



WEST BASIN MUNICIPAL WATER DISTRICT
EXECUTIVE SUMMARY

RECYCLED WATER MASTER PLAN

MARCH 2021



PREPARED BY:



Leading the Way for 30 Years

The West Basin Municipal Water District (West Basin) has been a leader in producing recycled water for its customers since the mid-1990s. Starting with establishing the agreement with the Los Angeles Bureau of Sanitation (LASAN) in 1991 to deliver treated effluent from the Hyperion Water Reclamation Plant (HWRP) to building the necessary infrastructure to West Basin to delivering nearly 250 billion gallons of recycled water to customers, West Basin has been a model for other regional, national, and international water agencies.

West Basin now delivers an average of 35 million gallons per day (MGD) in five different types of customer specific water, including:

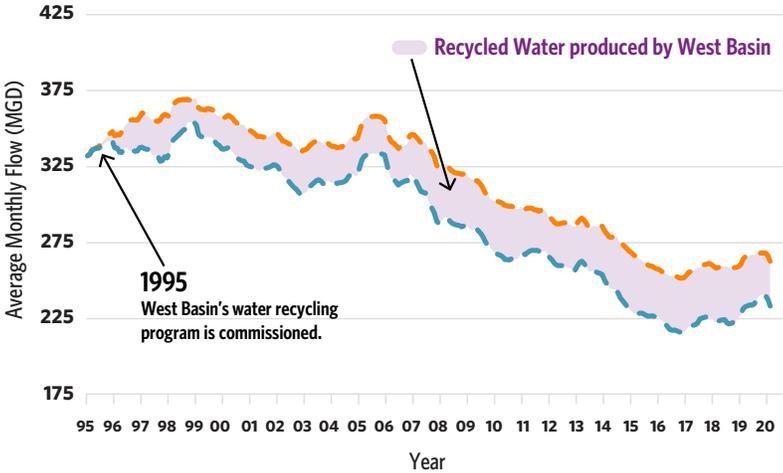
- Title 22 (Irrigation) Water
- Nitrified Water for Industrial Cooling Towers
- Single Pass Reverse Osmosis (RO) Low Pressure Boiler Feed
- Double Pass RO High Pressure Boiler Feed
- West Coast Barrier Feed/Groundwater Augmentation

The West Basin recycled water system now includes the largest recycled water treatment facility of it's kind at the Edward C. Little Water Recycling Facility (ECLWRF). The ECLWRF is recognized as a "National Center for Water Treatment Technology" with the ability to provide 100% of the recycled water supply to the seawater barrier for the West Coast Groundwater Basin.

Contents

Introduction	page 01
Existing System	page 05
Achieving West Basin's Goals	page 06
Recycled Water Master Plan Process	page 07
Key Findings	page 07
Capital Improvement Plan	page 13
Road Map for Potential Expansion and Next Steps	page 14

SINCE 1995, WEST BASIN'S RECYCLED WATER PROGRAM HAS SUCCESSFULLY DIVERTED NEARLY 250 BILLION GALLONS OF WASTEWATER EFFLUENT FROM DISPOSAL INTO SANTA MONICA BAY.



— Hyperion Influent, Average Monthly Flow in MGD
— Hyperion Five Mile Outfall to Bay, Average Monthly Flow in MGD



Updating the Recycled Water Master Plan

The last Recycled Water Master Plan was developed in 2009. A lot has changed in the last 12 years including:

- Revisions to State of California Potable Reuse Regulations
- The City of Los Angeles Hyperion 2035 & Operation NEXT Programs
- The Metropolitan District of Southern California (MWD) Recycled Water Program
- The Los Angeles Basin Groundwater Adjudication in 2014
- Expansions to the West Basin Recycled Water System

TECHNICAL MEMORANDUMS

The 2021 Recycled Water Master Plan is comprised of ten Technical Memorandums (TM). This Executive Summary provides an overview of the work that was performed.

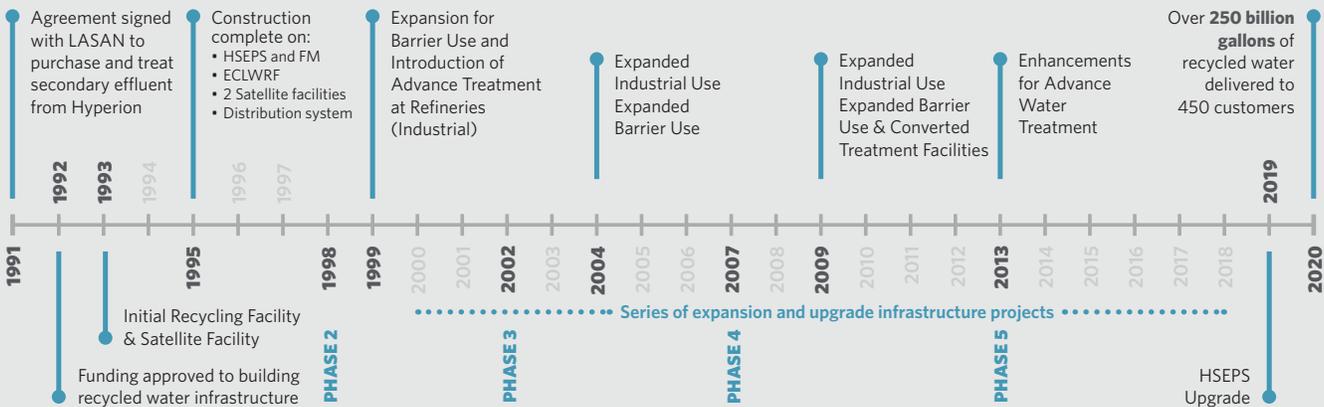
- **TM 1** Recycled Water Demand Analysis
- **TM 2** Existing Treatment Plant Evaluation
- **TM 3** Future Phased Treatment Plant Evaluation
- **TM 4** Regulatory Requirements and Planning Criteria
- **TM 5** Hydraulic Model Calibration Plan and Calibration Findings
- **TM 6** Existing System R&R Program
- **TM 7** Operational Reliability, Water Quality and Criticality Analysis
- **TM 8** Hyperion Pump Station Analysis
- **TM 9** Future System Evaluation
- **TM 10** Capital Improvement Plan

ADAPTIVE TOOLS

In addition to the TMs listed above, four adaptive tools were developed for West Basin including:

- **Recycled Water Customer Database**
- **Hydraulic Model/GIS Updates**
- **Pipe Criticality Model**
- **EconH2O Capital Improvement Program Model**

West Basin Recycled Water Program Timeline



ECLWRF

- ✓ **Largest recycling facility** of its kind
- ✓ **Recognized** as a "National Center for Water Treatment Technology"
- ✓ **Provides 100% of water supply** to the West Coast Seawater Intrusion Barrier (Barrier)
- ✓ **Could double capacity** in next 20 years to 70 mgd

Existing Recycled Water System

THE LARGEST RECYCLED WATER SYSTEM OF ITS KIND

The West Basin recycled water system is comprised of the following key facilities:

THE HYPERION SECONDARY EFFLUENT PUMP STATION (HSEPS) & FORCE MAIN

The HSEPS, located at the HWRP, pumps treated secondary effluent through a 60-inch diameter force main to the ECLWRF.

ECLWRF

ECLWRF has two primary treatment processes that allow the facility to meet all current system demands and types of recycled water. The Title 22 (irrigation) water process has a capacity of 40 MGD while the Barrier system has the capacity to provide over 17 MGD of advanced treated water for use in the West Coast seawater intrusion barrier system.

RECYCLED WATER SYSTEM

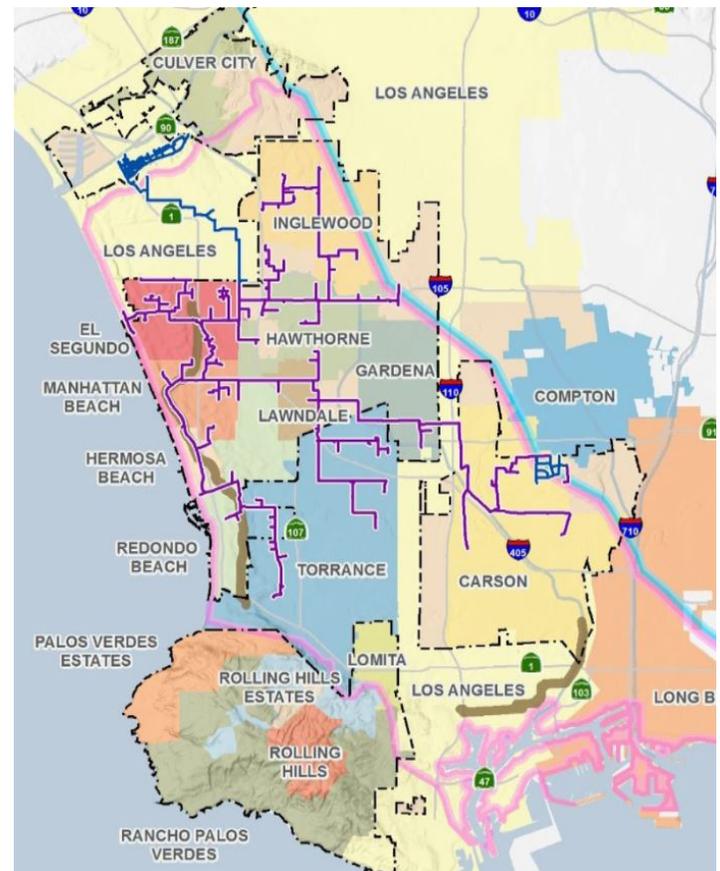
West Basin's recycled water system includes over 100 miles of pipelines that deliver treated water from the ECLWRF to non-potable irrigation customers, the seawater intrusion barrier system, and to three satellite treatment facilities.

SATELLITE TREATMENT PLANTS

The Title 22 water treated at the ECLWRF is pumped through the distribution system to satellite facilities to the Chevron Nitrification Treatment Plant (CNTP), the Torrance Refinery Water Reclamation Plant (TRWRP) and the Juanita Millender-McDonald Carson Regional Water Reclamation Plant (JMMCRWRP). These facilities use the Title 22 water to meet the required designer water needs for the industrial customers in those areas.

The map to the right shows the location of key facilities and configuration of the distribution system. As part of the Recycled Water Master Plan update, the team performed extensive investigations of these systems to evaluate current operating conditions and the potential for expansion.

FUTURE REGIONAL POTABLE REUSE PROJECTS



WEST BASIN SERVICE AREA AND EXISTING SYSTEM INFRASTRUCTURE

Achieving West Basin's Goals

West Basin identified six key goals and objectives to be achieved through the Recycled Water Master Plan Update.

Expanding Potable Reuse Through Regional Coordination

As West Basin considers how to move forward with maximizing recycled water use, it will be important to understand how other regional water agencies, such as LASAN, LADWP, WRD, and MWD are advancing their recycled water programs, as shown on the figure to the left.

LASAN and LADWP are working on combined program to provide advanced treated water from HWRP for both indirect and future direct potable reuse.

MWD is working with the LA County Sanitation Districts (LACSD) to construct a recycled water program that also includes indirect and future direct potable reuse.

Coordination with these agencies and WRD will be critical along with leaning on lessons learned from the Orange County Water District's Groundwater Replenishment System (GWRS), which has been operational since the 1990's.

The 2014 adjudication of the LA Groundwater Basin was significant as it now allows for groundwater augmentation using recycled water. WRD is taking advantage of this major change in advancing its plans for supplementing water supply in the West Coast Basin.



COLLABORATION. In order for the Recycled Water Master Plan to be ultimately successful, it was very important to develop collaboration with the surrounding community and interested stakeholders. To that end, meetings with key stakeholders were conducted to gain input.



REGULATORY FORESIGHT. To better understand how upcoming known and potential future regulations could impact the use of recycled water, the pertinent regulators were consulted and that insight was incorporated into the findings of the updated Recycled Water Master Plan.



TOOL DEVELOPMENT. This update to the Recycled Water Master Plan is not static and it will be important for West Basin to regularly reevaluate the key findings in this report. The tools developed as part of this Recycled Water Master Plan will allow for West Basin to update these findings.



SYSTEM OPTIMIZATION AND RELIABILITY. For the recycled water system to perform as intended, it was important to identify ways to optimize the system and look for ways provide additional reliability at the treatment facilities and in the distribution system.



MAXIMIZE RECYCLED WATER PRODUCTION. West Basin has unrealized production capacity in their existing infrastructure and also has a potential to access additional effluent from HWRP that would allow for meeting more recycled water demands.



ROADMAP TO THE FUTURE. The Recycled Water Master Plan provides a roadmap to guide West Basin in potentially expanding its local and regional participation in water reuse programs.



Recycled Water Master Plan Process

Recycled Water Market Assessment

Treatment Plant Evaluations

Hydraulic Model Update

Existing and Future System Evaluations

Capital Improvement Program

Road Map for Potential Expansion and Next Steps

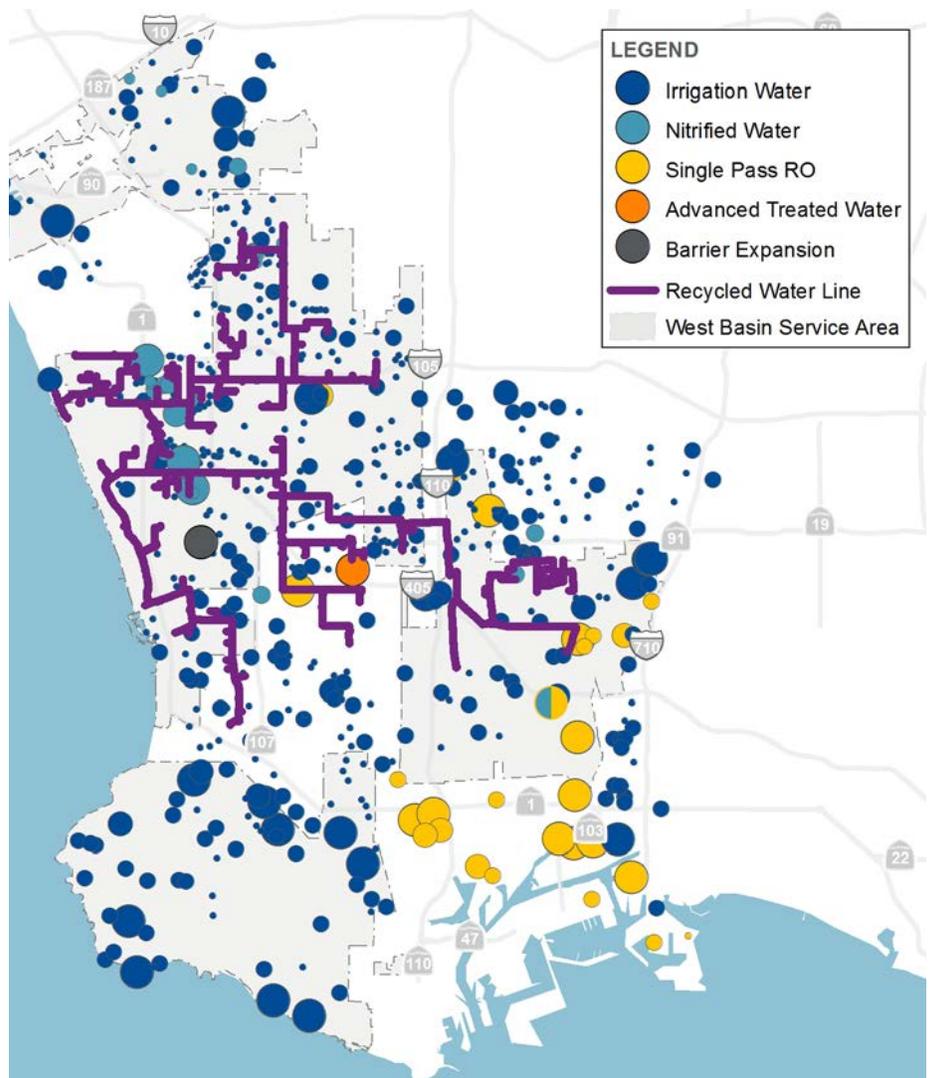
Key Findings

Comprehensive Market Assessment

To determine how to best maximize recycled water production, a market assessment was conducted to identify potential future customers. This assessment identified customers within a half mile of the existing system (tier 1 and 2 customers) that could be served with short lateral pipelines and those that could be grouped and served through longer extensions of the existing system.

Additionally, the Master Plan evaluated opportunities for expanding delivery of recycled water to the West Coast Seawater Barrier and expanding delivery of recycled water to the local refineries. New advanced water treatment projects to provide groundwater augmentation and single pass RO water service to industrial customers in the LA Harbor/Long Beach area were also considered.

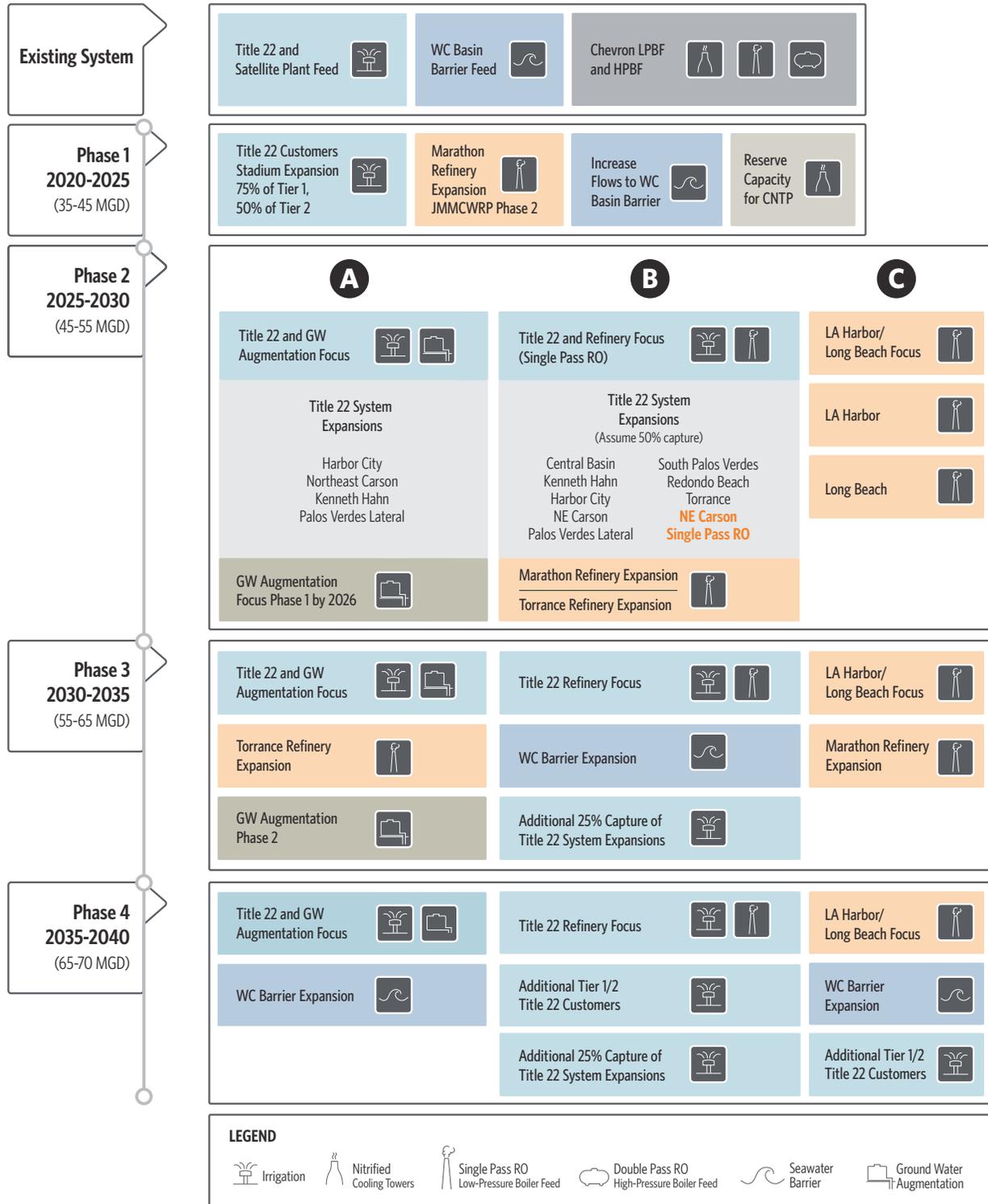
OVER 70,000 ACRE-FEET PER YEAR OR 62 MGD IN NEW, POTENTIAL DEMANDS IDENTIFIED



A Phased Approach with Multiple Scenarios

The findings from this plan were put into four phases, each in five-year segments, over the next 20 years. With so many opportunities, there were a multitude of options and permutations that would allow West Basin to expand its capacity to serve more customers. The Master Plan focused on three themes focused on the end use type, and then developed scenarios and phases to meet those needs.

- A Expansion to more Irrigation Customers and Groundwater Augmentation**
- B Expansion of the Irrigation System and more Refineries**
- C Deliveries to LA Harbor and Long Beach Industrial Customers**



Key Findings at ECLWRF

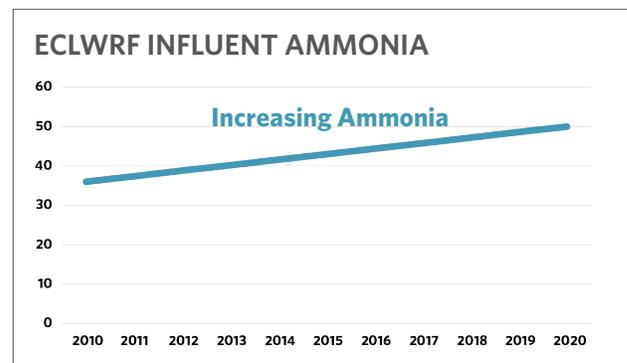
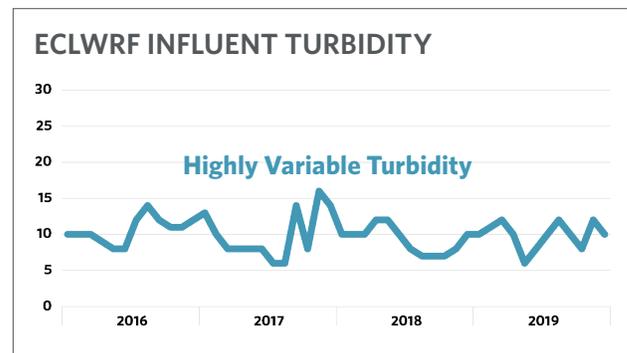
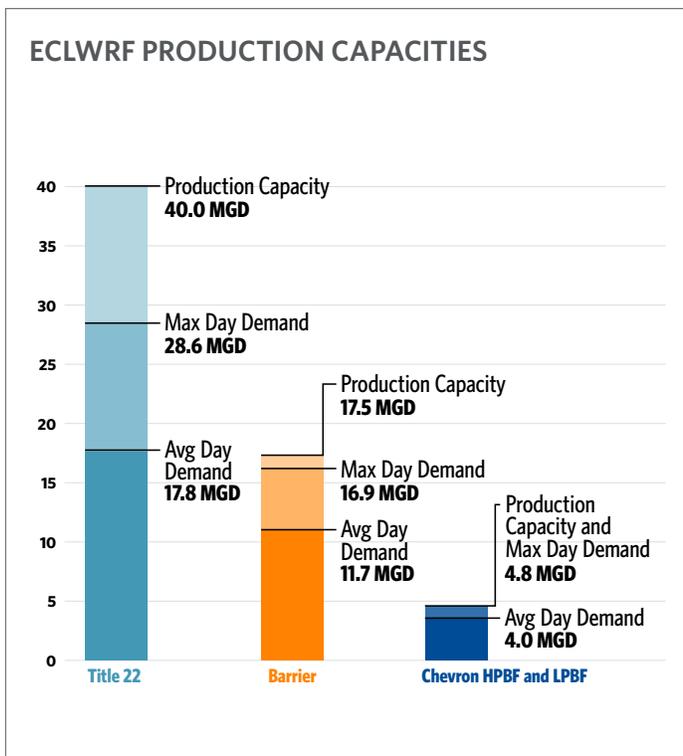
Treatment Capacity and Water Quality

The ECLWRF and all three satellite treatment facilities were evaluated in three steps:

1. **Defining the treatment plant capabilities** for both production capacity and meeting water quality objectives.
2. **Understanding the impacts to changing water supply quality**, the needs for future recycled water demands, and assessing the need for future recycled water quality.
3. **Identifying necessary improvements**, defining and evaluating treatment alternatives, and developing the recommended projects.

At ECLWRF the maximum day demand in the existing Title 22 system is only about 63% of the system's production capacity and Barrier system typically operates at about 70% of its production capacity.

The ECLWRF treatment system is challenged by influent water quality from the HWRP. Influent ammonia and turbidity are much higher than would normally be expected from secondary treatment systems, which leads to higher operations and maintenance costs. Several improvements were identified to address these issues. As part of the Master Plan, we assumed that proposed improvements at HWRP will reduce influent ammonia and turbidity to ECLWRF. However, alternatives were also evaluated that address operational impacts in the event that improvements to HWRP are deferred.





Rehabilitation and Replacement

As part of the evaluations, a robust list of rehabilitation and replacement (R&R) projects were identified. The top ten projects are listed below and are shown on the maps above and on the following page.

- ① TRWRP MF/RO Replacement Project

- ② HSEPS FM R&R Project

- ③ Chevron Refinery Boiler Feed System HP & LP Steel Tank R&R (offsite, not shown on maps)

- ④ ECLWRF Distributed Control System

- ⑤ ECLWRF Phase II & III MF Replacement Serving Chevron

- ⑥ ECLWRF Title 22 Filter R&R

- ⑦ Satellite Plant VFD R&R Improvements

- ⑧ Chemical Containment R&R Project (All Satellite Sites)

- ⑨ Chevron Nitrification Tank (offsite, not shown on maps)

- ⑩ ECLWRF Title 22 Common Filter Systems (Ancillary Facilities)

Expansion Alternatives

Several alternatives were evaluated for expanding the treatment processes to meet the goals of this Master Plan, including:

- **Alternative 1** Expanding the process with Pre-Treatment High Rate Clarifier (PTHRC) units and Tertiary Filter for the Title 22 process and additional Microfiltration (MF) and Reverse Osmosis (RO) expansions for the Barrier process.
- **Alternative 2** Expand and replace the Title 22 pretreatment process with Tertiary Membrane Bioreactors (TMBR) Modules with additional MF and RO for the Barrier Process.

The process selected will depend on the upgrades to the treatment process at HWRP. Currently LASAN is considering upgrading the process with Nitrification/Denitrification process, MBR, and advanced water treatment facilities (AWTF). If LASAN completes these upgrades, replacing the Densadeg units with TMBR modules will not be necessary. **For each scenario, the capacity at ECLWRF will increase average day production from 35 MGD to 70 MGD.** The map above shows how the ECLWRF expansion would impact the site under Alternative 1. All scenarios also include expansion of MF facilities at ECLWRF for increased Barrier production by 5 MGD.

Scenario A

TREATMENT

The primary improvements include expanding the nitrification process with additional Biofor units at the JMMCRWRP and the addition of advanced water treatment processes – MF/RO followed by ultraviolet advanced oxidation processes (UVAOP) at the TRWR – allowing for groundwater augmentation.

- **Up to 18 MGD new West Coast Basin IPR Project at TRWRP**
- **2.6 MGD expansion of JMMCRWRP Nitrification System**
- **1.4 MGD expansion of TRWRP Single Pass RO System**



Scenario B

TREATMENT

Improvements will be required at the JMMCRWRP to expand the nitrification process with additional Biofor units with a Phase 1 expansion to 3.75 MGD and a Phase 2 expansion to 5.0 MGD.

- **6.5 MGD expansion of JMMCRWRP Nitrification System**
- **4.2 MGD expansion of JMMCRWRP Single Pass RO System**
- **1.4 MGD expansion of TRWRP Single Pass RO System**



Scenario C

TREATMENT

Similar to Scenario B, improvements to the JMMCRWRP for Scenario C will include additional Biofor units to expand the nitrification process, but also MF/RO units for deliveries to LA Harbor/Long Beach.

- **18.5 MGD expansion of JMMCRWRP Single Pass RO System**
- **2.6 MGD expansion of JMMCRWRP Nitrification System**

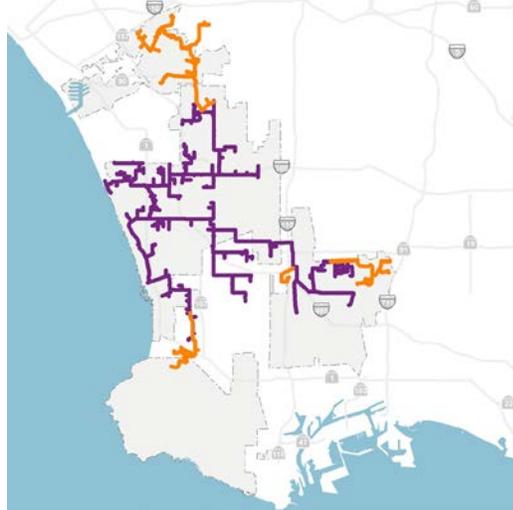


CONVEYANCE

Conveyance System Improvements for Scenario A include expansion of the system to the project areas shown in the figure, which will require:

- **25 miles of new pipe**
- **3 new storage reservoirs (3 million gallons total)**
- **5 new pump stations**
- **5 new disinfection stations**

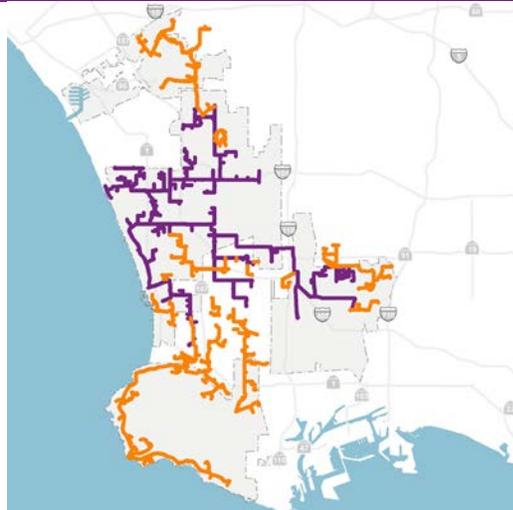
It is assumed conveyance projects to the Groundwater Augmentation Project will be constructed by others.



CONVEYANCE

Conveyance System Improvements for Scenario B will include expansion of the system into more areas than Scenario A, as shown in the figure, and includes the following:

- **90 miles of new pipe**
- **6 new storage reservoirs (6.4 million gallons total)**
- **11 new pump stations**
- **7 new disinfection stations**

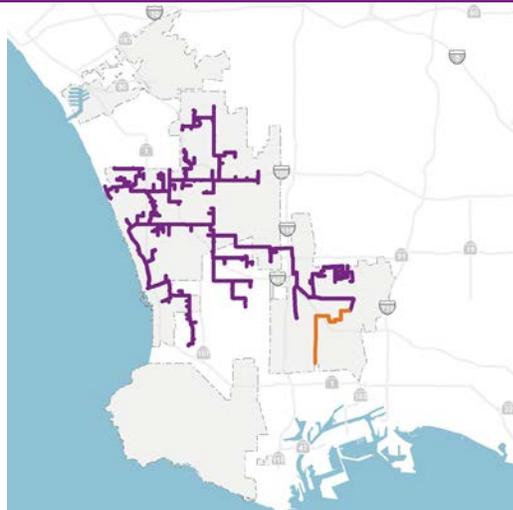


CONVEYANCE

Conveyance System Improvements for Scenario C will only require extension into the LA Harbor/Long Beach system as shown in the figure. Improvements include:

- **5 miles of new pipe**
- **No new storage reservoirs**
- **1 new pump station**

It is assumed conveyance projects beyond the West Basin boundary to LA Harbor/Long Beach will be constructed by others.



Capital Improvement Plan

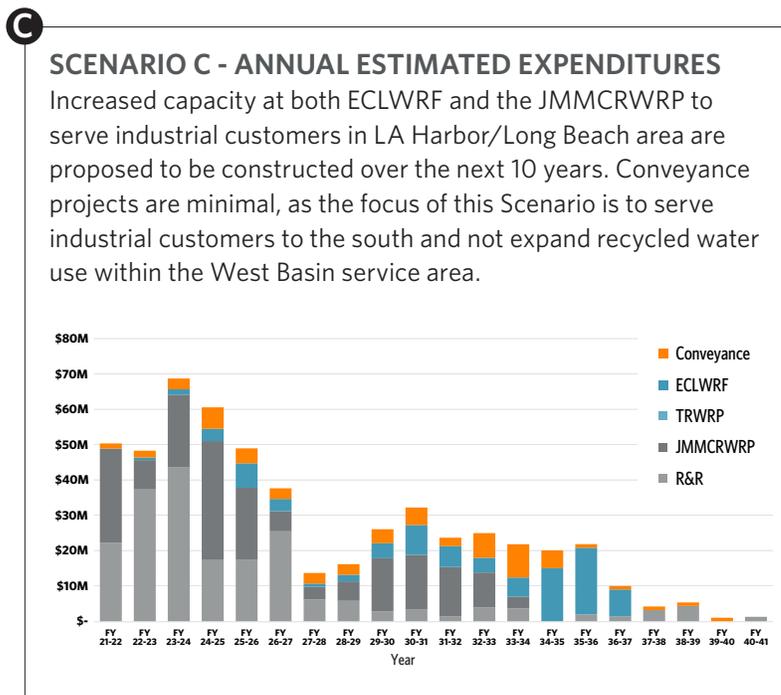
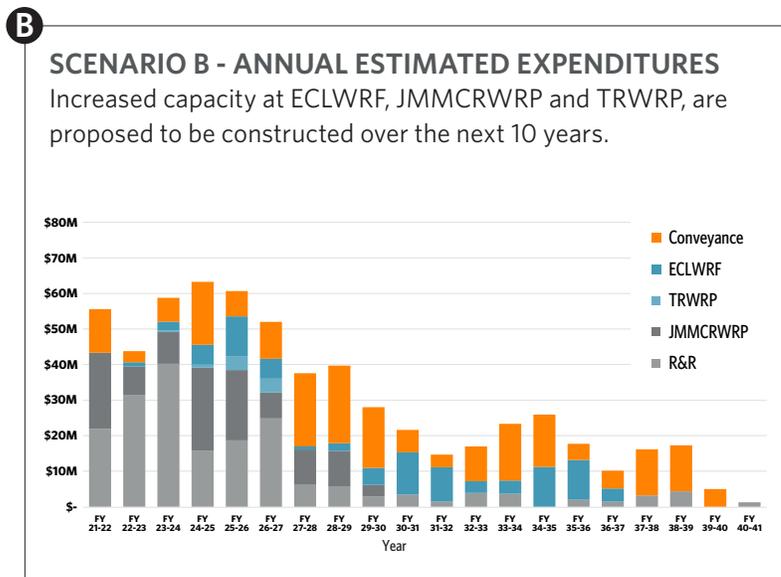
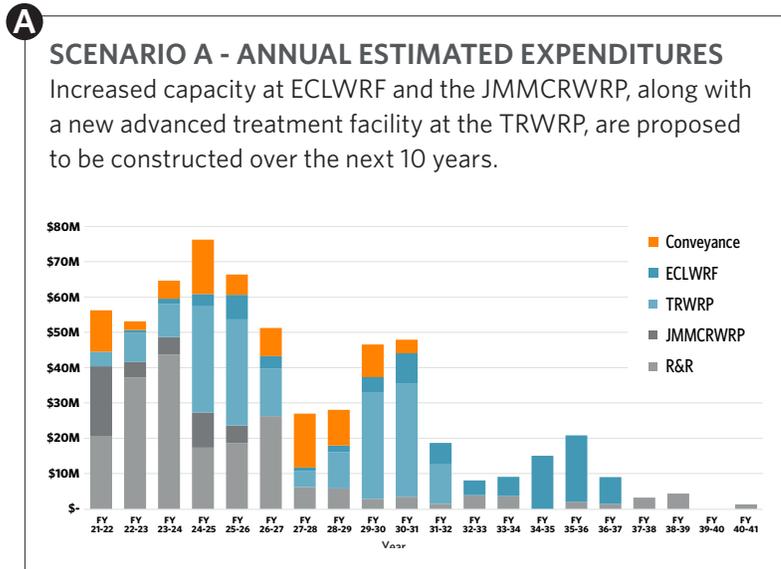
Scenario Definition and Prioritization

Using a parametric cost modeling software, planning level costs for CIP projects proposed under each scenario were developed. The projects were scheduled to be in place as needed to meet the projected increase in demand capacity for each phase of the scenario. For each scenario, estimated annual CIP expenditures are shown for the individual treatment facilities and conveyance system.

Regardless of the future scenario selected for advancement, West Basin’s plans to focus on R&R projects during the next five years. Projected R&R expenditures are identical for each scenario, and meet the prioritized need for improvement at each facility.

All scenarios include expansion improvements at ECLWRF for increased Barrier production by 5 MGD between 2030 and 2040.

Note that the project schedules identified in this Recycled Water Master Plan may be adjusted based on future funding opportunities and customer demand.



Road Map for Potential Expansion and Next Steps

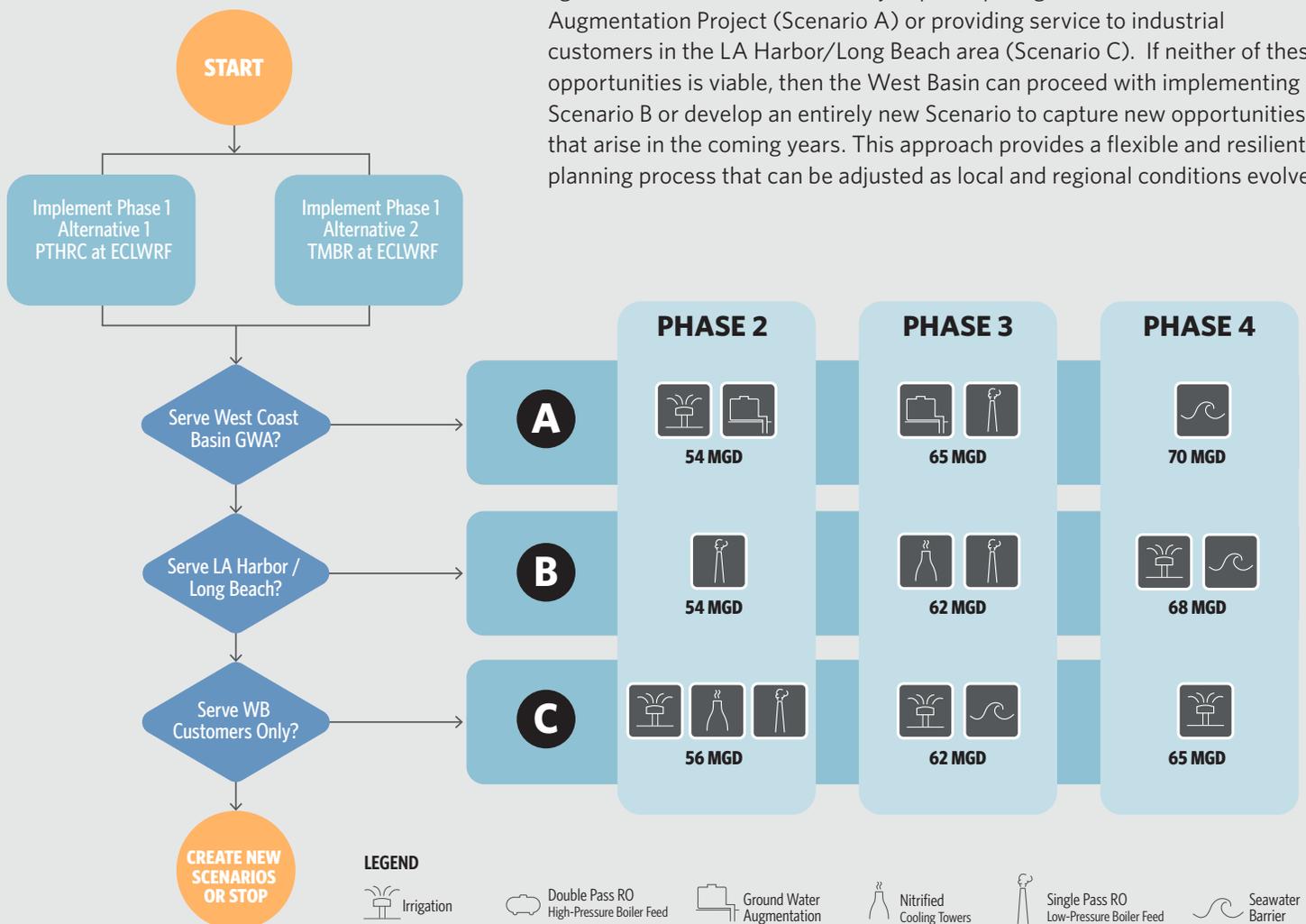
NEXT STEPS:

- Prioritize CIP and R&R projects
- Conduct Focused Feasibility Studies for Recycled Water Expansion projects
- Coordinate with Regional Stakeholders on providing Advanced Water Treatment for Groundwater Augmentation and Industrial Use

As West Basin proceeds to implement the future projects described in this Master Plan, the path forward will be made based on critical decision points, as shown in the flow chart below.

One of the key drivers will be if LASAN moves forward with proposed process improvements at HWRP, which would significantly improve the quality of the secondary effluent that is treated at the ECLWRF allowing the existing treatment process to be viable. However, if the improvements are not made at the HWRP, West Basin may need to implement Alternative 2 improvements at the ECLWRF. This will cost significantly more in capital, but could reduce O&M costs. This decision is anticipated to be made in the next few years and will set the stage for choosing treatment alternatives for the ECLWRF expansion project.

At the same time, West Basin staff will be collaborating with regional agencies to determine the viability of participating in a WRD Groundwater Augmentation Project (Scenario A) or providing service to industrial customers in the LA Harbor/Long Beach area (Scenario C). If neither of these opportunities is viable, then the West Basin can proceed with implementing Scenario B or develop an entirely new Scenario to capture new opportunities that arise in the coming years. This approach provides a flexible and resilient planning process that can be adjusted as local and regional conditions evolve.





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