS	$3,584,619.32	$3,584,619	
03300	12" Structural Flat Mat On Grade	2,061.11	CY	$619.29	$1,276,435	
03300	12" Edge Forms, Flat Mat On Grade, Add	950.00	LF	$4.37	$4,149	
03300	12" Straight Wall >8' High	155.56	CY	$2,000.00	$311,120	
03300	12" Straight Wall >8' High	196.30	CY	$2,000.00	$392,600	
03300	24" Structural Flat Mat On Grade	2,111.11	CY	$596.50	$1,259,274	
03300	24" Edge Forms, Slab On Grade, Add	728.00	LF	$15.03	$10,943	
03300	24" Straight Wall >8' High	168.89	CY	$1,800.00	$304,002	
03300	24" Straight Wall >8' High	370.37	CY	$1,800.00	$666,666	
03300	24" Structural Flat Mat On Grade	592.59	CY	$596.50	$353,479	
03300	24" Edge Forms, Slab On Grade, Add	564.00	LF	$15.03	$8,478	
03300	24" Straight Wall >8' High	71.11	CY	$1,800.00	$127,998	
03300	24" Straight Wall >8' High	555.56	CY	$1,800.00	$1,000,008	
03300	12" Straight Wall >8' High	311.11	CY	$2,000.00	$622,220	
03300	12" Straight Wall >8' High	392.59	CY	$2,000.00	$785,180	
03300	12" Straight Wall >8' High	41.48	CY	$2,000.00	$82,960	
03300	12" Straight Wall >8' High	40.00	CY	$2,000.00	$80,000	
03300	12" Straight Wall >8' High	155.56	CY	$2,000.00	$311,120	
03300	12" Straight Wall >8' High	88.89	CY	$2,000.00	$177,780	
03300	24" Structural Flat Mat On Grade	85.63	CY	$596.50	$51,078	
03300	24" Edge Forms, Slab On Grade, Add	68.00	LF	$15.03	$1,022	
03300	12" Elevated Slab To 20'	2,061.11	CY	$2,000.00	$4,122,220	
	Total					**$15,533,350**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	55,650.00	SF	$5.44	$302,656	
05500	304 Stainless Steel Grating, 2"	484.00	SF	$173.44	$83,943	
05500	Aluminum Stairs, Including Railing And Supports	10.00	RSR	$725.75	$7,258	
	Total					**$393,857**
	Division 11 - Equipment					
11000	MF BWW Pump	4.00	EA	$93,953.10	$375,812	
11000	MF System (Includes MF Feed Pumps, Automatic Strainers, 32 MF Trains, Backwash System, CIP System, Chemical dosing skids, Aeration Blowers, Compressed Air System, Controls and Automation, Engineering and Manufacturing Assembly)	1.00	LS	$79,753,798.84	$79,753,799	
11000	BAC Backwash Pump	3.00	EA	$291,828.53	$875,486	
11000	Sodium Hypochlorite Pump (MF Maintenance Cleans)	4.00	EA	$27,366.50	$109,466	
11000	Sodium Hypochlorite Pump (MF CIPs)	4.00	EA	$27,366.50	$109,466	
11000	Citric Acid Pump (MF CIPs)	8.00	EA	$27,366.50	$218,932	
11000	Sodium Bisulfite Pump (MF TMC Waste Neutralization)	4.00	EA	$27,366.50	$109,466	
11000	Sodium Bisulfite Pump (MF CIP Waste Neutralization)	4.00	EA	$27,366.50	$109,466	
	Total					**$81,661,893**
	Division 11 - Equipment					
11000	Sodium Hydroxide 25% Pump (MF CIP Waste Neutralization)	8.00	EA	$27,366.50	$218,932	
	Total					**$218,932**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Cab Operated Overhead Traveling Bridge Crane	3.00	EA	$379,534.53	$1,138,604	
	Total					**$1,138,604**
	Division 15 - Mechanical					

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**MF Building**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
15000	Bathroom Fixtures	1.00	LS	$100,000.00	$100,000	
	Total					**$100,000**
	Division 16 - Electrical					
16000	5 kV Switchgear	1.00	EA	$2,521,711.91	$2,521,712	
16000	MV VFD for 1000 HP	5.00	EA	$356,546.39	$1,782,732	
16000	MV VFD for 750 HP	10.00	EA	$301,813.40	$3,018,134	
16000	MCC Side B	2.00	EA	$296,695.08	$593,390	
16000	MCC Side A	2.00	EA	$491,797.89	$983,596	
	Total					**$8,899,564**
	Grand Total					**$115,324,476**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: DPR ROUVAOP Bldg

Format: MASTER FORMAT 17
Date : May 31,2024
By :
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	8,587.78	CY	$130.00	$1,116,411	
02000	Architectural Finishes	1.00	LS	$8,389,585.37	$8,389,585	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	5,089.33	CY	$58.23	$296,358	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	5,089.33	CY	$6.16	$31,373	
	Total					**$9,833,728**
	Division 03 - Concrete					
03000	Concrete Columns and Beams	1.00	LS	$5,992,560.98	$5,992,561	
03300	24" Edge Forms, Slab On Grade, Add	742.00	LF	$15.03	$11,153	
03300	24" Structural Flat Mat On Grade	2,191.11	CY	$596.50	$1,306,994	
03300	24" Edge Forms, Slab On Grade, Add	598.00	LF	$15.03	$8,989	
03300	24" Structural Flat Mat On Grade	831.11	CY	$596.50	$495,756	
03300	24" Edge Forms, Slab On Grade, Add	612.00	LF	$15.03	$9,199	
03300	24" Structural Flat Mat On Grade	963.33	CY	$596.50	$574,625	
03300	24" Straight Wall >8' High	1,700.00	CY	$1,800.00	$3,060,000	
03300	24" Straight Wall >8' High	255.56	CY	$1,800.00	$460,008	
03300	24" Straight Wall >8' High	97.78	CY	$1,800.00	$176,004	
03300	24" Straight Wall >8' High	113.33	CY	$1,800.00	$203,994	
03300	24" X 24" Square Column/Pier	106.67	CY	$1,093.95	$116,691	
03300	12" Straight Wall >8' High	185.19	CY	$2,000.00	$370,380	
03300	12" Straight Wall >8' High	103.70	CY	$2,000.00	$207,400	
03300	12" Edge Forms, Flat Mat On Grade, Add	1,030.00	LF	$4.37	$4,498	
03300	12" Structural Flat Mat On Grade	2,453.70	CY	$619.29	$1,519,563	
03300	12" Straight Wall >8' High	277.78	CY	$2,000.00	$555,560	
03300	12" Straight Wall >8' High	294.44	CY	$2,000.00	$588,880	
03300	12" Elevated Slab To 20'	2,453.70	CY	$2,000.00	$4,907,400	
03300	12" Straight Wall >8' High	47.41	CY	$2,000.00	$94,820	
03300	12" Straight Wall >8' High	25.93	CY	$2,000.00	$51,860	
03300	12" Edge Forms, Flat Mat On Grade, Add	182.00	LF	$4.37	$795	
03300	12" Structural Flat Mat On Grade	46.59	CY	$619.29	$28,853	
03300	12" Straight Wall >8' High	54.81	CY	$2,000.00	$109,620	
03300	12" Straight Wall >8' High	12.59	CY	$2,000.00	$25,180	
03300	12" Elevated Slab To 20'	46.59	CY	$2,000.00	$93,180	
	Total					**$20,973,963**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	10,000.00	SF	$22.50	$224,985	
04220	Standard Concrete Block, 12"	10,600.00	SF	$22.50	$238,484	
	Total					**$463,469**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	66,250.00	SF	$5.44	$360,305	
05310	Steel Deck, 1-1/2" X 22 Ga.	7,200.00	SF	$3.53	$25,397	
05500	Aluminum Stairs, Including Railing And Supports	40.00	RSR	$725.75	$29,030	
05500	304 Stainless Steel Grating, 1-1/2"	7,920.00	SF	$130.71	$1,035,233	
	Total					**$1,449,965**
	Division 11 - Equipment					
11000	UVAOP Reactor	6.00	EA	$4,132,899.72	$24,797,398	
11000	DPR RO System (Includes Low Pressure Forwarding Pumps, Cartridge Filters, RO High Pressure Pumps, 18 RO Trains, CIP System, Flush System, Controls and Automation, Engineering and Manufacturing Assembly)	1.00	LS	$100,083,198.55	$100,083,199	
11000	MF Backwash Pump	12.00	EA	$105,722.26	$1,268,667	
11000	Citric Acid Pump (RO CIPs)	4.00	EA	$68,259.87	$273,039	
11000	Citric Acid Pump (RO CIP Neutralization)	4.00	EA	$68,259.87	$273,039	
11000	Sodium Hydroxide 25% Pump (RO CIPs)	4.00	EA	$68,259.87	$273,039	
11000	Sodium Hydroxide 25% Pump (RO CIP Neutralization)	4.00	EA	$68,259.87	$273,039	
	Total					**$127,241,422**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Floor Operated Overhead Traveling Bridge Crane	4.00	EA	$358,029.41	$1,432,118	
	Total					**$1,432,118**
	Division 15 - Mechanical					
15000	Bathroom Fixtures	1.00	LS	$100,000.00	$100,000	

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**DPR ROUVAOP Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Total					**$100,000**
	Division 16 - Electrical					
16000	5 kV Switchgear (DPR RO/UVAP Building)	1.00	EA	$4,223,795.59	$4,223,796	
16000	LV Switchgear (DPR RO/UVAOP)	2.00	EA	$689,434.06	$1,378,868	
16000	MCC	1.00	EA	$305,077.05	$305,077	
16000	MV VFD for 1250 HP	12.00	EA	$392,513.79	$4,710,166	
	Total					**$10,617,906**
	Grand Total					**$172,112,571**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 36 Service Water Building

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	100 Ton Crawler Mounted Lattice Boom	48.00	MO	$50,000.00	$2,400,000	
	Total					**$2,400,000**
	Division 02 - Site Construction					
02000	Connections to Existing BEF, Cyro, HPE Cooling Water	1.00	LS	$597,000.00	$597,000	
02000	MBR Effluent Temporary Connection	1.00	EA	$450,000.00	$450,000	
02000	Secondary Effluent Channel Connection	1.00	EA	$466,000.00	$466,000	
02000	ABC Fill	1,244.25	CY	$60.00	$74,655	
02000	Tipping Fee	15,216.28	CY	$7.50	$114,122	
02000	Utility Relocation	1.00	LS	$175,000.00	$175,000	
02000	Dewatering	1.00	LS	$600,000.00	$600,000	
02000	Architectural Finishes	1.00	LS	$3,171,083.80	$3,171,084	
02260	Sheet Piling, 38#/Sf To 40' Deep, Driven, Pulled & Salvaged (Pits Only)	7,520.00	SF	$90.00	$676,800	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	15,216.28	CY	$20.00	$304,326	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	3,711.33	CY	$58.23	$216,116	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	15,492.78	CY	$15.00	$232,392	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	15,216.28	CY	$3.00	$45,649	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	276.50	CY	$11.24	$3,108	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	3,711.33	CY	$6.16	$22,878	
	Total					**$7,149,129**
	Division 03 - Concrete					
03300	48" Structural Flat Mat On Grade	1,562.96	CY	$850.00	$1,328,516	
03300	30" Straight Wall >8' High	1,055.00	CY	$1,800.00	$1,899,000	
03300	30" Straight Wall >8' High	666.67	CY	$1,800.00	$1,200,006	
03300	30" Straight Wall >8' High	370.00	CY	$1,800.00	$666,000	
03300	30" Straight Wall >8' High	121.67	CY	$1,800.00	$219,006	
03300	12" Elevated Slab, 33'-38' High	390.74	CY	$2,000.00	$781,480	
03300	30" Straight Wall >8' High	260.00	CY	$1,800.00	$468,000	
03300	30" Straight Wall >8' High	715.00	CY	$1,800.00	$1,287,000	
03300	12" Structural Flat Mat On Grade	92.59	CY	$850.00	$78,702	
	Total					**$7,927,710**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	6,330.00	SF	$50.00	$316,500	
04220	Standard Concrete Block, 12"	4,000.00	SF	$50.00	$200,000	
04220	Standard Concrete Block, 12"	4,000.00	SF	$50.00	$200,000	
04220	Standard Concrete Block, 12"	1,000.00	SF	$50.00	$50,000	
	Total					**$766,500**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	10,550.00	SF	$50.00	$527,500	
05310	Steel Deck, 3" X 20 Ga.	2,500.00	SF	$50.00	$125,000	
	Total					**$652,500**
	Division 11 - Equipment					
11000	Low Lift Pump	7.00	EA	$316,927.00	$2,218,489	
11000	Cooling Water Pump	3.00	EA	$153,054.20	$459,163	
11000	HPE Pump	5.00	EA	$112,404.50	$562,023	
11000	17.5 MGD Cooling Water Pump	5.00	EA	$258,147.50	$1,290,738	
11000	Rapid Mixer	2.00	EA	$70,000.00	$140,000	
	Total					**$4,670,412**
	Division 14 - Conveying Systems					
14631	20 Ton 75' Span Floor Operated Overhead Traveling Bridge Crane	1.00	EA	$358,029.41	$358,029	
	Total					**$358,029**
	Division 15 - Mechanical					
15000	24" Check Valve	6.00	EA	$72,605.00	$435,630	
15000	12" Check Valve	6.00	EA	$21,781.50	$130,689	
15112	36" 150# Fxf Awwa Butterfly Valve, No Op	4.00	EA	$35,000.00	$140,000	
15112	24" 150# Fxf Awwa Butterfly Valve, No Op	8.00	EA	$18,000.00	$144,000	

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 36 Service Water Building

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
15112	12" 150# Fxf Awwa Butterfly Valve, No Op	5.00	EA	$8,080.24	$40,401	
15252	36" A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	100.00	LF	$807.93	$80,793	
15252	24"A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	149.00	LF	$489.04	$72,867	
15252	12" A-53 Welded Steel 3/8" (Std) Wall Pipe In A Bldg	65.00	LF	$248.76	$16,170	
15252	12" 3/8" (Std) Wall 90° Lr Buttweld Ell	5.00	EA	$2,105.14	$10,526	
15252	36" 3/8" (Std) Wall A-234 Buttweld Straight Tee	8.00	EA	$31,001.51	$248,012	
15252	24" 3/8" (Std) Wall A-234 Buttweld Straight Tee	5.00	EA	$6,416.92	$32,085	
	Total					**$1,351,172**
	Division 16 - Electrical					
16000	LV Switchgear (SWB)	1.00	EA	$789,454.90	$789,455	
16000	MCC (SWB)	1.00	EA	$261,439.10	$261,439	
	Total					**$1,050,894**
	Grand Total					**$26,326,346**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**16 Electrical Substation No. 4**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	1,863.33	CY	$60.00	$111,800	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	191.33	CY	$58.23	$11,141	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	191.33	CY	$6.16	$1,179	
	Total					**$124,121**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	1672	CY	$850.00	$1,421,200	
	Total					**$1,421,200**
	Division 16 - Electrical					
16000	38 kV Drawout Vacuum Breaker	1	EA	$1,409,848.70	$1,409,849	
16000	20 MVA Transformer	2	EA	$2,471,986.40	$4,943,973	
16000	25 MVA Transformer	2	EA	$3,089,983.00	$6,179,966	
16000	25 MVA Transformer	2	EA	$210,600.00	$421,200	
	Total					**$12,954,988**
	Grand Total					**$14,500,308**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**24 Product Water PS Electrical Bldg**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	439.11	CY	$60.00	$26,347	
02000	Tipping Fee	585.48	CY	$7.50	$4,391	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	27.11	CY	$58.23	$1,579	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	27.11	CY	$6.16	$167	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	585.48	CY	$20.00	$11,710	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	683.07	CY	$15.00	$10,246	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	585.48	CY	$3.00	$1,756	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	97.59	CY	$11.24	$1,097	
	Total					**$57,293**
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	119.26	CY	$850.00	$101,371	
	Total					**$101,371**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	2,800.00	SF	$50.00	$140,000	
04220	Standard Concrete Block, 12"	1,840.00	SF	$50.00	$92,000	
	Total					**$232,000**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	3,220.00	SF	$50.00	$161,000	
	Total					**$161,000**
	Division 16 - Electrical					
16000	5 kV Switchgear	1.00	EA	$2,342,805.40	$2,342,805	
16000	MV VFD for 3000 HP	7.00	EA	$505,700.00	$3,539,900	
16000	MCC	1.00	EA	$231,405.20	$231,405	
	Total					**$6,114,111**
	Grand Total					**$6,665,774**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**17 Elect Bldg MBR Train A1, A2, B1 and**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 16 - Electrical					
16000	5 kV Switchgear (MBR Train B1)	1.00	EA	$2,357,496.70	$2,357,497	
16000	MV VFD for 500 HP	6.00	EA	$237,900.00	$1,427,400	
16000	MBR Trains LV Switchgear	1.00	EA	$558,436.00	$558,436	
16000	MCC A	1.00	EA	$408,835.70	$408,836	
16000	MCC BA	1.00	EA	$246,645.10	$246,645	
	Total					**$4,998,814**
	Grand Total					**$4,998,814**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 18 Elec Bldg MBR Train B2 and B3

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	238.81	CY	$850.00	$202,989	
	Total					**$202,989**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	2080	SF	$50.00	$104,000	
04220	Standard Concrete Block, 12"	4960	SF	$50.00	$248,000	
	Total					**$352,000**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	6448	SF	$50.00	$322,400	
	Total					**$322,400**
	Division 16 - Electrical					
16000	B2 5 kV Switchgear	1	EA	$2,256,763.60	$2,256,764	
16000	B2 LV Switchgear	1	EA	$560,925.30	$560,925	
16000	B3 LV Switchgear	1	EA	$510,450.20	$510,450	
16000	MCC A	2	EA	$408,835.70	$817,671	
16000	MCC B	2	EA	$246,645.10	$493,290	
16000	MV VFD for 500 HP	9	EA	$237,900.00	$2,141,100	
16000	B3 5 kV Switchgear	1	EA	$1,683,652.10	$1,683,652	
	Total					**$8,463,853**
	Grand Total					**$9,341,241**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**55B Module Electrical Building**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee	327.11	CY	$7.50	$2,453	
02000	ABC Fill	163.56	CY	$60.00	$9,814	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	327.11	CY	$20.00	$6,542	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	48.00	CY	$58.23	$2,795	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	363.44	CY	$15.00	$5,452	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	327.11	CY	$3.00	$981	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	36.33	CY	$11.24	$408	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	48.00	CY	$6.16	$296	
	Total					**$28,741**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	115.56	CY	$850.00	$98,226	
03300	12" Structural Flat Mat On Grade	44.44	CY	$850.00	$37,774	
	Total					**$136,000**
	Division 04 - Masonry					
04220	Concrete Block, Split Face 12" (Walls)	2,960.00	SF	$50.00	$148,000	
	Total					**$148,000**
	Division 05 - Metals					
05310	Steel Deck, 1-1/2" X 20 Ga. (Roof)	1,200.00	SF	$50.00	$60,000	
	Total					**$60,000**
	Division 16 - Electrical					
16000	0.5 MVA Transformer	2.00	EA	$69,550.00	$139,100	
16000	Module LV Switchgear	1.00	EA	$560,925.30	$560,925	
	Total					**$700,025**
	Grand Total					**$1,072,767**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**19 Ozone Electrical Building**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Tipping Fee	2,016.67	CY	$7.50	$15,125	
02000	ABC Fill	1,008.33	CY	$60.00	$60,500	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	2,016.67	CY	$20.00	$40,333	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	126.67	CY	$58.23	$7,376	
02300	Cat 235 Trackhoe 2.75Cy Bucket, Class C (Hard Digging), 0-20' D	2,240.74	CY	$15.00	$33,611	
02300	Loading Loose Materials, 8.25 Cy Bucket, 988-B Loader, All Classes	2,016.67	CY	$3.00	$6,050	
02300	D8 Dozer, Class C (Hard Dig), Grade, Cut, Fill & Compact, 600' Haul	224.07	CY	$11.24	$2,519	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	126.67	CY	$6.16	$781	
	Total					**$166,295**
	Division 03 - Concrete					
03300	12" Structural Flat Mat On Grade	76.59	CY	$850.00	$65,102	
03300	36" Structural Flat Mat On Grade	544.33	CY	$850.00	$462,681	
	Total					**$527,782**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	1,760.00	SF	$50.00	$88,000	
04220	Standard Concrete Block, 12"	188.00	SF	$50.00	$9,400	
	Total					**$97,400**
	Division 05 - Metals					
05310	Steel Deck, 3" X 20 Ga.	2,068.00	SF	$50.00	$103,400	
	Total					**$103,400**
	Division 16 - Electrical					
16000	15 MVA Transfermer (O2 & O3)	2.00	EA	$1,853,989.80	$3,707,980	
16000	3 MVA Transformer (O2 & O3)	6.00	EA	$196,300.00	$1,177,800	
16000	1.5 MVA Transformer (O2 & O3)	2.00	EA	$135,200.00	$270,400	
16000	5 kV Switchgear	1.00	EA	$1,917,090.50	$1,917,091	
16000	LV Switchgear	3.00	EA	$663,631.80	$1,990,895	
16000	MV VFD for 1500 HP	2.00	EA	$338,000.00	$676,000	
16000	MCC	1.00	EA	$251,613.70	$251,614	
	Total					**$9,991,779**
	Grand Total					**$10,886,656**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**20 SWF Generator Facility**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	3,044.22	CY	$60.00	$182,653	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	222.00	CY	$58.23	$12,927	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	222.00	CY	$6.16	$1,368	
	Total					**$196,949**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	2822.22	CY	$850.00	$2,398,887	
	Total					**$2,398,887**
	Division 05 - Metals					
05310	Steel Deck, 2" X 20 Ga.	15240	SF	$50.00	$762,000	
	Total					**$762,000**
	Division 16 - Electrical					
16000	Generator	10	EA	$2,554,500.00	$25,545,000	
16000	Paralleling Switchgear	2	EA	$4,420,000.00	$8,840,000	
	Total					**$34,385,000**
	Grand Total					**$37,742,836**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**22 MBR Trains B2 and B3 Transformers**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	ABC Fill	854.00	CY	$60.00	$51,240	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class A Material	120.67	CY	$58.23	$7,027	
02300	D8 Dozer, Class A (Easy Dig), Grade, Cut, Fill & Compact, 600' Haul	120.67	CY	$6.16	$744	
	Total					**$59,011**
	Division 03 - Concrete					
03300	36" Structural Flat Mat On Grade	733.33	CY	$850.00	$623,331	
	Total					**$623,331**
	Division 16 - Electrical					
16000	10 MVA Transformer	2.00	EA	$585,000.00	$1,170,000	
16000	3 MVA Transformer	4.00	EA	$196,300.00	$785,200	
16000	2.5 MVA Transformer	2.00	EA	$210,600.00	$421,200	
16000	1.5 MVA Transformer	2.00	EA	$135,200.00	$270,400	
16000	5 MVA Transformer	2.00	EA	$385,148.40	$770,297	
	Total					**$3,417,097**
	Grand Total					**$4,099,438**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**23 Xfrms MBR Train A1, A2, B1, SE EQ**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 16 - Electrical					
16000	10 MVA Transformer	2	EA	$585,000.00	$1,170,000	
16000	3 MVA Transformer	4	EA	$196,300.00	$785,200	
	Total					**$1,955,200**
	Grand Total					**$1,955,200**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**03 OGF Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Oxygen Generation Facility Demo	1	LS	$1,915,866.00	$1,915,866	
	Total					**$1,915,866**
	Grand Total					**$1,915,866**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**05 OGF Compressor Facility Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	OGF Compressor Facility Demo	1	LS	$4,786,503.00	$4,786,503	
	Total					**$4,786,503**
	Grand Total					**$4,786,503**

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DETAILED COST ESTIMATE

Project: Hyperion 2035
Client: LASAN
Location: Los Angeles, CA
Element: 66B Mod 3 Electrical Bldg Demo

Typical for All Module Electrical Bldgs

Format: MASTER FORMAT 17
Date : May 31, 2024
By : KTR
Reviewed:

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demolition of Existing Module 3 Electrical Building	1	LS	$553,540.00	$553,540	
	Total					**$553,540**
	Grand Total					**$553,540**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	Typical for All Module Vent Scrubber Bldgs	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**		**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**		**By :**	**KTR**
Element:	**25 Mod 2 Vent Scrubber Demo**		**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Demo of Module 2 Vent Scrubber Building	1	LS	$384,534.00	$384,534	
	Total					**$384,534**
	Grand Total					**$384,534**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**10 SC 5A-5D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	SC 5A-5D Demo	1	LS	$6,806,007.00	$6,806,007	
	Total					**$6,806,007**
	Grand Total					**$6,806,007**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**10 SC 6A-6D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	SC 6A-6D Demo	1	LS	$7,153,197.00	$7,153,197	
	Total					**$7,153,197**
	Grand Total					**$7,153,197**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**10 SC 7A-7D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	SC 7A-7D Demo	1	LS	$7,730,560.00	$7,730,560	
	Total					**$7,730,560**
	Grand Total					**$7,730,560**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**10 SC 8A-8D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	SC 8A-8D Demo	1	LS	$6,965,429.00	$6,965,429	
	Total					**$6,965,429**
	Grand Total					**$6,965,429**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**10 SC 9A-9D Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	SC 9A-9D Demo	1	LS	$6,496,752.00	$6,496,752	
	Total					**$6,496,752**
	Grand Total					**$6,496,752**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**12 Service Water Facility Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Service Water Facility Demo	1	LS	$3,650,491.00	$3,650,491	
	Total					**$3,650,491**
	Grand Total					**$3,650,491**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**12 Service Water Facility Generator Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Service Water Facility Generator Demo	1	LS	$71,181.00	$71,181	
	Total					**$71,181**
	Grand Total					**$71,181**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**10 Service Water Facility Substation**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Service Water Facility Substation Demo	1	LS	$73,181.00	$73,181	
	Total					**$73,181**
	Grand Total					**$73,181**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31, 2024**
Location:	**Los Angeles, CA**	**By :**	**KTR**
Element:	**10 Existing UCF Demo**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Existing UCF Demo	1	LS	$373,199.00	$373,199	
	Total					**$373,199**
	Grand Total					**$373,199**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**25 Phase 3 Yard Piping**	**Reviewed:**	

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Sloped Slab On Grade (To 30%)	888.89	CY	$565.51	$502,676	
03300	12" Edge Forms, Flat Mat On Grade, Add	1,835.54	LF	$4.37	$8,016	
03300	12" Structural Flat Mat On Grade	1,142.52	CY	$619.29	$707,557	
03300	12" Straight Wall, To 8' High	316.00	CY	$2,000.00	$632,000	
03300	12" Elevated Slab To 20'	250.00	CY	$2,000.00	$500,000	
	Total					**$2,350,249**
	Division 15 - Mechanical					
15000	Storm Drain Piping	1.00	LS	$1,000,000.00	$1,000,000	
15252	96" C200 3/8" Wall Wld Cs Pipe In Open Trench	150.00	LF	$2,131.07	$319,660	
15252	60" C200 3/8" Wall Wld Cs Pipe In Open Trench	3,000.00	LF	$1,192.88	$3,578,649	
15252	54" C200 3/8" Wall Wld Cs Pipe In Open Trench	300.00	LF	$1,047.48	$314,243	
15252	96" C200 3/8" Wall Wld Cs Pipe In Open Trench	100.00	LF	$2,131.07	$213,107	
15814	Frp Duct, 108"	3,000.00	LF	$770.29	$2,310,867	
	Total					**$7,736,526**
	Grand Total					**$10,086,775**

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DETAILED COST ESTIMATE

Project:	**Hyperion 2035**	**Format:**	**MASTER FORMAT 17**
Client:	**LASAN**	**Date :**	**May 31,2024**
Location:	**Los Angeles, CA**	**By :**	
Element:	**26 Phase 3 Site Work**	**Reviewed:**	

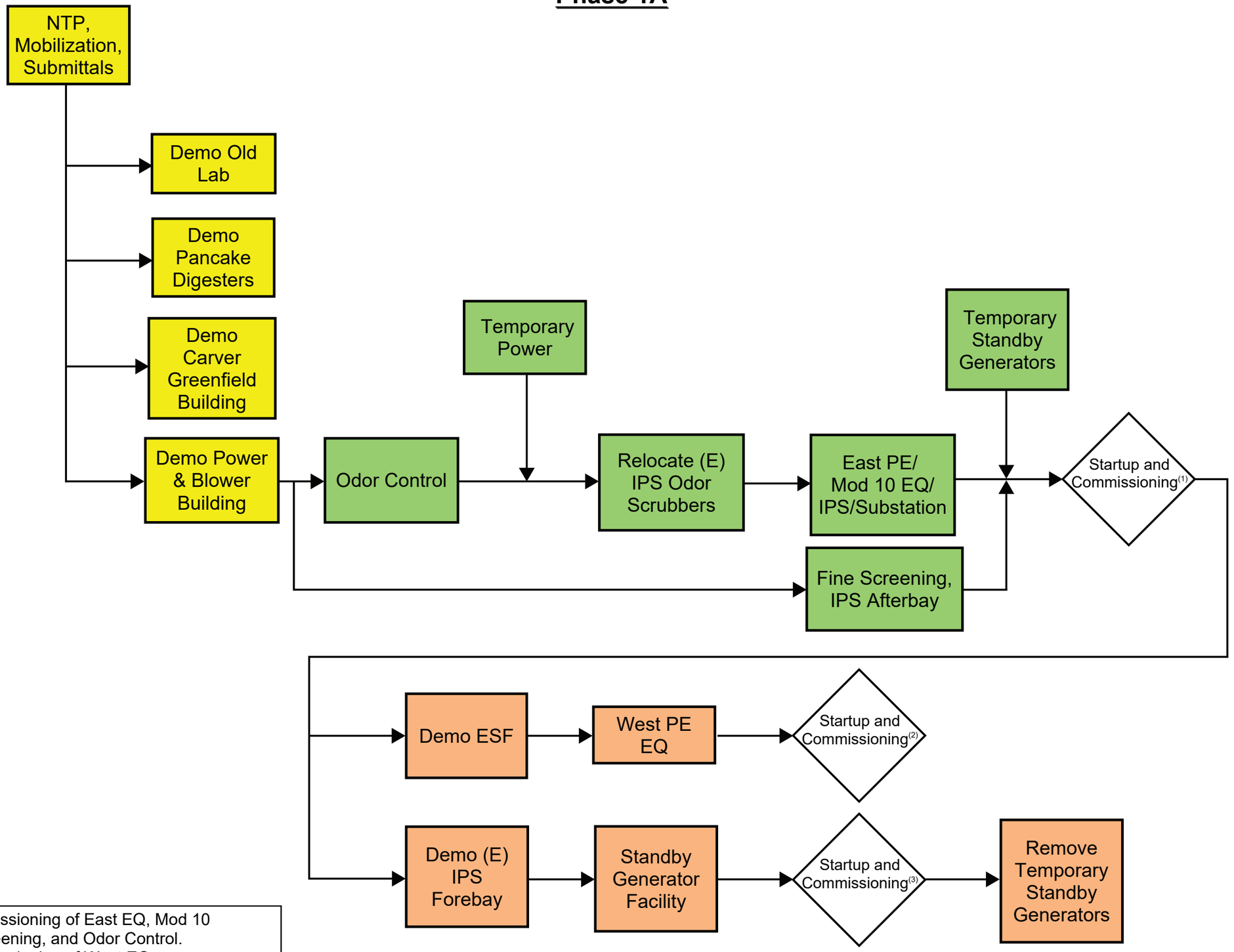
SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	General Conditions for Demo Items	1.00	LS	$350,000.00	$350,000	
02000	Bollards	350.00	EA	$480.00	$168,000	
02000	Construction Difficulty and Work Restrictions	1.00	LS	$750,000.00	$750,000	
02000	Pipe Rack Demo	1.00	LS	$750,000.00	$750,000	
02000	Structural Repair Cost	1.00	LS	$400,000.00	$400,000	
02000	Civil Shoring Design and Construction	1.00	LS	$400,000.00	$400,000	
02000	Dewatering	1.00	LS	$500,000.00	$500,000	
02000	Traffic Control	1.00	LS	$1,000,000.00	$1,000,000	
02000	Demo of large piping, channels and splitter	1.00	LS	$1,000,000.00	$1,000,000	
02220	Remove 2"-3" Asphalt Pavement	873,125.00	SF	$.47	$412,641	
02580	24" Dia. X 300 Lb Light Traffic Manhole Frame & Cover	10.00	EA	$417.40	$4,174	
02580	24" X 36" Precast Curb Inlet Catch Basin W/Frame & Grate	40.00	EA	$1,452.82	$58,113	
02742	4" Ac Paving On 10" Abc	97,013.89	SY	$70.15	$6,805,291	
02772	4" Thick Concrete Sidewalk,	10,000.00	SF	$6.09	$60,876	
	Total					**$12,659,096**
	Division 04 - Masonry					
04220	Standard Concrete Block, 12"	12,800.00	SF	$22.50	$287,981	
	Total					**$287,981**
	Division 05 - Metals					
05500	Aluminum Stairs, Including Railing And Supports	160.00	RSR	$725.75	$116,121	
	Total					**$116,121**
	Division 08 - Doors and Windows					
08110	3/0 X 6/8 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	12.00	EA	$1,172.18	$14,066	
	Total					**$14,066**
	Division 15 - Mechanical					
15000	Ducting in Tunnels	1.00	LS	$400,000.00	$400,000	
15000	Tunneel Supply Fan	18.00	EA	$39,095.00	$703,710	
15000	Tunnel Exhaust Fan	18.00	EA	$31,276.00	$562,968	
	Total					**$1,666,678**
	Grand Total					**$14,743,941**

Appendix D

CONSTRUCTION SEQUENCING FLOWCHARTS

Revised 9/17/24

Phase 1A



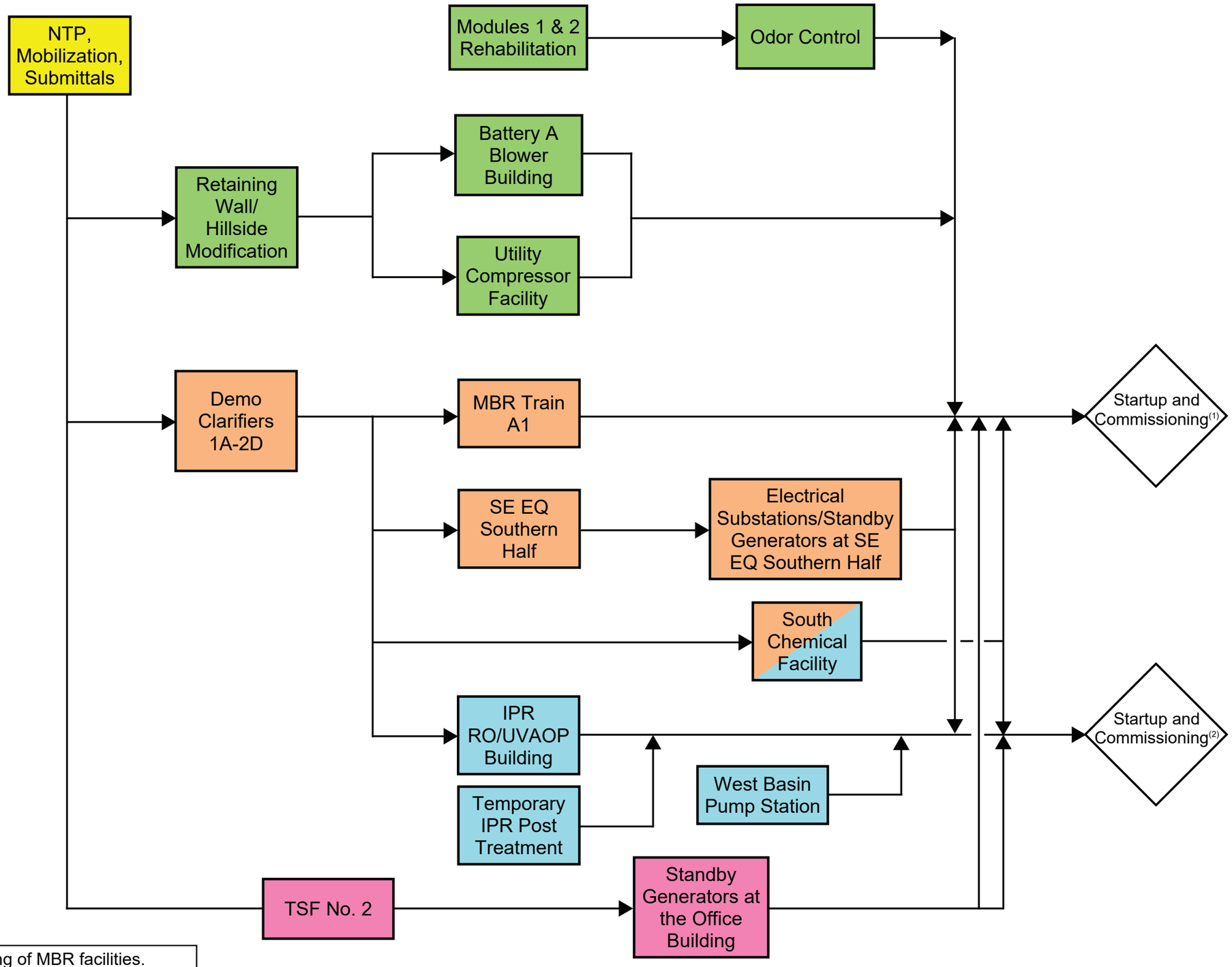
Legend

- Early Demolition
- Pre-IPS Construction
- Post-IPS Construction

(1): Startup and commissioning of East EQ, Mod 10 EQ, IPS, Fine Screening, and Odor Control.
(2): Startup and commissioning of West EQ.
(3): Startup and commissioning of standby generator facility.

Revised 9/17/24

Phase 1B



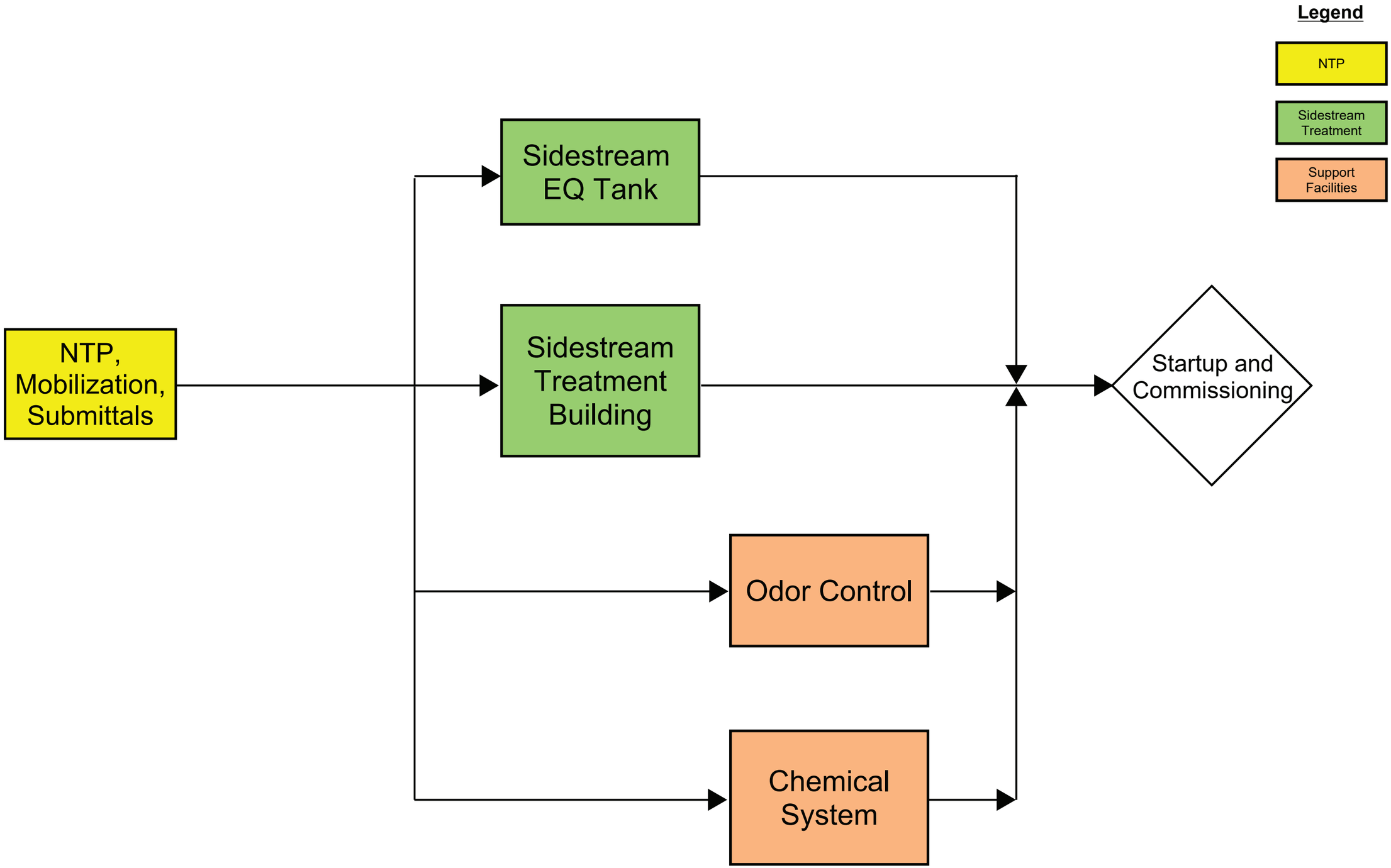
Legend

- NTP
- Hillside and Modules
- MBR Train
- IPR
- Facilities at Old Lab

(1): Startup and commissioning of MBR facilities.
(2): Startup and commissioning of AWT facilities (IPR).

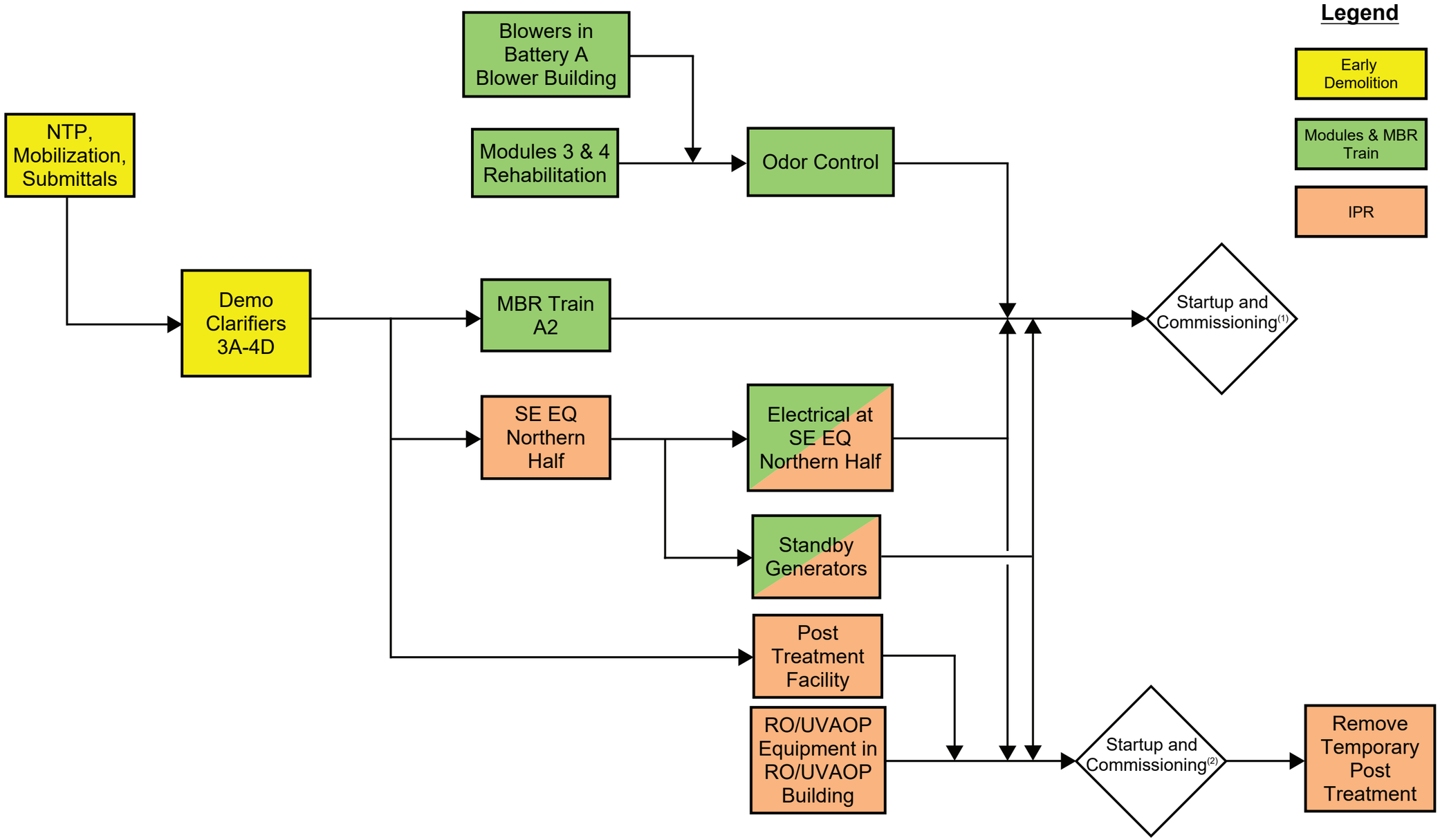
Revised 8/22/24

Sidestream Treatment



Revised 7/1/24

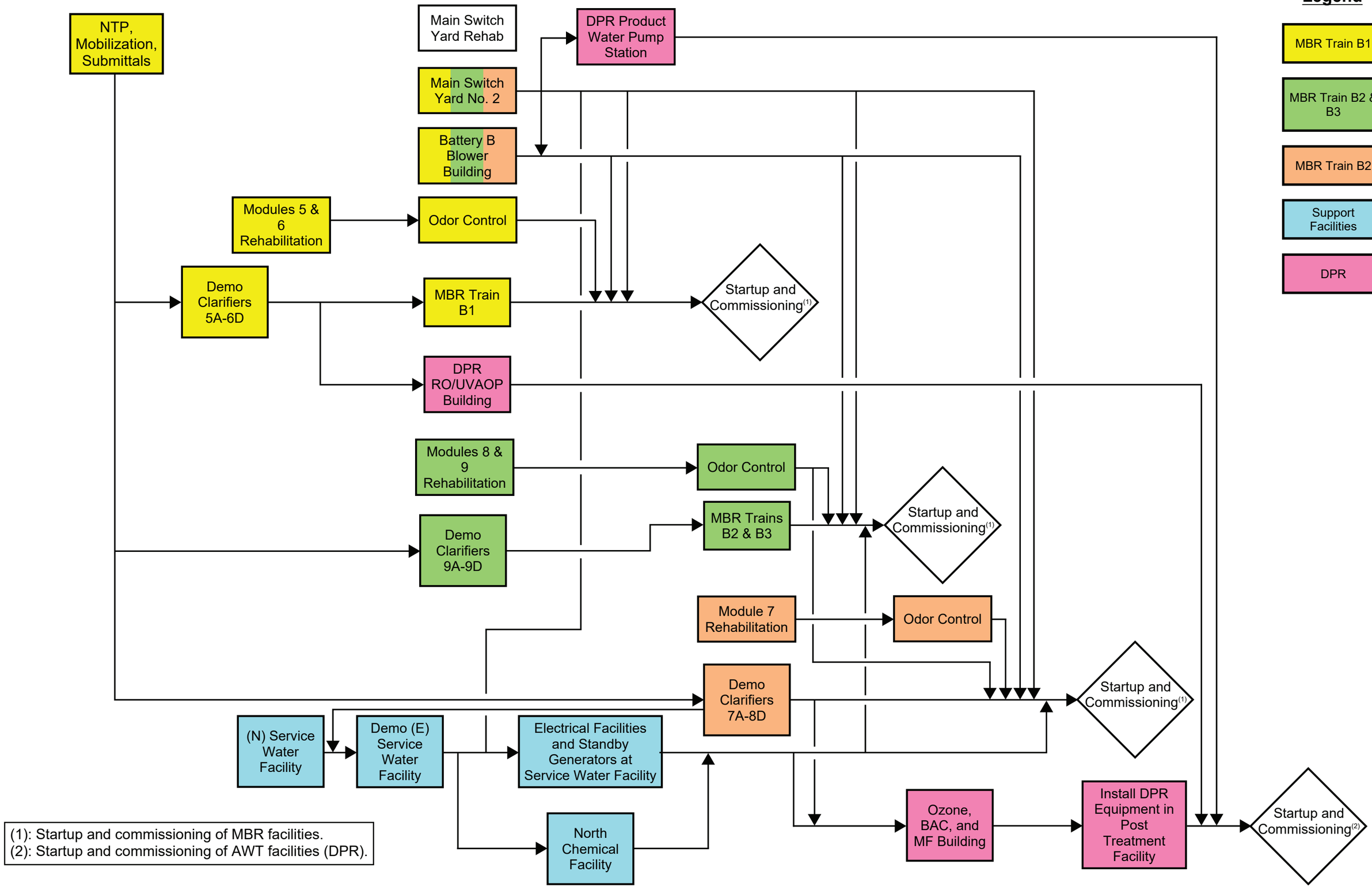
Phase 2



(1): Startup and commissioning of MBR facilities.
(2): Startup and commissioning of AWT facilities (IPR).

Revised 7/10/24

Phase 3



(1): Startup and commissioning of MBR facilities.
(2): Startup and commissioning of AWT facilities (DPR).