Recycled Water Master Plan

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ABBREVIATIONS

ADD	Average Daily Demand
AFY	Acre Foot Per Year
B/C	Benefit / Cost
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CIP	Capital Improvement Plan
CRA	Colorado River Aqueduct
CWA	Clean Water Act
DDT	Dichloro-Diphenyl-Trichloroethane
GPM	Gallons per minute
HOA	Home Owner Association
L.F.	Linear Feet
L.S.	Lump Sum
MARB	March Air Reserve Base
MJPA	March Joint Powers Authority
MDD	Maximum Daily Demand
MG	Million Gallon
MGD	Million Gallon per Day
March WRF	March Wastewater Reclamation Facility
MPN	Most Probable Number
MWD	Metropolitan Water District
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
PCB	Polychlorinated Biphenyls
PHD	Peak Hourly Demand
POD	Peak On Demand
PRV	Pressure Reducing Valve
PZ	Pressure Zone
RPU	City of Riverside Public Utilities
RWQCB	Regional Water Quality Control Board
SARWQCB	Santa Ana Regional Water Quality Control Board
SWRCB	State Water Resources Control Board
TIN	Total Inorganic Nitrogen
TDS	Total Dissolved Solids
USFWS	United States Fish and Wildlife Service
WMWD	Western Municipal Water District
WWRF	Western Water Recycling Facility

EXECUTIVE SUMMARY

Southern California is currently facing the most significant water crisis in its history. In order to respond directly to water resource issues, Western adopted "Western's Strategic Plan" in July 2008. One of the key action items in the strategic plan is 100 percent utilization of the recycled water produced in Western Municipal Water District's (Western's) retail and/or wholesale areas and to dramatically reduce use of potable water for outdoor areas. Western Water Recycling Facility (WWRF) has expanded to 3.0 MGD treatment capacity, expandable to 5.0 MGD, to provide tertiary recycled water (ultimately up to 3.6 MGD) to the existing non-potable water distribution system. In addition, Western can receive up to 2,000 ac-ft/year (AFY) of non-potable water from the City of Riverside Pubic Utilities at the Riverside Canal. Western plans to reduce and ultimately eliminate its use of imported non-potable water from the Colorado River Aqueduct. This study outlines the potential recycled water market within Western's retail area, determines the ultimate facilities required to serve that market, lays out a phased plan for implementation and presents cost estimates for each implementation phase.

The study identified five different categories for recycled water 1) existing recycled water users, 2) existing non-potable users who could convert to recycled water, 3) existing potable water users who can use recycled water, 4) existing irrigation uses in Orangecrest and Mission Grove areas, and 5) future potential customers. In total, the study estimated the ultimate demand of **8,018 AFY**; 6,168 AFY in the North Area and 1,850 AFY in the South Area.

A hydraulic analysis was performed for the existing and ultimate systems. The facilities plan for recycled water proposes to construct three new pump stations, one storage tank, and a total of 101,600 L.F. pipeline. The study also proposes a four phase implementation plan. Phase 1 is almost complete with the exception of the installation of an altitude valve for an existing tank. The phases are 1) converting existing non-potable water system to recycled water system in North Area, 2) converting existing potable water users to recycled water system in North Area, 3) converting existing non-potable water system to recycled water system in South Area, and 4) expanding facilities for future customers. A preliminary project cost estimate to complete these facilities is **$31.2 million**. Approximately half of the proposed improvements are located in the 1815 PZ.

SECTION 1 - Introduction

1.1 Background

Western Municipal Water District (Western) serves a 527-square mile area in the western portion of Riverside County with a population of approximately 850,000 people. As shown on **Figure 1-1**, Western is west of the boundaries of Eastern Municipal Water District. As a wholesale water purveyor, Western provides imported water to eight wholesale customers within the communities of Jurupa, Rubidoux, Riverside, Norco, Corona, Elsinore Valley, Murrieta, Riverside and Temecula. As a retail water purveyor, Western provides water to more than 24,000 residential and business customer accounts. **Figure 1-2** shows Western's entire service area, its wholesale customers and its retail service boundary. In addition to treated potable water, Western has provided imported untreated water (raw or non-potable water) from Colorado River Aqueduct for agriculture irrigation since 1954. More recently, Western has extended service to landscape irrigation customers and obtained additional water supply from local groundwater at the Riverside Canal. As a result, an independent non-potable water system has been maintained throughout Western's retail areas to serve these agricultural and irrigation users.

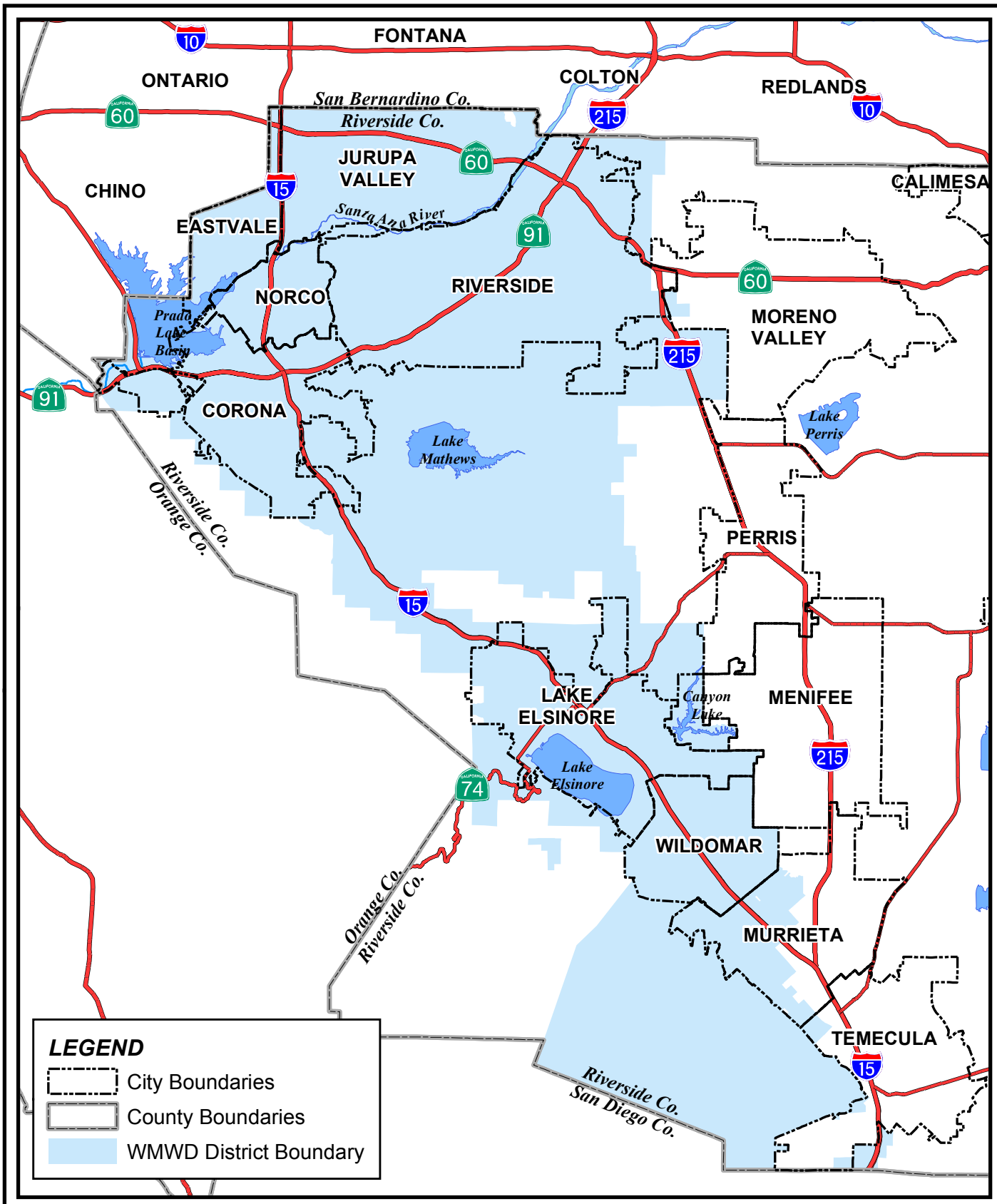
Southern California is currently facing the most significant water crisis in its history. Statewide delivery systems are challenged by a complex set of problems. Environmental regulation of the Bay-Delta system has led to a federal court ruling that cuts water supplies by up to one-third and has resulted in the largest court-ordered water supply reduction in history. The court-ordered cutback, when combined with recent drought conditions, aging infrastructure and rapid population growth, is putting unprecedented pressure on water supplies for both wholesale and retail water agencies.

Western also operates and maintains domestic and industrial wastewater collection and conveyance systems for retail and contract services customers in March Air Reserve Base, Mission Ranch, Lake Hills, Home Gardens, and Norco. The Western Water Recycling Facility (WWRF) treats domestic wastewater from MARB and Mission Ranch in the north central portion of Western's retail service area. This facility currently treats 0.8 MGD of wastewater to secondary standards and provides this recycled water to the adjacent Riverside National Cemetery and Archie J. Old Golf Course for landscape irrigation. Western has constructed improvements to increase the treatment capacity to 3.0 MGD. Ultimate wastewater flows are projected to increase up to an average of 3.6 MGD as development occurs within the service area for the WWRF. The plant could be expanded to 5.0 MGD as development warrants.

On July 16, 2008, Western adopted "Western's Strategic Plan" to respond directly to on-going water resource issues in Southern California area. Out of seven policy statements developed in the plan, Statement No.1 is to "Implement a diversified water supply portfolio in the region." A key action item for this policy is 100 percent utilization of the recycled water produced in Western's retail and/or wholesale areas and to dramatically reduce use of potable water for outdoor areas.

Western is planning to reuse the additional recycled water soon to be available from the WWRF to replace existing CRA raw water supply to meet existing irrigation water demand from its existing customer base which include agriculture, schools, parks, HOA's and public landscape areas, as well as future irrigation demand for these similar uses. In order to meet the California Department of Public Health (CDPH)

requirements for more widespread use of recycled water, tertiary treatment of the recycled water is required. Therefore, the plant expansion of WWRF included upgrading treatment facilities to tertiary treatment standards. In addition, Western has converted some of the existing non-potable water system to a recycled water distribution system. The effluent from the WWRF, the conversion of the remaining existing non-potable water distribution system and expansion of the recycled water system are the focus of this study.



Sources: WMWD, 2011;
Riverside County GIS, 2014.

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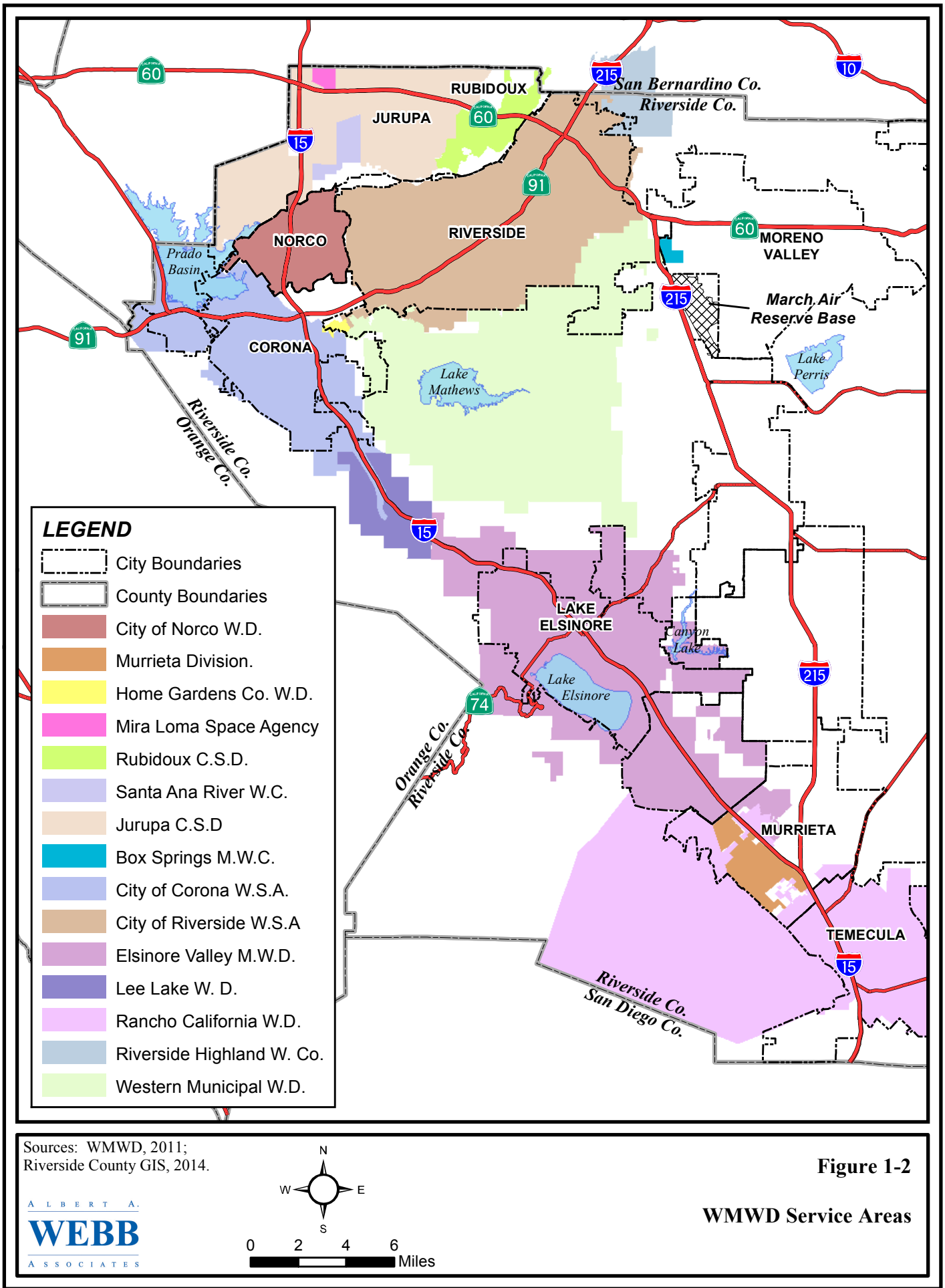
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Figure 1-1

WMWD Vicinity Map

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Sources: WMWD, 2011;
Riverside County GIS, 2014.

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Figure 1-2

WMWD Service Areas

Path: G:\2013\13-0306\GIS\Recycled_SAs.mxd

1.2 Purpose of Study

The purpose of this study is to update recycled water demand projections, update the recycled water master plan and phased implementation approach, and combine all concurrent recycled water projects into one master plan document to be used as a blueprint for timely and efficient implementation.

1.3 Scope of Work

In order to accomplish the study purpose, the following scope of work was defined:

- Evaluate existing and future non-potable / recycled water supply (**Section 2**)
- Compile information on potential recycled water users and demand (**Section 3**)
- Develop hydraulic model for major interim and ultimate conditions (**Section 4**)
- Update phased implementation plans of the recycled water system (**Section 5**)
- Prepare cost estimate of proposed recycled water system (**Section 6**)

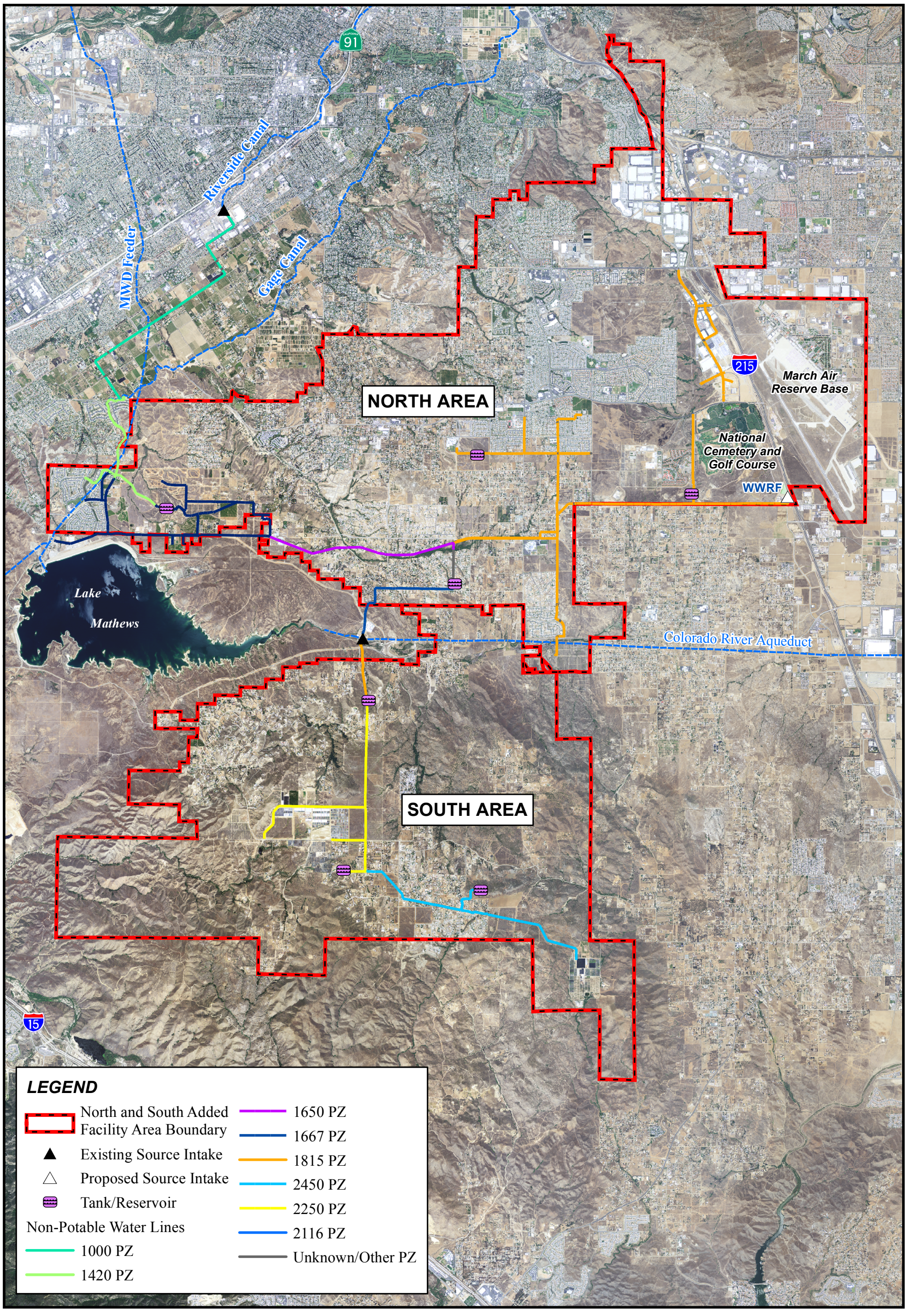
1.4 Study Area Characteristics

The study area is divided into two areas; North and South areas. The North Area covers Western's retail area north of Cajalco Road. The South Area covers the area known as Gavilan Plateau, and includes Western's retail service area mainly south of Cajalco Road. The North Area includes recent more densely developed land within the City of Riverside, County of Riverside and March Joint Power Authority (MJPA). An existing non-potable water supply from Riverside Canal is located at northwest end, and WWRF within the former MARB is located at east end. The South Area involves less densely developed land elevated by approximately 600-ft from the North Area. The Colorado River Aqueduct (CRA) is located near the boundary of the North and South Areas. Two separate pump stations deliver imported non-potable water from CRA to both the North Area and South Areas. Currently, the CRA is the only water source for the South Area non-potable distribution system, while the North Area has three water sources: the CRA, Riverside Canal and WWRF. The North Area contains three pressure zones, 1420 PZ, 1667 PZ, and 1815 PZ. The South Area encompasses three pressure zones, 1815S PZ, 2250 PZ, and 2450 PZ (See **Figure 1-3**).

Historically, Western's service area was agricultural, mainly citrus groves, or undeveloped rural land. Recently, the area has experienced rapid land development and urbanization. While this urbanization has decreased agricultural water use, the area continues to have outdoor water demand for such uses as parks, golf courses, street landscaping areas, and school grounds. Commercial uses are generally neighborhood shopping centers and commercial strips along major streets, such as Van Buren and Alessandro Boulevards. The industrial uses are limited to the Sycamore Canyon Business Park and Meridian Business Center and include a Pepsi Bottling Plant, Ralph's Grocery Dairy Unit and a large Fresh & Easy processing facility. Future phases of the Meridian Business Center are planned for other industrial/commercial uses and may have significant recycled water demand.

The study area has semi-arid climate, with hot and dry summers and wet and mild winters. Typical precipitation ranges from 11-25 inches per year, mostly occurring during the wet seasons from late October through April. Precipitation during the dry season is rare. As a result, irrigation demand occurs mostly during the dry-weather months, May through September. The transevaporation rate is generally about 4.5 ft/year.

The study area is located within the watershed management area of the Regional Water Quality Control Board, Santa Ana Region (Region 8). According to the Water Quality Control Plan (Basin Plan) for the Santa Ana Region (Santa Ana Regional Water Quality Control Board [SARWQCB], 1995), the Study Area is not underlain by a designated groundwater basin. The nearest groundwater basins are the Riverside basin to the north, the Arlington Basin to the northwest and the Perris North Basin to the east (**Figure 1-4**). The Study Area typically has near-surface weathered granitic bedrock at varying depth. Bedrock is visible at the surface in many areas. Groundwater may be found perched on the shallow bedrock or in bedrock fractures. Groundwater flow direction is controlled by bedrock topography and fracture direction. Groundwater information in the Study Area is limited and is assumed to be negligible except for a few fringe areas overlaying the adjacent groundwater basins. Private wells are known to exist especially in the extreme southern portion of the study area south and south-southeast of Lake Mathews, but extraction information is not known. Recharge of groundwater would be from infiltration of precipitation and applied imported water and extracted groundwater.



Sources: WMWD, 2013;
USDA NAIP, 2014.

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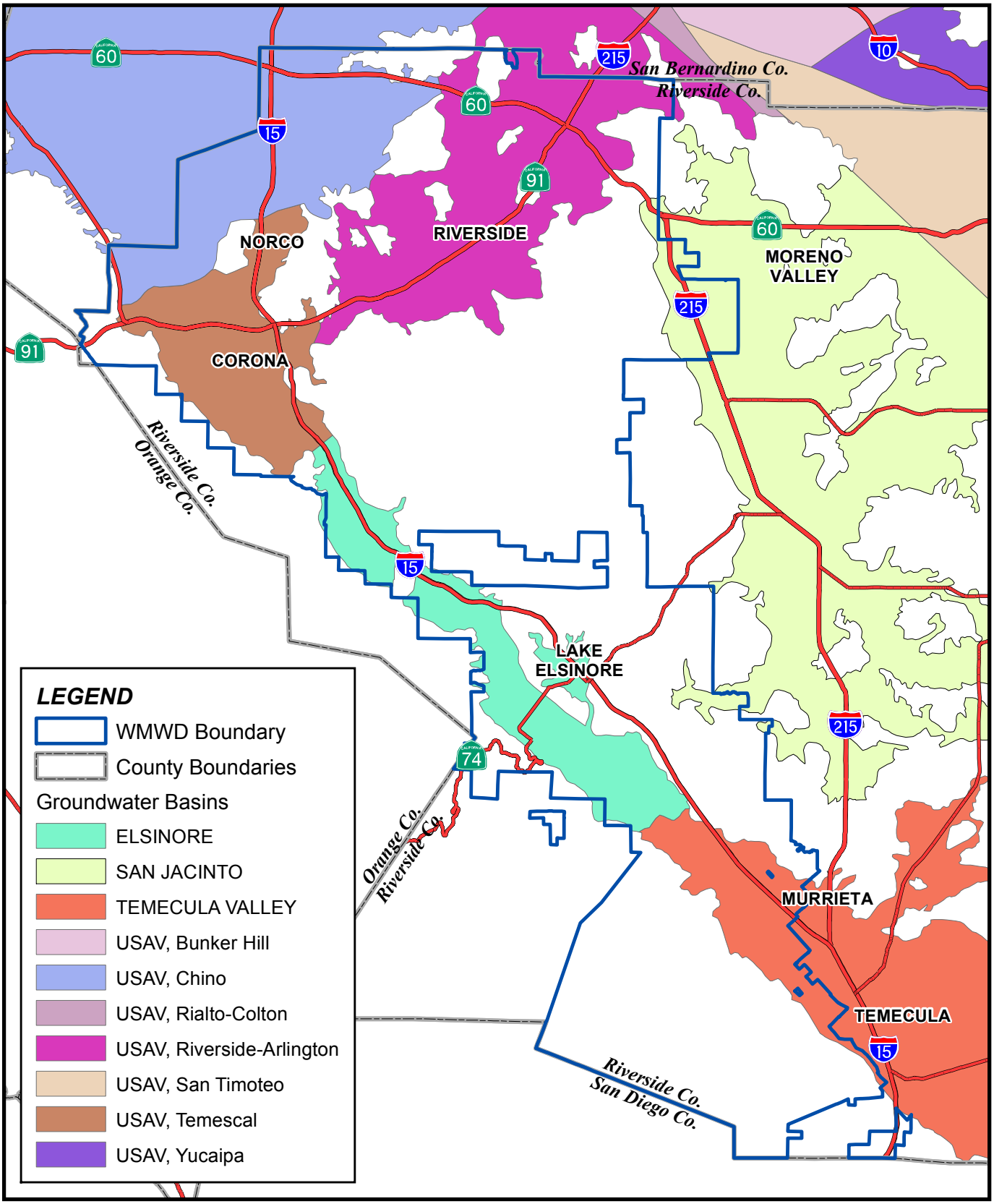
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Figure 1-3

Existing Non-Potable Water Sources

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Sources: WMWD, 2011; Calif. Water Resources Board, 2011.

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Figure 1-4

Groundwater Basin Map

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SECTION 2 - Recycled Water Quality and Supply

2.1 Water Quality Requirements to Protect Surface or Groundwater

Named for the late Los Angeles Assemblyman Carly V. Porter and State Senator Gordon Cologne, the 1969 Porter-Cologne Water Quality Act was recognized as one of the nation's strongest pieces of anti-pollution legislation. Sections of the Act were used as the basis for the 1972 Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA).

Under Porter-Cologne, the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) have been delegated with the authority to preserve and enhance beneficial uses of the state's waters. The Act is codified in the California Water Code, Division 7 – Water Quality, and has been modified and amended through subsequent years to address new issues and concerns affecting water use, clean water, water conservation and reuse, and water quality.

Discharges of recycled water to surface waters (rivers, lakes, and streams) are regulated under the CWA in California under Porter-Cologne. The Porter-Cologne Act also addresses recycled water discharges that may affect groundwater quality.

Water quality standards are the foundation of the water quality-based control program mandated by the CWA and enforced in California by the nine RWQCBs. Water Quality Standards define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from pollutants. Water Quality Standards may vary from basin to basin. A water quality standard consists of four basic elements:

- Designated uses of the water body (e.g., recreation, water supply, aquatic life, agriculture),
- Water quality criteria to protect designated uses (numeric pollutant concentrations and narrative requirements),
- An antidegradation policy to maintain and protect existing uses and high quality waters, and
- General policies addressing implementation issues (e.g., low flows, variances, mixing zones).

Within the Santa Ana River Basin, the Santa Ana RWQCB has identified the following as primary issues of concern:

- Reduce salts and nutrients in manure and wash water from dairy operations overlying the Chino Groundwater Basin that have severely degraded groundwater quality and threaten downstream water quality.
- Manage nonpoint sources of nutrients, silt, bacteria, metals, PCBs and the banned pesticide DDT that pose serious threats to Newport Bay.
- Control contaminated groundwater, which underlies many areas of the region, resulting from historic discharges of chlorinated solvents.
- Manage nonpoint sources of pathogens that continue to affect the quality of the Santa Ana River, thus rendering the river unsuitable for swimming.

The Regional Board issues Waste Discharge Requirements to individual dischargers containing specific limitations on discharged pollutants to address the above-referenced concerns.

2.2 Non-Potable Water Quality Considerations by Use Type

Federal and State regulations have developed rigorous standards for non-potable water uses. This section will address several non-potable uses and detail water quality requirements appropriate for those uses.

The SWRCB estimates that nearly 550,000 acre-feet of water were recycled in California during 2003 as detailed in **Table 2-1**. This includes both non-potable uses (such as irrigation) and indirect potable use (such as groundwater recharge).

California State Water Resources Control Board
Office of Water Recycling

RECYCLED WATER USE IN CALIFORNIA

06/2003

Types of Reuse	Volume of Recycled Water Use Within Region, Acre-Feet/Year											
	1	2	3	4	5F	5R	5S	6	7	8	9	Total
Agricultural irrigation	12,694	8,318	22,110	3,752	110,046	1,314	35,349	8,588	2,951	30,795	5,033	240,951
Landscape irrigation and	2,675	10,114	3,152	26,229	80	51	1,431	8,418	6,624	28,135	24,191	111,100
Industrial use	0	4,865	26	22,376	0	61	264	65	0	199	0	27,857
Ground water recharg	0	0	0	46,247	0	0	2,500	0	0	0	286	49,033
Seawater Barrier	0	0	0	10,651	0	0	0	0	0	15,000	0	25,651
Recreational impoundment	0	0	0	24,429	111	0	0	7,347	0	0	1,216	33,103
Wildlife habitat or misc.	1,977	6,198	5	6,437	0	0	1,009	0	172	4,361	41	20,200
Geysers/Energy Production	0	0	0	2,198	0	0	0	0	0	0	0	2,198
Other or mixed type	0	25	0	9,997	0	0	0	0	0	5,159	188	15,369
TOTAL	17,346	29,519	25,295	152,316	110,238	1,427	40,552	24,418	9,747	83,650	30,955	525,462

Source: Office of Water Recycling, California State Water Resources Control Board

Table 2-1: Recycled Water Use in California

- ***Irrigation***

As illustrated in **Table 2-1**, the primary non-potable use of recycled water in California is irrigation: both agricultural (47%) and landscape (21%). The principal constituents of concern when using recycled water for agricultural irrigation are salinity, sodium, trace inorganic elements, chlorine residual, and nutrients. Many of these can be toxic to plants or have long-term adverse effects on the soil. However different plants (and associated soil conditions) have different tolerances for these constituents.

Although irrigation water is not directly consumed, there may be indirect human contact and thus potential concerns regarding pathogen loads and public health. California categorizes recycled water (*e.g.*, "disinfected tertiary recycled water,") and then stipulates appropriate irrigation uses (22 *CCR* 60304). For example, only disinfected tertiary recycled water is allowed for irrigating school yards. Food crops where the edible portion is above ground and does not contact water may use a lesser grade (disinfected secondary-2.2 recycled water).

This study assumes that irrigation uses within Western service area will include mainly landscape irrigation for a larger institutional users and agricultural irrigation for large commercial nurseries. While it is recognized that front or back yard irrigation for individual parcels is a significant demand, because of the significant regulatory barriers, no demand for these uses has been included in the recycled water demand projections as part of this study.

- ***Groundwater Recharge***

The next largest use is for recharge groundwater. The objectives for groundwater recharge using recycled water include soil-aquifer treatment for future reuse, storage of recycled water, preventing ground subsidence, augmenting potable or non-potable aquifers, and saltwater intrusion barrier in coastal aquifers. Two principal methods for recharging are surface spreading and injection. Injection involves pumping recycled water directly into the groundwater zone and normally requires higher quality than surface spreading because of absence of soil matrix treatment afforded by surface spreading.

- ***Cooling Water***

For many industries, cooling water comprises the largest users of recycled water. Even this relatively innocuous application has stringent water quality requirements depending on the application (once-through cooling or recirculating/evaporative). The water quality parameters of concern include corrosion, biological growth, and scaling; issues that may also be present with treated potable water. Many of the industrial products used to control these issues with potable water supplies (biocides, anti-scaling agents, etc.) may also be useful in controlling those issues in recycled water.

- ***Boiler Make-Up Water***

Another industrial use for recycled water is boiler make-up. Pre-treatment of the recycled water will be required to further reduce hardness and other inorganic contaminants. Generally, higher boiler operating pressures and temperatures require higher quality water.

- ***Fire Protection***

The use of recycled water in fire protection is particularly problematic given the volumes necessary for firefighting and the enormous infrastructure required to support it. Water quality issues include corrosion by-products and biological growth as well as pathogenic considerations. In California, only disinfected tertiary recycled water is allowed for structural firefighting, while poorer quality water may be used for non-structural firefighting.

- ***Interior Sanitary Uses***

Recycled water may also be employed in interior sanitary uses such as flushing toilets and urinals and priming drain traps. While water quality is less of a concern in such applications, the presence of pathogens remains a concern with California requiring disinfected tertiary recycled water. Considering the complex array of regulations governing this type of re-use, Western has not included this potential demand in its recycled water projections.

- ***Other Industrial Processes***

Recycled water can be utilized by a number of other industries including pulp and paper, chemical processing, petroleum refining, and textiles. Obviously, the quality of water required for each of these sectors is application dependent. Some are capable of using water of fairly low quality, while others demand water that is highly treated. Typically, parameters of concern include inorganic contaminants, hardness, alkalinity, total dissolved/suspended solids, and color. Considering the complex array of regulations governing this type of re-use, Western has not included this potential demand in its recycled water projections.

- ***Other Uses***

Given the increasing scarcity of potable water, recycled water has also been used in decorative fountains and water features, commercial laundries, dust suppression, backfill consolidation, and artificial snow making. Each of these applications has its own individual requirements from both a water quality and pathogenic consideration.

2.3 California Water Recycling and Reuse Regulations

California has promulgated a number of definitions for differing grades of recycled water and then stipulated their allowed uses. Title 22 establishes process standards for recycled water depending on the type of application. The level of treatment required varies with the ultimate use of the recycled water but minimally, wastewater must receive secondary treatment prior to use as recycled water. Requirements for a specific recycled water use not addressed by the uniform statewide criteria are established by CDPH on a case-by-case basis.

The most stringent criteria require tertiary treatment. The level of disinfection required depends upon the ultimate use of the water, but the most restrictive requirement is for spray irrigation in parks, playgrounds, and residential landscaping where the potential for human contact exists. Since this restrictive use is anticipated in Western's service area, this plan assumes these more restrictive tertiary treatment requirements for essentially all of the recycled water in Western's system.

In addition to establishing recycled water quality standards, Title 22 specifies the reliability and redundancy for each recycled water treatment and use operation. Treatment plant design must allow for efficiency and convenience in operation and maintenance, yet provide the highest possible degree of treatment under varying circumstances. For recycled water piping, CDPH requires preventing backflow of recycled water into the public water system and eliminating cross-connection between the recycled and potable water systems.

1) Disinfection Grade and Definition

- ***Secondary 23 Recycled Water***

Secondary 23 recycled water has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a MPN of 23/100 mL utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240/100 mL in more than one sample in any 30-day period.

- ***Secondary 2.2 Recycled Water***

Secondary 2.2 Recycled water has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2/100 mL utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23/100 mL in more than one sample in any 30-day period.

- ***Tertiary Recycled Water***

Disinfected tertiary recycled water is defined a filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaqueforming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2/100 ML utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23/100 mL in more than one sample in any 30-day period. No sample shall exceed an MPN of 240/100 mL.

2) Recycled Water Use and Associated Required Treatment

The following tables present a number of potential irrigation and industrial uses for recycled water and the associated required treatment level under Title 22.

Irrigation	Treatment Levels			
	T*	2.2**	23***	U¶
Food crops where recycled water contacts the edible portion of the crop, including all root crops	A	N	N	N
Parks and playgrounds	A	N	N	N
School yards	A	N	N	N
Residential landscaping	A	N	N	N
Unrestricted access golf courses	A	N	N	N
Any other irrigation uses not prohibited by other provisions of the California Code of Regulations	A	N	N	N
Food crops where edible portion is produced above ground and not contacted by recycled water	A	A	N	N
Cemeteries	A	A	A	N
Freeway landscaping	A	A	A	N
Restricted access golf courses	A	A	A	N
Ornamental nursery stock and sod farms	A	A	A	N
Pasture for milk animals	A	A	A	N
Not edible vegetation with access control to prevent use as a park, playground, or school yard	A	A	A	N
Orchards with no contact between edible portion and recycled water	A	A	A	A
Vineyards with no contact between edible portion and recycled water	A	A	A	A
Non food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest	A	A	A	A
Fodder crops (e.g. alfalfa) and fiber crops (e.g. cotton)	A	A	A	A
Seed crops not eaten by humans	A	A	A	A
Food crops that undergo commercial pathogen-destroying processing before consumption by humans	A	A	A	A
Ornamental nursery stock, sod farms not irrigated less than 14 days before harvest	A	A	A	A

*: Disinfected tertiary treatment
**: Disinfected secondary 2.2 treatment
***: Disinfected secondary 23 treatment
¶: Undisinfected secondary treatment
A: Allowed
N: Not allowed

Table 2-2: Recycled Water Use by Treatment Level – Irrigation

Supply for Cooling /Air Conditioning / Other Use	Treatment Levels			
	T*	2.2**	23***	U¶
Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist	A	N	N	N
Industrial or commercial cooling or air conditioning not involving a cooling tower, evaporative condenser, or spraying that creates a mist	A	A	A	N
Groundwater recharge	Allowed under special case-by-case permits by RWQCBs			
Flushing toilets and urinals	A	N	N	N
Priming drain traps	A	N	N	N
Industrial process water that may contact workers	A	N	N	N
Structural fire fighting	A	N	N	N
Decorative fountains	A	N	N	N
Commercial laundries	A	N	N	N
Consolidation of backfill material around potable water pipelines	A	N	N	N
Artificial snow making for commercial outdoor uses	A	N	N	N
Commercial car washes not done by hand & excluding the general public from washing process	A	N	N	N
Industrial boiler feed	A	A	A	N
Nonstructural fire fighting	A	A	A	N
Backfill consolidation around nonpotable piping	A	A	A	N
Soil compaction	A	A	A	N
Mixing concrete	A	A	A	N
Dust control on roads and streets	A	A	A	N
Cleaning roads, sidewalks and outdoor work areas	A	A	A	N
Flushing sanitary sewers	A	A	A	A

*: Disinfected tertiary treatment
**: Disinfected secondary 2.2 treatment
***: Disinfected secondary 23 treatment
¶: Undisinfected secondary treatment
A: Allowed
N: Not allowed

Table 2-3: Recycled Water Use by Treatment Level – Other Uses

2.4 Current Non-Potable Water Supply

There are three major non-potable water supply sources for Western's service area: local groundwater via the Riverside Canal, imported water via the Colorado River Aqueduct (CRA), and recycled water from WWRF. Groundwater supply is produced locally by the City of Riverside and imported from the Riverside or San Bernardino basins through the Riverside Canal into Western's system. MWD supplies Western with untreated imported water from the Colorado River via the CRA, which has historically been used for agriculture irrigation only. As development has occurred, some landscape irrigation has been supplied by the CRA. Recycled water is generated from WWRF, and supplied from a secondary wastewater treatment plant via a dedicated conveyance system. Under 1993 Base Realignment and Closure Act, Western took over the operation and ownership of the March Wastewater Reclamation Facility (March WRF) in September 2000. This transfer allows Western to provide services for wastewater collection and treatment, and continues the practice of supplying secondary treated wastewater for landscape irrigation on the Riverside National Cemetery and the General Old Golf Course.

1) Non-Potable Water Supply from Riverside Canal

City of Riverside pumps and delivers local groundwater to fulfill its non-potable exchange demand with the Gage Canal Company and to supply Western at the Riverside Canal intake. An agreement between Western and City of Riverside Public Utilities (RPU) provides a framework whereby RPU supplies up to 2,000 ac-ft per year of non-potable water to Western through the Riverside Canal. The intake is located near Jefferson and Indiana Avenues where Western pumps that water into its system using the Riverside Canal Pump Station. The pump station with a capacity of approximately 7,200 gpm discharges through a pipeline, which is mainly located within the City of Riverside and the Gage Canal Company service area. No recycled water demand for customers within the City of Riverside or Gage Canal Company service areas has been included in the overall estimates. One connection has constructed for a City of Riverside's Arlington Sports Park located at the corner of Van Buren Blvd and Victoria Ave but is currently not active.

2) Non-Potable Water Supply from CRA

Western's water purchases from the MWD from the Colorado River Aqueduct at the Operations Center Intake. The water from the Colorado River Aqueduct is used as a non-potable water supply and is transferred through a series of pump stations, pipelines and tanks in the non-potable water distribution system. An air gap connection at the Roosevelt Tank allows non-potable water to be transferred safely into the recycled water distribution system. Significant effort is now underway in Southern California to reduce demands on the Colorado River water through water recycling, conservation, and development of local supplies. It is this supply that Western is planning to minimize while keeping the connection active for system redundancy and reliability.

3) Current Recycled Water Supply

Historically, WWRF (formerly March WRF) was designed to treat flows from the former March Air Force Base. With the realignment of the Base, the facility came under the ownership of Western. Construction of new residential development to the west of the WWRF, as well as major industrial development to the north, has expanded the WWRF service area. Treated wastewater is now fed into the existing converted non-potable irrigation distribution system for the North Area based on recent approval by RWQCB and CDPH. Recycled water is still transferred to the recycled water system and to the public golf course and the Riverside National

Cemetery which have their own on-site storage ponds and irrigation systems operated and maintained by their own personnel. These two irrigators use, on average, 0.75 MGD for seven months of the year. When recycled water flows exceed irrigation demands (during the winter months), excess treated wastewater is stored in an existing 35 million gallon pond until demand increases (during summer months). When irrigation demand exceeds the recycled water supply, untreated imported water from the Colorado River Aqueduct or local groundwater from the City of Riverside is pumped into the distribution system.

2.5 Future Recycled Water Supply from WWRF

1) WWRF Expansion Project

Upgrades to 3.0 MGD treatment capacity, including modification of the storage pond and a new recycled water pump station has been constructed and is operating. These components treat wastewater to tertiary standards and provide the required initial components to pump the tertiary treated wastewater into the existing non-potable distribution system. At maximum capacity, the WWRF expansion will generate over 2,200 acre-feet per year of tertiary treated wastewater. The recycled water pump station can deliver approximately 3,500 gpm to the existing non-potable water distribution system through an existing 20-in diameter pipeline. The storage pond is being divided into two sections; 2.75MG for tertiary filter balancing and 32.25 MG for tertiary recycled water storage. The project provides Western the opportunity to widely distribute tertiary treated wastewater to existing recycled water users.

The upgrade to tertiary treatment allowed reuse of recycled wastewater at locations other than the public golf course and the Riverside National Cemetery. The amount of available recycled water is anticipated to increase as the flows to the WWRF increase with the expansion of residential and commercial development within Western's service area (See **Table 2-4**). As flows exceed the demands of the golf course and the Riverside National Cemetery, the excess recycled water must be sold to other recycled water customers, stored on-site or discharged. Current agricultural and irrigation customers, including nurseries, are supplied tertiary treated recycled water through the existing recycled water distribution system. Based on wastewater generation projections and anticipated recycled water demand, it is expected that most recycled water generated can be used, except during unusually wet winter weather events.

Schedule	Treatment Capacity (MGD)			Anticipated Average Daily Flow (MGD)		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Current	3.0	3.0	3.0	0.8	0.8	0.8
2015	3.0	3.0	3.0	1.0	1.0	1.0
2020	3.0	3.0	3.0	2.0	2.0	2.0
2025	5.0	5.0	5.0	3.6	3.6	3.6

Table 2-4: WWRF Expansion and Influx Flowrate

2) Wet Weather Discharge

From time to time, wet weather may reduce recycled water demand below Western's ability to store excess wastewater treatment. Therefore, Western must be able to discharge excess recycled water from its system. It is anticipated that Western would discharge that excess recycled water to its existing sewer collection system and convey that flow to the WRCRWA treatment plant to be re-treated and eventually discharged to the

Santa Ana River. Western has the capability of discharging approximately 1.0 MGD to a new interconnection to the WRCRWA treatment plant. The interconnection is located on McAllister Street within a landscaped/park area of Tract 30337. Sewer capacity is available at this location due to oversizing that Western purchased for future development in the El Sobrante area. This sewer capacity can be used until more development occurs east of McAllister. As part of that future development, the capacity constraint would have to be resolved by either relocating the wet weather discharge, increasing Western's storage capacity or constructing additional sewer conveyance capacity.

SECTION 3 - Recycled Water Users

3.1 Existing Recycled Users

This section presents the recycled water users. The study identified five different categories for recycled water 1) existing recycled water users, 2) existing non-potable users who could convert to recycled water, 3) existing potable water users who can use recycled water, 4) existing irrigation uses in Orangecrest and Mission Grove areas, and 5) future potential customers. The total recycled water users includes both industrial uses within the Meridian Business Park and irrigation demand for agriculture, landscaping, nurseries, schools, cemetery, and golf courses. Currently, Western uses three water types to meet existing demand for these users; recycled water, non-potable, and potable water. These three different water resources currently have their own separate distribution systems.

Western has recently converted the North Non-Potable Distribution System to recycled water along with all customers connected to that system. In the near future, Western plans to connect the northern portion of Meridian Business Park to the recycled water system. There are no other major initiatives to convert other users to recycled water. This may change when additional recycled water production from the WWRF is generated in the future.

1) Orangecrest and Mission Grove Area

Additionally, the previous study reviewed potable water usage for irrigation purposes in Orangecrest and Mission Grove areas. The same information is presented in the following summary. Orangecrest and Mission Grove areas have changed from agriculture uses to suburban land development during the last two decades. The areas contains two major arterial roadways, Trautwein Road and Alessandro Boulevard, which have wide landscaping parkways, several retail shopping malls, seven public schools, four of which use potable water for irrigation (JFK Elementary School, Benjamin Franklin Elementary School, Rivera Elementary School, and Earhart Middle School), Grove Community Church, and two local parks, (Orange Terrace Community Park and Thundersky Park). There is significant opportunity for converting this landscape irrigation to recycled water with relatively short pipeline extensions, although all pipeline extensions are within already developed streets. The potential recycled water demand has been divided into six service areas based on logical pipeline extension segments. **Figure 3-1** illustrates proposed recycled water pipelines to accommodate these service areas. **Table 3-1** summarizes of the existing water usage by service area. Accumulatively, the total annual demand is slightly larger than Western's largest existing recycled water user, Riverside National Cemetery. Converting most of this demand to recycled water service could decrease potable water demand significantly.

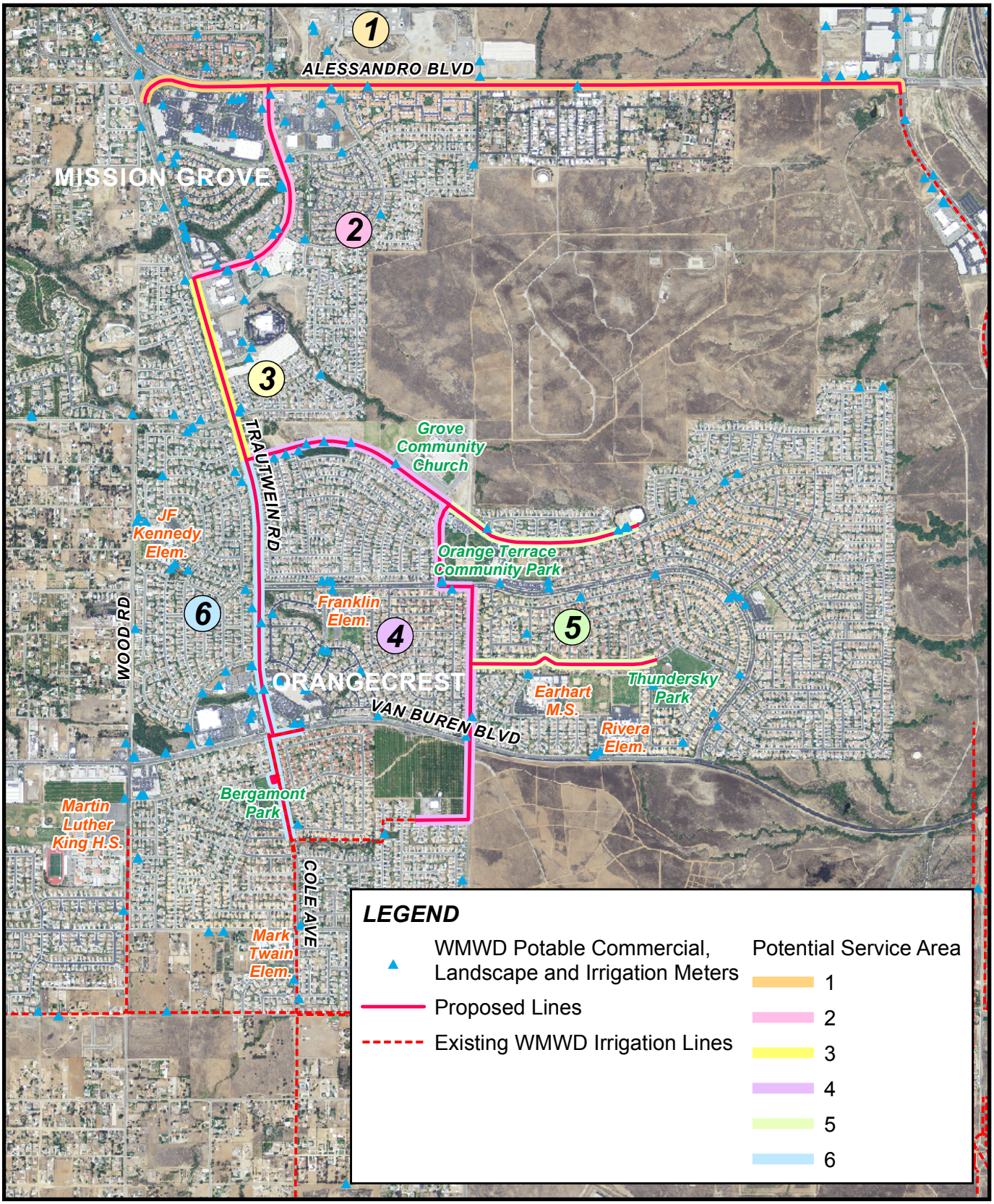
2) Meridian Business Park

Meridian Business Park is the newest large commercial development within Western's retail service area. Meridian is located north of the General Archie J. Old Golf Course and west of I-215 on former MARB lands. The developer has installed a separate recycled water distribution system in order to serve all landscaped areas and potential industrial uses. Currently, the system is being supplied with potable water through a check valve system. As Meridian extends southerly and westerly, the system will be connected to the existing non-potable distribution system at both Village West Drive and Barton Street. Since the Meridian

recycled water system has been designed and constructed as a separate system, it can be easily switched in the future when recycled water is available.

Service Area	2007~08 (ac-ft)	2006~07 (ac-ft)	2005~06 (ac-ft)
1	110	119	103
2	199	205	164
3	28	30	31
4	235	196	151
5	127	124	113
6	136	139	125
Total	**834**	**813**	**687**

Table 3-1: Potable Water Usage for Irrigation in Orangecrest and Mission Grove Areas



Sources: WMWD, 2013; USDA NAIP, 2012.

ALBERT A. WEBB ASSOCIATES

N
W E
S

0 2,000 4,000 Feet

Figure 3-1
Orange Terrace and Mission Grove Irrigation Service Areas

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3) Ultimate Recycled Water Demand for Master Plan

Based on the market segments presented in the previous sections, **Table 3-8** and **Table 3-9** summarize the ultimate annual demand volume for North and South Areas by pressure zone assuming conversion of all existing potential potable demand to the recycled water system and complete build-out of the planned recycled water uses.

The Gage Canal Company service area has not been included in Western's proposed service area nor within any demand projections with this study. Considering that RPU is planning an extensive recycled water system that could serve the Gage Canal Company service area and there is some concern about inorganic contaminants in recycled water that may adversely impacting citrus, any demand for this area would be very speculative. In the future, it is possible that Western, the Gage Canal Company and RPU could agree upon supply interconnections providing system reliability for all parties or service to a particular customer based on proximity to the existing distribution system. One such interconnection is the 40 acre Arlington Sports Park near the intersection of Cleveland and Gibson. Supply to Arlington Sports Park, however, is not considered additional demand for Western, since Western will receive additional non-potable water from RPU via Riverside Canal Pump Station matching this demand.

Demand Descriptions	Phase*	North Area (ac-ft/yr)			Total
		1420 PZ	1667 PZ	1815 PZ	
Existing recycled water demand	**I**	160	728	1,540	2,428
Existing potable water use to be converted to recycled water system	**II**	0	519	1,088	1,607
Existing potable water use in Orangecrest and Mission Grove areas	**II**	0	0	836	836
Future potential customers	**IV**	436	126	735	1,297
	Total:	**596**	**1,373**	**4,199**	**6,168**
*See Section 5 for phase definition					

Table 3-2: Ultimate Demand for North Area

Demand Descriptions	Phase*	South Area (ac-ft/yr)			Total
		1815 PZ	2250 PZ	2450 PZ	
Existing non-potable / recycled water demand	**III**	0	538	429	967
Existing potable water use to be converted to recycled water system	**III**	8	15	0	23
Future potential customers	**IV**	0	698	162	860
	Total:	**8**	**1,251**	**591**	**1,850**
*See Section 5 for phase definition					

Table 3-3: Ultimate Demand for South Area

4) Monthly Demand Variation

Based on Western's experience with its historic water sales data, monthly demand between winter months and summer months varies on average four fold. Based on the past five years of actual monthly variation of non-potable water demand, July has the highest average demand at 13.6% of annual demand and January has the lowest average demand at 3.6% of annual demand as shown in **Figure 3-2**. Monthly averages were used to project maximum daily demand for the system and monthly aggregate supply requirements. Note that these are averages and that actual demand can vary significantly (both up and down) based on weather conditions.

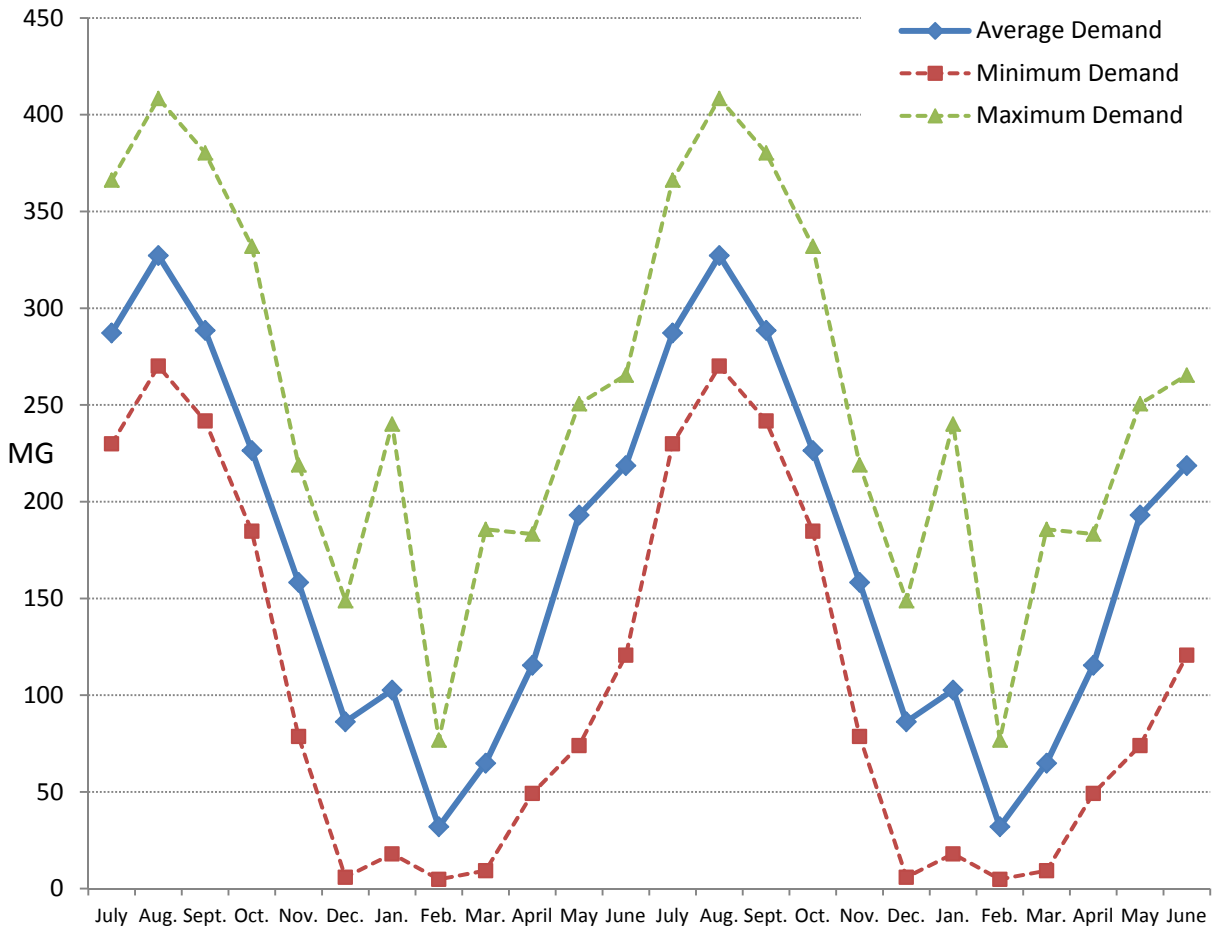


Figure 3-2: Typical Monthly Demand Variation

SECTION 4 - Recycled Water Distribution Facilities

4.1 Existing Recycled Water Distribution System

The existing recycled distribution system consists of an interconnected series of pipelines, tanks, reservoirs, and pump stations designed to distribute non-potable water through a large area of the Western's retail area (Figure 1.3). The South area is still served non-potable water and is separated from the North with an air gap at the Roosevelt Tank. The system has been in operation since Western's inception. Some of the facilities may be approaching their useful life span. A detailed analysis of potential asset replacement of the existing system is beyond the scope of this report. The water supply for this system is currently drawn from three sources – tertiary treated recycled water from WWRF, imported non-treated water from CRA and non-potable local groundwater pumped by the City of Riverside from nearby groundwater basins (Riverside-Colton Basin) and delivered via Riverside Canal to the system. The recycled water/non-potable distribution system has approximately 55.5 miles (292,800 feet) of main pipelines ranging from 4 inches to 42 inches in diameter. A series of eight pump stations move water within the distribution system with 25 pumps and a combined rating of 5,175 horsepower. There is approximately 13.3 million gallons available storage capacity in five tanks and one open reservoir, Lower El Sobrante Reservoir. Two open reservoirs, Upper El Sobrante and Lake March, are not currently used in the normal operation and therefore are not included in the storage totals. The effluent holding ponds at the WWRF or any on-site storage operated and maintained by individual customers are also not included in the storage totals. Because the existing system has open reservoirs and canals, Western must continue to control algae and other organic materials in the water supply.

1) Existing System Operation

The schematic configuration of the current recycled water / non-potable distribution system is shown in **Figure 4-1**. For the North Area, both Riverside Canal Intake and CRA are non-potable water sources. Roosevelt Tank, as a central storage facility, collects water from both sources and balances the peak demand. Conversely, CRA is the sole source for the South Area. The South Area relies on one linear distribution system. A single failure or outage along the system can result in service interruption for the entire South Area. Recycled water treated from the WWRF is delivered to the 1815 pressure zone, as well as the General Old Golf Course and Riverside National Cemetery. The recycled water and the non-potable water systems are operated independently.

The Riverside Canal and McAllister Pump Stations can convey up to 7,200 gpm from Riverside Canal into Western's distribution system. El Sobrante Pump Station and Upper El Sobrante Pump Station each have the capacity to convey 3,600 gpm into the 1667 pressure zone. Currently, the Upper El Sobrante Pump Station has been taken out of service. This pump station was acquired by Western from the El Sobrante Mutual Water Company when the mutual was dissolved in the late 1990's. This station was well beyond its useful life and has no operational facilities. Note that in order to convey enough local groundwater from the Riverside Canal into the 1815 PZ for ultimate conditions, the Upper El Sobrante Pump Station must be restored.

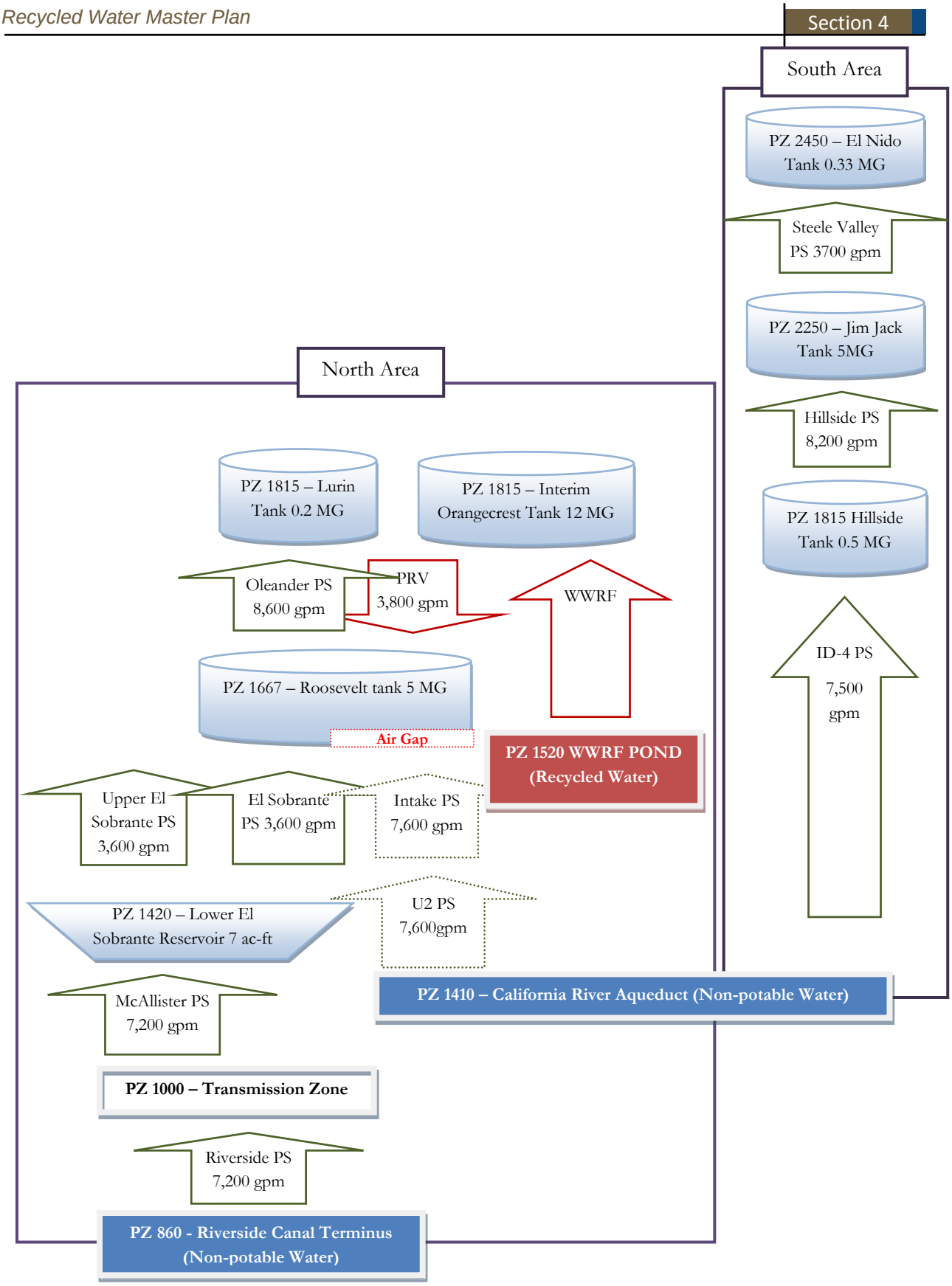


Figure 4-1: Existing Non-potable / Recycled Water Distribution System Schematics

2) Pumping Stations

A summary of Western's ten non-potable pump stations is listed below. More detailed information is given in Appendix "A"

- ***ID U-2 Pump Station***

The ID U-2 Pump Station is located at Western's Operation Center, and delivers non-treated water from CRA to the Inline Booster Station and eventually to North service area via an air gap at the Roosevelt Tank. The station has two 150-hp pumps and a capacity of 7,600 gpm.

- ***Inline Booster Station***

The Inline Booster Station boosts water from ID U-2 Pump Station to Roosevelt Tank via an air gap. Two 150-hp pumps deliver 7,600 gpm. Combined with ID U-2, these pump stations convey water from the CRA at 1410' to the 1667 PZ.

- ***Oleander Booster Station***

The Oleander Booster Station consists of four domestic water pumps and three recycled water pumps. For the three recycled water pumps; two are 200-hp pumps and one is 75-hp pump. All together, they convey up to 8,600 gpm from 1667 PZ to 1815 PZ.

- ***Riverside Canal Pump Station***

The Riverside Canal Pump Station is located at the Riverside Canal intake and is one of the non-potable water sources. With four pumps totaling 1,200-hp, the station conveys 7,200 gpm through a Transmission Zone from 850' to the McAllister Pump Station at an elevation of 1,000'.

- ***McAllister Pump Station***

The McAllister Pump Station provides the final lift from the Riverside Canal into Western's non-potable water distribution system. With four pumps totaling 1,200-hp, the station lifts 7,200 gpm from a small equalizing pond at an elevation of 1,000' into the 1420 PZ.

- ***El Sobrante Pump Station***

The El Sobrante Pump Station has four pumping units designed to pump from 1420 PZ to 1667 PZ. A total of 4 pumps with a total of 450-hp can deliver up to 3,600 gpm.

- ***Upper El Sobrante Pump Station***

The Upper El Sobrante Pump Station is currently out of operation. When operable, its design capacity should be approximately 3,600 gpm, lifting from 1420 PZ to 1667 PZ.

- ***ID 4 Pump Station***

The ID-4 Pump Station is located next to ID U-2 Pump Station at Western's Operations Center. The pump station also draws non-treated water from CRA and delivers it to the South Area. One 350-hp and one 600-hp pumps can boost up to 7,500 gpm from the CRA at 1410' to 1815S PZ.

- ***Hillside Pump Station***

The Hillside Pump Station - Irrigation has four pumping units, with a total of 1,100 hp, and is designed to pump from the 1815S PZ to the 2250 PZ in South Area. The pump station is capable of delivering up to 8,200 gpm.

- ***Steele Valley Pump Station***

The existing facility has four irrigation pumping units designed to pump from the 2250 PZ to the 2450 PZ in South Area. Two 150-hp pumps, one 75-hp pump and one 25-hp pump can deliver up to 3,700 gpm. The station has both TOU and regular electrical services to minimize cost for peak electrical loads and allows Western to use one pump during summer peak hours without high peak demand changes.

3) Pipelines

The distribution system has approximately 55 miles of main pipelines ranging from 4 inches to 42 inches in diameter. **Table 4-1** lists existing pipelines by pipe size.

Diameter (in)	Total Length (ft)
4	1,100
8	21,200
10	9,400
12	33,200
14	16,900
16	24,000
18	12,900
20	62,900
21	3,300
24	57,700
30	33,800
33	13,200
42	3,200
Grand Total	**292,800**

Table 4-1: Non-potable Pipeline Length by Pipe Size

4) Storage Facilities

There are six active storage facilities in the study area; Lower El Sobrante Reservoir, Lurin Tank, and Roosevelt Tank serving the North Area and are currently for recycled water, and Hillside Tank, Jim Jack Irrigation Tank, and El Nido Irrigation Tank serving the South Area and are currently for non-potable water. The Upper El Sobrante Reservoir and Lake March are normally off-line and not used in the normal operation of the system and therefore their storage capacities are not included in the system totals. The Lurin Tank has a capacity of only 0.2 MG, and, since it is within the zone with the largest potential demand, it only serves as pressure stabilization for the 1815PZ.

Name	Size (Gallon)	Diameter (ft)	Height (ft)	HWL	LWL	Constructed
El Nido	330,000	40	32	2450	2419	1989-90
Hillside	500,000	52	32	1815	1784	1965
Jim Jack	5,000,000	150	40	2250	2211	1966
Roosevelt	5,000,000	150	40	1667	1628	1965
Lower El Sobrante	2,280,000 (7 ac-ft)	Open Reservoir		1420	-	
Upper El Sobrante	0 (7 ac-ft)	Open Reservoir		1610	-	
Lake March	0 (5 ac-ft)	Open Reservoir		1750	-	
Lurin	200,000	48	15	1815	1798	
Subtotal	**13,310,000**					
Upper El Sobrante and Lake March is not on-line under normal operating conditions.						

Table 4-2: Non-Potable Storage Facilities

4.2 Design Criteria

1) Demand Calculations

The following definitions apply to demand calculations and projections for this study.

- ***Average Daily Demand (ADD)***

Average Daily Demand is based on annual demand divided evenly for all 365 days.

- ***Average Monthly Demand (AMD)***

Average Monthly Demand is based actual monthly irrigation demand of Western's non-potable system for each month. Western has tracked monthly demand fluctuation over the last five years yielding average demand for each month based on annual demand. Percentages of the annual demand have been determined for each month and then Average Monthly Demand is projected based on the annual demand projection. Average Monthly Demand is used to check whether the system has a balanced supply and demand in any one month.

- ***Maximum Daily Demand (MDD)***

Maximum Daily Demand is calculated from maximum monthly demand and dividing by 31 days. July is the maximum monthly demand, consuming approximately 13.5% of annual demand.

- ***Peak Hourly Demand (PHD)***

Peak Hourly Demand is calculated from MDD by multiplying by 3. Since future recycled water irrigation usage will tend to be concentrated during night and evening hours based on anticipated watering restrictions, it is very reasonable to assume that MDD will be consumed within a certain time frame rather than evenly spread over 24-hours. In this case, an 8-hour irrigation window has been assumed.

- ***Peak On Demand (POD)***

Peak On Demand is an additional peak flow demand beyond PHD. During the eight hour demand period for PHD, other localized peak demands are possible. POD is calculated by multiplying PHD by a factor of 2. If POD exceeds system capacity, then a scheduled delivery system can be implemented to mitigate demands back to PHD level. Therefore, sizing facilities based on POD is not recommended.

- ***Tank Refill (TR)***

Tank Refill is assumed to be 10% of PHD. The model assumed 10% demand starting with only 4-ft high of water in tanks. Facility Sizing Criteria

- ***Storage Facilities***

Storage requirements are classified as either short-term or long-term. Short-term storage is usually sized to provide working storage plus emergency reserve. No fireflow storage has been anticipated in the recycled water system. By providing working storage, demands greater than MDD up to PHD can be served from the storage facility. After supplying PHD, pump stations refill the tank during the remainder of day before the following day's PHD.

Long-term storage is usually provided in reservoir and lakes. These facilities can balance seasonal supply and demand variations. During winter season, when demand is low, the storage facilities can store excess recycled water produced for later months. This master plan does not analyze requirements for long-term storage. It is assumed that during any significant wet weather event where demand is low, excess recycled water will be discharged.

- ***Pumps***

Pumping stations used in conjunction with storage facilities will be sized to pump MDD for each service areas. This is based on the assumption that for PHD will be met by short-term storage.

- ***Pipes***

When designing recycled water distribution systems, the size of the pipelines must be balanced against the maximum velocity in the pipelines and the total headloss across the distribution system. If the pipelines are too small, headloss and pumping energy costs will increase. In general, pipe shall be sized to deliver PHD with a acceptable maximum velocity. No allowance for fire flow has been made in any of hydraulic modeling. The followings are summary of design criteria for pipe sizing.

a. Maximum velocity of 6-fps in transmission pipelines under either replenishment condition or PHD condition.
b. Maximum friction loss of 3.5ft/1000 ft of transmission line under replenishment conditions.

4.3 Hydraulic Modeling for Existing Conditions

The December 2009 Recycled Water Master Plan included a hydraulic analysis which has not been modified and is included herein for reference. A hydraulic model for the recycled water master plan included the ultimate demand data, existing distribution system and planned system improvements. In addition, hydraulic model conditions were developed to determine the adequacy of the existing distribution system under the current flow conditions. The water system was modeled by utilizing the computer software H2ONet Version

6 developed by MWH Soft, Inc. This software has the capability to analyze the system as a whole and to provide an efficient means of calculating the complex hydraulics attributed to a non-potable system of this magnitude.

Input for the model consisted of link (pipeline) data including diameter, length, and Hazen-Williams roughness constraints "C"; node (junctions, valves, pumps, tanks, and reservoirs) data including demands, elevations, and control settings; and scenario constraints. Most of the information for the existing facilities was based on Western's GIS database plus confirmation with more recent data provided by Western's staff and as-built plans retrieved from Western's on-line GIS database, www.goevieweronline.com. Based on the current and projected demand data and anticipated phasing, the demand and facility datasets were established for each scenario.

Existing demands were based on 2007 meter datasets. Western provided monthly billing records for the non-potable water accounts. These accounts were assigned a geographic location based on their APN or street address and then assigned to the nearest model junction with the help of GIS software (ArcMap).

The existing condition was analyzed using the existing facilities and existing demand determined from the datasets assuming no recycled water supply. The demands scenarios analyzed were MDD, PHD, POD, and TR. A matrix of the model parameters for each of the scenarios is provided in Appendix B. The existing facilities are hydraulically divided into North and South Areas. No capacity issues were observed in the existing system during each of the model run. Note that although many of the non-potable pipelines within the Meridian Business Park have been installed, the business park is utilizing potable water for irrigation as no connection has yet been made to the non-potable system. Therefore the Meridian area was not modeled in the existing system. The existing facilities providing recycled water to the General Archie J. Old Golf Course and Riverside National Cemetery are considered an independent self-contained system and were not included in the existing model.

4.4 Hydraulic Modeling for Interim Condition

An interim version of the ultimate system was evaluated. For the interim conditions, it was assumed that the North Area would now be supplied recycled water by proposed WWRF pump station and local groundwater by the Riverside Canal, and the South Area would be supplied by the CRA U2 pump station. Under this scenario, the North and South Areas were evaluated separately under the ultimate peak hour demand condition and both model results showed that the proposed ultimate facilities are adequately sized for the interim condition (See Figure 4-2). As implementation requirements, several improvements have been assumed; an air-gap for the CRA supply, the proposed WWRF Pump Station, pipeline extensions to parks and schools in Orangecrest and a storage tank in Orangecrest The temporary air-gap is proposed at the Roosevelt Tank. The air-gap will allow non-potable water supply from CRA when the North Area is converted to recycled water without the possibility of recycled water flowing back to the CRA. At the ultimate configuration, the pipelines between the Roosevelt Tank and the CRA are needed to supply recycled water to the South Area. Therefore, this air-gap must be moved to a new location near the CRA in order to maintain the protection of the CRA. The proposed WWRF Pump Station at 3,500 gpm will deliver up to 5 MGD of recycled water from the WWRF holding pond into the distribution system. In addition, an interim 12 MG tank is proposed for the 1815 PZ at the Orangecrest site to provide operational storage and stabilize

the system pressure in the Orangecrest area. The pipeline to the tank with accompanying services has also been included in the interim condition.for the Ultimate Recycled Water Distribution Facilities

Analysis of the ultimate facilities was also conducted utilizing the ultimate demand of MDD, PHD, and POD. The most significant difference in the distribution system is the complete disconnection from CRA to both North and South Areas in order to supply recycled water to South Area from North Area via Roosevelt tank. Hydraulic modeling under ultimate condition analyzed the capacity of the pump stations to meet peak hour demand and the required storage capacity in 1815 PZ. Pumping capacity shall be big enough to refill tanks during the off peak demand hours. The model results indicated that the Roosevelt Tank continues to drain during the tank refill scenario until the other tanks in the system have filled. No problems are anticipated with refilling the tanks within the off peak flow hours.

Modeling results indicated that several other system improvements are warranted at the ultimate system. These improvements, including those required for the interim condition, are summarized as follows:

1) Pumping Stations

Two new pump stations will be need for the ultimate condition.

1. Upper El Sobrante Pump Station – the proposed facility would be located near the Lower El Sobrante Tank and should be capable of pumping at a flow rate of 3,600 gpm. This facility is needed to provide more water from the Riverside Canal to the south portion of the system to replace the supply currently being provided by the CRA and meet peak summer demand at ultimate. It is sized at 3,600 gpm such that the full capacity of the Riverside Canal and McAllister Pump Station can be utilized to meet the ultimate MDD. Note that additional supply beyond the 2,000 ac-ft/year from the City of Riverside may be required.
2. New ID4 Pump Station – the new ID4 would be located east of the WMWD's Operation Center. A pumping capacity of 3,500 gpm would be needed to meet the South Area ultimate MDD.
3. WWRF Pump Station – a 3,500 gpm pump station has been constructed which can deliver up to 5 MGD from the WWRF holding pond. This pump station is located at the treatment plant.

2) Pipelines

A majority of the proposed pipelines are to extend the recycled water distribution system to new service to interim locations in the North Area or extend recycled water supply for the South Area. However, not all the potential customers identified in the previous master plan are included in the future service areas because some potential users are too remote from pipelines or have low demand to warrant recycled water service by extending the distribution system.

Table 4-3 lists all the proposed main pipelines for the Master Recycled Water Plan (refer to attached Exhibit "Recycled Water Master Plan - Hydraulic Analysis Model with Demand" for the locations). The total proposed length is approximately 101,600 L.F. Most of proposed reaches are located in 1815 PZ to capture large landscaped areas in this newly developed area.

Ultimate pipeline facilities were preliminary designed for the PHD conditions, not the POD. It is anticipated that Western will implement a scheduled deliver system before ultimate demands are reached to avoid excess pipe headloss and loss of system pressure.

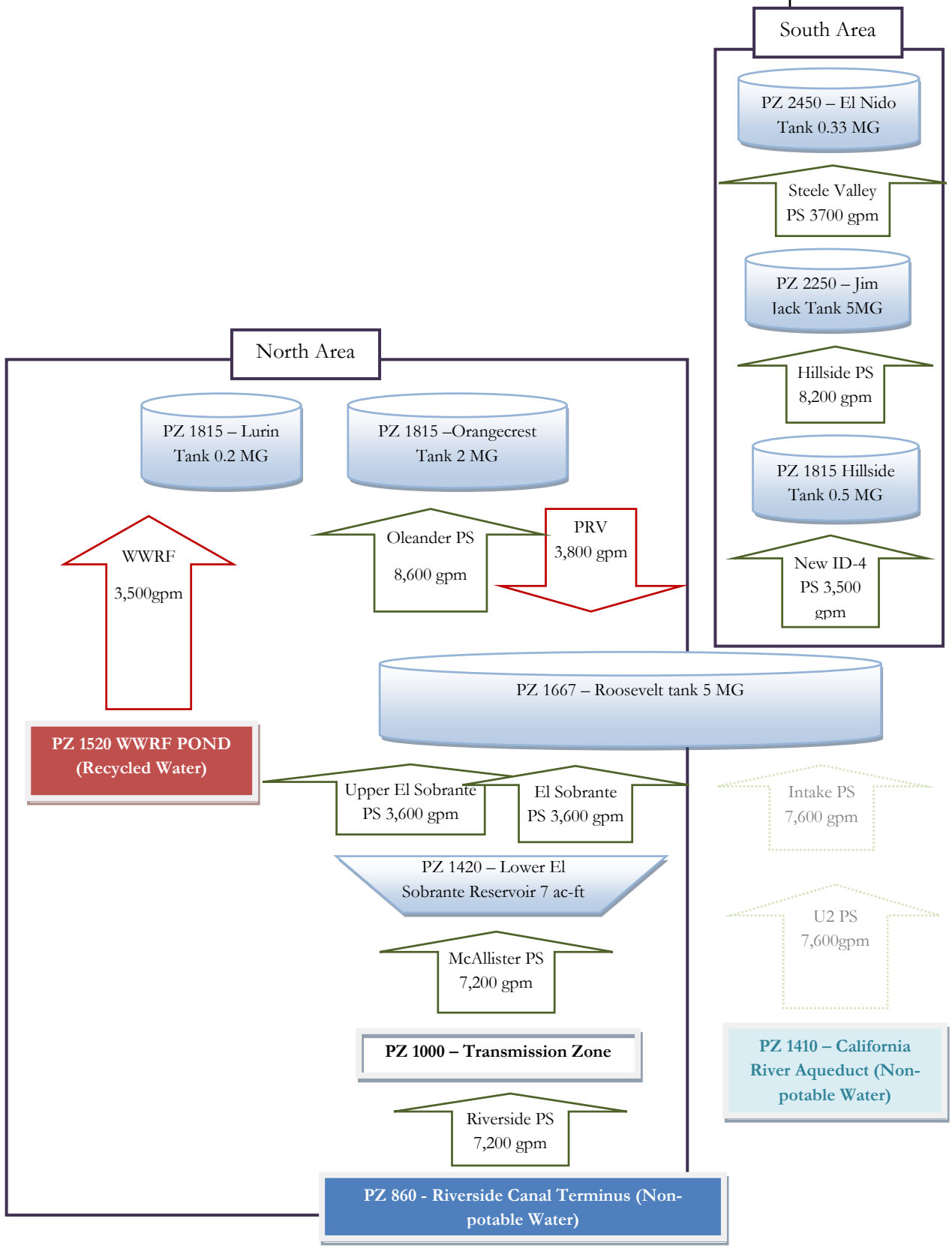


Figure 4-2: Ultimate Non-potable / Recycled Water Distribution System Schematics

ID	Street Location	Pressure Zone	Pipe Length	Pipe Diameter	Anticipated Phasing
1	Alessandro Blvd	1815	11,700 LF	12-in	Phase II
2	Village West Dr	1815	Conversion	14-in	Phase II
3	Mission Grove Pkwy	1815	4,000 LF	12-in	Phase II
4	Trautwein Rd	1815	9,000 LF	12-in	Phase II
5	John F. Kennedy Dr	1815	10,800 LF	8-in	Phase II
6	Grove Community Dr	1815	3,600 LF	8-in	Phase II
7	Grove Community Dr	1815	2,800 LF	18-in	Phase II
8	Deercreek Dr	1815	7,200 LF	8-in	Phase II
9	600 ft south of Van Buren Blvd (1)	1815	8,100 LF	12-in	Phase IV
10	Existing field south of Van Buren Blvd (1)	1815	4,000 LF	12-in	Phase IV
11	South of Van Buren Blvd through an existing field (1)	1815	3,300 LF	12-in	Phase II
12	Sweetbay Rd and Mesquite Canyon Rd	1815	3,400 LF	8-in	Phase II
13	Blackburn Rd	1667	2,300 LF	12-in	Phase IV
14	Harley John Rd	1815 South	5,400 LF	24-in	Phase III
15	Smith Rd	1815 South	6,800 LF	24-in	Phase III
16	Markham St	1667	9,000 LF	24-in	Phase II
17	Chicago Ave	1815	4,900 LF	8-in	Phase II
18	Carpinus Dr	1815	5,300 LF	8-in	Phase II
	See attached Exhibit "Recycled Water Master Plan - Hydraulic Analysis Model with Demand" for location	**Total:**	**101,600 LF**		See Section 5 for Phase Definition

Table 4-3: Proposed Recycled Water Pipeline for Ultimate Conditions

(1) On-site pipelines funded by developer as part of the conditions of approval for Meridian.

3) Storage Facilities

Currently, the 1815 zone has only 0.2 MG of storage at the Lurin Tank site. Centrally located in the 1815 zone is a 12 MG potable water storage tank known as the Orangecrest Tank. The Orangecrest Tank site has room for an additional 12 MG for future potable demand. Since more non-potable water storage is needed in the 1815 zone now, one alternative explored as part of this analysis was to construct a 12 MG tank for recycled water at the Orangecrest tank site and, then, in the future, when more potable water storage is required, more property could be purchased to build a smaller 2.0MG recycled water storage tank and convert the 12 MG tank from recycled water storage to potable water storage. As part of either proposed tank improvement, an altitude valve at the existing Lurin Site will be required to ensure that the site does not overflow during tank refill conditions.

Even with the aforementioned improvements proposed to meet the estimated ultimate demands, low pressures are expected in portions of the 1815 zone and the southern end of the system because of the topography. It was assumed that many future customers would be required to provide their own water boosting systems, customized to their specific applications. Enclosed Exhibit of "Recycled Water Master Plan - Hydraulic Analysis Model with Demand" displays residual pressure of each node under MDD run.

SECTION 5 - Project Implementation & Phasing

5.1 Project Implementation Phasing

It is anticipated that Western will implement the ultimate recycled water master plan in phases. Unlike potable water or sewer master plans, which normally can be implemented by adding pipelines and capacity, this implementation must first convert the existing non-potable water distribution system within zones to recycled water along with individual customer conversions for all existing non-potable customers within those zones. Then existing potable water users can be converted incrementally to recycled water when the system is extended to those services by constructing additional recycled water pipelines. Finally, future customers can be connected to the recycled water system directly when they request service.

The phasing plan is divided into two areas, North Area and South Area. The North Area has already been converted to recycled water. Crossing of the CRA must be finalized before the South Area can be converted. **Figure 5-1** presents conceptual phasing implementation. The proposed phasing implementation is not necessarily sequential since new customers can be connected as soon as recycled water is available adjacent to their project.

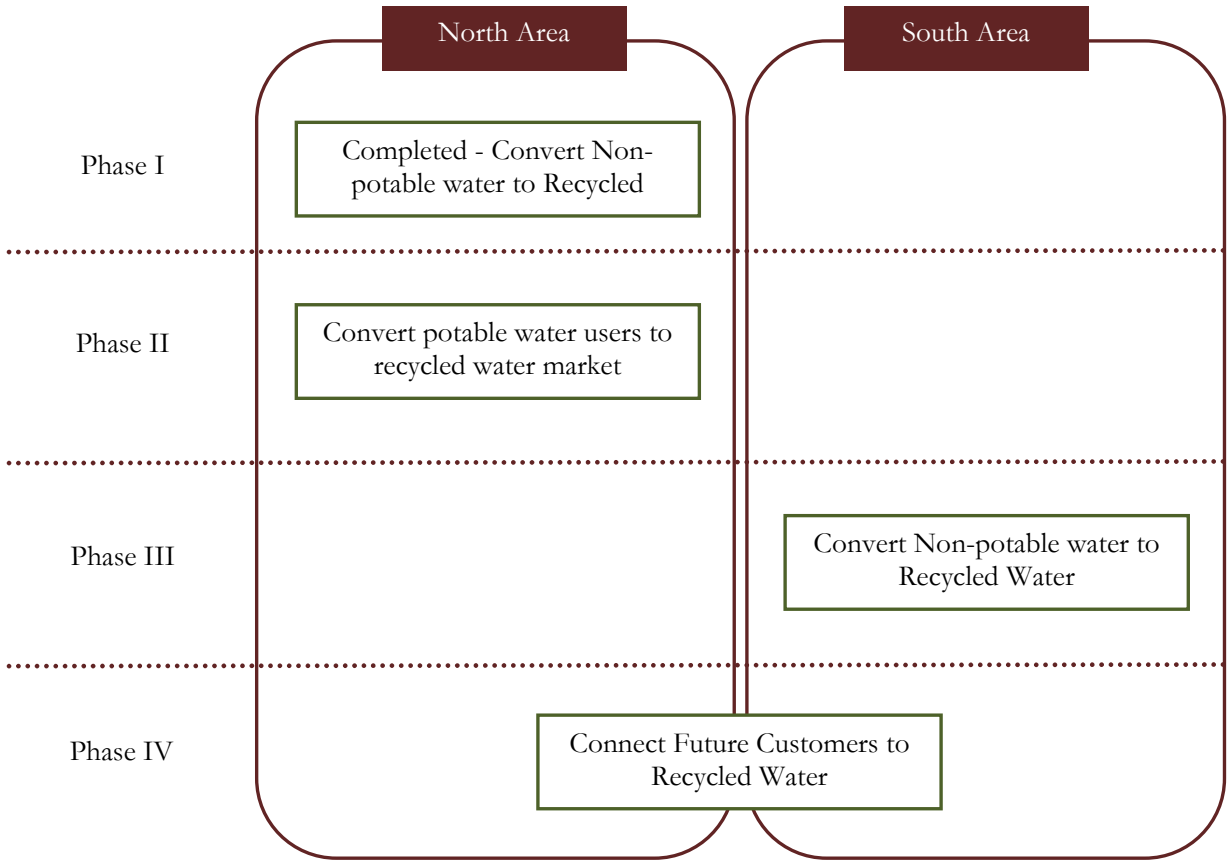


Figure 5-1: Recycled Water Master Plan Phasing Implementation

5.2 Phase I - Converting Non-Potable Water uses (North Area)

1) WWRF Phase 2 Expansion

WWRF Phase 2 expansion project included both the tertiary treatment facility described in Section 2-4 and a recycled water pump station to deliver the tertiary recycled water to the existing recycled water system. The pump station is sized to deliver 3,500 gpm, or 5 MGD. Four 200-hp pumps, three duty and one stand-by, are installed. Construction costs for WWRF Phase 2 Expansion and this pump station are not included in this report.

2) Construct Air-Gap in Roosevelt Tank

MWD requires physical separation between the CRA and any recycled water system to protect its raw water sources. Since Western needs to maintain the CRA as a back-up water source for system reliability, a physical disconnection between the two systems is required as an interim step. The air gap constructed at the Roosevelt Tank has been constructed. The existing non-potable system from CRA intake to the Roosevelt tank contains strictly non-potable water from the CRA. When the South Area is converted to recycled water,

this air gap at the Roosevelt Tank would need to be relocated elsewhere. (See **Figure 4-2**). The details of this connection and air gap location will need to be developed and reviewed by MWD.

3) Separation between Potable Water Pipeline

In preparation for the conversion, Western has identified all potential locations of non-compliance with the current California Department of Public Health (CDPH) separation standards (Section 64572 of Title 22, California Code of Regulations) between the existing non-potable system and Western's potable water system. A separate study, "Correction Plans for Horizontal & Vertical Separation," prepared by Albert A. Webb Associate in June 2009 identified 44 potential non-compliance crossings and an associated plan to verify and correct all separation issues. According to the study, no cross-connections between the potable and non-potable system were found. The correction plan has been approved by CDPH and the first phases in the North Area are completed.

4) Convertion from Non-potable Water to Recycled Water Supply

The existing non-potable water system has been converted to a recycled water system since the effluent pipeline from WWRF is tied into the existing 20-in non-potable pipeline in Nandina Avenue. Recycled water is lifted into the system by the WWRF pump station at an elevation of 1525 into 1815 PZ and delivered via the existing 20-in diameter pipeline along Nandina Avenue. Western has 'permitted' all existing non-potable users and performed on-site verification of those customers' systems. Until additional storage is provided in the 1815PZ, the WWRF Pump Station and the Oleander Pump Station will need to be operated to closely match demand. A PRV station at the Oleander Pump Station can supply recycled water from the 1815PZ down to the 1667PZ if required.

5.3 Phase II - Converting Potable Water Uses (North Area)

1) Additional Recycled Water Demand

Phase II will transfer existing potable demand to the recycled water system. The following potable users are major customers that should be considered for conversion during Phase II.

- Meridian Business Park
- Reverse frontage areas in along Alessandro Boulevard and Trautwein Road
- City of Riverside Parks and Grove Community Church in Orangecrest
- RUSD facilities in Orangecrest including Amelia Earhart Middle School, Tomas Rivera, JFK and Franklin Elementary Schools
- Villas at Rancho Valencia
- One-Kat Enterprise Inc. & grove area owned by John J. Gless
- T&R, Torres Nursery
- Home Nursery
- Sand Haven Pines Co.
- AAA Egg Farms
- Air Force Village West
- Additional demand Lake Mathews Elementary School and park (1667 PZ)

- Agricultural areas South of Upper El Sobrante Reservoir (1667 PZ)

All the customers except last two customers are located in 1815 PZ. Based on the 2007 meter record, the above customers will have approximately 1,896 ac-ft/yr demand, out of which more than 800 ac-ft/year generated in Orangecrest. Depending on the demand magnitude, distance from existing recycled water pipelines, and on-site conversion costs, some of these existing potable water customers will elect to remain on the potable system, paying higher water rates or cease operation.

2) Recycled Water Facilities Expansion

Most of Phase II customers are located away from the converted recycled water pipelines. **Table 4-3** in the previous section listed new pipeline construction required for Phase II implementation. Depending on actual recycled water supply generated at WWRF and non-potable water available at the Riverside Canal vs. the actual demand, some non-potable water from CRA will still be required to meet that demand. No additional pump capacity is required for this phase. Since Phase II demand is concentrated in 1815PZ, which has limited storage capacity, a 2 MG tank is ultimately proposed at an expanded Orangecrest tank site. The size of the tank is limited by the space available at the Orangecrest site with some additional property acquisition on the north side of the site. It is possible to construct a new 12 MG tank at this site and use that tank for recycled water purposes. The 12MG tank would be only for interim recycled water use until potable water demand increases and this tank is eventually be converted to potable use, at which time a permanent 2 MG recycled tank should be constructed. As part of either proposed tank improvement, an altitude valve at the existing Lurin Site will be required to ensure that the site does not overflow during tank refill conditions.

5.4 Phase III – Converting Non-Potable Water Uses (South Area)

Until an appropriate crossing of the CRA can be implemented, the South Area will be operated separately with untreated CRA water. Converting the non-potable water system in South Area to recycled water requires the following facilities:

- separation correction plan for twelve locations
- a new 3,500 gpm pump station
- a new 24-inch diameter pipeline to convey recycled water from Roosevelt Tank to Hillside Tank
- a new CRA connection with the appropriate air-gap separation from the recycled water

1) CRA Crossing Options

An alternative method for crossing the CRA has been developed which modifies the existing overhead CRA crossing. This option can minimize additional new pipeline required for the South Area supply. Western must obtain approval from MWD for this alternative. The master plan exhibit, however, shows an alignment along Harley John Road, avoiding a direct crossing over the open channel of the CRA. The costs for the Harley John Road alignment have been included as part of the master plan.

5.5 Phase IV – Adding Future Customers

Phase IV includes all the potential customers in North and South Areas. It also includes increased non-potable water demand or service expansions of current non-potable users, such as Altman Plants and Village Nurseries. Phase IV does not necessarily have to follow Phase III for future customers in the North Area.

Depending on future customer's development schedule, Western can proceed with recycled water supply with individual customers prior to Phase III.

5.6 Recycled / Non-Potable Water Supply and Demand for Ultimate Conditions

The availability of wastewater flows and the subsequent supply of recycled water are relatively consistent year-round. Conversely, recycled water demand in this semiarid area is concentrated during summer season. Historical data from Western's non-potable distribution system shows that only 3.4% of the annual demand is consumed during December, while 13.5% of annual demand is consumed during July, a fourfold increase. Previous projections of ultimate demand could reach 8,018 ac-ft/year from the current 3,236 ac-ft/year. Using the same monthly demand pattern, the ultimate monthly demand distribution graph was developed (see **Figure 5-2**). The assumed supply includes the baseline of 3.6 MGD (4,044 AFY) from WWRF and 2,000 AFY from Riverside Canal based on the Wheeling Agreements between Western and RPU. The Riverside Canal supply must be peaked during summer peak season to meet anticipated demand and dropped to essentially zero during winter season as shown in **Figure 5-2**. The supply and demand distribution curve indicates a significant shortage during the peak season at ultimate condition, shown as Additional Water Required. This shortage is estimated at 1,974 AFY, assuming the maximum ultimate demand of 8,018 AFY. While Western expands its recycled water market, balancing supply and demand, any demand increases over available supply can be met with the following options;

1. Increase local groundwater supply from Riverside Canal
2. Develop a regional or local wastewater treatment plant for other areas within Western's retail service area not served by WWRF
3. Scalp wastewater from the City of Riverside to maximize flows from WWRF
4. Construct non-potable wells within neighboring groundwater basins
5. Purchase imported water from MWD at the CRA

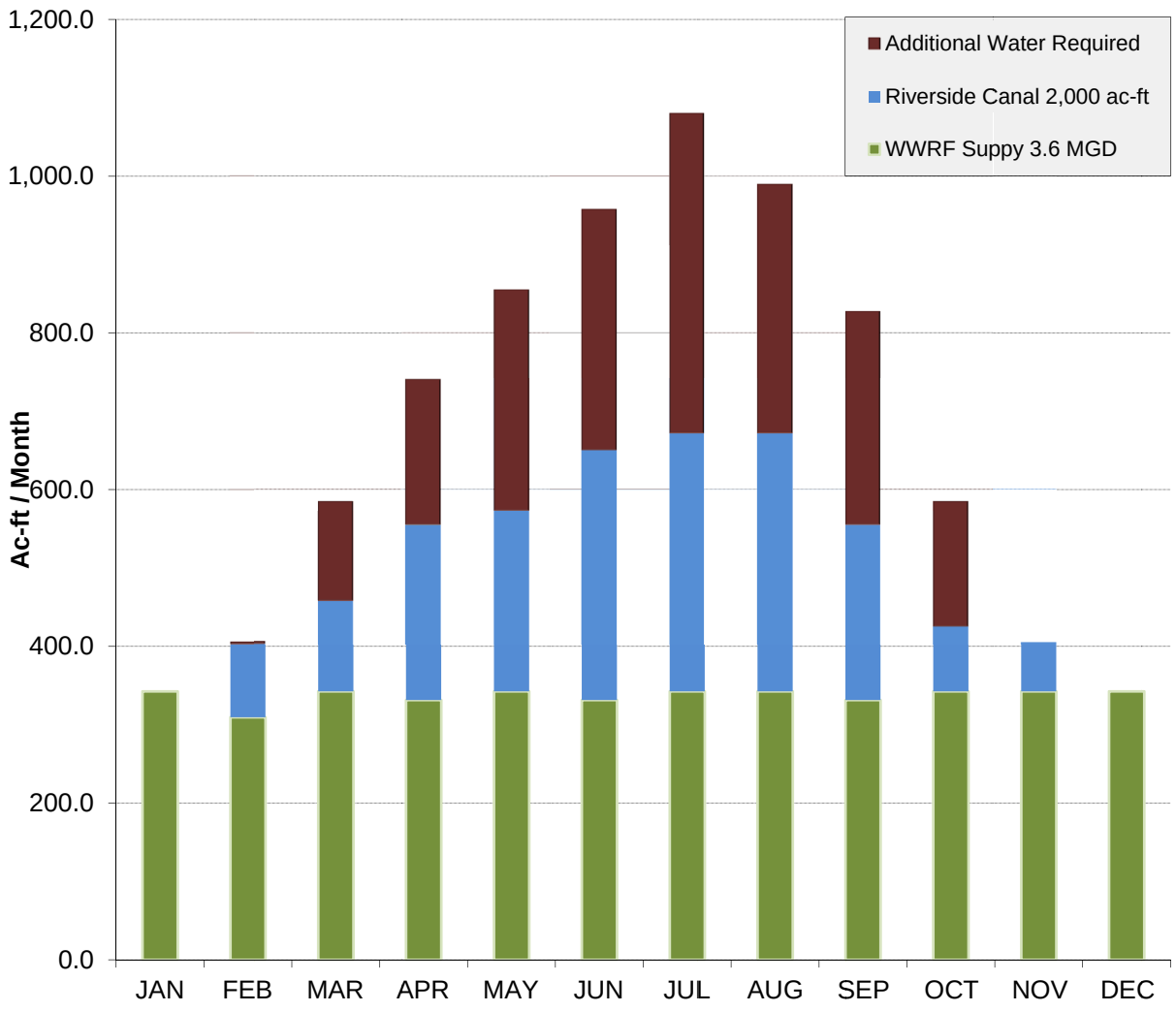


Figure 5-2: Recycled Water System Ultimate Supply and Demand

SECTION 6 - Cost Estimates

6.1 Project Cost Estimate for Ultimate Facilities

Cost estimates have been developed for the facilities proposed to serve each pressure zone at ultimate development. The cost estimates are based on unit costs for water pipelines ($/lf) and lump sum estimates for pump stations, tanks, and other miscellaneous improvements. The cost estimates for individual pressure zones are presented in **Tables 6-1** through **6-5**. No capital improvement projects are proposed for 2250 PZ and 2450 PZ in South Area other than the separation correction plan. Most of proposed facilities are concentrated in 1815 PZ. Pump Station and Pipeline improvements to convey water to the South Area are separately defined. Improvements in the 1420 PZ and 1667 PZ are only required to convey additional Riverside Canal water supply above the current 3,600 gpm limit.

The construction and project cost shown were obtained from manufacturers, construction firms and recorded data from bid results for similar water facilities. The estimated project cost shown on **Tables 6-1** through **6-5** is based on the January, 2014 ENR-Los Angeles Construction Cost Index of 10,736.19. Estimated project costs include construction cost and project overhead. Project overhead is estimated at 40% of construction costs and is broken down as follows:

1. Contingencies - 10% of construction cost.
2. Technical Services – 15% of construction cost which includes preparation of a non-controversial environmental assessment, processing of necessary approvals and permits, engineering survey and photogrammetry, design and specifications.
3. Field Engineering – 10% of construction costs which includes contract administration, coordination with other agencies, administration of geotechnical and other necessary outside services, construction surveying, construction inspection and preparation of as-built drawings.
4. District Contract Administration – 5% of construction cost.
5. Escalation, financing, interest during construction, legal, EIR/EIS, land acquisition except where explicitly noted and right of way agent costs are not included.

Western Municipal Water District
Proposed Recycled Water Facilities 1420 PZ

DESCRIPTION	QUANTITY	UNIT	UNIT COST	CONSTRUCTION COST
Restoration of Upper El Sobrante Pump Station @ 3600 GPM	1	EA.	$2,749,750	$2,750,000
Construction Cost				$2,750,000
Project overhead (40% of construction cost) [(1)]				$1,100,000
Total Project Cost				**$3,850,000**

[(1)] Project Cost is 1.4 times construction cost. Project cost includes: construction costs, construction contingencies, design engineering including plans and specifications; design and construction surveying and mapping; geotechnical evaluation and report; engineering contract administration; field inspection and nominal environmental documentation. Costs are based on ENR Construction Cost Index Los Angeles, January 2014 (ENR = 10,736.18). Escalation, financing, interest during construction, legal, EIR/EIS, land acquisition, except where explicitly noted and R-O-W agent costs are not included.

Table 6-1: Project Cost for Proposed Recycled Water Facilities in 1450 PZ

Western Municipal Water District
Proposed Recycled Water Facilities 1667PZ

DESCRIPTION	QUANTITY	UNIT	UNIT COST	CONSTRUCTION COST
12-inch Dia. Water Line	2,300	L.F.	$115	$270,000
24-inch Dia. Water Line[2]	9,000	L.F.	$205	$1,850,000
Pavement Repair	11,300	L.F.	$33	$380,000
Construction Cost				$2,500,000
Project overhead (40% of construction cost) [1]				$1,000,000
Total Project Cost				**$3,500,000**

[1] Project Cost is 1.4 times construction cost. Project cost includes: construction costs, construction contingencies, design engineering including plans and specifications; design and construction surveying and mapping; geotechnical evaluation and report; engineering contract administration; field inspection and nominal environmental documentation. Costs are based on ENR Construction Cost Index Los Angeles, January 2014 (ENR = 10.736.18). Escalation, financing, interest during construction, legal, EIR/EIS, land acquisition, except where explicitly noted and R-O-W agent costs are not included.

[2] Replacement pipeline

Table 6-2: Project Cost for Proposed Recycled Water Facilities in 1667 PZ

Western Municipal Water District
Proposed Recycled Water Facilities 1815 PZ

DESCRIPTION	QUANTITY	UNIT	UNIT COST	CONSTRUCTION COST
8-inch Dia. Water Line	30,300	L.F.	$88	$2,670,000
12-inch Dia. Water Line	39,400	L.F.	$115	$4,560,000
18-inch Dia. Water Line	2,800	L.F.	$159	$450,000
Pipe Conversion	1	L.S.	$54,995	$60,000
Pavement Repair	66,100	L.F.	$33	$2,190,000
Install Altitude Valve	1	EA.	$65,994	$70,000
Construct 2 MG Tank Orangecrest	1	EA.	$1,341,878	$1,350,000
Construction Cost				$11,350,000
Project overhead (40% of construction cost) [(1)]				$4,540,000
Total Project Cost				**$15,890,000**

[(1)] Project Cost is 1.4 times construction cost. Project cost includes: construction costs, construction contingencies, design engineering including plans and specifications; design and construction surveying and mapping; geotechnical evaluation and report; engineering contract administration; field inspection and nominal environmental documentation. Costs are based on ENR Construction Cost Index Los Angeles, January 2014 (ENR = 10.736.18). Escalation, financing, interest during construction, legal, EIR/EIS, land acquisition, except where explicitly noted and R-O-W agent costs are not included.

Table 6-3: Project Cost for Proposed Recycled Water Facilities in 1815 PZ

Western Municipal Water District
Proposed Recycled Water Facilities 1815S PZ

DESCRIPTION	QUANTITY	UNIT	UNIT COST	CONSTRUCTION COST
24-inch Dia. Water Line	12,200	L.F.	$205	$2,510,000
Pavement Repair	5,600	L.F.	$33	$190,000
New ID-4 Pump Station @ 3,500 GPM	1	EA.	$2,969,730	$2,970,000
Construction Cost				$5,670,000
Project overhead (40% of construction cost) [1]				$2,270,000
Total Project Cost				**$7,940,000**

[1] Project Cost is 1.4 times construction cost. Project cost includes: construction costs, construction contingencies, design engineering including plans and specifications; design and construction surveying and mapping; geotechnical evaluation and report; engineering contract administration; field inspection and nominal environmental documentation. Escalation, financing, interest during construction, legal, EIR/EIS, land acquisition, except where explicitly noted and R-O-W agent costs are not included.

Table 6-4: Project Cost for Proposed Recycled Water Facilities in 1815S PZ

6.2 Project Cost Estimate by Phase

Phase I includes installation of an altitude valve at the the Lurin tank and already completed separation correction plans in North Area. Phase II involves the most pipeline construction in both 1815 PZ and 1667 PZ. Phase III includes all the capital improvement projects for 1815S PZ. Separation correction plans in South Area are not included in the cost estimates but may be required when Phase III is implemented. Phase IV includes improvement in 1420 PZ and a new Orangecrest recycled water tank in 1815 PZ. Phase IV also includes three pipeline reaches in 1815 PZ. The cost for the interim 12 MG Orangecrest potable water tank is not included in this study. **Table 6-5** presents the project cost for the proposed capital improvement projects by phase. Grand total project cost is estimated to be $31,170,000. **Table 6-6** summarizes project cost by pressure zone and phase.

Phase	CIP Description	Demand (ac-ft)	Project Cost
Phase I	1. Install Altitude Valve in Lurin Tank	2,428	$100,000 *Sub total: $100,000*
Phase II	1. Twelve pipeline reaches construction in 1815 PZ 2. One pipeline reach replacement in 1667 PZ	2,443	$12,120,000 $3,010,000 *Sub total: $15,130,000*
Phase III	1. New ID-4 Pump station 2. Pipelines construction in 1815S PZ	990	$4,160,000 $3,770,000 *Sub total: $7,930,000*
Phase IV	1. Upper El Sobrante Pump Station 2. Pipeline in 1667 PZ 3. Two pipeline reaches construction in 1815 PZ 4. 2MG Orangecrest Tank	2,457	$3,850,000 $490,000 $1,780,000 $1,890,000 *Sub total: $8,010,000*
	Grand Total:	**8,018**	**$31,170,000**

Table 6-5: Recycled Water Master Plan Project Cost by Phasing

Pressure Zone	CIP Description	Phase I	Phase II	Phase III	Phase IV	Sub-Total
1420 PZ	1. Restoration of Upper El Sobrante Pump Station				$3,850,000	$3,850,000
	Sub Total					*$3,850,000*
1667 PZ	1. Pipeline Replacement		$3,010,000			$3,010,000
	2. Pipeline Construction				$490,000	$490,000
	Sub Total					*$3,500,000*
1815 PZ	1. Pipeline Construction and conversion		$12,120,000		$1,780,000	$13,900,000
	2. 2MG Orangecrest Tank				$1,890,000	$1,890,000
	3. Altitude Valve in Lurin Tank	$100,000				$100,000
	Sub Total					*$15,890,000*
1815S PZ	1. New ID-4 Pump Station			$4,160,000		$4,160,000
	2. Pipeline Construction			$3,770,000		$3,770,000
	Sub Total					*$7,930,000*
	Phase Total:	**$100,000**	**$15,130,000**	**$7,930,000**	**$8,010,000**	**$31,170,000**

Table 6-6: Recycled Water Master Plan Project Cost by Phase and Pressure Zone

6.3 Project Cost by Service Area in Orangecrest and Mission Grove Area

The study breaks down the project cost of the Orangecrest and Mission Grove areas into six service areas defined in **Figure 3-3**. **Table 6-7** presents the estimated project cost of the capital improvement projects. The table also presents each service area with potential demand for recycled water, then calculates the unit project cost per ac-ft. Some service areas such as Area 2, 3, and 5 will rely on the pipeline construction from other service areas. Service Area 1 involves the highest unit project cost per ac-ft, since it includes the pipe construction for looping from Meridian Business Park. Service Area 2 involves the most economic benefit, however, either pipeline ID 1 or 4 must be constructed first.

Service Area ID[1)]	2007~08 Demand (ac-ft)	Pipe ID[(2)]	Related Pipe Construction	Project Cost	Unit Project Cost ($/ac-ft)
1	110	1	11,700 LF @12-in	$1,890,000	
		2	Pipe conversion	$60,000	
		11	3,300 LF @12-in	$540,000	
			Pavement repair	$700,000	
			Sub total:	**$3,190,000**	**$29,000[3)]**
2	199	3	4,000 LF @12-in	$650,000	
			Pavement repair	$190,000	
			Sub total:	**$840,000**	**$4,220**
3	28	4	3,000 LF @12-in	$490,000	
			Pavement repair	$140,000	
			Sub total:	**$630,000**	**$22,500**
4	235	4	3,000 LF @12-in	$490,000	
		6	3,600 LF @8-in	$450,000	
		8	7,200 LF @8-in	$890,000	
			Pavement repair	$640,000	
			Sub total:	**$2,470,000**	**$10,510**
5	127	7	2,800 LF @18-in	$630,000	
		12	3,400 LF @8-in	$420,000	
			Pavement repair	$290,000	
			Sub total:	**$1,340,000**	**$10,550**
6	136	4	3,000 LF @12-in	$490,000	
		5	10,800 LF @8-in	$1,340,000	
			Pavement repair	$640,000	
			Sub total:	**$2,470,000**	**$18,160**
Total	**834**			**$10,870,000**	**$13,040**

[1)] Area ID matches the Service Area ID shown in **Figure 3-3**.
[2)] Pipe ID matches the proposed pipes for ultimate conditions in **Table 4-3**.
[3)] Area 1 includes Pipe ID 2 and ID 11 for looping through Meridian Business Park. Without Pipe ID 2 and 11, the unit cost drops to $20,100.
Project cost of pipe ID 4 is equally broken down into three reaches for Area 3,4, and 6.

Table 6-7: Project Cost by Service Area in Orangecrest and Mission Grove Area

RECYCLED WATER - EXISTING AND PROPOSED FACILITIES (JAN. 2014)

RIVERSIDE CANAL
RIVERSIDE CANAL PUMP STATION (7,200 GPM)
GAGE CANAL
MCALLISTER PUMP STATION (7,200 gpm)
EL SOBRANTE PUMP STATION (3,600 gpm)
RESTORE UPPER EL SOBRANTE PUMP STATION (3,600 GPM)
UPPER EL SOBRANTE RESERVOIR (1.5 MG, NOT IN SERVICE)
LOWER EL SOBRANTE RESERVOIR (4.5 MG)
LURIN TANK (0.2 MG)
OLEANDER PUMP STATION (8,600 GPM)
U2 INTAKE (7,600 GPM)
ALTERNATIVE 1
ROOSEVELT TANK (5 MG) (WITH EXISTING AIR-GAP FOR INTERIM)
CRA CROSSING AT WESTERN'S OPERATIONS CENTER
ALTERNATIVE 2 LAST PHASE
U2 PUMP STATION (7,600 GPM) ID-4 PUMP STATION (5,200 GPM)
NEW ID4 PUMP STATION (3,500 GPM)
HILLSIDE TANK (0.5 MG) AND PUMP STATION (8,200 GPM)
STEELE VALLEY PUMP STATION (3,750 GPM)
JIM JACK TANK (5 MG)
EL NIDO TANK (0.33 MG)
FUTURE ORANGE TANK INTERIM (12 MG) ULTIMATE (2 MG)
WWRF PUMP STATION 3,500 GPM RESERVOIR 40.5 MG
Lake Mathews
ALESSANDRO BLVD
MISSION GROVE PKWY
TRAUTWEIN RD
SIEGAL AVE
ORANGE TERRACE PKWY
MESQUITE CYN RD
MERIDIAN PKWY
WOOD RD
GOLE AVE
BARTON ST
VAN BUREN BLVD
WASHINGTON ST
CHICAGO AVE
LURIN AVE
NANDINA AVE
OLEANDER AVE
MARKHAM ST
EL SOBRANTE RD
HARLEY JOHN RD
CAJALCO RD
PFEIFER WAY
ROLLING MEADOWS DR
IDALEONA RD
LA SIERRA AVE
90
60
215
15

LEGEND

- Proposed Pump Station
- Proposed Tank

Proposed Lines (with Pipe ID)

- 15 1667 PZ
- 15 1815 PZ
- 15 1815S PZ

Existing Recycled/Raw Facilities

- Pressure Relief Valve
- Pressure Reducer
- Tank/Reservoir
- Pump Station

Existing Non-Potable Facilities

- Pressure Relief Valve
- Pressure Reducer
- Tank/Reservoir
- Pump Station

Existing Non-Potable Water Lines

- 1667 PZ
- 1815S PZ
- 2250 PZ
- 2450 PZ
- Other/Unknown PZ

Existing Recycled/Raw Water Lines

- 1000 PZ
- 1420 PZ
- 1667 PZ
- 1815 PZ
- Other/Unknown PZ
- Canals, Aqueduct (CRA)
- North and South Added Facility Area Boundary

WESTERN MUNICIPAL WATER DISTRICT

N W E S

ALBERT A. WEBB ASSOCIATES

0 4,000 8,000 Feet

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APPENDIX A

Existing Pumps / Pump Stations Detail Information

FACILITY DESCRIPTION	ADDRESS				
U-1 Booster Station #2 (3)	**10111 Cajalco Rd., Corona**				**5**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump U-1 (Not Used)	50 HP Irrigation	1402	1632	625.0	
2. Pump U-1	5 HP Irrigation	1402	1632	50.0	
3. Pump U-1 (Not Used)	100 HP Irrigation	1402	1632	1250.0	
4. Pump U-1 (Not Used)	200 HP Irrigation	1402	1632	2650.0	
	Total 5 Hp				
Hillside Irrigation Pump Station (3)	**16451 El Sobrante, Riverside**				**1100**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump ID 4	200 HP Hillside Irrigation	1814	2250	1500.0	
2. Pump ID 4	200 HP Hillside Irrigation	1814	2250	1500.0	
3. Pump ID 4	350 HP Hillside Irrigation	1814	2250	2600.0	
4. Pump ID 4	350 HP Hillside Irrigation	1814	2250	2600.0	
	Total 1100 HP				
CITP Cajalco Intake Pump Station (3) (Pumps Not Used)	**16451 El Sobrante, Riverside**				**300**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump CITP(Not Used)	150 HP Cajalco Intake	1404	1482	3000.0	
2. Pump CITP(Not Used)	150 HP Cajalco Intake	1404	1482	3000.0	
	Total 300 HP				
ID 4 Cajalco Intake Pump (Irrigation) (3)	**16451 El Sobrante, Riverside**				**700**

Pumps	Hp - Name	Grade Line Suction	Grade Line Pumping	Capacity (gpm)	$/Acft/ 100'lift
1. Pump ID 4	350 HP Cajalco Intake	1404	1814	2755.0	
2. Pump ID 4	600 HP Cajalco	1404	1814	4721.0	
	Total 950 HP				
Id U-2 Cajalco Intake Pump (Irrigation) (3)	**16451 El Sobrante, Riverside**				**300**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump U-2	150 HP Cajalco Intake	1404	1453	3800.0	
2. Pump U-2	150 HP Cajalco Intake	1404	1453	3800.0	
	Total 300 HP				
Inline Booster Plant (3)	**18830 Crop Road, Riverside, Ca 92504**				**300**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump U-2	150 HP	1479	1600	3800.0	
2. Pump U-2	150 HP	1479	1600	3800.0	
	Total 300 HP				
Oleander Booster Station (1) (3)	**18021 Markham St., Riverside, Ca 92504**				**1275**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump ID 1 (1)	200 HP Domestic	1660	1837	2300.0	
2. Pump ID 1 (1)	200 HP Domestic	1660	1837	2300.0	
3. Pump ID 1 (1)	200 HP Domestic	1660	1837	2300.0	
4. Pump ID 1 (1)	200 HP Domestic	1600	1837	2356.0	
1. Pump U-2 (3)	200 HP Irrigation	1660	1812	3800.0	
2. Pump U-2 (3)	200 HP Irrigation	1660	1812	3800.0	
3. Pump U-2 (3)	75 HP Irrigation	1660	1812	1000.0	
	Total 1275 HP				

Steele Valley Id 4 (3)	**16510 Rocky Bluff Rd. Perris, Ca 92570**				**400**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump**	150 HP Irrigation	2250	2450	1423.0	
2. Pump**	150 HP Irrigation	2250	2450	1042.0	
3. Pump**	75 HP Irrigation	2250	2450	900.0	
4. Pump*	25 HP Irrigation	2250	2450	378.0	
	Total 400 HP				
El Sobrante Pump Non-Potable (3)	**17170 Mcallister Riverside, Ca**				**450**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump	75 HP VFD			600	
2. Pump	75 HP VFD			600	
3. Pump	150 HP			1200	
4. Pump	150 HP			1200	
	Total 450 HP				
Riverside Canal Pump Station(4)	**3150 Jefferson St. Riverside, Ca**				**600**
Pumps	**Hp - Name**	**Grade Line Suction**	**Grade Line Pumping**	**Capacity (gpm)**	**$/Acft/ 100'lift**
1. Pump VFD	100 HP			1200	
2. Pump VFD	100 HP			1200	
3. Pump	200 HP			2400	
4. Pump	200 HP			2400	
	Total 600 HP				

McAllister Pump Station(3)	1979 John Street Riverside, Ca				1200
Pumps	Hp - Name	Grade Line Suction	Grade Line Pumping	Capacity (gpm)	$/Acft/ 100'lift
1. Pump VFD	200 Hp 500' TDH			1200.0	
2. Pump VFD	200 Hp 500' TDH			1200.0	
3. Pump	400 Hp 500' TDH			2400.0	
4. Pump	400 Hp 500' TDH			2400.0	
	Total 1200 Hp				

APPENDIX B

System Facility Parameters for Hydraulic Modeling

HYDRAULIC MODEL
SCENARIO PARAMETERS

		EXISTING SYSTEM				FUTURE SYSTEM (A+B)				INTERIM NORTH	INTERIM SOUTH
		EX Max Day Demand	EX Peak Hour Demand	EX Peak On-Demand	EX Tank Refill	FS Max Day Demand	FS Peak Hour Demand	FS Peak On-Demand	FS Tank Refill	FS Peak Hour Demand	FS Peak Hour Demand
DEMAND	**DATA SET**	**EX_MDD**	**EX_PHD**	**EX_POD**	**EXTR**	**FS_MDD**	**FS_PHD**	**FS_POD**	**FSTR**	**FS_PHD**	**FS_PHD**
	Factor	1.62 x ADD	3 x MDD	2 x PHD	10% of EX ADD	1.62 x ADD	3 x MDD	2x PHD	10% of FS ADD	3 x MDD	3 x MDD
	Model gpm	3,207	9,620	19,228	321	8,212	24,635	49,270	507	18,507	6,128
TANK	**DATA SET**	**EXMDD**	**EXMDD**	**EXTR**	**EXTR**	**FSMDD**	**FSMDD**	**FSMDD**	**FSTR**	**FSMDD**	**FSMDD**
	Lurin (0.2 MG)	1/2 Full	1/2 Full	2' below HWL	2' below HWL	1/2 Full	1/2 Full	1/2 Full	2' below HWL	1/2 Full	N/A
	Hillside (0.5 MG)	1/2 Full	1/2 Full	2' below HWL	2' below HWL	1/2 Full	1/2 Full	1/2 Full	2' below HWL	N/A	1/2 Full
	Jim Jack (5.0 MG)	1/2 Full	1/2 Full	2' below HWL	2' below HWL	1/2 Full	1/2 Full	1/2 Full	2' below HWL	N/A	1/2 Full
	El Nido (3.3 MG)	1/2 Full	1/2 Full	2' below HWL	2' below HWL	1/2 Full	1/2 Full	1/2 Full	2' below HWL	N/A	1/2 Full
	Roosevelt (5.0 MG)	1/2 Full	1/2 Full	2' below HWL	2' below HWL	1/2 Full	1/2 Full	1/2 Full	2' below HWL	1/2 Full	N/A
	L. El Sobrante (4.5 MG)	1/2 Full	1/2 Full	2' below HWL	2' below HWL	1/2 Full	1/2 Full	1/2 Full	2' below HWL	1/2 Full	N/A
	U. El Sobrante (X.X MG)	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use
	Orange Tank (2.0 MG)	N/A	N/A	N/A	N/A	1/2 Full	1/2 Full	1/2 Full	2' below HWL	1/2 Full	N/A
RESERVOIR (Supply)	**DATA SET**	**EX**	**EX**	**EX**	**EX**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**
	Lake March	Not in Use		Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use
	MARB WWTP Pond	Model using pump data given				3,500 gpm	3,500 gpm	3,500 gpm	3,500 gpm	1,750 gpm	N/A
	CRA	15074 max supply		15074 max supply	15074 max supply	Not in Use	Not in Use	Not in Use	Not in Use	N/A	5,174 gpm
	Gage Canal	7200 max supply	7200 max supply	7200 max supply	7200 max supply	7200 max supply	7200 max supply	7200 max supply	7200 max supply	7200 max supply	N/A
PIPE	**DATA SET**	**EX**	**EX**	**EX**	**EX**	**FS**	**FS**	**FS**	**FS**	**FS North of CRA**	**FS South of CRA**
		Pipe 49 closed	Pipe 49 closed	Pipe 49 closed	Pipe 49 closed						
CONTROL	**DATA SET**	**EX**	**EX**	**EX**	**EX**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**
PUMP STATIONS	**DATA SET**	**EX**		**EX**	**EX**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**
	McAllister/Gage Canal	7,200 gpm	7,200 gpm	7,200 gpm	7,200 gpm	7,200 gpm	7,200 gpm	7,200 gpm	7,200 gpm	7,200 gpm	N/A
	L. El Sobrante	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	N/A
	U. El Sobrante	Not in Use	Not in Use	Not in Use	Not in Use	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	3,600 gpm	N/A
	Oleander	8,600 gpm	8,600 gpm	8,600 gpm	8,600 gpm	8,600 gpm	8,600 gpm	8,600 gpm	8,600 gpm	8,600 gpm	N/A
	ID-4	5,174 gpm	5,174 gpm	5,174 gpm	5,174 gpm	Not in Use	Not in Use	Not in Use	Not in Use	Not in Use	5,174 gpm
	Hillside	8,200 gpm	8,200 gpm	8,200 gpm	8,200 gpm	8,200 gpm	8,200 gpm	8,200 gpm	8,200 gpm	N/A	8,200 gpm
	Steele Valley	3743 gpm	3743 gpm	3743 gpm	3743 gpm	3743 gpm	3743 gpm	3743 gpm	3743 gpm	N/A	3743 gpm
	U2 Pump Station	7,600 gpm	7,600 gpm	7,600 gpm	7,600 gpm	Not in Use	Not in Use	Not in Use	Not in Use	N/A	Not in Use
	U2 Intake	7,600 gpm	7,600 gpm	7,600 gpm	7,600 gpm	Not in Use	Not in Use	Not in Use	Not in Use	N/A	Not in Use
	New ID4	Not in Use	Not in Use	Not in Use	Not in Use	8,200 gpm	8,200 gpm	8,200 gpm	8,200 gpm	N/A	N/A

Abbreviations

ADD - Average Day Demand
EX - Existing System
FS - Future System
MDD - Maximum Day Demand
PHD - Peak Hour (Scheduled) Demand
POD - Peak Hour On Demand
TR - Tank Refill

RIVERSIDE CANAL PUMP STATION (7,200 GPM)

RIVERSIDE CANAL

MWD FEEDER

CAGE CANAL

MCALLISTER PUMP STATION (7,200 gpm)

EL SOBRANTE PUMP STATION (3,600 gpm)

RESTORE UPPER EL SOBRANTE PUMP STATION (3,600 GPM)

UPPER EL SOBRANTE RESERVOIR (1.5 MG, NOT IN SERVICE)

LOWER EL SOBRANTE RESERVOIR (4.5 MG)

TO BE DISCONNECTED

ROOSEVELT TANK (5 MG) (AIR GAP FOR INTERIM)

U2 INTAKE (7,600 GPM)

WESTERN'S OPERATIONS CENTER

U2 PUMP STATION (7,600 GPM) ID-4 PUMP STATION (8,200 GPM)

NEW ID4 PUMP STATION (3,500 GPM)

HILLSIDE TANK (0.5 MG) AND PUMP STATION (8,200 GPM)

OLEANDER PUMP STATION (8,600 GPM)

FUTURE ORANGE TANK INTERIM (12 MG) ULTIMATE (2 MG)

LURIN TANK (0.2 MG)

WWRF PUMP STATION 3,500 GPM RESERVOIR 40.5 MG

STEELE VALLEY PUMP STATION (3,750 GPM)

JIM JACK TANK (5 MG)

EL NIDO TANK (0.33 MG)

Lake Mathews

ALESSANDRO BLVD

EUCALYPTUS AVE

SH-60

I-215

FREDERICK ST

OAK ST

MISSION GROVE PKWY

TRAUTMAN RD

MERIDIAN PKWY

SIEGAL AVE

ORANGE TERRACE PKWY

MESQUITE CYN RD

WOOD RD

GOSE AVE

BARTON ST

VAN BUREN BLVD

CHICAGO AVE

LURIN AVE

WASHINGTON ST

NANDINA AVE

OLEANDER AVE

MARKHAM ST

EL SOBRANTE RD

HARLEY JOHN RD

CAJALCO RD

PFEIFER WAY

ROLLING MEADOWS DR

IDALEONA RD

LA SIERRA AVE

I-15

I-215 NBOFF

I-215 SBOFF

I-215

RIDER ST

CAJALCO RD

OLD ELSINORE RD

SANTA ROSA MINE RD

DEPRAD ST

ETHANAC RD

LEGEND

Junctions - Demand (gpm)

- 0 - 7
- 7 - 35
- 35 - 70
- 75 - 150
- 150 - 1070

15 Proposed Recycled Water System (with Pipe ID)

Exisiting Non-Potable System

Pressure Zones

- 1000 PZ
- 1420 PZ
- 1667 PZ
- 1815 PZ
- 1815S PZ
- 2250 PZ
- 2450 PZ
- Canals, Aqueduct (CRA)

Customer Type

- Potable, Irrigation
- Non-potable, Irrigation
- Non-potable, Agriculture
- North and South Added Facility Area Boundary

RECYCLED WATER MASTER PLAN HYDRAULIC ANALYSIS MODEL WITH DEMAND

WESTERN MUNICIPAL WATER DISTRICT

ALBERT A. WEBB ASSOCIATES

N W E S

0 4,000 8,000 Feet

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