ONE WATER LA 2040 PLAN

VOLUME 5

Integration Opportunities Analysis Details

FINAL DRAFT | APRIL 2018

CITY OF LOS ANGELES

ONE WATER LA
2040PLAN

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Integration Opportunities Analysis Details

FINAL DRAFT • APRIL 2018

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SUMMARY OF ONE WATER LA

The One Water LA 2040 Plan (Plan) takes a holistic and collaborative approach to consider all of the City's water resources from surface water, groundwater, potable water, wastewater, recycled water, dry-weather runoff, and stormwater as "One Water." The Plan also identifies multi-departmental and multi-agency integration opportunities to manage water in a more efficient, cost effective, and sustainable manner. The Plan represents the City's continued and improved commitment to proactively manage all its water resources and implement innovative solutions, driven by the Sustainable City pLAn. The Plan will help guide strategic decisions for integrated water projects, programs, and policies within the City.

PLAN ORGANIZATION

The One Water LA 2040 Plan consists of the following ten volumes:

- VOLUME 1 - Summary Report
- VOLUME 2 - Wastewater Facilities Plan
- VOLUME 3 - Stormwater and Urban Runoff Facilities Plan
- VOLUME 4 - LA River Flow Study
- VOLUME 5 - Integration Opportunities Analysis Details
- VOLUME 6 - Climate Risk & Resilience Assessment for Wastewater and Stormwater Infrastructure
- VOLUME 7 - Implementation Strategy Supporting Documents
- VOLUME 8 - Technical Support Materials
- VOLUME 9 - Stakeholder Engagement Materials
- VOLUME 10 - Programmatic Environmental Impact Report

The information presented in this Volume (Volume 5) includes a compilation of Technical Memoranda (TMs) that were prepared in support of the integration opportunities analysis. In addition, information presented in this volume is summarized and referenced in:

- Summary Report Chapter 5 – Current Integration Opportunities (Volume 1)
- Summary Report Chapter 6 – Future Integration Opportunities (Volume 1)
- Summary Report Chapter 9 – Plan Recommendations and Implementation Strategy (Volume 1)

VOLUME 5 OVERVIEW & ORGANIZATION

The two topics presented in Volume 5 include Current Integration Opportunities and Future Integration Opportunities. The Technical Memoranda associated with Current Integration Opportunities include TM 1.3, TM 3.1 and TM 3.2. The Technical Memoranda associated with Future Integration Opportunities include TM 5.1, TM 5.2, and TM 5.3. An overview of information presented in this volume is provided in the table below.

Disclaimer: It should be noted that the information presented in these TMs represent interim work products and may therefore include minor discrepancies with the information presented in the Summary Report (Volume 1). The information presented in Volume 1 supersedes information presented in this Volume.

TM No. and Name	Content Overview
TM 1.3 - Project Summary	Summarizes existing water-related projects and programs by identifying a broad mix of projects that could be implemented in the near-term, which demonstrate the advantages of collaboration between various departments and agencies.
TM 3.1 - Current Integration Opportunities Case Study Selection	Screens and ranks the 44 current integration opportunities gathered from the various City departments and agencies. Next, the TM describes the selection process of the top 10 and top five current integration opportunities. The selected top 10 current integration opportunities represent a broad mix of project components, lead departments/agencies, and collaboration partners. The top five opportunities are referred to as Case Studies because these projects could function as role models for taking a "One Water" approach during project development and implementation. The top five projects include two stormwater projects, one recycled water project, while two projects include a combination of both.

TM No. and Name	Content Overview
TM 3.2 - Current Integration Opportunities Case Studies	Develops the top five (5) Case Studies in more detail, which are: • **Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station.** This project involves a new advanced water purification facility at the HWRP to deliver advanced treated recycled water to Los Angeles International Airport (LAX) and Scattergood Power Plant/Generating Station (Scattergood). • **Capture of Off-Site Stormwater at LAUSD Schools.** This pilot study involves capture and treatment of off-site stormwater for reuse or recharge at a school site to serve as a role model for other school sites of the LAUSD. • **Rancho Park Water Reclamation Facility.** This project involves a new satellite water reclamation plant to produce recycled water, which would be augmented with stormwater when available to serve non-potable water demands in the vicinity of Rancho Park (West LA). • **Restoration of G2 Parcel at Taylor Yard.** This project includes development of a ~41-acre former rail yard site, consisting of stormwater BMPs, potentially recycled water, and site remediation. • **Water Management Strategies for the LA Zoo's Master Plan.** This project includes the consideration of both stormwater and recycled water in the LA Zoo Master Plan to promote the use of stormwater BMPs and the use of recycled water for animal exhibits, wash down, and irrigation at the LA Zoo. Information presented consists of: location & description; objective & benefits; concept development; implementation considerations; agreements; cost considerations; schedule; and recommendations.
TM 5.1 - Basis of Planning	Establishes the basis of planning (methodology, assumptions, and criteria) for the future alternatives analysis, and sets forth the criteria and methodology to evaluate water management alternatives. Key components of the TM include: • Definition of the study area and planning horizon • Development of a demand and flow forecasting envelope through planning year 2040 • Development of the future alternatives evaluation process • Development of project and portfolio evaluation criteria • Development of key planning assumptions, including long-term hydrologic analysis scenarios • Development of planning level cost-estimating assumptions

TM No. and Name	Content Overview
TM 5.2 - Project Development	Establishes the existing conditions for portfolio analysis purposes; identifies In-Progress Projects and Programs for the "benchmark" portfolio analysis (which represents existing conditions and the implementation of the In-Progress Projects and Stormwater Management Programs); and determines the benefits and costs of 25 Concept Options. The TM includes "Concept Description Sheets" to summarize the In-Progress Projects and Stormwater Management Programs and Concept Options in a clear and consistent format.
TM 5.3 - Portfolio Evaluation	Evaluates and develops a preferred future integration strategy that achieves stormwater compliance targets, which includes meeting water quality levels, and supports water supply goals in the most cost-effective and beneficial manner. Provides a description of the portfolio evaluation process and the evaluation of five (5) Portfolios, which were used to analyze a variety of extreme scenarios. The combination of future concept options was utilized to develop the core of the future integration strategy and the One Water LA 2040 Plan Implementation Strategy.

First Draft:	11/20/2015
Final Draft:	1/31/2016
Final:	8/29/2016
Lead Author:	Karen Miller

CITY OF LOS ANGELES

TECHNICAL MEMORANDUM NO. 1.3
EXISTING WATER PROJECTS AND PROGRAMS

FINAL
August 2016

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CITY OF LOS ANGELES

TECHNICAL MEMORANDUM
NO. 1.3
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LIST OF ABBREVIATIONS

Abbreviation	Description
ADA	Americans with Disabilities Act
AFY	acre-feet per year
AWT	advanced water treatment
BMPs	Best Management Practices
BOE	Los Angeles Bureau of Engineering
Caltrans	California Department of Transportation
CIP	Capital Improvement Plan
City	City of Los Angeles
CWA	Clean Water Act
DCP	Department of City Planning
DCTWRP	Donald C. Tillman Water Reclamation Plant
DSA	Division of State Architect
DWR	California Department of Water Resources
EPA	Environmental Protection Agency
EWMP	Enhanced Watershed Management Program
GHG	greenhouse gas
GIS	Geographic Information System
GRASS	Greenways to Rivers Arterial Stormwater System
GSD	General Services Department
HSR	California High-Speed Rail Authority
HWRP	Hyperion Water Reclamation Plant
IRP	integrated resources plan
JWPCP	Joint Water Pollution Control Plant
LABSS	Los Angeles Bureau of Street Services
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District
LADBS	Los Angeles Department of Building Safety
LADOT	Los Angeles Department of Transportation
LADWP	Los Angeles Department of Water and Power
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LARiverWorks	Los Angeles RiverWorks Office
LASAN	Los Angeles Sanitation
LAUSD	Los Angeles Unified School District
LAWA	Los Angeles World Airports
LEED	Leadership in Energy and Environmental Design
LID	low impact development
Metro	Metropolitan Transportation Authority
mgd	million gallons per day
MS4	Municipal Separate Storm Sewer System

Abbreviation	Description
MWD	Metropolitan Water District
MWELO	Model Water Efficient Landscape Ordinance
NGO	non-government organization
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PEIR	Programmic Environmental Impact Report
POLA	Port of Los Angeles
RAP	Los Angeles Department of Recreation and Parks
RW	recycled water
RWLs	receiving water limitations
SCAG	Southern California Association of Governments
SCMP	Stormwater Capture Master Plan
SW	stormwater
TIWRP	Terminal Island Water Reclamation Plant
TM	Technical Memorandum
TMDL	total maximum daily load
TPL	Trust for Public Land
UCLA	University of California Los Angeles
USACE	U.S. Army Corps of Engineers
USC	University of Southern California
WETS	Water Engineering and Technical Services
WMP	Watershed Management Programs
WQBELs	water quality-based effluent limits
WRD	Water Replenishment District
WWTP	wastewater treatment plant

EXISTING WATER PROJECTS AND PROGRAMS

1.0 INTRODUCTION

1.1 Background of One Water LA

The City of Los Angeles (City) recently embarked on the One Water LA 2040 Plan. This plan will provide a strategic vision and a collaborative approach for integrated water management. In 2006, the City completed and adopted its first integrated water resources plan (IRP). This plan was the start of a paradigm shift for the City and resulted in significant achievements. Since then, the water landscape in the City has changed with increased demands, new regulations, and threats of climate change.

In response to these changes and to help achieve water sustainability, the City initiated the One Water LA 2040 Plan. This plan builds upon the success of the Water IRP, which had a planning horizon to year 2020. The One Water LA 2040 Plan takes a holistic and collaborative approach, to consider all water resources from surface water, groundwater, potable water, wastewater, recycled water, dry-weather runoff, and stormwater as "One Water." The plan identifies multi-departmental and multi-agency integration opportunities to manage water in a more efficient, cost effective, and sustainable manner.

The One Water LA 2040 Plan represents the City's continued and improved commitment to proactively manage all its water resources and implement innovative solutions, driven by the Sustainable City pLAn. The Plan will guide the City with strategic decisions for water resource related projects, programs, and policies that will make Los Angeles a resilient and sustainable City.

1.2 Purpose of Task 1

The purpose of Task 1 of the One Water LA project is to establish a baseline of the City's existing conditions with respect to water management, flows, and integration opportunities between City departments and regional agencies. This baseline will be used to identify and develop future water integration strategies for the One Water LA 2040 Plan.

The deliverables of Task 1 will clearly identify the City department roles and responsibilities with respect to water-related projects and programs (Technical Memorandum [TM] 1.1), quantify the existing water flow balance (TM 1.2), and summarize existing water-related projects and programs (TM 1.3).

1.3 Objectives of TM No. 1.3

The objective of this TM is to summarize the existing water-related projects and programs from the various City departments as well as relevant regional agencies. The information presented herein builds upon the roles and responsibilities defined in TM 1.1. The goal of this TM is to identify which existing water-related project and programs could be enhanced, accelerated, or implemented with a multi-benefit approach through inter-departmental and/or inter-agency collaboration. Project integration opportunities are grouped into near-term, short-term, and long-term time frames. Additionally, this TM provides a baseline for the future integration opportunities that will be further evaluated during subsequent tasks of the One Water LA 2040 Plan.

2.0 METHODOLOGY

This section presents the methodology used to collect information on existing water-related projects and programs in the City relevant to One Water LA efforts, with a focus on water opportunities for inter-departmental/agency integration and implementation. It is noted that the term "*existing*" refers to project/programs that are currently planned or being implemented (as opposed to completed projects). This section begins with a summary of the data gathering process, followed by a listing of City departments and regional agencies contacted, as well as a summary of types of information gathered and its organization. The section concludes with a review of the One Water Geographic Information System (GIS) Database that is under development.

2.1 Data Gathering Process

The data gathering process focused on gathering known reports and existing information relevant to existing water projects/programs in the City. This effort was complemented by an exhaustive on-line search of City department and other regional agency websites. In addition, key individuals at each department/agency were responsible for gathering information from their respective department/agency. Information collected was categorized into the following project/program types: Capital Improvement Plan (CIP), Programs and Plans, and Pilot Studies. A list of reference documents used in the preparation of this TM is provided in Appendix A.

2.2 City Departments and Regional Agencies

City departments and selected regional agencies listed below were solicited to provide input for this TM. Information used in this TM was submitted on or before November 12, 2015.

City Departments

- Los Angeles Sanitation (LASAN)
- Los Angeles Bureau of Engineering (BOE)
- Los Angeles Department of Building Safety (LADBS)
- Los Angeles Bureau of Street Services (LABSS)
- Los Angeles Department of City Planning (DCP)
- Los Angeles Department of Transportation (LADOT)
- Los Angeles Department of Recreation and Parks (RAP)
- Los Angeles General Services Division (GSD)
- Port of Los Angeles (POLA)
- Los Angeles World Airports (LAWA)
- Los Angeles Department of Water and Power (LADWP)
- Los Angeles Zoo (Zoo)
- Los Angeles RiverWorks Office (LARiverWorks)

Regional Agencies

- Los Angeles Unified School District (LAUSD)
- Los Angeles County Metropolitan Transportation Authority (Metro)
- California High-Speed Rail Authority (HSR)
- California Department of Transportation (Caltrans)
- Los Angeles County Flood Control District (LACFCD)
- Los Angeles County Sanitation Districts (LACSD)
- Metropolitan Water District of Southern California (MWD)
- Southern California Association of Governments (SCAG)
- Division of State Architect, Los Angeles Regional Office (DSA)
- U.S. Army Corps of Engineers (USACE)

2.3 Project Information Organization

Information collected was tabulated into spreadsheet format (using an MS Excel workbook), with individual worksheets assigned by department/agency. As available, data input included:

- Project Type
- Project ID
- Project Name
- Description
- Water Type (i.e., recycled water [RW], stormwater [SW])
- Water Amount
- Timeline
  - Near-Term: 2015 – 2017
  - Short-Term: 2018 – 2025
  - Mid-Term: 2026 – 2035
  - Long-Term: Beyond 2035
- Estimated Start Date
- Estimated End Date
- Cost
- One Water GIS Database Layer (yes/no?)
- Integration Opportunity (yes/no?) – meaning the project presents an opportunity for integration or shared implementation with other City departments and/or regional agencies

Details on the City's existing water projects and programs is presented in Section 3.0; details on regional agency existing water projects and programs is presented in Section 4.0.

2.4 One Water GIS Database

As part of this task, development of the One Water GIS Database was started. The One Water GIS Database is an electronic living document with geospatial information of existing and proposed water projects, as well as a large number of base layers. All GIS data gathered and developed during the development of the One Water LA 2040 Plan are organized in the following categories:

- **Baseline Layers:** Files such as, but not limited to, City and Service Area boundaries, streets, parcels, land use, water bodies, topography, soil characteristics, and aerial imagery.
- **Water System:** Layers such as existing and proposed potable water pipelines, reservoirs, booster stations, groundwater wells, groundwater elevations, and potable water treatment facilities.
- **Recycled Water System:** Layers such as existing and proposed recycled water pipelines, reservoirs, booster stations, injection wells, spreading basins, water reclamation treatment facilities, refill stations, and large recycled water customers.
- **Wastewater System:** Layers such as existing and proposed sewer pipelines, lift stations, major diversion structures, and wastewater treatment facilities.
- **Stormwater System:** Layers such as existing and proposed stormwater pipelines, lift stations, low flow diversion structures, detention/retention facilities, green streets, and stormwater treatment facilities.

The One Water GIS Database files will be delivered to the City at the end of the project. During the development of this TM, the main focus was on the collection of base layers, existing key project integration opportunities, and future projects identified in other existing planning documents.

3.0 CITY'S EXISTING WATER PROJECTS AND PROGRAMS

City department existing water project and program integration opportunities identified during the development of this TM are summarized in this section, with a summary table provided. The water project and program opportunities presented in each department's table indicate that the department is the lead. General integration opportunities are denoted by an "X," or if known, a description of the specific inter-departmental opportunities. Again, the term *"existing"* infers that a project/program is currently planned for near- to long-term implementation or is being implemented. It should be noted that these City departments have other ongoing projects and programs that do not provide water-related integration opportunity, and are therefore not addressed in this TM.

3.1 LASAN - Los Angeles Bureau of Sanitation

LASAN is one of five bureaus under the Los Angeles Department of Public Works. Its primary responsibility is to collect, clean, and recycle waste and wastewater generated by users in the City and surrounding community. The bureau includes the following sub-departments/sub-divisions that has water-related activities:

- Wastewater Engineering Services
- Watershed Protection
- Regulatory Affairs
- Hyperion Water Reclamation Plant (HWTP)
- Donald C. Tillman Water Reclamation Plant (DCTWRP)
- Los Angeles-Glendale Water Reclamation Plant (LAGWRP)
- Terminal Island Water Reclamation Plant (TIWRP)

Water-related projects identified include Enhanced Watershed Management Program (EWMP) implementation projects, Green Streets, and low impact development (LID). In addition, there is a suite of recycled water Capital Improvement Projects. LASAN's existing project and program integration opportunities that were identified at the time of this TM development are summarized in Table 1.

Table 1 LASAN Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
EWMP - Ballona Creek Watershed(2)	Priority/Signature Regional Projects • Ballona Creek Low-Flow Treatment Facility-1 • Sepulveda Channel Diversion BMP Project • Westwood Neighborhood Greenway • Vermont Avenue Stormwater Capture and Green Street Project • Benedict Canyon Harvesting and Beneficial Use Project • Hollywood Hills Relief Sewer Stormwater Beneficial Reuse Project • Adams Drain Diversion Project • Del Rey Lagoon Water Quality Improvement Project • Pan Pacific Park Stormwater BMP • Rancho Cienega Sports Complex Regional BMP • Queen Anne Rec Center Stormwater Improvement • Lafayette Park Stormwater Improvement • Poinsettia Park Stormwater Improvement • Rancho Park Golf Course/Cheviot Hills Rec Center Stormwater Improvement	X	Near-Short
EWMP - Dominguez Channel Watershed(2)	Priority/Signature Regional Projects • Harbor City Park • Averill Park • Wilmington Recreation Center	X	Near-Short

Table 1 LASAN Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[1]	Time Line
EWMP - Upper LA River Watershed[2]	Priority/Signature Regional Projects • North Hollywood Park	X	Near-Short
EWMP - Marina Del Rey Watershed[2]	Priority/Signature Regional Projects • Venice Blvd. Neighborhood Green Streets Regional Project • Triangle Park BMP	X	Near-Short
EWMP - Santa Monica Bay Watershed[2]	Priority/Signature Regional Projects • Riviera Country Club Stormwater Reuse BMP • Mandeville Canyon Stormwater BMP • Santa Ynez Canyon BMP Project • Brentwood County Club Stormwater BMP • Oakwood Recreation Stormwater BMP • Rustic Canyon Recreation Center Stormwater BMP	X	Near-Short
EWMP Plans[2]	• Multiple TMDL and Permit milestones from near to long term.	X	Near-Long
Green Street Programs	• Green Streets Program • Green Alleys Program • GRASS • Green Sustainable Streets • Great Streets (Mayor's Office) • Living Streets (led by Heal the Bay) • Water LA (led by NGO – the River Project)	X	
Other Stormwater Projects/Green Infrastructure	• Avalon Green North: LID Demonstration Project Phase II • Broadway Neighborhood Stormwater Greenway Project • Laurel Canyon Boulevard Green Street Project • Penmar Water Quality and Reuse • University Park Neighborhood Rain Gardens Project • Vinegar Hill Parkway Restoration Project • Central Jefferson High Green Alley Network • Albion Riverside Park • Aliso Wash – Limekiln Creek Confluence Restoration • Argo Drain Sub-Basin Facility • Broadway Neighborhood Stormwater Greenway • Rory M. Shaw Wetlands Park • Temescal Canyon Park Stormwater Phase II • Penmar Water Quality Improvement Phase II • Branford St: Laurel Canyon to Pacoima Wash SCMP Great Street: Lankershim Blvd (Chandler to Victory)	X	Near-Long

Table 1 LASAN Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
	• Great Street: Van Nuys Blvd (Laurel Canyon Blvd to San Fernando Rd) • Glenoaks & Filmore SCMP • Agnes Ave: Vanowen to Kittridge SCMP • Wilmington Urban Re-Greening Plan • Hollenbeck Park • Rancho Park Golf • Macarthur Park Lake • Debris Basin Retrofit #1 (pilot), #2, and #3 • East Valley Baseball Park (Park Retrofit #2 and #3 – co-led with RAP) • LA Forebay Recharge System (LAR Pilot, LAR Full Scale, and Upper Ballona) • Sepulveda Basin – Hansen Spreading Grounds 54-inch Pipeline • Storm Drain Mining (Treat and Inject / Treat and Directly Use) • Van Nuys and Whiteman Airports		
Other	• Flood management projects • Prop O projects (Prop O funds projects to protect public health by cleaning up pollution in the City's watercourses, beaches and the ocean, to meet CWA requirements)		
City Plants	• City Plants is a public-private partnership between the City NGOs to plant trees in LA. Program includes a residential program with 7 trees per resident, tree giveaway events, tree adoption, and parkway plantings.	LADWP LABSS RAP	Near

Notes:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.
(2) EWMP plans may be accessed on the LA Stormwater Website at: http://www.lastormwater.org/green-la/enhanced-watershed-management-plans/

Abbreviations:
TMDL = total maximum daily load; SCMP = Stormwater Capture Master Plan;
NGO = non-government organization; LID = low impact development is a sustainable stormwater practice for land development/re-development to manage stormwater close to its source. Principles employed include preserving natural landscape features and minimizing imperviousness to create site drainage that treats stormwater as a resource (i.e., bio-retention facilities [rain gardens, vegetated rooftops]).

As shown, these opportunities can be divided into the following main categories:

- EWMP implementation
- Green Streets
- Other (i.e., green infrastructure, flood management, Proposition O projects)

3.1.1 Enhanced Watershed Management Plans

The 1987 amendment to the Clean Water Act (CWA), required that the U.S. Environmental Protection Agency (EPA) issue National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater permits for discharges from large Municipal Separate Storm Sewer Systems (MS4s). An NPDES Permit allows clean stormwater discharges into rivers, lakes, or the ocean. NPDES MS4 Permit Order No. R4-2012-0175 was adopted on November 8, 2012 by the Los Angeles Regional Water Quality Control Board (Regional Board) and became effective on December 28, 2012, requiring decreases in pollutants in stormwater and urban runoff. The purpose of the Permit is to ensure the MS4s in Los Angeles County are not causing or contributing to pollution exceedances of water quality objectives set to protect the beneficial uses in the receiving waters in the Los Angeles region. The Permit allows Permittees to customize their stormwater programs through the development/implementation of a Watershed Management Program (WMP or EWMP) to achieve compliance with receiving water limitations (RWLs) and water quality-based effluent limits (WQBELs). The EWMP compliance path enables permittees to collaborate within specific Watershed Management areas to implement multi-benefit regional and distributed projects (watershed control measures [aka, Best Management Practices (BMPs)]) that, where feasible, retain all non-stormwater runoff and stormwater runoff from the 85th percentile, 24-hour storm event. The City's draft watershed-based EWMPs were prepared with about 30 co-permittees and submitted to the Regional Board in June 2015 as part of the LASAN's compliance efforts with the MS4 Permit. Final approval of the plans is anticipated in April 2016. Table 1 lists each watershed EWMP, alongside the corresponding top priority/signature regional projects within the City identified by either LASAN staff and/or in the draft June 2015 EWMPs. It is recognized that the full network of projects, termed "implementation strategy," includes hundreds of regional and distributed BMPs and projects (a much larger listing than that shown), consisting of LID projects, Green Streets, and regional BMPs. The reader is referred to the June 2015 Draft EWMP documents available on LASAN's web site for additional details (website: http://www.lastormwater.org/green-la/enhanced-watershed-management-plans/).

The EWMP projects listed in Table 1 are limited to the top priority/signature projects either from the EWMP documents or as identified by LASAN for this TM that overlay (portions of) the City of Los Angeles. Each watershed EWMP defines an Implementation Strategy with varying compliance deadlines to address the watershed's water quality priorities. Cumulatively, based on these deadlines of the specific watershed, all of these projects have near - long implementation timelines (less than 5 years all the way to beyond 2035). The top priority/signature regional projects are the most urgent projects. Therefore, a timeline of near - short has been assigned to all EWMP projects that are included in the following table. It should be noted that the EWMPs identify many more projects in the short-, mid-, and long-term implementation timelines in order to ensure compliance with final regulatory deadlines.

3.1.2 Green Streets

A green street is a right-of-way that maximizes stormwater capture through a combination of stormwater BMPs and design considerations while maintaining the roadway's primary function of accommodating vehicular traffic and safe pedestrian access. Practices can be placed in the street and sidewalk (permeable pavement, dry wells) or in parkways (vegetated swales, bio-retention curb bump-outs, tree wells, and planters, and bio-retention basins). As shown in Table 1, the City has a large number of ongoing green street type projects and programs that require multi-agency collaboration.

There are a large number of green street and tree programs in the City. Each program has its own objectives, project components, mix of agencies involved, funding sources, and implementation timeline. A detailed summary of these programs is included in Appendix B, with a brief description of the major programs led by LASAN listed below (related programs led by other agencies are described under those agencies [i.e., Main Streets – Caltrans; Complete Streets – DCP; People Streets – LADOT]):

- **Green Streets:** Initiated to develop standard plans and specification for designing streets and sidewalks to capture runoff and infiltrate it through a variety of BMPs, including landscaped bioswales with drought tolerant plants, permeable pavement, and sub-surface infiltration systems. Complimentary efforts include:
  - *Living Streets Program*: Members of Green LA Water Committee, with Heal the Bay as the lead, initiated the Living Streets Program, which is a comprehensive strategy that combines Green Streets (stormwater capture), Complete Streets (mobility), and Cool Streets (reflective pavement) elements. The Living Streets Cost/Benefit Analysis, accompanying a set of policy recommendations, and two pilot case studies are in development.
  - *The River Project*: Supports a widespread implementation of multi-benefit, parcel-based water management strategies (aka urban acupuncture) through a collaborative multi-sector approach. The program seeks to provide standardized plans with streamlined permitting, and how-to guides to residents and businesses that want to retrofit properties and parkways.

- **Great Streets (Mayor's Office):** - The Great Streets Program was created as a result of Mayor Garcetti's Executive Directive 1. A working group developed the Selection criteria. In close collaboration with Council Offices, the program seeks to leverage various City department improvement efforts and concentrate them on specific corridors.

- **Green Alleys Program:** Began as a study led by the City, with LASAN (Watershed Protection), University of Southern California (USC), and the Trust for Public Land (TPL) as partners. The TPL received a grant to implement a pilot network and the City of Los Angeles to complete a Green Alleys Master Plan for South LA. The Master Plan and the Avalon Alley pilot network have been completed.

- **GRASS:** Greenways to Rivers Arterial Stormwater System (GRASS) is a tool for "bottom up" design to assist design engineers with developing projects to detain, retain, and distribute and reuse stormwater in a more regionally significant, scale-able, and systemic way in order to meet overarching citywide planning goals. The program goal is to create a priority grid of stormwater capture greenways. The tool was a collaborative effort between LASAN and the Departments of Landscape Architecture at both Cal-Poly Pomona, University of California Los Angeles (UCLA), and USC.

- **Green Sustainable Streets (co-led by BOE):** LA City Council Motion 14-0748 - Bonin/Fuentes directs agencies listed to develop checklists for evaluation of water quality improvement, stormwater infiltration feasibility, and flood mitigation in all public right-of-way projects. This also develops a handbook to guide the projects.

3.2 BOE - Bureau of Engineering

BOE is also one of five bureaus under the LA Department of Public Works. It serves as an engineering arm of the City and includes the following sub-departments/sub-divisions that have water-related activities:

- Municipal Facilities
- Engineering
- Wastewater

Water-related projects identified include sustainable design, flood water management, Prop O projects. BOE existing project and program integration opportunities that were identified at the time of this TM development are summarized in Table 2.

Table 2 BOE Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity$^{(1)}$	Time Line
CIP Projects at Buildings	Utilize recycled water at the HTP car wash.		Near-Long
	Consider alternative landscaping (recycled water) and signage.		
	Consider prioritizing LEED/Envision® points for water during preliminary design and construction of City Facilities.		
TIWRP – Advanced Water Treatment Facility	CIP will increase the advanced water treatment (AWT) capacity from 6 - 12 mgd. Additional reclaimed water will be distributed to Dominguez Gap, Machado Lake, Harbor Generating Station, Harbor Irrigation, and Industrial users.	LADWP LACDPW WRD	Near-Short
	NPDES permit requires discharge to harbor cease by 2020.		
	Convert air cleanup system from potable water to recycled water.		
Hyperion Treatment Plant	Conversion of chemical scrubbers from potable water to recycled water.		
	Re-evaluate which processes can use recycled water (vs. potable water).		
Policy - Recycled Water in Concrete	Require using recycled water in concrete.	LADBS	Mid
Stormwater	Plan/design stormwater projects for water quality improvement and reduction in flood risk.		Near
	Maintain GIS modeling and mapping.		
	Develop program for regular condition assessment on stormwater facilities.		
Sidewalk Repair Program	$1.4-billion dollar program ($31 million per year for 30 years) to ensure ADA accessible sidewalks (Co-led with LABSS).	LABSS	Near-Long
Turf Removal and LEED Projects	Identify/implement opportunities.	GSD HSR Others	Near

Note:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.

Abbreviations:
LEED = Leadership in Energy & Environmental Design; mgd = million gallons per day; ADA = Americans with Disability Act; WRD = Water Replenishment District of Southern California; LACDPW = Los Angeles County Department of Public Works; Envision® = guidance and rating system used to assess and improve the sustainability metrics of all types and sizes of infrastructure projects

3.3 LADBS - Los Angeles Department of Building Safety

The LADBS is charged with building and safety code development, compliance, and plan checks within the City, and includes the following sub-departments/sub-divisions that have water-related activities:

- Green Building Services
- Code Enforcement
- Plan Checks

Water-related projects identified include managing graywater, LID, water efficient fixtures, and use of recycled water in concrete. LADBS existing project and program integration opportunities that were identified at the time of this TM development are summarized in Table 3.

Table 3 LADBS Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[1]	Time Line
Green Building Code	All new buildings/additions are subject to the LA Green Building Code Ordinance, which includes provisions for: Wastewater reduction by 20% Graywater systems Dual plumbing with recycled water piping	LASAN LADWP	Near
Graywater System Permits	Permitting for residential graywater systems; currently, there are 44 permits issues.	LASAN LADWP	Existing-Near
Recycled Water in Concrete	Potential change to State building code to require use of recycled water in concrete.	BOE	

Notes:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.
(2) Information on the LA Green Building Code can be found at: http://ladbs.org/LADBSWeb/green-bldg.jsf

3.4 LABSS - Los Angeles Bureau of Street Services

The LABSS is one of five bureaus within the LA Department of Public Works and is responsible for maintaining numerous elements of the City's public works infrastructure and providing street-related services. This City department includes the following sub-departments/sub-divisions that has water-related activities:

- Resurfacing
- Engineering
- Special Projects
- Urban Forestry

Water-related projects identified include green streets, landscape design, sidewalk repair, recycled water in concrete, and street resurfacing. LABSS projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 4.

3.5 DCP - Department of City Planning

The DCP has the responsibility of preparing, maintaining, and implementing a General Plan for the City, providing guidance in areas such as transportation, housing, open space, and land use elements. Department of City Planning includes the following sub-departments/ sub-divisions that has water-related activities:

- Zoning Codes
- General Plans

Water-related projects identified include Re:Code LA, the Clean Up Green Up campaign, as well as Complete Streets. Complete Streets is a movement centered on redesigning streets so that they better accommodate multiple users. DCP revised and renamed LA's Transportation Element as Mobility Plan 2035, which is the primary vehicle for the City to create Complete Streets. The Plan is a guidance document with conceptual designs for streets. A "*Complete Streets Design Guide*" is a companion to the Mobility Plan 2035. DCP projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 5.

Table 4 LABSS Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Recycled Water Filling Stations	• New recycled water filling station at Street Services Yard along Chandler Blvd. to landscape along bike path. • Identify other locations for recycled water filling stations (1-2 per council district) for tree watering.	LASAN LADWP RAP	Near-Short
California Friendly Landscaping	• Convert medians to drought tolerant landscaping, mulch, and/or decomposed granite.		Near
Recycled Water in Medians	• Use recycled water for irrigation in medians.	LASAN	Near
Street Sweeping with Recycled Water	• Perform street sweeping with recycled water.	LADWP	Near
Enhanced Street Sweeping Program	• Opportunity exists to improve water quality with improved street sweeping. Current frequency is based on aesthetics and trash removal. However, if equipment is upgraded to enhanced sweepers, then sweeping can be timed to coincide with the timeframe prior to storms, which would result in water quality benefits.		Near
Artificial Turf/Parkway Standards	• Develop parkway guidance and standards for artificial turf.	BOE	Near
Tree Planting	• Possibly switch to 15-gallon trees as opposed to 24-gallon trees.		Near
Edible Landscaping Guidelines	• Add recycled water considerations in guidelines for parkways.	LASAN	
Recycled Water in Concrete Mix	• Potential change to State building code to require use of recycled water in concrete	X	
Study - Tree Well Installations	• Check the impact of dry-weather runoff contaminants on tree condition.	RAP	

Notes:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.
(2) Information on a California Friendly Garden can be found at: http://www.bewaterwise.com/Gardensoft/index.aspx and http://bss.lacity.org/Engineering/pdfs/Residential_Parkway_Landscaping_Guidelines_2015.pdf

Table 5 DCP Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Re:Code LA	• Comprehensive update to the zoning code that will be applied to various parts of the City as the Community Plans are updated. It includes new development standards and a possible new landscape ordinance.	X	Near
Clean Up Green Up	• The program employs mitigation strategies in industrial areas that includes tree planting in parkways and parking lots. Parking lot tree wells are extended to incorporate stormwater capture. Pilot areas are Pacoima and Boyle Heights.		Near
Complete Street Design Guidelines	• Guidelines & standards regarding physical changes to road right-of-way, in compliance with California Complete Streets Act.	X	Near
Mobility Plan	• The Mobility Element of the General Plan was recently updated with the adoption of the Mobility Plan 2035. The new plan includes policies relative to transportation sustainability and green streets.	LADOT	Near
Incentivize Efficient Water Use	• Explore incentivizing recycled water use and water conservation.		
Consolidate Turf Areas in Open Space	• Consolidate grassy areas in parks to primarily recreational fields as opposed to other open areas and individual lawns.	RAP	

Note:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.

3.6 LADOT - Los Angeles Department of Transportation

The LADOT is responsible for transportation planning, design, construction, maintenance, and operations in the City. This City department includes the following sub-departments/ sub-divisions that has water-related activities:

- Development Services/Transportation Planning
- Complete Streets
- Active Transportation

Water-related projects identified include Vision Zero, green streets, streetscape projects, and People Streets. People Streets is an outgrowth of Living Streets/Streets for People's efforts originally led by the NGO, Green LA. Rebranded as People Streets, this program allows residents, business owners, and non-profits to ask for and plan projects that convert portions of the street to bike corrals, parklets, or plazas. Applicants must use design specifications contained in Design Guides. LADOT projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 6.

Table 6 LADOT Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Vision Zero	• Incorporates stormwater capture and California Friendly landscaping components into intersection upgrades to improve pedestrian safety.		Near-Long
Safe Routes to School	• Infrastructure improvements at specific locations.	LAUSD	Near-Short
Pedestrian Safety	• Pedestrian safety improvements.		Near-Short
Highland Park Transit Village	• Joint development agreement between LADOT and private developer to construct mixed-use developments at 3 sites adjacent to Metro Gold Line stations in Highland Park.		
Pico-Robertson Senior Housing Development	• Joint development agreement between LADOT and a private developer to construct a senior housing development on a City-owned surface parking lot near the intersection of Pico & Robertson Boulevards.		
Mobility Plan	• The Mobility Element of the General Plan was recently updated with the adoption of the Mobility Plan 2035. The new plan includes policies relative to transportation sustainability and green streets.	DCP	Near
Bikeways along LA River	• Funding is available to implement bikeways along LA River	BOE LARiverWorks	
People Streets	• This program allows residents, business owners, and non-profits to ask for and plan projects that convert underused portions of the street to bike corrals, parklets, or plazas. Applicants must use design specifications contained in Design Guides.	LABSS BOE LASAN	Near-Short

Note:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.

3.7 RAP - Recreation and Parks

The RAP department is charged with promoting community welfare through programs and services at over 420 parks City-wide. The primary sub-department that has water-related activity is Planning, Maintenance, and Construction. Water-related projects identified include recycled water use, LID, turf removal, pedestrian enhancement, and stormwater capture projects. RAP projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 7.

Table 7 RAP Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[(1)]	Time Line
Smart Controllers	• Installed smart irrigation controllers.		Done
Stormwater Capture Projects	• Install underground drain sumps to capture stormwater beneath playgrounds (90% complete) and at other parks. • Project to capture stormwater near Arboretum. • Route stormwater to parks.	LASAN	Near
EWMP Project Implementation	• Assist LASAN on implementing EWMP projects located on city-owned recreational facilities (i.e., infiltration galleries, subsurface wetlands).	LASAN	Near-Long
Urban Runoff from Benedict Canyon Channel at Rancho Park Golf Course	• Explore opportunities to use urban runoff from Benedict Canyon Channel for the golf course.	LASAN	Near-Short
Recycled Water – Hansen Dam	• Use recycled water at South Park and Valley Inn Park.	LADWP	
Route Stormwater to Parks	• Route stormwater to parks in the Eastern San Fernando Valley.	LADWP	
Elysian Park Recycled Water	• Replace main line to reduce water losses. • Replace irrigation piping with combination of potable and recycled water.	LADWP	Near
City Park Irrigation Improvement Program	• Develop/promote water conservation by maximizing landscape water use efficiency.	LADWP	Near-Short
Drought Tolerant Planting	• Plant drought tolerant plants at parks.	LABSS	Ongoing-Near

Table 7 RAP Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Golf Course Irrigation	• Irrigation with recycled water – plans for three more golf courses to be supplied with recycled water.	LADWP	
Turf Replacement	• Replace turf at 15-20 parks with WaterSmart landscaping.	BOE	Near
Graywater Use	• Consider graywater use at Debs Park, Arts District Park, and Commonwealth Nursery at Griffith Park.	LADBS	
Pedestrian Enhancements	• No description provided.	LABSS	
Water Meter Monitoring	• No description provided	LADWP	
Water Audits	• Perform water audits for parks.	LADWP	

Note:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.

3.8 GSD - General Services Division

The GSD provides City leadership in managing facilities, equipment, supplies, maintenance, and other support services to City departments, residents, and elected officials. GSD includes the following sub-departments/sub-divisions that have water-related activities:

- Property management
- Building maintenance

Water-related projects identified include recycled water evaluations, green building retrofit program, and turf replacement. GSD projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 8.

Table 8 GSD Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Landscaping Improvement	• Projects will focus on 15 sites to start (starting with fire stations [40 identified]; this is not turf replacement).	RAP	Near
Library	• Seeking funding for 15 buildings.		
Smart Controllers Program	• Installation of smart irrigation controllers in City Parks and other sites with large irrigation areas to minimize water use based on temperature and soil moisture conditions.	RAP	
Water Loan Program	• Retrofit buildings with water efficient toilets, urinals, shower heads, and aerators.	LADWP	Near
Stormwater and Recycled Water Projects	• Evaluate projects at City buildings.	LASAN	
LEED	• Employ LEED to improve water conservation and recycled water use.	BOE	
Lawn Maintenance	• Implement Smart irrigation and drought tolerant plants at City buildings.	LADWP	
Customer Awareness	• Program to make customers aware of water usage.	LADWP	

Notes:

(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.
(2) Smart irrigation controllers use the latest technology to ensure landscapes receives the precise amount of water based on a number of factors including plant material, soil type, slope, sprinkler type, temperature, humidity, and rainfall.

3.9 POLA - Port of Los Angeles

The POLA is a gateway for international commerce, located in San Pedro Bay, consisting of 7,500 acres of land and water along 43 miles of waterfront, with 27 passenger and cargo terminals. Port Engineering is the primary department with water-related activities at POLA. Water-related projects identified include recycled water, stormwater, and wastewater. POLA projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 9.

Table 9 POLA Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Trapac Terminal Admin Building and Landscaping	• Incorporated dual plumbing and landscaping; uses purple pipe; will use recycled water after upgrade at Terminal Island WRP.	LASAN LADWP	Done-Near
Recycled Water Line Extension	• Extension of 24-inch recycled water main line for use of recycled water.	LASAN LADWP	Near
Front Street	• Landscaping improvements will incorporate recycled water irrigation as part of Front Street Improvements & Beautification.	LASAN LADWP	Near
Recycled Water	• Use recycled water for landscape irrigation, car wash at Port Police, watering truck, and dual plumbing.	LASAN LADWP	Near
Programs/Plans	• Use Smart controllers. • CA landscape ordinance. • Explore potential for stormwater capture.	X	

Note:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.

3.10 LAWA - Los Angeles World Airports

LAWA is the airport oversight and operations department for the City. It owns and operates a system of three airports (Los Angeles International [LAX], LA/Ontario International, and Van Nuys) to help meet the Southern California regional demand for passenger, cargo, and general aviation service. [Note – LA/Ontario will be transferred to Ontario International Airport Authority per the Los Angeles/Ontario Airport Settlement Agreement reached in December 2015]. LAWA includes the following sub-departments/sub-divisions that have water-related activities:

- Environmental Management
- Construction Services

Water-related projects identified include LID, porous paving (parking lots), and use of recycled water in concrete. LAWA projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 10.

Table 10 LAWA Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Tom Bradley International Terminal	• Installed dual plumbing (done). • Install dual plumbing in MSC Terminal (future).	LASAN LADWP	Done - Near
Recycled Water – Hyperion	• Use recycled water from Hyperion/West Basin – determine feasibility of providing recycled water from Hyperion/West Basin.	LASAN LADWP	Long
Recycled Water – Carwash	• Carwash facility and modernization, using recycled water.	LASAN LADWP	Mid-Long
Recycled Water – Dust Control	• Dust control at Westchester Parkway Connection.		
Recycled Water – Purple Pipe	• Irrigation – purple pipe along Imperial Highway.	LADWP	
Recycled Water – Construction	• Filling station for LAX construction – hydrant off of Sepulveda for a concrete batch plant. • Use for washdowns.	LASAN LADWP	Near
Stormwater Capture – LAX Parking Lots	• Evaluate permeable pavement for parking lots that is being re-done.	LASAN LADWP	
Landscaping	• Use drought tolerant landscaping, and recycled water for irrigation.	LADWP	

Note:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.

3.11 LADWP - Los Angeles Department of Water and Power

LADWP is the largest municipal water and power utility in the nation, providing water and power to 3.9 million people. On the Water System side, the LADWP has five divisions:

- Water Resources
- Water Distribution
- Water Quality
- Water Engineering and Technical Services (WETS)
- Water Operations

Water-related projects relevant to One Water LA identified include recycled water and stormwater. LADWP projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 11.

Table 11 LADWP Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Recycled Water CIP Projects	• Point of connection improvements – use of purple pipe landscape irrigation and dual plumbing by developers. • Recycled water system expansion of Valley System with xx miles of pipeline to serve appr. 1,000 AFY of new demand • Recycled water system expansion of Metro System with xx miles of pipeline to serve appr. 3,500 AFY of new demand • Recycled water system expansion of Westside System with xx miles of pipeline to serve approximately 2,000 AFY of new demand • Recycled water system expansion of Harbor System with xx miles of pipeline to serve approximately 14,000 AFY of new demands • Recycled water system expansion to serve Harbor Park and Roosevelt golf courses (106 acres) by 2017. • Installation of additional recycled water fill stations. • Public outreach program to promote and educate the public on recycled water use.	X	Near-Short
DCT IPR Project	• Advanced wastewater treatment facility at the Donald C. Tillman Wastewater Reclamation Plant combined with conveyance system and spreading grounds to treat and recharge appr. 30,000 AFY in the San Fernando Basin. • Installation of additional recycled water fill stations.		
2015 Urban Water Management Plan	• Will project future water demands and supplies through 2040; required by DWR. Scheduled for public review in Feb. 2016.		Near
Stormwater Projects at POLA	• To be implemented after Terminal Island WRP is on-line.	LASAN POLA	Near-Short

Table 11 LADWP Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Stormwater and Recycled Water Projects w/LAUSD	• LADWP entered into an MOU with LAUSD for $3M to install stormwater capture BMPs in several campuses. Potential projects are being evaluated.	LAUSD	Near-Short
Stormwater Capture Master Plan - Centralized Capture Projects	Centralized Project Alternatives • Canterbury Power Line Easement • Lakeside Reservoir (Options A and B) • North Hollywood Power Line Easement • Sheldon-Arleta Gas Management System • Silver Lake Stormwater Capture Project • Tujunga Spreading Grounds Enhancement Project • Valley Generating Station Stormwater Capture • Van Norman Stormwater Capture • Whitnall Hwy Power Line Easement	BOE LACFCD LARiverWorks LACDPW MWD LAUSD LASAN RAP LABSS Other Regional Agencies	Near-Long
Stormwater Capture Master Plan - Distributed Capture	Distributed Capture Alternatives • Self-Mitigating BMPs • On-Site Infiltration • On-Site Direct Use • Green Streets • Subregional Infiltration • Subregional Direct Use	BOE LACFCD LARiverWorks LACDPW MWD LABSS RAP Other Regional Agencies	Near-Long

Notes:

(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.
(2) *Centralized* stormwater capture facilities are engineered features located in specific locations that perform well at capturing large flows when available. These facilities can capture and infiltrate up to 500 acre-feet per year.
(3) *Distributed* stormwater capture includes stormwater management BMPs that utilize vegetation, soils, and natural processes to manage stormwater runoff close to the source. Distributed facilities can be placed throughout the City on any landscape, including parks, public and private development, public infrastructure and rights of way, and entire residential blocks.

Abbreviations:

DWR = California Department of Water Resources; AFY = acre-feet per year

3.12 Los Angeles Zoo

The Los Angeles Zoo, including the land, facilities, and animals, is owned by the City and home to more than 250 species of mammals, birds, amphibians, and reptiles. In addition, the Zoo's botanical collection includes several planted gardens with over 800 different plant species. Water-related projects identified include LID projects, recycled water use, and parking lot projects. Zoo projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 12.

Table 12 LA Zoo Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[(1)]	Time Line
Permeable Pavement in Parking Lots	• Installed permeable pavement in parking lot, with additional parking lots a possibility.		Done-Near
Water Efficient Fixtures	• Installed water efficient devices in buildings.		Done
Smart Irrigation	• Install Smart, computer-based irrigation system, and controllers.		
Drought Tolerant Gardens	• Plant gardens with drought tolerant plants.		
Recycled Water for Animals	• Evaluate using recycled water for animal washdown and other potential applications.	LASAN	
Rainwater Capture	• Potential to capture rainwater on animal barns and roofs.		
Filtration Systems	• Upgrade/retrofit filtration systems to reduce the amount of water waste.		

Note:

(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.

3.13 LARiverWorks - Los Angeles RiverWorks Office

The LARiverWorks, a specialized team within the Mayor's office, is charged with revitalization of the LA River and ecosystem restoration. Water-related projects identified include river revitalization, ecosystem restoration, landscaping, sustainable design, and flood water management. LA River projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 13.

Table 13	LARiverWorks Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3		
Project/ Program	**Description**	**Integration Opportunity(1)**	**Time Line**
CIP Projects	• Reach 1 – Confluence of Sepulveda Basin (channel widening, buried concrete box culverts) • Reach 2 – Sepulveda Dam to Tujunga Wash (channel widening, buried concrete box culverts) • Reach 3 – Tujunga Wash to Spreading Grounds (curried concrete box culverts, conversion of channel bottom) • Reach 4 – Cornfields – Chinatown Area to 1st Street (channel widening, buried concrete box culverts)		Long
LA Greenway 2020	• Movement to connect all 51 miles of the LA River, from Canoga Park to Long Beach, by 2020. Use the riverbank as a continuous 51-mile active transportation and recreational corridor.	X	Short
Urban Water Federal Partnership	• Monitor flows in LA River.		
LA River Revitalization Plan	• Master Plan for the LA River Revitalization – outlines strategies, recommendations, and projects to connect neighborhoods with the LA River corridor.	X	Near-Long

Notes:
(1) The subject department is the Lead department. General integration opportunities are denoted with an X, or if known, the specific inter-departmental opportunities.
(2) LA Greenway 2020 information can be found at http://www.larivercorp.com/greenway2020
(3) LA River Revitalization information can be found at http://www.lariver.org/index.htm

4.0 REGIONAL AGENCY WATER PROJECTS AND PROGRAMS

Existing water project and program integration opportunities that were identified at the time of this TM development for selected regional agencies are summarized in this section, with a summary table provided. The water project and program opportunities presented in each agency table indicates that the agency is the lead. General integration opportunities are denoted by an "X," or if known, the specific inter-agency opportunities. The term "existing" infers that a project/program is currently planned for near- to long-term implementation or being implemented, with relevance to One Water LA. It should be noted that these selected regional agencies have many other ongoing projects and programs that do not provide water-related integration opportunities, and are therefore not addressed in this TM.

4.1 LAUSD - Los Angeles Unified School District

The LAUSD is the City's school district, enrolling 640,000 students at over 900 schools and nearly 190 charter schools. District boundaries cover 720 square miles, including the City as well as all or parts of 31 smaller municipalities and several unincorporated sections of Southern California. Water-related projects identified include recycled water use and stormwater capture at LAUSD-owned properties. LAUSD projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 14.

Table 14 LAUSD Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[1]	Time Line
CIP Projects	• CIP projects related to LAUSD's Modernization Program and Critical Repair Program.		Near-Mid
CA Friendly Landscaping	• Incorporate CA Friendly landscaping and water-wise concepts into LAUSD properties.	LADWP	
DROPS	• Program that focuses on implementing stormwater BMPs; 7 sites have been identified.		Near
Retrofit of Water Fixtures and Plumbing	• Replace urinals and toilets with low-flow devices. • Retrofit potable water plumbing.	LADWP	Near-Short
Recycled Water	• Incorporate recycled water use; 15 sites total.	LADWP	Near-Short
Pilot Studies	• Explore leak detection. • Control irrigation from centralized location using smart controllers. • LA Water Awareness Contest for students. • Stormwater capture pilot projects.	LADWP	Near

Note:
(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.

4.2 METRO - LA County Metropolitan Transportation Authority

Metro serves as the transportation planner, coordinator, designer, builder, and operator for Los Angeles County, within a 1,433-square-mile service area. Water-related projects identified include recycled water use and stormwater capture opportunities. Metro projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 15.

Table 15 Metro Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[(1)]	Time Line
Stormwater Capture	• Use cisterns to capture and treat stormwater.	LASAN	Near
Marilla Parking Lot	• Incorporate LID and use detention basin to capture stormwater.	BOE	
Water Action Plan	• Strategies for Bus Division (i.e., example strategy is to use recycled water for washing buses).	LASAN	Near
Mayoral Save the Drop Campaign	• Comply with mayoral campaign on water conservation to reduce water use and address the drought.		Near-Short
O&M of Landscapes and Greenways	• Address associated O&M issues.	RAP	
De-Watering along Wilshire Ave.	• Reduce discharge and reuse of discharge water.	LASAN	
PEIR for Union Station Master Plan	• Include sustainable water practices and LEED.		
Pilot Studies	• Utilize enzymes as treatment at Division 9. • Install permeable pavement at Metro properties. • Evaluate use of recycled water for bus and railcar washes and irrigation.	LASAN	Near

Note:
(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.
Abbreviations:
O&M = operation and maintenance; PEIR = Programmatic Environmental Impact Report

4.3 HSR - High Speed Rail

The California HSR Authority is responsible for planning, designing, building, and operating the first High-Speed Rail system in the nation. California high-speed rail will run from San

Francisco to Los Angeles (by 2029) and will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations. Water-related projects relevant to One Water LA identified include recycled water use, stormwater capture opportunities, and a tree planting program within the City. HSR projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 16.

Table 16 HSR Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[(1)]	Time Line
Water Conservation Policy	• HSR has adopted policy for construction consistent with Caltrans. Design criteria specify goals for water conservation in facilities.		Ongoing-Long
Construction	• Recycled water is required for dust suppression. • HSR is considering requiring use of recycled water in concrete production as part of design criteria manual and general provisions.	LADWP	Ongoing-Long
Stormwater Capture	• Stormwater capture is required in station and facility design criteria. Prioritize infiltration, harvesting, re-use, and LID BMPs. Along the majority of linear right-of-ways, space available will likely focus on infiltration.	LADWP LASAN	Ongoing-Long
Landscaping	• Drought-tolerant landscaping will be used for HSR stations and alignment landscaping, along with recycled water for irrigation.	LADWP LASAN	Ongoing-Long
Water Efficiency	• Performance criteria target 50 reduction in potable water use.	LADWP	Ongoing-Long
Tree Planting Program	• HSR will recommend tree planting program that uses recycled water for tree installation and establishment period. This offset program will mitigate GHG emissions from HSR construction. Approximately 5,000 trees planned for urban program. Funding includes trees, installation costs, including stakes and ground prep, irrigation connection, annual maintenance for three years, and replacement of ailing trees. Not all trees may be located in City.	LADWP LASAN	Ongoing-Long

Note:
(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.

Abbreviation:
GHG - greenhouse gas

4.4 CALTRANS - California Department of Transportation

Caltrans is the State transportation department, managing more than 50,000 miles of California's highway and freeway lanes. In addition, Caltrans provides inter-city rail services, permits more than 400 public-use airports and special-use hospital heliports, and works with local agencies. Water-related projects in the City focus on recycled water use and Main Street California. Main Street California is an informational guide published in 2013 that reflects many of the recent updates to Caltrans manuals and policies that improve multi-modal access, livability, and sustainability within the transportation system. Caltrans projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 17.

Table 17 Caltrans Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[1]	Time Line
Smart Controllers	• Replace existing devices with weather-based smart controllers.		Near
Recycled Water Line at Magnolia & Chandler	• Recycled water line to provide recycled water for Highway 170 in Burbank area.	LADWP	Near
Recycled Water Use in State Right-of-Way	• Use recycled water for irrigation.	LADWP	
Main Street California	• An informational guide published in 2013 that reflects many of the recent updates to Caltrans manuals and policies that improve multi-modal access, livability, and sustainability within the transportation system	X	Near-Short
Model Water Efficient Landscape Ordinance Standards (MWELO)	• Apply standards to all Caltrans landscaping.		

Note:
(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.

4.5 LACFCD - LA County Flood Control District

The LACFCD provides flood protection, water conservation, recreation, and aesthetic enhancement within LA County. Water-related projects focus on stormwater capture and groundwater recharge. The Flood Control District encompasses more than 3,000 square miles, 85 cities, and approximately 2.1 million land parcels. It includes the vast majority of drainage infrastructure within incorporated and unincorporated areas in every watershed, including

500 miles of open channel, 2,800 miles of underground storm drain, and an estimated 120,000 catch basins. Water-related projects in the City focus on flood control, spreading grounds and dam projects, as well as EWMP signature projects. LACFCD projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 19. In addition, water-related integration opportunities include on-going implementation of Sun Valley Watershed Management Plan projects, including Rory Shaw Wetlands Park, and an LASAN/LADWP/LA Department of Public Works co-funded Multi-agency Collaborative facilitated by TreePeople that includes LAStormCatcher, a cistern demonstration project.

Table 18 LACFCD Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[(1)]	Time Line
Flood Mitigation, Spreading Grounds, and Dams	• Big Tujunga & Pacoima Dam to LA Filtration Plan • Big Tujunga Dam Sediment Removal • Big Tujunga Dam Seismic Retrofit • Boulevard Pit Multiuse • Branford Spreading Basin Upgrade • Bull Creek Pipeline • Hansen Dam Water Conservation Project • Hansen Spreading Grounds Upgrade • Old Pacoima Wash • Lopez Spreading Grounds Upgrade • Old Pacoima Wash • Pacoima Dam Sediment Removal • Pacoima Spreading Grounds Upgrade • Rory M Shaw Wetlands Park Project (Strathern) • San Fernando Road Swales • Sheldon Pit Multiuse • Spreading Grounds Optimization	LADWP USACE	
EWMP Signature Projects[(2)]	• Chester Washington Golf Course (Dominguez Channel EWMP) • Ladera Park (Ballona Creek EWMP) • Roosevelt Park (Upper Los Angeles River EWMP)	X	Near-Short

Notes:
(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.
(2) EWMP projects listed fall within Unincorporated Los Angeles County.

4.6 LACSD - LA County Sanitation Districts

LACSD is responsible for managing wastewater and solid waste, serving 5.5 million people in LA County. Its service area covers approximately 824 square miles and includes 78 cities and unincorporated territory within the County. Water-related projects in the City focus on recycled water use. LACSD projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 19.

Table 19 LACSD Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity[(1)]	Time Line
Regional Recycled Water Program		MWD	
Joint Water Pollution Control Plant (JWPCP) Pilot Study	• 1-mgd pilot study on recycled water.	MWD	
Model Design Manual for Living Streets	• LA County Program - Chapter 11 contains Stormwater Elements with design suggestions. Recommend as reference for LA Planning Complete Streets manual.		

Note:

(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.

Abbreviation:

WWTP = wastewater treatment plant

4.7 MWD - Metropolitan Water District

MWD is a regional wholesaler that delivers water to 26 member public agencies. MWD owns and operates an extensive water system, including the Colorado River Aqueduct, hydroelectric facilities, nine reservoirs, hundreds of miles of pipes, and five water treatment plants. Water-related projects in the City focus on recycled water use. MWD projects and program integration opportunities that were identified at the time of this TM development are summarized in Table 20.

Table 20 MWD Water Projects and Programs Summary
One Water LA 2040 Plan – TM 1.3

Project/ Program	Description	Integration Opportunity(1)	Time Line
Regional Recycled Water Program	• Long-term strategy for large-scale wastewater recycling from the JWPCP with up to 150 mgd of IPR/DPR projects at various locations in the greater LA area, including Orange County and Inland Empire. A specific example is to incorporate HTP flows into regional recycled water program.	LACSD LADWP LASAN	Near
JWPCP Pilot Study	• 1-mgd pilot study for the Regional Recycled Water Program.	LACSD	

Note:
(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.

4.8 Other Regional Agencies

Other relevant regional agencies include the following:

- SCAG – Metropolitan planning organization representing six counties (including LA County) responsible for a variety of planning and policy initiatives to encourage sustainability.
- DSA – State division providing design and construction oversight of schools, community colleges, and other state-owned/leased facilities.
- USACE – Federal agency (LA District) providing civil works and military engineering support to Southern California, with an emphasis on flood control and waterways. The USACE is responsible for O&M of dams and flood control channels under its jurisdiction.
- UCLA – The Los Angeles Sustainable Water Project is an ongoing study that outlines an integrated water management vision for each of the major watersheds. The Ballona Creek Watershed report was completed in November 2015, while the Dominguez Channel and LA River watershed reports will be completed in 2016.

Water-related projects and program integration opportunities by these agencies that were identified at the time of this TM development are summarized in Table 21.

Table 21 Other Regional Agency Water Projects and Programs Summary One Water LA 2040 Plan – TM 1.3

Agency	Project/Program	Integration Opportunity[1]	Time Line
SCAG	• Greenhouse Gas Reduction – explore ways of reducing GHGs due to pumping/importing water. • Sustainability Grant Program – fund local governments implementing good water practices. • Active Transportation & Special Programs – Increase transits and less street widening to reduce paving and increase stormwater capture. • Urban Forestry Grants – address stormwater using LID.	One Water LA Agencies	
USACE	• LA River ARBOR Study - LA River Ecosystem Feasibility Study, also known as the ARBOR study (Alternative with Restoration Benefits and Opportunities for Revitalization).	LARiverWorks	Near
UCLA	• Los Angeles Sustainable Water Project - Study separated into the three major watersheds (Ballona Creek, Dominguez Channel, and LA River) • Potential on-site wastewater reclamation plant on/near UCLA premises to provide recycled water for irrigation purposes at campus and other nearby customers.	X LASAN LADWP RAP	Short-Near

Note:

(1) The subject agency is the Lead agency. General integration opportunities are denoted with an X, or if known, the specific inter-agency opportunities.

5.0 NEAR-TERM INTEGRATION OPPORTUNITIES

Near-Term integration opportunities for stormwater and water recycling are discussed in this section and summarized in Table 22.

5.1 Stormwater

EWMPs and SCMP. Together, both the Enhanced Watershed Management Programs (led by LASAN) and the Stormwater Capture Master Plan (led by LADWP) encapsulate the largest opportunities for near-term integrated projects relevant to One Water LA. Both have rigorous drivers accelerating implementation in the near-term. For example, EWMPs are regulatory-driven, with a prescribed schedule for compliance to address water quality priorities. In a similar manner, the SCMP is driven by the City's need to increase stormwater capture, reduce its purchase of imported water, and develop a more reliable water supply portfolio, much of which is driven by recent years of persistent drought. The EWMPs and SCMP implementation strategies focus on centralized and distributed stormwater capture projects.

- *Centralized* stormwater capture facilities are engineered features located in specific locations that perform well at capturing large flows when available. These facilities are designed to capture and infiltrate over 100 AFY.

- *Distributed* stormwater capture includes stormwater management BMPs that utilize vegetation, soils, and natural processes to manage stormwater runoff close to the source. Distributed facilities can be placed throughout the City on any landscape, including parks, public and private development, public infrastructure and rights of way, as well as entire residential blocks.

Table 22 Key Water Projects and Programs Integration Opportunities
One Water LA 2040 Plan – TM 1.3

Water Type	Key Project/Programs	Lead Agency	Partnering Agencies	Time Line
Stormwater	EWMPs • Ballona Creek • Dominguez Channel • LA River • Marina Del Rey • Santa Monica Bay	LASAN	BOE LABSS DCP LADOT RAP POLA LADWP LAUSD Metro Caltrans USACE	Near-Short
	Stormwater Capture Master Plan • Regional Projects • Distributed Projects	LADWP	LASAN BOE LABSS DCP LADOT RAP LARiverWorks LAUSD LACFCD GSD	Near-Short
	Green Street-Type Programs • Green Streets • Green Alleys • GRASS • Green Sustainable Streets • Complete Streets • People Streets • Main Street California • Great Streets • Living Streets	Varies	LASAN BOE LABSS DCP LADOT RAP GSD POLA LAWA LADWP Zoo LAUSD Metro HSR Caltrans	Near-Short

Table 22 Key Water Projects and Programs Integration Opportunities
One Water LA 2040 Plan – TM 1.3

Water Type	Key Project/Programs	Lead Agency	Partnering Agencies	Time Line
	Low Impact Development • Dry/gravel swales • Dry wells • Permeable pavement • Planter boxes • Rain barrels • Cisterns • Rain gardens • Vegetated swales, and more • Rainwater harvesting (parcel level)	LASAN	BOE LADBS LABSS DCP LADOT GSD LADWP	Near - Short
Water Recycling	• Groundwater Replenishment Purple Pipe Extensions - Valley	LADWP	LASAN	
	• Purple Pipe Extensions - Metro	LADWP	RAP	
	• Purple Pipe Extensions - Westside	LADWP	RAP	
	• Purple Pipe Extensions - Harbor	LADWP	RAP, LAWA	
	• Recycled Water Filling Stations	LADWP	RAP, POLA	
		LADWP	LASAN, POLA, LAWA, Metro, HSR, LACSD	
	• Regional Recycled Water Program	MWD	All City & County	

Given the nature of centralized and distributed projects, there is widespread opportunity for inter-departmental/inter-agency coordination. As an example, a distributed project (i.e., a green street, a bioswale in a median) could require coordination of LADWP, LASAN, BOE, LABSS, LADOT, Caltrans, and/or RAP. In addition, the SCMP seeks partnerships with other agencies for implementing smaller-scale projects on City property, with the support and guidance from other City agencies. For example, LADWP could partner with LAUSD to construct a stormwater capture facility on LAUSD-owned property, which would necessitate inter-departmental coordination of additional City departments.

Green Street-Type Programs. There are many green street programs providing a lot of opportunity for collaboration, but at the same time they are important components in the EWMPs and SCMP. Each program has its own objectives, project components, mix of agencies involved, funding sources, and implementation timeline, but a common thing amongst these projects and programs is the opportunity for inter-department coordination and relevance to One Water LA.

Living Streets. The Living Streets Program, combining Green Streets (stormwater capture), Complete Streets (mobility), and Cool Streets (reflective pavement) elements provides opportunity for collaboration.

5.2 Water Recycling

The practice of water recycling and resultant use of recycled water is increasing rapidly. Policies, programs, and projects are being put in place for dual piping, recycled water application, groundwater recharge, and more. Furthermore, expanded recycled water pipelines are being constructed, all part of a larger effort to use recycled water for a variety of applications (i.e., irrigation, car washes, and more). This City-wide transition and broader adoption of the use of recycled water will require significant inter-agency coordination (LADWP, LASAN, POLA, LAWA, MWD, and many more). Many of these agencies have near-term recycled water projects and programs on tap for implementation.

APPENDIX A – REFERENCES

LADWP, 2010, *Urban Water Management Plan*.

LADWP, 2014, *Annual Recycled Water Report, Fiscal Year 2014-15*, August 2015.

LADWP, 2015, *Stormwater Capture Master Plan*, August 2015.

LADWP/LASAN, 2012, *Recycled Water Master Plan*, October 2012.

LASAN, 2015, *Enhanced Watershed Management Programs, Prepared for the Following Watersheds: Ballona Creek, Dominguez Channel, Santa Monica Bay, Upper Los Angeles River, Marine Del Ray*, June 2015.

LASAN, 2015, *Evaluating Municipal Recycled Water Usage in Concrete Mixes*, September 2015.

LASAN/LADWP, 2006, *City of Los Angeles Integrated Resources Plan*, December 2006.

Los Angeles Regional Water Quality Control Board (Regional Board), 2012, *Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4*, November 8, 2012.

USACE, 2015, *Los Angeles River Ecosystem Restoration Integrated Feasibility Report (aka, ARBOR Study – Alternative with Restoration Benefits and Opportunities for Revitalization)*, September 2015.

Others documents and sources utilized include:

- Draft Green Alleys Master Plan
- LA Green Building Code - http://ladbs.org/LADBSWeb/green-bldg.jsf
- California Friendly Garden information - http://www.bewaterwise.com/Gardensoft/index.aspx
- LA's Transportation Element as Mobility Plan 2035
- LA County Model Design Manual for Living Streets
- Complete Streets Design Guide
- LA Greenway 2020 information can be found at http://www.larivercorp.com/greenway2020
- LA River Revitalization information can be found at http://www.lariver.org/index.htm
- Metro, Union Station Master Plan - https://www.metro.net/projects/la-union-station/
- Caltrans, 2013. Main Street California is an informational guide published in 2013 – Caltrans
- www.livingstreetsla.org
- GRASS Summary Report - 2013
- Transforming Alleys into Green Infrastructure - USC 2008

APPENDIX B – GREEN STREET AND TREE PROGRAMS SUMMARY

STREET PROGRAMS SUMMARY TABLE (9/16/15)

							Green Infrastructure Components								
	Street Program	Description of Program & Objectives	Responsible Entity (s)	City Departments & Regional Agencies Involved	Role & Activity	Additional stakeholders/champions	Trees	Permeable Pavement	Curb Cuts	Sidewalk design	Drought Tolerant Plants	Bio Swales	Other	Timing/Status	Related documents
1	**Green Streets**	Designs streets & sidewalks to capture runoff and infiltrate it through a variety of best management practices including landscaped bioswales with drought tolerant plants, permeable pavements, and sub-surface infiltration systems.	LASAN	1. BOE	Develop Plan & Specs	Regular participation from NGOs, Incl. HTB, TreePeople, HBT, NE Trees, and Council for Watershed Health	X	X	X	X	X	X	X	On-going committee - Recently focused on incorporating stormwater capture into Great Streets Program. MOA between LASAN and LADWP is funding green streets (stormwater capture) elements for two Great Streets. Subcommittees include Tech/Standards, Funding and Communications.	Green streets Standard Plans, Map of projects, Project Master List. Green Streets Council Motion 14-0748 (Fuentes) was adopted by Council on 3/5/15. Standard plans- Include alleys, bum pouts, parkway swales, planting templates. Dry wells recently emphasized.
				2. BSS	Implementer	State Conservancies including MRCA and Coastal Conservancy									
				3 LASAN	WPD has been lead.										
				4 LADOT	Participant										
				5 DCP	Participant										
				6 LADWP	Participant										
				7 Bldg. and Safety											
				7 Mayor's office	Great Streets liaison										
2	**Great Streets**	Great Streets was created as a result of Mayor Garcetti's Executive Directive 1 A working group developed the Selection criteria. Effort led by Great Streets Studio at Mayor's office who works in close collaboration with Council Offices. The program seeks to leverage various City department improvement efforts and concentrate them on specific corridors.	BSS	1. DCP	Supports evaluation for impacts	Mayor Garcetti Initiative. Nat Gale and Carter Rubin are mayoral staff leads	X	X	X	X	X	X	X	Launched Oct. 2013. 1st 15 streets announced June 2014. Projects are in various stages of design. Initial budget 800k. Mayor issued Challenge Grants for 9 efforts. Quarterly working group includes all participating departments. Green Streets Committee has reviewed projects and is proposing addition of stormwater capture elements.	Separate standards not created for this effort. Not all projects will incorporate all of the Green infrastructure components. Project materials focused on public amenities and safety. http://www.lamayor.org/greatstreets
				2. LADOT	Project management and design	One Great Street in each of 15 Council Districts									
				3. BOE	Design support	Council District offices are co-leads.									
				4. BSS	Construction and maintenance										
				5. LASAN	Green Streets Committee and Clean Streets Initiative support										
				6. Cultural Affairs	Supporting challenge grants and arts activation										
				7. Economic Workforce Dev.	Leading economic development										
				LADWP	Funding partner										
				8. BSL	Supports as needed										
3	**Complete Streets**	"Complete Streets" is a movement centered on redesigning streets so that they better accommodate multiple users. The Department of City Planning led effort to revise and rename LA's Transportation Element as Mobility Plan 2035. Plan is the primary vehicle for the City to create Complete Streets. The Plan is a guidance document with conceptual designs for streets. A "Complete Streets Design Guide" is Companion to the Mobility Plan 2035.	DCP	1. LADOT	Advisor - plans to adopt guidelines consistent with Design Guide	Governing Authority is Street Standards Committee comprised of DCP, LADOT and BOE	X		X	X	X	X	X	Mobility Plan 2035 was adopted by Planning Commission on 5/28/15 and City Council on 8/11/15. Complete Streets Design Guide was adopted as Companion piece.	Complete Streets Design Guide and Plan at http://la2b.org/ Many sections have design details that can impact stormwater capture ability. Section 4.8 specifically addresses Stormwater Capture and Management.
				2. BOE	Provides technical input										
				3. BSS	Participant										
				4 LASAN	Provide input on stormwater mgmt.										

STREET PROGRAMS SUMMARY TABLE (9/16/15)

	Street Program	Description of Program & Objectives	Responsible Entity (s)	City Departments & Regional Agencies Involved	Role & Activity	Additional stakeholders/champions	Green Infrastructure Components: Trees	Permeable Pavement	Curb Cuts	Sidewalk design	Drought Tolerant Plants	Bio Swales	Other	Timing/Status	Related documents
4	**People Streets**	Project is an outgrowth of Living Streets/Streets for People's efforts originally let by the NGO Green LA. Rebranded as People Streets, or (People St), this is a program that allows residents, business owners and non-profits to ask for and plan projects that convert portions of the street to bike corrals, parklets or plazas. Applicants must use design specs. contained in Design Guides.	LADOT	1 LADOT	Manages application process and coordinates design guidelines								X	Announced in conjunction with Great Streets. First elements are Parklets, Plazas and Bike Corrals. Some pilots have been installed.	People Street kits with designs and specs for Parklets and Plazas - DOT Website. Peoplest.lacity.org Current program has no focus on stormwater management but could be incorporated if temporary elements move to more permanent designs. Website is problematic to access.
				2 DCP	Collaborator (per guides)									Next Call for Projects is Oct-Nov 2015	
				3 Depts. Public Works	Collaborator										
				4 Metro	Collaborator										
				5											
5	**Main Street California**	Main Street, California is an informational guide published in 2013 that reflects many of the recent updates to Caltrans manuals and policies that improve multi-modal access, livability and sustainability within the transportation system.	CalTrans	1 Caltrans	Document refers readers to Caltrans office of Stormwater Management Design Website		X	X	X		X	X		Document published in 2013, Chapter 4 " Sustainable Main Streets," describes stormwater bmps.	Main Street California - A guide for Improving Community and Transportation Vitality http://www.dot.ca.gov/hq/env/stormwater/index.htm; Caltrans 2004 BMP Study (Main Street folder)
				2											
				3											
				4											
6	**Green Alleys Program**	Lives within Green Streets Program. Effort began as a study led by USC with Trust for Public Land (TPL), Pacoima Beautiful and TreePeople as partners- TPL received grant to implement pilot network.	BOS	1 LASAN	Client for Alleys Amplified GAMP	TPL is an implementing partner	X	X			X	X	X	Draft Green Alleys Master Plan for South LA was submitted to State 4/30/15. Avalon Alley pilot network has been completed.	Alleys Amplified: The South LA Green Alley Master Plan 2015; Transforming Alleys into Green Infrastructure - USC 2008. Additional BMPs include dry wells. Avalon Alley designs.
				2 LADOT	Reviews when vacating alley is part of project										
				3 BOE	Approve any design standards										
				4 BSL	Lighting Standards										
				5 BSS	Maintenance, paving, etc.										
7	**Living Streets**	Living Streets is a comprehensive strategy that combines Green Streets (stormwater capture) Complete Streets (mobility) and Cool Streets (reflective pavement) elements. Led by members of Green LA Water Committee with Heal the Bay as lead. Living Streets Cost/Benefit Analysis, accompanying set of policy recommendations, and two pilot case studies are in development.	NGOs	1 LASAN	Peer Review Group	Green LA Water Committee	X	X	X	X	X	X	X	Living Streets Cost/Benefit and Feasibility Draft undergoing peer review. Estimated completion 12/2015.	Living Streets Feasibility Document - Cost Benefit and Policy recommendations (Draft). Many Green Streets costs were derived from Stormwater Capture Master Plan. www.livingstreetsla.org (website is currently dormant).
				2LADOT	Peer Review Group	Heal the Bay (Prime)									
				3		UCLA and Cal State Northridge									
				4		Northeast Trees									
				5		Climate Resolve									
				6		Coastal Conservancy (Grantor)									

STREET PROGRAMS SUMMARY TABLE (9/16/15)

	Street Program	Description of Program & Objectives	Responsible Entity (s)	City Departments & Regional Agencies Involved	Role & Activity	Additional stakeholders/champions	Green Infrastructure Components: Trees	Permeable Pavement	Curb Cuts	Sidewalk design	Drought Tolerant Plants	Bio Swales	Other	Timing/Status	Related documents
8	**GRASS Program**	GRASS is a design tool to assist design engineers develop projects to detain, retain, and distribute and reuse stormwater in a more regionally significant, scale-able, and systemic way. Program goal to create a priority grid of stormwater capture greenways	LASAN	1 LASAN	Lead agency	USC and Cal Poly Studio 606 are partners	X	X	X	X	X	X	X	Ongoing work includes GRASS class at USC Price School and class at Cal Poly. EPA has funded additional phase. Workshop to be held 9/24/15. Design tool completion date estimated January 2016.	GRASS Summary Report - 2013. Deborah Deets is lead from LASAN. Additional BMPs include under-street storage.
				2 LADWP	Collaborator	EPA - Collaborator									
				3 MTA	Collaborator	PALAPA, AIA, ASLA, APA									
						NPS - Funding partner									
9	**Model Design Manual for Living Streets**	County of Los Angeles led effort with many contributors	None			Wide range of local and national contributors - No City Staff	X	X	X	X	X	X	X	County of Los Angeles adopted manual in 2011	Chapter 11 contains Stormwater Elements with design suggestions. Recommend as reference for LA Planning Complete Streets manual
10	**Water LA**	A program to support widespread implementation of multi-benefit, parcel-based water management strategies (aka urban acupuncture) through a collaborative multi-sector approach. The program seeks to provide standardized plans with streamlined permitting, and how-to guides to residents and businesses that want to retrofit properties and parkways.	NGO - The River Project	DCP, LASAN, BSS, LADWP, BOE	Departments providing technical review for designs.	California Coastal Conservancy funded initial efforts. Funding for phase 2 includes IRWMP grant from Upper LA region and LADWP.	X	X	X		X	X	X	Strategies include Parkway and residential retrofits. Initial pilot area for residential retrofits Panorama City and Studio City. Woodman Ave. median project was a partnership with Water LA . Phase 2 (2016) includes 100 homes and 1,000 parkway basins.	Project info can be found at Waterla.org. No plans were provided. BOE is reviewing parkway basin design. Expect approval by end of 2015. Other BMPs include rain tanks and greywater systems.
11	**Green Sustainable Streets (Council Motion)**	LA City Council Motion 14-0748 - Bonin/Fuentes. Directs agencies listed to develop checklists for evaluation of water quality improvement, stormwater infiltration feasibility and flood mitigation in all public ROW projects. Also Develop a Handbook to guide the projects.	LASAN, BOE, BSS, LADWP	1 LASAN	Co-lead		X	X	X	X	X	X	X	Motion was passed by City Council on 3/5/15. Checklists and handbook directed in motion are in development.	Council Motion 14-0748. Interdepartmental Memo filed 1/14/15 and adopted with Motion
				2 BOE	Co-lead										
12	**Super Streets**	Not an official program. Term currently referenced in Enhanced Watershed Management Plan effort. Intent to convey comprehensive strategy similar to Living Streets			Was also term used for now unpopular plan to make several major streets one-way thoroughfares to ease traffic		X	X	X	X	X	X	X	Not formally adopted. Included for information purposes.	
	Save our Streets	Bond Campaign													

			Tree Programs Summary Table						
	Tree Program	**Responsible Entity**	**Description of Program & Objectives**	**Other Departments/Stakeholders**	**Incorporates other bmps/environmental benefits**	**Funding Source**	**Other**	**Timing/Status**	**Related documents**
1	Regulatory Affairs Division Tree Planting	RAD	Currently completing installation of 3,000 trees near bus lines citywide with funds from Transportation Enhancement Activities (TEA) grant. Recently received 750k Calfire grant (part of 3.3 million listed in City Plants info below) to install 1800 15 gallon trees including curb cuts and watering.	Obtain info		TEA (no longer funding urban forestry) CALFIRE			
2	City Plants	Public Works	City Plants is a public-private partnership between the City of LA and NGOs to plant trees in L.A. Program includes a residential program with 7 trees per resident, tree giveaway events, tree adoption, and parkway plantings. Four City Plants' partners (LASAN RAD, KYCC, LABT, LACC) received over $3.3 million from CalFire Cap and Trade Funding for urban and community forestry. LADWP is also providing 4.5 million over 2-years for tree planting to increase shade and improve energy efficiency. Funding est. to cover planting, care and watering for 40,000 trees.	LADWP, LASAN, BSS, RAP, Los Angeles Conservation Corps, LA Beautification Team, Korean Youth & Community Center, NE Trees, TreePeople, Fuego Tech Fire Rangers		Calfire, LADWP		CalFire funding announced July 2015 DWP MOA renewed Dec 2014.	
3	Clean Up Green Up Program	DCP, LASAN	The program employs mitigation strategies in industrial areas that includes tree planting in parkways and parking lots. Parking lot tree wells are extended to incorporate stormwater capture. Pilot areas are Pacoima and Boyle Heights	Will research	Yes - could be expanded			Due to go before City Council by end of year	CUGU Ordinance
4	High Speed Rail tree planting program	HSR	Offset program to mitigate GHG emissions from High Speed Rail Construction. Approximately 5,000 trees planned for urban program. Funding includes trees, installation costs including stakes and ground prep, irrigation connection, annual maintenance for three years, and replacement of ailing trees. Not all tree may be located in City of LA	TBD - this is an area for us to explore		HSR		Implementation strategy in planning phase	
6	City of LA Sidewalk Repair Program	BOE, BSS	1.4 billion dollar program (31 million per year for 30 years) to ensure ADA accessible sidewalks. Under current policy recommendation, responsibility for sidewalk damage from existing trees will be responsibility of property owner after sidewalk repair.	Many NGOs have been advocating for more tree protection for existing trees and incorporation of additional environmental benefits including stormwater capture	Current focus is ADA compliance			Program underway but implementation strategies are under review	

One Water LA

CITY OF LOS ANGELES

TECHNICAL MEMORANDUM NO. 3.1
CURRENT INTEGRATION OPPORTUNITIES
CASE STUDY SELECTION

FINAL
March 2018

First Draft:	9/28/2016
Final Draft:	11/04/2016
Final:	3/30/2018
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CITY OF LOS ANGELES

TECHNICAL MEMORANDUM
TM NO. 3.1
CURRENT INTEGRATION OPPORTUNITIES
CASE STUDY SELECTION

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LIST OF ABBREVIATIONS

Abbreviation	Description
AFY	acre-feet per year
BMPs	best management practices
BOE	Bureau of Engineering
BSS	Bureau of Street Services
CALTRANS	California Department of Transportation
City	City of Los Angeles
ED#5	Executive Directive No. 5
HSR	High-Speed Rail Authority
LACFCD	Los Angeles County Flood Control District
LADOT	Los Angeles Department of Transportation
LADWP	Los Angeles Department of Water and Power
LAMP	Landside Access Modernization Program
LARiverWorks	Los Angeles RiverWorks Office
LASAN	Los Angeles Bureau of Sanitation
LAUSD	Los Angeles Unified School District
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
Metro	Los Angeles County Metropolitan Transportation Authority
MWD	Metropolitan Water District
POLA	Port of Los Angeles
RAP	Los Angeles Department of Recreation and Parks
TM	Technical Memorandum
Water IRP	Water Integrated Resources Plan
Zoo	Los Angeles Zoo

EXISTING INTEGRATION PROJECTS

1.0 INTRODUCTION

1.1 Summary of One Water LA

The City of Los Angeles (City) recently embarked on the One Water LA 2040 Plan. This plan will provide a strategic vision and a collaborative approach for integrated water management. In 2006, the City completed and adopted its first Water Integrated Resources Plan (Water IRP). This plan was the start of a paradigm shift for the City and resulted in significant achievements. Since then, the water landscape in the City has changed with increased demands, new regulations, and threats of climate change.

In response to these changes and to help achieve water sustainability, the City initiated the One Water LA 2040 Plan. This plan builds upon the success of the Water IRP, which had a planning horizon to year 2020. The One Water LA 2040 Plan takes a holistic and collaborative approach, to consider all water resources from surface water, groundwater, potable water, wastewater, recycled water, dry-weather runoff, and stormwater as "One Water." The plan identifies multi-departmental and multi-agency integration opportunities to manage water in a more efficient, cost effective, and sustainable manner.

The One Water LA 2040 Plan represents the City's continued and improved commitment to proactively manage all its water resources and implement innovative solutions, driven by the Sustainable City pLAn. The plan will help guide strategic decisions for integrated water projects, programs, and policies within the City.

1.2 Purpose of Task 3

The overarching purpose of Task 3 is to identify current integration opportunities for existing and planned projects from the various City departments and regional agencies. This task builds upon the effort of Technical Memorandum (TM) 1.3 - Existing Water Projects and Programs (Final Draft, dated January 2016). The focus of this task is to first identify a broad mix of projects that can be implemented in the current, which demonstrate the advantages of collaboration between various departments and agencies. Subsequently, these potential project opportunities were ranked to select the top 10 integration opportunities, for which conceptual project descriptions were prepared. These project descriptions (fact sheets) were then used to conduct a more in-depth evaluation to select the top five project opportunities recommended for further pursuit at this time. The top five projects will move forward as Case Studies. Project descriptions were prepared for each of these Case Studies with input from the departments and agencies involved. The purpose of this task is to work through challenges and create momentum behind these Case Studies so that these can be implemented and function as examples or templates for similar projects by establishing the necessary relationships, policies, agreements, and/or collaborative arrangements required to implement multi-departmental/agency integrated projects.

1.3 Objective of Technical Memorandum No. 3.1

The objective of TM 3.1 is to select the top five Case Studies from a comprehensive list of all existing integration opportunities gathered from the various City departments and agencies. The screening and ranking process of the potential opportunities to determine the top five Case Studies is described in this TM, while the actual detailed Case Study descriptions are presented in TM 3.2.

2.0 BACKGROUND

This TM builds upon the work conducted and presented in TM 1.3 - Existing Water Projects and Programs, wherein, existing water-related projects and programs from the various City departments as well as relevant regional agencies are summarized. More specifically, water-related projects and programs with a multi-benefit approach utilizing inter-departmental and/or inter-agency collaboration are highlighted. In turn, project integration opportunities are grouped into current, short-term, and long-term time frames, providing a baseline for evaluation of future integration opportunities as part of the One Water LA 2040 Plan.

3.0 CASE STUDY SELECTION AND DEVELOPMENT PROCESS

This section describes the Case Study selection and development process. The process flow diagram shown on Figure 1 illustrates the overall Case Study selection process.

As shown, the selection process consisted of five overall steps, and two selection steps (seven total steps) to narrow down the list of 44 potential integration projects or concepts to the top five Case Studies. The considerations and findings of each step are described below.

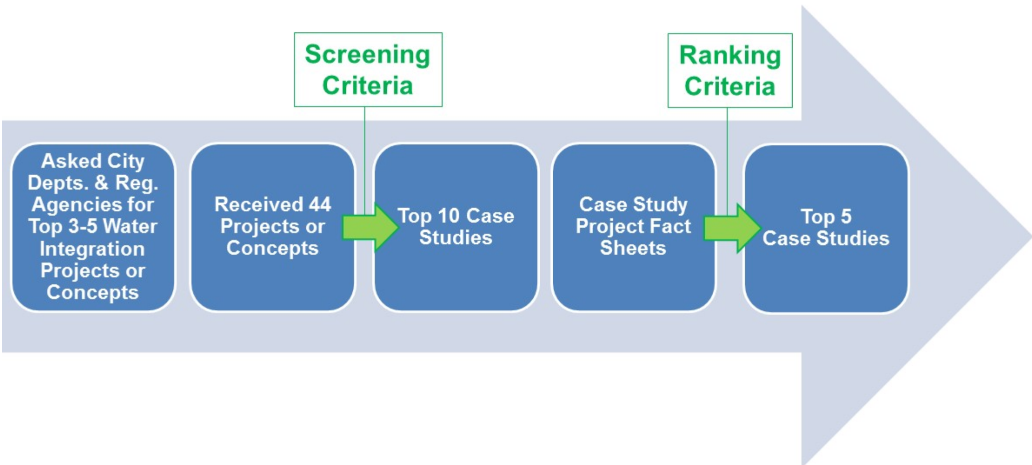


Figure 1 Case Study Selection and Development Process

3.1 Step 1 - Outreach to City Departments and Regional Agencies

On May 5, 2016, the One Water LA Group reached out to its Steering Committee, consisting of representatives from City departments and outside regional agencies to obtain a list of each department and agency's top three to five current project/planning effort integration opportunities. The purpose of obtaining the list of current integration opportunities was to create practical examples of interdepartmental/interagency collaboration, identify agreements and policies needed to resolve complexities hindering project implementation, and to highlight One Water LA "quick success" stories that provide multiple benefits (e.g. stormwater capture, recycled water expansion, etc.).

City Departments

- Los Angeles Bureau of Sanitation (LASAN)
- Los Angeles Bureau of Engineering (BOE)
- Los Angeles Bureau of Street Services (BSS)
- Los Angeles Department of Transportation (LADOT)
- Los Angeles Department of Recreation and Parks (RAP)
- Port of Los Angeles (POLA)
- Los Angeles World Airports (LAWA)
- Los Angeles Department of Water and Power (LADWP)
- Los Angeles Zoo (Zoo)
- Los Angeles RiverWorks Office (LARiverWorks)

Regional Agencies

- Los Angeles County Metropolitan Transportation Authority (Metro)
- California High-Speed Rail Authority (HSR)
- Los Angeles County Flood Control District (LACFCD)
- Metropolitan Water District of Southern California (MWD)

3.2 Step 2 - Compilation of Potential Integration Opportunities

By July 14, a total of 44 water-related projects and/or planning efforts were received from the Steering Committee, as summarized in Table 1. A brief description of these opportunities, as provided by the various departments and agencies, is provided in Appendix B.

Table 1 Summary of 44 Potential Case Studies
One LA Water – TM No. 3.1

Department/Agency	Project Name
LACFCD	Hancock Park Drainage Enhancement Project
	Rory M. Shaw Wetlands Park
LADOT	Cesar Chavez Pedestrian Improvements
	Central Avenue Pedestrian Improvements
	Bicycle Friendly Street Intersection Enhancements
LADWP	Stormwater Projects at the Port of Los Angeles
	Stormwater and Recycled Water Projects at a Los Angeles Unified School District (LAUSD) School
	Stormwater Capture Master Plan - Centralized Project
LARiverWorks	Restoration of G2 Parcel at Taylor Yard
	Central Service Yard Open Space
	LA River Natural Park
	Downtown LA River Open Spaces - Sixth Street Viaduct and "Piggyback Yard"
	In-Channel Actions
	Large-Scale Watershed Retention Projects
LASAN	Westwood Neighborhood Greenway
	Harbor City Park
	North Hollywood Park
	Venice Blvd. Neighborhood Green Streets Regional Project
	Riviera Country Club Stormwater Reuse BMP
	City Plants
LAUSD	Capture of Off-Site Stormwater at LAUSD Schools
LAWA	Prop "O" Stormwater Infiltration Facility at Los Angeles International Airport (LAX) and Hyperion Treatment Plant/North Central Outfall Sewer Connection
	Stormwater Management Plan - Dominguez Channel and Landside Access Modernization Program (LAMP)
	Design & Construction of a Recycled Water Pipeline
	Agreement No. WR-15-1062 (between LADWP and LAWA) Preparation of a Report for Design & Construction of a Recycled Water Pipeline
	Advanced Treated Recycled Water delivery to LAX and Scattergood Generating Station

Table 1 Summary of 44 Potential Case Studies
One LA Water – TM No. 3.1

Department/Agency	Project Name
LA Zoo	Permeable Pavement in Parking Lot – Phase 2
	Water Management Strategies for the LA Zoo Master Plan
	Recycled Water Fill Stations
Metro	Potential Planning Project Collaboration on the California Department of Transportation (CALTRANS) Sustainable Community Grant
	Funding a Metro Urban Green Demonstration Project
	LA River Bike Path Project
	Rail to Rail/River Active Transportation Corridor
MWD	Regional Recycled Water Program
	Local Resources Program
POLA	Wilmington Waterfront Park – Recycled Water Supply
	Recycled Water Filling Station for the Port Construction and Maintenance Division
	Wilmington Waterfront Development
	Ports O' Call Redevelopment
RAP	Albion Riverside Park
	MacArthur Park
	Hollenbeck Park and Lake Project
	Caballero Creek Park
	Rancho Park Water Reclamation Facility

3.3 Step 3 - Initial Project Screening

The following screening criteria were applied to these 44 projects and preliminary scoring was tabulated in order to narrow down the project list to the 10 top Case Studies (see Appendix B):

- *Does it support the Mayor's water goals?* This was a Yes/No criterion for each project in that selected Case Studies must contribute to and support Executive Directive No. 5 (ED#5) from the Mayor's office as well as the City's Sustainability pLAn.

- *Does the project have visibility?* This criterion was a Yes/No answer used to characterize a project as having the potential for visibility and interest to the public and citizens of Los Angeles as well as having the potential to generate One Water LA momentum.

- *Does the project provide social/environmental justice?* This criterion was a Yes/No answer, with the purpose of determining if a project takes place in a disadvantaged community, contributing to social and environmental benefits in such communities.

- *Does the project have replicability potential?* This criterion was a Yes/No answer used to determine if a project has the ability to be replicated and serve as a role model, wherein lessons learned could be applied to other projects with similar characteristics.

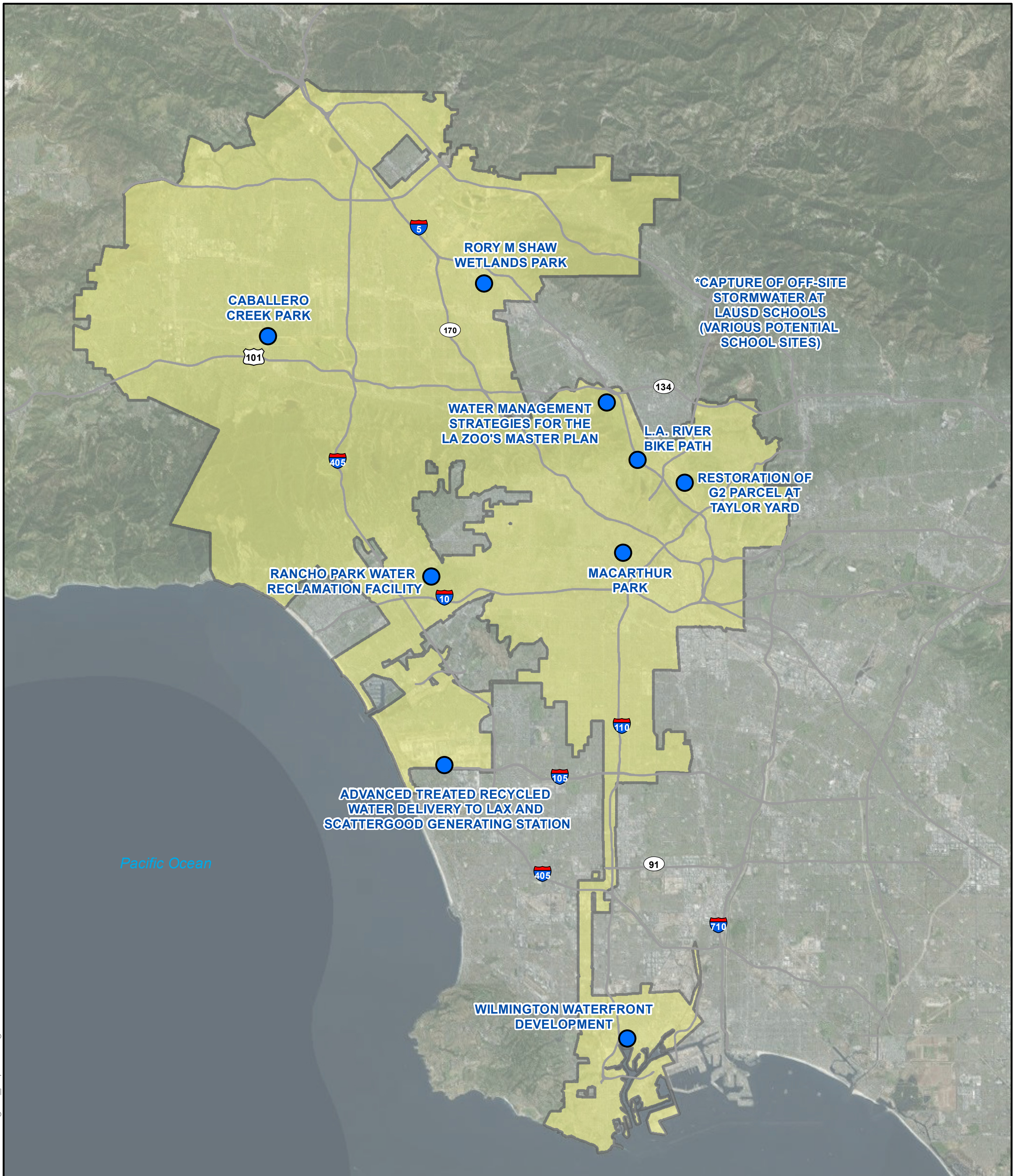
Furthermore, the timing of each of the 44 projects was considered. Selected Case Studies needed to be early enough in the planning process such that they could be positively influenced by the One Water LA effort, but not so early in concept that they could not occur within a reasonable timeframe. In addition, the goal of engaging and representing as many different City departments as possible (as lead agencies) contributed to Case Study selection. A brief description of all 44 potential project opportunities along with the screening scores are summarized in Appendix B.

3.4 Step 4 - Identification of Top 10 Case Studies

The previously-described screening effort resulted in the 10 top Case Studies identified for more detailed evaluation and consideration. A location map showing the distribution of these projects throughout the City is depicted on Figure 2, while the top 10 project listing is summarized in Table 2.

As shown in Table 2, there are nine stormwater projects and five recycled water projects, of which four projects include a combination of both. Furthermore, these 10 projects include participation of nearly all City departments and agencies listed in Section 3.1, either as lead department/agency or as a collaboration partner.

The selection of projects also considers the project locations throughout the City (Figure 2) so as to ensure that projects are distributed sufficiently throughout the City.



Legend

City of Los Angeles

Project Sites

N

0 2 4
Miles

Figure 2 - Location Map for Top 10 Case Studies
One Water LA 2040 Plan
TM 3.1 - Near-Term Integration Opportunities Case Study Selection

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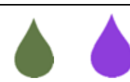
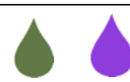
Table 2 Top 10 Case Studies
One LA Water – TM No. 3.1

Lead Agency	Project Name	Water Component	Department(s) Involved
LACFCD	Rory M. Shaw Wetlands Park		HSR, LADWP, LASAN, RAP
LARiverWorks	Restoration of G2 Parcel at Taylor Yard		BOE, HSR, LASAN, RAP
LAUSD	Capture Off-Site Stormwater at LAUSD Schools		LASAN, LADWP, DSA
LASAN	Rancho Park Water Reclamation Facility		LADWP, RAP
LASAN/ LADWP/ LAWA	Advanced Treated Recycled Water delivery to LAX and Scattergood Generating Station		N/A
LA Zoo	Water Management Strategies for the LA Zoo Master Plan		LADWP, LASAN, RAP
Metro	LA River Bike Path		LARiverWorks, LADOT, LASAN
POLA	Wilmington Waterfront Development		LASAN, LADWP
RAP	MacArthur Park		BOE, LASAN, LADWP
	Caballero Creek Park		LARiverWorks, LASAN

 = Stormwater

 = Recycled Water

3.5 Step 5 - Development of Case Study Project Fact Sheets

Detailed information was collected from represented departments/agencies, and Case Study project fact sheets were prepared for each project that includes the following information:

- Project location
- Project description
- Lead department/agency and number of departments/agencies involved
- Timing
- Water type
- Required agreements and policies
- Implementation challenges

Project fact sheets are provided on the following pages. These project fact sheets, along with the project scoring results, were presented to the One Water LA Steering Committee on July 28, 2016 to identify additional implementation challenges for the 10 Case Studies. Steering Committee members were tasked to provide additional feedback on the Case Studies presented and to provide any new water-related projects/concepts that could be considered for evaluation as a Case Study.

After the Steering Committee meeting, another form was sent out to City departments and regional agencies requesting additional projects/concepts to consider as a potential One Water LA Case Study. Several additional projects were submitted, and project ranking criteria were used to select to the top five Case Studies (as described in Steps 6 and 7).

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LARiverWorks - Restoration of G2 Parcel at Taylor Yard

Project Location

This project is located at 2070 North San Fernando Road, approximately 3 miles north of downtown Los Angeles in the community of Cypress Park (Council District 1) (**Figure 1**).

Figure 1 – Site Location Map

Project Description

The project includes development of a ~ 41-acre former rail yard site and consists of 2 phases (Phase 1 = 10 acres and Phase 2 = 31 acres). A conceptual site plan is provided as **Figure 2**.

- **Phase 1** includes site remediation activities, water quality improvements, as well as parkland and open space facilities:
  - **Site Remediation** - A ~ 10-acre portion of the site will be remediated for recreational use. The remaining 31 acres will be remediated to standards for industrial use. Conceptual site remediation activities include demolition of remaining surface and subsurface structures, removal of debris, and recycling of materials to off-site locations.
  - **Water Quality Improvements** - To achieve water quality benefits for the Los Angeles River and to assist in meeting LA River TMDLs, a listing of water quality improvements and BMPs includes: 1) to the extent possible, dry-weather and a portion of wet-weather stormwater flows in the vicinity of project site will be diverted and conveyed onto the project site, 2) construction of natural treatment systems (that mimic natural hydrologic processes), may be installed, and 3) installation of water quality treatment wetlands to function as habitat for wildlife.
  - **Parkland & Open Space** - Parkland and open space will be constructed within the 10-acre portion of the project site and consist of:
    1) creation of LA River buffers,
    2) installation of greenways,
    3) creation of LA River Gateways,

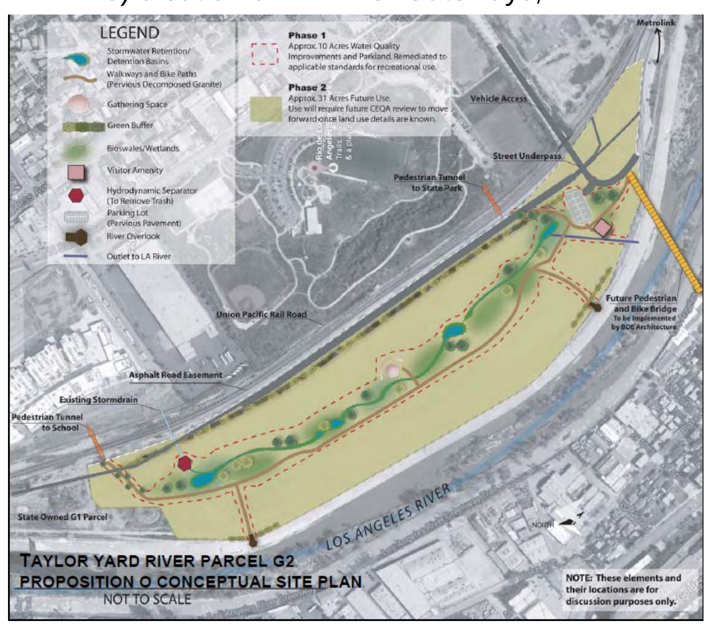

Figure 2 – Conceptual Site Plan

- 4) improvement of primary local green streets, and
  5) integration of people and habitat elements.

- **Phase 2** includes development of ~ 31 acres, which will occur once the appropriate future land use is identified. Further environmental analysis, including CEQA compliance may be required.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – LARiverWorks
- **Potential Partner Agencies** – BOE, HSR, LASAN, RAP
- **No. of Agencies** = 5

Timing

- **Phase 1** – 2017 – 2021
  - Anticipated to begin in 2017 and will require ~4 years, ending in 2021. Demolition of remaining existing structures, completion of site remediation, and contouring of the site for implementation of water quality improvements and BMPs will require ~ 24 months, from 2017 through 2019.
  - Construction of BMPs, parkland facilities, and open space will require ~ 24 months, from 2019 through 2021.
  - Project completion is expected in 2021.
- **Phase 2** – to be finalized at a later date once the appropriate future land use is identified.

Water Type

- Stormwater

Required Agreements & Policies

- O&M to be the responsibility of LASAN and RAP.
  - LASAN to be responsible for the BMP elements
  - RAP to be responsible for maintaining the parkland and open space, including the landscape and the irrigation system after improvements have been completed
- O&M procedures to be performed in accordance with a Master agreement between the Department of Public Works and RAP for the construction and maintenance of Prop O projects, as supplemented by a project-specific Memorandum of Understanding for the proposed project.
- Development of the entire ~ 41-acre site is subject to consultation with the Department of Toxic Substances Control.

Implementation Challenges

LA Zoo –Water Management Strategies for the LA Zoo Master Plan

Project Location

This project is located at the LA Zoo, 5333 Zoo Drive, Los Angeles, 90027 (Council District 4) (**Figure 1**).

Figure 1 - Site Location Map

Project Description

The LA Zoo is currently in the process of developing its Master Plan, which can be used as an opportunity to incorporate recycled water and stormwater capture where it is applicable because in the Master Plan, certain areas of the Zoo will be completely redone. In addition, there is an Event Center (1 acre) being designed.

There are two efforts being evaluated that can help decrease the City's reliance on potable water: (1) the use of recycled water for the LA Zoo's animal exhibits, irrigation network, new event center, and washdown activities, and (2) increase in the amount of stormwater being infiltrated or captured and reused with the implementation of stormwater BMPs throughout the zoo. It is noted that recycled water is already being used at the LA Zoo to irrigate the bioswales on its peripheral areas.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – LA Zoo
- **Potential Partner Agencies** – LASAN, LADWP, RAP
- **No. of Agencies** = 4

Timing

- Currently in research and evaluation phase

Water Type

- Recycled Water and Stormwater

Required Agreements & Policies

- New recycled water line connection
- Outreach and education – LA Zoo exhibit on drought resilience

Implementation Challenges

- Logistics associated with connecting to existing recycled water pipeline
- Determination of design demand requirements (sizing, capacity, etc.)
- Evaluation of animal class sensitivities
- Development of joint partnerships between City departments
- Evaluation of the LA Zoo's water recirculation systems to determine which water treatment system (if any) would yield the same water quality effluent if recycled water were to replace potable water as the influent
- Analysis of the site for stormwater BMP implementation

- Identification of operations and maintenance requirements
- Providing the LA Zoo with recycled water data as necessary
- Continued collaboration between: (1) LASAN and its Consultants (Master Plan and Event Center) and (2) LASAN and LA Zoo on stormwater and recycled water issues

LACFCD - Rory M. Shaw Wetlands Park

Project Location

The Rory M. Shaw Wetlands Park Project is located in the Sun Valley Watershed (**Figure 1**). This project is a major component of the Sun Valley Watershed Management Plan and was identified along with other potential project opportunities.

Figure 1 – Site Location Map

Project Description

The overarching project goal is to address major flooding problems in Sun Valley. Specific objectives are to retain stormwater runoff and reduce stormwater pollution, while increasing water conservation, recreational opportunities, and wildlife habitat. A conceptual site plan is provided as **Figure 2**. The project will include the following components:

- Conversion of a 46-acre, engineered, inert landfill into a multi-purpose wetlands park, featuring a 21-acre detention pond that will provide the capacity to store runoff collected from the upstream tributary area and reduce flooding in the surrounding areas.
- A 10-acre wetland that will serve as a natural water treatment system for removing pollutants from the collected stormwater runoff, which in turn, will provide a sustainable habitat for various plant and animal species.
- Treated stormwater will be pumped to the existing Sun Valley Park infiltration basins for groundwater recharge.
- Approximately 15 acres of open space and recreational areas.
- Proposed recreational enhancements include trails, basketball and tennis courts, a tot lot, picnic tables, educational signage, and restrooms, providing open space recreation to a community that is currently underserved for recreational opportunities.
- A storm drain system will be constructed as part of the project to capture and convey runoff from the 929-acre upper portion of the watershed and deliver it to the detention pond. The storm drain will be constructed along Glenoaks Blvd, San Fernando Road, Tuxford Street, and Tujunga Avenue

Lead Agency & No. of Agencies Involved

- **Lead Agency** – LACFCD
- **Partner Agencies** – LASAN, RAP, LADWP
- **Key Stakeholders** – Sun Valley Watershed Stakeholders Group
- **No. of Agencies** = 4

Timing

2017 – 2022

- Construction is planned to begin in 2017 and project completion is expected in Spring 2022
- Currently in design phase

Water Type

- Stormwater (~ 590 acre-feet/year)

Required Agreements & Policies

- **Proposition O Agreement between LACFCD and LASAN** – to accept funding from the Proposition O Grant received for this project
- **Maintenance Agreement between LACFCD, LASAN, and RAP** – to define the maintenance responsibilities for the completed project
- **Transfer of Land Agreement between LACFCD and City of LA** – to transfer ownership of the park space from the LACFCD to the City of LA

Implementation Challenges

- Soils – Characterization of the underlying soil conditions were delayed due to access limitations. Subsurface investigation found that the underlying soils were not suitable for the proposed design; therefore, many design elements needed to be reconfigured.
- Amenities – Selection of project amenities was challenging and required community involvement, particularly with regard to the inclusion of soccer fields. Ultimately, the local City Council District decided that the soccer fields are important to the community and should be included in the project design.

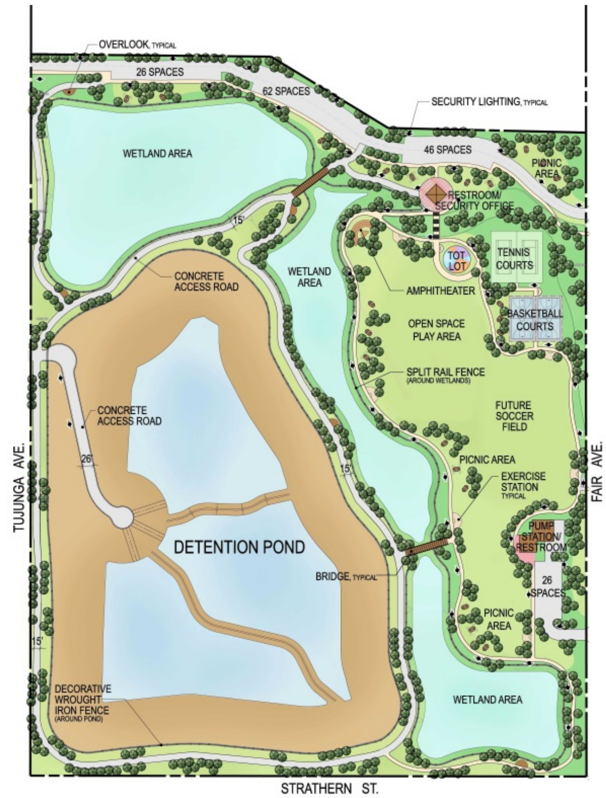

Figure 2 – Conceptual Site Plan
(Note – the wetlands area shown on the top left corner is a soccer field; an updated site plan not yet available)

LASAN/LADWP –Advanced Treated Recycled Water delivery to LAX & Scattergood Generating Station

Project Location

This project will deliver advanced treated recycled water (RW) from the Hyperion Water Reclamation Plant (WRP) to LAX and the Scattergood Generating Station (SGS) as well as other users. A site location map is shown on **Figure 1** and a conceptual site plan is provided as **Figure 2**.

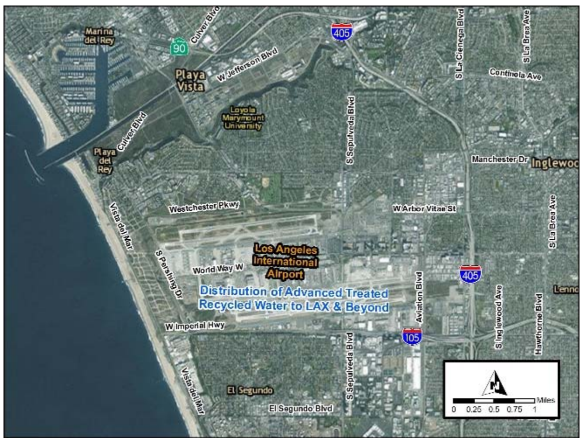

Figure 1 – Site Location Map

Project Description

The project will utilize advanced treated RW generated from Hyperion WRP for use at LAX and SGS as well as other users, in a vital region that serves as the gateway to Los Angeles and occur in 3 phases. The project will occur in phases, with an estimated plant capacity of ~ 2-3 million gallons per day (mgd).

Phase 1 is the delivery of advanced treated water to LAX to be used in existing and future dual plumbing and industrial application. The following RW demands (in gallons per minute [gpm]) are identified at this time:

Facility	Low	Average	Peak
MSC (N)	38	95	190
TBIT	42	105	209
T0	38	95	190
CUP	43	332	880
Totals	**166**	**627**	**1,469**

- Cooling water and dual plumbing at the Midfield Satellite Concourse (MSC) terminal (estimated to be completed by 2024)
- Toilet flushing at Tom Bradley International Terminal (TBIT) utilizing the dual plumbed water system
- Toilet flushing at future terminal next to Terminal 1 (T0) utilizing a dual plumbed water system
- Cooling water for the Central Utility Plant (CUP), which feeds to air conditioning systems of all the existing buildings including TBIT

Phase 2 – The project may then be expanded with a new pipeline along Imperial Highway to connect to the existing 24-inch recycled water pipeline on Aviation Boulevard that currently provides RW to the area as part of West Basin Municipal Water District's Title 22 system. This new pipeline could deliver advanced treated water to serve RW to other users, such as:

- Metro Light Rail Washing Station, with ~ demand of 100 gpm (estimated to be completed by 2022)
- Consolidated Rent-A-Car Center (CONRAC) Rental Car Washing Facility, with ~ demand of 21 gpm (estimated to be completed by 2022)

The combined, estimated peak demand for Phases 1 and 2 is 1,582 gpm, or 2.3 mgd.

Phase 3 – The project could be further expanded to serve private customers north of LAX, such as Playa Vista, Loyola Marymount (LMU), and the Westchester Community. Recycled water demand of these customers will need to be identified for proper pipeline sizing.

LAWA has initiated a scoping study to define the project parameters and pipeline alignment options to establish a future point of connection at or near the intersection of World Way West and Pershing Drive to serve some of the non-potable water needs on LAWA property in Phase 1.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – LASAN/LADWP
- **Potential Partner Agencies** – LAWA, Metro, Caltrans, Private Customers
- **No. of Agencies** = 5

Timing

- Early stages of collaboration

Water Type

- Recycled Water

Required Agreements & Policies

- Agreement No. WR-15-1062 (Executed in August 2015) – LAWA and LADWP will collaborate on a long-term engineering feasibility report for LAX to optimize use of recycled water and further decrease use of potable water across the campus.
- Future RW Service Agreement
- Future MOA/MOU between PW-SAN and LADWP for Infrastructure development and RW Distribution
- Maintenance agreement or ownership transfer for pipeline section that traverses LAWA property once connected to non-LAWA customers east and north of the airport.

Implementation Challenges

- Construction in high-traffic area, including crossing of Sepulveda Blvd (owned by Caltrans).
- Caltrans permit approval.
- Meeting water quality requirements for recycled water use in cooling towers dual plumbing, and car washing.
- Phasing of project by multiple agencies.
- Siting and cost for potential temporary source treatment to use T22 water for CONRAC and Metro sites.
- Reliability/ redundancy to ensure continuous flow.
- County Health Department approvals.
- Permit challenges and/or use restrictions of RW for outdoor irrigation around the Butterfly habitat along Pershing Drive

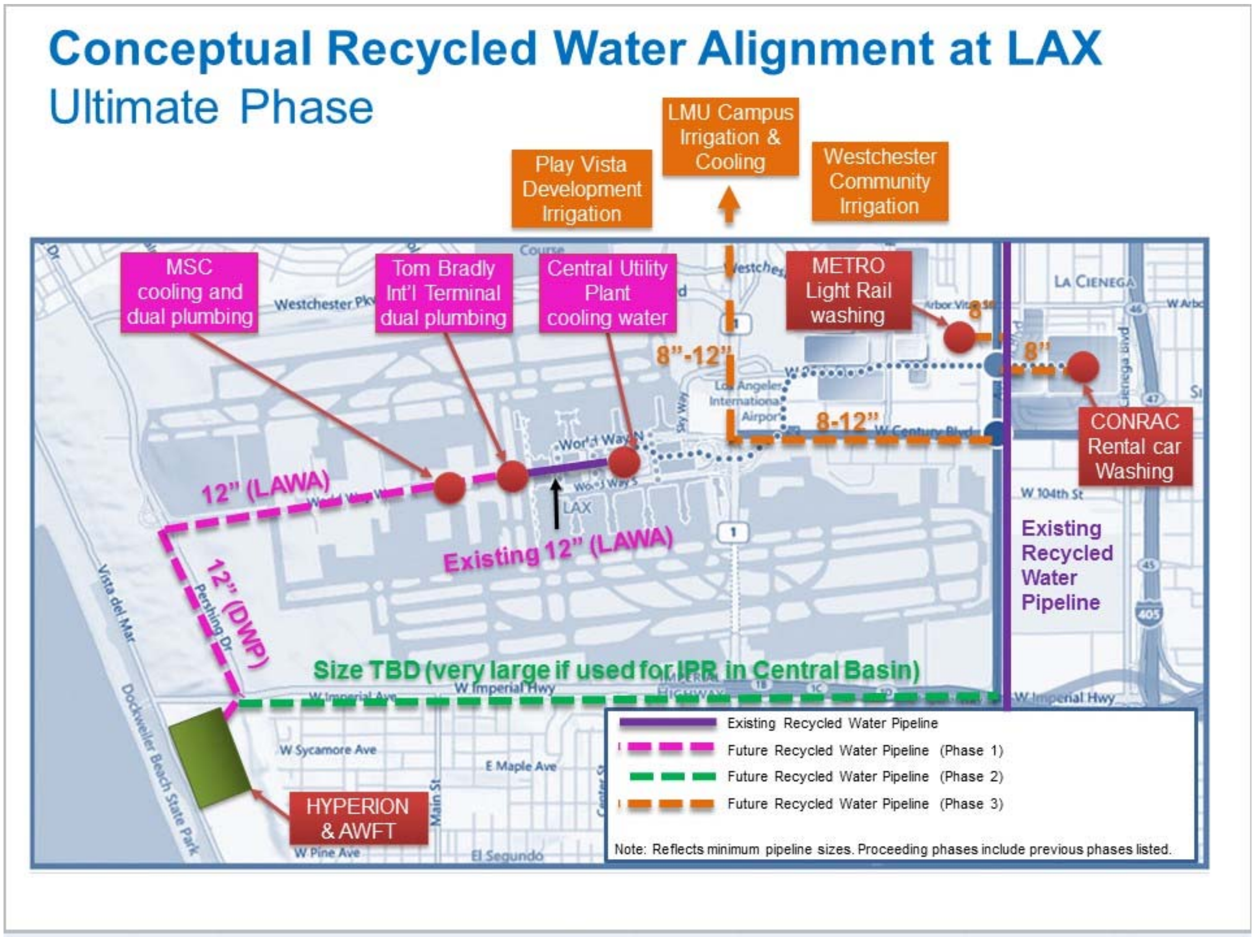

Figure 2 – Conceptual Site Plan

LASAN - Rancho Park Water Reclamation Facility

Project Location

The principal project site is a 150-acre golf course located at 10460 Pico Boulevard in Los Angeles, south of Pico Boulevard, and north of Lorenzo Place (**Figure 1**). It is bounded on the east and west by Motor Avenue and Patricia Avenue, respectively. The preferred location for both the stormwater and on-site recycled water facility is at the Rancho park area, the Rancho Park Golf Course and Cheviot Hills Recreation Center.

Figure 1 – Site Location Map

Project Description

The proposed project would include stormwater capture and reuse concepts to retain runoff from the watershed upstream of the Rancho Park Golf Course to treat and remove pollutants such as trash, metals, and bacteria. This would provide an alternative water supply for golf course and landscape irrigation. Additionally, the proposed project would construct an on-site water reclamation facility that would produce recycled water to meet non-potable irrigation and industrial demands in the regional Rancho Park area for average day non-potable demands and peak day non-potable demands. A conceptual site plan is presented as **Figure 2**.

- **Phase 1:** Stormwater BMPs and water treatment technologies include:
  - Lift station to divert stormwater from a confluence point in the storm drain system next to the golf course
  - Hydrodynamic separator to remove trash, suspended solids, oil and grease
  - Underground stormwater storage tank to hold diverted stormwater runoff for subsequent treatment
  - A Title 22 approved non-granular media filter to reduce turbidity
  - Ultraviolet light (UV) disinfection system to remove pathogens from the stored water prior to reuse
  - An underground storage tank to hold treated water until needed for irrigation
- **Phase 2:** The On-site water reclamation facility will utilize membrane bioreactor (MBR) and UV disinfection with an average day flow treatment capacity of 2.5 mgd.
- In **Phase 3:** The on-site water reclamation facility could later be increased to an average day flow of 4.23 mgd to meet peak day reclaimed water demands without potable water augmentation. Optional treatment of a portion of the product water with reverse osmosis may be desired based on end user water applications.

The stormwater system will provide supplemental irrigation water to the golf course and recreation center until the on-site recycled water system is constructed, after which recycled water would be used. The stormwater diversion lift station could then be reconfigured to divert stormwater flows to the on-site recycled water facility to supplement influent flows. The underground stormwater detention system could be repurposed as storage for Title 22 water produced from the on-site facility.

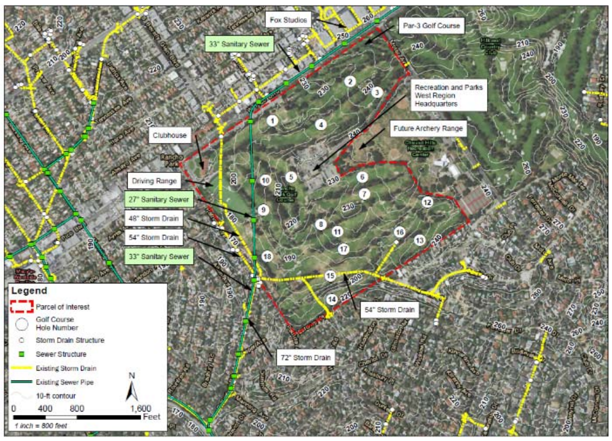

Figure 2 – Conceptual Site Plan

Lead Agency & No. of Agencies Involved

- **Lead Agency** – LASAN
- **Potential Partner Agencies** – RAP, LADWP, BOE
- **No. of Agencies** = 4

Timing

- 42 months – Stormwater capture and treatment facilities
- 6-7 years – On-site recycled water facility

Water Type

- Recycled Water and Stormwater

Required Agreements & Policies

- Extensive coordination with RAP
- Compliance with recycled water regulations

Implementation Challenges

- Thoughtful, proactive communication both within City government and with the surrounding community will be required
- Recommended that LASAN work with the Public Affairs Office to plan / implement a comprehensive outreach program, particularly for the on-site recycled water concept
- LADWP should be involved with the outreach program, particularly for the on-site recycled water concept
- Compliance with tree protection program
- Overall protection of landscape
- Appropriate staging area to protect trees and landscape

LAUSD – Capture of Off-Site Stormwater at LAUSD Schools

Project Location

The One Water LA team has focused on areas in the City of LA where regional stormwater facilities could meet multiple objectives and benefits. Maps and lists of potential school sites have been generated by watershed based on specific criteria that optimizes infiltration and on-site reuse. A map of potential school sites is shown as **Figure 1**.

Project Description

The proposed pilot project would consist of a pre-treatment system (off school site), concrete tank, monitoring system, valves, and potential irrigation systems. Trash and solids would be removed from stormwater diverted from a local storm drain. Diverted stormwater would then be conveyed onto the selected school site and used for either infiltration or irrigation.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – LAUSD
- **Potential Partner Agencies** – LASAN, LADWP, RAP
- **No. of Agencies** = 4
- **Other Stakeholders** – DSA, DTSC, SWRCB

Timing

- Currently in feasibility, research, and evaluation phase

Water Type

- Stormwater

Required Agreements & Policies

The following agreements would need to be negotiated:

- Agency(s) to operate and maintain the facility – this could include potential labor agreements
- Agency(s) to pay for design and construction of the project – this includes all geotechnical and structural considerations
- Development of a Standard Operating Procedure for all involved to follow
- LAUSD to allow construction on a school site and provide an easement for stormwater capture, treatment, and reuse for a minimum of 20 years
- Agreements would need to be put in place for the monitoring of various constituents

Implementation Challenges

- **Location of O&M Activities –** LAUSD prefers that the maintenance of pre-treatment activities occur off their premises. Similar to other Prop O projects, they would like to have those pre-treatment screens, etc. in the streets or right-of-way. LAUSD is concerned that they would be burdened with operating and maintaining facilities for which they do not have the resources to perform the work.
- **Health and Safety** – LAUSD is concerned about the health of the children. Any impacts to the site need to be identified and studied more carefully.

- **Liability Agreements** – Indemnification of the involved parties would need to be clarified.
- **Water Quality** – Water quality results from other existing sites was requested. LAUSD would like a whole suite of contaminants to be tested by LASAN's Watershed Protection Division. Determination of the types of constituents in each sub-watershed category based on land use would be needed.
- **Resources for O&M –** Identification of the agency(s) who have the skill sets and resources to provide operation and maintenance activities.
- **LAUSD Future Expansions –** Identify sites where a stormwater facility does not interfere with a school expansion.

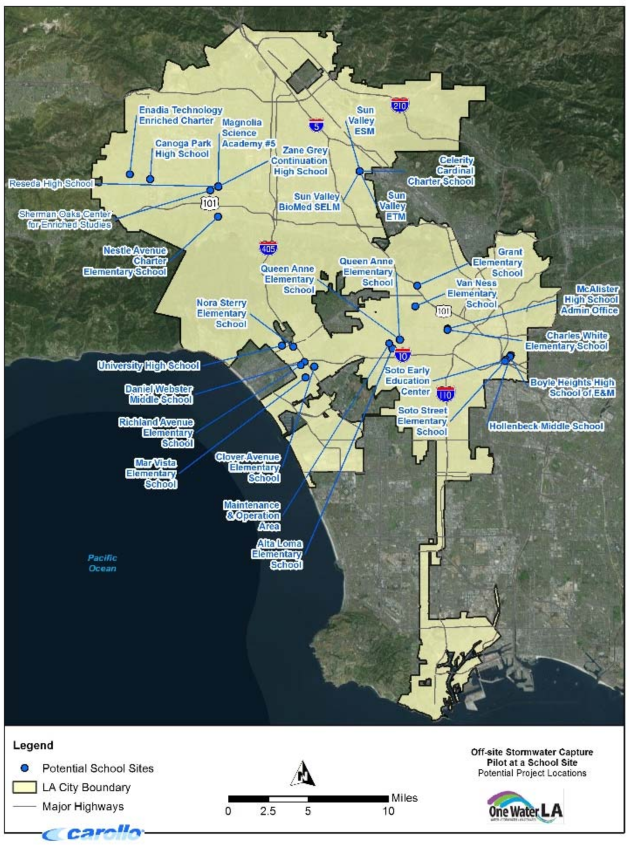

Figure 1 – Potential School Sites

Metro - LA River Bike Path

Project Location

The Los Angeles River Bike Path connects ~ 7 miles from the north side of Griffith Park at Riverside Drive along the LA River to Barclay Street in Elysian Valley, north of Downtown LA (**Figure 1**). Web links:
http://www.americantrails.org/NRTDatabase/trailDetail.php?recordID=3801
http://labikepaths.com/

Figure 1 – Site Location Map

Project Description

The proposed project will incorporate green infrastructure components into the LA River Bike Path, including:

- Bioswales
- Permeable pavement
- Planter boxes

This type of infrastructure represent practices used for collecting stormwater runoff from impervious or compacted areas for infiltration.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – Metro
- **Potential Partner Agencies** – LASAN, LARiverWorks, LADOT
- **No. of Agencies** = 4

Timing

Water Type

- Stormwater

Required Agreements & Policies

Implementation Challenges

POLA - Wilmington Waterfront Development

Project Location

The next area to be developed in the Wilmington Waterfront Development Program is the 8-acre Wilmington Waterfront Promenade, located at the southern end of Avalon Boulevard in Wilmington (**Figure 1**). Web Site: https://www.portoflosangeles.org/recreation/wwpark.asp

Figure 1 – Site Location Map

Project Description

The proposed project includes a waterfront promenade, a small overlook structure, a pedestrian plaza, a parking court on the western end of the project, realignment of Water Street, as well as landscaping & parking northwest of the community center. The development plans to incorporate stormwater capture elements, such as:

- Use landscape to convey/capture stormwater (i.e., biofilters, rain gardens, impervious surfaces using vegetated filter strips)
- Reduce impervious surface to improve water quality and reduce rate/volume of runoff (i.e., porous paving, green roof systems, turf, planting grid systems)
- Install infiltration best management practices (BMPs) (i.e., subsurface chambers, subsurface stone layers)
- Use manufactured structures (i.e., sand filters, water quality devices)
- Reuse stormwater runoff (i.e., gray water reuse for buildings, irrigation)
- Reduce water demand by using native drought-tolerant plantings

Additionally, development will be in close proximity to the existing LADWP recycled water mainline and could include a recycled water component. A conceptual site image is shown as **Figure 2**.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – POLA
- **Potential Partner Agencies** – LASAN, LADWP
- **No. of Agencies** = 3

Timing

Currently in planning & design; construction scheduled to start in Q1 2018.

Water Type

- Recycled Water and Stormwater

Required Agreements & Policies

Implementation Challenges

Figure 2 – Conceptual Site Image

RAP - Caballero Creek Park

Project Location

The Caballero Creek Park project is located at 6353 Lindley Avenue, Los Angeles (Assessor Parcel Map Number 2124-018-905), near the town of Reseda (**Figure 1**). The confluence of the LA River and Caballero Creek is visible from the site.

Figure 1 – Site Location Map

Project Description

The project will convert 1.6 acres of vacant land into a natural, multiple-benefit public park. A future segment of the Los Angeles River Bikeway will run adjacent to the park. The park will feature:

- Watershed learning areas
- A wetland
- Bio-swale best management practices (BMPs)
- Native drought-tolerant landscaping
- Wildlife habitat
- Other park amenities

Caballero Creek Park will be designed to use natural systems, flora, and minimal man-made materials to deliver a beneficial and natural experience in an urban environment. Serving an adjacent disadvantaged community, not only will the project benefit approximately 9,200 people who live and work within walking distance, but will also filter 17 acres of stormwater runoff from the adjacent street, Lindley Avenue. The wetland will treat an estimated 8.5 acre-feet/year (AFY) of water from Caballero Creek, which will be enough to sustain the park's landscaping.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – RAP
- **Potential Partner Agencies** – LARiverWorks, LASAN
- **No. of Agencies** = 3
- **Other Stakeholders** – Reseda High School

Timing

Water Type

- Stormwater (8.5 AFY)

Required Agreements & Policies

Implementation Challenges

- Compliance with tree protection program
- Overall protection of landscape
- Appropriate staging area to protect trees and landscape

RAP - MacArthur Park

Project Location

The MacArthur Park project is a 30-acre park site located at 2230 W. Sixth Street, Westlake, south of West Sixth Street and north of West Seventh Street, immediately west of downtown Los Angeles (**Figure 1**).

Figure 1 – Site Location Map

Project Description

The project will include stormwater best management practices (BMPs), in-lake improvements, and possibly a recycled water pipeline. A conceptual site plan is presented as **Figure 2**.

- **BMPs** and water treatment technologies will be used to capture, store, and treat runoff from the watershed upstream of MacArthur Park:
  - Lift station to divert stormwater from a confluence point in the storm drain system
  - Hydrodynamic separator to remove trash, suspended solids, oil, and grease
  - Underground stormwater detention system to hold diverted stormwater runoff for subsequent treatment
  - Ultraviolet light disinfection system to remove pathogens from stored water prior to reuse
- **In-lake improvements** will include:
  - Floating wetlands with recirculating constructed stream systems
  - Aeration devices
  - Re-circulated lake water pumping systems, strategically placed to improve oxygenation levels in the lake
- A potential 1.3-mile **recycled water pipeline** alignment could extend from the connection point at Los Angeles Convention Center to MacArthur Park via Pico Boulevard and Alvarado Street to provide supplemental water for MacArthur Park Lake.

Lead Agency & No. of Agencies Involved

- **Lead Agency** – RAP
- **Potential Partner Agencies** – BOE, LASAN, LADWP
- **No. of Agencies** = 4

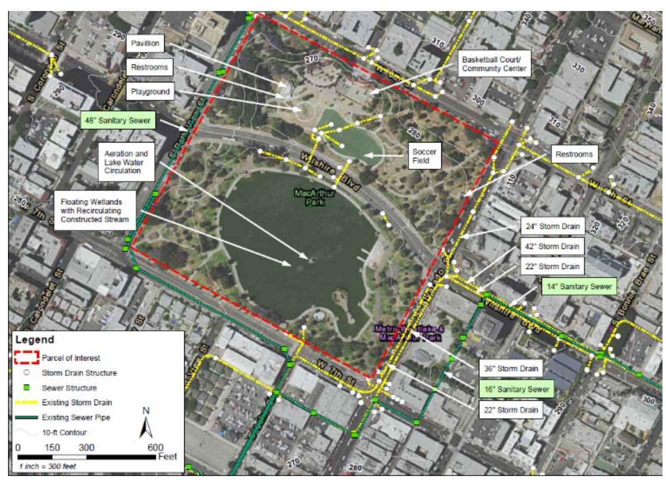

Figure 2 – Conceptual Site Plan

Timing

42 months (total implementation schedule for stormwater capture and treatment facilities)

- Potential construction of the recycled water extension is dependent on if / when LADWP implements the segment of the Downtown Water Recycling Project closest to MacArthur Park.
- An Environmental Impact Report (EIR) is assumed to be the appropriate CEQA document required for the recycled water pipeline extension and is estimated to take up to 2 years.

Water Type

- Recycled Water and Stormwater

Required Agreements & Policies

- EIR
- Compliance with recycled water regulations

Implementation Challenges

- Potential construction of the recycled water extension is dependent on if / when LADWP implements the segment of the Downtown Water Recycling Project closest to MacArthur Park.
- In order for the recycled water pipeline extension to MacArthur Park to be viable for LADWP, LASAN needs to investigate whether or not recycled water can be used as supplemental water for MacArthur Park Lake.
- The feasibility of adding recycled water to the lake should be studied to determine if the quantity and quality of recycled water added to the lake would impact its overall health.
- Project impact to the existing landscape, specifically each tree that falls within the estimated construction scope area.
- Impact of high salinity lake water on the future health of landscaping if water is to be continually used for irrigation of parkland.
- Compliance with tree protection program.
- Appropriate staging area to protect trees and landscape.

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3.6 Steps 6 and 7 - Ranking and Selection of Top 5 Case Studies

The project information in the fact sheets was used to score and rank the 10 projects. A set of ranking criteria was developed to quantify scoring and establish ranking as shown in Table 3.

Table 3 Scoring and Ranking Criteria
One LA Water – TM No. 3.1

Criteria	Description	Scoring
Implementation Complexity • Total No. of Departments • Need for Public Outreach • New Technical/ Institutional Challenges	Consideration of number of departments/agencies involved; Institutional agreements; Technical complexity; Constructability; Environmental issues; Extent of public outreach needed; The more complex projects received higher scores (i.e., potential to work through challenges and create momentum)	Score = 1 to 5 1 = Low 5 = High
Visibility/Education Potential	Number of people that can be reached at site annually; ability to educate public; potential for partnerships with educational institutions	Score = 1 to 5 1 = Low 5 = High
Disadvantaged Community	Potential ability of the project to enhance a disadvantaged community measured by the average household income of the neighborhood that the project is located in	Score = 1 to 5 1 = Low 5 = High
Replicability	Ability to utilize lessons learned in the future at other project sites with similar characteristics	Score = 1 to 5 1 = Low 5 = High
Unique Timing	Opportunity to implement the project in the next few years but with the ability to still influence the project elements (early planning stage)	Score = 1 to 5 1 = Low 5 = High
Potable Water Offset	Amount of potable water offset (in acre-feet per year [AFY] or estimated as low, medium, high; this is the total offset/yield increase)	Score = 1 to 5 1 = Low 5 = High
Stormwater Quality Improvement	Ability of a project to provide stormwater quality improvement benefits through Best Management Practices (BMPs) measured by the tributary area of a project	Score = 1 to 5 1 = Low 5 = High
Multiple Water Components	Opportunity of a project to demonstrate One Water integrated planning by adding a bonus point for projects with both stormwater and recycled water components	Score = 0 or 1 0 = No 1 = Yes

The initial scoring was tabulated for each project to establish a total project score and project ranking. Subsequently, the scoring was discussed and finalized with input from the One Water LA Team. The scoring exercise was intended to select which Integration Opportunities would be developed as Case Studies for the One Water LA 2040 Plan. The scoring cannot not be used as a measure to decide on further study or implementation of these opportunities, for the following reasons: 1) only limited project information was available at the time of scoring; 2) each of these projects continues to evolve; and 3) each lead agency needs to make its own decision on moving these projects forward.

The results of the final scoring and ranking process are graphically summarized on Figure 3, while the complete scoring table is provided in Table 4. As shown, the following project opportunities are selected as the top five Case Studies:

- **Rancho Park Water Reclamation Facility** – stormwater capture and reuse with recycled water distribution.
- **Advanced Treated Recycled Water delivery to LAX and Scattergood Generating Station** – includes delivery of advanced treated recycled water to LAX, as well as users beyond LAX.
- **Capture of Off-Site Stormwater at LAUSD Schools** – includes capture and treatment of offsite stormwater for reuse or recharge at a school site.
- **Restoration of G2 Parcel at Taylor Yard** – includes stormwater BMPs and potentially recycled water.
- **Water Management Strategies for the LA Zoo Master Plan** – includes use of recycled water for animal exhibits, wash down, and irrigation at the LA Zoo, with a possible stormwater component.

These five Case Studies will be developed in more detail with input from the agencies involved. The detailed case study descriptions will be presented in TM 3.2.

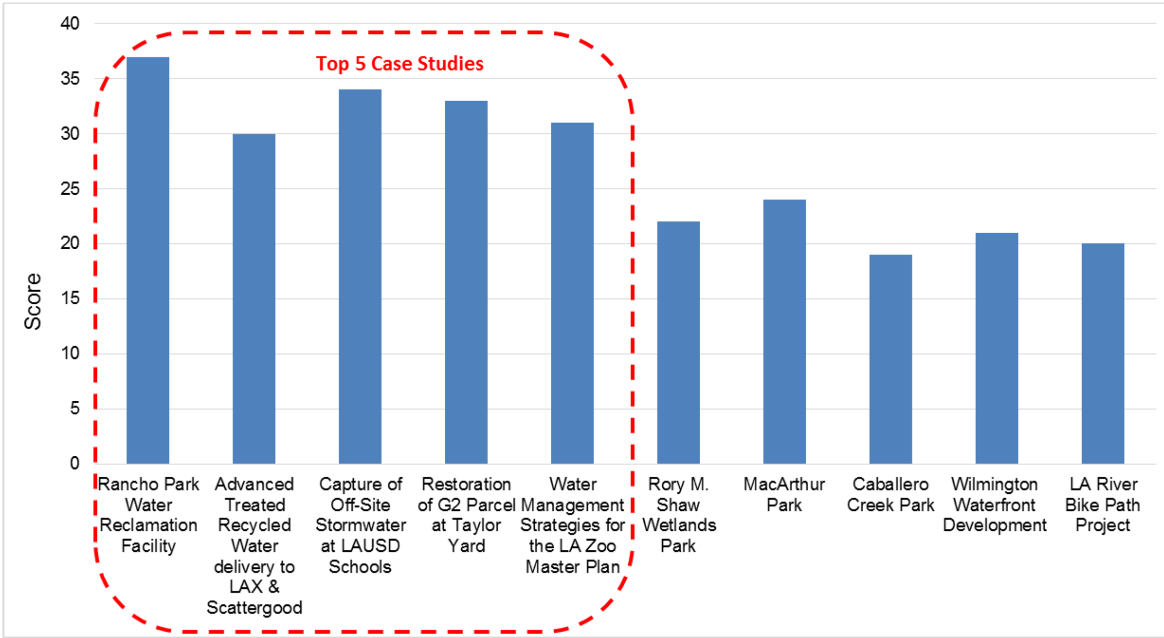

Figure 3 Ranking Scores of Top 10 Case Studies

Table 4 Scoring and Ranking Table for Top 10 Case Studies
One LA Water – TM No. 3.1

	Ranked Potential Case Studies	Implementation Complexity *[Score = 1 (low) to 5 (high)]*: Total # of Departments; Collaboration Score	Implementation Complexity: Need for Public Outreach *(with help from Mayor's office)*	Implementation Complexity: New Technical/ Institutional Challenges	Visibility/ Educational Potential *[Score = 1 (low) to 5 (high)]*	DAC *[Score = 1 (low) to 5 (high)]*	Replicability *[Score = 1 (low) to 5 (high)]*	Unique Timing *[Score = 1 (low) to 5 (high)]*	Potable Water Offset *[Score = 1 (low) to 5 (high)]*	Stormwater Quality Improvement *[Score = 1 (low) to 5 (high)]*	Multiple Water Components *[Score = 0 (No) or 1 (Yes)]*	Final Score *Sum of all Criteria*
1	Rancho Park Water Reclamation Facility	4	5	4	5	0	4	5	4	5	1	37
2	Advanced Treated Recycled Water to LAX & Scattergood Generating Station	5	4	5	4	0	2	5	5	0	0	30
3	Capture of Off-Site Stormwater at LAUSD Schools	4	4	4	5	3	5	5	1	3	0	34
4	Restoration of G2 Parcel at Taylor Yard	5	4	3	4	4	2	4	3	4	0	33
5	Water Management Strategies for the LA Zoo Master Plan	4	2	3	5	0	2	4	5	5	1	31
6	Rory M. Shaw Wetlands Park	6	1	1	4	2	2	1	2	4	0	22
7	MacArthur Park	4	1	1	2	5	2	2	3	3	1	24
8	Caballero Creek Park	3	2	1	2	1	4	3	1	2	0	19
9	Wilmington Waterfront Development	3	2	1	3	4	2	2	2	1	1	21
10	LA River Bike Path Project	4	2	1	2	3	2	3	1	2	0	20

4.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations can be made based on the work conducted for the preparation of this TM:

- 44 potential existing integration opportunities were gathered from 14 departments and other agencies.
- 10 potential projects were identified after the initial screening process (see Appendix B) that would be viable Case Studies at the time of this TM preparation.
- 5 Case Studies were identified to be the top candidates to move forward with at this time.
- The top 10 projects represent a broad mix of project components, lead departments/agencies, and collaboration partners.
- The top 5 projects include four stormwater projects, three recycled water projects, while two projects include a combination of both.

The top 5 and 10 Case Studies are summarized in Table 5. The top 5 Case Studies will be described in more detail in TM 3.2.

Table 5 Top 5 and 10 Case Studies
One LA Water – TM No. 3.1

Ranking	Lead Agency	Project Name	Water Component	Department(s) Involved
1	LASAN	Rancho Park Water Reclamation Facility	 	LADWP, RAP
2	LASAN/ LADWP/ LAWA	Advanced Treated Recycled Water delivery to LAX and Scattergood Generating Station		N/A
3	LAUSD	Capture of Off-Site Stormwater at LAUSD Schools		LASAN, LADWP, DSA
4	LARiverWorks	Restoration of G2 Parcel at Taylor Yard		BOE, HSR, LASAN, RAP
5	LA Zoo	Water Management Strategies for the LA Zoo Master Plan	 	LADWP, LASAN, RAP
6	LACFCD	Rory M. Shaw Wetlands Park		HSR, LADWP, LASAN, RAP
7	RAP	MacArthur Park	 	BOE, LASAN, LADWP
8	RAP	Caballero Creek Park		LARiverWorks, LASAN
9	POLA	Wilmington Waterfront Development	 	LASAN, LADWP
10	Metro	LA River Bike Path		LARiverWorks, LADOT, LASAN

 = Stormwater

 = Recycled Water

APPENDIX A – REFERENCES

Carollo Engineers, 2016. TM 1.3 – Existing Water Projects and Programs. One Water LA Plan. Final Draft. January.

City of Los Angeles – Mayor's Office, 2014. Executive Direction #5 – Emergency Drought Response, Creating a Water Wise City. October 14.

City of Los Angeles – Mayor's Office, 2015. Sustainability pLAn. April.

APPENDIX B – SUMMARY TABLE OF ALL PROJECTS WITH PRELIMINARY SCREENING

SUMMARY TABLE OF ALL PROJECTS WITH PRELIMINARY SCREENING										
#	**Lead Agency**	**Project Name**	**Description**	**Supporting Agencies**	**Water Type (e.g. RW, SW)**	**Total Score**	**Support Mayor's Goals (1 = Yes and 0 = No)**	**Visibility (1 = Yes and 0 = No)**	**Social/ Environmental Justice (1 = Yes and 0 = No)**	**Role Model/ Replicable? (1 =Yes and 0 = No)**
1	LACFCD	Hancock Park Drainage Enhancement Project	Located in the Hancock Park neighborhood in the City of Los Angeles, the project currently in the concept develoopment phase would receive runoff from 1,600 acres of urban development. Project features could include: 1) a new 1.5 mile storm drain and 8 acre-foot underground detention basin to temporarily detain storm runoff and alleviate flooding, 2) low-flow diversion structure and on-site water treatment and storage system to augment water supply and golf course irrigation with treated runoff and 3). Low-flow diversion structure would also improve water quality by reducing urban runoff into Ballona Creek and Santa Monica Bay	LADWP, LASAN, Wilshire Country Club	Stormwater	3	1	1		1
2	LACFCD	Rory M. Shaw Wetlands Park	The project's objective is to retain stormwater runoff while increasing water conservation, recreational opportunities, and wildlife habitat, and reducing stormwater pollution. The project will convert a 46-acre, engineered, inert landfill into a multi-purpose wetlands park. The project will feature a 21-acre detention pond that will provide the capacity to store runoff collected from the upstream tributary area and reduce flooding in the surrounding areas. The project will also feature a 10-acre wetland that will serve as a natural water treatment system for removing pollutants from the collected stormwater runoff. The wetlands will provide a sustainable habitat for various plant and animal species. The treated stormwater will be pumped to the existing Sun Valley Park infiltration basins for groundwater recharge. The project will include approximately 15 acres of open space and recreational areas. Proposed recreational enhancements include trails, basketball and tennis courts, a tot lot, picnic tables, educational signage, and restrooms. The project will provide an open space recreation to a community that is currently underserved for recreational opportunities.	HSR, LADWP, LASAN, RAP	Stormwater	4	1	1	1	1
3	LADOT	Cesar Chavez Pedestrian Improvements	Overall scope has not been ironed out yet but they anticipate the project may include curb extensions and sidewalk work along Cesar Chavez between Warren and Evergreen.	LASAN	Stormwater	3	1	1		1
4	LADOT	Central Avenue Pedestrian Improvements	Overall scope has not been ironed out yet but they anticipate the project may include curb extensions and sidewalk work along Central Avenue between Washington Blvd. and Slauson Ave.	LASAN	Stormwater	3	1	1		1
5	LADOT	Bicycle Friendly Street Intersection Enhancements	Implementation of mini-roundabouts at several key intersections.	LASAN	Stormwater	3	1	1		1
6	LADWP	Stormwater Projects at the Port of Los Angeles	To be implemented afar Terminal Island Water Reclamation Plant is on-line. Need more info on the actual project locations.	LASAN, POLA	Stormwater	3	1	1		1
7	LADWP	Stormwater and Recycled Water Projects at a LAUSD School	LADWP entered into an MOU with LAUSD for $3M to install stormwater capture BMPs in several campuses. Potential stormwater capture projects are being evaluated. LADWP is also looking to expand purple pipe in the future to the following school sites: Westchester MS (2016), Birmingham Complex (2017), Banning HS (2017), & Harry Bridges Wilmington ES (2017).	LAUSD	Stormwater, Recycled water	3	1	1		1
8	LADWP	Stormwater Capture Master Plan - Centralized Project	Tujunga Spreading Grounds Enhancement Project	BOE, BSS, LACFCD, LARiverWorks, LASAN, LAUSD, MWD, RAP	Stormwater	2	1	1		
9	LARiverWorks	Restoration of G2 Parcel at Taylor Yard	This 40-acre former rail yard has been identified by the LA River Revitalization Master Plan as a top priority for LA River-adjacent open space and habitat restoration – and could also include large-scale features for water quality improvement and stormwater detention.	BOE, HSR, LASAN,	Stormwater	4	1	1	1	1
10	LARiverWorks	Central Service Yard Open Space	The Central Service Yard facility is being evaluated (CD 13 is lead) for increased space-usage efficiency with a goal of freeing significant space at the river's edge for public use, including potential water-related infrastructure.	Need more info	Need more info	1	1	0	0	0
11	LARiverWorks	LA River Natural Park	Adjacent to the LA River in CD 2, the current Studio City Golf and Tennis facility has long-standing community backing for renovation into a public open space involving major stormwater capture and treatment facilities.	LASAN	Stormwater	3	1	1	0	1

SUMMARY TABLE OF ALL PROJECTS WITH PRELIMINARY SCREENING										
#	Lead Agency	Project Name	Description	Supporting Agencies	Water Type (e.g. RW, SW)	Total Score	Support Mayor's Goals (1 = Yes and 0 = No)	Visibility (1 = Yes and 0 = No)	Social/ Environmental Justice (1 = Yes and 0 = No)	Role Model/ Replicable? (1 =Yes and 0 = No)
12	LARiverWorks	Downtown LA River Open Spaces - Sixth Street Viaduct and "Piggyback Yard"	The Sixth Street Viaduct and LA Trailer and Container ("Piggyback Yard," owned by Union Pacific and included in the Army Corps of Engineer's LA River Ecosystem Restoration Project) locations each offer rare opportunities to soften the hardscape of Downtown's industrial terrain – for open space and stormwater treatment benefits.	BOE, LASAN	Stormwater	3	1	1	0	1
13	LARiverWorks	In-Channel Actions	The City and partners should mobilize to 1) explore various ways to use the river channel and its tributaries as detention facilities following rain events – with inflatable dams or othe modifications and 2) be prepared to address another water issue: an overabundance in the form of potential floodwaters. Preparation, in coordination with regional and federal leads should be community-focused and done in advance of rainy seasons.	Need more info	Stormwater	3	1	1	0	1
14	LARiverWorks	Large-Scale Watershed Retention Projects	Locations like the Chatsworth Reservoir, Van Nuys Airport, Dodger Stadium parking lot, and other massive expanses should be aggressively evaluated for capture, treatment, and infiltration potential.	Need more info	Stormwater	3	1	1	0	1
15	LASAN	Westwood Neighborhood Greenway		LACDPW	Stormwater	3	1	1		1
16	LASAN	Harbor City Park		LACDPW	Stormwater	3	1	1		1
17	LASAN	North Hollywood Park		LACDPW	Stormwater	3	1	1		1
18	LASAN	Venice Blvd. Neighborhood Green Streets Regional Project		LACDPW	Stormwater	3	1	1		1
19	LASAN	Riviera Country Club Stormwater Reuse BMP		LACDPW	Stormwater	3	1	1	0	1
20	LASAN	City Plants	A public-private partnership between the City Non Governmental Organizations to plant trees in Los Angeles. Includes a residential program with 7 trees per resident, tree giveaway events, tree adoption, and parkway plantings.	BSS, LADWP, RAP		1	0	0		1
21	LAUSD	Capture of Off-Site Stormwater at LAUSD Schools	Location to be determined.	LASAN, LADWP, RAP	Stormwater	3	1	1	0	1
22	LAWA	Prop "O" Stormwater Infiltration Facility at LAX and Hyperion Treatment Plant/North Central Outfall Sewer Connection	An MOU was executed between LAWA and LA Sanitation on May 11, 2015 (DA-4959) which formalized a collaboration between our agencies to build a storm water infiltration facility in the northwest corner of the LAX property and construct a storm water by-pass connection to HTP through the NCOS. Both projects are underway with LA Sanitation leading the design and construction of the infiltration facility and LAWA leading the design of the NCOS by-pass.	LASAN	Stormwater	1	1	0	0	0
23	LAWA	Stormwater Management Plan - Dominguez Channel and Landside Access Modernization Program (LAMP)	LAWA is in the advanced stages of preparing a Storm Water Management Plan that includes planning elements for the LAMP projects which will be tributary to the Dominguez Channel. As the storm water runoff mitigation and management measures for the program are evaluated, there will certainly need to be some coordination and collaboration with LA Sanitation on the implementation of those options, which could include permeable pavement, storage and pretreatment/reuse…	LASAN	Stormwater	1	1	0	0	0
24	LAWA	Design & Construction of a Recycled Water Pipeline	Agreement NO. WR-15-1062 between LADWP and LAWA - this agreement was executed in August 2015, and includes responsibilities for the design (LADWP) and construction (LAWA) of a 2500' RW pipeline to service the landscape areas in and around the Imperial Highway and Sepulveda Blvd interchange. The design is complete and in permit review by Caltrans. LAWA will be reimbursed up to $690 K for the cost of construction.	Caltrans, LADWP	Recycled water	2	1	0	0	1

One Water LA

#	Lead Agency	Project Name	Description	Supporting Agencies	Water Type (e.g. RW, SW)	Total Score	Support Mayor's Goals (1 = Yes and 0 = No)	Visibility (1 = Yes and 0 = No)	Social/ Environmental Justice (1 = Yes and 0 = No)	Role Model/ Replicable? (1 =Yes and 0 = No)
SUMMARY TABLE OF ALL PROJECTS WITH PRELIMINARY SCREENING										
25	LAWA	Agreement NO. WR-15-1062 (between LADWP and LAWA) Preparation of a Report for Design & Construction of a Recycled Water Pipeline	This agreement was executed in August 2015 and commits both departments to collaborate in the preparation of a Report that identifies future RW use opportunities. That report development is in progress.	LADWP	Recycled water	1	1	0	0	0
26	LAWA (originally a LAWA project - but later determined LASAN/LADWP would be the lead departments)	Advanced Treated Recycled Water delivery to LAX and Scattergood Generating Station	LA Sanitation and LADWP are in the early stages of collaborating on the production and distribution of Advanced Treated Recycled Water at the Hyperion Water Reclamation Plant. The proposed MBR/RO facility will produce water of a sufficient quality to be used by LAX in existing and future dual plumbing and industrial application. LAWA has initiated a scoping study to define the project parameters and pipeline alignment options to establish a future point of connection for this new RW water at or near the intersection of World Way West and Pershing Dr. The largest consumer of this water at LAX will be the Central Utility Plant which currently uses between 250,000 and 650,000 gallons of potable water per day as make-up water in the cooling towers.	LADWP, LASAN, METRO	Wastewater, Recycled water	3	1	1	0	1
27	LA ZOO	Permeable Pavement in Parking Lot - Phase 2	The project involves phase 2 of the Zoo Parking lot to expand the current use of recycled water for irrigation, drought tolerant plants, permeable paving, bio-swales and to include the possible addition of Solar Power structures. The project is in the early planning stages and there currently is no funding available.	BOE, LADWP, LASAN	Stormwater, Recycled water	2	1	0	0	1
28	LA ZOO	Water Management Strategies for the LA Zoo Master Plan	Currently, the One Water LA and the Zoo Department is collaborating to evaluate using recycled water for animal exhibits, irrigation, and washdown. The project is in the research phase and there are no plans or funding identified.	LADWP, LASAN, RAP	Recycled water, Stormwater	2	1	1	0	0
29	LA ZOO	Recycled Water Fill Stations	The Department of Water and Power is collaborating with the Zoo Department to provide a public recycled water fill station in the Zoo Parking Lot. DWP and the Zoo are anticipating the fill station to be operational for a trial period for this summer.	LADWP	Recycled water	1	1	0	0	0
30	METRO	Potential Planning Project Collaboration on the Caltrans Sustainable Community Grant	Mapping green infrastructure opportunities layered over transportation projects TOD areas.	Caltrans, LADOT, LASAN	Stormwater	1	1	0	0	0
31	METRO	Funding a Metro Urban Green Demonstration Project	Refer to Metro Urban Green Board Report pdf document.			0				
32	METRO	LA River Bike Path Project	Potential green infrastructure components.	LARiverWorks, LADOT, LASAN	Stormwater	4	1	1	1	1
33	METRO	Rail to Rail/River Active Transportation Corridor	Potential green infrastructure components.	HSR, LARiverWorks, LADOT, LASAN	Stormwater	3	1	1	1	0
34	MWD	Regional Recycled Water Program	Long-term strategy for large-scale wastewater recycling from the Joint Water Pollution Control Plant with up to 150 mgd of IPR/DPR projects at various locations in the greater LA area, including Orange County and Inland Empire. A specific example is to incorporate Hyperion flows into the regional recycled water program.	LACSD, LADWP, LASAN	Wastewater, Recycled water	1	1	0	0	0
35	MWD	Local Resources Program	Consists of groundwater recovery projects and recycled water projects.	Varies	Recycled water, Groundwater	1	1	0	0	0
36	POLA	Wilmington Waterfront Park – Recycled Water Supply	The Wilmington Waterfront Park was completed several years ago and was installed ready to receive recycle water however it has been using potable water since its completion. There is a recycled water mainline adjacent to the park and the Port would like to be able to connect the park to the recycled water.	LADWP	Recycled water	1	1	0	0	0

SUMMARY TABLE OF ALL PROJECTS WITH PRELIMINARY SCREENING											
#	Lead Agency	Project Name	Description	Supporting Agencies	Water Type (e.g. RW, SW)	Total Score	Support Mayor's Goals (1 = Yes and 0 = No)	Visibility (1 = Yes and 0 = No)	Social/ Environmental Justice (1 = Yes and 0 = No)	Role Model/ Replicable? (1 =Yes and 0 = No)
37	POLA	Recycled Water Filling Station for the Port Construction and Maintenance Division	The Port's Construction and Maintenance Division's yard is located in close proximity to a DWP recycled water mainline. The Port would like to have a filing station installed so that Port water trucks will be able to fill up with recycled water.	LADWP	Recycled water	2	1	0	0	1
38	POLA	Wilmington Waterfront Development	This public access development is currently in the planning stages. The public space will eventually incorporate storm water capture elements. Additionally the development will be in close proximity to the existing DWP recycled water main.	LADWP, LASAN	Stormwater, Recycled water	4	1	1	1	1
39	POLA	Ports O' Call Redevelopment	This project is in the planning stages. There will be opportunity in this development for storm water capture.	LASAN	Stormwater	1	1	0	0	0
40	RAP	Albion Riverside Park	8 acre river-adjacent project that expands an existing park with new land acquisition and adds major stormwater capture & infiltration infrastructure beneath the park. Project design is complete, and we are beginning bid & award phase. Design includes both on-site and off-site (diversion of local stormwater main) stormwater capture, treatment, and infiltration into underground galleries. Site features include renovated baseball field, 2 soccer fields, basketball courts, new playground & picnic areas, etc. Water quality elements include: bioswales for site water capture & treatment, permeable parking lot stalls, and native planting areas to reduce irrigation needs. Entire site will be irrigated with recycled water.		Need more info	0				
41	RAP	MacArthur Park	This 30-acre park project would intercept and treat stormwater runoff collected from the watershed upstream providing downstream water quality benefits in Ballona Creek and improve water quality in MacArthur Park Lake. Project would also explore the potential to provide supplement water to MacArthur Park and Lake through connection to a non-potable recycled water distribution system.	BOE, LASAN, LADWP	Stormwater, Recycled water	4	1	1	1	1
42	RAP	Hollenbeck Park and Lake Project	LASAN received a prelim concept - not released yet. Project would involve stormwater capture and possible recycled water extension to the park, parkland and lake rehabilitation	LADWP, LASAN	Stormwater, Recycled water	3	1	1		1
43	RAP	Caballero Creek Park	Caballero Creek Park will convert 1.6-acres of vacant land into a natural, multiple-benefit public park. Located in Reseda, the land is owned by the City of Los Angeles. A future segment of the Los Angeles River Bikeway will run adjacent to the park. The confluence of the L.A. River and Caballero Creek is visible from the site. The park will feature watershed learning areas, a wetland and bio-swale BMPs, native drought-tolerant landscaping, wildlif habitat, walking/jogging trails, fitness stations, seating and picnic areas and other park amenities. Caballero Creek Park will be designed to use natural systems, flora, and minimal man-made materials to deliver a beneficial and natural experience in an urban environment. Serving an adjacent disadvantaged community, not only will the project benefit approximately 9,200 people who live and work within walking distance, but it will filter 17 acres of storm runoff from the adjacent street, Lindley Avenue. The wetland will treat an estimated 8.5 acre feet of water from Caballero Creek each year, which is enough to sustain the park's landscaping	LARiverWorks, LASAN, Reseda High School	Stormwater	4	1	1	1	1
44	LASAN	Rancho Park Water Reclamation Facility		BOE, LADWP, RAP	Stormwater, Recycled water	3	1	1		1

Project Selected as Top 10 Case Study Opportunity

First Draft:	5/26/2017
Final Draft:	6/30/2017
Final:	3/30/2018
Lead Author:	Karen Miller

CITY OF LOS ANGELES

TECHNICAL MEMORANDUM NO. 3.2
CURRENT INTEGRATION OPPORTUNITIES
CASE STUDIES

FINAL
March 2018

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CITY OF LOS ANGELES

TECHNICAL MEMORANDUM
NO. 3.2
CURRENT INTEGRATION OPPORTUNITIES
CASE STUDIES

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LIST OF ABBREVIATIONS

Abbreviation	Description
AF	acre-feet
AFY	acre-feet per year
AOP	advanced oxidation process
APHIS	Animal and Plant Health Inspection Service
AQMD	Air Quality Management District
ARBOR	Area with Restoration Benefits and Opportunities for Revitalization
AWPF	Advanced Water Purification Facility
BMPs	Best Management Practices
BOE	Los Angeles Bureau of Engineering
BSS	building and safety
C	conservation
cBOD	carbonaceous biochemical oxygen demand
CCPP	calcium carbonate precipitation potential
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIP	Capital Improvement Plan
City	City of Los Angeles
COD	chemical oxygen demand
CONRAC	Consolidated Rent-A-Car Center
CUP	Central Utility Plant
DDW	Division of Drinking Water
DSA	Division of State Architect
DTSC	Department of Toxic Substances Control
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
EWMP	Enhanced Watershed Management Program
GAC	granular activated carbon
gal/yr	gallons per year
GIS	Geographic Information System
gpd	gallons per day
gpm	gallons per minute
HSR	California High-Speed Rail Authority
HWRP	Hyperion Water Reclamation Plant
IRP	integrated resources plan
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LADOT	Los Angeles Department of Transportation
LADWP	Los Angeles Department of Water and Power

Abbreviation	Description
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LAMP	Landside Access Modernization Program
LARiverWorks	Los Angeles RiverWorks Office
LASAN	Los Angeles Sanitation
LAUSD	Los Angeles Unified School District
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LFD	low flow diversion
LID	low impact development
LMU	Loyola Marymount University
LSI	Langlier's Saturation Index
LSS	Life Support Systems
MBR	membrane bioreactor
METRO	Metropolitan Transportation Authority
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
MSC	Midfield Satellite Concourse
NEPA	National Environmental Policy Act
NOS	North Outfall Sewer
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
POLA	Port of Los Angeles
Project	Recycled Water Case Study
RAA	Reasonable Assurance Analysis
RAP	Los Angeles Department of Recreation and Parks
RCH	Rios Clementi Hale
RFP	Request for Proposal
RO	reverse osmosis
ROW	right-of-way
RW	recycled water
RWQCB	Regional Water Quality Control Board
SCADA	supervisory control and data acquisition
Scattergood	Scattergood Generating Station
SIP	street-end interface points
sq ft	square feet
SW	stormwater
SWRCB	State Water Resources Control Board

Abbreviation	Description
TBD	to be determined
TDS	total dissolved solids
TM	Technical Memorandum
TOC	total organic carbon
TSS	total suspended solids
UCLA	University of California Los Angeles
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
UV	ultraviolet
UV/AOP	ultraviolet advanced oxidation process
WBMWD	West Basin Municipal Water District
WRF	water reclamation facility

CURRENT INTEGRATION OPPORTUNITIES CASE STUDIES

1.0 INTRODUCTION

1.1 Summary of One Water LA

The City of Los Angeles (City) recently embarked on the One Water LA 2040 Plan. This plan will provide a strategic vision and a collaborative approach for integrated water management. In 2006, the City completed and adopted its first Water Integrated Resources Plan (Water IRP). This plan was the start of a paradigm shift for the City and resulted in significant achievements. Since then, the water landscape in the City has changed with increased demands, new regulations, and threats of climate change.

In response to these changes and to help achieve water sustainability, the City initiated the One Water LA 2040 Plan. This plan builds upon the success of the Water IRP, which had a planning horizon to year 2020. The One Water LA 2040 Plan takes a holistic and collaborative approach, to consider all water resources from surface water, groundwater, potable water, wastewater, recycled water, dry-weather runoff, and stormwater as "One Water." The plan identifies multi-departmental and multi-agency integration opportunities to manage water in a more efficient, cost effective, and sustainable manner.

The One Water LA 2040 Plan represents the City's continued and improved commitment to proactively manage all its water resources and implement innovative solutions, driven by the Sustainable City pLAn. The plan will help guide strategic decisions for integrated water projects, programs, and policies within the City.

1.2 Purpose of Task 3

The overarching purpose of Task 3 is to identify current integration opportunities for existing and planned projects from the various City departments and regional agencies. This task builds upon the work conducted in Task 1.3 and documented in Technical Memorandum (TM) 1.3 - Existing Water Projects and Programs (Final Draft, dated January 2016).

Task 3 consists of two subtasks, wherein the focus of Subtask 3.1 was to first identify a broad mix of projects that can be implemented in the current (less than 5 years) that demonstrate the advantages of collaboration between various departments and agencies. Subsequently, these potential project opportunities were ranked to select the top ten current integration opportunities, for which conceptual project descriptions were prepared. These project descriptions (Fact Sheets) were then used to conduct a more in-depth evaluation to select the top five current integration opportunities recommended for further pursuit at this time. Results of this work are documented in TM 3.1 - Current Integration Opportunities Case Study Selection (Final, dated November 2016).

The top five projects moved forward as "Case Studies" in Subtask 3.2. However, it is noted that Case Study 4 was removed from consideration and placed on hold due to discussions and negotiations taking place for the project site (See Section 2.0 for additional information). Detailed project descriptions were prepared for each of the Case Studies with input from the departments and agencies involved. Accordingly, the purpose of Subtask 3.2 was to work through challenges and to create momentum behind these Case Studies. In turn, these current integration opportunities can be implemented and function as examples or templates for similar projects by establishing the necessary relationships, policies, agreements, and/or cost sharing arrangements required to implement multi-departmental/ agency projects.

1.3 Objective of Technical Memorandum No. 3.2

The objective of TM 3.2 is to present the top five Case Studies selected in TM 3.1, with a focus on creating momentum for these projects and establishing examples/templates that can be used for similar projects. Additional integration opportunities are captured at the conclusion of this TM in Section 7.0, in order to provide a "living" project/concept ideas list.

2.0 CASE STUDY SELECTION AND DEVELOPMENT PROCESS

This section describes the Case Study selection and development process. The process flow diagram shown on Figure 1 illustrates the overall Case Study selection process. As shown, the selection process consisted of five overall steps, and two screening steps to narrow down a list of 44 potential current integration projects or concepts to the top five Case Studies. This Case Study selection and screening process is described in detail in Section 3.0 of TM 3.1, with a short summary provided next.

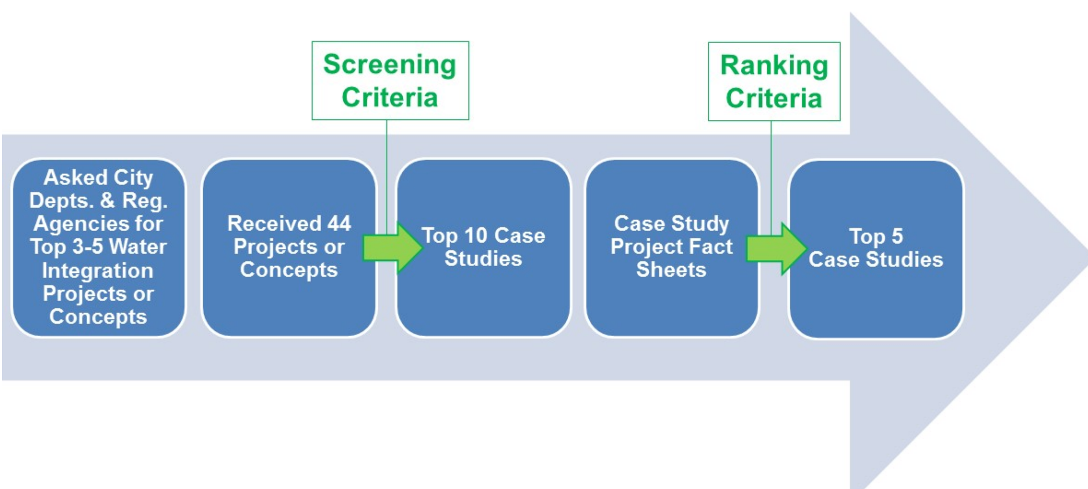


Figure 1 Case Study Selection and Development Process

In short, the Case Study screening and selection effort resulted in identification of the top five Case Studies and top ten current integration opportunities. The Case Study listing and ranking is summarized in Table 1. Most notably:

- The top ten projects represent a broad mix of project components, lead departments/agencies, and collaboration partners.
- The top five projects include two stormwater projects, one recycled water project, as well as two projects that include a combination of both.
- Five Case Studies were identified to be the top candidates to move forward with.

These top five Case Studies are developed in more detail in this TM, with two exceptions:

- Case Study 1 – Rancho Park Water Reclamation Facility – This project was initially developed as its own concept report. The project concept report is currently under development by City staff and therefore not included as part of the Plan. As ongoing project development discussions have not yet resulted in an updated feasibility study, this TM provides an abbreviated project description, which may include project elements that are no longer valid.
- Case Study 4 – Restoration of G2 Parcel at Taylor Yard – This project was placed on hold due to discussions and negotiations taking place for the project site during the development of this TM. It is now moving forward with the Bureau of Engineering and Case Study concept information will be shared with the City team managing the project.

Sections 3.0 – 6.0 present the Case Studies themselves in the order they are ranked (Table 1). Additional current integration opportunities are presented in Section 7.0, providing a "living" project/concept ideas list.

Table 1 Top 5 and 10 Case Studies
One Water LA – TM No. 3.2

Ranking	Project Name	Water Component	Lead Agency	Department(s) Involved
1	Rancho Park Water Reclamation Facility	Stormwater, Recycled Water	LASAN	LADWP, RAP
2	Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station	Recycled Water	LASAN/ LADWP/LAWA	N/A
3	Capture of Off-Site Stormwater at LAUSD Schools	Stormwater	LAUSD	LASAN, LADWP, DSA
4	Restoration of G2 Parcel at Taylor Yard	Stormwater	LA RiverWorks/ BOE	HSR, LASAN, RAP, LADWP
5	Water Management Strategies for the LA Zoo's Master Plan	Stormwater, Recycled Water	LA Zoo	LADWP, LASAN, RAP
6	Rory M. Shaw Wetlands Park	Stormwater	LACFCD	LADWP, LASAN, RAP, LACDPW
7	MacArthur Park	Stormwater, Recycled Water	RAP	BOE, LASAN, LADWP
8	Caballero Creek Park	Stormwater	RAP	LA RiverWorks, LASAN
9	Wilmington Waterfront Development	Stormwater, Recycled Water	POLA	LASAN, LADWP
10	LA River Bike Path	Stormwater	METRO	LA RiverWorks, LADOT, LASAN, BOE

= Stormwater

= Recycled Water

Abbreviations:

LASAN = Los Angeles Bureau of Sanitation; BOE = Los Angeles Bureau of Engineering;
LADOT = Los Angeles Department of Transportation; POLA = Port of Los Angeles:
RAP = Los Angeles Department of Recreation and Parks; LAWA = Los Angeles World Airports;
LA RiverWorks = Los Angeles RiverWorks Office; HSR = California High-Speed Rail Authority;
LADWP = Los Angeles Department of Water and Power; DSA = Division of State Architect;
LACDPW = Los Angeles County Department of Public Works;
METRO = Metropolitan Transportation Authority

3.0 RANCHO PARK WATER RECLAMATION FACILITY

The Rancho Park Water Reclamation Facility project is a multi-benefit project with potable water reduction concepts. The project concept considers two alternatives as described below. Figure 2 includes Alternative 1 conceptual site location map and Alternative 2 potential service areas. The purpose of multi-benefit projects is to promote smarter land use practices, healthier watersheds, greater reliability of our water and wastewater systems, increased efficiency, and operation of our utilities, enhanced livable communities, resilience against climate change impacts, and protection of public health. This section offers a short summary of the project. It should be noted that some information presented in this section may be outdated due to continuous discussions with the three city departments involved (LASAN, LADWP, and RAP) and as the project scope continues to develop.

Figure 2 Rancho Park Project Alternatives Location Map

The project includes stormwater and recycled water reuse components, providing excellent opportunity for integration into a multi-component project:

- **Alternative 1** – includes an onsite water reclamation facility (WRF) at the Rancho Park Golf Course/Cheviot Hills Recreation Center. The WRF would divert stormwater and wastewater from a local storm drain and a local primary sewer, respectively, to meet all non-potable demands in the Westside area. The facility size would treat up to 5 million gallons per day (mgd).

- **Alternative 2** – includes an onsite WRF at the Rancho Park Golf Course/Cheviot Hills Recreation Center and an additional onsite WRF near the University of California, Los Angeles (UCLA) due to UCLA being the single largest potential non-potable customer in the area. The facility located at the Rancho Park location would incorporate both stormwater and wastewater components while the facility near UCLA would treat only wastewater from a local primary sewer. Treated water would serve local non-potable demands.

For either alternative, a multi-component approach would provide an opportunity to co-locate both stormwater and WRF in order to share infrastructure and centralize the operations and maintenance (O&M) of both systems.

In **Alternative 1**, both stormwater and wastewater would be treated at Rancho Park to produce water suitable for non-potable reuse (i.e. irrigation) that complies with the standards for disinfected tertiary recycled water uses in Title 22 of the California Code of Regulations (CCR). The stormwater component is recommended to utilize a low flow diversion (LFD) in which flows would be intercepted and diverted into the wastewater system and subsequently the onsite WRF. Following a 24-hour storm event, the stormwater would provide up to 1.26 mgd of disinfected tertiary recycled water (Title 22 water). By capturing and reusing the runoff, the entire load of pollutants of concern in the captured runoff, including bacteria, would be removed from discharging to the downstream Ballona Creek.

The onsite WRF would produce treated water that has undergone the equivalent of preliminary, primary, and secondary treatment plus tertiary filtration and subsequent disinfection to comply with the standards for disinfected tertiary recycled water uses in Title 22. To meet compliance with the standards set forth in Title 22, the onsite WRF would utilize membrane bioreactor (MBR) and ultraviolet (UV) disinfection with a treatment capacity ranging from 3.13 mgd to 5 mgd to meet regional recycled water demands.

In **Alternative 2**, onsite treatment would occur at two locations: within the Rancho Park Golf Course and within the vicinity of UCLA. The onsite WRF at the Rancho Park location would incorporate both stormwater and wastewater components, similar to Alternative 1, but would be sized to supply recycled water demands to local users only. The onsite WRF near UCLA would incorporate wastewater treatment only. Both facilities would treat and produce water that complies with the standards set forth in Title 22 to meet local recycled water demands respective to each facility's proximity.

At each facility, optional treatment of a portion of product water with reverse osmosis (RO) may be desired based on specific end user water applications. Treatment technologies were selected based on ability to meet several criteria including: 1) reliability and proven technology; 2) compliance with Title 22; 3) capability of remote operation; 4) compact site footprint and 5) low environmental impact.

The multi-benefits provided from a multi-component approach include the following:

1. Implementation of Enhanced Watershed Management Program (EWMP) recommendations and water quality benefits to Ballona Creek;
2. Adequate source water to the satellite WRF to satisfy regional non-potable demands; and
3. Potential park/recreation improvement opportunities to the golf course and recreation center.

In either alternative, details that are yet to be determined include: users, treatment capacity, sizing and cost of facility, and distribution system. These components would be determined based on a Request for Proposal (RFP) submittals, which is anticipated to be the next step.

For the implementation of this project, an Environmental Impact Report (EIR) is assumed to be the most likely California Environmental Quality Act (CEQA) document required for the project and is estimated to take up to two years, during which the public outreach and funding/financing plan would need to be developed. The total implementation schedule is estimated to be approximately six to seven years.

Collaboration and coordination with stakeholders is going to be a key component for the successful implementation of this project. The LADWP should take the lead in customer outreach and negotiations, including entering into recycled water user agreements. Extensive coordination with RAP and UCLA is going to be needed for the project site(s) development and onsite recycled water usage. Successful implementation of this project is expected to require thoughtful, proactive communication both within City government and with the surrounding community. LASAN is currently engaged in ongoing discussions with LADWP, UCLA, and RAP.

4.0 ADVANCED TREATED RECYCLED WATER DELIVERY TO LAX AND SCATTERGOOD GENERATING STATION

As part of ongoing efforts to decrease the City's potable water use, LASAN, LADWP, and LAWA are partnering to plan and implement this Recycled Water Case Study (Project) to utilize advanced treated recycled water generated from the Hyperion Water Reclamation Plant (HWRP). The advanced treated recycled water would be delivered to Los Angeles International Airport (LAX), a vital region that serves as the gateway to Los Angeles, and LADWP's Scattergood Generating Station (Scattergood), located in El Segundo. It is noted that additional phases previously described in the Case Study selection TM (TM 3.1) have been eliminated from the Project described herein (see Section 4.1).

4.1 Location and Description

Geographically, the Project location extends from LAX on the north (*located at:* 1 World Way, Los Angeles, CA 90045), south to the HWRP (*located at:* 12000 Vista Del Mar, Playa Del Rey, CA 90293), and further south to Scattergood (*located at:* 685 W Grand Ave, Los Angeles, CA 90245). The Project location is shown on Figure 3.

This Project is expected to deliver advanced treated recycled water from a small-scale Advanced Water Purification Facility (AWPF) located at the HWRP to LAX and Scattergood. Intended uses of the advanced treated recycled water are both industrial and commercial, such as cooling tower make-up water at both LAX and Scattergood, as well as toilet flushing utilizing a dual plumb water system at LAX. Key Project components include the AWPF, distribution pump station, storage tank, and recycled water conveyance pipelines.

Figure 3
General Vicinity Map: Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station

0 0.5 1 Miles

One Water LA 2040 Plan
TM 3.2 - Near-Term Integration Opportunities Case Studies

Imagery Source: ESRI

Document Path: C:\Users\jsilber\Desktop\OWLA\MXD\LAXInset.mxd

As described in the Case Study selection process presented in TM 3.1, this project previously consisted of three distinct phases.

- **Phase 1** included delivery of advanced treated recycled water to LAX to be used in existing and future dual plumbing, as well as cooling tower make-up water.
- **Phase 2** expanded the Case Study with a new pipeline along Imperial Highway to connect to the existing 24-inch diameter recycled water pipeline on Aviation Boulevard that currently provides recycled water to the area as part of West Basin Municipal Water District's (WBMWD) Title 22 system. This new pipeline was envisioned to deliver advanced treated water to serve recycled water to other users (e.g., Metro Light Rail Washing Station and Consolidated Rent-A-Car Center [CONRAC] Rental Car Washing Facility.
- **Phase 3** further expanded the Case Study to serve private customers north of LAX, such as Playa Vista, Loyola Marymount (LMU), and the Westchester Community. Subsequent to completion of TM 3.1, Phase 1 has been expanded to include delivery of advanced treated recycled water to Scattergood for cooling water purposes. Phases 2 and 3 have been eliminated from consideration at this time for the following reasons:
  - There are significant institutional constraints to wheeling water in different pipelines owned by different agencies. For example, LAWA cannot transport water through its property for customers beyond LAX. This is an institutional hurdle that cannot be overcome at this time.
  - The water quality to be produced from the AWPF would be too high and too expensive for the proposed purposes in Phases 2 and 3 (e.g., irrigation, car washing), and does not represent a good use of the resource. Furthermore, it is inconceivable that customers to the north and east of LAX would be interested in spending additional money for advanced treated recycled water when they could pay a lower rate for Title 22 WBMWD water (Schedule D rates for Tertiary water are different than rates for Advanced Treated water).

The Project described in this TM only addresses Phase 1 with the expansion to Scattergood.

4.2 Lead Agency and Interagency Collaboration

There are three lead agencies for this Project, all of which are going to be responsible for interagency collaboration and select portions of the Project.

- **LASAN** – Responsible for the treatment of wastewater and secondary effluent at the AWPF to advanced treatment standards to the point-of-connection with LADWP's recycled water distribution system downstream of the distribution system pumps. LASAN is also responsible for reliability of the recycled water, including the construction of a tank with a potable water backup with air gap and a diesel generator back-up for the pump station, in case of an electrical outage.

- **LADWP** – Responsible for recycled water conveyance from the HWRP: (1) to the point-of-connection with LAWA's pipeline on Pershing Drive and (2) to Scattergood. Also, LADWP would be responsible for alternate potable water supply.
- **LAWA** – Responsible for recycled water conveyance from the connection with LADWP's recycled water pipeline on Pershing Drive to the various end users at LAX.

4.3 Objectives and Benefits

Project objectives and benefits include:

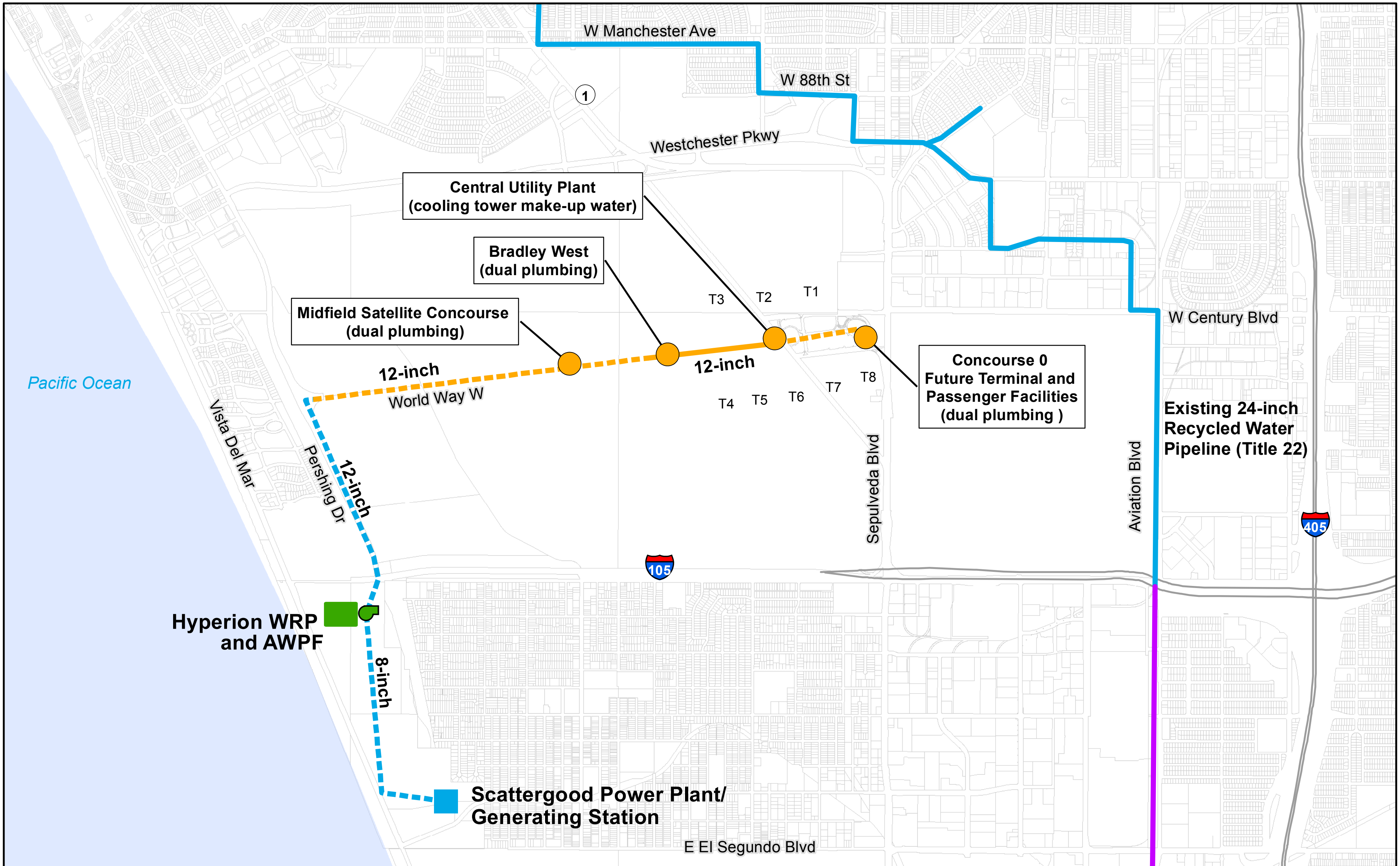
- Demonstrating the ability to produce potable reuse quality water at HWRP to facilitate future planning of indirect and direct potable reuse opportunities.
- Increasing recycled water production and use in the City, coupled with potable water offset.
- Providing increased water supply reliability, portfolio diversification, and reduced dependence on imported water.
- Increasing awareness of the benefits of recycled water through public outreach to the large amount of people, both residents and visitors, passing through LAX. There were approximately 80 million passengers at the airport in 2016.
- Demonstrating that the City leads by example by utilizing recycled water at two major facilities, LAX, and Scattergood Generating Station.

4.4 Concept Development

This section describes the technical details of the Project concept. The Project layout is shown in map view on Figure 4.

As shown on Figure 4, the Project plans to deliver advanced treated recycled water to LAX via a LADWP-owned 12-inch diameter pipeline, running north from HWRP along Pershing Drive. Once the pipeline bends east on World Way West, the pipeline enters LAWA property. The LAWA-owned 12-inch diameter pipeline would run east along World Way West to deliver the advanced treated recycled water to various customer sites. The planned customer sites and use applications at LAX include:

- Midfield Satellite Concourse [MSC] terminal: Dual plumbed system for toilet flushing
- Central Utility Plant [CUP]: Cooling tower make-up water
- Bradley West Terminal: Dual plumbed system for toilet flushing
- Concourse 0 (*Future terminal and passenger facilities/buildings*): Dual plumbed system for toilet flushing



Legend

Parcel

T# - LAX Terminal Number

Pump Stations (LASAN)

Ownership

LADWP

LAWA

West Basin

Planned/Future Recycled Water Pipeline

Existing Recycled Water Pipeline

N

0 0.25 0.5 Miles

Figure 4
Project Location Map and Layout: Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station

One Water LA 2040 Plan
TM 3.2 - Near-Term Integration Opportunities Case Studies

carollo

One Water LA

In addition, the Project would deliver advanced treated water through an LADWP-owned 8-inch diameter pipeline to the Scattergood Power Plant and Generation Station for cooling tower make-up water.

4.4.1 Recycled Water Demand

Recycled water demands are shown in Table 2. Demands for LAX are broken down by facility. The average LAX demand is 627 gallons per minute (gpm), with a peak demand approaching 1,500 gpm. For Scattergood, the recycled water demands include an average of 450 gpm, with a peak demand of 650 gpm.

Table 2 Recycled Water Demands for LAX and Scattergood
One Water LA – TM No. 3.2

Main Site	Facility	Low (gpm)	Average (gpm)	Peak (gpm)
LAX	Midfield Satellite Concourse (MSC) terminal (estimated to be completed by 2020) - Water for dual plumbing	38	95	190
	Bradley West - Toilet flushing utilizing the dual plumbed water system	42	105	209
	Concourse 0 - Toilet flushing at future terminal and passenger facilities/buildings utilizing a dual plumbed water system	38	95	190
	Central Utility Plant (CUP) - Cooling tower make-up water that feeds air to conditioning systems of all the existing buildings, including Bradley West	43	335	880
	Total North to LAX	**161**	**630**	**1,469**
Scattergood	Scattergood - Cooling tower make-up water	450	450	650
	Total	**611**	**1,080**	**2,119**

As shown in Table 2, the average demand is estimated to be 1,080 gpm, which equates to annual yield of 1,742 acre-feet per year (AFY) (or 1.6 mgd).

4.4.2 Project Components

Project components are listed in Table 3 and grouped by corresponding responsible agency.

Table 3 Case Study Project Components by Agency
One Water LA – TM No. 3.2

Responsible Agency	Key Infrastructure Components
LASAN	• 1.5 mgd AWPF (expandable to 5 mgd in the future) • Distribution pump station (Note - the configuration needs to be determined in later planning stages and could include either a single pump station, or a dual pump station that delivers water to LAX and/or Scattergood) • Diesel generator backup (for back-up power) • 1 million gallon (MG) Storage Tank • Potable water backup supply
LADWP	• 12-inch diameter RW pipeline to LAX (3,900 feet) • 8-inch diameter RW pipeline to Scattergood (4,900 feet) • Scattergood storage tank (a 1.25 MG tank would be repurposed for this Project) • Potable water backup supply
LAWA(1)	• 12-inch diameter RW pipeline from Pershing Dr./World Way West to existing RW pipeline (~6,700 feet) • RW pipeline extension to Concourse 0 (~1,600 feet)

Note:
(1) It is noted that construction of a future terminal and new passenger facilities/buildings, as well as associated installation of dual plumbing, is needed for the Project, but not technically part of this Project concept.

Advanced Water Purification Facility

A 1.5-mgd AWPF is planned to be constructed at the HWRP by LASAN. This facility would be designed such that the production capacity can be expanded to 5 mgd in the future. The AWPF would receive secondary effluent and utilize treatment upgrades consisting of a MBR, RO, and UV, followed by advanced oxidation process (AOP).

The AWPF would include an on-site distribution pump station(s) that would deliver the high advanced treated water to the point of conveyance. The configuration needs to be determined in later planning stages and could include either a single pump station, or a dual pump station that delivers water to LAX and/or Scattergood. Assuming two pump stations the, one pump station would be dedicated to delivering advanced treated water to LAWA after it goes through an additional polishing treatment process. Chlorine dosing may also be added to maintain a residual disinfectant to the recycled water that is delivered to LAX. The second pump station would deliver the advanced treated water to Scattergood where it would be further treated with an existing RO unit followed by a conditioning process.

Scattergood has requested sample water quality data from LASAN for the RO water before and after conditioning, with an indicated preference for water that is as pure as possible. If Scattergood requires water directly from the RO/AOP treatment train without conditioning agents, then a separate dedicated pump system may be required for the Project. The estimated product water quality is shown in Table 4.

Table 4 HWRP AWPF Projected Water Quality
One Water LA – TM No. 3.2

Flow Stream		1	2	3	4	5	6	7	8
Criteria	Units	MBR Filtrate	MBR Filtrate After Chemical Addition	RO Feedwater after pH Adjustment	RO Permeate	Decarb Effluent(3)	UV/AOP Effluent	Product Water	RO Concentrate(4)
Flow Rate	gpm	1,225	1,225	1,225	1,042	1,042	1,042	1,042	184
Flow Rate	mgd	1.8	1.8	1.8	1.5	1.5	1.5	1.5	0.3
Water Quality(1)(2)									
Calcium (Ca^{2+})	mg/L	60	60	60	0.46	0.46	0.46	10.46	397
Magnesium (Mg^{2+})	mg/L	29	29	29	0.21	0.21	0.21	0.21	192
Sodium (Na^{+})	mg/L	226	228	228	7.84	8.76	8.76	13.71	1,473
Ammonium (NH_4+)	mg/L	0.13	0.13	0.13	0.01	0.01	0.01	0.01	0.83
Chloride (Cl^{-})	mg/L	238	238	238	7.70	7.70	7.70	7.70	1,543
Nitrate (NO_{3-})	mg/L	9.07	9.07	9.07	1.99	1.99	1.99	1.99	49
Sulfate (SO_{4-2})	mg/L	338.00	338.00	340.94	2.80	5.73	5.73	5.73	2,257
Silica (SiO_2)	mg/L	20.00	20.00	20.00	0.49	0.49	0.49	0.49	131
Total Dissolved Solids (TDS)	mg/L	1,010	1,013	1,014	25.19	29.24	28.59	78.19	6,620
Total Organic Carbon (TOC)	mg/L	14	14	14	0.21	0.21	0.21	0.21	91
Carbonaceous Biochemical Oxygen Demand (cBOD)	mg/L	0.96	0.96	0.96	0.05	0.05	0.05	0.05	6.1
Chemical Oxygen Demand (COD)	mg/L	24	24	24	1.20	1.20	1.20	1.20	153
Total Suspended Solids (TSS)	mg/L	1.00	1.00	1.00	0.00	0.00	0.00	0.00	6.7
Calcium Hardness	mg/L as $CaCO_3$	150	150	150	1.16	1.16	1.16	26.16	993
Hardness	mg/L as $CaCO_3$	269	269	269	2.03	2.03	2.03	27.03	1,784
pH	S.U.	7.40	7.67	7.43	5.09	5.38	5.27	8.27	6.34
Alkalinity	mg/L as $CaCO_3$	100	103	100	4.52	4.52	3.47	61.73	643
Calcium Carbonate Precipitation Index (CCPP)	mg/L	8.02	-0.31	-5.66	-149.40	-86.08	-86.06	-1.19	58
Langlier's Saturation Index (LSI)	-	0.31	-0.01	-0.26	-5.86	-5.57	-5.80	-0.20	0.13
Temperature	deg C	20	20	20	20	20	20	20	20

Notes:
(1) Water quality based on process modeling, information in the 2011 West Basin Five Year Engineering Report, and other similar facilities with full nitrification/denitrification.
(2) Water quality and chemical dosing estimated using Rothberg, Tamburini & Winsor Model for Corrosion Control and Process Chemistry®.
(3) Assumed 100% of flow through the decarbonator.
(4) Assumed 85% for the RO recovery rate.

Pump Station and Backup Power

A distribution pump station is required to pump and deliver advanced treated recycled water. Again, the configuration needs to be determined in later planning stages and could include either a single pump station, or a dual pump station that delivers water to LAX and/or Scattergood. Assuming two pump stations, then each pump station would be sized to deliver peak hour demand, sending a peak demand of 1,500 gpm to LAX and 650 gpm to Scattergood (Table 2). Each pump station would include spare units. In addition, a diesel generator backup to provide back-up power would also be provided.

Storage Tanks

A storage tank with a capacity of 1 MG would be needed to store treated water onsite at HWRP. The purpose of the on-site storage is to provide enough storage to buffer diurnal fluctuations for maximum day demands primarily for LAX.

Scattergood has its own on-site potable back-up, including three existing 1.25-MG storage tanks located on site. One of these 1.25-MG storage tanks would be repurposed for Recycled Water to balance deliveries with demand.

Potable Water Backup Supply

LAX would require similar supply reliability as potable water; therefore, measures must be taken to provide appropriate redundancies and potable water back-up provisions.

LASAN would install a potable water backup supply at the AWPF storage tank in order to provide redundant supply in case the treatment process is interrupted. This would serve as the primary backup supply.

In addition, because recycled water was always planned, LAWA's CUP already has a potable air gap connection at the storage tank. LAWA would need to update the instrumentation controls to automatically switch to potable water in the event of an interruption, and maintain air gap integrity in the future.

Scattergood already has a dedicated potable water tank that would serve as back-up supply.

In order to provide an additional layer of reliability for LAWA, another option may be for LADWP to construct and operate an alternate potable water connection. The potable connection could be made utilizing a swivel-L pipe adapter, potentially located at the intersection of Pershing Drive and World Way West either on the distribution line or at the airport. This pipeline fitting would allow LAWA to switch to potable supply in the event of a long-term interruption in the delivery of advanced treated recycled water. However, a swivel-L is not currently permitted by the California Division of Drinking Water (DDW) for dual plumbing (see Section 4.5). Also, the process of switching the water source via the swivel-L is long. Before the swivel L can be activated, the backflow prevention assembly needs to be tested with test reports provided to DDW. Therefore, in an emergency, LADWP could not immediately switch over to the swivel-L. LADWP would need to work with the regulators to develop this additional layer of supply redundancy.

LADWP Recycled Water Pipeline

An 8-inch diameter recycled water pipeline would be constructed to deliver advanced treated recycled water to Scattergood. This pipeline is approximately 4,900 feet in length, travelling south-southeast from the point of connection to Scattergood. An alignment for this pipeline segment has not yet been established. To the north, a 12-inch diameter recycled water pipeline would convey advanced treated recycled water along Pershing Drive to point of connection with LAWA's pipeline on the west side of LAX. This pipeline is 3,900 feet in length, following an alignment along Pershing Drive.

LAWA Recycled Water Conveyance

LADWP's recycled water pipeline would connect with a 12-inch diameter LAWA recycled water pipeline at the intersection of World Way and Pershing Drive, and be approximately 6,700 feet in length. As shown on Figure 4, recycled water pipeline already exists between the Bradley West and CUP. The Project also includes a 12-inch diameter recycled water pipeline extension to Concourse 0 (approximately 1,600 feet in length). Combined, new LAWA RW pipeline is estimated to be 8,300 feet in length.

4.5 Implementation Considerations

Implementation considerations are described below.

- **Compliance with Recycled Water Regulations** – The production, discharge, distribution, and use of RW are subject to federal, state, and local regulations; the primary objectives of which are to protect public health. In the State of California, recycled water requirements are administered by the State Water Resources Control Board (SWRCB) DDW, formerly under California Department of Public Health (CDPH), and individual Regional Water Quality Control Boards (RWQCBs). The Water Recycling Criteria (CCR, 2014) became effective on June 18, 2014. The SWRCB defines recycled water as, *"water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource"* (SWRCB, 2016). These regulations are complex and necessitate planning and coordination with the regulatory agency. A summary of notable regulations relative to this Project include:
  - §06306 (CCR Title 22 Article 4, 2014) addresses the use of recycled water for cooling purposes.

    §06306. Use of recycled water for cooling.

    (a) Recycled water used for industrial or commercial cooling or air conditioning that involves the use of a cooling tower, evaporative condenser, spraying or any mechanism that creates a mist shall be a disinfected tertiary recycled water.

(b) Use of recycled water for industrial or commercial cooling or air conditioning that does not involve the use of a cooling tower, evaporative condenser, spraying, or any mechanism that creates a mist shall be at least disinfected secondary-23 recycled water.

(c) Whenever a cooling system, using recycled water in conjunction with an air conditioning facility, utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system shall comply with the following:

(1) A drift eliminator shall be used whenever the cooling system is in operation.

(2) A chlorine, or other, biocide shall be used to treat the cooling system recirculating water to minimize the growth of *Legionella* and other microorganisms.

– §06307 (CCR Title 22 Article 4, 2014) deals with the use of recycled water for other purposes, including toilet flushing.

§06307. Use of recycled water for other purposes.

(a) Recycled water used for the following shall be disinfected tertiary recycled water, except that for filtration being provided pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Flushing toilets and urinals,
(2) Priming drain traps,
(3) Industrial process water that may come into contact with workers,
(4) Structural fire fighting,
(5) Decorative fountains,
(6) Commercial laundries,
(7) Consolidation of backfill around potable water pipelines,
(8) Artificial snow making for commercial outdoor use, and
(9) commercial car washes, including hand washes if the recycled water is not heated, where the general public is excluded from the washing process.

– Article 5 (CCR Title 22 Article 4, 2014) is dedicated exclusively to dual plumbed recycled water systems.

- **Reliability/Redundancy for LAWA** – As previously described LAWA requires similar supply reliability as potable water; therefore, measures must be taken to provide appropriate redundancies and potable water back-up provisions. As described in Section 4.4, the potable connection could be made utilizing a swivel-L pipe adapter, potentially located at the intersection of Pershing Drive and World Way West either on the distribution line or at the airport. This pipeline fitting would allow LAWA to switch to potable supply in the event of a long-term interruption in the delivery of advanced treated recycled water. However, this type of a cross-connection is typically not permitted by DDW under its Recycled Water regulations. Permitting this type of connection is going to require meetings and negotiation with DDW. §06310 (CCR Title 22 Article 4, 2014) addresses Use Area Requirements, with the following applicable excerpt:

> (h) Except as allowed under section 7604 of title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

Furthermore, the process of switching the water source via the swivel-L is long. Before the swivel L can be activated, the backflow prevention assembly needs to be tested with test reports provided to DDW. Therefore, in an emergency, LADWP could not immediately switch over to the swivel-L. LADWP plans to work with the regulators to develop this additional layer of supply redundancy.

- **Construction in High-Traffic Area** – The pipeline alignments are in high-traffic areas; therefore, there challenges are expected that require planning to divert traffic during construction. LADWP plans to seek the support of LASAN and LAWA to construct the pipeline along Pershing Drive during normal business hours as opposed to nighttime work. Work in the crossing needs to be cleared with LADOT.
- **Water Quality Requirements** – Scattergood has requested sample water quality data from LASAN for the RO water before and after conditioning, with an indicated preference for water that is as pure as possible. Separate pump stations may be needed to accommodate the different water quality needs for LAX and Scattergood.
- **Schedule** – All three City agencies must collaborate and adhere to an agreed-upon Project schedule. Adherence to the schedule is going to require frequent communication and collaboration among each department's Project Manager.
- **O&M Considerations** – The primary project component that requires extensive O&M is the AWPF. To operate this facility, new operations staff needs to be hired or existing staff need to be trained and certified as an AWPF requires different skills and certifications that a wastewater treatment plant. Additionally, the pump stations need to be equipped with supervisory control and data acquisition (SCADA) as they will be pumping into a closed system. To avoid over-pressuring the system, it is recommended that the pump station be equipped with variable frequency drive (VFD) pumps and a surge tank to water hammer protection. Finally, the O&M responsibilities and communication protocols need to be clearly defined in an interagency agreement to minimize system interruptions.
- **Site Constraints** – HWRP is located on a relatively compact and built-out parcel, and the site allocated for the AWPF has space constraints. Therefore, it is necessary during design to optimize the limited space available to appropriately layout and design all necessary Project components.

- **LA County Health Department approvals** – The LA County Health Department needs to approve the design to issue a permit. Once the Project is constructed, the Health Department would conduct cross connection inspections, and the owner would be responsible for annual backflow testing and associated reporting.

- **Permit challenges –** The new AWPF requires permits from the Air Quality Management District (AQMD), DDW, Environmental clearance with National Environmental Policy Act (NEPA)/CEQA and a variety of construction permits, i.e. building and safety, fire department, etc. LADWP has already secured a Categorical Exemption for the recycled water pipeline along Pershing Drive.

4.6 Agreements and Policies

This Project is unique in that there are three lead City agencies. Accordingly, there is a suite of required agreements and policies.

- A three-way multi-party high-level interagency Memorandum of Agreement (MOA) between LADWP, LASAN, and LAWA is needed, and a draft MOA is already in progress. Specifically, this MOA is needed to address high-level commitment by all parties to the Project. The partnering commitment MOA should address agency responsibilities, including:
    - **LASAN** – (1) Construction of the AWPF, on-site storage, pump stations, and potable water backup (2) Oversight of entire Project schedule, and (3) O&M for HWRP and AWPF.
    - **LADWP** – (1) Construction of the recycled water pipelines, (2) O&M of its recycled water pipelines, and (3) Alternate potable water backup supply for LAX.
    - **LAWA** – (1) Construction of recycled water pipeline at LAX, (2) O&M of its recycled water pipeline, (3) Ensuring facilities are dual-plumbed, and (4) Updating instrumentation controls at the CUP potable air gap connection and maintaining its integrity.

- Agreement No. WR-15-1062 (Executed in August 2015) – This Agreement commits LAWA and LADWP to collaborate on a long-term engineering feasibility report for LAX to optimize use of recycled water and further decrease use of potable water across the campus.

- Two service agreements are needed to establish conditions and criteria for recycled water production and delivery. These are: (1) LADWP needs a service agreement with LAWA that specifies a water rate and performance assurance measures and (2) LADWP needs a service agreement with LASAN that specifies the water quality and delivery conditions for the advanced treated recycled water to the LADWP distribution system.

- Because each department is a lead agency, each Project component (by agency) is anticipated to need separate environmental documentation (e.g., EIRs, mitigated negative declaration). Yet, the Project has clear and distinct interrelationships; therefore, preparation of environmental documentation is expected to require collaboration.

4.7 Cost Considerations

Project costs are estimated and summarized in Table 5. This table utilizes the spreadsheet costing tool with industry-standard unit costs documented in TM 5.1 (Basis of Planning). These numbers are intended to represent a high-level cost estimate and are based on feasibility-level project sizing and cost estimating assumptions presented in Appendix B. As shown in Table 5, the total estimated capital cost is $51.2 million, which includes $36 million for the AWPF.

The estimated capital costs by agency are summarized in Table 6. As shown, the vast majority cost, namely ~ $42.9 million, is associated with project components that are the responsibility of LASAN. The estimated capital cost of components to be constructed by LADWP and LAWA are approximately $4.0 million and $4.3 million, respectively. A detailed cost estimated is included in Appendix B.

When the amortized capital cost, O&M, and energy costs are considered, the total annual cost is estimated to be $0.8 million. Assuming an average annual recycled water demand of approximately 1,742 AFY, the unit cost for the project is $1,472/acre-feet (AF).

Table 5 Capital Cost Estimates: Advanced Treated RW Delivery to LAX and Scattergood Generating Station
One Water LA – TM No. 3.2

Component	Size/Unit	Capital Cost ($M)
Pipeline from HWRP to LAX (~3,900 ft)	12-inch	$1.7
Pipeline from HWRP to Scattergood (~4,900 ft)	8-inch	$1.7
Pipeline on LAWA property	12-inch	$4.3
Jack & Bore	12-inch	$0.415
Storage tank	1 MG	$4.0
Pump Station to LAX	250 hp	$1.5
Pump Station to Scattergood	150 hp	$0.9
Diesel Generator Backup	400 hp	$0.32
Advanced Water Purification Facility	1.5 mgd	$36.0
Potable Water Backup at AWPF	1 connection	$0.2
Alternate Potable Water Backup	1 connection	$0.2
Total	**n/a**	**$51.2**

Table 6 Costs by Agency: Advanced Treated RW Delivery to LAX and Scattergood Generating Station
One Water LA – TM No. 3.2

Agency	Capital Cost ($M)
LASAN	$42.9
LADWP	$4.0
LAWA	$4.3
Total	**$51.2**

Note:
(1) Costs are subject to change during actual design, with the largest uncertainty being treatment.

4.8 Schedule

The overall Project schedule is estimated to be completed by 2020. The City has already developed a Memorandum of Understanding (MOU) between all three partnering agencies (LASAN, LADWP, and LAWA) that defines the commitment of moving forward and specifies the key responsibilities, commitments, and timeline for completion for each department. Individual components and their corresponding schedule are the responsibility of each agency, but there are interdependencies that need to be defined, as described under the section on Agreements and Policies. The preliminary schedule is summarized in bullet format and displayed in Table 7.

Table 7 Schedule: Advanced Treated RW Delivery to LAX and Scattergood Generating Station
One Water LA – TM No. 3.2

Component	2017	2018	2019	2020
Overall	■	■	■	■
LADWP: 12-inch diameter RW pipeline to LAX	■			
LADWP: Jacking at Pershing Dr. & Imperial Blvd.		■	■	
LADWP: 8-inch diameter RW pipeline to Scattergood			■	■
LASAN: AWPF, Pump Station & Storage	■	■	■	
LAWA: 12-inch diameter World Way RW Pipeline			■	■

LASAN:

- AWPF, pump station, storage, and potable backup supply to be completed by 2019.

LADWP:

- 12-inch diameter recycled water pipeline on Pershing Drive to be constructed in 2017.
- Jacking at Pershing Drive and Imperial Blvd. to be completed in 2019.
- 8-inch diameter recycled water pipeline to Scattergood to be constructed in 2019 – 2020.

LAWA:

- 12-inch diameter recycled water pipeline on World Way to be completed by the second quarter of 2020.

4.9 Next Steps

Next steps for continued development and implementation of this Project are listed below:

- Develop the necessary service agreement between LASAN and LADWP, as well as the service agreement between LADWP and LAWA.

- Develop a detailed schedule to include additional construction details with duration and lengths. In addition, environmental documentation and regulatory agency coordination must be added, with milestones identified. Finally, the schedule needs to include key decision points and routine collaboration meetings.

- Initiate discussions with DDW to discuss compliance with recycled water regulations, as well as the need for a potable water backup plan. The Project proposes a swivel L as one potential option to provide potable water backup. Typically this type of connection is only allowed for outdoor uses (e.g. irrigation) only, but not for indoor plumbing purposes (e.g. toilet flushing). Nevertheless, the need for potable water backup is critical to Project implementation. As a result, early communication, outreach, and collaboration with the regulators is essential.

5.0 CAPTURE OF OFF-SITE STORMWATER AT LAUSD SCHOOLS

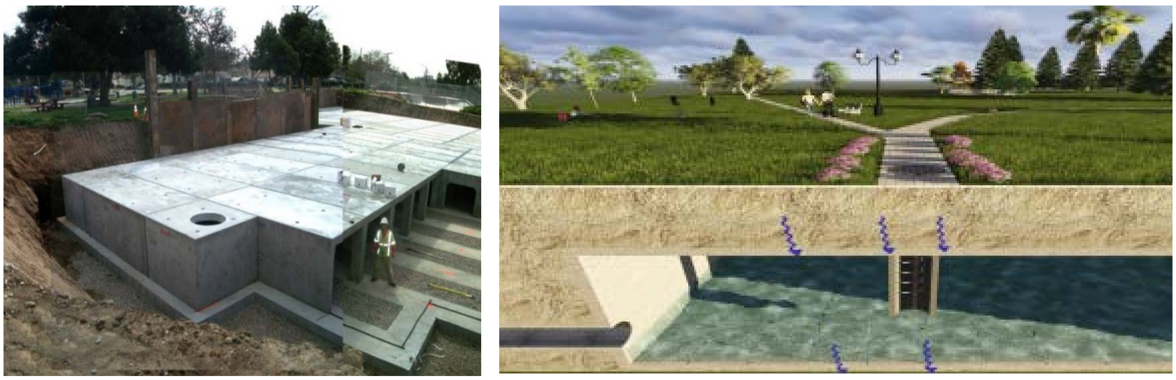
The One Water LA team has met with the Los Angeles Unified School District (LAUSD) since mid-2014 to discuss opportunities for LAUSD to take off-site stormwater to help improve the water quality throughout the City. Several opportunities for and barriers to LAUSD accepting off-site stormwater onto its properties have been identified. This Case Study was prepared by LASAN.

5.1 Location and Description

Founded in 1853, LAUSD has more than 900 schools and 187 public charter schools, and enrolls more than 640,000 students in kindergarten through the 12th grade. LAUSD underwent the nation's largest public works project, funded by bond measures, the District now has 115 new schools and campuses. The LAUSD boundaries spread over 720 square miles and the City of Los Angeles as well as all or parts of 31 smaller municipalities plus several unincorporated sections of Southern California.

This Case Study has focused on the feasibility of developing a pilot study for an LAUSD site to capture off-site stormwater. The conversations were initiated through the One Water LA Focus Meetings with LAUSD.

Meetings have occurred with LAUSD engineering, operations, and health and safety management. After reviewing stormwater capture, reuse and infiltration concept examples (seen on Figure 5), LAUSD was more comfortable with the development of and future implementation of a pilot study; however, a few issues need to be addressed. Some of the issues are still being evaluated between the City and LAUSD.



Garvanza Project | **Rendered Project Concept**

Figure 5 Stormwater Capture, Reuse, and Infiltration - Two Concept Examples

The proposed pilot study consists of a pre-treatment system (off school site), concrete sedimentation basin, concrete infiltration tank, monitoring system, valves, and potential irrigation systems. Trash and solids would be removed from stormwater diverted from a local storm drain in the pre-treatment facility. Diverted stormwater would then be conveyed onto the selected school site and either used for infiltration (or reuse, such as irrigation).

The Case Study site selection process focused on areas in the City of LA where regional stormwater facilities could meet multiple objectives and benefits. Maps and lists of potential school sites have been grouped by watershed based on specific criteria that optimizes infiltration and on-site reuse and a focus on areas where regional stormwater facilities could optimize infiltration and on-site use meeting multiple objectives and benefits.

5.2 Lead Agency and Interagency Collaboration

Coordination between LAUSD, LASAN, LADWP, Department of Toxic Substances Control (DTSC), SWRCB, and the DSA is key for a successful pilot.

5.3 Objectives and Benefits

The objective of this Case Study is to identify a potential pilot study that would successfully capture off-site stormwater runoff through the implementation of a Stormwater Best Management Practices (BMPs). The pilot project would be located at an existing

LAUSD school site and would enhance the water quality, reduce local flooding, and help increase the amount of local water supply

5.3.1 Potable Water Offset

The amount of potable water offset is dependent on the amount of water that is infiltrated or that is captured and reused. This amount would help reduce the City's reliance on purchased imported water and increase the amount of local water supply.

The amount of potable water offset would also depend on the selected school site for the pilot study. As presented in Appendix C, the location and size of the facilities varies between each potential school site.

5.3.2 Visibility/Education Potential

LAUSD is the nation's second-largest school district with 735,000 students, including adult school, enrolled (2016-2017). Adding stormwater BMPs to a school site would not only help improve the stormwater quality and water supply in the community, but it would also help educate the public on sustainable practices that improve the quality of life. Educating youth on sustainable practices would also help improve the support of similar projects in the future.

5.3.3 Social/Environmental Justice

One of the screening criteria for choosing the pilot location was identifying if the school site is in a disadvantaged/severely disadvantaged community. Adding stormwater BMPs to local school would improve the health of the local watershed while providing other educational and social benefits.

5.3.4 Replicability

LASAN plans to build on designs and projects that have functioned well. A review of Proposition O projects and others that can be duplicated in other places would be done. This multi-agency collaborative effort is expected to provide a path forward for other school districts to follow.

Due to the large number of school sites located throughout the City, this Case Study has a tremendous potential for replication.

5.3.5 Stormwater Quality Improvement

The implementation of the pilot study would yield multiple water quality benefits by reducing the volume of runoff delivered to receiving waters, thus reducing the pollutants discharged, and saving the City in treatment costs. The amount of stormwater that would be treated and the type of pollutants removed is going to depend on the site of the pilot study.

5.4 Project Analysis and Facility Evaluation

To determine the best site for the LAUSD pilot, maps and lists of potential school sites were generated by watershed. Using Geographic Information System (GIS) tools, an initial list of 348 schools within 500 feet of a current EWMP project site for each of the following watersheds was developed:

- Upper LA River (127 schools)
- Ballona Creek (201 schools)
- Dominguez Channel (13 schools)
- Marina Del Rey (4 schools)
- Santa Monica Bay (3 schools)

This list of 348 was narrowed by using the following screening criteria:

- Schools that overlap with high priority sub-drainage areas from the EWMP Reasonable Assurance Analysis (RAA) heat map
- Parcels identified during regional project screening and its corresponding score. For some, the school property was not able to match those that were ranked. Those that were matched are scored high.
- Schools immediately adjacent to the EWMP signature regional projects (Lafayette Park and Queen Anne Rec Center)

Upon application of the criteria listed above, the total list was reduced to 58 school sites with 31 sites located in the Ballona Creek watershed and 27 sites located in the Upper LA River watershed. However, the City wanted to reduce the number of schools to approximately ten sites per watershed. Therefore, the following screening/selection criteria were also applied:

- Saturated Hydraulic Conductivity – low hydraulic conductivity sites were less favorable
- Depth to Groundwater – sites with shallow groundwater were less favorable
- Estimated Usable Area – the estimated usable area was quantified in acres with more area being more desirable
- Site Size – same as above
- Upstream Watershed Land Use – the types of upstream land use was identified (i.e., commercial, residential) to identify potential land uses that could adversely affect runoff

- Water Quality improvements – water quality constituent improvements were identified (i.e., Copper, Lead, Suspended Solids)
- Community (Disadvantaged/Severely Disadvantaged) – sites that positively influenced a disadvantage community were more favorable

Schools with low saturated hydraulic conductivity and shallow depth to groundwater were removed from the list. Based on the attributes mentioned above, a total of 21 potential school sites for the off-site stormwater capture pilot were identified, with 11 school sites for in the Ballona Creek watershed and ten sites in the Upper LA watershed were identified (see Table 8 and Appendix C). The list of potential school sites is currently being evaluated and compared to LAUSD's existing Capital Improvement Plan (CIP) list to identify an optimal school site for the Stormwater pilot.

Table 8 Potential School Sites for Off-Site Stormwater Capture
One Water LA – TM No. 3.2

Watershed	School
Ballona Creek	Alta Loma Elementary School
	Grant Elementary School
	Queen Anne Elementary School/Queen Anne's Children Center
	University High School
	Daniel Webster Middle School / Magnolia Science Academy 4 Venice
	Richland Avenue Elementary School
	Clover Avenue Elementary School
	Mar Vista Elementary School
	Nora Sterry Elementary School
	Charles White Elementary School
	Van Ness Elementary School
Upper LA River	Sherman Oaks Center for Enriched Studies
	Reseda High School
	Hollenbeck Middle School
	Sun Valley Bus Garage
	Celerity Cardinal Charter School
	Enadia Technology Enriched Charter
	Nestle Avenue Charter Elementary School
	Soto Early Education Center
	Canoga Park High School
	Soto Street Elementary School

5.5 Implementation Considerations

As requested by LAUSD, LASAN has developed a concept of diverted stormwater system to help accomplish many objectives for the off-site stormwater capture pilot.

Figure 6 presents a process flow diagram of the concept diverted stormwater system that would capture off-site stormwater to be conveyed onto the selected school site and used for infiltration. Figure 6 and Figure 7 highlight the potential components that would be included in the LAUSD pilot. The components are as follows:

- **Diversion Valve –** to capture off-site stormwater and divert it to the LAUSD site.
- **Wet Well Monitoring Station –** real-time monitoring to trigger emergency shut off valve in an event where the stormwater becomes too contaminated.
- **Shut-off Valve –** the valve would close in an event where the stormwater becomes too contaminated.
- **Pre-treatment –** to remove trash and solids.
- **Sedimentation Basin –** to detain sediment laden runoff for a sufficient length of time to allow it to settle out in the basin.
- **Infiltration Basin –** to infiltrate the captured stormwater and recharge the City's aquifers.

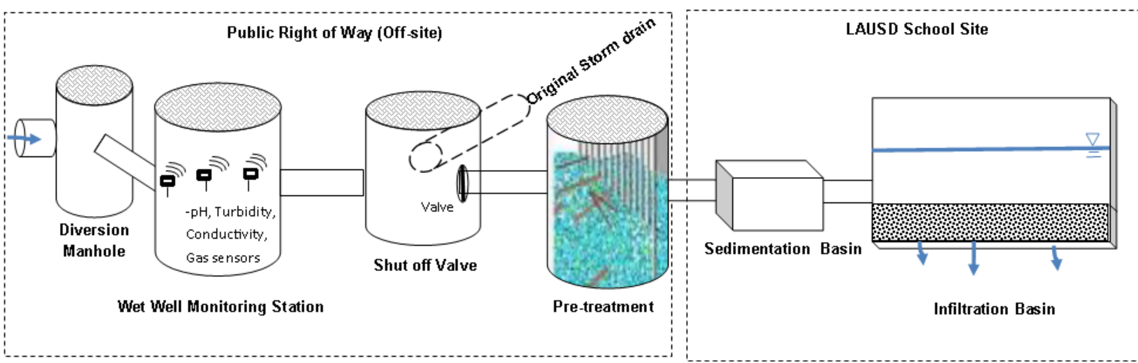


Figure 6 Conceptual Layout of Off-Site Stormwater Capture and On-Site Infiltration System (Profile View)

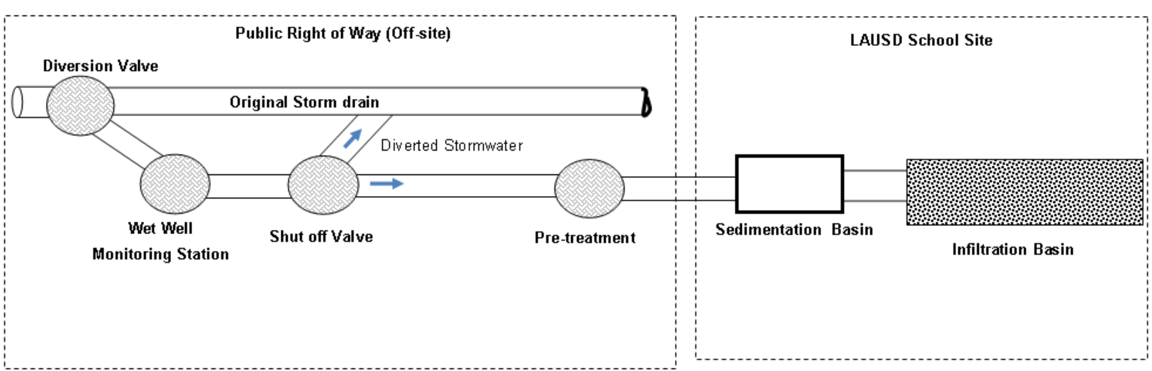


Figure 7 Conceptual Layout of Off-Site Stormwater Capture and On-Site Infiltration System (Plan View)

The initial key implementation considerations that were discussed are as follows:

- **LAUSD's compliance requirements with their new National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit –** Evaluate where LASAN can help and/or partner with LAUSD to help meet LAUSD's new 2018 permit requirements for a Stormwater Phase II Small MS4 Permit.
- **Operations and Maintenance –** LAUSD prefers that the maintenance of pre-treatment activities occurs off their premises. Similar to other Prop O projects, they would like to have those pre-treatment screens, etc. in the streets or right-of-way (ROW). LAUSD is concerned that they would be burdened with operating and maintaining facilities that they do not have resources to do the work.
- **Health and Safety –** LAUSD is concerned about the health of the children. Any stormwater project would need to take in to consideration children's health.
- **Liability –** Indemnification and responsibility of the involved parties needs to be clarified for various scenarios.
- **Water Quality** (list of constituents) **–** Typical constituents found by land-use to be evaluated in contributing sub-watershed. LA County's list of constituents by land use is an excellent place to find information.
- **Resources for Operations and Maintenance –** Identification of the agency(s) who have the skill sets and resources to provide operation and maintenance activities.
- **LAUSD Future Expansions –** Evaluate design requirements for a school where facilities are planned to be expanded in the future. Structural analysis that would enable constructing LAUSD's facilities above the Stormwater tank would need to be completed. Further, the all nearby structures would need to be evaluated to make sure they are adequate to handle stormwater infiltration and any resulting outside loads.

5.6 Agreements

In order for a Stormwater project to move forward, it is recommended that there is some sort of MOU that is agreed to by both parties. There are various talking points and suggestions that are listed below that could be addressed:

- Defined Stormwater capture capacity for both off-site and on-site Stormwater and water quality improvements
- Defined site improvements – this could be playing fields, tennis courts, parking lots, etc.
- Payment for the design and construction of the project – this includes all geotechnical and structural considerations
- Operation and maintenance of the facility – this could include potential labor agreements between LAUSD and the City

- Creation of a Standard Operating Procedure that both LASAN and LAUSD follow, as required
- Easement for construction, O&M, stormwater capture, treatment, and reuse for a minimum of 20 years
- Joint relationship during design and construction with the DSA, the SWRCB, and the DTSC

In addition, an agreement should consider the requirements for a Stormwater Phase II Small MS4 Permit. The six Phase II Small MS4 Program elements, termed "minimum control measures" as indicated from the U.S. Environmental Protection Agency (EPA) and the SWRCB website are outlined below:

- **Public Education and Outreach –** Distributing educational materials and performing outreach to inform citizens about the impacts polluted stormwater runoff discharges can have on water quality.
- **Public Participation –** Providing opportunities for citizens to participate in program development and implementation, including effectively publicizing public hearings and/or encouraging citizen representatives on a stormwater management panel.
- **Illicit Discharge Detention and Elimination –** Developing and implementing a plan to detect and eliminate illicit discharges to the storm sewer system.
- **Construction Site Runoff Control –** Developing, implementing, and enforcing an erosion and sediment control program for construction activities that disturb 1 or more acres of land.
- **Post-Construction Runoff Control –** Developing, implementing, and enforcing a program to address discharges of post-construction stormwater runoff from new development and redevelopment areas. Applicable controls could include preventative actions such as protecting sensitive areas (e.g., wetlands) or the use of structural BMPs.
- **Pollution Prevention/Good Housekeeping –** Developing and implementing a program with the goal of preventing or reducing pollutant runoff from municipal operations. The program must include municipal staff training on pollution prevention measures and techniques (e.g., regular street sweeping, reduction in the use of pesticides or street salt, or frequent catch-basin cleaning).

5.7 Cost Considerations

The capital project costs for off-site stormwater capture and treatment systems combined with on-site stormwater infiltration were estimated based on other stormwater projects that the City has completed (i.e., via Proposition O).

5.7.1 Capital

Table 9 summarizes the high level cost estimate of a typical stormwater infiltration tank and other additional components.

Table 9 Estimated Stormwater BMP Cost for a School Site
One Water LA – TM No. 3.2

Potential BMP	Capacity	Unit	Capital Cost(1)(2)(3)	Annual O&M(1)(2)(3)
Concrete Infiltration Tank	1.0	MG	$5,000,000	$50,000
Sedimentation Tank(3)	1.0	MG	$4,000,000	$80,000
Piping	5,280.0	feet	$2,218,000	$22,176
Monitoring System(4)	1.0	unit	$200,000	$10,000
Stormwater Treatment(5)	1.0	mgd	$3,000,000	$120,000
Stormwater Pre-treatment(6)	1.0	mgd	$1,500,000	$60,000
Manhole	4.0	unit	$20,000	$400
Shut off Valve(7)	1.0	unit	$50,000	$2,000
Other				
Pumps (under review)	2.0	cfs	$1,320,000	$39,606
		Total	**$17,308,000**	**$384,180**

Notes:
(1) Formulas were obtained from the Upper LA River Enhanced Watershed Management Plans, Table 9-1
(2) Regional project assumes 1 MG concrete tank, 1 mile of 12-inch gravity pipe, 1 monitoring system at $100,000, and 1 mgd treatment system.
(3) Cost is dependent on the volume of the tank.
(4) Monitoring system assumes two probes, one meter, electrical system, and controls.
(5) Treatment cost assumes filtration system and UV disinfection.
(6) Pre-treatment cost assumes mechanical screening and chemical pre-treatment.
(7) Shut-off valve assumes 12-inch diameter butterfly valve with electrical system (automatic shutoff) and controls.

Abbreviation:
cfs = cubic feet per second

5.7.2 Operations and Maintenance

Planning for long-term O&M costs at the conceptual project phase is critical to the implementation of large scale, multi-benefit stormwater infrastructure. Examples of general O&M requirements for green infrastructure can include:

- **Performance Monitoring –** drawdown time and infiltration rate
- **Cleaning Frequency –** remove trash and debris accumulation
- **Existing Conditions and Maintenance Documentation** (field log) **–** Based on the facility, the frequency of inspection and O&M typically ranges from quarterly to

annually, and is largely dictated by variables that are project-specific (e.g., type of project, location of project, drainage area to project, project phase, etc.)

The annual O&M cost of a medium-scale green infrastructure project, such as an infiltration basin is estimated to be 5 percent of the capital cost (U.S. EPA, 1999; Weiss et al., 2005). However, O&M costs presented in Table 9 vary from 1 – 5 percent of the capital cost, depending on the type of facility. O&M requirements for the proposed pilot would be determined as a joint effort between LASAN and LAUSD staff.

5.8 Schedule

The schedule is yet to be determined, but is going to be determined by the final design and facility components. The schedule for construction would be accommodating to LAUSD's school calendar.

5.9 Recommendations

On the basis of this Case Study, the following recommendations are presented:

- The optimal school site to be selected for a stormwater facility to capture and infiltrate off-site stormwater would be in a residential community, with no contaminated soil.
- The optimal school site selected is going to be based on the following criteria:
  - Saturated Hydraulic Conductivity
  - Depth to Groundwater
  - Estimated Usable Area
  - Site Size
  - Upstream Watershed Land Use
  - Water Quality Improvements
  - Community (Disadvantaged/Severely Disadvantaged)
  - LAUSD's CIP List
  - Other Geotechnical Conditions
- Develop an Agreement/MOU between LAUSD and LASAN
- Evaluate potential sites where LASAN can help and/or partner with LAUSD to help meet their new 2018 MS4 permit
- Successful implementation of an off-site stormwater pilot would lay the foundation for future opportunities for the City.

6.0 WATER MANAGEMENT STRATEGIES FOR THE LA ZOO'S MASTER PLAN

In efforts to decrease the City of LA's potable water use, One Water LA is working with Los Angeles Zoo Department (LA Zoo) to identify the necessary steps to implement Municipal recycled water use in the LA Zoo and help incorporate stormwater capture and infiltration components as part of their upcoming Master Plan.

The City of LA departments are working together to identify the information gaps, water quality requirements, uses of recycled water based on viable animal classes, funding opportunities, and all necessary steps needed for recycled water and stormwater project implementation. This Case Study was prepared by LASAN.

6.1 Location and Description

The LA Zoo is located on 5333 Zoo Drive, Los Angeles, CA 90027. It is located in the eastern portion of Griffith Park near the intersection of the Golden State Freeway (Interstate 5) as shown on Figure 8. A layout of the Zoo is provided as Figure 9. The Zoo is bordered by extremely hilly and sloping terrain and is located in the upper LA River within a watershed, which encompasses approximately 133 acres.

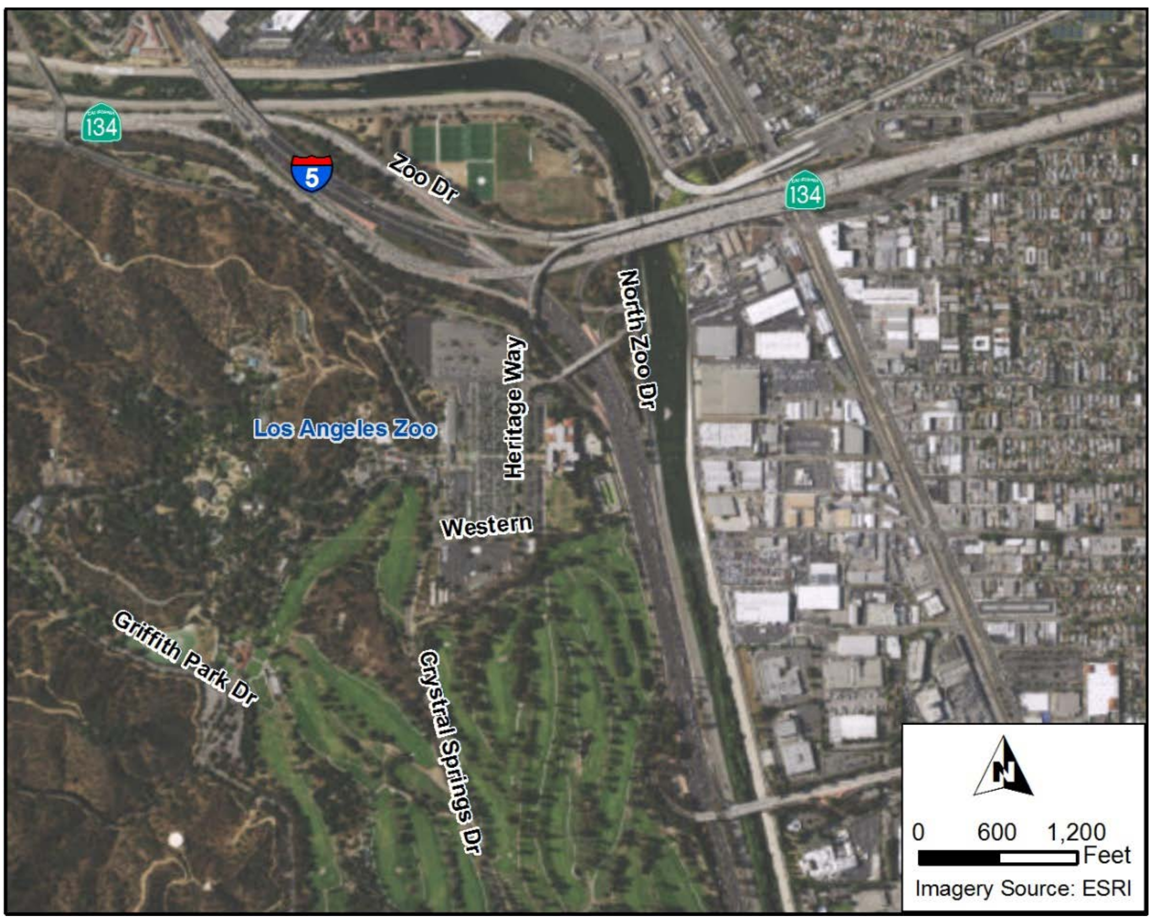


Figure 8 Site Location Map for the LA Zoo

Figure 9 LA Zoo Layout Map

The One Water LA team has met with LA Zoo since early-2015 to discuss opportunities for the expansion of Recycled Water use and Stormwater Capture at the LA Zoo. A total of five meetings have occurred with the LA Zoo operations, animal care, and veterinary staff to determine the feasibility of incorporating water components as promoted by One Water LA.

Through a series of meetings, the Zoo's current water related activities and use have been identified. There are two specific efforts that are on-going where One Water LA identified possible opportunities for the Zoo and One Water LA to collaborate:

- The LA Zoo Master Plan
- New CDC Park Event Center

Recycled water opportunities for, and barriers to, expanding the use of recycled water at the LA Zoo were identified as top on the list to investigate. Stormwater opportunities were also identified as important to explore, especially since both the Master Plan and the Event Center planning efforts have started.

In order to understand the current status of use of recycled at Zoo's, a literature search was conducted. The WateReuse Research Study titled *Recycled Water Use in Zoo and Wildlife Facility Settings, 2013* included useful information related to other Zoos' experience with using municipal recycled water at their premises.

6.1.1 LA Zoo Master Plan

In 2016, the LA Zoo awarded a contract to Torre Design Consortium to develop a new Master Plan for the Zoo. The purpose of the Master Plan is to facilitate, develop, and produce a Master Plan for future capital improvement projects at the LA Zoo. The last Master Plan developed for the Zoo started in 1992 and was updated in 1998. Completion of all of the recommendations and construction projects from this earlier plan was accomplished in 2014.

Water conservation is one of the Master Plan's goals for the future. The goal is to decrease the LA Zoo's potable water use to help achieve the City's local water supply goals. The plan is expected to create conservation programs that encourage local action. The Zoo plans on having conservation messages included in exhibits and green concepts within projects implemented.

As part of the collaboration effort, the LA Zoo is open to involving the One Water LA group through collaborative meetings at the early stage of development so that water saving measures and other opportunities can be captured in the Master Plan. Ideas already suggested and discussed with the Zoo include both stormwater and recycled water opportunities. Stormwater capture elements, such as cisterns, permeable paving, infiltration basins, and swales, are recommended. For recycled water, it was recognized that due to the Zoo's current irrigation line infrastructure it is more cost-effective to wait until Zoo upgrades are under construction to replace and retrofit irrigation lines for recycled water purposes. The Master Plan can be used as an opportunity to convert the irrigation systems to recycled water because certain areas of the zoo are going to be completely reconstructed.

6.1.2 LA Zoo's New Children's Discovery Center Park Events Center

To address the expanding need and interest in providing opportunities for Angelinos, the LA Zoo plans to create a 1.7-acre Event Space. Located near the existing auditorium and by the front parking lot, this space is going to accommodate numerous activities and events. Similar to the Master Plan effort, the LA Zoo is open to including One Water LA team members during the planning and design stage through focus meeting with the consultants. The Zoo has discussed with One Water LA team members exploring the feasibility of using recycled water for the restroom facilities and for irrigation of the event center's landscaping. Also, incorporating stormwater components, such as LID, drought tolerant and heat resistant plants & trees is also under consideration.

6.2 Lead Agency and Interagency Collaboration

The lead agency for this Case Study is the LA Zoo, and with support from LASAN, LADWP, RAP, and the United States Department of Agriculture (USDA).

6.3 Objectives and Benefits

The City's overarching objective of One Water LA is to improve water quality, reduce the amount of imported water supply purchases, and increase the amount of local water supply by implementing integrated multi-benefit projects. As the City aims to be more resilient and sustainable, the importance of interdepartmental collaboration becomes more apparent. This Case Study can serve as a guide to other city departments and zoos across the country also looking to reach similar goals.

This study explores the feasibility of implementing stormwater BMPs into new exhibits and the Event Center's design, and using recycled water for LA Zoo operations, as highlighted in Table 10.

One Water LA looks at increasing the City's water supply by offsetting the amount of potable water being used. It is recommended that the LA Zoo offset the amount of potable water by increasing the amount of recycled water use. One Water LA also looks to improve the City's stormwater quality by implementing the LID Ordinance.

The stormwater quality improvement and recycled water use recommendations are described in further detail below.

Table 10 Potential Recycled Water and Stormwater Uses at the LA Zoo
One Water LA – TM No. 3.2

	LA Zoo Master Plan	Event Center
Recycled Water Activities/ Use	Irrigation	Irrigation
	Washdown	Restrooms
	Restroom	
	Exhibit Use – treatment systems, pool filling, aesthetics, ponds, etc.	
Stormwater Activities/ Use	Infiltration	Infiltration
	Pervious Pavement	Pervious Pavement
	Rain Gardens, Rain Barrels	Rain Gardens, Rain Barrels
	Underground SW system	
	Storage Tank and Pump for capture and reuse	

6.3.1 Potable Water Offset

Through a series of meetings, the Zoo's current water use and water-related activities have been identified. The potential uses for recycled water for various LA Zoo operations, and the total estimated amount of potable water offset potential are summarized in Table 11.

Table 11 Potential Potable Water Demand Offsets
One Water LA – TM No. 3.2

Proposed Activity	Estimated Amount (gal/yr)
LA Zoo	
Recycled Water Use – Washdown (animal holding areas)	4,778,000
Recycled Water Use – Irrigation	36,089,000
Recycled Water Use – Exhibits (treatment systems, ponds, esthetics, etc.)	13,354,000
Recycled Water Use – Power Washers	1,349,000
Restrooms	2,363,000
Potential Stormwater Capture and Reuse – (landscape and planters)	TBD
LA Zoo Event Center	
Recycled Water Use – Irrigation	879,000
Recycled Water Use – Restrooms	5,565,000
Potential Stormwater Capture and Reuse	TBD
Total	**64,377,000**

Abbreviations:
gal/yr = gallons per year; TBD = to be determined

As shown, the LA Zoo has the potential to offset more than 64 million gallons per year, which equates to nearly 0.2 mgd or 200 AFY. The LA Zoo contributes to 90 percent (180 AFY) of the potable water offset potential, while the Event Center accounts for the remaining 10 percent (20 AFY).

6.3.2 Visibility/Education Potential

LA Zoo is open to ideas of marketing One Water LA and informing their customers on the importance of water conservation in order to share and communicate what the City of LA is doing in regards to water. The LA Zoo currently displays educational signs along the promenade to inform LA Zoo visitors about the parking lot's sustainable features.

6.3.3 Social/Environmental Justice

The LA Zoo is visited by nearly 1.8 million people every year, including about 500,000 school-aged children. People of different socio-economic backgrounds and ethnicities (as shown in Table 12) visit the LA Zoo every year.

Table 12 LA Zoo 2016 Visitor Distribution by Ethnicity and Race
One Water LA – TM No. 3.2

Ethnicity/Race		Percent
Hispanic		33%
Caucasian/Other		52%
African American		6%
Asian		9%
	Total	**100%**

Source: LA Zoo Visitors Survey Reports

Highlighting the water conservation methods implemented at the zoo would serve great educational value. For example, making one of the filtration systems visible to the public with explanatory signs and diagrams would educate the public of conservation of natural resources.

6.3.4 Replicability

Zoos and other animal facilities are often major water users. The usage of water includes: washdown, pond and tank filling, animal bathing and drinking, habitat enhancement, landscape irrigation and more. This Case Study could be replicated by other zoo's in the country, as well as, applied to a large number of animal shelters and similar facilities throughout the City.

Extensive research on the subject of using recycled water for zoos and other animal facilities was conducted by the LASAN team. As mentioned previously, one comprehensive study titled Water Reuse in Zoo and Wildlife Facility Settings was found and used as a benchmark. The water quality criteria protect the well-being of aquatic life, wildlife and livestock given in the study would be compared with the current water quality of the closest treatment plant to the LA Zoo (Los Angeles/Glendale Treatment Plant). The results would determine the type of pilot study that could be initiated as well as the appropriate locations recycled water could be implemented. This Case Study highlights the recommendations, solutions, findings, and results of both the treatment options and animal class opportunities for recycled water usage for other zoos to incorporate.

6.3.5 Stormwater Quality Improvement

The City of Los Angeles Stormwater passed the Low Impact Development (LID) Ordinance in November 14, 2011(last updated May 9, 2016). All projects where over 500 square feet (sq ft) are modified or added require LID compliance. The types of stormwater management techniques (BMPs) required are to be evaluated in priority order of:

- Capture and Infiltrate
- Capture and Use
- Capture, Treat, and Release (treated through high removal efficiency biofiltration)

The type of BMP selected would depend on the site and criteria such as; surrounding soil type, depth to groundwater, usable area, and more. The purpose of LID is to mitigate stormwater runoff by capturing and infiltrating rainwater before runoff is generated. Examples of LID practices include rain barrels, permeable pavement, storage tanks, and infiltration swales. Sample design calculations for stormwater BMPs are presented in the City's LID Handbook, Appendix F (City of Los Angeles, 2016).

6.4 Existing Conditions

Information on the existing facilities was obtained through various meetings and field visits with LADWP, LA ZOO, LASAN (Wastewater Collection Systems Division), and RAP staff. One Water LA examined the recycled water supply, existing stormwater management conditions, previous studies, and existing water treatment facilities of the LA Zoo. The existing conditions of the zoo are described below.

6.4.1 Recycled Water Supply Source

The LA Zoo currently receives recycled water from the Los Angeles-Glendale Water Reclamation Plant (LAGWRP) for their parking lot landscape watering needs. Future recycled water connections would also supply the LA Zoo with recycled water from the City's LAGWRP Plant.

LAGWRP is located in the Eastern side of the San Fernando Valley and has a water capacity of 20 mgd. The treatment plant currently treats an average of 16 mgd, with 33 percent of the treated wastewater becoming recycled water. The treatment process is currently at tertiary level; the treatment process can be seen on Figure 10.

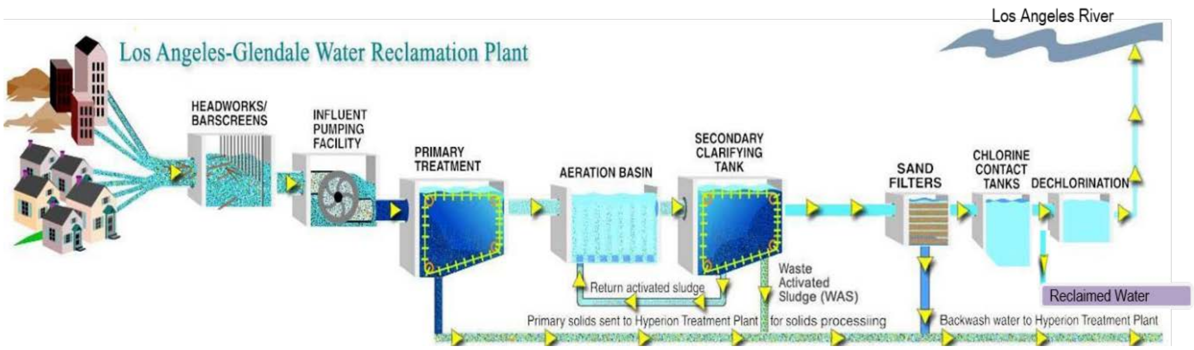


Figure 10 Treatment Process for the Los Angeles-Glendale WRP

It is understood that zoos in the U.S currently using recycled water do not use it in fish and reptile exhibits due to the animal's sensitivity to chlorine. LAGWRP's recycled water is chlorinated before it is distributed into the recycled water distribution system. The recycled water would potentially need to be dechlorinated before it could be used as part of the animals' natural environment such as the filling of ponds and pools.

As presented in Table 13, the supply source for activities requiring recycled water would be the LAGWRP's recycled water effluent. Using recycled water for operations that do not require potable water quality, can save both energy and money, and reduce dependence on potable water supplies.

Table 13 Potential Supply Source(s) for LA Zoo Activity One Water LA – TM No. 3.2

Activity	Source (RW/SW)
LA Zoo	
Washdown (animal holding areas)	LAGWRP's RW
Irrigation	LAGWRP's RW
Exhibits – Treatment Systems, Ponds, Esthetics, etc.	LAGWRP's RW
Powerwashers	LAGWRP's RW
Potential Stormwater Capture and Reuse	SW
LA Zoo Event Center	
Irrigation	LAGWRP's RW
Restrooms	LAGWRP's RW
Potential Stormwater Capture and Reuse	SW

6.4.2 Existing Water Treatment Facilities and Operations

The One Water LA team is working with the LA Zoo to determine the feasibility of using recycled water, instead of potable water, for their water treatment systems (Life Support Systems [LSS]). Simplified flow diagrams for each exhibit are included in Appendix D.

The drain and fill frequency for each exhibit varies. Some exhibits have large volumes and are drained frequently; some have small volumes but are drained frequently; and others have large volumes but are drained infrequently. Detailed frequency and drain schedule can be seen in Appendix F.

6.4.3 Existing Stormwater Facilities

The existing stormwater management facilities and practices of the LA Zoo include the following:

- The LA Zoo Wastewater Facility – Captures all stormwater and pond drainage and discharges to LAGWRP.
- Non-Structural Best Management Practices – Good housekeeping and record keeping.
- LA Zoo main parking lot – includes permeable pavement, bioretention cells, and pervious concrete.

The LA Zoo Wastewater Facility was constructed in 1994 and is located at 4700 1/2 Western Heritage Drive in Los Angeles. The construction of the LA Zoo Wastewater Facility was necessary for the following reasons:

- To eliminate and prevent water pollution and maintain water quality in the Los Angeles River by pumping the Zoo's animal wastewater to the North Outfall Sewer (NOS) and LAGWRP for treatment
- To meet federal water quality standards and comply with the NPDES permits
- To provide relief of localized sewers in the surrounding area

The zoo's wastewater facility temporarily stores pond drainage from the LA Zoo's animal ponds and washdown of animal yard areas. The facility also stores storm drainage captured from the zoo's storm drain system (See Figure 11).

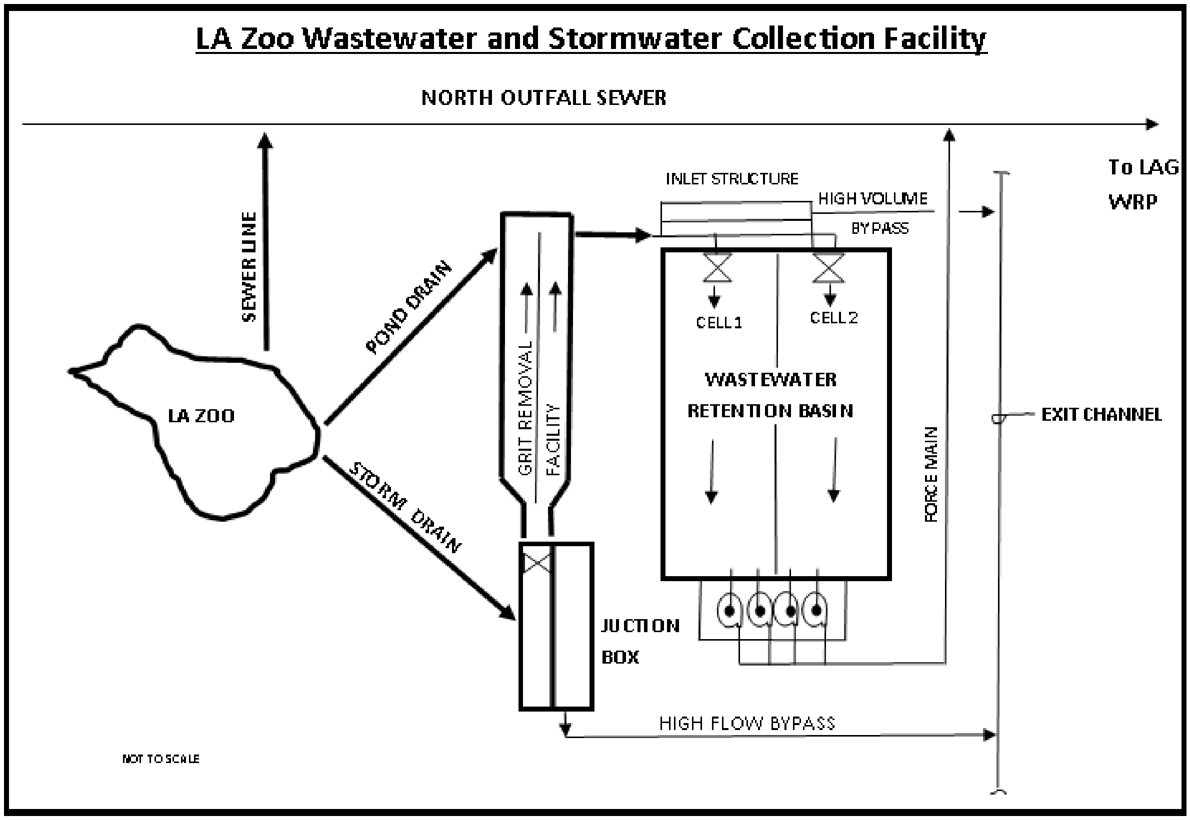


Figure 11 LA Zoo Collection/Storage Facility Schematic

The components for the LA Zoo collection facility (components are also seen on Figure 11) are listed below.

- Pond Drain
- Storm Drain
- Junction Box
- Grit Removal Facility
- Inlet Structure
- Wastewater Retention Basin
- Pumping Station
- Force Main

The wastewater facility's grit removal facility is designed to remove the storm drainage's grit and debris, while the pond drainage bypasses the grit removal facility and enters the wastewater facility after the grit chambers.

In the year 2000, the LA Zoo developed a stormwater BMP study too identify the best potential BMPs that can be implemented to reduce the quantity and/or improve the quality of stormwater runoff from the Zoo. The study was a joint effort between the LA Zoo, LASAN, RAP, and other stakeholders (Friends of the LA River).

The study concluded that the most effective structural BMP option recommended is the construction of a dry retention pond in the Zoo parking lot. Since the study, the LA Zoo has implemented the following measures to help manage stormwater runoff:

- Non-structural BMPs:
  - Schedule regular pickup and disposal of garbage, green waste, and animal waste
  - Use indoor feeding during rainfall, a practice which keeps more manure under roof and away from runoff
  - Routinely inspect conditions of waste containers and trucks; look for signs of leaks and leaching
  - Cover waste containers
- Structural BMPs:
  - Pervious Paved Parking Lot (includes: recycled water irrigation, bioretention cells, and permeable paving)
  - Zoo Drive Bioswale:
    - ➢ 120,000 gallons
    - ➢ Completed in 2001

It is important to note that the study was done 16 years ago, and that new structural BMPs have been developed. Also, the City was not going through a drought during the time of the study, therefore reusing the captured stormwater was not considered.

The City has also improved the water quality by retrofitting their main parking lot to include bioretention cells, drought tolerant plants, and permeable pavement, with construction completed in 2011 and illustrated on Figure 12.

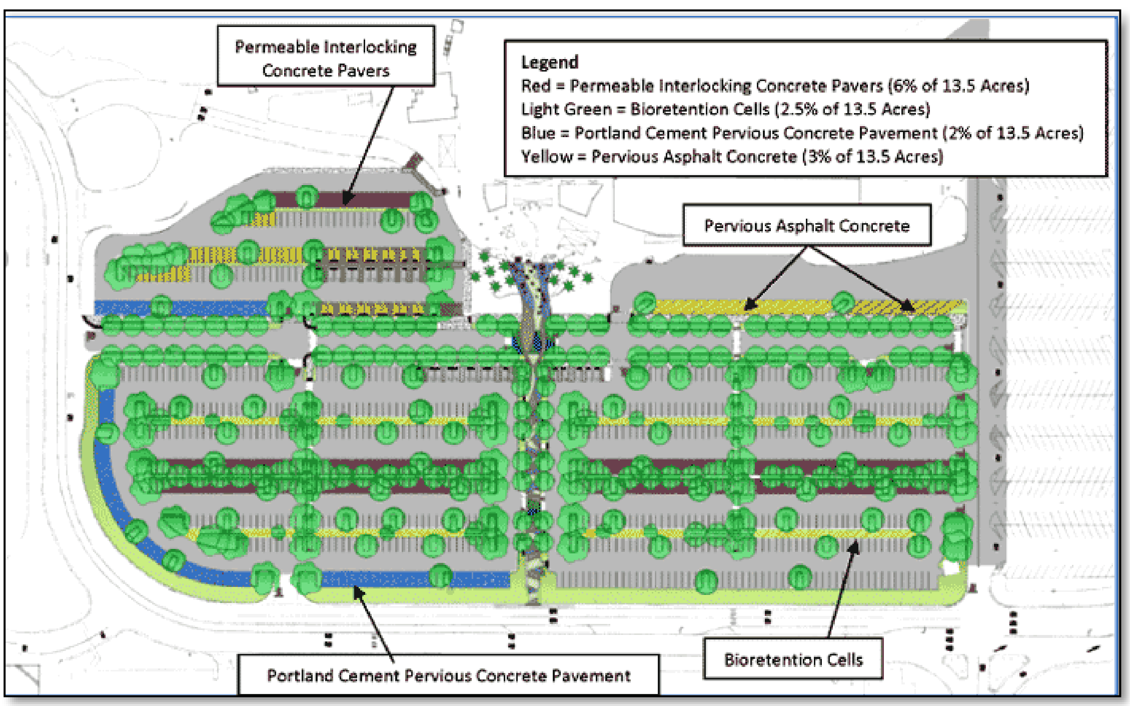


Figure 12 LA Zoo Parking Lot

The Stormwater BMPs in the parking lot are sized and designed to capture pollutants, trash, and other debris and significantly reduce runoff that would otherwise flow directly into the Los Angeles River.

6.5 Data Collection

One Water LA has been reviewing the viability of recycled water use based on water quality, animal needs, and animal sensitivity issues with the LA Zoo. In order to understand the opportunities for recycled water. In addition to interviews with Zoo personnel, an extensive literature review and field visits were completed to determine the feasibility of increasing recycled water use in the LA Zoo. This review resulted in understanding where recycled water currently is being used in the United States for animals and by whom, as well as what have been the benefits and lessons learned since implementation.

6.5.1 City Staff Interviews and Discussions

In order to determine the possibilities and opportunities at the LA Zoo, it was realized that more research and investigation of what was allowed at zoos was required, related to water quality. Early on, it was determined that the regulatory agency is the USDA. In addition, obtaining information on animal species and animal classes was critical to understanding water quality parameters. The WateReuse Study helped to identify which species are "sensitive" to recycled water and which are not. In addition, a survey of those zoos that were already using recycled water was conducted. Specific to the LA Zoo, the One Water LA team performed field visits and reviewed the following:

- Number and location of treatment facilities by exhibit
- Type and components of treatment facilities
- Use of potable water in each exhibit
- Number and size of pools, moats, and tanks
- Frequency of discharging water and re-filling with potable water
- Irrigation demands
- Existing recycled water lines near the Zoo and potential connection points
- Cleaning and maintenance activities and frequency, such as washdown

Appendix D provides a process flow diagram of each of the Zoo's treatment facilities for each exhibit.

During discussions, the Zoo's chief veterinarian had some concerns regarding the water quality of recycled water, and specifically asked about the micro-biomes in the water. The One Water LA team stated that they did not know, but would determine if that was something that the City's water labs tested for when measuring water quality. However, the One Water LA team is comparing the water quality of recycled water with potable water for those constituents that are tested by both laboratories. It was noted that there are a few constituents that are tested in potable water, but not in recycled water. To make a complete comparison, LASAN would need to test for those constituents that are tested in potable water, but not in recycled water.

The LA Zoo is open to using recycled water in exhibits where the animal is not in contact with the recycled water and would like more research to be done for the exhibits where the animal would be in contact with the recycled water. The LA Zoo plans to contact their USDA representative to attend future meetings.

The LA Zoo is also very interested in capturing more stormwater. Their Master Plan is expected to include re-development of the entire zoo. The LA Zoo staff is open to involving the One Water LA group through collaborative meetings at the early stage of development to help incorporate stormwater capture elements into the Master Plan.

6.5.2 Recycled Water Line Field Visits

The surrounding areas of the LA Zoo, such as Griffith Park, have been irrigated with recycled water for years. To determine the location of the current recycled water lines, the One Water LA team reached out to RAP and the LADWP.

Through various conversations with planners, architects, and irrigations specialist (stationed on-site), the areas that are irrigated with recycled water have been identified. In addition, field visits with the irrigation specialist at Griffith Park occurred and sites that are currently being irrigated with recycled water were identified. A City irrigation specialist also pointed out the locations of current recycled water fire hydrants located in the area, where he mentioned an 8-inch recycled water line runs underneath. As a result, a follow-up call was made to the recycled water planning group to obtain a map identifying the location of the hydrants and/or 8-inch line, but no records of the 8-inch line or recycled water hydrants could be found. However, the as-built maps of the 30-inch recycled water mainline GIS data was obtained. Further evaluation of the current recycled water network around the zoo is needed.

6.5.3 Recycled Water Activities at Other Wildlife Facilities

The One Water LA team has had follow-up discussions with zoos nationwide to identify any changes, hurdles, and/or the progress that has been made since the publication of the WateReuse study. These zoos and wildlife facilities are summarized in Table 14.

Table 14	Other Zoos and Shelters Currently using Recycled Water One Water LA – TM No. 3.2		
	Denver Zoo	**Martinez Animal Shelter**	**Santa Barbara Zoo**
Quantity of RW Used (gpd)	1,890[(1)]; 3,790[(2)]	820/1,100	TBD
No. of years using RW	11	12	26
RW Use			
Landscape Irrigation	x		x
Cage Washdown	x	x	
Water Features (pool filling)	x		x
Exhibits with RW Use			
	Lion/Hyena/ Wild dog	Cats (cage)	Swan Lake
	Elephant/Rhino/ Tapir	Dogs (cage)	Gibbon Island
			Capybara Exhibit

Notes:
(1) Irrigation (summer only)
(2) Cage washdown
Abbreviation:
gpd = gallons per day

Both the Denver and Santa Barbara Zoos are pleased with the implementation of recycled water use for their operations and are continuing to look for expanding its use as new improvement projects become available. The only hurdle with the use of recycled water that was mentioned was that the recycled water may be adversely affecting coniferous plants. However, this is still being studied.

6.6 Project Analysis and Evaluation

In efforts to decrease the City of LA's potable water use, One Water LA is working with Los Angeles Zoo to identify the necessary steps to implement municipal Recycled Water use and help incorporate stormwater capture components in the LA Zoo. An extensive analysis of the Zoo's existing facilities, recycled water use and stormwater capture opportunities were evaluated and are described below.

Because of the on-going discussions, pre-planning and analysis with Zoo managers and staff, conversations with numerous staff in various City departments (such as LADWP and RAP), field investigations, calculations, etc., data gaps were identified. Table 15 summarizes the potential recycled water and stormwater use activities in the LA Zoo, along with identified data gaps.

Table 15 Opportunities and Data Gaps for the LA Zoo Case Study
One Water LA – TM No. 3.2

No.	RW/SW Use Options	Description	Data Gaps	Party Responsible (for providing data)	Water type
1	New Event Space	The LA Zoo is open into incorporating RW use for irrigation, and toilet flushing (bathrooms would be designed for a capacity of 3,000 people). One Water LA would also assist in incorporating SW management techniques to the design.	Amount of water used and/or captured (projection)	LA Zoo	SW, RW
			Connection options: Map identifying current RW pipeline network around the LA Zoo(1)	LASAN/LADWP	RW
2	Animal Area Washdown	Approximately 300 animal areas are washed every day from 8:30 AM-11 AM.	LA Zoo's site plan(1); Location of each; Amount of water used	LA Zoo	RW
3	Powerwashing	The Zoo also washes the walkways and other areas of the zoo with power washers.	Location of connection; Amount of water used	LA Zoo	RW
4	Exhibits with Recirculating Water Treatment Systems	There are 15 exhibits currently using water treatment systems. The type of water treatment system varies with each exhibit.	RW vs. Potable Water Comparison; Cost of comparison study	LASAN	RW
			Determine which LSS are feasible for RW use.	LASAN	RW
5	Exhibits with Aesthetic Water Features	There are currently 12 exhibits that include some type of water feature as part of the exhibit (moat, pool, aesthetic purposes, etc.). The total water demand for these exhibits is 11.1 MG per year.	None		RW, SW
6	Irrigation (long-term)	LA Zoo would like to include supplying RW for irrigation inside the Zoo and convert all systems to smart irrigation controllers as part of their Master Plan.	Amount of water used	LA Zoo	RW
7	Parking Lot (far north and far south)	Stormwater Capture BMPs in the far north and far south parking lot is possible (23 acres)	Feasibility of retrofitting to include SW capture	LASAN, LA Zoo	SW
8	Capture SW from barns and roofs within the Zoo	Capture rainwater runoff from barns and roofs within the Zoo. SW runoff in the zoo property currently goes to a pump station and then the sewer.	Amount of water currently being captured- look at aerial	LA Zoo, LASAN	SW
9	Other SW Management Techniques	Determine opportunities for SW capture in the LA Zoo (Refer to LID).		LASAN	SW

Note:
(1) Applies to all RW options

6.6.1 Zoo's Life Support System's Water Use

One Water LA team visited the LA Zoo to determine the existing water treatment systems and their corresponding water demand. The zoo currently has 15 Life Support Systems (recirculating systems). The LSS vary in treatment process and are dependent on the animal's needs. LADWP currently provides potable water for all LSS. However, recycled water may be a potential alternate supply source that could be used for select animal exhibits. The water quality testing constituent and frequency varies for each exhibit. Testing for pH, chlorine, ammonia, nitrate, and nitrite is conducted for certain exhibits.

Most LSS are recirculating systems, which may only discharge wastewater once per month. LA Zoo has provided the water use and discharge frequency for each of their LSS, presented in Table 16.

Table 16 Summary of the Zoo's Life Support System's Water Demand and Use One Water LA – TM No. 3.2

No.	Exhibit	Exhibit's Water Demand (gal/yr)	Water to Sewer[(1)] (gal/yr)
1	Peacock Bass Aquarium	5,200	5,200
2	Piranha Aquarium	10,400	10,400
3	Water Lily	TBD	TBD
4	Giant Otter	373,200	893,200
5	Tapir	915,200	915,200
6	Pachyderm (Elephant)		
	South Pool	160,000	214,750
	North Pool	280,000	334,750
7	China Pool (Chinese Muntjac)	21,200	26,000
8	Gorilla Reserve	48,000	50,600
9	False Gharial	416,000	416,000
10	Japanese Giant Salamander	450	500
11	Fly River Turtle	7,920	7,920
12	Tiger	965,250	1,147,750
13	Orangutan-Red Ape Rain Forest	54,000	56,500
14	Harbor Seals (Sea Life Cliffs)	26,000	-
	Total	**3,282,820 (10.07 AFY)**	**4,078,770 (12.52 AFY)**

Note:
(1) Includes water for LSS maintenance (i.e., backwash)

According to Table 16, there is a potential to offset more than 12 AFY (backwash), which equates to four million gallons per year (assuming all LSS can switch their influent from potable water to recycled water).

Table 17 presents each exhibit's treatment components. As presented in Table 17, each exhibit's treatment varies depending on the animal class. The One Water LA team is going to need to verify if the treatment system is sufficient to meet the animal's needs if recycled water is to be used instead of potable water.

Table 17 Summary of LA Zoo's Water Treatment Systems One Water LA – TM No. 3.2

		Treatment Components					
No.	Exhibit	Filter System	UV	Ozone	Chemical Addition	De-aeration/ Degasser	Preliminary Treatment
1	Peacock Bass Aquarium	x	x				
2	Piranha Aquarium (Freshwater Aquarium)	x	x			x	
3	Water Lily	x			x		
4	Giant Otter	x		x			
5	Tapir						Static Drum
	Pachyderm (Elephant)						
6	South Pool	x			x		Drum Screen
7	North Pool	x			x		Drum Screen
8	China Pool	x		x		x	
9	Gorilla Reserve	x			x		
10	Alligator Swamp	x			x		
11	Japanese Giant Salamander	x	x			x	
12	Fly River Turtle	x	x			x	
13	Tiger	x		x	x		
14	Orangutan-Red Ape Rain Forest	x		x			
15	Harbor Seals (Sea Life Cliffs)	x		x	x	x	

6.6.2 Water Quality Considerations

It is understood that zoos currently using recycled water do not use it in fish and reptile exhibits due to the animal's sensitivity to chlorine, although the Denver Zoo is considering adding recycled water to these exhibits in the near future (de-chlorinated recycled water). Zoos using recirculated water in fish and reptile exhibits use non-chlorinated disinfection treatments such as UV to allow the use of the recirculated water.

All of LASAN's recycled water is chlorinated before it is distributed in to the recycled water distribution system. It is anticipated that the recycled water would need to be dechlorinated before it could be used as part of the animal's natural environment such as the filling of ponds, pools, fish tanks, and other potentially chlorine sensitive exhibits.

6.6.3 Drainage Operations at the LA Zoo

The Zoo wastewater and runoff are collected and conveyed by three drainage systems: the sanitary sewer, pool drain, and storm drain systems:

- The sanitary sewer system that conveys wastewater generated from snack bars, restrooms, offices, and covered animal night quarters, and discharges directly to the NOS of the City of Los Angeles for treatment at the LAGWRP.
- A pool drain system conveys animal pool wastewater to the Zoo collection/storage facility via a 21-inch pool drain line. The system was designed for an average dry weather flow of 0.5 mgd and peak dry weather of 2.8 mgd. The Sea Life Cliffs pool drains directly into the NOS.
- A stormdrain system conveys storm and non-storm runoff to the Zoo collection/storage facility via a 66-inch storm drain line. The flows collected in the storm drain system include stormwater runoff, irrigation runoff, and wash-down water from animal exhibits. In addition, tributary hillside runoff is also conveyed into the storm drain system. The system was designed to handle peak flow of 186 mgd.
- An open channel system that drains southeast portion of the Zoo and the Mineral Wells Picnic Area located just outside of the Zoo boundary to the west. Runoff collected in this system in conveyed to a Caltrans' channel located near the Interstate 5 and is discharged directly into the LA River.
- Zoo collection/storage facility (Figure 11) – The facility receives pool drain and stormwater from the Zoo (with the exception of the parking lot), removes large debris and grit from storm drainage, retains the water until midnight, and pumps the stored water into the NOS for eventual treatment at the LAGWRP and disposal. Table 18 shows average daily flow from the Zoo collection tank to the LAGWRP for Fiscal year 2015-16.

The LA Zoo Parking lot, under Prop O, was retrofitted to include porous pavement BMPs. The project encompasses the entire 33-acre parking area and the implementation of BMPs for the 10-acre main parking area. Enhancements to mitigate stormwater runoff include various types of permeable pavement, grassy swales, native trees, and other vegetation. There is a bio-swale between Zoo Drive and the Zoo Parking Lot that retains 120,000 to 150,000 gallons of stormwater for percolation after a storm event. The drainage comes from Zoo Drive and from a small section of the South Main Parking Lot.

Table 18 LA Zoo Stormwater Tank Monthly Flow (FY '15-16)
One Water LA – TM No. 3.2

Month	Flow (gal/month)
July	2,980,000
August	2,438,000
September	2,796,000
October	2,463,000
November	2,352,000
December	3,410,000
January	3,480,000
February	2,048,000
March	2,205,000
April	1,957,000
May	1,825,000
June	1,818,000
Total (gal/yr)	**29,772,000**
Daily Average (gpd)	**81,567**
Average gpm	**57**

As shown in Table 18, the LA Zoo tank captures nearly 30 million gallons per year, which equates to an average flow rate of 57 gpm.

6.6.4 Stormwater Management Opportunities

Incorporation of LID in development and redevelopment projects to the maximum extent practical is a critical component in improving the City's water quality and attaining regulatory compliance. LASAN and the LA Zoo plan to coordinate to ensure LID standards are incorporated at the design stage of the Master Plan and the Event Center.

To understand the stormwater capture opportunities in the LA Zoo, Figure 13 has been developed to identify the impermeable and permeable areas in the LA Zoo.

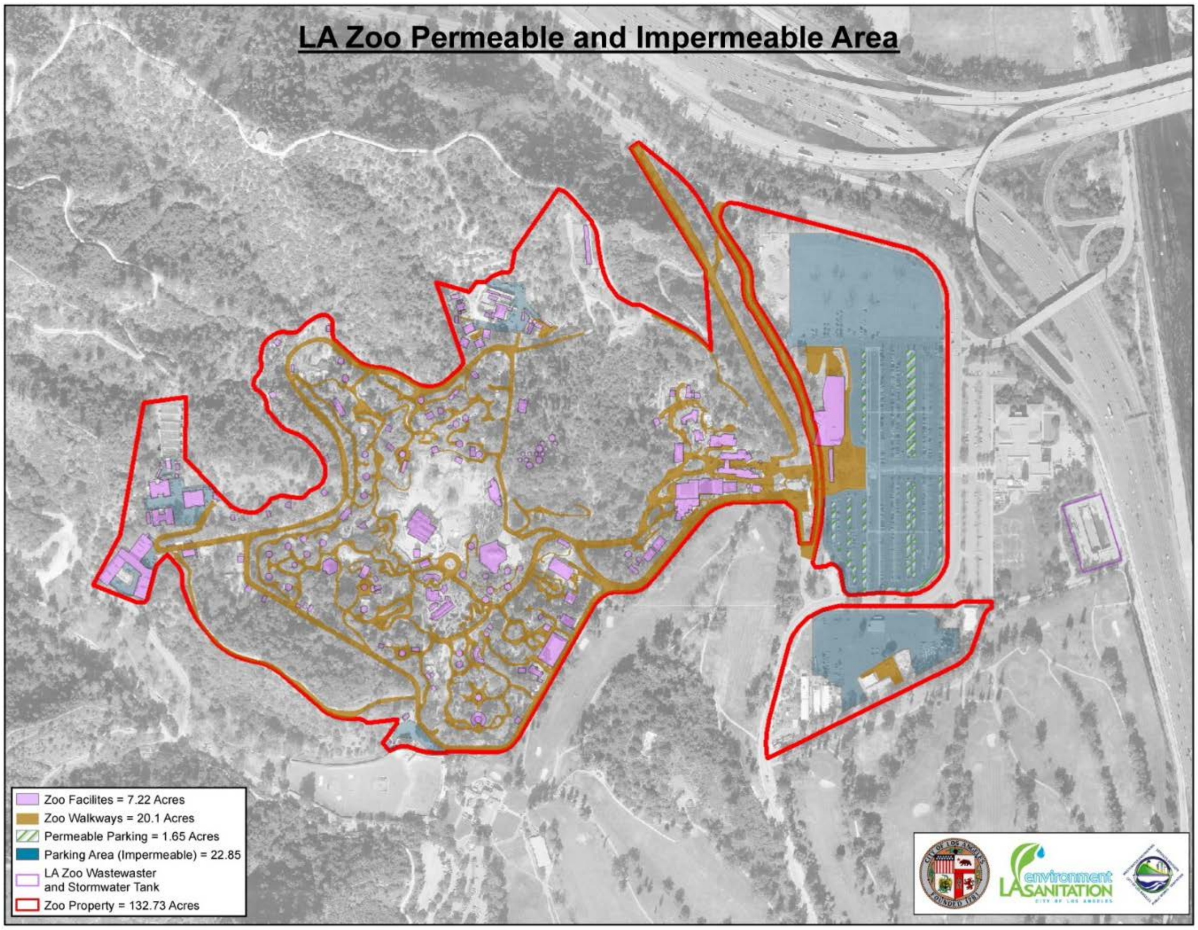


Figure 13 LA Zoo Permeable and Impermeable Area Map

The LA Zoo encompasses approximately 133 acres, with 50.2 acres being impermeable. As shown on Figure 13, the LA Zoo has large permeable areas that are suitable for stormwater capture and infiltration.

The City has already retrofitted the zoo's parking lot to include stormwater capture elements. The zoo's permeable parking lot is located east of the zoo and can be see within the parking lot (shaded blue).

6.7 Implementation Considerations

In this Case Study the potential to use recycled water for various zoo operations was evaluated, as well as the potential to increase the implementation of stormwater BMPs. The implementation considerations for this Case Study can be divided into pertinent recycled water regulations and implementation phases and funding, as discussed next.

6.7.1 Pertinent Recycled Water Regulations

All zoos in the United States are regulated by USDA's Animal and Plant Health Inspection Service (APHIS). The USDA develops and enforces the regulations concerning animal welfare (Animal Welfare Act).There was an initial concern, from the LA Zoo staff, that the USDA would not approve the use of recycled water for certain activities. After reviewing the USDA regulations, Animal Welfare Act (USDA, 2013), the regulations that were found relevant are the following:

- *Sec. 3.83* - Drinking water source of an animal must be of potable water quality
- *Sec. 3.106* - States specific water quality parameters for marine mammals

Additionally, conversations with USDA representatives have occurred. LASAN reached out to LA Zoo's USDA inspector to understand the approval process from USDA with regards to the use of recycled water in zoos and wildlife facilities. LASAN was referred to the Regional Animal Care Specialist. During a phone call (September 19, 2016) conversation, the specialist indicated the following key points:

- USDA cannot send a letter to approve or disapprove the use of recycled water in the LA Zoo.
- Since the regulations are not specific to the use of recycled water, the following requirements have to be met:
  - Animals must have a potable water source for drinking water,
  - The recycled water cannot cause any harm to the animals,
  - The veterinary staff must approve the use of recycled water,
  - The inspector may ask for informational material addressing the general concerns about recycled water
  - If recycled water is used, then the inspector would conduct monitoring on the animals health to be certain that the recycled water does not cause any harmful effects.
- The LA Zoo can contact her directly if they have any additional questions or concerns.
- Refer to the Animal Health Care Act for additional regulations.

LASAN has been investigating the ability of the LA Zoo to use municipal recycled water (advanced treated wastewater from treatment plants) for almost 2 years. Conversations with LA Zoo staff and with other zoos in the nation that are currently using recycled water have occurred. Other zoos agree that it is not USDA's policy to send letters of approval or disapproval for specific projects. As long as the water meets the water quality parameters for marine mammals and the health of animals are not negatively impacted, there are no regulatory issues. As of today, there are no specific USDA requirements pertaining to the use of recycled water at wildlife facilities, such as the LA Zoo.

6.7.2 Implementation Phases and Funding

Projects would be prioritized and phased, pending available funding (capital and O&M).

6.8 Agreements and Policies

One of One Water LA's objectives is to integrate management of water resources and policies by increasing coordination and cooperation between all City departments, partners, and stakeholders. One Water LA objectives are in line with the City Sustainability pLAn, which creates a platform for collaboration to identify, create, and strengthen programs, policies, and partnerships that cut across bureaucratic boundaries to improve the city and neighborhoods.

To help meet the Mayor's goal of increasing the use of local water supply by 50 percent by 2035, the Zoo would need to consider the following as part of their Master Plan:

- Increase recycled water Use - for irrigation, ponds, washdown, power washing, etc.
- Include stormwater BMPs

The expected agreements for this project include an agreement between LASAN and the LA Zoo, where collaboration in the development and implementation of the Master Plan continues to occur, and an agreement between the LA Zoo and LADWP, for the distribution of recycled water within the zoo.

6.9 Costs Considerations

It is important to consider the amount of savings that could occur from switching from potable water to recycled water (assuming a 30 percent savings).

6.9.1 Capital Cost Estimates

Existing zoos using recycled water (i.e., Denver and Santa Barbara Zoos) budget for the implementation of recycled water use as new projects come on board (expansion of recycled water lines is included as part of the project). Projects include: landscape irrigation projects, new animal facilities, toilet flushing in new buildings, and more.

The cost of incorporating stormwater capture BMPs and recycled water would depend on the projects listed in the LA Zoo Master Plan. Based on the recommendations of this Case Study, the estimated operations and maintenance costs and capital costs for incorporating recycled water and stormwater capture have been tabulated (Table 19 and Table 20).

Table 19 Cost Estimate for Recycled Water Use at the LA Zoo
One Water LA – TM No. 3.2

Purpose	Component(s)	Unit	Quantity	Unit Cost	Estimated Construction Cost
Backbone System	Pipe System[1][2]	ft	16,000	$480/ft	$7,700,000
Granular Activated Carbon (GAC) Treatment[3]	Systemwide Treatment	gpd	1,400,000	$1.50/gal	$2,100,000
Irrigation[4]	Automatic "Smart" Irrigation System Area	sq ft[5][6]	3,500,000	$2.50/sq ft	$8,800,000
Washdown	Connection[7] Retrofit (if needed)		530	$500/conn.	$270,000
Powerwashing	Connection[8] Retrofit (if needed)		316	$1,000/conn.	$320,000
Exhibits[9]	Connection		30	$10,000/conn.	$300,000
Restrooms[10]	Connection		10	$5,000/conn.	$50,000
				Total	**$19,540,000**

Notes:

(1) Pipeline costs based on One Water LA TM 5.1
(2) Assumes 3 miles of 8-inch diameter pipeline. Some pipelines would be larger and others smaller, but these would need to be defined more fully.
(3) Assumes GAC pressure vessel treatment, treating both LSS and irrigation. Total demands defined as 64,377,005 gal/yr. Assumes a 8.0 multiplier from peak hour to average day for sizing.
(4) Irrigation demand for both the Zoo and Event Center
(5) Assuming 60% is landscaped and requires irrigation
(6) Irrigation demand (LA Zoo and Event Center) = 36,968,222 gal/yr; peak hour to average day assumed at 8.0 multiplier.
(7) Assume average 2 connections per exhibit (realistically, there would be 1 connection per exhibit and 5 connections per exhibit for large size exhibits); map provided has 265 labeled areas
(8) Assume 1 hose connection/50 feet for walkway/assume 3 miles of walkway
(9) Assumes thirty exhibits that require recycled water connections. Assumes additional treatment would not be required at locations that do not have LSS.
(10) Zoo map shows 10 restrooms.

Table 20 Estimated Stormwater BMP Cost
One Water LA – TM No. 3.2

Potential BMP	Area, A (ft)(2)	Volume, Vt (ft)(3)	Media Volume, Vm (ft)(3)	Underdrain Volume, Vu (ft)(3)	Capacity	Unit	Capital Cost(2) ($M)	Annual O&M(2) ($/year)
BMPs (Rain Barrel, hardscape removal, etc.)	-	-	-	-			$-	-
Bioretention Area with Underdrain	-	-	-	-			$-	$-
Bioretention Area without Underdrain	-	-	-	-			$-	$-
Permeable Pavement with Underdrain	986,634	-	-	986,634			$36,400,875	$1,716,743
Permeable Pavement without Underdrain	986,634	-	-	-			$25,005,252	$1,716,743
Regional Project(4)								
Concrete Infiltration Tank					1.0	MG	$5,000,000	$50,000
Sedimentation Tank(5)					1.0	MG	$4,000,000	$80,000
Piping					5,280.00	ft	$2,217,600	$22,176
Stormwater Pre-treatment(6)					1.0	mgd	$1,500,000	$60,000
Manhole					1.0	unit	$5,000	$100
Shut off Valve(7)					1.0	unit	$50,000	$2,000
Modified Tank							TBD	TBD
Other								
Pumps(2)	-	-	-	-	5.0	cfs	$1,488,871	$44,666
						Total	$75,667,597	$3,692,428

Notes:

(1) Functions describe 20-year life cycle costs including O&M using the following variables: (A) is the area of the BMP footprint in square feet, (Vt) is the total volume of the BMP in cubic feet, (Vm) is the volume of the BMP soil media in cubic feet, and (Vu) is the volume of the BMP underdrain in cubic feet.
(2) Formulas were obtained from the Upper LA River Enhanced Watershed Management Plans, Table 9-1
(3) Calculations show trails and parking lot are 45.3 acres. This has been divided 50% between permeable pavement with and without underdrain.
(4) Regional project assumes 1 MG concrete tank, 1 mile of 12-inch gravity pipe, 1 monitoring system at $100,000, and 1 mgd treatment system.
(5) Cost is dependent on the volume of the tank.
(6) Pre-treatment cost assumes mechanical screening and chemical pre-treatment.
(7) Shut-off valve assumes 12-inch diameter butterfly valve with electrical system (automatic shutoff) and controls.

6.9.2 Operations and Maintenance

Operation and maintenance requirements would depend on the specific types of water components implemented at the Zoo. Each design element would have its unique location and purpose and may be presented in the Master Plan. There are two types of components that would have O&M efforts: recycled water and stormwater. An in-depth discussion, particularly for stormwater, can be found in the One Water LA Stormwater Facilities Plan which has a section dedicated to O&M.

6.10 Schedule

The schedule is based on the design and construction phase of each of the following efforts:

- Master Plan – Torre Design Consortium LTD has been selected to develop the LA Zoo Master Plan. The LA Zoo mentioned that the Master Plan would take time (3-4 years) before implementation occurs. The implementation of the Master Plan can be phased within the next 15-20 years. The Master Plan is expected to be completed late 2017.
- Event Center – Rios Clementi Hale (RCH) was awarded the contract for developing the design for the event space. The design phase is expected to be completed in 2017.

The implementation phase of the Master Plan is going to depend on available funding, new regulations, animal needs, and goals of Zoo management.

6.11 Next Steps and Recommendations

The following next steps to advance the incorporation of water management strategies for both stormwater and recycled water at the LA Zoo include:

- Include the use of recycled water for irrigation in the Master Plan (long-term) and Event Center Design (short-term).
- Implement recycled water use for wash-down and power-washing activities at the LA Zoo.
- Incorporate stormwater management BMPs in the Master Plan and Event Center Design.
- Determine if there are any additional agreements needed.
- Verify if the treatment system is sufficient to meet the animal's water quality needs if recycled water is used instead of potable water.
- Determine recycled water connection options to the LA Zoo.
- Determine implementation resources, such as the Mayor's Water Cabinet support.

On the basis of this Case Study, the following recommendations are presented:

- Continue collaboration with the Zoo and engagement with the design consultants involved in any future improvement projects with the zoo.
- Retrofit all eligible exhibits (based on location, sensitivity, and water treatment system) with current LSS systems, to connect to a future recycled water distribution system within the LA Zoo. For redundancy, it is recommended that a backup connection is maintained with the existing potable water system.
- Evaluate the 50.2 acres of permeable area in the LA Zoo and determine the amount of area available for stormwater capture and infiltration.

7.0 ADDITIONAL CURRENT OPPORTUNITIES

This section presents additional integration opportunities with the intent of providing a "living" project/concept ideas list. This listing of projects is derived from the initial listing of 44 potential Case Studies received from the Steering Committee, special studies, Steering Committee Meeting #4 on November 2, 2016, and the Project Ideas Workshop on November 18, 2016.

Projects are tabulated in Table 21 and represent not only integration opportunities from the entire list of 44 projects described in TM 3.1, but also new ideas from stakeholders and other projects that have emerged since that time. This table includes the following information [*Note – if information is not yet known, then the cell has been left blank*]:

- # – this number has been automatically assigned for project tabulation purposes and does not represent a ranking of any kind.
- Lead Agency – designates the project's lead agency.
- Project Name – current name of the project.
- Supporting Agencies – agencies that would collaborate on the project.
- Water Type – water types include recycled water (RW), stormwater (SW), and conservation (C).
- Timing – identifies the project as either a current integration opportunity (within the next 5 years) or a future integration opportunity (greater than 5 years).

Table 21 Additional Water-related Integration Opportunities
One Water LA – TM No. 3.2

#	Lead Department or Agency	Project Name	Supporting Agencies	Water Type	Timing
				RW, SW, C	NT, LT
1	BOE	Deploying New Equipment to provide for optimization of aeration system and significant energy savings	LASAN		NT
2	BOE	TIWRP Phase 2 Advanced Water Purification Facility	LASAN	RW	LT
3	BOE	LAGWRP Primary Effluent Equalization Storage	LASAN	RW	LT
4	BOE	HWRP Cryogenic Facility Upgrade	LASAN	RW	LT
5	BOE	Ballona Creek 29 mgd Disinfection Facility	LASAN	RW	LT
6	BOE	Sepulveda Channel 1.3 mgd Disinfection Facility	LASAN		LT
7	HSR	Building High-Speed Rail throughout California			LT
8	HSR	Connecting to and within Southern California (e.g. Airports, Multi-Modal Transportation Hubs)			LT
9	HSR	Concurrent Projects Along Corridor			LT
10	HSR	Remnant Properties			LT
11	LACFCD	Hancock Park Drainage Enhancement Project	LADWP, LASAN, Wilshire Country Club	SW	NT
12	LACFCD	Rory M. Shaw Wetlands	LADWP, LASAN, RAP	SW	LT
13	LADOT	Cesar Chavez Pedestrian Improvements	LASAN	SW	NT
14	LADOT	Central Avenue Pedestrian Improvements	LASAN	SW	NT
15	LADOT	Bicycle Friendly Street Intersection Enhancements	LASAN	SW	NT

Table 21 Additional Water-related Integration Opportunities
One Water LA – TM No. 3.2

#	Lead Department or Agency	Project Name	Supporting Agencies	Water Type RW, SW, C	Timing NT, LT
16	LADOT	Chandler Bike Path Reclaimed Water Irrigation System	LADWP	RW	NT
17	LADOT	Expand number of green infrastructure and street sites through LADOT 5-Year Capital Plan		SW	NT
18	LADOT	Drip Irrigation System at Bike Paths			LT
19	LADOT	Permanent Construction of People St Plazas			LT
20	LADWP	Stormwater Projects at the Port of Los Angeles	LASAN, POLA	SW	
21	LADWP	Stormwater and Recycled Water Projects at LAUSD Schools	LAUSD	SW, RW	NT
22	LADWP	Stormwater Capture Master Plan Centralized Projects	BOE, BSS, LACFCD, LA RiverWorks, LASAN, LAUSD, MWD, RAP	SW	NT
23	LADWP	San Fernando Groundwater Replenishment Project	LASAN	RW	LT
24	LA RiverWorks	Central Service Yard Open Space Project	Council District 13		
25	LA RiverWorks	LA River Natural Park Project	LASAN	SW	NT
26	LA RiverWorks	Sixth Street Viaduct and Piggyback Yard Project	BOE, LASAN	SW	NT
27	LA RiverWorks	In-Channel Actions	LASAN	SW	
28	LA RiverWorks	Large-Scale Watershed Retention Projects	LASAN, LADWP	SW	
29	LA RiverWorks	LA River Ecosystem Restoration (ARBOR) Construction	USACE, BOE, LASAN, LADWP	SW	LT

Table 21 Additional Water-related Integration Opportunities
One Water LA – TM No. 3.2

#	Lead Department or Agency	Project Name	Supporting Agencies	Water Type RW, SW, C	Timing NT, LT
30	LA RiverWorks/BOE	LARiver G2 Parcel Project	HSR, LADWP, LASAN	SW, RW	LT
31	LA RiverWorks	Taylor Yard Pedestrian and Bicycle Bridge	LADWP	RW	LT
32	LA RiverWorks	Street-end Interface Points (SIPs)	BOE, LASAN		LT
33	LASAN	Westwood Neighborhood Greenway Project	LACDPW	SW	NT
34	LASAN	Harbor City Park Project	LACDPW	SW	NT
35	LASAN	North Hollywood Park Project	LACDPW, LADWP	SW	NT
36	LASAN	Venice Boulevard Neighborhood Green Streets Regional Project	LACDPW	SW	NT
37	LASAN	Riviera Country Club Stormwater Reuse BMP Project	LACDPW, LADWP	SW	NT
38	LASAN	Tree Planting Projects	BSS, LADWP, RAP		NT
39	LASAN	Stormwater Diversion to WWTPs		SW	NT
40	LASAN	Green Street Stormwater Capture and Reuse	LADWP	SW	NT
41	LASAN	Glenoaks Blvd Street Median Stormwater Capture Project	LADWP	SW	NT
42	LADWP	Whitnall Highway Powerline Easement	LASAN	SW	NT
43	LASAN	Sycamore Park		SW	NT
44	LASAN	Lincoln Park Lake		SW	NT
45	LASAN	San Pedro Gateway Project	Caltrans, LADWP, POLA	SW, RW	NT

Table 21 Additional Water-related Integration Opportunities
One Water LA – TM No. 3.2

#	Lead Department or Agency	Project Name	Supporting Agencies	Water Type RW, SW, C	Timing NT, LT
46	LASAN	HWRP Demonstration Plant Project & Delivery to LAX and Vicinity	LAWA	RW	LT
47	LASAN	HWRP Delivery expansion to 70 mgd for WBMWD and Harbor	West Basin, Harbor, LADWP	RW	LT
48	LASAN	Wilmington Recreation Center Stormwater Detention Project		SW	LT
49	LASAN	Harbor City Park Stormwater Recreation		SW	LT
50	LASAN	Averill Park Stormwater Detention Project		SW	LT
51	LASAN	Victory Blvd From Encino to Aleda		SW	LT
52	LASAN	North Broadway from Ave 18 to Ave 20		SW	LT
53	LASAN	Huntington Drive from Monterey Road to Yorba		SW	LT
54	LASAN	Broadway Blvd at 40th Place		SW	LT
55	LAUSD	Recycled Water Infrastructure		RW	LT
56	LAUSD	On-Site Water Capture and Infiltration		SW	LT
57	LAUSD	Investigating Off-Site Water Capture and Infiltration		SW	LT
58	LAUSD	Graywater Capture			LT
59	LAUSD	Low Water Use Fixtures (e.g. Irrigation, Toilets, etc.)		C	LT
60	LAUSD	Smart Metering/Leakage Detection		C	LT

Table 21 Additional Water-related Integration Opportunities
One Water LA – TM No. 3.2

#	Lead Department or Agency	Project Name	Supporting Agencies	Water Type	Timing
				RW, SW, C	NT, LT
61	LAWA	Prop O Stormwater Infiltration Facility at LAX and Hyperion Treatment Plant/North Central Outfall Sewer Connection	LASAN	SW	NT
62	LAWA	Dominguez Channel and Landside Access Modernization Program	LASAN	SW	NT
63	LAWA	Design and Construction of a Recycled Water Pipeline	Caltrans, LADWP	RW	NT
64	LA Zoo	Permeable Pavement in Parking Lot – Phase 2	BOE, LADWP, LASAN	SW, RW	NT
65	LADWP	Recycled Water Fill Stations	LA Zoo	RW	NT
66	LA Zoo	Children's Discovery Center (CDC) Park Events Center			LT
67	METRO	Planning Project Collaboration on Caltrans Sustainable Community Grant	Caltrans, LADOT, LASAN	SW	NT
68	METRO	Funding Metro Urban Green Demonstration Project			NT
69	METRO	LA River Bike Path Gap Closure (Downtown)	LA RiverWorks, LADOT, LASAN	SW	LT
70	METRO	Rail to Rail/River Active Transportation Corridor Project	HSR, LA RiverWorks, LADOT, LASAN	SW	NT
71	MWD	Regional Recycled Water Program	LACSD, LADWP, LASAN	RW	LT
72	MWD	Local Resources Program		RW	NT
73	POLA	Recycled Water Supply for Wilmington Waterfront Park	LADWP	SW, RW	NT

Table 21 Additional Water-related Integration Opportunities
One Water LA – TM No. 3.2

#	Lead Department or Agency	Project Name	Supporting Agencies	Water Type RW, SW, C	Timing NT, LT
74	POLA	Recycled Water Filing Station for the Port Construction and Maintenance Division	LADWP	RW	NT
75	POLA	AltaSea Research Complex – Sea Water Use			LT
76	RAP	Albion Riverside Park Project	BOE, LADWP, LASAN	SW, RW	NT
77	RAP	MacArthur Park Project	BOE, LADWP, LASAN	SW,RW	NT
78	RAP	Hollenbeck Park and Lake Project	LADWP, LASAN	SW, RW	NT
79	RAP	Caballero Creek Park Project	LA RiverWorks, LASAN, Reseda High School	SW	NT
80		Commercial-scale Composting Toilet Project	LADWP, LASAN	C	NT
81	City of San Fernando	San Fernando Green Streets – Calle Verdes	LADWP	SW	NT
82		Septic System Retrofit to prevent pollution and Reuse Water	LASAN, Dept. of Public Health	C	NT
83		Untapped Water Mar Vista	LADWP, LASAN		

Notes:

(1) Blue Font: Future Project Integration Opportunities received from Steering Committee on 11/2/16.
(2) Red Font: Project Ideas received from Project Ideas Workshop on 11/18/16.

Abbreviations:

BSS = building and safety; HWRP = Hyperion Water Reclamation Plant; LAGWRP = Los Angeles-Glendale Water Reclamation Plant; TIWRP = Terminal Island Water Reclamation Plant; LACFCD = Los Angeles County Flood Control District; USACE = U.S. Army Corps of Engineers

At this time, the following project ideas are suggested for further exploration:

- **MacArthur Park –** The MacArthur Park project is a 30-acre park site located at 2230 W. Sixth Street, Westlake, south of West Sixth Street and north of West Seventh Street, immediately west of downtown Los Angeles. The project would include stormwater BMPs, in-lake improvements, and possibly a recycled water pipeline. BMPs and water treatment technologies would be used to capture, store, and treat runoff from the watershed upstream of MacArthur Park. In-lake improvements would consist of floating wetlands with recirculating constructed stream systems, aeration devices, and re-circulated lake water pumping systems strategically placed to improve oxygenation levels in the lake. A potential 1.3-mile recycled water pipeline alignment could extend from the connection point at Los Angeles Convention Center to MacArthur Park via Pico Boulevard and Alvarado Street to provide supplemental water for MacArthur Park Lake.

- **San Pedro Gateway –** The San Pedro Gateway project would employ stormwater BMPs and water treatment technologies to store and treat runoff from the watershed upstream of the San Pedro Gateway Parcel. By capturing and reusing runoff, the entire load of pollutants of concern in the captured runoff, including bacteria and metals, would be removed from discharging to the San Pedro Bay thus providing water quality and aesthetic benefit to the San Pedro Gateway benefitting multiple stakeholders including Caltrans, the Mayor's Office, the San Pedro community, and the Port of Los Angeles.

- **LADWP's Stormwater Capture Master Plan Centralized Projects –** Engineered features located in specific locations that could capture and infiltrate large stormwater flows when available.

- **LA RiverWorks In-Channel Actions –** City Departments and Regional Entities could explore various ways to use the LA River channel and its tributaries as detention facilities following rain events – with inflatable dams or other modifications. Preparation in coordination with regional and federal leads should be community-focused and done in advance of rainy seasons.

- **LA RiverWorks Large-Scale Retention Projects –** Large areas in the City (e.g. Chatsworth Reservoir, Van Nuys Airport, Dodger Stadium parking lot, etc.) could be aggressively evaluated for stormwater capture, treatment, and infiltration potential.

- **LAWA Dominguez Channel and Landside Access Modernization Program (LAMP) –** Promote collaboration and coordination on the implementation of LAWA's Stormwater Management Plan that includes planning elements (e.g. permeable pavement, pretreatment/reuse, storage, etc.) for LAMP projects that would be tributary to the Dominguez Channel.

- **METRO Potential Planning Project Collaboration on the Caltrans Sustainable Community Grant –** Map green infrastructure opportunities layered over transportation project areas.
- **METRO LA River Bike Path Gap Closure Project (Downtown) –** This is primarily a transportation project but needs to maintain flood control capacity of the River and not preclude future revitalization efforts in project area. There could be opportunities to incorporate potential green infrastructure components.
- **Commercial-Scale Composting Toilet and Septic System Retrofit Projects –** Work with relevant entities to create a regulatory pathway to permit and monitor use of these systems.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations can be made based on the work conducted for all of Task 3 and preparation of this TM:

- 44 potential current integration opportunities were gathered from 14 departments and other agencies in Subtask 3.1.
- Ten potential projects were identified after the initial screening process that would be viable Case Studies; five Case Studies were identified to be the top candidates to move forward with.
- The top ten projects represent a broad mix of project components, lead departments/agencies, and collaboration partners.
- The top five projects include four stormwater projects, three recycled water projects, while two projects include a combination of both.
- Four of the top five Case Studies are developed in this TM with the intention of with a focus on creating momentum for these projects and establishing examples/templates that can be used for similar projects.
- A list of 83 other current and future integration opportunities are presented in this TM, providing a "living" project/concept ideas list.
- Nine of these 83 project opportunities are suggested for further development in the near future.

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APPENDIX A – REFERENCES

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APPENDIX B – DETAILED COST ESTIMATE: ADVANCED TREATED RECYCLED WATER DELIVERY TO LAX AND SCATTERGOOD GENERATING STATION

Detailed Cost Estimate
Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline (LADWP to Scattergood) [1]	8"	4,900	$ 204	$ 1,000,000	$ 1,700,000	$ 10,000	
Pipeline and (LADWP to LAX) [1]	12"	3,900	$ 256	$ 1,000,000	$ 1,700,000	$ 10,000	
Jack & Bore @ Pershing (LADWP) [1]	12"	100	$ 2,441	$ 244,118	$ 415,000	$ 2,441	
Pipeline (LAWA)	12"	8,300	$ 256	$ 2,128,000	$ 4,256,000	$ 21,280	
Subtotal for Pipelines				*$ 4,372,118*	*$ 8,071,000*	*$ 43,721*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	Unit	$/unit				
New storage tank	1	MG	$ 2.00	$ 2,000,000	$ 4,000,000	$ 20,000	
Subtotal for Tanks and Equalization Basins				*$ 2,000,000*	*$ 4,000,000*	*$ 20,000*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	Unit	$/unit				
Pump station to Scattergood	150	hp	$ 3,000	$ 450,000	$ 900,000	$ 9,000	$ 55,000
Pump station to LAX	250	hp	$ 3,000	$ 750,000	$ 1,500,000	$ 15,000	$ 128,000
Diesel generator backup	400	hp	$ 400	$ 160,000	$ 320,000	$ 3,200	$ -
Potable water backup at AWPF	1		$ 100,000	$ 100,000	$ 200,000	$ 10,000	$ -
Subtotal for Pump Stations				*$ 1,200,000*	*$ 2,920,000*	*$ 37,200*	*$ 183,000*
Other Project Components							
	Quantity	Unit	$/unit				
Alternate potable water backup connection	1		$ 100,000	$ 100,000	$ 200,000	$ 10,000	$ -
MBR	1.5	mgd	$ 5,000,000	$ 7,500,000	$ 15,000,000	$ 300,000	$ 154,692
AWPF [2]	1.5	mgd	$ 7,000,000	$ 10,500,000	$ 21,000,000	$ 420,000	$ 228,876
Subtotal for Other Project Components				*$ 18,100,000*	*$ 36,200,000*	*$ 730,000*	*$ 383,568*
TOTAL				**$ 25,672,118**	**$ 51,191,000**	**$ 830,921**	**$ 566,568**

Net Yield (afy)	**1,742**
Amortized Capital Costs ($/af)	**$1,166,994**
Amortized O&M ($/af)	**$830,921**
Amortized Value w/ O&M & Energy ($/af)	**$2,564,484**
Energy (kWh/af)	**2,711**
Unit Cost ($/af)	**$1,472.30**

Pump Station to RW System

Pump Station	Peak Demand (gpm)	ADD rounded (gpm)	Facility Capacity (gpm)	TDH (ft)	Calculated Horsepower (hp)	Required Horsepower (hp)	Calculated Energy Use (hp)
1 - PS to LAX	650.00	450	975	300	106	150	70
2 - PS to Scattergood	1,500.00	630	2,250	300	244	250	162
TOTALS	**2,150.00**	**1,080**	**3,225**	**600**	**349**	**400**	**233**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 46,100,000	$ 51,200,000	$ 61,400,000
Amortized Capital ($/year)	$ 1,050,000	$ 1,170,000	$ 1,400,000
Annual O&M ($/year)	$ 750,000	$ 830,000	$ 1,000,000
Annual Energy ($/year)	$ 510,000	$ 570,000	$ 680,000
Total Annual Cost ($/year)	$ 2,300,000	$ 2,560,000	$ 3,070,000
Yield (afy)	1,740	1,740	1,740
Energy Required (kWh/AF)	2,440	2,710	3,250
Unit Cost ($/AF)	**$ 1,320**	**$ 1,470**	**$ 1,760**

1) Pipeline and jack & bore capital costs provided by LADWP.
2) AWPF assumes RO + UV/AOP + chlorination

APPENDIX C – POTENTIAL SCHOOL SITES FOR OFF-SITE STORMWATER CAPTURE

Appendix C - Potential School Sites for Off-Site Stormwater Capture

Potential School Sites for Off-Site Stormwater Capture

No.	School Name	Address	City	Soil Type	Saturated Hydro. Conductivity	Shallowest Ground Water Table (ft)	Estimated Usable Area (acres)	Site Size (acre)	Upstream Sub-Watershed Landuse	Water Quality Improvements (Cu, Pb, etc.)	Disadvantaged Community	Severly Disadvantaged Community	Proposed BMP	
													Irrigation	Infiltration
Ballona Creek Watershed														
1	Alta Loma Elementary School	1745 Vineyard Ave	Los Angeles	Ramona Loam	1.320	60.0	1.8	3.8	Multi- Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead,	FALSE	TRUE		
2	Grant Elementary School	1530 N Wilton Pl	Los Angeles	Hanford Fine Sandy Loam	2.590	18.5	1.4	5.4	Commercial, Mixed Residential	Suspended Solids, Total Phosphorus, Total Nitrogen,Total Kjeldahl Nitrogen, Copper , Lead, Zinc	FALSE	TRUE		
3	Queen Anne Elementary School/Queen Anne's Children Center	1212 Queen Anne Pl	Los Angeles	Ramona Loam	1.320	45.0	1.6	4.3	Mix Residential	suspended Solids, Total Phosphorus, Total Nitrogen, Copper , Lead, Zinc	FALSE	TRUE		
4	University High School	11800 Texas Ave	Los Angeles	Ramona Loam	1.320	24.0	14.7	26.9	Multi- Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	FALSE	FALSE		
5	Daniel Webster Middle School/Magnolia Science Academy 4 Venice	11330 Graham Pl	Los Angeles	Yolo Loam	1.320	58.0	10.9	26.9	Single Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	FALSE	FALSE		
6	Richland Avenue Elementary School	11562 Richland Ave	Los Angeles	Yolo Loam	1.320	57.3	4.6	8.2	Single Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	TRUE	FALSE		
7	Clover Avenue Elementary School	11020 Clover Ave	Los Angeles	Yolo Loam	1.320	61.6	3.0	7.9	Mix Residential	suspended Solids, Total Phosphorus, Total Nitrogen, Copper , Lead, Zinc	FALSE	FALSE		
8	Mar Vista Elementary School	3330 Granville Ave	Los Angeles	Yolo Loam	1.320	65.5	2.4	5.4	Single Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	FALSE	FALSE		
9	Nora Sterry Elementary School	1730 Corinth Ave	Los Angeles	Yolo Loam	1.320	47.6	1.5	4.2	Commercial	Suspended Solids, Total Phosphorus, Total, Nitrogen, Total Kjeldahl Nitrogen	TRUE	FALSE		
10	Charles White Elementary School	2401 Wilshire Blvd	Los Angeles	Ramona Loam	1.320	24.6	1.5	1.9	Mix Residential	suspended Solids, Total Phosphorus, Total Nitrogen, Copper , Lead, Zinc	FALSE	TRUE		
11	Van Ness Elementary School	501 N Van Ness Ave	Los Angeles	Ramona Loam	1.320	17.6	1.4	4.9	Multi- Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	TRUE	FALSE		
Upper LA River Watershed														
1	Sherman Oaks Center for Enriched Studies	18605 Erwin St	Reseda	Yolo Loam	1.320	20.0	9.8	22.4	Commercial, Mixed Residential	Suspended Solids, Total Phosphorus, Total Nitrogen,Total Kjeldahl Nitrogen, Copper , Lead, Zinc	TRUE	FALSE		
2	Reseda High School[1]	18230 Kittridge St	Reseda	Yolo Loam	1.320	16.1	8.6	32.5	Single Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	FALSE	TRUE		
3	Hollenbeck Middle School[1]	2510 E Sixth St	Los Angeles	Ramona Loam	1.320	170.2	5.4	11.3	Single Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	FALSE	TRUE		
4	Sun Valley Bus Garage	11247 Sherman Way	Sun Valley	Tujunga Fine Sandy Loam	2.590	171.0	5.2	23.4	Mix Residential	suspended Solids, Total Phosphorus, Total Nitrogen, Copper , Lead, Zinc	TRUE	FALSE		

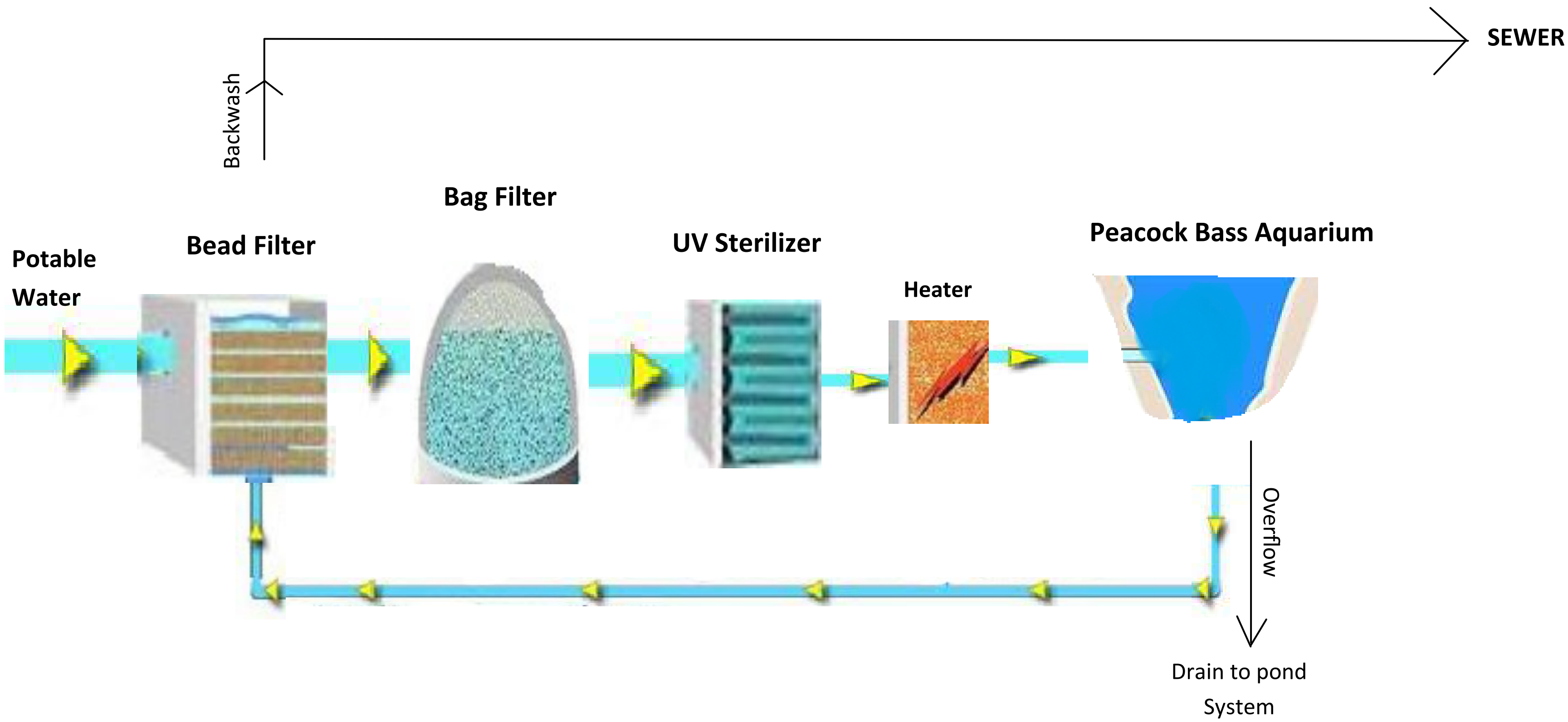
No.	School Name	Address	City	Soil Type	Saturated Hydro. Conductivity	Shallowest Ground Water Table (ft)	Estimated Usable Area (acres)	Site Size (acre)	Upstream Sub-Watershed Landuse	Water Quality Improvements (Cu, Pb, etc.)	Disadvantaged Community	Severly Disadvantaged Community	Proposed BMP	
													Irrigation	Infiltration
5	Celerity Cardinal Charter School[1]	7330 Bakman Ave	Sun Valley	Tujunga Fine Sandy Loam	2.590	177.2	5.1	17.5	Single Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	TRUE	FALSE		
6	Enadia Technology Enriched Charter	22944 West Enadia Way	Los Angeles	Yolo Loam	1.320	17.8	2.9	7.3	Single Family Residential	Suspended Solids, Total Phosphorus, Copper, Lead, Zinc	FALSE	FALSE		
7	Nestle Avenue Charter Elementary School	5060 Nestle Ave	Tarzana	Yolo Fine Sandy Loam	2.590	40.6	2.1	7.5	Mix Residential	suspended Solids, Total Phosphorus, Total Nitrogen, Copper , Lead, Zinc	FALSE	FALSE		
8	Soto Early Education Center	2616 E 7Th St	Los Angeles	Ramona Loam	1.320	173.1	1.2	4.3	Mix Residential	suspended Solids, Total Phosphorus, Total Nitrogen, Copper , Lead, Zinc	FALSE	FALSE		
9	Canoga Park High School	6850 Topanga Cyn Blvd	Canoga Park	Yolo Loam	1.320	10.0	6.1	25.7	Commercial, Mixed Residential	Suspended Solids, Total Phosphorus, Total Nitrogen,Total Kjeldahl Nitrogen, Copper , Lead, Zinc	TRUE	FALSE		
10	Soto Street Elementary School	1020 S Soto St	Los Angeles	Ramona Loam	1.320	174.0	0.2	1.8	Mix Residential	suspended Solids, Total Phosphorus, Total Nitrogen, Copper , Lead, Zinc	FALSE	FALSE		

APPENDIX D – FLOW DIAGRAMS FOR LA ZOO LIFE SUPPORT SYSTEMS

The following diagrams for LA Zoo life support systems are presented in this Appendix:

- Peacock Bass Aquarium
- Freshwater Aquarium/Piranha Aquarium
- Water Lily
- Giant Otter
- Tapir
- North Pool (Pachyderm Exhibit)
- India and South Pool (Pachyderm Exhibit)
- China Pool (Calamian Deer)
- Gorilla Reserve
- False Gharial (Alligator Swamp)
- Japanese Giant Salamander
- Fly River Turtle
- Sea Life Cliffs
- Sea Life Cliffs (Waterfall)

Peacock Bass Aquarium



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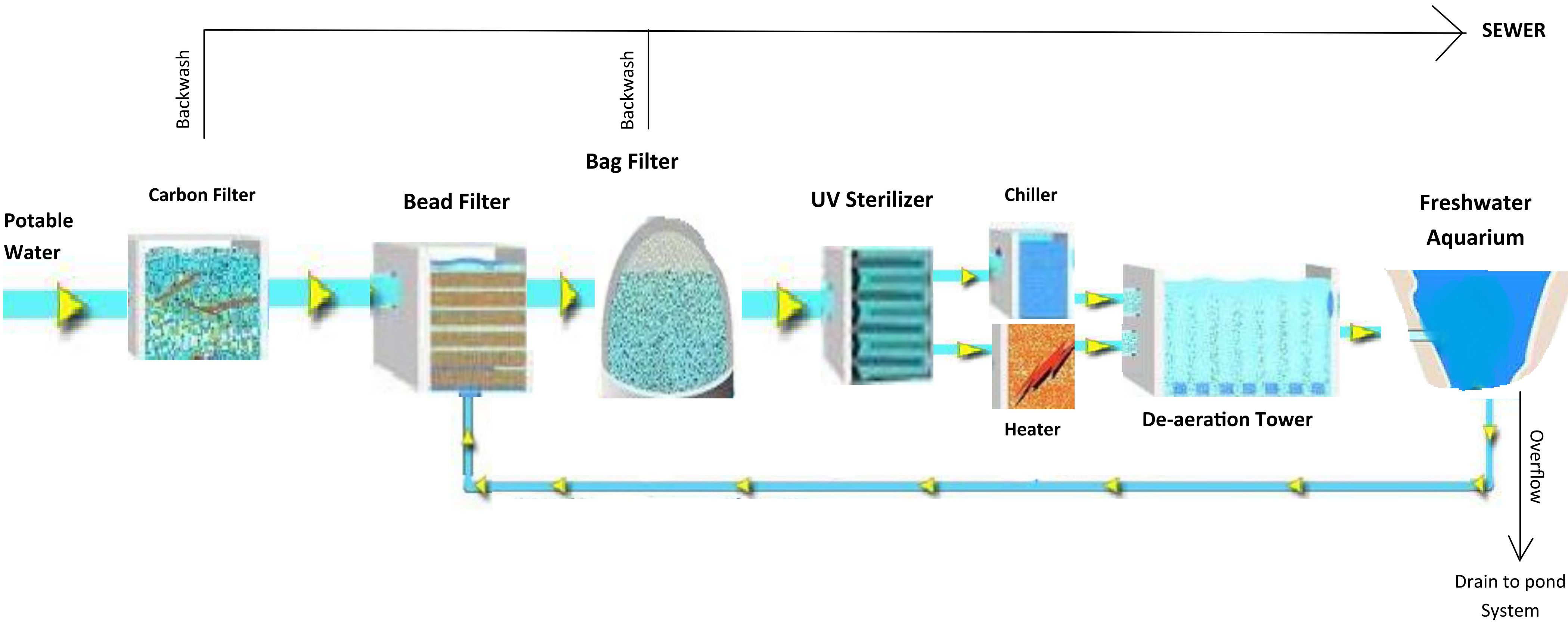
Freshwater Aquarium /Piranha Aquarium



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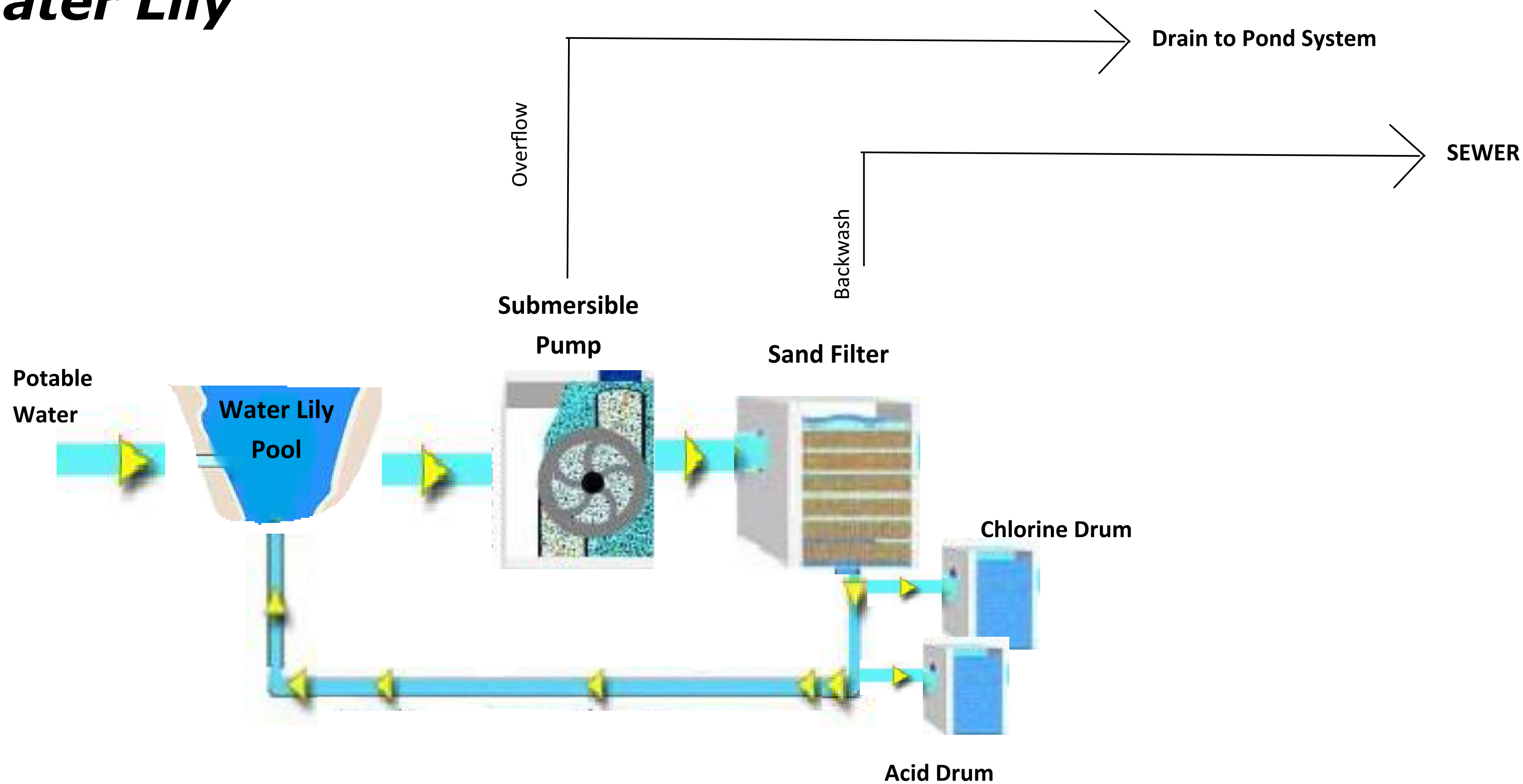
Water Lily



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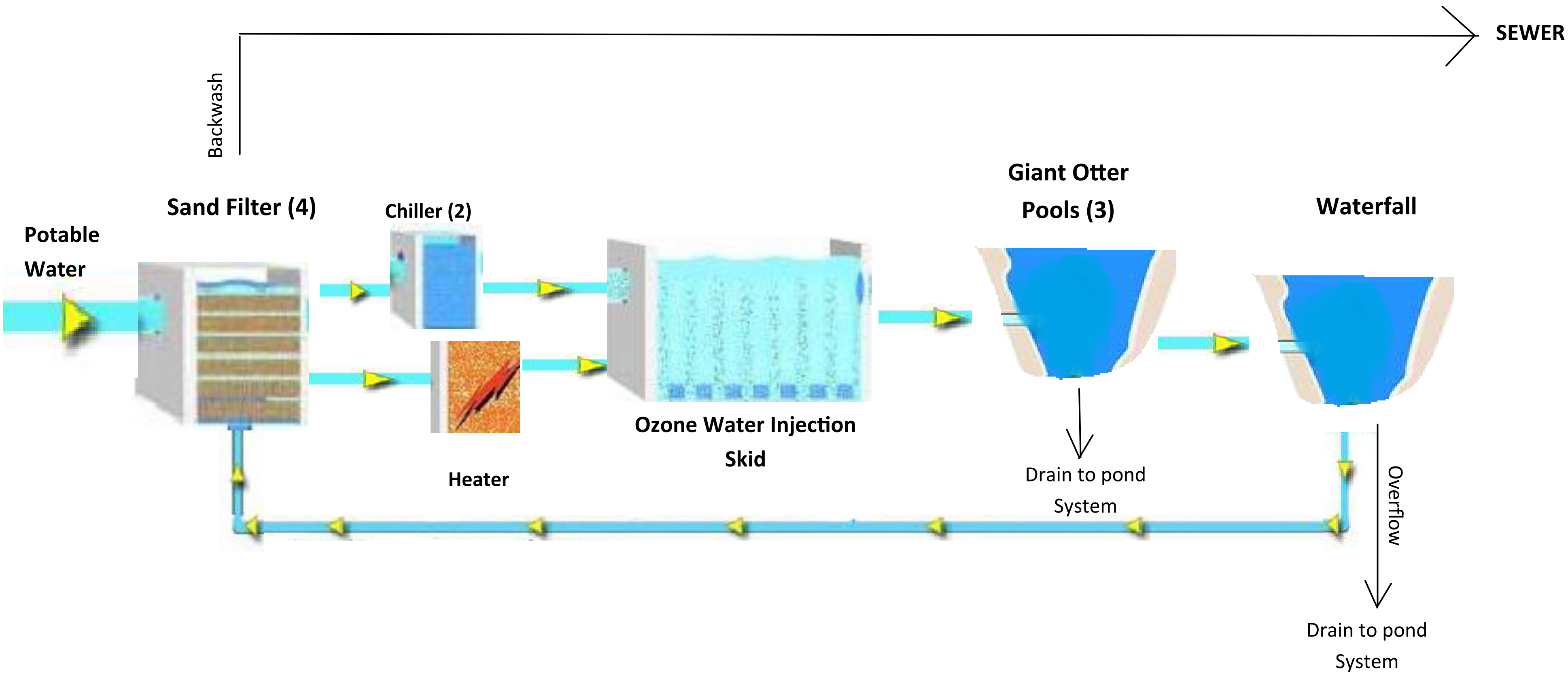
Giant Otter



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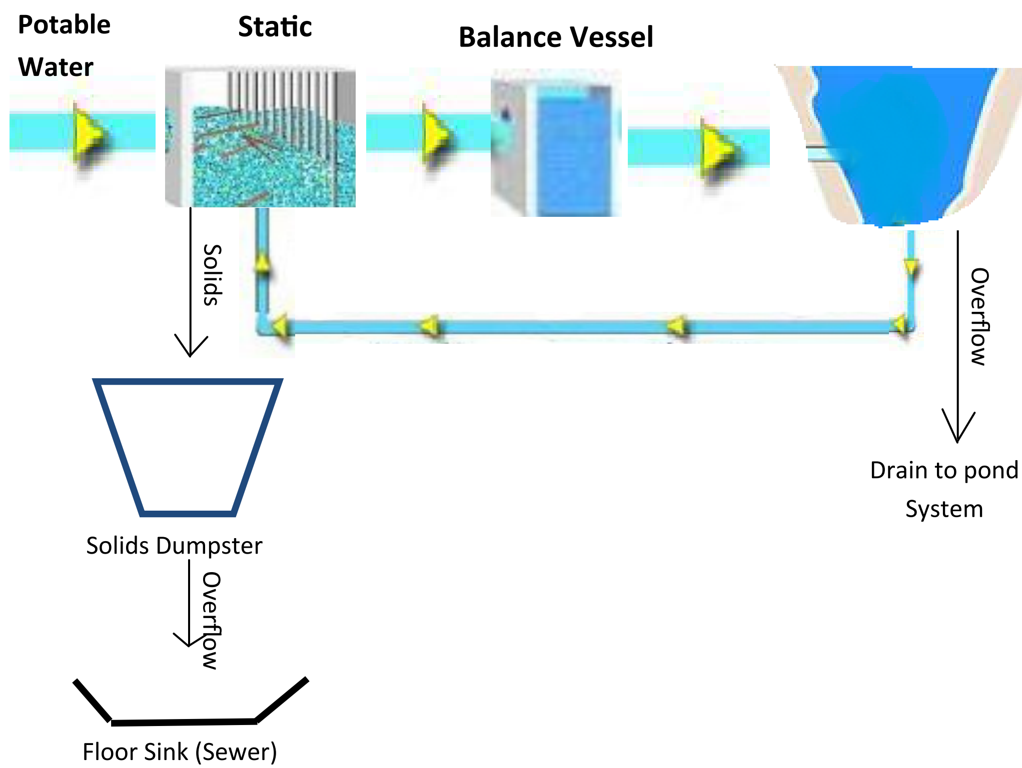
Tapir



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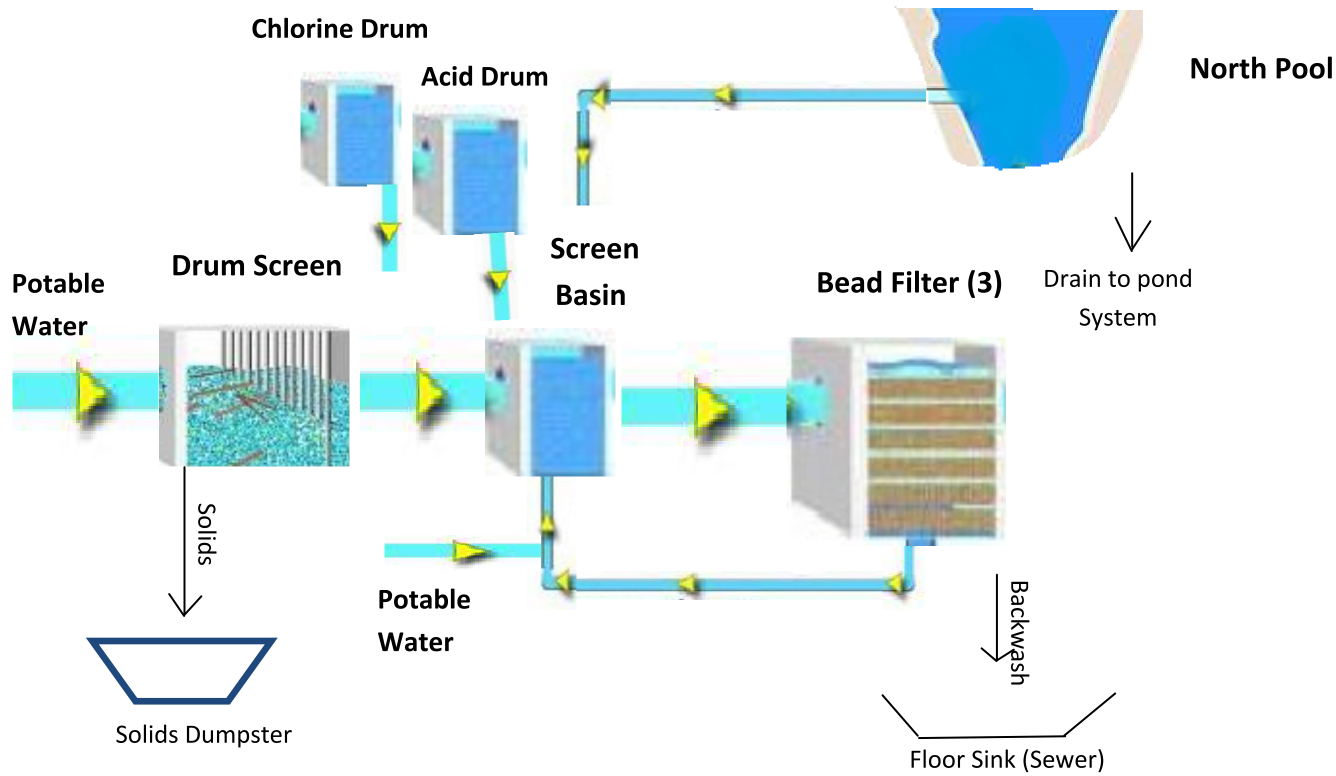
North Pool (Pachyderm Exhibit)



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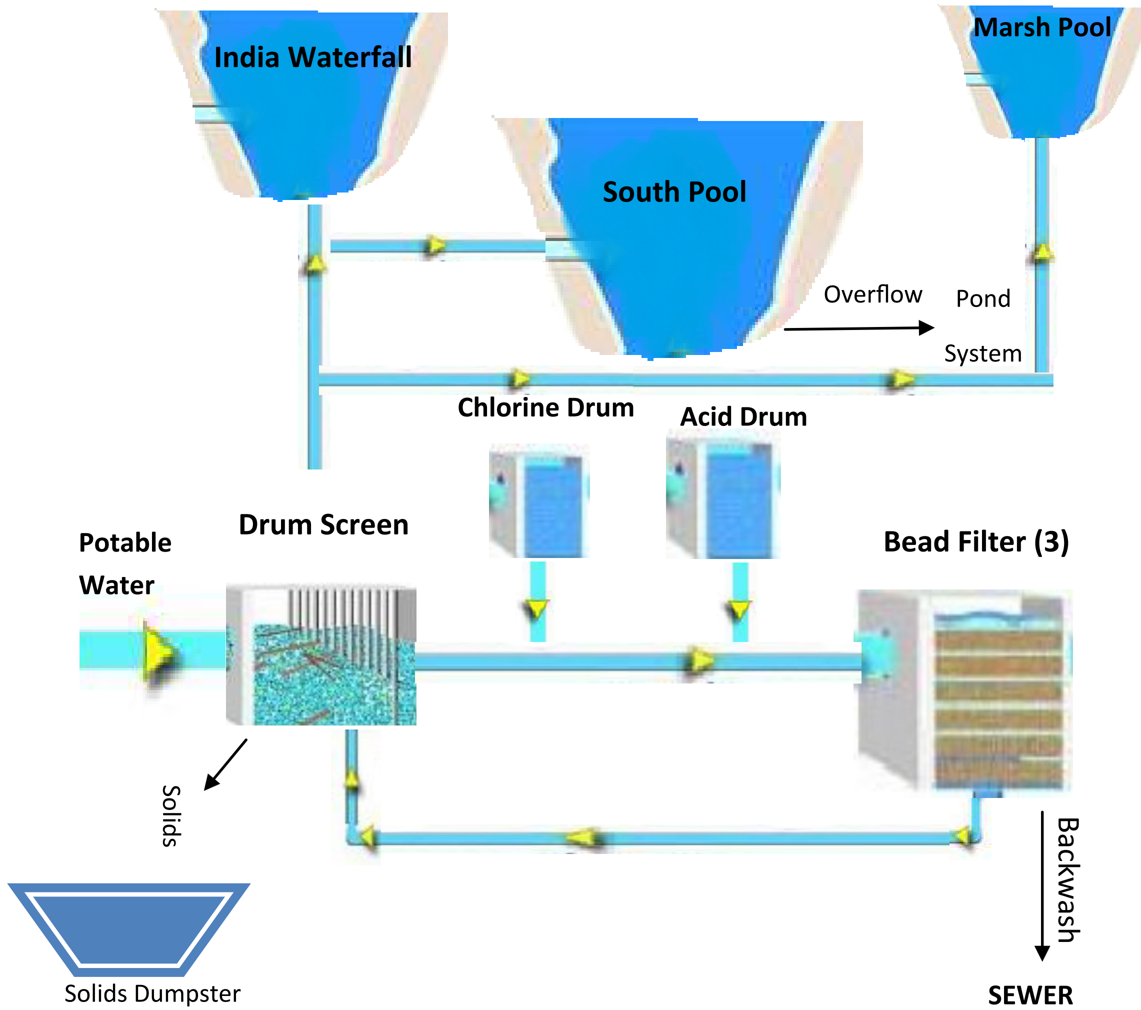
India and South Pool (Pachyderm Exhibit)



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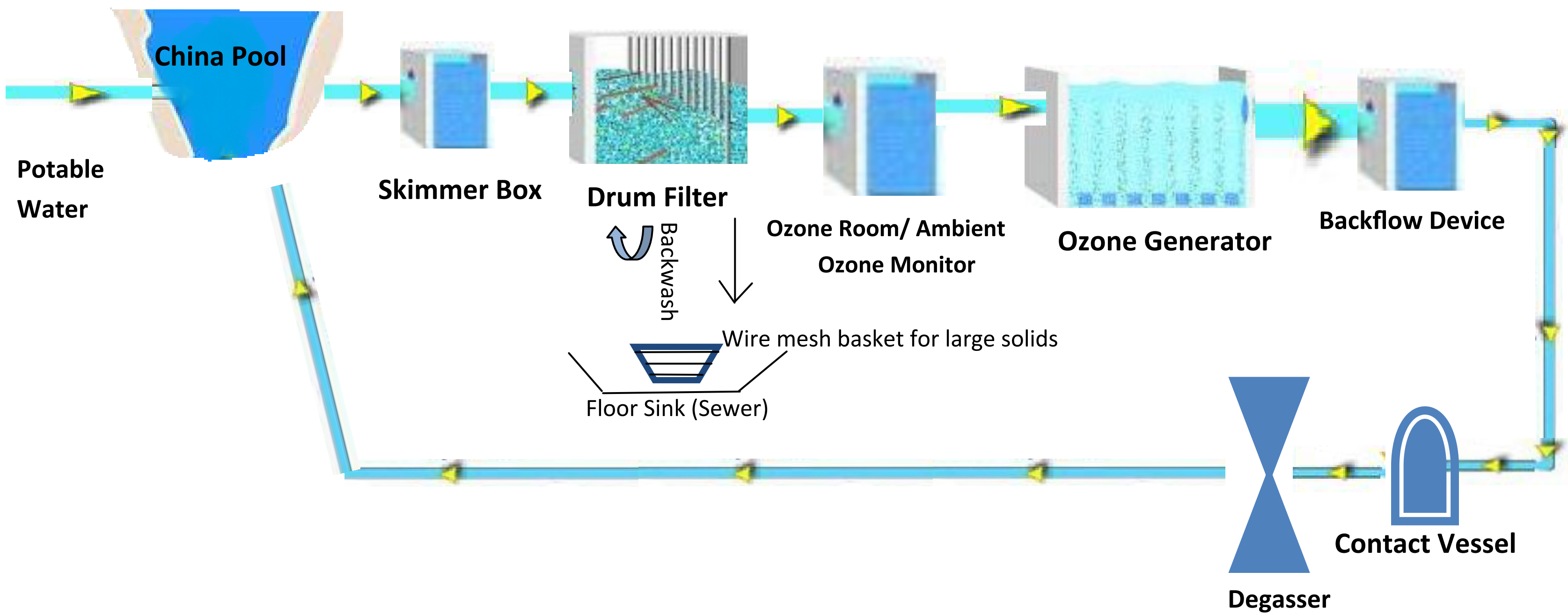
China Pool (Calamian Deer)



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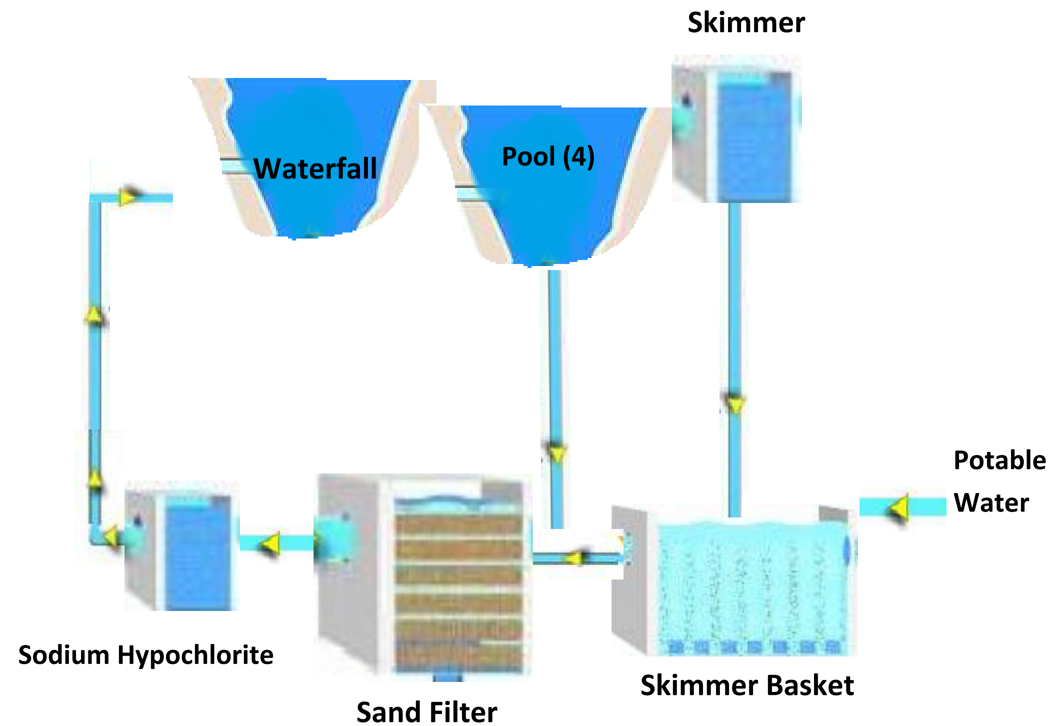
Gorilla Reserve



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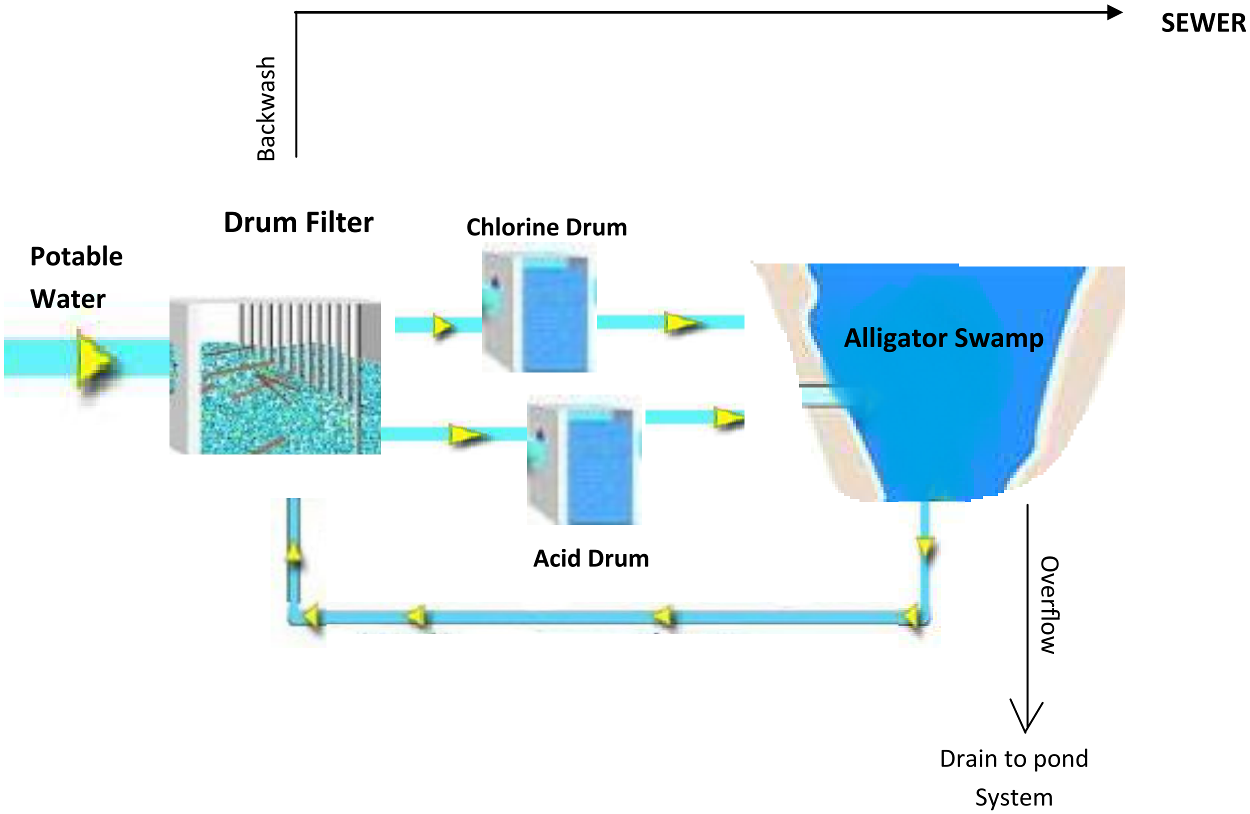
False Gharial (Alligator Swamp)



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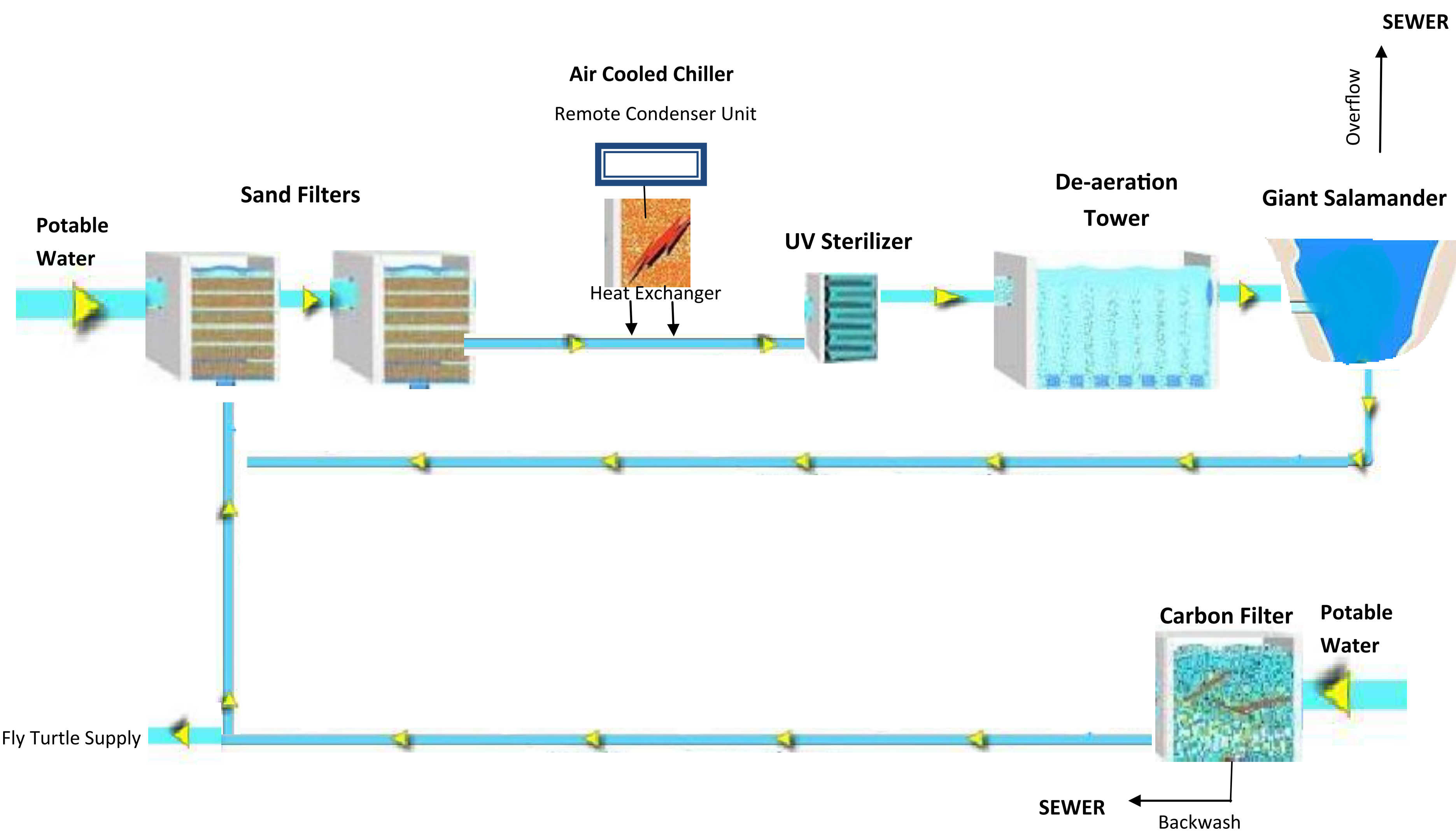
Japanese Giant Salamander



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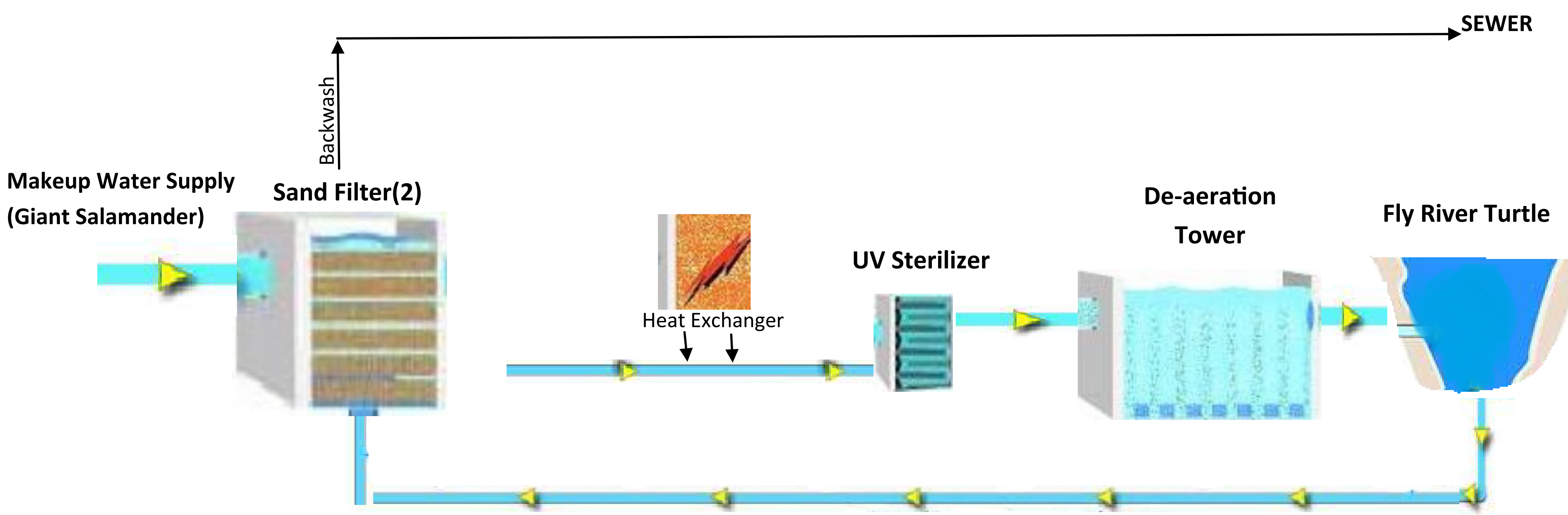
Fly River Turtle



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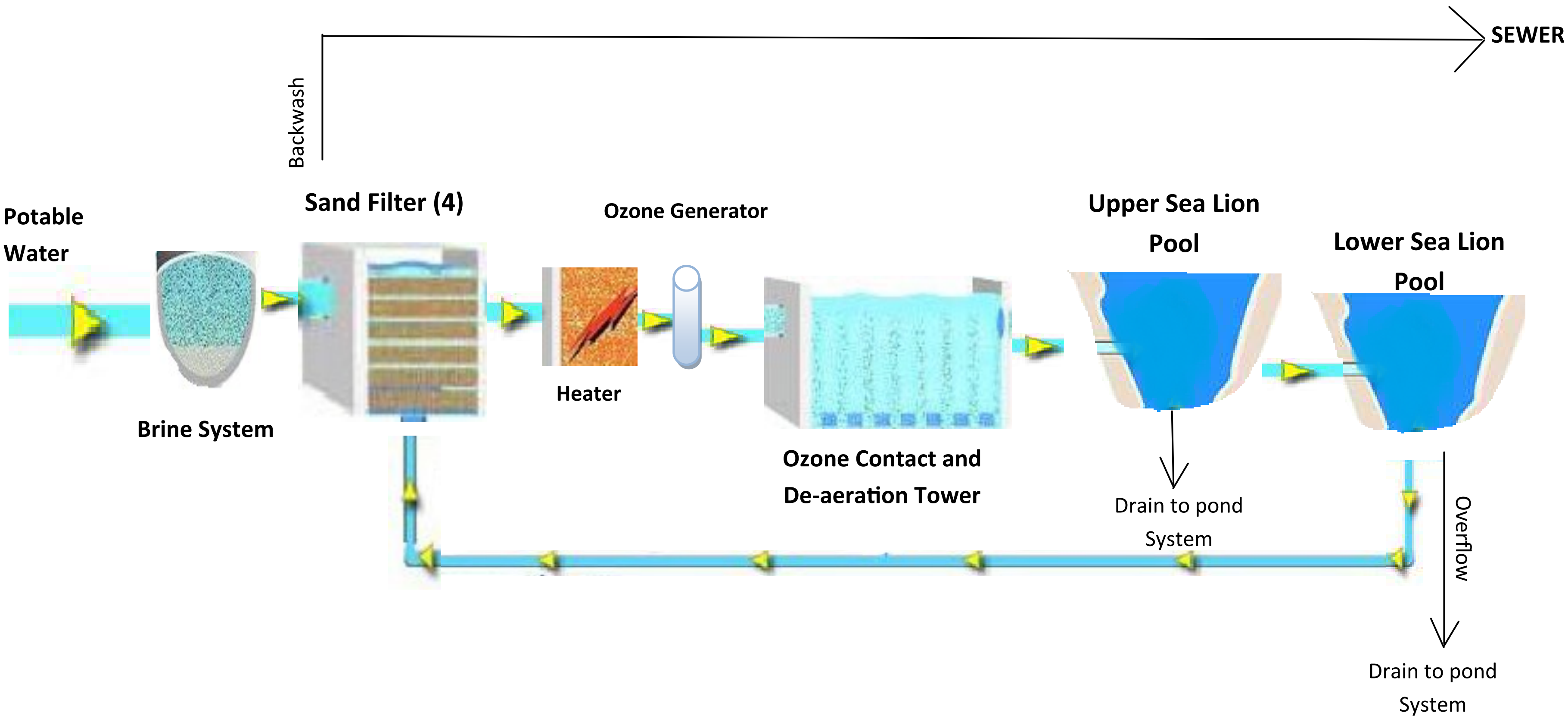
*Sea Life Cliffs**



*Need Clarification

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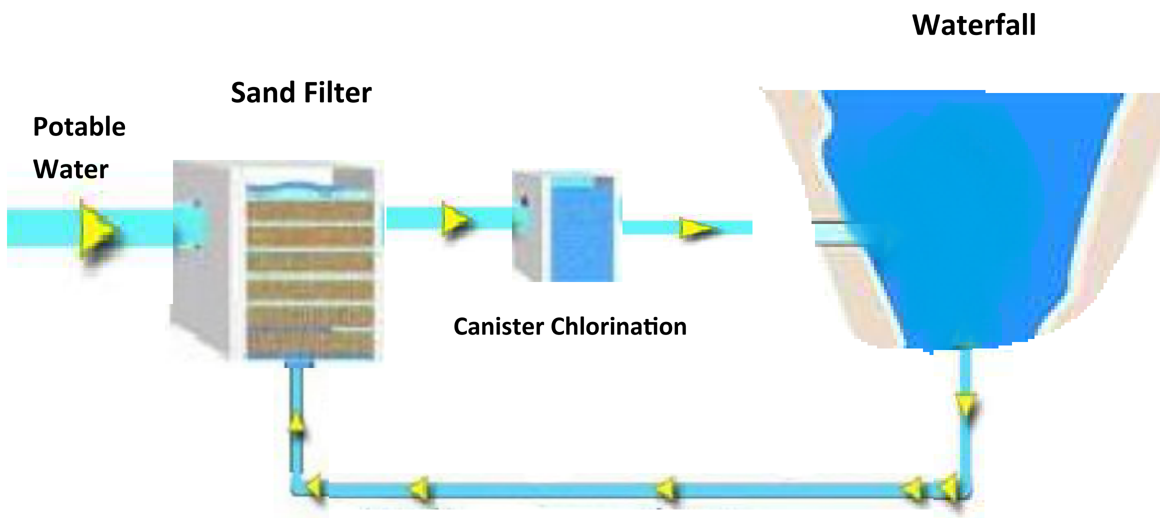
Sea Life Cliffs (waterfall)



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APPENDIX E – WATER USE FOR LA ZOO ANIMAL EXHIBITS

Animal Exhibit	Volume of Water (gallons)	Separate Drinking Water Source (Y/N)	Frequency of Drain/Fill	Number of Times Emptied per year			Number of Times Backwashed per year	Exhibit Annual Water Demand (gal/yr)	Water to the Sewer (gal/yr)
				Summer (Assumes 6 months, 4wks/month)	Winter (Assumes 6 months, 4wks/month)	Total	Total		
Gray Seals vacant	90,000	N	Vacant						
Sea Life Cliffs	130,000	N	Backwashed once every 2 weeks uses 1,000 gallons per backwash[1,2]				26	26,000	-
Pelicans (Adventure Island) vacant	37,707	N	Vacant						
Alligator Exhibit Reggies	3,500	N	Once every 3 weeks in Summer Once every 8 weeks in Winter	8	3	11		38,500	38,500
Zebra	1,300	Y	Twice a week			104		135,200	135,200
Wild Dogs	0	Y	Once every 2 weeks in summer Once every 3 weeks in winter	12	8	20			0
Elephant	80,000	Y	*2 times per year*			2		160,000	160,000
			Backwash 600 gal every 4 days				91.25		54,750
Elephant	140,000		*2 times per year*			2		280,000	280,000
			Backwash 600 gal every 4 days				91.25		54,750
Indian Rhinoceros	4,350	Y	daily			365		1,587,750	1,587,750
Hippopotamus	10,125	Y	daily			365		3,695,625	3,695,625
Flamingos	3,000	N	Twice a week			104		312,000	312,000
Black-necked swan	18,600	N	Once every 4 weeks			13		241,800	241,800
Maned Wolf	9,900	Y	Three times a week			156		1,544,400	1,544,400
Mountain Tapir old	2,100	Y	Twice a week			104		218,400	218,400
Tigers	74,250	Y	Once every 4 weeks			13		965,250	965,250
			Backwashed every day 500 gallons				365		182,500
Lions	75,000	Y	Once every 2 weeks in summer Once every 3 weeks in winter	12	8	20		1,500,000	1,500,000
Flight Cage	5,400	N	Once every 20 weeks			2.6		14,040	14,040
Flight Cage	10,400	N	Once a week			52		540,800	540,800
Alligators (vacant)-Indian Gharial	0	N	Vacant						-
Okapi	12,150	Y	Once every 2 weeks in summer Once every 3 weeks in winter	12	8	20		243,000	243,000
Gorilla Reserve	12,000	Y	*4 times a year dumped*			4		48,000	48,000
			Backwashed every 2 weeks use 100 per backwash				26		2,600
Crane/water deer	10,600	Y	*Twice a year dumped*			2		21,200	21,200
			Filter uses 400 gallon per month			12			4,800
			Once every 8 weeks in Summer						

Animal Exhibit	Volume of Water (gallons)	Separate Drinking Water Source (Y/N)	Frequency of Drain/Fill	Number of Times Emptied per year			Number of Times Backwashed per year	Exhibit Annual Water Demand (gal/yr)	Water to the Sewer (gal/yr)
				Summer (Assumes 6 months, 4wks/month)	**Winter** (Assumes 6 months, 4wks/month)	**Total**	**Total**		
Orangutan - Red Ape Forest	6,000	Y	Once every 4 weeks in Winter	3	6	9		54,000	54,000
			Back wash 500 gallons per week	3	2		5		2,500
Giant River Otter	31,100	N	Dumped once a month			12		373,200	373,200
			Backwashed 2 times per week 5,000 gal per backwash				104		520,000
Tapir Pool	17,600	Y	*Once a week, no backwash*			52		915,200	915,200
Piranha Aquarium (2 filters)	7,800	N	*Never dumped - backwash 100 gal per filter, per week*				52	10,400	10,400
Peacock Bass Aquarium (1 filter)	1,700	N	*Never dumped - backwash 100 gal per filter, per week*				52	5,200	5,200
LAIR Fly River Turtle	3,300	N	*20% water change every month*			12		7,920	7,920
LAIR -Salamandars	1,700	N	Backwashed every other month, 75 gallons[1]				6	450	450
LAIR - False Gharial	16,000	N	*Once every 2 weeks dump*			26		416,000	416,000
TOTAL (gal/yr)								**13,354,335**	**14,150,235**

Total estimated Water Use*

* not included in the totals are water consumption data for the new elephant exhibit, gorrilla reserve, Crane/Water deer & Alligators

1. Never Completely Drained
2. Backwash water is recirculated

First Draft Date:	10/13/2016
Final Draft Date:	1/13/2017
Final Date:	3/30/2018
Lead Author:	Inge Wiersema

CITY OF LOS ANGELES

TECHNICAL MEMORANDUM NO. 5.1
BASIS OF PLANNING

FINAL
April 2018

707 WILSHIRE BOULEVARD, SUITE 3920 • LOS ANGELES, CALIFORNIA 90017 • P. 213.489.1587 • F. 213.489.1500

CITY OF LOS ANGELES

**TECHNICAL MEMORANDUM
NO. 5.1
BASIS OF PLANNING**

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Abbreviation	Description
AFY	acre-feet per year
AWPF	Advanced Water Purification Facility
BOR	U.S. Bureau of Reclamation
CCI	Construction Cost Index
CIP	Capital Improvement Plans
City	City of Los Angeles
DCTWRP	Donald C. Tillman Water Reclamation Plant
DPR	direct potable reuse
ENR	Engineering News Record's
EWMP	Enhanced Watershed Management Program
ft/sec	feet per second
GPA	grade point average
HWRP	Hyperion Water Reclamation Plant
I/I	inflow and infiltration
in	inch/inches
IPR	indirect potable reuse
IRP	Integrated Resources Plan
LADWP	Los Angeles Department of Water and Power
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LASAN	Los Angeles Sanitation
MBT	Mass Balance Tool
MF	microfiltration
mgd	million gallons per day
MS4	Municipal Separate Storm Sewer System
MWD	Municipal Water District
NOAA	National Oceanic and Atmospheric Administration
NPR	non-potable reuse
O&M	operations and maintenance
RO	reverse osmosis
RWMP	Recycled Water Master Plan
SCMP	Stormwater Capture Master Plan
TIWRP	Terminal Island Water Reclamation Plant
TMDL	total maximum daily load
UF	ultrafiltration
UV/AOP	ultraviolet advanced oxidation process
UWMP	Urban Water Management Plan
WY	water year

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1.0 INTRODUCTION

1.1 Background of One Water LA

The City of Los Angeles (City) recently embarked on the One Water LA 2040 Plan. This plan will provide a strategic vision and a collaborative approach for integrated water management. In 2006, the City completed and adopted its first Water Integrated Resources Plan (Water IRP). This plan was the start of a paradigm shift for the City and resulted in significant achievements. Since then, the water landscape in the City has changed with increased demands, new regulations, and threats of climate change.

In response to these changes and to help achieve water sustainability, the City initiated the One Water LA 2040 Plan. This plan builds upon the success of the Water IRP, which had a planning horizon to year 2020. The One Water LA 2040 Plan takes a holistic and collaborative approach, to consider all water resources from surface water, groundwater, potable water, wastewater, recycled water, dry-weather runoff, and stormwater as "One Water." The plan identifies multi-departmental and multi-agency integration opportunities to manage water in a more efficient, cost effective, and sustainable manner.

The One Water LA 2040 Plan represents the City's continued and improved commitment to proactively manage all its water resources and implement innovative solutions, driven by the Sustainable City pLAn. The plan will help guide strategic decisions for integrated water projects, programs, and policies within the City.

1.2 Purpose of Task 5

The purpose of Task 5 is to identify a future strategy to 1) support achievement of the City's Sustainability pLAn goals relative to water, 2) implement the guiding principles and objectives set forth in Phase 1 of the One Water LA 2040 Plan and, 3) highlight the best projects to inform consideration for implementation through 2040. Furthermore, this work complements other key City planning documents (i.e., Urban Water Management Plan [UWMP], Stormwater Capture Master Plan [SCMP], Recycled Water Master Planning Documents [RWMP]).

The water-related Sustainability pLAn goals include:

- Water Conservation - Reducing per capita water use by 25 percent by 2035.
- Water Supply - Reduce the purchase of imported water by 50 percent by 2025 and increase locally sourced water to 50 percent by 2035.

- Wastewater and Recycled Water - Reduce annual sewer spills to fewer than 100 by 2025 and 67 by 2035. Increase annual recycled water production by 6 million gallons per day (mgd) by 2017 as well as expanding recycled water production to prioritize indirect potable reuse (IPR) over non-potable reuse (NPR) and include direct potable reuse (DPR).
- Stormwater - Increase stormwater capture to 150,000 acre-feet per year (AFY) by 2035, improve dry weather beach water quality grade point average (GPA) to 4.0 by 2035, improve wet weather beach water quality GPA to 3.5 by 2035, comply with Total Maximum Daily Load (TMDL) requirements for Municipal Separate Storm Sewer Systems (MS4) permit compliance, and revitalize the LA River.

The One Water LA 2040 Plan guiding principles were developed through an extensive and collaborative process by City staff and stakeholders. The seven objectives are as follows:

- Integrate management of water resources and policies
- Balance environmental, economic, and societal goals
- Improve health of local watersheds
- Improve local water supply reliability
- Implement, monitor, and maintain a reliable wastewater system
- Increase climate resilience
- Increase community awareness and advocacy for sustainable water

The guiding principles are a list of 38 principles on how the preceding objectives for the One Water LA 2040 Plan will be achieved, including additional specificity regarding means and direction. The principles were developed to guide the development of more detailed planning, rather than to define specific targets, and can be found in Volume 9 Guiding Principles Report.

Results of Task 5 will provide a prioritized list of major projects and project portfolios, which complements other key City planning documents, collectively achieving the City's Sustainability pLAn goals and highlighting strategic projects through 2040.

Task 5 deliverables include the Basis of Planning TM (TM 5.1), Project Development TM (TM 5.2), and Portfolio Development TM (TM 5.3), with TM 5.1 forming the subject of this deliverable.

1.3 Objectives of TM 5.1

The overarching objectives of TM 5.1 are to establish the basis of planning for the entire One Water LA 2040 Plan alternatives analysis, and to set forth the criteria and methodology to evaluate water management alternatives. These criteria and methodology will provide the framework to define the most optimum strategy to manage the City's water resources and meet compliance deadlines through the planning year 2040. The key objective of this TM is to establish the methodology, fundamental assumptions, and criteria for the future alternatives analysis of the One Water LA 2040 Plan. To accomplish this goal, this TM includes the following key components:

1. Definition of the study area and planning horizon
2. Development of a demand and flow forecasting envelope through planning year 2040
3. Development of the future alternatives evaluation process
4. Development of project and portfolio evaluation criteria
5. Development of key planning assumptions, including future hydrologic analysis scenarios
6. Development of planning level cost-estimating assumptions that will be used to prepare high-level cost estimates for potential future projects that will be described in TM 5.2.

Disclaimer: It should be noted that the information presented in this TM represents interim work products and may therefore include minor discrepancies with the information presented in the Summary Report (Volume 1). The information presented in Volume 1 supersedes information presented in this TM.

2.0 STUDY AREA AND PLANNING HORIZON

The study area was defined in TM 2.1 - Existing Flow Conditions, of which an excerpt is included in Appendix B for reference. In summary, the study area is defined as the City of Los Angeles boundary, which encompasses an area of approximately 301,950 acres or 472 square miles, and is inhabited by approximately four million people. Although the study area of the One Water LA 2040 Plan is focused on the City of Los Angeles boundaries, as depicted on Figure B.1, the sphere of influence extends beyond the City boundary. The figures provided in Appendix B illustrate the City's water service area, groundwater basins, watershed areas, and wastewater service areas, with the following overview:

- The water service area is managed in four service areas (Harbor, Metro, Valley, and Westside).
- The City overlays eight groundwater basins that most of which partially extend beyond the City boundary.

- There are 5 major watershed areas (LA River, Ballona Creek Dominguez, Santa Monica Bay, and Marina Del Rey) that encompass the City and drain water from outside the City boundaries into the City where it either infiltrates into the underlying groundwater aquifers or gets discharged into the ocean via storm drains, creeks, surface flows, direct runoff to the ocean, direct runoff to other receiving waters from adjacent land areas, or the LA River.
- The City's wastewater service area encompasses approximately 305,280 acres or 477 square miles, of which 291,840 acres or 456 square miles are located within the City.

The planning horizon for One Water LA 2040 Plan is 2040. Three levels of projects are considered in this horizon:

- Existing facilities and supplies – includes current facilities and operations existing as of January 2016
- In-Progress Projects – projects that are expected to be implemented outside and independent of the One Water LA 2040 Plan. These projects may or may not be funded, may or may not have completed environmental documentation, and may or may not be included in existing Capital Improvement Plans (CIPs).
- Potential Concepts – those that are being evaluated to determine feasibility.

The portfolio evaluation, which will consist of developing themed project portfolios that combine projects that match a portfolio theme (see Section 4.0), will include analysis for the near-, mid-, and long-term.

2.1 Future Demand and Flow Forecasts

This section presents a summary of future demand and flow forecasts for potable water, wastewater, recycled water, and stormwater through year 2040. Detailed supporting data for these forecasts is included in TM 2.1.

The baseline water, wastewater, and stormwater projections presented herein already assume the implementation of the "In-Progress Projects." To account for the risk associated with unknown future conditions, each forecast consists of a range in flows or demands so that future facilities can be phased based on the range of capacity required to meet future supply reliability and regulatory goals.

Previous work conducted as part of Tasks 1 and 2 of the One Water LA 2040 Plan project were documented in the following technical memoranda:

- TM 1.2 – Existing Flow Conditions – summarizes the existing flow conditions for existing water supply, wastewater, recycled water, stormwater, LA River flows (Carollo, 2016).
- TM 2.1 – Future Flow Conditions – extends the horizon of the City's existing water management and flows to planning year 2040 and quantifies the future water flow balance (Carollo, 2016).

The flow conditions described in TM 1.2 refer to current conditions, meaning year 2015, consistent with the 2015 UWMP (LADWP, 2015). Future conditions described in TM 2.1 refer to so called "baseline" conditions and utilized the water demand projections from the 2015 UWMP and some In-Progress Projects that are anticipated to be implemented independent of the recommendations of the One Water LA 2040 Plan. The In-Progress Projects included in the future demand and flow forecasts presented in this TM are:

- Potable water demand and water conservation forecasts per the 2015 UWMP.
- Non-Potable Reuse (NPR) system expansions per the 2015 UWMP and/or currently planned by LADWP.
- San Fernando Groundwater Basin cleanup project.
- Indirect potable reuse spreading project at Donald C. Tillman Water Reclamation Plant (DCTWRP) Advanced Water Purification Facility (AWPF) (up to 30,000 AFY into the San Fernando Groundwater Basin).
- Projects underway at Terminal Island Water Reclamation Plant (TIWRP) including the AWPF, Los Angeles-Glendale Water Reclamation Plant (LAGWRP), and Hyperion Water Reclamation Plant (HWRP).
- Regional projects as described in the EWMP.

2.2 Boundary Conditions

Previous work (TMs 1.2 and 2.1) present both wastewater flows and water demands by sewershed area to maintain a clear correlation of indoor water demands and wastewater flows. Recycled water flows are presented by the City's four water reclamation plants, with these locations shown on Figure 1. Stormwater flows are presented by major groundwater basin and by river reach for the share of stormwater that reaches the LA River.

The City is committed to maintaining the environmental needs of the LA River. While the goal of the One Water LA Plan is to maximize the amount of water for reuse, it is recognized that tertiary-treated recycled water would continue to be provided to the local lakes and rivers.

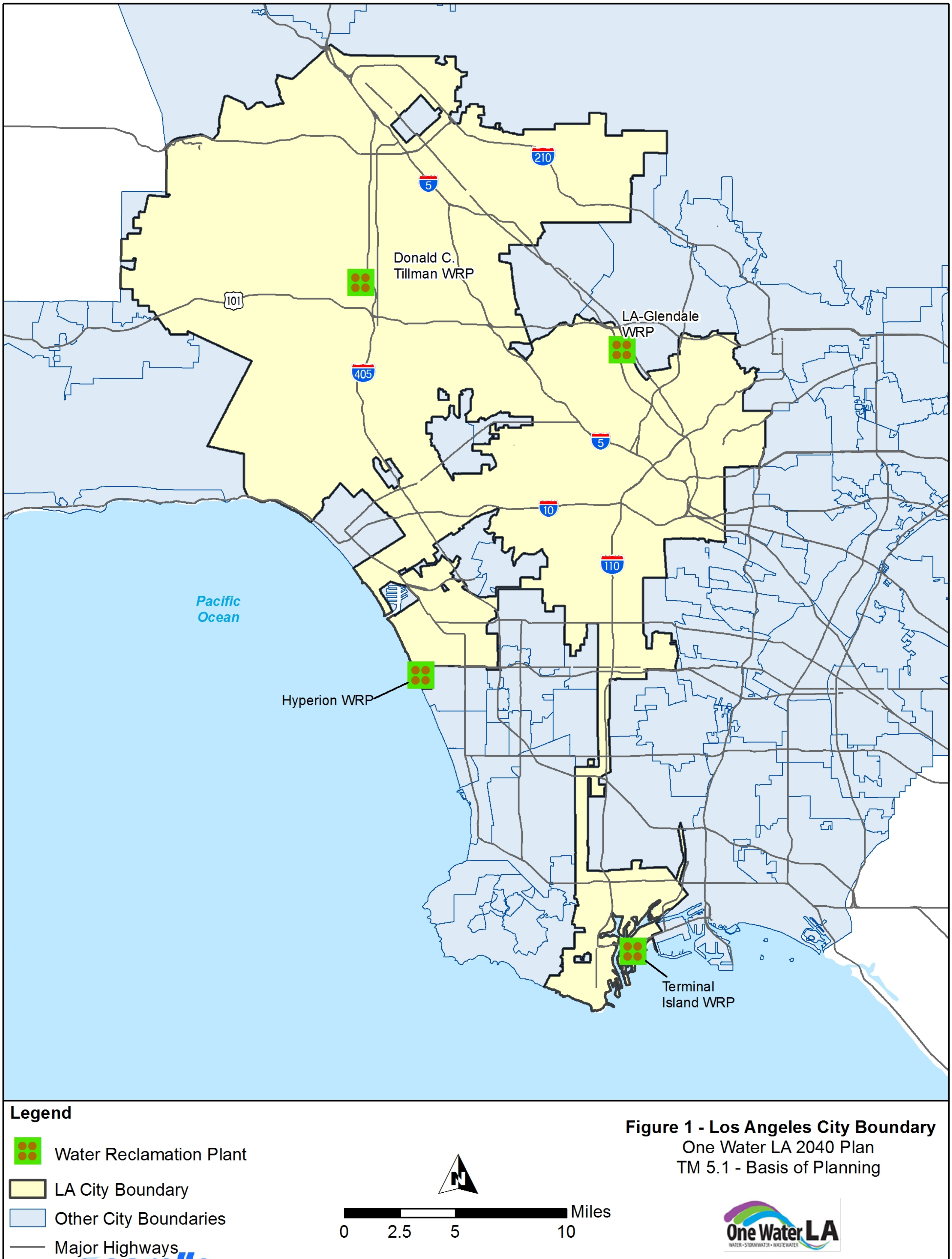

Figure 1 - Los Angeles City Boundary
One Water LA 2040 Plan
TM 5.1 - Basis of Planning

Document Path: E:\KRC D DRIVE\LA ONE WATER\MXDs\Revisions_20170106\Figure 1 - Los Angeles City Boundary.mxd

2.3 Data Sources & Assumptions

Flow data sources and assumptions are documented and are detailed in TMs 1.2 and 2.1. A full listing of references and citations used in these TMs are listed in the corresponding Appendix A. Generally speaking, the primary data sources include: existing demands and flows based on potable water billing data and recycled water usage provided by the Los Angeles Department of Water and Power (LADWP); existing wastewater flows provided by the Wastewater Engineering Services Division; potable water, recycled water, and groundwater demands from the 2015 UWMP (LADWP, 2015); LA River flows documented in TM 12.4 of the One Water LA Plan; projects and flows documented in the EWMPs; and stormwater flows from Task 8 of the One Water LA Plan.

For various types of projects developed in TM 5.2, assumptions are developed. Pipelines are sized at a maximum velocity of 5 feet per second (ft/sec). Pump stations are sized assuming four duty and one standby pump, with water pump stations operating at 75 percent efficiency, and sewer lift stations operating at 50 percent efficiency.

The following assumptions are associated with the groundwater portion of IPR projects:

- In the San Fernando Basin, extraction wells are sized at 2.7 mgd and injection wells are sized at 1.8 mgd.
- In the Central and West Coast Basins, extraction wells are sized at 1.5 mgd and injection wells are sized at 1.0 mgd.
- Extraction capacity is required to be 1.5 times injection capacity to account for seasonal variations in water demands.

The following assumptions are associated with water reclamation plants and potential concepts:

- HWRP requires membrane bioreactors for all IPR and DPR reuse.
- HWRP requires equalization storage at 25 percent of the daily project flow. The other treatment plants have sufficient equalization storage in place or in progress.
- Brine loss is 20 percent of the flow for IPR and DPR.
- IPR assumes microfiltration (MF) or ultrafiltration (UF), reverse osmosis (RO), and ultraviolet advanced oxidation process (UV/AOP).
- DPR assumes ozone with biologically active filters (O_3/BAF), UF, RO, and UV/AOP.
- Engineered storage is required downstream of NPR, IPR, or DPR projects.
  - The engineered storage is sized at 12.5 percent of the daily project flow if the effluent is pumped to another facility (such as a reservoir or injection wells).
  - The engineered storage is sized at 25 percent of the daily project flow if the effluent is pumped to a distribution system for NPR.
  - The engineered storage is sized at 100 percent of the daily project flow if the effluent is pumped to a distribution system for DPR.

2.4 Flows and Demand Forecasts by Water Type

Flow and demand forecasts are summarized for water demands, wastewater flows, recycled water flows, and stormwater flows. For each of these flow types, a "forecasting envelope" has been developed for planning to account for unknown future conditions.

The purpose of this forecasting envelop is to demonstrate that there is uncertainty when developing demands/flow forecasts. In order to quantify this uncertainty a range of future flows and demands is estimated within the planning horizon (2018-2040) of this Plan. The last decade has demonstrated the importance of acknowledging this uncertainty as the wastewater flow forecasts presented in the 2006 Water Integrated Resources Plan (IRP) was opposite to what actually occurred. Due to the state-wide drought (2011-2016), mandatory conservation and behavioral changes resulted in a 21 percent reduction in wastewater flows between 2006 and 2015, compared to a 16 percent increase projected in the 2006 IRP. The net change was roughly 125,000 AFY, a trend reversal that few anticipated just ten years ago. In preparation of a 25-year forecast for this Plan, it is therefore important to acknowledge that the actual flows and demands in 2040 may (greatly) differ from the baseline forecast used in this Plan. The baseline forecast used in this Plan is the 2015 UWMP. LADWP continues to monitor city-wide and gallon per capita water use to compare actual demands with the UWMP forecast. Moreover, LADWP updates its UWMP every five years to comply with the UWMP Act.

For the purpose of this Plan a forecasting envelop was prepared to quantify a range of flows and demands using assumptions about more/less water conservation than the baseline (2015 UWMP) forecast. The intent of the forecasts presented in this Section is to provide order of magnitude wastewater flow impacts to avoid potentially oversizing non-potable and potable water reuse facilities. Due to lack of empirical data and wide variety of service area conditions, it is assumed that the amount of water conservation would linearly impact wastewater flows. This simplifying assumption was made when preparing the forecasting envelops presented in the next subsections. However, in future it is more likely that the majority of conservation will be related to a reduction of outdoor demands, which would therefore reduce wastewater flows by a lower percentage.

2.4.1 Water Demands

Potable water demands are summarized in 5-year increments utilizing information developed in LADWP's 2015 UWMP. The total water is LADWP's projection of water demands without conservation in a normal year, while the pLAn water demand target is the best projection of water demands with conservation. Based on historical data and additional analysis conducted for the calibration of the Mass Balance Tool (MBT), demands are assumed to consist of 60 percent indoor demands and 40 percent outdoor demands. This breakdown is consistent with the numbers presented in LADWP's 2015 UWMP.

The UWMP assumed passive and active conservation to meet pLAn goals; however, the true rate of conservation that will be attained is unknown. Therefore, a planning envelope of plus 10 percent and minus 10 percent has been assumed to account for a range of low to high water conservation for planning year 2040. The 2015 UWMP demand forecast along with the demand forecasting envelope is presented on Figure 2. It is recognized that graywater use may also reduce demand, however, its use is not accounted for in this TM.

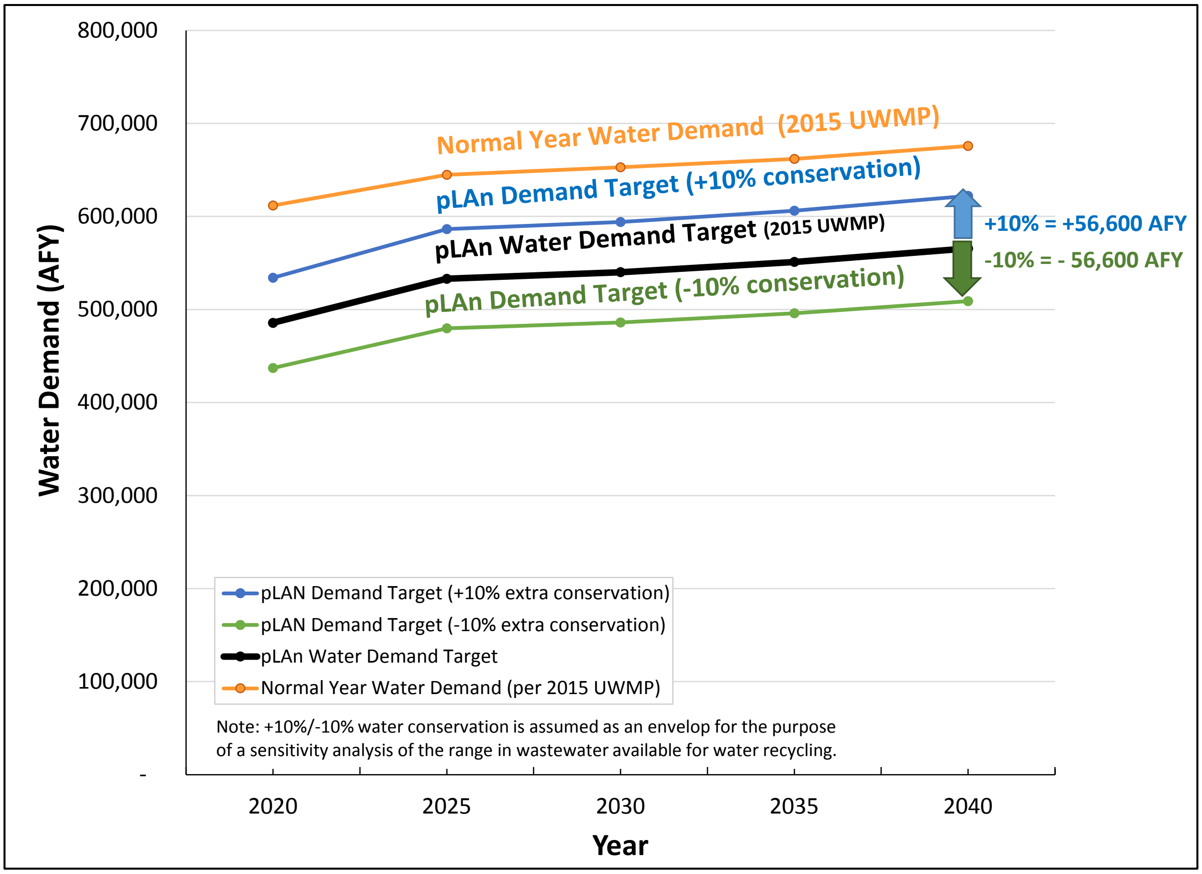

Figure 2 Projected Water Demand - Normal Year

As shown on Figure 2, the potable water demand (shown in yellow) is projected to increase from a historical amount of 610,000 AFY (1991 - 2014 average) to 676,000 AFY by 2040, representing an 11 percent increase. However, the pLAn demand target (shown in black) is 565,600 AFY for 2040, which is the baseline water demand projection in the 2015 UWMP and the One Water LA 2040 Plan.

The water demand forecast from the 2015 UWMP was used as the baseline of the water demand forecasting envelope in the One Water LA 2040 Plan. It is important to emphasize that the purpose of the envelope is solely to quantify the impacts on future wastewater flows under extreme conservation scenarios to avoid oversizing new wastewater recycling facilities. Preliminary conservation potential results are listed in Chapter 3 of the 2015 UWMP. The +10% scenario would far exceed conservation levels, and represents the extreme conservation scenario where other external factors, such as potential new regulatory conservation mandates, are requiring additional conservation is achieved by 2040.

To develop a water forecasting envelope, a range of plus 10 percent and minus 10 percent water conservation was applied to the pLAn demand target. A larger range (10 percent) was used for the scenario with more conservation to provide a conservative estimate of the minimum wastewater flows, meaning a minimum wastewater flow forecast to avoid oversizing wastewater recycling facilities. A lower range (10 percent) was used for the scenario with less conservation due to compliance needs with the pLAn target demand and water usage trends in the last five years in response to the drought and increased water scarcity awareness. The lower conservation range would result in higher wastewater flows, which could trigger larger wastewater recycling facilities compared to the 2015 UWMP forecast baseline.

As shown on Figure 2, this forecast creates a water demand projection range from approximately 509,000 AFY (565,600 AFY - 56,600 AFY) to 622,200 AFY (565,600 + 56,600). This equates to a total demand range of approximately 113,200 AFY.

It should be noted that water demands also fluctuate based on hydrological conditions. Demands typically decrease during wet years and increase during dry years. However, water conservation mandates in the recent and ongoing statewide drought have resulted in decreasing demand despite record-dry conditions in Southern California. However, with recent changes to conservation mandates becoming voluntary, there has been a slight uptick in demands.

2.4.2 Wastewater Flows

Wastewater flows summarized in 5-year increments utilizing information are developed in TM 2.1. This information is presented graphically on Figure 3. As shown, the wastewater flows that are conveyed to the City's four wastewater treatment plants consist of three major components, 1) sewer flows generated by customers within the City, 2) sewer flows from the City's 29 contract agencies, and 3) stormwater inflow and infiltration (I/I) and existing low flow diversions (LFDs).

The flows presented on Figure 3 represent normal year conditions. During wet years, wastewater flows are generally higher due to an increase in I/I flows.

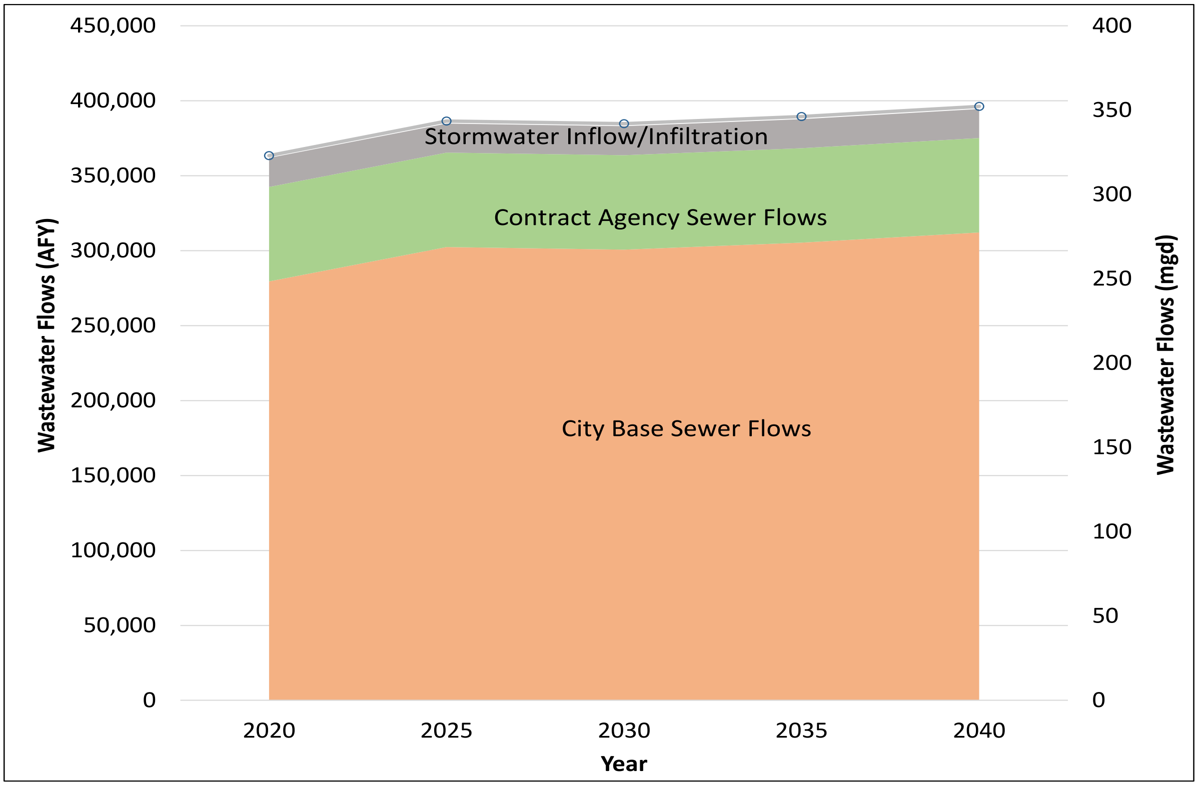

Figure 3 Baseline Wastewater Flow Forecast

As shown on Figure 3, the City's wastewater flows are projected to increase from 362,000 AFY (323 mgd) in year 2020 to 394,000 AFY (352 mgd) in year 2040. This equates to a wastewater flow increase of nearly 29 mgd over the 20-year planning horizon under normal year conditions.

This baseline wastewater flow projection was used to develop a wastewater flow projection envelope by utilizing the same +10 percent and -10 percent water conservation scenarios described in Section 2.4.1. Utilizing a 60 percent indoor demand factor, the wastewater flows generated by City customers was decreased by 6 percent for the scenario with 10 percent extra conservation. Similarly, City customers' wastewater flows were increased by 6 percent for the scenario with 10 percent less conservation. The flows of the contract agencies and I/I contributions were not modified. The results are presented on Figure 4.

As shown on Figure 4, this forecast creates a 2040 wastewater flow projection range from approximately 335 mgd (352 - 17 mgd) to 369 mgd (352 + 17 mgd). This equates to a total wastewater flow range of nearly 33 mgd. This is a very wide range and demonstrates the importance of conservative project sizing and trigger-based planning to avoid stranded assets while achieving wastewater recycling goals.

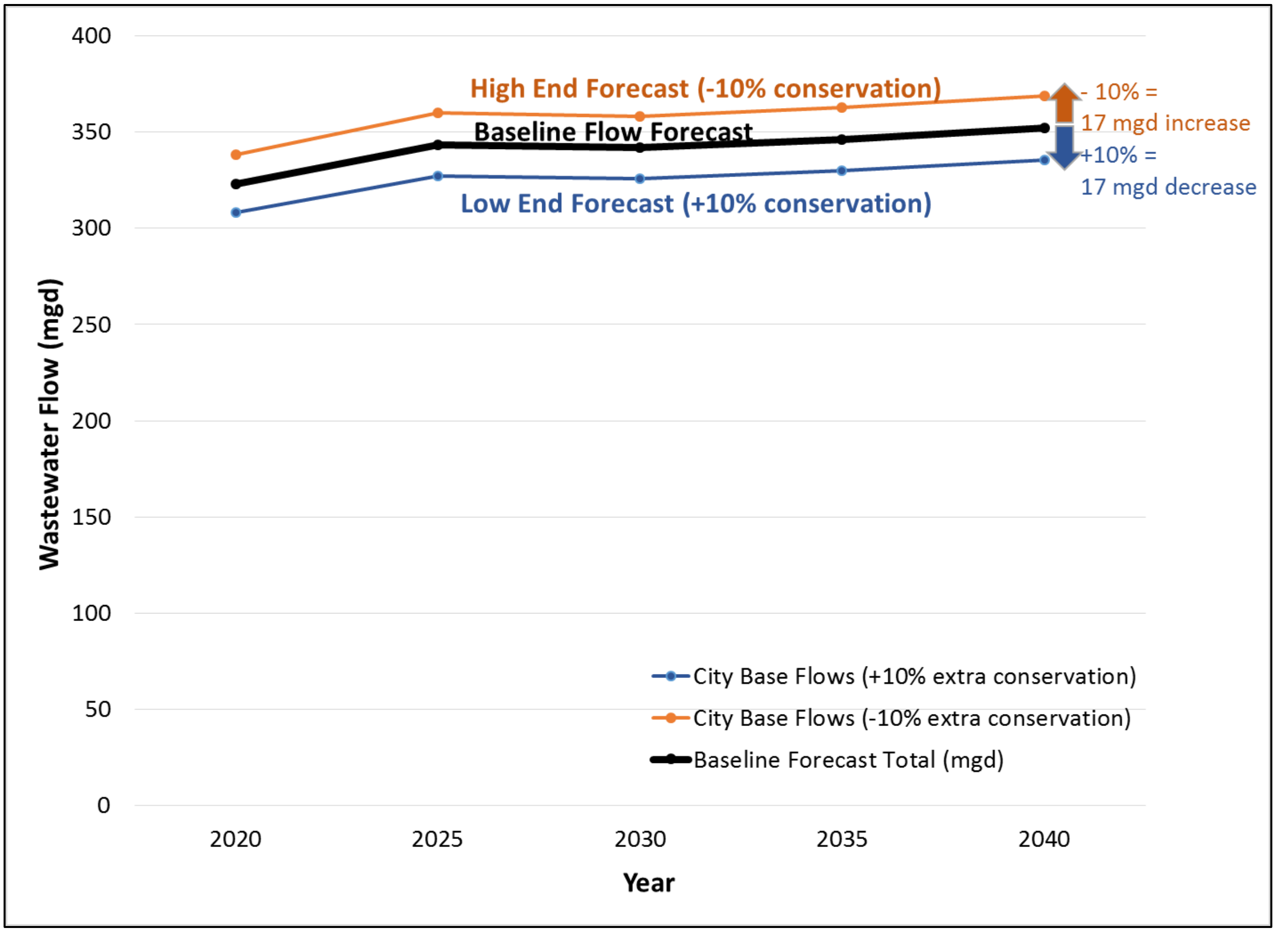

Figure 4 Wastewater Flow Projection Envelope

It should be noted that these flows represent the baseline forecast that will be used for the alternatives analysis. These flows could change based on the implementation of projects recommended in the One Water LA 2040 Plan or other planning efforts and capital improvement programs. For example, the baseline flow forecast does not include proposed projects, such as flow diversions from the stormwater system to the sewer collection system.

2.4.3 Recycled Water Demands

Recycled water demands are summarized in 5-year increments and are shown on Figure 5. Municipal and industrial uses, indirect potable reuse, and environmental reuse are from the UWMP and seawater intrusion barriers and sold to other agencies assume that existing volumes will continue to be served at the same rates. This figure shows the projected recycled water demands based on the projects that the City currently has underway and correspond to the 2015 UWMP forecast. It should be noted that the projected recycled water demands do not include other potential projects that will be defined and evaluated as part of TM 5.2.

Based on a comparison of the projected baseline wastewater flows as shown on Figure 3 (395,000 AFY in 2040) and the recycled water demand needs shown on Figure 5 (144,000 AFY), it can be concluded that there is more than sufficient wastewater available to produce the recycled water for the currently identified purposes. However, the location and diurnal fluctuations in sewer flows and demand can cause localized constraints. This will need to be considered when evaluating potential water recycling options outside of the 2015 UWMP. It should be noted that the planned increase in deliveries to West Basin Municipal Water District (MWD), IPR projects beyond the first phase of the San Fernando Groundwater Basin spreading project, and DPR projects are not included on Figure 5.

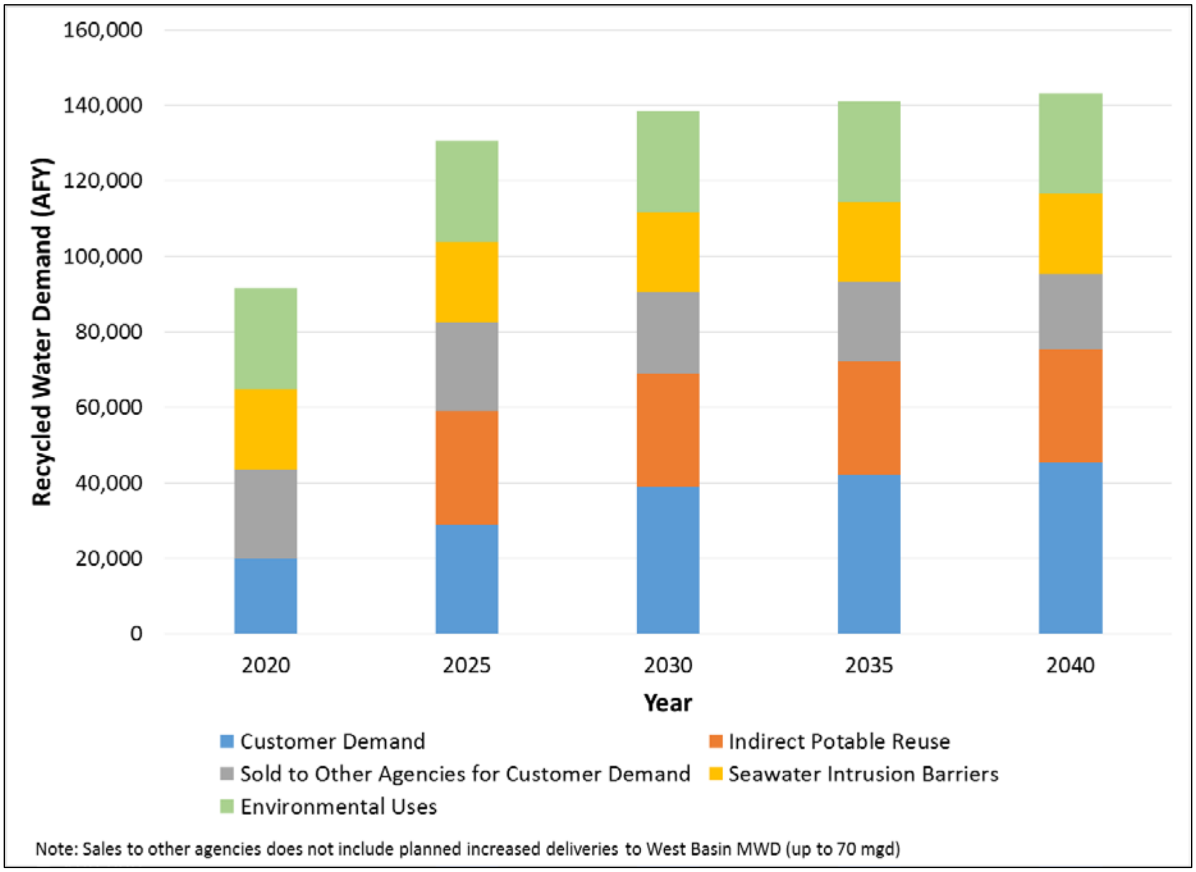

Figure 5 Recycled Water Demand Forecast

2.4.4 <u>Stormwater Flows and Capture</u>

The SCMP estimates that the City actively captures and recharges approximately 29,000 AFY of stormwater, along with another 35,000 AFY infiltrating into aquifers through incidental recharge. Additionally, the SWFP (Volume 3 of this Report) demonstrates that an additional 80,000 AFY could be captured through a suite of projects, programs, and policies over the next 20 years. The water supply BMPs are based on the conservative approach for stormwater projects in the SCMP; the water quality BMPs are based on additional expected recharge based on EWMPs. The baseline stormwater capture (both centralized and distributed capture), along with stormwater managed due to water supply and water quality projects are shown on Figure 6.

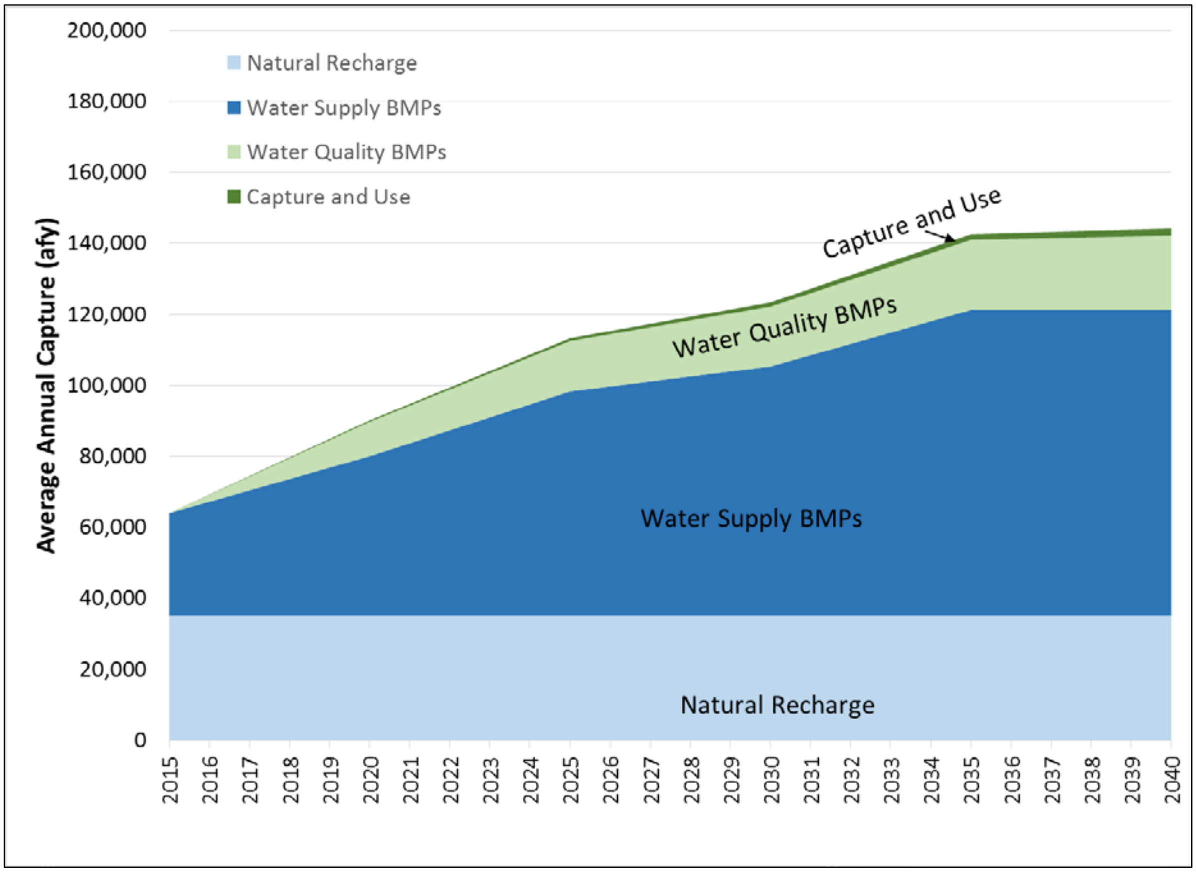

Figure 6 Projected Baseline and Potential Stormwater Capture Volumes

3.0 PROJECT AND PORTFOLIO EVALUATION PROCESS

This section describes the approach and methodology for the alternatives evaluation, which is schematically presented on Figure 7, followed by a detailed discussion of the project evaluation criteria. In addition, the methodology to score projects and develop portfolios consisting of groups of projects is presented and discussed.

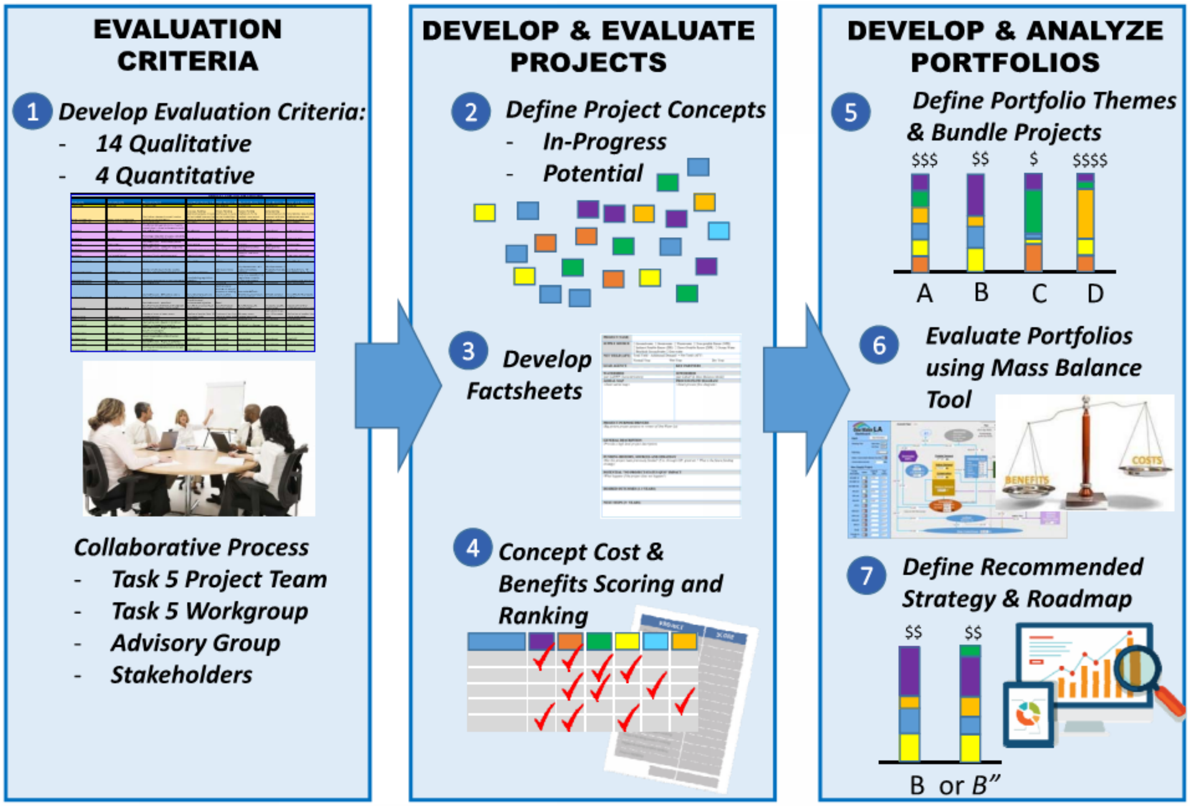

Figure 7 Alternatives Analysis Methodology Overview

3.1 Project and Portfolio Evaluation Process

As shown on Figure 7, the alternatives evaluation process can be divided into three major phases and seven separate steps. The three phases and steps are described below.

Phase 1 - Development of Evaluation Criteria, In-Progress Projects, & Potential Concepts

- Step 1 was the development of the concept evaluation criteria through a collaborative process with the One Water LA 2040 Plan project team, Task 5 Workgroup, Advisory group, and stakeholders. A total of 18 criteria, along with individual weighting factors, were developed mostly consisting of qualitative criteria and a few quantitative criteria. These criteria and their measures are described in more detail in Section 3.3, while the individual weighting factors are discussed in Section 3.4.

- Step 2 was the definition of major future water projects that could be implemented. These projects were divided into two categories: 1) In-Progress Projects and 2) Potential Concepts.
  - In-Progress Projects are projects that will be performed independent of the One Water LA 2040 Plan as these projects are already defined in other completed planning efforts, and are assumed to be moving forward at this point in time. These In-Progress Projects will be described in TM 5.2 (Project Development).

  - Potential Concepts are major water opportunities that are more uncertain and that are being evaluated as part of the One Water LA 2040 Plan alternatives evaluation process to determine whether they should be advanced and included in the One Water LA 2040 Implementation Plan or eliminated from further evaluation. These Potential Projects are described in TM 5.2 (Project Development).

- Step 3 consisted of the development of Concept Description Sheets that summarize the key characteristics of the In-Progress and Potential Concepts. The In-Progress Projects were briefly summarized, while the Potential Concepts were described in more detail and include descriptions for each of the major evaluation criteria categories to facilitate the Potential Concept scoring process. The In-Progress Projects and Potential Concepts templates are provided in Appendix D.

Phase 2 - Evaluating and Scoring Potential Concepts Benefits

- Step 4 consisted of evaluating and scoring the Potential Concepts benefits utilizing the scoring criteria, measures, and weighting factors described in Section 3.4 and in Appendix E. The Potential Concepts were grouped by concept type, and the concepts with the most perceived benefits (ranking the highest) for each concept type will be recommended to move forward to the portfolio evaluation phase. LADWP and Los Angeles Sanitation (LASAN) collaboratively reviewed the scoring results and confirmed which Potential Concepts are to move forward into the portfolio evaluation phase.

Phase 3 - Development and Evaluation of Concept Portfolios

- Step 5 consisted of the development of themed project portfolios that combined projects that match the portfolio theme s. Similar to the evaluation criteria, the project portfolios were developed through a collaborative process with the One Water LA 2040 Plan project team, Task 5 Workgroup, Advisory group, and stakeholders. A total of five portfolios were developed, including a "Benchmark" portfolio.

- Step 6 consisted of the portfolio evaluation utilizing both the concept evaluation criteria developed in Step 1 and the MBT developed during Tasks 1 and 2 of the One Water LA Plan project. The total cost of each portfolio was compared with a total benefit score to obtain a cost-benefit ratio to compare the five portfolios.

- Step 7 consists of the development of the preferred mix of concepts by creating a hybrid portfolio that combined the best combination of concepts that result in a maximum cost-benefit score. This combination of concepts was utilized to develop the core of the future road map of the One Water LA 2040 Plan. The portfolio development and evaluation process is further described in Section 3.5 and was documented in TM 5.3 (Portfolio Development).

3.2 Criteria Development Approach

As mentioned in Step 1 above, evaluation categories and criteria were developed to evaluate projects included in the One Water LA 2040 Plan. The purpose of the evaluation criteria is to establish a high-level evaluation, ranking, and weighting system for future projects; these projects are to be identified and evaluated in TM 5.2. Subsequent to the evaluation of projects, projects will be grouped together into portfolios. The following subsections describe key guiding principles, plans, and studies that contributed to the development of evaluation criteria.

3.2.1 <u>One Water LA Guiding Principles</u>

The guiding principles are one of two primary documents used to develop the evaluation criteria, the second is the Sustainability pLAn. The One Water LA 2040 Plan guiding principles were developed through an extensive and collaborative process by City staff and stakeholders to provide a path forward on how the seven objectives developed for the One Water LA 2040 Plan will be achieved (City of LA, 2015). The seven objectives are listed in Section 1.0.

The 38 guiding principles provide a path for how the objectives for the One Water LA 2040 Plan will be achieved, including additional specificity regarding means and direction (see Volume 9 Guiding Principles Report). The principles were developed to guide the development of more detailed planning, rather than to define specific targets. The guiding principles cannot be used directly as evaluation criteria, but the guiding principles assisted with the development of criteria. In general, the 38 guiding principles were grouped into 3 categories that can be applied to 1) Project Criteria, 2) Project Selection, or 3) the One Water LA planning process. All guiding principles that could be applied to projects are incorporated in the evaluation criteria presented in this TM.

3.2.2 <u>Sustainability pLAn</u>

The Sustainability pLAn is one of the primary documents used to develop the evaluation criteria, the first being the One Water LA Guiding Principles. In 2015, the Mayor issued the City's first Sustainability pLAn (also referred to as pLAn) to address sustainable living within the City. In the pLAn, the Mayor's office issued targets for water including the development of local resources, reducing water demand through conservation, improving stormwater quality, and reducing sewer spills as previously described (LA Mayor's Office, 2015). The strategies and priority initiatives developed as part of the pLAn are used as a basis for criteria, with the goal of developing criteria to encompass as many of the targets and strategies as possible.

3.2.3 Reference Studies for Evaluation Criteria

Several other documents were used as a reference for developing the evaluation criteria. These projects were chosen because they included many of the same stakeholders who are involved in the One Water LA 2040 Plan process. Criteria used in these plans were reviewed to confirm that the concepts proposed to evaluate projects and portfolios in those plans are addressed in the One Water LA 2040 Plan criteria.

Sun Valley Watershed Management Plan

The Sun Valley Watershed Management Plan was the first stormwater basin management plan developed by Los Angeles County (LACDPW, 2004). As part of the plan, guiding principles applicable to any watershed were developed; these were used as a basis for later basin plans. The guiding principles suggested by this plan are considered in the development of criteria for the One Water LA 2040 Plan.

Los Angeles Basin Stormwater Conservation Study

In 2016, the U.S. Bureau of Reclamation (BOR) completed the Los Angeles Basin Stormwater Conservation Study in conjunction with the County of Los Angeles Department of Public Works and the Los Angeles County Flood Control District. In this project, BOR had an extensive stakeholder process, including many of the same stakeholders as the One Water LA 2040 Plan. As part of the project, BOR developed two sets of evaluation measures, one for projects (BOR Task 5, 2015) and one for a trade-off analysis (BOR, Task 6, 2016). Both of these measures were reviewed; it was found that the One Water LA 2040 Plan criteria encompassed each of the measures in the Basin Study.

3.3 Project Evaluation Criteria

The project evaluation criteria will be applied to all the potential future concepts that will be defined in TM 5.2. The proposed criteria can be divided into the following four major categories:

- Economic
- Resiliency
- Implementation
- Environmental

Within each category, criteria were established to characterize the effectiveness of a given project in meeting that category. Table 1 presents a summary of all 18 evaluation criteria by category. Detailed descriptions of these criteria are included in Appendix C.

Table 1 Evaluation Categories and Criteria
One Water LA – TM 5.1

Category	Criteria
Economic	Unit cost
	Financial benefits
	Funding mechanism
	Likelihood to obtain outside funding
Resiliency	Drought resiliency
	Earthquake resiliency
	Flood risk mitigation
	Local supply benefit
	Energy Impact/Greenhouse Gas emissions
Implementation	Constructability
	Institutional collaboration
	Regulatory approval
	Public engagement
	Public and Political support
Environmental	Environmental justice
	Open/natural space and recreational benefit
	Stormwater quality
	Ecological benefit

Category 1 – Economic

Economic represents the present and future costs for implementation of a project, referring to the unit cost per acre-foot or million gallons of water. It is inclusive of operation and maintenance costs, as well as capital costs and also considers the economic and financial benefits of a project. Furthermore, this category accounts for a project's mutual benefits, relative eligibility and probability for obtaining funding, such as the availability of grants, funding mechanisms, or other methods to fund the project.

Criteria include: Unit cost, Financial Benefits, Funding Mechanism, and Likelihood to obtain outside Funding.

Category 2 – Resiliency

Resiliency is used to characterize the project's resiliency to drought, earthquakes, floods, fire and landslides, and changes in the climate, as well as its ability to provide a local water supply benefit.

Criteria include: Drought Resiliency, Earthquake Resiliency, Flood Risk Mitigation, Local Supply Benefit, and Energy Impact/Greenhouse Gas Emissions.

Category 3 – Implementation

Implementation considers the project's constructability; institutional collaboration; regulatory approval, issues, and constraints; public engagement; as well as public and political support.

Criteria include: Constructability, Institutional Collaboration, Regulatory Approval, Public Engagement, and Public and Political Support.

Category 4 – Environmental

Environmental refers to the ancillary benefits of a project for the City and its communities, such as environmental justice, open/natural space, recreational benefits, improvement of stormwater quality, as well as ecological impacts/benefits.

Criteria include: Environmental Justice, Open/Natural Space and Recreational Benefit, Stormwater Quality, and Ecological Benefit.

The final evaluation criteria listed in Table 1 were developed through a multi-step and collaborative process as depicted on Figure 8.

As shown on Figure 8, initial evaluation criteria ideas developed based on similar planning studies were presented in the first Task 5 workshop (consisting of city staff and technical consultants) and to the One Water LA Advisory Group. These initial criteria were then compared with the One Water LA 2040 Plan guiding principles and the LA Basin Stormwater Conservation Study (BOR, 2016). The criteria correlation exercise that demonstrates how the guiding principles and LA Basin Plan criteria are reflected in the draft evaluation criteria is included in Table C.20 in Appendix C. Subsequently, these draft criteria were further refined based on additional input from the Task 5 workgroup, LASAN and LADWP management, advisory group, stakeholders, and a select group of technical advisors. A detailed description for each criterion along with measurements and scoring guidelines are included in Appendix C.

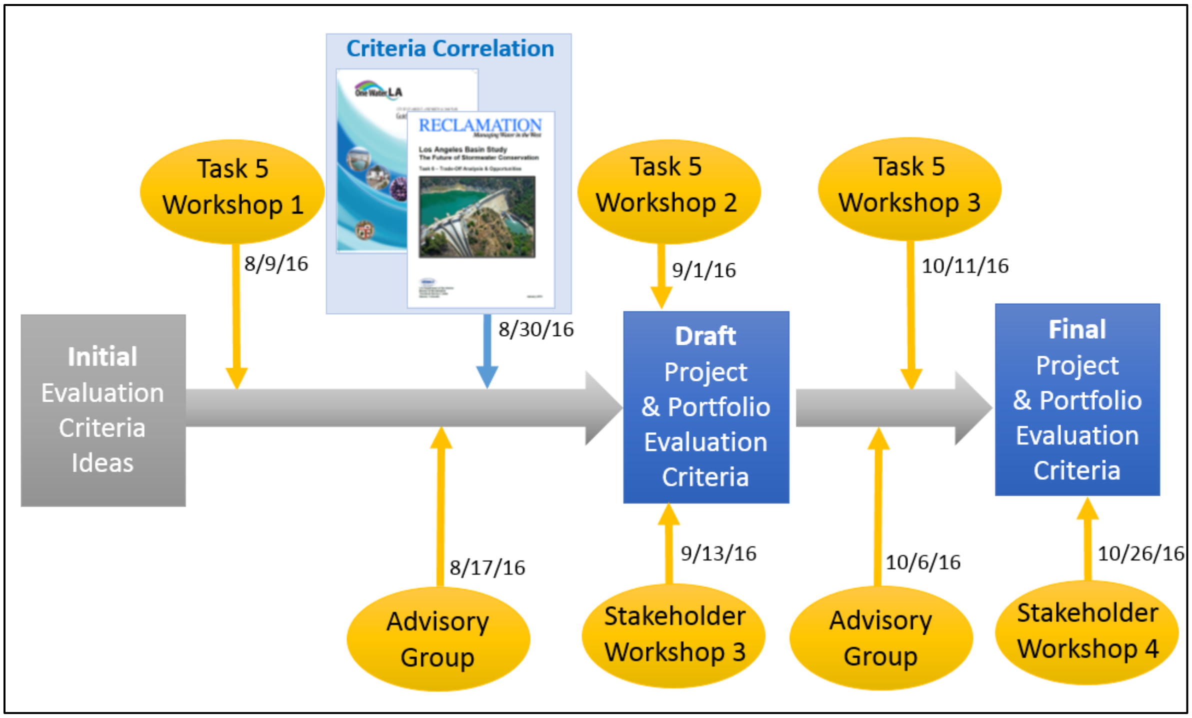

Figure 8 Alternatives Analysis Development Process

3.4 Concept Scoring and Weighting

Each of the Potential Concepts (defined in TM 5.2) will be scored utilizing the project description templates and the evaluation criteria measurements presented in Appendix C. A group of LASAN, LADWP, Consultant staff, and the Advisory Group will score each of the various concepts by the criteria in a workshop/collaborative setting. Based on the scores, a weighted project score will be calculated for each concept.

The scored concepts will be combined into themed portfolios. Once grouped into portfolios an overall cost benefit ratio can be developed for each portfolio. Upon evaluation of the themed portfolios, concepts with lower scores may be eliminated from further evaluation as part of the One Water LA 2040 Plan, and concepts with higher scores could be combined to build preferred portfolio options.

In order to establish and allocate relative weights to the 18 evaluation criteria listed in Table C.1, a paired comparison exercise was conducted. This exercise was conducted with the Task 5 workgroup, and the Advisory Group. In addition, input on the relative importance of the 18 criteria was obtained through an interactive exercise in a stakeholder workshop, where each of the criteria were ranked against each other (paired comparison). Details of the paired comparison exercise including the scoring sheets are included in Appendix E, while the weighting factor results are graphically depicted from highest to lowest ranked on Figure 9.

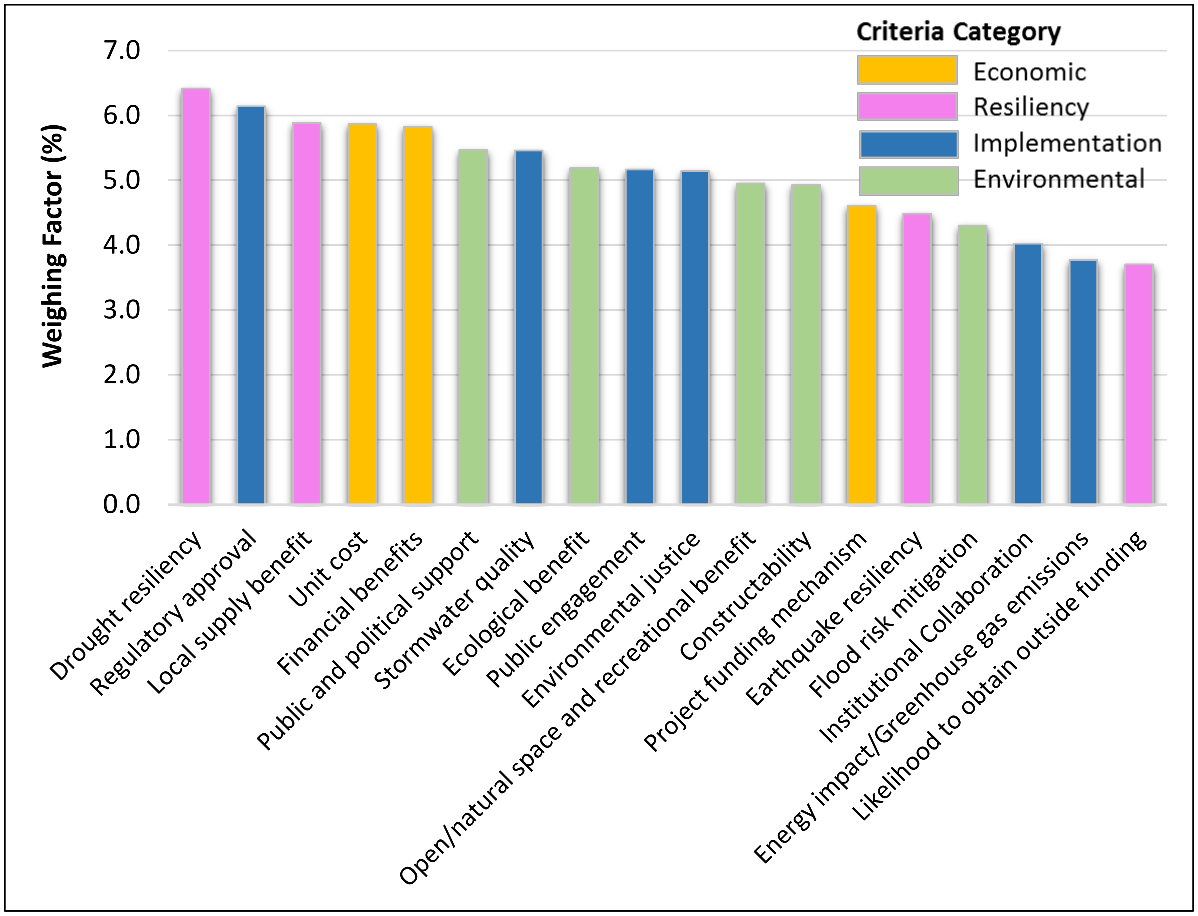

Figure 9 Project Criteria Weighting Factors

As shown on Figure 9, the calculated relative weights of each of the 18 criteria ranges from 3.7 percent (Likelihood to obtain outside funding) to 6.4 percent (drought resiliency). This equates to a variance of -27 percent to +28 percent compared to the average weight of 5.0 percent per criterion. It can also be observed that there is no correlation between the weighting score and the criteria category as all categories are distributed throughout the spectrum of scores. As further explained in Appendix E, all major categories have an equal average weight and concept scores should therefore be based on the individual criteria only.

Lastly, it should be noted that the three highest scored criteria are Drought Resiliency, Regulatory Approval, and Local Supply Benefit. These criteria align strongly with the major water issues facing the City as of November 2016. Concepts that address these issues and provide local supply benefits during droughts and/or contribute to regulatory approval and stormwater quality (e.g. stormwater quality total maximum daily load [TMDL] deadlines) will therefore be given a higher weight in the project scoring.

The weighting criteria presented on Figure 9 shows the relative level of importance of each criteria that will be used to score and rank a concept as described in the next section.

3.5 Portfolio Scoring Methodology

Once the Potential Concepts are scored and ranked, the lowest ranked concepts may be eliminated from further evaluation as part of the One Water LA 2040 Plan. The higher ranked concepts will move forward in the portfolio evaluation by including these in one or more of the project portfolios. A total of five portfolios will be developed, including one "No Action" portfolio, which will represent existing conditions along with the implementation of the In-Progress Projects.

The remaining four portfolios will be arranged around themes that emphasize a particular strategy, such as maximizing stormwater capture, maximizing water recycling, or optimizing local water supplies. The project portfolios will be scored using a combination of measures. These are:

- **Total Portfolio Cost:** The total life cycle cost of all projects within a portfolio will be calculated by combining the total capital cost, annual operations, and maintenance (O&M) cost, and corresponding asset depreciation period.
- **Total Benefit Score:** The combined benefit score of all projects within a portfolio will be calculated by prorating each project score based on its yield to normalize for project size.
- **Supply Resiliency Score:** A separate analysis will be conducted utilizing the MBT and the three 10-year hydrologic sequences described in Section 4.0. The MBT will be for each portfolio by activating all In-Progress and Potential Projects in that particular portfolio. The MBT will then be run under normal, wet, and dry year conditions for year 2040 to calculate the percentage of local water supply under these three single-year hydrologic conditions. To account for a range of future hydrologic conditions, the average local water supply contribution of each portfolio will be calculated using the three, 10-year hydrologic sequences to develop a supply resiliency score.

Depending on future input from City staff and the calculated scores, the local supply resiliency score can be integrated in the total benefit score or maintained as a separate metric. Ultimately, a preferred future strategy that achieves both local water supply goals, the Mayor's Sustainability pLAn goals, and stormwater compliance targets will be developed optimizing portfolios and projects to achieve a maximum cost-benefit score and/or cost-supply resiliency score. This combination of projects will be utilized to develop the core of the future road map of the One Water LA 2040 Plan. The portfolio development and evaluation process will be documented in TM 5.3 (Portfolio Development).

4.0 HYDROLOGY SCENARIOS

The hydrologic conditions described in TMs 1.2 and 2.1 are based on precipitation records from 71 rain gauges distributed throughout the City and areas that drain to the City for a 20-year period of record, extending from 1991 to 2011. For this TM, the hydrologic scenarios presented were extended through 2015 to capture the recent drought years and include a longer historical sequence starting in 1922. The hydrologic analysis presented herein provides a high-level analysis using monthly precipitation data for the full 94-year period of record from the Downtown Los Angeles (USC) weather station. Data was obtained from the National Oceanic and Atmospheric Administration (NOAA) website.

Monthly data was organized and used to calculate annual precipitation totals in inches (in) by water year (WY) for the complete period of record (WY 1922 - 2015 [Note that sporadic monthly data is available from 1906 - 1914, but was not used due to its incompleteness]). The U.S. Geological Survey defines a WY as the 12-month period beginning on October 1, for any given year, through September 30 of the following year. In turn, the WY is designated by the calendar year in which it ends. For this analysis precipitation data used is from October 1, 1921 - September 30, 2015 or WYs 1922 - 2015. Organized data is provided in Appendix F. Precipitation through time is plotted on Figure 10, while Figure 11 displays a histogram of the data, showing frequency of data in 5-inch bins.

These plots show that the most recent 10-year period (WY 2006 - 2015) is the driest on record. In contrast, the 10-year period from WY 1935 - 1944 is the wettest on record. Meanwhile, the 10-year period from 1968 - 1977 represents normal (average) conditions.

Annual precipitation WY totals were used to determine statistics of the data set, which are provided in Appendix F. The sample mean is 14.41 inches and median is 12.41 inches, describing the central tendency or "location" of the data distribution. It is interesting to note that the median is 2 inches lower than the mean, indicating that dry years are more common than wet years.

Results of the historical hydrology analysis were used to characterize each year in the data set as being the Historical Dry, Normal, or Wet Years, using the following definitions:

- Historical Normal Year: between 10.8 and 18.3 inches of annual rainfall.
- Historical Dry Year: Less than 10.8 inches of annual rainfall.
- Historical Wet Year: Greater than 18.3 inches of annual rainfall.

Each historical 10-year hydrologic sequence, was then translated into the number of dry, normal, and wet years, as shown in Table 2. It should be noted that the amount of annual rainfall is subject to change due to climate change dynamics. However, for the purpose of the alternatives analysis, only historical data was readily available and utilized to develop a range of hydrologic sequences to conduct a sensitivity analysis for the supply reliability of each portfolio. The historical hydrologic conditions described herein are further referred to as "Normal Year", "Dry Year", and "Wet Year".

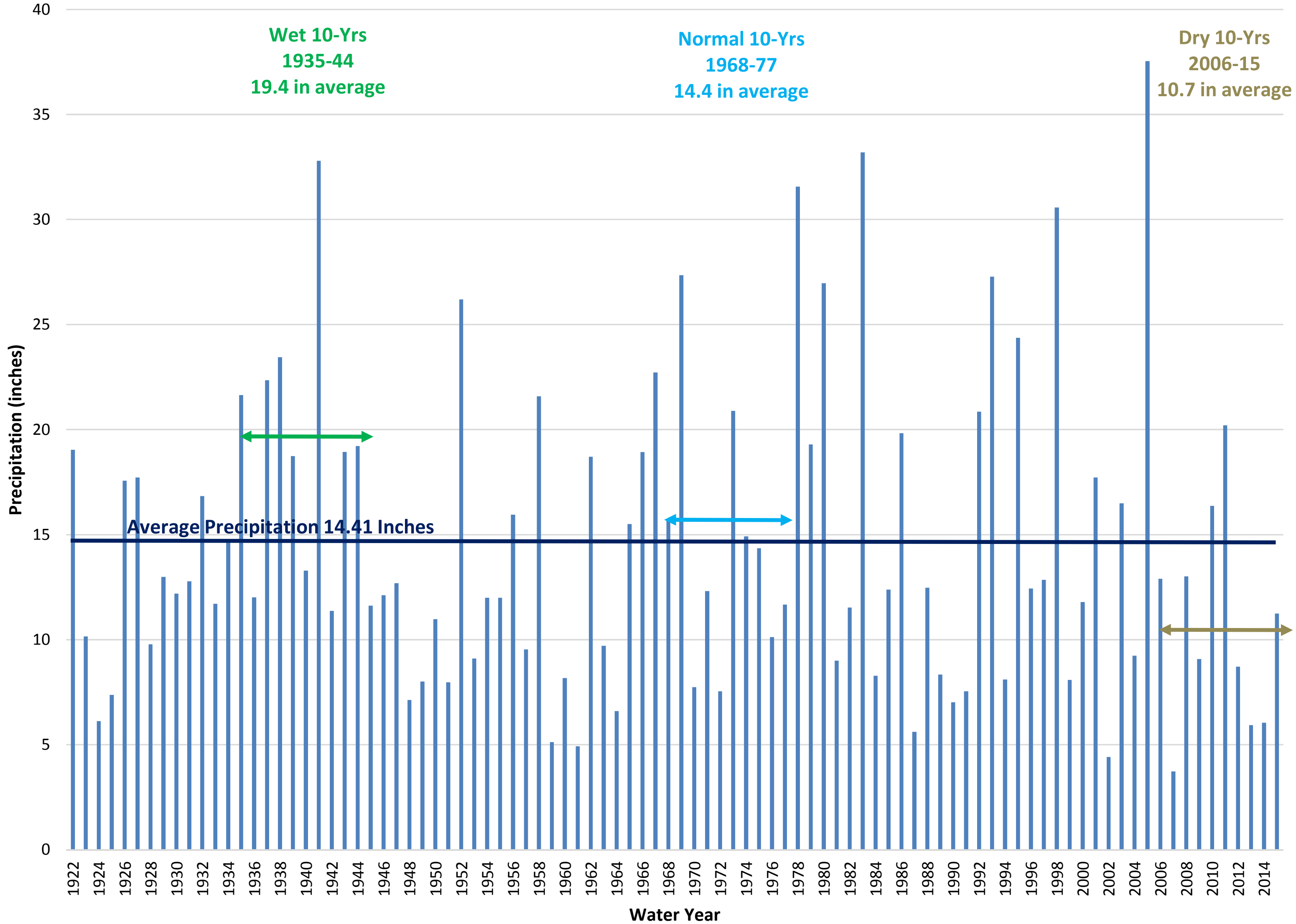

Figure 10 - Precipitation by Water Year 1922 - 2015
One Water LA 2040 Plan
TM 5.1 - Basis of Planning

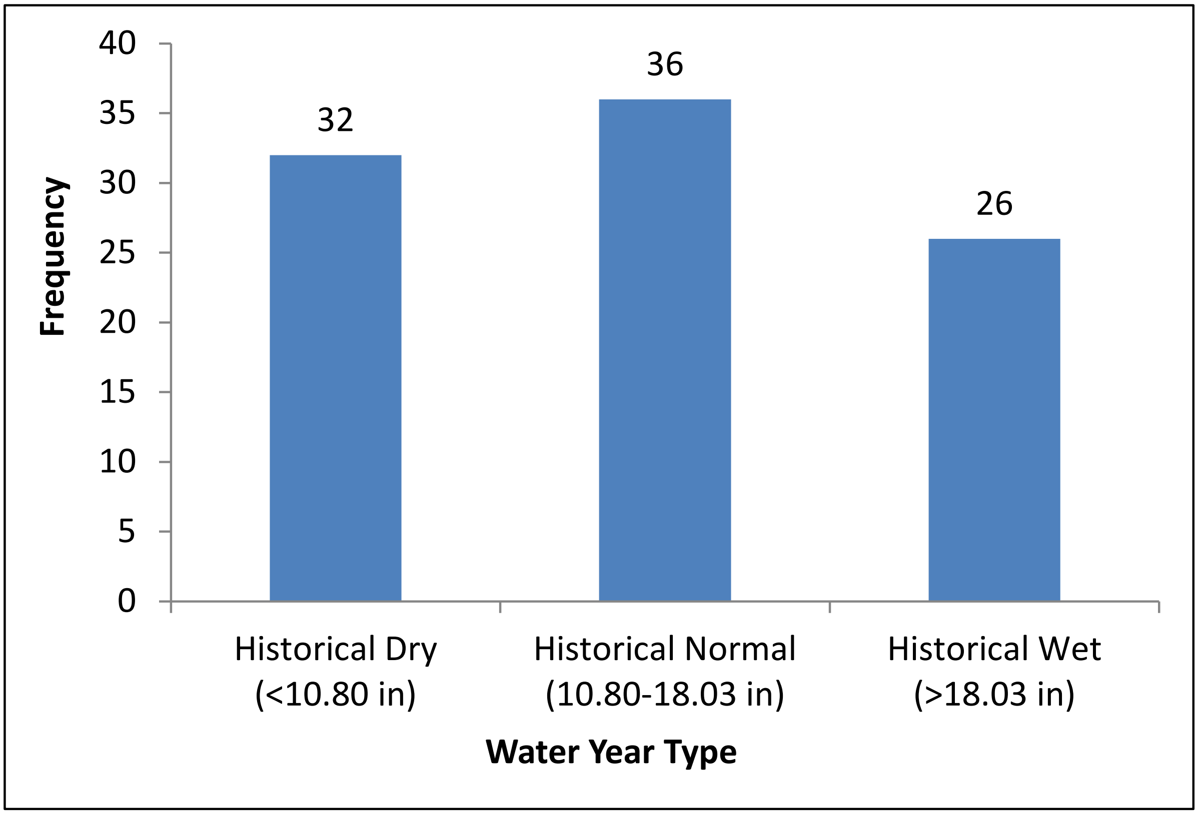

Figure 11 Distribution of Historical Dry, Normal, and Wet Years in the Period 1922 - 2015

As shown in Table 2, the three 10-year hydrologic scenarios can be characterized by the following sequences:

- Normal 10-year hydrologic scenario (A sequence of 5 normal + 3 dry + 2 wet years).
- Dry 10-year hydrologic scenario (A sequence of 4 normal + 5 dry + 1 wet years).
- Wet 10-year hydrologic scenario (A sequence of 3 normal + 0 dry + 7 wet years).

These three future hydrologic scenarios will be utilized in the portfolio evaluation by combining the results of the Mass Balance Model runs for each single-year scenario to these three different 10-year sequences to develop a local supply resiliency score for each portfolio. This methodology is described in more detail in Section 3.5.

Table 2 Summary of Dry, Normal, and Wet Year Scenarios One Water LA – TM 5.1

Dry Scenario WY 2006 - 2015			Normal Scenario WY 1968 - 1977			Wet Scenario WY 1935 - 1944		
WY	**Precip (in)**	**Year Type**	**WY**	**Precip (in)**	**Year Type**	**WY**	**Precip (in)**	**Year Type**
2006	12.9	Normal	1968	15.71	Normal	1935	21.64	Wet
2007	3.73	Dry	1969	27.35	Wet	1936	12.02	Normal
2008	13.01	Normal	1970	7.74	Dry	1937	22.35	Wet
2009	9.08	Dry	1971	12.32	Normal	1938	23.45	Wet
2010	16.37	Normal	1972	7.54	Dry	1939	18.74	Wet
2011	20.2	Wet	1973	20.89	Wet	1940	13.29	Normal
2012	8.71	Dry	1974	14.92	Normal	1941	32.8	Wet
2013	5.94	Dry	1975	14.35	Normal	1942	11.37	Normal
2014	6.04	Dry	1976	10.12	Dry	1943	18.94	Wet
2015	11.24	Normal	1977	11.67	Normal	1944	19.22	Wet
Summary 5 Dry + 4 Normal + 1 Wet			**Summary** 3 Dry + 5 Normal + 2 Wet			**Summary** 0 Dry + 3 Normal + 7 Wet		

5.0 COST ASSUMPTIONS

This section describes the data and cost estimates that will be used to evaluate the potential future projects in preparation of the One Water LA Plan. Due to the conceptual planning level of the alternatives analysis, only major cost components of each project alternative will be developed using the unit cost and cost assumptions provided herein.

The major cost assumptions are broken into the following categories:

- Unit Cost Assumptions - Describes the costs and sources of costs for all major facilities and project components that could be part of the potential projects.
- Rates - Describes the current water rates for both treated imported water and local groundwater.
- Construction Markups - Describes the markups applied to construction costs to arrive at capital costs.
- Life Cycle Cost - Useful Life and Replacement Age, including capital and O&M costs.

Project cost criteria is the total capital investment necessary to complete a project, including costs for land acquisition, all necessary engineering services, construction, environmental documentation, contingencies, and overhead items such as legal and administrative services, and financing.

Construction costs typically undergo long-term changes in keeping with corresponding changes in the regional and national economy. A commonly accepted barometer of these changes is Engineering News Record's (ENR) Construction Cost Index (CCI) that is computed from prices of construction materials and labor based on a value of 100 in the year 1913. Costs in this study are based on the Greater Los Angeles ENR CCI of 11155 from July 2016.

The tables presented in Appendix G summarize the estimated capital, O&M, and energy unit cost assumptions for all facilities and processes considered in the Task 5 Alternatives Analysis of the One Water LA 2040 Plan. Conceptual unit costs were developed based on other similar projects, industry publications, and typical pipeline installation costs; the sources of the information are stated in the footnotes of each table.

Some projects, where the projects have already been well-defined, have capacity cost assumptions based on preliminary design reports or other planning documents.

APPENDIX A – REFERENCES

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APPENDIX B – STUDY AREA AND BOUNDARY CONDITIONS

Although the study area of the One Water LA 2040 Plan is focused on the City of Los Angeles boundaries, the sphere of influence extends beyond the City boundary, which is depicted on Figure B.1. The City boundary encompasses an area of approximately 301,500 acres or 426 square miles, which is inhabited by approximately four million people. The City's potable water service area closely mirrors that of the City Boundary. The water service area encompasses approximately 305,700 acres or 478 square miles and is typically divided into the following four sub areas; Harbor, Metro, Valley, and Westside.

The City overlays eight (8) groundwater basins that partially extend beyond the City boundary as depicted on Figure B.2, with the largest basin being the San Fernando Basin, located north of the Santa Monica Mountains. This basin is an important local water supply source for the City. The other two basins that are underlying the northern part of the city are the Sylmar Basin and the Verdugo Basin. Additionally, there are five basins located south of the Santa Monica Mountains: Hollywood Basin, Santa Monica Basin, Eagle Rock Basin, West Coast Basin, and Central Basin.

The watershed areas that are tributary to each of these basins are shown on Figure B.3. As shown, There are 5 major watershed areas (Los Angeles River, Ballona Creek, Dominguez, Santa Monica Bay, and Marina Del Rey) that encompass the City and drain water from outside the City boundaries into the City where it either infiltrates into the underlying groundwater aquifers or gets discharged into the ocean via storm drains, creeks, surface flows, direct runoff to the ocean, direct runoff to other receiving waters from adjacent land areas, or the LA River.

The Regional Water Quality Control Board (RWQCB) has divided the LA River into six major reaches, which are depicted on Figure B.4. Reach 1 and Reach 2 are located outside the City boundary as well as many of the upstream creeks that feed into the LA River. Therefore, flows from outside the City boundary enter the City through the river, which ultimately discharges through the Long Beach Harbor into the ocean.

The City's wastewater service area extends beyond the City boundary to the east and south as shown on Figure B.5. In addition, there are areas that are currently not connected to the wastewater system, which have been excluded from the wastewater service area boundary. The City receives wastewater from 29 contract agencies that are located outside the City boundary, such as portions of the cities of Glendale and Burbank. The City's wastewater service area encompasses approximately 305,280 acres or 477 square miles, of which 291,840 acres or 456 square miles are located within the City. The wastewater service area has been divided into the following seven (7) major sewersheds: Hyperion Water Reclamation Plant (HWRP), Coastal Interceptor Sewer (CIS), Donald C. Tillman Water Reclamation Plant (DCTWRP), Foreman Line (FL), Los Angeles – Glendale Water Reclamation Plant (LAGWRP), Terminal Island Water Reclamation Plant (TIWRP), and Valley Spring Lane (VSL).

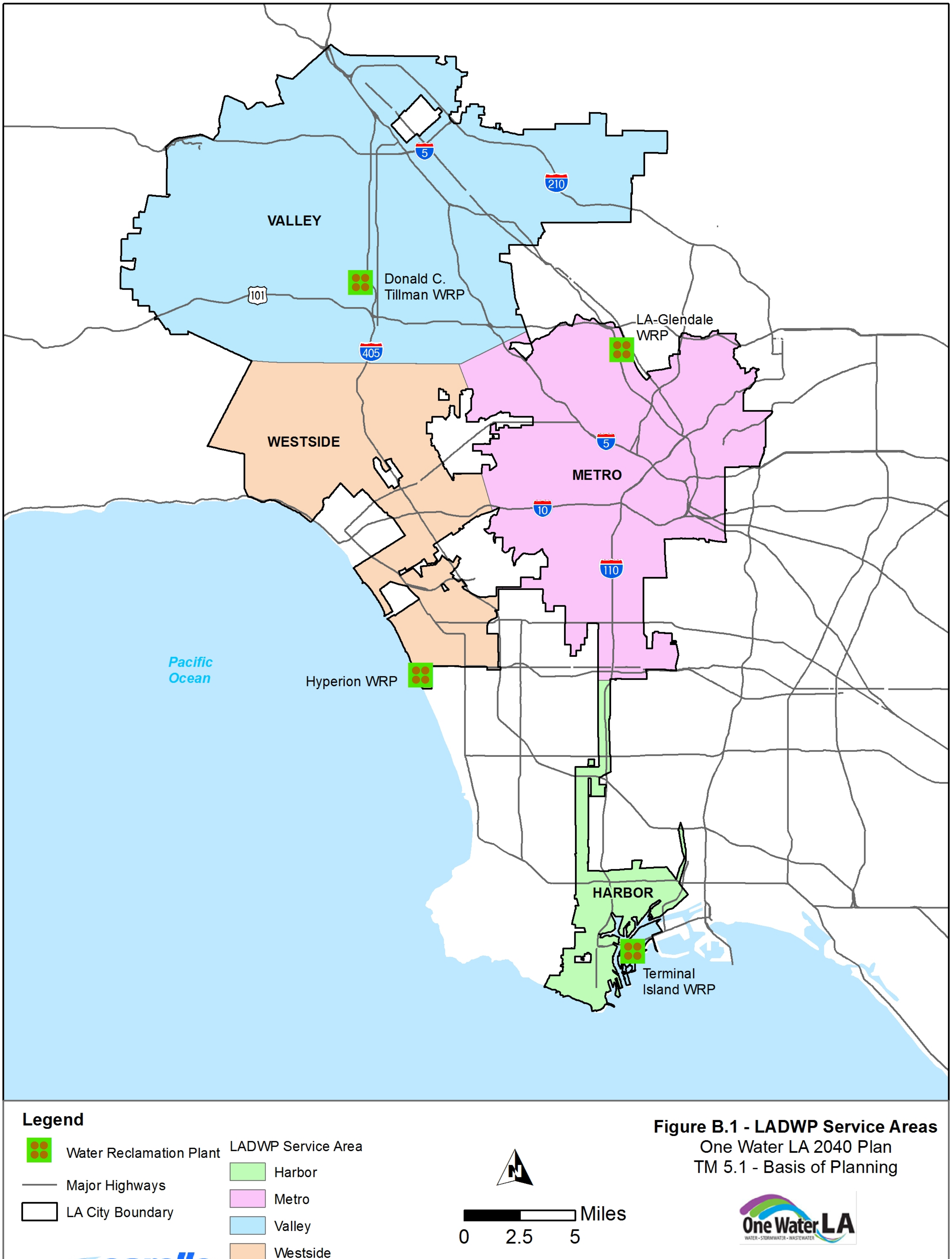

Figure B.1 - LADWP Service Areas
One Water LA 2040 Plan
TM 5.1 - Basis of Planning

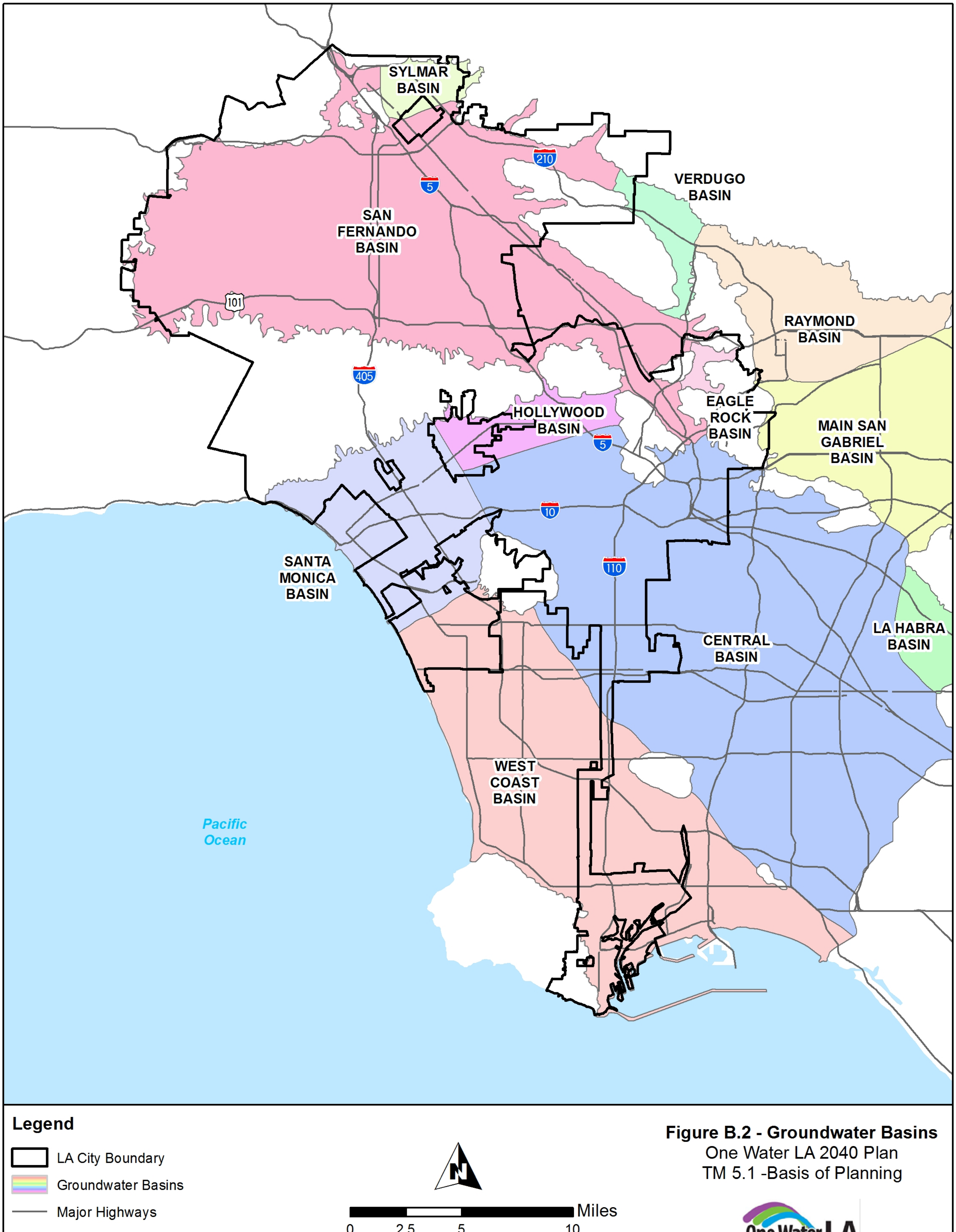

Figure B.2 - Groundwater Basins
One Water LA 2040 Plan
TM 5.1 -Basis of Planning

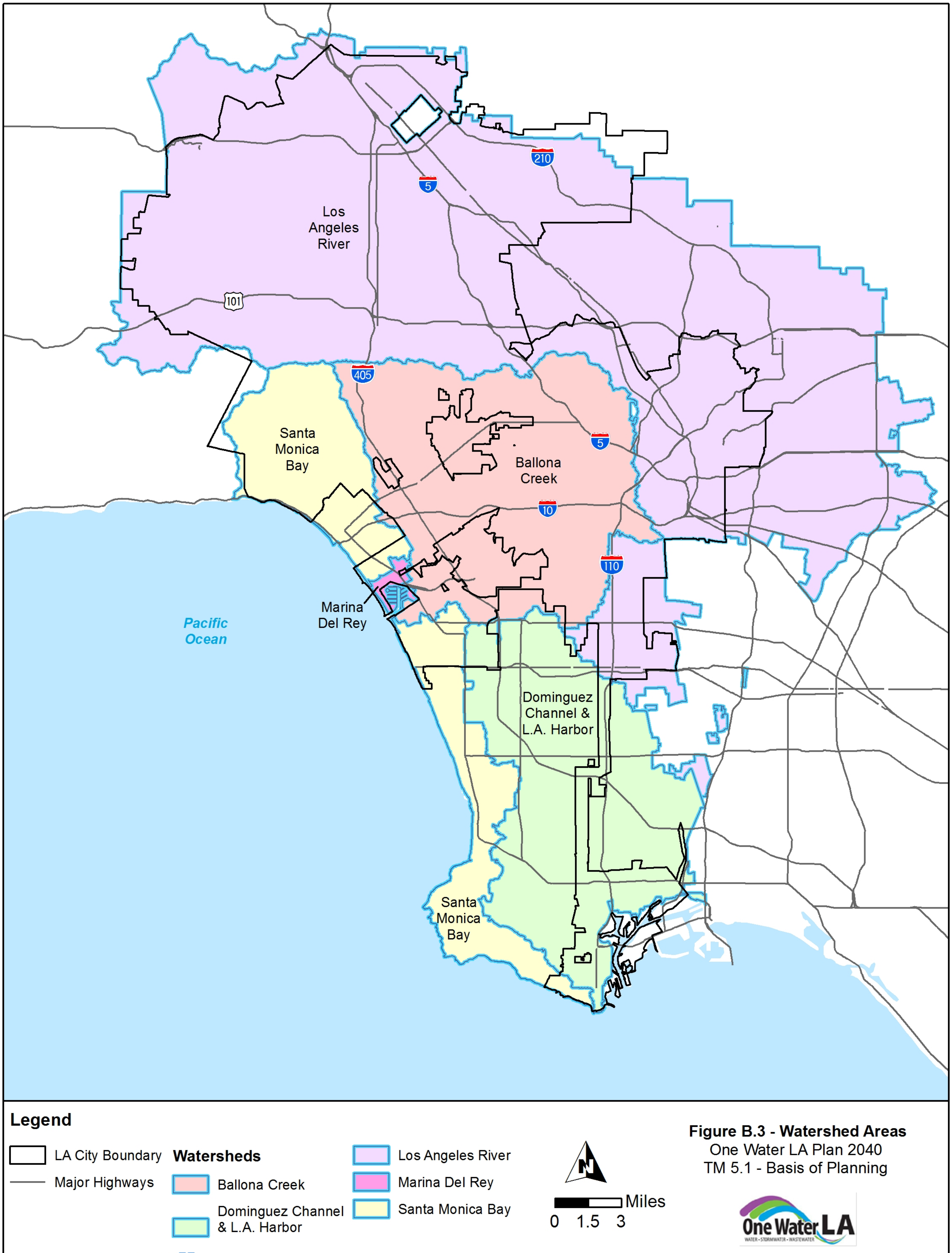

Figure B.3 - Watershed Areas
One Water LA Plan 2040
TM 5.1 - Basis of Planning

One Water LA

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Figure B.4 - LA River and Major Creeks
One Water LA 2040 Plan
TM 5.1 - Basis of Planning

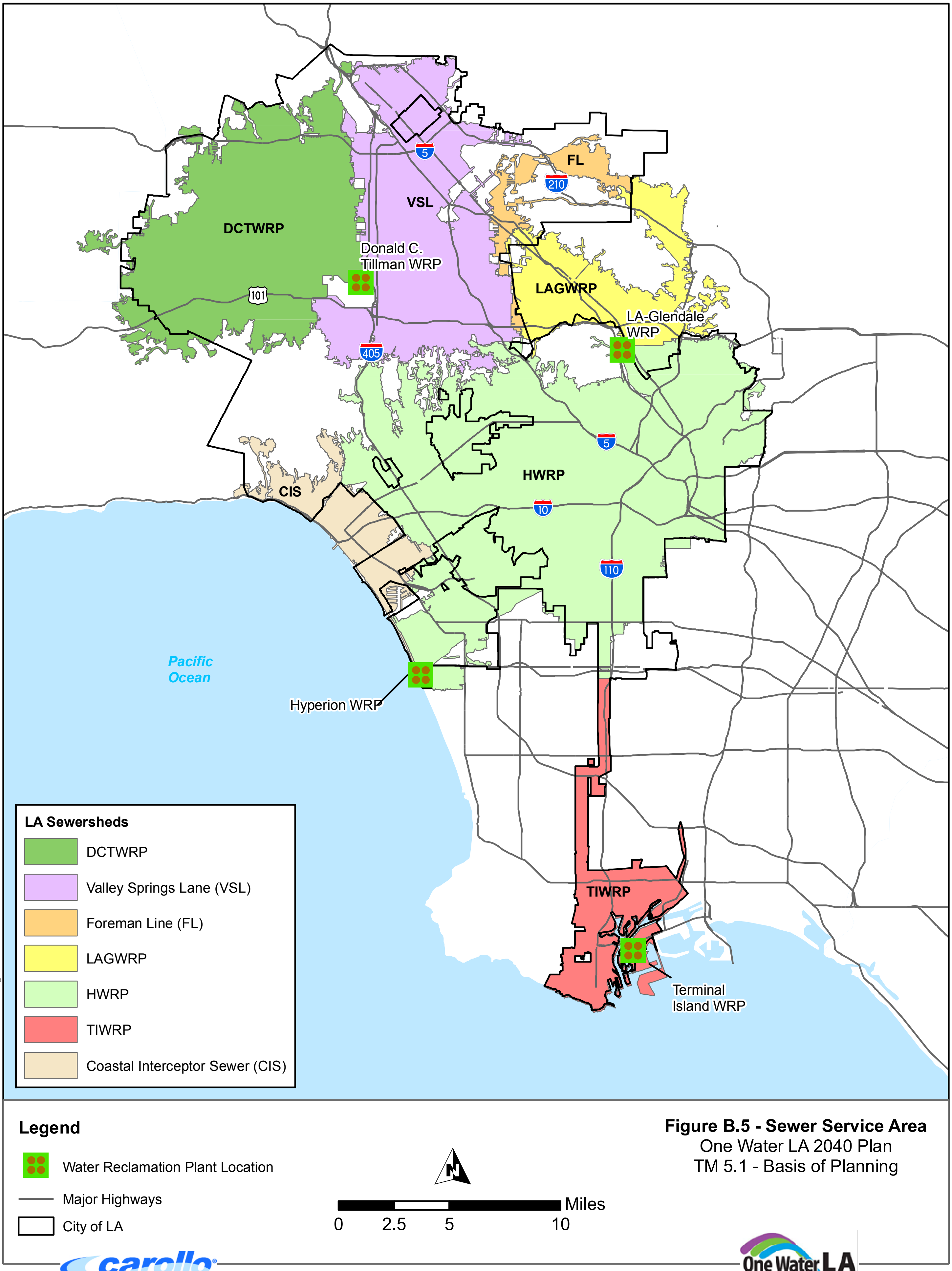

Figure B.5 - Sewer Service Area
One Water LA 2040 Plan
TM 5.1 - Basis of Planning

APPENDIX C – EVALUATION CRITERIA DETAILS

This Appendix includes detailed descriptions of the 18 evaluation criteria listed in Table C.1. In addition, the criteria correlation exercise that demonstrates how the One Water LA Guiding Principles, and the LA Basin Stormwater Conservation Plan were used to develop the draft evaluation criteria is tabulated at the end of this appendix in Table C.20.

Table C.1 Evaluation Categories and Criteria One Water LA 2040 Plan – TM 5.1

Category	Criteria	Appendix Table
Economic	Unit Cost	Table C.2
	Financial Benefits	Table C.3
	Funding Mechanism	Table C.4
	Likelihood to Obtain Outside Funding	Table C.5
Resiliency	Drought Resiliency	Table C.6
	Earthquake Resiliency	Table C.7
	Flood Risk Mitigation	Table C.8
	Local Supply Benefit	Table C.9
	Energy Impact/Greenhouse Gas Emissions	Table C.10
Implementation	Constructability	Table C.11
	Institutional Collaboration	Table C.12
	Regulatory Approval	Table C.13
	Public Engagement	Table C.14
	Public and Political Support	Table C.15
Environmental	Environmental Justice	Table C.16
	Open/Natural Space and Recreational Benefit	Table C.17
	Stormwater Quality	Table C.18
	Ecological Benefit	Table C.19

Table C.2 Economic – Unit Cost
One Water LA 2040 Plan – TM 5.1

CRITERIA	Unit Cost
CATEGORY	Economic
DESCRIPTION	Evaluate the unit cost of water supply for the project. It is calculated as: $Unit\ Cost = \frac{Annualized\ Capital\ Cost + Annual\ O\&M\ Cost}{Annual\ Net\ Yield}$, where $Annual\ Net\ Yield = Total\ Annual\ Yield - Annual\ Demand\ Created$. The unit cost calculation includes both capital cost and operation & maintenance (O&M) costs. Land acquisition costs are not included. Annual amortized costs are based on typical inflation rates, interest rates, and life expectancies.

SCORE	SCORE DEFINITION
5	Overall Rating - Very Low Cost • Less than $1,000/AF
4	Overall Ratings - Low Cost • $1,000-2,500/AF
3	Overall Ratings - Medium Cost • $2,500-4,000/AF
2	Overall Ratings - High Cost • $4,000-6,000/AF
1	Overall Rating - Very High Cost • greater than $6,000/AF

Table C.3	Economic – Financial Benefits One Water LA 2040 Plan – TM 5.1
CRITERIA	Financial Benefits
CATEGORY	Economic
DESCRIPTION	Evaluate financial merits and financial impacts should the Project be implemented, OR consequences if the Project is not implemented considering opportunity cost, revenue loss, avoidance of repairs, damage/restoration or fine costs.
SCORE	**SCORE DEFINITION**
5	Overall Ratings - No Financial Impact • No financial impact - additional revenue is not required OR • If project is not implemented, major financial consequences from revenue loss, repairs, damage/restoration, and fines
4	Overall Ratings - Low Financial Impact • Unlikely to require additional revenue OR • If project is not implemented, high financial consequences from revenue loss, repairs, damage/restoration, and fines
3	Overall Ratings - Medium Financial Impact • Possible to require additional revenue OR • If project is not implemented, medium financial consequences from revenue loss, repairs, damage/restoration, and fines
2	Overall Ratings - High Financial Impact • Likely to require additional revenue OR • If project is not implemented, low financial consequences from revenue loss, repairs, damage/restoration, and fines
1	Overall Rating - Major Financial Impact • Very likely to require additional revenue OR • If project is not implemented, no financial consequences from revenue loss, repairs, damage/restoration, and fines

Table C.4 Economic – Funding Mechanism
One Water LA 2040 Plan – TM 5.1

CRITERIA	Funding Mechanism
CATEGORY	Economic
DESCRIPTION	Evaluate the opportunity for the Project to be funded using existing funding mechanisms or structures, creating new funding mechanisms, and the ability to gain sufficient revenue from those mechanisms for funding the Project. New funding mechanisms would include items such as creating a new type of charge (e.g. a stormwater fee, where there is not one already). Existing structures include existing rates or fees.

SCORE	SCORE DEFINITION
5	Overall Rating - Traditional Funding Mechanism • Project has funding mechanism/structures in place • Project can be funded from existing revenues
4	Overall Rating - Very likely to be Funded • Project has funding mechanism/structures in place • Project can be funded by deferring or modifying other projects to free-up resources
3	Overall Rating - Likely to be Funded • Project has funding mechanism/structures in place OR • Project can be funded with low rate increases/low fees OR • Project can be funded by forgoing other projects to free-up resources
2	Overall Rating - Less Likely to be Funded • Project requires new funding mechanism/structure, but the mechanism can be created relatively simply OR • Project can be funded with medium rate increases/medium fees
1	Overall Rating - Least likely to be Funded • Project requires new funding mechanism/structure OR • Project requires high rate increases/high fees AND/OR • Project requires large modifications to the overall capital improvement plan (CIP)

Table C.5	Economic –Likelihood to Obtain Outside Funding One Water LA 2040 Plan – TM 5.1
CRITERIA	Likelihood to Obtain Outside Funding
CATEGORY	Economic
DESCRIPTION	Evaluate the opportunity to obtain outside funding based on mutual project benefits aligned with departmental/agency/organizational missions and the portion of the project that could receive outside funding. Outside funding is defined as funds from State, Federal, Regional entities or community grant or low-interest loan programs. (Note: assume outside funding is available).
SCORE	**SCORE DEFINITION**
5	Overall Rating - Expectation to receive outside funding • Expectation to obtain outside funding based on mutual project benefits aligned with departmental/agency/organizational missions • Assumes benefitting agencies pay proportional share of cost • Nearly identical types of projects have defined mutual benefits/obtained outside funding
4	Overall Rating - Very likely to receive outside funding • Very likely opportunity to obtain outside funding based on mutual project benefits aligned with departmental/agency/organizational missions • Assumes benefiting agencies pay some share of cost • Similar projects have defined mutual project benefits/obtained outside funding
3	Overall Rating - Likely to receive outside funding • Likely opportunity to obtain outside funding based on mutual project benefits aligned with departmental/agency/organizational missions • Assumes benefitting agencies share resources but not costs • Similar projects have defined mutual project benefits; however, have yet to obtain outside funding
2	Overall Rating - Less likely to receive outside funding • Less likely opportunity to obtain outside funding based on mutual project benefits aligned with departmental/agency/organizational missions • Similar projects are included in departmental/agency/organizations funding strategy but have yet to define mutual benefits/obtain outside funding
1	Overall Rating - Least likely to receive outside funding • Least likely opportunity to obtain outside funding based on multiple project benefits aligned with departmental/agency/organizational missions • Would require significant coordination with departmental/agency/organizations to establish mutual benefits/receive outside funding

Table C.6	**Resiliency – Drought Resiliency One Water LA 2040 Plan – TM 5.1**
CRITERIA	Drought Resiliency
CATEGORY	Resiliency
DESCRIPTION	Evaluate the ability for a project to provide water during a drought. This will be calculated by a ratio between normal and dry year supplies as follows: $Drought\ resiliency\ ratio = \frac{Volume\ of\ water\ available\ in\ a\ dry\ year}{Volume\ of\ water\ available\ in\ a\ normal\ year}$

SCORE	**SCORE DEFINITION**
5	Overall Rating - Very robust • Drought proofing ratio = 95-100%, meaning that that the amount of water available in a dry year ranges is the same in a normal year
4	Overall Ratings - Robust • Drought proofing ratio = 90-95%
3	Overall Ratings - Intermediate • Drought proofing ratio = 85-90%
2	Overall Ratings - Less robust • Drought proofing ratio = 80-85%
1	Overall Rating - Not robust • Drought proofing ratio less than 80%, meaning that no water is available in a dry year

Table C.7 Resiliency – Earthquake Resiliency
One Water LA 2040 Plan – TM 5.1

CRITERIA	Earthquake Resiliency
CATEGORY	Resiliency
DESCRIPTION	Evaluate the ability for the project to withstand earthquakes, based on the ability for the project to deliver water after a major earthquake, the duration operation may be interrupted after a major earthquake and the facility type.

SCORE	SCORE DEFINITION
5	Overall Rating - Highly robust • Project is highly unlikely to be damaged during an earthquake • Water is likely to be delivered immediately (within 4 hours) after an earthquake • Concept has significant distributed water supply facilities such as groundwater wells
4	Overall Rating - Robust • Project is unlikely to be damaged during an earthquake • Water is likely to be delivered within 1-2 days after an earthquake • Concept has distributed water supply facilities such as groundwater wells
3	Overall Rating - Average • Project may/may not be damaged during an earthquake • Water is likely to be delivered within 1-2 weeks after an earthquake • Concept includes centralized facilities
2	Overall Rating - Fragile • Project is likely to be damaged during an earthquake • Water is likely to be delivered within 3 months after an earthquake • Concept includes significant centralized facilities without redundancy
1	Overall Rating - Very fragile • Project is highly likely to be damaged during an earthquake • Project is likely to be out of service greater than 3 months after an earthquake • Concept includes long stretches of pipelines without redundancy

Table C.8	**Resiliency – Flood Risk Mitigation One Water LA 2040 Plan – TM 5.1**
CRITERIA	Flood Risk Mitigation
CATEGORY	Resiliency
DESCRIPTION	Evaluate the ability for the project to mitigate and/or reduce existing flood risk.
SCORE	**SCORE DEFINITION**
5	Overall Rating - Regional (neighborhood) benefit • Project mitigates/reduces existing flood risk on a regional basis
4	Overall Rating - Local (multi-parcel) benefit • Project mitigates/reduces existing flood risk on a local basis
3	Overall Rating - No benefit or impact • Project does not mitigate/reduce existing flood risk
2	Overall Rating - Local (multi-parcel) impact • Project may increase flood risk on a local basis
1	Overall Rating - Regional (neighborhood) impact • Project may increase flood risk on a regional basis

Table C.9	**Resiliency – Local Supply Benefit One Water LA 2040 Plan – TM 5.1**
CRITERIA	Local Supply Benefit
CATEGORY	Resiliency
DESCRIPTION	Evaluate the ability for the project to deliver local supplies to the City, offsetting purchased imported water supplies.
SCORE	**SCORE DEFINITION**
5	Overall Rating - Very high • Greater than 75,000 AFY of local supply
4	Overall Rating - High • 20,000-75,000 AFY of local supply
3	Overall Rating - Medium • 10,000-20,000 AFY of local supply
2	Overall Rating - Low • 2,500-10,000 AFY of local supply
1	Overall Rating - Very low • Less than 2,500 AFY of local supply

Table C.10 Resiliency – Energy Impact/Greenhouse Gas Emissions One Water LA 2040 Plan – TM 5.1	
CRITERIA	Energy Impact/Greenhouse Gas Emissions
CATEGORY	Resiliency
DESCRIPTION	Evaluate power consumption, defined as amount of power used per unit of water processed (kWh per acre-foot [AF] of water). The total annual energy consumption per unit of supply is the metric for greenhouse gas emissions and associated climate change impacts. Power can be from a variety of sources with preference to renewable energy.
SCORE	**SCORE DEFINITION**
5	Overall Rating - Net-zero Energy Impact • Zero kWh/AF
4	Overall Rating - Low Energy Impact • 0-500 kWh/AF
3	Overall Rating - Moderate Energy Impact • 500-2,000 kWh/AF
2	Overall Rating - High Energy Impact • 2,000-4,000 kWh/AF
1	Overall Rating - Very High Energy Impact • Greater than 4,000 kWh/AF

Table C.11 Implementation – Constructability
One Water LA 2040 Plan – TM 5.1

CRITERIA	Constructability
CATEGORY	Implementation
DESCRIPTION	Evaluate the ease of constructing the project. Types of major project components that are considered include groundwater injection or extraction wells, pipelines, treatment plants, green infrastructure, habitat restoration, wetlands etc. (Does not include land acquisition).

SCORE	SCORE DEFINITION
5	Overall Rating - Very straight-forward • Nearly all project components are located inside the fence (of a City parcel or treatment facility) • No underground utilities • Project is expected to be significantly less complicated to construct compared to a typical project
4	Overall Rating - Straight-forward • Most project components are located inside the fence and some outside the fence • Less than 5 miles of underground utilities • Project is expected to be less complicated to construct compared to a typical project
3	Overall Rating - Typical • Project components are located both inside and outside the fence • 5-20 miles of underground utilities • Project is expected to have typical construction concerns
2	Overall Rating - Difficult • Most project components are located outside the fence • 20-50 miles of underground utilities • Project will be difficult to construct
1	Overall Rating - Very difficult • Nearly all project components are located outside the fence • Greater than 50 miles of underground utilities • Project will be extremely difficult to construct

Table C.12 Implementation – Institutional Collaboration
One Water LA 2040 Plan – TM 5.1

CRITERIA	Institutional Collaboration
CATEGORY	Implementation
DESCRIPTION	The potential to create a framework supporting collaboration on current/future Projects/Programs between City departments, partners, stakeholders and outside agencies OR opportunity for collaboration based on benefits that are aligned with departmental/agency/organizational missions measured by the ability to increase collaboration between City departments, partners, stakeholders and outside agencies (such as Metropolitan Water District [Metropolitan] or METRO).

SCORE	SCORE DEFINITION
5	Overall Rating - Very significant collaboration benefit • Very significant potential to create a framework supporting collaboration on current/future Projects/Programs between City departments, partners, stakeholders and outside agencies OR • Project/program increases collaboration between many City departments, partners, stakeholders and outside agencies
4	Overall Rating - Significant collaboration benefit • Significant potential to create a framework supporting collaboration on current/future Projects/Programs between City departments, partners, stakeholders and outside agencies OR • Project/program increases collaboration between a few City departments, partners, stakeholders and outside agencies
3	Overall Rating – Some collaboration benefit • Some potential to create a framework supporting collaboration on current/future Projects/Programs between City departments, partners, stakeholders and outside agencies OR • Project/program increases collaboration between a couple of City departments, partners, stakeholders and outside agencies
2	Overall Rating – Minimal collaboration benefit • Minimal potential to create a framework supporting collaboration on current/future Projects/Programs between City departments, partners, stakeholders and outside agencies OR • Project/program involves a single City department with minimal collaboration required from partners, stakeholders and outside agencies
1	Overall Rating - No collaboration benefit • No potential to create a framework supporting collaboration on current/future Projects/Programs between City departments, partners, stakeholders and outside agencies OR • Project/program involves a single City department with no collaboration required from partners, stakeholders and outside agencies

Table C.13 Implementation – Regulatory Approval One Water LA 2040 Plan – TM 5.1	
CRITERIA	Regulatory Approval
CATEGORY	Implementation
DESCRIPTION	Evaluate the regulatory approval requirements for the Project. Considers whether existing regulatory framework exists for approving the project, such as California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA).
SCORE	**SCORE DEFINITION**
5	Overall Rating - Mandated regulations in place • Project is part of a mandated regulatory program • Existing regulations are sufficient for the project • Processes for obtaining regulatory approval are already in place
4	Overall Rating - Existing regulations are sufficient • Project is not part of a mandated regulatory program • Existing regulations are sufficient for the project • Processes for obtaining regulatory approval are already in place
3	Overall Rating - Some regulations may need drafting • Project meets recently adopted regulations; however may be the first of its kind in the region
2	Overall Rating - Significant regulations need to be drafted • Some new regulations will be required • Some clarity exists on anticipated future regulatory requirements
1	Overall Rating - Extremely significant regulations need to be drafted • Substantial new regulations will be required • Limited clarity exists on anticipated future regulatory requirements

Table C.14 Implementation – Public Engagement One Water LA 2040 Plan – TM 5.1	
CRITERIA	Public Engagement
CATEGORY	Implementation
DESCRIPTION	Evaluate the opportunity for the public to be engaged in and take ownership of the Project/Program from initial project planning through implementation, and after project completion (through presentations, solicitation of input/feedback, ongoing education programs, volunteer opportunities, potential maintenance partnerships, etc.).

SCORE	**SCORE DEFINITION**
5	Overall Rating - Very Significant Engagement Opportunities • Very significant opportunities for active and continuous public engagement in project planning, implementation and after project completion
4	Overall Rating - Significant Engagement Opportunities • Significant opportunities for active public engagement in project planning, implementation and after project completion
3	Overall Rating - Some Engagement Opportunities • Some opportunities for public engagement in project planning, implementation and after project completion
2	Overall Rating - Limited Engagement Opportunities • Limited opportunities for public engagement in project planning, implementation and after project completion
1	Overall Rating - Very Limited Engagement Opportunities • Very Limited opportunities for public engagement in project planning, implementation and after project completion

Table C.15 Implementation – Public and Political Support
One Water LA 2040 Plan – TM 5.1

CRITERIA	Public & Political Support
CATEGORY	Implementation
DESCRIPTION	Level of City Hall, City Council, Commissioners, Mayor's Office, non-governmental organizations (NGOs), Neighborhood Councils, other governmental agencies, and the public or other political stakeholders support, acceptance and willingness to embrace and be involved in the Project.

SCORE	**SCORE DEFINITION**
5	Overall Rating - Highly favorable • Expect the public & political stakeholders to perceive the project very positively • Expect the public & political stakeholders to embrace the project quickly as being good for the City
4	Overall Rating - Favorable • Expect the public & political stakeholders to perceive the project positively
3	Overall Rating - Neutral/Mixed • Expect the public & political stakeholders to have a mixed opinion of the project, with some support and some opposition
2	Overall Rating - Less favorable • Expect the public & political stakeholders to perceive the project negatively • Expect opposition from the public & political stakeholders on the project
1	Overall Rating - Not favorable • Expect the public & political stakeholders to perceive the project very negatively • Expect significant opposition from the public & political stakeholders on the project

Table C.16 Implementation – Environmental Justice
One Water LA 2040 Plan – TM 5.1

CRITERIA	Environmental Justice
CATEGORY	Environmental
DESCRIPTION	The fair treatment and meaningful involvement of all people in the development and implementation of a project (including the enforcement of environmental laws, regulations, and policies) with the goal of delivering specific benefits to previously underserved communities.

SCORE	SCORE DEFINITION
5	Overall Rating - Very beneficial • Strongly remedies past environmental injustices with significant benefits to underserved communities
4	Overall Rating - Beneficial • Remedies past environmental injustices with some benefits to underserved communities
3	Overall Rating - Neutral • No environmental justice impacts on underserved communities
2	Overall Rating - Some impacts • Somewhat negatively impacts underserved communities
1	Overall Rating - Significant impact • Negatively impacts underserved communities

Table C.17	Environmental – Open/Natural Space and Recreational Benefit One Water LA 2040 Plan – TM 5.1
CRITERIA	Open/Natural Space and Recreational Benefit
CATEGORY	Environmental
DESCRIPTION	Level to which the project creates locations of open/natural space for recreation. Defined as the amount of open/natural space created. Paved open space is not considered beneficial. Turf is limited to recreational benefits.

SCORE	SCORE DEFINITION
5	Overall Rating - Very beneficial • Creation of large amounts of open/natural space • Creation of large amounts of recreational opportunities
4	Overall Rating - Beneficial • Creation of small amounts of open/natural space • Creation of small amounts of recreational opportunities
3	Overall Rating - Neutral • No open/natural space created • No recreational opportunities created
2	Overall Rating - Harmful • Negatively impacts small amounts of open/natural space • Negatively impacts small amounts of land previously used for recreation
1	Overall Rating - Very harmful • Negatively impacts large amounts of open/natural space • Negatively impacts small amounts of land previously used for recreation

Table C.18	**Environmental – Stormwater Quality One Water LA 2040 Plan – TM 5.1**
CRITERIA	Stormwater Quality
CATEGORY	Environmental
DESCRIPTION	The goal is assessing the quality of stormwater and dry water runoff reaching rivers and oceans. This will be calculated by stormwater and dry water runoff volume reduction to meet Total Maximum Daily Load (TMDL) compliance.
SCORE	**SCORE DEFINITION**
5	Overall Rating - High Volume Reduction to meet TMDLs • Project reduces greater than 20% of the water needed for Total Maximum Daily Load (TMDL) compliance
4	Overall Rating - Medium Volume Reduction to meet TMDLs • Project reduces 10-20% of the water needed for TMDL compliance
3	Overall Rating - Low Volume Reduction to meet TMDLs • Project reduces 5-10% of the water needed for TMDL compliance
2	Overall Rating - No Volume reduction to meet TMDLs • Project reduces 0-5% of the water needed for TMDL compliance
1	Overall Rating - Increases stormwater volume • Increase in stormwater flows • Increase need for other measures in the watershed to achieve TMDL compliance

Table C.19 Environmental – Ecological Benefit One Water LA 2040 Plan – TM 5.1	
CRITERIA	Ecological Benefit
CATEGORY	Environmental
DESCRIPTION	Degree of potential ecological benefit, defined by: restoring ecosystems, improving watershed health/ecosystem function/connectivity, minimizing pollutants, improving air quality and reducing heat-island impacts.

SCORE	SCORE DEFINITION
5	Overall Rating - Significant benefits • Significantly restores ecosystems, improves watershed health, improving ecosystem function/connectivity • Significantly reduces pollutants to mitigate downstream impacts • Significant air quality improvement and heat-island reduction
4	Overall Rating - Moderate benefits • Moderately restores ecosystems, improves watershed health, improving ecosystem function/connectivity • Moderately reduces pollutants to mitigate downstream impacts • Moderately improves air quality • Moderately reduces heat-island impacts
3	Overall Rating - Neutral • Limited benefit and no known negative impact • No benefit or negative impact to air quality or heat-island impacts
2	Overall Rating - Moderate negative impacts • Moderate negative impacts to ecosystems, and watershed health, needed for ecosystem function/connectivity • Potential source of environmental pollutants • Air pollution mitigation required • Moderate negative heat-island impacts
1	Overall Rating - Significant negative impacts • Significant negative impacts to ecosystems and watershed health needed for ecosystem function/connectivity • Known source of environmental pollutants • Significant air pollution mitigation required • Significant heat-island impacts

Table C.20 Evaluation Criteria Comparison with Guiding Principles and LA Basin Plan
One Water LA 2040 Plan – TM 5.1

Category	Criteria	Metric	One Water LA Phase 1 Guiding Principles	LA Basin Conservation Plan (Project Evaluation)
Economic	Unit Cost	$/million gallons or $/acre-foot (AF) of water	Analyze financial merits of programs	Cost per unit stormwater conserved
	Financial Benefits	Qualitative - level of impact	Analyze financial merits of programs	n/a
	Funding Mechanism	Qualitative - degree of project funding complexity and availability	Identify opportunities for interdepartmental cost-sharing based on benefits aligned with departmental missions	n/a
	Likelihood to Obtain Outside Funding	Qualitative - a measure of the eligibility for outside funding	Maximize available state funding and explore private, local, state and federal funding opportunities to implement multi-benefit projects	n/a

Table C.20 Evaluation Criteria Comparison with Guiding Principles and LA Basin Plan
One Water LA 2040 Plan – TM 5.1

Category	Criteria	Metric	One Water LA Phase 1 Guiding Principles	LA Basin Conservation Plan (Project Evaluation)
Resiliency	Drought Resiliency	Drought resiliency ratio - % reduction of supply availability between normal and dry year	Consider supply availability; Improve water sustainability; Raise priority of water issues that impact sustainability	n/a
	Earthquake Resiliency	Qualitative - risk of supply failure after earthquake and the level of impact	Raise priority of water issues that impact emergency preparedness	n/a
	Flood Risk Mitigation	Qualitative - ability of a project to reduce existing flood risk and bring flood protection benefits	Support multi-purpose strategies for reducing impacts of localized flooding, emphasizing natural systems and green infrastructure	Flood Risk Mitigation
	Local Supply Benefit	Amount of local supply generated (AFY)	Align Mayor water resources plans to reduce the City's demand for potable water	n/a
	Energy Impact/ Greenhouse Gas Emissions	Power consumption (kilowatt [kWh]/AF water processed)	Identify citywide metrics for greenhouse gas emissions	Climate Adaptation; Energy Impact

Table C.20 Evaluation Criteria Comparison with Guiding Principles and LA Basin Plan
One Water LA 2040 Plan – TM 5.1

Category	Criteria	Metric	One Water LA Phase 1 Guiding Principles	LA Basin Conservation Plan (Project Evaluation)
Implementation	Constructability	Qualitative - ease of construction	Implement distributed (parcel-scale) solutions to achieve water sustainability objectives	Implementability/ Permitting/Site modification requirements
	Institutional Collaboration	Qualitative - ability to increase coordination between City departments, partners, stakeholders, and outside agencies	Enhance coordination and partnerships with regional water, transportation, education and other public agencies	Legal & institutional challenges
	Regulatory Approval	Qualitative - degree of dependence on regulations and ease of obtaining regulatory approval	Consider regulatory requirements	Implementability/ Permitting/Site modification requirements
	Public Engagement	Qualitative - willingness of the public to embrace/ support a project	Broaden community involvement; Increase public awareness and education for all water resource issues, with focus on influencing individual behaviors around water use	n/a
	Public & Political Support	Qualitative - level of political stakeholders support or acceptance	Create framework for integration and collaboration with City; Enhance coordination with NGOs; Engage elected officials and governing boards	n/a

Table C.20 Evaluation Criteria Comparison with Guiding Principles and LA Basin Plan One Water LA 2040 Plan – TM 5.1

Category	Criteria	Metric	One Water LA Phase 1 Guiding Principles	LA Basin Conservation Plan (Project Evaluation)
Environmental	Environmental Justice	Qualitative - perceived benefits/ impacts distributed throughout City	Incorporate environmental justice into decision-making on where projects are implemented, and focus on increasing benefits in underserved communities	Environmental Justice Impacts
	Open/Natural Space and Recreational Benefit	Qualitative - level to which creates locations of open/natural space or recreational areas	Consider water-energy-land use nexus	Recreation
	Stormwater Quality	Stormwater volume reduction into river/oceans	Support EWMP plans and LADWP SCMP	Stormwater Conservation; Water Quality Impact
	Ecological Benefit	Qualitative - degree in potential benefit or damage to ecosystems/flora/fauna	Consider environmental goals improve ecosystem restoration	Connectivity

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APPENDIX D – PROJECT DESCRIPTION TEMPLATE

A Project Description Template will be used to summarize both In-Progress Projects, and Potential Concepts in TM 5.2. The templates provide a clear and consistent structure ensuring a high level analysis of each project or concept. The information incorporated into these Project Description Templates will be conceptual and assumed based on information known as of November 2016. Previous plans will be used to develop the project information, which will be cited as endnotes, and assumed information will be typed in italic font. The City will utilize the information in the Project Description Templates to develop portfolios for the 2040 analysis.

The following template is to be used for In-Progress project or program descriptions.

IN-PROGRESS PROJECT #	
PROJECT CONCEPT NAME	Project/Program Name
PROJECT CONCEPT DESCRIPTION	*(Provide a one sentence description of the project.)*
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: ___ AFY ___ mgd Wet Year: ___ AFY ___ mgd Dry Year: ___ AFY ___ mgd Yield estimates are based on: *(List assumptions and/or sources used to develop yield estimates).* • Normal year: • Wet year: • Dry year:
ESTIMATED COST	Capital: O&M: Unit: Energy: *Cost assumptions: *(List assumptions and/or sources used to develop cost estimates).*

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
(Which of the following guiding principles does this project meet?)	☐ LASAN	☐ Caltrans
☐ Integrate management of water resources & policies	☐ LADWP	☐ LADOT
☐ Balance environmental, economic & societal goals	☐ BOE	☐ METRO
☐ Improve health of local watersheds	☐ RAP	☐ LA RiverWorks
☐ Improve local water supply reliability	☐ LA County Flood Control District	☐ HSR
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LAWA	☐ LAUSD
☐ Increase climate resilience	☐ Other (____)	
☐ Increase community awareness & advocacy for sustainable water		

GENERAL BACKGROUND/PURPOSE
(Provide a high-level description of project including funding history/sources/strategy, consequences if project does not happen etc.)
POTENTIAL CHALLENGES
(List challenges in bullets) •
EXPECTED TIMELINE
(Describe the general timeframe from 2016 to 2040)
SOURCES
1 *(Document sources for information described in template)*
Disclaimer: This Project Description is limited to conceptual planning level information, based on information known as of December 2016, & costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is typed in italic font.

The following template is to be used for Potential Concept descriptions.

CONCEPT OPTION #	
PROJECT CONCEPT NAME	**Project Name**
PROJECT CONCEPT DESCRIPTION	*(Provide a one sentence description of the project.)*
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: ___ AFY ___ mgd Wet Year: ___ AFY ___ mgd Dry Year: ___ AFY ___ mgd Yield estimates are based on: *(List assumptions and/or sources used to develop yield estimates).* • Normal year: • Wet year: • Dry year:
ESTIMATED COST	Capital: O&M: Unit: Energy: *Cost assumptions: *(List assumptions and/or sources used to develop cost estimates).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M
(Which of the following guiding principles does this project meet?) ☐ Integrate management of water resources & policies ☐ Balance environmental, economic & societal goals ☐ Improve health of local watersheds ☐ Improve local water supply reliability ☐ Implement, monitor, & maintain a reliable wastewater system ☐ Increase climate resilience ☐ Increase community awareness & advocacy for sustainable water	☐ LASAN ☐ Caltrans ☐ LADWP ☐ LADOT ☐ BOE ☐ METRO ☐ RAP ☐ LA RiverWorks ☐ LA County Flood Control District ☐ HSR ☐ LAWA ☐ LAUSD ☐ Other (Upper Los Angeles River Watershed Management Group)

PROJECT CONCEPT FLOW SCHEMATIC
(Insert process flow schematic)
GENERAL BACKGROUND/PURPOSE
(Provide a high-level description of project including funding history/sources/strategy, consequences if project does not happen etc.)
KEY CONCEPT COMPONENTS
(List key concept components in bullets) This project concept consists of the following key components: •
POTENTIAL CHALLENGES
(List challenges in bullets) •

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
(Describe the general timeframe from 2020 to 2040)	*(List triggers in bullets)* •

POTENTIAL CONCEPT EVALUATION CRITERIA
ECONOMIC CATEGORY
(Based on information known as of December 2016, provide assumptions for each criteria pertaining to the concept). • Estimated Unit Cost: • Financial benefits: • Funding mechanism: • Likelihood to obtain outside funding:
RESILIENCY CATEGORY
(Based on information known as of December 2016, provide assumptions for each criteria pertaining to the concept). • Drought Resiliency: • Earthquake Resiliency: • Flood Risk Mitigation: • Local supply benefits: • Energy Impact/Greenhouse Gas Emissions:
IMPLEMENTATION CATEGORY
(Based on information known as of December 2016, provide assumptions for each criteria pertaining to the concept). • Constructability: • Institutional collaboration: • Regulatory approval: • Public engagement: • Public & Political Support:
ENVIRONMENTAL CATEGORY
(Based on information known as of December 2016, provide assumptions for each criteria pertaining to the concept). • Environmental justice: • Open/Natural space and recreational benefit: • Stormwater Quality: • Ecological benefit:
SOURCES
1 *(Document sources for information described in template)*
Disclaimer: This Concept Description is limited to conceptual planning level information, based on information known as of November 2016, & costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is typed in italic font.

APPENDIX E – PAIRED COMPARISON ANALYSIS DETAILS

Paired Comparison Exercise

A paired comparison exercise was conducted to allocate weights to each of the 20 criteria. The criteria weighting exercise is critical as this is how the level of importance of each criteria is compared. Ultimately, the criteria weight influences the final rank of each project.

The entire Task 5 workgroup ranked each of the categories and criteria against each other on a 10-point scale. Average rankings and standard deviations for each of the criteria are listed in Table E.1 and are shown on Figure E.1.

Table E.1 Paired Comparison Results
One Water LA 2040 Plan – TM 5.1

Category	Criteria	Calculated Weight (%)	Standard Deviation	Average Weight Per Criteria
Economic	Unit Cost	5.9	2.6	5.6%
	Financial Benefits	5.8	1.2	
	Funding Mechanism	4.6	1.4	
	Likelihood to Obtain Outside Funding	3.7	1.5	
Resiliency	Drought Resiliency	6.4	2.2	5.6%
	Earthquake Resiliency	4.5	2.0	
	Flood Risk Mitigation	4.3	1.4	
	Local Supply Benefit	5.9	2.3	
	Energy Impact/Greenhouse Gas Emissions	3.8	1.8	
Implementation	Constructability	4.9	2.8	5.6%
	Institutional Collaboration	4.0	1.4	
	Regulatory Approval	6.1	1.4	
	Public Engagement	5.2	1.2	
	Public and Political Support	5.5	2.0	
Environmental	Environmental Justice	5.1	1.7	5.6%
	Open/Natural Space and Recreational Benefit	5.0	1.3	
	Stormwater Quality	5.5	1.7	
	Ecological Benefit	5.2	1.4	

As shown in Table E.1, the calculated relative weights of each of the 18 criteria ranges from 3.7 percent (eligibility for outside funding) to 6.4 percent (drought proofing). This equates to a variance of -26 percent to +28 percent compared to the average weight of 5.0 percent per criterion.

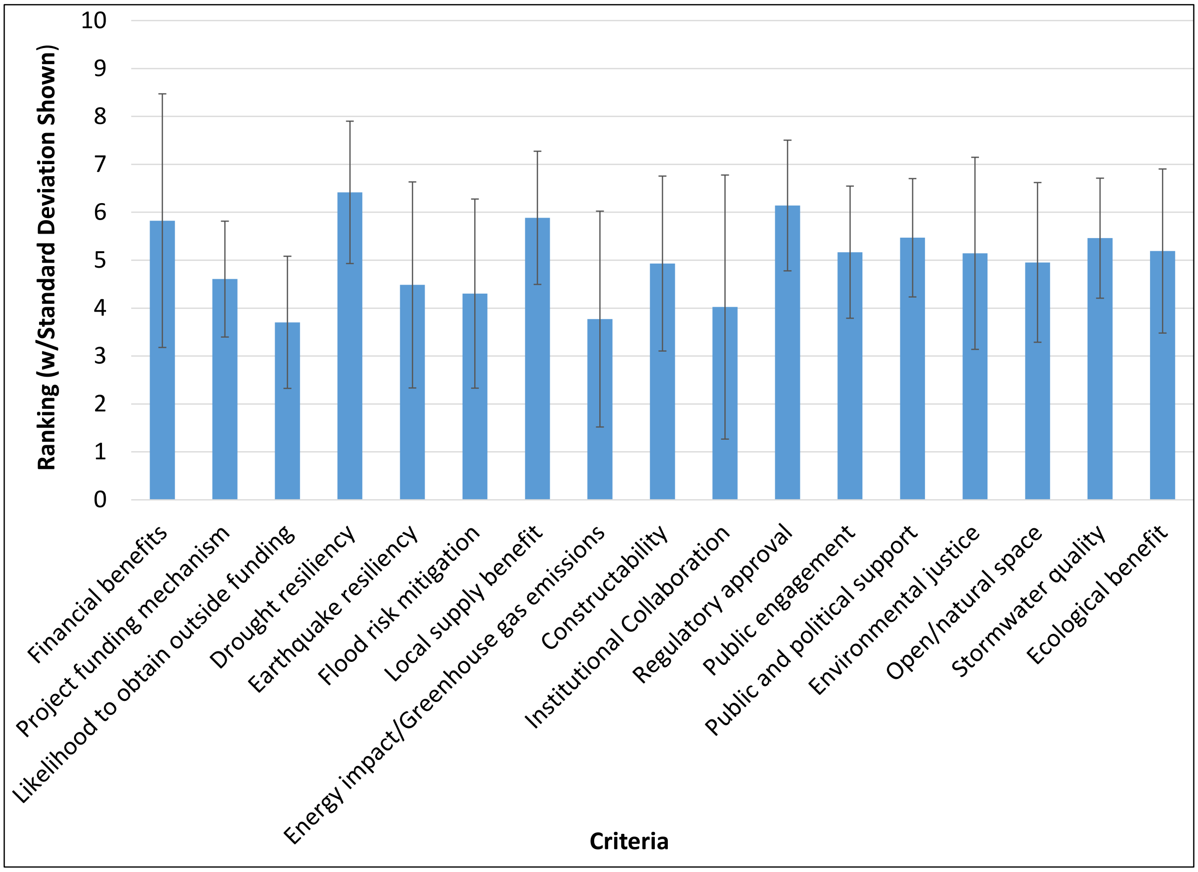

Figure E.1 Average Rankings and Standard Deviations for All Criteria

Table E.1 also shows that the average weight for each of the four criteria category is exactly 5 percent. Similarly, the average standard deviation of the four categories is very similar ranging from 1.7 to 2.0. Hence, all major categories have an equal average weight and project scores should be based on the individual criteria only. The weighting factors of the individual 18 evaluation criteria are graphically depicted from highest to lowest ranked on Figure E.2.

As shown on Figure E.2, the three highest scored criteria are Drought Proofing, Regulatory Compliance, and Local Supply Benefit. These criteria align strongly with the major water issues facing the City at this time. Projects that address these issues and provide local supply benefit benefits during droughts and/or contribute to regulatory compliance (of the upcoming stormwater quality TMDL deadlines) will therefore be given a higher weight in the project scoring. The three lowest scored criteria are Eligibility for outside funding, Climate Change impacts associated with GHG emissions, and Property Ownership. These criteria represent project elements that are not aligned with primary plan objectives and will be given a below average weight in the project scoring.

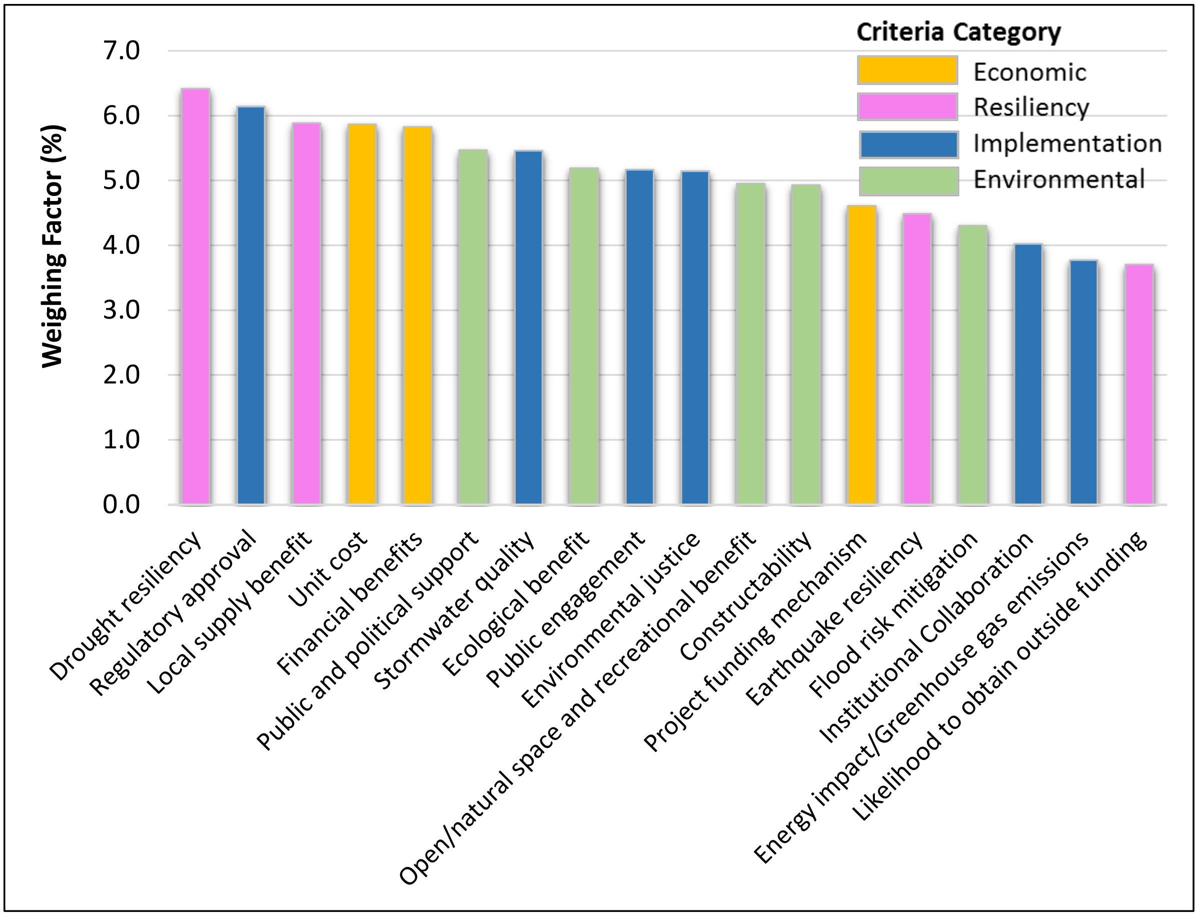

Figure E.2 Project Criteria Weighting Factors

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APPENDIX F – HYDROLOGIC ANALYSIS DETAILS

This Appendix includes the hydrologic analysis details. Annual precipitation WY totals as shown on Figure F.1 were used to determine statistics of the data set as shown in Table F.1.

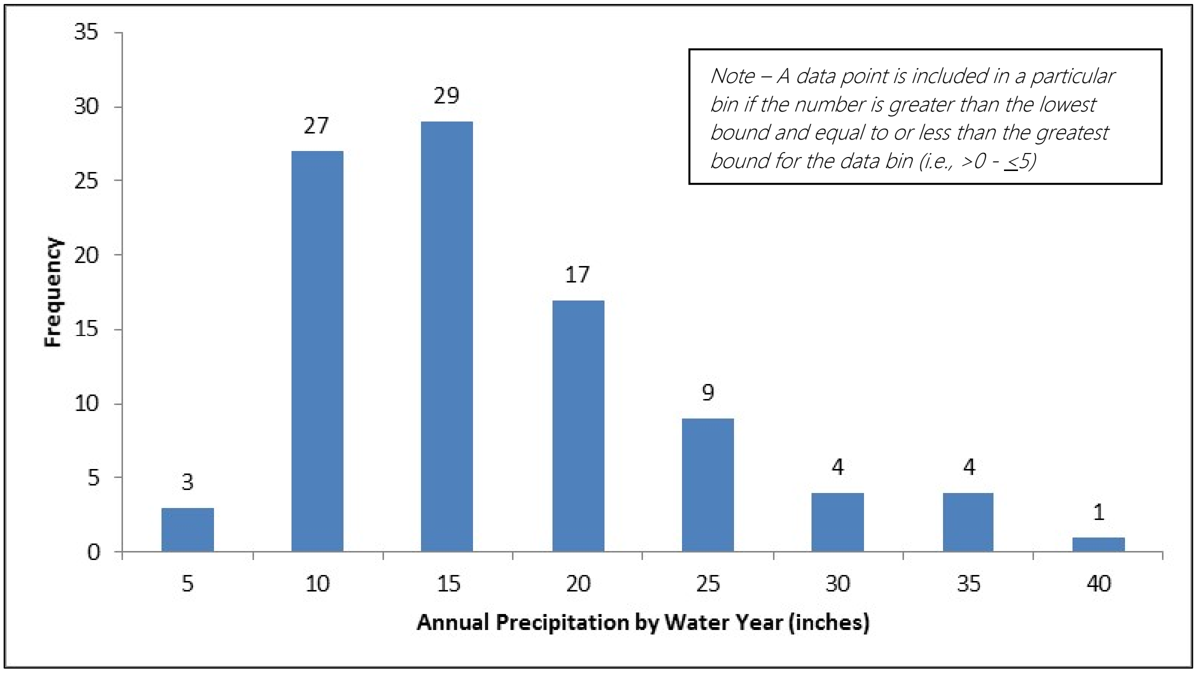


Figure F.1 Histogram of Annual Precipitation by Water Year from 1922 – 2015

Table F.1 Summary Statistics for Precipitation for WYs 1922 – 2015
One Water LA 2040 Plan – TM 5.1

Statistic		Description
Sample Size	94	The sample size, n, is the number of observations or data points. There are 94 WYs in the data set (1922 – 2015).
Average/Mean	14.41	The sample mean and median describe the central tendency or "location" of the data distribution. The arithmetic mean is the average value of the Water Year totals. The median is the "middle" value or the 50th Percentile, meaning that 50% of the data are less than the median. It is interesting to note that the median is 2 inches lower than the mean, indicating that dry years are more common than wet years.
Median	12.41	
1 Standard Deviation	7.23	The standard deviation and range (maximum, minimum) describe the spread of the data. More specifically, standard deviation characterizes the data spread relative to the average/mean.
1/2 Standard Deviation	3.61	
Maximum	37.54	
Minimum	3.73	
Skewness	1.03	Skewness describes the asymmetry of the distribution relative to the mean. A positive skewness indicates that the distribution has a longer right-hand tail (skewed towards more positive values). A negative skewness indicates that the distribution is skewed to the left.
Kurtosis	0.74	Kurtosis describes the peakedness or flatness of a distribution relative to the Normal distribution. Positive kurtosis indicates a more peaked distribution. Negative kurtosis indicates a flatter distribution.

The running 10-year average was computed by WY in order to identify the driest, normal (most closely reflecting average), and wettest 10-year periods. The purpose of this computation was to identify 10-year hydrologic sequences that represent the range of dry, normal, and wet year combinations. Results of this work is summarized below in Table F.2.

Table F.2 Summary of 10-Year Wet, Dry, and Normal Hydrologic Sequences for WYs 1922 - 2015
One Water LA 2040 Plan – TM 5.1

Hydrologic Sequence	Precipitation 10-yr Running Average (in)	10-Year Range (WYs)		Precipitation Range (using 10-yr Running Average [in])		Precipitation Range (using Actual Data [in])	
		Start	End	Max	Min	Max	Min
Wet	19.38	1935	1944	32.8	11.37	19.38	12.00
Dry	10.72	2006	2015	20.2	3.73	12.42	10.72
Normal	14.41	1968	1977	27.35	7.54	18.37	14.26

Finally, these 10-year hydrologic sequences, as well as all years in the period of record, were translated into dry, normal, and wet years to determine the sequencing of dry, normal, and wet years. A variety of commonly-used techniques were considered to characterize water years:

- Classification of annual precipitation into a tiered scheme, wherein the data set is evenly divided into thirds to represent dry, normal, and wet conditions. This approach was abandoned because of its arbitrary nature.

- Use of standard deviation, wherein a standard deviation represents the average distance from the mean. For this data set, one standard deviation is too large (7.23) as almost all years would be classified as normal. Therefore, 1/2 of a standard deviation was selected, as the selection of 1/2 of a standard deviation allows for an appropriate number of years to fall in each classification.

- Use of percent of normal, whereby normal is the average/mean for the period of record, and the percent of normal is calculated relative to that. The percent of normal was then classified into a tiered scheme (less than 75 percent of Normal is Dry; 75 percent - 125 percent of Normal is Normal; Greater than 125 percent is Wet).

Precipitation WY totals were ordered from lowest to highest, and 1/2 standard deviation was applied to the mean to characterize dry, normal, and wet conditions. Given a mean of 14.41 inches ± 1/2 standard deviation of 3.61 inches, the range of a Normal year is 10.80 – 18.03 inches. Therefore, Dry years are those with precipitation less than 10.80 inches; Wet years are those with precipitation greater than 18.03 inches. A histogram plot of the data is shown on Figure F.2.

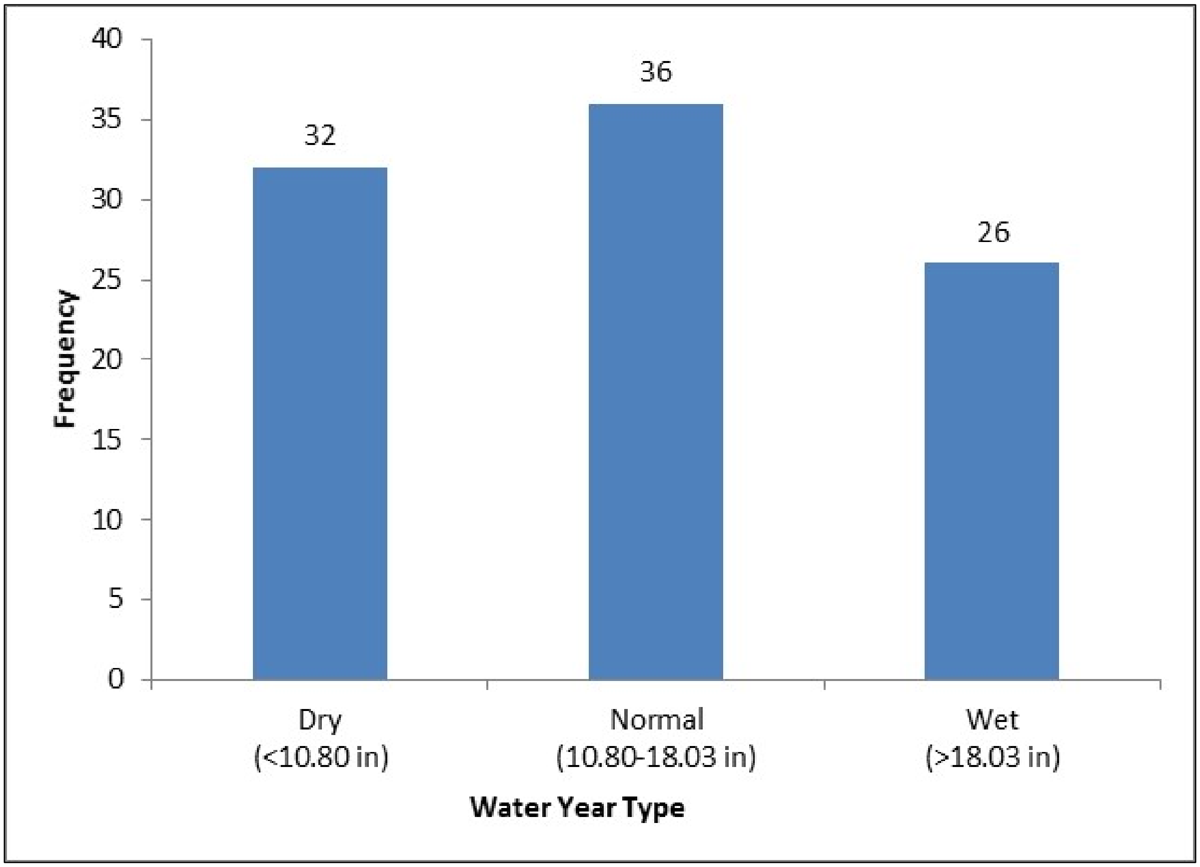


Figure F.2 Distribution of Dry, Normal, and Wet Years in the period 1922 - 2015

The third approach to this analysis characterized years based on the percent of normal precipitation, divided into a three-tiered scheme. The data frequency and histogram plot for this approach is the same as that for using 1/2 standard deviation.

Ultimately, these two approaches result in the same frequency and distribution of WY totals into 32 Dry, 36 Normal, and 26 Wet years over the 94-year period of record from downtown Los Angeles. Although the use of 1/2 standard deviation has more statistical significance, the percent of normal approach is easier to conceptualize and aligns with the method that LADWP uses to report its eastern Sierra snowpack.

APPENDIX G – COST ASSUMPTIONS INFORMATION

This Appendix includes detailed unit cost assumption information for the development of conceptual planning level cost estimates for the potential projects. Due to the conceptual planning level of the alternatives analysis, only major cost components of each project alternative will be developed using the unit cost and cost assumptions provided in the tables as indicated in Table G.1.

Table G.1 Evaluation Categories and Criteria One Water LA 2040 Plan – TM 5.1

Category	Criteria	Appendix Table
Construction Costs	Potable/Recycled Pipelines	Table G-2
	Sewer, Force Mains, and Brine Lines	Table G-3
	Pressure Reducing Stations	Table G-4
	Recharge Basins	Table G-5
	Stormwater Infiltration Drywell	Table G-6
	Tanks and Equalization Basins	Table G-7
	Water/Recycled Water Pump Stations	Table G-8
	Sewer Lift Stations	Table G-9
	Groundwater Wells	Table G-10
	Groundwater Injection Wells	Table G-11
	Groundwater Treatment	Table G-12
	Low Flow Stormwater Diversions	Table G-13
	Rubber Dams	Table G-14
	Satellite Treatment Plants	Table G-15
	Membrane Bioreactor Treatment	Table G-16
	Advanced Water Treatment Facilities for IPR	Table G-17
	Advanced Water Treatment Facilities for DPR	Table G-18
	Brackish Groundwater Desalination Treatment	Table G-19
	Ocean Desalination Treatment	Table G-20
Operations and Maintenance Costs	Planning Level Operation and Maintenance Cost	Table G-21
	Energy Assumptions for Advanced Water Treatment Facilities	Table G-22
Rates	Metropolitan Tier 2 Full Service Treated Volumetric Costs 2016-2040	Table G-23
	Purchased Recycled Water Rates	Table G-24
Markups	Planning Level Construction Markups for Supply Projects	Table G-25
Life Cycle Cost	Depreciation/Replacement Periods	Table G-26

G.1.0 UNIT COST ASSUMPTIONS

G.1.1 Potable/Recycled Pipelines

Pipeline sizes used for existing pipeline upgrades or new pipelines were primarily based on standard diameters. Table G.2 presents a list of pipeline sizes used in the development of new pipelines or upgrade of existing supply or distribution system pipelines. As shown, the smallest pipeline considered was 6 inches in diameter. The unit construction costs were based on the observed costs of recent similar projects.

Table G.2 Construction Cost – Potable/Recycled Pipelines
One Water LA 2040 Plan – TM 5.1

Pipe Diameter	Unit Construction Cost (per linear foot)
6"	$150
8"	$196
12"	$240
16"	$282
20"	$368
24"	$450
30"	$528
36"	$690
42"	$900
48"	$1,176
54"	$1,440
60"	$1,728
72"	$1,920
84"	$2,304
96"	$2,688

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.2 Sewer, Force Mains and Brine Lines

Sewer, force main, and brine line sizes used for existing main upgrades or new mains were primarily based on standard diameters. Table G.3 presents a list of sizes used in the development of new mains or upgrade of existing mains. As shown, the smallest main considered was 4 and 6 inches in diameter, respectively. The unit construction costs were based on the observed costs of recent similar projects.

Table G.3 Construction Cost – Sewer, Force Mains, and Brine Lines
One Water LA 2040 Plan – TM 5.1

	Unit Construction Cost (per linear foot)	
Pipe Diameter	**Gravity Mains**	**Force Mains**
8"	$240	$200
12"	$336	$300
14"	$378	$343
16"	$416	$384
20"	$500	$460
24"	$600	$552
30"	$780	$720
36"	$1,008	$936
42"	$1,260	$1,218
48"	$1,536	$1,488
54"	$1,836	$1,782

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.3 Pressure Reducing Stations

Table G.4 presents a list of sizes and unit costs for the development of pressure reducing stations.

Table G.4 Construction Cost – Pressure Reducing Stations
One Water LA 2040 Plan – TM 5.1

Size	Unit Construction Cost (per station)
Small (1-2 valves <8")	$150,000
Medium (2-3 valves 8" and up)	$200,000
Large (3-4 valves 12" and up)	$350,000
Rehab and Repair	$100,000

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.4 Stormwater Capture and Groundwater Recharge

Costs associated with stormwater capture for groundwater recharge were estimated based on recent projects in Southern California, including stormwater diversion, infiltration basins, and a nature park resulting in a capital cost of $750,000 per acre.

Table G.5 presents unit construction costs for the development of an aesthetically appealing recharge basin.

Table G.5 Construction Costs – Recharge Basins
One Water LA 2040 Plan – TM 5.1

Facility Component	Unit Construction Cost ($/acre)
Recharge Basin Construction	$750,000

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

Table G.6 presents unit construction costs for the development of stormwater infiltration drywells, which can range from 20-100 feet deep.

Table G.6 Construction Costs – Stormwater Infiltration Drywell
One Water LA 2040 Plan – TM 5.1

Facility Component	Unit Construction Cost ($/unit)
Stormwater Infiltration Drywell	$50,000

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.5 Storage Tanks and Equalization Basins

Table G.7 presents a list of sizes and unit costs for the development of a new storage tanks and equalization basins.

Table G.7 Construction Costs – Tanks and Equalization Basins
One Water LA 2040 Plan – TM 5.1

Size	Storage Tank Construction Cost ($/gal)	Equalization Basin Unit Construction Cost ($/gal)
<1.0 MG	$2.50	$2.00
1.0-5.0 MG	$2.00	$1.50
5.0-10.0 MG	$1.75	$1.25
>10.0 MG	$1.50	$1.00

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.6 Pump Stations

Pump stations costs vary considerably depending on factors such as architectural design, pump type, driver type, pumping head, need for standby power, and station capacity. Table G.8 shows costs for pump, motors, minimal site piping, and appurtenances are included in the following unit construction costs expressed by the pump station capacity range expressed in horsepower (hp).

Table G.8 Construction Costs – Water/Recycled Water Pump Stations One Water LA 2040 Plan – TM 5.1

Pump Station Capacity Range	Unit Construction Cost ($/hp)
<100 hp	$5,000
100-500 hp	$3,000
500-1000 hp	$2,500
1000 hp and larger	$2,000

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.7 Sewer Lift Stations

Table G.9 presents unit construction costs for the development of a lift station.

Table G.9 Construction Costs – Sewer Lift Stations One Water LA 2040 Plan – TM 5.1

Type	Unit Construction Cost ($/gallon)
Lift Station	$0.75

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.8 Groundwater Extraction Wells

Table G.10 presents unit construction costs for the installation of a new groundwater wells, categorized by the range in depth.

Table G.10 Construction Costs – Groundwater Wells One Water LA 2040 Plan – TM 5.1

Facility	Unit Cost	Unit
Deep Well (>1000 ft)	$2,000,000	$/well site
Medium Depth Well (500-1000 ft)	$1,750,000	$/well site
Shallow Well (500 ft)	$1,500,000	$/well site
Well Equipping	$1,000,000	$/well

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.9 Groundwater Injection Wells

Table G.11 presents unit construction costs for the installation of a new groundwater wells, categorized by the range in depth.

Table G.11 Construction Costs – Groundwater Injection Wells
One Water LA 2040 Plan – TM 5.1

Facility	Unit Cost	Unit
Deep Well (>1000 ft)	$2,000,000	$/well site
Medium Depth Well (500-1000 ft)	$1,750,000	$/well site
Shallow Well (,500 ft)	$1,500,000	$/well site

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.10 Groundwater Treatment

Table G.12 presents unit construction costs for treatment of groundwater wells (using ion exchange or similar technologies for nitrate or other similar constituents).

Table G.12 Construction Costs – Groundwater Treatment
One Water LA 2040 Plan – TM 5.1

Facility	Unit Cost	Unit
Nitrate Treatment	$1	$/gallon

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.11 Stormwater Low Flow Diversion Structures

Table G.13 presents unit construction costs in the development of stormwater low flow diversion structures.

Table G.13 Construction Costs – Low Flow Stormwater Diversions
One Water LA 2040 Plan – TM 5.1

Facility Flow Rate	Unit Cost	Unit
Less than 10,000 gpd	$500,000	$/site
10,000-100,000 gpd	$1,000,000	$/site
100,000-500,000 gpd	$2,000,000	$/site
5,000,000-1,000,000 gpd	$3,000,000	$/site
Greater than 1,000,000 gpd	$4,000,000	$/site

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.12 Stormwater Control Structures

Table G.14 presents unit construction costs in the development of adding rubber dams to a river as a stormwater control structure. The water would then be collected from the river for use.

Table G.14 Construction Costs – Rubber Dams
One Water LA 2040 Plan – TM 5.1

Facility	Unit Cost	Unit
Rubber Dams	$500	$/AFY stored

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.13 Satellite Treatment Plants

Table G.15 presents unit construction costs for the development of a satellite surface water, wastewater, or stormwater treatment plant.

Table G.15 Construction Costs – Satellite Treatment Plants
One Water LA 2040 Plan – TM 5.1

Facility	Unit Cost	Unit
Satellite Surface Water Treatment Plant	$3	$/gal
Satellite Water Reclamation (Wastewater) Plant	$15	$/gal
Satellite Stormwater Treatment Plant	$3	$/gal

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.14 Advanced Treated Water Facilities

G.1.14.1 Membrane Bioreactor Treatment

Table G.16 presents unit construction costs for the addition of membrane bioreactors at a water reclamation plant amortized over 30 years with a 3 percent inflation rate. Additionally, facilities may be necessary for concentrate and residuals management, however, depending on the project.

Table G.16 Construction Costs – Membrane Bioreactor Treatment
One Water LA 2040 Plan – TM 5.1

Type	Unit Cost	Unit
Capital	$5	$/gal

Note:

(1) Total unit costs are rounded to the nearest hundred.

Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.14.2 Advanced Treatment for IPR

Table G.17 presents unit construction costs for the development of an Advanced Water Treatment facility to allow Indirect Potable Reuse (IPR) amortized over 30 years with a 3 percent inflation rate. Additionally, facilities may be necessary for concentrate and residuals management, however, depending on the project.

Table G.17 Construction Costs – Advanced Water Treatment Facilities for IPR One Water LA 2040 Plan – TM 5.1

Type	Unit Cost	Unit
Capital	$7	$/gal

Note:
(1) Total unit costs are rounded to the nearest hundred.
Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.14.3 Advanced Treatment for DPR

Table G.18 presents unit construction costs for the development of an Advanced Water Treatment facility to allow Direct Potable Reuse (DPR) amortized over 30 years with a 3 percent inflation rate. Additionally, facilities may be necessary for concentrate and residuals management, however, depending on the project, there may be sufficient capacity in existing facilities for brine management.

Table G.18 Construction Costs – Advanced Water Treatment Facilities for DPR One Water LA 2040 Plan – TM 5.1

Type	Unit Cost	Unit
Capital	$8	$/gal

Note:
(1) Total unit costs are rounded to the nearest hundred.
Source: Based on Table 2.2 of the WateReuse AWWA WEF NWRI Framework for DPR 2015 (WEF, 2015).

The information presented in Table G.18 is based on Table 2.2 of the WateReuse AWWA WEF NWRI Framework for DPR 2015 based on the following assumptions:

- Treatment cost would be on the high end or above the range shown
- Residuals management would be on the high end, because of odor control and residuals hauling
- Concentrate management would be on the low end should the plant be a coastal facility with presumed ocean discharge through an existing outfall
- Conveyance and blending is assumed to be on the high end due to presumed water quality regulations

G.1.14.4 Brackish Groundwater Desalination Facilities

Table G.19 presents unit construction costs for the development of a brackish groundwater desalination facility based on cost data received from the Goldsworthy groundwater desalination facility of the Water Replenishment District (WRD). The net yield is assumed to be 90 percent of the plant production capacity due to a brine stream of 10 percent.

Table G.19 Construction Costs – Brackish Groundwater Desalination Treatment One Water LA 2040 Plan – TM 5.1

Type	Unit Cost	Unit
Capital Cost	$4	$/gal

Note:
(1) Total unit costs are rounded to the nearest hundred.
Source: Based on observed cost of recent similar projects and escalated using the Los Angeles ENR index of 11155 (July 2016).

G.1.14.5 Ocean Desalination Facilities

Table G.20 presents unit construction costs for the development of an ocean desalination facility amortized over 30 years with a 3 percent inflation rate. The net yield is assumed to be 80 percent of the plant production capacity due to a brine stream of 20 percent.

Table G.20 Construction Costs – Ocean Desalination Treatment One Water LA 2040 Plan – TM 5.1

Type	Unit Cost	Unit
Capital Cost	$12	$/gal

Note:
(1) Total unit costs are rounded to the nearest hundred.
Source: Carlsbad Desalination Plant ($2,300/AF)

G.1.15 Operations and Maintenance

The following general unit costs are assumed for O&M:

- Energy costs $0.12/kWh
- Land Acquisition is not included due to high market variability and site specific information required. However, it should be included in the analysis. For planning purposes a range of $500,000 to $5 million per acre foot (AF).

Table G.21 presents planning-level O&M costs for selected facility types, not including energy costs. Table G.22 presents planning-level energy assumptions for advanced treatment facilities.

Note that the Los Angeles Aqueduct Filtration Plant (LAAFP) has an existing operations and maintenance cost of $75.24/AF treated.

Table G.21 Planning Level Operation and Maintenance Cost
One Water LA 2040 Plan – TM 5.1

Type of Facility	% of Initial Capital Cost
Reservoirs	1%
Wells	2%
Pump station	2%
Recharge basin	2%
Pipelines	1%
Pressure Reducing Stations	1%
Lift Station	3%
Low Flow Diversions (LFD)	2%
Sewer and Force Mains	2%
Stormwater Detention Ponds	2%
Storage Tanks & Equalization Basins	1%
Groundwater Treatment	4%
Surface Water/Wastewater/Stormwater Treatment	3%
DPR/IPR/Desalination	4%
Rubber Dams	4%
Membranes	20% after 10 years; 20% each year after to 15 years

Source: Based on observed cost of recent similar projects.

Table G.22 Energy Assumptions for Water Treatment Facilities
One Water LA 2040 Plan – TM 5.1

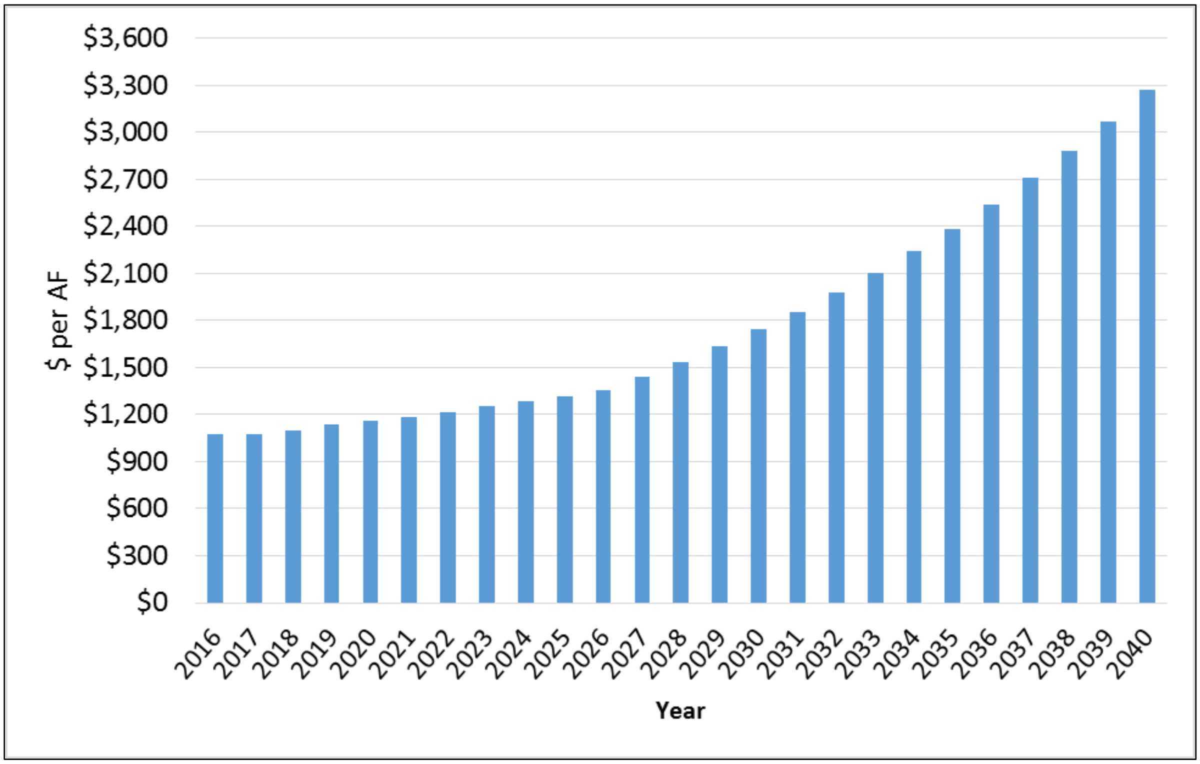
Facility	Energy Required (kWh/AF)
Brackish water desalination	1,750
Ocean water desalination	4,000
IPR/DPR	1,095
MBR	740
UV Treatment	13

Source: Based on observed cost of recent similar projects, with some data from Water Science Technology, 2012, 65(2): 380-92.

G.2.0 RATES

G.2.1 Imported Water

Imported Water Costs were projected using MWD's Ten-Year Financial Forecast (2016/17 and 2017/18 Proposed Budget), which provides projected water rates and charges through 2026. The Tier 2 Full Service Treated Volumetric Costs are provided on Figure G.1 from 2016 to 2026, increasing on average of 2.6 percent per year over the ten-year period. MWD costs beyond 2027 to 2040 were extrapolated using existing forecast data (assuming imported water rates would increase at an annual rate of 6.5 percent after 2026). The total projected imported water costs are provided on Figure G.1 for reference.



Source: Metropolitan Water District, Ten-Year Financial Forecast, 4/12/2016 Board Meeting, http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003736595-1.pdf

Figure G.1 Metropolitan Tier 2 Full Service Treated Volumetric Costs 2016-2040

Projected Metropolitan rates are shown in Table G.23.

Table G.23 Projected Metropolitan Rates
One Water LA 2040 Plan – TM 5.1

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Tier 1 Supply Rate ($/AF)	$156	$201	$209	$214	$226	$238	$245	$250	$261	$273	$285
Tier 2 Supply Rate ($/AF)	$290	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295
System Access Rate ($/AF)	$259	$289	$299	$320	$335	$358	$383	$412	$440	$469	$499
Water Stewardship Rate ($/AF)	$41	$52	$55	$59	$60	$61	$61	$62	$62	$62	$62
System Power Rate ($/AF)	$138	$124	$132	$145	$162	$178	$187	$193	$198	$204	$210
Full Service Untreated Volumetric Cost ($/AF)											
Tier 1	$594	$666	$695	$738	$783	$835	$876	$917	$961	$1,008	$1,056
Tier 2	$728	$760	$781	$819	$852	$892	$926	$962	$995	$1,030	$1,066
Treatment Surcharge ($/AF)	$348	$313	$320	$315	$309	$288	$288	$288	$288	$288	$288
Full Service Treated Volumetric Cost ($/AF)											
Tier 1	$942	$979	$1,015	$1,053	$1,092	$1,123	$1,164	$1,205	$1,249	$1,296	$1,344
Tier 2	$1,076	$1,073	$1,101	$1,134	$1,161	$1,180	$1,214	$1,250	$1,283	$1,318	$1,354
Readiness-to-Serve Charge ($M)	$153	$135	$140	$143	$148	$156	$168	$182	$196	$211	$228
Capacity Charge ($/cfs)	$10,900	$8,000	$8,700	$9,000	$9,300	$9,700	$10,000	$10,500	$11,100	$11,100	$11,300

Source: MWD's Ten-Year Financial Forecast (2016/17 and 2017/18 Proposed Budget)

G.2.2 Recycled Water Rates

LADWP may purchase recycled water from neighboring water agencies. The purchased recycled water rates for treated Title 22 water are shown in Table G.24.

**Table G.24 Purchased Recycled Water Rates
One Water LA 2040 Plan – TM 5.1**

Agency	Energy Required (kWh/AF)
Central Basin MWD	$500/AF
Las Virgenes MWD	$500/AF
West Basin MWD	$728/AF

Source: LADWP NPR Master Plan, 2012.

G.2.3 Groundwater Rates

LADWP has rights to native water in the San Fernando, West Coast, and Central Basins, and may pump their water rights without payment. For pumping above their native water right, LADWP may pump from the West Coast and Central Basins, but must pay a Replenishment Assessment to Water Replenishment District (WRD) of $322 AF.

G.3.0 CONSTRUCTION MARKUPS

A summary of construction markup assumptions used in the development of capital costs of various supply projects are defined below and presented in Table G.25. These markups were applied to construction costs to arrive at capital costs. As shown, the construction contingency, implementation factor, engineering, construction management, environmental, legal and project contingency cost markups combined was estimated at about 160 percent.

- 15 percent construction contingency to account for unknown or unforeseen construction costs.
- 30 percent implementation factor to account for the costs of program management and planning.
- 10 percent to account for engineering, design, and construction services.
- 10 percent to account for construction management and inspections.
- 20 percent to account for environmental documentation, permits, administration and unknown or unforeseen legal fees.
- 15 percent project contingency to account for the level of detail of the project concept.

Table G.25 Planning Level Construction Markups for Supply Projects One Water LA 2040 Plan – TM 5.1	
Description	**Markup (%)**
Project Contingency (PC)	15%
Construction Contingency (CC)	15%
Implementation Factor (IF)	30%
Engineering (ENG)	10%
Construction management (CM)	10%
Environmental & Administrative & Legal (E&A&L)	20%
Total Markup(1)	**100%**
Capital Cost/Construction Cost	**200%**
Note: (1) Total Markup = (1 + CC + IF + ENG + CM + E&A&L+ PC) - 1	

G.4.0 LIFECYCLE COST EVALUATION

Project alternatives will be compared on a dollars per AF basis in order to assess financial feasibility against the cost of imported water or other potential water supplies. These life cycle costs assess the commodity cost of various potable and non-potable water but do not quantify project benefits or avoided costs.

In order to determine the cost per AF of each project, the capital cost will be annualized using a discount rate (i) of 2 percent over a duration (n) of 25 years assuming 2016 is the base year. This discount rate assumes 5 percent inflation annually and 3 percent interest annually. The annual recurring costs and the annualized capital cost will be combined and divided by the Average Annual Demand (AAD) of that project to determine the cost per AF for comparison to the cost of imported water.

Unit costs will be presented at a range of -10 percent to +20 percent to present a range of costs.

G.4.1 Depreciation Periods

Depreciation will be evaluated based on the general useful life and replacement age of each type of (assumed new) facility/asset owned and operated by the City departments, summarized in Table G.26.

Table G.26 Depreciation/Replacement Periods
One Water LA 2040 Plan – TM 5.1

Type of Facility	Years
Reservoirs	50
Wells	50
Pump Station	40
Recharge Basin	75
Potable/Recycled Pipelines	50
Pressure Reducing Stations	30
Lift Station	40
Low Flow Diversions (LFD)	30
Sewer and Force Mains	30
Stormwater Detention Pond	30
Storage Tanks & Equalization Basins	30
Groundwater Treatment	30
Wastewater/Stormwater Treatment	30
DPR/IPR/Desalination	30
Membranes	15
Rubber Dams	15

Source: Based on observed cost of recent similar projects.

G.4.2 Avoided Cost

Avoided costs also need to be considered to account the cost of not implementing a certain project or program (groups of projects). Major avoided cost components considered as part of this alternatives analysis include:

- Avoided cost of purchasing imported water (see Tier 1 imported water rates presented on Figure G.1).
- Avoided cost of penalties due to non-compliance of TMDL regulations. Based on California Regional Water Quality Control Board Los Angeles Region Order No. R4-2012-0175 plus amendments, penalties for non-compliance with TMDLs is assumed to be $37,500/site/day.

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First Draft:	12/30/2016
Final Draft:	4/6/2017
Final:	3/30/2018
Lead Author:	Jacquelin Reed, Matt Huang

CITY OF LOS ANGELES

TECHNICAL MEMORANDUM NO. 5.2
PROJECT DEVELOPMENT

FINAL
March 2018

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CITY OF LOS ANGELES

TECHNICAL MEMORANDUM
NO. 5.2
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LIST OF ABBREVIATIONS

Abbreviation	Description
$/AF	dollars per acre-feet
AF	acre-feet
AFY	acre-feet per year
ARR	Aquifer Recharge and Recovery
AWPF	Advanced Water Purification Facility
BMPs	Best Management Practices
CBWRP	Central Basin Water Rights Panel
CCI	Construction Cost Index
cfs	cubic feet per second
CIP	Capital Improvement Plans
City	City of Los Angeles
Cr(VI)	hexavalent chromium
CRA	Colorado River Aqueduct
DCTWRP	Donald C. Tillman Water Reclamation Plant
DPR	Direct Potable Reuse
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ENR	Engineering News Record
EWMP	Enhanced Watershed Management Program
EWVIS	East-West Valley Interceptor Sewer
FY	fiscal year
GDAP	Groundwater Development and Augmentation Plan
GPA	grade point average
GWR	groundwater recharge
HFD	High Flow Diversions
HWRP	Hyperion Water Reclamation Plant
in	inch/inches
IPR	Indirect Potable Reuse
IRWMP	Integrated Regional Water Management Plan
LAA	Los Angeles Aqueduct
LADWP	Los Angeles Department of Water and Power
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LASAN	Los Angeles Bureau of Sanitation
LAWA	Los Angeles World Airport
LFD	low flow diversions
LID	Low Impact Development
LORP	Lower Owens River Project
MBR	membrane bioreactor
MBT	Mass-Balance Tool
Metropolitan	Metropolitan Water District of Southern California

MF	microfiltration
mgd	million gallons per day
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NPR	Non-potable Reuse
O&M	operation and maintenance
PCE	tetrachloroethylene
Plan	One Water LA 2040 Plan
Prop O	Proposition O
RWMP	Recycled Water Master Planning Documents
SCADA	supervisory control and data acquisition
SCMP	Stormwater Capture Master Plan
SFB	San Fernando Basin
SGMA	Sustainable Groundwater Management Act
SWP	State Water Project
TCE	trichloroethylene
TDS	total dissolved solids
TIWRP	Terminal Island Water Reclamation Plant
TM	Technical Memorandum
UF	ultrafiltration
ULARA	Upper Los Angeles River Area
USC	University of Southern California
UV	ultraviolet
UV/AOP	ultraviolet advanced oxidation process
UWMP	Urban Water Management Plan
Water IRP	2006 Water Integrated Water Resources Plan
WRD	Water Replenishment District
WRF	water reclamation facility
WRP	wastewater reclamation plant

PROJECT DEVELOPMENT

1.0 INTRODUCTION

1.1 Background of One Water LA

The City of Los Angeles (City) recently embarked on the One Water LA 2040 Plan. This plan will provide a strategic vision and a collaborative approach for integrated water management. In 2006, the City completed and adopted its first Water Integrated Resources Plan (Water IRP). This plan was the start of a paradigm shift for the City and resulted in significant achievements. Since then, the water landscape in the City has changed with increased demands, new regulations, and threats of climate change.

In response to these changes and to help achieve water sustainability, the City initiated the One Water LA 2040 Plan. This plan builds upon the success of the Water IRP, which had a planning horizon to year 2020. The One Water LA 2040 Plan takes a holistic and collaborative approach, to consider all water resources from surface water, groundwater, potable water, wastewater, recycled water, dry-weather runoff, and stormwater as "One Water." The plan identifies multi-departmental and multi-agency integration opportunities to manage water in a more efficient, cost effective, and sustainable manner.

The One Water LA 2040 Plan represents the City's continued and improved commitment to proactively manage all its water resources and implement innovative solutions, driven by the Sustainable City pLAn. The plan will help guide strategic decisions for integrated water projects, programs, and policies within the City.

1.2 Purpose of Task 5

The purpose of Task 5 is to identify a long-term strategy to 1) support achievement of the Sustainable City pLAn goals relative to water, 2) implement the seven key objectives and thirty-eight guiding principles, and 3) recommend multi-benefit projects to implement through 2040. Furthermore, this work complements other key City planning documents (i.e., Urban Water Management Plan [UWMP], Stormwater Capture Master Plan [SCMP], Recycled Water Master Planning documents [RWMP], Enhanced Watershed Management Program [EWMP], and Groundwater Development and Augmentation Plan [GDAP] [to be developed]).

The water-related Sustainable City pLAn goals include:

- Water Conservation - Reduce per capita water use by 25 percent by 2035.
- Water Supply - Reduce the purchase of imported water by 50 percent by 2025 and increase locally sourced water to 50 percent by 2035.

- Wastewater - Reduce annual sewer spills to fewer than 100 by 2025 and 67 by 2035.
- Recycled Water - Increase annual recycled water production by 6 million gallons per day (mgd) by 2017 as well as expand recycled water production to include indirect potable reuse (IPR) and direct potable reuse (DPR).
- Stormwater Capture - Increase stormwater capture to 150,000 acre-feet per year (AFY) by 2035.
- Water Quality - Improve dry weather beach water quality grade point average (GPA) to 4.0 by 2035 and improve wet weather beach water quality GPA to 3.5 by 2035.
- EWMPs - Implement EWMPs for Municipal Separate Storm Sewer Systems (MS4) permit compliance.
- LA River - Revitalize the LA River.

Results of Task 5 will provide a prioritized list of future concepts and a preferred portfolio, which complements other key City planning documents, collectively achieving the Sustainable City pLAn goals and highlighting strategic projects through 2040.

Task 5 deliverables include the following: Basis of Planning Technical Memorandum (TM) TM 5.1, Project Development TM 5.2, and Portfolio Development TM 5.3, with TM 5.2 forming the basis of this deliverable.

1.3 Objectives of TM No. 5.2

The objectives of TM 5.2 are to:

1. Establish the existing conditions for portfolio analysis purposes
2. Identify In-Progress Projects and Programs for the "No Action" portfolio analysis (which represents existing conditions and the implementation of the In-Progress Projects and Programs)
3. Determine the benefits and costs of 25 concept options

To accomplish these objectives, TM 5.2 includes "Concept Description Sheets" to summarize the In-Progress Projects and Programs and concept options in a clear and consistent format. The Concept Description Sheets document conceptual planning level information, based on information known as of December 2016. Existing plans used to develop the information are cited as endnotes, and assumed information is shown in italics.

Disclaimer: It should be noted that the information presented in this TM represents interim work products and may therefore include minor discrepancies with the information presented in the Summary Report (Volume 1). The information presented in Volume 1 supersedes information presented in this TM.

2.0 PROJECT DEVELOPMENT PROCESS

A preliminary list of projects was developed in multiple brainstorming workshops soliciting ideas and input from the Task 5 workgroup, Los Angeles Bureau of Sanitation (LASAN) and Los Angeles Department of Water and Power (LADWP) management, advisory group, stakeholders, and a select group of technical advisors. In these discussions, three distinct levels of projects were established within the 2040 planning horizon, which are defined in Table 1:

1. Existing facilities and supplies
2. In-Progress Projects and Programs
3. Concept options

Table 1 Level of Projects Considered in the Plan
One Water LA 2040 Plan – TM 5.2

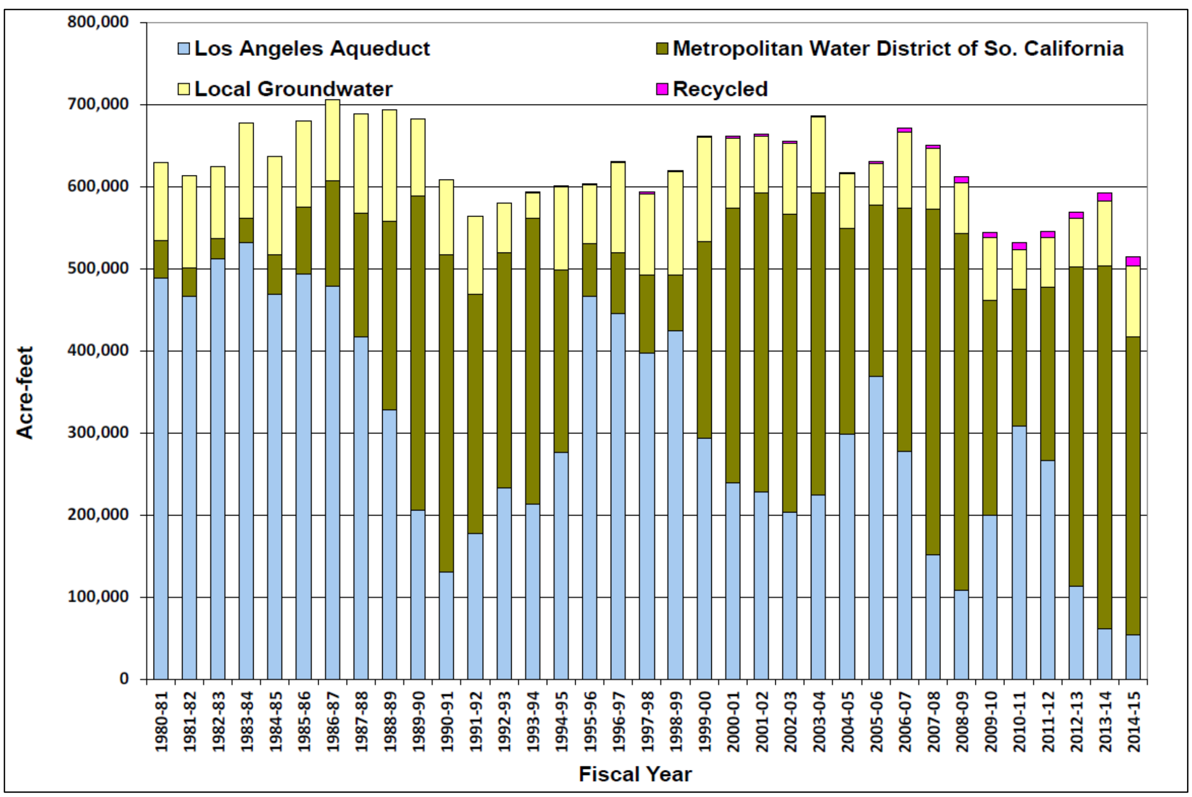
Level		Definition
1	Existing Facilities and Supplies	Includes current facilities and operations existing as of January 2016. Existing facilities and supplies are documented to establish the baseline scenario for analysis purposes. Details are provided in Section 3.0.
2	In-Progress Projects and Programs	In-Progress Projects and Programs are planned projects or programs for water supply, groundwater, recycled water, and stormwater that are expected to be implemented outside and independent of the Plan. These projects are already defined in other completed planning efforts and are assumed to be moving forward as of November 2016. The projects are at various stages of implementation, and may or may not be funded, have completed environmental documentation, or be included in existing Capital Improvement Plans (CIPs). Details are provided in Section 4.0.
3	Concept Options	Concept options are primarily new concepts that have not previously been evaluated by the City. Concept options are local water opportunities that are more uncertain and that are being analyzed as part of the Plan alternatives evaluation process to assess their benefits and estimated costs. This analysis will determine if these concepts should be selected and included in the Plan's Implementation Strategy. Details are provided in Section 4.4.

3.0 EXISTING SUPPLIES AND FACILITIES

The City's existing facilities and supplies are used to establish the existing conditions, which provide the baseline scenario for the Mass-Balance Tool developed during Task 1 and 2. TM 5.3 will describe the separate analysis utilizing the Mass-Balance Tool for each portfolio, which includes activating all In-Progress and concept options in that particular portfolio.

3.1 Historical Water Supply Mix

The Los Angeles Aqueduct (LAA) from the Owens Valley, local groundwater, and supplemental water purchased from Metropolitan Water District of Southern California (Metropolitan) are the primary sources of water supply for the City. Water from the Metropolitan is delivered through the Colorado River Aqueduct (CRA) and the State Water Project's California Aqueduct (SWP). Implementation of recycled water projects is progressing and expected to fill a larger role in Los Angeles' water supply portfolio. Stormwater capture projects for groundwater recharge to improve groundwater reliability are also being developed. As shown on Figure 1, the historical water supply mix of these four sources varies greatly annually and is largely influenced by hydrological and environmental water needs.



Source: 2015 UWMP (LADWP, 2015)

Figure 1 Historical Water Supply Mix

The City's water infrastructure includes a complex network of conveyance facilities, treatment plants, and distribution systems, and is discussed by the following categories:

- Drinking water
- Recycled Water
- Stormwater

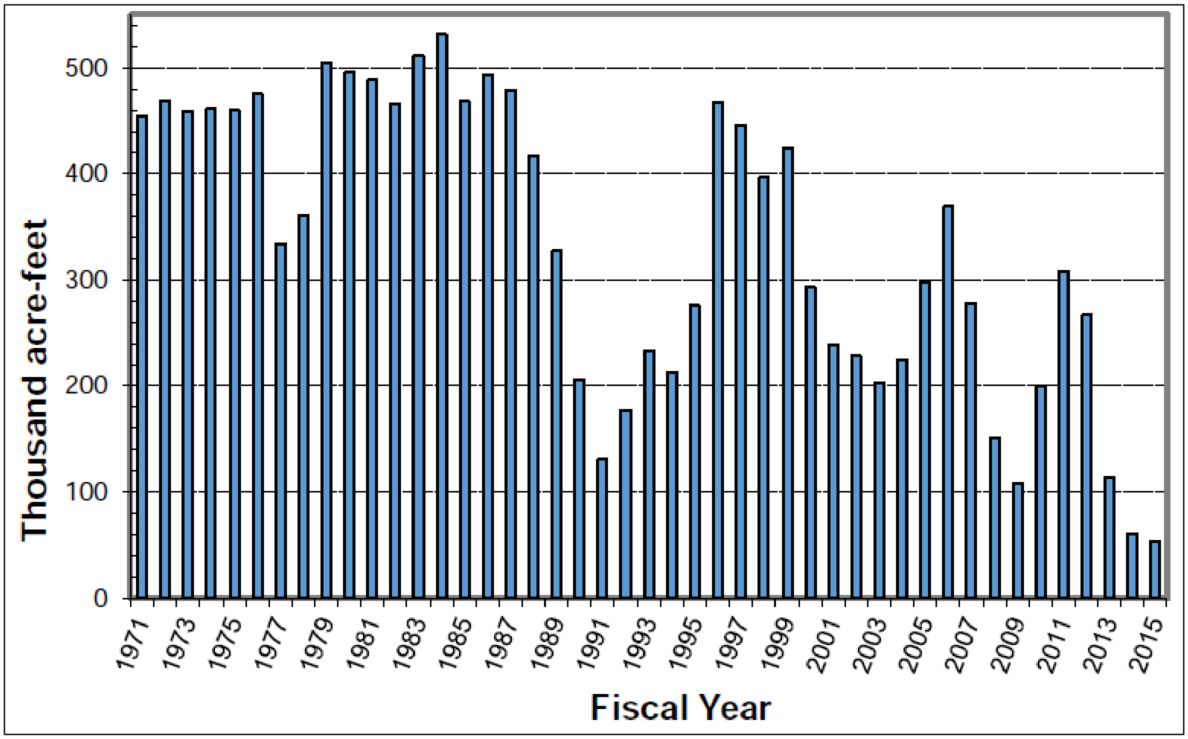
3.2 Drinking Water

The City's LA Aqueduct Filtration Plant is located at the far northern end of the City's water service area, where the LAA terminates in the LA Aqueduct Filtration Plant forebay. The treatment plant has a capacity of 600 mgd and is located at an elevation of approximately 1,100 feet above mean sea level, providing gravity supply to the City's water distribution system after ozonation, direct filtration, and ultraviolet (UV) disinfection. The City's treated LAA water blends at various locations with the City's local groundwater and treated imported water purchased from Metropolitan. Because of the City's topography, the City's potable water distribution system is divided into 124 pressure zones and consists of 7,263 miles of pipelines, 114 storage tanks and reservoirs, 78 booster pumping stations, and 421 pressure-reducing stations. The following subsections describe the City's drinking water supplies, including a brief overview of yield and costs.

3.2.1 Los Angeles Aqueduct

Since its construction in the early 1900s, the LAA has provided the vast majority of water for the City. Annual LAA deliveries depend on snowfall in the eastern Sierra Nevada. Years with abundant snowpack result in larger water deliveries. Requirements to release water for environmental enhancement efforts in the eastern Sierra Nevada have influenced the delivery of supplies from the Mono Basin and Owens Valley to Los Angeles (LADWP, 2015). In the last decade, environmental considerations have required the City to reallocate LAA source water supply to environmental mitigation and enhancement projects, wildlife and recreational uses, Mono Basin releases, Owens Lake dust mitigation, and the Lower Owens River Project (LORP), leaving only approximately 43 percent of the supply for export to the LAA and ultimately the City.

The cyclical nature of hydrology is exhibited best by LAA deliveries over the last fifteen years. More specifically, from fiscal year (FY) 2010/11 through 2014/15, LAA deliveries supplied an average of 29 percent of the City's water needs. The impact of hydrologic cycles on the reliability of LAA supplies, coupled with the requirements to release water for environmental enhancement, is evident throughout historical deliveries. A plot of historical deliveries is shown on Figure 2 (LADWP, 2015).

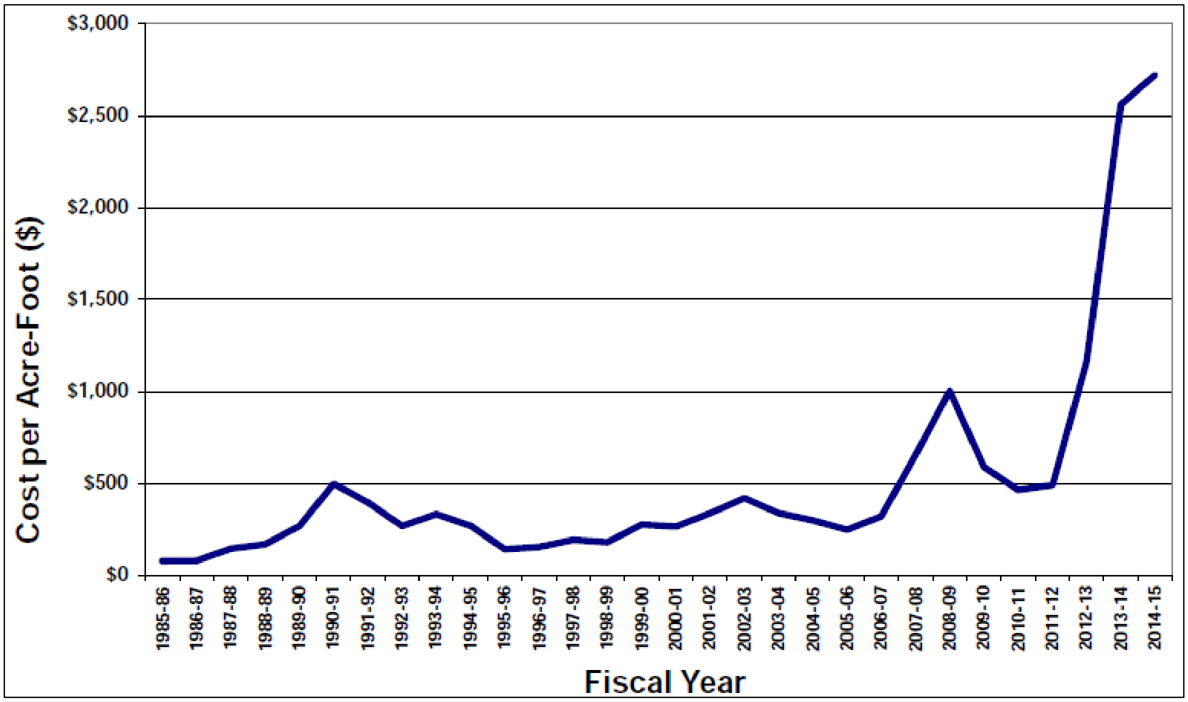


Source: 2015 UWMP (LADWP, 2015)

Figure 2 LAA Deliveries through Time

Looking to the future deliveries are expected to be approximately 278,000 AFY and gradually decline to 267,000 AFY due to climate change impact. However, with the anticipated completion of the Owens Lake Master Project by 2024, the projected LAA delivery will increase to 286,000 AFY due to water conserved at Owens Lake (LADWP, 2015). The Owens Lake Master Project will enhance the design and effectiveness of Owens Lake dust control, through a combination of water conservation, dust control and habitat management.

The delivery of LAA supplies has been relatively low since the 1980s. Costs associated with the LAA water supply are primarily for operation and maintenance. The unit cost of delivering water from the LAA to the City varies with the quantity of water delivered, which is turn, is highly dependent on hydrologic conditions. Over the years, Eastern Sierra Nevada environmental enhancement project costs have also contributed to rising overall LAA delivery unit costs. The unit cost of water deliveries through time is shown on Figure 3, with the most recent unit cost for FY 2014/15 of $2,723/acre-feet (AF) (LADWP, 2015).



Source: 2015 UWMP (LADWP, 2015)

Figure 3 Unit Cost of Los Angeles Aqueduct Deliveries through Time

3.2.2 Local Groundwater

Local groundwater is a key resource that the City has relied upon as a major component of its water supply portfolio. Over the last five years, local groundwater has provided approximately 12 percent of the total water supply for Los Angeles, and since 1970 has provided up to 23 percent of total supply during extended dry periods when imported supplies become less reliable (LADWP, 2015). There are several sources of local groundwater, with the Upper Los Angeles River Area (ULARA) watershed being the principal resource (Note – the ULARA watershed includes the San Fernando, Sylmar, Verdugo, and Eagle Rock groundwater basins [as defined by California Department of Water Resources [DWR] Bulletin 118]). The City also produces local groundwater from the Central Basin, with an additional entitlement in the neighboring West Coast Basin. In addition, the Hollywood and Santa Monica Basins are local resources where the City may potentially develop future supplies in partnership with local municipalities. Given the water rights in each groundwater basin, the City could develop infrastructure assets that could supply 110,000 AFY. In the case of adjudicated groundwater basins, the amount of water available for extraction could increase or decrease based on the management of the basin. In the case of unadjudicated basins, development of groundwater resources would need to be done in close coordination with other overlying entities and would be limited by the Sustainable Groundwater Management Act (SGMA). Table 2 is a summary of local groundwater basins, including details on the City's water rights and historical yield, and Figure 4 displays the City's water rights by groundwater basin.

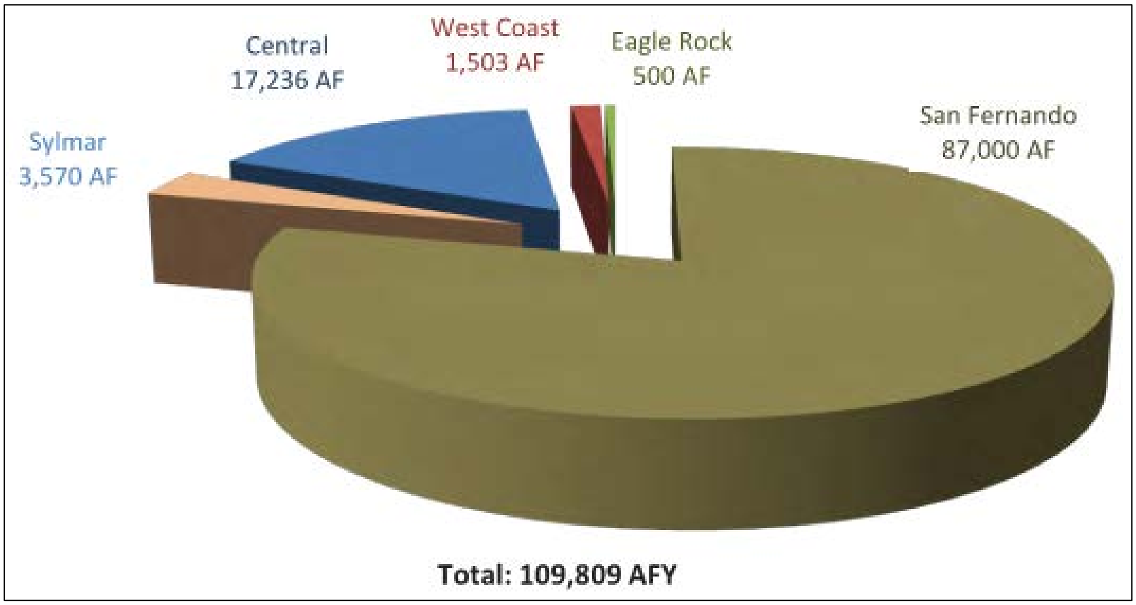
Table 2 Summary of Local Groundwater Basins One Water LA 2040 Plan – TM 5.2

Basin	Adjudicated	Water Right (AFY)[(1)]	Watermaster	Historical Yield (AF) 2014/15	Historical Yield (AF) 5-Yr Average	Historical Yield (AF) % of Supply
San Fernando	Yes	87,000	ULARA Watermaster[(2)]	~58,000	29,000	88%
Eagle Rock	Yes	500	ULARA Watermaster[(2)]	-	-	-
Sylmar	Yes	3,570	ULARA Watermaster[(2)]	880	2,690	1%
West Coast	Yes	1,503	West Coast Basin Watermaster Administrative Body[(3)]	-	-	-
Central	Yes	17,236	Central Basin Watermaster Administrative Body[(4)]	7,514	9,722	11%
Santa Monica & Hollywood Basins	No	Any party owning property overlying the aquifers has a right to pump groundwater	None	-	-	-

Source: This table was adapted from the 2015 UWMP (LADWP, 2015).

Notes:

(1) Water right is not equivalent to water available for use.
(2) Upper Los Angeles Area Watermaster. Basin adjudication is administered by the ULARA Watermaster on behalf of the Los Angeles Superior Court. Groundwater production in the ULARA Basins is constrained by the 1979 Final San Fernando Judgment (1979 Judgment) and the 1984 Sylmar Basin Stipulation (1984 Stipulation).
(3) The amended West Coast Basin Judgment (2014) allows parties to pump unused West Coast Basin rights out of the Central Basin, per the Central Basin Judgment. The Watermaster consists of three separate arms with different functions: Administrative – Water Replenishment District (WRD); West Coast Basin Water Rights Panel; Storage Panel.
(4) The Central Basin Judgment Third Amendment (Dec. 2013) allows parties to augment and store groundwater. The Watermaster consists of three separate arms with different functions: Administrative – Water Replenishment District (WRD); Central Basin Water Rights Panel (CBWRP) – includes 7 water rights holders selected through election; Storage Panel - CBWRP and WRD Board of Directors.



Source: 2015 UWMP (LADWP, 2015)

Figure 4 City Water Rights by Groundwater Basin

Existing groundwater pumping infrastructure exists in the San Fernando, Sylmar, Central, and West Coast basins as described herein. The approximate location of these groundwater basins are depicted on Figure 2 in TM 1.2.

San Fernando Basin – The LADWP has 10 wellfields within the San Fernando Basin (SFB), containing 115 wells, which, if fully operational, have a maximum pumping capacity of 540 cubic feet per second (cfs), and the ability to pump the City's full entitlement (Note: 1 cfs = 448 gallons per minute = 0.6 gallon per day). These wellfields include the:

- Tujunga, Rinaldi-Toluca, North Hollywood West, North Hollywood East Wellfields – these are the largest and primary wellfields
- Erwin, Verdugo, and Whitnall Wellfields – these provide flexibility and additional capacity
- Pollock Wellfield – provides a small amount of capacity
- Crystal Springs and Headworks Wellfields – historically provided additional pumping capacity, but are no longer in service

Groundwater contamination caused by industrial pollutants has severely degraded groundwater quality in the San Fernando Basin (SFB), adversely affecting the use of the groundwater, triggering Federal and State cleanup activities, requiring cleanup and remediation for environmental and public benefit, as well as to prevent further loss of this local water resource. The City has 58 wells in service (per the 2015 UWMP) with 57 wells inactive due to contamination. There are organic and inorganic contaminants of concern present (i.e., trichloroethylene [TCE], tetrachloroethylene [PCE], 1,4-Dioxane, hexavalent chromium (Cr[VI]), perchlorate, carbon tetrachloride, nitrate, and others). The City is undertaking a remediation program to restore the beneficial use of the SFB as described in the concept description for In-Progress Project 1.

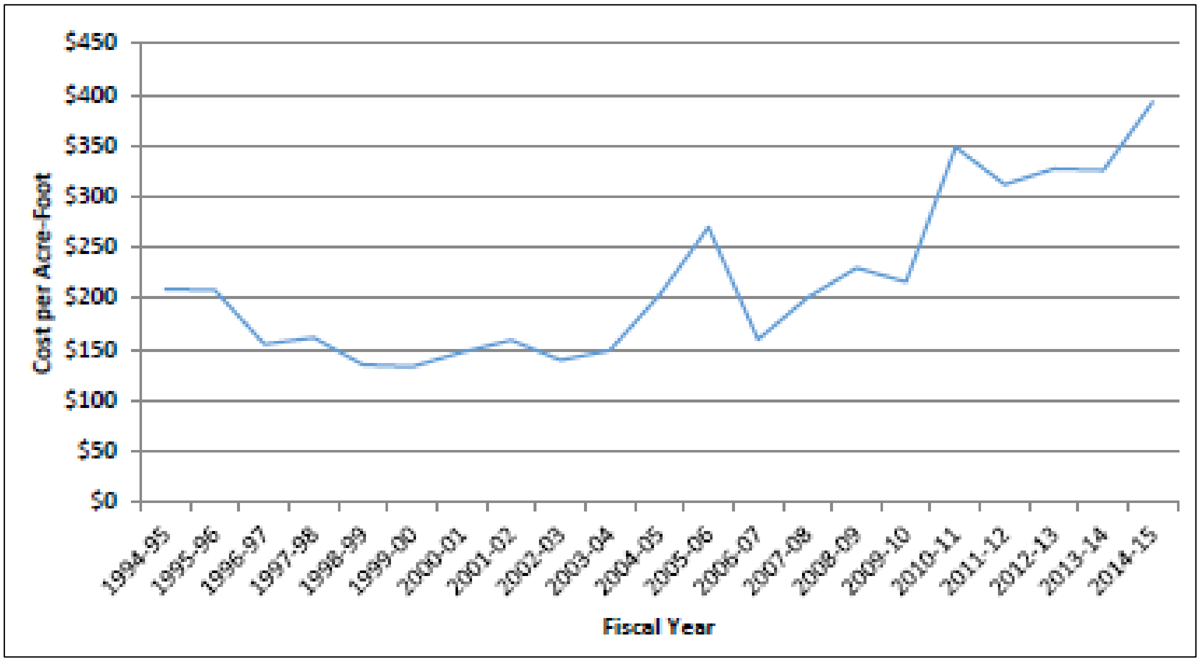
Sylmar Basin – In the Sylmar Basin, the Mission Wellfield has a total of seven wells, with two constructed prior to 1961 and the other five built between 1961 and 1977. However, only two wells are operable, of which one has been removed from service due to groundwater contamination (TCE). The Mission Wells Improvement Project is installing three replacement wells and associated infrastructure to restore groundwater use and pumping capacity in the Basin in order to utilize the City's full entitlement of 3,570 AFY.

Central Basin – The City pumps groundwater from two Central Basin wellfields (Manhattan and 99th Street).

- Manhattan Wellfield – There are six wells in the Manhattan Wellfield that were installed between 1928 – 1974. However, only two wells remain active, with a combined production capacity of 7.0 cfs (approx. 5,000 AFY). Manhattan wells are approaching the end of their useful life, experiencing mechanical deterioration and water quality issues. The Manhattan Wells Improvement Project is restoring the City's pumping capacity and addressing groundwater contamination issues (primarily TCE). This project will rehabilitate and/or construct up to eight production wells, along with related infrastructure (pipeline, electrical upgrades, and supervisory control and data acquisition [SCADA]). These improvements are currently underway.
- 99th Street Wellfield – Wells in the 99th Street Wellfield are newer, installed between 1974 – 2002. There are four active wells, with a combined production capacity of 6.1 cfs (approx. 4,400 AFY). These wells do not have the industrial contamination issues that exist in the Manhattan Wellfield, but iron and manganese do exist. However, the wellfield has been temporarily turned off, pending treatment system implementation.

West Coast Basin – The West Coast Basin includes one City wellfield, the Lomita Wellfield. This wellfield has been impacted by localized groundwater contamination and deterioration of water quality (total dissolved solids [TDS], hydrocarbons, and chlorides), such that LADWP has discontinued operation, and there has not been any City pumping since 1980.

The unit cost for groundwater pumping through time is shown on Figure 5, with the most recent unit cost for FY 2014/15 of $392/AF (LADWP, 2015). Costs include operating and maintaining water well pumps, conveyance piping, disinfection treatment systems, electrical services, associated repairs, annualized depreciation of fixed infrastructure, and related financing and overhead costs. Payments of groundwater replenishment fees to an outside agency are also included. Other related costs were recently recognized and are now being incorporated into this analysis beginning with FY 2010-11; these related costs include pressurization of groundwater to service pressure, payment of fees to the Court-appointed Watermasters, and groundwater planning and management services (LADWP, 2015).



Source: 2015 UWMP (LADWP, 2015)

Figure 5 Unit Cost of Local Groundwater

Industrial contamination and water quality issues are the principle reason for restricted use of local groundwater pumping by the City. In addition, declining groundwater levels and overdraft conditions have become additional concerns for Los Angeles basins. Aging wellfields and distribution system infrastructure also present challenges to the development and use of local groundwater.

3.2.3 Metropolitan Water District of Southern California

Metropolitan delivers approximately 5,000 AF per day of treated and untreated water to its member agencies through its vast infrastructure network. Major facilities include the Colorado River Aqueduct, California Aqueduct, pumping plants, pipelines, treatment plants, reservoirs, and hydroelectric recovery power plants. As a member agency of the Metropolitan, the City, through the LADWP, purchases water to supplement its supplies.

State Water Project – One of Metropolitan's two major sources of water is the State Water Project (SWP), which is owned by the State and operated by the California Department of Water Resources. This project transports Feather River water stored in and released from Oroville Dam and unregulated flows diverted directly from the San Francisco Bay/Sacramento-San Joaquin River Delta south via the California Aqueduct to four delivery points near the northern and eastern boundaries of Metropolitan's service area. The total length of the California Aqueduct is approximately 444 miles. SWP is allocated to its long-term contractors. Based on precipitation, runoff, and water supply conditions, Metropolitan annually projects what percent of this allocation will be delivered to its contractors.

Colorado River Aqueduct – The Colorado River was Metropolitan's original source of water after its establishment in 1928 and is the other major source of water. The Colorado River Aqueduct, which is owned and operated by Metropolitan, transports water from the Colorado River approximately 242 miles to its terminus at Lake Mathews in Riverside County.

LADWP has historically purchased Metropolitan water to make up the deficit between City demands and City supplies. Historically, annual purchases of Metropolitan water have varied greatly. For the most recent 5 years (FY 2011 – 2015), LADWP imported 57 percent of its supply from Metropolitan, an equivalent of 313,574 AF (LADWP, 2015).

Metropolitan's rates are structured on a tier–based system with two tiers. The costs of maintaining existing supplies and developing additional supplies are recovered through the two-tiered pricing approach. The Tier 1 Supply Rate recovers the cost of maintaining a reliable amount of supply. Each member agency has a predetermined amount of water that can be purchased at the lower Tier 1 Supply Rate. Purchases in excess of this limit are made at the higher Tier 2 Supply Rate. The Tier 2 Supply Rate reflects Metropolitan's cost of purchasing water transfers north of the Bay-Delta. The Tier 2 Supply Rate encourages the member agencies and their customers to maintain existing local supplies and develop cost-effective local supply resources and conservation (LADWP, 2015).

Metropolitan's water rates vary from $594 per AF of Tier 1 untreated water to $1,076 per AF of Tier 2 treated water in 2016. The average unit cost of Metropolitan water supply depends on the proportions of treated water and untreated water, Tier 1 water, and Tier 2 water purchased in a given period (LADWP, 2015).

3.3 Wastewater

The City's wastewater collection system conveys wastewater from both City customers and 29 contract agencies that discharge their wastewater at various locations into the City's sewer system. The total average dry weather wastewater flow conveyed through the City's 6,700-mile sewer collection system is approximately 350 mgd. This average dry weather flow is down from a rate of 442 mgd in 2005 as a direct result of the success of water conservation. During wet weather conditions, sewer flows can increase to as high as 420 mgd with instantaneous peak flows as high as 650 mgd.

The City's wastewater is treated at four wastewater treatment facilities: the Donald C. Tillman Wastewater Reclamation Plant (DCTWRP), with a permitted capacity of 80 mgd, the Los Angeles-Glendale Water Reclamation Plant ([LAGWRP], 20 mgd), the Terminal Island Water Reclamation Plant ([TIWRP], 30 mgd), and the Hyperion Water Reclamation Plant ([HWRP], 450 mgd). DCTWRP, LAGWRP, and TIWRP, facility treat wastewater to tertiary Title 22 standards, providing a non-potable water supply source typically referred to as "recycled water."

3.4 Recycled Water and Non-Potable Reuse

Recycled water is wastewater that has been highly treated and is approved for non-potable reuse, such as irrigation of golf courses, cemeteries, freeway medians, and other large landscapes. It is also approved for other uses, such as street sweeping, industrial cooling, dust control, groundwater replenishment, and environmental benefits.

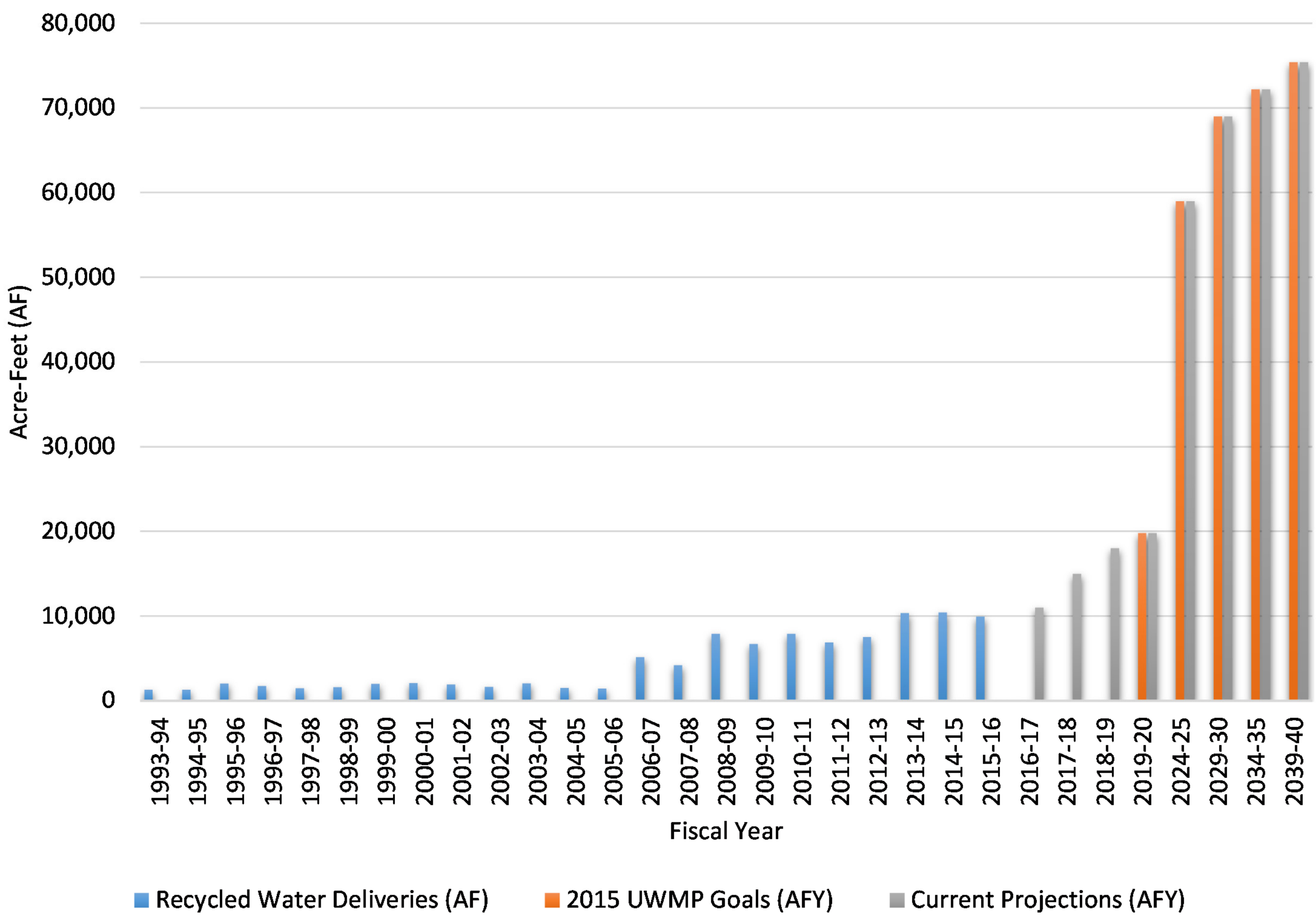
LA currently recycles more than 100 million gallons of water per day, using it for irrigation, industrial purposes, environmental beneficial reuse, and injection at seawater intrusion barriers. The City owns 56 miles of recycled water pipelines and supporting infrastructure to deliver over 10,000 AFY of recycled water to its non-potable customers. In addition, the City has installed 11 recycled water fill stations to provide certified customers access to recycled water, even if their properties are not located near a recycled water pipeline. These stations are an ideal solution for customers whose regular activities include trucking water for nurseries, dust control, concrete mixing, hardscape cleaning, and other approved uses. A historical summary of recycled water use is shown on Figure 6.

3.5 Stormwater

Despite the limited rainfall, the City has an extensive stormwater collection system to manage flooding risk from the large watershed and hydrology characteristics. With a season normal of 17.3 inches of rain per year on average (LACDPW, 2016), the City generates an average of 415,000 AFY of stormwater runoff (LADWP, SCMP, 2015). During dry and wet years, stormwater flows range from 114,000 AFY to 1,000,000 AFY, respectively.

The City operates a separate storm drainage system consisting of roughly 1,000 miles of pipelines and channels, which also interconnects with LA County's storm drain system. Due to the City's Pueblo water rights, the City has all water rights to the LA River upstream of the confluence of the Arroyo Seco. The majority of stormwater is directed to storm drains and ultimately discharges into the Pacific Ocean. This stormwater picks up and transports many pollutants that are harmful to marine life and public health. Other important watersheds within the City are the Ballona Creek, Santa Monica Bay, and Dominguez Channel watersheds.

A large portion of the City's stormwater reaches the ocean via the channelized LA River, which operates as a flood control channel. The LA River is 51 miles in length, of which the first 32 miles traverse within the City boundary. Under typical dry weather conditions, the river discharges approximately 207 mgd into the Pacific Ocean.



Source: Developed from Table in Recycled Water Annual Report (LADWP, 2016)

Figure 6 - Recycled Water Deliveries through Time
One Water LA 2040 Plan
TM 5.2 - Project Development

Stormwater capture is an important part of the City's overall plan to enhance its local water supply. The principle involves capturing rainfall and runoff from open space and urban lands for either direct use or for future use by allowing the water to percolate into groundwater basins.

However, the region's highly urbanized nature leaves limited open space opportunities for new large-scale groundwater recharge projects within the City's watersheds. For this reason, the City is implementing distributed stormwater capture projects that utilize vegetation, soils, and natural processes to manage stormwater runoff close to the source (e.g., LADWP/LASAN completed projects in Sun Valley and Penmar Park and LADWP planned projects in the SCMP). To date, the City has successfully implemented numerous sustainable green infrastructure, stormwater, and landscaping projects throughout the City.

Today, on average, approximately 29,000 AFY of stormwater is actively captured at centralized spreading grounds to recharge groundwater. Additionally, approximately 35,000 AFY is infiltrated into groundwater aquifers through distributed stormwater capture projects and incidental recharge.

In 2004, Proposition O (Prop O) authorized the City of Los Angeles to fund projects (up to $500 million) designed to prevent and remove pollutants from our regional waterways and ocean, consequently protecting public safety while meeting Federal Clean Water Act regulations. Los Angeles voters overwhelmingly passed the measure in 2004.
Prop O-funded projects are represented in one or more of the following categories:

- Water-quality protection of rivers, lakes, beaches, bays, and the ocean
- Water conservation, drinking water, and source protection
- Flood water reduction, river and neighborhood parks that prevent polluted runoff, and improve water quality
- Stormwater capture, cleanup, and re-use

To date, approximately $450 million has been spent implementing Prop O projects. Of the 29 Prop O projects completed, some of which are designed to capture rainwater and/or replenish our groundwater supplies.

Looking to the future, the City prepared a SCMP to identify large-scale stormwater capture projects (i.e., centralized spreading grounds) and smaller distributed green infrastructure projects (i.e., bio-swales, drywells, rain gardens, rain barrels, and permeable pavers) in order to increase stormwater capture and fully utilize this precious resource. Also, the EWMPs will implement multi-benefit regional and distributed projects (watershed control measures [aka, Best Management Practices (BMPs)]) that, where feasible, retain all non-stormwater runoff and stormwater runoff from the 85th percentile, 24-hour storm event in accordance with the MS4 permit requirements.

4.0 IN-PROGRESS AND PLANNED PROJECTS AND PROGRAMS

Eleven In-Progress Projects and Programs for the "benchmark" portfolio analysis (which includes existing supply sources, In-Progress Projects & Programs, and Planned Stormwater Management Projects) are presented in this Section.

4.1 Definition

In-Progress and Planned Projects and Programs are in-progress and planned projects or programs for potable reuse, non-potable reuse, regional or centralized stormwater and distributed stormwater that are expected to be implemented outside and independent of the Plan. These projects are already defined in other completed planning efforts and are assumed to be moving forward as of November 2016. The projects are at various stages of implementation, may or may not be funded, may or may not have completed environmental documentation, and may or may not be included in existing CIPs. Most In-Progress Projects and Programs are already in the design or construction phase, and some may have been completed.

4.2 List of In-Progress Projects and Programs

The In-Progress Projects and Programs are broken down into two types and are summarized in Table 3.

- Groundwater
- Recycled Water

Stormwater projects are considered Planned Projects and are discussed in Section 4.4.

Table 3 List of In-Progress and Planned Projects and Programs One Water LA 2040 Plan – TM 5.2

Type	#	Name
Groundwater	1	Increase Groundwater Pumping
	2	Groundwater Replenishment Project with Advanced Water Purification Facility (AWPF) at Donald C. Tillman WRP (up to 30,000 AFY in San Fernando Basin)
Recycled Water	3	Terminal Island AWPF Expansion to 12 mgd (completed in 2017)
	4	Expansion of Non-Potable Reuse (NPR) per 2015 Urban Water Management Plan
	5	Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station
	6	Hyperion WRP Delivery Expansion to 70 mgd for West Basin MWD and LA Harbor Area
Stormwater	7	In-Progress and Planned Stormwater Management Projects (per Stormwater & Urban Runoff Facilities Plan)

4.3 Summary of In-Progress Projects and Programs Descriptions

Descriptions of the 11 In-Progress Projects and Programs are provided in Appendix B. These descriptions include the following estimates for: normal, wet and dry year yields, costs (capital, O&M, unit, energy), One Water LA Objectives, project partners, general background and purpose, potential challenges and considerations, and the expected project concept timeline. Overall, the Concept Description Sheets document conceptual planning level information, based on information known as of December 2016; yields, costs and other descriptions included will continue to evolve and change as additional information becomes available. Previous plans were used to develop the information, which are cited as endnotes, while assumed information is shown in italics. A summary of the In-Progress Projects and Programs and associated costs is provided in Table 4.

Table 4 In-Progress and Planned Projects and Programs Yield, Capital Cost and Unit Cost Comparison One Water LA 2040 Plan – TM 5.2

Category	#	In-Progress Project or Program	Yield (AFY)	Capital Cost ($M)	Unit Cost ($/AF)
Groundwater	1	Increased Groundwater Pumping	47,000	N/A	$392
	2	Groundwater Replenishment Project with AWPF at Donald C. Tillman WRP (up to 30,000 AFY in San Fernando Basin)	30,000	$410	$910
Recycled Water	3	Terminal Island AWPF Expansion to 12 mgd	6,700	$77	$250
	4	Expansion of NPR per 2015 Urban Water Management Plan	18,872	$435	$1,500
	5	Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station	5,600	$130	$2,400
	6	Hyperion WRP Delivery Expansion to 70 mgd for West Basin MWD and Harbor	39,200	$15.6	$80
Stormwater	7	In-Progress and Planned Stormwater Management Projects (per Stormwater & Urban Runoff Facilities Plan)	79,500	Varies(1)	Varies(1)

Note:
(1) See Volume 3, Stormwater & Urban Runoff Facilities Plan for details.

4.4 Planned Stormwater Management Projects

In addition to the in-progress projects and programs, the City has planned stormwater management projects. The projects have been aggregated from the EWMPs, SCMP, remaining Prop O projects, and other 5-year CIP projects as required to meet MS4 Permit Compliance. A complete listing of the planned stormwater management projects is included in the Stormwater & Urban Runoff Facilities Plan (see One Water LA 2040 Plan - Volume 3). These planned projects are summarized as In Progress Projects 7 through 11. The list of projects also includes all the Green Streets projects in each of the City's four major watersheds (Concept Options 1 through 4).

The Stormwater & Urban Runoff Facilities Plan prioritized 'optimal stormwater projects' as achieving the three-legged stool, which are flood risk mitigation, water quality improvement, and water supply augmentation. Flooded areas provide an opportunity to maximize stormwater capture. Implementation of stormwater best management practices is designed to improve water quality downstream. It is estimated that the city-wide water supply augmentation benefit of the stormwater program is approximately 110,000 AFY under normal year conditions, while the total stormwater capture goal is 150,000 AFY which also includes water captured for water quality improvements. These numbers will vary greatly depending on hydrologic conditions and sequencing of storm events. To provide an equal basis for a relative comparison, the entire cost of the stormwater program is included in both the benchmark and all themed portfolios. Due to the high cost of the stormwater program ($5.4 billion), the unit cost will increase significantly compared to current conditions.

5.0 CONCEPT OPTIONS

Twenty-five (25) concept options are presented in this Section.

5.1 Definition

Concept options are primarily new concepts that have not been previously assessed by the City. Concept options are local water opportunities that are more uncertain and that are being analyzed as part of the Plan alternatives evaluation process to assess their benefits and estimated costs. This analysis will determine if these concepts should be selected and included in the Plan's Implementation Strategy.

5.2 List of Concept Options

The concept options are grouped into four types, as follows:

- **Stormwater –** Stormwater concepts capture or use stormwater to increase water supply and/or meet water quality goals.
- **Indirect Potable Reuse (IPR) –** Treated recycled water is blended with other environmental systems such as a river, reservoir, or groundwater basin, before the water is reused. Regulations are in place in California to guide the implementation and operation of such projects.
- **Direct Potable Reuse (DPR) –** Advanced treated recycled water is distributed directly into a potable water supply distribution system downstream of a water treatment plant or into the source water supply immediately upstream of the water treatment plant. Regulations for DPR in California are pending.
- **Other Concepts –** Other projects are concepts that do not fall in the category of stormwater, IPR or DPR. These include sewer rerouting projects, non-potable reuse (NPR), and ocean water desalination.

The concept options listed in Table 5 are depicted in a simplified manner on Figure 7.

Table 5 List of Concept Options
One Water LA 2040 Plan – TM 5.2

Type	#	Name
Stormwater	1	Green Streets – Upper Los Angeles River Watershed
	2	Green Streets – Ballona Creek Watershed
	3	Green Streets – Dominguez Channel Watershed
	4	Green Streets – Santa Monica Bay/Marina del Rey Watersheds
	5	Dry Weather Low Flow Diversions
	6	Wet Weather Flow Diversions
	7	Upper Los Angeles River to Tillman WRP
	8A	LA River Recharge into LA Forebay using Injection Wells
	8B	LA River Recharge into LA Forebay using Dry Wells(1)
Indirect Potable Reuse	9	Tillman WRP to San Fernando Basin Injection Wells
	10	Hyperion WRP to West Coast Basin Injection Wells
	11	Hyperion WRP to Central Basin Injection Wells
	12	Hyperion WRP to Central Basin with Spreading Basins
	13	MBR at Hyperion WRP to Regional System
	14	Hyperion WRP to San Fernando Basin Injection Wells
Direct Potable Reuse	15	Tillman WRP to Los Angeles Aqueduct Filtration Plant
	16	Tillman WRP to LADWP Distribution System
	17	LA/Glendale (LAG) WRP to Headworks Reservoir
	18	Hyperion WRP to LADWP Distribution System
	19	Hyperion WRP to Headworks Reservoir
	20	Hyperion WRP to Los Angeles Aqueduct Filtration Plant
	21	Central LA Satellite WRP to Los Angeles Aqueduct Filtration Plant
Other	22	East-West Valley Interceptor Sewer
	23	Increase Recycled Water Demand beyond 2015 UWMP
	24	Rancho Park Water Reclamation Facility
	25	Ocean Desalination
	26	Japanese Garden & Sepulveda Basin Lakes Recirculation(1)

Note:
(1) Concept Options 8B and 26 were developed at a later planning stage, and were therefore not included in the concept scoring exercise

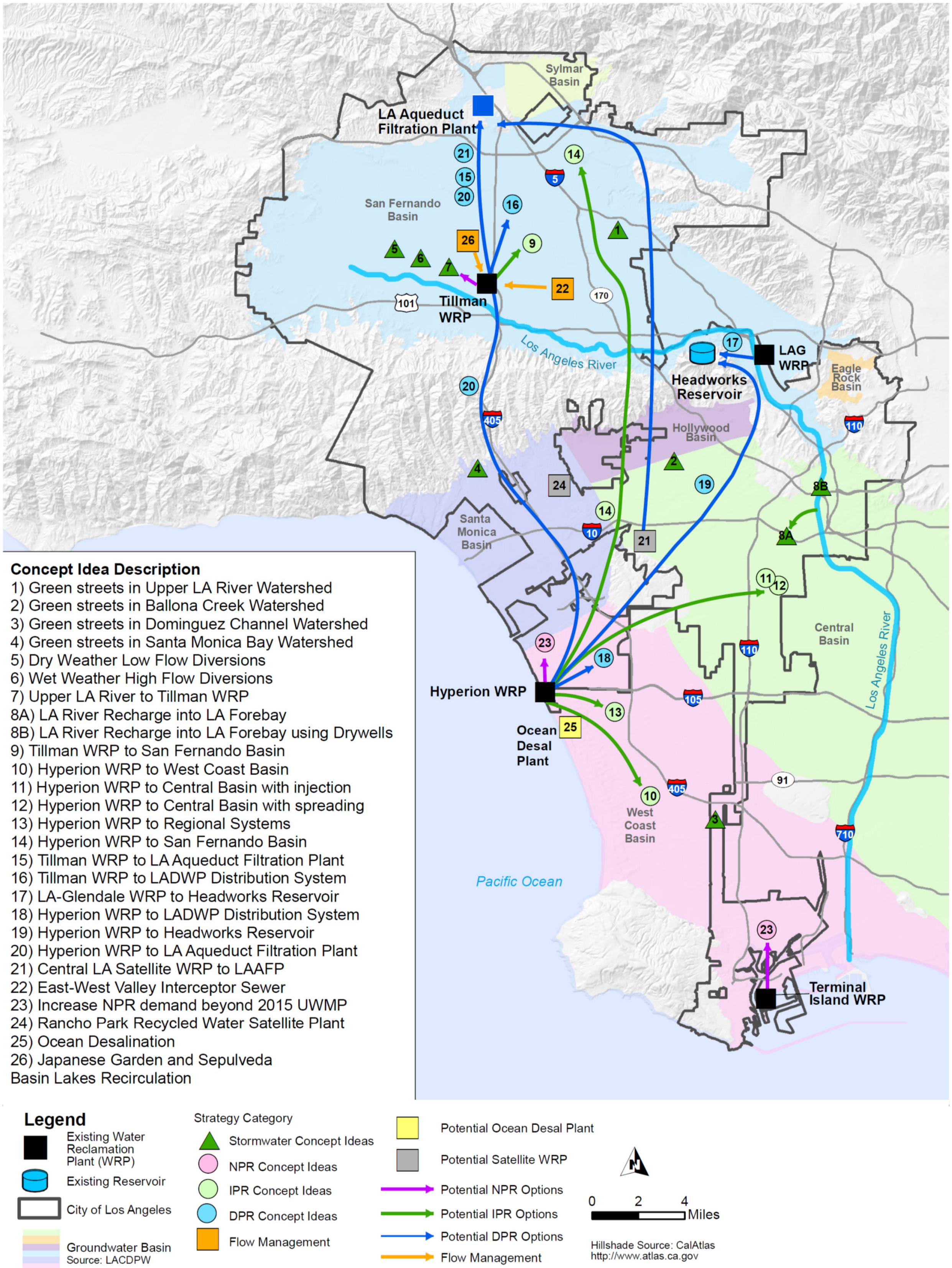


Figure 7 - Concept Options Overview Map
One Water LA 2040 Plan
TM 5.2 - Project Development

5.3 Component Sizing Assumptions

A variety of sizing assumptions were used to develop the 25 concept options described in Appendix C. This section presents the key sizing assumptions used for the major concept components, while a complete listing of sizing assumptions are documented in TM 5.1 (Basis of Planning). These assumptions were used to size the major infrastructure components required to implement each of the 25 concept options and to develop high level cost estimates. It should be noted that the sizing of each of these concepts can be adjusted and need to be refined if these concepts are developed further. The following key sizing assumption categories are presented below:

- Flow Assumptions
- Advanced Water Treatment
- Pipelines and Pump Stations
- NPR System Expansions
- IPR Groundwater Recharge and Extraction
- Miscellaneous

5.3.1 Flow Assumptions

The key sizing assumptions related to available flow for water recycling at the DCTWRP and HWRP are listed in Table 6 and Table 7, respectively.

As shown in Table 6, the maximum available flow for future water recycling projects from the DCTWRP is estimated to be 15 mgd or 17,000 AFY. This assumes that the East-West Valley Interceptor Sewer (EWVIS) is implemented and the minimum flow to the LA River can be reduced to 5 mgd.

As shown in Table 7, the maximum available flow for future water recycling projects from the HWRP is estimated to be 85 mgd or 95,000 AFY. This flow estimate considers flows delivered to West Basin MWD for increased usage in the Harbor area, expanded reuse to LAWA and from LAGWRP, as well as the implementation of Rancho Park Water Reclamation Facility (WRF).

Flow assumptions for LAGWRP assume that the City of Los Angeles has rights to 10 mgd, half the flows from LAGWRP, and that flows not used for NPR are available or IPR or DPR.

Table 6 DCTWRP Flow Assumptions
One Water LA 2040 Plan – TM 5.2

Flow Component	Flows (mgd)	Flows (AFY)
DCTWRP Existing Inflows	56	63,000
Sludge to HWRP	-5	-6,000
Existing NPR Uses	-2	-3,000
Existing Environmental Uses	-9	-10,000
Total Existing Available Flows	**40**	**45,000**
GWR Phase I	-27	-30,000
East-West Valley Interceptor Sewer (EWVIS)	15.8	18,000
Additional Sludge Flows due to GWR Phase I and EWVIS	-5	-6,000
Remaining Flows Available for LA River, IPR/DPR	24	27,000
Assumed LA River Flows	-5	-6,000
Remaining Flows Available for AWPF	19	21,000
Brine Loss for AWPF	-4	-4,000
Available Flows for IPR/DPR	15	17,000

Note:
(1) The sizing of the concept options are based on these flow assumptions, however, new information after this table was developed may have caused these flows to change. Updated information is located in the Wastewater Facilities Plan.

Table 7 HWRP Flow Assumptions
One Water LA 2040 Plan – TM 5.2

Flow Component	Flows (mgd)	Flows (AFY)
Hyperion Existing Inflows	250	280,000
Hyperion In Plant Reuse	-30	-34,000
To WBMWD + Harbor	-70	-78,000
HWRP to LAWA	-5	-6,000
Expanded DCTWRP Reuse (adjusted for brine losses)	-34	-38,000
Expanded LAGWRP Reuse	-3	-4,000
Potential Rancho Park Water Reclamation Facility	-3	-4,000
Remaining Flows Available	**105**	**117,000**
Brine Loss for AWPF(1)	-20	-24,000
Available Flows for IPR/DPR	**85**	**95,000**

Notes:
(1) Assume AWPF at HWRP for the purpose of this analysis only. Advanced treatment at HWRP has not been determined.
(2) The sizing of the concept options are based on these flow assumptions, however, new information after this table was developed may have caused these flows to change. Updated information is located in the Wastewater Facilities Plan.

5.3.2 Advanced Water Treatment

The key sizing assumptions related to advanced water treatment for the implementation of IPR or DPR using Advanced Water Purification Facility (AWPF) to treat the water to required standards are listed in Table 8.

Table 8 AWPF and Treatment Assumptions One Water LA 2040 Plan – TM 5.2

Category	Assumptions
Brine Loss	20% of the design flow
Equalization Storage Upstream of AWPF	25% of average flow
Engineered Storage Downstream of AWPF:	
Effluent pumped to another facility (such as a reservoir or injection wells)	12.5% of design flow
Effluent pumped to a distribution system for DPR	100% of design flow
HWRP Treatment	Membrane bioreactors (MBR) prior to IPR or DPR
IPR Treatment	Microfiltration (MF) or ultrafiltration (UF), reverse osmosis (RO), and ultraviolet advanced oxidation process (UV/AOP)
DPR Treatment	Ozone with biologically active filters (O3/BAF), MF or UF, RO, and UV/AOP

5.3.3 Pipelines and Pump Stations

The key sizing assumptions related to pipelines and pump stations are listed in Table 9.

Table 9 General Component Sizing Assumptions One Water LA 2040 Plan – TM 5.2

Component	Type	Size
Pressurized pipelines	Maximum Velocity	5 feet/second
Pump Stations (potable and recycled water)	Configuration	4 duty + 1 standby
	Efficiency	75%
Lift stations	Configuration	4 duty + 1 standby
	Efficiency	50%

5.3.4 NPR System Expansions

The key sizing assumptions related to NPR system expansions are listed in Table 10.

Table 10 NPR Assumptions
One Water LA 2040 Plan – TM 5.2

Category	Assumptions
Equalization Storage	25% of Maximum Day Demands
Pumping Station	Sufficient capacity to meet Maximum Day Demands with the largest unit out of service, if there is storage downstream of the pump station. Sufficient capacity to meet Peak Hour Demands with the largest unit out of service, if there is no storage downstream of the pump station.

5.3.5 IPR - Groundwater Recharge and Extraction

The key sizing assumptions related to groundwater recharge and extraction for IPR concepts are listed by groundwater basin in Table 11. As shown, it is assumed that the required groundwater well extraction capacity is 1.5 times greater than the groundwater injection capacity to account for seasonal variations in water demands.

Table 11 IPR Groundwater Well Concept Sizing Assumptions
One Water LA 2040 Plan – TM 5.2

Groundwater Basin	Injection Well Sizing	Extraction Well Sizing	Additional Wells Needed	Treatment Required(1)
San Fernando	1.8 mgd	2.7 mgd	Existing extraction wells have sufficient capacity	Nitrate Removal
Central	1.0 mgd	1.5 mgd	New extraction wells needed	Ion Exchange
West Coast	1.0 mgd	1.5 mgd	New extraction wells needed	Brackish groundwater desalination

Note:
(1) The treatment required will be based on the water quality of the specific groundwater well; for costing purposes, these treatment types and sizes have been assumed.

5.3.6 Miscellaneous Assumptions

Other key sizing assumptions are listed in Table 12.

Table 12 Miscellaneous Assumptions
One Water LA 2040 Plan – TM 5.2

Category	Assumptions
Green Streets	Cost based on TM 8.1. Sizing based on Addendum to TM 8.1.
Low Flow Diversions	Flows developed based on estimated existing stormwater flows of tributary areas upstream from selected low flow diversion (LFD) locations
Wet Weather Flow Diversions	Wet weather flow diversions are possible at 50% of the LFD locations. Annual wet weather flow capture is based on 25 storms/yr, with an average storage tank size of 500,000 gallons per site.
LA River Flows	LA River flows based on the minimum available flows report in the LA River Flow Study (One Water LA TM 12.4)
EWVIS	EWVIS sizing and cost based on EWVIS Concept Report (Arcadis, January 2017), assuming a total flow reversal of 11.41 mgd back to DCTWRP vs the gravity flow HWRP
Rancho Park Water Reclamation Facility	Rancho Park Water Reclamation Facility based on Project Concept Report. Recycled water distribution system cost information provided by LADWP (October 2016).
Ocean Water Desalination	Ocean water desalination sized at 25 mgd, based on available space at Scattergood Generating Station (DMJMM+N and Metcalf & Eddy, 2004).

5.4 Cost Assumptions

This section presents the key cost estimating assumptions used for the major concept components, while a complete summary of cost assumptions are documented in TM 5.1. The major cost assumptions that were used to prepare high level planning cost for each of the concept options are as follows:

- **Capital Cost –** The costs to construct a project, including construction contingencies, implementation factors, engineering services, environmental documentation, contingencies, and overhead items such as legal and administrative services. Land acquisition costs are not included. All projects have a construction cost to capital cost multiplier of 2.0. Due to the large unknowns regarding these concepts, a conservative markup is used for project planning.

- **Operations and Maintenance Cost –** The annual cost to operate and maintain the project, not including energy costs. It includes the cost of purchasing water, where applicable, and the costs of operating and maintaining facilities.

- **Energy Cost –** The annual cost for energy to operate the project. Energy costs are assumed to be $0.12/kWh.

- **Unit Cost –** The total project cost on a unit basis of yield. The cost considers depreciation periods ranging from 15 to 75 years based on the facility types. The capital cost is annualized using a discount rate of 2 percent (5 percent inflation and 3 percent interest annually).

Construction costs typically undergo long-term changes in keeping with corresponding changes in the regional and national economy. A commonly accepted barometer of these changes is Engineering News Record's (ENR) Construction Cost Index (CCI) that is computed from prices of construction materials and labor based on a value of 100 in the year 1913. Costs in this study are based on the Greater Los Angeles ENR CCI of 11155 from July 2016.

Some projects, where the projects have already been well-defined, have capacity cost assumptions based on preliminary design reports or other planning documents.

5.5 Summary of Concept Descriptions

Descriptions of the 25 concept options is provided in Appendix C. These descriptions include the following estimates for: normal, wet and dry year yields, water supply benefit, drought resiliency, costs (capital, O&M, unit, energy), One Water LA Objectives, project partners, general background and purpose, list of components, potential challenges and considerations, expected project concept timeline, triggers and a schematic. Maps are provided to aid in the concept options understanding and LADWP's hydraulic model was used to size conveyance needs for specific concept elements in order to provide high-level cost estimates. Overall, the Concept Description Sheets document conceptual planning level information, based on information known as of December 2016; yields, costs and other descriptions included will continue to evolve and change as additional information becomes available. Previous plans were used to develop the information, which are cited as endnotes, while assumed information is shown in italics. A summary of the concepts and associated costs is provided in Table 13.

Table 13 Summary of Concept Options Yields and Costs One Water LA 2040 Plan – TM 5.2

Category	#	Concept Options	Yield (AFY)	Capital Cost ($M)	Unit Cost ($/AF)
Stormwater	1	Green Streets - Upper Los Angeles River Watershed	11,900	$850	$7,500
	2	Green Streets - Ballona Creek Watershed	2,300	$390	$17,600
	3	Green Streets - Dominguez Channel Watershed	2,600	$135	$5,400
	4	Green Streets - Santa Monica Bay/Marina Del Rey Watersheds	460	$120	$27,000
	5	Dry Weather Low Flow Diversions	6,200	$110	$1,000
	6	Wet Weather Flow Diversions	1,000	$190	$10,300
	7	Upper Los Angeles River to Tillman WRP	5,600	$18	$160
	8A	LA River Recharge into LA Forebay using Injection Wells	25,000	$980	$2,100
	8B(1)	LA River Recharge into LA Forebay using Dry Wells	25,000	$540	$1,000
IPR	9	IPR - Tillman WRP to San Fernando Basin Injection Wells	15,000	$360	$1,600
	10	IPR - Hyperion WRP to West Coast Basin Injection Wells	20,000	$900	$3,200
	11	IPR - Hyperion WRP to Central Basin Injection Wells	75,000	$3,300	$2,700
	12	IPR - Hyperion WRP to Central Basin with Spreading Basins	95,000	$4,000	$2,600
	13	IPR - MBR at Hyperion WRP to Regional System	95,000	$900	$1,500
	14	IPR - Hyperion WRP to San Fernando Basin Injection Wells	20,000	$680	$2,400
DPR	15	DPR - Tillman WRP to LA Aqueduct Filtration Plant	15,000	$310	$1,500
	15 & 22	DPR - Tillman WRP to LA Aqueduct Filtration Plant (with EWVIS)	15,000	$395	$1,930
	16	DPR - Tillman WRP to LADWP Distribution System	15,000	$295	$1,300
	16 & 22	DPR - Tillman WRP to LADWP Distribution System (with EWVIS)	15,000	$380	$1,730
	17	DPR - LA/Glendale (LAG) WRP to Headworks Reservoir	6,000	$140	$1,500
	18	DPR - Hyperion WRP to LADWP Distribution System	95,000	$2,800	$2,100
	19	DPR - Hyperion WRP to Headworks Reservoir	95,000	$3,200	$2,400
	20	DPR - Hyperion WRP to Los Angeles Aqueduct Filtration Plant	95,000	$3,600	$2,600
	21	DPR - Central LA Satellite WRP to Los Angeles Aqueduct Filtration Plant	95,000	$5,100	$3,400
Other	22	East-West Valley Interceptor Sewer	12,800	$85	$430
	23	Increase Recycled Water Demand beyond 2015 UWMP	16,700	$680	$2,100
	24	Rancho Park Water Reclamation Facility	3,600	$180	$2,900
	25	Ocean Desalination	28,000	$710	$2,100
	26(1)	Japanese Garden and Sepulveda Basin Lakes Recirculation	20,000	$20	$70

Note:
(1) Concept Options 8B and 26 were developed at a later planning stage, and were therefore not included in the concept scoring exercise.

As shown in Table 13, the estimated yield ranges from 1,000 to 94,000 AFY, while the capital costs are estimated to range from $11 million to $4 billion. It is important to note that the listed yield does not reflect new supply yield for all concepts. Hence, the unit supply cost is not an equal metric for all concept options. However, as unit costs expressed in dollar per acre-foot ($/AF) is such a common benchmark, a unit cost was calculated for all 25 concept options. As shown the calculated unit costs range from just under $500/AF (Concept Option 7) to more than $27,000/AF (Concept Option 4). The estimated unit costs of the concepts are also graphically depicted on Figure 8 and Figure 9.

Figure 8 shows the unit cost for each concept option, colored by category (stormwater, IPR, DPR, and other). As shown on Figure 8, the stormwater projects have the highest unit cost, with Concept Options 4 and 6 clearly exceeding the unit cost of all other concept options due to the low supply yield that these options would provide as the key benefits of these concepts are related to water quality.

Figure 8 also shows that a the stormwater concept options reflect the widest range in unit cost as it includes both the highest and lowest unit costs, while the unit cost range of the other three categories are not as wide. The unit costs of the six IPR concept options range from $1,500/AF (Concept Option 13) to $3,200/AF (Concept Option 10).

Similarly, the unit costs of the DPR concepts have a similar spread, ranging from $1,300/AF (Concept Option 16) to $$3,400/AF (Concept Option 21). As presented in Appendix C, the higher cost options involve substantially more conveyance infrastructure than the lowest cost DPR option, which would consist of flange-to-flange delivery of advanced treated water into the potable water distribution system.

Lastly, the unit cost of the other concept options also range widely from $600/AF (Concept Option 22) to $2,900/AF (Concept Option 24). It is interesting to note that the estimated unit cost of additional NPR expansions are ocean desalination are roughly the same.

As stated above, some of the concepts provide direct water supply benefit, while other concepts provide primarily water quality or other benefits, but do not provide a direct water supply benefit without the implementation of other concepts. The concept options that provide a local supply benefit are shown in blue on Figure 9, while concept options that provide other benefits or are needed to implement other concept options to result in a supply benefit are shown in red. As shown, the unit costs of concept options that provide a direct local supply benefit range from just under $500/AF (Concept Option 7) to $3,400/AF (Concept Option 21).

In addition to unit cost, many other criteria need to be considered to determine which concept options are most beneficial to implement. The scoring results that reflect the benefits related to all 18 evaluation criteria are presented in the following section.

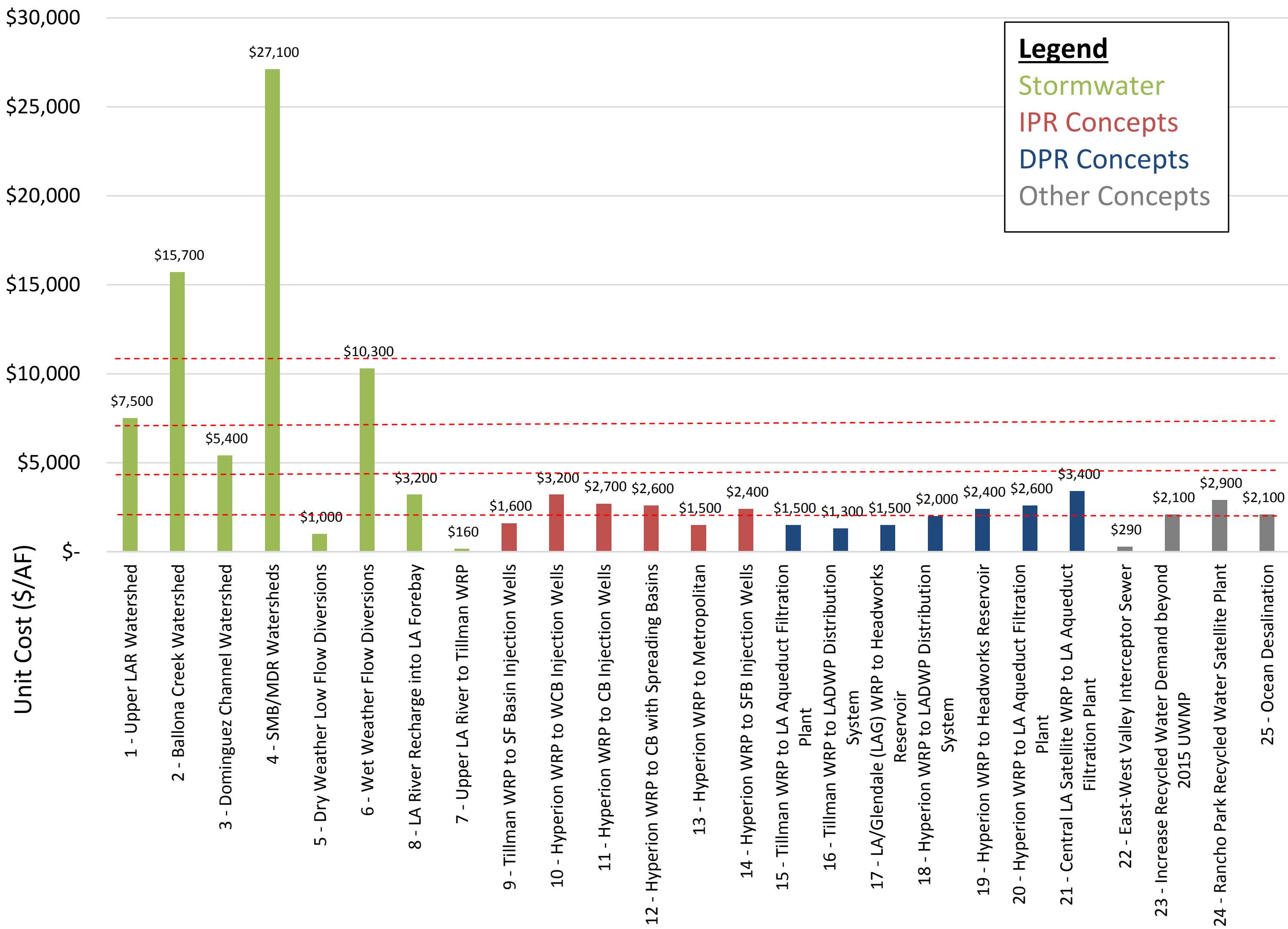


Figure 8 - Unit Costs by Concept and Type
One Water LA 2040 Plan
TM 5.2 - Project Development

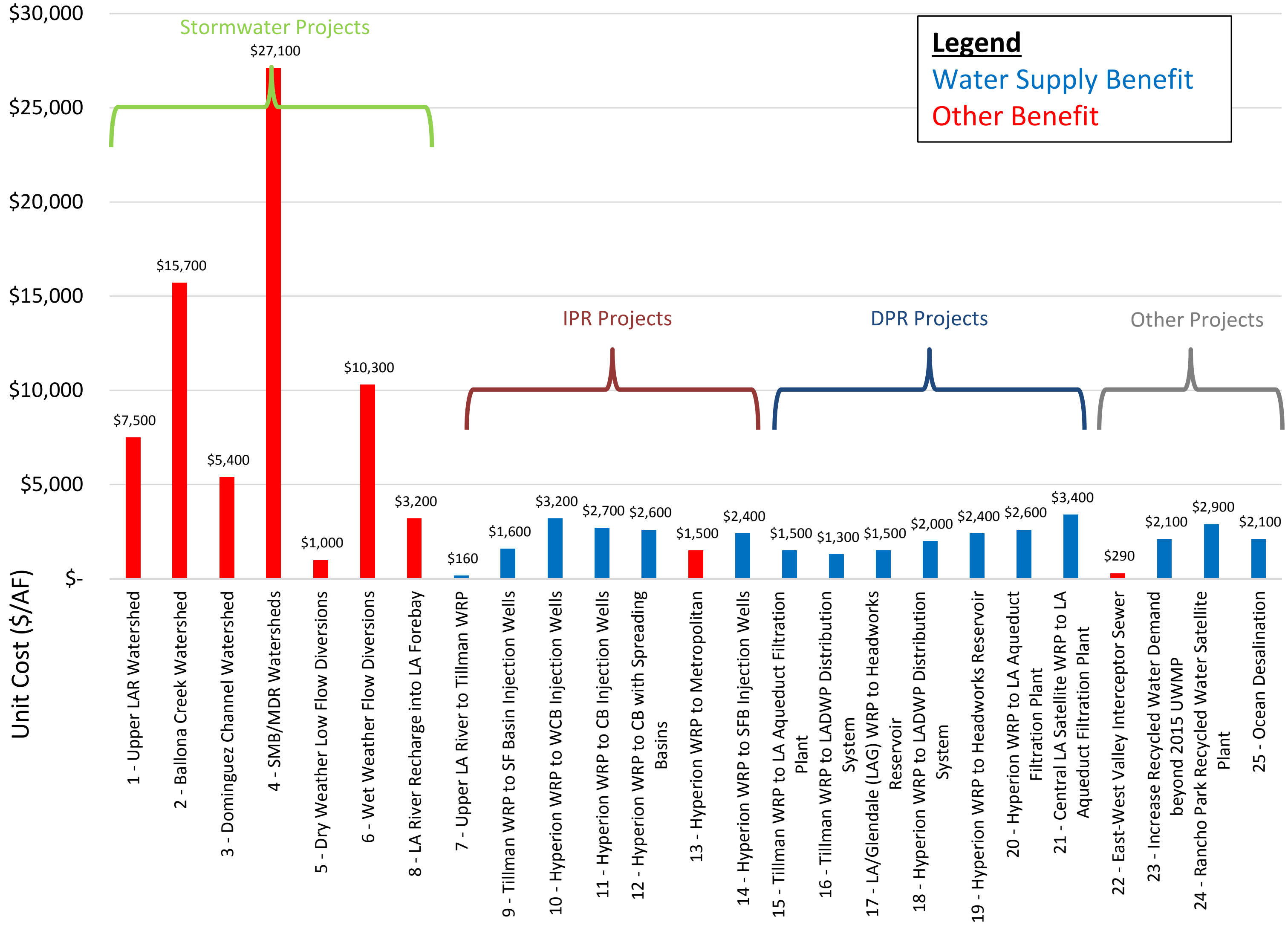


Figure 9 - Unit Costs by Concept and Supply Benefit
One Water LA 2040 Plan
TM 5.2 - Project Development

6.0 SCORING OF CONCEPT OPTIONS

6.1 Concept Scoring Methodology

Each of the Potential Concepts were scored utilizing the Concept Description Sheets and the evaluation criteria metrics presented in TM 5.1 Appendix C. Weights for each of the criteria were evaluated by both the City team and stakeholders. Members of the City team and technical advisors have scored each of the concept options by the criteria in a workshop/collaborative setting. Based on the scores, a weighted score is calculated for each Potential Concept.

After the concept options were scored, the concepts were combined into themed portfolios, which will be discussed in TM 5.3. Once grouped into themed portfolios, an overall cost/benefit ratio can be developed for each themed portfolio. Upon evaluation of the themed portfolios, concept options with lower scores may be eliminated, and concept options with better scores could be combined to build preferred portfolio options.

6.2 Concept Scoring Results

The scoring for the concept options is shown in Table 14. The criteria and concepts with the highest scores are shown in red, while the lowest scores are in black. Figure 10 shows a comparison of weighted and unweighted scores; the weightings do not change the scoring of the concept options significantly. Figure 11 shows the concept options by rank. The highest ranked concept options are the Green Streets concepts (Concept Option 1 through 4) and HWRP to Regional System (Concept Option 13). The lowest ranked concept options are Wet Weather Flow Diversions (Concept Option 6), Ocean Desalination (Concept Option 25), and DPR: Central LA Satellite WRP to LAAFP (Concept Option 21).

6.3 Conclusions

Based on these rankings, the concept options with the highest rankings in certain criteria will be combined and used to develop portfolios. The concept option scores are relatively close to each other, and are sensitive to individual scores in individual categories.

IPR - Hyperion WRP to Central Basin with Spreading Basins (Concept Option 12) is eliminated from further consideration due to a fatal flaw, as there is no capacity in the existing Rio Hondo Spreading Grounds for additional recharge and there is no space available to construct new spreading basins. All other concept options will be considered for a portfolio, if their scores are high enough to warrant inclusion in a portfolio.

Table 14 Concept Option Scoring
One Water LA 2040 Plan – TM 5.2

Project Concept Number	Project Category	Economic				Resiliency					Implementation					Environmental			
	Project Concept Name	Unit cost	Financial benefits	Project funding mechanism	Likelihood to obtain outside funding	Drought resiliency	Earthquake resiliency	Flood risk mitigation	Local supply benefit	Energy Impact/Greenhouse Gas emissions	Constructability	Institutional collaboration	Regulatory approval	Public engagement	Public and Political support	Environmental justice	Open/natural space & recreational benefit	Stormwater quality	Ecological benefit
1	Upper Los Angeles River Watershed	●	🔴	○	◓	◓	◓	◓	●	🔴	◓	🔴	🔴	🔴	◓	🔴	◓	🔴	🔴
2	Ballona Creek Watershed	●	🔴	○	◓	◓	◓	◓	●	🔴	◓	◓	🔴	🔴	◓	◓	◓	🔴	🔴
3	Dominguez Channel Watershed	●	◓	◒	◓	◓	◓	◓	●	🔴	◓	◓	🔴	🔴	◓	🔴	◓	🔴	🔴
4	Santa Monica Bay/Marina del Rey Watersheds	●	🔴	◒	◓	○	◓	◓	●	🔴	◓	◓	🔴	🔴	◓	◓	◓	🔴	🔴
5	Dry Weather Low Flow Diversions	🔴	◓	◓	○	○	◓	◓	●	◓	◓	○	🔴	○	◓	◓	○	◓	◓
6	Wet Weather Flow Diversions	●	◓	○	◓	●	○	◓	●	◓	◓	○	◓	○	◓	◓	○	◓	◓
7	Upper Los Angeles River to Tillman WRP	🔴	◓	◓	◓	●	◓	◓	●	◓	◓	◓	○	◓	◓	○	○	◓	○
8A	LA River Recharge into LA Forebay using Injection Wells	◒	○	○	○	●	◓	◓	◓	○	◒	🔴	○	🔴	○	○	◓	◓	○
9	Tillman WRP to San Fernando Basin Injection Wells	◓	○	◓	◓	🔴	◓	◓	○	◒	◓	◓	○	◓	◓	○	○	◒	○
10	Hyperion WRP to West Coast Basin Injection Wells	○	○	○	◓	🔴	🔴	○	○	●	○	🔴	◓	◓	◓	○	○	◒	○
11	Hyperion WRP to Central Basin Injection Wells	○	○	○	◓	🔴	🔴	○	◓	◒	○	🔴	◓	◓	◓	○	○	◒	◓
12	Hyperion WRP to Central Basin with Spreading Basins[1]	○	○	○	◓	🔴	🔴	○	🔴	◒	○	🔴	◓	◓	◓	○	◓	○	◓
13	Hyperion WRP to Regional System	◓	○	◓	🔴	🔴	◓	○	🔴	○	◓	🔴	◓	◓	◓	◓	○	○	◓
14	Hyperion WRP to San Fernando Basin Injection Wells	○	○	○	◓	🔴	◓	○	○	◒	◒	◓	◓	○	○	○	○	○	◓

Table 14 Concept Option Scoring
One Water LA 2040 Plan – TM 5.2

Project Concept Number	Project Category	Economic				Resiliency					Implementation					Environmental			
	Project Concept Name	Unit cost	Financial benefits	Project funding mechanism	Likelihood to obtain outside funding	Drought resiliency	Earthquake resiliency	Flood risk mitigation	Local supply benefit	Energy Impact/Greenhouse Gas emissions	Constructability	Institutional collaboration	Regulatory approval	Public engagement	Public and Political support	Environmental justice	Open/natural space & recreational benefit	Stormwater quality	Ecological benefit
15	Tillman WRP to Los Angeles Aqueduct Filtration Plant	4	3	4	4	5	4	4	3	2	4	4	2	4	3	3	3	2	3
16	Tillman WRP to LADWP Distribution System	4	4	4	4	5	4	4	3	3	5	4	2	4	3	3	3	2	3
17	LA/Glendale (LAG) WRP to Headworks Reservoir	4	4	4	4	5	4	4	2	3	4	4	2	4	3	3	3	2	3
18	Hyperion WRP to LADWP Distribution System	4	3	4	4	5	4	3	5	2	4	4	2	4	3	3	3	3	4
19	Hyperion WRP to Headworks Reservoir	3	3	3	4	5	4	3	5	2	3	4	3	4	3	3	3	3	4
20	Hyperion WRP to Los Angeles Aqueduct Filtration Plant	3	2	3	4	5	4	3	5	2	3	4	3	4	3	3	3	3	4
21	Central LA Satellite WRP to Los Angeles Aqueduct Filtration Plant	2	2	3	4	5	3	3	5	2	2	4	2	4	3	3	3	3	3
22	East-West Valley Interceptor Sewer	5	4	4	3	5	4	3	1	4	4	4	4	3	4	3	3	3	3
23	Increase Recycled Water Demand beyond 2015 UWMP	3	3	3	3	5	4	4	3	4	3	4	4	4	4	3	3	3	3
24	Rancho Park Water Reclamation Facility	3	3	4	4	4	4	4	2	2	3	4	4	4	4	3	3	3	3
25	Ocean Desalination	3	3	3	3	5	4	3	4	1	3	4	3	5	3	3	3	3	2

Harvey Ball Concept Scores: ● = 1 (Low Score) ◒ = 2 ○ = 3 ◓ = 4 ● = 5 (High Score)

Notes:
(1) Concept Option 12 has been eliminated due to a fatal flaw due to implementation constraints.
(2) Concept Options 8B and 26 were developed at a later planning stage, and were therefore not included in the concept scoring exercise.

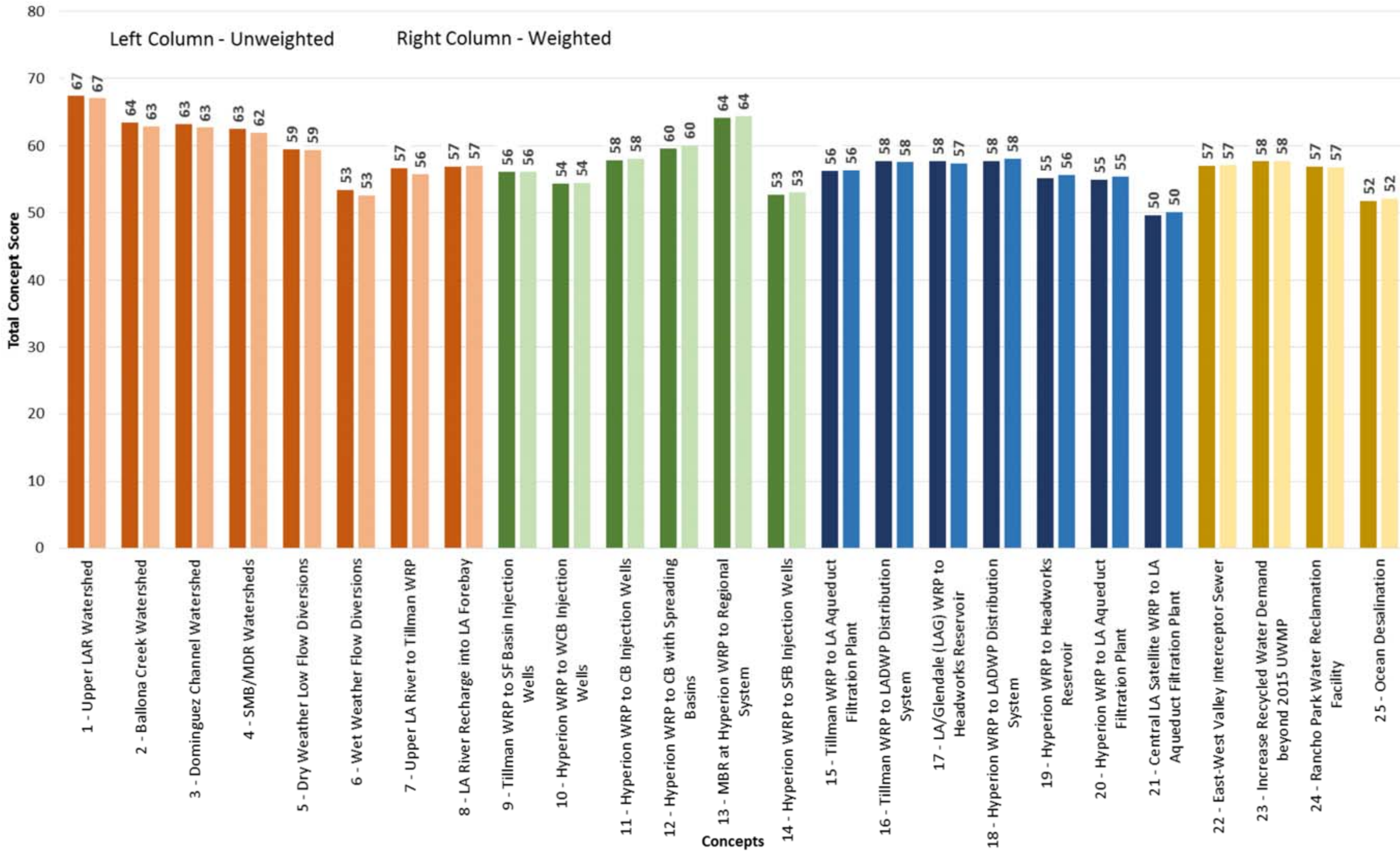


Figure 10 - Comparison of Concept Option Rankings - Unweighted and Weighted Scores
One Water LA 2040 Plan
TM 5.2 - Project Development

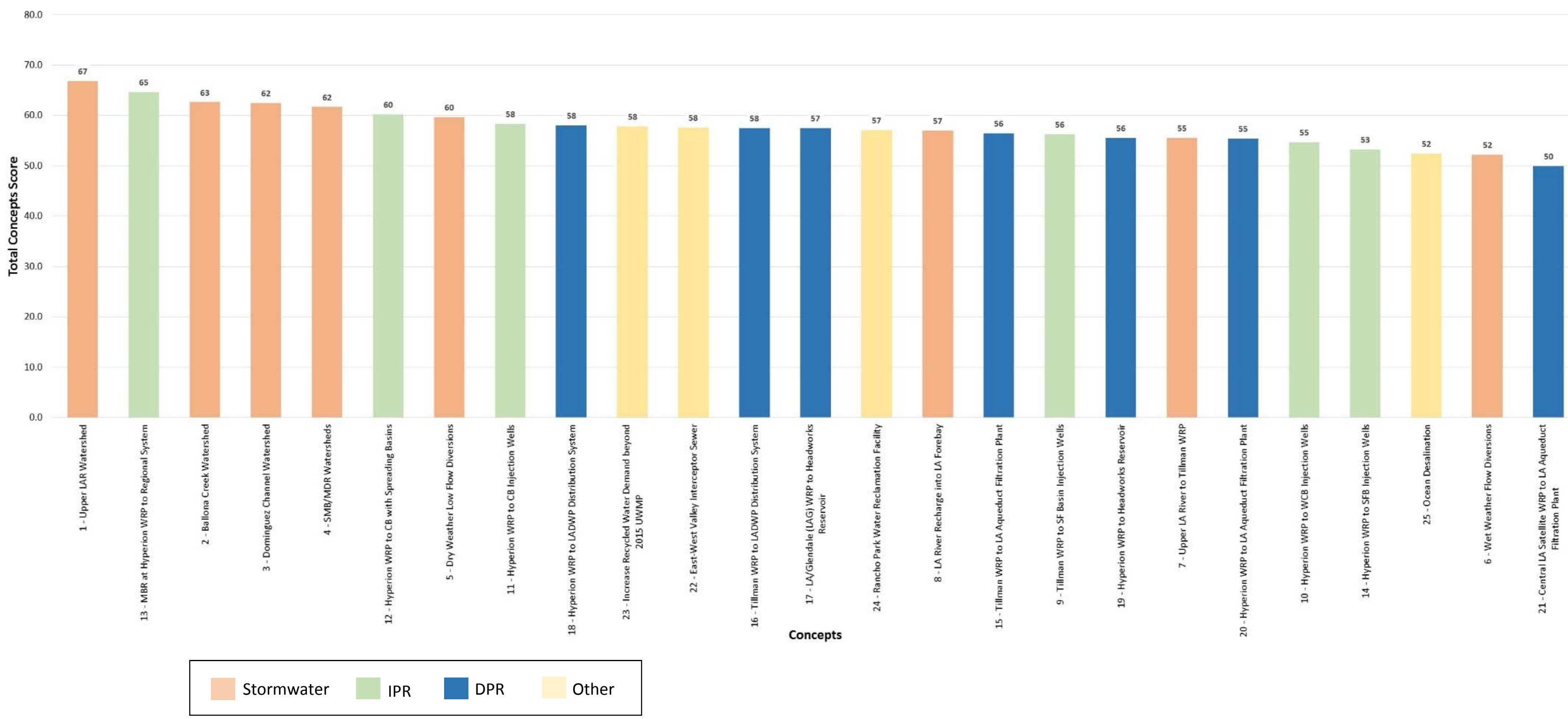


Figure 11 - Concept Option Weighted Scores by Rank

One Water LA 2040 Plan

TM 5.2 - Project Development

7.0 NEXT STEPS

7.1 Portfolio Scoring Methodology

The majority of Potential Concepts will move forward into the portfolio evaluation through inclusion in one or more of the themed project portfolios, although the lowest ranked concepts may be eliminated from further evaluation as part of the Plan. A total of five portfolios will be developed, including one "No Action" portfolio. The No Action portfolio will represent existing conditions along with the implementation of the In-Progress Projects.

The remaining four portfolios will be arranged around themes that emphasize a particular strategy, such as maximizing stormwater capture, maximizing water recycling, or optimizing local water supplies. The themed portfolios will be analyzed using a combination of measures:

- **Total Portfolio Cost –** The total life cycle cost of all concepts within a portfolio will be calculated by combining the total capital cost, annual operation and maintenance (O&M) cost, and corresponding asset depreciation period.
- **Total Benefit Score –** The combined benefit score of all concepts within a portfolio will be calculated by prorating each concept score based on its yield to normalize for concept size.
- **Supply Resiliency Score –** A separate analysis will be conducted utilizing the Mass Balance Tool (MBT) and the three 10-year hydrologic sequences described in Section 3.0. The MBT will be used for each portfolio by activating all In-Progress and concept options in that particular portfolio. The MBT will then be run under normal, wet, and dry year conditions for year 2040 to calculate the percentage of local water supply under these three single-year hydrologic conditions. To account for a range of long-term hydrologic conditions, the average local water supply contribution of each portfolio will be calculated using the three, 10-year hydrologic sequences to develop a supply resiliency score.

Depending on future input from City staff and the calculated scores, the local supply resiliency score can be integrated into the total benefit score or maintained as a separate metric. Ultimately, a preferred long-term strategy that achieves both local water supply goals, the City Sustainability pLAn goals, and stormwater compliance targets will be developed optimizing portfolios and concepts to achieve a maximum cost-benefit score and/or cost-supply resiliency score. This combination of concepts will be utilized to develop the core of the long-term road map of the One Water LA 2040 Plan. The portfolio development and evaluation process will be documented in TM 5.3 (Portfolio Development).

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ADDENDUM TO CONCEPT OPTION 24 - RANCHO PARK WATER RECLAMATION FACILITY

As part of the City of Los Angeles (the City) One Water LA 2040 Plan, the Rancho Park Water Reclamation Facility (WRF) project concept report was developed on September 2016. Since then, the City has updated project parameters such as wastewater supply, recycled water demands, and capital cost estimates. This document is an addendum to concept option 24 in TM 5.2- Long term concepts development. Developed by the City, this document serves as an amendment to the original concept report, and includes updated estimation for project capital cost and potential project concept alternatives.

1.0 UPDATED PROJECT COST ESTIMATES

During the initial development of the Rancho Park WRF concept report, CDM Smith provided conceptual cost estimates for the project capital and O&M costs based on other similar projects, industry publications, and typical pipeline installation costs. The WRF capital and O&M costs were estimated as $120,770,000 and $3,038,000, respectively (CDM Smith, 2016). In late December 2016, after the final draft concept report was drafted, the City issued a Request for Interest (RFI) to collect additional project ideas on treatment technologies, cost estimates, and delivery methods. A total of fifteen (15) consulting firms responded to the RFI of which four (4) provided detailed project related ideas in their responses. In reviewing the responses and studying similar projects, the capital cost for the WRF was found to be much lower than initially estimated.

One case study is the Santa Paula Water Recycling Facility, which was completed and began operations in May 2010. In early 2000s, the City of Santa Paula engaged a local engineering firm to develop plans for a new wastewater treatment facility. The firm developed a 30 percent complete design and calculated cost estimates for the eventual construction price. The early estimates were between $80 and $100 million dollars, leading to significant concern over the City's ability to afford the facility (University of North Carolina, 2016). However, during the actual RFP process in 2008, the project contractor, PERC Water, decreased treatment capital cost to $58 million dollars by optimizing the project design, minimizing the project footprint, and utilizing underground spaces. Table E-2 lists some key details of this project:

Table E-2 Key Project Details of Santa Paula WRF[1]
One Water LA 2040 Plan - TM 12.1 Amendment
City of Los Angeles, CA

Local Government Entity:	Santa Paula Utility Authority and City of Santa Paula
Primary Facility/Service:	Wastewater treatment and water reuse
Treatment Facility:	3.4 MGD, expandable to 4.2 MGD
Type of Treatment Technology:	Membrane Bioreactor + Ultraviolet & Biosolids
Project Schedule:	2 Years

Table E-2 Key Project Details of Santa Paula WRF[1] One Water LA 2040 Plan - TM 12.1 Amendment City of Los Angeles, CA	
Major Initial Outlays:	$62 million (initial capital cost of WRF and related facilities)
Treatment Facility Capital Cost[2]:	$58 million
Delivery Model:	Design Build Operate Finance (DBOF)
Contract Period:	30 Years P3 Contract

Notes:
(1) Santa Paula Water Recycling Facility. University of North Carolina, Environmental Finance Center. November 2016.
(2) Brian Cullen (President, PERC Water), conversation with Author, May 8, 2017.

Based on the collected information from responses to RFI, discussion with designers of similar project and other most recent studies, the City revised the cost estimates for treatment facility capital cost to $58 million. The O&M cost estimates remain the same, $1.9 million/year to 2.5 million/year, as discussed in TM 5.2. Similar to the previous cost estimates, these revised estimates are still considered Class 5 estimates, based on a level of project definition of 0 to 2 percent, per the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System.

2.0 PROJECT CONCEPT ALTERNATIVES

Based on previous correspondence with University of California Los Angeles (UCLA), the average annual non-potable demand for UCLA could increase to 1.0 mgd. However, infrastructure retrofit needs to be performed to accommodate the increases in non-potable water usage. Currently, LADWP and LASAN are actively reaching out to UCLA, along with other customers in the area to confirm their future non-potable demands. Meanwhile, two alternatives were developed regarding the potential project siting locations.

Alternative 1 includes one WRF at Rancho Park Golf Course that will meet the total non-potable water demand for the West LA/Westwood Area. Alternative 2 includes one WRF near UCLA that will provide 1.0 mgd non-potable water for UCLA, and one WRF at Rancho Park Golf Course that will produce recycled water to meet non-potable demand for golf course and other potential users in the area.

These two project alternatives are currently under detailed evaluation by multiple City Departments.

APPENDIX A – REFERENCES

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LADWP, 2016, *Recycled Water Annual Report Fiscal Year 2015-16*. August 2016.

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LADWP/LASAN, 2012, *Long Term Concepts Report*, March 2012. Prepared by RMC and CDM.

LADWP/LASAN, 2012, *Non-Potable Reuse Master Planning Report*, March 2012. Prepared by RMC and CDM.

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LADWP/LASAN, 2012, *Terminal Island Water Reclamation Plant Barrier Supplement and Non-Potable Reuse Concepts Report*, March 2012. Prepared by RMC and CDM.

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LASAN, 2015, *Evaluating Municipal Recycled Water Usage in Concrete Mixes*, September 2015.

LASAN, 2015, *Upgrades to Pump Plants and Associated Stormwater Treatment Opportunities in the City of Los Angeles Santa Monica Bay Watershed: Implementation Strategy for Pump Plant 647*, June 11, 2015. Prepared by Tetra Tech and Black & Veatch.

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West Basin Municipal Water District, *Desalination Demonstration Facility Intake Effects Assessment Report*, August 13, 2014. Prepared by Tenera Environmental.

Other documents utilized for the preparation of this TM include:

- Draft Green Alleys Master Plan
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- California Friendly Garden information - http://www.bewaterwise.com/Gardensoft/index.aspx
- Lastormwater.org
- LA's Transportation Element as Mobility Plan 2035
- LA County Model Design Manual for Living Streets
- Complete Streets Design Guide
- LA Greenway 2020 information can be found at http://www.larivercorp.com/greenway2020
- LA River Revitalization information can be found at http://www.lariver.org/index.htm
- Metro, Union Station Master Plan - https://www.metro.net/projects/la-union-station/
- Caltrans, 2013. Main Street California is an informational guide published in 2013 – Caltrans
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APPENDIX B – IN-PROGRESS PROJECTS

IN-PROGRESS PROJECT 1	
PROJECT CONCEPT NAME	**Increase Groundwater Pumping**
PROJECT CONCEPT DESCRIPTION	The Los Angeles Department of Water & Power (LADWP) is undertaking a number of projects to increase groundwater pumping where possible.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: up to 47,000 AFY 42 mgd Wet Year: up to 47,000 AFY 42 mgd Dry Year: up to 47,000 AFY 42 mgd Water Supply Benefit = up to 47,000 AFY Yield Assumptions: LADWP estimates that, based on fully utilizing groundwater rights and other available groundwater, they will be able to pump a total of 114,070 AFY (UWMP, 2015). In comparison, LADWP's 5-year average of groundwater pumping is 67,135 AFY (UWMP, 2015). Thus, using native yield, LADWP could increase its groundwater pumping by 47,000 AFY.
ESTIMATED COST	Capital: Undefined O&M: $392/AF (2014/15 unit cost to pump groundwater [UWMP, 2015]) Unit: $392/AF (2014/15 unit cost to pump groundwater [UWMP, 2015]) Energy: 580 kWh/AF (UWMP, 2015) *Cost assumptions: (OneWaterLA, TM 5.1) *Note: The unit cost includes operating and maintaining water well pumps, conveyance piping, disinfection treatment systems, electrical services, associated repairs, annualized depreciation of fixed infrastructure, and related financing and overhead costs. Payments of groundwater replenishment fees to an outside agency are also included. Other related costs were recently recognized and are now being incorporated into this analysis beginning with Fiscal Year 2010-11; these related costs include pressurization of groundwater to service pressure, payment of fees to the Court-appointed Watermasters, and groundwater planning and management services (UWMP, 2015).*

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☒ Integrate management of water resources & policies	☐ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (ULARA Watermaster, Central and West Coast Basin Watermaster, Other Agencies Pumping from Basins)	

GENERAL BACKGROUND/PURPOSE

LADWP is undertaking an effort to maximize its groundwater pumping.

In the San Fernando Groundwater Basin, there is an existing remediation program that will result in a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-quality groundwater cleanup that restores the beneficial use of the SFB. The San Fernando Groundwater Basin is adjudicated, and the City has water rights of 87,000 AFY from this basin (UWMP, 2015). LADWP is pursuing this program to maintain its ability to utilize their groundwater rights from the San Fernando Basin. In the past five years, the City has pumped an average of 58,000 AFY (UWMP, 2015), 29,000 AFY less than their water right. In the Sylmar Basin, LADWP owns the Mission Wellfield. Due to groundwater contamination, the City has been pumping less than its annual water right of 3,570 AFY. LADWP is currently drilling new wells to restore LADWP's pumping capacity and ability to produce its water right in this basin.

In the Central Basin, LADWP owns the Manhattan and 99th Street Wellfields. The City has an annual water right of 17,236 AFY, but has not been pumping its full allocation due to groundwater contamination. LADWP is currently rehabilitating and constructing groundwater wells and treatment facilities to pump its full water right. Additionally, the Central Basin Judgment Third Amendment allows the City to pump its unused West Coast Basin water right (1,503 AFY) out of the Central Basin, which the City has not used in recent years. The City might exercise its right to transfer its water right from the West Coast Basin to the Central Basin.

The City is also developing groundwater management strategies for the Hollywood, Santa Monica, and Eagle Rock Basins to increase its groundwater supply.

Based on developing groundwater supplies, LADWP expects to be able to pump 114,070 AFY of groundwater yield, 47,000 AFY above historical pumping.

POTENTIAL CHALLENGES

- Regulatory compliance and permitting
- Groundwater contamination and water quality issues
- Plume migration
- Potential for emerging contaminants
- High cost for treating groundwater supplies with degraded quality
- Environmental risk from contaminants
- Sustainable management
- Declining water levels and overdraft
- Aging infrastructure and mechanical deterioration
- Seawater intrusion (in West Coast and Santa Monica Basins)
- Water quantity available in non-managed basins
- Compliance with SGMA in non-managed basins – focused on empowering local agencies with tools needed to manage local groundwater basins in a sustainable manner; requires local agencies to form Groundwater Sustainability Agencies, develop and implement Groundwater Sustainability Plans, and monitor/report status of groundwater conditions within each basin.
- Collaboration with regional partners

EXPECTED PROJECT CONCEPT TIMELINE

2016 - 2022

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 Brown and Caldwell, 2015. Groundwater System Improvement Study Remedial Investigation Update Report. February 26.
4 LADWP, 2015. UWMP.
5 ULARA Watermaster, 2016. Web Site. http://ularawatermaster.com/
6 Central Basin Watermaster. Web Site. http://www.cbwatermaster.org/about.html
7 DWR, Bulletin 118 (California's Groundwater) and Web Site. (http://www.water.ca.gov/groundwater/sgm/basin_boundaries.cfm)
8 MWD, 2007. Groundwater Assessment Study. Chapter IV – Groundwater Basin Reports. September.

Disclaimer: This Conceptual Project/Program Description is limited to conceptual planning level information, based on information known as of December 2016, & costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is typed in italic font.

IN-PROGRESS PROJECT 2

PROJECT CONCEPT NAME	**Groundwater Replenishment Project with AWPF at Donald C. Tillman WRP (up to 30,000 AFY in San Fernando Basin)**
PROJECT CONCEPT DESCRIPTION	The project would provide up to 30,000 AFY of purified recycled water from the Donald C. Tillman (DCT) Water Reclamation Plant (WRP), for groundwater replenishment in the San Fernando Basin (SFB).
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other

ESTIMATED YIELD & COST

ESTIMATED YIELD	Normal Year: 30,000 AFY 27 mgd	Wet Year: 30,000 AFY 27 mgd	Dry Year: 30,000 AFY 27 mgd
	Water Supply Benefit = 30,000 AFY		
ESTIMATED COST	Capital: $410 million O&M: $11.5 million/year Unit: $910/AF Energy: $7 million/year *Cost assumptions: (Capital, O&M and energy costs from LADWP, GWR NPR, 2012, adjusted to July 2016 costs; Unit costs from LADWP, UWMP, 2015)		

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other (…)	

GENERAL BACKGROUND/PURPOSE

The groundwater replenishment (GWR) project would provide up to 30,000 AFY of purified recycled water from the DCTWRP, for groundwater replenishment in the SFB. Existing and new recycled water pipelines would convey purified water to the Hansen and Pacoima Spreading Grounds in the eastern San Fernando Valley, replenishing the SFB. Hansen Spreading Grounds is located in Sun Valley, along the northwest side of the Tujunga Wash Channel. Pacoima Spreading Grounds is located in Arleta, adjacent to Pacoima Wash and the Pacoima Diversion Channel. Infiltrated water would travel underground as groundwater for several years until it would be pumped out by existing groundwater wells to supplement the City's local potable water supplies. This project would include three components: (1) construction of an advanced water purification facility (AWPF) at DCTWRP, (2) recycled water conveyance, and (3) groundwater replenishment.

AWPF at DCTWRP – The DCTWRP produces recycled water for non-potable water uses. In order to comply with State Groundwater Regulations on groundwater recharge with recycled water, advanced treatment processes are needed. A new AWPF would be built at the DCTWRP to purify the recycled water for groundwater replenishment. The AWPF would be located in the southeast corner of the DCTWRP complex on an approximate 1.75-acre vacant site. This facility would utilize purification processes and technologies that could include ozonation, biologically activated carbon, microfiltration, reverse osmosis, and advanced oxidation. Pilot testing would evaluate other processes/technologies for water quality, operational efficiencies, and cost effectiveness. To improve operations of the existing WRP, operate the AWPF at a constant flow, as well as maximize production, a primary flow equalization tank is being added with capacity of 6.5 MG in the northeastern part of DCTWRP.

Recycled Water Pipeline and Conveyance – Purified water produced at the AWPF would be conveyed to Hansen Spreading Grounds using an existing 10-mile, 54-inch diameter recycled water pipeline. Also, a newly constructed 2-mile long, 42-inch diameter recycled water pipeline would convey purified water to the Pacoima Spreading Grounds.

Groundwater Replenishment – Purified water would be used to recharge the SFB at the existing spreading grounds (Hansen and Pacoima). Up to 19,000 AFY and 23,000 AFY could be recharged at Hansen and Pacoima spreading grounds, respectively. However, each facility would recharge at an estimated average of 15,000 AFY with a combined total of 30,000 AFY.

LADWP holds adjudicated water rights in the SFB to extract 87,000 AFY. Allowable pumping would increase an amount equal to the GWR of the SFB provided by this project, contributing to local supply sustainability and reliability. LADWP would use existing groundwater production wells to extract groundwater.

POTENTIAL CHALLENGES

- Recycled water regulations: permitting, regulatory approval, and compliance (i.e., retention time, blending requirements, etc.)
- Public acceptance
- Construction challenges
- Groundwater mounding and rising groundwater levels (i.e., interaction with landfills)
- Influence on existing contaminant plumes in the SFB

EXPECTED PROJECT CONCEPT TIMELINE

The GWR Project is currently in the planning and environmental analysis stage. A Final Environmental Impact Report (EIR) was certified in December 2016. The City plans to begin groundwater replenishment operations in 2023. The project is planned to be implemented in multiple phases. Phase 1 will add ozone treatment and deliver up to 6 mgd. Phase 2 will add biologically active carbon (BAC) and make capital improvements to divert additional flows to DCT. Phase 3 will include the AWPF.

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 AECOM (prepared for LADWP), 2016. Draft EIR for the Los Angeles Groundwater Replenishment Project. May.
4 LADWP, 2016. Notice of Availability of Draft EIR for the Los Angeles Groundwater Replenishment Project. May.
5 LADWP, 2016. Web Site – Water. www.ladwp.com
6 LADWP, undated. Fact Sheet – Groundwater Replenishment Project.
7 RMC/CDM Smith (Prepared for the City of LA), 2012. Groundwater Replenishment Master Planning Report. March.
8 LAGWR May 2016 Draft EIR, ES-10.

Disclaimer: This Conceptual Project/Program Description is limited to conceptual planning level information, based on information known as of December 2016, & costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is typed in italic font.

IN-PROGRESS PROJECT 3			
PROJECT CONCEPT NAME	**Terminal Island AWPF Expansion to 12 mgd**		
PROJECT CONCEPT DESCRIPTION	The AWPF expansion at TIWRP (Phase 2) will provide reliable and highly-purified recycled water to recharge the Dominguez Gap Barrier (DGB), as well as to supply recycled water to Harbor Area industrial users and to replenish the evaporation losses at Machado Lake.		
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other		
ESTIMATED YIELD & COST			
ESTIMATED YIELD	Normal Year: 6,700 AFY 6 mgd	Wet Year: 6,700 AFY 6 mgd	Dry Year: 6,700 AFY 6 mgd
	Water Supply Benefit = 0 AFY, unless NPR using this water is completed (In-Progress Project 9)		
ESTIMATED COST	Capital: $77 million O&M: $2.3 million/yr Unit: $250/AF Energy: $600,000/yr *Cost assumptions: Capital costs from LASAN Wastewater Capital Improvement Program FY 2015/16. O&M and energy costs assumed based on OneWaterLA, TM 5.1		

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☒ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other (...)	

GENERAL BACKGROUND/PURPOSE

The goal of the AWPF expansion at TIWRP (Phase 2) is to provide reliable and highly-purified recycled water to recharge the Dominguez Gap Barrier (DGB), to supply recycled water to Harbor Area industrial users, to replenish the evaporation losses at Machado Lake, and to eliminate discharges from TIWRP to the ocean.

LASAN constructed the first phase of TIWRP AWPF, as well as a pipeline distribution network, to route up to 6 mgd of recycled water to the DGB for groundwater replenishment and to protect the groundwater basin from seawater intrusion. Phase 1 of the AWPF has been in operation since 2006, consisting of membrane filtration (MF) and reverse osmosis (RO).

Phase 2 TIWRP AWPF Expansion Project will double the current advanced recycled water treatment capacity from 6 mgd (6,700 AFY) to 12 mgd (13,400 AFY) of product water and would upgrade the TIWRP to full advanced treatment (FAT), with the addition of treatment with advanced oxidation processes (AOP). The main reasons for the upgrade were to increase the amount of recycled water produced by TIWRP while meeting current and anticipated regulations and to avoid secondary effluent discharge to the harbor by 2020. Phase 2 includes additional MF, RO, and AOP systems and upgrades to existing pump stations and systems, a chemical addition system, auxiliary systems, and utilities. To operate the AWPF at a constant flow, as well as maximize production, Phase 2 also includes a two (2) million gallon (MG) tertiary effluent equalization tank, upstream of the AWPF.

The primary funding source for this project is a cost reimbursement from LADWP and subsequent sale of water to the Water Replenishment District (WRD) and various non-potable water users.

This project will also include supplying recycled water to Harbor Area industrial users, and this portion of the project is termed the "Harbor Water Recycled Project." LASAN, BOE, and LADWP partnered to form the Harbor Water Recycling Project.

POTENTIAL CHALLENGES

- Connecting additional customers
- Expanding recycled water distribution system infrastructure

EXPECTED PROJECT CONCEPT TIMELINE

Phase 2 expansion of TIWRP was online in February 2017.

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 Terminal Island Water Reclamation Plant Advanced Water Purification Facility Operation Optimization Plan Draft October 2016.
4 LADWP, 2015. UWMP.
5 One Water LA - TM NO. 7.4 Terminal Island Water Reclamation Plant Facility Plan Final Draft October 2016.
6 LASAN projects information website https://www.lacitysan.org/san/faces/home/portal/s-lsh-sp/s-lsh-sp-awpf?_adf.ctrl-state=h8imyl4k2_53&_afrLoop=4643485709223648#.

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IN-PROGRESS PROJECT 4

PROJECT CONCEPT NAME	**Expansion of NPR per 2015 Urban Water Management Plan**
PROJECT CONCEPT DESCRIPTION	This project would expand non-potable reuse (NPR) in accordance with the 2015 Urban Water Management Plan.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other

ESTIMATED YIELD & COST

ESTIMATED YIELD	Normal Year: 18,872 AFY 17 mgd Wet Year: 18,872 AFY 17 mgd Dry Year: 18,872 AFY 17 mgd Water Supply Benefit = 18.872 AFY
ESTIMATED COST	Capital: $400 Million O&M: $4 Million/year Unit: $1,500/AF Energy: $435,000/year *Cost assumptions: (OneWaterLA, TM 5.1)

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☐ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (LADPW)	

GENERAL BACKGROUND/PURPOSE

This project would expand non-potable reuse (NPR) in accordance with the 2015 Urban Water Management Plan. In 2015, Mayor Garcetti set forth a roadmap to transform Los Angeles into an environmentally healthy and prosperous city with numerous goals in his "Sustainable City Plan" such as increased recycled water usage. LADWP currently supplies approximately 11,000 AFY of recycled water to its customers. To achieve the 2015 Urban Water Management Goal to offset potable water usage with 59,000 AFY of recycled water by 2025 (52.7 mgd), the City is implementing the Groundwater Replenishment Project (30,000 AFY) and intends to expand NPR by approximately 19,000 AFY.

To meet the 2025 target, the NPR water must expand customer usage and the purple pipe infrastructure. Meeting the expected demands would involve a combination of new pipelines, pump stations and reservoirs, and connecting new customers. LADWP expects to receive additional recycled water supplies that would be available in the Valley, Metro, Westside, and Harbor service areas.

The total cost of the NPR projects is estimated at $750M (LADWP, UWMP 2015). The current primary funding source for these projects is LADWP water rates. Other identified funding sources are federal funding from the Federal Water Project Authorization and Adjustment Act of 1992 and the US Bureau of Reclamation Title XVI Program, state funding from the State Water Resources Control Board (SWRCB), and project funding from the Metropolitan Water District of Southern California's "Local Resources Program (LRP)." LADWP will pursue these aforementioned sources as they become available.

POTENTIAL CHALLENGES
• There will be a significant effort for the feasibility, constructability, and cost associated with expanding the purple pipe infrastructure. • The recycled water may not be available consistently at times. • The recycled water quality must be tested and consistently meet regulations.
EXPECTED PROJECT CONCEPT TIMELINE
2016 to 2025
SOURCES
1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016. 2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016. 3 LADWP, UWMP 2015. Urban Water Management Plan. 2015. 4 LADWP and LADPW, Recycled Water Master Planning documents, March 2012.

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IN-PROGRESS PROJECT 5	
PROJECT CONCEPT NAME	**Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station**
PROJECT CONCEPT DESCRIPTION	The Hyperion WRP would provide advanced treated reclaimed water to serve non-potable water demands at LAX and the Scattergood Generating Station.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 5,600 AFY 5 mgd Wet Year: 5,600 AFY 5 mgd Dry Year: 5,600 AFY 5 mgd Water supply benefit = 5,600 AFY
ESTIMATED COST	*Capital: $130 million* *O&M: $4 million/year* *Unit: $2,400/AF* *Energy: $ 1.5 million/year* **Cost assumptions: (One Water LA, TM 5.1)*

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☐ Increase climate resilience	☒ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other (…)	

GENERAL BACKGROUND/PURPOSE

The intent of this project is to implement the initial steps of a long-term strategy that would seek to "fully" reuse water from the Hyperion Water Reclamation Plant (HWRP.) The proposed facilities would include the Los Angeles World Airports (LAWA) Plant (1.5 mgd of advanced treatment, expandable to 5 mgd). The advanced water treatment (AWT) facility would be a production facility serving LAX and Scattergood Generating Station. Further details on the first 1.5 mgd project are defined in TM 3.2.

The objective of the AWT would be to produce advanced treated reclaimed water supplied to LAX to reduce potable consumption, to demonstrate the high levels of quality and reliability for this alternative water supply, and to provide HWRP staff with experience in the O&M of advanced water treatment facilities. The objective is to develop a design basis for full-scale conversion of a portion of the existing high purity oxygen activated sludge (HPOAS) system to 70 mgd of nitrified denitrified (NDN) secondary treatment using air-membrane bioreactor (MBR), to assess the impacts of the MBR treatment to downstream membrane processes and other advanced treatment systems, to determine the ability to obtain pathogen removal credit from the State Water Resources Control Board (SWRQB) - Division of Drinking Water (DDW) for the MBR membranes to achieve full advanced treatment (FAT), to develop operational experience with the systems, to compare performance between vendors, and to develop a more detailed estimate of costs for the capital value of the conversion envisioned and long-term operations.

POTENTIAL CHALLENGES
• Obtaining approval from the SWRCB - DDW for FAT of the MBR system would require an in-depth sampling plan. • Confined space within HWRP would limit the LAWA and the Demonstration plants ability to expand. • Construction of approximately 8,000 to 10,000 feet of purple pipe from Hyperion to LAX and SGS • Difficult pipe jacking at the intersection of Pershing and Imperial • Construction of a 500,000 to 1 million gallon tank at Hyperion to provide operational flexibility and reliability for LAX and SGS • Additional forms of water backup for LAX and SGS including a swivel "L" at the tank at Hyperion and a diesel generator for the pump station
EXPECTED PROJECT CONCEPT TIMELINE
2019 to 2020
SOURCES
1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016. 2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.

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IN-PROGRESS PROJECT 6

PROJECT CONCEPT NAME	**Hyperion WRP Delivery Expansion to 70 mgd for West Basin MWD and Harbor**
PROJECT CONCEPT DESCRIPTION	HWRP is delivering up to 70 mgd of secondary treated effluent to ECLWRF to be treated to recycled water standards and beneficially reused.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other

ESTIMATED YIELD & COST

ESTIMATED YIELD	Normal Year: 39,200 AFY 35 mgd	Wet Year: 39,200 AFY 35 mgd	Dry Year: 39,200 AFY 35 mgd
	Water Supply Benefit = 0 AFY to City of LA; regionally, water supply benefit is 39,200 AFY.		
ESTIMATED COST	*Capital: $15.6 Million. Does not include West Basin MWD's costs.* *O&M: $315,000/year* *Unit: $80/AF* *Energy: $1.9 Million/year* **Cost assumptions: (One Water LA, TM 5.1)*		

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (WBMWD)	

GENERAL BACKGROUND/PURPOSE

The Hyperion Water Reclamation Plant (HWRP) currently delivers an average of 35 mgd of secondary treated effluent to Edward C. Little Water Recycling Facility (ECLWRF) to be treated to recycled water standards and beneficially reused. The pump station that sends water to ECLWRF currently has a firm capacity of 50 mgd and total capacity of 70 mgd. For HWRP to deliver an additional 35 mgd the pump station is being expanded to a firm capacity of 83 mgd and total capacity of 98 mgd, pumping a total of 70 mgd of secondary treated effluent to ECLWRF. The pump station expansion is a joint effort between LASAN, WBMWD, and LADWP. Upon completion of the pump station expansion, HWRP is delivering up to 70 mgd of secondary treated effluent to ECLWRF to be treated to recycled water standards and beneficially reused.

POTENTIAL CHALLENGES

- *Additional recycled water customers need to be identified*

EXPECTED PROJECT CONCEPT TIMELINE

2024-2028

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 2015 Urban Water Management Plan

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IN-PROGRESS PROJECT 7	
PROJECT CONCEPT NAME	**Upper LA River Watershed (EWMP/SCMP Regional/Centralized & Prop. O)**
PROJECT CONCEPT DESCRIPTION	This project would include implementation of numerous stormwater projects in the Upper Los Angeles River Watershed area identified in various plans and programs.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD*	Normal Year: 83,000 AFY 74 mgd; Wet Year: 290,000 AFY 260 mgd; Dry Year: 13,000 AFY 11 mgd *The dry and wet year yields are based calculations presented in TM 2.1 and the Stormwater Facilities Plan. The normal year yield estimate of 83,000 AFY is attributed to numerous stormwater projects as calculated in the Stormwater Facilities Plan and includes EWMP, SCMP, Prop O projects, regional, centralized, distributed, and green streets. There are 4 Propositions O projects in the Los Angeles River Watershed. The yields of these projects have not yet been estimated, but these projects are included in this project concept.
ESTIMATED COST	Refer to Volume 3 Stormwater Facilities Plan for cost information.

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (LA River Watershed Management Group)	

GENERAL BACKGROUND/PURPOSE

This Project Concept includes numerous stormwater projects in the Upper Los Angeles River Watershed area identified in various plans and programs, including:

- Regional projects (inclusive of signature regional projects and all others identified) as described in the Upper Los Angeles River Watershed EWMP (Black and Veatch et al, 2015).
- Prop O projects, scheduled for completion after March 2017.
- All projects identified in the SCMP (Geosyntec, 2015).
- All projects identified in the 5-Year CIP (LABOS, 2015) (Note - the CIP includes some of the Upper Los Angeles River Watershed EWMP regional, green street projects, and other planned projects).

This Project Concepts includes the following projects, which fall within the above categories and within the Upper Los Angeles River Watershed:

- 118 regional projects, of which there are 8 signature regional projects, as identified in the Upper Los Angeles River Watershed EWMP.
- 4 Prop O projects.
- 29 centralized projects from the SCMP.
- 8 other projects identified in the 5-Year CIP that are not in the Upper Los Angeles River Watershed EWMP.

The various plans and programs, as discussed above, were developed to meet multiple objectives related to water quality and water supply. If the projects within the Upper Los Angeles River Watershed are not implemented then the water quality benefits, MS4 compliance, and groundwater recharge benefits might not be realized.

POTENTIAL CHALLENGES

- Funding - Sources of funding for implementing the Upper Los Angeles River EWMP and the Storm Water Capture Master Plan are not clearly identified
- Institutional - Agreement on priority of implementation
- Institutional - Ability to implement projects on private land
- Environmental Impacts - Biological resources, cultural resources, air quality, hazardous materials, hydrology/water quality, noise, and recreation (Based on Environmental Checklist for Upper Los Angeles River EWMP)

EXPECTED PROJECT CONCEPT TIMELINE

Expected completion dates for the foundational projects include:

- 2021 - The 5-year CIP and Proposition O projects
- Between 2017 and 2037 - Upper Los Angeles River Watershed EWMP regional projects
- Between 2018 and 2034 - SCMP projects (conservative schedule)

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 Black and Veatch et al. (2015) Enhanced Watershed Management Plan for the Upper Los Angeles River Watershed
4 City of Los Angeles Bureau of Engineering (2016) Proposition O - Clean Water Bond Program: August 2016 Monthly Report
5 City of Los Angeles Bureau of Sanitation (2015) City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan
6 Geosyntec (2015) Stormwater Capture Master Plan

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IN-PROGRESS PROJECT 8	
PROJECT CONCEPT NAME	Ballona Creek Watershed (EWMP/SCMP Regional/Centralized & Prop. O)
PROJECT CONCEPT DESCRIPTION	This project would include implementation of numerous stormwater projects in the Ballona Creek Watershed identified in various plans and programs
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD*	Normal Year: 17,500 AFY 15.6 mgd; Wet Year: 58,000 AFY 52 mgd; Dry Year: 2,600 AFY 2.3 mgd *The dry and wet year yields are based on wet to normal year and dry to normal year assumptions presented in TM 2.1 and the Stormwater Facilities Plan. The normal year yield estimate of 17,500 AFY is attributed to numerous stormwater projects and is attributed to the projects in the Enhanced Watershed Management Plan (EWMP) for the Ballona Creek Watershed (Ballona Creek watershed EWMP). This estimate is based on a "capture volume" from recent modeling that represents full implementation of the Ballona Creek watershed EWMP (inclusive of regional projects, green streets, and Low Impact Development [LID]).
ESTIMATED COST	Refer to Volume 3 Stormwater Facilities Plan for cost information.

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (Ballona Creek Watershed Management Group)	

GENERAL BACKGROUND/PURPOSE

This Project Concept includes numerous stormwater projects in the Ballona Creek Watershed, as identified in various plans and programs, including:

- Regional projects (inclusive of signature regional projects and all other identified) as described in the Ballona Creek Watershed EWMP (Black and Veatch et al, 2015).
- All projects identified in the SCMP (Geosyntec 2015).
- All projects identified in the 5-Year CIP (LABOS, 2015) (Note that the CIP includes some of the Ballona Creek EWMP regional, green streets projects and other planned projects.)

This Project Concept includes the following projects, which fall within the above categories and within the Ballona Creek Watershed:

- 68 regional projects, of which there are 10 signature regional projects, as identified in the Ballona Creek Watershed EWMP.
- 2 centralized projects from the SCMP (Silver Lake and LA Forebay Upper Ballona Creek Projects).
- 5 other projects identified in the 5-Year CIP that are not in the Ballona Creek Watershed EWMP (Del Rey Lagoon Water Quality Improvement Project, Vermont Square Park Stormwater Treatment and Infiltration Project, National Boulevard Runoff Treatment Project, Manchester Neighborhood Greenway Project, Occidental Blvd Green Street Greening).

The various plans and programs, as discussed above, were developed to meet multiple objectives related to water quality and water supply. If the projects within the Upper Los Angeles River Watershed are not implemented then the water quality benefits, MS4 compliance, and groundwater recharge benefits might not be realized.

POTENTIAL CHALLENGES

- Funding - Sources of funding for implementing the Ballona Creek Watershed EWMP and the SCMP are not clearly identified
- Institutional - Agreement on priority of implementation. Ability to implement projects on private land
- Environmental Impacts - Biological resources, cultural resources, air quality, hazardous materials, hydrology/water quality, noise, recreation, transportation (Based on Environmental Checklist for Ballona Creek EWMP)

EXPECTED PROJECT CONCEPT TIMELINE

Expected completion dates include:

- 2021 - The Ballona Creek Watershed EWMP projects and projects in the 5-year CIP
- Between 2024 and 2029 - The two SCMP project in the Ballona Creek Watershed (conservative schedule)

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 Black and Veatch et al. (2015) Enhanced Watershed Management Plan for the Ballona Creek Watershed
4 City of Los Angeles Bureau of Engineering (2016) Proposition O - Clean Water Bond Program: August 2016 Monthly Report
5 City of Los Angeles Bureau of Sanitation (2015) City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan
6 Geosyntec (2015) Stormwater Capture Master Plan

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IN-PROGRESS PROJECT 9	
PROJECT CONCEPT NAME	Dominguez Channel Watershed (EWMP/SCMP Regional/Centralized & Prop. O)
PROJECT CONCEPT DESCRIPTION	This project would include implementation of numerous stormwater projects in the Dominguez Channel Watershed area identified in various plans and programs.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD*	Normal Year: 7,800 AFY 7 mgd; Wet Year: 26,000 AFY 23 mgd; Dry Year: 1,200 AFY 1 mgd *The dry and wet year yields are based on wet to normal year and dry to normal year assumptions presented in TM 2.1 and the Stormwater Facilities Plan. The normal year yield estimate of 7,800 AFY is attributed to numerous stormwater projects and is attributed to the projects in the Enhanced Watershed Management Plan (EWMP) for the Dominguez Channel Watershed (Dominguez Channel watershed EWMP). This estimate is based on a "capture volume" from recent modeling that represents full implementation of the Dominguez Channel watershed EWMP (inclusive of regional projects, green streets, and Low Impact Development [LID]).
ESTIMATED COST	Refer to Volume 3 Stormwater Facilities Plan for cost information.

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (Dominguez Channel Watershed Management Group…)	

GENERAL BACKGROUND/PURPOSE

This Project Concept includes numerous stormwater projects in the Dominguez Channel Watershed area identified in various plans and programs, including:

- Regional projects (inclusive of signature regional projects and all others identified) as described in the Dominguez Channel Watershed EWMP (Dominguez Channel Watershed Management Group, 2015)
- Prop O projects, scheduled for completion after March 2017
- All projects identified in the Stormwater Capture Master Plan (SCMP) (Geosyntec, 2015)
- All projects identified in the 5-Year CIP (LABOS, 2015)

The following projects fall within the above categories and within the Dominguez Channel Watershed:

- 9 recommended regional projects, as identified in the Dominguez Channel Watershed EWMP (Note that 3 of the 9 recommended regional projects are also included in the 5-Year CIP: Harbor City Park, Averill Park, and Wilmington Recreation Center).
- 1 Prop O project (Machado Lake Ecosystem Rehabilitation project).
- 33 green streets projects that are in the in the 5-Year CIP. These green streets projects are assumed to be located within the City of LA. The 33 green streets projects are a subset of the total green streets projects included in the Dominguez Channel Watershed EWMP).

The various plans and programs, as discussed above, were developed to meet multiple objectives related to water quality and water supply. If the projects within the Dominguez Channel Watershed are not implemented then the water quality benefits, MS4 compliance, and groundwater recharge benefits might not be realized.

POTENTIAL CHALLENGES

- Constructability - The feasibility of injecting and possibly treating captured stormwater, has not been evaluated
- Funding - Sources of funding for implementing the Dominguez Channel Watershed EWMP are not clearly identified
- Institutional - Agreement on priority of implementation; ability to implement projects on private land
- Environmental Impacts - Biological resources, cultural resources, air quality, hazardous materials, hydrology/water quality, noise, transportation, and recreation (Based on Environmental Checklists for other EWMPs as the Dominguez Channel Watershed EWMP does not include an environmental checklist)

EXPECTED PROJECT CONCEPT TIMELINE

Expected completion dates for the foundational projects include:

- 2021 - The green streets projects in the 5-year CIP and Proposition O projects
- Between 2017 and 2026 - Dominguez Channel Watershed EWMP regional projects.

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 Dominguez Channel Watershed Management Group (2015) Enhanced Watershed Management Plan for the Dominguez Channel Watershed
4 City of Los Angeles Bureau of Engineering (2016) Proposition O - Clean Water Bond Program: August 2016 Monthly Report
5 City of Los Angeles Bureau of Sanitation (2015) City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan
6 Geosyntec (2015) Stormwater Capture Master Plan

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IN-PROGRESS PROJECT 10	
PROJECT CONCEPT NAME	**Santa Monica Bay/Marina del Rey Watersheds (EWMP/SCMP Regional/Centralized & Prop. O)**
PROJECT CONCEPT DESCRIPTION	This project would include implementation of numerous stormwater projects in the Santa Monica Bay Watershed and Marina del Rey Watershed Upper Los Angeles River Watershed area identified in various plans and programs.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD*	Normal Year: 2,500 AFY 2.3 mgd Wet Year: 8,500 AFY 7.6 mgd Dry Year: 400 AFY 0.3 mgd *The dry and wet year yields are based on wet to normal year and dry to normal year assumptions presented in TM 2.1 and the Stormwater Facilities Plan. The 1,500 AFY yield is attributed to the regional projects in the Enhanced Watershed Management Plan (EWMP) for the Santa Monica Bay Watershed (SMB Watershed EWMP) and the EWMP for the Marina del Rey Watershed (MDR Watershed EWMP). This estimate is based on a "capture volume" from recent modeling that represents full implementation of the SMB and MDR watershed EWMPs (inclusive of regional projects, green streets, and Low Impact Development [LID]).
ESTIMATED COST	Refer to Volume 3 Stormwater Facilities Plan for cost information.

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (SMB and MDR Watershed Management Groups)	

GENERAL BACKGROUND/PURPOSE

This Project Concept includes numerous stormwater projects in the Santa Monica Bay Watershed and Marina del Rey Watershed Upper Los Angeles River Watershed area identified in various plans and programs, including:

- Regional projects within the City of LA (inclusive of signature regional projects and all others identified) as described in the SMB Watershed EWMP (MWH, 2015) and the MDR Watershed EWMP (Weston, 2015)
- Prop O projects scheduled for completion after March 2017
- All projects identified in the Stormwater Capture Master Plan (SCMP) (Geosyntec 2015) that are also within the City of LA
- All projects identified in the 5-Year CIP (LABOS, 2015)

This Project Concepts includes the following projects, which fall within the above categories and within the SMB and MDR watersheds and within:

- A total of 24 regional projects, with 12 identified in each of the SMB Watershed EWMP and MDR Watershed EWMPs.
- 3 Prop O projects (also included in the 5-Year CIP) (Argro Drain Subbasin Facility, Penmar Water Quality Improvement Phase II, Temescal Canyon Park Stormwater BMP Phase II).
- 17 green streets projects that are in the in the 5-Year CIP (a subset of all the green streets projects included in the SMB Watershed EWMP and MDR Watershed EWMP).

The various plans and programs, as discussed above, were developed to meet multiple objectives related to water quality and water supply. If the projects within the Upper Los Angeles River Watershed are not implemented then the water quality benefits, MS4 compliance, and groundwater recharge benefits might not be realized.

POTENTIAL CHALLENGES

- Funding - Sources of funding for implementing the SMB and MDR EWMPs are not clearly identified.
- Institutional - Agreement on priority of implementation. Ability to implement projects on private land.
- Environmental Impacts - aesthetics, air quality, biological resources, hazardous materials, hydrology/water quality, noise, land use, transportation, and utilities (Based on Environmental Checklists for the SMB and MDR EWMPs)

EXPECTED PROJECT CONCEPT TIMELINE

The expected completion dates for the foundational projects include:

- Between 2018 and 2021

SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 MWH (2015) Enhanced Watershed Management Plan for the Santa Monica Bay Watershed
4 Weston (2015) Enhanced Watershed Management Plan for the Marina del Rey Watershed
5 City of Los Angeles Bureau of Engineering (2016) Proposition O - Clean Water Bond Program: August 2016 Monthly Report
6 City of Los Angeles Bureau of Sanitation (2015) City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan
7 Geosyntec (2015) Stormwater Capture Master Plan

Disclaimer: This Conceptual Project/Program Description is limited to conceptual planning level information, based on information known as of December 2016, & costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is typed in italic font.

IN-PROGRESS PROJECT 11	
PROJECT CONCEPT NAME	**Other Planned Projects within the City (e.g. Sun Valley Watershed Management Plan & Greater LA IRWMP)**
PROJECT CONCEPT DESCRIPTION	This project would include implementation of a variety of centralized and regional stormwater projects identified in other planning documents, including the Sun Valley Watershed Management Plan and the Greater LA County Integrated Regional Water Management Plan 2014 Update.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 3,400* AFY 3 mgd; *Wet Year: 4,400 AFY 4 mgd*; *Dry Year: 2,500 AFY 2.2 mgd* *Approximately 3,400 AFY (preliminary estimate) yield is based on the capture of stormwater from projects within the City of LA, as identified in the Sun Valley Watershed Management Plan & Greater LA Integrated Regional Water Management Plan (IRWMP). *The yields from projects that were identified in other plans (i.e., the Stormwater Capture Master Plan) are not included in the estimated yield. The wet and dry year yields are based on the assumption that the wet year is 130% of the normal year and that the dry year is 75% of a normal year.*
ESTIMATED COST	Refer to Volume 3 Stormwater Facilities Plan for cost information.

ONE WATER LA OBJECTIVES	PROJECT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☒ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (…)	

GENERAL BACKGROUND/PURPOSE

This project would include implementation of a variety of centralized and regional stormwater projects identified in other planning documents, including the Sun Valley Watershed Management Plan (Sun Valley WMP) (MWH, 2004) and The Greater LA County Integrated Regional Water Management Plan 2014 Update (GLAC IRWMP) (Greater LA County Leadership Committee, 2013). Projects selected would be based on the following:

- Any project not within the City of LA would be excluded
- Any project not related to stormwater would be excluded
- Any project already included the Enhanced Watershed Management Plans (EWMPs) or the Stormwater Capture Master Plan (SCMP) would be excluded

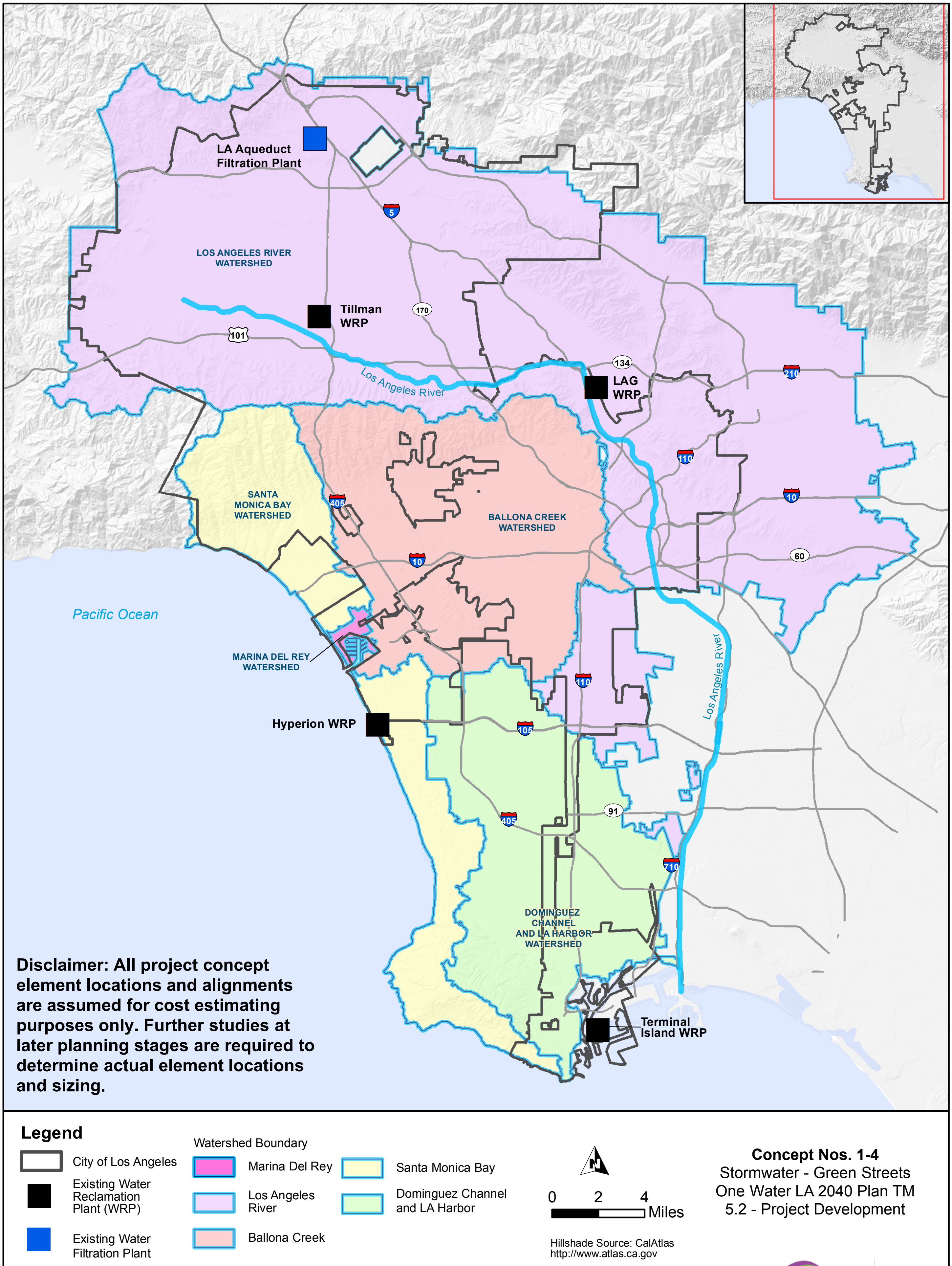
Projects range from stormwater diversions, to green infrastructure, to regional/centralized projects. The stormwater projects would meet water supply/capture objectives as well as other benefits, including improving water quality and habitat. If these projects are not implemented, then the multiple project benefits might not be realized.

POTENTIAL CHALLENGES
• Funding - Specific funding strategies for these projects have not been identified. However, may of the GLAC IRWMP projects have identified local funds or matching funds. These multi-benefit projects would have potential for grant funding. • Institutional - Agreement on priority of implementation. • Environmental Impacts - Environmental impacts will be project specific. Several of the GLAC IRWMP projects are planning to prepare Mitigated Negative Declarations.
EXPECTED PROJECT CONCEPT TIMELINE
The schedule outlined in the Sun Valley WMP has been exceeded. The schedule for completion of projects from both plans will likely depend on the availability of grant funding for the projects.
SOURCES

1 (OneWaterLA, TM 5.1) TM 5.1 Appendix C, Cost Estimating Assumptions, 2016.
2 (OneWaterLA, TM 5.2) TM 5.2 Project Development, 2016.
3 MWH (2004) Sun Valley Watershed Management Plan
4 Greater LA County Leadership Committee (2013) The Greater LA County Integrated Regional Water Management Plan 2014 Update
5 Geosyntec (2015) Stormwater Capture Master Plan

Disclaimer: This Conceptual Project/Program Description is limited to conceptual planning level information, based on information known as of December 2016, & costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is typed in italic font.

APPENDIX C – CONCEPT OPTIONS



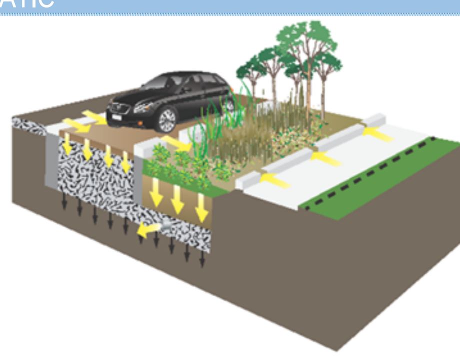
Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing.

Concept Nos. 1-4
Stormwater - Green Streets
One Water LA 2040 Plan TM
5.2 - Project Development

CONCEPT OPTION 1	
PROJECT CONCEPT NAME	**Green Streets – Upper Los Angeles River Watershed**
PROJECT CONCEPT DESCRIPTION	Develop green streets projects as identified in the Enhanced Watershed Management Plan for the Los Angeles River Watershed (Los Angeles River Watershed EWMP).
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Total Yield - Additional Demand = 11,900 AFY* *Potential Water Supply Benefit: up to 11,900 AFY. The concept does not provide new water supply rights, however, the concept replenishes the San Fernando Valley Groundwater Basin, so that the City is able to pump their adjudicated rights.* *Drought Resiliency: 75% (8,900 AFY Dry Year/11,900 AFY Normal year) is the estimated drought resiliency.* *Normal Year: 11,900 AFY 11 mgd; Wet Year: 14,900 AFY 13 mgd; Dry Year: 8,900 AFY 8 mgd* *The dry year yields are based on the assumption that the dry year precipitation is 75% of the normal year and there is a 100% capture efficiency. The wet year yields are based on the assumption that the wet year precipitation is 130% of the normal year and that there is a 75% capture efficiency.* *Yield Assumptions: Yield based on Appendix to TM 8.1: Updated Water Balance. 75% of the water is assumed to be recharged into the San Fernando Valley Groundwater Basin.*
ESTIMATED COST	*Capital: $750 million - $1.0 billion* *Unit: $7,000-$9,000/AF (Calculated Unit Cost: $7,500/AF)* *Energy: $0/yr (0/kWh)* *Cost Assumptions: Cost based on Table 23 of One Water LA, TM 8.1*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☒ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☒ LADOT
☒ Improve health of local watersheds	☒ BOE	☒ METRO
☒ Improve local water supply reliability	☒ RAP	☒ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (Upper Los Angeles River Watershed Management Group)	

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

The Enhanced Watershed Management Plan for the Upper Los Angeles River Watershed (Upper Los Angeles River Watershed EWMP) (Black and Veatch et al, 2015) identified a large number and variety of stormwater capture and treatment projects (regional and distributed) that are needed to reduce pollutant loads to comply with the 2012 MS4 Permit and TMDLs. The potential distributed stormwater projects include two types of projects, namely green streets and LID projects. This Project Concept includes the green streets projects, as described as follows:

- All green streets projects identified in the Upper Los Angeles River Watershed EWMP (1,723 miles), with the exception of the green streets projects (approximately 30 miles) that are included in the City's Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan (5-Year CIP)(LABOS, 2015), because these projects are considered as part of Foundational Stormwater Project #12. Hence, this project concept includes a total of approximately 1,690 miles of green streets projects throughout the Upper Los Angeles River Watershed.

The distributed projects in the Upper Los Angeles River Watershed EWMP are a component of the "recipe" for compliance with the 2012 MS4 Permit and TMDLs. The Upper Los Angeles River Watershed EWMP green streets projects are estimated to provide approximately 30% of the total control measure capacity associated with implementation of the EWMP. If the green streets projects are not implemented then compliance with the 2012 MS4 Permit will not be achieved. In addition, green streets contribute to infiltration and groundwater recharge. The concept will recharge the San Fernando Groundwater Basin, but based on the current adjudication, will not give the City additional pumping rights.

Specific examples of distributed projects to be considered in the Upper LA River Watershed are the following:

Alternate Projects	Former Name	Description	Concept Components	Benefits	Timeline
Sheldon Green Street Project (I-5 to Tujunga Spreading Grounds)	Fernangeles Park SWCP	Distributed stormwater capture underneath Fernangeles Park. Two subwatersheds (combined 291 acres) drain nearby Fernangeles Park. CalTrans sump pump ejects water from I-5 Freeway onto Sheldon St.	Underground infiltration gallery; street improvements along Morehart Ave	Estimated 129 AFY of stormwater capture; reduced flooding	2021 Estimated Completion Date
Glenoaks-Nettleton Median SWCP	No change	Distributed stormwater capture along Glenoaks-Nettleton Median. Subwatershed of approximately 45 acres adjacent to median.	Underground infiltration gallery; aesthetic improvements along Glenoaks-Nettleton Median	Estimated 49 AFY of stormwater capture; reduced flooding	2020 Estimated Completion Date
Victory-Goodland Median SWCP	No change	Distributed stormwater capture along Victory-Goodland Median. Subwatershed of approximately 135 acres.	Underground infiltration gallery; aesthetic improvements along Victory-Goodman Median	Estimated 97 AFY of stormwater capture; reduced flooding	2020 Estimated Completion Date
Saticoy Street SWCP	No change	Distributed stormwater capture along Saticoy St (Tujunga Ave to Vineland Ave). Subwatershed of approximately 126 drains along Saticoy St.	Underground infiltration chambers; drywells; aesthetic improvements along Saticoy St	Estimated 84 AFY of stormwater capture; reduced flooding	2020 Estimated Completion Date
Lankershim Blvd SWCP	No change	Distributed stormwater capture along Lankershim Blvd (Tuxford St to Strathern St). Subwatershed of approximately 214 acres drains along section of Lankershim Blvd.	Drywells	Estimated 230 AFY of stormwater capture; reduced flooding	2020 Estimated Completion Date
San Fernando Gardens SWCP	No change	Distributed stormwater capture within San Fernando Gardens (public housing owned by the City of LA Housing Authority). Subwatershed of approximately 38 acres within San Fernando Gardens.	Underground infiltration chambers; drywells; aesthetic improvements within San Fernando Gardens	Estimated 25 AFY of stormwater capture; reduced flooding	2021 Estimated Completion Date

Whiteman Airport	Whiteman Airport SWCP	Distributed stormwater capture within Whiteman Airport (general aviation airport managed by the County of Los Angeles). Subwatershed of approximately 199 acres within Whiteman Airport and along adjacent Jessup Park.	Underground infiltration gallery/chambers; drywells	Estimated 185 AFY of stormwater capture; reduced flooding	2021 Estimated Completion Date
North Hollywood Recreation Center	North Hollywood Recreation Center SWCP	Distributed stormwater capture within North Hollywood Recreation Center. Subwatershed of approximately 28 acres within and around the North Hollywood Recreation Center.	Underground infiltration gallery/chambers; drywells	Estimated 20 AFY of stormwater capture; reduced flooding	2021 Estimated Completion Date

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- Approximately 1,690 miles of green streets (All green streets from ULAR EWMP, except green streets included in the City of LA Stormwater & Green Infrastructure 5-year CIP).

POTENTIAL CHALLENGES & CONSIDERATIONS

- Operation & maintenance
- Sources of funding are not identified
- Monitoring for grant funding
- Agreement on priority of implementation
- Community participation and support
- Construction challenges
- Schedule compliance
- Quantifying benefits

EXPECTED PROJECT CONCEPT TIMELINE

Expected completion date for the potential concept is 2037.

TMDL compliance dates include:

- 2028 for the Los Angeles River metals TMDL
- 2032 for the Los Angeles/Long Beach Harbors Toxics TMDL
- 2037 for the Los Angeles River bacteria TMDL

TRIGGERS

- Pollutant load reduction required for compliance with the MS4 Permit per EWMP
- Sustainable City plan yield requirements

SOURCES

1 Black and Veatch et al. (2015) Enhanced Watershed Management Plan for the Upper Los Angeles River Watershed
2 City of Los Angeles Bureau of Sanitation (2015) City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan
3 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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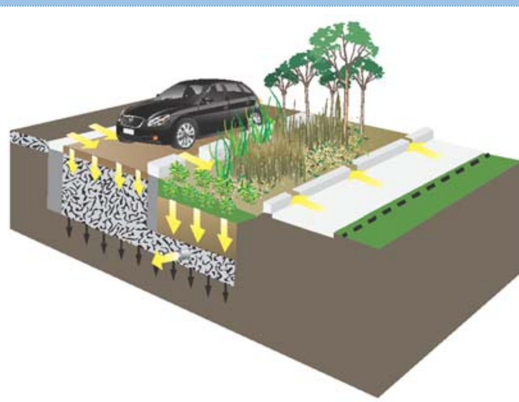
CONCEPT OPTION 2	
PROJECT CONCEPT NAME	**Green Streets – Ballona Creek Watershed**
PROJECT CONCEPT DESCRIPTION	Develop distributed projects (green streets) as identified in the Enhanced Watershed Management Plan for the Ballona Creek Watershed (Ballona Creek watershed EWMP).
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 2,300 AFY 2.1 mgd* *Wet Year: 3,000 AFY 2.6 mgd* *Dry Year: 1,700 AFY 1.6 mgd* *Potential Water Supply Benefit: up to 900 AFY. Some of the water replenishes the Central Groundwater Basin, so that the City is able to increase their pumping allocation.* *Drought Resiliency: 875% (1.700 AFY Dry Year/2,300 AFY Normal year) is the estimated drought resiliency.* *The dry year yields are based on the assumption that the dry year precipitation is 75% of the normal year and there is a 100% capture efficiency. The wet year yields are based on the assumption that the wet year precipitation is 130% of the normal year and that there is a 75% capture efficiency.* *Yield Assumptions: Yield based on Appendix to TM 8.1: Updated Water Balance. 40% of the water is assumed to be recharged into the Central Groundwater Basin.*
ESTIMATED COST	*Capital: $350-500 million.* *O&M: $16-21 million/yr.* *Unit: $15,800-21,100/AF (Calculated Unit Cost: $17,600/AF)* *Energy: $0/year (0 kWh/AF)* *Cost Assumptions: Cost based on Table 23 of One Water LA, TM 8.1*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☒ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☒ LADOT
☒ Improve health of local watersheds	☒ BOE	☒ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (Ballona Creek Watershed Management Group)	

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE	
The Enhanced Watershed Management Plan for the Ballona Creek Watershed (Ballona Creek Watershed EWMP) (Black and Veatch et al, 2015) identified a large number and variety of stormwater capture and treatment projects (regional and distributed) that are needed to reduce pollutant loads to comply with the 2012 MS4 Permit and TMDLs. The potential distributed stormwater projects include two types of projects, namely green streets and LID projects. This Project Concept includes the green streets projects, as described as follows: • All green streets projects identified in the Ballona Creek Watershed EWMP (547 miles), with the exception of green streets projects (approximately 50 miles) that are already included in the City's Stormwater and Green Infrastructure 5-Year Capital Improvement Plan (5-Year CIP) (LABOS, 2015), because these projects are considered as part of Foundational Stormwater Project #13 Hence, this project concept includes a total of approximately 500 miles of green streets projects throughout the Ballona Creek Watershed The green streets projects in the Ballona Creek Watershed EWMP are a component of the "recipe" for compliance with the 2012 MS4 Permit and TMDLs. The Ballona Creek EWMP green streets projects are estimated to provide approximately 17% of the total control measure capacity associated with implementation of the EWMP. If the green streets projects are not implemented then compliance with the 2012 MS4 Permit will not be achieved. In addition, green streets contribute to infiltration and groundwater recharge. The concept will recharge the West Coast and Central Groundwater Basins, but unless there is a method to measure the volume of water recharged and WRD issues groundwater credits, the concept will not give the City additional pumping rights.	
KEY CONCEPT COMPONENTS	
This project concept consists of the following key components: • Approximately 500 miles of green streets	
POTENTIAL CHALLENGES & CONSIDERATIONS	
• Operation & maintenance • Sources of funding are not identified • Monitoring for grant funding • Agreement on priority of implementation • Community participation and support • Construction challenges • Schedule compliance • Quantifying benefits	
EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The expected completion date for the potential green streets project is by 2021. TMDL attainment dates include: • 2021 Ballona Creek Metals and Bacteria TMDLs	• Pollutant load reduction required for compliance with the 2012 MS4 Permit
SOURCES	
1 Black and Veatch et al. (2015) Enhanced Watershed Management Plan for the Ballona Creek Watershed 2 City of Los Angeles Bureau of Sanitation (2015) City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan 3 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.	

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CONCEPT OPTION 3

PROJECT CONCEPT NAME	**Green Streets – Dominguez Channel Watershed**
PROJECT CONCEPT DESCRIPTION	Develop the green streets projects as identified in the Enhanced Watershed Management Plan for the Dominguez Channel Watershed (Dominguez Channel Watershed EWMP).
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other

ESTIMATED YIELD & COST

ESTIMATED YIELD	*Normal Year: 2,600 AFY 2.3 mgd* · *Wet Year: 3,400 AFY 3.0 mgd* · *Dry Year: 1,900 AFY 1.7 mgd* *Potential Water Supply Benefit: up to 0 AFY* *Drought Resiliency: 75% (1,900 AFY Dry Year/2,600 AFY Normal year).* *The dry year yields are based on the assumption that the dry year precipitation is 75% of the normal year and there is a 100% capture efficiency. The wet year yields are based on the assumption that the wet year precipitation is 130% of the normal year and that there is a 75% capture efficiency.* *Yield Assumptions: Yield based on Appendix to TM 8.1: Updated Water Balance.*
ESTIMATED COST	*Capital: $120 - $160 million.* *O&M: $7-10 million/yr.* *Unit: $4,900-6,500/AF (Calculated Unit Cost: $5,400/AF)* *Energy: 0 AF/yr (0 kWh/AF)* *Cost Assumptions: Cost based on Table 23 of One Water LA, TM 8.1*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☒ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☒ LADOT
☒ Improve health of local watersheds	☒ BOE	☒ METRO
☐ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (Dominguez Channel Watershed Management Group)	

PROJECT CONCEPT FLOW SCHEMATIC

GENERAL BACKGROUND/PURPOSE

The Enhanced Watershed Management Plan for the Dominguez Channel Watershed (Dominguez Channel Watershed EWMP) prepared by the Dominguez Channel Watershed Management Group (DCWMP, 2015) identified a large number and variety of stormwater capture and treatment projects (regional and distributed) that are needed to reduce pollutant loads to comply with the 2012 MS4 Permit and TMDLs. The potential distributed stormwater projects include two types of projects, namely green streets and LID projects. This Project Concept includes the green streets projects, as described as follows:

- All green streets projects identified in the Dominguez Channel Watershed EWMP (411 miles) with the exception of the green streets projects (approximately 50 miles) that are already included in the City's Stormwater and Green Infrastructure 5-Year Capital Improvement Plan (5-Year CIP)(LABOS, 2015), because these projects are considered as part of In-Progress Project #14. Hence, this project concept includes a total of approximately 360 miles of green streets projects throughout the Dominguez Channel Watershed.

The Dominguez Channel Watershed EWMP green streets projects are estimated to provide approximately 81% of the pollutant load reduction associated with implementation of the EWMP. If the distributed projects are not implemented, then compliance with the 2012 MS4 Permit will not be achieved.

In addition, green streets contribute to infiltration and groundwater recharge. However, in the Dominguez Channel Watershed, it is important to recognize that the water supply aquifer is 200 to 400 feet below ground surface. The beneficial use of the water captured by the green streets projects would require additional infrastructure. For example, one approach is to implement aquifer recharge and recovery (ARRF), which are currently being explored by the Water Replenishment District of Southern CA. This alternative involves capturing the water that is allowed to infiltrate the shallow groundwater and then injecting it into the drinking water aquifer. The cost of an ARRF or any other infrastructure that would convey the captured stormwater to the water supply aquifer, have not been included in the cost estimates.

The concept will recharge the West Coast and Central Groundwater Basins, but unless there is a method to measure the volume of water recharged, the concept will not give the City additional pumping rights.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- Approximately 184 lane miles of green streets

POTENTIAL CHALLENGES & CONSIDERATIONS

- Operation & maintenance
- Sources of funding are not identified
- Monitoring for grant funding
- Agreement on priority of implementation
- Community participation and support
- Construction challenges
- Schedule compliance
- Quantifying benefits

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The expected completion dates for the potential project concept are: • Between 2026 to 2041 - Dominguez Channel Watershed EWMP green streets projects • TMDL attainment dates include: 2018 (Nutrients TMDLs for Wilmington Drain and Machado Lake), 2019 (Toxics for Wilmington Drain and Machado Lake), 2032 (Metals TMDLs for Dominguez Channel, Dominguez Channel Estuary and Harbor), 2040 (Nitrogen for Wilmington Drain) and 2040 (Bacteria for Dominguez Channel, Dominguez Channel Estuary, Machado Lake and Harbor)	• Pollutant load reduction required for compliance with the 2012 MS4 Permit

SOURCES

1 (LASAN, 2015) Los Angeles Bureau of Sanitation, *City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan*, 2015.
2 (DCWMG, 2015) *Enhanced Watershed Management Plan for the Dominguez Channel Watershed* 2015.
3 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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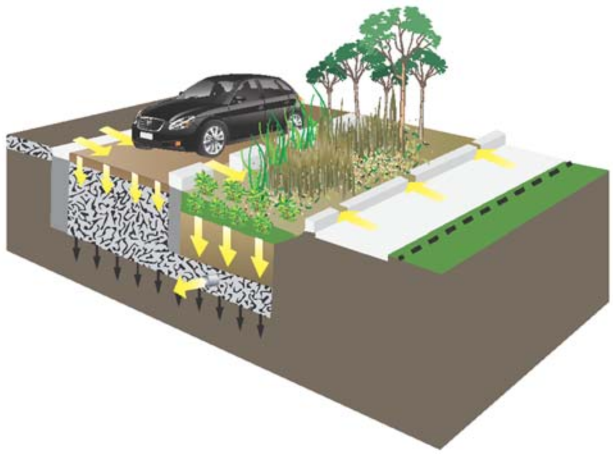
CONCEPT OPTION 4	
PROJECT CONCEPT NAME	**Green Streets – Santa Monica Bay/Marina del Rey Watersheds**
PROJECT CONCEPT DESCRIPTION	Develop the green streets projects as identified in the Enhanced Watershed Management Plan for the Santa Monica Bay Watershed (SMB J2 & J3 EWMP and SMB J7 WMP) and in the Enhanced Watershed Management Plan for the Marina del Rey Watershed (MDR Watershed EWMP).
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 580 AFY 0.5 mgd* *Wet Year: 460 AFY 0.5 mgd* *Dry Year: 350 AFY 0.3 mgd* *Potential Water Supply Benefit: up to 0 AFY* *Drought Resiliency: 75% (350 AFY Dry Year/460 AFY Normal year) is the estimated drought resiliency.* *The dry year yields are based on the assumption that the dry year precipitation is 75% of the normal year and there is a 100% capture efficiency. The wet year yields are based on the assumption that the wet year precipitation is 130% of the normal year normal year and that there is a 75% capture efficiency.* *Yield Assumptions: Yield based on Appendix to TM 8.1: Updated Water Balance.*
ESTIMATED COST	*Capital: $110-140 million.* *O&M: $7-9 million/yr.* *Unit: $24,400-32,500/AF. Calculated Unit Cost: $27,100/AF.* *Energy: $0/yr (0 kWh/AF)* *Cost Assumptions: Cost based on Table 23 of One Water LA, TM 8.1*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☒ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☒ LADOT
☒ Improve health of local watersheds	☒ BOE	☒ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (Santa Monica Bay and Marina del Rey Watershed Management Groups)	

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

The Enhanced Watershed Management Plan for the Santa Monica Bay Watershed (MWH, 2015) (SMB Watershed EWMP) and the Enhanced Watershed Management Plan for the Marina del Rey Watershed (Weston, 2015) (MDR Watershed EWMP) identified projects (regional, green streets and LID) that were needed to reduce pollutant loads to comply with 2012 MS4 Permit (Order No R4-2012-0175) and TMDLs. The potential distributed stormwater projects include:

- All green streets projects within the City of LA, approximately 520 acres, as identified in the SMB Watershed EWMP and MDR Watershed EWMP, with the exception of green streets projects (approximately 20 miles) that are included in the City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan (5-Year CIP) (LABOS, 2015), because these projects are considered as part of In-Progress Project #15. Since the acres of green streets in the 5-Year CIP are not quantified, it is assumed that this Project Concept includes 520 acres of green streets distributed throughout the SMB and MDR Watersheds.

The distributed projects in the Santa Monica Bay and Marina del Rey Watershed EWMPs are a component of the "recipe" for compliance with the 2012 MS4 Permit and TMDLs. The distributed projects are estimated to provide a significant portion of the pollutant load reduction associated with implementation of the EWMP. If the distributed projects are not implemented, then compliance with the 2012 MS4 Permit will not be achieved.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- Approximately 520 acres of green streets projects.

POTENTIAL CHALLENGES & CONSIDERATIONS

- Operation & maintenance
- Sources of funding are not identified
- Monitoring for grant funding
- Agreement on priority of implementation
- Community participation and support
- Construction challenges
- Schedule compliance
- Quantifying benefits

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The expected completion date for the potential concept is 2021. There are a number of TMDLs with compliance dates ranging from 2017 to 2021.	• Pollutant load reduction required for compliance with the 2012 MS4 Permit

SOURCES

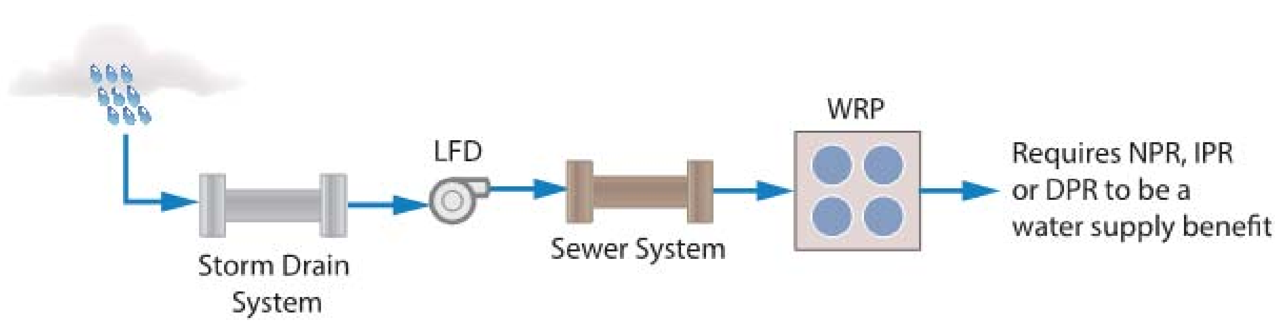
1 MWH (2015) Enhanced Watershed Management Plan for the Santa Monica Bay Watershed
2 Weston (2015) Enhanced Watershed Management Plan for the Marina del Rey Watershed
3 City of Los Angeles Bureau of Sanitation (2015) City of Los Angeles Stormwater and Green Infrastructure 5-Year Capital Improvement Plan
4 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

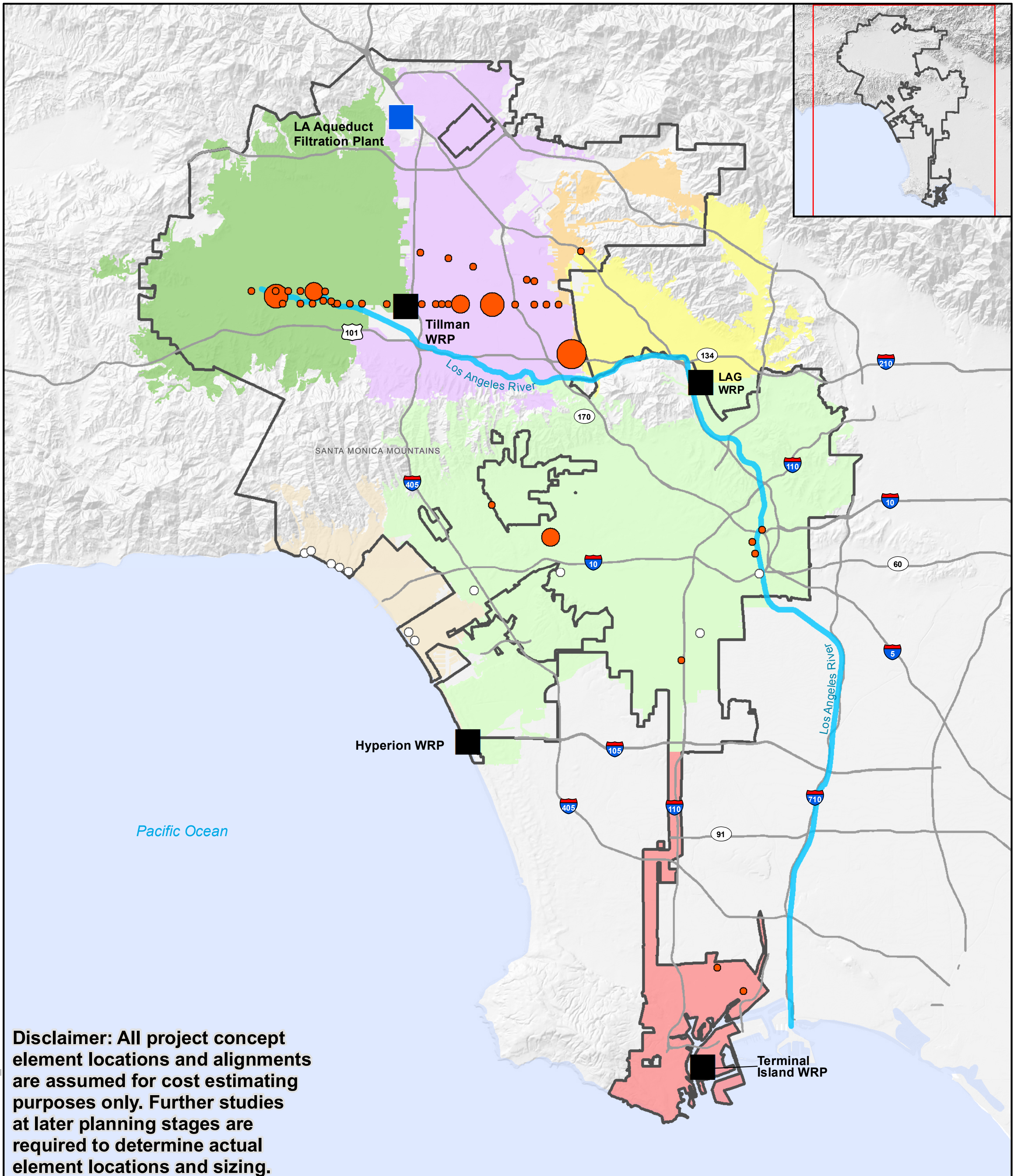
Disclaimer: This Conceptual Program Description is limited to conceptual planning level information, based on information known as of November 2016, and costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is shown in italics.

CONCEPT OPTION 5	
PROJECT CONCEPT NAME	**Dry Weather Low Flow Diversions**
PROJECT CONCEPT DESCRIPTION	Collect low flows from the stormwater system and transfer the collected flows to the sewer system for treatment.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 6,200 AFY 5.5 mgd* *Wet Year: 6,200 AFY 5.5 mgd* *Dry Year: 5,600 AFY 5 mgd* *Potential Water Supply Benefit: up to 0 AFY, unless other concepts implemented. This yield only contributes to water supply if all water to the City's WRPs is recycled and utilized to offset potable demand, requiring some of Concepts 9-21, 23, or 24 to be implemented.* *Drought Resiliency: 90% (5,600 AFY Dry Year/6,200 AFY Normal year) is the estimated drought resiliency. If there is a drought, the amount of flow from LFDs will decrease significantly.* *Yield assumptions: Assumed 45 new LFDs. Normal year yields are based on draft modeling analysis. Wet year yield is assumed to be the same as normal yield, as it is assumed that the system is at capacity and there is no additional capacity for an increase in flows. Dry year yield is assumed to be 10% less than a normal year. This project will help meet MS4 compliance for TMDL reduction.*
ESTIMATED COST	*Capital: $100-$130 million* *O&M: $1.0 - $1.3 million/yr* *Unit: $900-$1,200/AF (overall average; Calculated Unit Cost: $1,000/AF)* *Energy: $20,000-30,000/yr (30 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☐ LADWP	☐ LADOT
☒ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☐ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

- Existing Water Reclamation Plant (WRP)
- Existing Water Filtration Plant
- City of Los Angeles
- Existing LFD
- Conceptual Location of Potential LFD
- Proposed LFD (Provided by LASAN)
- Existing Low Flow Diversion Location

Proposed Low Flow Diversion Locations Inflow (GPD)

- < 10,000
- 10,000 - 100,000
- 100,000 - 500,000
- 500,000 - 1,000,000
- > 1,000,000

0 4 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 5
Stormwater - Dry Weather
Low Flow Diversions
One Water LA 2040 Plan
TM 5.2 - Project Development

Document Path: E:\JACKIEBKUP\OWLA\MXD\FactSheet_Clean.mxd

carollo

One Water LA

GENERAL BACKGROUND/PURPOSE

A Low Flow Diversion (LFD) is a structural system that diverts dry weather runoff in the stormwater collection system to the sewer collection system, where it is then conveyed to a wastewater treatment plant, where it is treated and discharged or treated and reused. The LFDs are effective at minimizing or eliminating the discharge of potentially polluted dry-weather flow runoff from receiving waters. There are numerous LFDs currently in operation throughout Los Angeles County. Forty-five additional LFDs are proposed within the following sewersheds with the following average flows:

- Donald C. Tillman (DCT) - 20 LFDs (2,360 AFY, 2.1 mgd)
- Valley Springs (VS) - 9 LFDs (1,570 AFY; 1.4 mgd)
- Foreman Line (FL) - 0 LFDs
- Los Angeles Glendale (LAG) - 1 LFD (240 AFY; 0.02 mgd)
- Hyperion Treatment Plant Metro (HYP) - 12 LFDs (2,000 AFY; 1.8 mgd)
- Coastal Interceptor Sewer (CIS)-1 LFD (10 AFY; 0.01 mgd)
- Terminal Island (TI)-2 LFD (10 AFY; 0.01 mgd)

KEY CONCEPT COMPONENTS

This concept consists of the following key components:

- 45 dry weather low flow diversions, pumping from storm drain to sewer

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Funding*
- Public Support
- Property Ownership (if private property is impacted by LFDs)

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
Expected completion date: • Between 2015 and 2030	• Stormwater quality compliance deadlines • Water recycling projects

SOURCES

1 Capture volumes based on draft modeling analysis provided by Geosyntec.
2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

Disclaimer: This Conceptual Program Description is limited to conceptual planning level information, based on information known as of November 2016, and costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is shown in italics.

<table>
<tr><th colspan="3">CONCEPT OPTION 6</th></tr>
<tr><td>PROJECT CONCEPT NAME</td><td colspan="2">Wet Weather Flow Diversions</td></tr>
<tr><td>PROJECT CONCEPT DESCRIPTION</td><td colspan="2">Store a portion of wet weather flows from the stormwater system, after the rain event transfer the collected flows to the sewer system for treatment.</td></tr>
<tr><td>SUPPLY SOURCE CATEGORY</td><td colspan="2">☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other</td></tr>
<tr><th colspan="3">ESTIMATED YIELD & COST</th></tr>
<tr><td>ESTIMATED YIELD</td><td colspan="2">Normal Year: 1,000 AFY 0.9 mgd — Wet Year: 1,000 AFY 0.9 mgd — Dry Year: 800 AFY 0.7 mgd
Potential Water Supply Benefit: up to 0 AFY, unless other concepts implemented. This yield only contributes to water supply if all water to the City's WRPs is recycled and utilized to offset potable demand, requiring some of Concepts 9-21, 23, or 24 to be implemented, however, the supply will occur when the NPR demand is lowest.
Drought Resiliency: 80% (800 AFY Dry Year/1,000 AFY Normal year) is the estimated drought resiliency. If there is a drought, the amount of flow from WFDs would decrease significantly.
Yield assumptions: Wet weather flow diversion yield assumes that approximately half of the LFD sites will have wet weather storage. Wet year yield is assumed to be the same as normal yield, as it is assumed that the system is at capacity and there is no additional capacity for an increase in flows. Dry year yield is assumed to be 20% less than a normal year. This project will help meet MS4 compliance for TMDL reduction. The yield of 1,000 AFY is equal to 25 sites, 25 storms/yr, with 500,000 gal of storage per site.</td></tr>
<tr><td>ESTIMATED COST</td><td colspan="2">Capital: $170-$230 million
O&M: $1.7 million - $2.3 million/yr
Unit: $9,000-12,000/AF (Calculated Unit Cost: $10,300/AF)
Energy: $9,000 - $12,000/yr (80 kWh/AF)
*Cost assumptions: Based on LASAN Conceptual Design Reports for pumping plants 621, 622, and 647</td></tr>
<tr><th>ONE WATER LA GUIDING PRINCIPLES -
MAIN OBJECTIVES</th><th colspan="2">PROJECT CONCEPT PARTNERS
*Limited to Planning, Cost sharing, O&M</th></tr>
<tr><td>☒ Integrate management of water resources & policies</td><td>☒ LASAN</td><td>☐ Caltrans</td></tr>
<tr><td>☒ Balance environmental, economic & societal goals</td><td>☐ LADWP</td><td>☐ LADOT</td></tr>
<tr><td>☒ Improve health of local watersheds</td><td>☐ BOE</td><td>☐ METRO</td></tr>
<tr><td>☒ Improve local water supply reliability</td><td>☐ RAP</td><td>☐ LA RiverWorks</td></tr>
<tr><td>☐ Implement, monitor, & maintain a reliable wastewater system</td><td>☒ LA County Flood Control District</td><td>☐ HSR</td></tr>
<tr><td>☐ Increase climate resilience</td><td>☐ LAWA</td><td>☐ LAUSD</td></tr>
<tr><td>☐ Increase community awareness & advocacy for sustainable water</td><td>☐ Other</td><td></td></tr>
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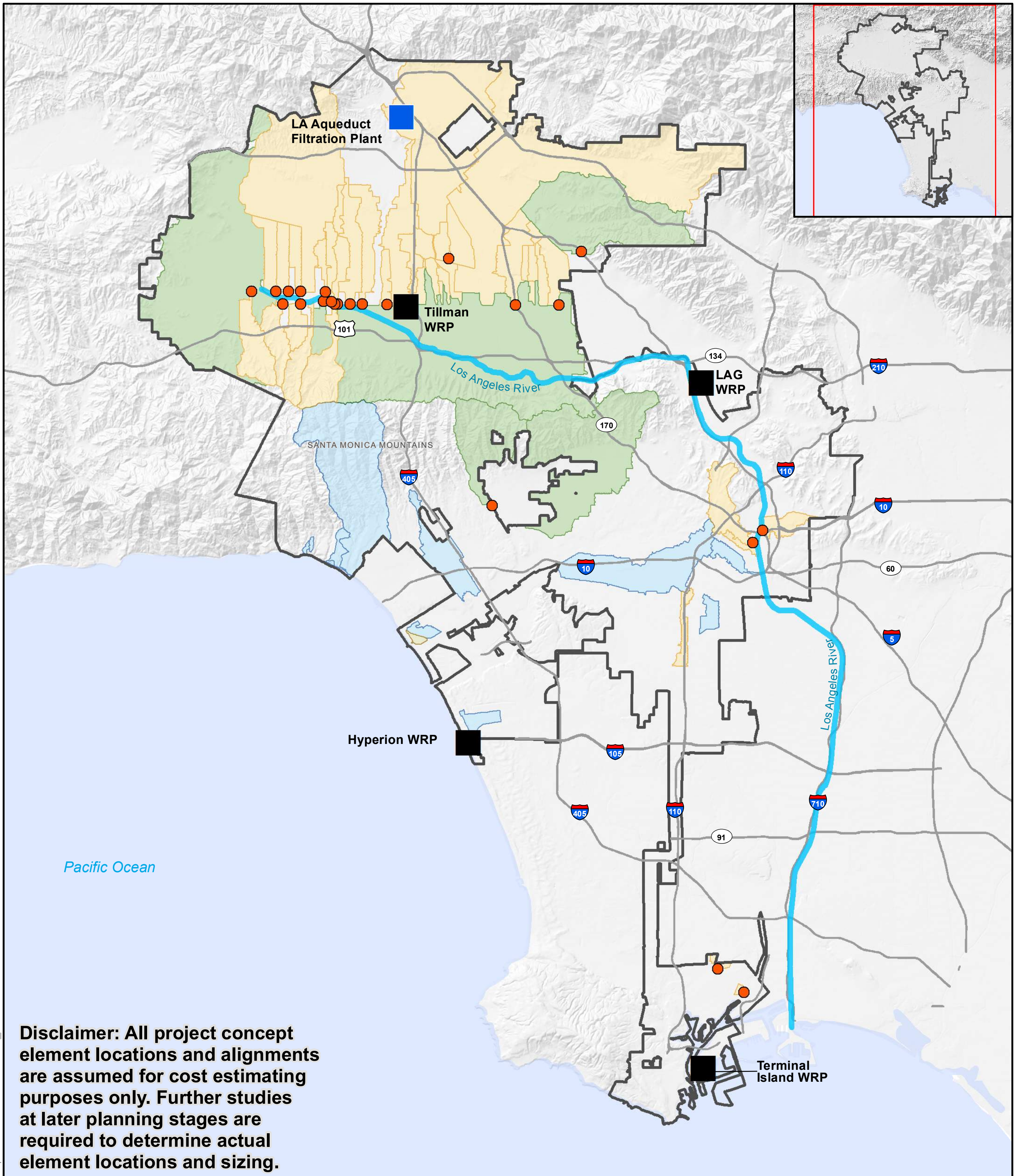


Legend

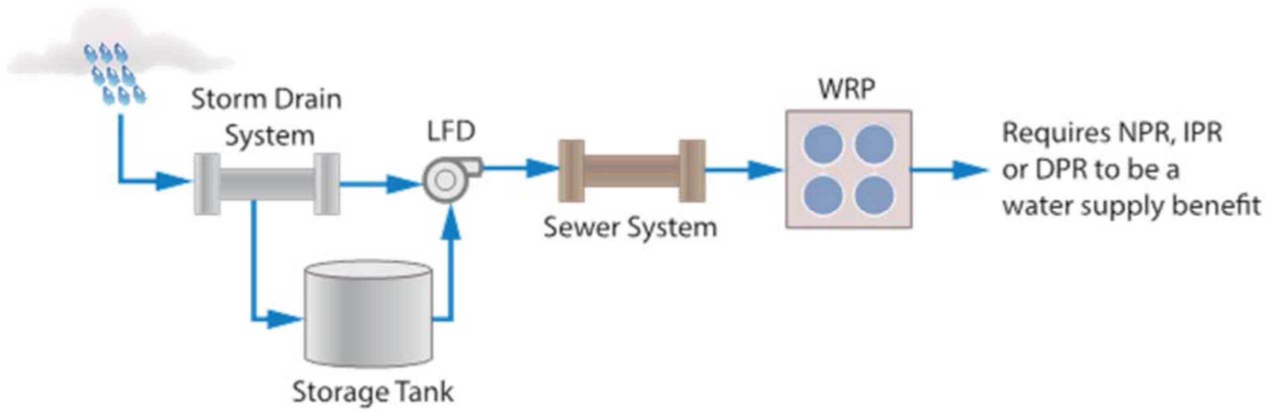
- Existing Water Reclamation Plant (WRP)
- Existing Water Filtration Plant
- City of Los Angeles
- Existing LFD
- Conceptual Location of Potential LFD
- Proposed LFD (Provided by LASAN)
- Potential Wet Weather Flow Diversion Location

0 1.5 3 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 6
Stormwater - Wet Weather
Flow Diversions
One Water LA 2040 Plan
TM 5.2 - Project Development

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

A wet weather flow diversion (WFD) is a structural system that diverts wet weather runoff in the stormwater collection system to a storage tank. This system would likely be used 15-25 times each year depending on the number of storms. The storage tank is sized so that it fills during typical storms (but not high volume storms) and the sizes may range from 10,000 gallons to 5 MG. After the storm passes, the water is pumped to the sewer collection system, where it is then conveyed to a wastewater treatment plant, where it is treated and can be reused. The flow rates from the WFD can be as high as 8 mgd. The WFDs are effective at minimizing or eliminating the discharge of potentially polluted first flush wet-weather flow runoff from receiving waters. Three locations have been identified for the inclusion of storage of stormwater, however, it is assumed that approximately half of the LFD sites could accommodate a WFD.

KEY CONCEPT COMPONENTS

This concept consists of the following key components:

- Wet weather flow diversions with storage, pumping from storm drain to sewer

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Funding*
- Public Support
- Property Ownership (if private property is impacted by WFDs)

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
Expected completion date: • Between 2015 and 2030	• Stormwater quality compliance deadlines • Water recycling projects

SOURCES

1 Capture volumes based on draft modeling analysis provided by Geosyntec.
2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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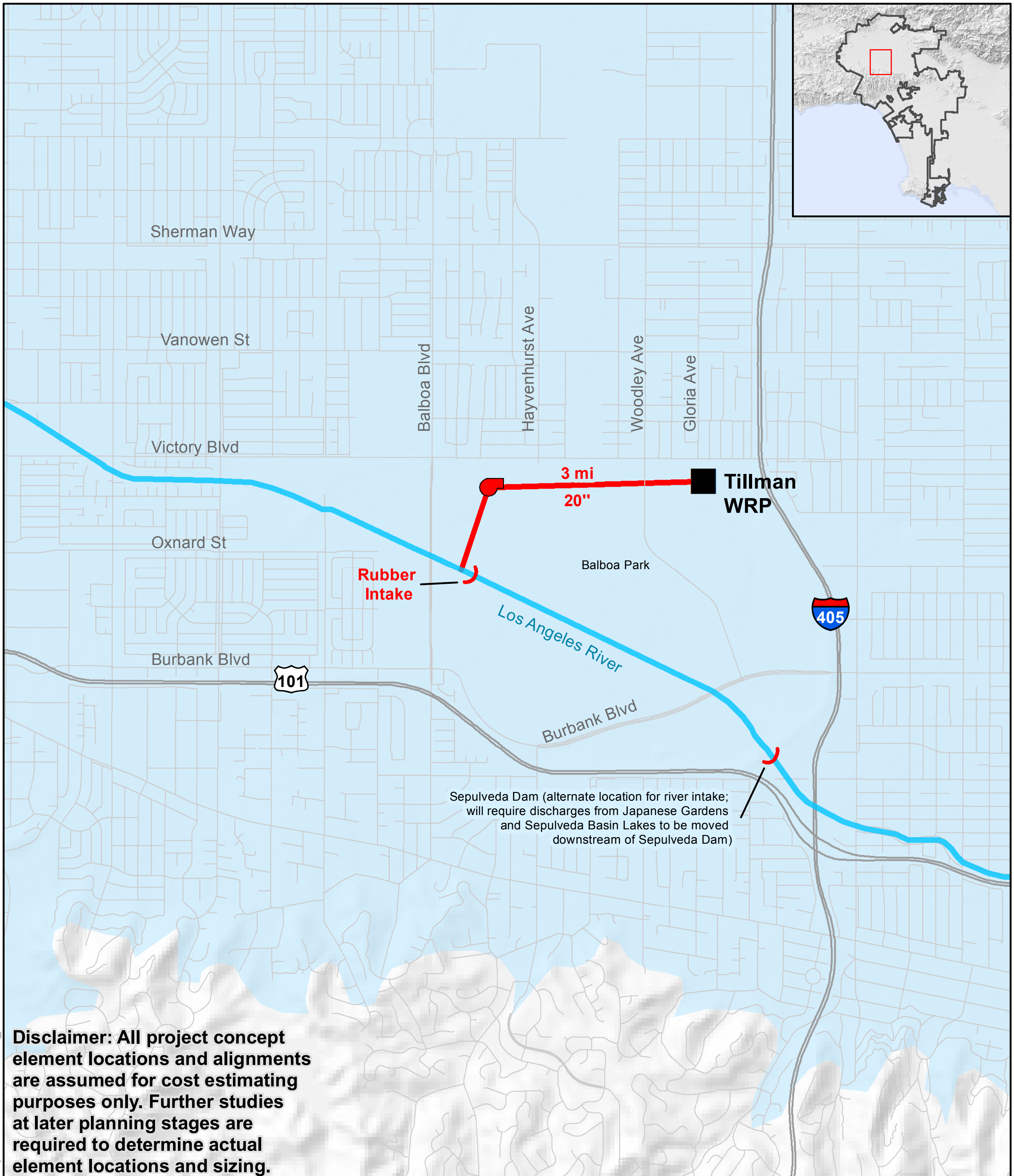
CONCEPT OPTION 7	
PROJECT CONCEPT NAME	**Upper Los Angeles River to Tillman WRP**
PROJECT CONCEPT DESCRIPTION	Divert flows from the Upper LA River to Tillman WRP for reuse.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 5,600 AFY 5 mgd Wet Year: 5,600 AFY 5 mgd Dry Year: 4,500 AFY 4 mgd *Potential Water Supply Benefit: up to 0 AFY, unless other concepts implemented. This yield only contributes to water supply if all water to the DCTWRP is recycled and utilized to offset potable demand, requiring Concept 9, 15 or 16 to be implemented (or water used as part of In Progress Project 9).* *Drought Resiliency: 80% (4,500 AFY Dry Year/5,600 AFY Normal year) is the estimated drought resiliency. The project will assist with maximizing reliability through maximum use of local water supplies and reduce dependence of imported water that is limited in availability due to drought and judicial constraint.* Yield Assumptions: Wet year same as normal year due to limitations in facility capacity. Dry year is assumed to be 80% of the flow as a normal year. *This project will help meet MS4 compliance for TMDL reduction. Yield based on dry weather flow from LA River Flow Study (OneWaterLA, TM 12.4).*
ESTIMATED COST	*Capital: $16 million to $22 million* *O&M: $140,000 to $180,000/yr* *Unit: $140 to 190/AF (Calculated Unit Cost: $160/AF)* *Energy: $40,000 to $50,000/yr (60 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☒ LA RiverWorks
☒ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (ULARA)	



Legend

Existing Water Reclamation Plant (WRP)

Pump Station

City of Los Angeles

Pipeline

Groundwater Basin
Source: LACDPW

Dam

0 0.5 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 7
System Upgrades for Upper Los Angeles River DCTWRP
One Water LA 2040 Plan
TM 5.2 - Project Development

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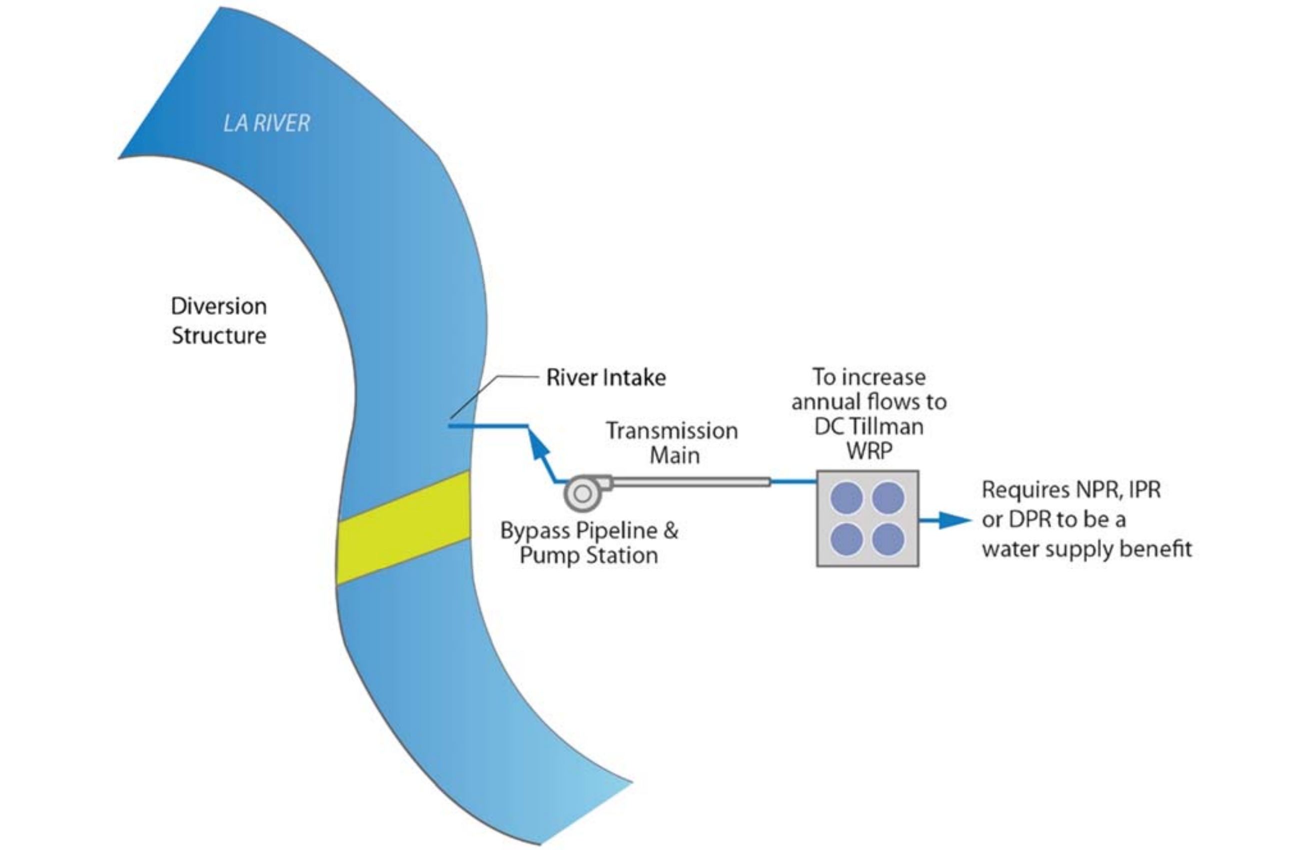
PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

There is existing natural flow in LA River upstream of Lake Balboa in the San Fernando Valley. This concept would capture the flow in the LA River upstream of Lake Balboa and divert the flow to Tillman WRP for treatment and reuse. Due to the City's Pueblo Water rights, the City has the rights to the entire flow in the LA River upstream of the confluence with the Arroyo Seco.

In order to capture the flow in the LA River, a diversion structure would be installed upstream of Lake Balboa, and flow would be pumped from the LA River to a pipeline, which would convey the flow to Tillman WRF. At Tillman WRF, the water would be treated with conventional wastewater treatment and the proposed AWPF, where the water would be used through one of the IPR or DPR alternatives discussed in the other concepts.

An alternate configuration will be to use the Sepulveda Dam instead, diverting the water upstream of Sepulveda Dam to Tillman WRP. In this case, the discharge location from Lake Balboa, Japanese Garden, and Wildlife Lake will need to be rerouted downstream of the Sepulveda Dam.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- River intake (cost estimate assumes a rubber dam installation)
- 100 hp pump station from LA River
- 3 miles of 20-inch diameter pipeline

POTENTIAL CHALLENGES & CONSIDERATIONS	
• *Water rights; permitting issues* • *Reduced flow in the LA River downstream.* • *Stormwater anticipated to be captured upstream through runoff capture/use and EWMP projects would not available as a source for this project.* • *Regulatory/Permitting Process involving groundwater recharge regulations on retention time, NPDES requirements, Public Health and Safety associated requirements by California Department of Public Health.* • *Operational Challenges such as infiltration rates that drives the spreading cycles for continuous movement of water.* • *Potential aquatic life impacts associated with diversion gate modifications and continuous monitoring of diversion and coordination with California Department of Fish and Wildlife.* • *Reduced flow to LA River.* • *Public Perception. Stakeholder involvement and approval.*	
EXPECTED PROJECT CONCEPT TIMELINE	**TRIGGERS**
2020 to 2030	LA River flow availability
SOURCES	
1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.	

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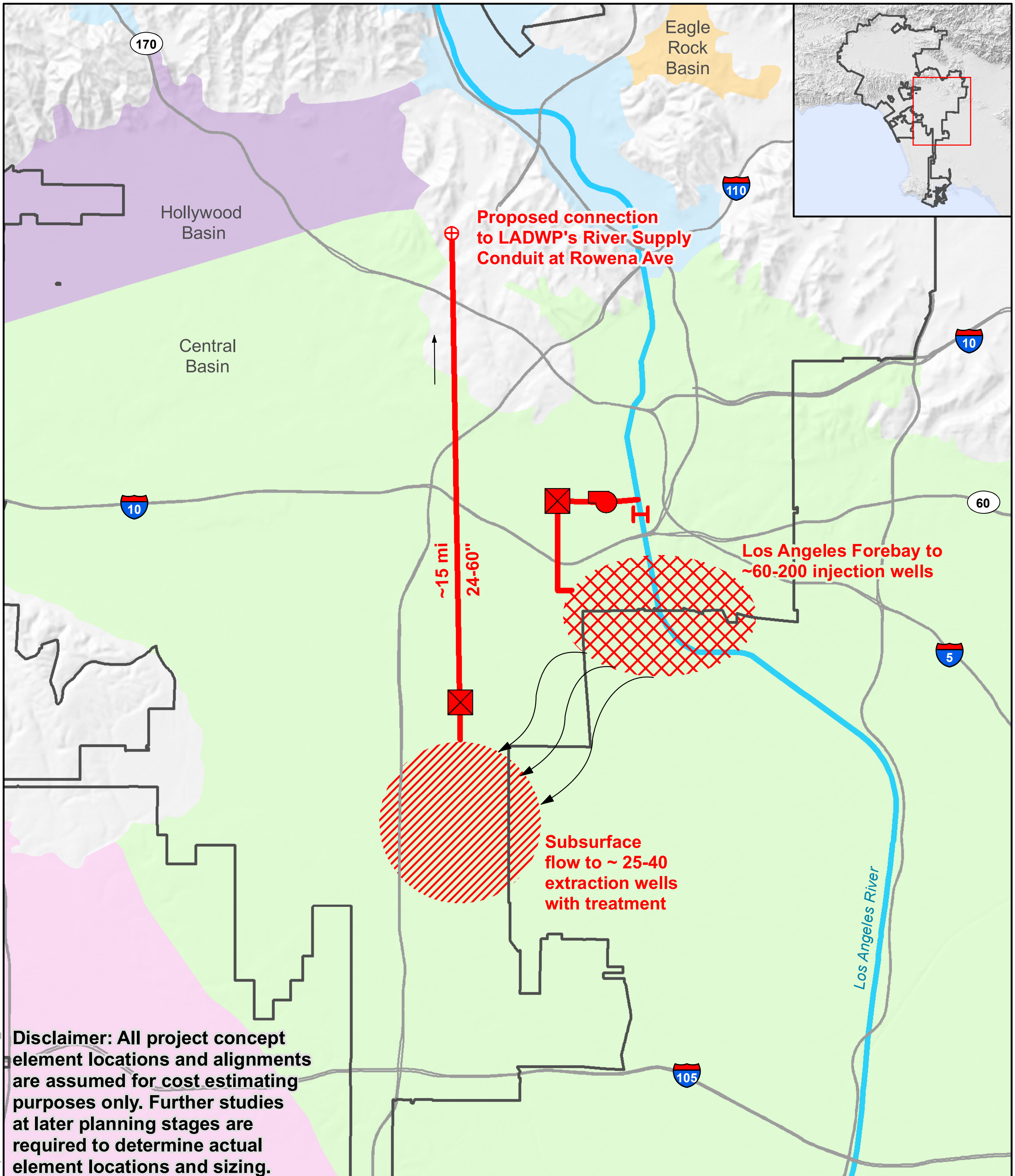
<table>
<tr><th colspan="3">CONCEPT OPTION 8A</th></tr>
<tr><td>PROJECT CONCEPT NAME</td><td colspan="2">LA River Recharge into LA Forebay using Injection Wells</td></tr>
<tr><td>PROJECT CONCEPT DESCRIPTION</td><td colspan="2">Divert flows from the LA River to the LA Forebay to recharge Central Basin.</td></tr>
<tr><td>SUPPLY SOURCE CATEGORY</td><td colspan="2">☒ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other</td></tr>
<tr><td colspan="3">ESTIMATED YIELD & COST</td></tr>
<tr><td>ESTIMATED YIELD</td><td colspan="2">Normal Year: 25,000 AFY 22 mgd   Wet Year: 25,000 AFY 22 mgd   Dry Year: 20,000 AFY 18 mgd
Potential Water Supply Benefit: up to 25,000 AFY
Drought Resiliency: 80% (20,000 AFY Dry Year/25,000 AFY Normal year) is the estimated drought resiliency. The project will assist with maximizing reliability through maximum use of local water supplies and reduce dependence of imported water that is limited in availability due to drought and judicial constraint.
Yield Assumptions: Yield can be increased/decreased, however, an increase in yield would lead to a significant increase in cost, in order to capture larger storms. Wet years are not assumed to have an increase in yield, due to limitations on facility sizes; dry years are assumed to be 20% less than a normal year.</td></tr>
<tr><td>ESTIMATED COST</td><td colspan="2">Estimated Cost (25,000 AFY)
Capital: $900 million - $1.2 billion
O&M: $10 to $14 million/yr
Unit: $1,900-$2,500/AF (Calculated Unit Cost: $2,100/AF)
Energy: $3 to $4 million/yr (1,100 kWh/AF)

Estimated Cost to Increase Project Size from 25,000 AFY to 45,000 AFY:
Capital: $1.7 to 2.2 billion
O&M: $20 to $25 million/yr
Unit: $4,000-6,000/AF (Calculated Unit Cost: $4,700/AF)
Energy: $3 million to $4 million/yr (1,100 kWh/AF)
*Cost assumptions: (OneWaterLA, TM 5.1).</td></tr>
<tr><th>ONE WATER LA OBJECTIVES</th><th colspan="2">PROJECT CONCEPT PARTNERS
*Limited to Planning, Cost sharing, O&M</th></tr>
<tr><td>☐ Integrate management of water resources & policies</td><td>☒ LASAN</td><td>☐ Caltrans</td></tr>
<tr><td>☒ Balance environmental, economic & societal goals</td><td>☒ LADWP</td><td>☐ LADOT</td></tr>
<tr><td>☒ Improve health of local watersheds</td><td>☐ BOE</td><td>☐ METRO</td></tr>
<tr><td>☒ Improve local water supply reliability</td><td>☒ RAP</td><td>☒ LA RiverWorks</td></tr>
<tr><td>☒ Implement, monitor, & maintain a reliable wastewater system</td><td>☒ LA County Flood Control District</td><td>☐ HSR</td></tr>
<tr><td>☒ Increase climate resilience</td><td>☐ LAWA</td><td>☐ LAUSD</td></tr>
<tr><td>☒ Increase community awareness & advocacy for sustainable water</td><td colspan="2">☒ Other (WRD, CBMWD, Army Corps of Engineers)</td></tr>
</table>



Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing.

Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Groundwater Basin Source: LACDPW
- Flow direction
- Subsurface flow
- Pump Station
- Pipeline
- Connection Point with LADWP system
- Injection Well Area
- Extraction Area
- Treatment Facility
- Rubber Dam

N

0 0.5 1 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 8A
LA River with recharge in LA Forebay
One Water LA 2040 Plan
TM 5.2 - Project Development

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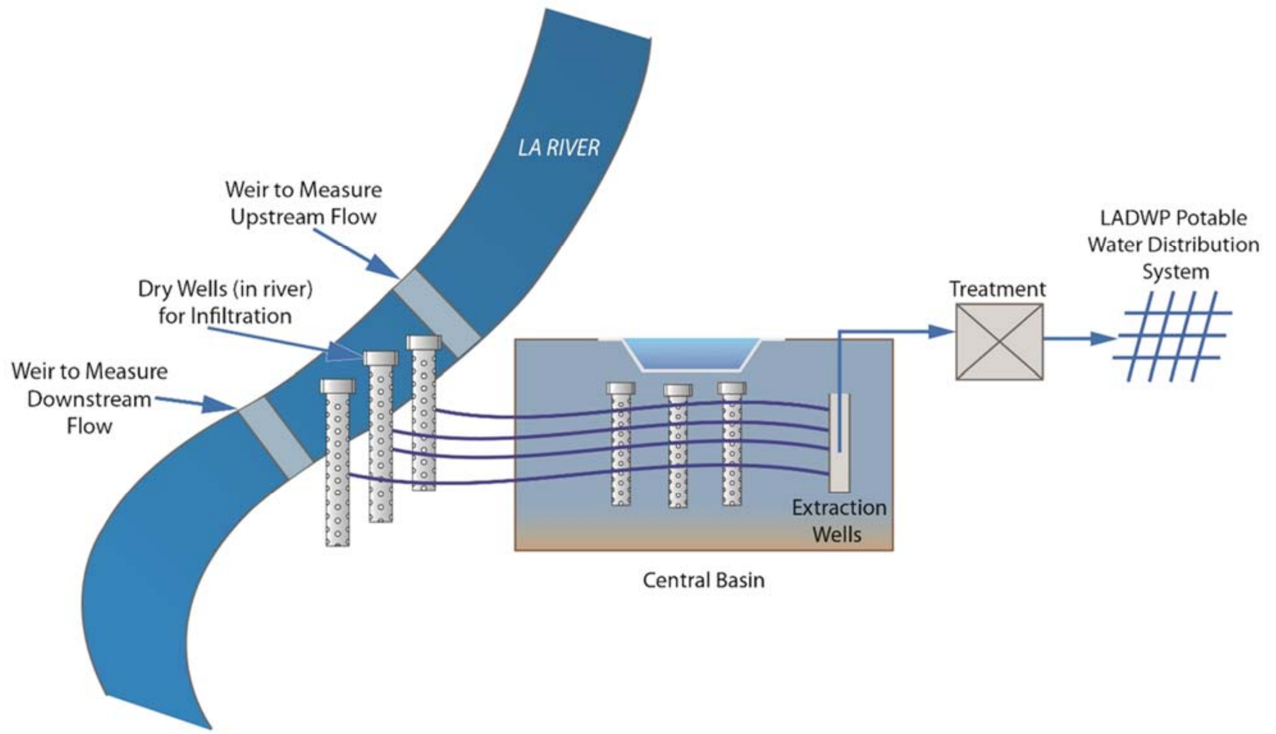
carollo

One Water LA

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

The westerly portion of the Central Basin Non-Pressure Area is occupied by the Los Angeles Forebay. Historically, this area has served as a recharge area for the Los Angeles River. However, this forebay's recharge capability has been substantially reduced since the Los Angeles River channel was lined. One of the key strategic locations along the River for extraction of excess water, that otherwise would have been lost to the ocean, is the Los Angeles Forebay. This project would facilitate the excess water to be extracted further downstream and used to recharge the Central Basin by injection. One of the consequences if this concept, diversion of water to Los Angeles River Forebay for recharge, is carried forward, it would result in additional pumping rights for the City. Due to the City's Pueblo Water rights, the City has the rights to the entire flow in the LA River upstream of the confluence with the Arroyo Seco.

This concept would involve diversion of water to Los Angeles River Forebay groundwater injection coupled with temporary hydraulic structures such as inflatable rubber dams as a proven technology to halt river flow and promote infiltration. The water would then be pumped and treated, then injected into the Central Basin. The water could later be pumped via groundwater wells.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components (sizing based on 25,000 AFY alternative):

- River intake (cost estimate assumes a rubber dam installation)
- 3,000 hp pump station (increased to 10,000 hp in the 45,000 AFY alternative)
- 65 mgd stormwater treatment (filter/UV); oversized to capture wet weather flows (increased to 200 mgd in 45,000 AFY alternative)
- 8 MG storage (increased to 24 MG in the 45,000 AFY alternative)
- 65 injection wells (increased to 200 injection wells in the 45,000 AFY alternative)
- 20 extraction wells with treatment (30 mgd, to increase for seasonal peaking in water demands; increased to 30 wells/60 mgd in the 45,000 AFY alternative)
- 60 miles of transmission/distribution pipelines (increased to 120 miles in the 45,000 AFY alternative)

POTENTIAL CHALLENGES & CONSIDERATIONS	
• *One of the water sources considered for this project is stormwater and can be anticipated to be captured upstream through runoff capture/use and EWMP projects and thereby not available as a source of runoff for this project.* • *Regulatory/Permitting Process involving groundwater recharge regulations on retention time, NPDES requirements, Public Health and Safety associated requirements by California Department of Public Health.* • *Potential aquatic life impacts associated with diversion gate modifications and continuous monitoring of diversion and coordination with California Department of Fish and Wildlife.* • *Reduced flow to LA River.* • *Public Perception. Stakeholder involvement and approval.*	
EXPECTED PROJECT CONCEPT TIMELINE	**TRIGGERS**
General timeframe from 2020 to 2040	LA River flow availability
SOURCES	

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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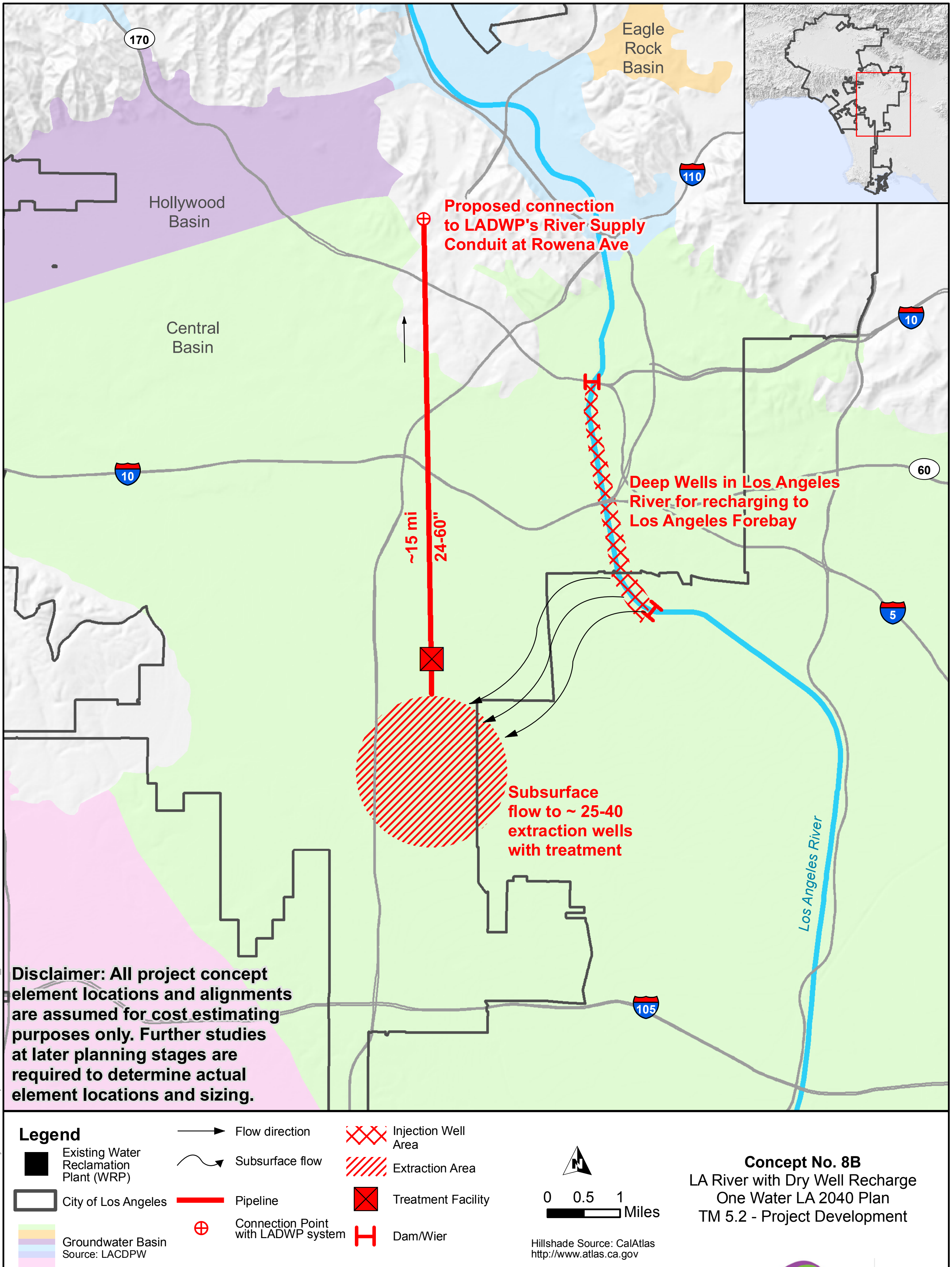
CONCEPT OPTION 8B	
PROJECT CONCEPT NAME	**LA River Recharge into LA Forebay using Dry Wells**
PROJECT CONCEPT DESCRIPTION	Divert flows from the LA River to the LA Forebay to recharge Central Basin.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 25,000 AFY 22 mgd; Wet Year: 25,000 AFY 22 mgd; Dry Year: 20,000 AFY 18 mgd *Potential Water Supply Benefit: up to 25,000 AFY* *Drought Resiliency: 80% (20,000 AFY Dry Year/25,000 AFY Normal year) is the estimated drought resiliency. The project will assist with maximizing reliability through maximum use of local water supplies and reduce dependence of imported water that is limited in availability due to drought and judicial constraint.* Yield Assumptions: Yield can be increased/decreased, however, an increase in yield would lead to a significant increase in cost, in order to capture larger storms. Wet years are not assumed to have an increase in yield, due to limitations on facility sizes; dry years are assumed to be 20% less than a normal year.
ESTIMATED COST	Estimated Cost: Capital: $500 million - $650 million O&M: $5 to $7 million/yr Unit: $900-$1,200/AF (Calculated Unit Cost: $1,000/AF) Energy: $1.5 to $2 million/yr (600 kWh/AF) **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☒ LA RiverWorks
☒ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (WRD, CBMWD, Army Corps of Engineers)	



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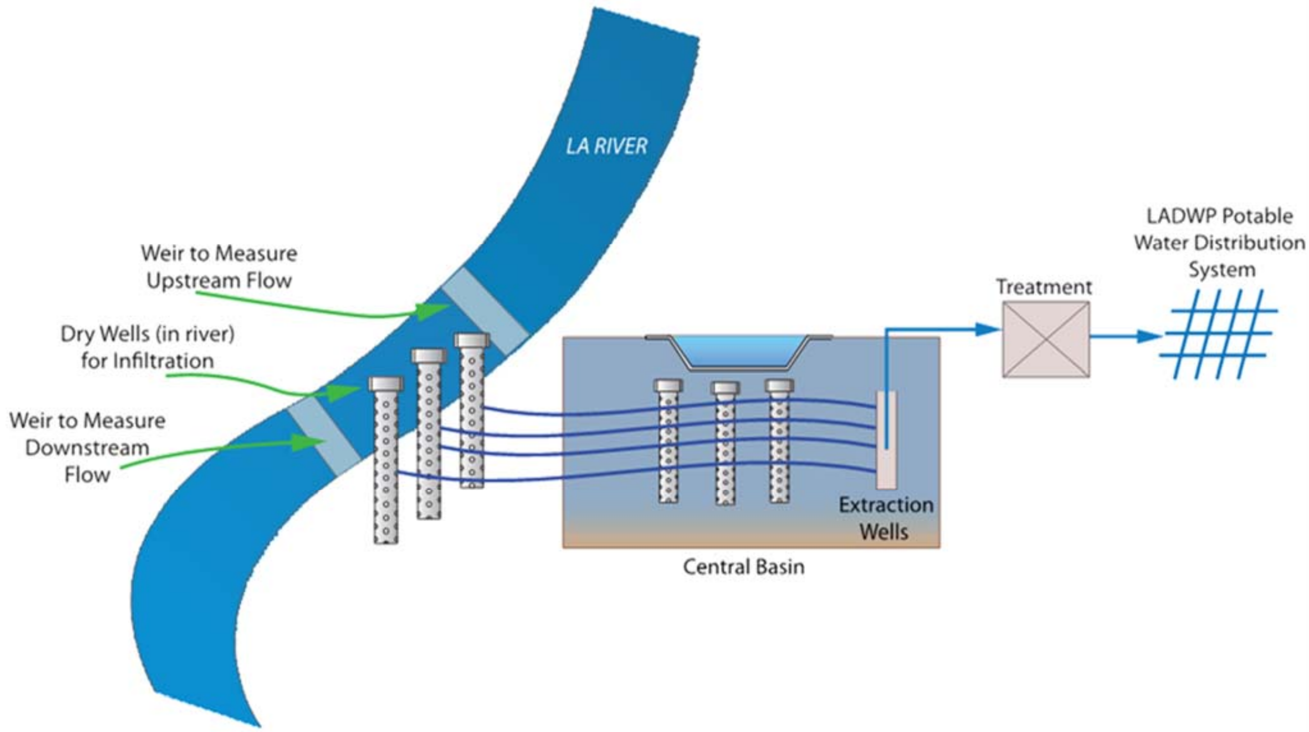
carollo

One Water LA

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

The westerly portion of the Central Basin Non-Pressure Area is occupied by the Los Angeles Forebay. Historically, this area has served as a recharge area for the Los Angeles River. However, this forebay's recharge capability has been substantially reduced since the Los Angeles River channel was lined. One of the key strategic locations along the River for extraction of excess water, that otherwise would have been lost to the ocean, is the Los Angeles Forebay. This project would facilitate the excess water to be extracted further downstream and used to recharge the Central Basin by injection. One of the consequences if this concept, diversion of water to Los Angeles River Forebay for recharge, is carried forward, it would result in additional pumping rights for the City. Due to the City's Pueblo Water rights, the City has the rights to the entire flow in the LA River upstream of the confluence with the Arroyo Seco.

This concept would involve installation of dry wells within the Los Angeles River to recharge the water into the Central Basin. Dams and weirs would be installed upstream of downstream of the dry wells to measure the amount of water recharged. The water could later be pumped via groundwater wells.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 65 dry wells in Los Angeles River
- Two dams with weirs in Los Angeles River to measure upstream and downstream flows
- 20 extraction wells with treatment (30 mgd, to increase for seasonal peaking in water demands; increased to 30 wells/60 mgd in the 45,000 AFY alternative)
- 60 miles of transmission/distribution pipelines (increased to 120 miles in the 45,000 AFY alternative)

POTENTIAL CHALLENGES & CONSIDERATIONS	
• *One of the water sources considered for this project is stormwater and can be anticipated to be captured upstream through runoff capture/use and EWMP projects and thereby not available as a source of runoff for this project.* • *Regulatory/Permitting Process involving groundwater recharge regulations on retention time, NPDES requirements, Public Health and Safety associated requirements by California Department of Public Health.* • *Potential aquatic life impacts associated with diversion gate modifications and continuous monitoring of diversion and coordination with California Department of Fish and Wildlife.* • *Reduced flow in LA River.* • *Regional Water Quality Control Board Stream Alteration Permit* • *Public Perception. Stakeholder involvement and approval.*	
EXPECTED PROJECT CONCEPT TIMELINE	**TRIGGERS**
General timeframe from 2020 to 2040	LA River flow availability
SOURCES	
1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.	

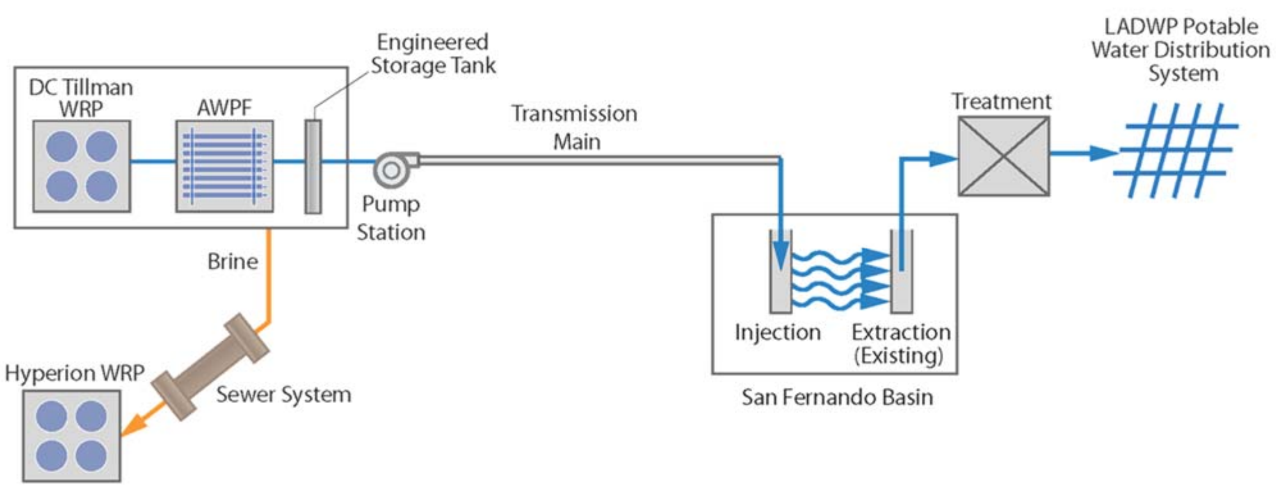
Disclaimer: This Conceptual Program Description is limited to conceptual planning level information, based on information known as of November 2016, and costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is shown in italics.

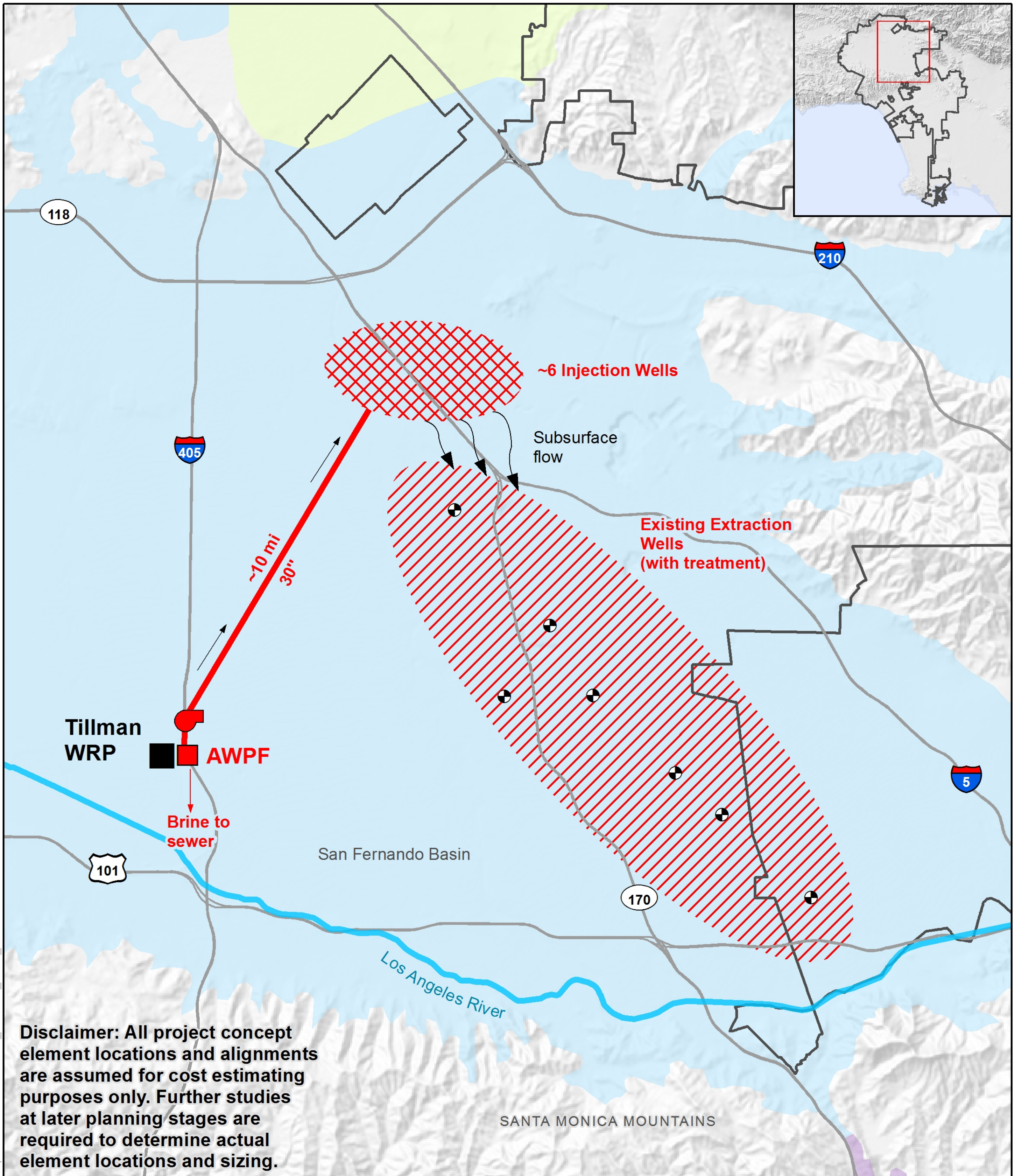
Note that this Conceptual Program Description was added after the ranking and prioritization of projects and was not included in the ranking and scoring of concept options.

CONCEPT OPTION 9	
PROJECT CONCEPT NAME	**Tillman WRP to San Fernando Basin Injection Wells**
PROJECT CONCEPT DESCRIPTION	Treat Donald C. Tillman Water Reclamation Plant (DCTWRP) effluent with Advanced Water Purification Facility (AWPF); recharge into San Fernando Basin (SFB) by injection wells; extract water for potable use
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 15,000 AFY 14 mgd; Wet Year: 15,000 AFY 14 mgd; Dry Year: 15,000 AFY 14 mgd *Potential Water Supply Benefit: up to 15,000 AFY* *Drought Resiliency: 100% (19,000 AFY Dry Year/19,000 AFY Normal year. This concept would increase drought resiliency by supplying a groundwater source from wastewater during times of drought that are currently not available.* *Yield estimates assume EWVIS; does not assume LFD to EWVIS.
ESTIMATED COST	*Capital: $320 - $430 million* *O&M: $5 - $7 million/year* *Unit: $1,400 - $1,900/AF (Calculated Unit Cost: $1,600/AF)* *Energy: $3.5 million to $4.5 million/year (2,100 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (ULARA)	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Groundwater Basin Source: LACDPW
- Existing Extraction Well
- Flow direction
- Subsurface flow
- Pump Station
- Pipeline
- Injection Well Area
- Extraction Area

0 0.5 1 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 9
IPR - Tillman WRP to San Fernando Basin Injection Wells
One Water LA 2040 Plan
TM 5.2 - Project Development

GENERAL BACKGROUND/PURPOSE

Using water currently released to the LA River, this indirect potable reuse (IPR) groundwater replenishment project concept would provide up to 15,000 AFY (14 mgd) of purified recycled water from the DCTWRP. Water would be treated at an AWPF located at the DCTWRP. Purified water would be conveyed through a new recycled water pipeline and ancillary lateral piping to a series of injection wells for the purpose of replenishing the SFB and its underlying aquifers. Injected water would then travel underground as groundwater for several years until it is pumped out by existing groundwater production wells to supplement the City's local potable water supplies. This project concept would reduce dependence on imported water and diversify the City's water portfolio, increasing supply reliability and sustainability.

Treatment and Conveyance – The AWPF would need to produce 14 mgd of purified water, after which the purified water would be conveyed to the injection wells using a new 3,500 horse power (hp) pump station, 10 miles of 30-inch diameter recycled water pipeline, and 3 miles of 12-inch diameter lateral pipeline. Brine disposal would utilize the existing sewer system and Hyperion outfall.

Injection Wells – Six (6) injection wells would be sited and designed to recharge and yield 15,000 AFY (14 mgd). The operational capacity per well is assumed to be ~2.5 mgd. Based on the Groundwater Replenishment Master Planning Report, it is assumed that injection wells would be sited along Canterbury Avenue to take advantage of City-owned land or rights-of-way and underground retention time compliance requirements for recycled water contribution to groundwater.

LADWP holds adjudicated water rights in the SFB to extract 87,000 AFY. Allowable pumping would increase an amount equal to the groundwater replenishment provided by this project concept, contributing to both local supply sustainability and reliability. LADWP would use existing groundwater production wells to extract groundwater for potable use.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 14 mgd AWPF (17 mgd inflow, 20% brine loss)
- 2 MG storage
- 3,500 hp pump station
- 10 miles of 30-inch diameter pipeline
- 6 injection wells (14 mgd total)
- Use existing extraction wells
- 20 mgd groundwater treatment (accounts for seasonal peaking in water demands)
- 3 miles of 12-inch diameter lateral pipelines
- Brine disposal is assumed to utilize the existing sewer system and Hyperion outfall (no facilities included)
- Land acquisition cost not included

POTENTIAL CHALLENGES & CONSIDERATIONS

- Wastewater flow availability (*i.e., after GWR and EWVIS projects, there would be 22 mgd remaining at DCTWRP, of which 5 mgd could go to Balboa Lakes and 17 mgd could be potentially available*)
- Recycled water regulations: permitting, regulatory approval, and compliance *(i.e., retention time, blending requirements, etc.)*
- Construction challenges
- Land acquisition/siting of 6 new injection wells
- Hydrogeologic constraints (i.e., *wells likely to be sited east of the 405 Freeway*)
- Groundwater mounding and rising groundwater levels (*i.e., interaction with landfills*)
- Groundwater rights
- Influence on existing contaminant plumes in the SFB
- LA River permit and discharge requirements
- Brine disposal

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
• 2025 or later • Dependent on completion of the GWR project (schedule for completed by 2023) • Dependent on completion of EWVIS project and feasibility study for additional IPR in the SFB	• Completion of GWR project (AWPF at DCTWRP to recharge SFB using spreading basins) • Completion of EWVIS (increase flows at DCT) • Feasibility study for additional IPR in SFB

SOURCES

1 RMC/CDM Smith (Prepared for the City of LA), 2012. Groundwater Replenishment Master Planning Report. March.

2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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CONCEPT OPTION 10

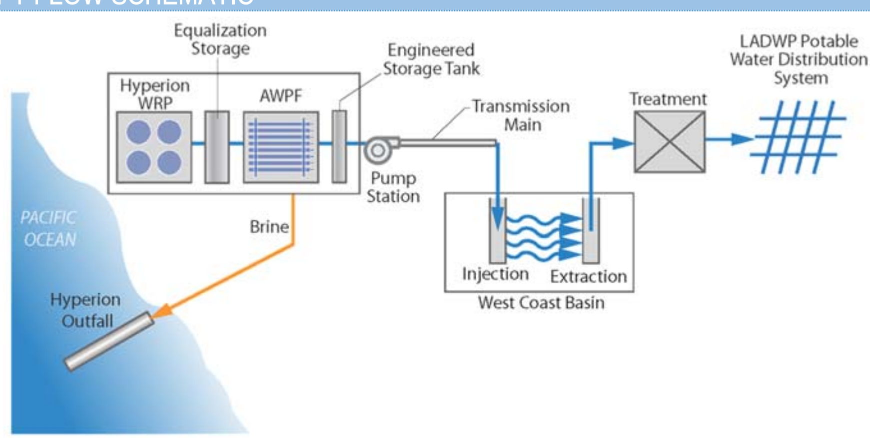
PROJECT CONCEPT NAME	**Hyperion WRP to West Coast Basin Injection Wells**
PROJECT CONCEPT DESCRIPTION	Treat HWRP effluent with AWPF; recharge into West Coast Basin by injection wells; extract water for potable use.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other

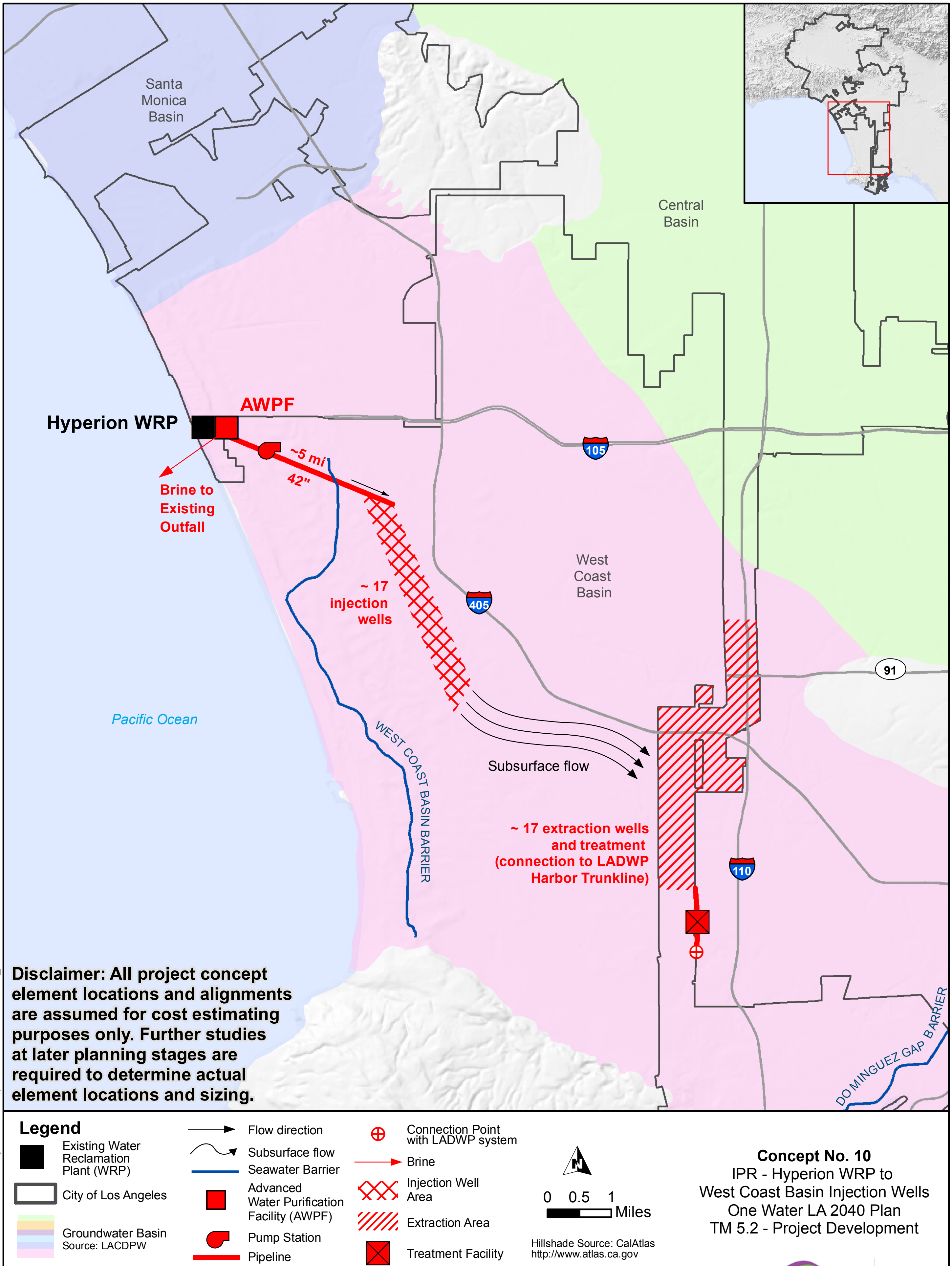
ESTIMATED YIELD & COST

ESTIMATED YIELD	Normal Year: 20,000 AFY 17 mgd; Wet Year: 20,000 AFY 17 mgd; Dry Year: 20,000 AFY 17 mgd Potential Water Supply Benefit: up to 30,000 AFY *Drought Resiliency: 100% (20,000 AFY Dry Year/20,000 AFY Normal year). This concept would increase drought resiliency by supplying a groundwater source from wastewater during times of drought that are currently not available.* Yield Assumptions: Flow available for reuse from Hyperion. The flow rate for this concept option could be increased or decreased based on the volume of water available from HWRP as well as the amount of water that could be recharged into and extracted from the West Coast Basin. A flow rate of 20,000 AFY has been used to evaluate this concept, however, the project could be as large as 30,000 AFY.
ESTIMATED COST	*Capital: $800 million to $1.0 billion* *O&M: $13 million to $17 million/year* *Unit: $2,900 to $3,800/AF (Calculated Unit Cost: $3,200/AF)* *Energy: $12 million to $16 million/year (6,000 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (WRD, Metropolitan, West Coast Basin Watermaster)	

PROJECT CONCEPT FLOW SCHEMATIC





Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing.

Concept No. 10
IPR - Hyperion WRP to West Coast Basin Injection Wells
One Water LA 2040 Plan
TM 5.2 - Project Development

GENERAL BACKGROUND/PURPOSE

The HWRP to West Coast Basin Injection Wells recharge concept would consist of newly constructed advanced treatment facilities at HWRP, combined with recharge in the West Coast Basin and subsequent recovery via new production wells. The concept would produce, recharge, and reuse up to 30,000 AFY of recycled water in the West Coast Basin. This concept would include advanced treatment at Hyperion, with brine disposal assumed to utilize Hyperion's outfall and a new pump station to pump the treated water to the injection well fields. The water would then be extracted, treated, and pumped into LADWP's potable distribution system. This concept would require advanced treatment facilities, pump stations, additional pipelines, and supplemental injection and extraction wells. WRD has included a similar project as part of their master plan, injection water in an expansion of the West Coast Barrier in an effort to reduce the salinity of the water in the West Coast Basin inside the seawater intrusion barrier as well as further inland as part of an aquifer and storage recovery project.(4)

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 17 mgd (20,000 AFY) Advanced Water Treatment Facilities
- 5 MG of wastewater flow equalization storage
- 3,500 hp pump station at HWRP to pump water to the injection well fields
- Approximately 5 miles of a large diameter pipeline (42-inch diameter assumed for cost estimating purposes)
- Approximately 15 miles of lateral pipelines ranging from 12-inch to 16-inch in diameter (to injection wells and from extraction wells)
- 17 medium depth injection wells (approx. 17 mgd total)
- 17 medium depth extraction wells (approx. 25 mgd total)
- 25 mgd of groundwater treatment
- Brine disposal is assumed to utilize the existing Hyperion outfall (no facilities included)
- Land acquisition cost for new well sites is not included

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Additional recharge/injection wells would be required.*
- *Pumping and storage rights, as well as the available groundwater storage capacity for the West Coast Basin would need to be addressed for ability to store and withdraw the recharge water.*
- *System demands would need to be evaluated to verify that the pumped water can be fully utilized by the City and/or regional partners.*
- *There may not be sufficient room at Hyperion to construct the necessary treatment facilities, including wastewater flow equalization basins and other capital improvements. Hyperion treatment technology may need to be upgraded for advanced treatment.*
- *Institutional agreements would be required with regional agencies, including possible revisions to the groundwater basin adjudication agreements which is very time consuming and costly.*
- *LADWP distribution system would need to be evaluated to ensure sufficient capacity for extraction wells during peak demands.*
- *Land acquisition for large number of new injection and extraction wells.*
- *Significant cost associated with the O&M of groundwater injection wells.*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
Likely 2030-2040.	• Management decision that this is the concept of choice • Funding • Cooperation with WRD and Watermasters

SOURCES

1 LADWP and DPW. *Long-Term Concepts Report.* March 2012. Prepared by RMC and CDM Smith. The concept could be downsized to whatever size is appropriate. Capacity based on amount of flow remaining at HWRP after foundational projects are complete.

2 LADWP and DPW. *Long-Term Concepts Report.* March 2012. Prepared by RMC and CDM Smith. Appendix F - Regional Groundwater Assessment TM.

3 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

4 WRD, 2016. *Groundwater Basins Master Plan*. Prepared by CH2M and RMC.

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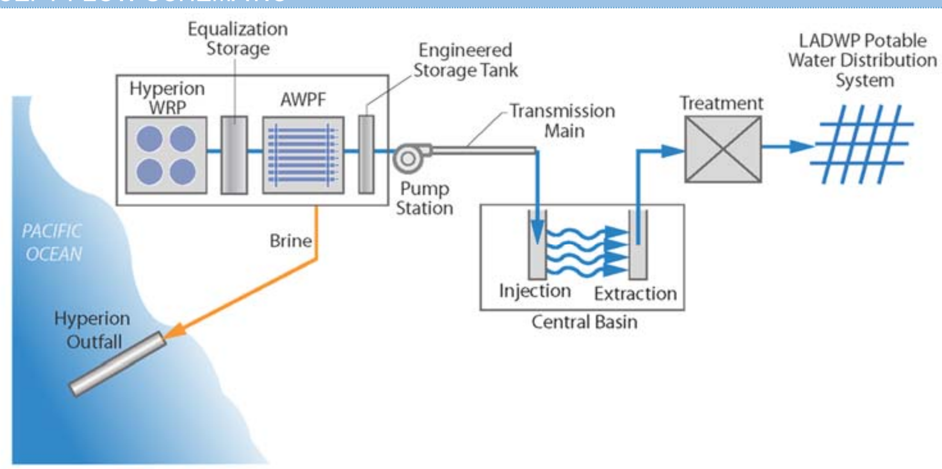
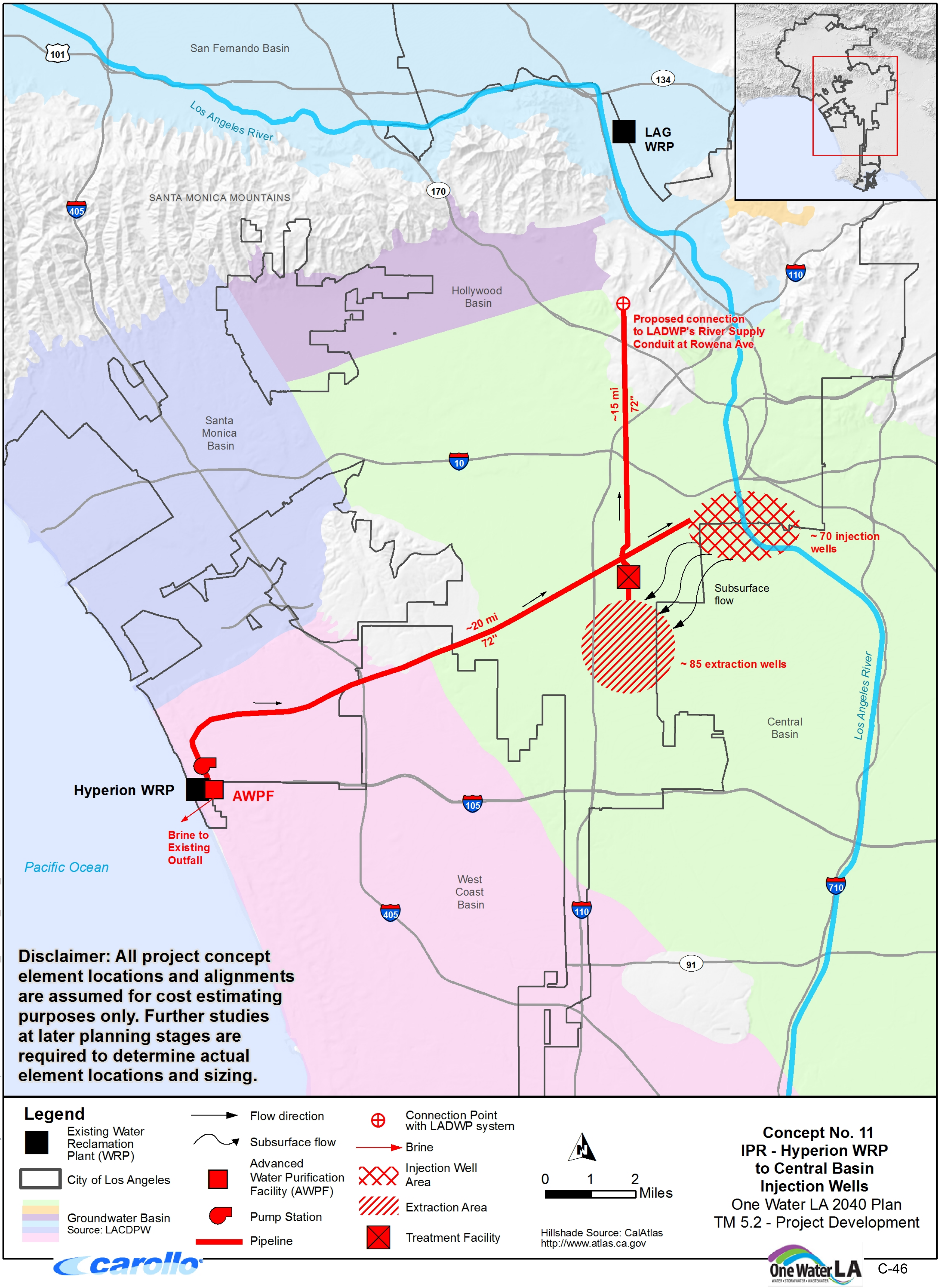
CONCEPT OPTION 11	
PROJECT CONCEPT NAME	**Hyperion WRP to Central Basin Injection Wells**
PROJECT CONCEPT DESCRIPTION	Treat HWRP effluent with AWPF; recharge into Central Basin by injection wells; extract water for potable use.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 75,000 AFY 70 mgd Wet Year: 75,000 AFY 70 mgd Dry Year: 75,000 AFY 70 mgd Potential Water Supply Benefit: up to 75,000 AFY *Drought Resiliency: 100% (75,000 AFY Dry Year/75,000 AFY Normal year). This concept would increase drought resiliency by supplying a groundwater source from wastewater during times of drought that are currently not available.* Yield Assumptions: Flow available for reuse from HWRP. Variation between Wet and Dry years is assumed to be minimal for the purposes of this conceptual evaluation. The flow rate for this concept option could be increased based on the volume of water available from HWRP, however, a flow rate of 75,000 AFY has been used to evaluate this concept.
ESTIMATED COST	*Capital: $3.0 billion to $4.0 billion* *O&M: $40 million to $55 million/year* *Unit: $2,400 to $3,200/AF (Calculated Unit Cost: $2,700/AF)* *Energy: $30 million to $40 million/year (3,500 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA GUIDING PRINCIPLES - MAIN OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost-sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (WRD, Metropolitan, Central Basin Watermaster)	

PROJECT CONCEPT FLOW SCHEMATIC




San Fernando Basin
101
134
Los Angeles River
LAG WRP
SANTA MONICA MOUNTAINS
170
405
110
Hollywood Basin
Proposed connection to LADWP's River Supply Conduit at Rowena Ave
~15 mi
72"
Santa Monica Basin
10
~ 70 injection wells
Subsurface flow
~20 mi
72"
~ 85 extraction wells
Central Basin
Los Angeles River
Hyperion WRP
AWPF
105
Brine to Existing Outfall
Pacific Ocean
West Coast Basin
405
110
710
91
Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing.
Legend
Existing Water Reclamation Plant (WRP)
City of Los Angeles
Groundwater Basin
Source: LACDPW
Flow direction
Subsurface flow
Advanced Water Purification Facility (AWPF)
Pump Station
Pipeline
Connection Point with LADWP system
Brine
Injection Well Area
Extraction Area
Treatment Facility
N
0 1 2 Miles
Hillshade Source: CalAtlas
http://www.atlas.ca.gov
Concept No. 11
IPR - Hyperion WRP to Central Basin Injection Wells
One Water LA 2040 Plan
TM 5.2 - Project Development
Document Path: C:\Users\jsilber\Desktop\OWLA\MXD\FactSheet_Potential_Letter_20161222.mxd

GENERAL BACKGROUND/PURPOSE

The HWRP to Central Basin Injection Wells recharge concept would consist of newly constructed advanced treatment facilities at HWRP, combined with recharge in the Central Basin and subsequent recovery via new production wells. The concept would produce, recharge, and reuse up to 75,000 AFY in the Central Basin. This concept would include advanced treatment at Hyperion, with brine disposal assumed to utilize Hyperion's outfall and a new pump station to pump the treated water to the injection well fields. The water would then be extracted, treated, and pumped into LADWP's potable distribution system. This concept would require advanced treatment facilities, pump stations, additional pipelines, and supplemental injection and extraction wells. For cost estimating purposes it is assumed that recharge and extraction in the Central Basin would take place east of the 110 Freeway and south of the 5 Freeway.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 70 mgd (75,000 AFY) Advanced Water Treatment Facilities
- 20 MG of wastewater flow equalization storage
- 13,000 hp pump station at HWRP to pump water to the injection well fields
- Approximately 20 miles of a large diameter pipeline from Hyperion to injection wells (72-inch diameter assumed for cost estimating purposes).
- Approximately 50 miles of lateral pipelines ranging from 12-inch to 16-inch in diameter (to injection wells and from extraction wells)
- 70 medium depth injection wells (approx. 70 mgd total)
- 70 medium depth extraction wells (approx. 100 mgd total)
- 100 mgd of groundwater treatment
- Approximately 10 miles of a large diameter pipeline from extraction wells to LADWP distribution system. (72-inch diameter assumed for cost estimating purposes, with tie-in point from extraction wells into LADWP distribution system is assumed to be on the River Supply Conduit at Rowena Avenue, upstream of the former Ivanhoe Reservoir).
- Brine disposal is assumed to utilize the existing Hyperion outfall (no facilities included)
- Land acquisition cost for new well sites is not included

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Additional recharge/injection wells would be required.*
- *There are significant amount of piping that would be required to connect to the Central Basin locations from HWRP and from the extraction wells to the distribution system.*
- *Pumping and storage rights, as well as the available groundwater storage capacity for the Central Basin would need to be addressed for ability to store and withdraw the recharge water.*
- *System demands would need to be evaluated to verify that the pumped water can be fully utilized by the City and/or regional partners.*
- *There may not be sufficient room at Hyperion to construct the necessary treatment facilities, including wastewater flow equalization basins and other capital improvements. Hyperion treatment technology may need to be upgraded for advanced treatment.*
- *Institutional agreements would be required with regional agencies, including possible revisions to the groundwater basin adjudication agreements which is very time consuming and costly.*
- *LADWP distribution system would need to be evaluated to ensure sufficient capacity for extraction wells during peak time.*
- *Land acquisition for large number of new injection and extraction wells.*
- *Significant cost associated with the O&M of groundwater injection wells.*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
This concept would require upgrade of HWRP, new recharge and production wells, new production treatment facilities, and large amount of conveyance. Likely 2030-2040.	• Management decision that this is the concept of choice • Funding • Cooperation with WRD and Watermasters

SOURCES

1 LADWP and DPW. *Long-Term Concepts Report.* March 2012. Prepared by RMC and CDM Smith. The concept could be downsized to whatever size is appropriate. Capacity based on amount of flow remaining at HWRP after foundational projects are complete.
2 LADWP and DPW. *Long-Term Concepts Report.* March 2012. Prepared by RMC and CDM Smith. Appendix F - Regional Groundwater Assessment TM.
3 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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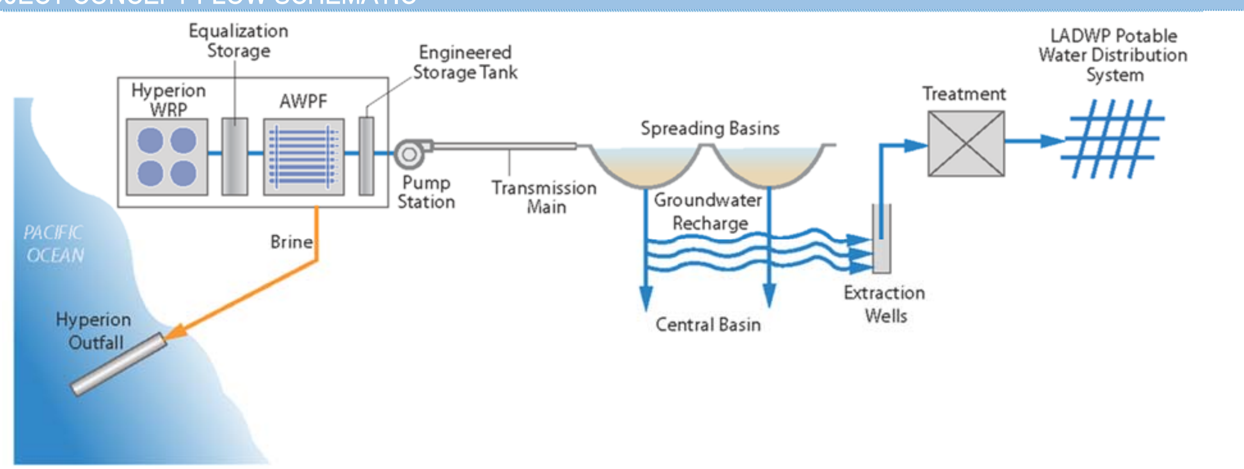
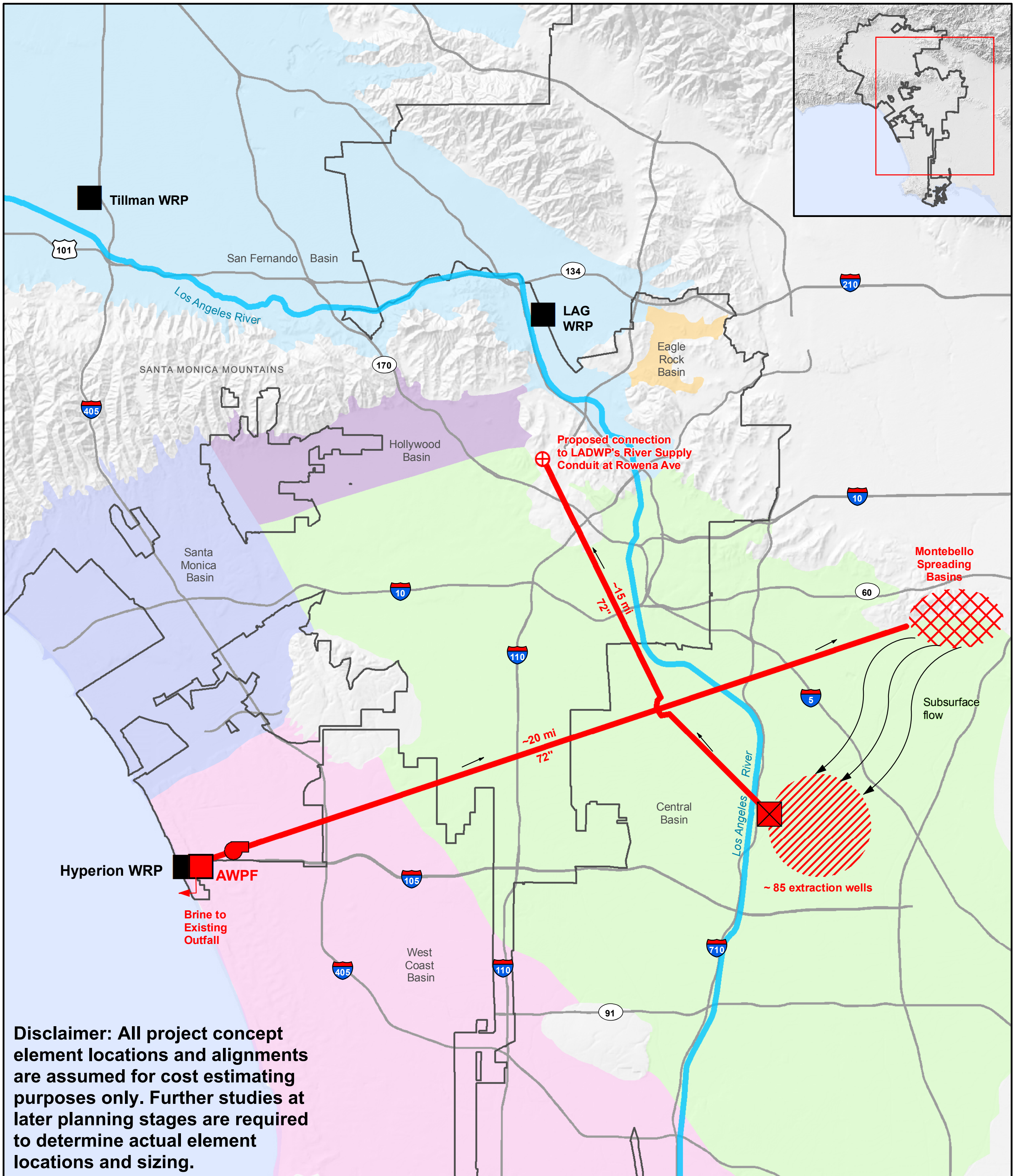
CONCEPT OPTION 12	
PROJECT CONCEPT NAME	**Hyperion WRP to Central Basin with Spreading Basins**
PROJECT CONCEPT DESCRIPTION	Treat Hyperion Water Reclamation Plant (HWRP) effluent with Advanced Water Purification Facility (AWPF) and convey water to the existing Rio Hondo Spreading Basins at Montebello Forebay; recharge by surface spreading; extract, treat and pump potable water into LADWP distribution system.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 95,000 AFY[1] 85 mgd; Wet Year: 95,000 AFY 85 mgd; Dry Year: 95,000 AFY 85 mgd *Potential Water Supply Benefit: up to 95,000 AFY* *Drought Resiliency: 100% (95,000 AFY Dry Year/95,000 AFY Normal year). This concept would increase drought resiliency by supplying a groundwater source from wastewater during times of drought that are currently not available.* *Yield Assumptions: Assumes EWVIS; does not include LFDs. It is expected that after the in-progress projects are completed, there will be 105 mgd of flow available for this concept. The concept could be downsized to whatever size is appropriate.*
ESTIMATED COST	*Capital: $3.5 billion to $5 billion* *O&M: $50 to $65 million/year* *Unit: $2,300 to $3,100/AF (Calculated Unit Cost: $2,600/AF)* *Energy: $30 to 40 million/year (2,900 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA GUIDING PRINCIPLES - MAIN OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (Central Basin Watermaster, WRD, Metropolitan)	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Groundwater Basin
  Source: LACDPW
- Flow direction
- Subsurface flow
- Advanced Water Purification Facility (AWPF)
- Pump Station
- Pipeline
- Connection Point with LADWP system
- Brine
- Spreading Basin Area
- Extraction Area
- Treatment Facility

0 1.25 2.5 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 12
IPR - Hyperion WRP to Central Basin with Spreading Basins
One Water LA 2040 Plan
TM 5.2 - Project Development

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GENERAL BACKGROUND/PURPOSE

This project would consist of newly constructed advanced treatment facilities at HWRP, combined with recharge using existing capacity in the Rio Hondo Spreading Grounds to the Montebello Forebay and subsequent recovery via production wells. The project would produce and reuse 95,000 AFY of recycled water. Secondary effluent feed flows from HWRP would be available continuously during the year. Advanced treatment facilities, a pump station, and a tunnel from HWRP would be constructed to provide recycled water for ground water recovery at the existing Rio Hondo Spreading Grounds in Central Basin. The concept also includes new production wells east of the 5 Freeway and south of the 60 Freeway, along with laterals from the wells connecting to the existing potable distribution system further northwest. Due to the large production flows, three potential connection points on the existing potable distribution system would likely be needed.

This option would depend on new production well fields to increase the recovery potential in the Central Basin. The HWRP treatment upgrades consist of equalization (EQ), microfiltration (MF), reverse osmosis (RO), and advanced oxidation process (AOP) and a post-stabilization step intended to raise the pH of the recycled water product water to within acceptable limits.

The current available capacity of the spreading grounds is estimated at 95,000 AFY.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *20 MG wastewater flow equalization (6 hours)*
- *85 mgd MBR/AWPF (105 mgd inflow, 20% brine loss)*
- *10 MG Reservoir (3 hours)*
- *20,000 hp pump station*
- *15 miles of 54- to 60-inch diameter pipeline*
- *45 miles of 12-inch diameter lateral pipelines*
- *35 miles of 72-inch diameter pipelines*
- *85 extraction wells (125 mgd total to account for seasonal peaking in water demands)*
- *125 mgd groundwater treatment*
- *Brine disposal is assumed to utilize the existing Hyperion outfall (no facilities included)*
- *Land acquisition cost not included*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Additional capacity of the spreading grounds required, potential fatal flaw (GRIP EIR plans may utilize remaining capacity of Rio Hondo Spreading Basins)*
- *Significant amount of piping and tunneling required*
- *Groundwater pumping rights, storage rights, and available groundwater storage capacity*
- *System demands need to be evaluated to verify the pumped water can be fully utilized*
- *Space constraints at Hyperion to construct facilities*
- *Institutional agreements with regional agencies, including possible revisions to the groundwater basin adjudication agreements*
- *Land acquisition for large number of new injection and extraction wells*
- *Space constraints for basins or additional land acquisition*
- *Brine disposal*

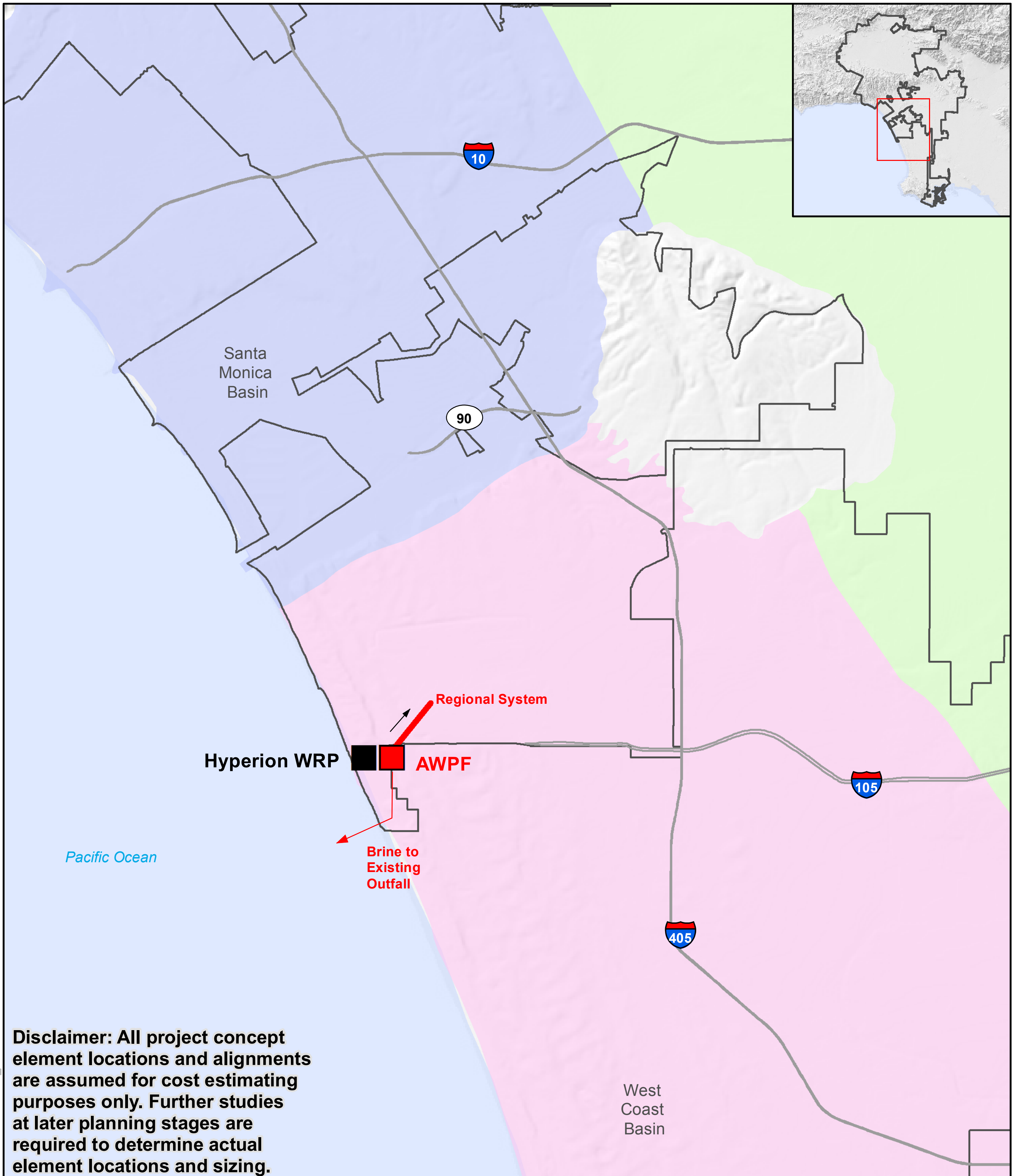
EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
Likely 2030-2040.	• Management decision that this is the concept of choice • Funding • Cooperation with WRD and Central Basin Watermaster • Additional/confirmation of sufficient capacity in Rio Hondo Spreading Basins

SOURCES

1 LADWP and DPW. *Long-Term Concepts Report.* March 2012. Prepared by RMC and CDM Smith. Appendix F - Regional Groundwater Assessment TM.
2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

Disclaimer: This Conceptual Program Description is limited to conceptual planning level information, based on information known as of November 2016, and costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is shown in italics.

CONCEPT OPTION 13		
PROJECT CONCEPT NAME	MBR at Hyperion WRP to Regional System	
PROJECT CONCEPT DESCRIPTION	Treat HWRP effluent with a membrane bioreactor (MBR). Deliver water to a regional system for recharge into a groundwater basin to be extracted for potable use by other regional systems. This project also may be used for direct potable reuse in the future. Other treatment by the regional system will be required. LADWP could purchase this water from a regional system for potable use.	
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other	
ESTIMATED YIELD & COST		
ESTIMATED YIELD	Normal Year: 95,000 AFY 85 mgd; Wet Year: 95,000 AFY 85 mgd; Dry Year: 95,000 AFY 85 mgd Water Supply Benefit requires regional partner to construct facilities, but could be equal to amount of water regional partner takes from HWRP. *Drought Resiliency: 100% (95,000 AFY Dry Year/95,000 AFY Normal year). This concept would increase drought resiliency by supplying a groundwater source from wastewater during times of drought that are currently not available.* *Yield Assumptions: Assumes EWVIS; does not include LFDs. It is expected that after the in-progress projects are completed, there will be 105 mgd of flow available for this concept.*	
ESTIMATED COST	*Capital: $800 million to $1.1 billion. Regional partner's costs not included.* *O&M: $15 million to $20 million/year. Regional partner's costs not included. LADWP water purchase costs from regional partner at $75 million/yr.* *Unit: $600 to $800/AF for MBR treatment. $1,400 to $1,800/AF including purchase of water from regional system. (Calculated Unit Cost: $1,500/AF)* *Energy: $8 to $10 million/year. Regional partner's costs not included. (700 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1). Assumes purchase of water from regional partner at Metropolitan Tier 2 full service treated rates, minus the Local Resources Program incentive*	
ONE WATER LA GUIDING PRINCIPLES - MAIN OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☒ Other (Watermaster(s), Metropolitan Water District)	



Legend

- ■ Existing Water Reclamation Plant (WRP)
- ▭ City of Los Angeles
- Groundwater Basin Source: LACDPW
- → Flow direction
- ■ Advanced Water Purification Facility (AWPF)
- → Brine

N

0 1 Miles

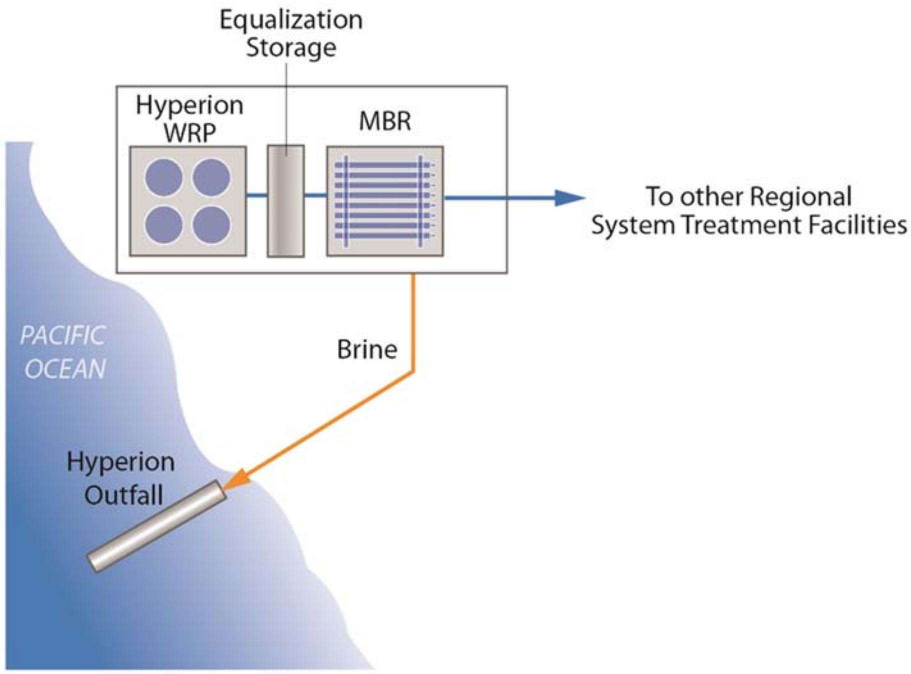
Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 13
IPR - MBR at Hyperion WRP to Regional System
One Water LA 2040 Plan
TM 5.2 - Project Development

carollo

One Water LA

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

The Hyperion Water Reclamation Plant (HWRP) has potential capacity to produce 78,000 to 95,000 AFY (70 - 85 mgd) of purified recycled water to potentially be distributed to a regional partner, who would further distribute the water to other regional users. If advanced treatment is implemented, the potential flow to other regional systems is dependent upon the flow required by other projects taking precedent over distribution to other regional systems. Depending on the associated regional system, this indirect potable reuse option may include an advanced treatment facility, a pump station, conveyance, recovery via extraction wells, and connection to a potable distribution system, as well as new production facilities to recover recharged water and convey it to provide recycled water to a regional system. For purposes of this CPDS, it is assumed that LASAN will treat the water at HWRP with MBR, and then deliver the water to a regional system for further processing.

The regional partner would then make the water available to LADWP and other water retailers at their full service rates. By purchasing this water from the regional partner, this water would become a water supply benefit to the City.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 25 MG wastewater flow equalization
- 85 mgd MBR (105 mgd inflow, 20% brine loss)
- Does not include any downstream facilities
- Brine disposal is assumed to utilize the existing Hyperion outfall (no facilities included)
- Purchase of water from Metropolitan or regional system
- Land acquisition cost not included

POTENTIAL CHALLENGES & CONSIDERATIONS	
• *Institutional agreements with other regional agencies including cost-sharing, infrastructure, and treatment requirements* • *System demands need to be evaluated to verify the pumped water can be fully utilized* • *Space constraints at Hyperion to construct facilities* • *Requires investment from regional partner for infrastructure for the advanced treatment, land, plant operations, and purchasing water from HWRP* • *Providing recycled water to other regional users does not prioritize the use of water within the City* • *Brine disposal*	
EXPECTED PROJECT CONCEPT TIMELINE	**TRIGGERS**
Potentially 2030-2040.	• Management decision that this is the concept of choice • Funding • Cooperation with regional agencies • Regional partner agreement to pursue this concept

SOURCES

1 City of Los Angeles. Draft Technical Memorandum 5.1 Basis of Planning. October 2016. Prepared for One Water LA.
2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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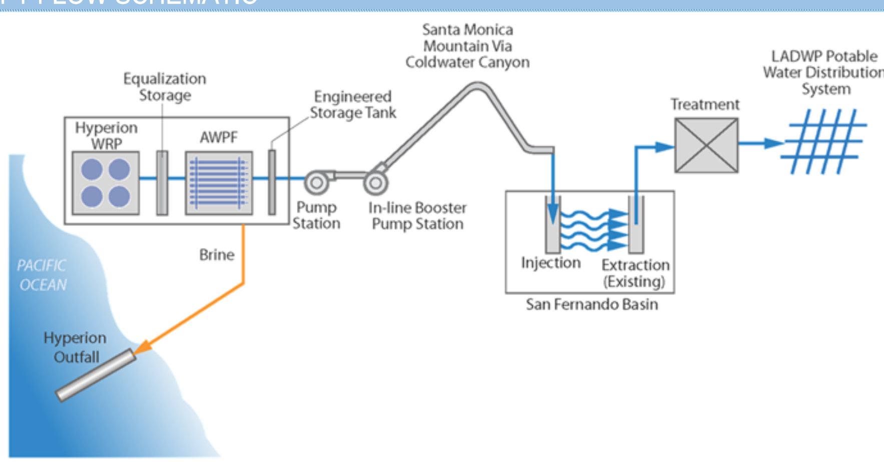
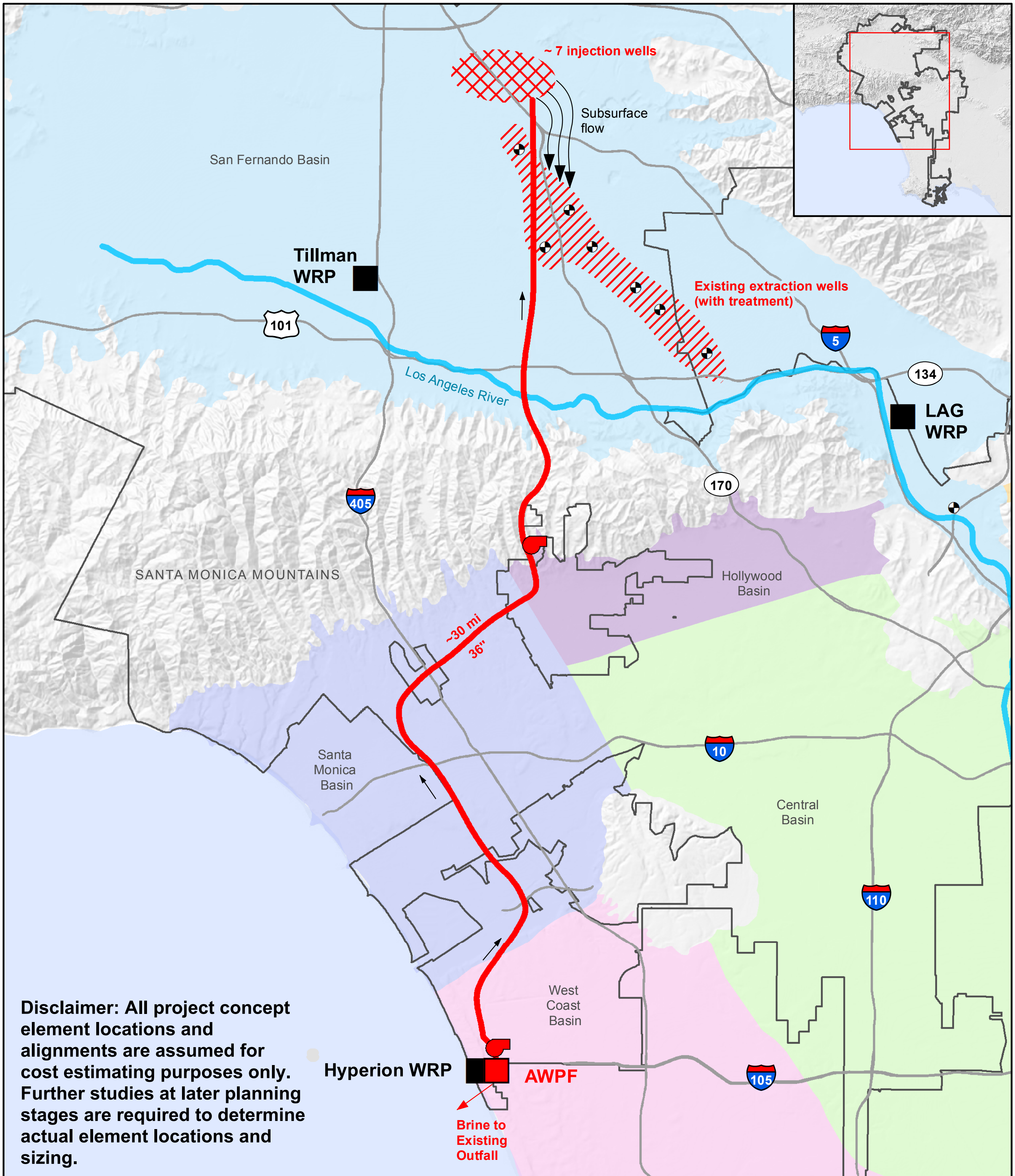
CONCEPT OPTION 14	
PROJECT CONCEPT NAME	Hyperion WRP to San Fernando Basin Injection Wells
PROJECT CONCEPT DESCRIPTION	Treat Hyperion Water Reclamation Plant (HWRP) effluent with Advanced Water Purification Facility (AWPF) and pump water over the Santa Monica Mountains to recharge into SFB by injection wells; extract water for potable use
SUPPLY SOURCE CATEGORY	☐ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: up to 20,000 AFY 18 mgd* *Wet Year: 20,000 AFY 18 mgd* *Dry Year: 20,000 AFY 18 mgd* *Potential Water Supply Benefit: up to 20,000 AFY* *Drought Resiliency: 100% (20,000 AFY Dry Year/20,000 AFY Normal year). This concept would increase drought resiliency by supplying a groundwater source from wastewater during times of drought that are currently not available.* *Yield Assumptions: Yield based on the ability to get 20,000 AFY into the San Fernando Basin by injection (18 mgd facility). The facility could be increased or decreased based on the amount of water that could be injected into the SFB. Further studies need to be completed to verify the additional amount that could be injected and recovered.*
ESTIMATED COST	*Capital: $600 million to 800 million* *O&M: $5 to 7 million/year* *Unit: $2,200 to $2,900/AF (Calculated Unit Cost: $2,400/AF)* *Energy: $7.5 million to 10 million/yr (3,500 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA GUIDING PRINCIPLES - MAIN OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other (ULARA Watershed Management Group)	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Groundwater Basin Source: LACDPW
- Existing Extraction Well
- Flow direction
- Subsurface flow
- Advanced Water Purification Facility (AWPF)
- Pump Station
- Pipeline
- Brine
- Injection Well Area
- Extraction Area

0 1 2 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 14
IPR - Hyperion WRP to San Fernando Basin Injection Wells
One Water LA 2040 Plan
TM 5.2 - Project Development

carollo

One Water LA

GENERAL BACKGROUND/PURPOSE

HWRP has 105 mgd excess water available after the foundational projects are complete that would be discharged to the ocean. Rather than discharging the flow to the ocean, one option is to treat a portion of the water with an Advanced Water Purification Facility (AWPF) located at the HWRP, then pump the water in a new pipeline over the Santa Monica Mountains to the San Fernando Valley (SFV). In the San Fernando Valley, the water would be stored in the San Fernando Valley groundwater basin, with the water entering the basin using injection wells. The project sizing has been limited to 20 mgd due to the unknown ability for the groundwater basin to accept additional water. The brine from the AWPF will be sent for discharge through the Hyperion Outfall. (Surface spreading is not considered for this conceptual description, as for this description, it is assumed that there will not always be capacity for additional surface recharge after the foundational project, Groundwater Replenishment Project with AWPF at Tillman WRP is completed.) The water would be stored in the groundwater basin until it is pumped using existing extraction wells.

AWPF - Additional treatment will be required after tertiary treatment for use for IPR. It is assumed that the process would be MF or UF, followed by RO, UV, and AOP.

Recycled Water Conveyance - Purified water produced at the AWPF will be conveyed over the Santa Monica Mountains via the Sepulveda Pass, requiring a lift of approximately 1,500 foot including dynamic losses. Recycled water will be recharged with new injection wells, requiring an approximate 30 mile, 36-inch diameter recycled water pipeline. Additional lateral piping will be needed to each injection well.

Pump Stations - Pump stations would be required to pump the water over the Santa Monica Mountains to the San Fernando Valley. One pump station would be located at Hyperion WRF, with other(s) located on the Metro side of the Santa Monica Mountains.

Injection Wells - The suite of injection wells will be designed to the full capacity of the AWPF (18 mgd). The operational capacity per well is assumed to be 2.7 mgd (Groundwater Replenishment Master Planning Report, 2012); therefore, requiring 7 injection wells for the project. The capacity for the individual wells was estimated at 2.7 mgd, or ~50% of the capacity of the larger production wells at the Tujunga Well Field. The potential injection wells would be sited on City-owned land or rights-of-way and compliance with blending and underground retention time requirements for recycled water contribution to groundwater.

Extraction Wells - LADWP holds adjudicated water rights in the SFB to extract 87,000 AFY. Allowable pumping will increase an amount equal to the GWR of the SFB provided by this project, contributing to both local supply sustainability and reliability. LADWP would use existing groundwater production wells to extract groundwater.

It must be noted that there are limits to how much recharge and extraction can occur within the SFB. Any injection points would need to be analyzed in consideration of the groundwater remediation projects currently under development. Groundwater modeling and other studies would need to be performed to determine the feasibility of the scope of this project.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *5 MG equalization storage (6 hours)*
- *18 mgd MBR+AWPF (22 mgd inflow, 20% brine loss)*
- *2 MG effluent storage tank (3 hours)*
- *3,000 hp pump station*
- *4,000 hp pump station*
- *30 miles of 36-inch diameter transmission pipeline*
- *3 miles of 12-inch diameter lateral pipeline*
- *7 injection wells (18 mgd total)*
- *Use existing extraction wells*
- *27 mgd groundwater treatment (accounts for seasonal peaking in water demands)*
- *Brine is assumed to be discharged into the existing sewer system & Hyperion ocean outfall (no improvements included).*
- *Land acquisition costs have not been included.*

POTENTIAL CHALLENGES & CONSIDERATIONS	
• *Significant amount of piping that would be required to pump from the HWRP to the SFV groundwater basin (30-35 miles)* • *Large pumping facilities required to convey water over the Santa Monica Mountains* • *Space constraints at HWRP for new AWPF and equalization storage* • *Permitting* • *Regulatory approvals.* • *Construction challenges* • *Additional production wells and groundwater treatment facilities* • *Groundwater storage space constraints in the SFB due to the GWR Project and stormwater capture projects* • *Significant costs associated with the O&M of groundwater injection wells* • *Flow yield dependent on groundwater modeling* • *Brine disposal*	
EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The concept could be implemented between 2030 and 2040.	• Completion of the foundational GWR project (DCTWRP to SFB using spreading basins) • Feasibility study for additional IPR in SFB

SOURCES

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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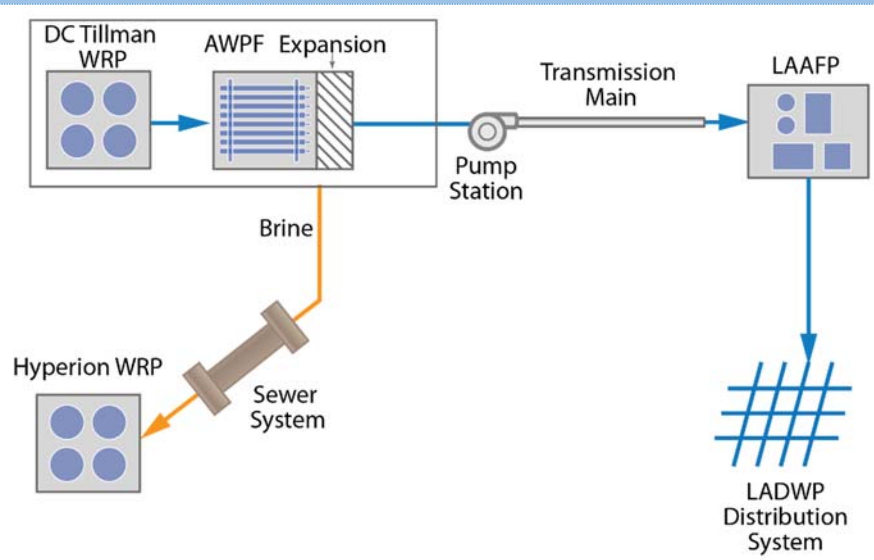
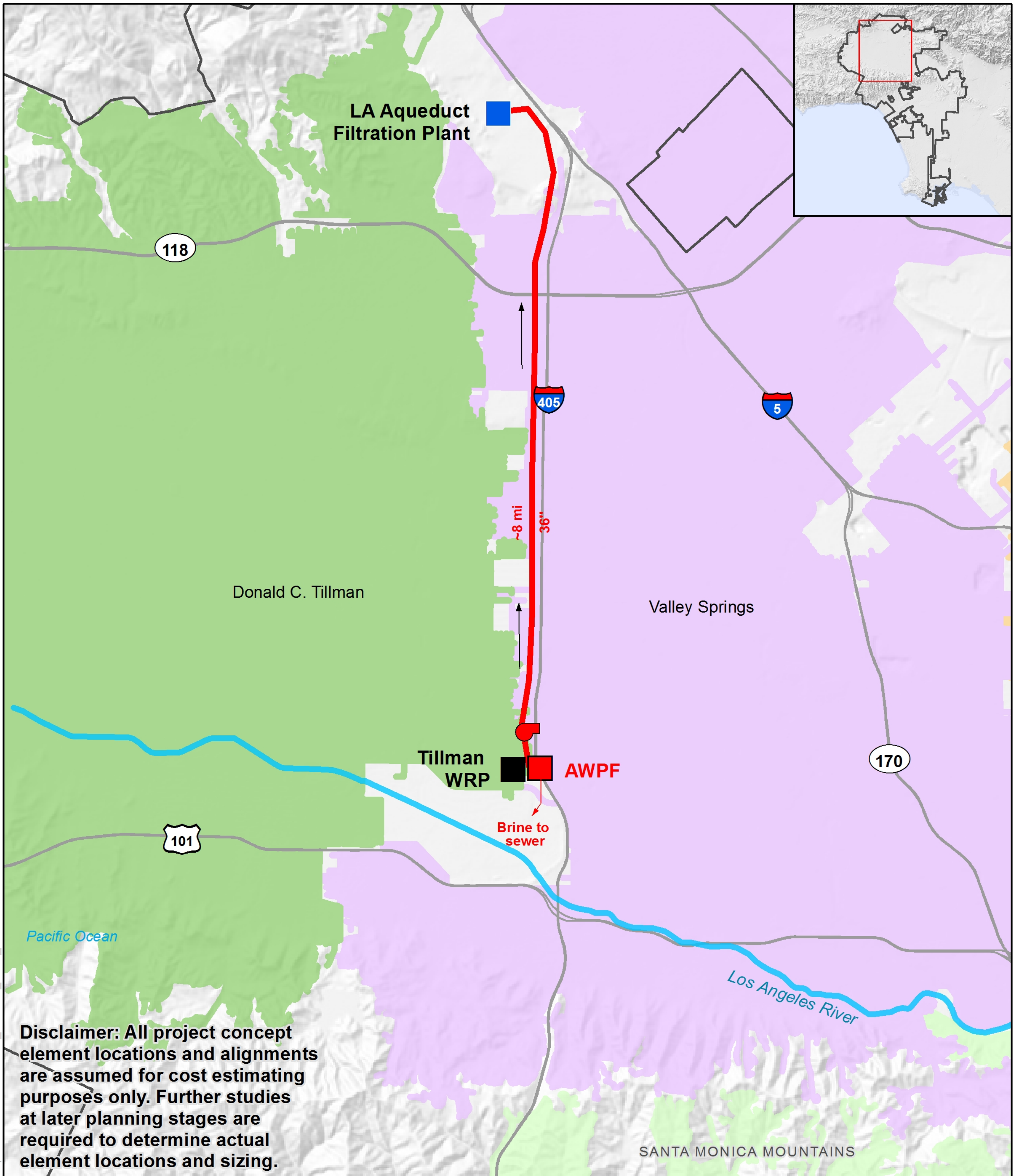
CONCEPT OPTION 15	
PROJECT CONCEPT NAME	**Tillman WRP to Los Angeles Aqueduct Filtration Plant**
PROJECT CONCEPT DESCRIPTION	Expand Donald C. Tillman Water Reclamation Plant (DCTWRP) Advanced Water Purification Facility (AWPF) and convey direct potable reuse flows to the Los Angeles Aqueduct Filtration Plant (LAAFP) and then to LADWP distribution.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☒ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 15,000 AFY 14 mgd* · *Wet Year: 15,000 AFY 14 mgd* · *Dry Year: 15,000 AFY 14 mgd* *Potential Water Supply Benefit: up to 15,000 AFY* *Drought Resiliency: 100% (15,000 AFY Dry Year/15,000 AFY Normal year) is the estimated drought resiliency. This concept will increase drought resiliency by supplying a potable water source from wastewater during times of drought that are currently not available.* *Assumes EWVIS; does not assume LFD to EWVIS.*
ESTIMATED COST	*Capital: $280 million to $380 million* *O&M: $5.5 million to $7.5 million/year* *Unit: $1,400 to $1,800/AF (Calculated Unit Cost: $1,500/AF)* *Energy: $3.5 million to $5 million/year (2,100 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

- Existing Water Reclamation Plant (WRP)
- Existing Water Filtration Plant (WRP)
- Advanced Water Purification Facility (AWPF)
- City of Los Angeles
- Flow direction
- Pump Station
- Pipeline
- Groundwater Basin Source: LACDPW
- Brine

0 0.5 1 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 15
DPR - Tillman WRP to Los Angeles Aqueduct Filtration Plant
One Water LA 2040 Plan
TM 5.2 - Project Development

GENERAL BACKGROUND/PURPOSE

The Donald C. Tillman Water Reclamation Plant (DCTWRP) currently produces recycled water for non-potable water uses. As part of the Groundwater Replenishment Project (GWR) an AWPF will be built at the DCTWRP. This project concept would include expansion of the AWPF facilities and additional processes likely required to comply with anticipated future DPR regulations.

This DPR project concept assumes increasing the capacity of the DCTWRP AWPF from 30,000 AFY (30 mgd) to 45,000 AFY (45 mgd), which is dependent upon the following:

1. *East West Valley Interceptor Sewer Expansion*
2. *Construction and operation of Low Flow Diversions (possibly High Flow Diversions)*
3. *Reduced effluent to the LA River*

To operate the AWPF at a constant flow, as well as maximize production, this project concept includes a two (2) million gallon (MG) tertiary effluent equalization tank, upstream of the AWPF. *Brine would be discharged from the expanded AWPF back into the sewer for further treatment at Hyperion WRP.*

From the DCTWRP AWPF, direct potable reuse water would be pumped to the LA Aqueduct Filtration Plant (LAAFP). The pipeline would be approximately 8 miles long and 36-inch diameter.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 14 mgd AWPF (with the addition of processes that may be required by DPR regulations; 17 mgd inflow, 20% brine loss)
- 2 MG storage
- 2,500 hp pump station
- 8 miles of 36-inch diameter transmission pipeline
- Brine disposal is assumed to utilize existing sewers to Hyperion (no facilities included)
- Land acquisition cost not included

POTENTIAL CHALLENGES & CONSIDERATIONS

- *DPR regulations. Raw water augmentation regulations have not yet been developed.*
- *DPR permitting/regulatory approval*
- *Discharge permit related to LA River flow requirement*
- *Impacts to LA River flows*
- *Expanded water conservation and/or graywater systems could significantly alter the amount of additional water available from the East-West Valley Interceptor Sewer.*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The City plans to begin GWR operations in 2023. This project concept could be implemented between 2035 and 2040.	• *DPR regulations* • *Increased flow to DCTWRP (EWVIS Expansion or LFDs)* • *LA River minimum flow requirements*

SOURCES

1 For planning and costing purposes, it is assumed that the flows will be diverted to LA Reservoir.
2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.
3 AECOM (prepared for LADWP), 2016. Draft EIR for the Los Angeles Groundwater Replenishment Project. May.
4 LADWP, 2016. Notice of Availability of Draft EIR for the Los Angeles Groundwater Replenishment Project. May.
5 LADWP, 2016. Web Site – Water. www.ladwp.com
6 LADWP, undated. Fact Sheet – Groundwater Replenishment Project.
7 RMC/CDM Smith (Prepared for the City of LA), 2012. Groundwater Replenishment Master Planning Report. March.

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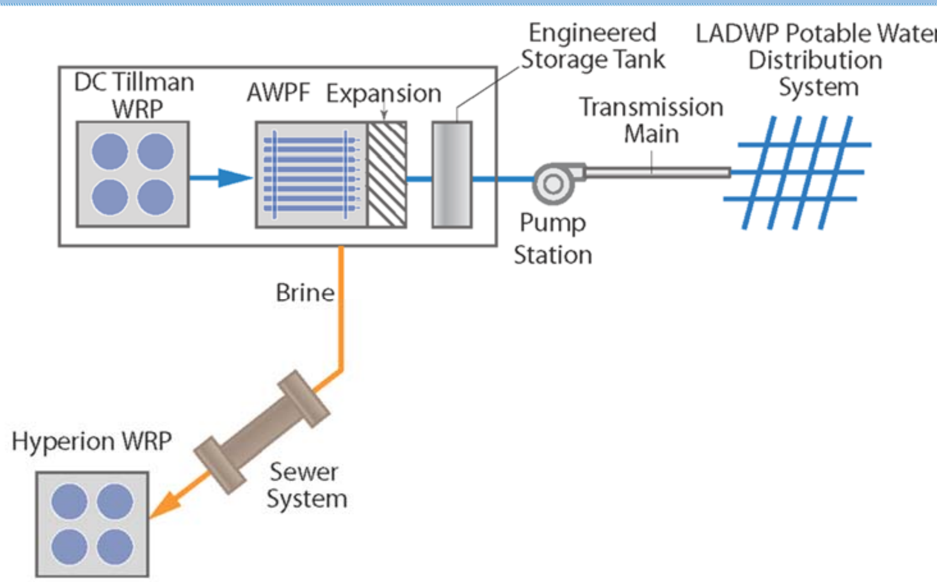
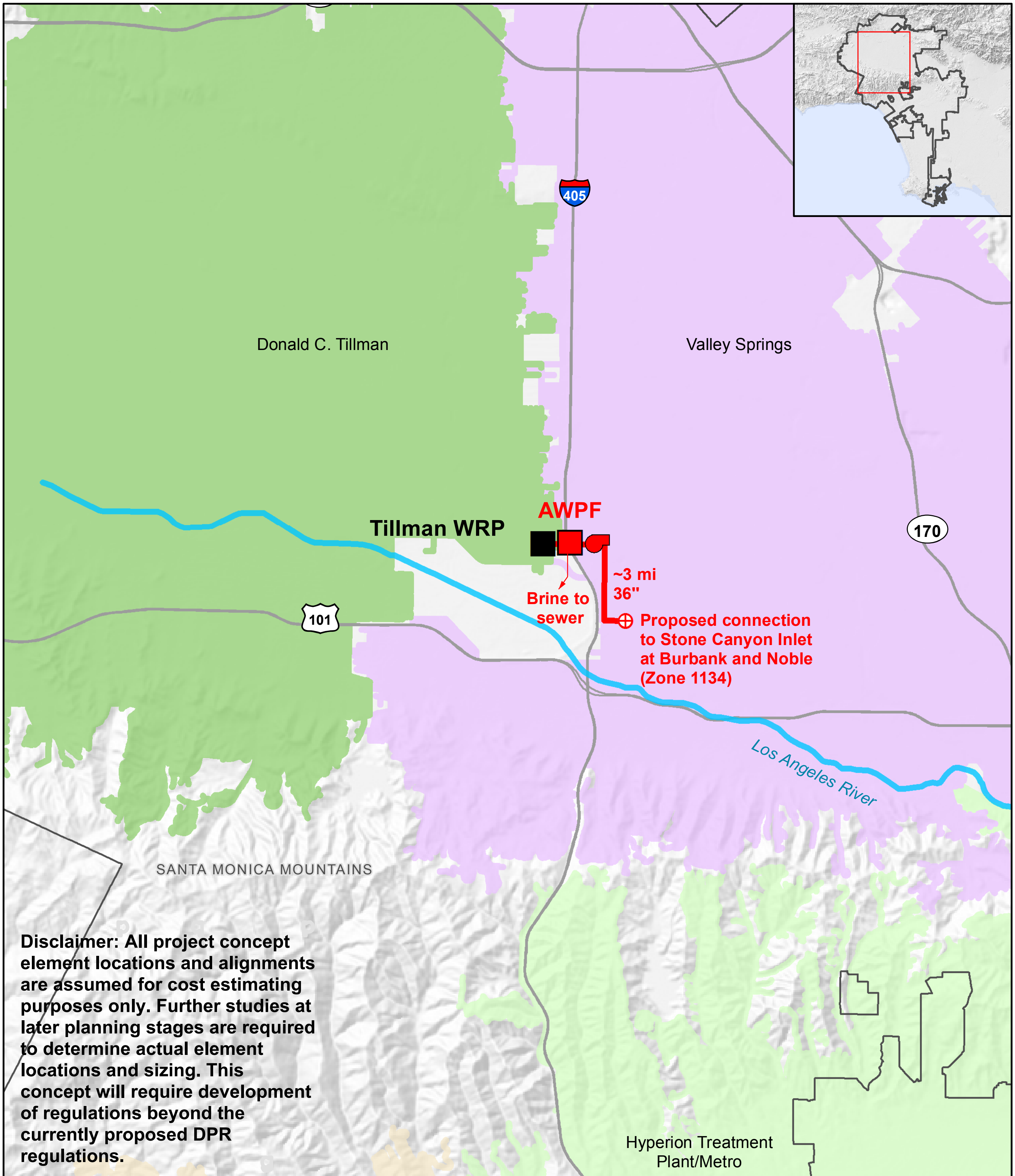
CONCEPT OPTION 16	
PROJECT CONCEPT NAME	**Tillman WRP to LADWP Distribution System**
PROJECT CONCEPT DESCRIPTION	Treat Donald C. Tillman (DCT) effluent at the Advanced Water Purification Facility (AWPF) and pump water directly into the LADWP distribution system.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☒ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 15,000 AFY 14 mgd* *Wet Year: 15,000 AFY 14 mgd* *Dry Year: 15,000 AFY 14 mgd* *Potential Water Supply Benefit: up to 15,000 AFY* *Drought Resiliency: 100% (15,000 AFY Dry Year/15,000 AFY Normal year) is the estimated drought resiliency. This concept will increase drought resiliency by supplying a potable water source from wastewater during times of drought that are currently not available.* *Assumes EWVIS; does not assume LFD to EWVIS.*
ESTIMATED COST	*Capital: $250 million to $350 million* *O&M: $4 million to $6 million/year* *Unit: $1,200 to $1,600/AF (Calculated Unit Cost: $1,300/AF)* *Energy: $3 million to $4 million/year (1,800 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing. This concept will require development of regulations beyond the currently proposed DPR regulations.

Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Sewershed
- Advanced Water Purification Facility (AWPF)
- Pump Station
- Pipeline
- Connection Point with LADWP system
- Brine

0 0.5 1 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 16
DPR - Tillman WRP to
LADWP Distribution System
One Water LA 2040 Plan
TM 5.2 - Project Development

carollo

One Water LA

GENERAL BACKGROUND/PURPOSE

Donald C. Tillman Water Reclamation Plant (DCTWRP) may have additional water diverted to the WRP with the implementation of the East-West Valley Interceptor Sewer, low flow and high flow diversions. This project assumes that the In-Progress project, Groundwater Replenishment Project (GWR) with AWPF at Tillman WRP is completed. The GWR project includes upgrading the full capacity of DCTWRP to AWPF. Since there is not expected to be additional surface recharge capacity after the first phase of IPR, another option would be implementation of DPR at DCTWRP, delivering the water directly into the water distribution system.

Implementing DPR with the excess water would include expansion of the AWPF facilities and additional processes likely required to comply with anticipated future DPR regulations. The treated water would be pumped directly to the LADWP distribution system.[(2)] For costing purposes, it is assumed that, to connect to appropriate locations in LADWP's distribution system, a 36-inch diameter 3 mile pipeline will be required, along with a pump station and tank.

Brine would be returned to sewer for further treatment at Hyperion Water Reclamation Plant.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *14 mgd AWPF (17 mgd inflow, 20% brine loss)*
- *14 MG engineered storage tank (1-day)*
- *2,000 hp pump station*
- *3 miles of 36-inch diameter transmission pipeline*
- *Brine disposal is assumed to utilize existing sewers to Hyperion (no facilities included)*
- *Land acquisition cost not included*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *DPR regulations. Potable water augmentation regulations have not yet been developed.*
- *DPR permitting/regulatory approval*
- *Permitting related to LA River minimum flow requirements*
- *Impacts to LA River flows*
- *Expanded water conservation and/or greywater systems could significantly alter the amount of additional water available from the East-West Valley Interceptor Sewer.*
- *Depending on the amount of recycled water ultimately available for the GWR Project, this may not be a cost effective option compared to augmenting IPR at the Hansen, Pacoima, and, possibly, Tujunga Spreading Grounds.*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The concept could be implemented between 2030 and 2040.	• *DPR regulations* • *Increased flow to DCTWRP (EWVIS Expansion or LFDs)* • *LA River minimum flow requirements*

SOURCES

1 Wastewater projects are typically calculated in mgd, however, for consistency with other descriptions, AFY has been used.
2 For purposes of this calculations associated with this fact sheet, it is assumed that the tie-in point is along the City Trunkline at the intersection at Burbank Blvd and Noble Ave.
3 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

Disclaimer: This Conceptual Program Description is limited to conceptual planning level information, based on information known as of November 2016, and costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is shown in italics.

CONCEPT OPTION 17

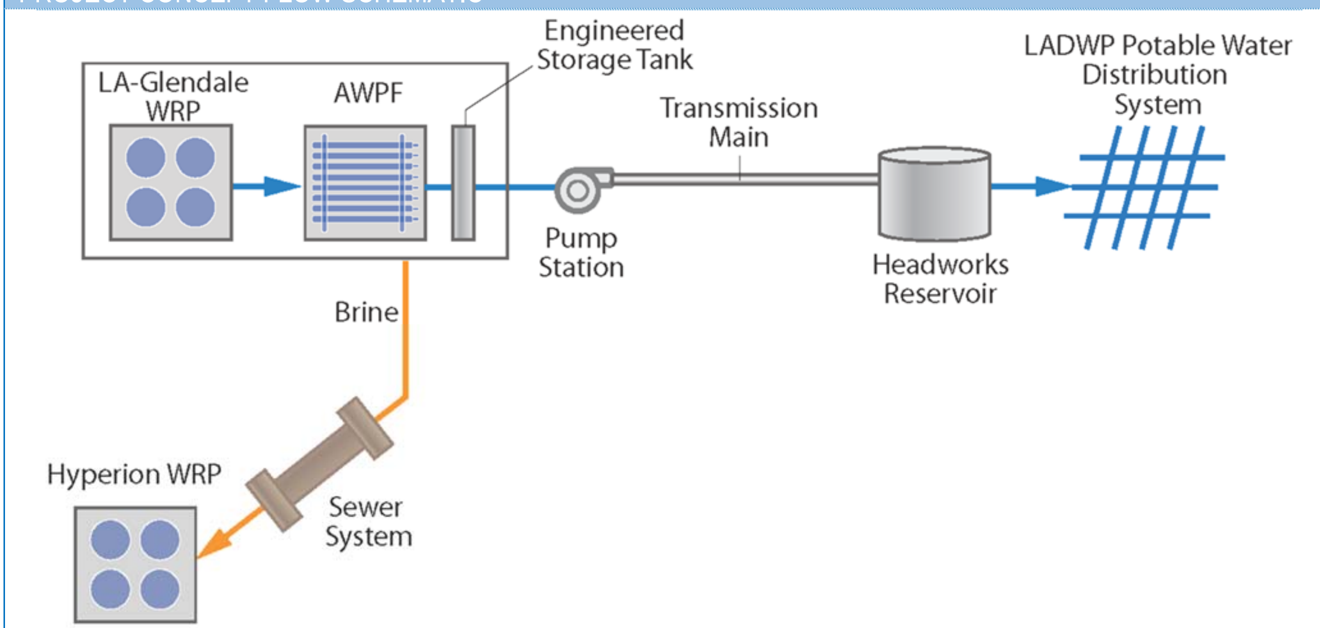
PROJECT CONCEPT NAME	**LA/Glendale (LAG) WRP to Headworks Reservoir**
PROJECT CONCEPT DESCRIPTION	Treat LA/Glendale WRP effluent at a Advanced Water Purification Facility (AWPF) and pump water directly into the LADWP distribution system at Headworks Reservoir.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☒ Direct Potable Reuse (DPR) ☐ Other

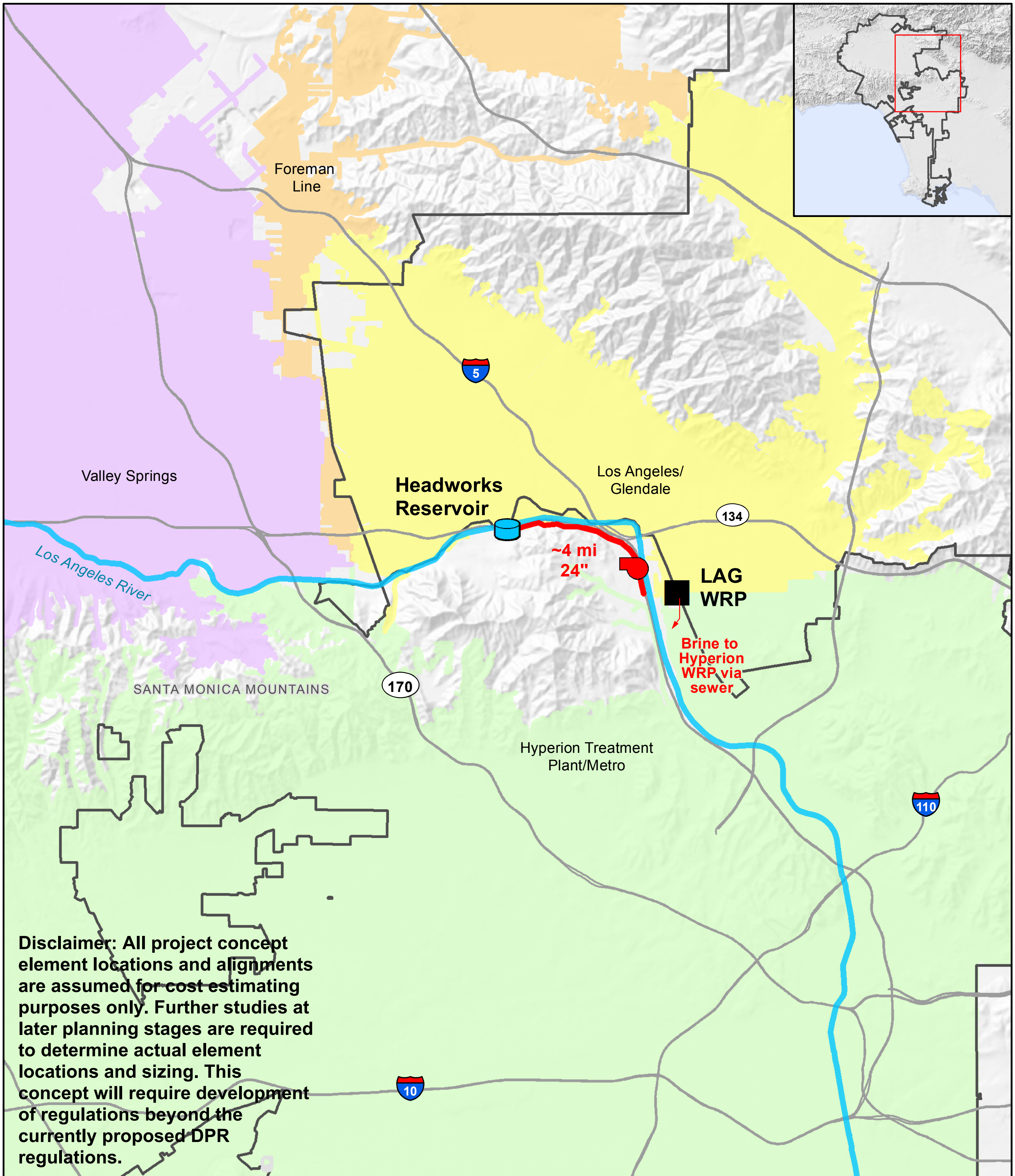
ESTIMATED YIELD & COST

ESTIMATED YIELD	*Normal Year: 6,000 AFY 5 mgd* *Wet Year: 6,000 AFY 5 mgd* *Dry Year: 6,000 AFY 5 mgd* *Potential Water Supply Benefit: up to 6,000 AFY* *Drought Resiliency: 100% (6,000 AFY Dry Year/6,000 AFY Normal year) is the estimated drought resiliency. This concept will increase drought resiliency by supplying a potable water source from wastewater during times of drought that are currently not available.*
ESTIMATED COST	*Capital: $130 million to $170 million* *O&M: $2 million to $3 million/year* *Unit: $1,400 to $1,800/AF (Calculated Unit Cost: $1,500/AF)* *Energy: $800,000 to $1.1 million/year (1,200 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☒ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☒ LADOT
☐ Improve health of local watersheds	☐ BOE	☒ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing. This concept will require development of regulations beyond the currently proposed DPR regulations.

Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Sewershed
- Existing Reservoir
- Pump Station
- Pipeline
- Brine

0 0.5 1 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 17
DPR - LA/Gendale (LAG) to Headworks Reservoir
One Water LA 2040 Plan
TM 5.2 - Project Development

carollo

One Water LA

GENERAL BACKGROUND/PURPOSE

Not all the water treated at the LA/Glendale WRP (LAGWRP) is used for non-potable reuse (NPR); the water that is not used is currently returned to sewer and retreated at Hyperion Water Reclamation Plant (HWRP). This concept would further treat this unused water by adding an Advanced Water Purification Facility (AWPF) at the LAGWRP. The AWPF would comply with anticipated future DPR regulations.

The treated water would be delivered directly to the LADWP distribution system downstream of Headworks Reservoir along LADWP's River Supply Conduit. From there, the water would serve the LADWP distribution system directly. To deliver the water to Headworks Reservoir, a 4 mile, 24-inch diameter pipeline would be required as well as a pump station at LAGWRP.

Brine would be returned to sewer for further treatment at HWRP.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *7 mgd AWPF (flows not used for NPR will be used for DPR; plant expanded to use all excess WRP flows in winter; assumes no flow to LA River; 8 mgd inflow; 20% brine loss)*
- *1 MG engineered storage tank (3 hours)*
- *4 miles of 24-inch diameter transmission pipeline*
- *200 hp pump station*
- *Brine disposal is assumed to utilize the existing sewers to Hyperion (no facilities included)*
- *Land acquisition cost not included*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *DPR regulations. Potable water augmentation regulations have not yet been developed.*
- *DPR permitting/regulatory approval*
- *Construction challenges: Pipeline construction will have to cross under the I-5 in vicinity of Griffith Park.*
- *City of Glendale has rights to approximately 50 percent of the flow*
- *Impacts to LA River flows (concept assumes 0 mgd flows to LA River)*
- *Potential reduction of wastewater flows due to water conservation and/or greywater systems*
- *Depending on the amount of recycled water available, this option may not be cost effective compared to expanded NPR.*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The concept could be implemented between 2035 and 2040.	• DPR regulations • LA River minimum flow requirements

SOURCES

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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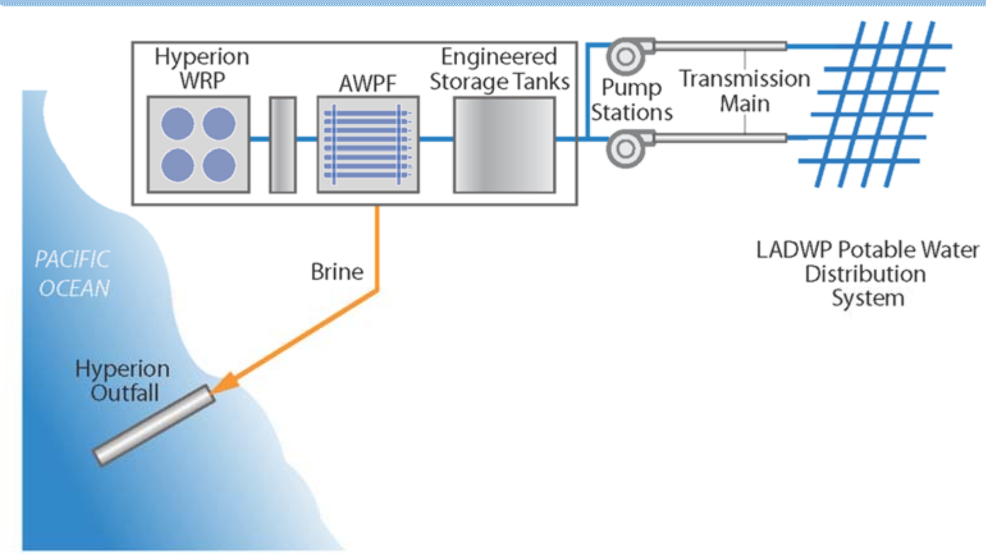
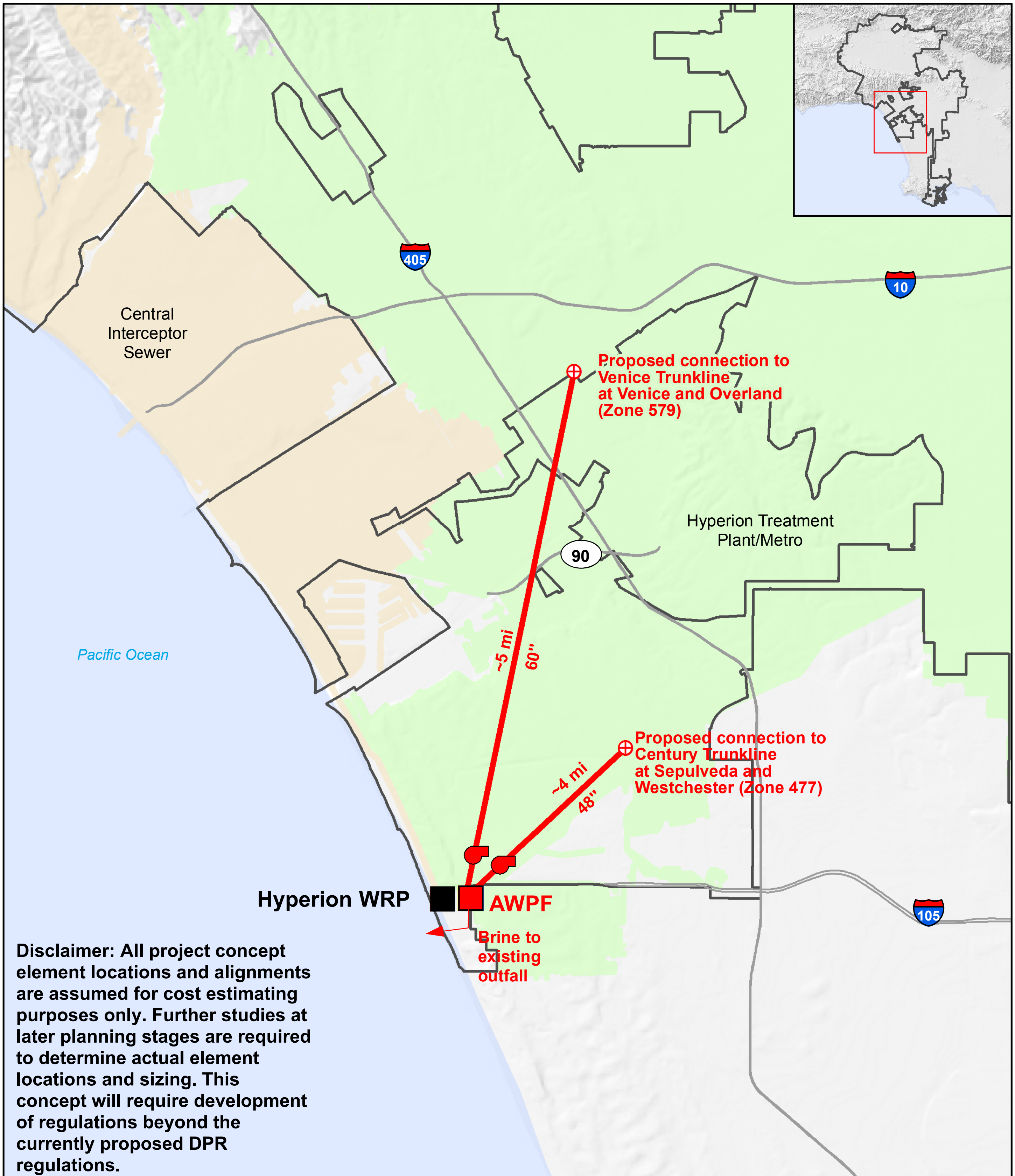
CONCEPT OPTION 18		
PROJECT CONCEPT NAME	Hyperion WRP to LADWP Distribution System	
PROJECT CONCEPT DESCRIPTION	Treat Hyperion Water Reclamation Plant (HWRP) effluent at a Advanced Water Purification Facility (AWPF) and pump water directly into the LADWP distribution system.	
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☒ Direct Potable Reuse (DPR) ☐ Other	
ESTIMATED YIELD & COST		
ESTIMATED YIELD	*Normal Year: 95,000 AFY 85 mgd* *Wet Year: 95,000 AFY 85 mgd* *Dry Year: 95,000 AFY 85 mgd* *Potential Water Supply Benefit: up to 95,000 AFY* *Drought Resiliency: 100% (95,000 AFY Dry Year/95,000 AFY Normal year) is the estimated drought resiliency. This concept will increase drought resiliency by supplying a potable water source from wastewater during times of drought that are currently not available.* *Yield Assumptions: Assumes EWVIS; does not include LFDs. It is expected that after the in-progress projects are completed, there will be 105 mgd of flow available for this concept.*	
ESTIMATED COST	*Capital: $2.4 billion to $3.2 billion* *O&M: $40 million to $55 million/year* *Unit: $1,800 to $2,400/AF (Calculated Unit Cost: $2,000/AF)* *Energy: $25 million to $35 million/year (2,600 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*	

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing. This concept will require development of regulations beyond the currently proposed DPR regulations.

Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Sewershed
- Advanced Water Purification Facility (AWPF)
- Pump Station
- Pipeline
- Connection Point with LADWP system
- Brine

0 0.5 1 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 18
DPR - Hyperion WRP to LADWP Distribution System
One Water LA 2040 Plan
TM 5.2 - Project Development

GENERAL BACKGROUND/PURPOSE

HWRP has excess water available that is currently discharged to the ocean. After the In-Progress projects are completed, it is expected that HWRP would have 105 mgd remaining. Rather than discharging the flow to the Pacific Ocean, one option is to treat the water with an Advanced Water Purification Facility (AWPF) located at the HWRP and pump the water directly to the LADWP distribution system. The AWPF would be required to comply with anticipated future DPR regulations.

Brine from the AWPF will be discharged through the Hyperion outfall.

The water would be conveyed using pump stations and pipelines to deliver the water to LADWP's distribution system. It is estimated that approximately 4 miles of 48-inch pipeline would be required, as well as two pump stations. Connection points to the LADWP distribution system would be determined by future studies.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *25 MG equalization storage (6 hours)*
- *85 mgd MBR+AWPF (105 mgd inflow, 20% brine loss)*
- *85 MG engineered storage tank (1-day)*
- *14,000 hp pump station*
- *4 miles of 48-inch diameter transmission pipeline. For planning purposes, it is assumed that half of the water would be delivered to Venice & Overland, and half the water to Sepulveda & Westchester.*
- *5 miles of 60-inch diameter transmission pipeline*
- *Brine disposal is assumed to utilize the existing Hyperion outfall (no facilities included)*
- *Land acquisition cost not included*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *DPR regulations. Potable water augmentation regulations have not yet been developed. DPR permitting/regulatory approval.*
- *System demands need to be evaluated to verify the pumped water can be fully utilized.*
- *Significant flow equalization (estimated 6 acre footprint) would be required to provide operational flexibility, reliability and an engineered buffer per the draft DPR regulations.*
- *Space constraints at Hyperion to construct facilities*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The concept could be implemented between 2030 and 2040.	• DPR regulations

SOURCES

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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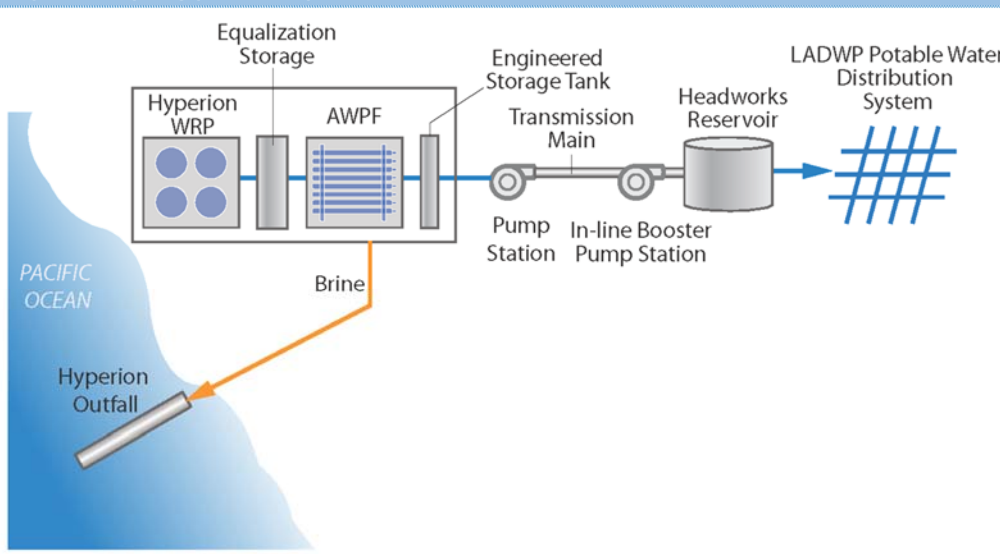
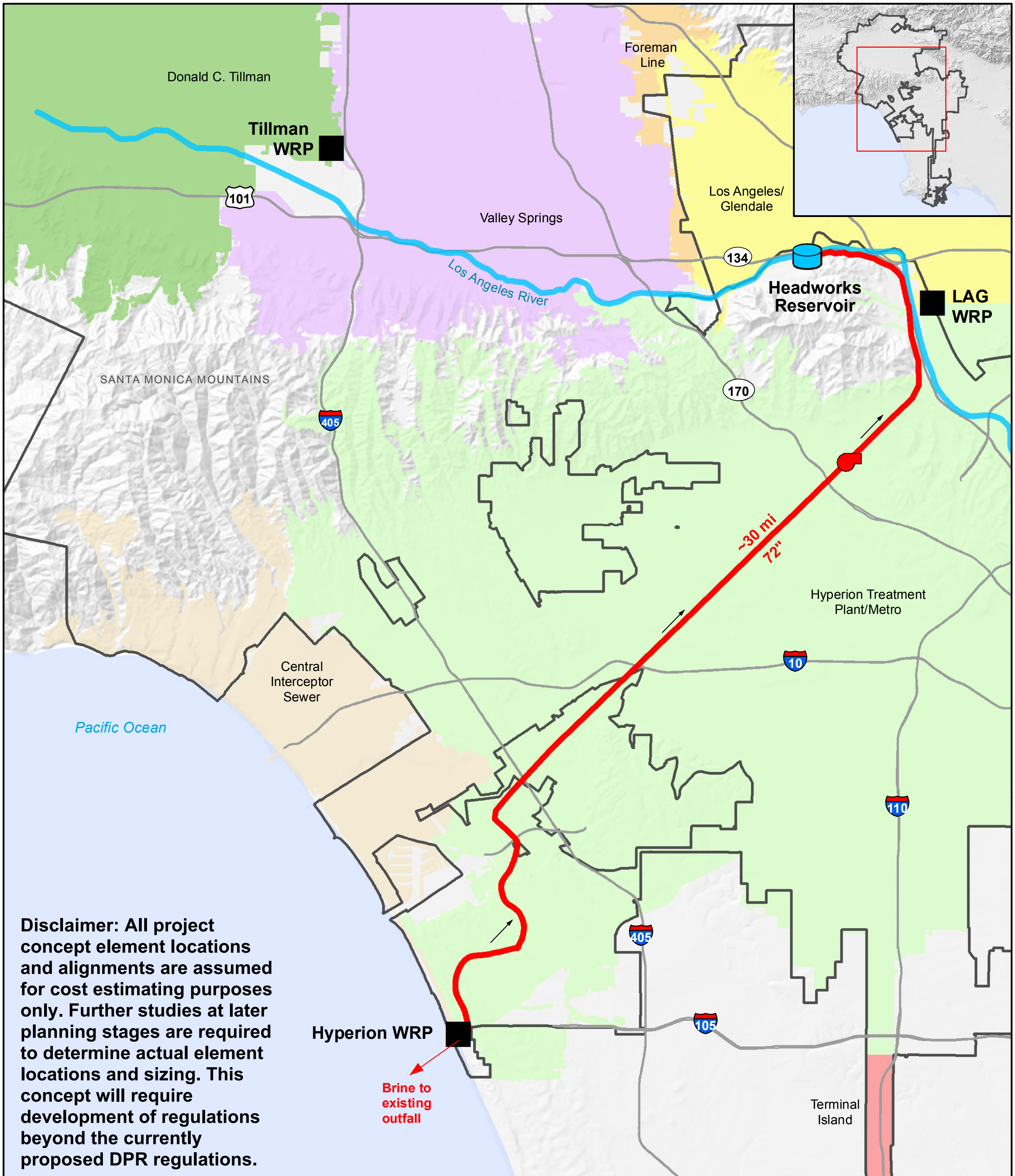
CONCEPT OPTION 19	
PROJECT CONCEPT NAME	**Hyperion WRP to Headworks Reservoir**
PROJECT CONCEPT DESCRIPTION	Treat Hyperion Water Reclamation Plant (HWRP) effluent at a Advanced Water Purification Facility (AWPF) and pump water directly to the Headworks Reservoir.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☒ Direct Potable Reuse (DPR) ☐ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 95,000 AFY 85 mgd* *Wet Year: 95,000 AFY 85 mgd* *Dry Year: 95,000 AFY 85 mgd* *Potential Water Supply Benefit: up to 95,000 AFY* *Drought Resiliency: 100% (95,000 AFY Dry Year/95,000 AFY Normal year) is the estimated drought resiliency. This concept will increase drought resiliency by supplying a potable water source from wastewater during times of drought that are currently not available.* *Yield Assumptions: Assumes EWVIS; does not include LFDs. It is expected that after the in-progress projects are completed, there will be 105 mgd of flow available for this concept.*
ESTIMATED COST	*Capital: $2.8 billion to $3.8 billion* *O&M: $45 million to $60 million/year* *Unit: $2,200 to $2,900/AF (Calculated Unit Cost: $2,400/AF)* *Energy: $40 million to $55 million/year (3,900 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

- Existing Water Reclamation Plant (WRP)
- City of Los Angeles
- Sewershed
- Existing Reservoir
- Flow direction
- Pump Station
- Pipeline
- Brine

N

0 0.75 1.5 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 19
DPR - Hyperion WRP to Headworks Reservoir
One Water LA 2040 Plan
TM 5.2 - Project Development

carollo
One Water LA

GENERAL BACKGROUND/PURPOSE

HWRP has approximately 105 mgd excess water available after the In-Progress Projects are complete that would be discharged to the ocean. Rather than discharging the flow to the Pacific Ocean, one option is to treat the water with an Advanced Water Purification Facility (AWPF) located at the HWRP. The AWPF would be required to comply with anticipated future DPR regulations.

To create an engineered buffer, the water would be pumped and piped to Headworks Reservoir. This would require large pump stations, and approximately 30 miles of 72-inch diameter pipeline. Water from Headworks Reservoir would be discharged into the LADWP distribution system by gravity.

Brine generated at the AWPF will be disposed using the Hyperion Outfall.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *25 MG equalization storage (6 hours)*
- *85 mgd MBR+AWPF (105 mgd inflow, 20% brine loss)*
- *13 MG engineered storage tank (3 hours)*
- *18,000 hp pump station (In-line booster)*
- *8,000 hp pump station (In-line booster)*
- *30 miles of 72-inch diameter transmission pipeline*
- *Brine disposal is assumed to utilize the existing Hyperion outfall (no facilities included)*
- *Land acquisition cost not included*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Depending on the selected pipeline alignment, the pipeline may run through the busy areas of the City of Los Angeles. This may pose construction challenges as well as space limitations for the pump stations.*
- *DPR regulations. Potable water augmentation regulations have not yet been developed. DPR permitting/regulatory approval.*
- *System demands need to be evaluated to verify the pumped water can be fully utilized*
- *Significant flow equalization (estimated 6 acre footprint) would be required to provide operational flexibility, reliability and an engineered buffer per the draft DPR regulations.*
- *Space constraints at Hyperion to construct facilities*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The concept could be implemented between 2030 and 2040.	• DPR Regulations

SOURCES

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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CONCEPT OPTION 20

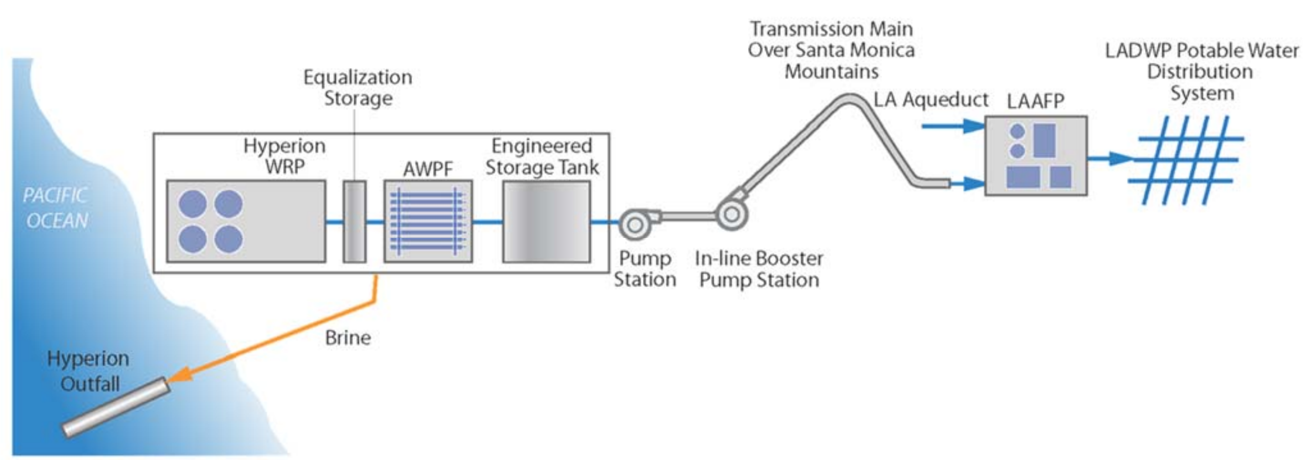
PROJECT CONCEPT NAME	**Hyperion WRP to Los Angeles Aqueduct Filtration Plant**
PROJECT CONCEPT DESCRIPTION	Treat Hyperion Water Reclamation Plant (HWRP) effluent at an Advanced Water Purification Facility (AWPF) and pump water over the Santa Monica Mountains to the LA Aqueduct Filtration Plant (LAAFP).
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☒ Direct Potable Reuse (DPR) ☐ Other

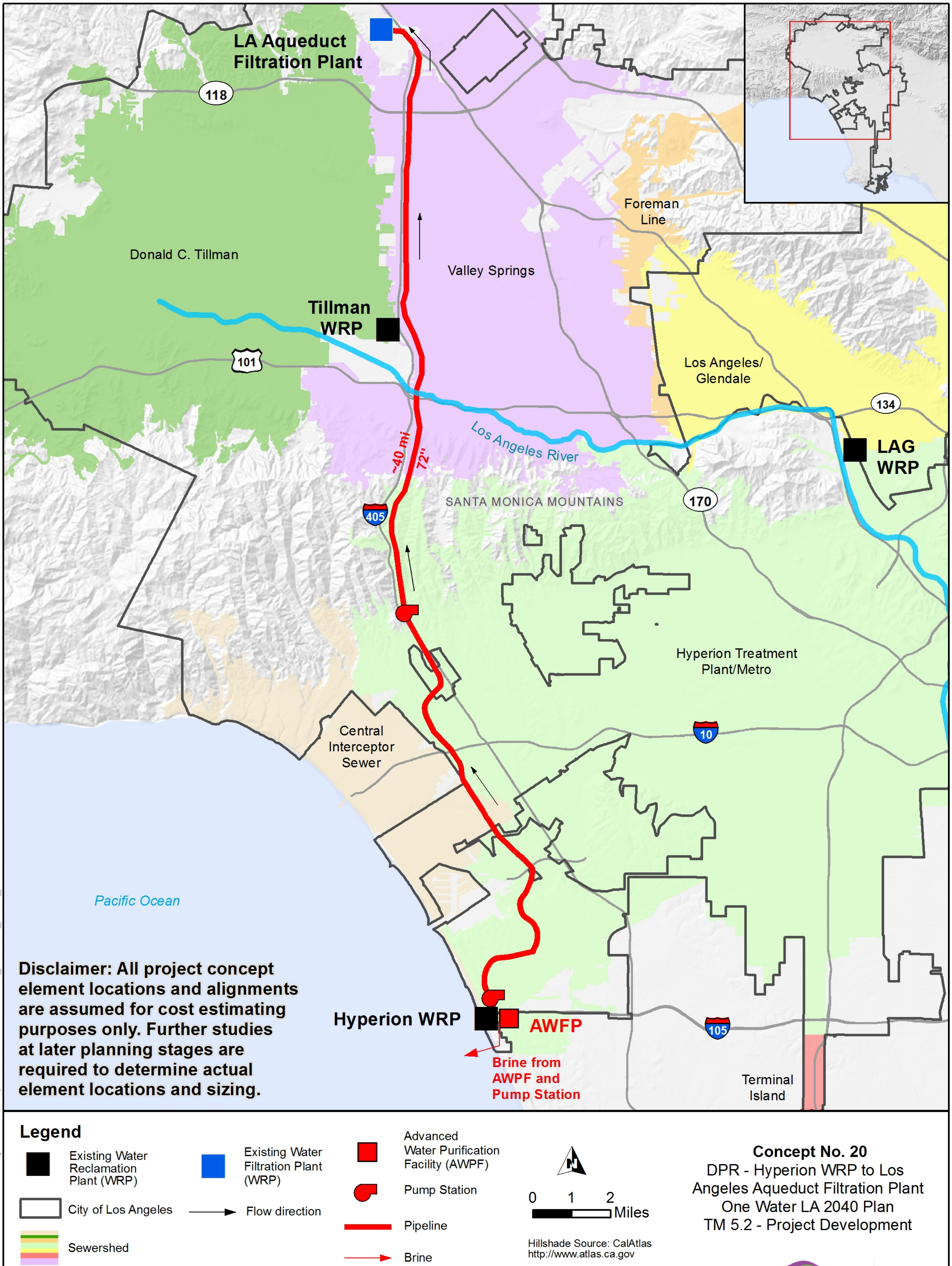
ESTIMATED YIELD & COST

ESTIMATED YIELD	*Normal Year: 95,000 AFY 85 mgd* — *Wet Year: 95,000 AFY 85 mgd* — *Dry Year: 95,000 AFY 85 mgd* *Potential Water Supply Benefit: up to 95,000 AFY* *Drought Resiliency: 100% (95,000 AFY Dry Year/95,000 AFY Normal year) is the estimated drought resiliency. This concept will increase drought resiliency by supplying a potable water source from wastewater during times of drought that are currently not available.* *Yield Assumptions: Assumes EWVIS; does not include LFDs. It is expected that after the in-progress projects are completed, there will be 105 mgd of flow available for this concept.*
ESTIMATED COST	*Capital: $3.2 billion to $4.3 billion* *O&M: $50 million to $70 million/year* *Unit: $2,300 to $3,100/AF (Calculated Unit Cost: $2,600/AF)* *Energy: $40 million to $55 million/year (3,900 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☒ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☒ LADOT
☐ Improve health of local watersheds	☐ BOE	☒ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





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GENERAL BACKGROUND/PURPOSE

HWRP has 105 mgd excess water that is discharged to the ocean after the In-Progress Projects are complete. Rather than discharging the flow to the Pacific Ocean, one option is to treat the water with an Advanced Water Purification Facility (AWPF) located at the HWRP. The AWPF would be required to comply with anticipated future DPR regulations.

Assuming a 85 mgd facility, using a new pump station, the water would then be pumped in a new pipeline (approximately 35 miles, 72-inch diameter) over the Santa Monica Mountains to the San Fernando Valley (SFV). From there, the water would be delivered to the LA Aqueduct Filtration Plant. If water is pumped to LA Aqueduct Filtration Plant, it would be commingled with flow from MWD or the LA Aqueduct, retreated at the LA Aqueduct Filtration Plant, and sent into the distribution system. Brine produced at the AWPF will be discharged to the Pacific Ocean through the Hyperion Outfall.

Recycled water delivered to the LA Aqueduct Filtration Plant could be distributed throughout the entire City with minimal capacity or distribution restrictions. This concept would optimize the beneficial use of recycled water for the City *and may be more cost effective over the long-term compared to IPR projects that require significant pipeline construction, new wellfields, and potential groundwater rights.*

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *25 MG equalization storage (6 hours)*
- *85 mgd MBR+AWPF (105 mgd inflow, 20% brine loss)*
- *85 MG engineered storage tank (1-day)*
- *15,000 hp pump station (In-line Booster)*
- *20,000 hp pump station*
- *35 miles of 72-inch diameter transmission pipeline*
- *Uses LAAFP*
- *Brine disposal is assumed to utilize the existing Hyperion outfall (no facilities included)*
- *Land acquisition cost not included*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *DPR regulations. Raw water augmentation regulations have not yet been developed.*
- *DPR permitting/regulatory approval*
- *There is a significant amount of piping that would be required to deliver potable reuse from the HWRP to the LA Reservoir or the LA Aqueduct Filtration Plant (38 miles).*
- *Large pumping facilities would be required to convey water over the Santa Monica Mountains to the LA Reservoir or the LA Aqueduct Filtration Plant.*
- *Construction challenges*
- *Significant flow equalization (estimated 6 acre footprint) would be required to provide operational flexibility, reliability and an engineered buffer per the draft DPR regulations.*
- *Space constraints at Hyperion to construct facilities.*
- *Brine disposal*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The concept could be implemented between 2030 and 2040.	• DPR regulations

SOURCES

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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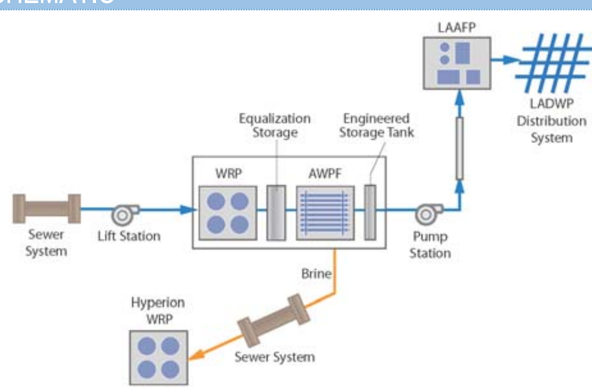
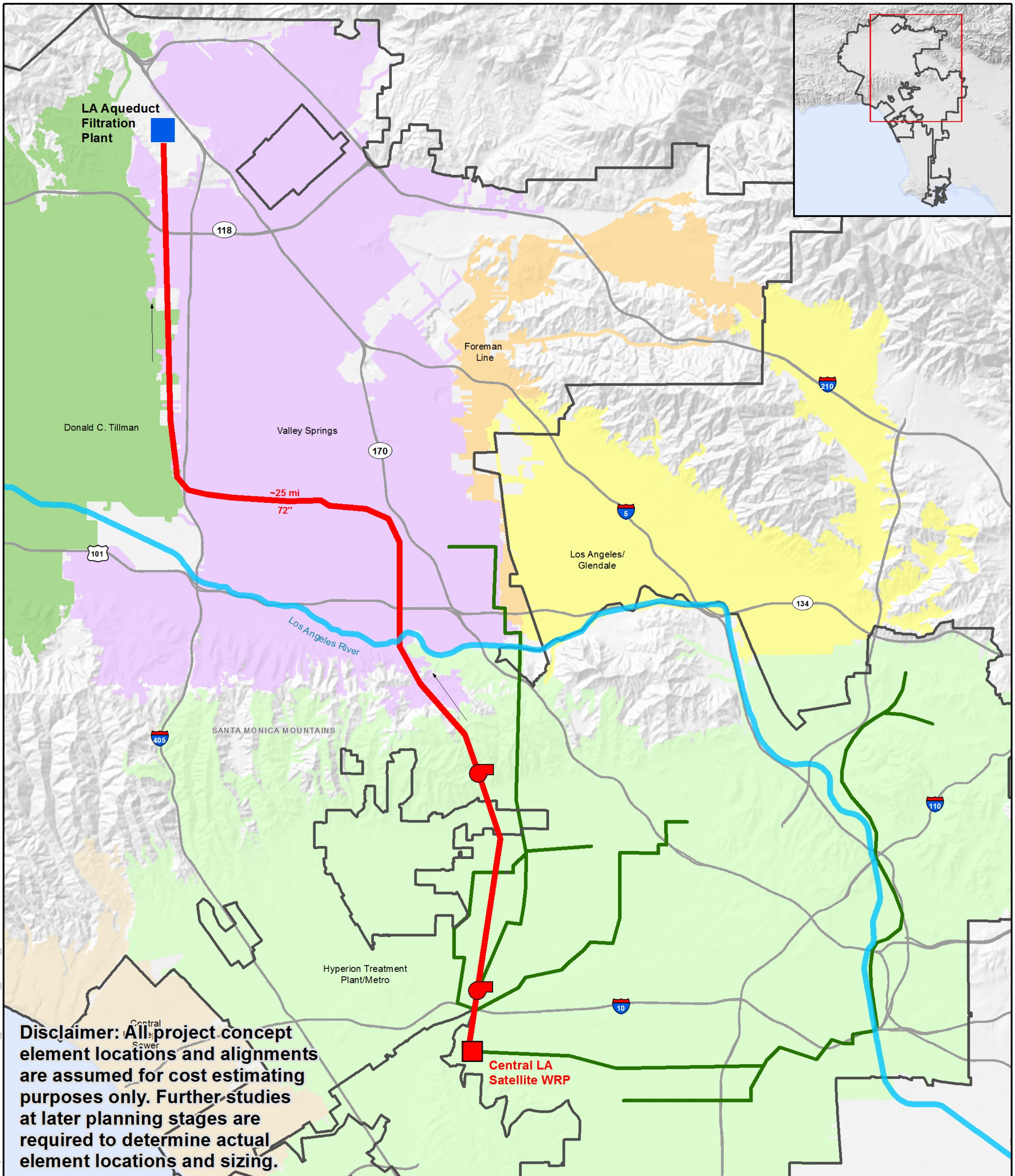
CONCEPT OPTION 21	
PROJECT CONCEPT NAME	Central LA Satellite WRP to Los Angeles Aqueduct Filtration Plant
PROJECT CONCEPT DESCRIPTION	Construct a new satellite treatment plant in Central LA (downtown or mid-City). Collect wastewater flows at the satellite plant and at an Advanced Water Purification Facility (AWPF) and pump water over the Santa Monica Mountains to the LA Reservoir or LA Aqueduct Filtration Plant (LAAFP).
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☒ Direct Potable Reuse (DPR) ☐ Other Note: This alternative is also applicable to IPR, but for comparison purposes, has been developed as a DPR option.
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 95,000 AFY 85 mgd* *Wet Year: 95,000 AFY 85 mgd* *Dry Year: 95,000 AFY 85 mgd* *Potential Water Supply Benefit: up to 95,000 AFY* *Drought Resiliency: 100% (95,000 AFY Dry Year/95,000 AFY Normal year) is the estimated drought resiliency. This concept will increase drought resiliency by supplying a potable water source from wastewater during times of drought that are currently not available.* *Yield Assumptions: Flows from LASAN's sewers (ECIS, LCSFVRS, and NOS) would serve this satellite WRP. These sewers provide greater flows than 105 mgd, but since the remainder of the water at HWRP is already accounted for, 105 mgd of flow is expected to be available for this concept. Existing sewer flows (provided by LASAN) in this area are 40 mgd in NOS-ECIS, 70 mgd in LCSFVRS, and 25.6 mgd in NOS.*
ESTIMATED COST	*Capital: $4.5 billion to $6 billion* *O&M: $70 million to $95 million/year* *Unit: $3,100 to $4,100/AF (Calculated Unit Cost: $3,400/AF)* *Energy: $35 million to $50 million/year (3,600 kWh/AF)*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☒ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☒ LADOT
☐ Improve health of local watersheds	☐ BOE	☒ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

- Existing Water Reclamation Plant (WRP)
- Existing Water Filtration Plant (WRP)
- Sewershed
- City of Los Angeles
- Flow direction
- Existing Sewer
- Advanced Water Purification Facility (AWPF)
- Pump Station
- Pipeline

0 1 2 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 21
LA Central Satellite WRP
to LA Aqueduct Filtration Plant
One Water LA 2040 Plan
TM 5.2 - Project Development

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carollo

One Water LA

GENERAL BACKGROUND/PURPOSE

Hyperion Water Reclamation Plant (HWRP) has 105 mgd excess water that is discharged to the ocean after the foundational projects are complete. A large amount of wastewater flows to HWRP and is treated before discharging to the Pacific Ocean. Rather than discharging the flow to the Pacific Ocean, one option is to capture some of the water mid-stream in Central LA (downtown or mid-City) treat the water with a satellite WRP and an Advanced Water Purification Facility (AWPF). The AWPF would be required to comply with anticipated future DPR regulations.

Two potential locations have been identified for this satellite WRP, based on where a number of large sewers flow together. One location is in the mid-City area, where the LCIS, LCSFVRS, WHIS, ECIS, and NOS meet. The potential flow in these sewers are approximately 120 mgd after EWVIS. This alternative, with an inflow of 105 mgd (the excess water expected at HWRP after the foundational projects are complete. The alternate location would be south of Downtown LA, capturing flow from the NEIS and NOS, at some lower flow. For purposes of the calculations for this concept description sheet, the mid-City location is used.

Assuming an inflow of 105 mgd, considering brine losses, the WRP would produce 85 mgd. Using a new pump station, the water would then be pumped in a new pipeline (approximately 25 miles, 72-inch diameter) over the Santa Monica Mountains to the San Fernando Valley (SFV). From there, the water would be delivered to either the LA Reservoir or the LA Aqueduct Filtration Plant. If water is pumped to LA Aqueduct Filtration Plant, it would be commingled with flow from MWD or the LA Aqueduct, retreated at the LA Aqueduct Filtration Plant, and sent into the distribution system. Brine produced at the AWPF will be discharged to the Pacific Ocean through the Hyperion Outfall.

Recycled water delivered to the LA Aqueduct Filtration Plant could be disturbed throughout the entire City with minimal capacity or distribution restrictions.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *25 mgd flow equalization basin*
- *85 mgd satellite WRP and AWPF*
- *85 MG effluent storage tank*
- *Pump stations totaling 30,000 hp*
- *25 miles of 72-inch diameter pipeline*
- *Treatment at LAAFP*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *DPR regulations. Raw water augmentation regulations have not yet been developed.*
- *There is a significant amount of piping that would be required to deliver potable reuse from the Central LA Satellite WRP to the LA Reservoir or the LA Aqueduct Filtration Plant (25 miles).*
- *Large pumping facilities would be required to convey water over the Santa Monica Mountains to the LA Reservoir or the LA Aqueduct Filtration Plant.*
- *Permitting*
- *Regulatory approvals*
- *Construction challenges*
- Wastewater flow equalization would be required to provide operational flexibility.
- *Identifying a location for satellite WRP of such magnitude may be impossible.*
- *Addition of this concept would create significant amounts of stranded capacity at HWRP.*
- *Brine disposal.*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The concept could be implemented between 2030 and 2040.	• DPR regulations

SOURCES

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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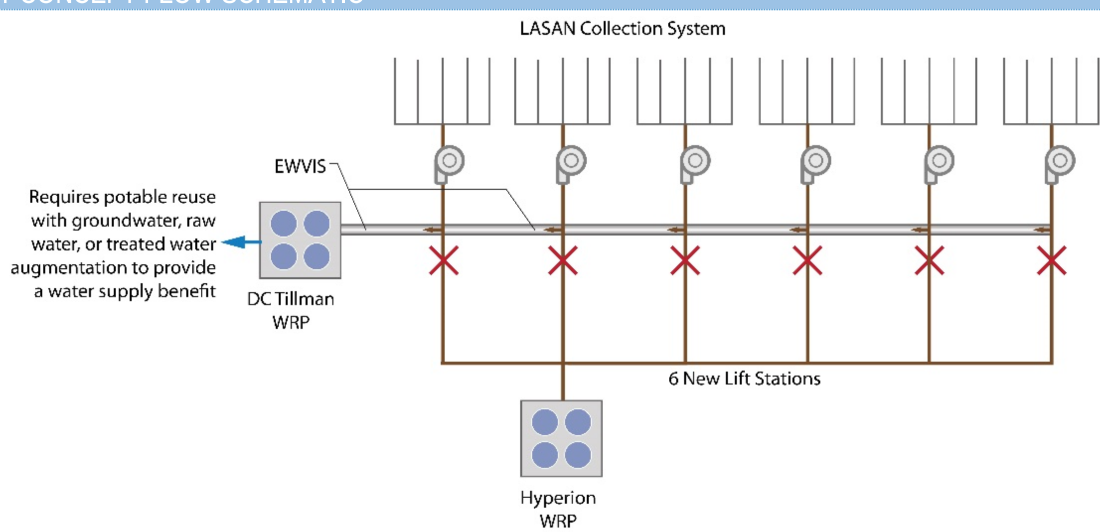
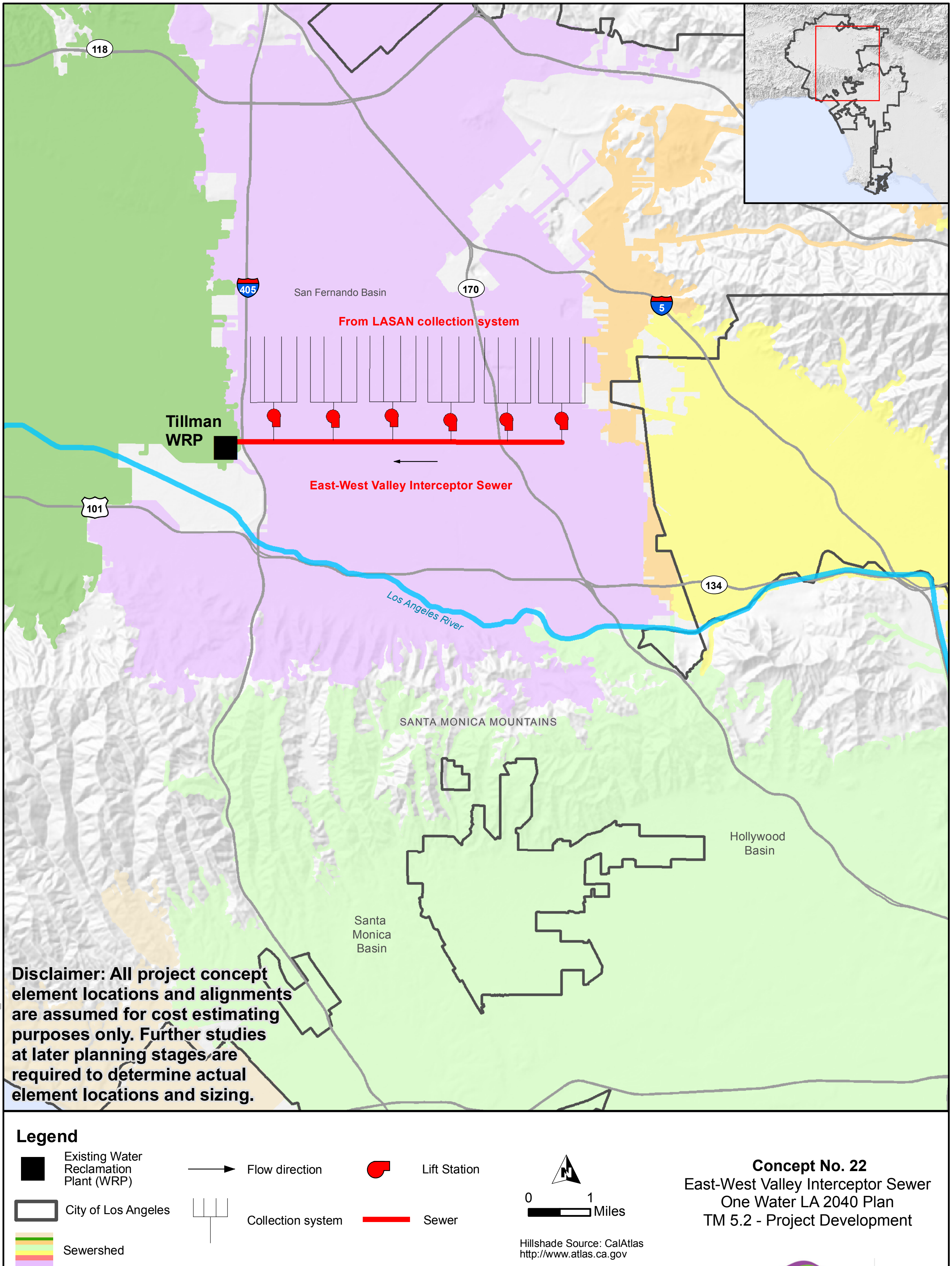
CONCEPT OPTION 22	
PROJECT CONCEPT NAME	**East-West Valley Interceptor Sewer**
PROJECT CONCEPT DESCRIPTION	Construct the EWVIS and transfer 17,800 AFY (15.9 mgd) to Donald C. Tillman Water Reclamation Plant (DCTWRP).
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 12,780 AFY(1) 11.4 mgd* *Wet Year: 12,780 AFY 11.4 mgd* *Dry Year: 12,780 AFY 11.4 mgd* *Potential Water Supply Benefit: up to 0 AFY, unless other concepts implemented. This yield only contributes to water supply if all water to the DCTWRP is recycled and utilized to offset potable demand, requiring Concept 9, 15, or 16 to be implemented (or water used as part of In Progress Project 2).* *Drought Resiliency: 100% (17,800 AFY Dry Year/17,800 AFY Normal year). This concept would increase drought resiliency by redirecting wastewater flows from one sewershed to another sewershed for recycling.*
ESTIMATED COST	*Capital: $85 million* *O&M: $1.3 - $1.7 million/year* *Unit: $390 to $520 AF (Calculated Unit Cost: $430/AF)* *Energy: $580,000 to $770,000/year (420 kWh/AF)* **Cost assumptions: (Arcadis, EWVIS Concept Report, January 2017; OWLA TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☐ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☒ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☐ Increase climate resilience	☐ LAWA	☐ LAUSD
☐ Increase community awareness & advocacy for sustainable water	☐ Other (East West County FCD)	

PROJECT CONCEPT FLOW SCHEMATIC





Concept No. 22
East-West Valley Interceptor Sewer
One Water LA 2040 Plan
TM 5.2 - Project Development

GENERAL BACKGROUND/PURPOSE

Sewers from much of East San Fernando Valley are currently connected to major truck sewers that lead to Hyperion Water Reclamation Plant (HWRP). The EWVIS is a series of lift stations, and force main that will redirect flows from HWRP to the DCTWRP. The force main required would be approximately 6 miles in length, with diameters ranging from 24 to 42 inches, requiring 6 lift stations.

By redirecting wastewater from one sewershed to another, the City can maximize water reclamation plants available treatment, recycling and potable reuse capacity (i.e. direct water where it is needed).

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 6 new lift stations
- 6 miles of force main, ranging from 24- to 42-inch diameter
- 6 diversion structures
- 6 sewer bypass
- 5,000 ft of gravity sewer pipes, ranging from 15- to 24-inch diameter
- Land acquisition cost not included

POTENTIAL CHALLENGES & CONSIDERATIONS

- *EWVIS is required to maximize potential of Groundwater Replenishment Project (GWR)*
- *Additional flow to DCTWRP is not useful without a WRP expansion and a demand for the newly created recycled water.*
- *Public engagement is a necessity*
- *Stranded assets from water conservation or DPR*
- *Continued conservation efforts could reduce the expected yield*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
Preliminary design is currently underway. Construction is anticipated to be completed in 2020-2025 timeframe.	• Groundwater Replenishment Project (GWR) Phase I • Future IPR and DPR options from DCTWRP.

SOURCES

1 Arcadis, East West Valley Interceptor Concept Report, January 2017. Prepared for LASAN.
2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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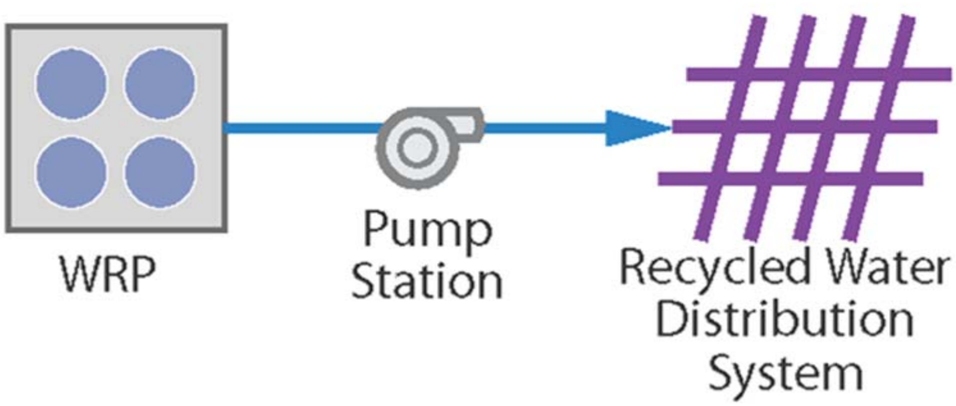
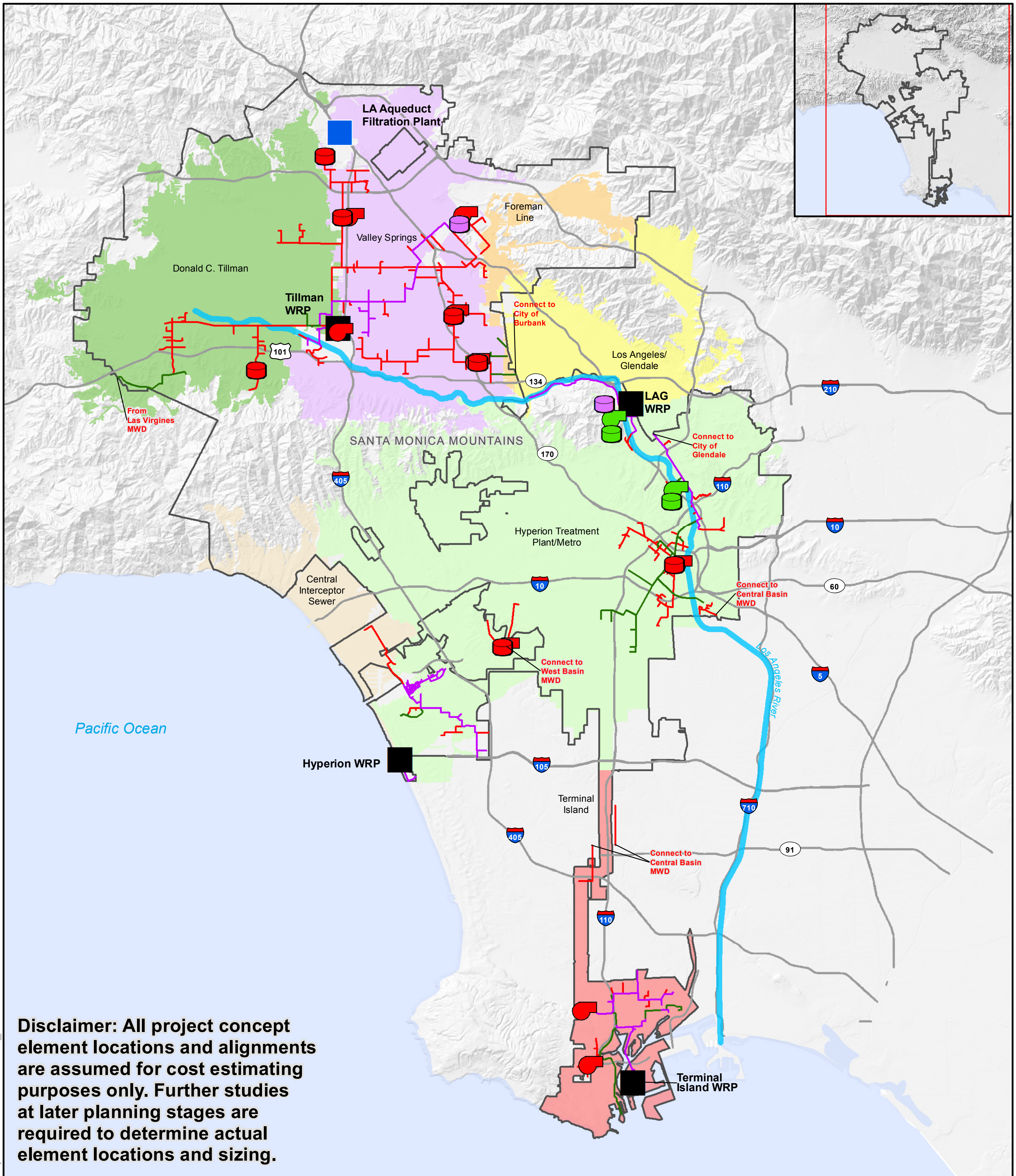
CONCEPT OPTION 23	
PROJECT CONCEPT NAME	**Increase Recycled Water Demand beyond 2015 UWMP**
PROJECT CONCEPT DESCRIPTION	Non-potable reuse (NPR) purple pipe system expansion near Terminal Island Water Reclamation Plant (TIWRP), Hyperion Water Reclamation Plant (HWRP), and Donald C. Tillman Water Reclamation Plant (DCTWRP).
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 16,700 AFY 15 mgd* *Wet Year: 16,700 AFY 15 mgd* *Dry Year: 16,700 AFY 15 mgd* *Potential Water Supply Benefit: up to 16,700 AFY. This value could be reduced based on which customers and recycled water systems are implemented.* *Drought Resiliency: 100% (16,700 AFY Dry Year/16,700 AFY Normal year).*
ESTIMATED COST	*Capital: $600 million to $800 million* *O&M: $8 million to $10 million* *Unit: $1,900 to $2,500/AF (Calculated Unit Cost: $2,100/AF)* *Energy: $1.2 million to $1.6 million/year (700 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☐ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☐ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☐ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☒ LAWA	☒ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	

PROJECT CONCEPT FLOW SCHEMATIC





Legend

Existing Water Reclamation Plant (WRP)

City of Los Angeles

Sewershed

Existing Water Filtration Plant (WRP)

Existing Recycled Water Pipes

Planned Recycled Water Pipes (2015 UWMP)

Proposed Recycled Water Pipes beyond 2015 UWMP

Existing Tank

Planned Facilities (2015 UWMP)

Pump Station   Tank

Proposed Facilities beyond 2015 UWMP

Pump Station   Tank

0 1.5 3 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 23
Increase Recycled Water Demand beyond 2015 Urban Water Management Plan (UWMP)
One Water LA 2040 Plan
TM 5.2 - Project Development

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One Water LA

GENERAL DESCRIPTION/PURPOSE

The total estimated demand from identified customers in the 2015 UWMP by FY 2024/2025 is approximately 18,000 AFY. Total recycled water demands through 2040 have been projected up to 45,400 AFY. Recycled water customers from FY2024/2025 through 2040 have been conceptually identified to account for the additional 16,400 AFY of estimated demand. The supporting infrastructure to support this demand would consist of additional recycled water pipelines, recycled water tanks, recycled water pump stations, recycled water regulator stations, and potential expanded treatment at select treatment plants.

2040 Demand (AFY)	2024/2025 Demand (AFY)	Additional Demand (AFY)
45,400	29,000	16,400

The additional demand is split up into the following four categories:

- NPR from DCTWRP - 4,200 AFY
- NPR from LAGWRP – 1,100 AFY
- NPR through West Basin WD (using water from HWRP) – 4,900 AFY
- NPR from non-City sources of water (Burbank, Central Basin MWD, Las Virgines MWD, Long Beach) - 6,600 AFY

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 150 miles of recycled water pipes, ranging from 6- to 24-inch diameter
- Up to 9 new pump stations with a total capacity of 30 mgd (oversized to account for seasonal/daily peaking)
- 6 recycled water storage tanks with a total capacity of 7 MG
- 2 pressure reducing stations
- Land acquisition, potable water backup, backflow preventer, customer retrofit and additional treatment costs not included

POTENTIAL CHALLENGES & CONSIDERATIONS

- *While new recycled water customers have been identified, they have not all been approached.*
- *Source of recycled water for new customers has not been secured for some potential customers.*
- *Significant recycled water infrastructure improvements (pipelines, pumps, storage tanks, booster pumps, and regulator stations) are required for increased demand.*
- *May not be cost effective compared to IPR and DPR alternatives.*
- *Increased recycled water demands will result in additional recycled water infrastructure which could lead to a risk of stranded assets*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
Likely 2025-2040.	• Increasing recycled water customer demand • New regulations on wastewater treatment discharge

SOURCES

1 2015 Urban Water Management Plan.
2 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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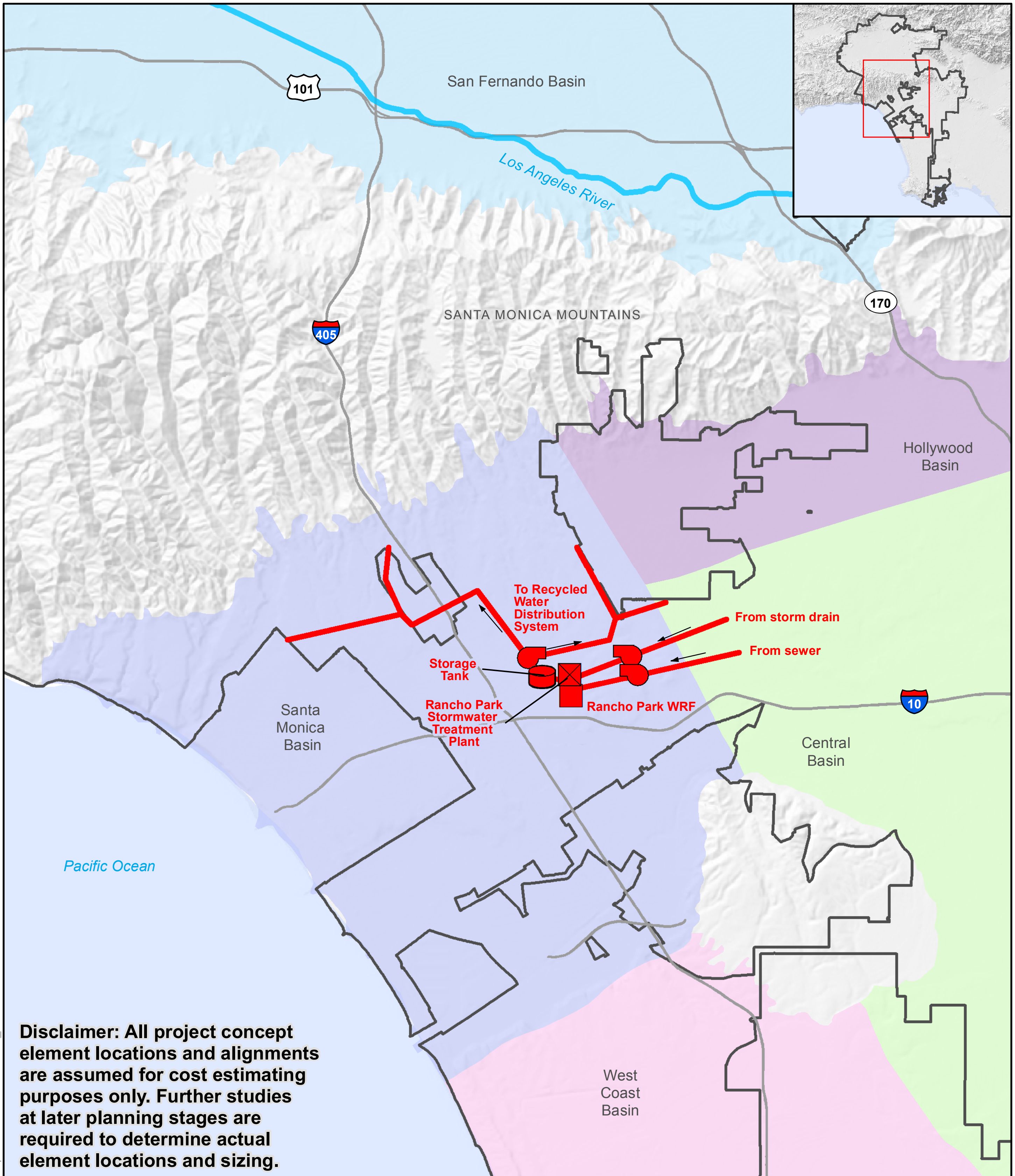
CONCEPT OPTION 24	
PROJECT CONCEPT NAME	Rancho Park Water Reclamation Facility
PROJECT CONCEPT DESCRIPTION	Construct an advanced water treatment facility and deliver a combination of recycled water and stormwater to serve local non-potable reuse water demands.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 3,600 AFY 3.2 mgd; Wet Year: 3,700 AFY 3.3 mgd; Dry Year: 3,400 AFY 3.0 mgd Potential Water Supply Benefit: up to 3,600 AFY *Drought Resiliency: 94% (3,400 AFY Dry Year/3,600 AFY Normal year). Wastewater would offset the stormwater during the days/months/years when stormwater is not available. This concept will increase drought resiliency by recycling wastewater flows.* Wet & Dry Year assumptions are based on: • Normal Year: 3,430 AFY recycled water plus 170 AFY stormwater • Wet year: Assumes slightly increased stormwater capture. Note that in an average year, stormwater contribution is only 170 AFY. • Dry year: Assumes minimal stormwater capture.
ESTIMATED COST	Capital: $160 million to $210 million (treatment systems $120 million; recycled water distribution $60 million) O&M: $1.9 million to $2.5 million/year Unit: $2,600 to $3,500/AF (Calculated Unit Cost: $2,900/AF) Energy: $1.2 million to $1.6 million/year (2,900 kWh/AF) *Cost assumptions: The estimated capital cost for all three phases is used because the ultimate build-out capacity is provided for future concepts; the estimated capital cost for the first phase of the facility is $58 million for an estimated yield of 1,860 AFY. The costs for the first phase of the facility do not include the required LADWP recycled water distribution piping. (LADWP, NPR RWMP, 2012, adjusted to 2016 costs, for recycled water distribution).

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☒ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☒ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	



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Legend

City of Los Angeles
Groundwater Basin
Source: LACDPW
Flow direction
Water Reclamation Facility (WRF)
Lift Station
Pipeline
Treatment Facility
Storage Tank

0 0.5 1 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 24
Rancho Park Water Reclamation Facility
One Water LA 2040 Plan
TM 5.2 - Project Development

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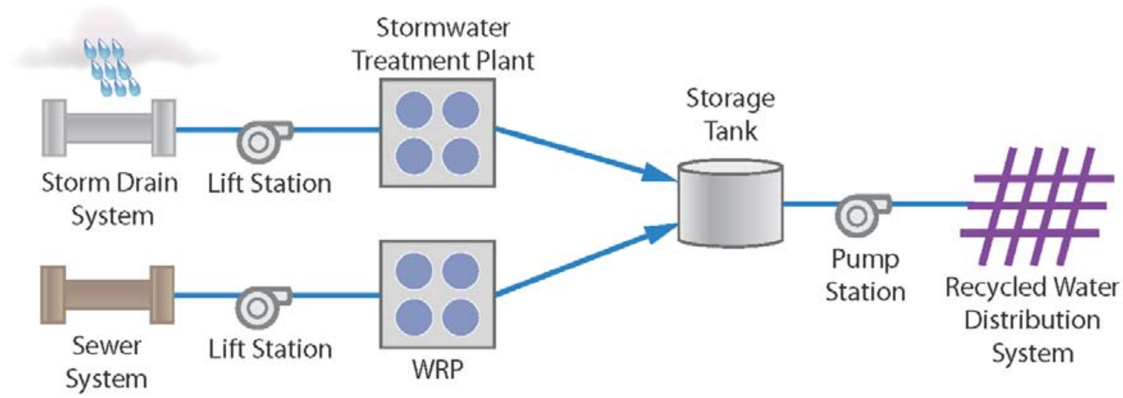
One Water LA

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

Rancho Park has been identified as a location for an advanced water treatment facility.[1] Stormwater would be piped from an existing pipeline during dry weather flow and low levels of wet weather flow, and treated using a filtration and disinfection system. Wastewater would be diverted from an existing pipeline and treated on site to Title 22 recycled water, most likely using membrane bioreactor, and UV treatment. After treatment, a pump station and pipelines would then deliver the water to recycled water non-potable reuse (NPR) customers. For the proposed facility, runoff would be 4.3 million gallons (MG) for a 1.15-inch storm event, and a water reclamation facility (WRF) would be sized at 4.2 mgd, with an annual average supply of 2,800 AFY.[2]

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- Lift station to SWTF
- Stormwater Treatment System (SWTF)
- Lift station to WRF
- Satellite WRF System
- 2 MG storage
- 12.5 miles of pipeline, 20-inch diameter
- Brine disposal is assumed to utilize existing sewers to Hyperion (no facilities included)
- Land acquisition cost not included

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Identifying alignment of distribution system of treated water and possibly treated water storage locations.*
- *Feasibility, constructability, and cost associated with constructing purple pipe in the Westside area.*
- *Establishing location and siting for a satellite water reclamation facility.*
- *Gaining community support for potential interruption of services and construction.*
- *Ability and mechanism to fund, design, and construct the project.*
- *Identifying locations for storage tank(s) and pumps.*
- *Production of treated wastewater and treated stormwater are mutually exclusive.*
- *Obtaining approval from DWR, Regional Board, and/or County DPH for characterization of this non-potable water.*
- *Brine disposal*
- *Cost included distribution system Phase 1, 2, and 3 treatment and distribution systems, storage and pipelines.*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
The Rancho Park is in a conceptual phase. It is possible this project could be completed by 2024.	• Assist in meeting TMDL requirements.

SOURCES

1 There may be other locations where satellite water reclamation plants may be feasible, but no other concepts have been developed at this time. This conceptual project description sheet describes the Rancho Park WRF as representative of other potential projects.
2 Carollo and CDM Smith.
3 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

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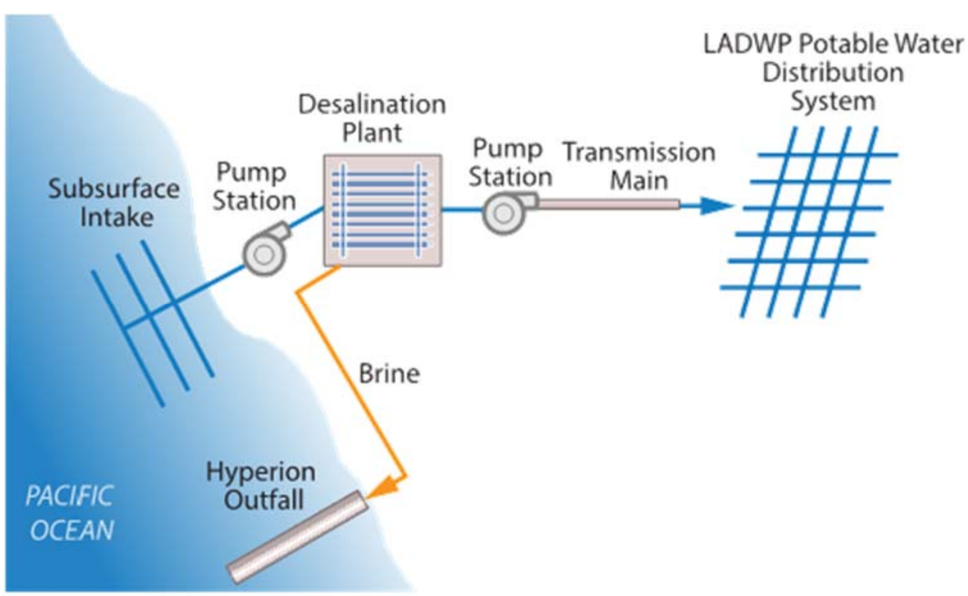
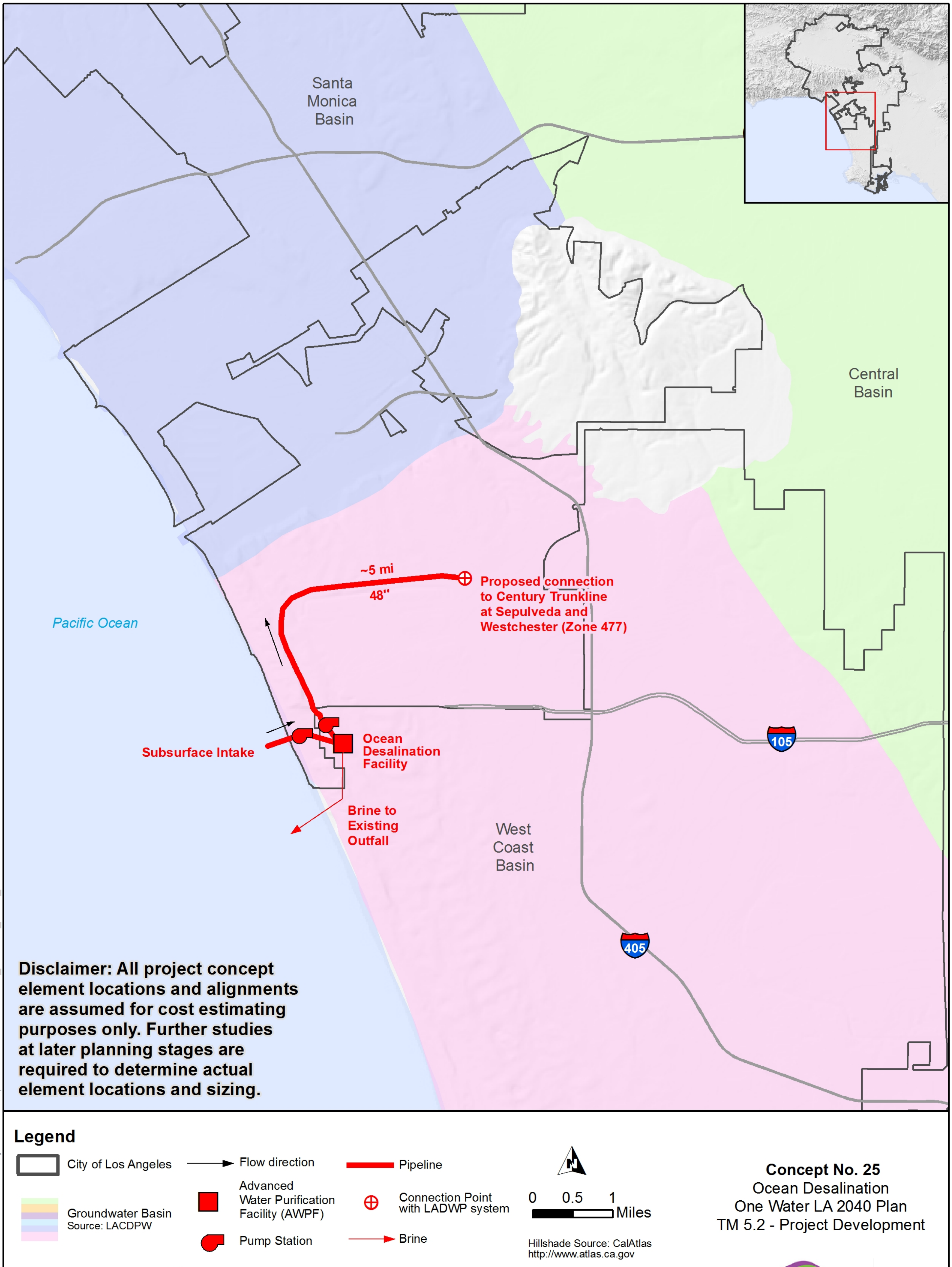
CONCEPT OPTION 25	
PROJECT CONCEPT NAME	**Ocean Desalination**
PROJECT CONCEPT DESCRIPTION	Ocean desalination from the Santa Monica Bay; delivering water directly to the LADWP or regional distribution system.
SUPPLY SOURCE CATEGORY	☐ Stormwater ☐ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	*Normal Year: 28,000 AFY 25 mgd(3)* *Wet Year: 28,000 AFY 25 mgd* *Dry Year: 28,000 AFY 25 mgd* *Potential Water Supply Benefit: up to 28,000 AFY* *Drought Resiliency: 100% (28,000 AFY Dry Year/28,000 AFY Normal year) is the estimated drought resiliency. This project concept could increase drought resiliency by supplying a potable source from ocean water during times of drought that are currently not available.*
ESTIMATED COST	*Capital: $650 million to $850 million* *O&M: $12 million to $16 million/yr* *Unit: $1,900 to $2,500/AF (Calculated unit cost: $2,100/AF)* *Energy: $14 million to $19 million/yr (4,600 kWh/AF)* **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☐ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☐ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☒ Other (California Coastal Commission, Heal the Bay)	

PROJECT CONCEPT FLOW SCHEMATIC




Santa Monica Basin
Central Basin
West Coast Basin
Pacific Ocean
~5 mi
48"
Proposed connection to Century Trunkline at Sepulveda and Westchester (Zone 477)
Subsurface Intake
Ocean Desalination Facility
Brine to Existing Outfall
105
405
Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing.
Legend
City of Los Angeles
Groundwater Basin
Source: LACDPW
Flow direction
Advanced Water Purification Facility (AWPF)
Pump Station
Pipeline
Connection Point with LADWP system
Brine
N
0 0.5 1 Miles
Hillshade Source: CalAtlas
http://www.atlas.ca.gov
Concept No. 25
Ocean Desalination
One Water LA 2040 Plan
TM 5.2 - Project Development

GENERAL BACKGROUND/PURPOSE

Ocean desalination is a technology used to remove salinity from ocean water using ultrafiltration and reverse osmosis membrane processes. On average ocean water salinity is 35,000 mg/L of total dissolved solids (TDS). Through desalination technology, ocean desalination facilities can remove TDS to a sufficient level to meet the California Department of Drinking Water (DDW) drinking water standards. An ocean desalination facility located in the Santa Monica Bay could substantially reduce the dependence on imported water by providing a reliable local source of supply. A reasonably sized Ocean Water Desalination facility is approximately 28,000 AFY (25 mgd) per prior studies indicating 28,000 AFY as the optimum potential project at the Scattergood Generation Station (SGS) site(3). Depending on the location of the ocean desalination facility and associated LADWP or regional distribution system, this ocean desalination option may include an ocean water intake (potentially collocated with SGS to reduce environmental impact and construction of a new subsurface intake structure), an influent pump station, conveyance, desalination processes, pumping into LADWP's or other regional potable distribution system (per prior studies to pressure zone 325 requiring high service pumping facilities at the desalination plant or to pressure zone 447 requiring a booster pump station(3)) and a brine discharge potentially collocated with the Hyperion Outfall. Note, information for this concept was based on prior studies and engineer's current understanding of similar projects; specific funding, implementation and environmental impacts and challenges requires further analysis and studies to incorporate changed conditions.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- *Subsurface intake*
- *Ocean desalination plant (25 mgd)*
- *3 MG effluent storage tank*
- *3,000 hp pump station*
- *5 miles of 48-inch transmission main. For planning purposes, it is assumed that the pipeline would tie in to LADWP's system at Sepulveda & Westchester.*
- *1 mile of 20-inch brine pipeline to existing Hyperion outfall*

POTENTIAL CHALLENGES & CONSIDERATIONS

- *State and California Coastal Commission Permitting*
- *Availability of low-interest tax-exempt bonds*
- *Water rate increases*
- *Approval and implementation of the desalination facility*
- *Siting*
- *Space constraints at Scattergood Generating Station*
- *Significant amount of piping and tunneling could be required to connect to LADWP or other regional systems*
- *Significant regional collaboration*
- *Environmental and marine life considerations*
- *Construction and permitting of a new subsurface intake structure*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
Identified as a long term project concept, requiring significant regional collaboration. Likely 2040 and beyond.	• Severe drought • Maximized use of recycled water, stormwater and groundwater supplies • Limitation on imported water supplies

SOURCES

1 2005 Brine Dilution Study (Scripps) 2-11-05.pdf
2 Fatal Flaw Analysis - 4.02.pdf
3 Final Preliminary Evaluation Report 3-10-08.pdf
4 LADWP Desal Optimization Study - 8.04.pdf
5 LADWP Seawater Desalination Brochure.pdf
6 City of Los Angeles. Draft Technical Memorandum 5.1 Basis of Planning. October 2016. Prepared for One Water LA.
7 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.
8 West Basin Municipal Water District. Desalination Demonstration Facility Intake Effects Assessment Report. August 2014.

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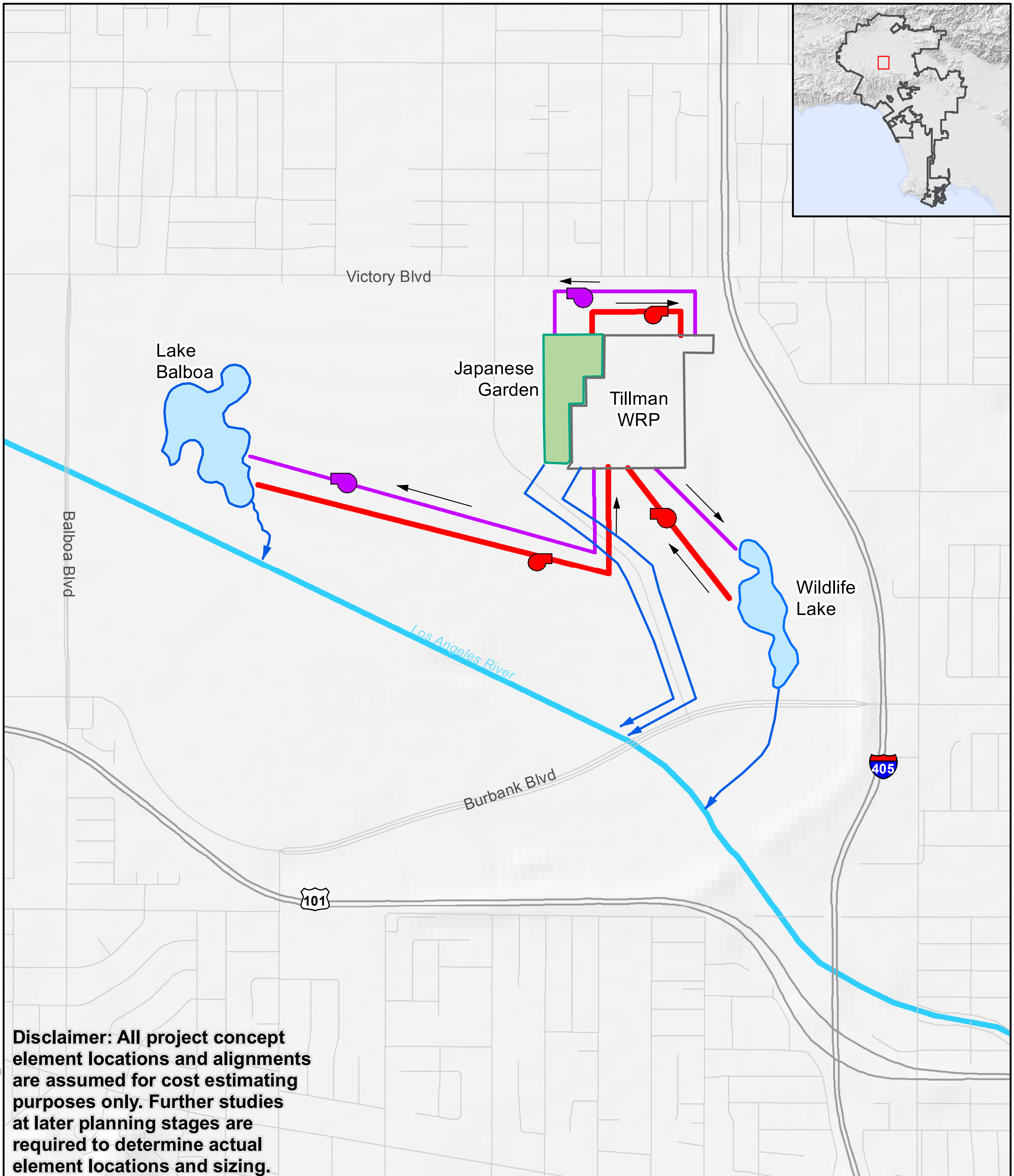
CONCEPT OPTION 26	
PROJECT CONCEPT NAME	**Japanese Garden & Sepulveda Basin Lakes Recirculation**
PROJECT CONCEPT DESCRIPTION	Recycle flows from Lake Balboa, Japanese Gardens, and Wildlife Lake to Tillman WRP.
SUPPLY SOURCE CATEGORY	☒ Stormwater ☒ Indirect Potable Reuse (IPR) ☐ Direct Potable Reuse (DPR) ☒ Other
ESTIMATED YIELD & COST	
ESTIMATED YIELD	Normal Year: 20,000 AFY 17 mgd Wet Year: 20,000 AFY 17 mgd Dry Year: 20,000 AFY 17 mgd *Potential Water Supply Benefit: up to 25,000 AFY* *Drought Resiliency: 100% (20,000 AFY Dry Year/25,000 AFY Normal year) is the estimated drought resiliency. The project will assist with maximizing reliability through maximum use of local water supplies and reduce dependence of imported water that is limited in availability due to drought and judicial constraint.* Yield Assumptions: Yield is based on flow through the existing Lake Balboa, Japanese Gardens, and Wildlife Lake, and assumes 5 mgd flow to the Los Angeles River.
ESTIMATED COST	Estimated Cost: Capital: $17 million - $23 million O&M: $100,000 to $140,000/yr Unit: $60-$80/AF (Calculated Unit Cost: $50/AF) Energy: $300,000-$400,000/yr (160 kWh/AF) **Cost assumptions: (OneWaterLA, TM 5.1).*

ONE WATER LA OBJECTIVES	PROJECT CONCEPT PARTNERS *Limited to Planning, Cost sharing, O&M	
☒ Integrate management of water resources & policies	☒ LASAN	☐ Caltrans
☒ Balance environmental, economic & societal goals	☒ LADWP	☐ LADOT
☐ Improve health of local watersheds	☐ BOE	☐ METRO
☒ Improve local water supply reliability	☐ RAP	☒ LA RiverWorks
☐ Implement, monitor, & maintain a reliable wastewater system	☒ LA County Flood Control District	☐ HSR
☒ Increase climate resilience	☐ LAWA	☐ LAUSD
☒ Increase community awareness & advocacy for sustainable water	☐ Other	



Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only. Further studies at later planning stages are required to determine actual element locations and sizing.

Legend

- Flow direction
- Discharge direction
- Proposed Pump Station
- Existing Pump Station
- Proposed Pipeline
- Existing Recycled Water Pipeline

0 0.2 Miles

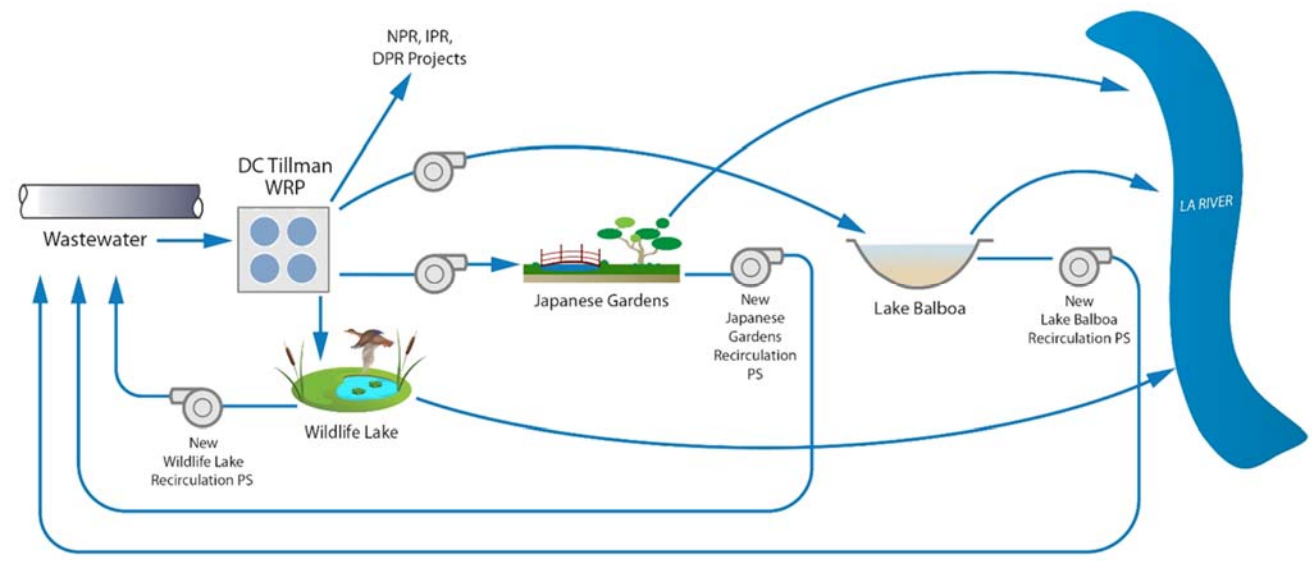
Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Concept No. 26
Japanese Garden and Sepulveda Lakes Recirculation
One Water LA 2040 Plan
TM 5.2 - Project Development

carollo

One Water LA

PROJECT CONCEPT FLOW SCHEMATIC



GENERAL BACKGROUND/PURPOSE

Recycled water from Tillman WRP is currently used in Lake Balboa, the Japanese Garden, and Wildlife Lake for environmental purposes, at a rate of approximately 25,000 AFY. Currently, after flowing through the garden and lakes, the water is released to the Los Angeles River. Some of the water could be returned to Tillman WRP, retreated, and reused, rather than releasing the flow to the Los Angeles River. While there would continue to be evaporative losses of 200 AFY, the remainder of the flow not released to the LA River would be available for another potable or non-potable reuse project.

KEY CONCEPT COMPONENTS

This project concept consists of the following key components:

- 3 new pump stations, from Lake Balboa, Japanese Gardens, and Wildlife Lake to the headworks of Tillman WRP
- 2 miles of new pipelines

POTENTIAL CHALLENGES & CONSIDERATIONS

- *Conservation, which could reduce the available flow into Tillman WRP*
- *Potential aquatic life impacts associated with diversion gate modifications and continuous monitoring of diversion and coordination with California Department of Fish and Wildlife.*
- *Reduced flow in LA River and associated water rights permit*
- *Public Perception. Stakeholder involvement and approval.*

EXPECTED PROJECT CONCEPT TIMELINE	TRIGGERS
General timeframe from 2020 to 2040	Need for additional water at Tillman WRP

SOURCES

1 (Carollo, 2016) TM 5.1 Appendix C, *Cost Estimating Assumptions*, 2016.

Disclaimer: This Conceptual Program Description is limited to conceptual planning level information, based on information known as of November 2016, and costs reflect 2016 dollars. Previous plans were used to develop the concept information, which are cited as endnotes. All assumed information is shown in italics.

Note that this Conceptual Program Description was added after the ranking and prioritization of projects and was not included in the ranking and scoring of concept options.

APPENDIX D – CONCEPT OPTION COST CALCULATIONS

Concept 1: Greenstreets - Upper Los Angeles River Watershed

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost(1) ($/Year)
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
Green streets					$ 849,508,920	$ 50,970,535	$ -
Subtotal for Other Project Components				*$ -*	*$ 849,508,920*	*$ 50,970,535*	*$ -*
TOTAL				**$ -**	**$ 849,508,920**	**$ 50,970,535**	**$ -**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 764,600,000	$ 849,500,000	$ 1,019,400,000
Amortized Capital ($/year)	$ 34,100,000	$ 37,900,000	$ 45,500,000
Annual O&M ($/year)	$ 45,900,000	$ 51,000,000	$ 61,200,000
Annual Energy ($/year)	$ -	$ -	$ -
Total Annual Cost ($/year)	$ 80,000,000	$ 88,900,000	$ 106,700,000
Yield (afy)	11,900	11,900	11,900
Energy Required (kWh/AF)	0	0	0
Unit Cost ($/AF)	**$ 6,800**	**$ 7,500**	**$ 9,000**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 2: Greenstreets - Ballona Creek Watershed

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost[(1)] ($/Year)
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
Green streets					$ 388,834,640	$ 23,330,078	$ -
Subtotal for Other Project Components				*$ -*	*$ 388,834,640*	*$ 23,330,078*	*$ -*
TOTAL				**$ -**	**$ 388,834,640**	**$ 23,330,078**	**$ -**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 349,900,000	$ 388,800,000	$ 466,600,000
Amortized Capital ($/year)	$ 15,700,000	$ 17,400,000	$ 20,900,000
Annual O&M ($/year)	$ 21,000,000	$ 23,300,000	$ 28,000,000
Annual Energy ($/year)	$ -	$ -	$ -
Total Annual Cost ($/year)	$ 36,600,000	$ 40,700,000	$ 48,800,000
Yield (afy)	2,300	2,300	2,300
Energy Required (kWh/AF)	0	0	0
Unit Cost ($/AF)	**$ 15,800**	**$ 17,600**	**$ 21,100**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 3: Greenstreets - Dominguez Channel Watershed

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost[1] ($/Year)
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
Green streets					$ 134,373,888	$ 8,062,433	$ -
Subtotal for Other Project Components				*$ -*	*$ 134,373,888*	*$ 8,062,433*	*$ -*
TOTAL				**$ -**	**$ 134,373,888**	**$ 8,062,433**	**$ -**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 121,000,000	$ 134,400,000	$ 161,300,000
Amortized Capital ($/year)	$ 5,400,000	$ 6,000,000	$ 7,200,000
Annual O&M ($/year)	$ 7,300,000	$ 8,100,000	$ 9,700,000
Annual Energy ($/year)	$ -	$ -	$ -
Total Annual Cost ($/year)	$ 12,700,000	$ 14,100,000	$ 16,900,000
Yield (afy)	2,600	2,600	2,600
Energy Required (kWh/AF)	0	0	0
Unit Cost ($/AF)	**$ 4,900**	**$ 5,400**	**$ 6,500**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 4: Greenstreets - Santa Monica Bay/Marina del Rey Watersheds

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost(1) ($/Year)
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
Green streets					$ 120,176,546	$ 7,210,593	$ -
Subtotal for Other Project Components				*$ -*	*$ 120,176,546*	*$ 7,210,593*	*$ -*
TOTAL				**$ -**	**$ 120,176,546**	**$ 7,210,593**	**$ -**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 108,200,000	$ 120,200,000	$ 144,200,000
Amortized Capital ($/year)	$ 4,900,000	$ 5,400,000	$ 6,500,000
Annual O&M ($/year)	$ 6,500,000	$ 7,200,000	$ 8,600,000
Annual Energy ($/year)	$ -	$ -	$ -
Total Annual Cost ($/year)	$ 11,300,000	$ 12,600,000	$ 15,100,000
Yield (afy)	460	460	460
Energy Required (kWh/AF)	0	0	0
Unit Cost ($/AF)	**$ 24,400**	**$ 27,100**	**$ 32,500**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 5: Dry Weather Low Flow Diversions

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost[(1)] ($/Year)
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
LFDs (<10,000 gpd)	5	each	$ 500,000	$ 2,500,000	$ 5,000,000	$ 50,000	
LFDs (10,000-100,000 gpd)	31	each	$ 1,000,000	$ 31,000,000	$ 62,000,000	$ 620,000	
LFDs (100,000-500,000 gpd)	6	each	$ 2,000,000	$ 12,000,000	$ 24,000,000	$ 240,000	
LFDs (500,000-1,000,000 gpd)	2	each	$ 3,000,000	$ 6,000,000	$ 12,000,000	$ 120,000	
LFDs (> 1,000,000 gpd)	1	each	$ 4,000,000	$ 4,000,000	$ 8,000,000	$ 80,000	
LFD Energy Cost							$ 23,000
Subtotal for Other Project Components				*$ 55,500,000*	*$ 111,000,000*	*$ 1,110,000*	*$ 23,000*
TOTAL				**$ 55,500,000**	**$ 111,000,000**	**$ 1,110,000**	**$ 23,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 99,900,000	$ 111,000,000	$ 133,200,000
Amortized Capital ($/year)	$ 4,500,000	$ 5,000,000	$ 6,000,000
Annual O&M ($/year)	$ 1,000,000	$ 1,100,000	$ 1,300,000
Annual Energy ($/year)	$ 21,000	$ 23,000	$ 28,000
Total Annual Cost ($/year)	$ 5,500,000	$ 6,100,000	$ 7,300,000
Yield (afy)	6,200	6,200	6,200
Energy Required (kWh/AF)	28	31	37
Unit Cost ($/AF)	**$ 900**	**$ 1,000**	**$ 1,200**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 6: Wet Weather Flow Diversions

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost(1) ($/Year)
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
Wet Weather Flow Diversion 621		3	$ 849,040	$ -	$ 849,040	$ 8,490	$ 40
Wet Weather Flow Diversion 622		5	$ 1,287,340	$ -	$ 1,287,340	$ 12,873	$ 100
Wet Weather Flow Diversion 647		47	$ 8,409,360	$ -	$ 8,409,360	$ 84,094	$ 500
Other Wet Weather Flow Diversions		957	$ 188,505.65	$ -	$ 180,410,483	$ 1,804,105	$ 9,200
Subtotal for Other Project Components				*$ -*	*$ 190,956,223*	*$ 1,909,562*	*$ 9,840*
TOTAL				**$ -**	**$ 190,956,223**	**$ 1,909,562**	**$ 9,840**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 171,900,000	$ 191,000,000	$ 229,200,000
Amortized Capital ($/year)	$ 7,680,000	$ 8,530,000	$ 10,240,000
Annual O&M ($/year)	$ 1,720,000	$ 1,910,000	$ 2,290,000
Annual Energy ($/year)	$ 8,800	$ 9,800	$ 11,800
Total Annual Cost ($/year)	$ 9,410,000	$ 10,450,000	$ 12,540,000
Yield (afy)	1,010	1,010	1,010
Energy Required (kWh/AF)	70	80	100
Unit Cost ($/AF)	**$ 9,300**	**$ 10,300**	**$ 12,400**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 7: Upper Los Angeles River to Tillman WRP

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	20"	13,000	$ 450	$ 5,850,000	$ 11,700,000	$ 58,500	
Subtotal for Pipelines				*$ 6,414,000*	*$ 12,828,000*	*$ 64,140*	*$ -*
Water and Recycled Water Pump Station							
	Quantity	**Unit**	**$/unit**				
PS (100 to 500 hp)	100	hp	$ 3,000	$ 300,000	$ 600,000	$ 6,000	$ 43,000
Subtotal for Pump Stations				*$ 300,000*	*$ 600,000*	*$ 6,000*	*$ 43,000*
Other Project Components							
	Quantity	**Unit**	**$/unit**				
Rubber Dam	250	LF	$ 6,000	$ 1,500,000	$ 3,000,000	$ 60,000	
River Intake	1		$ 800,000	$ 800,000	$ 1,600,000	$ 16,000	
Subtotal for Other Project Components				*$ 2,300,000*	*$ 4,600,000*	*$ 76,000*	*$ -*
TOTAL				**$ 9,014,000**	**$ 18,028,000**	**$ 146,140**	**$ 43,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 16,200,000	$ 18,000,000	$ 21,600,000
Amortized Capital ($/year)	$ 640,000	$ 710,000	$ 850,000
Annual O&M ($/year)	$ 140,000	$ 150,000	$ 180,000
Annual Energy ($/year)	$ 39,000	$ 43,000	$ 52,000
Total Annual Cost ($/year)	$ 810,000	$ 900,000	$ 1,080,000
Yield (afy)	5,600	5,600	5,600
Energy Required (kWh/AF)	50	60	70
Unit Cost ($/AF)	**$ 140**	**$ 160**	**$ 190**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 8A: LA River Recharge to LA Forebay (25,000 afy)

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	12"	175,272	$ 282	$ 49,427,000	$ 98,854,000	$ 494,270	
Pipeline	24"	52,800	$ 528	$ 27,878,000	$ 55,756,000	$ 278,780	
Pipeline	36"	5,280	$ 900	$ 4,752,000	$ 9,504,000	$ 47,520	
Subtotal for Pipelines				*$ 82,057,000*	*$ 164,114,000*	*$ 820,570*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (6 to 10 MG)	8.1	MG	$ 1.75	$ 14,139,000	$ 28,278,000	$ 141,390	
Subtotal for Tanks and Equalization Basins				*$ 14,139,000*	*$ 28,278,000*	*$ 141,390*	*$ -*
Additional Recycled Water Treatment Capacity							
	Quantity	**Unit**	**$/unit**				
Stormwater Treatment Facility	65	mgd	$ 3,000,000	$ 193,907,520	$ 387,815,000	$ 5,817,226	503,264
Subtotal for Recycled Water Treatment				*$ 193,907,520*	*$ 387,815,000*	*$ 5,817,226*	*$ 503,264*
Water and Recycled Water Pump Station							
	Quantity	**Unit**	**$/unit**				
PS (100 to 500 hp)	500	hp	$ 3,000	$ 1,500,000	$ 3,000,000	$ 30,000	$ 111,000
PS (>1,000 hp)	3,300	hp	$ 2,000	$ 6,600,000	$ 13,200,000	$ 132,000	$ 887,000
Subtotal for Pump Stations				*$ 8,100,000*	*$ 16,200,000*	*$ 162,000*	*$ 998,000*
Groundwater Wells							
	Quantity	**Unit**	**$/unit**				
Medium Depth Well (500-1,000 ft)	23	well	$ 1,750,000	$ 40,250,000	$ 80,500,000	$ 805,000	$ 1,433,000
IX Treatment System	35	mgd	$ 1,026,000	$ 35,397,000	$ 70,794,000	$ 1,415,880	$ 307,000
Subtotal for Groundwater Wells				*$ 75,647,000*	*$ 151,294,000*	*$ 2,220,880*	*$ 1,740,000*
River Intake and Groundwater Injection Wells							
	Quantity	**Unit**	**$/unit**				
Rubber Dam	275	LF	$ 6,000	$ 1,650,000	$ 3,300,000	$ 66,000	
River Intake	1		$ 800,000	$ 800,000	$ 1,600,000	$ 16,000	
Medium Depth Well (500-1,000 ft)	65	well	$ 1,750,000	$ 113,112,720	$ 226,225,000	$ 2,262,254	
Subtotal for Groundwater Injection Wells				*$ 115,562,720*	*$ 231,125,000*	*$ 2,344,254*	*$ -*
TOTAL				**$ 489,413,240**	**$ 978,826,000**	**$ 11,506,320**	**$ 3,241,264**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 880,900,000	$ 978,800,000	$ 1,174,600,000
Amortized Capital ($/year)	$ 33,500,000	$ 37,200,000	$ 44,600,000
Annual O&M ($/year)	$ 10,400,000	$ 11,500,000	$ 13,800,000
Annual Energy ($/year)	$ 2,900,000	$ 3,200,000	$ 3,800,000
Total Annual Cost ($/year)	$ 46,800,000	$ 52,000,000	$ 62,400,000
Yield (afy)	25,000	25,000	25,000
Energy Required (kWh/AF)	1,000	1,100	1,300
Unit Cost ($/AF)	**$ 1,900**	**$ 2,100**	**$ 2,500**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 8B: LA River Recharge using Dry Wells

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	12"	46,000	$ 282	$ 12,972,000	$ 25,944,000	$ 129,720	
Pipeline	42"	52,800	$ 1,176	$ 62,093,000	$ 124,186,000	$ 620,930	
Pipeline	36"		$ 900	$ -	$ -	$ -	
Subtotal for Pipelines				*$ 75,065,000*	*$ 150,130,000*	*$ 750,650*	*$ -*
Additional Recycled Water Treatment Capacity							
	Quantity	**Unit**	**$/unit**				
Stormwater Treatment Facility	0	mgd	$ 3,000,000	$ -	$ -	$ -	-
Subtotal for Recycled Water Treatment				*$ -*	*$ -*	*$ -*	*$ -*
Water and Recycled Water Pump Station							
	Quantity	**Unit**	**$/unit**				
PS (100 to 500 hp)	0	hp	$ 3,000	$ -	$ -	$ -	
PS (>1,000 hp)	0	hp	$ 2,000	$ -	$ -	$ -	
Subtotal for Pump Stations				*$ -*	*$ -*	*$ -*	*$ -*
Groundwater Wells							
	Quantity	**Unit**	**$/unit**				
Medium Depth Well (500-1,000 ft)	23	well	$ 1,750,000	$ 40,250,000	$ 80,500,000	$ 805,000	$ 1,433,000
IX Treatment System	35	mgd	$ 1,026,000	$ 35,397,000	$ 70,794,000	$ 1,415,880	$ 307,000
Subtotal for Groundwater Wells				*$ 75,647,000*	*$ 151,294,000*	*$ 2,220,880*	*$ 1,740,000*
River Intake and Groundwater Injection Wells							
	Quantity	**Unit**	**$/unit**				
Rubber Dam	550	LF	$ 6,000	$ 3,300,000	$ 6,600,000	$ 132,000	
River Intake	0		$ 800,000	$ -	$ -	$ -	
Medium Depth Well (500-1,000 ft)	65	well	$ 1,750,000	$ 113,750,000	$ 227,500,000	$ 2,275,000	
Subtotal for Groundwater Injection Wells				*$ 117,050,000*	*$ 234,100,000*	*$ 2,407,000*	*$ -*
TOTAL				**$ 267,762,000**	**$ 535,524,000**	**$ 5,378,530**	**$ 1,740,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 482,000,000	$ 535,500,000	$ 642,600,000
Amortized Capital ($/year)	$ 16,500,000	$ 18,300,000	$ 22,000,000
Annual O&M ($/year)	$ 4,900,000	$ 5,400,000	$ 6,500,000
Annual Energy ($/year)	$ 1,500,000	$ 1,700,000	$ 2,000,000
Total Annual Cost ($/year)	$ 22,900,000	$ 25,400,000	$ 30,500,000
Yield (afy)	25,000	25,000	25,000
Energy Required (kWh/AF)	500	600	700
Unit Cost ($/AF)	**$ 900**	**$ 1,000**	**$ 1,200**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 9: IPR - Tillman WRP to San Fernando Valley Injection Wells

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	12"	12,000	$ 282	$ 3,384,000	$ 6,768,000	$ 33,840	
Pipeline	30"	52,800	$ 690	$ 36,432,000	$ 72,864,000	$ 364,320	
Subtotal for Pipelines				*$ 39,816,000*	*$ 79,632,000*	*$ 398,160*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (1 to 5 MG)	1.7	MG	$ 2.00	$ 3,400,000	$ 6,800,000	$ 34,000	
Subtotal for Tanks and Equalization Basins				*$ 3,400,000*	*$ 6,800,000*	*$ 34,000*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	3,400	hp	$ 2,000	$ 6,800,000	$ 13,600,000	$ 136,000	$ 1,424,000
Subtotal for Pump Stations				*$ 6,800,000*	*$ 13,600,000*	*$ 136,000*	*$ 1,424,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for IPR)	14	mgd	$ 7,000,000	$ 95,200,000	$ 190,400,000	$ 3,808,000	$ 1,601,000
Injection Wells	6	wells	$ 2,000,000	$ 12,000,000	$ 24,000,000	$ 240,000	$ -
Extraction Well Treatment System	20	mgd	$ 1,026,000	$ 20,930,400	$ 41,861,000	$ 837,216	$ 280,000
Subtotal for Other Project Components				*$ 128,130,400*	*$ 256,261,000*	*$ 4,885,216*	*$ 2,487,000*
TOTAL				**$ 178,146,400**	**$ 356,293,000**	**$ 5,453,376**	**$ 3,911,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 320,700,000	$ 356,300,000	$ 427,600,000
Amortized Capital ($/year)	$ 13,000,000	$ 14,400,000	$ 17,300,000
Annual O&M ($/year)	$ 5,000,000	$ 5,500,000	$ 6,600,000
Annual Energy ($/year)	$ 3,500,000	$ 3,900,000	$ 4,700,000
Total Annual Cost ($/year)	$ 21,300,000	$ 23,700,000	$ 28,400,000
Yield (afy)	15,000	15,000	15,000
Energy Required (kWh/AF)	1,900	2,100	2,500
Unit Cost ($/AF)	**$ 1,400**	**$ 1,600**	**$ 1,900**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 10: IPR - Hyperion WRP to West Basin Injection Wells

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	12"	71,429	$ 282	$ 20,143,000	$ 40,286,000	$ 201,430	
Pipeline	42"	25,000	$ 1,176	$ 29,400,000	$ 58,800,000	$ 294,000	
Subtotal for Pipelines				*$ 49,543,000*	*$ 99,086,000*	*$ 495,430*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (1-5 MG)	2.2	MG	$ 2.00	$ 4,464,000	$ 8,928,000	$ 44,640	
Equalization Basin (5-10 MG)	5.6	MG	$ 1.25	$ 6,975,000	$ 13,950,000	$ 69,750	
Subtotal for Tanks and Equalization Basins				*$ 11,439,000*	*$ 22,878,000*	*$ 114,390*	*$ -*
Additional Recycled Water Treatment Capacity							
	Quantity	**Unit**	**$/unit**				
MBR	18	mgd	$ 5,000,000	$ 89,285,714	$ 178,571,000	$ 3,571,429	$ 1,776,000
Advanced Water Treatment Facility	18	mgd	$ 7,000,000	$ 125,000,000	$ 250,000,000	$ 5,000,000	2,628,000
Subtotal for Recycled Water Treatment				*$ 214,285,714*	*$ 428,571,000*	*$ 8,571,429*	*$ 4,404,000*
Water and Recycled Water Pump Station							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	3,400	hp	$ 2,000	$ 6,800,000	$ 13,600,000	$ 136,000	$ 1,761,000
Subtotal for Pump Stations				*$ 6,800,000*	*$ 13,600,000*	*$ 136,000*	*$ 1,761,000*
Groundwater Wells							
	Quantity	**Unit**	**$/unit**				
Medium Depth Well (500-1,000 ft)	18	well	$ 1,750,000	$ 31,250,000	$ 62,500,000	$ 625,000	$ 1,656,000
Brackish Groundwater Desalination	27	mgd	$ 4,000,000	$ 107,142,857	$ 214,286,000	$ 4,285,714	$ 6,300,000
Subtotal for Groundwater Wells				*$ 138,392,857*	*$ 276,786,000*	*$ 4,910,714*	*$ 7,956,000*
Groundwater Injection Wells							
	Quantity	**Unit**	**$/unit**				
Medium Depth Well (500-1,000 ft)	18	well	$ 1,750,000	$ 31,250,000	$ 62,500,000	$ 625,000	
Subtotal for Groundwater Injection Wells				*$ 31,250,000*	*$ 62,500,000*	*$ 625,000*	*$ -*
TOTAL				**$ 451,710,571**	**$ 903,421,000**	**$ 14,852,963**	**$ 14,121,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 813,100,000	$ 903,400,000	$ 1,084,100,000
Amortized Capital ($/year)	$ 30,900,000	$ 34,300,000	$ 41,200,000
Annual O&M ($/year)	$ 13,400,000	$ 14,900,000	$ 17,900,000
Annual Energy ($/year)	$ 12,700,000	$ 14,100,000	$ 16,900,000
Total Annual Cost ($/year)	$ 57,000,000	$ 63,300,000	$ 76,000,000
Yield (afy)	20,000	20,000	20,000
Energy Required (kWh/AF)	5,300	5,900	7,100
Unit Cost ($/AF)	**$ 2,900**	**$ 3,200**	**$ 3,800**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 11: IPR - Hyperion WRP to Central Basin Injection Wells

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	12"	268,800	$ 282	$ 75,802,000	$ 151,604,000	$ 758,020	
Pipeline	72"	159,200	$ 2,304	$ 366,797,000	$ 733,594,000	$ 3,667,970	
Subtotal for Pipelines				*$ 442,599,000*	*$ 885,198,000*	*$ 4,425,990*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (5-10 MG)	8.4	MG	$ 1.75	$ 14,700,000	$ 29,400,000	$ 147,000	
Equalization Basin (>10 MG)	21	MG	$ 1.00	$ 21,000,000	$ 42,000,000	$ 210,000	
Subtotal for Tanks and Equalization Basins				*$ 35,700,000*	*$ 71,400,000*	*$ 357,000*	*$ -*
Additional Recycled Water Treatment Capacity							
	Quantity	**Unit**	**$/unit**				
MBR	67	mgd	$ 5,000,000	$ 336,000,000	$ 672,000,000	$ 13,440,000	$ 6,684,000
Advanced Water Treatment Facility	67	mgd	$ 7,000,000	$ 470,400,000	$ 940,800,000	$ 18,816,000	9,890,000
Subtotal for Recycled Water Treatment				*$ 806,400,000*	*$ 1,612,800,000*	*$ 32,256,000*	*$ 16,574,000*
Water and Recycled Water Pump Station							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	13,200	hp	$ 2,000	$ 26,400,000	$ 52,800,000	$ 528,000	$ 6,898,000
Subtotal for Pump Stations				*$ 26,400,000*	*$ 52,800,000*	*$ 528,000*	*$ 6,898,000*
Groundwater Wells							
	Quantity	**Unit**	**$/unit**				
Medium Depth Well (500-1,000 ft)	67	well	$ 1,750,000	$ 117,600,000	$ 235,200,000	$ 2,352,000	$ 6,504,000
IX Treatment System	101	mgd	$ 1,026,000	$ 103,420,800	$ 206,842,000	$ 4,136,832	$ 1,380,000
Subtotal for Groundwater Wells				*$ 221,020,800*	*$ 442,042,000*	*$ 6,488,832*	*$ 7,884,000*
Groundwater Injection Wells							
	Quantity	**Unit**	**$/unit**				
Medium Depth Well (500-1,000 ft)	67	well	$ 1,750,000	$ 117,600,000	$ 235,200,000	$ 2,352,000	
Subtotal for Groundwater Injection Wells				*$ 117,600,000*	*$ 235,200,000*	*$ 2,352,000*	*$ -*
TOTAL				**$ 1,649,719,800**	**$ 3,299,440,000**	**$ 46,407,822**	**$ 31,356,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 2,969,500,000	$ 3,299,400,000	$ 3,959,300,000
Amortized Capital ($/year)	$ 113,300,000	$ 125,900,000	$ 151,100,000
Annual O&M ($/year)	$ 41,800,000	$ 46,400,000	$ 55,700,000
Annual Energy ($/year)	$ 28,300,000	$ 31,400,000	$ 37,700,000
Total Annual Cost ($/year)	$ 183,300,000	$ 203,700,000	$ 244,400,000
Yield (afy)	75,000	75,000	75,000
Energy Required (kWh/AF)	3,200	3,500	4,200
Unit Cost ($/AF)	**$ 2,400**	**$ 2,700**	**$ 3,200**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 12: IPR - Hyperion WRP to Central Basin with Spreading Basins

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	10"	69,000	$ 240	$ 16,560,000	$ 33,120,000	$ 165,600	
Pipeline	12"	169,643	$ 282	$ 47,839,000	$ 95,678,000	$ 478,390	
Pipeline	54"	68,500	$ 1,728	$ 118,368,000	$ 236,736,000	$ 1,183,680	
Pipeline	60"	5,300	$ 1,920	$ 10,176,000	$ 20,352,000	$ 101,760	
Pipeline	72"	184,800	$ 2,304	$ 425,779,000	$ 851,558,000	$ 4,257,790	
Subtotal for Pipelines				*$ 618,722,000*	*$ 1,237,444,000*	*$ 6,187,220*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (>10 MG)	10.6	MG	$ 1.50	$ 15,904,000	$ 31,808,000	$ 159,040	
Equalization Basin (>10 MG)	26.5	MG	$ 1.00	$ 26,507,000	$ 53,014,000	$ 265,070	
Subtotal for Tanks and Equalization Basins				*$ 42,411,000*	*$ 84,822,000*	*$ 424,110*	*$ -*
Additional Recycled Water Treatment Capacity							
	Quantity	**Unit**	**$/unit**				
MBR	85	mgd	$ 5,000,000	$ 424,107,563	$ 848,215,000	$ 16,964,303	$ 8,437,000
Advanced Water Treatment Facility	85	mgd	$ 7,000,000	$ 593,750,588	$ 1,187,501,000	$ 23,750,024	$ 12,483,000
Subtotal for Treatment Systems				*$ 1,017,858,151*	*$ 2,035,716,000*	*$ 40,714,326*	*$ 20,920,000*
Water and Recycled Water Pump Station							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	20,700	hp	$ 2,000	$ 41,400,000	$ 82,800,000	$ 828,000	$ 4,749,000
Subtotal for Pump Stations				$ 41,400,000	$ 82,800,000	$ 828,000	$ 4,749,000
Groundwater Wells							
	Quantity	**Unit**	**$/unit**				
Medium Depth Well (500-1,000 ft)	85	well	$ 1,750,000	$ 148,437,647	$ 296,875,000	$ 2,968,753	$ 5,420,000
IX Treatment System	127	mgd	$ 1,026,000	$ 130,540,308	$ 261,081,000	$ 5,221,612	$ 1,163,000
Subtotal for Groundwater Wells				*$ 278,977,955*	*$ 557,956,000*	*$ 8,190,365*	*$ 6,583,000*
Groundwater Injection Wells							
	Quantity	**Unit**	**$/unit**				
Deep Well (> 1,000 ft)		*$/well*	*$ 2,000,000*	*$ -*	*$ -*	*$ -*	
Medium Depth Well (500-1,000 ft)		*$/well*	*$ 1,500,000*	*$ -*	*$ -*	*$ -*	
Shallow Well (500 ft)		*$/well*	*$ 1,000,000*	*$ -*	*$ -*	*$ -*	
Subtotal for Groundwater Injection Wells				$ -	$ -	$ -	$ -
Land Purchase							
	Quantity	**Unit**	**$/unit**				
Subtotal for Land Purchases							
TOTAL				**$ 1,999,369,106**	**$ 3,998,738,000**	**$ 56,344,021**	**$ 32,252,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 3,598,800,000	$ 3,998,700,000	$ 4,798,400,000
Amortized Capital ($/year)	$ 141,400,000	$ 157,100,000	$ 188,500,000
Annual O&M ($/year)	$ 50,700,000	$ 56,300,000	$ 67,600,000
Annual Energy ($/year)	$ 29,100,000	$ 32,300,000	$ 38,800,000
Total Annual Cost ($/year)	$ 221,100,000	$ 245,700,000	$ 294,800,000
Yield (afy)	95,000	95,000	95,000
Energy Required (kWh/AF)	2,500	2,800	3,400
Unit Cost ($/AF)	**$ 2,300**	**$ 2,600**	**$ 3,100**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 13: MBR at HWRP to Regional System

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Treatment Systems							
	Quantity	**Unit**	**$/unit**				
MBR	85	mgd	$ 5,000,000	$ 424,107,563	$ 848,215,000	$ 16,964,303	8,437,000
Subtotal for Treatment Systems				*$ 424,107,563*	*$ 848,215,000*	*$ 16,964,303*	*$ 8,437,000*
Water and Recycled Water Pump Station							
	Quantity	**Unit**	**$/unit**				
PS (<100 hp)		*hp*	*$ 5,000*	*$ -*	*$ -*	*$ -*	
PS (100 to 500 hp)		*hp*	*$ 3,000*	*$ -*	*$ -*	*$ -*	
PS (600 to 1,000 hp)		*hp*	*$ 2,500*	*$ -*	*$ -*	*$ -*	
PS (>1,000 hp)		*hp*	*$ 2,000*	*$ -*	*$ -*	*$ -*	*$ -*
Subtotal for Pump Stations				$ -	$ -	$ -	$ -
Tanks and Equalization Basins							
	Quantity	**Unit**	**$/unit**				
Equalization Basin (> 10 MG)	26.5	MG	$ 1.00	$ 26,507,000	$ 53,014,000	$ 265,070	
Tier 2 Purchased Water from Metropolitan	95000	AFY	$ 1,073		$ -	$ 101,935,000	
Metropolitan Local Resources Program	95000	AFY	$ (305)	$ (28,975,000)		$ (28,975,000)	
Subtotal for Tanks and Equalization Basins				*$ (2,468,000)*	*$ 53,014,000*	*$ 73,225,070*	*$ -*
Groundwater Injection Wells							
	Quantity	**Unit**	**$/unit**				
Deep Well (> 1,000 ft)		*well*	*$ 2,000,000*	*$ -*	*$ -*	*$ -*	
Shallow Well (500 ft)		*well*	*$ 1,500,000*	*$ -*	*$ -*	*$ -*	
Subtotal for Groundwater Injection Wells				$ -	$ -	$ -	$ -
Land Purchase							
	Quantity	**Unit**	**$/unit**				
Land Cost							
Subtotal for Land Purchases							
TOTAL				**$ 421,639,563**	**$ 901,229,000**	**$ 90,189,373**	**$ 8,437,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 811,100,000	$ 901,200,000	$ 1,081,400,000
Amortized Capital ($/year)	$ 35,600,000	$ 39,600,000	$ 47,500,000
Annual O&M ($/year)	$ 81,200,000	$ 90,200,000	$ 108,200,000
Annual Energy ($/year)	$ 7,600,000	$ 8,400,000	$ 10,100,000
Total Annual Cost ($/year)	$ 124,400,000	$ 138,200,000	$ 165,800,000
Yield (afy)	95,000	95,000	95,000
Energy Required (kWh/AF)	600	700	800
Unit Cost ($/AF)	**$ 1,400**	**$ 1,500**	**$ 1,800**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Option 14: IPR - Hyperion WRP to San Fernando Basin Injection Wells

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	12"	13,228	$ 282	$ 3,730,000	$ 7,460,000	$ 37,300	
Pipeline	36"	162,600	$ 900	$ 146,340,000	$ 292,680,000	$ 1,463,400	
Subtotal for Pipelines				*$ 150,070,000*	*$ 300,140,000*	*$ 1,500,700*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (1 to 5 MG)	2.2	MG	$ 2.00	$ 4,464,000	$ 8,928,000	$ 44,640	
Equalization Basin (6 to 10 MG)	5.6	MG	$ 1.25	$ 6,975,000	$ 13,950,000	$ 69,750	
Subtotal for Tanks and Equalization Basins				*$ 11,439,000*	*$ 22,878,000*	*$ 114,390*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	3,200	hp	$ 2,000	$ 6,400,000	$ 12,800,000	$ 128,000	$ 2,146,000
PS (>1,000 hp)	4,200	hp	$ 2,000	$ 8,400,000	$ 16,800,000	$ 168,000	$ 2,645,000
Subtotal for Pump Stations				*$ 14,800,000*	*$ 29,600,000*	*$ 296,000*	*$ 4,791,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
MBR	18	mgd	$ 5,000,000	$ 89,285,714	$ 178,571,000	$ 3,571,429	$ 1,776,000
AWPF (for IPR)	18	mgd	$ 7,000,000	$ 125,000,000	$ 250,000,000	$ 2,500,000	$ 2,628,000
Injection Wells	7	wells	$ 2,000,000	$ 13,227,513	$ 26,455,000	$ 264,550	$ 103,000
IX Treatment System	27	mgd	$ 1,026,000	$ 27,482,143	$ 54,964,000	$ 1,099,286	$ 246,000
Subtotal for Other Project Components				*$ 165,709,656*	*$ 331,419,000*	*$ 3,863,836*	*$ 3,510,000*
TOTAL				**$ 342,018,656**	**$ 684,037,000**	**$ 5,774,926**	**$ 8,301,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 615,600,000	$ 684,000,000	$ 820,800,000
Amortized Capital ($/year)	$ 30,400,000	$ 33,800,000	$ 40,600,000
Annual O&M ($/year)	$ 5,200,000	$ 5,800,000	$ 7,000,000
Annual Energy ($/year)	$ 7,500,000	$ 8,300,000	$ 10,000,000
Total Annual Cost ($/year)	$ 43,100,000	$ 47,900,000	$ 57,500,000
Yield (afy)	20,000	20,000	20,000
Energy Required (kWh/AF)	3,200	3,500	4,200
Unit Cost ($/AF)	**$ 2,200**	**$ 2,400**	**$ 2,900**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 15: DPR - Tillman WRP to LA Aqueduct Filtration Plant

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	36"	44,800	$ 900	$ 40,320,000	$ 80,640,000	$ 403,200	
Subtotal for Pipelines				*$ 40,320,000*	*$ 80,640,000*	*$ 403,200*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (>10 MG)	2	MG	$ 1.50	$ 2,550,000	$ 5,100,000	$ 25,500	
Subtotal for Tanks and Equalization Basins				*$ 2,550,000*	*$ 5,100,000*	*$ 25,500*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	2,300	hp	$ 2,000	$ 4,600,000	$ 9,200,000	$ 92,000	$ 1,866,000
Subtotal for Pump Stations				*$ 4,600,000*	*$ 9,200,000*	*$ 92,000*	*$ 1,866,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for DPR)	14	mgd	$ 8,000,000	$ 108,800,000	$ 217,600,000	$ 4,352,000	$ 2,001,000
LAAFP Treatment	14	mgd		$ -	$ -	$ 1,122,056	$ 24,000
Subtotal for Other Project Components				*$ 108,800,000*	*$ 217,600,000*	*$ 5,474,056*	*$ 2,025,000*
TOTAL				**$ 156,270,000**	**$ 312,540,000**	**$ 5,994,756**	**$ 3,891,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 281,300,000	$ 312,500,000	$ 375,000,000
Amortized Capital ($/year)	$ 11,500,000	$ 12,800,000	$ 15,400,000
Annual O&M ($/year)	$ 5,400,000	$ 6,000,000	$ 7,200,000
Annual Energy ($/year)	$ 3,500,000	$ 3,900,000	$ 4,700,000
Total Annual Cost ($/year)	$ 20,400,000	$ 22,700,000	$ 27,200,000
Yield (afy)	15,000	15,000	15,000
Energy Required (kWh/AF)	1,900	2,100	2,500
Unit Cost ($/AF)	**$ 1,400**	**$ 1,500**	**$ 1,800**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 16: DPR - Tillman WRP to LADWP Distribution System

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	36"	15,200	$ 900	$ 13,680,000	$ 27,360,000	$ 136,800	
Subtotal for Pipelines				*$ 13,680,000*	*$ 27,360,000*	*$ 136,800*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (>10 MG)	14	MG	$ 1.50	$ 20,400,000	$ 40,800,000	$ 204,000	
Subtotal for Tanks and Equalization Basins				*$ 20,400,000*	*$ 40,800,000*	*$ 204,000*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	2,000	hp	$ 2,000	$ 4,000,000	$ 8,000,000	$ 80,000	$ 1,243,000
Subtotal for Pump Stations				*$ 4,000,000*	*$ 8,000,000*	*$ 80,000*	*$ 1,243,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for DPR)	14	mgd	$ 8,000,000	$ 108,800,000	$ 217,600,000	$ 4,352,000	$ 2,001,000
Subtotal for Other Project Components				*$ 108,800,000*	*$ 217,600,000*	*$ 4,352,000*	*$ 2,001,000*
TOTAL				**$ 146,880,000**	**$ 293,760,000**	**$ 4,772,800**	**$ 3,244,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 264,400,000	$ 293,800,000	$ 352,600,000
Amortized Capital ($/year)	$ 11,000,000	$ 12,200,000	$ 14,600,000
Annual O&M ($/year)	$ 4,300,000	$ 4,800,000	$ 5,800,000
Annual Energy ($/year)	$ 2,900,000	$ 3,200,000	$ 3,800,000
Total Annual Cost ($/year)	$ 18,200,000	$ 20,200,000	$ 24,200,000
Yield (afy)	15,000	15,000	15,000
Energy Required (kWh/AF)	1,600	1,800	2,200
Unit Cost ($/AF)	**$ 1,200**	**$ 1,300**	**$ 1,600**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 17: DPR - LA/Glendale (LAG) WRP to Headworks Reservoir

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	24"	21,500	$ 528	$ 11,352,000	$ 22,704,000	$ 113,520	
Subtotal for Pipelines				*$ 11,352,000*	*$ 22,704,000*	*$ 113,520*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (1 to 5 MG)	1	MG	$ 2.00	$ 1,800,000	$ 3,600,000	$ 18,000	
Subtotal for Tanks and Equalization Basins				*$ 1,800,000*	*$ 3,600,000*	*$ 18,000*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (100 to 500 hp)	200	hp	$ 3,000	$ 600,000	$ 1,200,000	$ 12,000	$ 110,000
Subtotal for Pump Stations				*$ 600,000*	*$ 1,200,000*	*$ 12,000*	*$ 110,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for DPR)	7	mgd	$ 8,000,000	$ 57,600,000	$ 115,200,000	$ 2,304,000	$ 802,000
Subtotal for Other Project Components				*$ 57,600,000*	*$ 115,200,000*	*$ 2,304,000*	*$ 802,000*
TOTAL				**$ 71,352,000**	**$ 142,704,000**	**$ 2,447,520**	**$ 912,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 128,400,000	$ 142,700,000	$ 171,200,000
Amortized Capital ($/year)	$ 5,400,000	$ 6,000,000	$ 7,200,000
Annual O&M ($/year)	$ 2,200,000	$ 2,400,000	$ 2,900,000
Annual Energy ($/year)	$ 800,000	$ 900,000	$ 1,100,000
Total Annual Cost ($/year)	$ 8,500,000	$ 9,400,000	$ 11,300,000
Yield (afy)	6,000	6,000	6,000
Energy Required (kWh/AF)	1,100	1,200	1,400
Unit Cost ($/AF)	**$ 1,400**	**$ 1,500**	**$ 1,800**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 18: DPR - Hyperion WRP to LADWP Distribution System

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	48"	21,600	$ 1,440	$ 31,104,000	$ 62,208,000	$ 311,040	
Pipeline	60"	25,100	$ 1,920	$ 48,192,000	$ 96,384,000	$ 481,920	
Subtotal for Pipelines				*$ 79,296,000*	*$ 158,592,000*	*$ 792,960*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Equalization Basin (>10 MG)	26.50666987	MG	$ 1.00	$ 26,507,000	$ 53,014,000	$ 265,070	
Storage (>10 MG)	85	MG	$ 1.50	$ 127,232,000	$ 254,464,000	$ 1,272,320	
Subtotal for Tanks and Equalization Basins				*$ 153,739,000*	*$ 307,478,000*	*$ 1,537,390*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	12,500	hp	$ 2,000	$ 25,000,000	$ 50,000,000	$ 500,000	$ 7,823,000
PS (>1,000 hp)	15,000	hp	$ 2,000	$ 30,000,000	$ 60,000,000	$ 600,000	$ 9,415,000
Subtotal for Pump Stations				*$ 55,000,000*	*$ 110,000,000*	*$ 1,100,000*	*$ 17,238,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for DPR)	85	mgd	$ 8,000,000	$ 678,570,749	$ 1,357,141,000	$ 27,142,830	$ 12,483,000
MBR	85	mgd	$ 5,000,000	$ 424,106,718	$ 848,213,000	$ 16,964,269	$ 8,437,000
Subtotal for Other Project Components				*$ 1,102,677,466*	*$ 2,205,354,000*	*$ 44,107,099*	*$ 20,920,000*
TOTAL				**$ 1,390,712,466**	**$ 2,781,424,000**	**$ 47,537,449**	**$ 38,158,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 2,503,300,000	$ 2,781,400,000	$ 3,337,700,000
Amortized Capital ($/year)	$ 105,600,000	$ 117,300,000	$ 140,800,000
Annual O&M ($/year)	$ 42,800,000	$ 47,500,000	$ 57,000,000
Annual Energy ($/year)	$ 34,400,000	$ 38,200,000	$ 45,800,000
Total Annual Cost ($/year)	$ 182,700,000	$ 203,000,000	$ 243,600,000
Yield (afy)	95,000	95,000	95,000
Energy Required (kWh/AF)	3,000	3,300	4,000
Unit Cost ($/AF)	**$ 1,900**	**$ 2,100**	**$ 2,500**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 19: DPR - Hyperion WRP to Headworks Reservoir

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	72"	154,700	$ 2,304	$ 356,429,000	$ 712,858,000	$ 3,564,290	
Subtotal for Pipelines				*$ 356,429,000*	*$ 712,858,000*	*$ 3,564,290*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (> 10 MG)	10.60268907	MG	$ 1.50	$ 15,904,000	$ 31,808,000	$ 159,040	
Equalization Basin (> 10 MG)	26.50672268	MG	$ 1.00	$ 26,507,000	$ 53,014,000	$ 265,070	
Subtotal for Tanks and Equalization Basins				*$ 42,411,000*	*$ 84,822,000*	*$ 424,110*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	18,300	hp	$ 2,000	$ 36,600,000	$ 73,200,000	$ 732,000	$ 11,522,000
PS (>1,000 hp)	19,700	hp	$ 2,000	$ 39,400,000	$ 78,800,000	$ 788,000	$ 12,388,000
Subtotal for Pump Stations				*$ 76,000,000*	*$ 152,000,000*	*$ 1,520,000*	*$ 23,910,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for DPR)	85	mgd	$ 8,000,000	$ 678,572,101	$ 1,357,144,000	$ 27,142,884	$ 12,483,000
MBR	85	mgd	$ 5,000,000	$ 424,107,563	$ 848,215,000	$ 16,964,303	$ 8,437,000
Subtotal for Other Project Components				*$ 1,102,679,663*	*$ 2,205,359,000*	*$ 44,107,187*	*$ 20,920,000*
TOTAL				**$ 1,577,519,663**	**$ 3,155,039,000**	**$ 49,615,587**	**$ 44,830,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 2,839,500,000	$ 3,155,000,000	$ 3,786,000,000
Amortized Capital ($/year)	$ 116,500,000	$ 129,400,000	$ 155,300,000
Annual O&M ($/year)	$ 44,600,000	$ 49,600,000	$ 59,500,000
Annual Energy ($/year)	$ 40,300,000	$ 44,800,000	$ 53,800,000
Total Annual Cost ($/year)	$ 201,500,000	$ 223,900,000	$ 268,700,000
Yield (afy)	95,000	95,000	95,000
Energy Required (kWh/AF)	3,500	3,900	4,700
Unit Cost ($/AF)	**$ 2,200**	**$ 2,400**	**$ 2,900**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 20: DPR - Hyperion WRP to LA Aqueduct Filtration Plant

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	72"	200,800	$ 2,304	$ 462,643,000	$ 925,286,000	$ 4,626,430	
Subtotal for Pipelines				*$ 462,643,000*	*$ 925,286,000*	*$ 4,626,430*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Equalization Basin (>10 MG)	26.50672268	MG	$ 1.00	$ 26,507,000	$ 53,014,000	$ 265,070	
Storage (>10 MG)	85	MG	$ 1.50	$ 127,232,000	$ 254,464,000	$ 1,272,320	
Subtotal for Tanks and Equalization Basins				*$ 153,739,000*	*$ 307,478,000*	*$ 1,537,390*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	14,300	hp	$ 2,000	$ 28,600,000	$ 57,200,000	$ 572,000	$ 8,978,000
PS (>1,000 hp)	23,400	hp	$ 2,000	$ 46,800,000	$ 93,600,000	$ 936,000	$ 14,717,000
Subtotal for Pump Stations				*$ 75,400,000*	*$ 150,800,000*	*$ 1,508,000*	*$ 23,695,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for DPR)	85	mgd	$ 8,000,000	$ 678,572,101	$ 1,357,144,000	$ 27,142,884	$ 12,483,000
MBR	85	mgd	$ 5,000,000	$ 424,107,563	$ 848,215,000	$ 16,964,303	$ 8,437,000
LAAFP Treatment	85	mgd		$ -	$ -	$ 6,998,807	$ 149,000
Subtotal for Other Project Components				*$ 1,102,679,663*	*$ 2,205,359,000*	*$ 51,105,994*	*$ 21,069,000*
TOTAL				**$ 1,794,461,663**	**$ 3,588,923,000**	**$ 58,777,814**	**$ 44,764,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 3,230,000,000	$ 3,588,900,000	$ 4,306,700,000
Amortized Capital ($/year)	$ 128,900,000	$ 143,200,000	$ 171,800,000
Annual O&M ($/year)	$ 52,900,000	$ 58,800,000	$ 70,600,000
Annual Energy ($/year)	$ 40,300,000	$ 44,800,000	$ 53,800,000
Total Annual Cost ($/year)	$ 222,100,000	$ 246,800,000	$ 296,200,000
Yield (afy)	95,000	95,000	95,000
Energy Required (kWh/AF)	3,500	3,900	4,700
Unit Cost ($/AF)	**$ 2,300**	**$ 2,600**	**$ 3,100**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 21: DPR - Central LA Satellite WRP to LA Aqueduct Filtration Plant

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	72"	121,440	$ 2,304	$ 279,798,000	$ 559,596,000	$ 2,797,980	
Subtotal for Pipelines				*$ 279,798,000*	*$ 559,596,000*	*$ 2,797,980*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Equalization Basin (>10 MG)	26.50672268	MG	$ 1.00	$ 26,507,000	$ 53,014,000	$ 265,070	
Storage (>10 MG)	85	MG	$ 1.50	$ 127,232,000	$ 254,464,000	$ 1,272,320	
Subtotal for Tanks and Equalization Basins				*$ 153,739,000*	*$ 307,478,000*	*$ 1,537,390*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	11,500	hp	$ 2,000	$ 23,000,000	$ 46,000,000	$ 460,000	$ 7,232,000
PS (>1,000 hp)	18,900	hp	$ 2,000	$ 37,800,000	$ 75,600,000	$ 756,000	$ 11,914,000
Subtotal for Pump Stations				*$ 60,800,000*	*$ 121,600,000*	*$ 1,216,000*	*$ 19,146,000*
Sewer Lift Stations							
	Quantity	**Unit**	**$/unit**				
Lift Station	110	mgd	$ 750,000	$ 82,700,975	$ 165,402,000	$ 2,481,029	$ 629,000
Subtotal for Pump Stations				*$ 82,700,975*	*$ 165,402,000*	*$ 2,481,029*	*$ 629,000*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
AWPF (for DPR)	85	mgd	$ 8,000,000	$ 678,572,101	$ 1,357,144,000	$ 27,142,884	$ 12,483,000
Satellite Wastewater Treatment Plant	85	mgd	$ 15,000,000	$ 1,272,322,689	$ 2,544,645,000	$ 38,169,681	$ 8,437,000
LAAFP Treatment	85	mgd		$ -	$ -	$ 6,998,807	$ 149,000
Subtotal for Other Project Components				*$ 1,950,894,789*	*$ 3,901,789,000*	*$ 72,311,372*	*$ 21,069,000*
TOTAL				**$ 2,527,932,764**	**$ 5,055,865,000**	**$ 80,343,771**	**$ 40,844,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 4,550,300,000	$ 5,055,900,000	$ 6,067,100,000
Amortized Capital ($/year)	$ 185,700,000	$ 206,300,000	$ 247,600,000
Annual O&M ($/year)	$ 72,300,000	$ 80,300,000	$ 96,400,000
Annual Energy ($/year)	$ 36,700,000	$ 40,800,000	$ 49,000,000
Total Annual Cost ($/year)	$ 294,700,000	$ 327,400,000	$ 392,900,000
Yield (afy)	95,000	95,000	95,000
Energy Required (kWh/AF)	3,200	3,600	4,300
Unit Cost ($/AF)	**$ 3,100**	**$ 3,400**	**$ 4,100**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 22: East-West Valley Interceptor Sewer

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost(1) ($/Year)
GRAVITY SEWER & FORCE MAINS							
Subtotal for Gravity & Force Mains				*$ 31,296,705*	*$ 47,739,743*	*$ 625,934.09*	*$ -*
Lift Station							
Subtotal for Lift Stations				*$ 24,426,677*	*$ 37,260,257*	*$ 732,800.30*	*$ 637,000*
TOTAL				**$ 55,723,381**	**$ 85,000,000**	**$ 1,358,734**	**$ 637,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 76,500,000	$ 85,000,000	$ 102,000,000
Amortized Capital ($/year)	$ 3,200,000	$ 3,500,000	$ 4,200,000
Annual O&M ($/year)	$ 1,300,000	$ 1,400,000	$ 1,700,000
Annual Energy ($/year)	$ 573,300	$ 637,000	$ 764,400
Total Annual Cost ($/year)	$ 5,000,000	$ 5,500,000	$ 6,600,000
Yield (afy)	12,800	12,800	12,800
Energy Required (kWh/AF)	380	420	500
Unit Cost ($/AF)	**$ 390**	**$ 430**	**$ 520**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 23: Increase Recycled Water demand beyond 2015 UWMP

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	6"	321,113	$ 150	$ 48,167,000	$ 96,334,000	$ 481,670	
Pipeline	8"	113,953	$ 196	$ 22,335,000	$ 44,670,000	$ 223,350	
Pipeline	10"	18,531	$ 240	$ 4,447,000	$ 8,894,000	$ 44,470	
Pipeline	12"	142,743	$ 282	$ 40,254,000	$ 80,508,000	$ 402,540	
Pipeline	16"	133,473	$ 368	$ 49,118,000	$ 98,236,000	$ 491,180	
Pipeline	20"	57,154	$ 450	$ 25,719,000	$ 51,438,000	$ 257,190	
Pipeline	24"	29,350	$ 528	$ 15,497,000	$ 30,994,000	$ 154,970	
Subtotal for Pipelines				*$ 205,537,000*	*$ 411,074,000*	*$ 2,055,370*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (6 to 10 MG)	7.05	MG	$ 1.75	$ 12,338,000	$ 24,676,000	$ 123,380	
Subtotal for Tanks and Equalization Basins				*$ 12,338,000*	*$ 24,676,000*	*$ 123,380*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (100 to 500 hp)	110	hp	$ 3,000	$ 330,000	$ 660,000	$ 6,600	$ 58,000
PS (800 to 1,000 hp)	820	hp	$ 2,500	$ 2,050,000	$ 4,100,000	$ 41,000	$ 383,000
PS (> 1,000 hp)	1,200	hp	$ 2,000	$ 2,400,000	$ 4,800,000	$ 48,000	$ 701,000
Subtotal for Pump Stations				*$ 4,780,000*	*$ 9,560,000*	*$ 95,600*	*$ 1,142,000*
Pressure Reducing Stations							
	Quantity	**Unit**	**$/unit**				
Large (3-4 valves 12" and up)	2	each	$ 350,000	$ 700,000	$ 1,400,000	$ 7,000	
Subtotal for Pressure Reducing Stations				*$ 700,000*	*$ 1,400,000*	*$ 7,000*	*$ -*
Other Project Components							
	Quantity	**Unit**	**$/unit**				
Purchase from WBMWD	645	afy	$ 728	$ -	$ -	$ 469,560	$ -
Purchase from CBMWD	3831	afy	$ 500		$ -	$ 1,915,500	$ -
Purchase from LVMWD	954	afy	$ 500		$ -	$ 477,000	$ -
Satellite WRPs	8	mgd	$ 15,000,000	$ 117,900,000	$ 235,800,000	$ 3,537,000	$ 176,000
Subtotal for Other Project Components				*$ 117,900,000*	*$ 235,800,000*	*$ 6,399,060*	*$ 176,000*
TOTAL				**$ 341,255,000**	**$ 682,510,000**	**$ 8,680,410**	**$ 1,318,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 614,300,000	$ 682,500,000	$ 819,000,000
Amortized Capital ($/year)	$ 22,400,000	$ 24,900,000	$ 29,900,000
Annual O&M ($/year)	$ 7,800,000	$ 8,700,000	$ 10,400,000
Annual Energy ($/year)	$ 1,200,000	$ 1,300,000	$ 1,600,000
Total Annual Cost ($/year)	$ 31,400,000	$ 34,900,000	$ 41,900,000
Yield (afy)	16,700	16,700	16,700
Energy Required (kWh/AF)	600	700	800
Unit Cost ($/AF)	**$ 1,900**	**$ 2,100**	**$ 2,500**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 24: Rancho Park Water Reclamation Facility

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	20"	66,000	$ 450	$ 29,700,000	$ 51,233,000	$ 297,000	
Subtotal for Pipelines				*$ 29,700,000*	*$ 51,233,000*	*$ 297,000*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (1 to 5 MG)	2	MG	$ 2.00	$ 4,000,000	$ 6,900,000	$ 40,000	
Subtotal for Tanks and Equalization Basins				*$ 4,000,000*	*$ 6,900,000*	*$ 40,000*	*$ -*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
Stormwater Treatment System	1	each		$ -	$ 38,530,000	$ 138,000	$ 50,000
Satellite WRF System	1	each		$ -	$ 60,700,000	$ 910,000	$ 820,000
Satellite WRF Expansion	1	each		$ -	$ 21,540,000	$ 730,000	$ 390,000
Subtotal for Other Project Components				*$ -*	*$ 120,770,000*	*$ 1,778,000*	*$ 1,260,000*
TOTAL					**$ 178,903,000**	**$ 2,115,000**	**$ 1,260,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 161,000,000	$ 178,900,000	$ 214,700,000
Amortized Capital ($/year)	$ 6,600,000	$ 7,300,000	$ 8,800,000
Annual O&M ($/year)	$ 1,900,000	$ 2,100,000	$ 2,500,000
Annual Energy ($/year)	$ 1,200,000	$ 1,300,000	$ 1,600,000
Total Annual Cost ($/year)	$ 9,600,000	$ 10,700,000	$ 12,800,000
Yield (afy)	3,600	3,600	3,600
Energy Required (kWh/AF)	2,600	2,900	3,500
Unit Cost ($/AF)	**$ 2,600**	**$ 2,900**	**$ 3,500**

Note: The estimated capital cost for all three phases is approximately $180 million for an estimated yield of 3,600 AFY which is used in the future integration opportunity discussion because the ultimate build-out capacity is provided for all future concepts; the estimated capital cost for the first phase of the facility is $58 million for an estimated yield of 1,860 AFY. The costs for the first phase of the facility do not include the required LADWP recycled water distribution piping.

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 25: Ocean Desalination

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($)	Energy Cost ($)
Potable and Recycled Water Pipelines							
Pipeline	48"	26,900	$ 1,440	$ 38,736,000	$ 77,472,000	$ 775,000	
Subtotal for Pipelines				*$ 38,736,000*	*$ 77,472,000*	*$ 775,000*	*$ -*
Tanks and Equalization Basins							
	Quantity (MG)	**Unit**	**$/unit**				
Storage (6 to 10 MG)	3.125	MG	$ 1.75	$ 5,469,000	$ 10,938,000	$ 109,000	
Subtotal for Tanks and Equalization Basins				*$ 5,469,000*	*$ 10,938,000*	*$ 109,000*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (>1,000 hp)	3,100	hp	$ 2,000	$ 6,200,000	$ 12,400,000	$ 248,000	$ 1,915,000
Subtotal for Pump Stations				*$ 6,200,000*	*$ 12,400,000*	*$ 248,000*	*$ 1,915,000*
Brine Lines (Using Gravity Sewer Pricing)							
Gravity Sewer	20"	5,800	$ 460	$ 2,668,000	$ 5,336,000	$ 107,000	
Subtotal for Brine Lines				*$ 2,668,000*	*$ 5,336,000*	*$ 107,000*	*$ -*
OTHER PROJECT COMPONENTS							
	Quantity	**Unit**	**$/unit**				
Ocean Desalination (Plant and subsurface intake)	25	mgd	$ 12,000,000	$ 300,000,000	$ 600,000,000	$ 12,000,000	$ 13,440,000
Subtotal for Other Project Components				*$ 300,000,000*	*$ 600,000,000*	*$ 12,000,000*	*$ 13,440,000*
TOTAL				**$ 353,073,000**	**$ 706,146,000**	**$ 13,239,000**	**$ 15,355,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 635,500,000	$ 706,100,000	$ 847,300,000
Amortized Capital ($/year)	$ 27,200,000	$ 30,200,000	$ 36,200,000
Annual O&M ($/year)	$ 11,900,000	$ 13,200,000	$ 15,800,000
Annual Energy ($/year)	$ 13,900,000	$ 15,400,000	$ 18,500,000
Total Annual Cost ($/year)	$ 52,900,000	$ 58,800,000	$ 70,600,000
Yield (afy)	28,000	28,000	28,000
Energy Required (kWh/AF)	4,100	4,600	5,500
Unit Cost ($/AF)	**$ 1,900**	**$ 2,100**	**$ 2,500**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

Concept 26: Japanese Garden and Sepulveda Basin Lakes Recirculation

Facility Type	Diam. (in)	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost ($)	Operations and Maintenance Cost ($/Year)	Energy Cost[1] ($/Year)
Potable and Recycled Water Pipelines							
Pipeline	16"	7,700	$ 368	$ 2,834,000	$ 5,668,000	$ 28,340	
Pipeline	30"	6,900	$ 690	$ 4,761,000	$ 9,522,000	$ 47,610	
Subtotal for Pipelines				*$ 7,595,000*	*$ 15,190,002*	*$ 75,950*	*$ -*
Water and Recycled Water Pump Stations							
	Quantity	**Unit**	**$/unit**				
PS (100 to 500 hp)	250	hp	$ 3,000	$ 750,000	$ 1,500,000	$ 15,000	$ 189,000
PS (<100 hp)	60	hp	$ 5,000	$ 300,000	$ 600,000	$ 6,000	$ 42,000
PS (100 to 500 hp)	200	hp	$ 3,000	$ 600,000	$ 1,200,000	$ 12,000	$ 134,000
Subtotal for Pump Stations				*$ 1,650,000*	*$ 3,300,000*	*$ 33,000*	*$ 365,000*
TOTAL				**$ 9,245,000**	**$ 18,490,002**	**$ 108,950**	**$ 365,000**

Summary

	Low Estimate (-10%)	Calculated Estimate	High Estimate (+20%)
Capital Cost ($)	$ 16,700,000	$ 18,500,000	$ 22,200,000
Amortized Capital ($/year)	$ 700,000	$ 800,000	$ 1,000,000
Annual O&M ($/year)	$ 100,000	$ 110,000	$ 130,000
Annual Energy ($/year)	$ 328,500	$ 365,000	$ 438,000
Total Annual Cost ($/year)	$ 1,200,000	$ 1,300,000	$ 1,600,000
Yield (afy)	20,000	20,000	20,000
Energy Required (kWh/AF)	140	150	180
Unit Cost ($/AF)	**$ 50**	**$ 60**	**$ 70**

Disclaimer: All project concept element locations and alignments are assumed for cost estimating purposes only.
Further studies at later planning stages are required to determine actual element locations, sizing, and costs.

First Draft:	6/30/2017
Final Draft:	9/1/2017
Final:	3/30/2018
Lead Author:	Inge Wiersema, Jacquelin Reed, and Matthew Huang

CITY OF LOS ANGELES

TECHNICAL MEMORANDUM NO. 5.3
PORTFOLIO DEVELOPMENT AND EVALUATION

FINAL
March 2018

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CITY OF LOS ANGELES

**TECHNICAL MEMORANDUM
NO. 5.3
PORTFOLIO DEVELOPMENT AND EVALUATION**

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LIST OF ABBREVIATIONS

Abbreviation	Description
$/AF	dollars per acre-foot
$M	millions of dollars
AF	acre-feet
AFY	acre-feet per year
AWPF	Advanced Water Purification Facility
BMPs	Best Management Practices
CIP	Capital Improvement Plan
City	City of Los Angeles
CRA	Colorado River Aqueduct
DCTWRP	Donald C. Tillman Water Reclamation Plant
DPR	direct potable reuse
EWMP	Enhanced Watershed Management Program
FY	fiscal year
GPA	grade point average
HWRP	Hyperion Water Reclamation Plant
IPR	indirect potable reuse
kWh/AF	kilowatts hour per acre-foot
kWh/year	kilowatts per year
LAA	Los Angeles Aqueduct
LAAFP	Los Angeles Aqueduct Filtration Plant
LADWP	Los Angeles Department of Water and Power
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LAX	Los Angeles International Airport
MBT	Mall Balance Tool
MWD	Metropolitan Water District of Southern California
mgd	million gallons per day
MS4	Municipal Separate Storm Sewer System
N/A	not applicable
NPR	non-potable reuse
O&M	operations and maintenance
pLAn	Sustainable City pLAn
Prop O	Proposition O
SCMP	Stormwater Capture Master Plan
SIP	Stormwater Improvement Program
SWP	State Water Project
TIWRP	Terminal Island Water Reclamation Plant
TM	Technical Memorandum
UWMP	Urban Water Management Plan
Water IRP	2006 Water Integrated Water Resources Plan
WBMWD	West Basin Municipal Water District
WRP	water reclamation plant

PORTFOLIO DEVELOPMENT AND EVALUATION

1.0 INTRODUCTION

1.1 Summary of One Water LA

The City of Los Angeles (City) recently embarked on the One Water LA 2040 Plan. This plan will provide a strategic vision and a collaborative approach for integrated water management. In 2006, the City completed and adopted its first Water Integrated Resources Plan (Water IRP). This plan was the start of a paradigm shift for the City and resulted in significant achievements. Since then, the water landscape in the City has changed with increased demands, new regulations, and threats of climate change.

In response to these changes and to help achieve water sustainability, the City initiated the One Water LA 2040 Plan. This plan builds upon the success of the Water IRP, which had a planning horizon to year 2020. The One Water LA 2040 Plan takes a holistic and collaborative approach, to consider all water resources from surface water, groundwater, potable water, wastewater, recycled water, dry-weather runoff, and stormwater as "One Water." The plan identifies multi-departmental and multi-agency integration opportunities to manage water in a more efficient, cost effective, and sustainable manner.

The One Water LA 2040 Plan represents the City's continued and improved commitment to proactively manage all its water resources and implement innovative solutions, driven by the Sustainable City pLAn. The plan will help guide strategic decisions for integrated water projects, programs, and policies within the City.

1.2 Purpose of Task 5

The purpose of Task 5 is to identify a future strategy to 1) support achievement of the Sustainable City pLAn goals relative to water quality and water supply, 2) support the seven key objectives and thirty-eight guiding principles, and 3) recommend multi-benefit projects to implement to 2040 and beyond. Furthermore, this work complements other key City planning documents (i.e., Urban Water Management Plan [UWMP], Stormwater Capture Master Plan [SCMP], Recycled Water Master Planning documents, and Enhanced Watershed Management Program [EWMP]).

Results of Task 5 will provide a prioritized list of future concepts and a recommended preferred portfolio, which complements other key City planning documents, collectively achieving the Sustainable City pLAn goals and highlighting strategic projects through 2040 and beyond.

Task 5 deliverables include the following: Basis of Planning Technical Memorandum (TM) 5.1, Project Development TM 5.2, and Portfolio Development and Evaluation TM 5.3, with TM 5.3 forming the basis of this deliverable.

1.3 Objectives of TM No. 5.3

The portfolio development and evaluation described in this TM builds upon the information presented in TM 5.2 Project Development, where in-progress projects and programs, planned stormwater management as well as future concept options were documented. The purpose of this TM is to provide a description of the portfolio evaluation process and the evaluation of five Portfolios which were used to analyze a variety of extreme scenarios. The portfolio evaluation results were subsequently reviewed and the analysis was used to better define the preferred portfolio, which is a combination of the evaluated concept options. The objective of the portfolio evaluation is to develop a preferred future integration strategy that achieves stormwater compliance targets, which includes meeting water quality levels, and supports water supply goals in the most cost-effective and beneficial manner. The combination of future concept options will be utilized to develop the core of the future integration strategy and the One Water LA 2040 Plan Implementation Strategy.

Disclaimer: It should be noted that the information presented in this TM represents interim work products and may therefore include minor discrepancies with the information presented in the Summary Report (Volume 1). The information presented in Volume 1 supersedes information presented in this TM.

2.0 EXISTING WATER MANAGEMENT STRATEGIES

The City uses multiple water supply sources, programs, and practices to meet the City's environmental water quality requirements, water demands, drinking water quality standards, and wastewater discharge limits. In fiscal years (FY) 2011-2015, the City has imported approximately 86 percent of its entire water supply from hundreds of miles away. This includes imported water via the city-owned Los Angeles Aqueduct (LAA), as well as imported water purchased from the Metropolitan Water District of Southern California (MWD). Imported water purchased from MWD comes from two sources: 1) water from the Sierra Nevada Mountains in Northern California that is conveyed via the State Water Project (SWP), and 2) water from the Colorado River that is conveyed via the Colorado River Aqueduct (CRA). The remaining 14 percent of the City's water supply comes from local groundwater and recycled water. The average supply sources in FY 2011-2015 is shown on Figure 1.

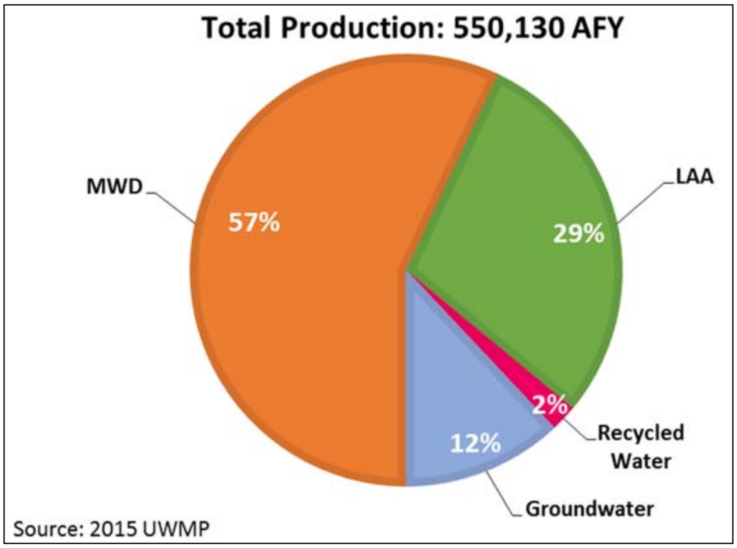
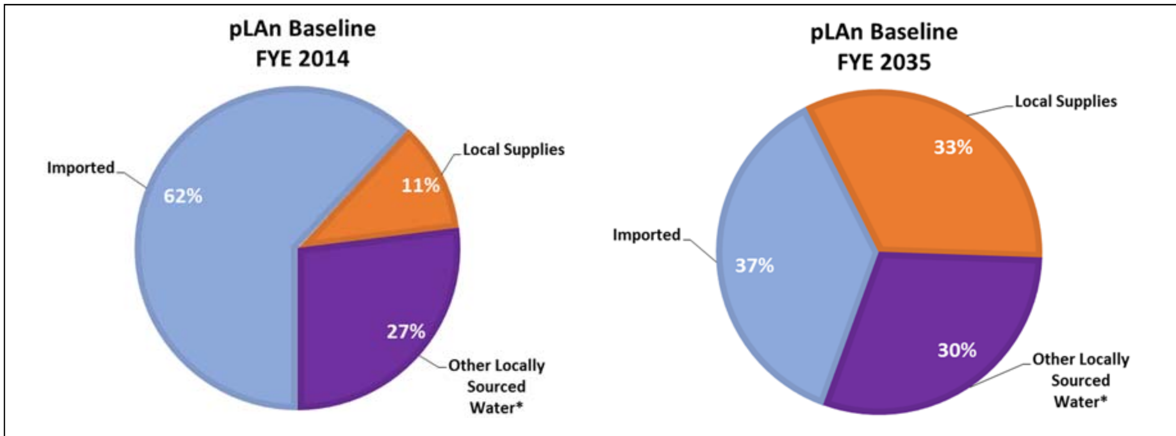


Figure 1 Average Water Supply Mix FY 2011-2015

The distribution of the existing supply sources is projected to change significantly over the next two decades. As presented in the 2015 UWMP, the City is anticipating that the contribution of imported supplies (LAA deliveries and MWD water purchases) will decrease from 62 percent in 2014 to 37 percent by 2035. As shown on Figure 2, 2015 UWMP provides a strategy for the City to meet the Sustainable City pLAn goal to increase local supplies from 38 percent in 2014 to 63 percent by 2035. It should be noted that this supply strategy reflects normal year conditions and includes historical conservation.



*Other Locally Sourced Water consists of Historical Conservation, Stormwater Capture, Beneficial Reuse/Other
Source: 2015 UWMP

Figure 2 Projected Water Supply Mix for Year 2035

The Benchmark Portfolio used in this analysis includes the supply mix changes as presented in the 2015 UWMP and some other in-progress and planned projects presented in Section 6.1.1.2. The purpose of the portfolio evaluation presented in this TM is to identify the most beneficial mix of concept options that could supplement the City's local water supplies to further offset purchased imported water supplies, specifically during dry year conditions to 2040 and beyond.

3.0 FUTURE INTEGRATION STRATEGIES

One Water LA's future integration strategies consist of a mix of projects and programs that support the One Water LA objectives, the Sustainable City pLAn goals, and the supply strategy defined in the 2015 UWMP. As described in detail in TM 5.2, 25 concept options were developed. These concept options can be grouped into the eight categories illustrated on Figure 3.

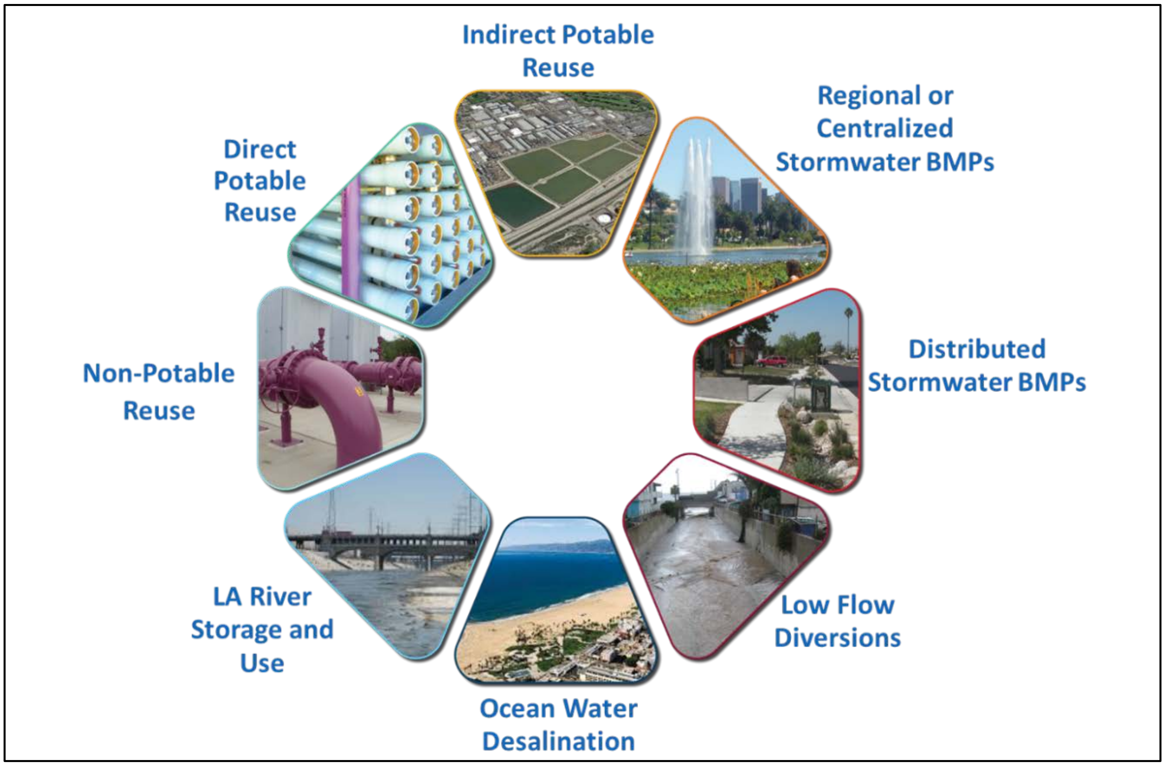


Figure 3 Future Integration Strategy Categories

As part of the future integration strategy development, the concept options were developed, evaluated, scored, and ranked as documented in TM 5.2 (Project Development). The concepts include a wide variety of stormwater, groundwater, potable reuse, and other local water management strategies. The most promising ideas are combined as recommended future integration strategies to maximize recycled water use, contribute to supply resiliency, and provide multiple water quality benefits. The combination of selected ideas will be integrated in the dynamic trigger-based One Water LA Implementation Strategy.

4.0 PORTFOLIO DEVELOPMENT

The scoring results presented in TM 5.2 (Project Development) were used to select which concept options moved forward into the portfolio evaluation through inclusion in one or more themed portfolios. A total of five portfolios were developed, including one benchmark portfolio and four themed portfolios. The benchmark portfolio represents existing supply sources along with the implementation of the In-Progress Projects & Programs and the

Planned Stormwater Management Projects. The remaining four portfolios were arranged around themes that emphasize planning strategies, such as maximizing environmental benefits, maximizing collaboration, minimizing cost or maximizing local water supplies. The themed portfolios were developed and analyzed to assess the sensitivity of extremes.

4.1 Portfolio Analysis Methodology

The Portfolio Analysis Methodology can be broken down into the following four steps as shown on Figure 4.

1. **Portfolio Definition –** A total of five portfolios were defined with input from City staff to conduct a comparison of extremes. As shown on Figure 4, the five portfolios include one benchmark portfolio and four themed portfolios. Each portfolio includes a different combination and number of concept options, which was based on the benefit score rankings described in TM 5.2. The concept options with the highest rankings in certain criteria were combined and used to develop four themed portfolios.
2. **Portfolio Evaluation –** The themed portfolios were then evaluated using a combination of analysis metrics. These metrics include but are not limited to environmental benefits, support of Sustainable City pLAn goals, cost, yield, and flow balance. The metrics are described in detail in Section 5.0. The Mass Balance Tool (MBT) was used to perform the portfolio analysis under normal, wet, and dry year conditions in the year 2040. Note, the wet year evaluation is provided in Appendix B.
3. **Develop Preferred Portfolio –** Results of the portfolio evaluation step were used to develop the recommended preferred portfolio. The recommended preferred portfolio then becomes an input to the One Water LA Implementation Strategy. The recommended preferred portfolio is a list of recommended future integration strategies and specific concept options that could be implemented in the future.
4. **Implementation Strategy –** A dynamic trigger-based implementation strategy allows concept options to be implemented only if and when needed. Some concept options in the recommended preferred portfolio are dependent on certain triggers occurring. A trigger is defined as an internal or external force that causes (an event or situation) to happen or exist (Oxford English Dictionary, 2017). The dynamic trigger-based implementation strategy is further documented in the One Water LA Implementation Strategy (TM 10).

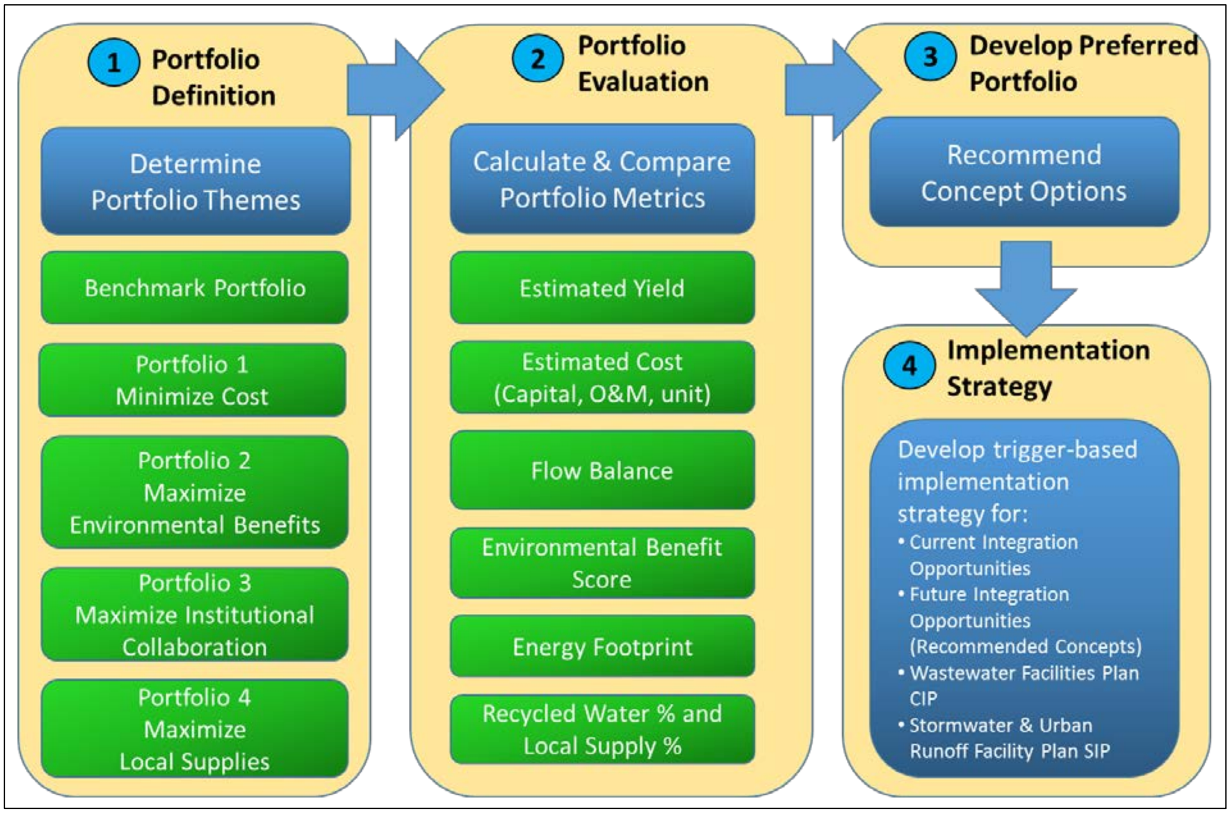


Figure 4 Portfolio Analysis Methodology

4.2 Portfolio Definition

A total of five portfolios were developed to conduct a sensitivity analysis when choosing concept options around a specific benefit.

The five portfolios are:

- Benchmark Portfolio
- Portfolio 1 - Minimize Cost
- Portfolio 2 - Maximize Environmental Benefits
- Portfolio 3 - Maximize Institutional Collaboration
- Portfolio 4 - Maximize Local Supplies

Portfolio themes were established as a result of key questions asked by City staff and stakeholders. The following key questions are illustrated on Figure 5, while the definitions of each Portfolio are summarized in Table 1.

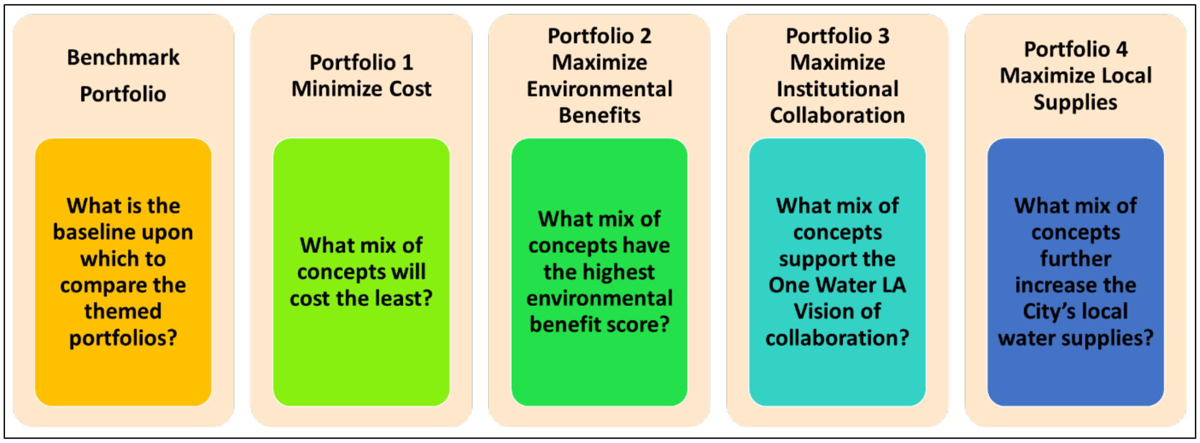


Figure 5 Establishing Portfolio Themes

Table 1 Portfolio Definitions
One Water LA 2040 Plan – TM 5.3

Portfolio Title	Portfolio Definition
Benchmark Portfolio	Scenario to simulate no further action or implementation of the future concept options presented in TM 5.2. The Benchmark Portfolio includes: • Existing supply sources • In-Progress Projects & Programs • Planned Stormwater Management Projects Note: Planned stormwater management projects include all projects in the Stormwater & Urban Runoff Facilities Plan required to meet Municipal Separate Storm Sewer System (MS4) Permit Compliance.
Portfolio 1 - Minimize Cost	Scenario to simulate the tradeoff if only the most cost-effective concept options are implemented. A threshold of $2,000 per acre-foot (AF) was used for concept options with new supply benefits (excluding flow management concepts).
Portfolio 2 - Maximize Environmental Benefits	Scenario to simulate the tradeoff if all of the concept options with the most environmental benefits were implemented. All concept options with a combined environmental benefit score of about 12 or more (out of 20) were included in this portfolio.
Portfolio 3 - Maximize Institutional Collaboration	Scenario to simulate the tradeoff if the most collaborative concept options were implemented, increasing coordination (and potentially cost savings) between City departments, partners, stakeholders and outside agencies. All concept options with an institutional collaboration score of 3.0 or greater (out of 5) were included in this portfolio.
Portfolio 4 - Maximize Local Supplies	Scenario to simulate the tradeoff if only concept options that maximize local supply were implemented, increasing local water supplies, and reducing dependence on purchased imported water supplies. The most cost-effective local supply concept options were included from each supply source to avoid double counting of supplies.

The purpose of the portfolio evaluation is to analyze trade-offs when implementing concept options that are selected based on the identified themes. In other words, it provides a sensitivity analysis of extremes. The portfolios are therefore not intended to be an alternative that should be implemented as a group of projects without further consideration. Instead, the results of the portfolio evaluation were used to develop a more balanced approach that accomplishes multiple goals by grouping the most beneficial concept options of each portfolio in a recommended preferred portfolio. The results of the portfolio sensitivity analysis exercise were used to develop the recommended preferred portfolio as illustrated on Figure 6.

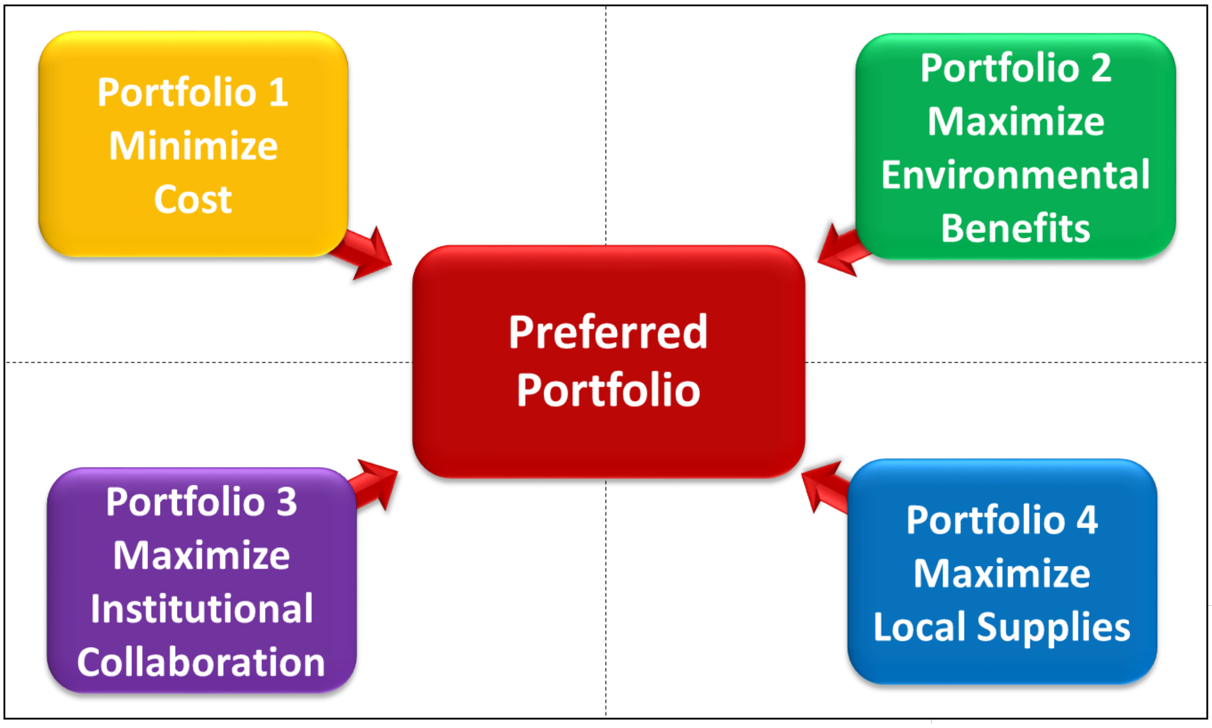


Figure 6 Portfolio Sensitivity Analysis Process

4.3 Portfolio Summary

The majority of concept options documented in TM 5.2 were utilized in the portfolio analysis through inclusion in one or more themed portfolios. The concept options that make-up each portfolio are illustrated on Figure 7 and are summarized in Table 2.

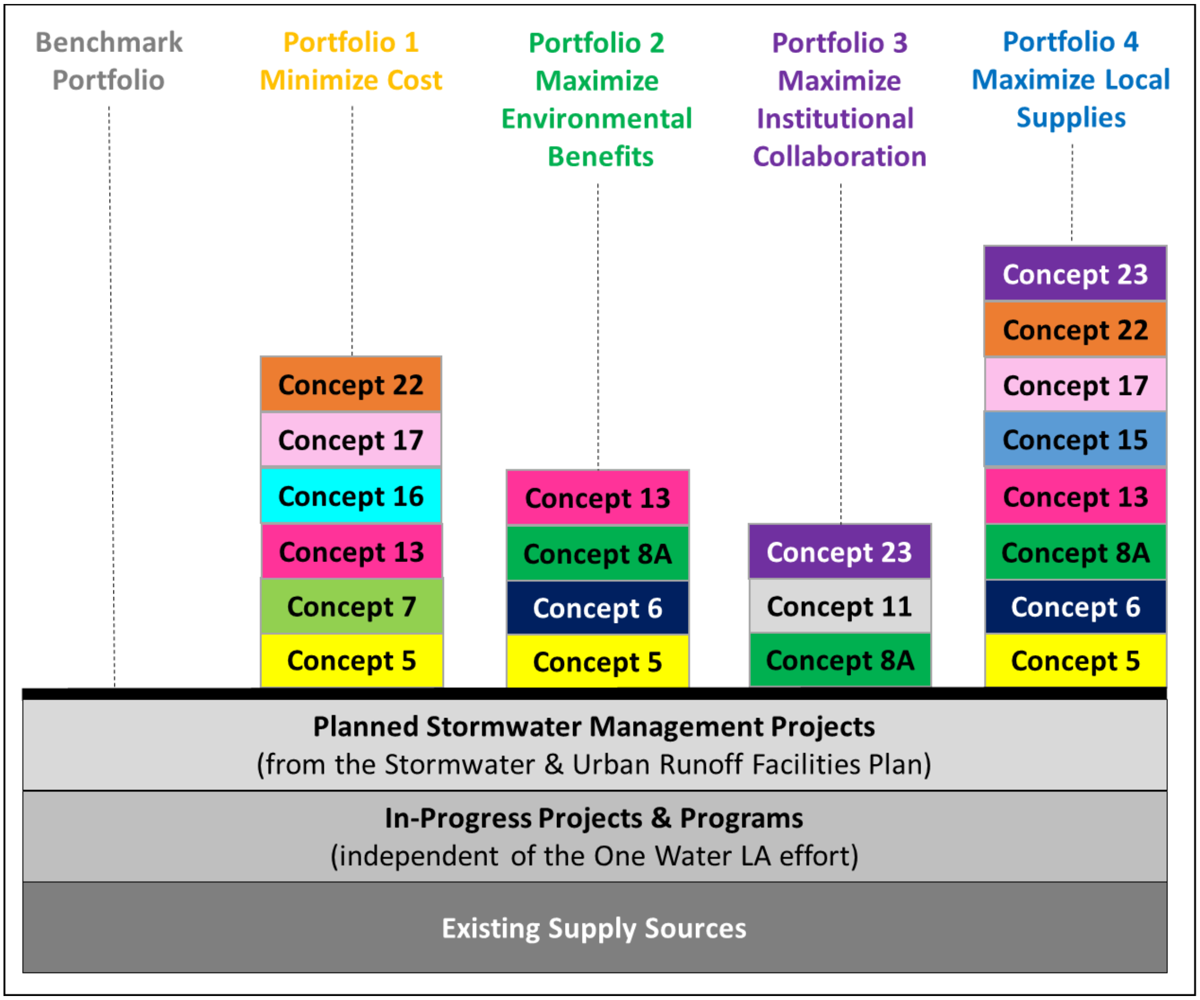


Figure 7 Portfolio Summary

As shown on Figure 7, the selection and number of concept options included in each of the portfolios varies substantially. Concept options 1 through 4 (Green Streets of the City's four watersheds) are included in all portfolios because the Green Street program is part of the recommended Stormwater Improvement Program (SIP) as presented in the Stormwater and Urban Runoff Facilities Plan (Volume 3). The Benchmark Portfolio does not include any other concept options.

Table 2 Portfolio Summary
One Water LA 2040 Plan – TM 5.3

#	Concept Option Name	Benchmark Portfolio	Portfolio 1 Minimize Cost	Portfolio 2 Max. Env. Benefits	Portfolio 3 Max. Inst. Collaboration	Portfolio 4 Max. Local Supplies
1	Green Streets – Upper Los Angeles River Watershed	X	X	X	X	X
2	Green Streets – Ballona Creek Watershed	X	X	X	X	X
3	Green Streets – Dominguez Channel Watershed	X	X	X	X	X
4	Green Streets - Santa Monica Bay/Marina Del Rey Watersheds	X	X	X	X	X
5	Dry Weather Low Flow Diversions		X	X		X
6	Wet Weather High Flow Diversions			X		X
7	Upper LA River to DCTWRP		X			
8A	LA River Recharge into LA Forebay			X	X	X
9	DCTWRP to San Fernando Basin Injection Wells					
10	HWRP to West Coast Basin Injection Wells					
11	HWRP to Central Basin Injection Wells				X	
13	IPR - MBR at HWRP to Regional System		X	X		X
14	HWRP to San Fernando Basin Injection Wells					
15	DCTWRP to Los Angeles Aqueduct Filtration Plant					X
16	DCTWRP to LADWP Distribution System		X			
17	LAGWRP to Headworks Reservoir		X			X
18	HWRP to LADWP Distribution System					
19	HWRP to Headworks Reservoir					
20	HWRP to Los Angeles Aqueduct Filtration Plant					
21	Central LA Satellite WRP to LAAFP					
22	East-West Valley Interceptor Sewer		X			X
23	Increase Recycled Water Demand beyond 2015 UWMP				X	X
25	Ocean Desalination					

Note:
(1) Descriptions of the concept options can be found in TM 5.2.

Abbreviations:
DCTWRP = Donald C. Tillman Water Reclamation Plant; HWRP = Hyperion Water Reclamation Plant; WRP = water reclamation plant
LAGWRP = Los Angeles-Glendale Water Reclamation Plant; LADWP = Los Angeles Department of Water and Power;
LAAFP = Los Angeles Aqueduct Filtration Plant

As shown in Table 2, some concept options are utilized in multiple portfolios, while other concept options are not included in any of the four portfolios. It must be noted that some of these concept options remain viable alternatives to the selected concept options.

Two of the concept options described in TM 5.2 are eliminated from Table 2 for the reasons provided below:

- Concept option 12 - indirect potable reuse (IPR) from Hyperion via spreading basins in the Central Basin. This option was eliminated in a fatal flaw analysis due to insufficient open space to construct new spreading basins.
- Concept option 24 - Rancho Park Water Reclamation Facility. This option was excluded as it is already categorized as a near-term integration opportunity.

A detailed evaluation of each Portfolio is provided in Section 6.0, while the evaluation metrics are first described in Section 5.0.

5.0 PORTFOLIO EVALUATION METRICS

To compare the results of the portfolio evaluation, a variety of metrics were defined that capture the wide range of factors to be considered for developing a balanced future implementation strategy. The evaluation metrics are summarized in Table 3.

Table 3 Evaluation Metrics Summary
One Water LA 2040 Plan – TM 5.3

Category	Metrics
Estimated Yield	• Estimated new supply yield
Estimated Cost	• Estimated capital cost • Estimated annual operations and maintenance (O&M) cost • Estimated unit cost
Flow Balance	• Water recycling flow (AFY) • Water recycling ratio (%) • Stormwater recharge (AFY) • DCTWRP and LAGWRP discharges to LA River (mgd) • Ocean discharge (AFY)
Environmental Benefits	• Environmental benefit score • Energy footprint
Sustainable City pLAn Goals	• Stormwater quality grade-point average (GPA) • Stormwater capture (AFY) • Reduction in purchased imported water (%) • Local water supply (%)

Abbreviations:
AFY = acre-feet per year; mgd = million gallons per day

As shown in Table 3, the metrics can be grouped in 5 categories, namely Yield, Cost, Flow Balance, Environmental Benefits, and support of the Sustainable City pLAn goals. Each metric is discussed in further detail in the following subsections.

5.1 Total Demand and Estimated New Supply Yield

Total demand is the amount of water supplies needed during any particular year expressed in AFY and is based on the demands presented in TM 2.1. It is the total of the water supplied plus conservation. It is also equal to the total yield of the existing supplies, In Progress projects, and concept options used for that portfolio. Total demand is reported for normal and dry years. Although total demand is not considered a metric, it is shown for each portfolio for reference and to demonstrate the difference is demand between normal and dry years.

The estimated new supply yield is the amount of new supplies that would be generated by the concept options included in a specific portfolio expressed in AFY. The estimated new supply yield could be used to augment existing and planned supplies to meet future demands. A minimum MWD purchase of 65,000 AFY was considered in the evaluation due to water distribution limitations. The estimated new supply yield used is the amount of new supplies that could actually be used based on a specific hydrology. These new potable supplies minimally affect normal year scenarios and more significantly affect dry year scenarios.

5.2 Cost Metrics

For each portfolio, three cost components are defined: capital cost, O&M cost, and unit cost. These estimated costs were calculated by using the combined estimated cost of all concept options in a specific portfolio. The cost components for each concept are defined as follows:

- Estimated capital cost is the amount of money required to implement a concept, consisting of planning, design, construction, permitting, and legal expenses. The capital cost is expressed in million dollars, which are estimated using the unit construction cost and a combined multiplier of 2.0 to account for all mark-ups as detailed in TM 5.1. Capital costs do not change based on hydrology.

- Estimated O&M cost is the amount of money required to operate and maintain a concept on an annual basis, consisting of labor, materials, and energy costs. The O&M costs are estimated based on the assumptions detailed in TM 5.1. O&M costs vary based on the hydrology and are reported separately for normal and dry years.

- Estimated unit cost for supply is the cost of delivering one AF of water per year. The unit cost reflects the combined amortized capital cost and annual O&M costs divided by the total new yield of a concept. The amortized capital cost utilizes the corresponding asset depreciation period which ranges from 15 to 75 years depending on the project component (e.g. membranes vs. pipelines). Unit costs vary based on the hydrology and are reported separately for normal and dry years.

The total estimated capital and annual O&M costs of a portfolio consists of the sum of the capital and O&M costs associated with In-Progress projects, Planned Projects, and concept options included in each portfolio. The estimated unit cost of a portfolio reflects the yield weighted average of the projects and concepts included in each portfolio.

5.3 Flow Balance Metrics

The MBT was run for each portfolio. The MBT can provide a large number of annual flow estimates under normal, wet, and dry year hydrologic conditions. The following key flow balance characteristics were used for a relative comparison of the portfolios:

- Water recycling flow (AFY)
- Water recycling ratio (percent)
- Stormwater recharge (AFY)
- Ocean discharge (AFY)

Water recycling flow is the total amount of water recycled in the portfolio expressed in AFY. The project types included in this metric are both non-potable reuse (NPR) and potable reuse (indirect or direct). This metric also includes recycled water used for environmental purposes.

Water recycling ratio is the percent of treated wastewater that is recycled for beneficial purposes. The ratio is calculated by dividing the total water recycling flow by the annual volume of wastewater treated.

Stormwater managed is the total volume of stormwater managed using Best Management Practices (BMPs) expressed in AFY. This metric includes stormwater captured for groundwater aquifer recharge, captured for direct use, or captured to provide a water quality benefit.

Ocean discharge is the total volume of wastewater and stormwater discharge to the ocean expressed in AFY. This metric is used to provide a relative comparison of portfolios on the remaining amount of water lost to the ocean that could potentially be utilized for water recycling with additional concept options.

5.4 Environmental Benefit Metrics

The following two environmental benefit metrics are used to evaluate each portfolio:

- Environmental benefit score
- Energy footprint (kilowatt hours per acre-foot [kWh/AF])

The environmental benefit score of each concept option is calculated as the average score of the following four environmental subcategories, namely 1) Environmental justice, 2) Open/natural space and recreational benefits, 3) Stormwater quality, and 4) Ecological benefits. The definition of these environmental criteria and the associated scoring metrics are defined in Table C.20 of TM 5.2.

Energy footprint of each portfolio is calculated for normal and dry year hydrology conditions to provide a relative comparison basis between portfolios that reflects future "average" conditions. The energy footprint calculation includes the estimated energy usage of both the existing supplies and the new concept options in that portfolio. Energy footprint is reported in kWh/AF and reflects the supply weighted energy usage of the various supply sources included in a portfolio. The Environmental Benefits analysis summarizes scores based on available information for each of the high level concepts known as of November 2016. Additional and/or unknown environmental benefits (e.g. environmental justice) may result once concepts move forward into future planning phases

5.5 Sustainable City pLAn Goals

The Sustainable City pLAn (pLAn) goal metrics compare each portfolio with the goals set forth in the pLAn. These goals were set by the Mayor's office in 2015. The metrics are as follows:

- Stormwater Quality (GPA)
- Stormwater Capture (AFY)
- Reduction in Purchased Imported Water (percent)
- Local Water Supply Source (percent)

The pLAn sets stormwater quality goals to improve beach water quality grade-point average (GPA) in dry and wet years respectively to 3.9 and 3.2 by 2025 and 4.0 and 3.5 by 2035. Continued stormwater quality GPA improvement is assumed when all of the stormwater projects are implemented over time. The MBT cannot predict the GPA improvement, therefore it is not quantified in this TM.

The pLAn sets a goal of 150,000 AFY of stormwater capture by year 2035. The stormwater capture metric reports the ability of a portfolio to help achieve this goal. The amount of stormwater captured for recharge, reuse, and or water quality improvement is expressed in AFY. This volume is calculated as the estimated volume of stormwater capture from In-Progress Projects & Programs, Planned Stormwater Management Projects, as well as, the new concept options included in each portfolio. The amount of stormwater managed is reported for all hydrology conditions as the amount of stormwater capture will vary substantially between normal, wet, and dry years.

The metric "50 percent Reduction in Purchased Imported Water by 2025" reports the percentage of purchased imported water from MWD compared to FY 2013-14, which is defined at 441,871 AFY. This metric is reported for all hydrologic conditions because the imported water offset potential varies substantially between normal, wet, and dry years.

The pLAn also sets a goal to source 50 percent of the City's water supply locally by 2035. This goal targets the reduction of water imported from outside of the Los Angeles region, which includes both purchased water from MWD and water imported via the City-owned LAA. This pLAn goal promotes the development of water supplies generated locally in the Los Angeles Basin. The Local Water Supply Source metric is calculated as the total volume of locally sourced water including historical conservation and is expressed in AFY. This metric is reported for all hydrologic conditions because the amount of imported water offset potential varies substantially between normal, wet, and dry years.

6.0 PORTFOLIO EVALUATION

The portfolios are evaluated by using the previously described analysis metrics. The MBT also supported the portfolio evaluation. The results of each portfolio evaluation are described in the following subsections.

6.1 Benchmark Portfolio

6.1.1 Portfolio Description

The Benchmark Portfolio is a scenario to simulate future conditions from projects and programs that are either already in-progress or planned. The Benchmark Portfolio includes the following three major components:

- Existing Supply Sources
- In-Progress Projects & Programs
- Planned Stormwater Management Projects

The Benchmark Portfolio is the foundation upon which the themed portfolio analysis is built as previously illustrated on Figure 7. The purpose of the Benchmark Portfolio is to provide a comparison basis for the other themed portfolios. The Benchmark Portfolio includes projects and programs that are already in-progress or planned to be implemented by the City. It does not include any of the concept options developed as part of the One Water LA effort (with exception of concept options 1-4 as explained in Section 4.2).

The components of the Benchmark Portfolio are further broken down as summarized on Figure 8 and described in greater detail below.

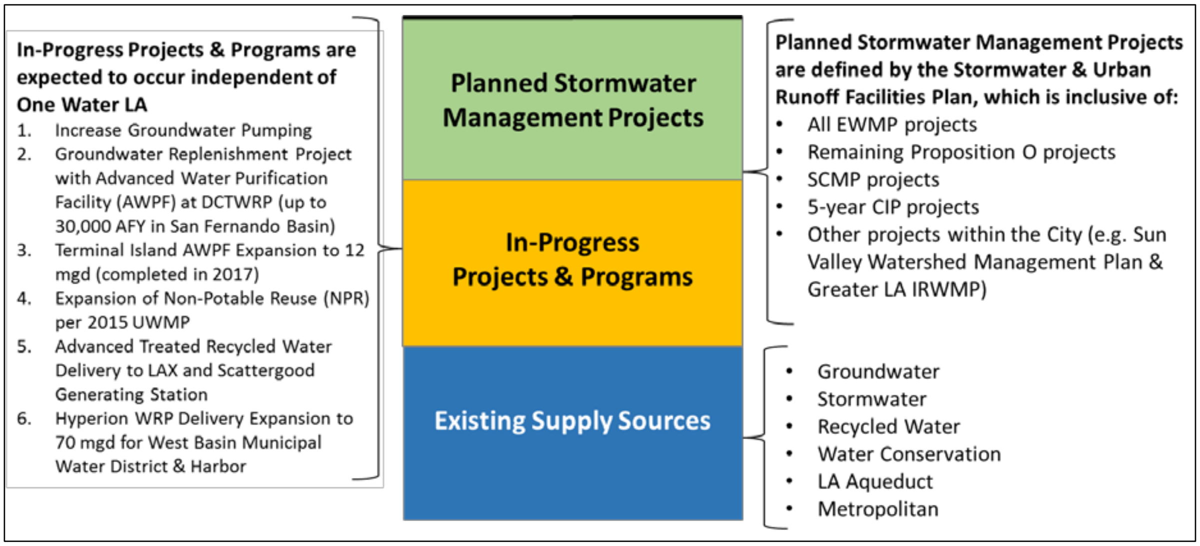


Figure 8 Benchmark Portfolio Components

Many workshops were held with City staff to define currently in-progress projects & programs, as well as the planned stormwater management projects. The Planned Stormwater Management Projects are defined by the Stormwater & Urban Runoff Facilities Plan, which is inclusive of projects from the EWMPs, SCMP, remaining Proposition O (Prop O) projects, 5-year Capital Improvement Program (CIP) projects, and other projects within the City as required to meet MS4 Permit Compliance. A detailed list of the recommended stormwater projects is included in the Stormwater & Urban Runoff Facilities Plan (One Water LA 2040 Plan - Volume 3). A map showing the general vicinity of each In-Progress Project and Program and the Planned Stormwater Management Projects described in the One Water LA 2040 Plan in the City is provided on Figure 9.

6.1.1.1 Existing Supply Sources

As described in more detail in Section 2.0, the City uses the following six primary water supply sources to meet its water demands:

- Imported water from the LAA
- Imported water purchased from MWD
- Groundwater
- Recycled water supplies
- Conservation
- Historical conservation

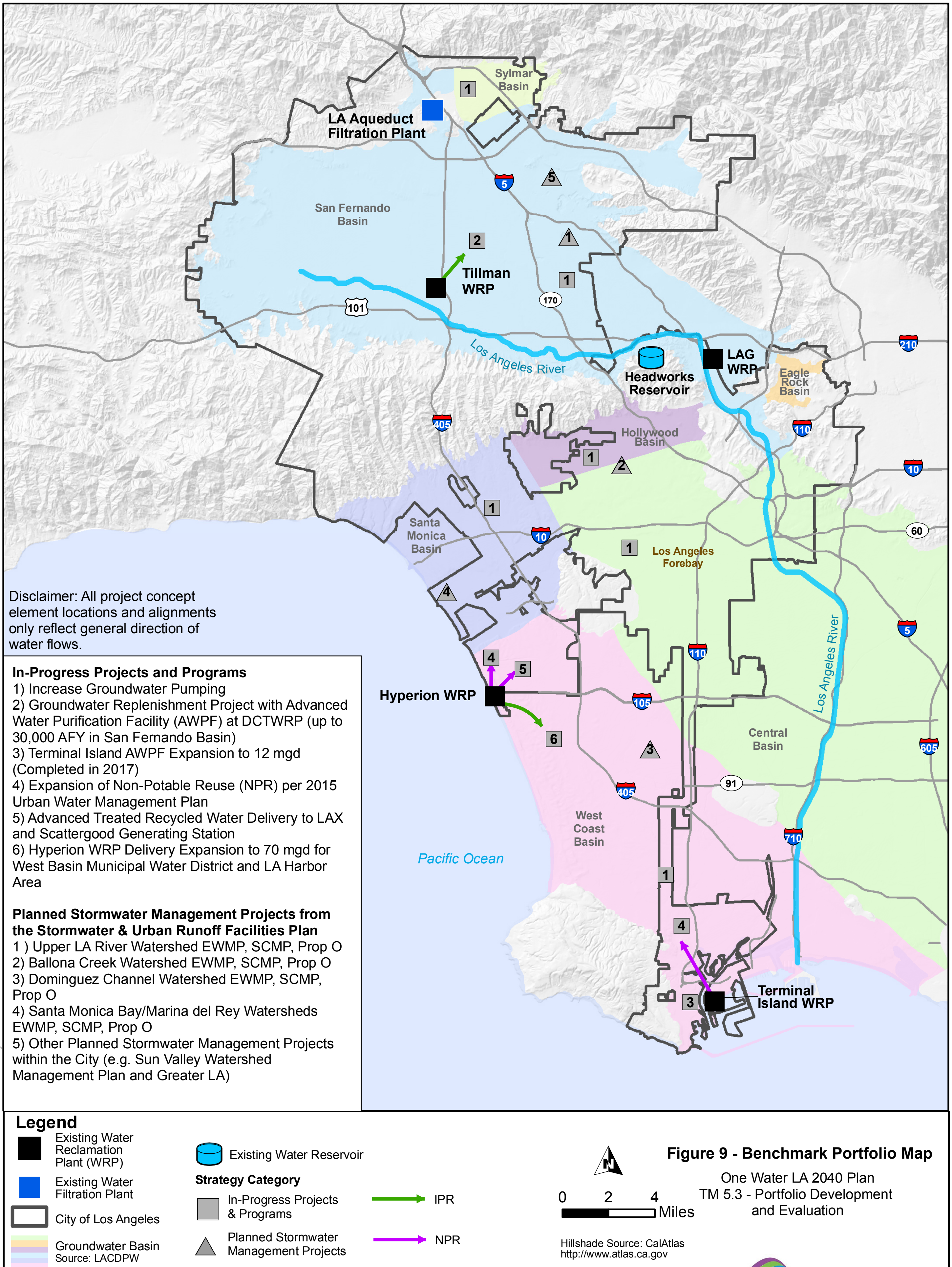


Figure 9 - Benchmark Portfolio Map

The Benchmark Portfolio reflects the supply mix as projected for year 2040 in the 2015 UWMP. It also assumes that all the In-Progress and Planned projects and programs are in place by year 2040. The projects are described in more detail in the next subsection.

6.1.1.2 In-Progress Projects & Programs

The In-Progress Projects & Programs expected to occur independent of One Water LA are listed in Table 4. This list of project reflects conditions as of November 2016.

Table 4 Benchmark Portfolio - List of In-Progress Projects & Programs One Water LA 2040 Plan – TM 5.3

#	Project Name
1	Increase Groundwater Pumping
2	Groundwater Replenishment Project with Advanced Water Purification Facility (AWPF) at DCTWRP (up to 30,000 AFY in San Fernando Basin)
3	Terminal Island AWPF Expansion to 12 mgd (completed in 2017)
4	Expansion of NPR per 2015 Urban Water Management Plan
5	Advanced Treated Recycled Water Delivery to Los Angeles International Airport (LAX) and Scattergood Generating Station
6	HWRP Delivery Expansion to 70 mgd for West Basin Municipal Water District and LA Harbor Area

6.1.1.3 Planned Stormwater Management Projects

The Stormwater & Urban Runoff Facilities Plan includes more than 1,200 centralized and distributed stormwater project opportunities in a stormwater database. The projects have been aggregated from the EWMPs, SCMP, remaining Prop O projects, and other 5-year CIP projects as required to meet MS4 Permit Compliance. A complete listing of the planned stormwater management projects is included in the Stormwater & Urban Runoff Facilities Plan (see One Water LA 2040 Plan - Volume 3). The list of projects also includes all the Green Streets projects in each of the City's four major watersheds (concept options 1 through 4).

The Stormwater & Urban Runoff Facilities Plan prioritized 'optimal stormwater projects' as achieving the three-legged stool, which are flood risk mitigation, water quality improvement, and water supply augmentation. Flooded areas provide an opportunity to maximize stormwater capture. Implementation of stormwater best management practices is designed to improve water quality downstream. It is estimated that the city-wide water supply augmentation benefit of the stormwater program is approximately 86,000 AFY under normal year conditions, while the total stormwater capture goal is 150,000 AFY which also includes water captured for water quality improvements. These numbers will vary greatly depending on hydrologic conditions and sequencing of storm events. To provide an equal basis for a relative comparison, the entire cost of the stormwater program is included in both the benchmark and all themed portfolios. Due to the high cost of the stormwater program ($5.4 billion), the unit cost will increase significantly compared to current conditions.

6.1.2 Estimated Yield & Cost Summary

The estimated project yields and costs associated with each of the In-Progress Projects & Programs, as well as the Planned Stormwater Management Projects are listed in Table 5.

Table 5 Benchmark Portfolio - Yield of In-Progress and Planned Projects
One Water LA 2040 Plan – TM 5.3

#	Name	Yield (AFY)(1)
1	Increase Groundwater Pumping	47,000(2)
2	Groundwater Replenishment Project with AWPF at DCTWRP (up to 30,000 AFY in San Fernando Basin)	30,000
3	Terminal Island AWPF Expansion to 12 mgd (completed in 2017)	6,700
4	Expansion of NPR per 2015 Urban Water Management Plan	18,872
5	Advanced Treated Recycled Water Delivery to LAX and Scattergood Generating Station	5,600
6	HWRP Delivery Expansion to 70 mgd for West Basin Municipal Water District and LA Harbor Area	39,200(3)
7	In-Progress and Planned Stormwater Management Projects (per Stormwater & Urban Runoff Facilities Plan)	79,500(4)

Notes:
(1) Further details on these in-progress and planned projects can be found in TM 5.2 Appendix B In-Progress Project 1.
(2) Estimated using City pumping actuals, based on the City pumping its full water right (above existing) plus pumping water in additional basins.
(3) Existing delivery to West Basin Municipal Water District (WBMWD) is 35 mgd, the expansion is an additional 35 mgd for a total delivery of 70 mgd.
(4) LADWP has estimated that these stormwater management projects will allow for an additional 15,000 AFY of pumping.

As shown in Table 5, the estimated combined yield of the In-Progress and Planned Projects and Programs is roughly 150,000 AFY, excluding the planned stormwater management projects, which provide water supply and quality benefits, but may or may not provide new yield.

6.1.3 Evaluation Results

The results of the benchmark portfolio evaluation are presented in Table 6. This table summarizes the yield, cost, flow balance, environmental benefits and how the benchmark portfolio supports the pLAn stormwater capture and water supply goals.

Table 6 Benchmark Portfolio Evaluation Summary One Water LA 2040 Plan – TM 5.3

Metric	2040 Normal Year Hydrology	2040 Dry Year Hydrology	Unit
Demand and Supply Yield			
Total Demand	676,000	710,000	AFY
Estimated New Supply Yield	0	0	AFY
Estimated Cost			
Total Capital Cost(1)	8,200	8,200	$M
Combined Annual O&M Cost	660	810	$M/year
Average Unit Cost	2,000	2,300	$/AF
Flow Balance			
Water Recycling Flow	128,000	128,000	AFY
Water Recycling Ratio	30%	31%	%
Stormwater Recharge	110,000	17,000	AFY
Ocean Discharge	600,000	310,000	AFY
Environmental Benefits			
Environmental Benefit Score	4.4	4.4	N/A
Energy Footprint	660	1,500	kWh/year
Sustainable City pLAn Goals			
Stormwater Capture	147,000	27,000	AFY
Reduce Purchase of Imported Water by 50% by 2025	83%	30%	%
Source 50% of Water Locally by 2035	55%	56%	%

Note:
(1) Capital Cost includes stormwater management cost of approximately $5.4 Billion, which provides primarily water quality benefits, and therefore increases the unit cost.

Abbreviations:
$M = millions of dollars; $/AF = dollars per acre-foot; N/A = not applicable;
kWh/year = kilowatts per year

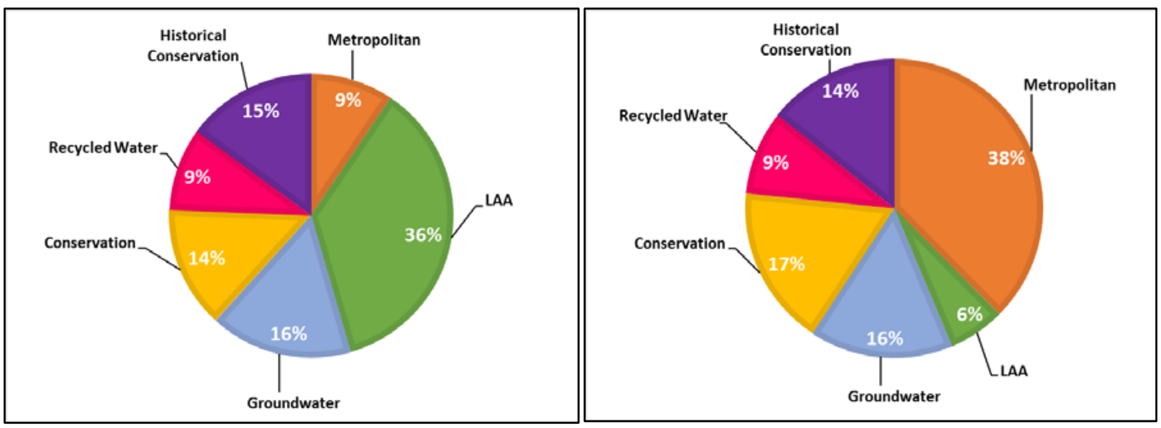
The following observations are made from the evaluation results presented in Table 6:

- Total demands are higher in a dry year than normal year.
- Stormwater recharge and ocean discharge are much lower in a dry year compared to a normal year due to less rainfall and associated stormwater flows.

- The pLAn goal to reduce purchased imported water by 50 percent is met under normal year conditions, but not under dry year conditions.
- The pLAn goal to source 50 percent of the City's water supply locally is met under both normal and dry year conditions.
- The pLAn goal to capture 150,000 AFY of stormwater capture is almost met in a normal year.

6.1.4 Flow Balance Summary

For the Benchmark Portfolio, Figure 10 shows the supply mix during normal and dry years. The wet weather analysis results are included in Appendix B, while a screenshot of the MBT results showing the full flow balance is located in Appendix C. For all graphs, recycled water includes NPR, IPR, DPR, and other environmental uses. Groundwater includes native groundwater pumping, as well as additional pumping due to recharge (except IPR).



Normal Year **Dry Year**

Figure 10 Benchmark Portfolio - 2040 Supply Mix

The following observations regarding the demands and flow balance are made from the Benchmark Portfolio results:

- The total amount of imported water (MWD and LAA) is 45 percent and 44 percent under normal and dry year conditions respectively.
- Purchased water from MWD is much higher in a dry year (38 percent) compared to a normal year (9 percent); LAA flows are much higher in a normal year (36 percent) compared to a dry year (6 percent).

As shown in Table 6 and detailed in Table 7, the In-Progress and Planned stormwater capture projects are estimated to result in a combined stormwater capture of 147,000 AFY under normal year conditions. Additional details can be found in TM 2.1. Due to the substantial and uncertain variability in hydrology, it is assumed that this stormwater program will achieve the pLAn goal (refer to the Stormwater & Urban Runoff Facilities Plan).

Table 7 Benchmark Portfolio - Stormwater Capture Summary for 2040
One Water LA 2040 Plan – TM 5.3

Category	Normal Year (AFY)	Wet Year (AFY)	Dry Year (AFY)
Groundwater Recharge BMPs	86,000	311,000	13,000
Water Quality Compliance BMPs	76,000	N/A	N/A
Total Stormwater Management BMPs	**110,000**	**363,000**	**17,000**
Natural Recharge	35,000	58,000	10,000
Low Flow Diversions	2,000	3,000	0
Total - Stormwater Capture	**147,000**	**424,000**	**27,000**

6.1.5 Environmental Benefits Summary

The Environmental Benefits analysis summarizes scores based on available information for each of the high level concepts. Additional and/or unknown environmental benefits (e.g. environmental justice) may result once concepts move forward into future planning phases.

The environmental benefit score of the Benchmark Portfolio is 4.4 on a scale of 5.0. This high score reflects the average score of concept options 1 through 4, which is the Green Streets program within the City's four major watersheds. In addition to stormwater quality benefits, implementing these programs is expected to have significant positive environmental justice benefits, open/natural space and recreational benefits, and ecological benefits.

The average energy footprint of the supply source mix utilized in the Benchmark Portfolio is estimated to be 660 kWh/AF and 1,500 kWh/AF under normal and dry year conditions, respectively. This is substantially lower than the energy use of 2,072 kWh/AF that was reported in the UWMP for 2015 (a dry year) because the UWMP number also includes energy use for distribution, which is not accounted for in this TM.

6.1.6 Conclusion

The Benchmark Portfolio provides a comparison basis for the other themed portfolios. The important conclusions to draw from the Benchmark Portfolio evaluation are:

- The benchmark portfolio utilizes 30 percent of the available recycled water flow in a normal year and 31 percent in a dry year.
- The Sustainable City pLAn goal of reducing imported water purchases by 50 percent, and sourcing 50 percent of the City's supply locally are met and exceeded under normal year conditions in 2040. However, the reduction of purchased imported water by 50 percent is not met in a dry year.
- The stormwater capture goal of 150,000 AFY is nearly met with an estimated capture of 147,000 AFY in a normal year.
- The total capital cost of the Benchmark Portfolio is $8.2 billion, which includes $5.6 billion for the planned stormwater management projects. The unit cost will go up substantially compared to current (2016) conditions, primarily due to the inclusion of the planned stormwater management projects as discussed in Section 6.1.1.3.

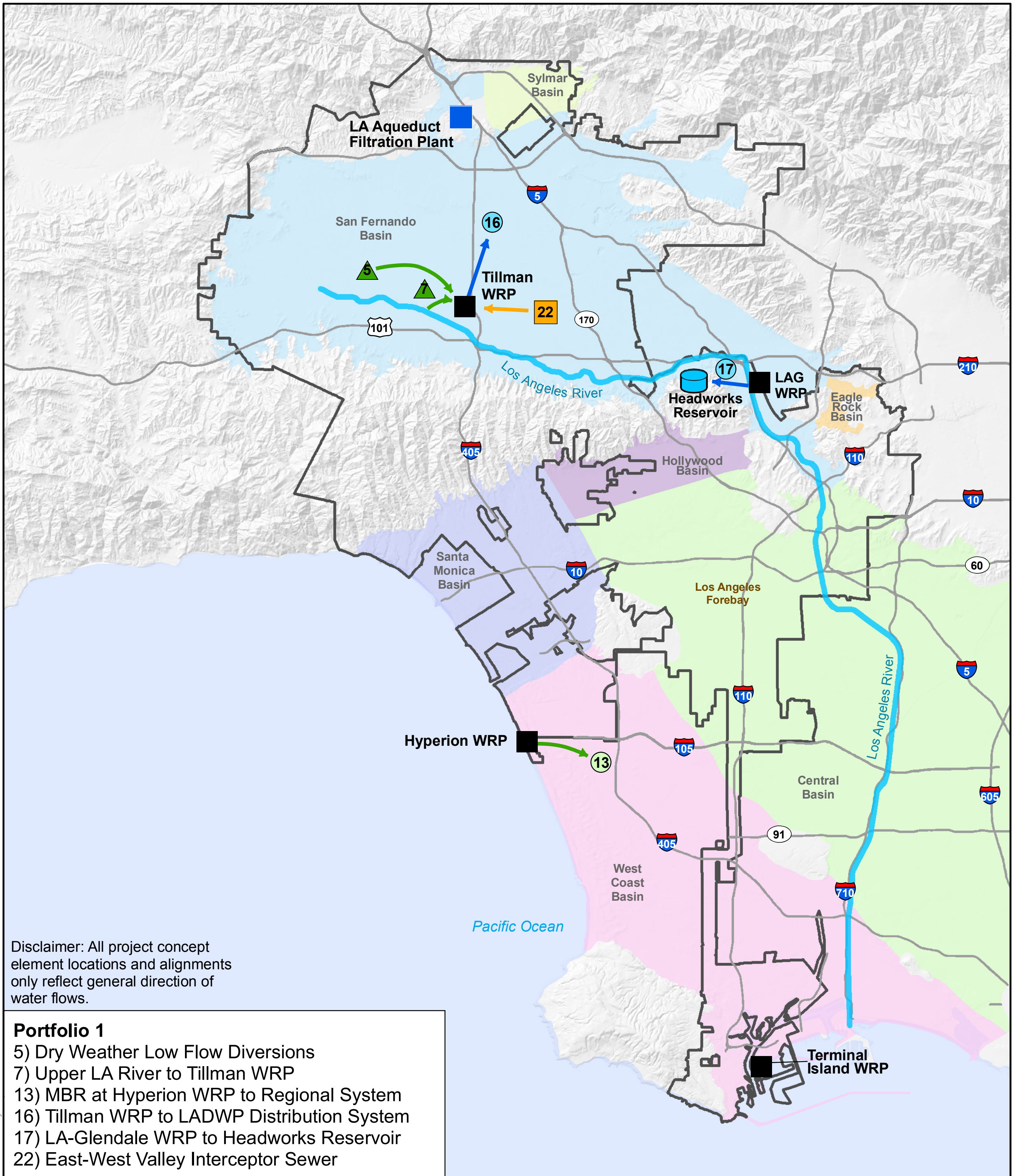
6.2 Portfolio 1 - Minimize Cost

6.2.1 Portfolio Description

Portfolio 1 is characterized by concept options that were selected to "Minimize Cost." In addition to the In-Progress and Planned projects and programs included in the Benchmark Portfolio, Portfolio 1 includes the following concept options:

- Dry Weather Low Flow Diversions
- Upper LA River to DCTWRP
- IPR - MBR at HWRP to Regional System
- DPR - DCTWRP to LADWP Distribution System
- DPR - LAGWRP to Headworks Reservoir
- East West Valley Interceptor Sewer

The purpose of this portfolio is a scenario to simulate the tradeoff if the lowest cost concepts were implemented. A map showing the general vicinity of each concept in Portfolio 1 in the City of LA is provided on Figure 11.



Legend

- Existing Water Reclamation Plant (WRP)
- Existing Water Filtration Plant
- City of Los Angeles
- Groundwater Basin Source: LACDPW
- Existing Water Reservoir

Strategy Category

- IPR Concept Ideas
- DPR Concept Ideas
- Stormwater Concept Ideas
- Flow Management
- IPR Options
- DPR Options
- NPR Options
- Flow Management

N

0 2 4 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Figure 11 - Portfolio 1 Map

One Water LA 2040 Plan
TM 5.3 - Portfolio Development and Evaluation

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One Water LA

6.2.2 Estimated Yield & Cost Summary

The estimated yields and costs associated with each of the concept options included in Portfolio 1 are listed in Table 8.

Table 8 Portfolio 1 - Yields and Costs of New Concept Options One Water LA 2040 Plan – TM 5.3

#	Concept Option Name	Estimated New Yield (AFY)	Estimated Capital Cost ($M)	Estimated Unit Cost ($/AF)
5	Dry Weather Low Flow Diversions	6,200	$110	$1,000
7	Upper LA River to DCTWRP	5,600	$18	$160
13	IPR - MBR at Hyperion to Regional System	95,000	$900	$1,500
16	DPR - DCTWRP to LADWP Distribution System(1)	15,000	$295	$1,300
17	DPR - LAGWRP to Headworks Reservoir	6,000	$140	$1,500
22	East-West Valley Interceptor Sewer	11.4 mgd(2)	$85	$430
	Totals of New Concepts Only(3)	**127,800**	**$1,500**	**$1,300**

Notes:

(1) Requires the East-West Valley Interceptor Sewer (Concept #22) or other flow management option to increase flows to DCTWRP.

(2) Estimated capacity of EWVIS is 11.4 mgd does not provide a new supply, but only a flow increase to DCTWRP due to rerouting. EWVIS is excluded from the total estimated new yield.

(3) Excludes new yield and cost associated with Benchmark Portfolio projects and programs. Values are rounded.

As shown in Table 8, the estimated combined yield of the new concept options included in Portfolio 1 is 127,800 AFY, which excludes the new yield capacity of Concept Option #22 (East West Valley Interceptor Sewer) as this is a flow management concept that does not generate new supply by itself. A potential alternative or addition to the EWVIS is Concept Option #26 (Japanese Garden & Sepulveda Basin Lakes Recirculation), which may require a Wastewater Change Petition (Water Code Section 1211) to allow reduced discharge into the LA River and is therefore not included at this planning stage. The corresponding capital investment of the new concept options included in Portfolio 1 is approximately $1.5 billion. The yield weighted average unit cost is approximately $1,444/AF assuming that all projects can be fully utilized on a continuous basis. However, the MBT indicated that the capacity of concept options 16 and 17 had to be reduced during some hydrologic conditions due to insufficient flow availability. Hence, further optimization of concept sizing would be required to avoid building facilities with stranded capacity. As noted previously, the intent of the Benchmark Portfolio and Portfolios 1 through 4 is not to provide a valid future alternative but only compare a range of extreme scenarios.

6.2.3 Evaluation Results

The results of the Portfolio 1 - Minimize Cost evaluation are presented in Table 9. This table includes the projects in the Benchmark Portfolio and summarizes the yield, cost, flow balance, environmental benefits and how Portfolio 1 supports the Sustainable City pLAn stormwater capture and water supply goals.

Table 9 Portfolio 1 Minimize Cost Evaluation Summary
One Water LA 2040 Plan - TM 5.3

Metric	2040 Normal Year Hydrology	2040 Dry Year Hydrology	Unit
Demand and Supply Yield			
Total Demand	676,000	710,000	AFY
Estimated New Supply Yield Used	22,900	124,800	AFY
Estimated Cost			
Total Capital Cost	9,700	9,700	$M
Combined Annual O&M Cost	650	780	$M/year
Average Unit Cost	2,100	2,400	$/AF
Flow Balance			
Water Recycling Flow	139,000	241,000	AFY
Water Recycling Ratio	32%	58%	%
Stormwater Recharge	110,000	17,000	AFY
Ocean Discharge	590,000	200,000	AFY
Environmental Benefits			
Environmental Benefit Score	3.6	3.6	N/A
Energy Footprint	640	1,230	kWh/year
Sustainable City pLAn Goals			
Stormwater Capture	159,000	39,000	AFY
Reduce Purchase of Imported Water by 50% by 2025	85%	55%	%
Source 50% of Water Locally by 2035	56%	70%	%

The following observations are made from the evaluation results presented in Table 9:

- Total demands are higher in a dry year than normal year.
- Stormwater recharge and ocean discharge are much lower in a dry year compared to a normal year due to less rainfall and associated stormwater flows.

- The pLAn goal to reduce purchased imported water by 50 percent is met under both normal and dry year conditions.
- The pLAn goal to source 50 percent of the City's water supply locally is met under both normal and dry year conditions.
- The pLAn goal to capture 150,000 AFY of stormwater capture is met in a normal year.

6.2.4 <u>Flow Balance Summary</u>

The projected water supply mix under normal and dry year conditions with the Benchmark Portfolio and concept options of Portfolio 1 are shown on Figure 12. The wet weather analysis results are included in Appendix B, while a screenshot of the MBT dashboard showing the full flow balance is located in Appendix C.

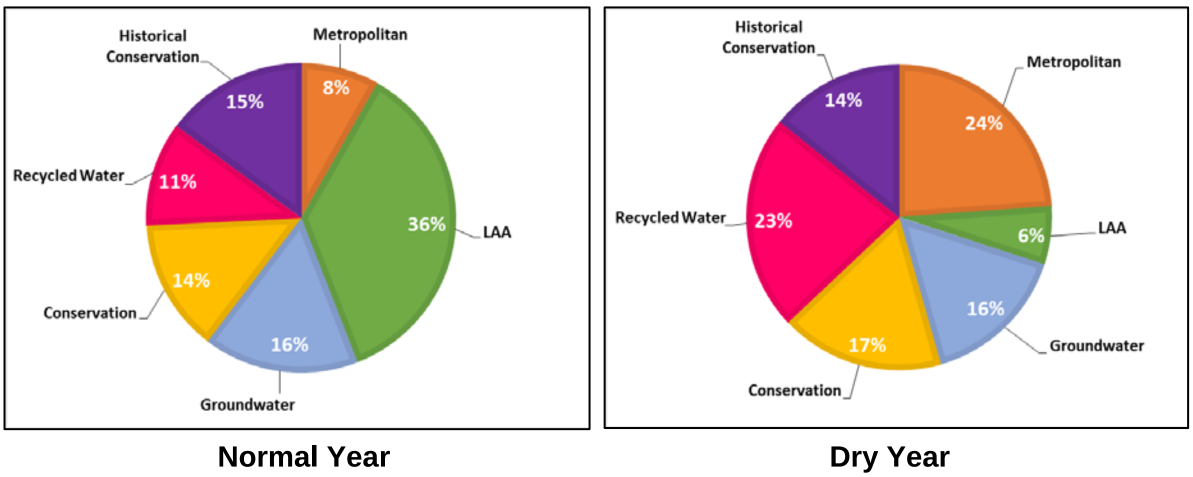

Figure 12 Portfolio 1 – 2040 Supply Mix

As shown on Figure 12, the following observations can be made when comparing the supply mix under normal and dry year hydrologic conditions with the Benchmark Portfolio:

- The total amount of imported water (MWD and LAA) is 44 percent and 30 percent under normal and dry year conditions respectively.
- Purchased water from MWD is much higher in a dry year (24 percent) compared to a normal year (8 percent); LAA flows are much higher in a normal year (36 percent) compared to a dry year (6 percent).
- Purchased imported water from MWD is reduced to 8 percent compared to 9 percent in the Benchmark Portfolio in a normal year; and 24 percent compared to 38 percent in the Benchmark Portfolio in a dry year. Although the new concept options provide sufficient supply capacity to reduce MWD purchases to zero in a normal year, a minimum delivery of 65,000 AFY was maintained due to water distribution limitations.

6.2.5 Environmental Benefits Summary

The Environmental Benefits analysis summarizes scores based on available information for each of the high level concepts. Additional and/or unknown environmental benefits (e.g. environmental justice) may result once concepts move forward into future planning phases.

The environmental benefit score of Portfolio 1 is 3.6 compared to 4.4 for the Benchmark Portfolio. This score reflects the average score of concept options included in this portfolio. The concept option that has the highest environmental benefits besides the Green Street programs in the City's four major watersheds (Concept Options #1-4) is Concept Option #5 (Dry Weather Low Flow Diversions). The remaining concept options included in this portfolio do not provide significant environmental justice, open/natural space and recreation, stormwater quality, and/or ecological benefits.

The average energy footprint of the supply source mix utilized in Portfolio 1 is estimated to be 640 kWh/AF and 1,230 kWh/AF under normal and dry year conditions, respectively. This is approximately 20 kWh/AF or 3 percent lower than the Benchmark Portfolio under normal year conditions, and 18 percent lower under dry year conditions. This decrease in energy usage is primarily the result of the addition of 116,000 AFY of potable reuse projects with the implementation of Concept Options #13 (IPR - MBR at HWRP to Regional System), #16 (DPR from DCTWRP to LADWP Distribution System), and #17 (DPR from LAGWRP to Headworks Reservoir), which have a lower energy usage than purchased water from MWD.

6.2.6 Conclusion

The following observations are made in comparing Portfolio 1 to the Benchmark Portfolio:

- Portfolio 1 would increase the amount of water recycling compared to the Benchmark Portfolio due to Concept Options #13, #16, and #17. In a normal year, the amount of additional water recycling is limited because the 2015 UWMP only relies on 75,000 AFY of imported water purchased from MWD, which cannot be reduced below 65,000 AFY due to distribution system constraints. However, during dry years these new potable reuse concepts could be fully utilized and increase the amount of water recycling from 128,000 AFY (Benchmark) to 241,000 AFY (Portfolio 1). This means that the City would nearly utilize 58 percent of the available recycled water flow compared to 31 percent in the Benchmark Portfolio in a dry year.

- The Sustainable City pLAn goals of reducing imported water purchases by 50 percent and sourcing 50 percent of the City's supply locally would be met and exceeded under normal and dry year conditions. The stormwater capture goal from the pLAn is met under normal year conditions due to the addition of Concept Option #5 (Low Flow Diversions). Imported water purchases from MWD are significantly reduced in dry years compared to the Benchmark Portfolio.

- Portfolio 1 will cost the City an additional $1.5 billion, on top of the $8.2 billion Benchmark Portfolio, for a total cost of $9.7 billion.
- The unit cost of Portfolio 1 is $2,100/AF under normal year conditions, approximately 5 percent higher than the Benchmark which has a unit cost of $2,000/AF under normal year conditions. It should be noted that this is only intended as a relative comparison rather than a typical unit supply cost as it also includes significant investments in stormwater quality improvement projects.

6.3 Portfolio 2 - Maximize Environmental Benefits

6.3.1 Portfolio Description

Portfolio 2 is characterized by concept options that were selected to "Maximize Environmental Benefits." In addition to the In-Progress and Planned projects and programs included in the Benchmark Portfolio, Portfolio 2 includes the following concept options:

- Dry Weather Low Flow Diversions
- Wet Weather Flow Diversions
- LA River Recharge into LA Forebay
- IPR - MBR at HWRP to Regional System

The purpose of this portfolio is a scenario to simulate the tradeoff if the most environmentally beneficial solutions were implemented. A map showing the general vicinity of each concept in Portfolio 2 in the City of LA is provided on Figure 13.

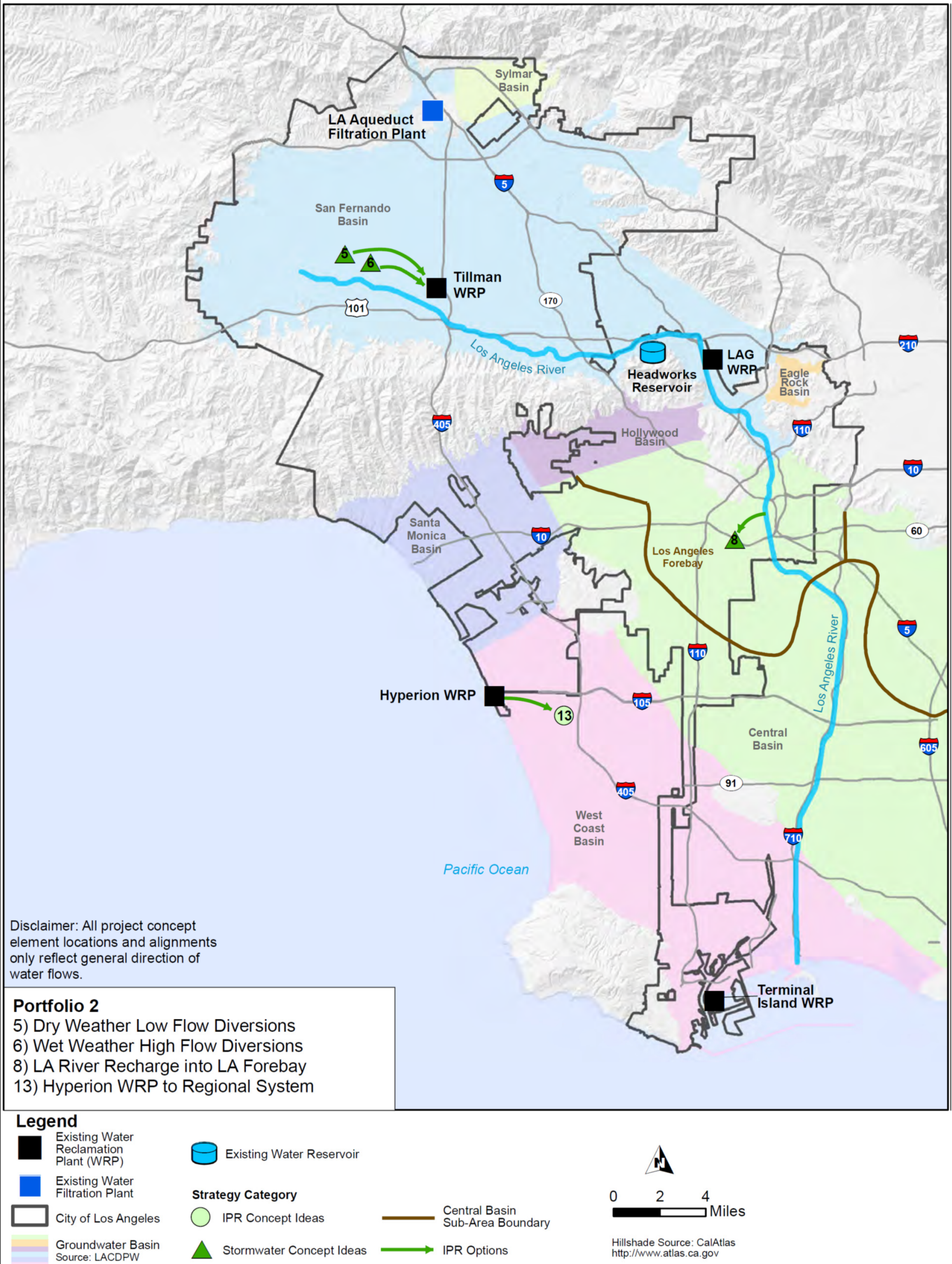

Figure 13 - Portfolio 2 Map
One Water LA 2040 Plan
TM 5.3 - Portfolio Development and Evaluation

One Water LA

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6.3.2 Estimated Yield & Cost Summary

The estimated yields and costs associated with each of the concept options included in Portfolio 2 are listed in Table 10.

Table 10 Portfolio 2 - Yield and Cost of New Concept Options One Water LA 2040 Plan – TM 5.3

#	Concept Option Name	Estimated New Yield (AFY)	Estimated Capital Cost ($M)	Estimated Unit Cost ($/AF)
5	Dry Weather Low Flow Diversions	6,200	$110	$1,000
6	Wet Weather Flow Diversions	1,000	$190	$10,300
8A	LA River Recharge into LA Forebay using Injection Wells	25,000	$980	$2,100
13	IPR - MBR at Hyperion to Regional System	95,000	$900	$1,500
	Totals of New Concept Options Only(1)	**127,200**	**$2,200**	**$1,700**

Note:
(1) Excludes cost associated with Benchmark Portfolio projects and program. Values are rounded.

As shown in Table 10, the estimated combined yield of the new concept options included in Portfolio 2 is 127,200 AFY. The corresponding capital investment is approximately $2.2 billion. The yield weighted average unit cost is approximately $1,700/AF assuming that all projects can be fully utilized on a continuous basis. However, further optimization of the concept sizing is recommended to avoid building stranded capacity. As noted previously, the intent of the portfolios is not to provide a valid future alternative but only compare a range of extreme scenarios.

6.3.3 Evaluation Results

The results of the Portfolio 2 Maximize Environmental Benefits evaluation are presented in Table 11. This table includes the projects in the Benchmark Portfolio and summarizes the yield, cost, flow balance, environmental benefits and how Portfolio 2 supports the Sustainable City pLAn stormwater capture and water supply goals.

Table 11 Portfolio 2 - Maximize Environmental Benefits Summary One Water LA 2040 Plan – TM 5.3

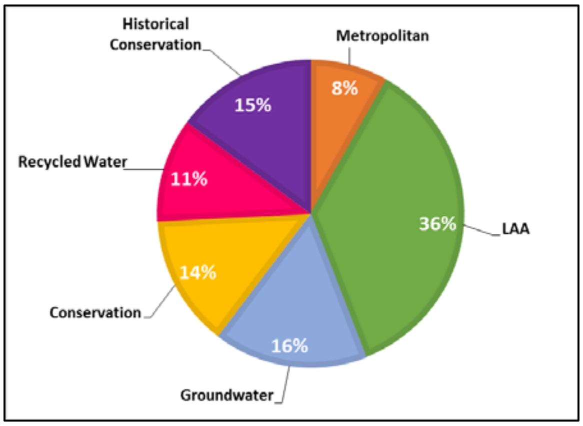
Metric	2040 Normal Year Hydrology	2040 Dry Year Hydrology	Unit
Demand and Supply Yield			
Total Demand	676,000	710,000	AFY
Estimated New Supply Yield Used	18,300	127,200	AFY
Estimated Cost			
Total Capital Cost	10,300	10,300	$M
Combined Annual O&M Cost	650	790	$M/year
Average Unit Cost	2,200	2,500	$/AF
Flow Balance			
Water Recycling Flow	139,000	223,000	AFY
Water Recycling Ratio	32%	54%	%
Stormwater Recharge	110,000	17,000	AFY
Ocean Discharge	590,000	190,000	AFY
Environmental Benefits			
Environmental Benefit Score	3.8	3.8	N/A
Energy Footprint	640	1,210	kWh/year
Sustainable City pLAn Goals			
Stormwater Capture	155,000	35,000	AFY
Reduce Purchase of Imported Water by 50% by 2025	85%	57%	%
Source 50% of Water Locally by 2035	56%	71%	%

The following observations are made from the flow evaluation results presented in Table 11:

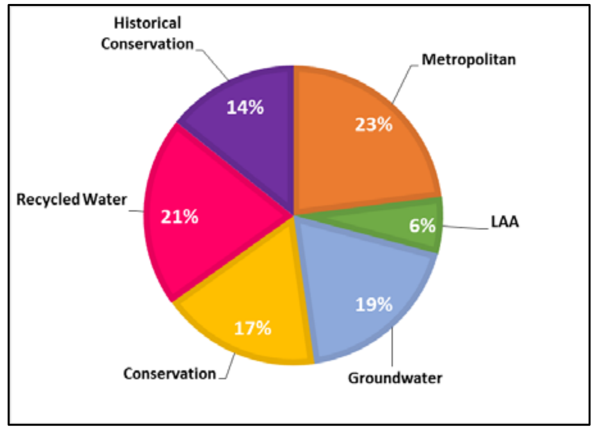
- Total demands are higher in a dry year than normal year.
- Stormwater recharge and ocean discharge are much lower in a dry year compared to a normal year due to less rainfall and associated stormwater flows.
- The pLAn goal to reduce purchased imported water by 50 percent is met under both normal and dry year conditions.
- The pLAn goal to source 50 percent of the City's water supply locally is met under both normal and dry year conditions.
- The pLAn goal to capture 150,000 AFY of stormwater capture is met in a normal year.

6.3.4 Flow Balance Summary

The projected water supply mix under normal and dry year conditions with the Benchmark Portfolio and concept options of Portfolio 2 are shown on Figure 14. The wet weather analysis results are included in Appendix B, while a screenshot of the MBT dashboard showing the full flow balance is located in Appendix C.



Normal Year



Dry Year

Figure 14 Portfolio 2 – 2040 Supply Mix

As shown on Figure 14, the following observations can be made when comparing the supply mix under normal and dry year hydrologic conditions with the Benchmark Portfolio:

- The total amount of imported water (MWD and LAA) is 44 percent and 29 percent under normal and dry year conditions respectively.
- Purchased water from MWD is much higher in a dry year (23 percent) compared to a normal year (8 percent); LAA flows are much higher in a normal year (36 percent) compared to a dry year (6 percent).
- Purchased imported water from MWD is reduced to 8 percent compared to 9 percent in the Benchmark Portfolio in a normal year; and 23 percent compared to 38 percent in the Benchmark Portfolio in a dry year. Although the new concept options provide sufficient supply capacity to reduce MWD purchases to zero in a normal year, a minimum delivery of 65,000 AFY was maintained due to water distribution limitations.

6.3.5 Environmental Benefits Summary

The Environmental Benefits analysis summarizes scores based on available information for each of the high level concepts. Additional and/or unknown environmental benefits (e.g. environmental justice) may result once concepts move forward into future planning phases.

The environmental benefit score of Portfolio 2 is 3.8 compared to 4.4 for the Benchmark Portfolio. This score reflects the average score of concept options included in this portfolio. The concept option with the highest environmental benefits is the Green Street programs in the City's four major watersheds (Concept Options #1-4). The next highest environmental benefits are Concept Option #5 (Dry Weather Low Flow Diversions) and Concept Option #6 (Wet Weather High Flow Diversions). The remaining Concept Options #8A (LA River Recharge to LA Forebay) and #13 (IPR - MBR at HWRP to Regional System) provide some environmental justice, open/natural space and recreation, stormwater quality, and/or ecological benefits.

The average energy footprint of the supply source mix utilized in Portfolio 2 is estimated to be 640 kWh/AF and 1,210 kWh/AF under normal and dry year conditions, respectively. In a dry year, this is approximately 290 kWh/AF or 24 percent lower than the Benchmark Portfolio under dry year conditions. This decrease in energy usage is primarily the result of the addition of 120,000 AFY of potable reuse projects, with Concept Options #8A (LA River Recharge to LA Forebay Recharge) and #13 (IPR - MBR at HWRP to Regional System). Both projects have a lower in energy usage than purchased water from MWD.

6.3.6 Conclusion

The following observations are made in comparing Portfolio 2 to the Benchmark Portfolio:

- Portfolio 2 would increase the amount of water recycling compared to the Benchmark Portfolio due to Concept Option #13. Similar to Portfolio 1, the additional water recycling is limited to 10,000 AFY under normal year conditions. However, during dry years these new potable reuse concepts could be fully utilized and increase the amount of water recycling from 128,000 AFY (Benchmark) to 223,000 AFY (Portfolio 2). This means that the City would nearly utilize 54 percent of the available recycled water flow compared to 31 percent in the Benchmark Portfolio.

- The Sustainable City pLAn goals of reducing imported water purchases by 50 percent and sourcing 50 percent of the City's supply locally would be met and exceeded under normal and dry year conditions. The stormwater capture goal from the pLAn is met under normal year conditions due to the addition of Concept Option #5 (Low Flow Diversions). Imported water purchases from MWD are significantly reduced in dry years compared to the Benchmark Portfolio.

- Portfolio 2 will cost the City an additional $2.1 billion, on top of the $8.2 billion Benchmark Portfolio, for a total cost of $10.3 billion.

- The unit cost of Portfolio 2 is $2,200/AF under normal year conditions, approximately 10 percent higher than the Benchmark which has a unit cost of $2,000/AF under normal year conditions. It should be noted that this is only intended as a relative comparison rather than a typical unit supply cost as it also includes significant investments in stormwater quality improvement projects.

6.4 Portfolio 3 - Maximize Institutional Collaboration

6.4.1 Portfolio Description

Portfolio 3 is characterized by concept options that were selected to "Maximize Institutional Collaboration." In addition to the In-Progress and Planned projects and programs included in the Benchmark Portfolio, Portfolio 3, includes the following concept options:

- LA River Recharge into LA Forebay
- IPR - HWRP to Central Basin Injection Wells
- Increase Recycled Water Demand Beyond 2015 UWMP

The purpose of this portfolio is a scenario to simulate the tradeoff if the most collaborative projects or programs were implemented, increasing coordination (and potentially cost savings) between City departments, partners, stakeholders and outside agencies (such as the MWD, WBMWD, the Water Replenishment District or Metro). A map showing the general vicinity of each concept in Portfolio 3 in the City of LA is provided on Figure 15.

6.4.2 Estimated Yield and Cost Summary

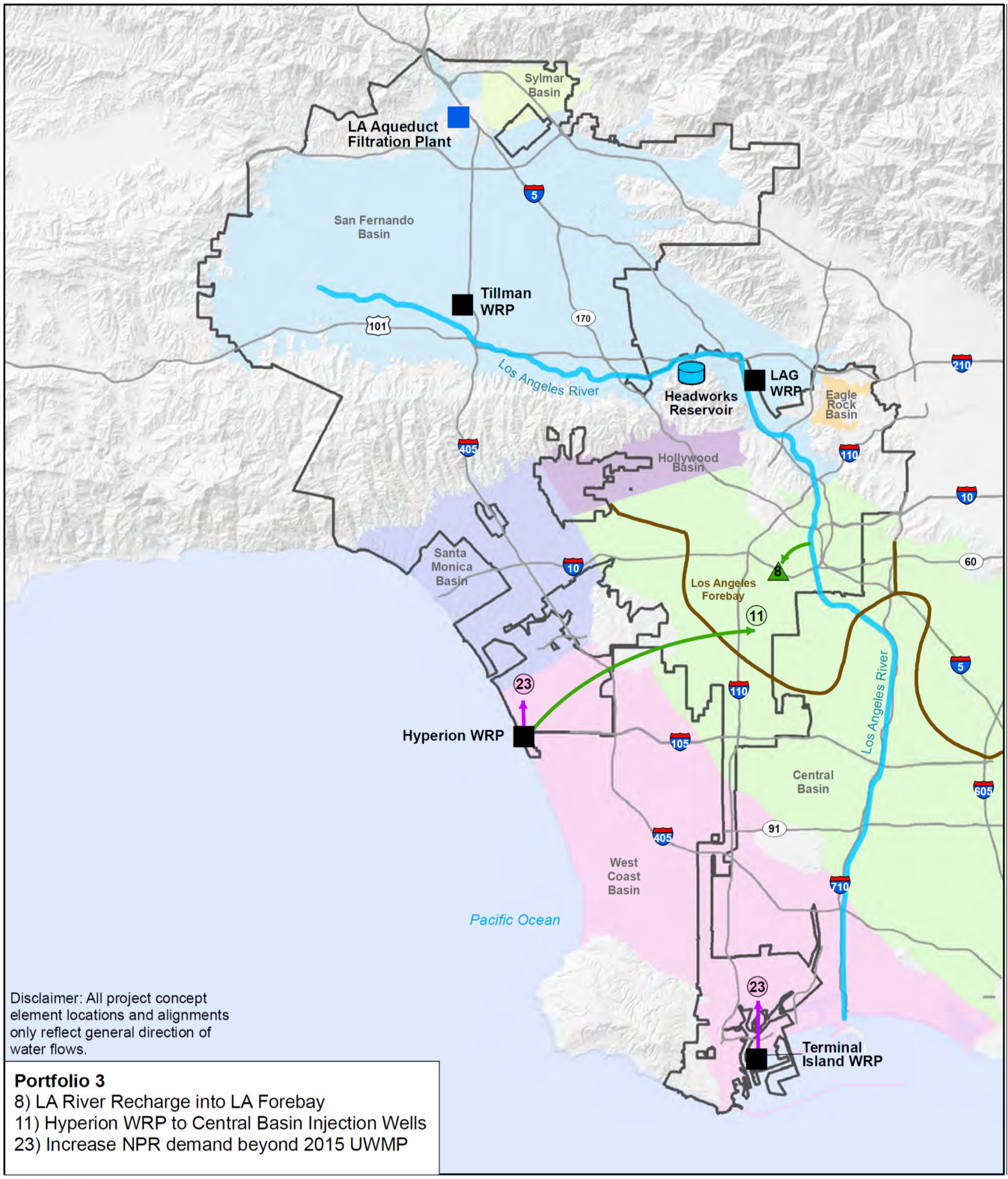
The estimated yields and costs associated with each of the concept options are listed in Table 12.

Table 12 Portfolio 3 - Summary of Concept Options Yields and Costs One Water LA 2040 Plan – TM 5.3

#	Concept Option Name	Estimated New Yield (AFY)	Estimated Capital Cost ($M)	Estimated Unit Cost ($/AF)
8A	LA River Recharge into LA Forebay using Injection Wells	25,000	$980	$2,100
11	IPR - HWRP to Central Basin Injection Wells	75,000	$3,300	$2,700
23	Increase Recycled Water Demand Beyond 2015 UWMP(1)	6,600	$370	$2,100
	Totals of New Concept Options Only(2)	**106,600**	**$4,700**	**$2,500**

Notes:
(1) Partially included, using water only from HWRP (through West Basin) and non-City sources at Terminal Island Water Reclamation Plant (TIWRP).
(2) Excludes cost associated with Benchmark Portfolio projects and program. Values are rounded.

As shown in Table 12, the estimated combined yield of the new concept options included in Portfolio 3 is 106,600 AFY. The corresponding capital investment is approximately $4.7 billion. The yield weighted average unit cost is approximately $2,500/AF assuming that all projects can be fully utilized on a continuous basis. However, further optimization of the concept sizing is recommended to avoid building stranded capacity. As noted previously, the intent of the portfolios is not to provide a valid future alternative but only compare a range of extreme scenarios.



Legend

- Existing Water Reclamation Plant (WRP)
- Existing Water Filtration Plant
- City of Los Angeles
- Groundwater Basin Source: LACDPW
- Existing Water Reservoir

Strategy Category

- IPR Concept Ideas
- NPR Concept Ideas
- Stormwater Concept Ideas
- Central Basin Sub-Area Boundary
- IPR Options
- NPR Options

0 2 4 Miles

Hillshade Source: CalAtlas
http://www.atlas.ca.gov

Figure 15 - Portfolio 3 Map
One Water LA 2040 Plan
TM 5.3 - Portfolio Development and Evaluation

6.4.3 Evaluation Results

The results of the Portfolio 3 Maximize Institutional Collaboration evaluation are presented in Table 13. Table 13 includes the projects in the Benchmark Portfolio and summarizes the yield, cost, flow balance, environmental benefits and how Portfolio 3 supports the Sustainable City pLAn stormwater capture and water supply goals.

Table 13 Portfolio 3 Maximize Institutional Collaboration Summary One Water LA 2040 Plan – TM 5.3

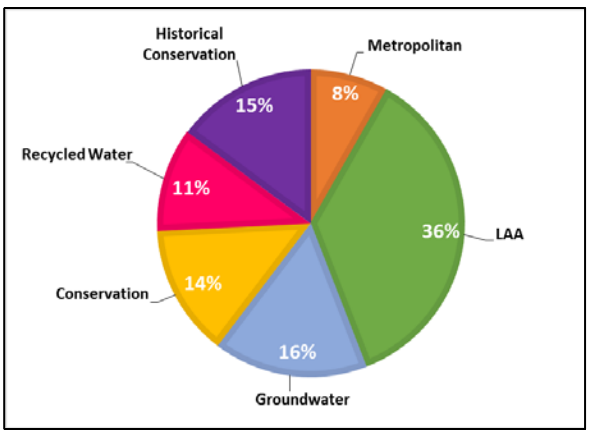
Metric	2040 Normal Year Hydrology	2040 Dry Year Hydrology	Unit
Demand and Supply Yield			
Total Demand	676,000	710,000	AFY
Estimated New Supply Yield Used	11,100	116,700	AFY
Estimated Cost			
Total Capital Cost	12,800	12,800	$M
Combined Annual O&M Cost	640	750	$M/year
Average Unit Cost	2,400	2,600	$/AF
Flow Balance			
Water Recycling Flow	128,000	203,000	AFY
Water Recycling Ratio	30%	50%	%
Stormwater Recharge	110,000	17,000	AFY
Ocean Discharge	600,000	210,000	AFY
Environmental Benefits			
Environmental Benefit Score	3.8	3.8	N/A
Energy Footprint	630	1,500	kWh/year
Sustainable City pLAn Goals			
Stormwater Capture	147,000	27,000	AFY
Reduce Purchase of Imported Water by 50% by 2025	85%	56%	%
Source 50% of Water Locally by 2035	56%	70%	%

The following observations are made from the flow balance results presented in Table 13:

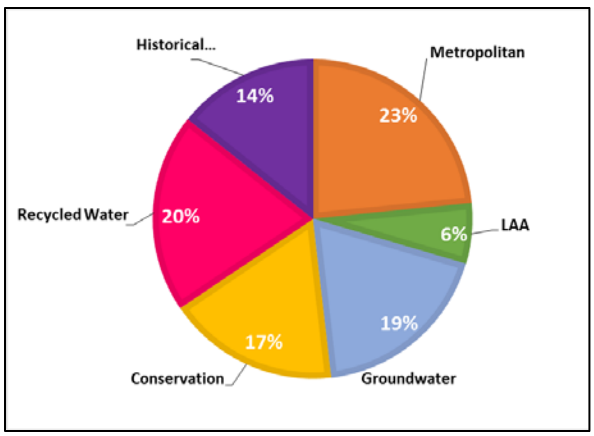
- Total demands are higher in a dry year than normal year.
- Stormwater recharge and ocean discharge are much lower in a dry year compared to a normal year due to less rainfall and associated stormwater flows.
- The pLAn goal to reduce purchased imported water by 50 percent is met under normal and dry year conditions.
- The pLAn goal to source 50 percent of the City's water supply locally is met under both normal and dry year conditions.
- The pLAn goal to capture 150,000 AFY of stormwater capture is almost met in a normal year.

6.4.4 Flow Balance Summary

The projected water supply mix under normal and dry year conditions with the Benchmark Portfolio and concept options of Portfolio 3 are shown on Figure 16. The wet weather analysis results are included in Appendix B, while a screenshot of the MBT dashboard showing the full flow balance is located in Appendix C.



Normal Year



Dry Year

Figure 16 Portfolio 3 – 2040 Supply Mix

As shown on Figure 16, the following observations can be made when comparing the supply mix under normal and dry year hydrologic conditions with the Benchmark Portfolio:

- The total amount of imported water (MWD and LAA) is 44 percent and 29 percent under normal and dry year conditions respectively.
- Purchased water from MWD is much higher in a dry year (23 percent) compared to a normal year (8 percent); LAA flows are much higher in a normal year (36 percent) compared to a dry year (6 percent).

- Purchased imported water from MWD is reduced to 8 percent compared to 9 percent in the Benchmark Portfolio in a normal year; and 23 percent compared to 38 percent in the Benchmark Portfolio in a dry year. Although the new concept options provide sufficient supply capacity to reduce MWD purchases to zero in a normal year, a minimum delivery of 65,000 AFY was maintained due to water distribution limitations.

6.4.5 Environmental Benefits Summary

The Environmental Benefits analysis summarizes scores based on available information for each of the high level concepts. Additional and/or unknown environmental benefits (e.g. environmental justice) may result once concepts move forward into future planning phases.

The environmental benefit score of Portfolio 3 is 3.8 compared to 4.4 for the Benchmark Portfolio. This score reflects the average score of concept options included in this portfolio. The concept option that has the highest environmental benefits besides the green street programs in the City's four major watersheds (Concept Options #1-4) is Concept Option #8A (LA River Recharge into LA Forebay). The remaining concept options included in this portfolio do not provide significant environmental justice, open/natural space and recreation, stormwater quality, and/or ecological benefits.

The average energy footprint of the supply source mix utilized in Portfolio 3 is estimated to be 630 kWh/AF and 1,500 kWh/AF under normal and dry year conditions, respectively. This is approximately 30 kWh/AF or 5 percent lower than the Benchmark Portfolio under normal conditions, and the same as the Benchmark Portfolio under dry year conditions. This decrease in energy usage is primarily the result of the addition of 100,000 AFY of potable reuse projects, with Concept Options #8A (LA River Recharge to LA Forebay Recharge using Injection Wells), which has a lower energy usage than purchased water from MWD, and #13 (IPR - MBR at HWRP to Regional System), which has a higher energy usage than purchased water from MWD.

6.4.6 Conclusion

The following observations are made in comparing Portfolio 3 to the Benchmark Portfolio:

- Portfolio 3 would increase the amount of water recycling compared to the Benchmark Portfolio due to Concept Options #11 and #23. Similar to Portfolio 1, the additional water recycling is limited under normal year conditions due to minimum supplies required from MWD. However, during dry years these new potable reuse concepts could be fully utilized and increase the amount of water recycling from 128,000 AFY (Benchmark) to 203,000 AFY (Portfolio 3). This means that the City would nearly utilize 50 percent of the available recycled water flow compared to 31 percent in the Benchmark Portfolio.

- The Sustainable City pLAn goals of reducing imported water purchases by 50 percent and sourcing 50 percent of the City's supply locally would be met and exceeded under normal and dry year conditions. However, the amount of stormwater capture goal remains the same as in the benchmark portfolio, about 3,000 AFY below the pLAn goal under normal year conditions. Imported water purchases from MWD are significantly reduced in dry years compared to the Benchmark Portfolio.

- Portfolio 3 will cost the City an additional $4.6 billion, on top of the $8.2 billion Benchmark Portfolio, for a total cost of $12.8 billion.

- The unit cost of Portfolio 3 is $2,400/AF under normal year conditions, approximately 20 percent higher than the Benchmark which has a unit cost of $2,000/AF under normal year conditions. It should be noted that this is only intended as a relative comparison rather than a typical unit supply cost as it also includes significant investments in stormwater quality improvement projects.

6.5 Portfolio 4 - Maximize Local Supplies

6.5.1 Portfolio Description

Portfolio 4 is characterized by concept options that were selected to "Maximize Local Water Supplies." In addition to the In-Progress and Planned projects and programs included in the Benchmark Portfolio, Portfolio 4, includes the following concept options:

- Dry Weather Low Flow Diversions
- Wet Weather Flow Diversions
- LA River Recharge into LA Forebay
- IPR - MBR at HWRP to Regional System
- DPR - DCTWRP to LA Aqueduct Filtration Plant
- DPR - LAGWRP to Headworks Reservoir
- East West Valley Interceptor Sewer
- Increase Recycled Water Demand Beyond 2015 UWMP

The purpose of this portfolio is a scenario to simulate the tradeoff if options to maximize local supply were implemented, increasing local water supplies, and reducing dependence on purchased imported water supplies. A map showing the general vicinity of each concept in Portfolio 4 in the City of LA is provided on Figure 17.

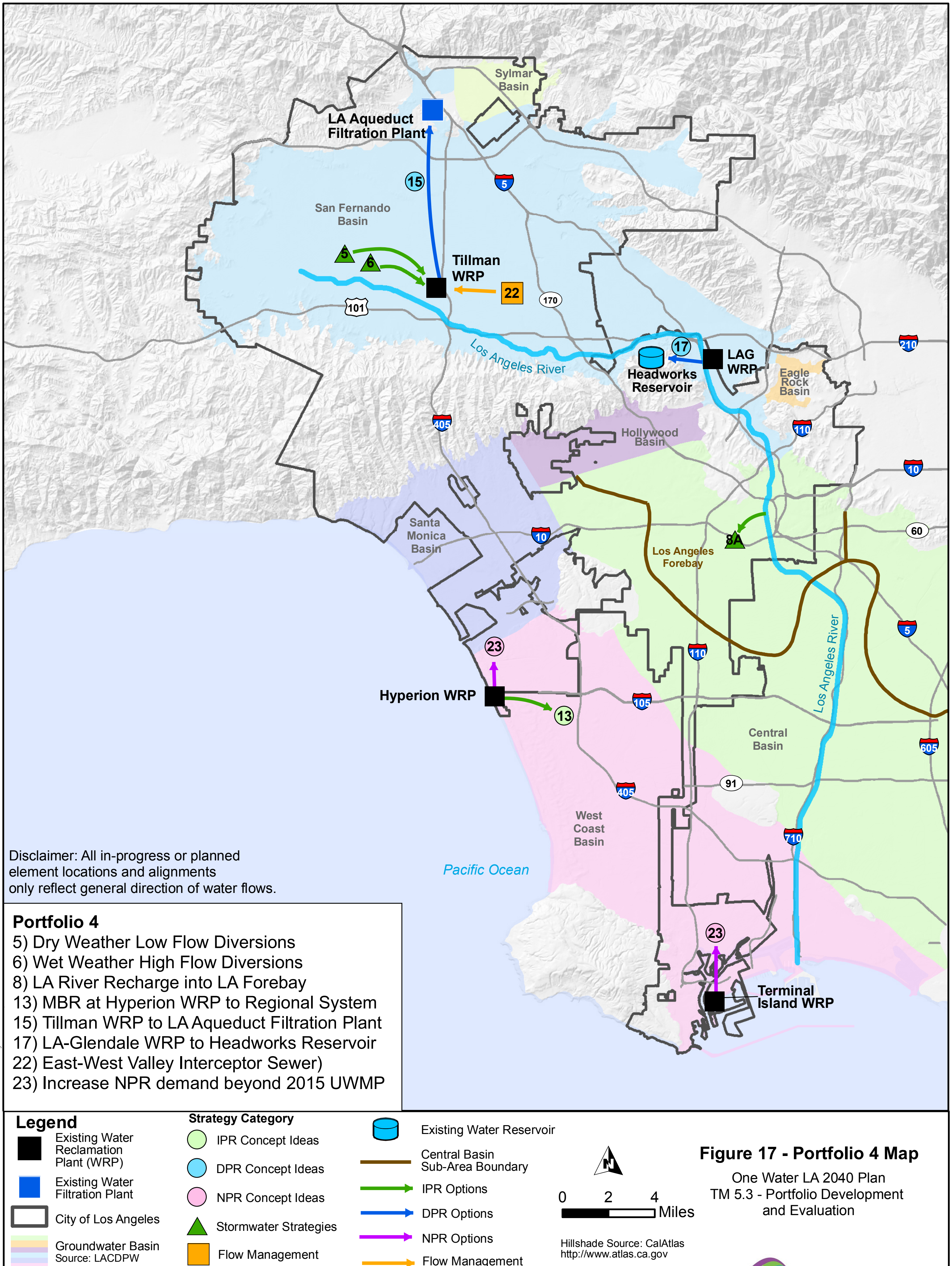


Figure 17 - Portfolio 4 Map

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6.5.2 Estimated Yield and Cost Summary

Table 14 lists the estimated yields and costs associated with each of the concept options.

Table 14 Portfolio 4 - Yield and Cost of New Concept Options
One Water LA 2040 Plan – TM 5.3

#	Concept Option Name	Estimated New Yield (AFY)	Estimated Capital Cost ($M)	Estimated Unit Cost ($/AF)
5	Dry Weather Low Flow Diversions	6,200	$110	$1,000
6	Wet Weather Flow Diversions	1,000	$190	$10,300
8A	LA River Recharge into LA Forebay using Injection Wells	25,000	$980	$2,100
13	IPR - MBR at Hyperion to Regional System	95,000	$900	$1,500
15	DPR - DCTWRP to LA Aqueduct Filtration Plant(1)	15,000	$310	$1,500
17	DPR - LAGWRP to Headworks Reservoir	6,000	$140	$1,500
22	East-West Valley Interceptor Sewer	11.4 mgd(2)	$85	$430
23	Increase Recycled Water Demand Beyond 2015 UWMP(3)	6,600	$370	$2,100
	Totals of New Concept Options Only(4)	**154,800**	**$3,100**	**$1,700**

Notes:

(1) Requires the East-West Valley Interceptor Sewer (Concept #22) or other flow management option to increase flows to DCTWRP
(2) Estimated capacity of EWVIS is 11.4 mgd does not provide a new supply, but only a flow increase to DCTWRP due to rerouting.
(3) EWVIS is excluded from the total estimated new yield. Partially included, using water only from HWRP (through West Basin) and non-City sources at TIWRP
(4) Excludes new yield and cost associated with Benchmark Portfolio projects and programs. Values are rounded.

As shown in Table 14, the estimated combined yield of the new concept options included in Portfolio 4 is 154,800 AFY, which excludes the estimated new yield capacity of Concept Option #22 (East-West Valley Interceptor Sewer) as this is a flow management concept that does not generate new supply by itself. A potential alternative or addition to the EWVIS is Concept Option #26 (Japanese Garden & Sepulveda Basin Lakes Recirculation), which may require a Wastewater Change Petition (Water Code Section 1211) to allow reduced discharge to the LA River and is therefore not included at this planning stage. The corresponding capital investment of the new concept options included in Portfolio 4 is approximately $3.1 billion. The yield weighted average unit cost is approximately $1,700/AF assuming that all projects can be fully utilized on a continuous basis. However, the MBT indicated that the capacity of Concept Options #15 and 17 had to be reduced during some hydrologic conditions due to insufficient flow availability. Hence, further optimization of concept sizing would be required to avoid building facilities with stranded capacity. As noted previously, the intent of the portfolios is not to provide a valid future alternative but only compare a range of extreme scenarios.

6.5.3 Evaluation Results

The results of the Portfolio 4 Maximize Local Supply evaluation are presented in Table 15. This table includes the projects in the Benchmark Portfolio and summarizes the yield, cost, flow balance, environmental benefits and how Portfolio 4 supports the Sustainable City pLAn stormwater capture and water supply goals.

Table 15 Portfolio 4 Maximize Local Supply Summary One Water LA 2040 Plan - TM 5.3

Metric	2040 Normal Year Hydrology	2040 Dry Year Hydrology	Unit
Demand and Supply Yield			
Total Demand	676,000	710,000	AFY
Estimated New Supply Yield Used	18,300	161,900	AFY
Estimated Cost			
Total Capital Cost	11,200	11,200	$M
Combined Annual O&M Cost	640	760	$M/year
Average Unit Cost	2,200	2,500	$/AF
Flow Balance			
Water Recycling Flow	128,000	241,000	AFY
Water Recycling Ratio	30%	58%	%
Stormwater Recharge	110,000	17,000	AFY
Ocean Discharge	600,000	170,000	AFY
Environmental Benefits			
Environmental Benefit Score	3.5	3.5	N/A
Energy Footprint	630	1,130	kWh/year
Sustainable City pLAn Goals			
Stormwater Capture	155,000	35,000	AFY
Reduce Purchase of Imported Water by 50% by 2025	85%	65%	%
Source 50% of Water Locally by 2035	56%	75%	%

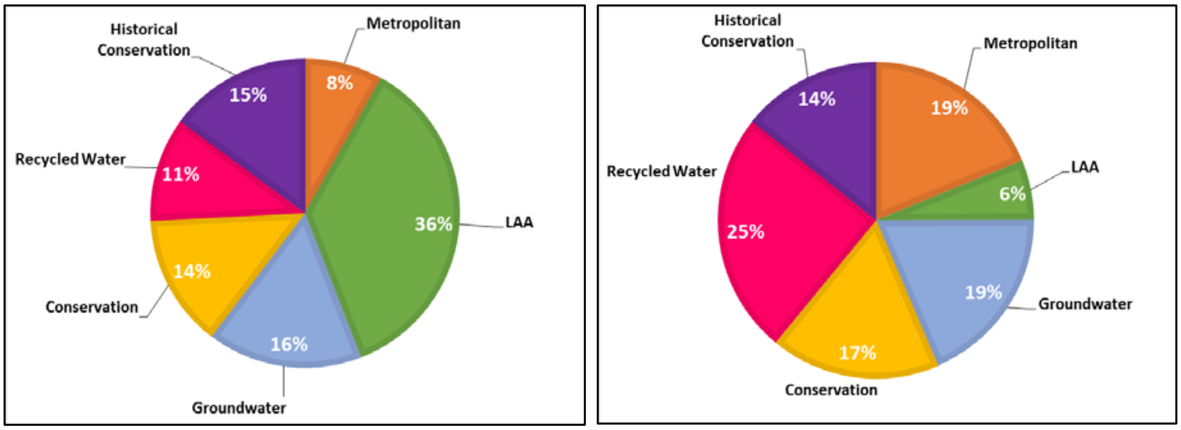
The following observations are made from the flow balance results presented in Table 15:

- Total demands are higher in a dry year than normal year.
- Stormwater recharge and ocean discharge are much lower in a dry year compared to a normal year due to less rainfall and associated stormwater flows.

- The pLAn goal to reduce purchased imported water by 50 percent is met under both normal and dry year conditions.
- The pLAn goal to source 50 percent of the City's water supply locally is met under both normal and dry year conditions.
- The pLAn goal to capture 150,000 AFY of stormwater capture is met in a normal year.

6.5.4 Flow Balance Summary

The projected water supply mix under normal and dry year conditions with the Benchmark Portfolio and concept options of Portfolio 4 are shown on Figure 18. The wet weather analysis results are included in Appendix B, while a screenshot of the MBT dashboard showing the full flow balance is located in Appendix C.



Normal Year **Dry Year**

Figure 18 Portfolio 4 – 2040 Supply Mix

As shown on Figure 18, the following observations can be made when comparing the supply mix under normal and dry year hydrologic conditions with the Benchmark Portfolio:

- The total amount of imported water (MWD and LAA) is 44 percent and 25 percent under normal and dry year conditions respectively.
- Purchased water from MWD is much higher in a dry year (19 percent) compared to a normal year (8 percent); LAA flows are much higher in a normal year (36 percent) compared to a dry year (6 percent).
- Purchased imported water from MWD is reduced to 8 percent compared to 9 percent in the Benchmark Portfolio in a normal year; and 19 percent compared to 38 percent in the Benchmark Portfolio in a dry year. Although the new concept options provide sufficient supply capacity to reduce MWD purchases to zero in a normal year, a minimum delivery of 65,000 AFY was maintained due to water distribution limitations.

6.5.5 Environmental Benefits Summary

The Environmental Benefits analysis summarizes scores based on available information for each of the high level concepts. Additional and/or unknown environmental benefits (e.g. environmental justice) may result once concepts move forward into future planning phases.

The environmental benefit score of Portfolio 4 is 3.5 compared to 4.4 for the Benchmark Portfolio. This score reflects the average score of concept options included in this portfolio. The concept options that have the highest environmental benefits besides the green street programs in the City's four major watersheds (Concept Options #1-4) is Concept Option #5 (Dry Weather Low Flow Diversions) and #6 (Wet Weather High Flow Diversion). Concept Option #8A (LA River Recharge to LA Forebay) and #13 (IPR - MBR at HWRP to Regional System) provide some environmental justice, open/natural space and recreation, stormwater quality, and/or ecological benefits. The remaining two concept options do not provide significant environmental benefits.

The average energy footprint of the supply source mix utilized in Portfolio 4 is estimated to be 630 kWh/AF and 1,130 kWh/AF under normal and dry year conditions, respectively. This is approximately 370 kWh/AF or 25 percent lower than the Benchmark Portfolio under dry year conditions. This decrease in energy usage is primarily the result of the addition of 141,000 AFY of potable reuse projects with the implementation of Concept Options #8A (LA River Recharge into LA Forebay), #13 (IPR - MBR at HWRP to Regional System), #15 (DPR from DCTWRP to LAAFP), and #17 (DPR from LAGWRP to Headworks Reservoir), which are lower in energy usage than purchased water from MWD.

6.5.6 Conclusion

The following observations are made in comparing Portfolio 4 to the Benchmark Portfolio:

- Portfolio 4 would increase the amount of water recycling compared to the Benchmark Portfolio due to Concept Options #13, #15, #17, and #23. Similar to Portfolio 1, the additional water recycling is limited under normal year conditions due to minimum supplies required from MWD. However, during dry years these new potable reuse concepts could be fully utilized and increase the amount of water recycling from 128,000 AFY (Benchmark) to 241,000 AFY (Portfolio 4). This means that the City would nearly utilize 58 percent of the available recycled water flow compared to 31 percent in the Benchmark Portfolio.

- The Sustainable City pLAn goals of reducing imported water purchases by 50 percent and sourcing 50 percent of the City's supply locally would be met and exceeded under normal and dry year conditions. The stormwater capture goal from the pLAn is met under normal year conditions due to the addition Concept Option #5 (Low Flow Diversions). Imported water purchases from MWD are significantly reduced in dry years compared to the Benchmark Portfolio.

- Portfolio 4 is more expensive than the Benchmark Portfolio. Portfolio 4 will cost the City an additional $3.0 billion, on top of the $8.2 billion Benchmark Portfolio, for a total cost of $11.2 billion.
- The unit cost of Portfolio 4 is $2,200/AF under normal year conditions, approximately 10 percent higher than the Benchmark which has a unit cost of $2,000/AF under normal year conditions. It should be noted that this is only intended as a relative comparison rather than a typical unit supply cost as it also includes significant investments in stormwater quality improvement projects.

7.0 PREFERRED PORTFOLIO

The portfolio analysis and definitions of themes were used to assess the sensitivities of the concept options under differing future scenarios and/or extremes. As shown on Figure 6, the results of the portfolio evaluation were considered to develop the Preferred portfolio. The Preferred portfolio is a list of recommended future concept options that could be implemented in the future to provide additional resiliency in dry years. This section provides a description of the concept options included in the Preferred Portfolio followed by the evaluation results and the associated observations related to cost, flow balance, and environmental benefits. Overall conclusions of the Preferred Portfolio are presented at the end of this section.

7.1.1 Portfolio Description

The preferred portfolio is a scenario to simulate the combination of concept options that were selected based on the results of the four extreme portfolios and discussions with City staff. In addition to the In-Progress and Planned projects and programs included in the Benchmark Portfolio, the Preferred Portfolio includes the following concept options:

- Dry Weather Low Flow Diversions
- LA River Recharge into LA Forebay
- IPR - MBR at Hyperion to Regional System
- DPR - DCTWRP to LA Aqueduct Filtration Plant
- DPR - LAGWRP to Headworks Reservoir
- East West Valley Interceptor Sewer

The purpose of this portfolio is to create a scenario that can be implemented that balances the various benefits that are desired to achieve the One Water vision and demonstrate an opportunities to increase resiliency by meeting the pLAn's 50 percent local supply goal in dry years. A map showing the general vicinity of each concept in the Preferred Portfolio in the City of LA is provided on Figure 19.

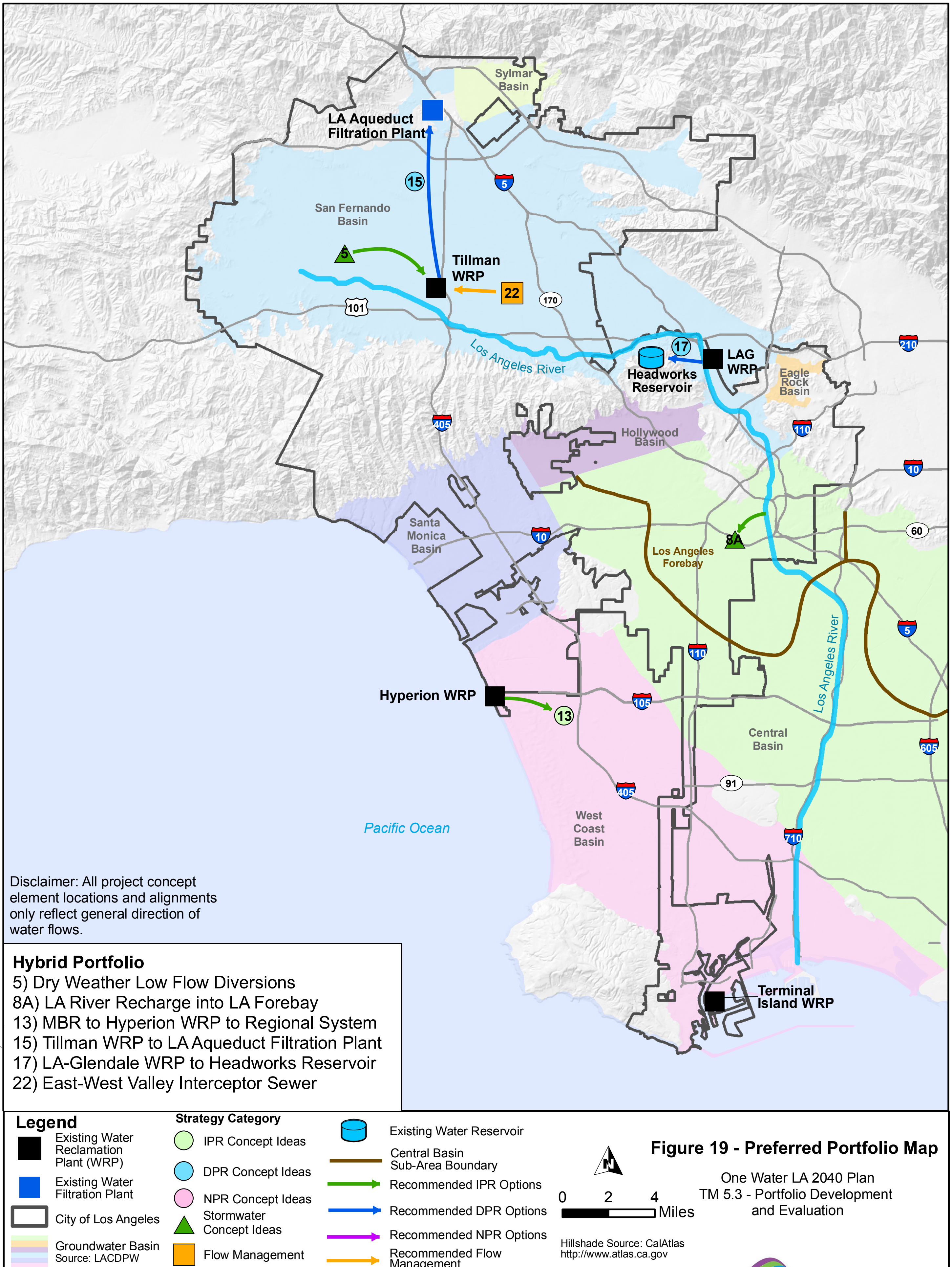


Figure 19 - Preferred Portfolio Map

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7.1.2 Estimated Yield and Cost Summary

The estimated yield and cost associated with each of the concept options that are included in the Preferred Portfolio are listed in Table 16.

Table 16 Preferred Portfolio - Yield and Cost of New Concept Options One Water LA 2040 Plan – TM 5.3

#	Concept Option Name	Estimated New Yield (AFY)	Estimated Capital Cost ($M)	Estimated Unit Cost ($/AF)
5	Dry Weather Low Flow Diversions	6,200	$110	$1,000
8A	LA River Recharge into LA Forebay using Injection Wells	25,000	$980	$2,100
13	Potable Reuse Groundwater Augmentation - Hyperion to Regional System	95,000	$900	$1,500
15	Potable Reuse Raw Water Augmentation - DCTWRP to LA Aqueduct Filtration Plant(1)	15,000	$310	$1,500
17	Potable Reuse Treated Water Augmentation - LAGWRP to Headworks Reservoir	6,000	$140	$1,500
22	East-West Valley Interceptor Sewer	11.4 mgd(2)	$85	$430
	Totals of New Concept Options Only(3)	**147,200**	**$2,500**	**$1,600**

Notes:

(1) Requires the East-West Valley Interceptor Sewer (Concept #22) or other flow management option to increase flows to DCTWRP

(2) Estimated capacity of EWVIS is 11.4 mgd does not provide a new supply, but only a flow increase to DCTWRP due to rerouting. EWVIS is excluded from the total estimated new yield.

(3) Excludes new yield and cost associated with Benchmark Portfolio projects and programs. Values are rounded.

As shown in Table 16, the estimated combined yield of the new concept options included in the Preferred Portfolio is 147,200 AFY, which excludes the capacity of Concept Option #22 (East-West Valley Interceptor Sewer) as this is a flow management concept that does not generate new supply by itself. A potential alternative or addition to the EWVIS is Concept Option #26 (Japanese Garden & Sepulveda Basin Lakes Recirculation), which would require a Wastewater Change Petition (Water Code Section 1211) to allow reduced discharge to the LA River and is therefore not included at this planning stage. The corresponding capital investment of the new concept options included in the Preferred Portfolio is approximately $2.5 billion. The yield weighted average unit cost is approximately $1,600/AF assuming that all projects can be fully utilized on a continuous basis. However, the MBT indicated that the capacity of Concept Options #15 and 17 had to be reduced during some hydrologic conditions due to insufficient flow availability. Hence, further optimization of concept sizing would be required to avoid building facilities with stranded capacity.

7.1.3 Evaluation Results

The results of the Preferred Portfolio evaluation are presented in Table 17. This table includes the projects in the Benchmark Portfolio and summarizes the yield, cost, flow balance, environmental benefits and how Preferred Portfolio supports the Sustainable City pLAn stormwater capture and water supply goals.

Table 17 Preferred Portfolio Summary
One Water LA 2040 Plan - TM 5.3

Metric	2040 Normal Year Hydrology	2040 Dry Year Hydrology	Unit
Demand and Supply Yield			
Total Demand	676,000	710,000	AFY
New Supply Yield	17,300	144,200	AFY
Estimated Cost			
Total Capital Cost	10,700	10,700	$ M
Combined Annual O&M Cost	650	780	$M/year
Average Unit Cost	2,200	2,500	$/AF
Flow Balance			
Water Recycling Flow	139,000	241,000	AFY
Water Recycling Ratio	32%	58%	%
Stormwater Recharge	110,000	17,000	AFY
Ocean Discharge	590,000	170,000	AFY
Environmental Benefits			
Environmental Benefit Score	3.5	3.5	N/A
Energy Footprint	640	1,190	kWh/year
Sustainable City pLAn Goals			
Stormwater Capture	154,000	34,000	AFY
Reduce Purchase of Imported Water by 50% by 2025	85%	61%	%
Source 50% of Water Locally by 2035	56%	73%	%

The following observations are made from the flow balance results for the Preferred Portfolio as shown in Table 17:

- Similar to the other portfolios, total demands are higher in a dry year than normal year.
- The amount of recycling in the preferred portfolio is equal to or at a higher rate than all other portfolios in both normal and dry years.

- Stormwater recharge and ocean discharge are much lower in a dry year compared to a normal year due to less rainfall and associated stormwater flows. Stormwater recharge and ocean discharge are at similar rates for the preferred portfolio than the other portfolios.
- The pLAn goal to reduce purchased imported water by 50 percent is met in normal and dry years. Purchased imported water is reduced by 85 percent in normal years, which is the same as Portfolios 1 through 4. Purchased imported water is reduced by 61 percent in dry years, which is equal to or higher than the other portfolios.
- The pLAn goal to source 50 percent of the City's water supply locally is met in normal and dry year conditions. The local water supply percentage is 56 percent in normal years, which is similar to Portfolios 1 through 4. Local water supply is 73 percent in dry years, which is also similar to the other portfolios.
- The pLAn goal to capture 150,000 AFY of stormwater capture is met in a normal year.

7.1.4 <u>Flow Balance Summary</u>

The projected water supply mix under normal and dry year conditions with the Benchmark Portfolio and concept options of the Preferred Portfolio are shown on Figure 20. The wet weather analysis results are included in Appendix B, while a screenshot of the MBT showing the full flow balance is located in Appendix C.

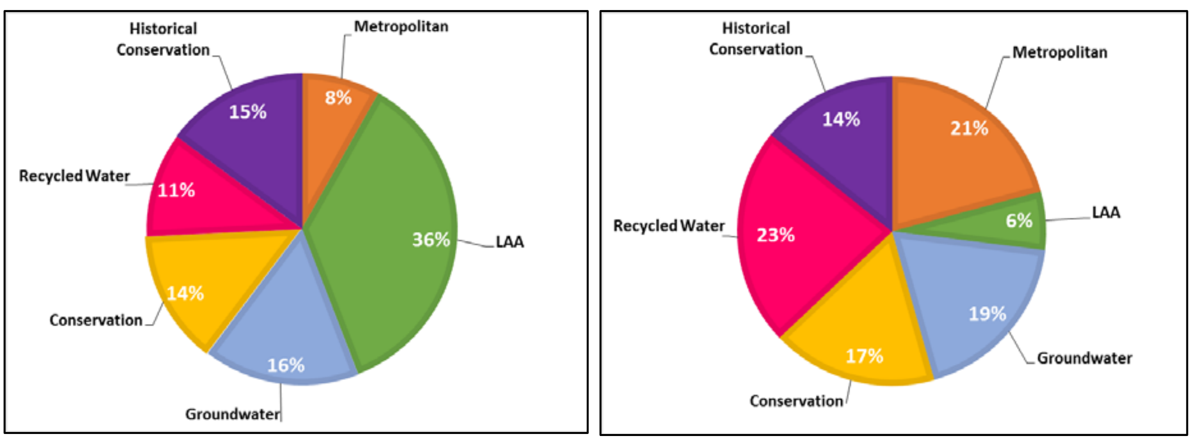

Figure 20 Preferred Portfolio – 2040 Supply Mix

As shown on Figure 20, the following observations can be made when comparing the supply mix under normal and dry year hydrologic conditions with the Benchmark Portfolio:

- The total amount of imported water (MWD and LAA) is 44 percent and 27 percent under normal and dry year conditions respectively.
- Similar to the other portfolios, purchased water from MWD is much higher in a dry year compared to a normal year; LAA flows are much higher in a normal year compared to a dry year.
- Similar to the Benchmark Portfolio, the amount of imported water from the LAA is substantially higher during normal years (36 percent) than dry years (6 percent).
- Purchased imported water from MWD is reduced to 8 percent compared to 9 percent in the Benchmark Portfolio in a normal year; and 21 percent compared to 38 percent in the Benchmark Portfolio in a dry year. Although the new concept options provide sufficient supply capacity to reduce MWD purchases to zero in a normal year, a minimum delivery of 65,000 AFY was maintained due to water distribution limitations.

7.1.5 Environmental Benefits Summary

The Environmental Benefits analysis summarizes scores based on available information for each of the high level concepts. Additional and/or unknown environmental benefits (e.g. environmental justice) may result once concepts move forward into future planning phases.

The environmental benefit score of the Preferred Portfolio is 3.5 compared to a range of 3.5 to 3.8 for Portfolios 1 through 4, and is much lower than a score of 4.4 for the Benchmark Portfolio. This score reflects the average score of concept options included in this portfolio. The concept option that has the highest environmental benefits besides the green street programs in the City's four major watersheds (Concept Options #1-4) is Concept Option #5 (Dry Weather Low Flow Diversions). The remaining concept options included in this portfolio do not provide significant environmental justice, open/natural space and recreation, stormwater quality, and/or ecological benefits. Concept Options #8A (LA River Recharge to LA Forebay) and #13 (IPR - MBR at HWRP to Regional System) provide some environmental justice, open/natural space and recreation, stormwater quality, and/or ecological benefits. The remaining two concept options do not provide significant environmental benefits.

The average energy footprint of the supply source mix utilized in the Preferred Portfolio is estimated to be 640 kWh/AF and 1,190 kWh/AF under normal and dry year conditions, respectively. The energy footprint is approximately 310 kWh/AF or 21 percent lower than the Benchmark Portfolio under dry year conditions. This decrease in energy usage is primarily the result of the addition of 141,000 AFY of potable reuse projects with the implementation of Concept Options #8A (LA River Recharge into LA Forebay), #13 (IPR - MBR at HWRP to Regional System), #15 (DPR from DCTWRP to LA Aqueduct Filtration Plant), and #17 (DPR from LAGWRP to Headworks Reservoir), which are lower in energy usage than purchased water from MWD.

7.1.6 Conclusion

The following observations are made in comparing the Preferred Portfolio to the other Portfolios:

- The Preferred Portfolio recycling rate is equal to or higher than the other portfolios. In a normal year, the Preferred Portfolio utilizes 32 percent of the available recycled water flow and in a dry year the Preferred Portfolio utilizes 58 percent of the available recycled water flow.
- The Sustainable City pLAn goals of reducing imported water purchases by 50 percent and sourcing 50 percent of the City's supply locally are met and exceeded under normal and dry year conditions. The stormwater capture goal from the pLAn is also met under normal year conditions due to the addition of Concept Option #5 (Low Flow Diversions).
- The Preferred Portfolio will cost the City an additional $2.5 billion, on top of the $8.2 billion Benchmark Portfolio, for a total cost of $10.7 billion (or $2,500/AF). However, the capital and unit cost of the Preferred Portfolio reflects the average cost of the other four Portfolios. As shown in Table 20 and Table 21, the capital cost of Portfolios 1 and 2 is lower than the Preferred Portfolio, while Portfolios 3 and 4 are more expensive.
- The unit cost of the Preferred Portfolio is $2,200/AF under normal year conditions, approximately 9 percent higher than the Benchmark which has a unit cost of $2,000/AF under normal year conditions. It should be noted that this is only intended as a relative comparison rather than a typical unit supply cost as it also includes significant investments in stormwater quality improvement projects.

8.0 PORTFOLIO ANALYSIS SUMMARY

One Water LA's future integration strategies consist of a mix of projects and programs that support the One Water LA objectives, the Sustainable City pLAn goals and the supply strategy defined in the 2015 UWMP. As part of the One Water LA planning process, 25 new concept options were developed that include a wide variety of stormwater, groundwater, potable reuse, and other local water management strategies. These concept options were developed, evaluated, scored, and ranked (see TM 5.2). Subsequently, the most promising concepts were selected to move forward into the portfolio evaluation through inclusion in one or more themed portfolios (purpose of TM 5.3).

8.1.1 Portfolio Definition

A total of six portfolios were developed, including one benchmark portfolio, four themed portfolios, and one preferred portfolio. The benchmark portfolio reflects the supply mix changes as presented in the 2015 UWMP, as well as some other in-progress and planned projects presented in Section 6.1.1.2. The remaining four portfolios were arranged around themes that emphasize the following strategies to assess the sensitivity of extremes:

- Portfolio 1: Minimize Cost
- Portfolio 2: Maximize Environmental Benefits
- Portfolio 3: Maximize Institutional Collaboration
- Portfolio 4: Maximize Local Water Supplies.

Based on the results of the four extreme portfolios and discussions with City staff, the "Preferred Portfolio" was compiled. This is the preferred portfolio that consists of the most beneficial concept options considering a wide range of benefits and availability of water from the various potential sources including recycled water, stormwater, and dry weather runoff. The concept options that were included in each of the four themed and preferred portfolio are summarized in Table 18.

As shown in Table 18, some concept options are included in multiple portfolios while other options are not included in any portfolios. It should be noted that some of the concept options that are currently not included in the Preferred Portfolio remain good viable alternatives in case certain triggers do not materialize. A detailed discussion on triggers and implementation strategy will be included in Chapter 10 of the summary report (see One Water LA 2040 Plan - Volume 1).

Table 18 Portfolio Summary
One Water LA 2040 Plan - TM 5.3

#	Concept Option Name	Benchmark Portfolio	Portfolio 1 Minimize Cost	Portfolio 2 Max. Env. Benefits	Portfolio 3 Max. Inst. Collaboration	Portfolio 4 Max. Local Supplies	Preferred Portfolio
1	Green Streets – Upper Los Angeles River Watershed	X	X	X	X	X	X
2	Green Streets – Ballona Creek Watershed	X	X	X	X	X	X
3	Green Streets – Dominguez Channel Watershed	X	X	X	X	X	X
4	Green Streets – Santa Monica Bay/Marina Del Rey Watersheds	X	X	X	X	X	X
5	Dry Weather Low Flow Diversions		X	X		X	X
6	Wet Weather High Flow Diversions			X		X	
7	Upper LA River to DCTWRP		X				
8A	LA River Recharge into LA Forebay			X	X	X	X
9	DCTWRP to San Fernando Basin Injection Wells						
10	HWRP to West Coast Basin Injection Wells						
11	HWRP to Central Basin Injection Wells				X		
13	IPR - MBR at HWRP to Regional System		X	X		X	X
14	HWRP to San Fernando Basin Injection Wells						
15	DCTWRP to Los Angeles Aqueduct Filtration Plant					X	X
16	DCTWRP to LADWP Distribution System		X				
17	LAGWRP to Headworks Reservoir		X			X	X
18	HWRP to LADWP Distribution System						
19	HWRP to Headworks Reservoir						
20	HWRP to Los Angeles Aqueduct Filtration Plant						
21	Central LA Satellite WRP to LAAFP						
22	East-West Valley Interceptor Sewer		X			X	X
23	Increase Recycled Water Demand beyond 2015 UWMP				X	X	
25	Ocean Desalination						

Note: Detailed descriptions of the concept options can be found in TM 5.2.

8.1.2 Estimated Yield and Cost Summary

The estimated new yield, capital cost, and unit cost of all portfolios under dry year conditions are summarized in Table 19.

Table 19 Portfolio Summary of Yields and Costs - Dry Year One Water LA 2040 Plan – TM 5.3

Portfolio	Portfolio Name	Estimated New Yield Used (AFY)	Estimated Capital Cost ($M)	Estimated Unit Cost ($/AF)
B	Benchmark	N/A(1)	$8,200	$2,300
1	Minimize Cost	124,800	$9,700	$2,400
2	Maximize Environmental Benefits	127,200	$10,300	$2,500
3	Maximize Collaboration	116,700	$12,800	$2,600
4	Maximize Local Supplies	161,900	$11,200	$2,500
H	Preferred	144,200	$10,700	$2,500

Note:

(1) The estimated yield associated with the Benchmark Portfolio projects are listed in Table 4. The yields presented in this table only reflect the new supply capacity associated with the new concept options in each portfolio.

As shown in Table 19, the estimated new yield ranges from approximately 100,000 to 150,000 AFY. It should be noted that the majority of this new supply can only be utilized during dry years and during normal years if other planned supplies as outlined in the 2015 UWMP cannot produce the estimated deliveries.

The capital cost for the Benchmark Portfolio is $8.2 billion, of which $5.6 billion support stormwater quality, and includes a large number of major projects and programs that are already in-progress and planned. As shown the total capital cost of the other portfolios ranges from $9.7 to $12.8 billion, which represents an incremental increase of $1.5 to $4.7 billion for new projects and programs. As shown in Table 19, the average unit cost of all water supplies and projects to meet future demand and regulatory conditions would increase from $2,300/AF in the Benchmark Portfolio to a range of $2,400/AF to $2,600/AF in the other portfolios. The incremental increase is lower than the capital cost increase due to the large amount of existing water supplies that are considered in the MBT when calculating the cost of the total water supply mix to meet 2040 demand conditions.

8.1.3 Portfolio Analysis Results Summary

As shown on Figure 2, the 2015 UWMP already provides a strategy for the City to meet the Sustainable City pLAn goal to meet 50 percent of the City's 2035 demand with locally sourced water. It should be noted that this supply strategy reflects normal year conditions and includes historical conservation. The purpose of the portfolio evaluation presented in this TM is to identify the most beneficial mix of concept options that could supplement the City's local water supplies to further offset purchased imported water supplies increasing local resiliency, specifically during dry year conditions. These most beneficial concept options are intended to provide potential alternative water supply options in case some of the assumptions in the 2015 UWMP need to be adjusted and/or to plan ahead for projects beyond year 2040.

A summary of the portfolio evaluation results under both normal and dry year conditions are presented in Table 20 and Table 21, respectively, while the results under wet year conditions are presented in Appendix B. In addition to the cost observations discussed in Section 8.1.2, the following observations can be made:

- The amount of water recycling does not increase substantially (from 30 percent to 30-32 percent) during normal years because the City does not purchase much imported water that can be offset with the new local supplies generated by the various concept options included in the portfolios, and therefore ocean discharge remains similar as well.
- The amount of water recycling increases substantially (from 31 percent to 50-58 percent) during dry years because the City has planned to purchase more than 300,000 AFY of imported water due to lower LAA deliveries, which can be offset with the new local supplies generated by the various concept options included in the portfolios. As a result, ocean discharges decrease substantially as well.
- The amount of stormwater recharge is the same for all portfolios, but for some portfolios, the amount of stormwater capture is higher due to the inclusion of low flow and high flow diversions (Concept Options #5 and #6). Naturally, both capture and recharge are estimated to be much higher under normal year conditions compared to dry year conditions. As shown in Table 20, it is estimated that 110,000 AFY of the approximately 150,000 AFY captured stormwater would be recharged under normal year conditions. Similarly, Table 21 shows that the amount of stormwater capture and recharge under dry year conditions are estimated to be 34,000 AFY and 17,000 AFY, respectively.
- The environmental benefit score is the highest in the Benchmark Portfolio because it is based on the average score of Concept Options #1-4 (Green Streets in all four watersheds), which have the highest environmental justice, open/natural space and recreation, stormwater quality, and ecological benefits of all 25 concept options. When more concept options are added in the other portfolios, the average score will

automatically decrease. As expected, Portfolio 2 (Maximize Environmental Benefits) has the highest score of the other four portfolios.

- The energy footprint of the portfolio is generally lower than the Benchmark Portfolio in dry years due to the increase of potable reuse concepts, which have a lower energy usage than purchased imported water when considering the high energy for long distance conveyance.

- The pLAn goal to achieve 150,000 AFY of stormwater capture is nearly met by the Benchmark Portfolio. Due to the addition of Concept Option #5 (Dry Weather Low Flow Diversions) and Concept Option #6 (Wet Weather High Flow Diversions), the goal is exceeded in portfolios 1, 2, 4, and the preferred portfolio under normal year conditions. Due to less rainfall, the goal is not met for any portfolio under dry year conditions.

- The pLAn goal to reduce purchased imported water by 50 percent is met under normal conditions in the Benchmark Portfolio, and is only reduced by 30 percent under dry year conditions. This goal is met under both normal and dry year conditions for all other portfolios.

- The pLAn goal to source 50 percent of the City's water supply locally is met under normal and dry conditions in all portfolios. Although new concept options could provide significant supply capacity that could reduce MWD purchases to zero percent in a normal year, a minimum delivery of 65,000 AFY was maintained due to water distribution limitations. However, the utilization of local supplies is significantly higher in the portfolios under dry year conditions, ranging from 65 percent to 70 percent versus 56 percent in the Benchmark Portfolio. Portfolios 1, 4, and the Preferred Portfolio would result in the highest utilization of local supplies.

8.1.4 <u>Next Steps</u>

As shown in Table 18, some concept options are included in multiple portfolios while other options are not included in any portfolios. Although some of the concept options did not score favorably due to high cost and/or other limited benefits, it should be noted that some of the concept options that are currently not included in the Preferred Portfolio remain good viable alternatives as some the recommended concept options depend on certain triggers occurring. In case certain triggers do not materialize, other concept options could provide an alternative to achieve the same overall goals. A dynamic trigger based implementation strategy guides the City with the decision process to implement individual concept options only when needed and feasible. The trigger-based implementation strategy will be developed and presented in Chapter 10 of the summary report (see One Water LA 2040 Plan - Volume 1).

Table 20 Portfolio Analysis Comparison - Normal Year Conditions One Water LA 2040 Plan - TM 5.3

	Portfolio Name					
Metric	**Benchmark**	**1 Minimum Cost**	**2 Maximum Environ. Benefits**	**3 Maximum Institutional Collaboration**	**4 Maximum Local Supplies**	**Preferred**
Yield						
Total Demand (AFY)	676,000	676,000	676,000	676,000	676,000	676,000
Estimated New Supply Yield Used (AFY)	0	22,900	18,300	11,100	18,300	17,300
Estimated Cost						
Total Capital Cost ($M)	8,200	9,700	10,300	12,800	11,200	10,700
Combined Annual O&M Cost ($M/yr)	660	650	650	640	640	650
Average Unit Cost ($/AF)	2,000	2,100	2,200	2,400	2,200	2,200
Flow Balance						
Water Recycling Flow (AFY)	128,000	139,000	139,000	128,000	128,000	139,000
Water Recycling Ratio (%)	30%	32%	32%	30%	30%	32%
Stormwater Recharge (AFY)	110,000	110,000	110,000	110,000	110,000	110,000
Ocean Discharge (AFY)	600,000	590,000	590,000	600,000	600,000	590,000
Environmental Benefits						
Environmental Benefit Score	4.4	3.6	3.8	3.8	3.5	3.5
Energy Footprint (kWh/AF)	660	640	640	630	630	640
Sustainable City pLAn Goals						
Stormwater Capture (AFY)	147,000	159,000	155,000	147,000	155,000	154,000
Reduction of Purchase Imported Water %	83%	85%	85%	85%	85%	85%
Locally Sourced Water (%)	55%	56%	56%	56%	56%	56%

Table 21 Portfolio Analysis Comparison - Dry Year Conditions
One Water LA 2040 Plan - TM 5.3

	Portfolio Name					
Metric	**Benchmark**	**1 Minimum Cost**	**2 Maximum Environ. Benefits**	**3 Maximum Institutional Collaboration**	**4 Maximum Local Supplies**	**Preferred**
Yield						
Total Demand (AFY)	710,000	710,000	710,000	710,000	710,000	710,000
Estimated New Supply Yield Used (AFY)	0	124,800	127,200	116,700	161,900	144,200
Estimated Cost						
Total Capital Cost ($M)	8,200	9,700	10,300	12,800	11,200	10,700
Combined Annual O&M Cost ($M/yr)	810	780	790	750	760	780
Average Unit Cost ($/AF)	2,300	2,400	2,500	2,600	2,500	2,500
Flow Balance						
Water Recycling Flow (AFY)	128,000	241,000	223,000	203,000	241,000	241,000
Water Recycling Ratio (%)	31%	58%	54%	50%	58%	58%
Stormwater Recharge (AFY)	17,000	17,000	17,000	17,000	17,000	17,000
Ocean Discharge (AFY)	310,000	200,000	190,000	210,000	170,000	170,000
Environmental Benefits						
Environmental Benefit Score	4.4	3.6	3.8	3.8	3.5	3.5
Energy Footprint (kWh/AF)	1,500	1,230	1,210	1,500	1,130	1,190
Sustainable City pLAn Goals						
Stormwater Capture (AFY)	27,000	39,000	35,000	27,000	35,000	34,000
Reduction of Purchase Imported Water %	30%	55%	57%	56%	65%	61%
Locally Sourced Water (%)	56%	70%	71%	70%	75%	73%

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APPENDIX A – REFERENCES

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APPENDIX B – WET YEAR PORTFOLIO ANALYSES

A summary of the portfolio evaluation results under wet year conditions are presented in Table B.1.

Table B.1 Portfolio Analysis Comparison - Wet Year Conditions

	Portfolio Name					
Metric	Benchmark	1 Minimum Cost	2 Maximum Environ. Benefits	3 Maximum Institutional Collaboration	4 Maximum Local Supplies	Preferred
Yield						
Total Demand (AFY)	642,000	642,000	642,000	642,000	642,000	642,000
Estimated New Supply Yield Used (AFY)	0	21,700	17,100	9,900	17,100	16,100
Estimated Cost						
Total Capital Cost ($M)	8,200	9,700	10,300	12,800	11,200	10,700
Combined Annual O&M Cost ($M/yr)	640	640	640	620	630	640
Average Unit Cost ($/AF)	2,000	2,100	2,200	2,400	2,200	2,200
Flow Balance						
Water Recycling Flow (AFY)	128,000	138,000	138,000	128,000	128,000	138,000
Water Recycling Ratio (%)	29%	31%	31%	29%	29%	32%
Stormwater Recharge (AFY)	386,000	386,000	386,000	386,000	386,000	386,000
Ocean Discharge (AFY)	1,270,000	1,260,000	1,260,000	1,270,000	1,270,000	1,260,000
Environmental Benefits						
Environmental Benefit Score	4.4	3.6	3.8	3.8	3.5	3.5
Energy Footprint (kWh/AF)	700	670	670	660	660	670
Sustainable City pLAn Goals						
Stormwater Capture (AFY)	424,000	436,000	431,000	424,000	431,000	430,000
Reduction of Purchase Imported Water %	83%	85%	85%	85%	85%	85%
Locally Sourced Water (%)	52%	54%	54%	54%	54%	54%

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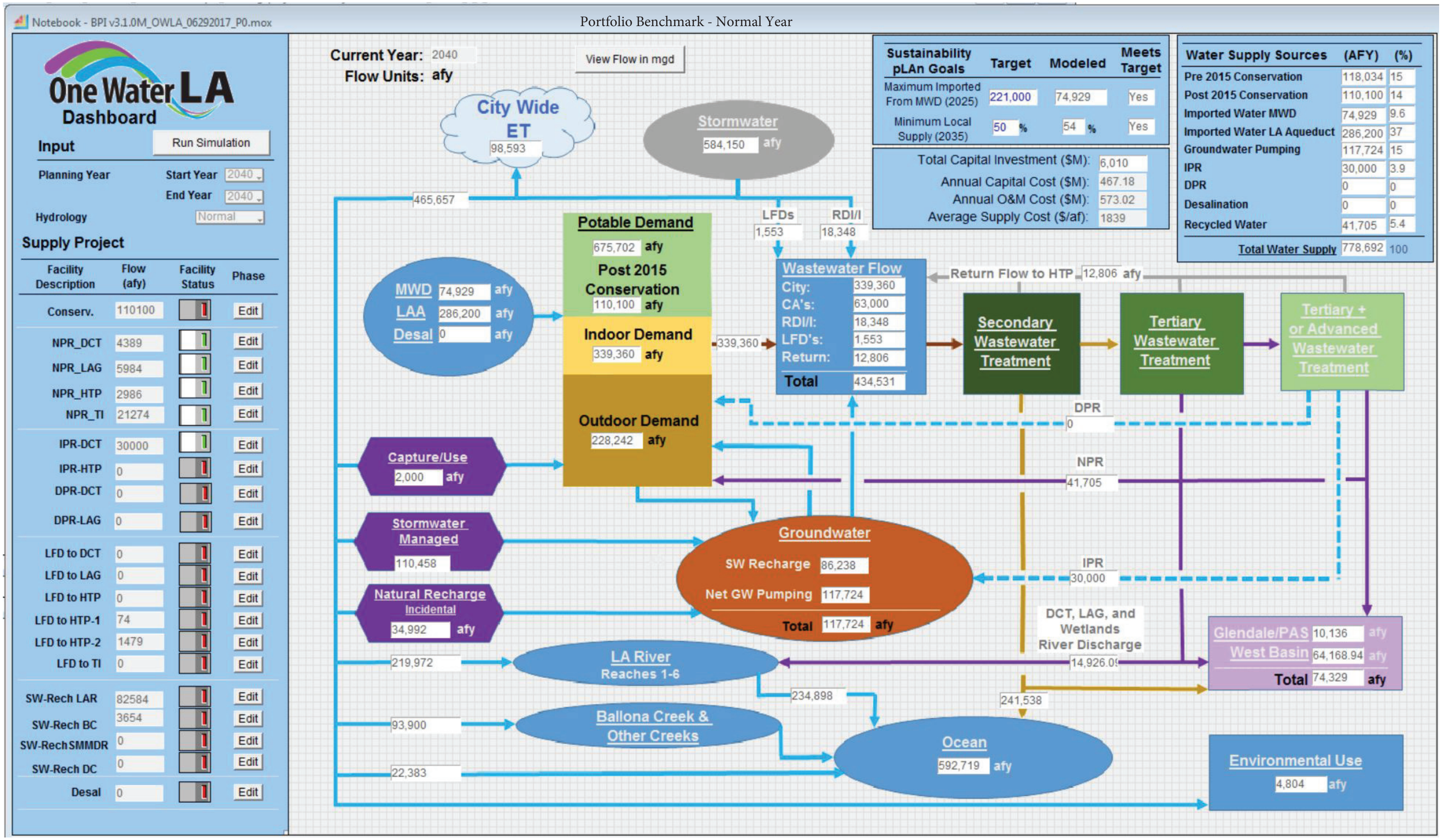
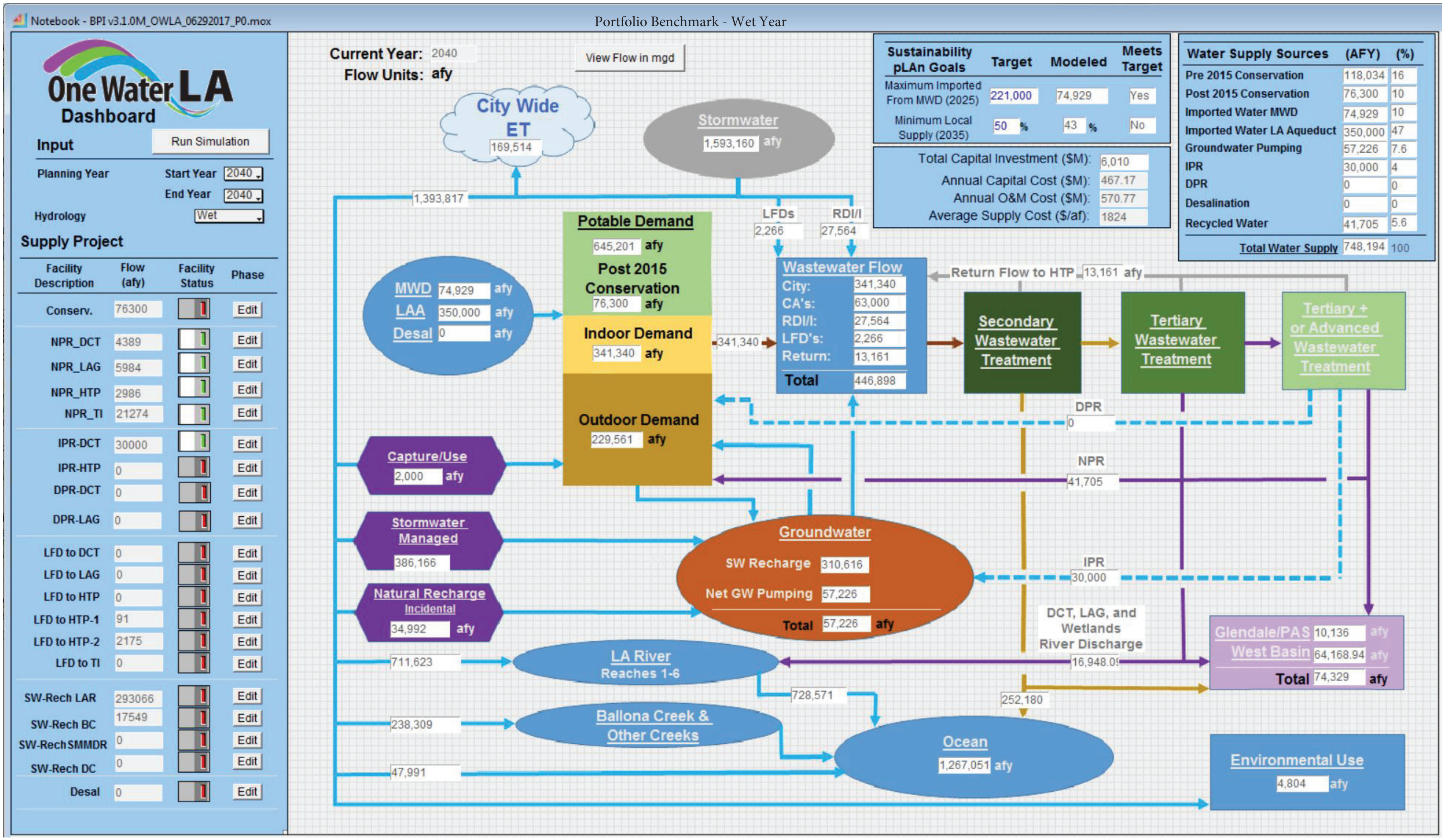
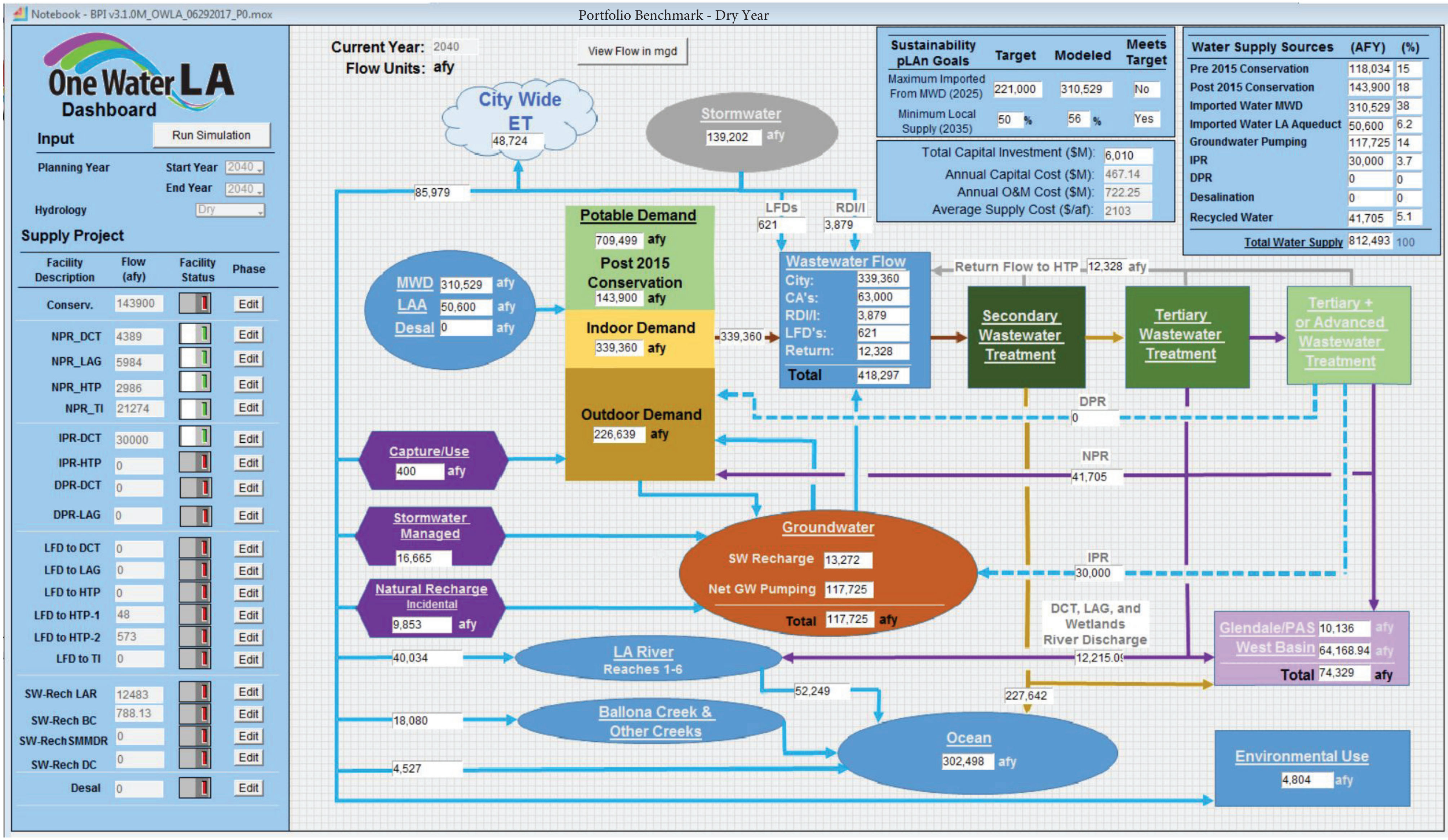
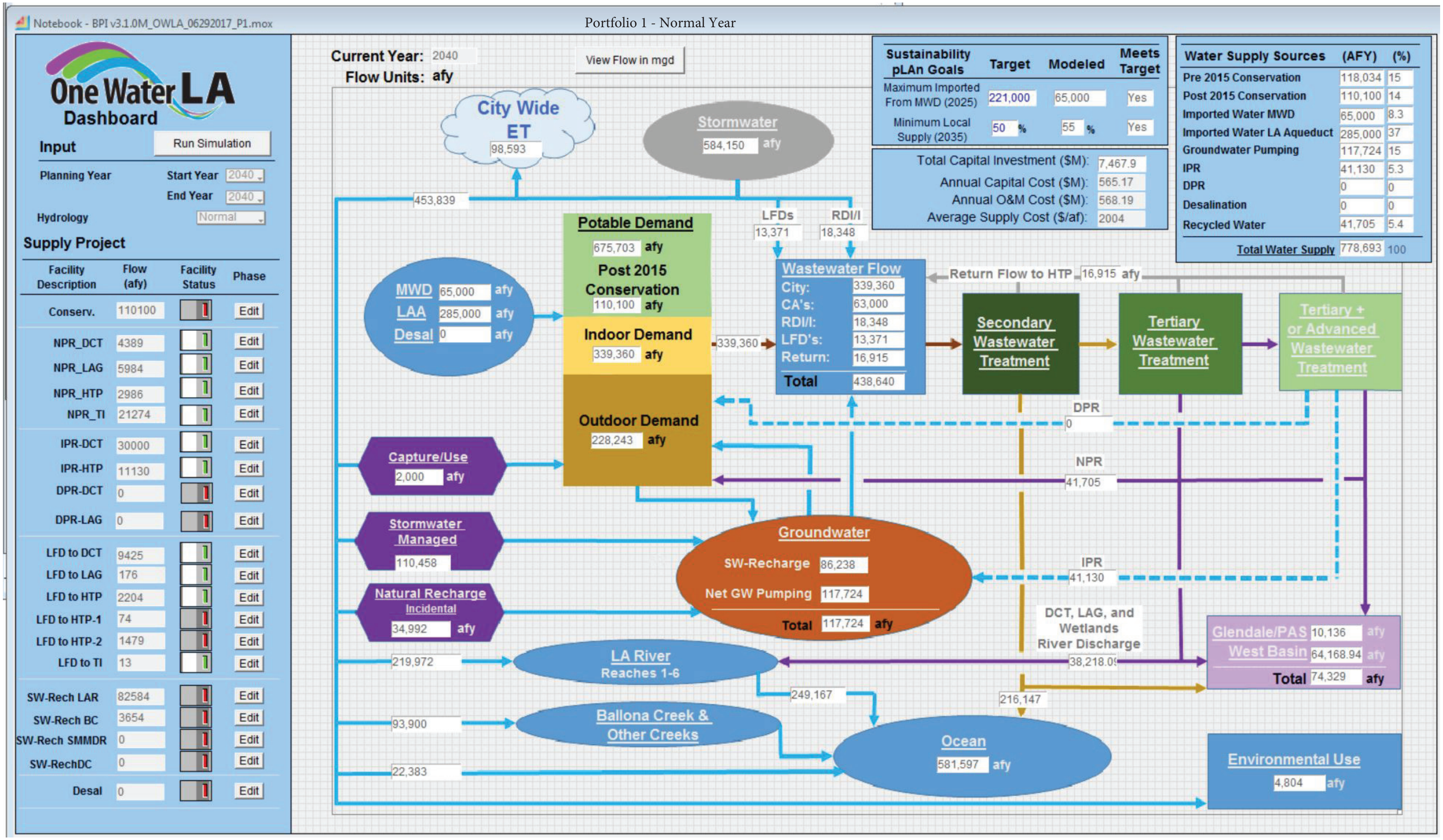
APPENDIX C – MASS BALANCE TOOL DASHBOARD SCREEN CAPTURES


Notebook - BPI v3.1.0M_OWLA_06292017_P0.mox
Portfolio Benchmark - Normal Year
One Water LA Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Normal
Supply Project
Facility Description | Flow (afy) | Facility Status | Phase
Conserv. 110100 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 0 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 0 Edit
LFD to LAG 0 Edit
LFD to HTP 0 Edit
LFD to HTP-1 74 Edit
LFD to HTP-2 1479 Edit
LFD to TI 0 Edit
SW-Rech LAR 82584 Edit
SW-Rech BC 3654 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET 98,593
Stormwater 584,150 afy
465,657
Potable Demand 675,702 afy
Post 2015 Conservation 110,100 afy
Indoor Demand 339,360 afy
Outdoor Demand 228,242 afy
MWD 74,929 afy
LAA 286,200 afy
Desal 0 afy
LFDs 1,553
RDI/I 18,348
Wastewater Flow
City: 339,360
CA's: 63,000
RDI/I: 18,348
LFD's: 1,553
Return: 12,806
Total 434,531
339,360
Return Flow to HTP 12,806 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR 0
NPR 41,705
IPR 30,000
Capture/Use 2,000 afy
Stormwater Managed 110,458
Natural Recharge Incidental 34,992 afy
Groundwater
SW Recharge 86,238
Net GW Pumping 117,724
Total 117,724 afy
DCT, LAG, and Wetlands River Discharge
14,926.09
LA River Reaches 1-6
219,972
234,898
241,538
Ballona Creek & Other Creeks
93,900
22,383
Ocean 592,719 afy
Glendale/PAS 10,136 afy
West Basin 64,168.94 afy
Total 74,329 afy
Environmental Use 4,804 afy
Sustainability pLAn Goals | Target | Modeled | Meets Target
Maximum Imported From MWD (2025) | 221,000 | 74,929 | Yes
Minimum Local Supply (2035) | 50 % | 54 % | Yes
Total Capital Investment ($M): 6,010
Annual Capital Cost ($M): 467.18
Annual O&M Cost ($M): 573.02
Average Supply Cost ($/af): 1839
Water Supply Sources | (AFY) | (%)
Pre 2015 Conservation | 118,034 | 15
Post 2015 Conservation | 110,100 | 14
Imported Water MWD | 74,929 | 9.6
Imported Water LA Aqueduct | 286,200 | 37
Groundwater Pumping | 117,724 | 15
IPR | 30,000 | 3.9
DPR | 0 | 0
Desalination | 0 | 0
Recycled Water | 41,705 | 5.4
Total Water Supply | 778,692 | 100

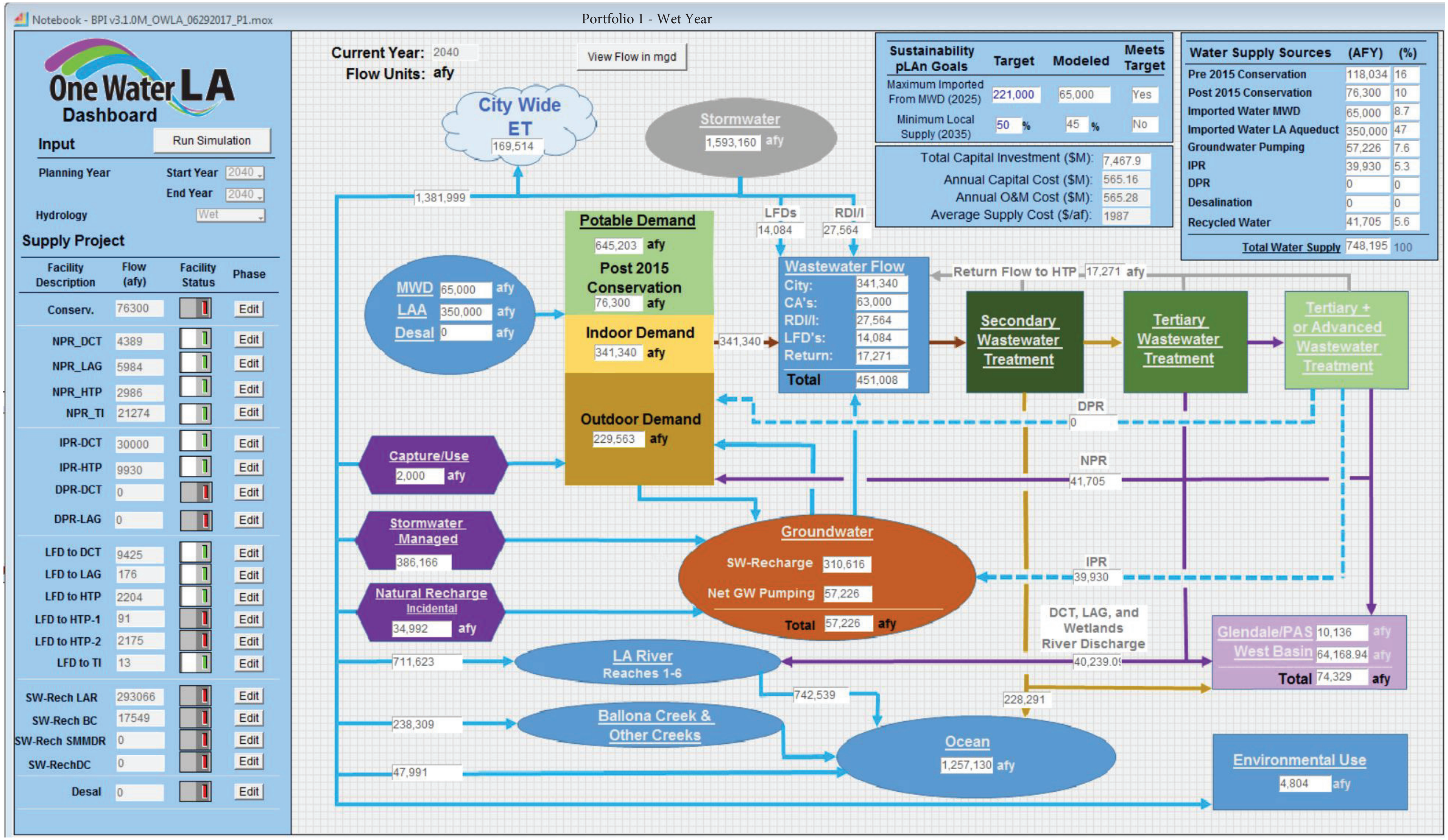


Notebook - BPI v3.1.0M_OWLA_06292017_P0.mox
Portfolio Benchmark - Wet Year
One Water LA Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Wet
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 76300 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 0 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 0 Edit
LFD to LAG 0 Edit
LFD to HTP 0 Edit
LFD to HTP-1 91 Edit
LFD to HTP-2 2175 Edit
LFD to TI 0 Edit
SW-Rech LAR 293066 Edit
SW-Rech BC 17549 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET 169,514
Stormwater 1,593,160 afy
1,393,817
LFDs 2,266
RDI/I 27,564
Potable Demand 645,201 afy
Post 2015 Conservation 76,300 afy
Indoor Demand 341,340 afy
Outdoor Demand 229,561 afy
MWD 74,929 afy
LAA 350,000 afy
Desal 0 afy
341,340
Wastewater Flow
City: 341,340
CA's: 63,000
RDI/I: 27,564
LFD's: 2,266
Return: 13,161
Total 446,898
Return Flow to HTP 13,161 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR 0
NPR 41,705
IPR 30,000
Capture/Use 2,000 afy
Stormwater Managed 386,166
Natural Recharge Incidental 34,992 afy
Groundwater
SW Recharge 310,616
Net GW Pumping 57,226
Total 57,226 afy
DCT, LAG, and Wetlands River Discharge
16,948.09
711,623
LA River Reaches 1-6
728,571
252,180
238,309
Ballona Creek & Other Creeks
47,991
Ocean 1,267,051 afy
Glendale/PAS 10,136 afy
West Basin 64,168.94 afy
Total 74,329 afy
Environmental Use 4,804 afy
Sustainability pLAn Goals | Target | Modeled | Meets Target
Maximum Imported From MWD (2025) | 221,000 | 74,929 | Yes
Minimum Local Supply (2035) | 50 % | 43 % | No
Total Capital Investment ($M): 6,010
Annual Capital Cost ($M): 467.17
Annual O&M Cost ($M): 570.77
Average Supply Cost ($/af): 1824
Water Supply Sources (AFY) (%)
Pre 2015 Conservation 118,034 16
Post 2015 Conservation 76,300 10
Imported Water MWD 74,929 10
Imported Water LA Aqueduct 350,000 47
Groundwater Pumping 57,226 7.6
IPR 30,000 4
DPR 0 0
Desalination 0 0
Recycled Water 41,705 5.6
Total Water Supply 748,194 100

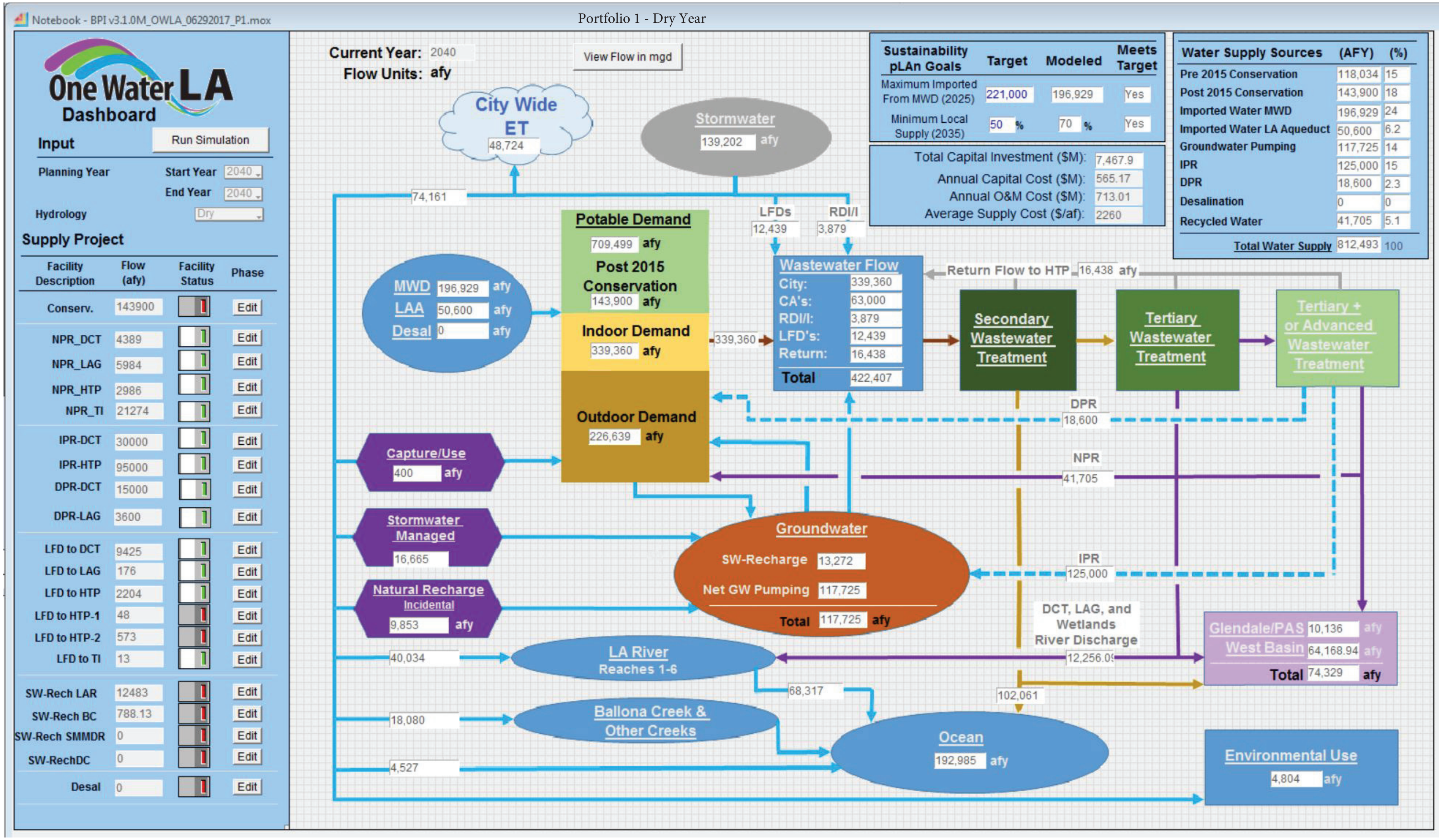

Notebook - BPI v3.1.0M_OWLA_06292017_P0.mox
Portfolio Benchmark - Dry Year
One Water LA
Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Dry
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 143900 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 0 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 0 Edit
LFD to LAG 0 Edit
LFD to HTP 0 Edit
LFD to HTP-1 48 Edit
LFD to HTP-2 573 Edit
LFD to TI 0 Edit
SW-Rech LAR 12483 Edit
SW-Rech BC 788.13 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET
48,724
Stormwater
139,202 afy
85,979
LFDs
621
RDI/I
3,879
Potable Demand
709,499 afy
Post 2015 Conservation
143,900 afy
Indoor Demand
339,360 afy
Outdoor Demand
226,639 afy
MWD 310,529 afy
LAA 50,600 afy
Desal 0 afy
339,360
Wastewater Flow
City: 339,360
CA's: 63,000
RDI/I: 3,879
LFD's: 621
Return: 12,328
Total 418,297
Return Flow to HTP 12,328 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR
0
NPR
41,705
Capture/Use
400 afy
Stormwater Managed
16,665
Natural Recharge Incidental
9,853 afy
Groundwater
SW Recharge 13,272
Net GW Pumping 117,725
Total 117,725 afy
IPR
30,000
DCT, LAG, and Wetlands River Discharge
12,215.09
40,034
LA River Reaches 1-6
52,249
227,642
18,080
Ballona Creek & Other Creeks
4,527
Ocean
302,498 afy
Glendale/PAS 10,136 afy
West Basin 64,168.94 afy
Total 74,329 afy
Environmental Use
4,804 afy
Sustainability pLAn Goals
Target
Modeled
Meets Target
Maximum Imported From MWD (2025) 221,000 310,529 No
Minimum Local Supply (2035) 50 % 56 % Yes
Total Capital Investment ($M): 6,010
Annual Capital Cost ($M): 467.14
Annual O&M Cost ($M): 722.25
Average Supply Cost ($/af): 2103
Water Supply Sources (AFY) (%)
Pre 2015 Conservation 118,034 15
Post 2015 Conservation 143,900 18
Imported Water MWD 310,529 38
Imported Water LA Aqueduct 50,600 6.2
Groundwater Pumping 117,725 14
IPR 30,000 3.7
DPR 0 0
Desalination 0 0
Recycled Water 41,705 5.1
Total Water Supply 812,493 100



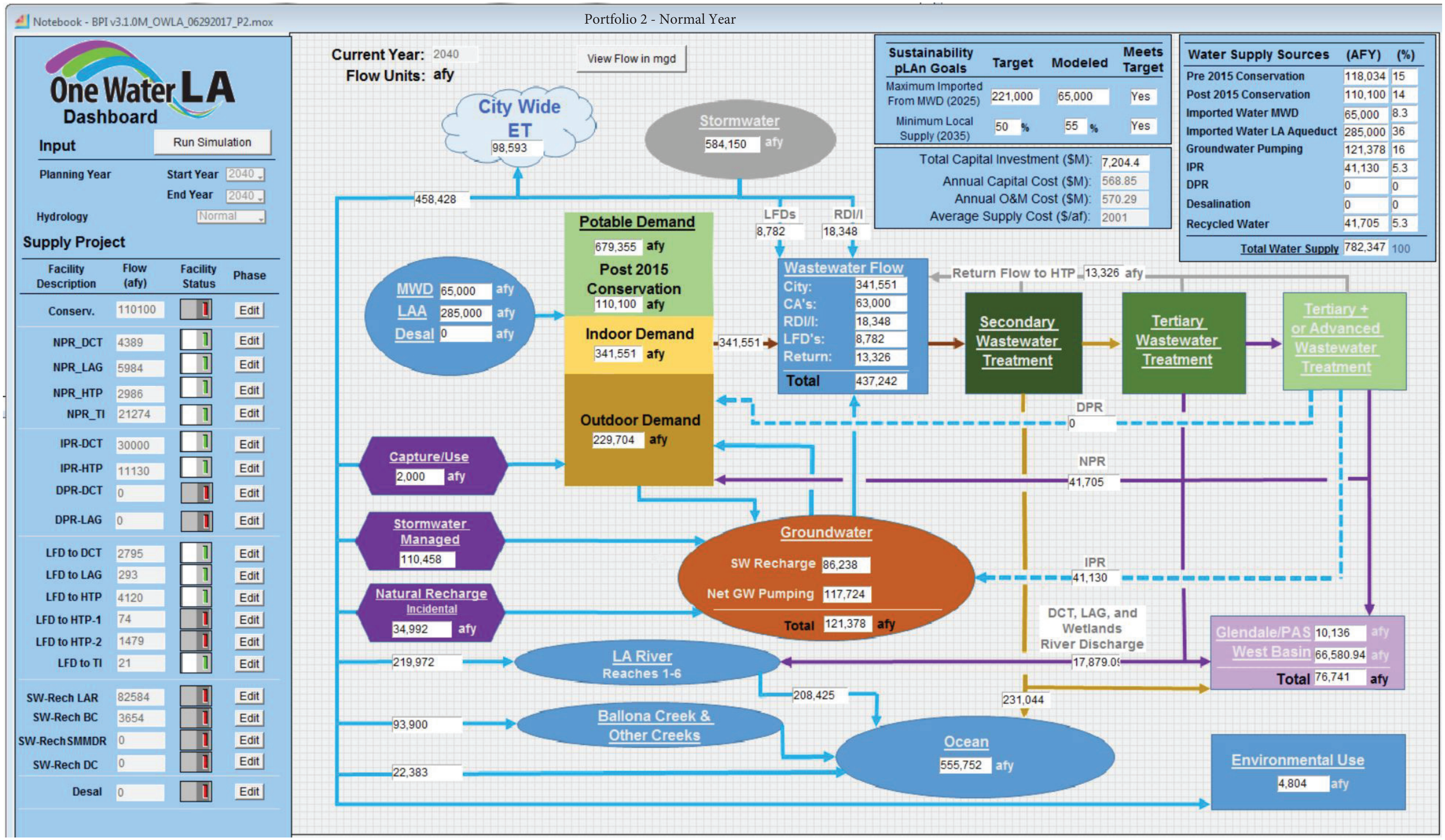
Notebook - BPI v3.1.0M_OWLA_06292017_P1.mox
Portfolio 1 - Normal Year
One Water LA Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Normal
Supply Project
Facility Description | Flow (afy) | Facility Status | Phase
Conserv. 110100 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 11130 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 9425 Edit
LFD to LAG 176 Edit
LFD to HTP 2204 Edit
LFD to HTP-1 74 Edit
LFD to HTP-2 1479 Edit
LFD to TI 13 Edit
SW-Rech LAR 82584 Edit
SW-Rech BC 3654 Edit
SW-Rech SMMDR 0 Edit
SW-RechDC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET 98,593
Stormwater 584,150 afy
453,839
LFDs 13,371
RDI/I 18,348
Potable Demand 675,703 afy
Post 2015 Conservation 110,100 afy
Indoor Demand 339,360 afy
Outdoor Demand 228,243 afy
MWD 65,000 afy
LAA 285,000 afy
Desal 0 afy
339,360
Wastewater Flow
City: 339,360
CA's: 63,000
RDI/I: 18,348
LFD's: 13,371
Return: 16,915
Total 438,640
Return Flow to HTP 16,915 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR 0
NPR 41,705
IPR 41,130
Capture/Use 2,000 afy
Stormwater Managed 110,458
Natural Recharge Incidental 34,992 afy
Groundwater
SW-Recharge 86,238
Net GW Pumping 117,724
Total 117,724 afy
DCT, LAG, and Wetlands River Discharge
38,218.09
LA River Reaches 1-6
219,972
249,167
216,147
Ballona Creek & Other Creeks
93,900
22,383
Ocean 581,597 afy
Glendale/PAS 10,136 afy
West Basin 64,168.94 afy
Total 74,329 afy
Environmental Use 4,804 afy
Sustainability pLAn Goals | Target | Modeled | Meets Target
Maximum Imported From MWD (2025) | 221,000 | 65,000 | Yes
Minimum Local Supply (2035) | 50 % | 55 % | Yes
Total Capital Investment ($M): 7,467.9
Annual Capital Cost ($M): 565.17
Annual O&M Cost ($M): 568.19
Average Supply Cost ($/af): 2004
Water Supply Sources | (AFY) | (%)
Pre 2015 Conservation | 118,034 | 15
Post 2015 Conservation | 110,100 | 14
Imported Water MWD | 65,000 | 8.3
Imported Water LA Aqueduct | 285,000 | 37
Groundwater Pumping | 117,724 | 15
IPR | 41,130 | 5.3
DPR | 0 | 0
Desalination | 0 | 0
Recycled Water | 41,705 | 5.4
Total Water Supply | 778,693 | 100

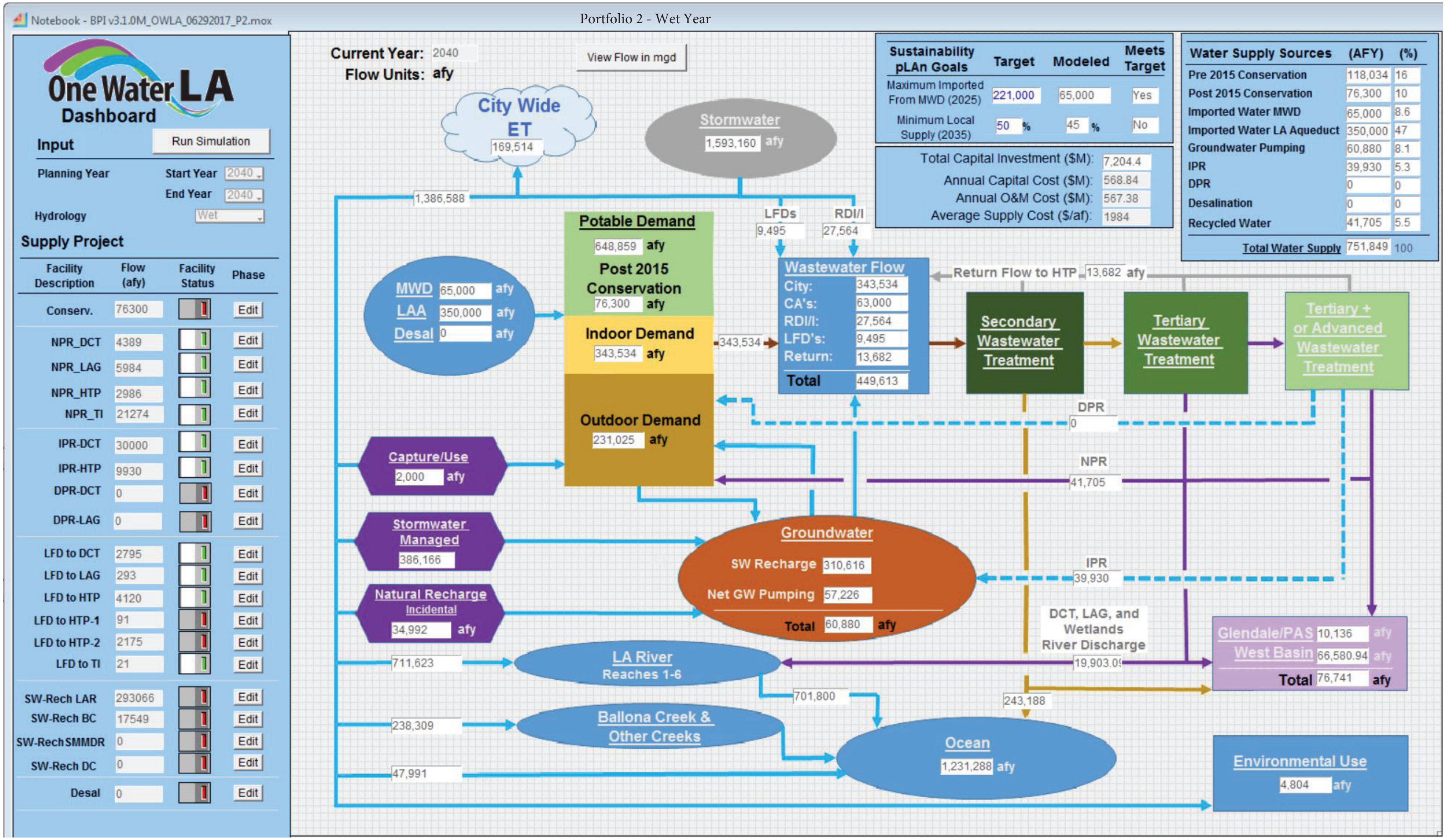


Notebook - BPI v3.1.0M_OWLA_06292017_P1.mox
Portfolio 1 - Wet Year
One Water LA
Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Wet
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 76300 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 9930 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 9425 Edit
LFD to LAG 176 Edit
LFD to HTP 2204 Edit
LFD to HTP-1 91 Edit
LFD to HTP-2 2175 Edit
LFD to TI 13 Edit
SW-Rech LAR 293066 Edit
SW-Rech BC 17549 Edit
SW-Rech SMMDR 0 Edit
SW-RechDC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET
169,514
Stormwater
1,593,160 afy
1,381,999
LFDs 14,084
RDI/I 27,564
Potable Demand
645,203 afy
Post 2015 Conservation
76,300 afy
Indoor Demand
341,340 afy
Outdoor Demand
229,563 afy
MWD 65,000 afy
LAA 350,000 afy
Desal 0 afy
341,340
Wastewater Flow
City: 341,340
CA's: 63,000
RDI/I: 27,564
LFD's: 14,084
Return: 17,271
Total 451,008
Return Flow to HTP 17,271 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR
0
NPR
41,705
IPR
39,930
Capture/Use
2,000 afy
Stormwater Managed
386,166
Natural Recharge Incidental
34,992 afy
Groundwater
SW-Recharge 310,616
Net GW Pumping 57,226
Total 57,226 afy
DCT, LAG, and Wetlands River Discharge
40,239.0
Glendale/PAS 10,136 afy
West Basin 64,168.94 afy
Total 74,329 afy
711,623
LA River Reaches 1-6
742,539
228,291
238,309
Ballona Creek & Other Creeks
47,991
Ocean
1,257,130 afy
Environmental Use
4,804 afy
Sustainability pLAn Goals | Target | Modeled | Meets Target
Maximum Imported From MWD (2025) | 221,000 | 65,000 | Yes
Minimum Local Supply (2035) | 50 % | 45 % | No
Total Capital Investment ($M): 7,467.9
Annual Capital Cost ($M): 565.16
Annual O&M Cost ($M): 565.28
Average Supply Cost ($/af): 1987
Water Supply Sources (AFY) (%)
Pre 2015 Conservation 118,034 16
Post 2015 Conservation 76,300 10
Imported Water MWD 65,000 8.7
Imported Water LA Aqueduct 350,000 47
Groundwater Pumping 57,226 7.6
IPR 39,930 5.3
DPR 0 0
Desalination 0 0
Recycled Water 41,705 5.6
Total Water Supply 748,195 100



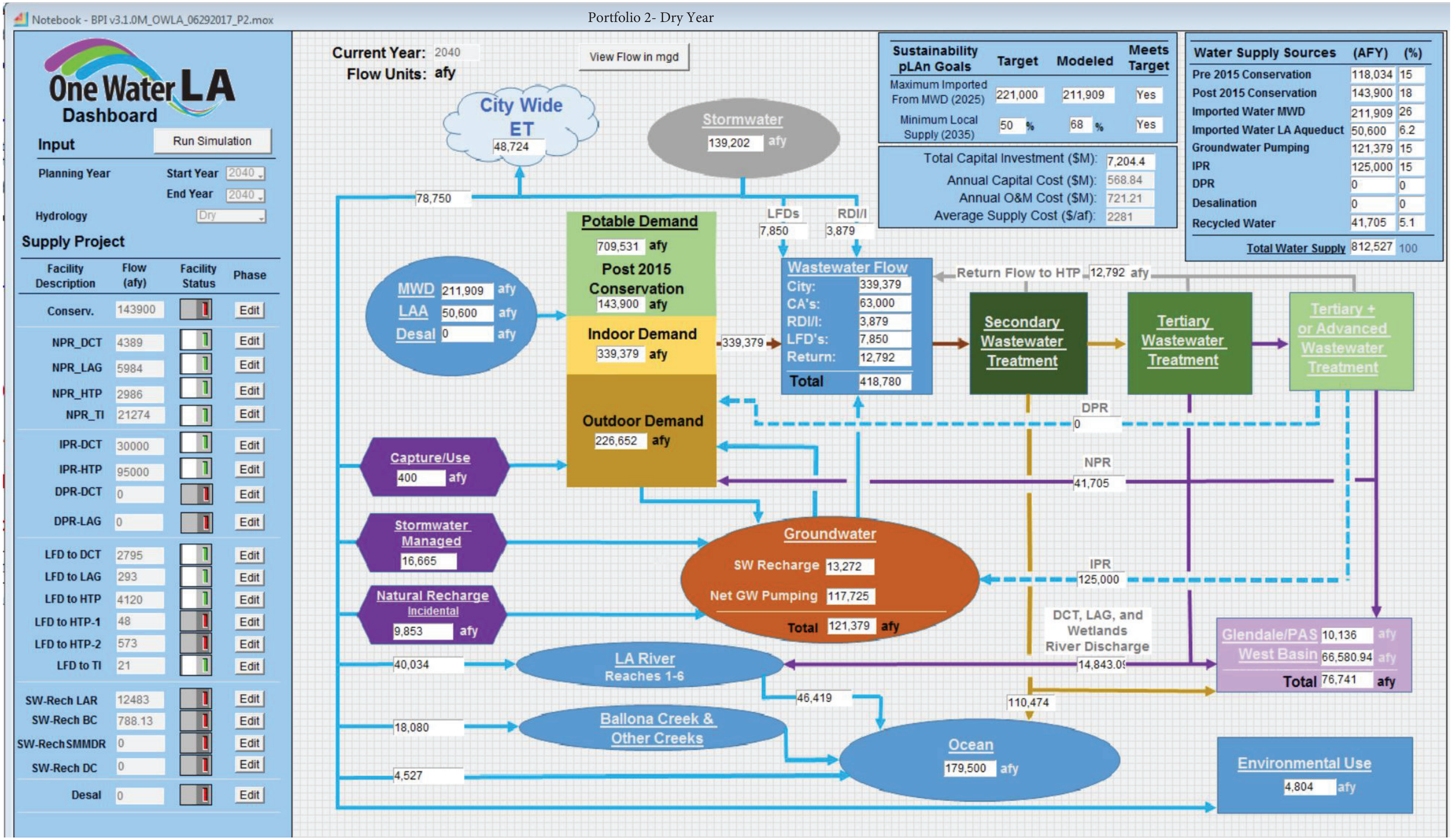
Portfolio 1 - Dry Year

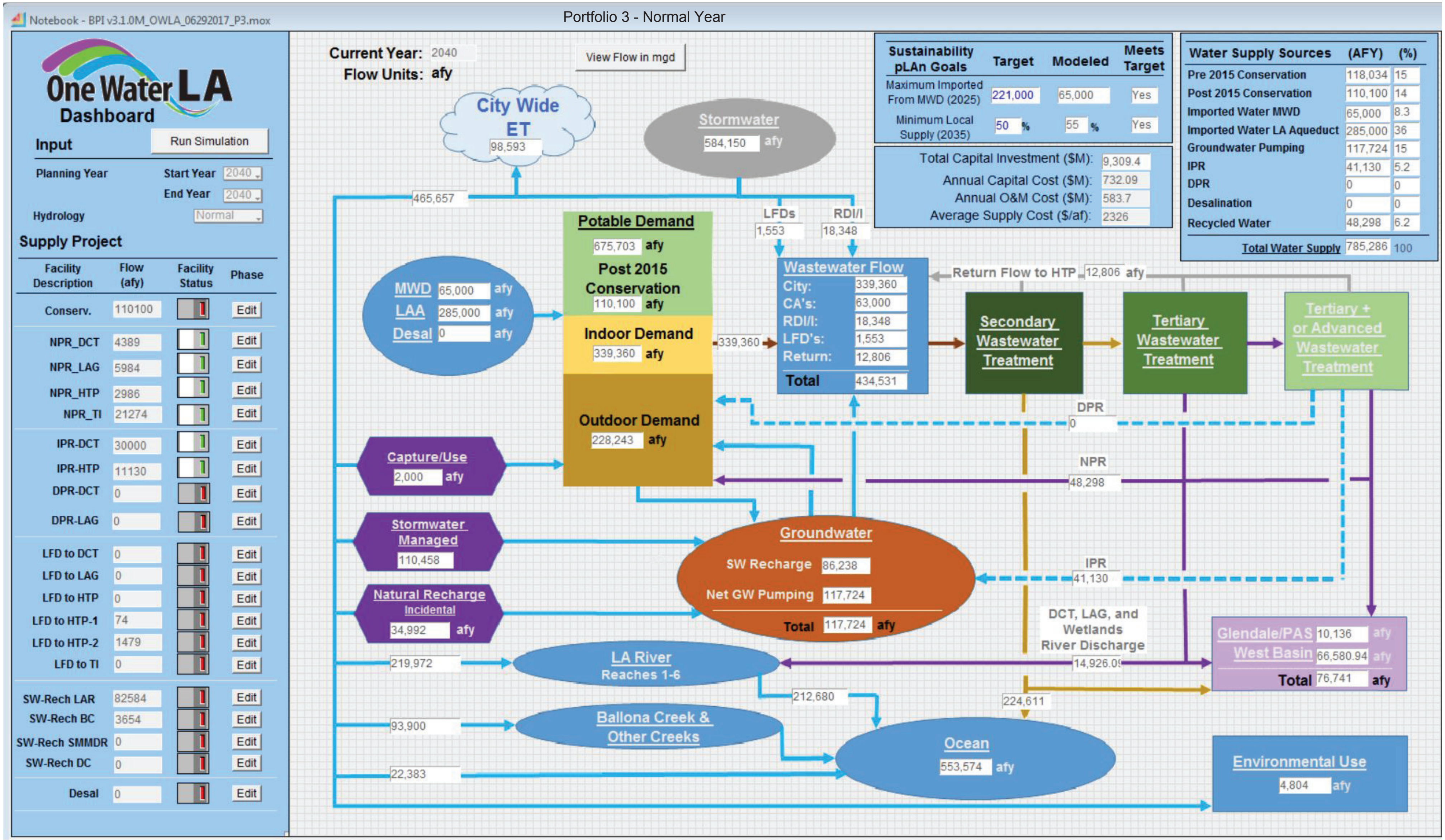

Notebook - BPI v3.1.0M_OWLA_06292017_P2.mox
Portfolio 2 - Normal Year
One Water LA
Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Normal
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 110100 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 11130 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 2795 Edit
LFD to LAG 293 Edit
LFD to HTP 4120 Edit
LFD to HTP-1 74 Edit
LFD to HTP-2 1479 Edit
LFD to TI 21 Edit
SW-Rech LAR 82584 Edit
SW-Rech BC 3654 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET 98,593
Stormwater 584,150 afy
458,428
Sustainability pLAn Goals
Target
Modeled
Meets Target
Maximum Imported From MWD (2025) 221,000 65,000 Yes
Minimum Local Supply (2035) 50 % 55 % Yes
Total Capital Investment ($M): 7,204.4
Annual Capital Cost ($M): 568.85
Annual O&M Cost ($M): 570.29
Average Supply Cost ($/af): 2001
Water Supply Sources (AFY) (%)
Pre 2015 Conservation 118,034 15
Post 2015 Conservation 110,100 14
Imported Water MWD 65,000 8.3
Imported Water LA Aqueduct 285,000 36
Groundwater Pumping 121,378 16
IPR 41,130 5.3
DPR 0 0
Desalination 0 0
Recycled Water 41,705 5.3
Total Water Supply 782,347 100
Potable Demand 679,355 afy
Post 2015 Conservation 110,100 afy
Indoor Demand 341,551 afy
Outdoor Demand 229,704 afy
MWD 65,000 afy
LAA 285,000 afy
Desal 0 afy
LFDs 8,782
RDI/I 18,348
Wastewater Flow
City: 341,551
CA's: 63,000
RDI/I: 18,348
LFD's: 8,782
Return: 13,326
Total 437,242
341,551
Return Flow to HTP 13,326 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR 0
NPR 41,705
IPR 41,130
Capture/Use 2,000 afy
Stormwater Managed 110,458
Natural Recharge Incidental 34,992 afy
Groundwater
SW Recharge 86,238
Net GW Pumping 117,724
Total 121,378 afy
DCT, LAG, and Wetlands River Discharge
17,879.09
Glendale/PAS 10,136 afy
West Basin 66,580.94 afy
Total 76,741 afy
219,972
LA River Reaches 1-6
208,425
231,044
93,900
Ballona Creek & Other Creeks
22,383
Ocean 555,752 afy
Environmental Use 4,804 afy



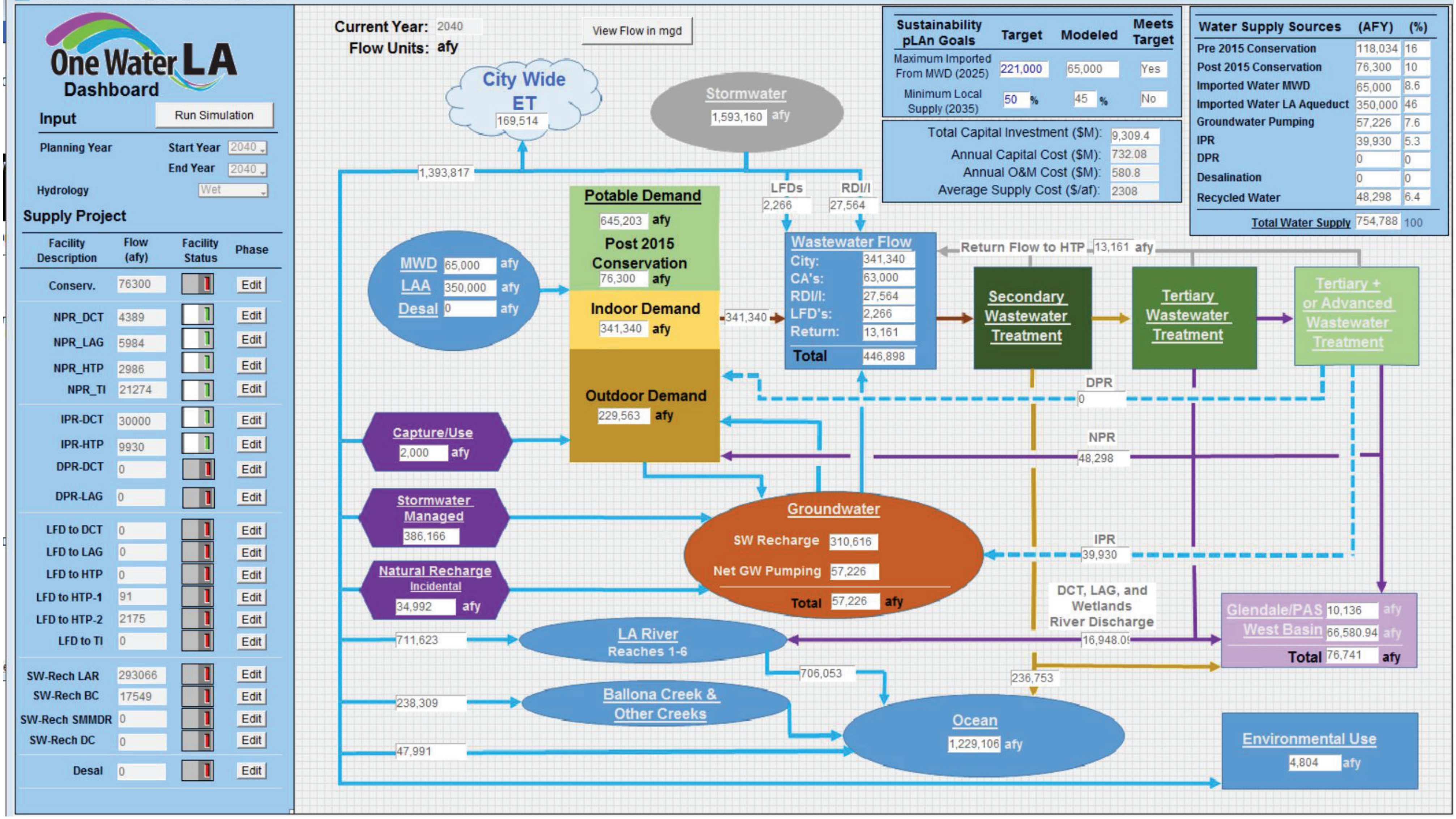
Portfolio 2 - Wet Year

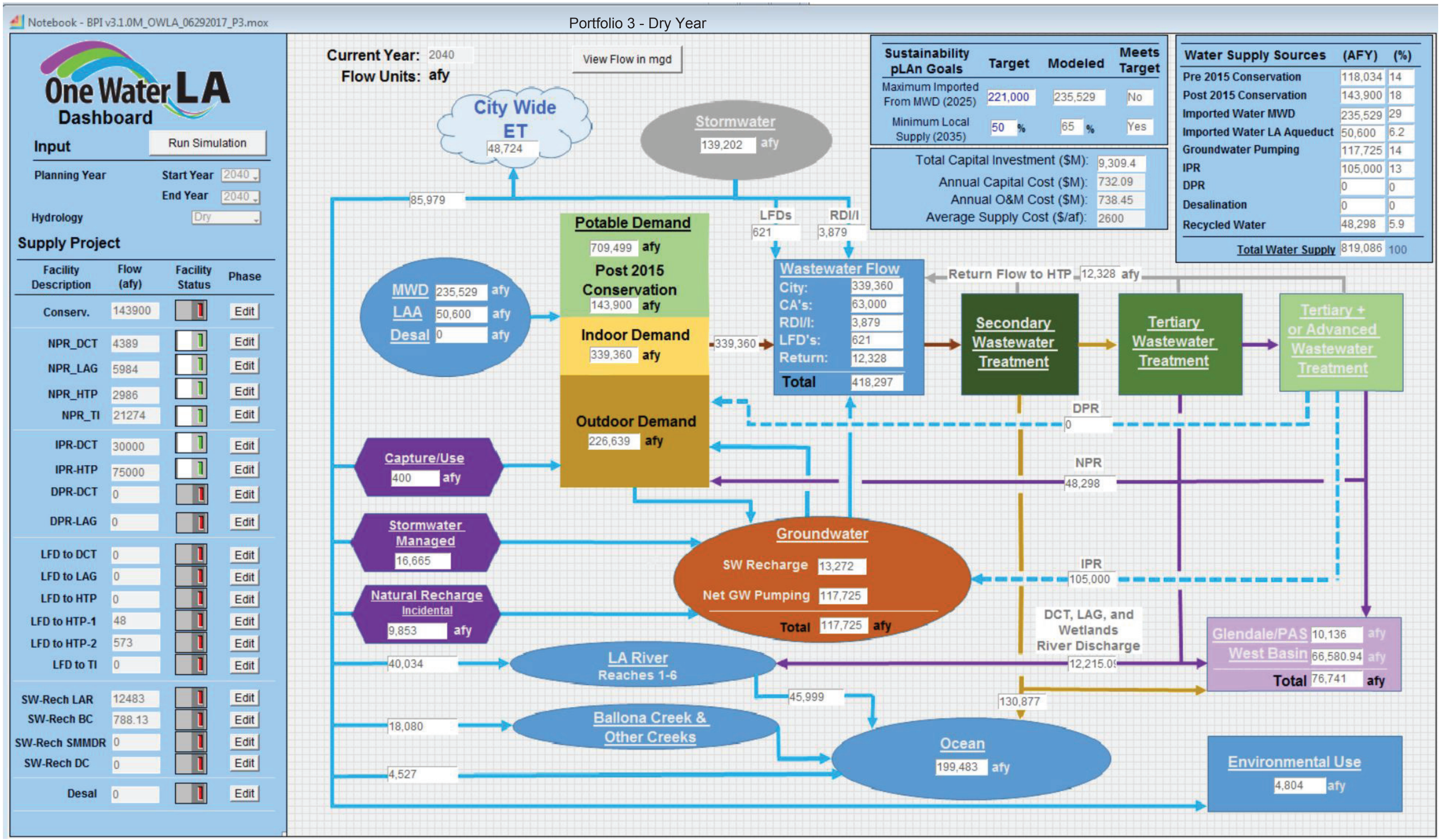
Portfolio 2- Dry Year

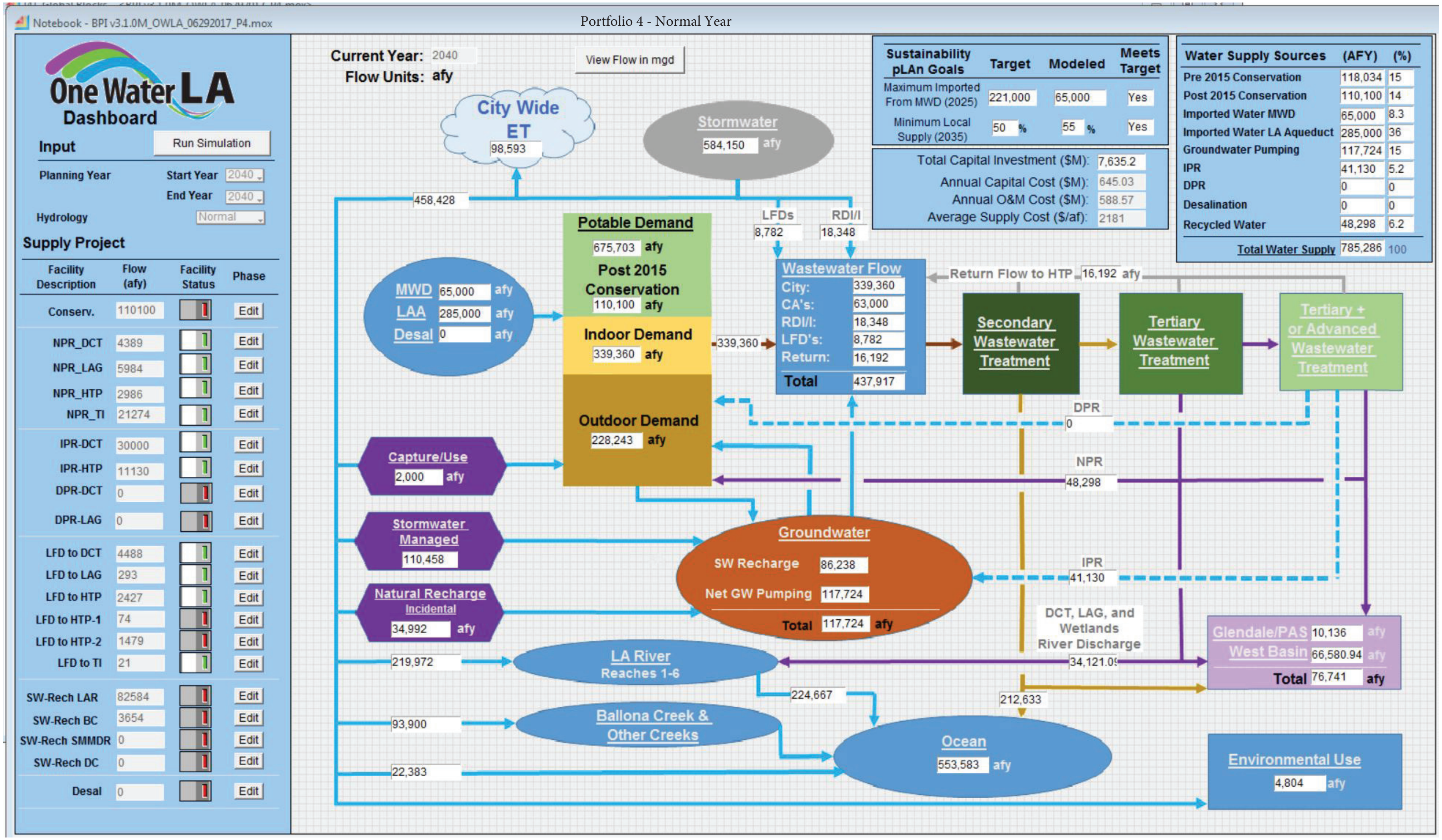



Notebook - BPI v3.1.0M_OWLA_06292017_P3.mox
Portfolio 3 - Normal Year
One Water LA
Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Normal
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 110100 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 11130 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 0 Edit
LFD to LAG 0 Edit
LFD to HTP 0 Edit
LFD to HTP-1 74 Edit
LFD to HTP-2 1479 Edit
LFD to TI 0 Edit
SW-Rech LAR 82584 Edit
SW-Rech BC 3654 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET 98,593
Stormwater 584,150 afy
465,657
LFDs 1,553
RDI/I 18,348
Potable Demand 675,703 afy
Post 2015 Conservation 110,100 afy
Indoor Demand 339,360 afy
Outdoor Demand 228,243 afy
MWD 65,000 afy
LAA 285,000 afy
Desal 0 afy
339,360
Wastewater Flow
City: 339,360
CA's: 63,000
RDI/I: 18,348
LFD's: 1,553
Return: 12,806
Total 434,531
Return Flow to HTP 12,806 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR 0
NPR 48,298
IPR 41,130
Capture/Use 2,000 afy
Stormwater Managed 110,458
Natural Recharge Incidental 34,992 afy
Groundwater
SW Recharge 86,238
Net GW Pumping 117,724
Total 117,724 afy
DCT, LAG, and Wetlands River Discharge
14,926.0
224,611
Glendale/PAS 10,136 afy
West Basin 66,580.94 afy
Total 76,741 afy
219,972
LA River Reaches 1-6
212,680
93,900
Ballona Creek & Other Creeks
22,383
Ocean 553,574 afy
Environmental Use 4,804 afy
Sustainability pLAn Goals
Target
Modeled
Meets Target
Maximum Imported From MWD (2025) 221,000 65,000 Yes
Minimum Local Supply (2035) 50 % 55 % Yes
Total Capital Investment ($M): 9,309.4
Annual Capital Cost ($M): 732.09
Annual O&M Cost ($M): 583.7
Average Supply Cost ($/af): 2326
Water Supply Sources (AFY) (%)
Pre 2015 Conservation 118,034 15
Post 2015 Conservation 110,100 14
Imported Water MWD 65,000 8.3
Imported Water LA Aqueduct 285,000 36
Groundwater Pumping 117,724 15
IPR 41,130 5.2
DPR 0 0
Desalination 0 0
Recycled Water 48,298 6.2
Total Water Supply 785,286 100

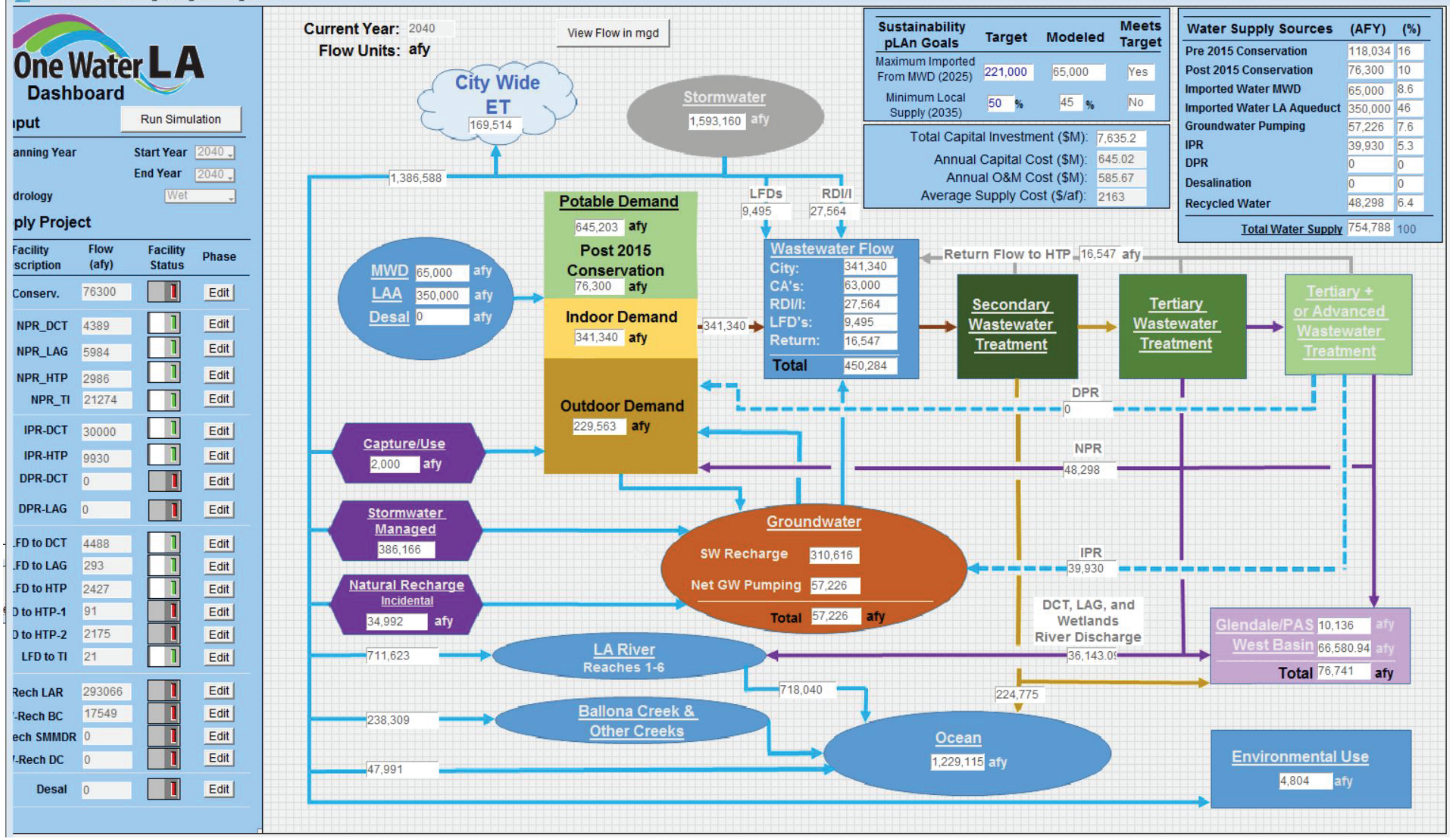
Portfolio 3 - Wet Year




Notebook - BPI v3.1.0M_OWLA_06292017_P3.mox
Portfolio 3 - Dry Year
One Water LA
Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Dry
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 143900 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 75000 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 0 Edit
LFD to LAG 0 Edit
LFD to HTP 0 Edit
LFD to HTP-1 48 Edit
LFD to HTP-2 573 Edit
LFD to TI 0 Edit
SW-Rech LAR 12483 Edit
SW-Rech BC 788.13 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET
48,724
Stormwater
139,202 afy
85,979
LFDs
621
RDI/I
3,879
Potable Demand
709,499 afy
Post 2015 Conservation
143,900 afy
Indoor Demand
339,360 afy
Outdoor Demand
226,639 afy
MWD 235,529 afy
LAA 50,600 afy
Desal 0 afy
339,360
Wastewater Flow
City: 339,360
CA's: 63,000
RDI/I: 3,879
LFD's: 621
Return: 12,328
Total 418,297
Return Flow to HTP 12,328 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR
0
NPR
48,298
IPR
105,000
Capture/Use
400 afy
Stormwater Managed
16,665
Natural Recharge Incidental
9,853 afy
Groundwater
SW Recharge 13,272
Net GW Pumping 117,725
Total 117,725 afy
DCT, LAG, and Wetlands River Discharge
12,215.0
130,877
Glendale/PAS 10,136 afy
West Basin 66,580.94 afy
Total 76,741 afy
40,034
LA River Reaches 1-6
45,999
18,080
Ballona Creek & Other Creeks
4,527
Ocean
199,483 afy
Environmental Use
4,804 afy
Sustainability pLAn Goals | Target | Modeled | Meets Target
Maximum Imported From MWD (2025) | 221,000 | 235,529 | No
Minimum Local Supply (2035) | 50 % | 65 % | Yes
Total Capital Investment ($M): 9,309.4
Annual Capital Cost ($M): 732.09
Annual O&M Cost ($M): 738.45
Average Supply Cost ($/af): 2600
Water Supply Sources (AFY) (%)
Pre 2015 Conservation 118,034 14
Post 2015 Conservation 143,900 18
Imported Water MWD 235,529 29
Imported Water LA Aqueduct 50,600 6.2
Groundwater Pumping 117,725 14
IPR 105,000 13
DPR 0 0
Desalination 0 0
Recycled Water 48,298 5.9
Total Water Supply 819,086 100

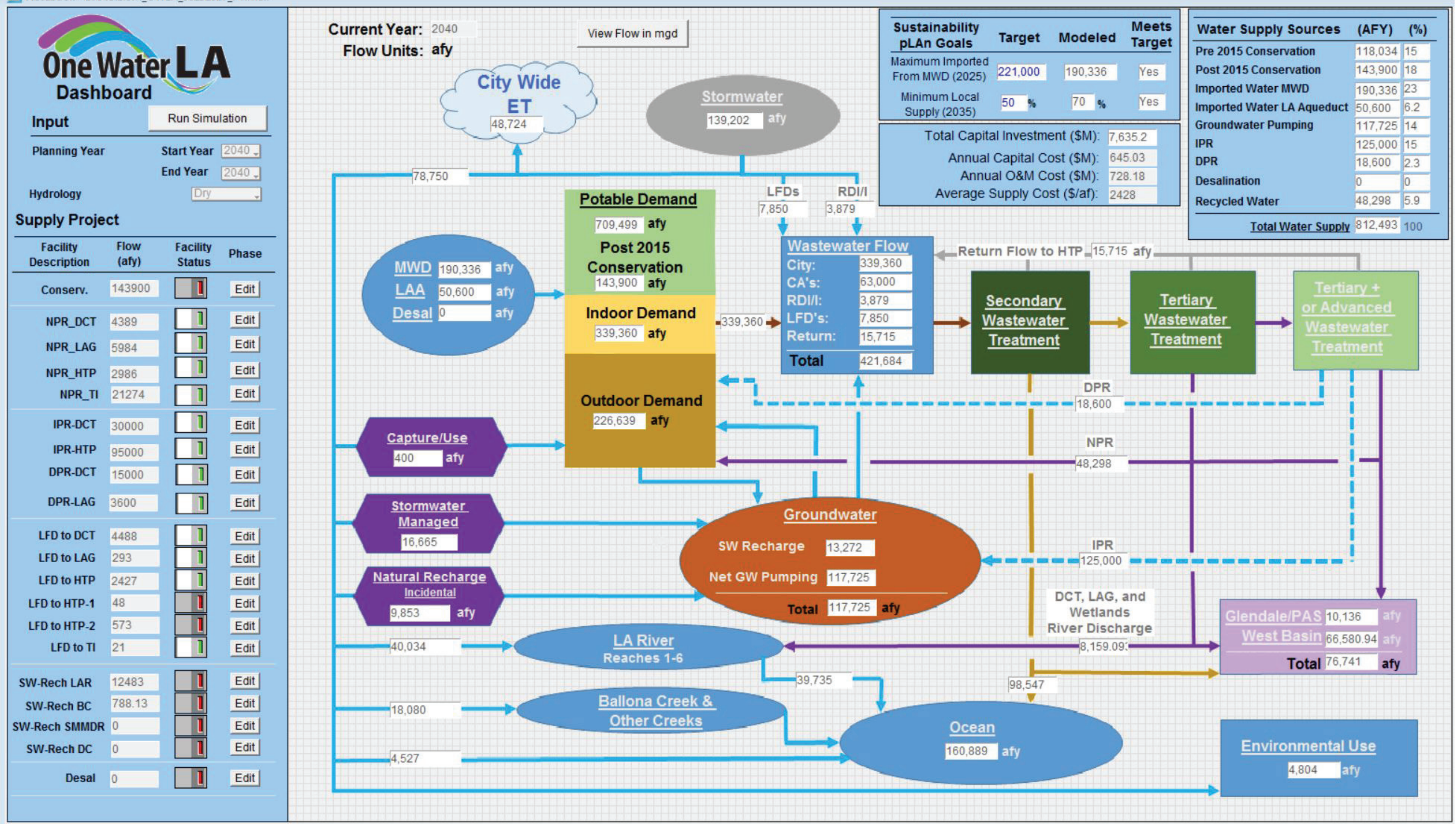

Notebook - BPI v3.1.0M_OWLA_06292017_P4.mox
Portfolio 4 - Normal Year
One Water LA
Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Normal
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 110100 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 11130 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 4488 Edit
LFD to LAG 293 Edit
LFD to HTP 2427 Edit
LFD to HTP-1 74 Edit
LFD to HTP-2 1479 Edit
LFD to TI 21 Edit
SW-Rech LAR 82584 Edit
SW-Rech BC 3654 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET 98,593
Stormwater 584,150 afy
458,428
LFDs 8,782
RDI/I 18,348
Potable Demand 675,703 afy
Post 2015 Conservation 110,100 afy
Indoor Demand 339,360 afy
Outdoor Demand 228,243 afy
MWD 65,000 afy
LAA 285,000 afy
Desal 0 afy
339,360
Wastewater Flow
City: 339,360
CA's: 63,000
RDI/I: 18,348
LFD's: 8,782
Return: 16,192
Total 437,917
Return Flow to HTP 16,192 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR 0
NPR 48,298
IPR 41,130
Capture/Use 2,000 afy
Stormwater Managed 110,458
Natural Recharge Incidental 34,992 afy
Groundwater
SW Recharge 86,238
Net GW Pumping 117,724
Total 117,724 afy
DCT, LAG, and Wetlands River Discharge
34,121.09
Glendale/PAS 10,136 afy
West Basin 66,580.94 afy
Total 76,741 afy
LA River Reaches 1-6
219,972
224,667
212,633
Ballona Creek & Other Creeks
93,900
22,383
Ocean 553,583 afy
Environmental Use 4,804 afy
Sustainability pLAn Goals | Target | Modeled | Meets Target
Maximum Imported From MWD (2025) | 221,000 | 65,000 | Yes
Minimum Local Supply (2035) | 50 % | 55 % | Yes
Total Capital Investment ($M): 7,635.2
Annual Capital Cost ($M): 645.03
Annual O&M Cost ($M): 588.57
Average Supply Cost ($/af): 2181
Water Supply Sources | (AFY) | (%)
Pre 2015 Conservation | 118,034 | 15
Post 2015 Conservation | 110,100 | 14
Imported Water MWD | 65,000 | 8.3
Imported Water LA Aqueduct | 285,000 | 36
Groundwater Pumping | 117,724 | 15
IPR | 41,130 | 5.2
DPR | 0 | 0
Desalination | 0 | 0
Recycled Water | 48,298 | 6.2
Total Water Supply | 785,286 | 100

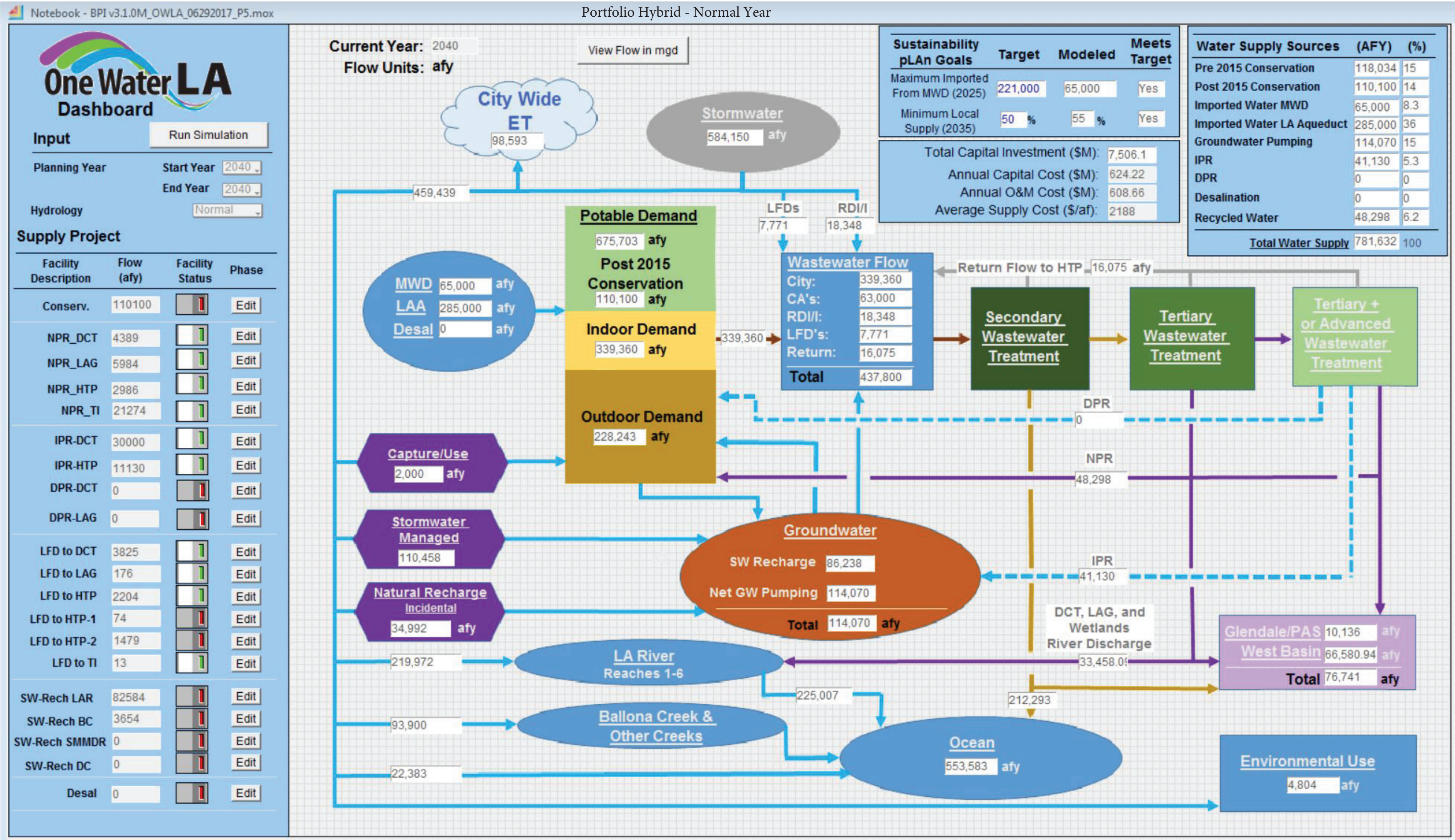
Portfolio 4 - Wet Year



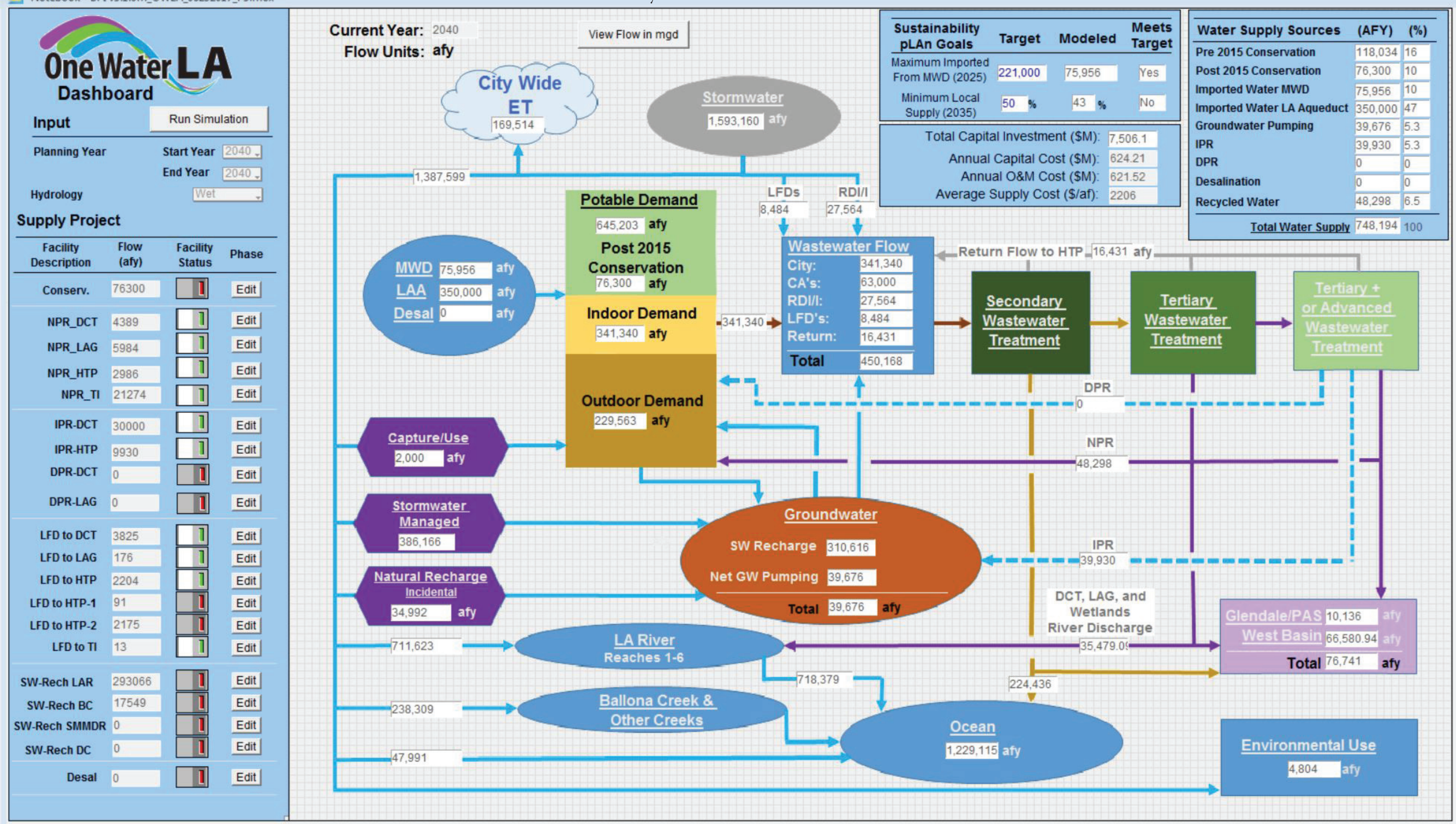
Notebook - BPI v3.1.0M_OWLA_06292017_P4.mox

Portfolio 4 - Dry Year

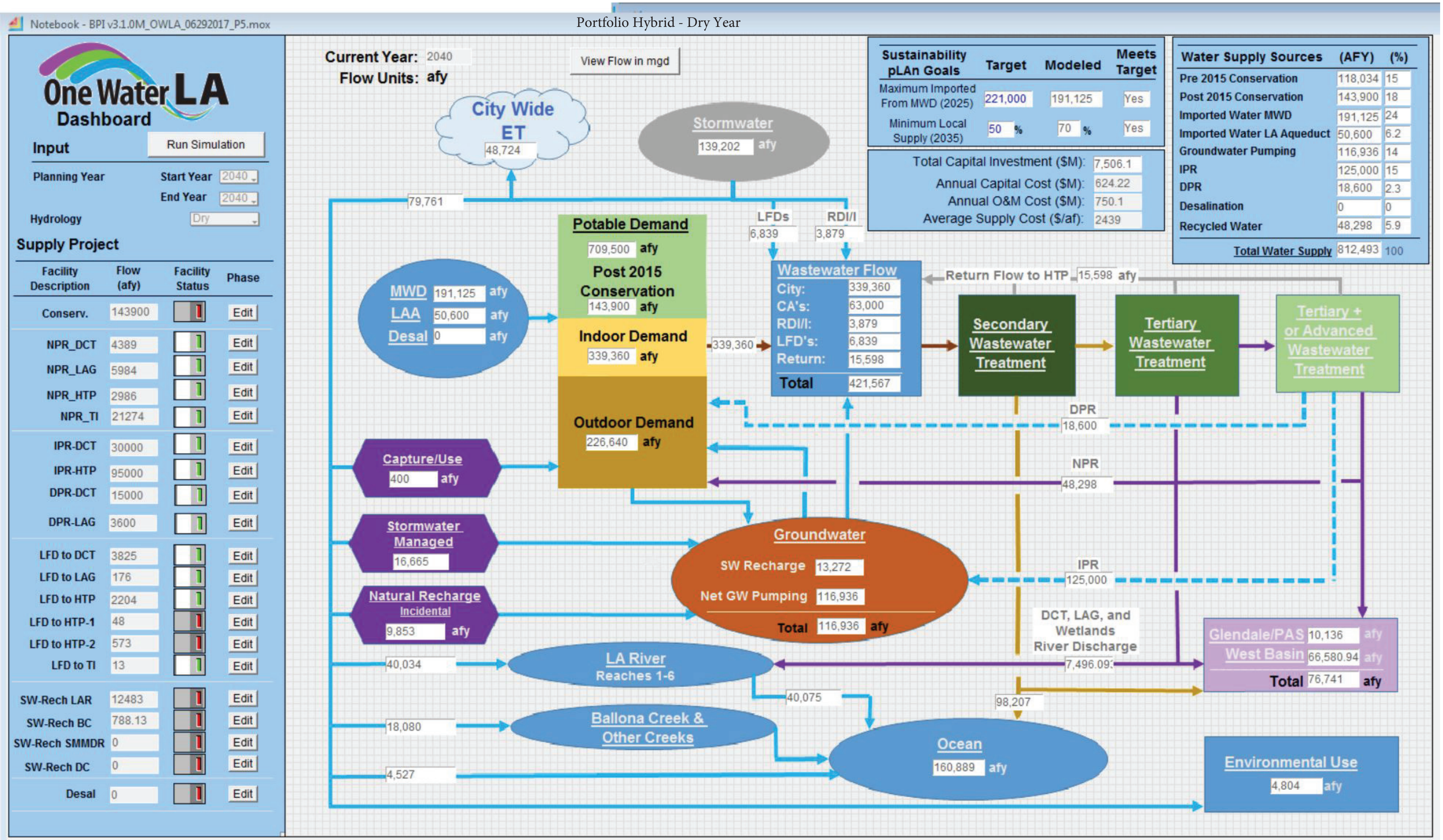



Notebook - BPI v3.1.0M_OWLA_06292017_P5.mox
Portfolio Hybrid - Normal Year
One Water LA
Dashboard
Input
Run Simulation
Planning Year
Start Year 2040
End Year 2040
Hydrology Normal
Supply Project
Facility Description
Flow (afy)
Facility Status
Phase
Conserv. 110100 Edit
NPR_DCT 4389 Edit
NPR_LAG 5984 Edit
NPR_HTP 2986 Edit
NPR_TI 21274 Edit
IPR-DCT 30000 Edit
IPR-HTP 11130 Edit
DPR-DCT 0 Edit
DPR-LAG 0 Edit
LFD to DCT 3825 Edit
LFD to LAG 176 Edit
LFD to HTP 2204 Edit
LFD to HTP-1 74 Edit
LFD to HTP-2 1479 Edit
LFD to TI 13 Edit
SW-Rech LAR 82584 Edit
SW-Rech BC 3654 Edit
SW-Rech SMMDR 0 Edit
SW-Rech DC 0 Edit
Desal 0 Edit
Current Year: 2040
Flow Units: afy
View Flow in mgd
City Wide ET
98,593
Stormwater
584,150 afy
459,439
Sustainability pLAn Goals
Target
Modeled
Meets Target
Maximum Imported From MWD (2025) 221,000 65,000 Yes
Minimum Local Supply (2035) 50 % 55 % Yes
Total Capital Investment ($M): 7,506.1
Annual Capital Cost ($M): 624.22
Annual O&M Cost ($M): 608.66
Average Supply Cost ($/af): 2188
Water Supply Sources (AFY) (%)
Pre 2015 Conservation 118,034 15
Post 2015 Conservation 110,100 14
Imported Water MWD 65,000 8.3
Imported Water LA Aqueduct 285,000 36
Groundwater Pumping 114,070 15
IPR 41,130 5.3
DPR 0 0
Desalination 0 0
Recycled Water 48,298 6.2
Total Water Supply 781,632 100
Potable Demand
675,703 afy
Post 2015 Conservation
110,100 afy
Indoor Demand
339,360 afy
Outdoor Demand
228,243 afy
MWD 65,000 afy
LAA 285,000 afy
Desal 0 afy
LFDs 7,771
RDI/I 18,348
Wastewater Flow
City: 339,360
CA's: 63,000
RDI/I: 18,348
LFD's: 7,771
Return: 16,075
Total 437,800
339,360
Return Flow to HTP 16,075 afy
Secondary Wastewater Treatment
Tertiary Wastewater Treatment
Tertiary + or Advanced Wastewater Treatment
DPR
0
NPR
48,298
Capture/Use
2,000 afy
Stormwater Managed
110,458
Natural Recharge
Incidental
34,992 afy
Groundwater
SW Recharge 86,238
Net GW Pumping 114,070
Total 114,070 afy
IPR
41,130
DCT, LAG, and Wetlands River Discharge
33,458.09
219,972
LA River
Reaches 1-6
225,007
212,293
Glendale/PAS 10,136 afy
West Basin 66,580.94 afy
Total 76,741 afy
93,900
Ballona Creek & Other Creeks
22,383
Ocean
553,583 afy
Environmental Use
4,804 afy

Portfolio Hybrid - Wet Year



Portfolio Hybrid - Dry Year



APPENDIX D – FUTURE STRATEGIES STAKEHOLDER ENGAGEMENT

The future integration opportunities include a wide variety of stormwater, groundwater, potable reuse, and other local water management strategies. Future integration opportunities are a mix of projects and programs called "concept options" to maximize recycled water use, contribute to supply resiliency, and provide multiple water quality benefits to 2040 and beyond. A total of twenty-seven concept options were developed. These concept options can be grouped into the eight strategies illustrated on Figure D.1 and defined in alphabetical order as follows:

- Direct Potable Reuse (DPR) – Projects that would deliver advanced treated recycled water (purified water) to a potable water system. DPR could be implemented in various configurations from any of the City's four water reclamation plants.

- Distributed Stormwater Best Management Practices (BMPs) – A program of many small scale projects that would involve any technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution from stormwater at a local level. Distributed stormwater projects are designed to capture stormwater prior to collection in the storm drain, which includes green streets and parcel level BMPs such as cisterns, rain gardens, and bioswales.

- Indirect Potable Reuse (IPR) – Projects that would spread or inject recycled water into a groundwater basin that could be used as potable water after extraction and further treatment. IPR could be implemented in various configurations from any of the City's four water reclamation plants.

- LA River Storage and Use – Projects that would involve the use of (inflatable) dams, weirs, or other devices to allow (seasonal) storage of flows in the LA River, which would help the City to balance water supply and river needs.

- Non-Potable Reuse (NPR or Purple Pipe) – Projects that would expand the City's purple pipe network to deliver recycled water to new customers that can use recycled water for irrigation, industrial cooling, street sweeping, dust control, and environmental uses. NPR could be implemented in various configurations from any of the City's four water reclamation plants.

- Ocean Water Desalination – An Ocean Desalination Plant near the Hyperion Water Reclamation Plant that would remove salinity from ocean water using ultrafiltration and reverse osmosis membrane processes to a sufficient level to meet drinking water standards.

- Regional or Centralized Stormwater BMPs – Large scale projects that involve structural solutions that capture and treat, and potentially recharge, urban runoff and stormwater at a regional level. These projects can contain multiple green infrastructure elements.

- Stormwater to Sewer Low Flow Diversions (LFDs) – Projects that would increase the number of low flow diversions (LFDs) in the City, which are designed structures to route urban runoff and stormwater from the stormdrain into the sewer collection system. This concept could be implemented at strategic locations throughout the City to increase flows to the City's water reclamation plants to increase the potential for water recycling through NPR, IPR, or DPR.

In May 2017, over 300 stakeholders were requested to provide input on the above described strategies. The survey was completed by 54 stakeholders who shared the most favorable and least favorable strategies, which is illustrated on Figure D.1. Note at the time, Potable Reuse Raw Water Augmentation and Potable Reuse Treated Water Augmentation were bundled under Direct Potable Reuse, and therefore ranking for each was not provided.

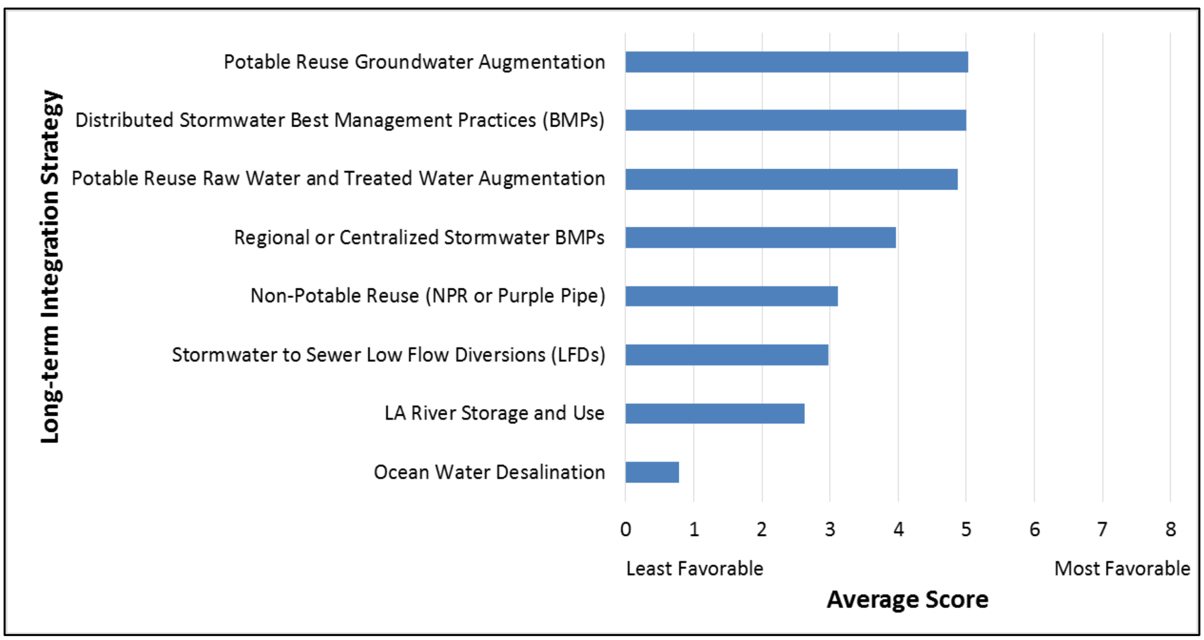


Figure D.1 Future Integration Strategy Stakeholder Survey Results

The One Water team analyzed the feedback received from stakeholders, presented the results at the subsequent Stakeholder Workshop and considered the input on concept strategy preferences in the portfolio analysis process and development of the implementation strategy.

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