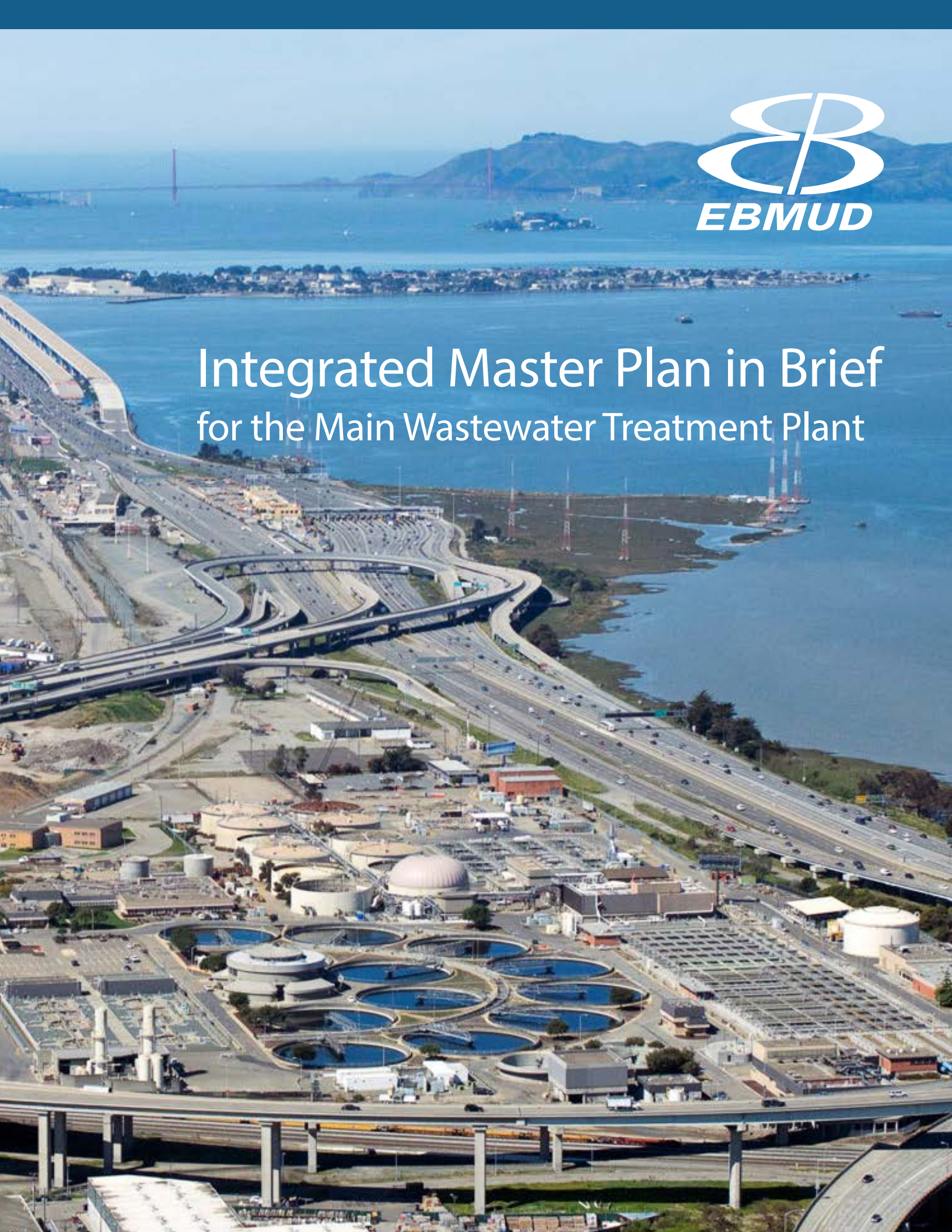




Integrated Master Plan in Brief for the Main Wastewater Treatment Plant



Introduction to EBMUD Wastewater

Since 1951, the East Bay Municipal Utility District (EBMUD) has treated wastewater to protect public health and the San Francisco Bay.

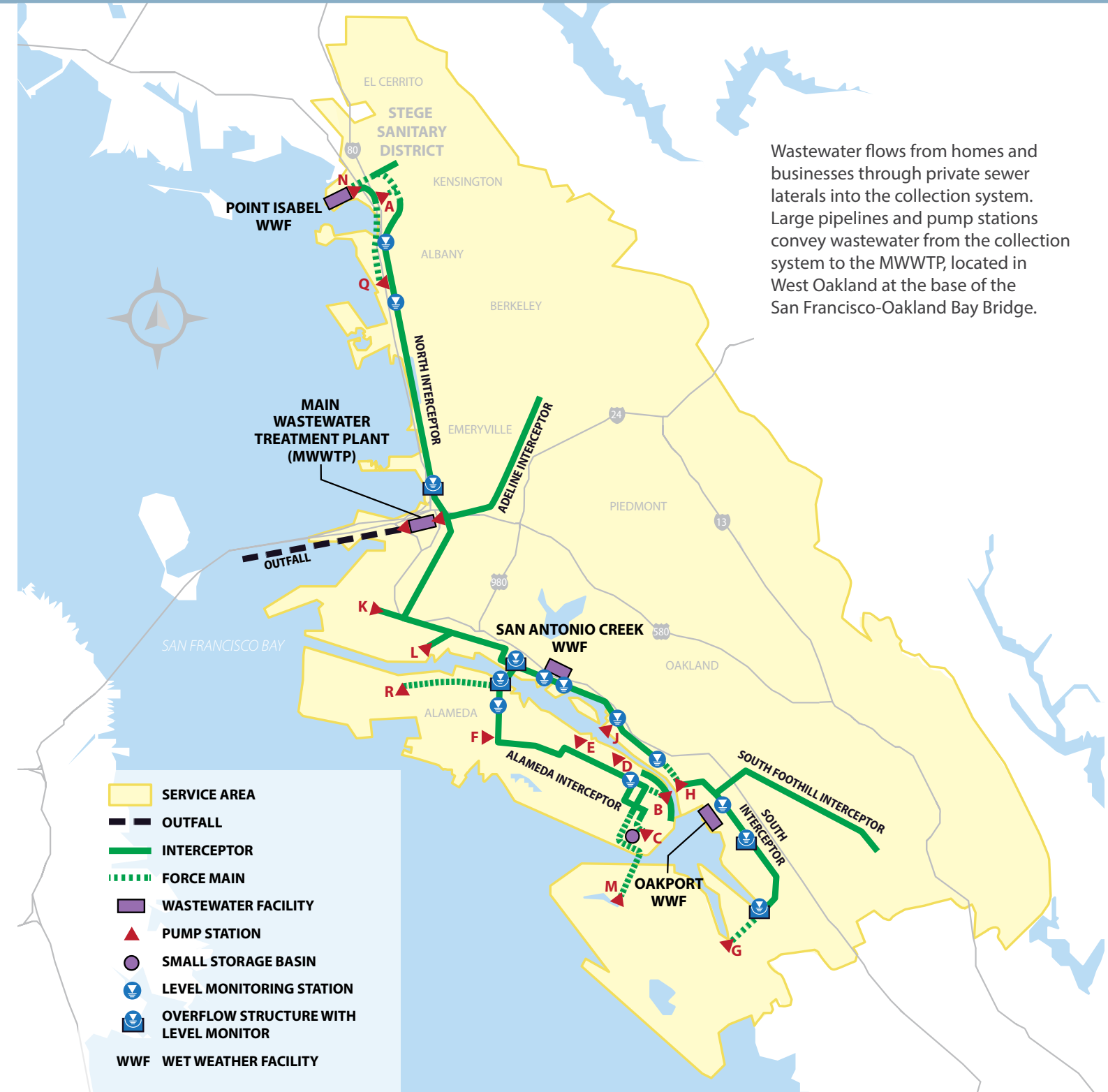
Today, the wastewater service area is home to residents living in seven East Bay communities, including Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont, and Stege Sanitary District (El Cerrito, Kensington, and part of Richmond). EBMUD's wastewater system (pictured on the right) uses gravity sewer interceptors, force mains, and pump stations to convey wastewater to the Main Wastewater Treatment Plant (MWWTP).

The MWWTP contains a variety of types of infrastructure such as administrative buildings, concrete structures, equipment, and piping. Over the past 70 years, major modifications to the MWWTP have been made in response to changing needs and regulations. The MWWTP continues to evolve as the wastewater industry, environmental movement, and communities we serve grow. The Integrated Master Plan for the MWWTP discussed throughout this summary illustrates how EBMUD plans to adapt to the next 30 years of potential changes.

By the Numbers

- 88** Square-Mile Service Area
- 740K** Customers in 2021
- 1,600** Miles of Private Sewer Laterals
- 1,600** Miles of Pipe in the Collection System
- 37** Miles of Large Pipelines (Up to 9 ft in Diameter)
- 15** Pump Stations
- 10** Level Monitoring Stations
- 5** Overflow Structures
- 3** Wet Weather Facilities
- 1** Main Wastewater Treatment Plant

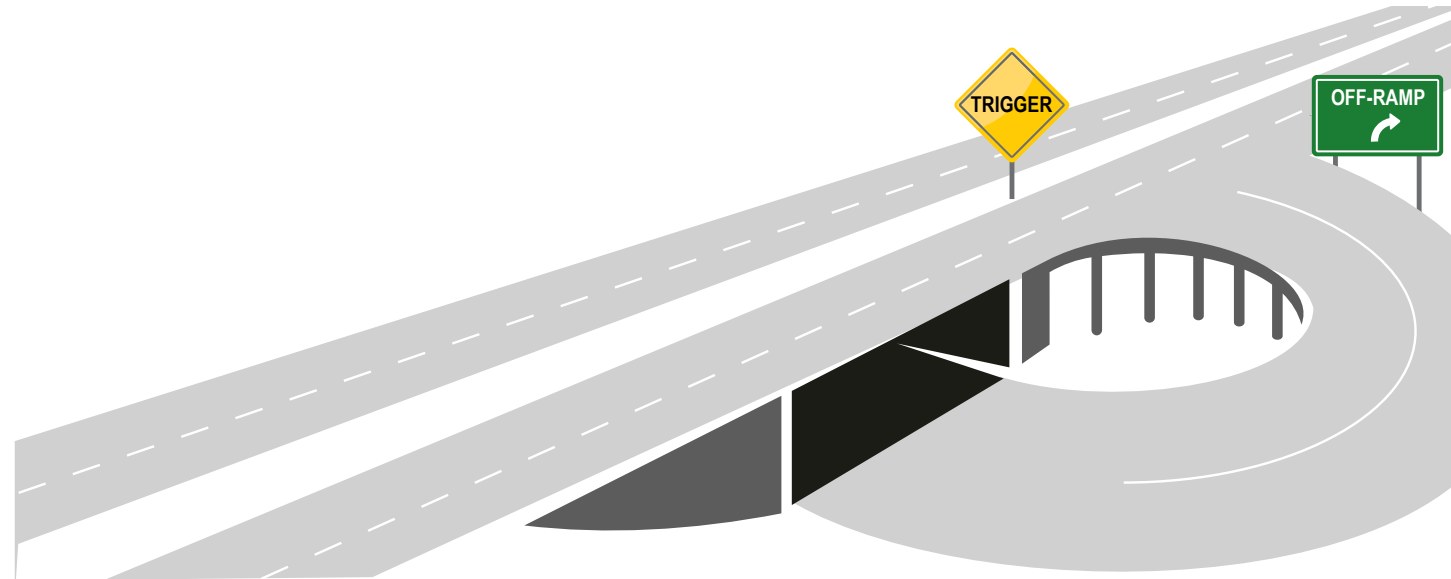
EBMUD COLLECTION AND TREATMENT



Integrated Master Plan for the Main Wastewater Treatment Plant

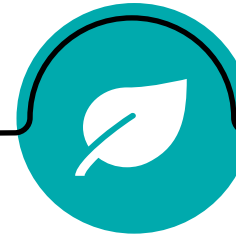
The goal of the Integrated Master Plan is to inform an adaptive 30-year roadmap for EBMUD's capital improvement program (CIP) to proactively manage aging infrastructure, alleviate capacity constraints, prepare for new regulations, and build climate change resiliency.

The concept of a roadmap is figurative to illustrate how current plans can be altered by various triggers, which divert EBMUD's course onto off-ramps. The roadmap is "integrated" because it holistically synthesizes all of EBMUD's competing priorities, while remaining flexible for uncertainties. Accordingly, the roadmap is not a recipe that is ready to be implemented immediately and many next steps are required.



MASTER PLAN GUIDING PRINCIPLES

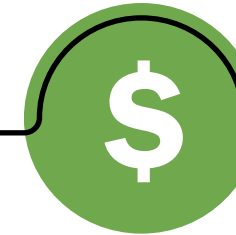
The guiding principles establish a framework for all future planning. Like the North Star, the guiding principles show the direction of our course. The guiding principles are organized in four categories: environmental, financial, social, and technical. The best solutions are synergistic across all four categories.



ENVIRONMENTAL

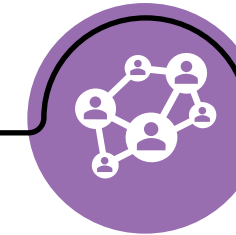
Protect the environment, public health, and safety through reliable wastewater treatment that can proactively meet future regulations and minimize impacts to the local (San Francisco Bay) and global environment.

Promote resource recovery as a sustainable enterprise benefitting the region through responsible waste management and renewable energy generation.



FINANCIAL

Maintain fair and reasonable rates for customers by maximizing economic benefits through operating efficiencies and cost-effective solutions.



SOCIAL

Maintain positive relationships with community groups and minimize adverse community impacts through improved aesthetics, noise abatement, reduced truck traffic, and odor controls.

Maintain a safe and engaging work environment at EBMUD facilities.



TECHNICAL

Maintain reliable wastewater treatment by preserving, implementing, and utilizing assets that provide sufficient treatment capacity and are resilient to changing conditions, both imminent and gradual (e.g., seismic events and sea level rise).



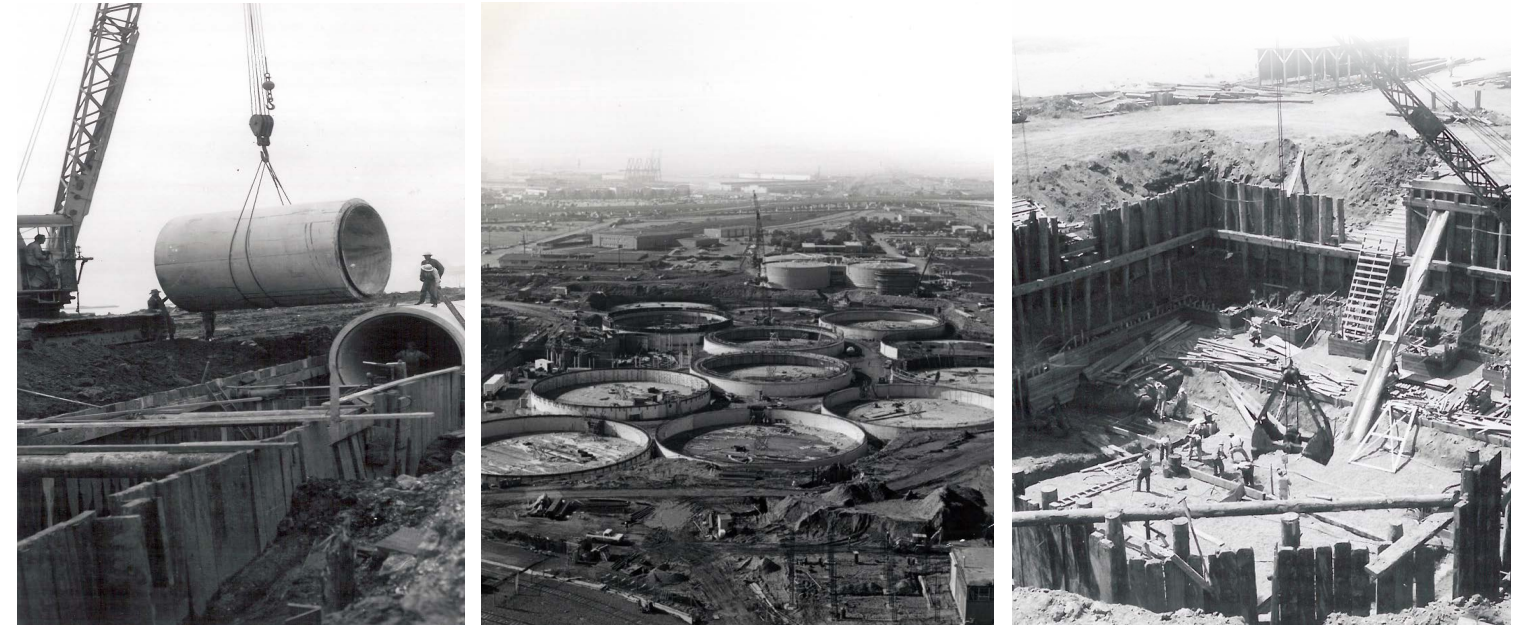
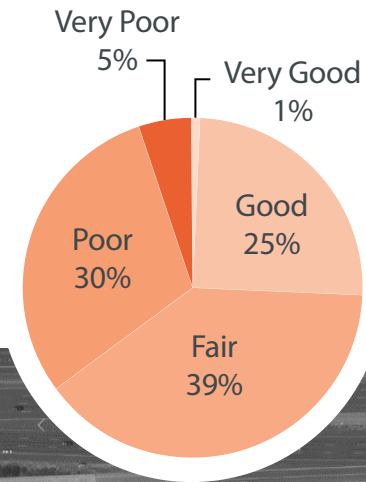
MASTER PLAN DRIVERS

The term “driver” refers to a factor – internal or external – that enacts change. For the Master Plan, four drivers were considered: managing aging infrastructure, alleviating capacity constraints, preparing for new regulations, and building climate change resiliency. Each driver is discussed in more detail below.

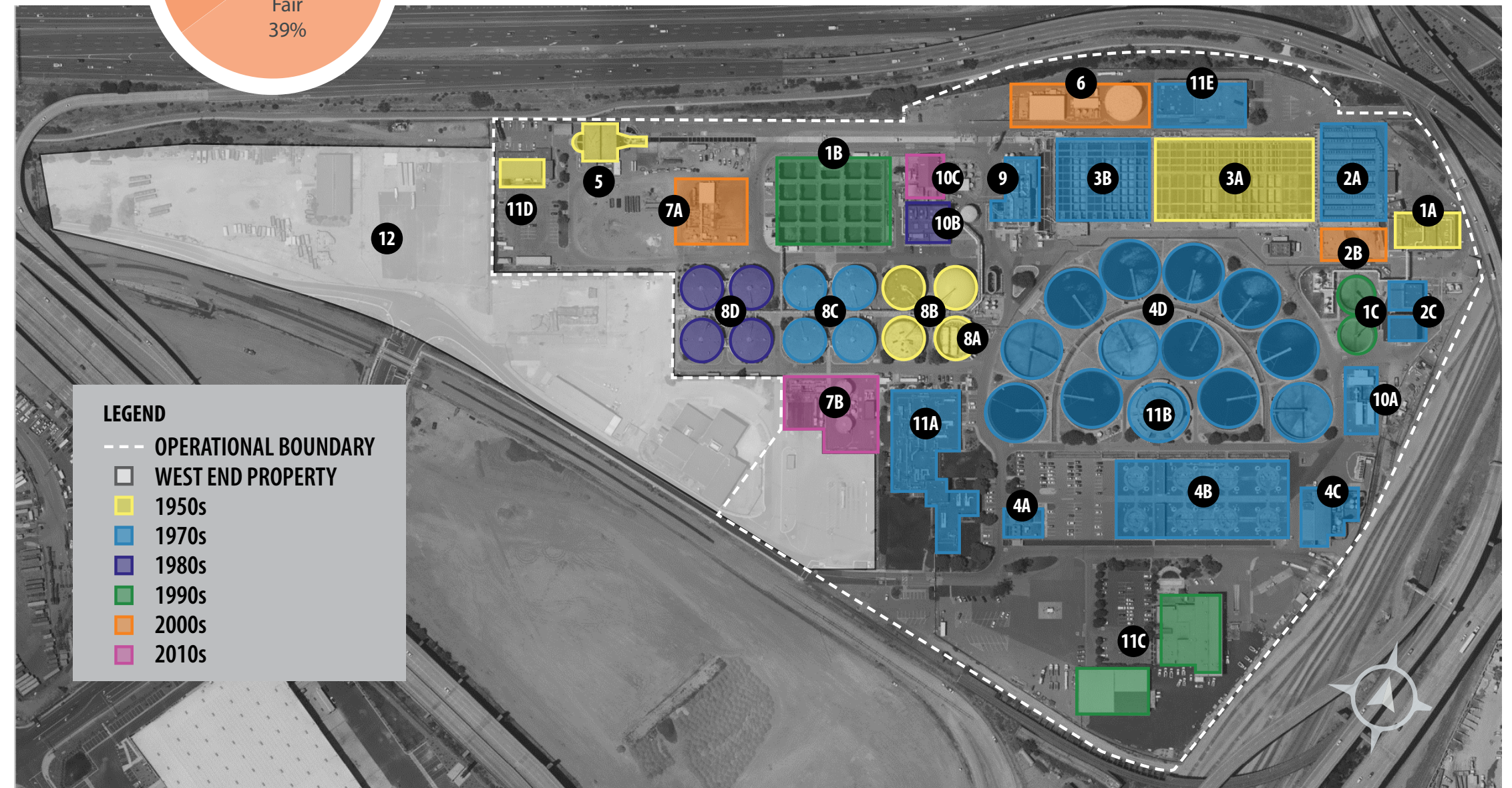
Managing Aging Infrastructure

The MWWTP began operating in 1951, and the majority of facilities were constructed over 40 years ago. To maintain reliable treatment, continued rehabilitation and replacement (R&R) of aging infrastructure is needed across all treatment processes, as well as seismic retrofits for certain facilities. The focus of the Master Plan with respect to aging infrastructure was to ensure that all R&R investments are strategic and no regrets. For example, R&R of aging infrastructure is not prudent if, within a short timeframe, the infrastructure may need to be modified to address a different driver such as a regulatory requirement.

What is the condition of infrastructure at the MWWTP?



1A	INFLUENT PUMP STATION
1B	WET WEATHER STORAGE BASIN
1C	GRAVITY SLUDGE THICKENERS
2A	AERATED GRIT TANKS
2B	VORTEX GRIT TANKS
2C	GRIT DEWATERING
3A	PRIMARY SEDIMENTATION TANKS 1-10
3B	PRIMARY SEDIMENTATION TANKS 11-16
4A	MID-PLANT PUMP STATION
4B	HIGH-PURITY OXYGEN ACTIVATED SLUDGE REACTORS
4C	OXYGEN PRODUCTION PLANT
4D	SECONDARY CLARIFIERS
5	EFFLUENT PUMP STATION
6	EAST BAYSHORE RECYCLED WATER FACILITY
7A	SOLID/LIQUID WASTE RECEIVING STATION
7B	FATS, OILS, AND GREASE RECEIVING STATION AND BLEND TANKS
8A	SODIUM HYPOCHLORITE STORAGE
8B	ANAEROBIC DIGESTERS 2-4
8C	ANAEROBIC DIGESTERS 5-8
8D	ANAEROBIC DIGESTERS 9-12
9	DEWATERING BUILDING
10A	ELECTRICAL SUBSTATION
10B	POWER GENERATION STATION 1
10C	POWER GENERATION STATION 2
11A	ADMINISTRATION AND LABORATORY BUILDING
11B	OPERATIONS CENTER
11C	MAINTENANCE CENTER
11D	FIELD SERVICES BUILDING
11E	OLD MAINTENANCE BUILDING
12	WEST END PROPERTY



Alleviating Capacity Constraints

Capacity refers to the size or throughput of a treatment plant. A treatment plant is said to have sufficient capacity if it can successfully treat the wastewater for a range of expected conditions (flows and composition).

Population growth and wet weather flows are the main factors driving capacity constraints. By 2050, the population in EBMUD's wastewater service area is projected to increase from 740,000 to 1.1 million people. During wet weather, stormwater can enter the wastewater system through old, leaky pipes. EBMUD is collaborating with homeowners and the satellite cities under a Consent Decree to repair private sewer laterals and the collection system.

The Master Plan evaluated whether the existing capacity of treatment processes at the MWWTP is sufficient through 2050, taking into account anticipated growth of both the population and the Resource Recovery program. Some capacity limitations were identified under infrequent circumstances for the influent and effluent pump stations, primary treatment, secondary treatment, blend tanks, waste activated sludge thickening, and dewatering. Projects to mitigate these capacity limitations were identified for the roadmap.



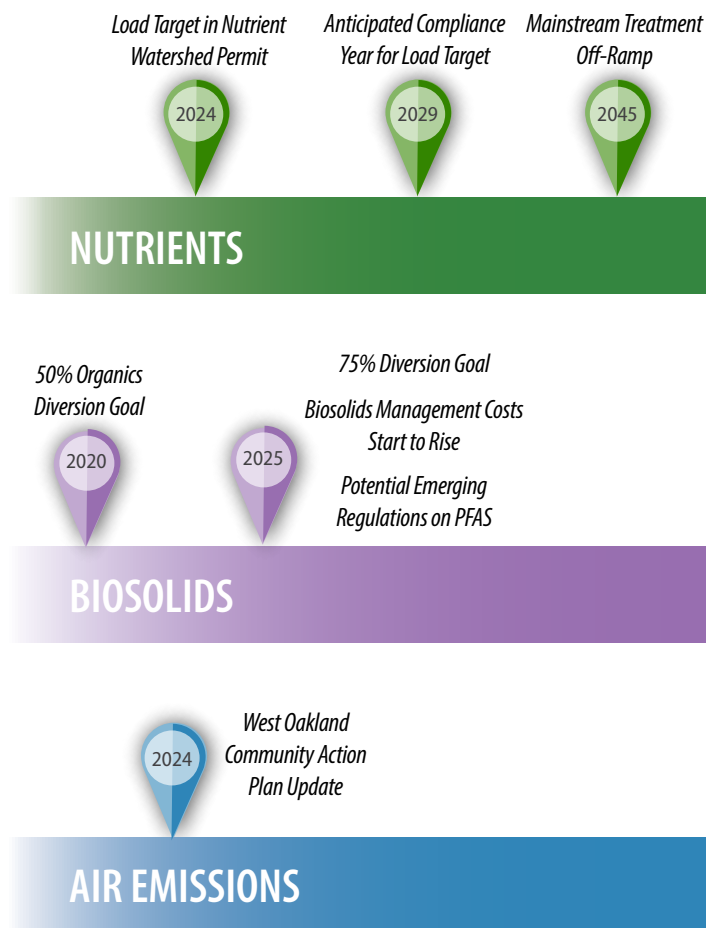
Preparing for New Regulations

New regulations regarding nutrients, biosolids, and air emissions may likely or will emerge within the 30-year planning horizon:

Nutrients: Regional scientific monitoring and modeling studies are being conducted to understand the impact of nutrients on the Bay. Historically, the Bay has not been adversely impacted by nutrient loading even though it is nutrient-enriched compared to other estuaries around the country. Stakeholders throughout the region are working together to better understand this resiliency, and whether it may be threatened in the future. EBMUD provides funding for these studies and collaborates with other Bay stakeholders, including regulators, wastewater agencies, scientists, and non-governmental organizations, to ensure that any future nutrient effluent limits are based on sound science and will improve the water quality of the Bay.

Biosolids: Biosolids are a nutrient-rich byproduct of wastewater treatment. New solid waste regulations limit the end uses of biosolids and have caused economic changes in the market, leading to higher management costs.

Air Emissions: The MWWTP is located in West Oakland, which is a community that has historically been disproportionately impacted by air pollution. New regulations seek to reduce air emissions from all types of industry in the area.

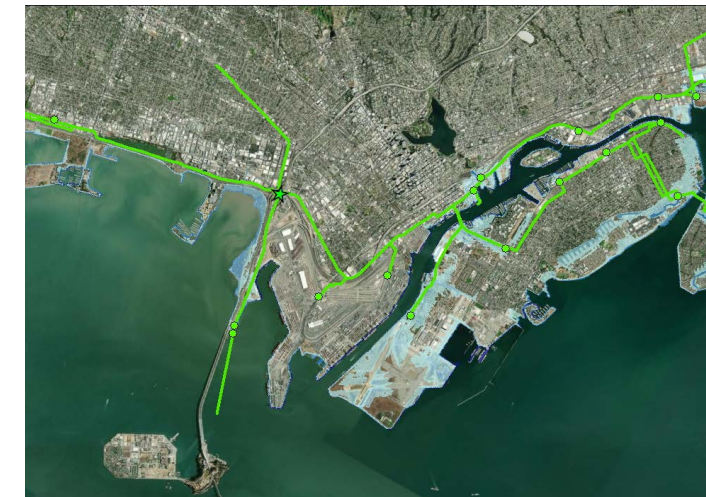


Building Climate Change Resiliency

Climate change resiliency considers both mitigating and adapting to the effects of climate change. For the wastewater system, climate change is considered in four ways:



Reduce Greenhouse Gas (GHG) Emissions: EBMUD has established a goal for the wastewater system to reduce indirect GHG emissions to a net zero increase and to reduce direct GHG emissions by 50% by 2040, compared to 2000 levels. Indirect emissions are a consequence of EBMUD's activities, but occur at sources owned or controlled by another entity. Direct emissions are from sources that are owned or controlled by EBMUD. To help achieve this goal, EBMUD generates its own renewable electricity on-site using energy-rich biogas.



Adapt to Sea Level Rise: EBMUD recognizes the imminent threat of sea level rise and performed a thorough analysis of different scenarios to evaluate the corresponding impacts to wastewater facilities.



Complete the Carbon Cycle: EBMUD promotes the beneficial use of biosolids at farms and compost facilities. Biosolids help with climate change resiliency by sequestering carbon and increasing the water retention capacity of soils.



Create Water Supply with Recycled Water: Recycled water refers to wastewater that undergoes additional treatment so it can be reused for other purposes. EBMUD has established a goal to achieve 20 million gallons per day of recycled water by 2040.



Want to learn more? Read about climate change and recycled water using the links below:

www.ebmud.com/about-us/sustainability/climate-change

www.ebmud.com/water/recycled-water/

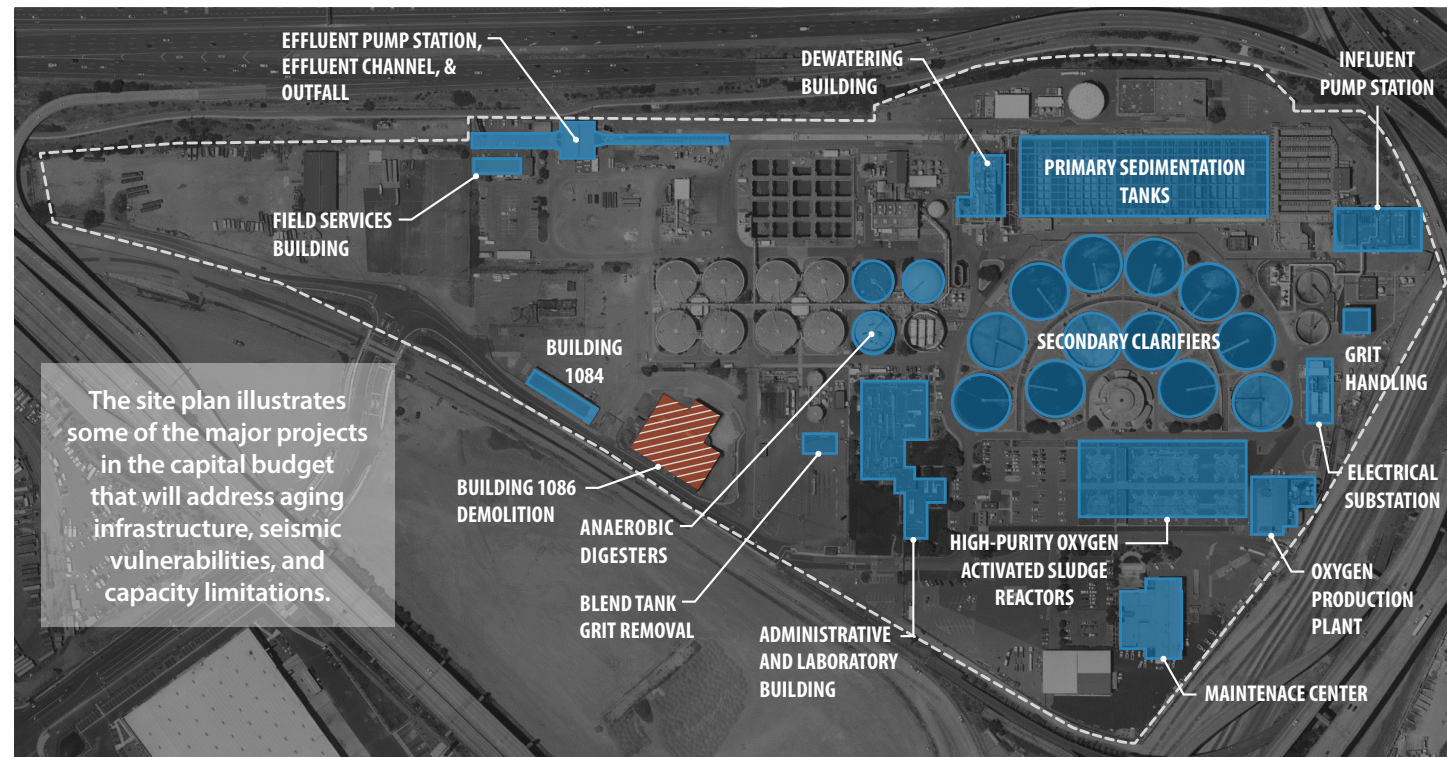
INTEGRATED ROADMAP

The roadmap is comprised of projects that address the Master Plan drivers. The roadmap is integrated because it holistically evaluates the drivers and all of EBMUD's competing priorities, in light of the guiding principles, to find the best synergistic and no-regrets solutions.

Aging Infrastructure

Infrastructure at the MWWTP is aging and in need of continued replacement and rehabilitation. EBMUD conducted a condition assessment and forecasted \$40 million in annual spending on infrastructure renewal over the next 30 years. Infrastructure renewal projects rehabilitate or replace the structures, equipment, piping, and other facilities in their current form and function.

The Fiscal Year 22-31 capital budget includes infrastructure renewal projects for diverse types of infrastructure such as buildings and civil, mechanical, and electrical assets. The capital budget also includes seismic retrofit projects for critical facilities to meet EBMUD's life safety goals.



Climate Change Resiliency

The climate change roadmap incorporates the principles of sustainability and resiliency to mitigate and adapt to the effects of climate change.

Sea Level Rise: EBMUD will continue to implement its climate change design guidelines on capital projects in areas that are vulnerable to sea level rise. Additionally, EBMUD will continue to collaborate with Bay stakeholders to develop regional, win-win solutions.

Greenhouse Gases: The roadmap includes a variety of strategies to minimize emissions at the MWWTP such as reducing nutrient discharges to the Bay, minimizing use of natural gas, and seeking credit for the carbon sequestration value of biosolids.

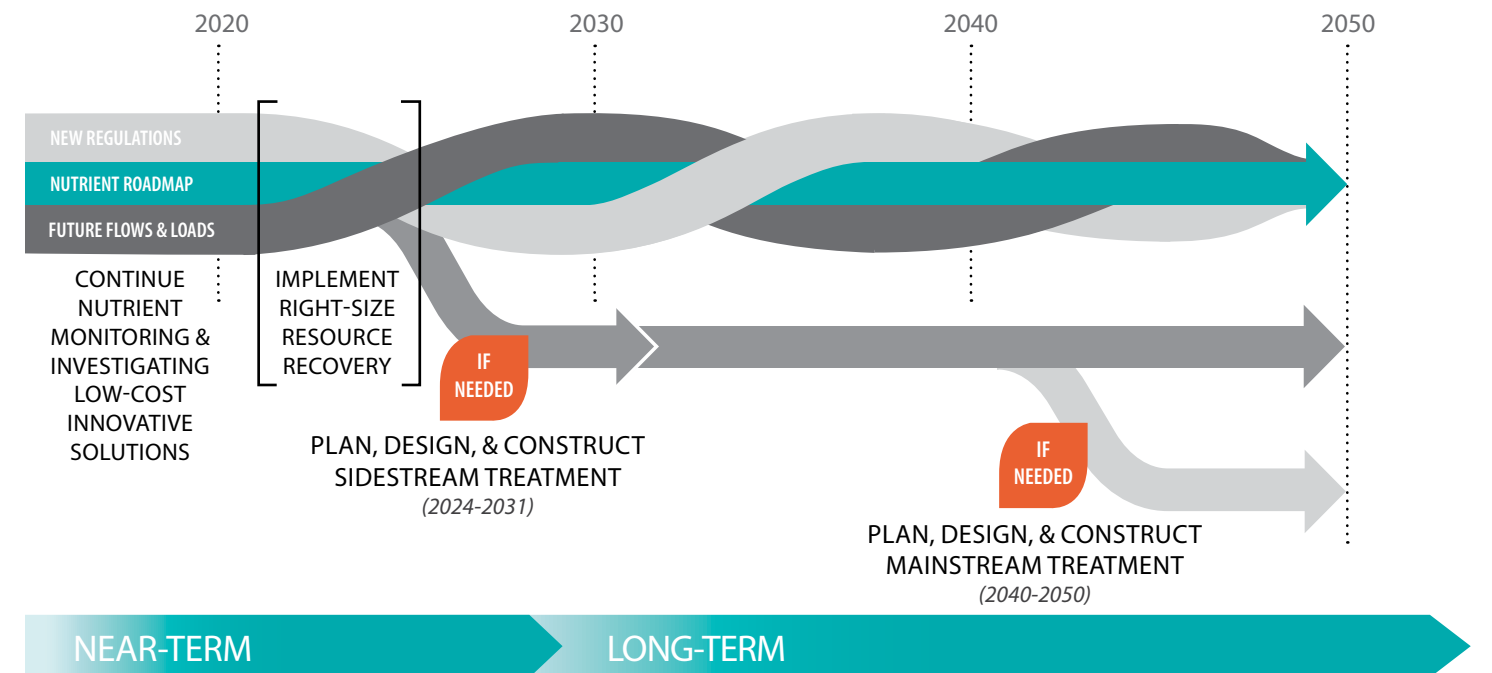
Renewable Energy Generation & Utilization: EBMUD will continue to invest in producing renewable energy on-site to power the MWWTP. The roadmap includes evaluating new potential ways to utilize biogas, as well as switching to 100% renewable diesel.

Recycled Water: EBMUD will continue to implement cost-effective projects to reach its goal of recycling 20 million gallons per day by 2040, as described in the 2019 Recycled Water Master Plan Update.



Nutrients

The nutrient roadmap is flexible for future uncertainties, and has several off-ramps depending on if and how new regulations emerge.



Low-Cost Innovative Solutions: EBMUD will continue to investigate low-cost, innovative nutrient reduction solutions to utilize existing infrastructure and evaluate the need for new infrastructure. For example, EBMUD is currently performing testing of its existing secondary treatment system to evaluate the potential for nitrogen removal under a modified operating configuration.

Right-Size Resource Recovery (R2): Modifications to the R2 program will be implemented to reduce and/or eliminate waste streams that contain high amounts of nitrogen.

Sidestream Treatment: If a nutrient load target is established, sidestream treatment facilities can be considered. Sidestream treatment is efficient and cost-effective because it targets a low-flow stream called centrate that is highly concentrated with nutrients. Centrate refers to the water that is removed during the dewatering step of the solids treatment process. Pilot testing would be necessary to confirm technological feasibility, refine design criteria, and further develop the cost in order to select the best alternative.

Mainstream Treatment: If new regulations ever required stringent removal of nutrients, mainstream treatment facilities would be constructed to treat a portion of or the entire wastewater flow, depending on the extent of the regulation. Of all the projects in the entire Master Plan roadmap, mainstream treatment would be the most expensive and challenging to implement.





Liquid Treatment Facilities

The roadmap identifies projects for pumping systems, primary treatment, and secondary treatment:

Pumping Systems: The near-term roadmap for the Influent and Effluent Pump Stations includes aging infrastructure rehabilitation, seismic rehabilitation, and capacity improvements.

Primary Treatment: The near-term roadmap identifies enhanced primary treatment as a way to improve the capacity of downstream secondary treatment facilities. Additional engineering analysis is required to select the best alternative. In the long-term roadmap, odor control improvements will be further evaluated.

Secondary Treatment: The roadmap includes continued monitoring of the secondary treatment system for capacity limitations. If capacity limitations develop with sufficient frequency, existing facilities may be modified or upgraded. Additional engineering analysis is required to select the best alternative.

Solids Treatment Facilities

The roadmap for solids treatment facilities focuses on the dewatering process, which is a critical step that produces biosolids by removing excess water. The current Dewatering Building was originally constructed in the 1970s and is challenging to operate due to aging infrastructure, capacity constraints, and an overall lack of reliability.

As such, the roadmap includes the planning, design, and construction of a new Dewatering Building, which will be located near the potential sidestream treatment and post-digestion facilities for synergistic benefits. The new Dewatering Building project is divided into two phases. Phase 1 is planned from 2022 to 2029. Based on anticipated population growth, expansion of the new Dewatering Building during Phase 2 is planned from 2040 to 2044.

Biosolids

The near-term roadmap for biosolids is based on a combination of parallel activities, including negotiating longer-term management contracts, monitoring local price trends and markets for beneficial end uses, collaborating on potential new merchant facilities, and further evaluating the feasibility and cost of off-site storage through the 2020s. The long-term roadmap is based on the planning, design, and construction of a new on-site post-digestion facility when biosolids management costs approach a trigger point, which is anticipated in the 2030s. A post-digestion facility would be advantageous because it would open up new end uses, making biosolids management more flexible.

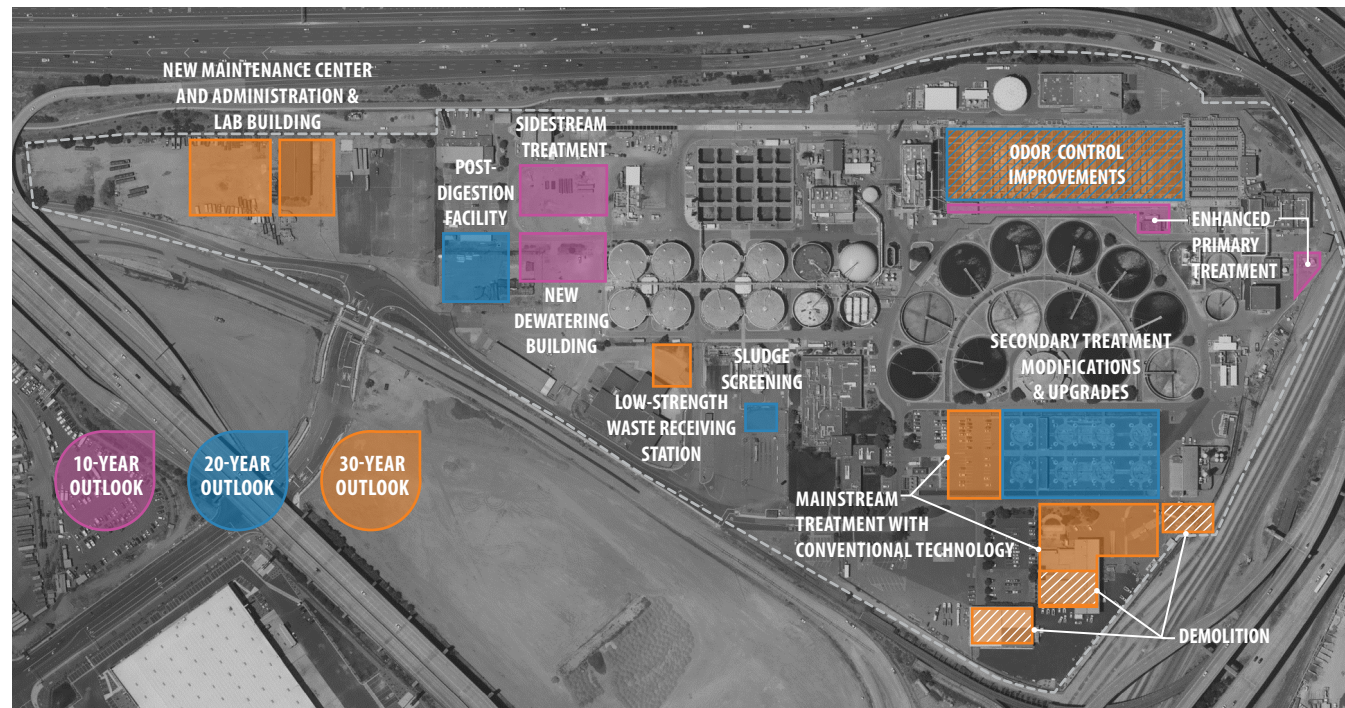
Process Improvements

EBMUD will continue to explore innovative approaches to improving wastewater treatment at the lowest cost to its ratepayers. Projects identified for the roadmap include grit removal enhancements and screening of solids.



SITE PLAN

Site planning for the next 10, 20, and 30 years was a critical component of the Master Plan. One of the key goals was to ensure that enough space is reserved for future potential facilities to address all the drivers. In the site plan below, mainstream treatment to remove nutrients is conservatively assumed to be a conventional technology, which has a large footprint and thus requires existing facilities to be demolished and relocated. Over time, new nutrient removal technologies with compact footprints may emerge, allowing for further optimization of the site plan.



NEXT STEPS

The roadmap is based on a set of assumptions that were developed with the best information available today. These assumptions must be tracked and re-evaluated as new information becomes available. Prior to implementing capital projects, detailed engineering analyses are required during project planning to confirm and refine the analyses performed as part of this Master Plan. Furthermore, new technologies and approaches to wastewater treatment are expected to emerge over time, and new analyses will be required to inform decision making.

KEY TAKEAWAYS

- 1 EBMUD is an industry leader in wastewater treatment, resource recovery, and environmental stewardship.
- 2 EBMUD is proactively addressing the four Master Plan drivers: managing aging infrastructure, alleviating capacity constraints, preparing for new regulations, and building climate change resiliency.
- 3 Significant spending will be required in the near- and long-term future to address the drivers.

“As a public agency, we are committed to providing high-quality service at fair and reasonable rates. As such, all our financial decisions must be transparent and in the best interest of serving our community while achieving our mission. As we implement projects identified in the Master Plan roadmap, we are committed to ensuring that we make no-regrets investments in our infrastructure.”

- Eileen M. White, Director of Wastewater

COLLABORATION

EBMUD actively participates at the local, state, and national levels with regulatory agencies, publicly owned treatment works, professional organizations, and research institutions to protect public health and the Bay.

At local the level, EBMUD collaborates with our regional wastewater collection system agencies (Cities of Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont, and Stege Sanitary District), San Francisco Bay Regional Water Quality Control Board, Bay Area Clean Water Agencies, San Francisco Estuary Institute, Baykeeper, Bay Area Climate Adaptation Network, San Francisco Bay Conservation and Development Commission, Bay Planning Coalition, Bay Area Biosolids Coalition, Alameda County Department of Public Health, Bay Area Air Quality Management District, West Oakland community, and other organizations.

At the state and national levels, EBMUD collaborates with the California Association of Sanitation Agencies, National Association of Clean Water Agencies, State Water Resources Control Board, U.S. Geological Survey, and U.S. Environmental Protection Agency.





375 11th Street
Oakland, CA 94607
1-866-40-EBMUD
ebmud.com

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