SUNNYVALE CLEANWATER PROGRAM

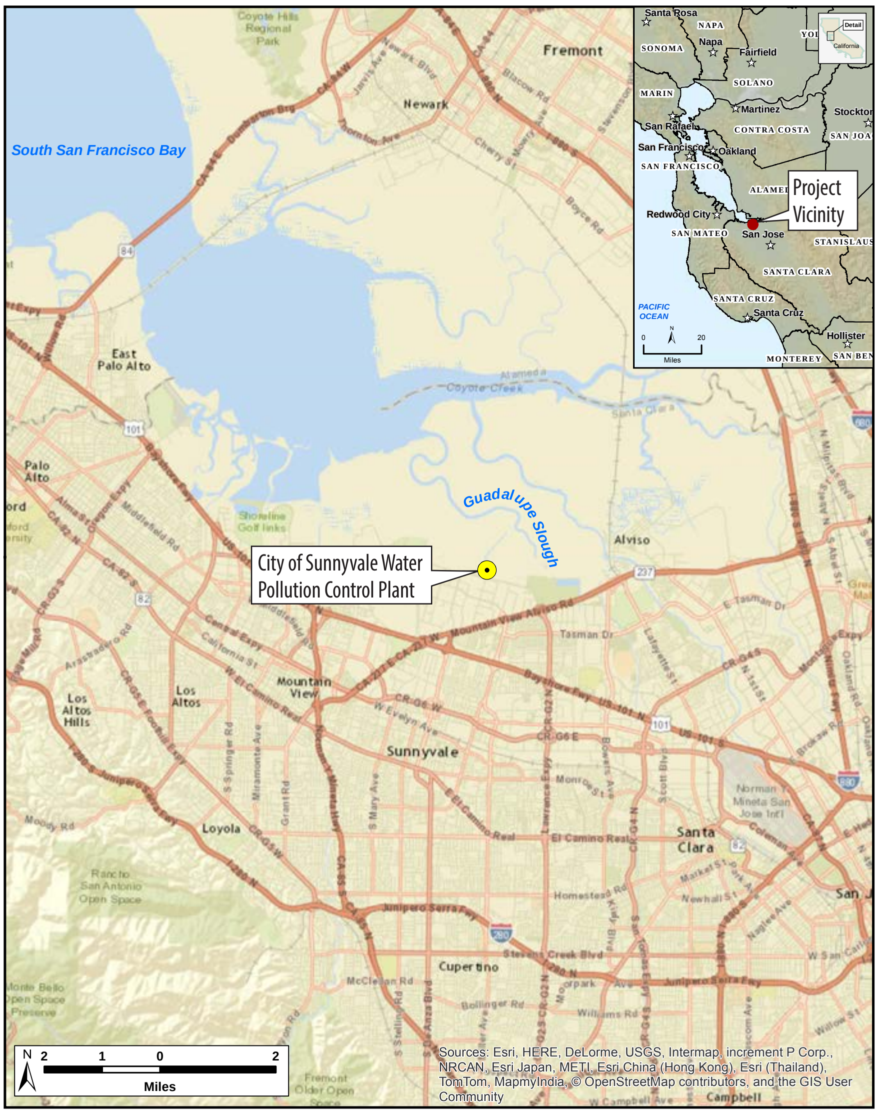
The WPCP Master Plan Executive Summary

The Donald M. Somers Water Pollution Control Plant

Purpose of the Plant

The Donald M. Somers Water Pollution Control Plant (WPCP) provides treatment of wastewater from residential, commercial, and industrial sources from the City of Sunnyvale, the Rancho Rinconada portion of Cupertino, and Moffett Federal Airfield. The WPCP is designed to combine physical, chemical, and natural biological processes to treat wastewater. This wastewater treatment process provides advanced treatment to produce a high quality effluent, suitable for discharge into the San Francisco Bay (Bay) under a National Pollutant Discharge Elimination System (NPDES) permit.

In addition to preventing pollution, the WPCP is a source of recycled water and renewable power, reducing demand on the potable water supply and returning power to the grid. Over the next 20-plus years, the City will take advantage of recent technological innovations, transforming the WPCP into a highly-automated resource recovery center.

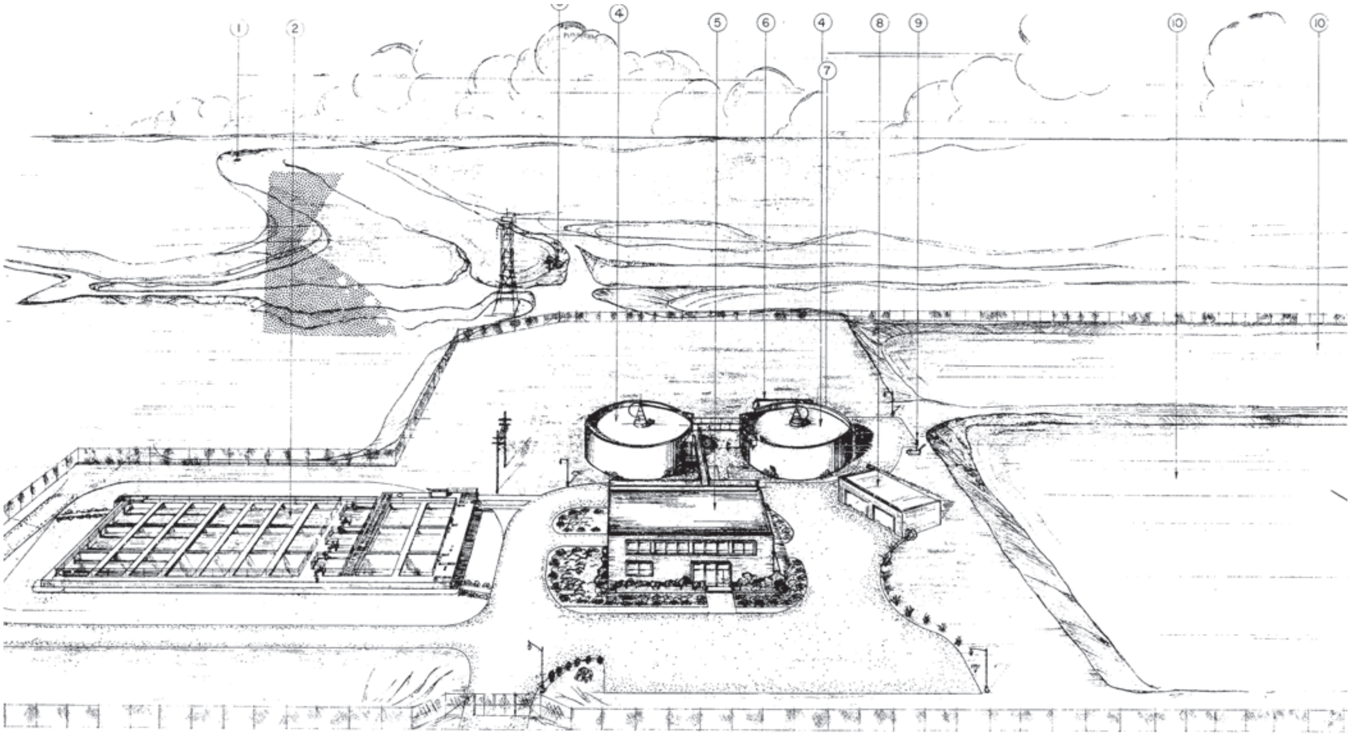


Area Map

WASTEWATER TREATMENT TERMS

- **Flow:** Daily volume of water that moves through a facility; measured in millions of gallons per day (MGD)
- **Load:** The mass of solids and organic material carried into the plant as part of wastewater
- **Preliminary treatment:** Initial treatment step which removes larger material, like grit and paper, from wastewater
- **Primary treatment:** Gravity settling step which removes solid material that floats or sinks
- **Secondary treatment:** Biological treatment step which removes organic matter
- **Tertiary treatment:** Filtering, disinfecting, and dechlorinating the wastewater, making it clean for discharge
- **Final Effluent:** Cleaned water that is piped out of the treatment plant
- **Recycled water :** Final effluent which is distributed through purple pipes for irrigation, decorative ponds, and other non-potable uses
- **Biogas:** Byproduct of wastewater treatment that can be used as fuel; similar to natural gas
- **Cogeneration:** Using an internal combustion engine to produce heat and electrical power from biogas, rather than purchasing it from PG&E
- **Biosolids:** Organic byproduct of wastewater treatment; biosolids resemble dark soil and can be used as a nutrient-rich soil amendment

The Plant — Then and Now

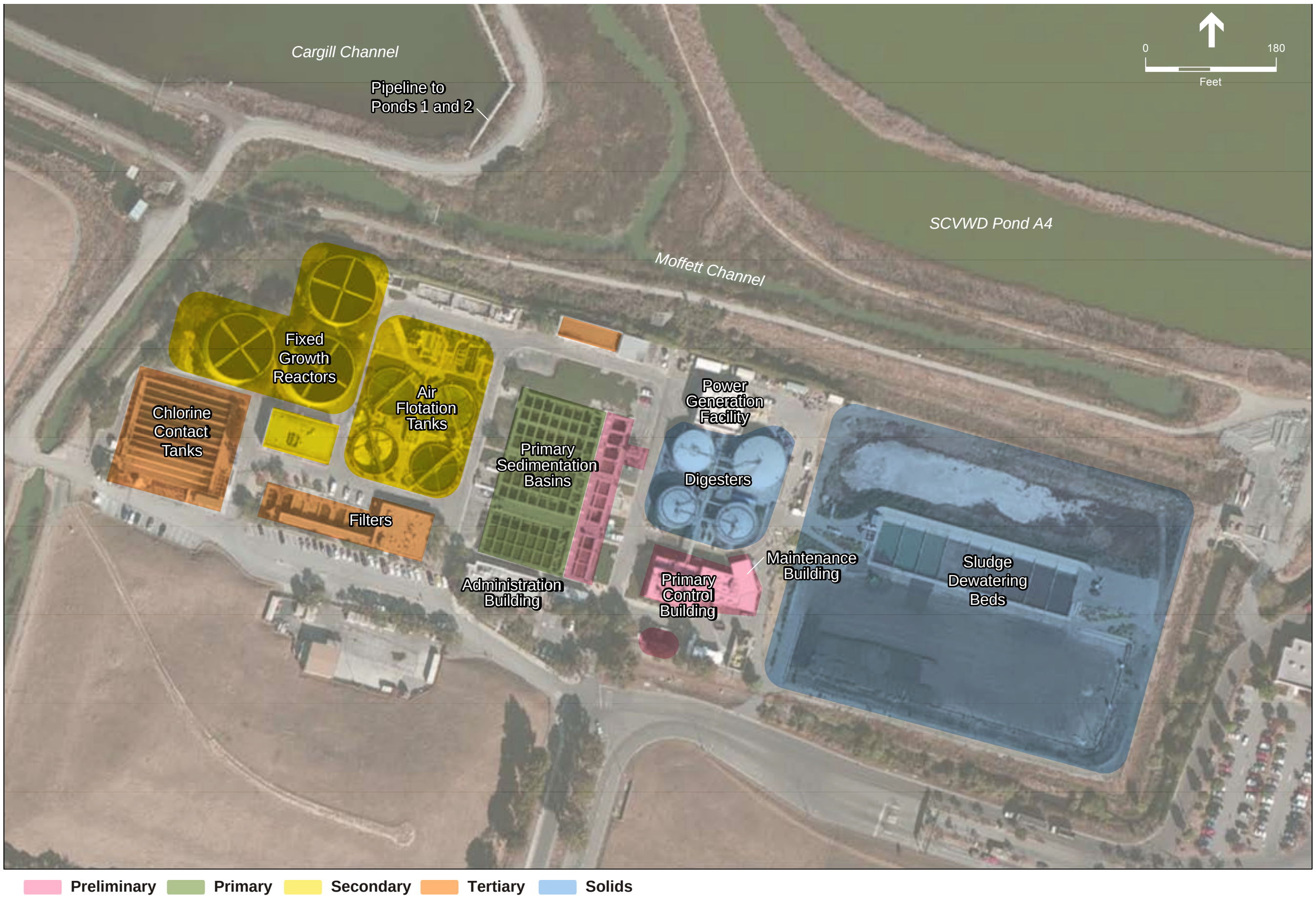


1955 Sketch of the Plant

History of the Plant

When first constructed in 1956, the WPCP consisted only of primary treatment facilities. As the population boomed, the plant was expanded to increase capacity. Ponds were purchased from the Leslie Salt Company (which is now Cargill) to naturally treat the effluent and avoid depleting the oxygen in the Bay's aquatic ecosystem. In the 1970s, the enactment of the Clean Water Act prompted the construction of additional treatment processes to improve effluent quality.

The final upgrade to increase the WPCP to its present capacity was completed in 1984. While minor projects have continued, no major facility changes have occurred in more than 30 years.



Aerial view of the WPCP

The Plant Today

Today, the WPCP handles wastewater treatment for more than 148,000 residents and business people. In its present form, the WPCP is designed to treat 29.5 million gallons of wastewater per day (MGD). While "wastewater treatment" may sound simple, it involves a number of physical, chemical, and natural biological process steps and facilities to get the job done. The three major treatment levels are primary, secondary, and tertiary treatment. Throughout the treatment, the WPCP focuses with great attention on these imperatives: safety, compliance, efficiency, and cost-effectiveness.

Some 60 talented employees from various backgrounds keep the WPCP humming and in service. Staffing includes managers, operations staff, maintenance staff, laboratory staff, industrial pretreatment inspectors and technicians, compliance and technical support. WPCP operations are performed by a highly skilled group of State Water Board-certified Operators organized into five shifts. A minimum of four Operators are on duty at all times.

With decades of operation under its belt, some components of the WPCP are nearing the end of their useful lives and much of the aging infrastructure needs replacing. Fortunately, the City is well into planning for the future.

Three Steps for Effective Treatment

The Water Pollution Control Plant is a tertiary treatment facility (three major steps) serving the City of Sunnyvale. The objective of the Plant is to remove pollutants and produce a high quality effluent suitable either for safe discharge to the South San Francisco Bay or for non-potable (non-drinking) uses. The Plant combines physical, chemical, and natural biological processes to consistently maintain this high quality.

PRIMARY TREATMENT:

Main objective: remove solids, influent screening/grinding, raw sewage pumping and metering, grit removal and primary sedimentation. Following primary treatment, 60% of influent solids will have been removed.

Preaeration tanks and primary sedimentation basins.

Rotating arm of fixed growth reactors distributing pond effluent over plastic growth media.

SECONDARY TREATMENT:

Biological treatment using 440 acres of oxidation ponds and fixed-growth reactors. The goal of secondary treatment is to remove most of the remaining dissolved and suspended solids and nutrients. After most of the heavy solids have been removed, the water flows by gravity into the ponds, from where it is pumped to the fixed-growth reactors, followed by the dissolved-air flotation units. Following secondary treatment, 92% of influent solids will have been removed.

Secondary Treatment: aerial Photo of 440 Acres of Oxidation Ponds

TERTIARY TREATMENT:

Effluent from the dissolved-air flotation units is pumped to the tertiary treatment facilities, which include effluent filtering, disinfection, and dechlorination prior to discharge. Following tertiary treatment, 96% of influent solids will have been removed.

Chlorine contact channels treating effluent prior to discharge to Moffett Channel.

The Water Pollution Control Plant Master Plan

Master Plan Purpose

The Master Plan will serve as a long-term guide for replacing the WPCP's facilities and operations. The purpose of the Master Plan is to ensure that the WPCP can meet changing regulations, treat existing and projected wastewater flows reliably and cost-effectively, and increase recycled water production.

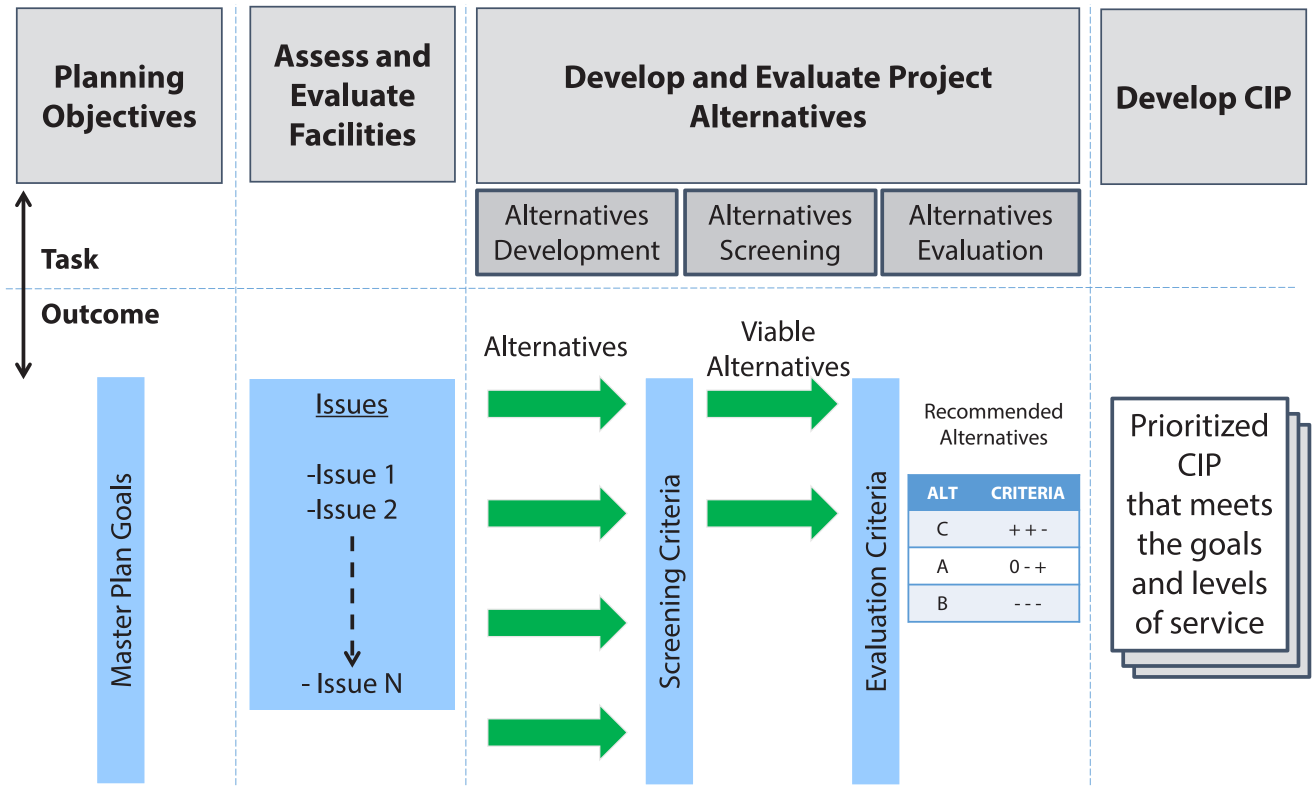
Master Plan Objectives

The City established overall objectives for the Master Plan in 2013. These objectives include:

1. Meet current and future water quality, biosolids and air quality treatment needs.
2. Minimize capital and operational costs for rate payers.
3. Add efficiency through innovative technologies and by promoting water recycling.
4. Provide a more reliable power supply through renewable energy produced by the Plant.
5. Maximize use of space and enhance safety.
6. Meet regulatory requirements.
7. Provide flexibility related to financial and regulatory uncertainty.
8. Maximize the useful life of existing facilities.
9. Incorporate back-up plans and facilities to ensure uninterrupted operations.
10. Protect against flooding and risks of sea level rise.

Master Planning Process

The Master Plan identifies challenges confronting the WPCP, evaluates solutions to overcome these challenges, and presents recommendations for the best path forward. These recommendations were developed through a multi-year analytical and collaborative process, utilizing national wastewater experts and engaging both internal and external stakeholders.



Building on Previous Studies

In 2006, a condition assessment of the WPCP's aboveground assets was conducted. This assessment estimated the remaining useful life of the WPCP's equipment, piping, and structures and identified near-term needs for repair and replacement. The condition assessment consultant recommended that the City proceed with a facilities Master Plan, so that needed replacements could be implemented efficiently.

In 2008-2011, a Strategic Infrastructure Plan (SIP) was completed, and peer reviews were conducted. The SIP compared the broad alternative of renovating and optimizing the existing plant facilities against the broad alternative of generally replacing the existing facility with new treatment processes. Council considered the outcome of the SIP in 2011 and again in 2012, and issued direction to proceed with developing a plan that included reconstructing the plant with new treatment processes.

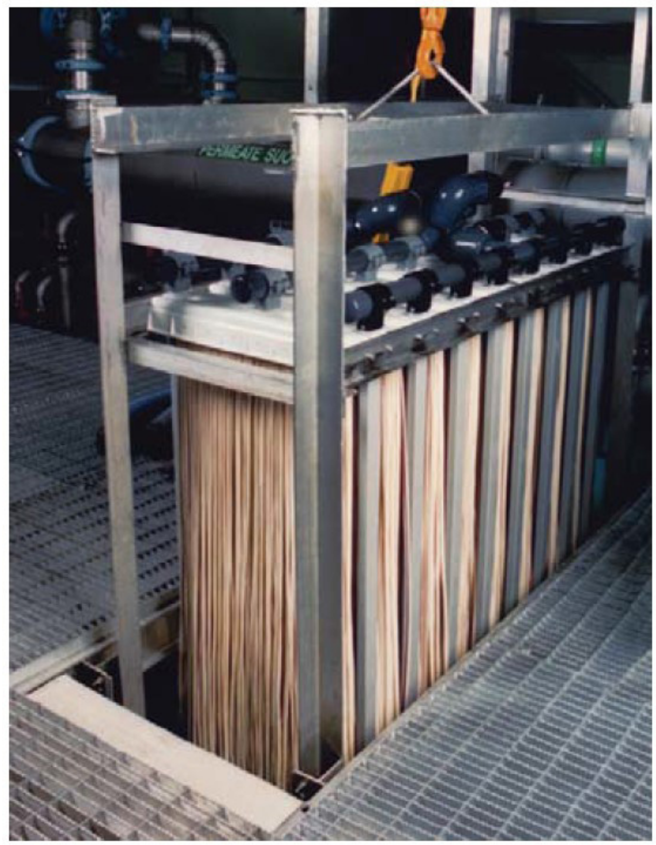
Channel Monster corrosion

Site Planning and Alternatives Analysis

After validating and updating the assumptions from the SIP, the Master Plan drilled down to identify the specific site layout, treatment process technologies, support facility configurations, and design standards that will be used as the plan is executed. For each issue, the master planning consultant developed several alternatives and presented the pros and cons in a series of formal workshops with the City. The resulting decisions and supporting analysis are documented in technical memoranda. All reports were independently reviewed by the program management consultant.

In addition to contending with the urgent issue of failing infrastructure, the Master Plan addresses the complex technical decision of how to solve the WPCP's reliance on natural ponds for secondary treatment. Since temperature and other natural parameters are not easily controlled in the ponds, treatment effectiveness is subject to seasonal variability. This variability will not be sufficient to meet future water quality requirements. Plus the pond levees are all in varying condition of disrepair and are subject to further damage and inundation due to sea level rise. To solve these challenges while maximizing the benefit of existing infrastructure, the master plan centers on a split flow concept: most flow will be treated in new conventional activated sludge (CAS) facilities, and the existing facilities will help during periods of high flow. Beyond 20 years, depending on actual flows, regulatory requirements and the state of the levees and original infrastructure, the second phase of the CAS facilities will be built and the ponds will be repurposed for other beneficial uses, such as further polishing of the treated effluent, wildlife habitat, and terraced levee creation for protection from sea level rise.

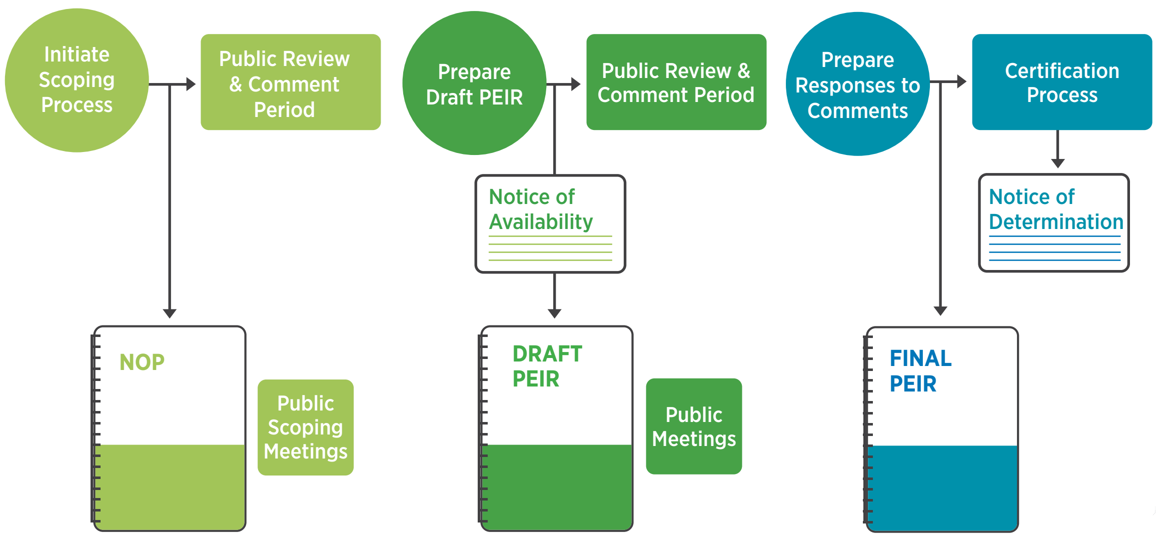
As an alternative to the split-flow CAS implementation, the Santa Clara Valley Water District (SCVWD) has funded an engineering evaluation for a water purification facility (WPF) that uses a membrane bioreactor (MBR) to treat wastewater to indirect potable reuse standards. The City and SCVWD have formed a recycled water joint committee to provide policy direction on partnership opportunities between the two agencies, including exploration of the WPF. This concept reflects current regional water supply planning efforts, including the South Bay Water Recycling Strategic and Master Plan, which identify recycled and purified water sources as significant supply additions for Santa Clara County.



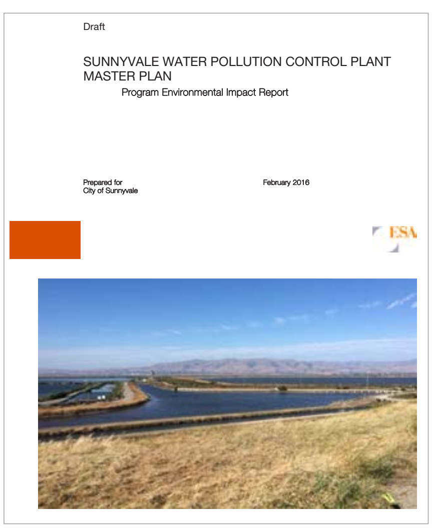
Membranes in an example MBR facility

Stakeholder Involvement and the Program Environmental Impact Report (PEIR)

Potential environmental impacts of both implementations are analyzed in the Program Environmental Impact Report (PEIR), pursuant to the California Environmental Quality Act (CEQA). The purpose of a PEIR is to provide public agencies and the public with detailed information about the effects and cumulative impacts which a series of proposed activities are likely to have on the environment. Beyond identifying environmental impacts, a PEIR also identifies ways to mitigate those impacts. The PEIR process provides for technical study of a variety of environmental issues, as well as public input and participation. The City has hosted open houses, conducted tours, published newsletter articles, and established a website to communicate these changes to the public. In addition, the SCVWD is engaged in extensive outreach efforts related to potable reuse planning highlighting the regional efforts to boost water supplies, including the WPF alternative at the Sunnyvale WPCP.



CEQA Process for Program EIR (PEIR)



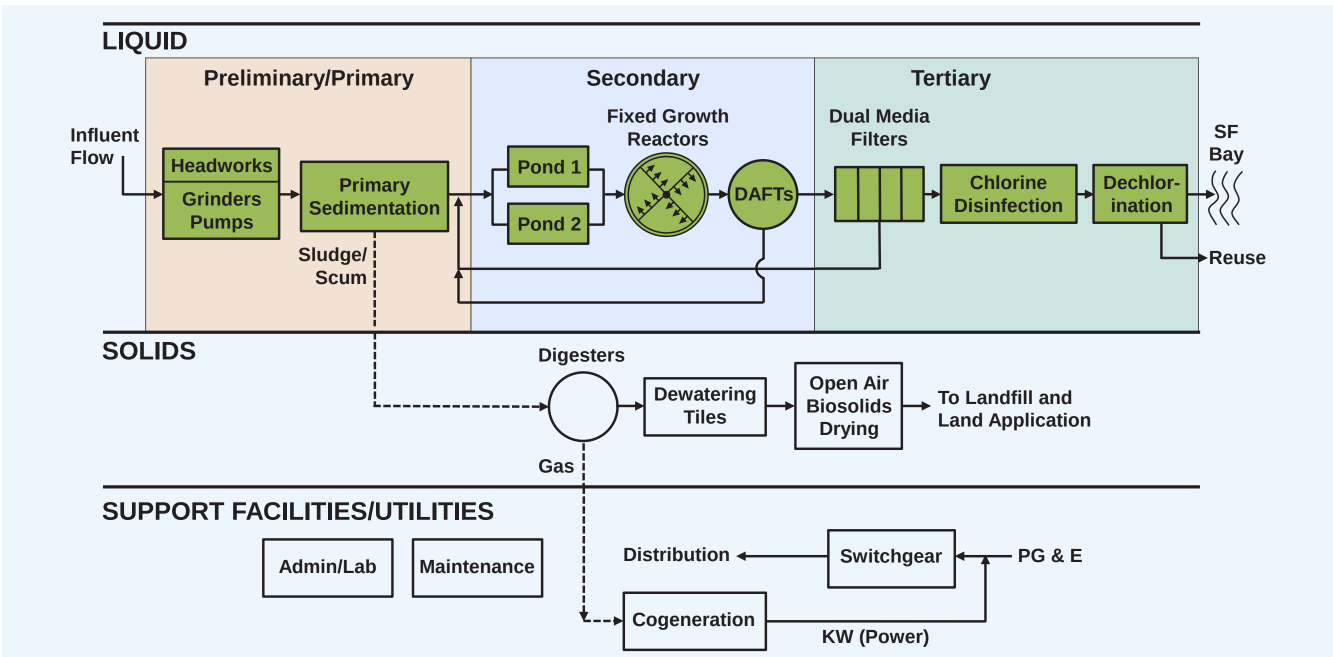
STAKEHOLDER INVOLVEMENT

Throughout the master planning and PEIR process, the City has worked collaboratively with the public and other agencies in the region. The City presented an overview of the improvements to the Regional Water Quality Control Board in 2014 and the State Water Resources Control Board in 2015. Santa Clara Valley Water District has partnered with the City on a possible alternative that would allow them to inject purified effluent into their aquifer to be reused as drinking water.

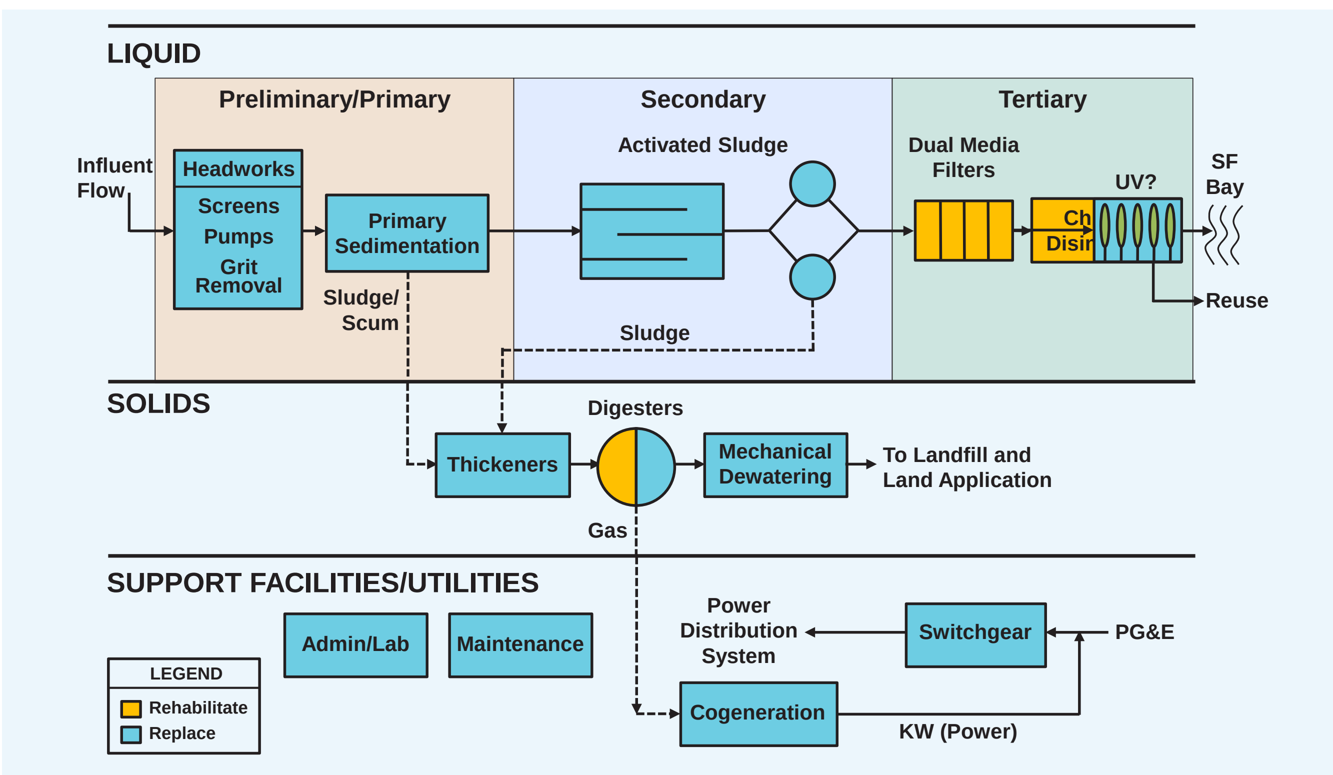
The Water Pollution Control Plant Transformation

The master planning process concludes with a roadmap for two Capital Improvement Programs (CIPs): CAS and MBR. These CIPs define projects, their schedules, costs, and linkages with other projects within the program.

If SCVWD commits to provide funding for the MBR option, the MBR CIP will be implemented. Otherwise, the CAS CIP will be implemented.



Existing WPCP Flow Schematic



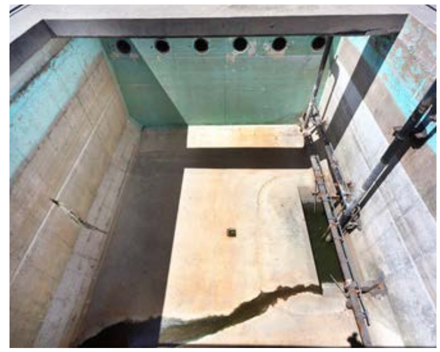
Proposed WPCP Flow Schematic

Project Drivers

The projects identified in the Master Plan were developed in response to five drivers: Condition, Economic Savings, Regulations, Policy Decisions, and Flows & Loads. In many cases, a project may be triggered by more than one driver.

1. Condition

Aging infrastructure is the most urgent challenge facing the WPCP today. Projects with a Condition trigger will be implemented as facilities reach the end of their useful life. For example, the primary treatment facility and the primary effluent pipeline are past the end of their economic life. Extensive repairs to air floatation tanks (AFTs) were completed in 2015. Other components of the secondary and tertiary treatment processes have been gradually deteriorating. Implementing the split-flow CAS concept means many elements of these treatment processes will stay in service longer than if the WPCP converted to CAS all at once. To get the most of the existing equipment and facilities, an additional condition assessment will be conducted in 2017 to confirm which assets need to be rehabilitated or replaced.



Older structures show signs of deterioration

2. Economic Savings

Projects with an Economic Savings trigger will be implemented when doing so can reduce operating and maintenance costs sufficiently to offset the capital cost of the project. By recovering resources that would otherwise be eliminated as waste, the WPCP is able to save money and function more sustainably. For example, upgrading the cogeneration facility with modern equipment will reduce maintenance costs and increase the efficiency of heat and power generation. In addition to the hot water needed for plumbing, the WPCP has four large tanks (digesters) that must be kept around 95°F so the bacteria that treat sludge can thrive. Without its own means of generating heat and power, the WPCP's utility bill would be very high.

Modern cogeneration engines efficiently convert biogas to heat and power

3. Regulations

The Regional Water Quality Control Board (RWQCB) regulates discharges into the Bay through NPDES permits. Every five years, the WPCP must obtain a permit renewal. The quality of recycled water, treated biosolids, and air emissions are similarly regulated. Additionally, the WPCP is required to protect all facilities from earthquakes and flooding.

There is a general trend toward increasing regulatory stringency over time. The Master Plan anticipates tightening regulations so the City can prepare for change. Projects with a Regulations trigger will be implemented in time to comply with new regulations.

Corroded equipment needs replacement

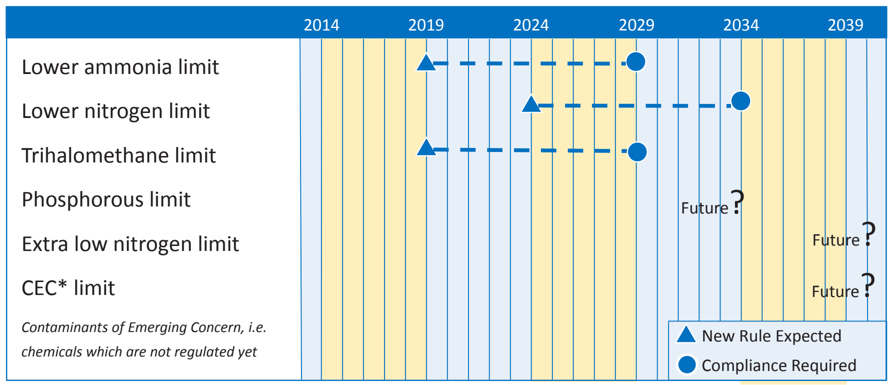
SEA LEVEL RISE AND FLOOD RISKS AT THE WPCP

Global warming is expected to raise the Bay by up to two feet in the 21st century. The WPCP was not built to withstand sea level rise. Protection of inland properties is addressed at a regional level in the South San Francisco Bay Shoreline Study, which will define long-term alternatives around the South Bay.

Meanwhile, efforts are underway to fortify the WPCP against the flood risk it faces today. The primary treatment facility upgrade includes a perimeter wall to protect the WPCP from tidal flooding. Also, SCVWD is completing design of flood walls along West Channel, which will prevent water from overflowing its banks during storms.

4. Policy Decision

The policy direction of the WPCP is to provide sustainable stewardship of land and resources while controlling customers' rates. By capitalizing on new technology and partnering with local businesses and other agencies, the WPCP can be repurposed as a resource recovery center that delivers more than wastewater treatment. Projects with a Policy Decision trigger will be implemented when opportunities are available to further community goals, such as restoration of salt marsh habitat, protection from sea level rise, increased supply of recycled water, and enhancement of recreational access.



New rules will trigger the implementation of projects that enable the WPCP to achieve lower limits before the compliance deadline.

5. Flows & Loads

The permitted capacity of the WPCP is 29.5 MGD, which is greater than projected future flows. Current average flows are around 12 MGD. The phased implementation of CAS means that the WPCP would initially be able to treat 17 MGD to a higher standard, and any excess would be treated by the existing ponds. If future standards necessitate treating all flow by CAS, flows are expected to exceed 17 MGD, and/or the existing secondary treatment facilities are failing, then CAS would be modularly expanded to increase its capacity.

Furthermore, the amount of solid material carried into the WPCP and the additional mass of microorganisms coming out of the CAS will eventually necessitate a fifth digester. Projects with a Flows & Loads trigger add more units to treatment processes which may require an increase in capacity.

Specific Improvements

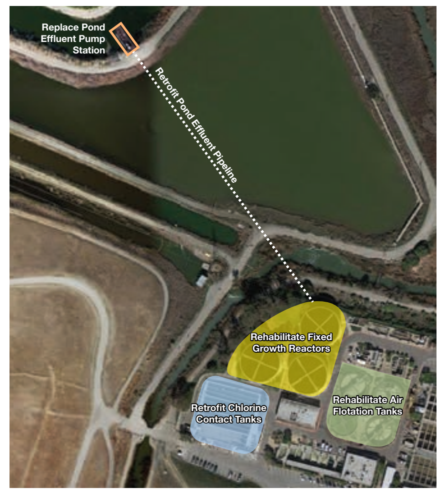
Over the next 30 years, almost every process and building in the WPCP will be rehabilitated or replaced. This will be accomplished through up to 35 individual projects, each including several major elements and some involving multiple facilities.

The WPCP today, and the WPCP after the Master Plan is implemented, is shown schematically in the diagrams below. For at least a decade during the transformation, both the existing and the new secondary treatment facilities will run in parallel, should the City proceed with the split-flow CAS implementation.

Existing pipelines are corroded

Rehabilitation of Existing Facilities

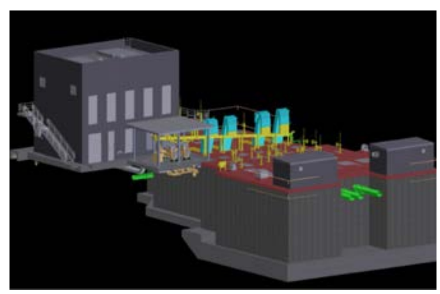
Next year, the City will perform an assessment to determine the repairs and replacements needed to keep secondary and tertiary treatment facilities operating in a split flow configuration for up to 20 years. Assessment of the pipeline from the primary treatment facility to the ponds has already been conducted. The pipeline is corroded, but not severely enough to require complete replacement. The pipeline can be rehabilitated in place. Rehabilitation of the tertiary, disinfection, and anaerobic digestion facilities are also anticipated. The extent of rehabilitation varies for each component based on its current condition and the expected life prior to replacement.



Planned Rehab Activities

New Primary Treatment Facilities

The primary treatment facilities are now 60 years old. The controls are outdated, the structures may not be able to withstand current earthquakes, the engines are no longer allowed by air quality regulations, bits of concrete are chipping off, and metal parts are rusted. Due to this extensive deterioration, construction of a new facility is already underway under a separate project that aligns with the goals and objectives of the Master Plan. The new facility will feature electric pumps, screenings/grit handling, odor control, and six primary sedimentation tanks.



Rendering of New Primary Treatment Facilities

ODOR CONTROL AT THE WPCP

The WPCP does not have any equipment specifically used to control odor. Although no complaints have been received, City staff wish to plan ahead for odor control, so the WPCP can continue to be a good neighbor and avoid sanctions.

Odor control at treatment plants is typically accomplished by ventilating air through "bioscrubbers," i.e. towers which house bacteria that consume and neutralize sulfurous gases. The Master Plan makes provisions for odor control equipment at primary treatment and solids handling facilities, where odors are most likely to be a concern.

When they are no longer needed to treat wastewater, Ponds 1 and 2 may be restored as salt marshes.

The ponds can provide habitat for protected species like the salt marsh harvest mouse.

New Secondary Treatment Facilities (CAS)

CAS will replace the ponds, fixed growth reactors, and AFTs as the main method to provide secondary treatment. During periods of higher flows, the existing ponds and associated facilities will continue to be used in a "split flow mode." When this is no longer adequate, the CAS facility will be expanded and the current secondary facilities will be demolished.

Although they are not optimal for treatment, the ponds have the advantage of being able to store wastewater during peak inflow and then steadily release it back to the plant. Without storage, a sewage plant has to be large enough to treat the wastewater as fast as it enters from the sewer. A plant that is able to equalize its flows can perform just as effectively with smaller facilities. Also, equipment lasts longer because

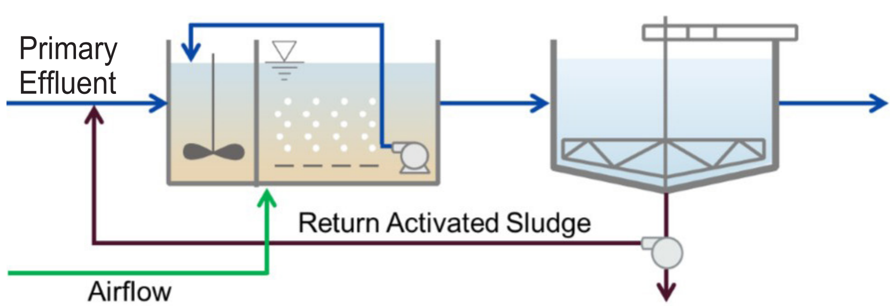


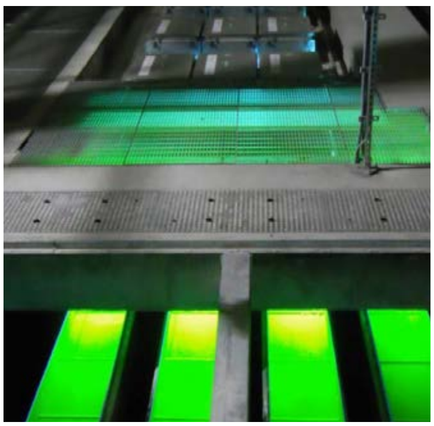
Diagram of Secondary Treatment

Future facilities may include Denitrification Filters

it is protected from overloading. When the ponds are decommissioned, their storage will be replaced by smaller circular concrete tanks in the same vicinity as the ponds. These tanks would store up to one day's worth of wastewater.

New Tertiary Treatment Facilities

A new building with updated electrical equipment, instrumentation, and controls will be constructed for the tertiary treatment facilities. With some repairs, these treatment facilities are expected to continue working into the 2030s. The chlorine contact tanks, built in 1978, may eventually be replaced with ultraviolet (UV) disinfection. With this technology, wastewater slowly flows past lamps that emit UV rays, killing almost all bacteria. Depending on the timing of future effluent limits and increasing demand for recycled water, the existing filters may also ultimately be replaced with more sophisticated equipment.



Example of UV treatment

New Solids Handling Facilities

Once new secondary treatment facilities are constructed, a thickening and dewatering facility will be needed to handle the additional solid material generated. Solids handling equipment will be housed in a new building and the ventilated air will be treated by an odor control system prior to discharge to the atmosphere. When the new solids handling system is completed, Sunnyvale will no longer have to engage an outside vendor to perform this function.

Power, Automation, and Heating Upgrades

Rotary drum thickener

The electrical service and distribution system at the WPCP will be upgraded to serve the higher power needs at the new facilities.

Automation equipment will be modernized and standardized, increasing the WPCP's reliability. With better automation equipment, operators will be able to monitor data in real-time and optimize the WPCP's operations and energy usage.

Example cogeneration engine to produce heat and power

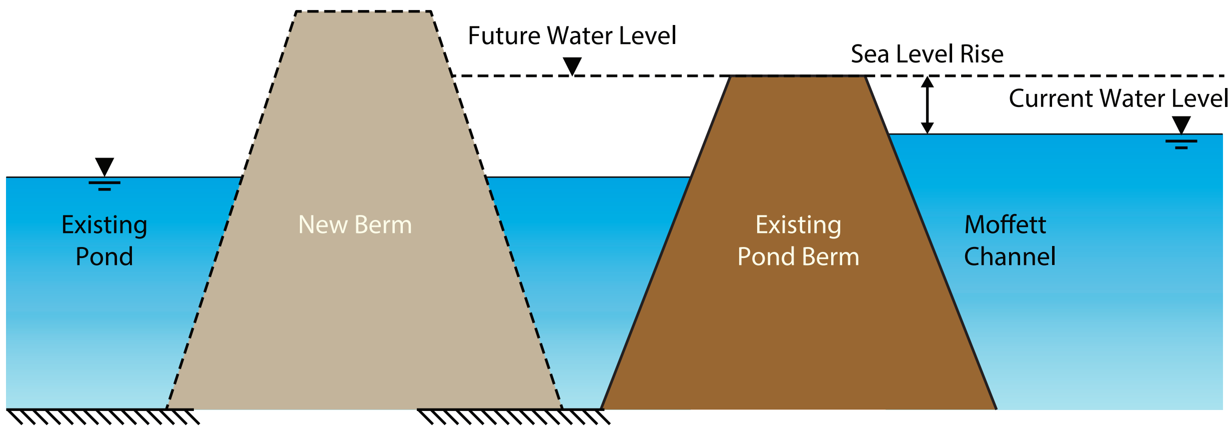
The existing on-site power generation facility will be refurbished, including installation of new engines and replacement of controls, heat recovery equipment, and piping. This system reduces the utility bill, by generating electrical power and hot water used for process heating.

Rotary drum thickener for solids handling

New Support Facilities

A new Administration Building will be constructed on the south side of Carl Road. This building will consolidate several functions under one roof. A new Maintenance Building with shops and storage will be constructed on the site of the existing Administration Building. Public access to the San Francisco Bay Trail will be relocated from Carl Road to Caribbean Drive. This maintains accessibility for recreational users while avoiding conflicts of the public with operations at the WPCP by keeping Carl Road dedicated to deliveries and maintenance vehicles.

Concrete and vinyl sheet walls will be constructed around the WPCP, to protect it from tidal flooding. There will be a retractable floodgate at each access entrance gate. Security fencing and cameras will be included with the perimeter wall. Future parking needs for staff and the public have been assessed and incorporated into the overall site layout.



New Berm Constructed Against Sea Level Rise

Phasing and Cost

The projects are grouped into five phases, correlating with the timing and types of improvements. It is clear that all projects in Phases 1 through 3 will be needed by 2030. The cost for these projects is budgeted at $456 million and includes design, permitting, program management, construction management, and construction. Estimates for future years have been escalated to account for price inflation. Contingencies have been included to manage risk. Since engineering is still at the conceptual stage, these costs are approximate and may shift between projects and fiscal years. Note that the budget does not include operating costs (staff salaries, utilities, chemicals, and other consumables).

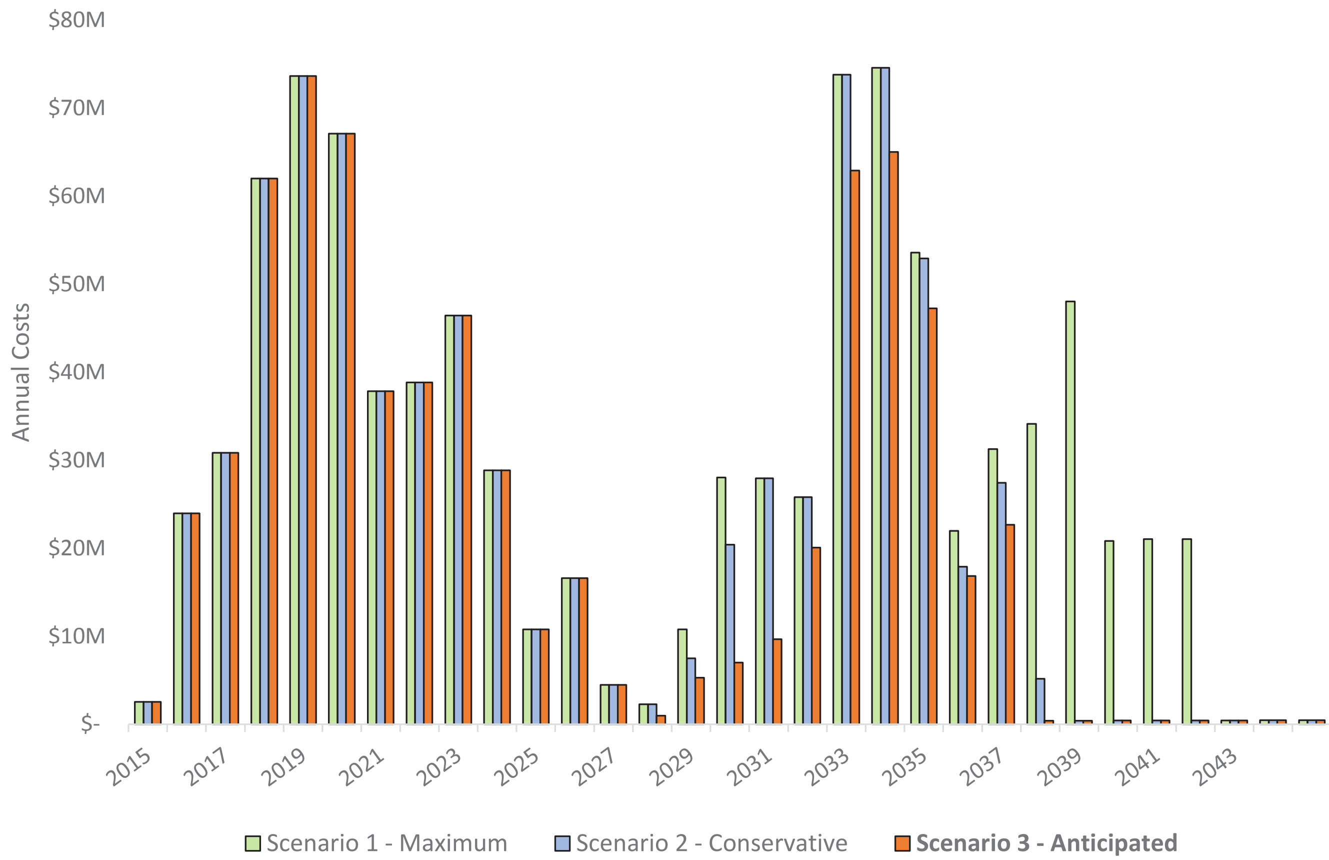
The scope and cost for Phases 4 and 5—transition to full CAS and tertiary treatment upgrades—is less certain. Three potential scenarios are envisioned:

- ❖ Scenario 1 is maximum build-out, driven by the most comprehensive resource recovery and tightest foreseeable regulations;
- ❖ Scenario 2 is still conservative but involves less stringent regulations and lower recycled water demand;
- ❖ Scenario 3 is the least aggressive, assuming a smaller expansion for the transition to full CAS and no need for increased biosolids processing.

At this time, Scenario 3 is most likely. However, this will be reevaluated periodically as part of the City budgeting cycle. Specific project costs and contingencies will also be confirmed as design detail develops for each project through implementation. Current annual cash flow projections are shown on the following page.

WPCP Process	Master Plan Components	2015-2020	2020-2025	2025-2030	2030-2035	2035 +
Secondary	Rehabilitation of Existing Facilities					
	Split Flow Conventional Activated Sludge					
	Air Flotation Tank Pump Station, Pipeline					
	Conventional Activated Sludge					
	Diurnal Equalization, Emergency Storage					
	Chemical Phosphorus Removal					
	Decommissioning of Ponds 1 and 2					
Tertiary	Rehabilitation of Existing Facilities					
	Filter Control Building					
	Chloramine Disinfection					
	Filter Backwash Storage					
	Denitrification Filters					
	Microfiltration					
	Ultraviolet Disinfection					
Solids	Thickening/Dewatering (Stage 1)					
	Digester No. 5					
	Fats, Oils, and Grease Facility					
	Thickening/Dewatering (Stage 2)					
	Biosolids Post-processing					
	Phosphorus Recovery (Struvite)					
Energy	Power Generation Building					
Support	Bay Trail Access Relocation					
	Administration Building					
	Tidal Flood Protection					
	Maintenance Building					

Five Phases of Project Implementation



Forecasted Cost to Implement the Master Plan for CAS Treatment

Conclusion

For 60 years, the WPCP has protected the Bay from pollution and met the needs of a growing population. Due to deteriorating infrastructure, tightening regulations, economic efficiencies, and opportunities to improve stewardship, it is time to start rebuilding what has worked so well. Through a rigorous and collaborative three-year process, the WPCP Master Plan was developed to define the projects necessary to execute this rebuild. Along the way, the City has engaged internal and external stakeholders in outreach for CEQA requirements and regional planning.

The improvements identified include rehabilitation of existing facilities; new primary, secondary, and tertiary treatment facilities; new support facilities; and upgrades to power, automation, and heating. Over the next 20 years, 21 projects with an estimated cost of $456 million must be completed. Beyond that horizon, a range of scenarios are possible. The Master Plan is robust with respect to future uncertainty, so the City can accommodate changes as they occur.