NOTICE OF SPECIAL MEETING
OF THE
BOARD OF DIRECTORS OF
EAST ORANGE COUNTY WATER DISTRICT

NOTICE IS HEREBY GIVEN that a Special Meeting of the Board of Directors of the East Orange County Water District has been called by the President of the Board of Directors thereof to be held on Thursday, July 9, 2015 at 5:00 p.m., at the offices of the East Orange County Water District, 185 N. McPherson Road, Orange, California.

The following business will be transacted:

1. see Exhibit "A" attached to this Notice

2. _____

3. _____

4. _____

DATED THIS 3rd day of July, 2015.

_____
JOAN C. ARNESON
Secretary
East Orange County Water District
and of the Board of Directors thereof

July 3, 2015

Board of Directors
East Orange County Water District
185 N. McPherson Road
Orange, California 92869

Dear Members of the Board,

Please be advised that a special meeting of the Board of Directors of the East Orange County Water District will be held on Thursday, **July 9, 2015**, at **5:00 p.m.** in the offices of the East Orange County Water District, 185 N. McPherson Road, Orange, California. Enclosed please find the agenda for the meeting.

Very truly yours,

EAST ORANGE COUNTY WATER DISTRICT

By: Joan C. Arneson
Secretary

JCA/

Enclosures

cc: Mailing List

150473 .20

EXHIBIT A to
Notice of Special Meeting

AGENDA

EAST ORANGE COUNTY WATER DISTRICT
(EOCWD)

Thursday,
July 9, 2015
5:00 p.m.
185 N. McPherson Road, Orange, California*

[*Director Everett will participate by teleconference. Agenda posted at La Costa Resort and Spa, 2100 Costa Del Mar Road, Carlsbad, California]

1. Call Meeting to Order and Pledge of Allegiance – President VanderWerff

2. Public Communications to the Board

3. Operation, Management and Construction Matters

A. Review of draft strategic plan (Exhibit "**A**")

B. Wholesale and Retail Zone capital improvement programs (Exhibit "**B**")

4. Adjournment

The scheduled date of the next Regular Meeting of the Board of Directors is **July 16, 2015**, at 5:00 p.m., in the offices of the East Orange County Water District, 185 N. McPherson Road, Orange, California.

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Availability of agenda materials: Agenda exhibits and other writings that are disclosable public records distributed to all or a majority of the members of the East Orange County Water District Board of Directors in connection with a matter subject to discussion or consideration at an open meeting of the Board are available for public inspection in the District's office, 185 N. McPherson Road, Orange, California ("District Office"). If such writings are distributed to members of the Board less than 72 hours prior to the meeting, they will be available at the reception desk of the District Office during business hours at the same time as they are distributed to the Board members, except

that if such writings are distributed less than one hour prior to, or during, the meeting, they will be available in the meeting room of the District Office.

Disability-related accommodations: The East Orange County Water District Board of Directors meeting room is wheelchair accessible. If you require any special disability-related accommodations (e.g., access to an amplified sound system, etc.) please contact Sylvia Prado in the District Office at (714) 538-5815 during business hours at least seventy-two (72) hours prior to the scheduled meeting. This agenda can be obtained in alternative format upon written request to Sylvia Prado in the District Office, at least seventy-two (72) hours prior to the scheduled meeting.

MEMO

TO: BOARD OF DIRECTORS

FROM: GENERAL MANAGER

SUBJECT: STRATEGIC PLANNING EFFORT – REVIEW OF DRAFT PLAN

DATE: JULY 9, 2015

Background

At the April 11, 2015 Special Meeting, the Board authorized the retention Mr. Ed Means of Means Consulting, LLC to assist the District with the preparation of a Strategic Plan.

On May 8th, Board Members individually met with Mr. Means to review district issues and priorities, and on May 29th the Board participated in a 6-hour workshop where five priority focus areas were identified:

1. Water Reliability
2. Infrastructure
3. Community Representation & Engagement
4. Financial Integrity
5. Professional Workforce

Mr. Means has taken the input received at the workshop and developed a draft Strategic Plan; General Manager Ohlund and Mr. Means subsequently met, reviewed the draft and revised it based upon further discussion.

The attached staff recommended draft will be reviewed with the Board at the meeting. It should also be noted that this document is meant to be rather broad and general; specific details of how each focus area's objectives will be achieved will be developed in detailed workplans.

Please note that while this draft is recommended by staff, there may be additional policy issues that require Board input and discussion, and further revision may be necessary in order to develop a document that is truly a meaningful and effective document that will carry on the vision and values of the district's 54 year history.

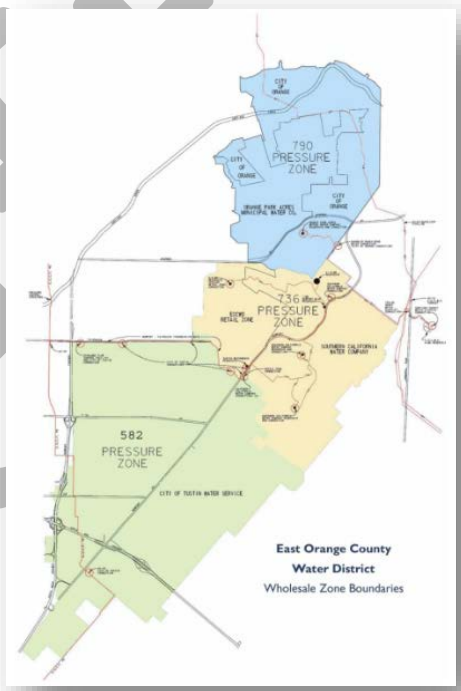
Recommendation

For review and discussion only; if appropriate, Board adoption may occur at the July 16th Regular Board Meeting.

2015 Five-Year Strategic Plan

Message from the Board

Welcome to the East Orange County Water District's (EOCWD) 5-Year Strategic Plan. This document is a blueprint for how EOCWD will respond to current challenges and make the best of future opportunities for the benefit of our customers. It confirms our mission and goals as a public agency dedicated to providing high quality water service to the more than 100,000 residents in the EOCWD service area. It outlines the specific goals, strategies, and objectives we will pursue to move us from where we are to where we want to be.



EOCWD is a locally governed, public wholesale and retail water district formed in 1961 encompassing an area of approximately 100,000 acres. It is a member of the Municipal Water District of Orange County, which is a member of the Metropolitan Water District and therefore entitled to receive Colorado River and Northern California imported water. This treated imported water is delivered to the City of Tustin, a portion of the City of Orange and the adjoining unincorporated communities of North Tustin, Lemon Heights, Cowan Heights, Orange Park Acres and Panorama Heights. In addition, in July of 1985, the District assumed the operations of Orange County Water Works District # 8 and became a retail water provider.

The EOWD Board of Directors and staff are charting a course for continued success in the future through the development and execution of this Strategic Plan. The Plan defines the vision, mission, values, goals and 5-year business strategy for EOCWD. Our commitments to the communities we serve fall into five areas: water reliability, infrastructure, community representation and engagement, professional workforce, and financial integrity. These commitments are established as the five goals of the plan. Our Board actions will consistently support these commitments and we will track our progress against this plan, revisiting the plan regularly to adjust as conditions warrant.

2015 Five-Year Strategic Plan

Director William VanderWerff, President

Director Richard Bell

Director John Dulebohn

Director Douglass S. Davert

Director Seymour Everett

Strategic Plan Project Team

Lisa Ohlund, General Manager
Ed Means, Means Consulting LLC

Message from the General Manager

While our core business has remained constant over time, this plan directs how we will take on the complex issues and challenges we face in the next several years. In developing this Strategic Plan, we focused on five priority areas:

1. Water reliability
2. Infrastructure
3. Community representation and engagement
4. Financial integrity
5. Professional workforce

Why these five? These five areas summarize the "big picture" of what we need to do – and do well – so that we achieve our mission to: "*Provide our customers with reliable, high quality water services featuring home town service, fiscal discipline and direct accountability"*

We plan to periodically review the Strategic Plan in conjunction with our budget process to readjust as changing conditions dictate. With the support of the Board, I am confident this plan will help us achieve the expectations of those we serve in the months and years to come.

Respectfully submitted,

Lisa Ohlund,
General Manager

2015 Five-Year Strategic Plan

Introduction

Strategic Planning is a structured process to prioritize issues. Due to the reality of finite resources, staff must be focused on the key issues that are critical to its mission.

The planning process enabled EOCWD staff to step back from daily activities and deliberate on ways to achieve the EOCWD mission to "*Provide our customers with reliable, high quality water services featuring home town service, fiscal discipline and direct accountability*".

The Strategic Plan was developed under the guidance of the Board of Directors and senior management representing all of the EOCWD's functions. This team met over a -month period. The focus of the staff's strategic deliberations was the key issues EOCWD will face in the next five-year planning horizon (and beyond). Workshops were held with the Board and the Senior Management staff to identify strengths, weaknesses, opportunities and threats (SWOT Analysis) that the plan should consider. A workshop was held with the Board of Directors in May of 2015 to identify the vision, mission, goals and values statements and establish the five goals that set the framework for the strategies and objectives development by the management team. The Board adopted the plan on xxx.

- ***Review background documents***
- ***Review current operating environment – strengths, weaknesses, opportunities, & threats***
- ***Review Vision, Mission, Values and establish Goals***
- ***Develop Strategies and Objectives***
- ***Develop staffing and resource needs in conjunction with the Annual Budgeting Process***
- ***Regularly update the Plan***

The five-year Strategic Plan will be implemented and tracked through the annual budget process. Strategic Plan activities that are not budgeted in FY2015-16 will be budgeted in later years, subject to Board review and approval. In the future, staff will ensure the proposed budgets reflect the priorities established in the Strategic Plan.

2015 Five-Year Strategic Plan

Vision Statement

Our vision is to:

"Maintain our community's high quality of life through provision of valued water and wastewater services"

Mission Statement

Our mission is to:

"Provide our customers with reliable, high quality water services featuring home town service, fiscal discipline and direct accountability"

Values

EOCWD will embody the following core values in the setting and implementation of its policies and practices:

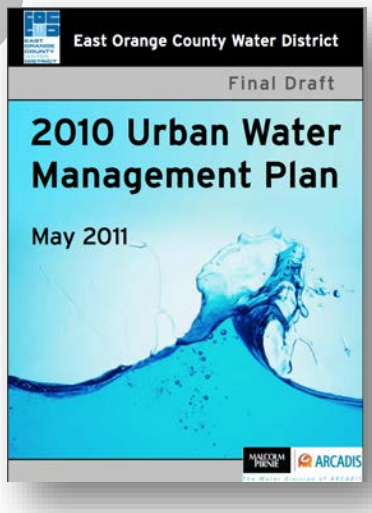
- Integrity and ethical behavior – EOCWD will consistently adhere to high moral and ethical principles
- Community – EOCWD will cooperatively work together and with stakeholders to further the mission and goals of the organization
- Customer service – EOCWD will professionally and responsively serve the needs of its customers

- Respect – EOCWD will work with our stakeholders in a respectful, professional, and courteous fashion
- Disciplined (Fiscally and operationally) – EOCWD will be good stewards of the facilities, people, and financial resources entrusted to it
- Creative – EOCWD will encourage and value the introduction of new ideas and methods
- Transparent – EOCWD will engage its stakeholders and interact with them in a fair, open and honest manner

Goals / Strategies / Objectives

The Board developed goal areas that represent the key EOCWD commitments to the community it serves.

- **Goal 1: Water Reliability** – EOCWD will provide reliable water services that consider the environment to meet the needs of the community
- **Goal 2: Infrastructure** – EOCWD will acquire, maintain, and operate our infrastructure to ensure reliable water services
- **Goal 3: Community Representation and Engagement** – EOCWD will provide responsive local governance, value and outreach to the communities we serve
- **Goal 4: Financial Integrity** – EOCWD will manage our financial assets to provide and maintain reliable water services



- **Goal 5: Professional Workforce** – EOCWD will maintain workforce expertise to ensure service quality, continuity, and reliability

2015 Five-Year Strategic Plan

Management and staff identified specific strategies and measureable objectives for each goal area to ensure the proper actions are taken to fulfill the commitment implicit in the goal area. The strategies and objectives listed below encompass both current and new activities. The implementation of these strategies and objectives will be further detailed through specific memoranda.

Goal 1: EOCWD will provide reliable water services that consider the environment to meet the needs of the community

Strategy 1 – Operate the system to achieve service level standards

Objective 1	Set practical service level goals
Objective 2	Meet the service level goals
Objective 3	Comply with applicable environmental standards

Strategy 2 – Determine appropriate role of water treatment for EOCWD

Objective 1	Refine treatment plant financial and reliability benefits
Objective 2	Provide a decision pathway for board action

Strategy 3 – Provide adequate backup supply for groundwater production

Objective 1	Assess required level of reliability
Objective 2	Implement solution

Strategy 4 – Conduct planning to ensure reliable water supply

Objective 1 Complete the 2016 UWMP

Objective 2 Participate in and review the MWDOC Reliability Study

Objective 3 Develop an EOCWD Integrated Resources Plan that informs and integrates with the Master Plan

Objective 4 Develop additional appropriate water supplies if/as needed

Strategy 5 – Maintain an active water conservation program

Objective 1 Implement water conservation programs to reflect the value of water and water service

Objective 2 Leverage funding through regional water agencies

Goal 2: Infrastructure – EOCWD will acquire, maintain and operate our infrastructure to ensure reliable water services

Strategy 1 – Ensure EOCWD can adequately respond to anticipated emergencies

Objective 1 Update the emergency response plan

Objective 2 Evaluate expansion of interconnections

Objective 3 Continue active participation in WEROC

Objective 4 Explore additional mutual aid agreements

Objective 5 Evaluate radio communications needs and capability

Objective 6 Evaluate need for a business continuity plan

Strategy 2 – Ensure infrastructure is appropriately maintained and replaced

Objective 1	Complete the Master Plan / Capital Improvement Plan
Objective 2	Continue to refine *Sedaru* system to incorporate remaining facilities
Objective 3	Annually report on the operations and maintenance status of key assets
Objective 4	Report to Board on deferred maintenance and provide solutions

Strategy 3 – Develop an energy strategy

Objective 1	Implement and track the strategy
Objective 2	Evaluate backup power requirements

Goal 3: Community Representation and Engagement – EOCWD will provide responsive local governance, value and outreach to the communities we serve

Strategy 1 – Build alliances to support the interests of EOCWD

Objective 1	Identify and engage opinion leader customers
Objective 2	Develop action plans for engaging the member agencies
Objective 3	Identify and develop outreach programs for key constituencies
Objective 4	Leverage external communications resources
Objective 5	Engage representation in Sacramento

Strategy 2 – Streamline Board deliberations

Objective 1	Fold committees into a two Board meetings/month
Objective 2	Evaluate and ensure adequate checks and balances and proper delegation of authority to the GM

Strategy 3 – Maintain excellent customer service

Objective 1	Develop measures to assess customer satisfaction
Objective 2	Measure and report customer satisfaction

Goal 4: Financial Integrity – EOCWD will manage our financial assets to provide and maintain reliable water services

Strategy 1 – Ensure that adequate financial capacity exists to maintain District assets

Objective 1	Complete the rate study
Objective 2	Integrate CIP requirements into financial plan
Objective 3	Evaluate fixed vs variable charges
Objective 4	Evaluate water budget based rates
Objective 5	Evaluate reserve policy for the retail system
Objective 6	Assess penalty rates during allocations
Objective 7	Develop an annual budget
Objective 8	Manage within the budget (beyond emergencies)
Objective 9	Receive an unqualified audit outcome each year

Strategy 2 – Consider rate parity with neighboring communities in the establishment of our rates and charges

Objective 1	Periodically conduct rate surveys

Strategy 3 – Provide mutually beneficial water services to area and contiguous utilities

Objective 1	Examine opportunities for service expansion
Objective 2	Actively engage in LAFCO proceedings

Strategy 4 – Ensure the District operations are efficient and effective

Objective 1	Conduct selected benchmarking to track performance

Strategy 5 – Implement the Strategic Plan

Objective 1	Track and report progress to the Board

Strategy 6 – Consolidate policies and make easily assessable to Directors

Objective 1	Explore website system to house key policies

Goal 5: Professional Workforce – EOCWD will maintain workforce expertise to ensure service quality, continuity, and reliability

Strategy 1 – Develop long-term strategy to retain staff

Objective 1 Assess staff morale

Objective 2 Conduct staffing assessment to identify needs and present to Board for consideration

Objective 3 Determine appropriate mix of financial and benefit incentives (including evaluation of current housing stock)

Objective 4 Develop a succession plan

Strategy 2 – Ensure that technology is appropriately deployed within the District

Objective 1 Complete evaluation of expanding AMI/AMR (integrating into Neptune and *Sedaru*)

Objective 2 Evaluate and implement SCADA system improvements

Objective 3 Develop and implement knowledge management

Strategy 3 – Ensure staff training and certifications are adequate to maintain capability

Objective 1 Develop a training plan

Objective 2 Track training activities

Next Steps

The plan is intended to be a living document and will be reviewed and updated annually to remain current. It will be used in planning and budgeting the activities of EOCWD. Formal "action plans" will be developed for some of the key strategies.

Glossary

The following key terms are used in this Strategic Plan:

Action Plan – a detailed set of tactical actions that will be developed in order for some of the strategies / objectives to be achieved

Core Values - non-negotiable standards that the staff and the Board believe in and embody how they will act individually and as an organization

Goal - EOCWD's commitment to the community it serves

Mission – the primary reason(s) for the existence of the organization

Objective - measurable work activity that, when accomplished, will directly lead to the success of the strategy

Issue - a problem or opportunity facing the EOCWD

Strategy - how an issue is solved to achieve the goal

Strategic Plan - a structured plan to drive EOCWD to achieve its goals

SWOT Analysis - description of strengths, weaknesses, opportunities and threats to identify areas of focus in the Strategic Plan

Tactic - specific work activities to accomplish a strategy

Vision - what EOCWD aspires to become

MEMO

TO: BOARD OF DIRECTORS

FROM: GENERAL MANAGER

SUBJECT: REVIEW OF WHOLESALE AND RETAIL ZONE CAPITAL IMPROVEMENT PLANS

DATE: JULY 9, 2015

Background

Attached to this memo are two important Technical Memorandums: TM-2A – Wholesale Zone Water System Analysis and Capital Improvement Program and TM 2B – Retail Zone Water System Analysis and Capital Improvement Program. These documents were developed as part of the Master Plan Update being conducted by Carollo Engineers and are foundational documents for not only the FY 2015/16 Capital Improvement Budgets, but also for the district's capital improvement plans for the next 25 years.

In the latter part of 2014/early 2015, Carollo conducted a condition assessment of the Wholesale and Retail Zones (Technical Memorandum-01). Using the information developed in the condition assessment, Carollo then examined: 1) Water Demand and Supply Sources, 2) Emergency Storage and, 3) Hydraulic Capacity and put together a list of recommended improvements that form the basis for the Capital Improvement program. The details of these analyses and recommendations are presented in the attached TMs.

Mr. Graham Juby, Carollo's Project Manager for our Master Plan Update, will be present at the meeting to provide a summary presentation of this information and answer questions. This information will also be reviewed with the Wholesale Zone agencies at a July 7th meeting.

Recommendation

For review and discussion only; the Board adopted the Capital Improvement Program associated with these recommendations at the June 18, 2015 meeting.

EAST ORANGE COUNTY WATER DISTRICT

WHOLESALE ZONE SYSTEM
WATER MASTER PLAN

TECHNICAL MEMORANDUM NO. 2A
WATER SYSTEM ANALYSIS &
CAPITAL IMPROVEMENT PROGRAM

DRAFT
June 2015

3150 BRISTOL STREET, SUITE 500 • COSTA MESA, CALIFORNIA 92626 • P. 714.593.5100 • F. 714.593.5101

EAST ORANGE COUNTY WATER DISTRICT

PETERS CANYON WATER TREATMENT PLANT
FEASIBILITY STUDY AND MASTER PLANS UPDATE

TECHNICAL MEMORANDUM
NO. 2A
WHOLESALE ZONE
WATER SYSTEM ANALYSIS AND CAPITAL IMPROVEMENT PROGRAM

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

WHOLESALE ZONE WATER SYSTEM ANALYSIS & CAPITAL IMPROVEMENT PROGRAM

1.0 INTRODUCTION

This technical memorandum (TM) summarizes the water system analysis and capital improvement plan (CIP) recommendations for the Wholesale Zone of East Orange County Water District (EOCWD or District).

The TM starts with a summary of the District's historical water demands and future water demand projections for the Wholesale and Retail Zones. Subsequently, the water supply analysis and transmission system analysis for the Wholesale Zone is described. The recommendations to address system deficiencies, as well as major rehabilitation and replacement (R&R) improvements are compiled and summarized in a phased CIP. The findings presented in this memorandum will be combined with the findings from Technical Memorandum No. 1 - Water Facilities Condition Assessment to develop the District's Wholesale Zone Master Plan Report.

1.1 Overview

EOCWD was formed in December 1961 and currently operates under the County Water District Law. The District is an independent Special District governed by its Board of Directors elected by the voters within the District. Initially the District was formed to provide wholesale imported water to retail agencies within its boundaries.

In July 1985, EOCWD incorporated the County of Orange Waterworks District No. 8 (OWWD#8) which became known as EOCWD's Retail Zone. The original EOCWD became known as the Wholesale Zone. EOCWD provides water to a population of approximately 100,000 throughout the Wholesale Zone and Retail Zone service areas.

EOCWD receives its water from both the Lower Santa Ana River Groundwater basin, managed by Orange County Water District (OCWD) and imported water from Metropolitan Water District of Southern California (Metropolitan) through the Municipal Water District of Orange County (MWDOC). EOCWD's Retail Zone pumps groundwater from two active wells located within its service area and receives imported water treated at the Diemer Filtration Plant delivered through three imported water connections.

1.2 Service Areas

EOCWD operates as a wholesale supplier servicing central Orange County. The District's wholesale system service encompasses an area of approximately 10,000 acres is shown on Figure 1.1. The District's Retail Zone lies within the unincorporated community of Panorama Heights in the central portion of the wholesale system, as depicted on Figure 1.2.

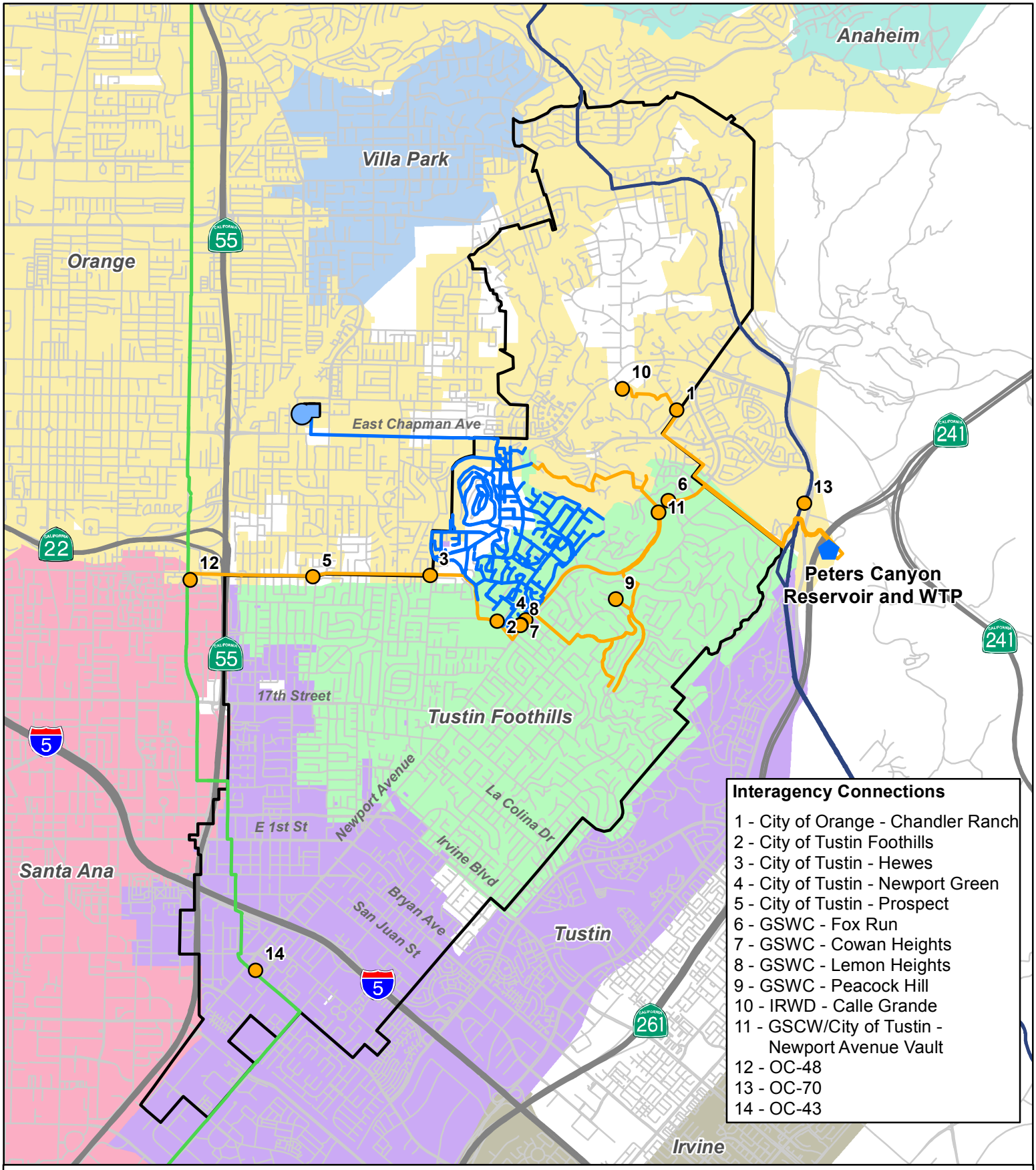


Figure 1.1
Wholesale and Retail Zone Overview
East Orange County Water District

carollo
Engineers...Working Wonders With Water™

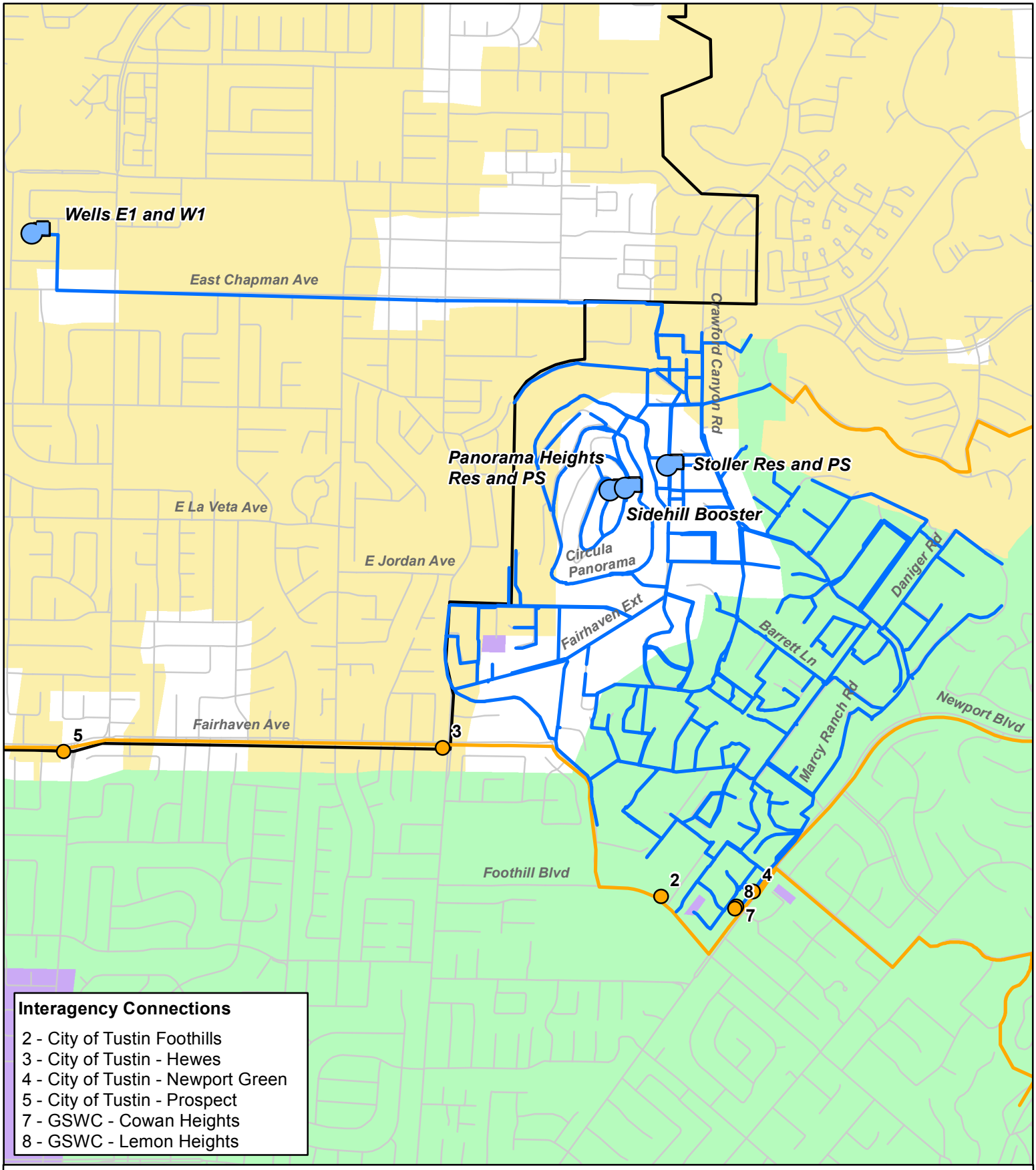


Figure 1.2
Retail Zone Overview
East Orange County Water District

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As shown on Figure 1.1, the District's Wholesale Zone includes the City of Tustin, a portion of the City of Orange, and adjoining unincorporated communities of North Tustin, East Tustin, Red Hill, Lemon Heights, Cowan Heights, Orange Park Acres, and Panorama Heights. EOCWD lies east of the Costa Mesa (55) Freeway, north of the Santa Ana (5) Freeway, west of Jamboree Road, and south of Santiago Canyon Road.

As shown on Figure 1.2, the District's Retail Zone lies within the unincorporated community of Panorama Heights in the central portion of the Wholesale Zone. It is generally bounded on the west by Hewes Avenue, on the south by Foothill Boulevard, on the east by Newport Boulevard, and Crawford Canyon Road, and on the north by Chapman Avenue.

2.0 WATER DEMAND AND SUPPLY SOURCES

This section describes the development of water demand projections to be used for the Wholesale Zone Water Master Plan Update.

2.1 Wholesale Zone System

The main source of water supply for the District's Wholesale Zone is imported water from Metropolitan Water District of Southern California (Metropolitan) delivered through the Municipal Water District of Orange County (MWDOC). This imported water is treated at the Diemer Filtration Plant, which receives water from the Colorado River, via Lake Mathews, and the State Water Project (SWP), through the Yorba Linda Feeder or the Inland Feeder.

EOCWD's Wholesale Zone sells imported water to the EOCWD Retail Zone, portions of Irvine Ranch Water District (IRWD), portions of Golden State Water Company (GSWC), portions of the City of Orange, and all imported demand needs for the City of Tustin. The combined wholesale water demand based on a 10-year historical average (Hunt, 2014) delivered to the member agencies in the Wholesale Zone was 6,983 acre-feet per year (afy). The breakdown of this historical demand by member agencies is summarized in Table 2.1.

Table 2.1 Historical Wholesale Water Demands by Agency
Wholesale Zone Water Master Plan
East Orange County Water District

Wholesale Agency	Historical Average Demand (afy)	Portion (%)
Golden State Water Company (GSWC)	1,642	24%
Irvine Ranch Water District (IRWD)	222	3%
City of Orange	369	5%
City of Tustin	4,507	65%
Retail Zone (Imported Water only)	243	3%
Wholesale Agency Total	**6,983**	**100%**

As shown in Table 2.1, the City of Tustin obtained the highest portion of the total wholesale demand delivered by EOCWD, with 4,507 afy contributing to nearly 65 percent of the total District's wholesale demand. The high demand from the City of Tustin is primarily caused by its dependence on EOCWD to meet peak demands and its inability to access its full groundwater allocation. In the 10-year period, IRWD contributed to the lowest water demand of 222 afy, contributing to only 3 percent of the total District's wholesale demand.

In February 2015, EOCWD sent a letter to each member agency requesting updated information regarding the anticipated long-term water supply needs from the District's Wholesale Zone system. Responses were received from all member agencies. Both the Cities of Orange and Tustin indicated a decrease in long-term demands of 19 and 3,832 afy, respectively. The District's 2010 Urban Water Management Plan (UWMP) long-term demands indicated an increase in water demands for all member agencies with the exception of IRWD, which was anticipated to remain at its historical demands.

For conservative planning purposes, EOCWD elected to use the higher of the water demands between the UWMP projections and the member agencies response from the February 2015 letter. For GSWC, City of Orange, City of Tustin, and the District's Retail Zone the projected water demands provided in the 2010 UWMP were used for the existing and future water system analysis and planning. IRWD indicated in its response letter that its water demand on the EOCWD Wholesale Zone system would increase from 222 afy to 800 afy during the planning period; however, the District elected to use the demands projected in the 2010 UWMP for IRWD for existing and future system analysis and planning.

The estimated long-term demands for the member agencies of the Wholesale Zone are presented in Table 2.2.

Table 2.2 Long-term Water Demands
Wholesale Zone Water Master Plan
East Orange County Water District

Wholesale Agency	Long-Term Demand from UWMP (afy)	Long-Term Demand from 2015 Letters (afy)	Demand for 2015 Water Master Plan (afy)	Demand for 2015 Water Master Plan (mgd)
GSWC	1,790	1,790	1,790	1.6
IRWD	222	800	222	0.2
City of Orange	379	350	379	0.3
City of Tustin	4,429	675	4,429	4.0
Retail Zone (Imported Water only)	418	n/a	418	0.4
Wholesale Total	**7,238**	**3,615**	**7,238**	**6.5**

Historical water billing data was used to determine the peaking factors for each of the Wholesale Zone member agencies. IRWD and the District's Retail Zone have the greatest maximum day demand (MDD) to average day demand (ADD) peaking factor of 2.0, while both GSWC and the City of Tustin have MDD to ADD peaking factors of approximately 1.8. The MDD for GSWC, IRWD, and the City of Tustin is 2.9 million gallons per day (mgd), 0.4 mgd, and 7.0 mgd, respectively. The City of Orange has a MDD to ADD of 1.0; therefore, the MDD for the City of Orange is equal to the ADD at 0.3 mgd. The District's Retail Zone has a MDD of 0.4 mgd. Each of the member agency's ADD, peaking factors, and resulting MDD are shown in Table 2.3.

Table 2.3 Peaking Factors
Wholesale and Retail Zone Water Master Plans
East Orange County Water District

Wholesale Agency	Average Day Demand (mgd)	MDD/ADD Peaking Factor	Maximum Day Demand (mgd)	PHD/MDD Peaking Factor	Peak Hour Demand (gpm)
GSWC	1.6	1.8	2.9	1.0	2,014
IRWD	0.2	2.0	0.4	1.7	472
City of Orange	0.3	1.0	0.3	1.0	208
City of Tustin	4.0	1.8	7.0	2.0	9,722
Retail Zone (Imported Water only)	0.4	2.0	0.8	1.7	944
Wholesale Total	**6.5**	**1.7**	**11.4**	**n/a**	**13,360**

The peak hour demand (PHD) to MDD peaking factors are also listed in Table 2.3. The PHD demand is used for the hydraulic analysis of the pipelines associated with delivering the water demands to the member agencies. Both GSWC and the City of Orange have PHD to MDD peaking factors of 1.0; therefore, the PHD is equivalent to the MDD. IRWD and the District's Retail Zone have PHD to MDD peaking factors of 1.7 and the City of Tustin is at 2.0. The resulting PHDs for IRWD, the District's Retail Zone, and the City of Tustin are 472 gallons per minute (gpm), 944 gpm, and 9,722 gpm, respectively.

3.0 EXISTING SYSTEM

3.1 Wholesale and Retail Zone Layout

The District's water distribution system is comprised of two separate systems, namely; the Wholesale Zone and the Retail Zone. The Wholesale Zone conveys imported water from Metropolitan through MWDOC connections to the EOCWD member agencies. The Retail Zone conveys either imported water or groundwater to the District's retail customers, which are mostly residential as described in the previous section. The entire system consists of approximately 60 miles of pipeline. A schematic of the entire EOCWD distribution system is shown on the hydraulic profile on Figure 3.1.

3.2 Description of Existing Facilities

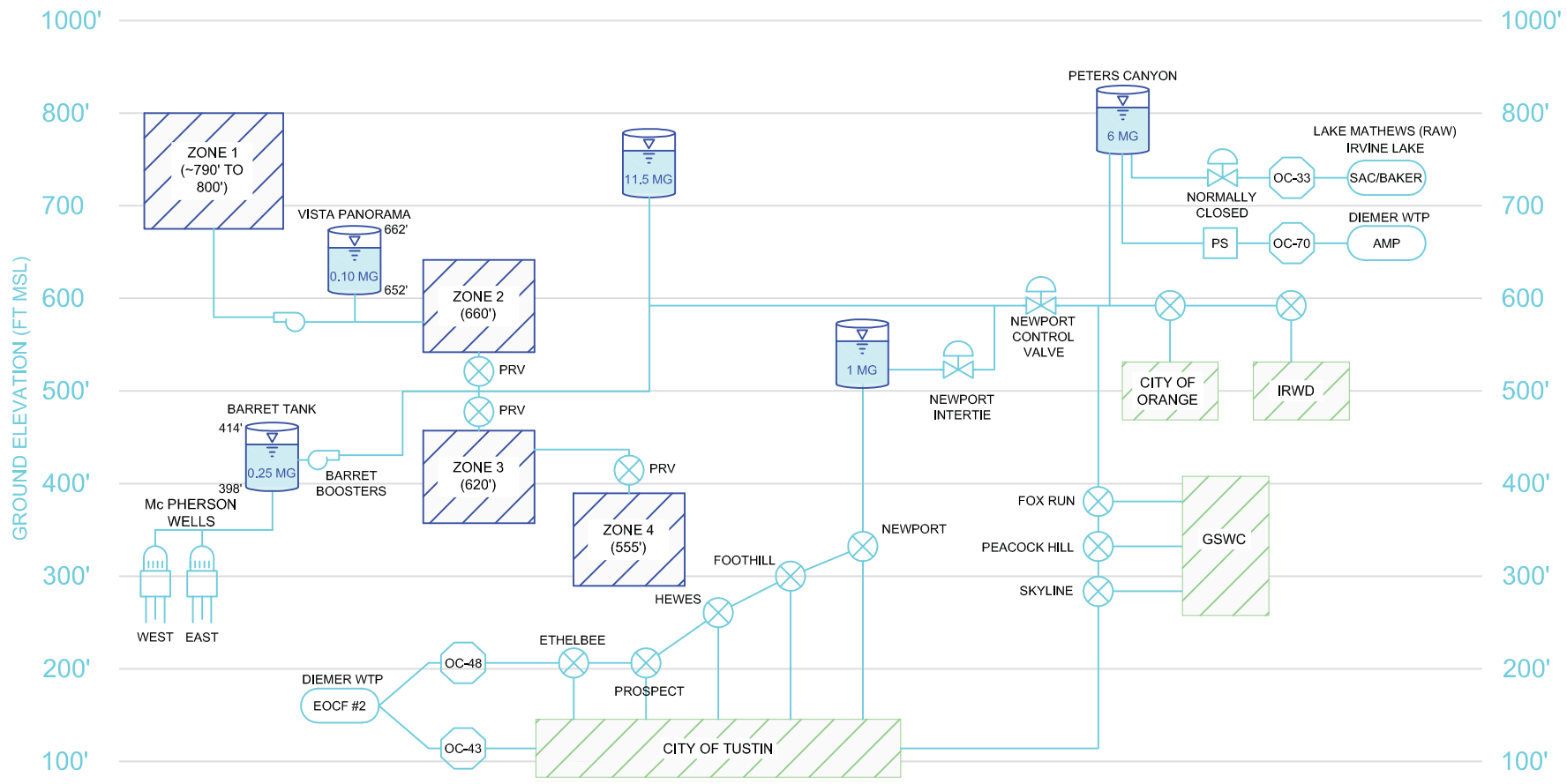
The following section describes the Wholesale Zone system in more detail.

3.2.1 Wholesale Zone

The Wholesale Zone provides imported water to the following member agencies: GSWC, City of Tustin, City of Orange, and IRWD. Currently IRWD does not take water from EOCWD but it is expected that the IRWD connection will become active in the near future.

The Wholesale Zone facilities are shown on Figure 3.2. The imported water from Metropolitan's Diemer Filtration Plant is supplied through MWDOC at three metered connections: OC-43 and OC-48, off the East Orange County Feeder No. 2 and OC-70, off the Allen-McColloch Pipeline (AMP). Distribution facilities include three reservoirs, one pump station, and twelve customer interties. There are three pressure within the Wholesale Zone system; 560 Pressure Zone, 736 Pressure Zone, and 790 Pressure Zone, where the pressure zone identification numbers represent the hydraulic grade line of each. The three reservoirs include the Newport 1 million gallon (MG) Reservoir (located at Newport Boulevard), the Peters Canyon 6 MG Reservoir (located at Peters Canyon), and the 11.5 MG Reservoir. A small portion, 1.5 MG, of storage capacity in the 11.5 MG Reservoir is reserved for the District's Retail Zone.

C:\pw_working\projectwise\bhawes\d0324205\Figure 1_EOCWD Hydraulic Profile



LEGEND

FACILITIES

- Groundwater Well
- Reservoir (1.0 MG) — Volume Inside Tank; HWL= High Water Level (ft msl)
- Booster Pumping Station
- Pressure Regulating Station
- Interagency Connector
- OC-XX — Imported Water Connection
- Imported Water Feeders
- ZONE (HGL) — Pressure Zone; HGL: Hydraulic Grade Line For Zone
- NAME — Wholesale Agency Systems

Figure 3.1
Hydraulic Profile
East Orange County Water District

carollo

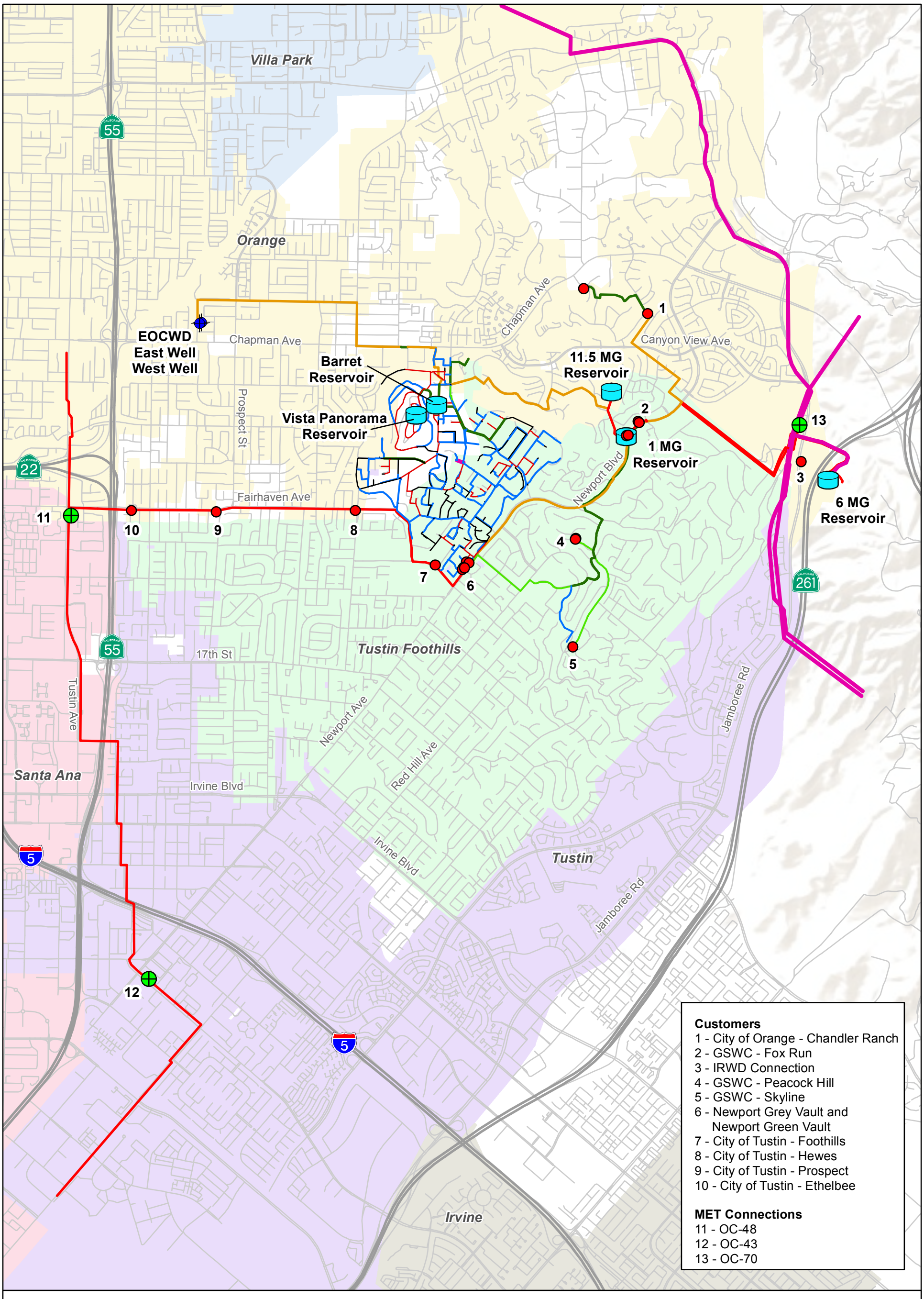


Figure 3.2
Wholesale Zone Facilities
East Orange County Water District

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3.2.1.1 Wholesale Zone Connections and Turnouts

OC-43 Connection

The OC-43 connection is a 20-inch diameter metered connection to the City of Tustin and does not connect to the remainder of the Wholesale Zone.

560 Pressure Zone

The 560 Pressure Zone is primarily served from the OC-48 connection. There are five customer turnouts within the 560 Pressure Zone listed in Table 3.1. The OC-48 connection can be used to fill the Newport Reservoir, which floats on the 560 Pressure Zone.

Table 3.1 560 Pressure Zone Customer Turnouts
Wholesale Zone Water Master Plan
East Orange County Water District

Turnout	Location	Customer
Ethelbee	Ethelbee Way & Fairhaven Ave	City of Tustin
Prospect	Prospect Ave & Fairhaven Ave	City of Tustin
Hewes	Hewes Ave & Fairhaven Ave	City of Tustin
Foothill	Foothill Boulevard near Orange Knoll Drive	City of Tustin
Newport Grey Vault	Newport Ave and St. Johns Place	City of Tustin and GSWC

736 Pressure Zone

The 736 Pressure Zone is served from the Newport Intertie from the 790 pressure zone, which is also located near the 1 MG Newport Reservoir. The Newport Reservoir can be filled from the 736 pressure zone (the District's Retail Zone). The District's 11.5 MG Reservoir is also within the 736 pressure zone. Water is transferred to the Newport Reservoir through a valve station located at the reservoir site.

790 Pressure Zone

The 790 pressure zone is served from the OC-70 connection. The OC-70 connection fills the 6 MG Peters Canyon Reservoir and water is then distributed to member agencies within the 790 pressure zone. Water can also be transferred to the 736 pressure zone from the 790 pressure zone through the Newport Intertie. In addition, there is a pressure reducing station (PRS) located at Coronel Road and Yarmouth Road that reduces the hydraulic grade line of the water flowing towards the Newport Green vault. The customer turnouts within the 790 pressure zone are listed in Table 3.2.

Table 3.2 790 Pressure Zone Customer Turnouts Wholesale Zone Water Master Plan East Orange County Water District		
Turnout	**Location**	**Customer**
IRWD Connection	Jamboree Road	IRWD
Chandler	Chandler Ranch Road & Morninglory Way	City of Orange
Foxrun	Newport Ave near Foxrun Drive	GSWC
Skyline	Skyline Drive	GSWC
Peacock	Peacock Hill Drive	GSWC
Newport Green Vault	Newport Avenue & St. Johns Place	City of Tustin

3.2.1.2 Wholesale Zone Demands by Pressure Zone

The Wholesale Zone demands used for hydraulic modeling analysis are shown in Table 3.3. These are based on the demand projections described in the Section 2 and are separated by pressure zone. For member agencies with more than one turnout or connection, the agency's total demand was divided equally between the turnouts available for that agency.

Table 3.3 Hydraulic Modeling Demands Wholesale Zone Water Master Plan East Orange County Water District					
Pressure Zone	**Customer**	**Turnout**	**Average Day Demand (gpm)**	**Maximum Day Demand (gpm)**	**Peak Hour Demand (gpm)**
560	City of Tustin	Ethelbee	463	810	1,620
		Prospect	463	810	1,620
		Hewes	463	810	1,620
		Foothill	463	810	1,620
		Newport Grey Vault	463	810	1,620
Subtotal 560 Zone			**2,315**	**4,051**	**8,102**
736	District	Retail Zone	694	1,389	2,361
Subtotal 736 Zone			**694**	**1,389**	**2,361**
790	GSWC	Foxridge	370	671	671
		Peacock Hill	370	671	671
		Skyline	370	671	671
	City of Orange	Chandler	56	111	200
	IRWD	IRWD	208	208	208
	City of Tustin	Newport Green Vault	463	810	1,620
Subtotal 790 Zone			**1,838**	**3,143**	**4,042**
Total			**4,847**	**8,583**	**14,505**

4.0 EMERGENCY STORAGE EVALUATION

This section presents an evaluation of emergency storage availability. A desktop comparison between the demands identified in Section 3.0 to the available storage was completed. The results of the desktop analysis were confirmed through hydraulic model runs. For this evaluation, the reservoir storage levels were assumed to be at 70 percent of capacity, which equates to approximately 12.95 million gallons (MG) available. The Retail Zone demands were assumed to be supplied by the groundwater wells, not imported water from the Wholesale Zone. The emergency storage evaluation conditions, requirements, and results for five different scenarios are presented in Table 4.1.

Table 4.1 Emergency Storage Evaluation
Wholesale Zone Water Master Plan
East Orange County Water District

Reliability Scenario	Demand Condition	Desired Duration (days)	Actual Duration (days)	System Demand (mgd)	Demand Required from Storage (mgd)
1. Planned Outage Diemer WTP (EOCF #2 and AMP)	ADD	10	2.17	5.98	5.98
2. Emergency Outage (Earthquake): Diemer WTP/Lower Feeder	MinDD	60	3.61	3.59	3.59
3. EOCF #2 Outage (Outage OC-48 and OC-43)[1]	MDD	10	3.10	10.36	4.17
4. AMP Outage Diemer (Outage OC-70)[2]	MDD	14	3.85	10.36	3.36
5. Peters Canyon Reservoir Rehabilitation[3]	ADD	150	150	5.98	0

Notes:
(1) Scenario assumes 6.18 mgd available from OC-70. If the District can take additional water from OC-70, then the actual duration is increased as water can be transferred from 736 Pressure Zone to 560 Pressure Zone.
(2) Scenario assumes OC-48 is available but there is no method to transfer water from 560 Pressure Zone to either of the upper pressure zones.
(3) Scenario assumes the 790 Pressure Zone will be converted to the 736 Pressure Zone while the reservoir rehabilitation is being completed. Additionally, the District will be unable to serve the City of Orange for the duration of the reservoir rehabilitation.

As shown in Table 4.1, the District's available storage (with the assumptions as stated previously) does not meet the desired duration (column 3) for any of the scenarios except for Scenario 5, during the Peters Canyon Reservoir rehabilitation work. The actual duration (column 4) for storage supplies varies from approximately 2 days during a planned outage at the Diemer WTP to almost 4 days during an outage of OC-70.

5.0 AGE-BASED ANALYSIS

This section presents the findings from a pipeline age analysis that was performed on the District's available GIS-based pipeline data. The age analysis was used to help identify the estimated pipeline replacements that will be needed through the 2040 planning period.

5.1 Existing Wholesale Zone System

Based on available GIS data, the District's Wholesale and Retail Zones have a combined total of approximately 37 miles of pipeline. The Wholesale Zone accounts for approximately 13 miles of the total pipe. Pipe materials for the Wholesale Zone vary and are listed in Table 5.1.

Table 5.1 Pipeline Material Distribution
Wholesale Zone Water Master Plan
East Orange County Water District

Pipeline Material	Wholesale Zone (Miles)	Percent of Wholesale Zone (%)
Asbestos Concrete	7.3	56%
Concrete	0	0%
Ductile Iron	0.3	2%
Galvanized	0	0%
PVC	0	0%
Steel Mortar Coated	5.4	42%
Unknown	0	0%
Total	**13**	**100%**

Note:
(1) Data based on EOCWD pipeline geodatabase.

As shown in Table 5.1, approximately 56 percent of the pipe in the Wholesale Zone is asbestos concrete. The second most frequently used pipe material is steel mortar coated pipe, which represents approximately 42 of the Wholesale Zone. Approximately 0.3 miles, or 2 percent, of the Wholesale Zone pipes are ductile iron.

The installation years for the pipes in the Wholesale Zone are presented in Table 5.2.

Table 5.2 Pipeline Age Distribution
Wholesale Zone Water Master Plan
East Orange County Water District

Pipeline Installation Decade	Wholesale Zone (Miles)	Percent of Wholesale Zone (%)
1950-1959	0	0%
1960-1969	4.7	36%
1970-1979	5.1	39%
1980-1989	3.3	25%
1990-1999	0	0%
Other	0	0%
Total	**13.1**	**100%**

Note:
(1) Data based on EOCWD pipeline geodatabase

Approximately five miles of the Wholesale Zone was installed in the 1960s, while the majority of the Wholesale Zone expansion occurred from the 1970s through the 1980s. This span of two decades added approximately 8.4 miles, or 64 percent, of the total pipe in the Wholesale Zone. Since the 1980s, there has not been any pipe added to the Wholesale Zone.

The distribution of pipeline diameters for the Wholesale Zone is summarized in Table 5.3.

Table 5.3 Pipeline Diameter Distribution
Wholesale Zone Water Master Plan
East Orange County Water District

Pipeline Diameter (inches)	Wholesale Zone (Miles)	Percent of Wholesale Zone (%)
3”	0	0%
4”	0	0%
5”	0	0%
6”	0	0%
8”	1.6	12%
10”	1.3	10%
12”	0.8	6%
14”	2.4	18%
16”	0.9	7%
18”	2.9	22%

Table 5.3 Pipeline Diameter Distribution Wholesale Zone Water Master Plan East Orange County Water District		
Pipeline Diameter (inches)	**Wholesale Zone (Miles)**	**Percent of Wholesale Zone (%)**
20”	1.1	8%
21”	1.6	12%
24”	0.5	4%
27”	0	0%
45”	0	0%
Unknown	0	0%
Total	**13.1**	**100%**
Note: (1) Data based on EOCWD pipeline geodatabase		

As shown in Table 5.3, 14-inch diameter and 18-inch diameter pipelines represent the largest percentage of the Wholesale Zone accounting for approximately 5.3 miles, or 40 percent, of the total 13 miles.

5.2 Analysis Methodology

The age replacement analysis consisted of using pipeline age and material data from EOCWD’s GIS database to estimate when pipelines in the system will require replacement.

Remaining useful life (RUL) can be estimated, in years, using a single assumed pipe age (based on pipe material) or can be based on a range of years, referred to as a pipe material’s replacement period (RP). The analysis developed four pipe replacement forecasts. These are:

- Fixed replacement age
- Full Replacement Period
- 50 percent of full replacement period
- 25 percent of full replacement period

The approach using four forecasts was used in order to determine the effect of adopting various smoothing functions (replacement curves) across the replacement horizon. The calculation of the replacement period (RP) for each of these four methods is graphically depicted on Figure 5.1 and described in more detail in the text following the figure.

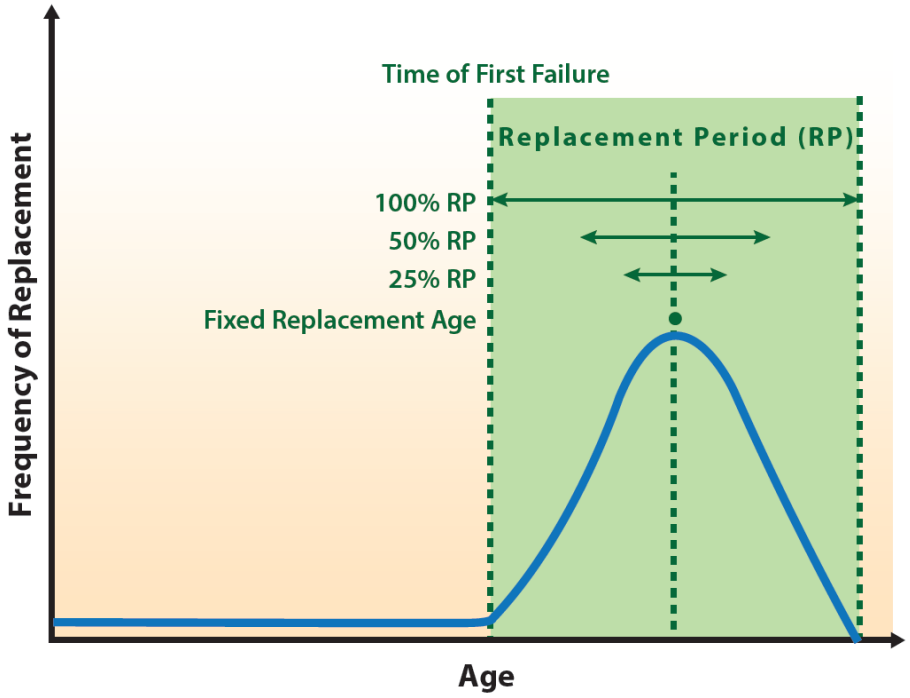

Figure 5.1 Pipeline Age Analysis Model

Several key assumptions are associated with the replacement forecast. The primary assumption is that each pipe material has an average age of failure. This is a critical assumption because soil and water corrosivity, bedrock stability, tree roots, construction methods, and other factors all contribute to the age of failure.

For the fixed replacement age analysis, the average age of failure was simply added to the year of installation in order to determine a year of failure and replacement. For the analyses utilizing a replacement period, each material was assigned a time to first failure, followed by a replacement period. It was assumed that each pipe will require replacement during its replacement period. For example, asbestos concrete is assumed to have a time to first failure of 60 years. The replacement curve extends from year 60 to year 120, based on a replacement period of 60 years. It is assumed, therefore, that all asbestos concrete pipes will fail sometime between 60 and 120 years from their installation date.

A spreadsheet model was used to calculate each of the four replacement forecasts for every pipeline in the system. This model is called the below ground asset management (BAM) model. The BAM model assumes that the failure distribution during the replacement period follows a normal distribution pattern, typically expressed as a bell curve. For the fixed replacement age calculations, the mean of the replacement curve was used.

As shown in Figure 5.1, no pipe replacement is anticipated until the time to first failure. For replacement period forecasts, pipe failure is calculated to occur during the replacement period, represented by the curve in Figure 5.1. For the fixed replacement age analysis, replacement is assumed based on the average useful life, and therefore equals install year plus the average of the replacement period.

The pipe material age assumptions for each pipe material are shown below in Table 5.4.

Table 5.4 Pipeline Replacement Period Assumptions
Wholesale Zone Water Master Plan
East Orange County Water District

Material	Average Life (Years)	First Failure (Years)	Replacement Period (Years)	50% Replacement Period[(1)] (Years)	25% Replacement Period[(2)] (Years)
Asbestos Concrete	90	60	60	30	15
Ductile Iron	75	50	50	25	13
PVC	115	70	90	45	23
Galvanized	50	40	20	10	5
Steel	80	70	20	10	5
Steel Mortar	100	70	60	30	15
Concrete	80	70	20	10	5

Notes:
(1) A replacement period equal to one half of the normal replacement period. Average lifespan is assumed to be unchanged, therefore is increased to account for the smaller replacement period.
(2) A replacement period equal to one quarter of the normal replacement period.

As shown in Table 5.4, an average pipe lifespan is assumed to range from 75 years for ductile iron pipe materials, to 115 years for PVC pipes. These age based failure rates are based on American Water Works Association (AWWA) research and data, but are often adjusted to account for location specific variables.

The exact replacement period range for each material is fully detailed in Table 5.5.

Table 5.5 Pipeline Replacement Period Methods
Wholesale Zone Water Master Plan
East Orange County Water District

Material	Fixed Replacement Age (Years)	100% Replacement Period (Years)	50% Replacement Period (Years)	25% Replacement Period (Years)
Asbestos Concrete	90	60-120	75-105	82.5-97.5
Ductile Iron	75	50-100	62.5-87.5	68.8-81.3
PVC	115	70-160	92.5-137.5	103.8-126.3
Galvanized	50	40-60	45-55	47.5-52.5
Steel	80	70-90	75-85	77.5-82.5
Steel Mortar	100	70-130	85-115	92.5-107.5
Concrete	80	70-90	75-85	77.5-82.5

As shown in Table 5.5, the 25 percent replacement period method assumes considerably shorter replacement windows compared to the 50 percent and 100 percent replacement period methods. This was the variable used to control the smoothness of the replacement forecast.

5.3 Results

5.3.1 Fixed Replacement Age Method

The projected pipeline replacements needed, assuming that all the pipes in the system will require replacement at the end of the estimated average life of material, is shown in Figure 5.2. The estimated life of material corresponds to the Fixed Replacement Age column in Table 5.4 (column 2).

As shown in Figure 5.2, this approach to pipe replacement yields a very “spiky” forecast of pipeline replacement needs. There are no replacements identified before year 2040, which is the planning horizon of this water master plan. The remaining 13.02 miles of pipeline are all projected to require replacement after year 2040, a significant number of replacements in 2054, 2064 and 2068.

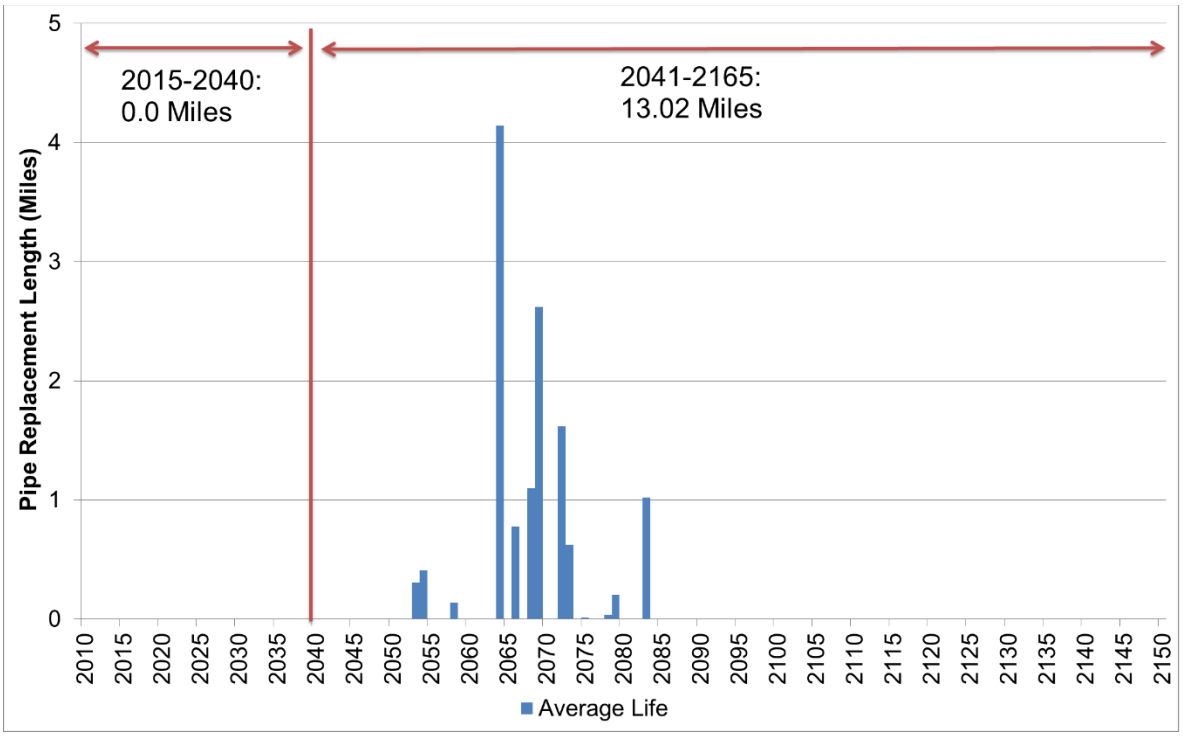

Figure 5.2 Pipeline Age Replacement - Fixed Age

5.3.2 Full Replacement Period

The projected pipeline replacements requirements, assuming that all pipes in the system will require replacement sometime during the full (or 100 percent) replacement period, is shown in Figure 5.3. In this forecast, the lifespan of each pipeline was generated by adding a randomly distributed value (in years) from 100 percent of the corresponding replacement period listed in Table 5.5 to the age at first failure.

As shown in Figure 5.3, the use of the full replacement period results in a longer and less uneven replacement forecast. With this method, 0.4 miles of replacements are identified before year 2040, while the remaining 12.67 miles of pipeline are all projected to require replacement after year 2040. Due to the smoothing effect of utilizing the full replacement period, the maximum length of replacement is also reduced from more than 4 miles to less than 2.0 miles in a single year.

The assumption that all pipelines of a given material will require replacement over a range of years instead of a uniform, exact average life has the effect of spreading replacement out across the planning horizon. In utilizing the full (100 percent) replacement period, replacements will occur continually beginning in roughly year 2020 and continue through year 2150.

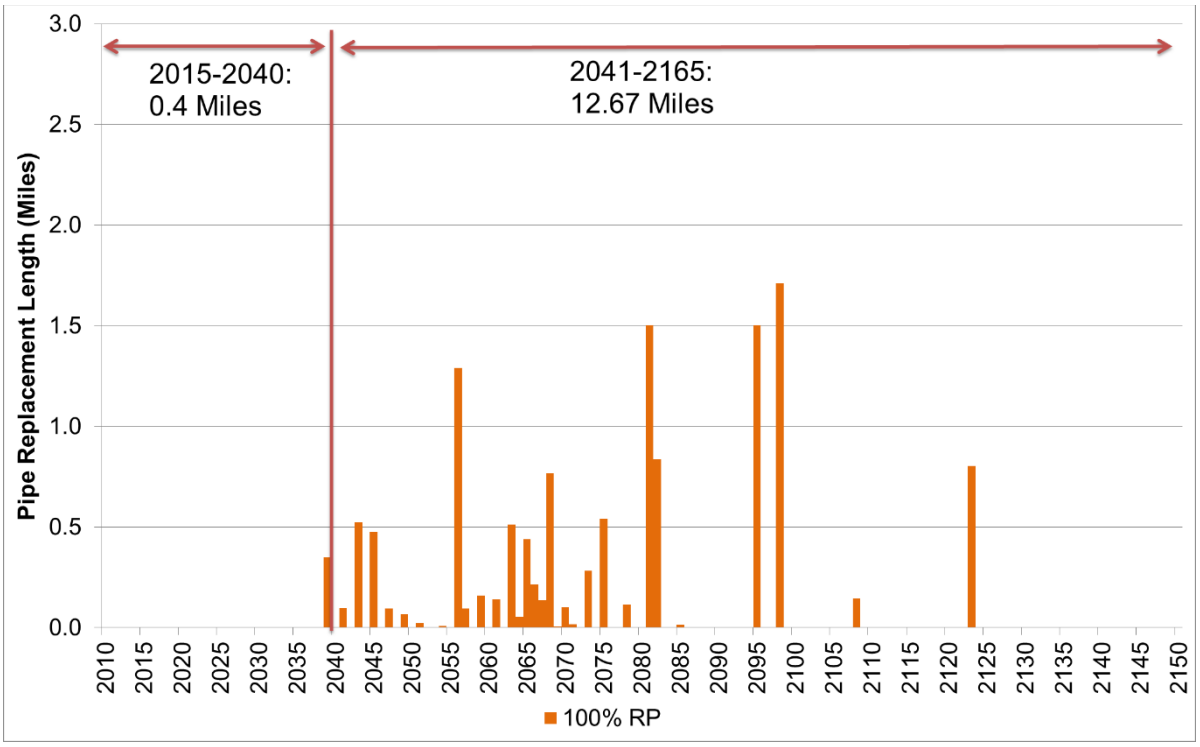

Figure 5.3 Pipeline Age Replacement - Full Replacement Curve

5.3.3 50 Percent Replacement Period

The projected pipeline replacements requirements, assuming that all pipes in the system will require replacement sometime during half (or 50 percent) of the full replacement period, is shown in Figure 5.4. In this forecast, the lifespan of each pipeline was generated by adding a randomly distributed value (in years) from 50 percent of the corresponding replacement period listed in Table 5.5 to the age at first failure.

As shown in Figure 5.4, the use of the half the replacement period results in a shorter and replacement forecast than the full replacement forecast method. With this method, there are no replacements identified before year 2040, while the remaining 13.02 miles of pipeline are all projected to require replacement after year 2040. Due to the smoothing effect of utilizing half of the full replacement period, the maximum length of replacement is also reduced from more than 4 miles to less than 1.5 miles in a single year compared to the fixed replacement method.

The assumption that all pipelines of a given material will require replacement over a range of years instead of a uniform, exact average life has the effect of spreading replacement out across the planning horizon. In utilizing the half of the full (or 50 percent) replacement period, replacements will occur continually beginning in roughly year 2035 and continue through year 2140.

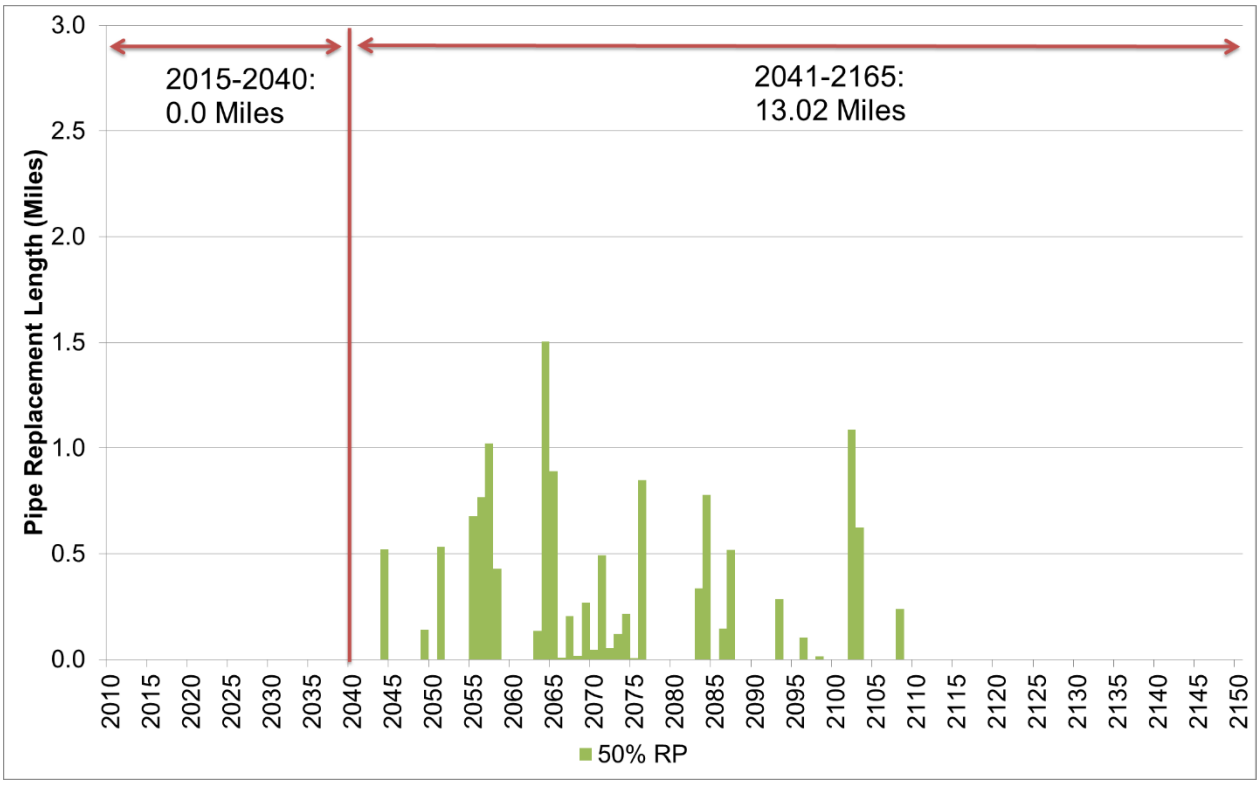

Figure 5.4 Pipeline Age Replacement - Half Replacement Curve

5.3.4 25 Percent Replacement Period

The projected pipeline replacements requirements, assuming that all pipes in the system will require replacement sometime during one quarter (or 25 percent) of the full replacement period, is shown in Figure 5.5. In this forecast, the lifespan of each pipeline was generated by adding a randomly distributed value (in years) from 25 percent of the corresponding replacement period listed in Table 5.5 to the age at first failure.

As shown in Figure 5.5, the use of 25 percent of the full replacement period results in a shorter and more uneven replacement forecast than the 50 percent replacement forecast method. With this method, there are no replacements identified before year 2040, while the remaining 13.02 miles of pipeline are all projected to require replacement after year 2040. Due to the smoothing effect of utilizing only 25 percent of the full replacement period, the maximum length of replacement is also slightly higher than the 2.5 miles in a single year when compared to the 50 percent replacement method.

The assumption that all pipelines of a given material will require replacement over a range of years instead of a uniform, exact average life has the effect of spreading replacement out across the planning horizon. In utilizing only 25 percent of the full replacement period, replacements will occur continually beginning in roughly year 2030 and continue through year 2130.

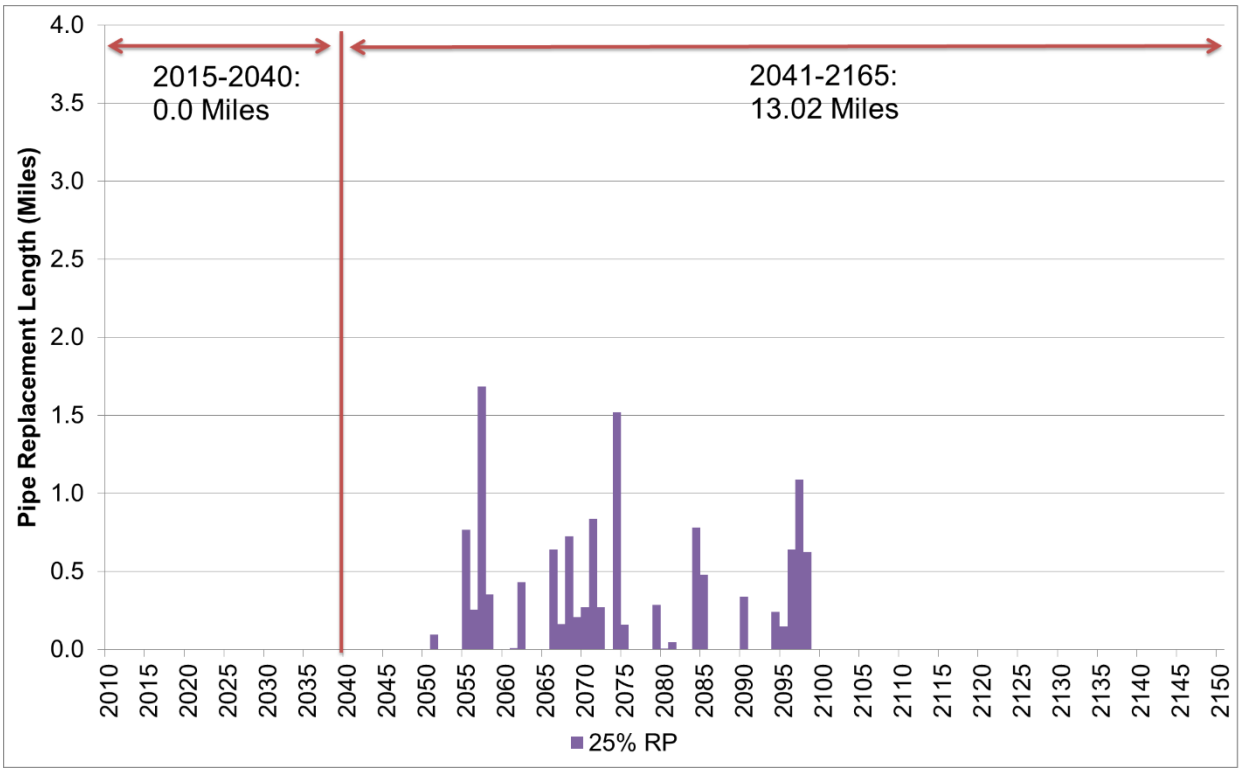

Figure 5.5 Pipeline Age Replacement - Quarter Replacement Curve

5.3.5 Pipeline Age Replacement Summary

The greatest concentration of pipeline replacement under all methods begins in 2055 and goes until about 2065. The full replacement period forecast projects replacements to begin slightly earlier in year 2038, while the fixed age forecast predicts a few specific years with very high replacement rates. The selection of the method will mostly impact the number of pipeline replacements that will fall within the planning horizon of this water master plan. As discussed, the total replacement length before 2040 ranges from 0 miles (Fixed Age, 50 percent RP, and 25 percent RP), to 0.4 miles (100 percent RP).

6.0 HYDRAULIC EVALUATION CRITERIA

This section presents the planning criteria and methodologies for the hydraulic analysis used to evaluate the existing and future Wholesale Zone.

The Wholesale Zone system was evaluated under a range of normal and emergency operating conditions. The normal operating conditions are: ADD, PHD, and MDD.

Hydraulic evaluation criteria are required to determine the performance of the District's water system under the range of operating conditions as discussed above to identify system deficiencies and improvement projects to address them. Under each operating condition, the capacities and performance of the water system are compared with the evaluation criteria to determine which pipelines or water facilities need to be upgraded or replaced. The evaluation criteria for water systems consist of the following categories:

- System Pressure
- Pipeline Velocity

A list of recommended criteria used in the evaluation of the District's Wholesale Zone system is presented in Table 6.1. Detailed descriptions for each evaluation criterion are provided in the following subsections.

6.1 System Pressures

Minimum system pressures are evaluated under two different conditions: PHD and MDD plus fire flow. Maximum system pressures are evaluated under ADD. The minimum pressure criterion for normal PHD conditions is 40 pounds per square inch (psi), while the minimum pressure criterion under MDD with fire flow conditions is 20 psi. The pressure analysis is limited to demand nodes, because only locations with service conditions need to meet such pressure requirements. Lower pressures are only acceptable for junctions at water system facilities and on transmission mains. However, no pressure shall be less than 5 psi to avoid potential contamination through groundwater intrusion.

Maximum system pressures are evaluated under the ADD scenario. The maximum pressure criterion for normal ADD conditions is 80 psi for service connections without individual pressure-reducing valves. In areas where the maximum pressure exceeds 80 psi, individual pressure-reducing valves are required on service connections; however, the system pressure shall generally not exceed 150 psi.

Table 6.1 Potable Water System Evaluation Criteria Wholesale Zone Water Master Plan East Orange County Water District		
Description	**Value**	**Units**
Maximum Pressure		
Without individual pressure regulator at meter	90	psi
With individual pressure regulator at meter	150	psi
Minimum Pressure		
Peak Hour Demand (PHD)	40	psi
Maximum Day Demand (MDD) + Fire Flow	20	psi
Pipeline Criteria		
Maximum Velocity with PHD	5	fps
Maximum Velocity with MDD + Fire Flow	10	fps
Hazen-Williams C-factor		
Pipelines equal or less than 12-inch diameter	120	n/a
Pipelines greater than 12-inch diameter	130	n/a
Minimum Size for Pipeline Replacement	8	Inches
Fire Flow Requirements(1)		
Residential	1,500	gpm for 2 hours
Commercial	3,000	gpm for 3 hours
Schools	3,000	gpm for 4 hours
Park and Open Space	1,000	gpm for 1 hour
Storage Volume		
Operational	30% of MDD	MG
Fire Fighting Storage	Max. Fire Flow demand x duration	MG
Emergency Storage	100% of MDD	MG
Pump Station Capacity(2)		
Zones with gravity storage	Meet MDD + Fire Flow with largest unit out-of-service by pressure zone	gpm
Zones without gravity storage	Meet PHD + Fire Flow with largest unit out-of-service by pressure zone	gpm

6.2 Pipeline Velocities

Pipeline velocities are evaluated using two different maximum velocity criteria for selected flow conditions under the demand scenarios. For transmission and distribution pipelines, a maximum velocity of 5 feet per second (fps) and 10 fps were used for peak hour demand conditions and MDD plus fire flow, respectively. Fire hydrant laterals are excluded from these criteria, as higher velocities are acceptable. Ideally, all transmission and distribution pipelines should have maximum velocities less than 8 fps in order to minimize headloss; however, higher velocities in existing pipelines is not, by itself, sufficient justification for pipeline replacement.

7.0 HYDRAULIC EVALUATION

This section presents the findings and improvement recommendations based on the hydraulic analysis performed for the Wholesale Zones under the future demand conditions. The hydraulic model scenarios were run to identify system deficiencies and proposed improvements were added to the model to correct the deficiencies.

7.1 Wholesale Zone Analysis

The Wholesale Zone was analyzed using the PHD presented in Table 3.3 at each customer turnout to represent the worst case scenario for pressure and pipeline velocity. The demand distribution for each member agency's turnout was determined by the District. As discussed previously, the member agencies with multiple turnouts had the total demand distributed equally to each turnout. The results of the hydraulic evaluation for the Wholesale Zone are presented on Figure 7.1.

During PHD conditions, low pressures existed at the Peacock and Skyline turnouts for the GSWC. The pressure at the Peacock turnout was 28 psi and the pressure at the Skyline turnout was 30 psi. Since these turnouts are used to fill GSWC reservoirs and are not directly connected to the member agency's distribution system, the low pressures were not considered a deficiency. If the District would operate off the 11.5 MG tank (Zone 736') then the pressures at Peacock and Skyline turnouts would be 6 and 8 psi, respectively. This pressure may not be sufficient to fill the GSWC reservoirs, depending on the water level in the tank at the time.

During emergency conditions, the Skyline and Peacock turnouts can be fed water from the 736 pressure zone which is actually 54 feet lower than the 790 pressure zone. Under these emergency conditions, the 12-inch diameter pipeline in Newport Boulevard experiences flow velocities as high as 9 fps and the resulting pressures at the Peacock and Skyline turnouts were insufficient. Since the pressures were low at the turnouts, it is recommended that approximately one mile of the 12-inch diameter pipeline in Newport Boulevard be replaced with a 16-inch diameter pipeline.

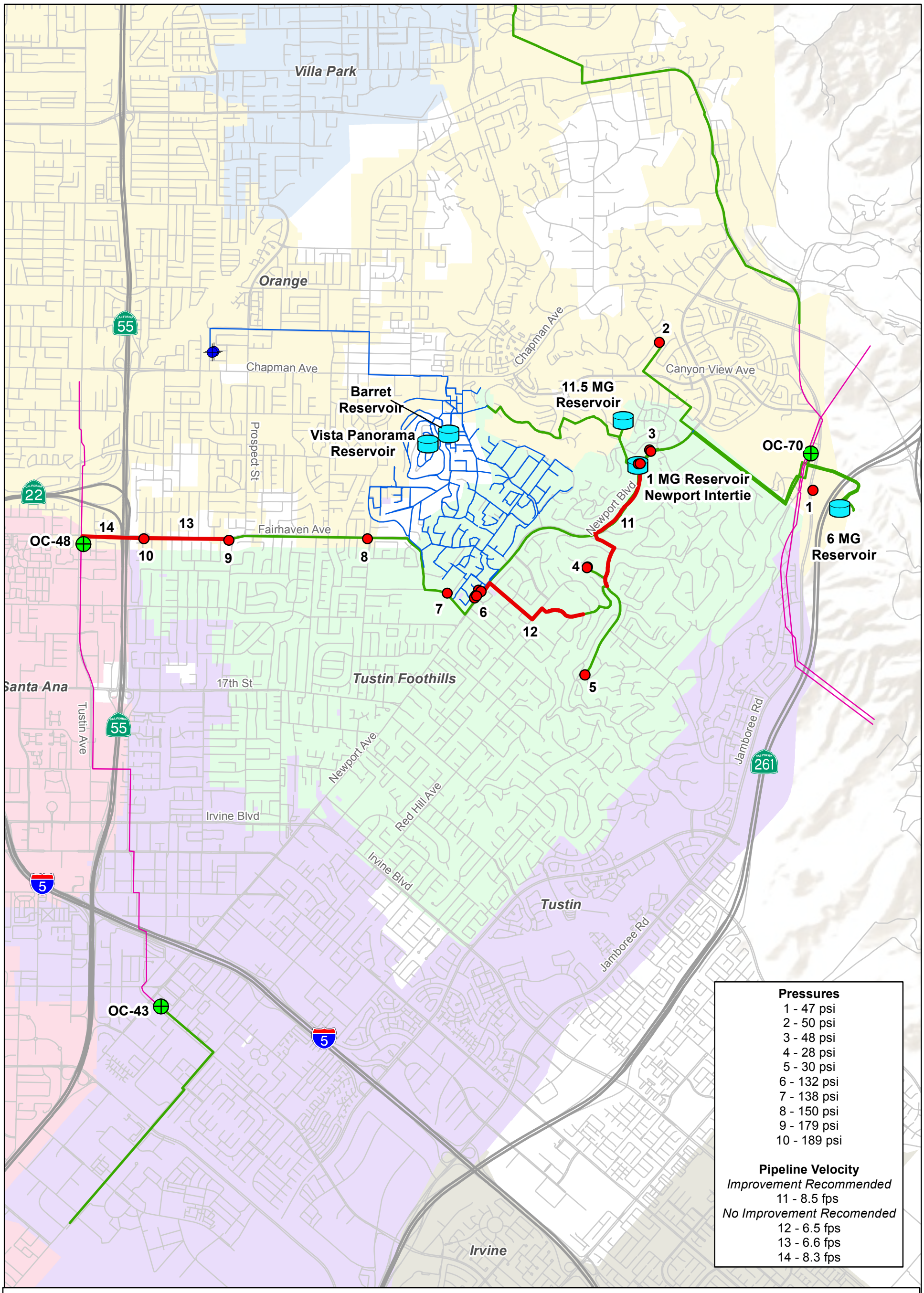

Figure 7.1
Wholesale Zone
System Analysis
East Orange County Water District

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In the 560 pressure zone, approximately the first mile of 20-inch diameter pipeline from the OC-48 connection experienced flow velocities exceeding 5 fps during the PHD condition. Because the pressures are typically high in this pressure zone, the high flow velocity does not result in significant headloss to result in low pressures. Therefore, it was determined that upsizing this 20-inch diameter pipeline is not necessary.

The Wholesale Zone was analyzed again once the 12-inch diameter pipeline in Newport Boulevard was replaced with a 16-inch diameter pipeline. With the installation of the 16-inch diameter pipeline, the flow velocity is reduced to 4.8 fps, which is under the maximum flow velocity as specified in the evaluation criteria. There were no improvements needed for the 560 pressure zone of the Wholesale Zone system.

8.0 SUMMARY OF RECOMMENDATIONS

The recommendations for capital improvements are summarized in this section. Detailed cost estimates for each of these recommendations are included in the Capital Improvement Program (CIP) of this technical memorandum (see Section 9.0). The CIP is divided into three main priority phases: 2015-2020, 2021-2030, and 2031-2040. Within the 2015-2020 period certain "top priority" projects were identified as those projects needing to take place in fiscal year 2015/2016.

A project prioritization matrix was used to determine the project phasing in the CIP. Seven individual categories were included in the prioritization matrix as follows:

- Risk or Consequence of Failure
- Asset Age
- Hydraulic Issues
- Corrosive Soils
- Operational Reliability
- District Known Potential Issues
- Topography Significance

If applicable, each project was given a score of 1 for the individual category. The category scores were summed to determine a total priority score for each project. Based on the analysis of the Wholesale Zone water systems, the improvements and associated total priority ranking scores are summarized in Table 8.1. The higher the score, the more urgent the project.

Table 8.1	Wholesale Zone Improvements & Priority Scores Wholesale Zone Water Master Plan East Orange County Water District	
Map ID	**Description**	**Total Priority Score**
WZ D-1	Replace 12" along Newport Blvd with 16"	**2**
WZ D-2	Replace valve at Newport Intertie (due to cavitation)	**1**
WZ RR-1	Repair Peters Canyon (6 MG) Reservoir Roof	**3**
WZ RR-2	Add'l Seismic Retrofit of Peters Canyon (6 MG) Reservoir (with RR-1 complete)	**2**
WZ RR-3	Install Corrosion Protection System for 11.5 MG Andres Reservoir (ASAP due to recent recoating)	**2**
WZ RR-4	Install Corrosion Protection Systems for Wholesale Zone	**1**
WZ RR-5	Acoustic Field Condition Assessments WZ (1 mi/year)	**1**
WZ RR-6	Other Field Condition Assessments WZ (method TBD)	**1**
WZ RR-7	OC-70 PS - Corrosion improvements for instrumentation (To be funded by MWDSC)	**1**
WZ RR-8	All Wholesale PRS - Pipe Support R&R	**1**
WZ RR-9	Orange Knoll PRS - Replace with above grade PRS	**1**
WZ RR-10	Ethelbee PRS - Flowmeter Rehab and Corrosion Repairs	**1**

9.0 CAPITAL IMPROVEMENT PROGRAM

This section presents the recommended CIP for the Wholesale Zone of EOCWD. The proposed CIP presents improvement projects based on the system evaluations discussed in Section 5 and through discussions with District staff. The planning horizon for this CIP is year 2040. The CIP is divided into three phases, Priority 1 through 2020, Priority 2 is 2021 through 2030, and Priority 3 is 2031 through 2040.

This section starts with a summary of the cost estimating assumptions, followed by the Wholesale Zone CIP.

9.1 Cost Estimating Assumptions

The cost estimates presented in this CIP are opinions developed from bid tabulations, cost curves, information obtained from previous studies, and Carollo Engineers, Inc. (Carollo) experience on other similar projects. The costs are based on an Engineering News Record Construction Cost Index (ENR CCI) 10981 (Greater Los Angeles Index, June 2015).

The construction costs are representative of system facilities under normal construction conditions and schedules. Costs have been estimated for public works construction.

9.2 Cost Estimating Accuracy

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as preliminary alignment generation, investigation of alternative routings, and detailed utility and topography surveys.

The Association for the Advancement of Cost Engineering (AACE) defines an Order of Magnitude Estimate, deemed appropriate for master plan studies, as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within plus 50 percent to minus 30 percent. This section presents the assumptions used in developing order of magnitude cost estimates for recommended facilities.

9.3 Capital Cost Development

Capital costs developed for this CIP are estimated by multiplying the estimated construction cost with various mark-ups. The various cost components used in the development of capital cost estimates are described below.

9.3.1 Baseline Construction Cost

This is the total estimated construction cost, in dollars, of the proposed improvement projects. Baseline construction costs were calculated by multiplying the estimated number of units by the unit cost, such as length of pipeline times the average cost per lineal foot of pipeline. The majority of unit construction costs used for this CIP are presented in Section 1.1.1.

9.3.2 Estimated Construction Cost

Contingency costs must be reviewed on a case-by-case basis because they will vary considerably with each project. Consequently, it is appropriate to allow for uncertainties associated with the preliminary layout of a project. Such factors as unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are a few of the items that can increase project costs for which it is wise to make allowances in preliminary estimates. To assist the District in making financial decisions for these future construction projects, contingency costs will be added to the planning budget as percentages of the total construction cost, divided into two categories: Estimated Construction Cost and Capital Improvement Cost.

Since knowledge about site-specific conditions of each proposed project is limited at the master planning stage, a 30 percent contingency was applied to the Baseline Construction

Cost to account for unforeseen events and unknown conditions. This contingency accounts for unknown site conditions such as poor soils, unforeseen conditions, environmental mitigations, and other unknowns and is typical for master planning projects. The Estimated Construction Cost for the proposed wastewater, potable water, and recycled water system improvements consists of the Baseline Construction Cost plus the 30 percent construction contingency.

9.3.3 Capital Improvement Cost

Other project construction contingency costs include costs associated with engineering, construction phase professional services, and project administration. Engineering services associated with new facilities include preliminary investigations and reports, Right of Way (ROW) acquisition, foundation explorations, preparation of drawings and specifications during construction, surveying and staking, sampling of testing material, and start-up services. Construction phase professional services cover such items as construction management, engineering services, materials testing, and inspection during construction. Finally, there are project administration costs, which cover such items as legal fees, environmental/California Environmental Quality Act (CEQA) compliance requirements, financing expenses, administrative costs, and interest during construction.

The cost of these items can vary, but for the purpose of this study, it is assumed that the other project contingency costs will equal approximately 27.5 percent of the Estimated Construction Cost.

As shown in the following sample calculation of the capital improvement cost, the total cost of all project construction contingencies (construction, engineering services, construction management, and project administration) is approximately 65.8 percent of the baseline construction cost. Calculation of the 65.8 percent is the overall mark-up on the baseline construction cost to arrive at the capital improvement cost. It is not an additional contingency.

Example:

Baseline Construction Cost	**$1,000,000**
Construction Contingency (30%)	$300,000
Estimated Construction Cost	**$1,300,000**
Engineering Cost (10%)	130,000
Construction Management (10%)	130,000
Project Administration (7.5%)	$97,500
Capital Improvement Cost	**$1,657,500**

9.3.4 Unit Construction Cost

Due to the large number of types of projects presented in this CIP, there are many unit construction costs utilized. The following unit construction costs are presented below:

- Pipeline Cost (see Table 9.1)
- Pump Station Cost (see Table 9.2)
- Reservoir Cost (see Table 9.3)
- Pressure Reducing Stations (see Table 9.4)

Table 9.1 Unit Construction Costs - Pipelines
Wholesale Zone Water Master Plan
East Orange County Water District

Pipe Size (inches)	Unit Construction Cost[(1)] ($/LF)
6"	$155
8"	$170
10"	$210
12"	$220
16"	$290
20"	$365
24"	$415
30"	$435

Notes:
(1) ENR Greater Los Angeles Index, June 2015 = 10981.
(2) District Staff requested that a unit cost of $250/LF be used for projects that may require granite rock trenching excavation (Hot Spot Projects H-3, H-8, and H-13).

Table 9.2 Unit Construction Costs – Pump Stations
Wholesale Zone Water Master Plan
East Orange County Water District

Station Size (HP)	Unit Construction Cost ($/HP)
100 hp	$5,000
200 hp	$4,000
300 hp	$3,500

Table 9.3 Unit Construction Costs – Reservoir Storage Wholesale Zone Water Master Plan East Orange County Water District	
Volume (MG)	**Unit Construction Cost ($/MG)**
<1	$2.00
1 to 3	$1.50
3 to 5	$1.25
5 to 10	$1.00

Table 9.4 Unit Construction Costs – Pressure Reducing Stations Wholesale Zone Water Master Plan East Orange County Water District	
Type	**Unit Construction Cost ($/PRS)**
Small (1-2 valves <8")	$100,000
Medium (2-3 valves 8" and up)	$200,000
Large (3-4 valves 12" and up)	$300,000
Rehab and Repair	variable

It should be noted that these unit costs, along with some project specific unit costs, are listed in the detailed summary CIP tables presented at the end of this Chapter. A summary of unit cost assumptions for major miscellaneous items is presented in Table 9.5. Consistent with typical master planning cost estimating, pipeline materials are not specified at this time. Storage reservoirs are assumed to be steel cylindrical tanks as concrete reservoirs are typically more costly. Pump station costs are based on total horsepower. For conservative planning purposes, no differentiation is made between new pump stations or pump station upgrades, as the condition of existing pump stations that require upgrades can vary greatly.

Table 9.5 Unit Construction Costs – Major Miscellaneous Items Wholesale Zone Water Master Plan East Orange County Water District		
Type	**Specific Location (if applicable)**	**Unit Construction Cost ($/unit)**
Roof Replacement	6 MG Reservoir	$800,000
Seismic Retrofit	6 MG Reservoir	$500,000
Seismic Retrofit	Vista Panorama	$100,000
Corrosion Protection System	Andes Reservoir	$60,000
Corrosion Protection Systems	Large Diameter Pipes (WZ)	$50,000
Corrosion Protection Systems	Small Diameter Pipes (RZ)	$60,000
New Well	New Well - Drilling only	$1,200,000
	New Well - Equipping	$300,000
	New Well - Total	$1,500,000
New Valve at PRS	Replace valve(s) at Newport Intertie PRS	$50,000
Gate Valves (500 total)	In-line valve replacements	$5,000
Pipelines	Acoustic Testing (per mile)	$20,000

9.4 Wholesale Agency System

The improvement projects included in the Wholesale Zone CIP include the following project categories:

- Distribution System Improvements (Condition Assessment)
- Rehabilitation and Replacements (R&R)

A detailed list of Wholesale Zone CIP projects with project descriptions, sizing, and cost estimating information is provided at the end of this section in Tables 9.7 through 9.8. The locations of these recommended improvements are depicted on Figure 9.1, while a summary of these projects are listed below by phase.

Priority 1 Projects (2015 - 2020)

The Priority 1 projects have a combined cost of $4.9 million as shown in Table 9.6. As listed in Tables 9.7 and 9.8, the Priority 1 projects include:

- WZ D-1 (Replace 12-inch diameter pipeline along Newport Blvd with 16-inch diameter pipeline)
- WZ RR-1 (Repair Peters Canyon Reservoir Roof)
- WZ RR-3 (Install Corrosion Protection System for 11.5 MG Reservoir)

- WZ RR-4 (Install Corrosion Protection Systems for Wholesale Zone)
- WZ RR-5 (Acoustic Field Condition Assessments for Wholesale Zone)
- WZ RR-6 (Other Field Condition Assessments for Wholesale Zone)
- WZ RR-7 (OC-70 PS Corrosion Improvements for Instrumentation)
- WZ RR-8 (Pipe Supports at all Wholesale PRS)
- WZ RR-9 (Replace Orange Knoll PRS with above grade PRS)
- WZ RR-10 (Ethelbee PRS Flowmeter Rehabilitation and Corrosion Repairs)

Priority 2 Projects (2021 - 2030)

As shown in Table 9.6, the Priority 2 projects have a combined cost of $1.7 million. The Priority 2 projects listed in Tables 9.7 and 9.8 include:

- WZ D-2 (Replace valve at Newport Intertie due to cavitation)
- WZ RR-2 (Additional Seismic Retrofit on Peters Canyon Reservoir)
- WZ RR-5 (Acoustic Field Condition Assessments for Wholesale Zone)
- WZ RR-6 (Other Field Condition Assessments for Wholesale Zone)

Priority 3 Projects (2031 - 2040)

The Priority 3 projects have a combined cost of $0.8 million as shown in Table 9.6. As listed in Tables 9.7 and 9.8, the Priority 3 projects include:

- WZ RR-5 (Acoustic Field Condition Assessments for Wholesale Zone)
- WZ RR-6 (Other Field Condition Assessments for Wholesale Zone)

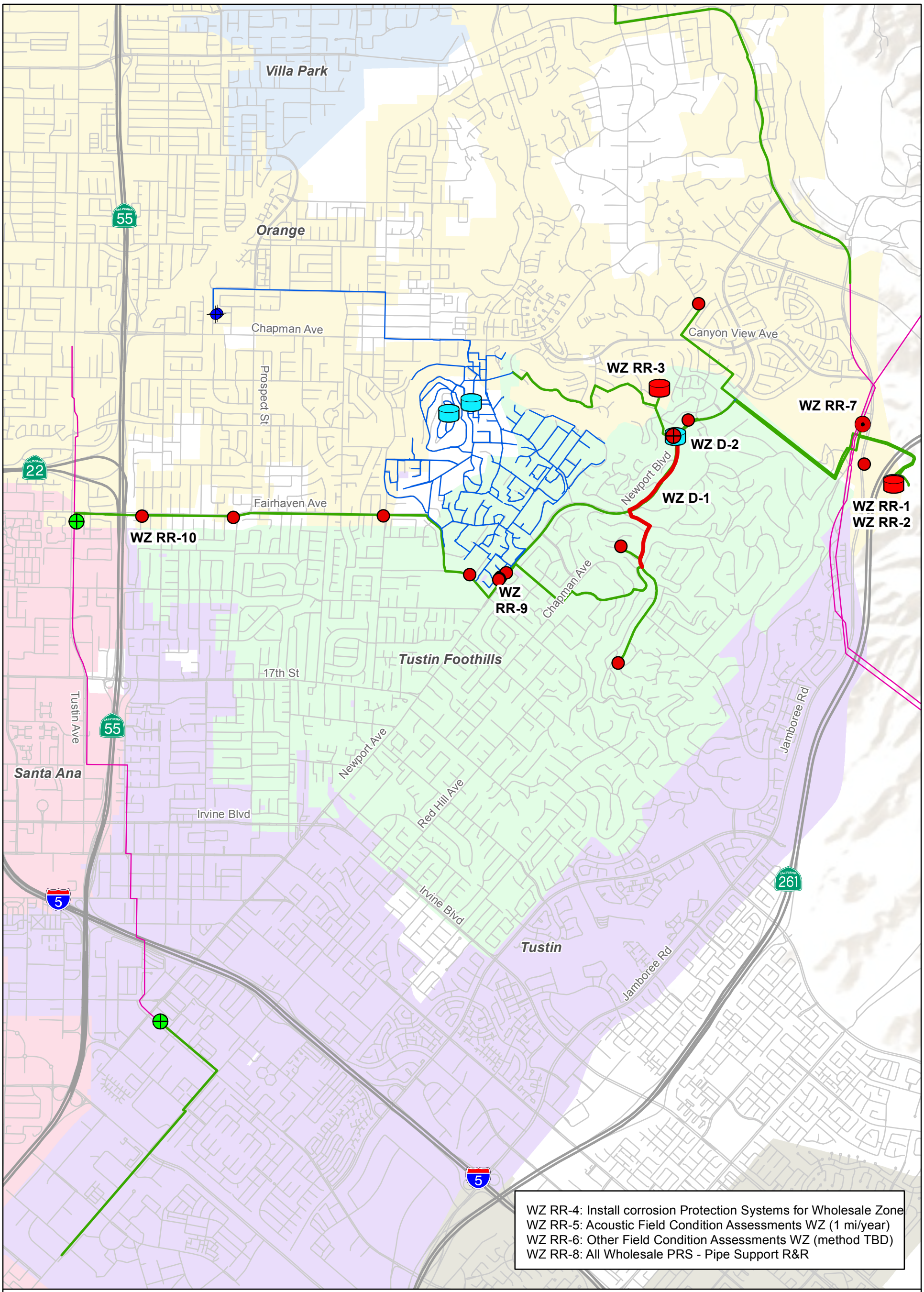

Figure 9.1
Wholesale Zone
Capital Improvement Program
East Orange County Water District

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The estimated cost breakdown of the Wholesale Zone system CIP is presented by improvement category and phase in Table 9.6.

Table 9.6 Wholesale Zone CIP by Improvement Type and Phase
Wholesale Zone Water Master Plan
East Orange County Water District

Improvement Category	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)	Capital Cost ($M)
Distribution System	$2.5	$0.1	$0.0	$2.6
R&R Improvements	$2.4	$1.6	$0.8	$4.8
Total	**$4.9**	**$1.7**	**$0.8**	**$7.4**
Average ($M/yr)	$1.0	$0.2	$0.1	$0.3

Note:
A detailed breakdown of all CIP projects is presented in Tables 9.7 and 9.8.
(1) There are no developer funded projects in the Wholesale Zone CIP.

As shown in Table 9.6, the total recommended Wholesale Zone CIP is $7.4 million, with $4.9 allocated to the next five years, $1.7 for 2021 through 2030, and $0.8 million for 2031 through 2040. This equates to an average expenditure of nearly $0.3 million/year. Note that this total does not include the cost of a proposed new Peters Canyon Water Treatment Plant because such a project is considered to be separate to the CIP and would require a separate source of funding. The preliminary cost estimate for the proposed new treatment plant is $17.2 M. Details are provided in TM 3.

The projected costs allocated for each priority year of the CIP are shown by improvement type in Figure 9.2.

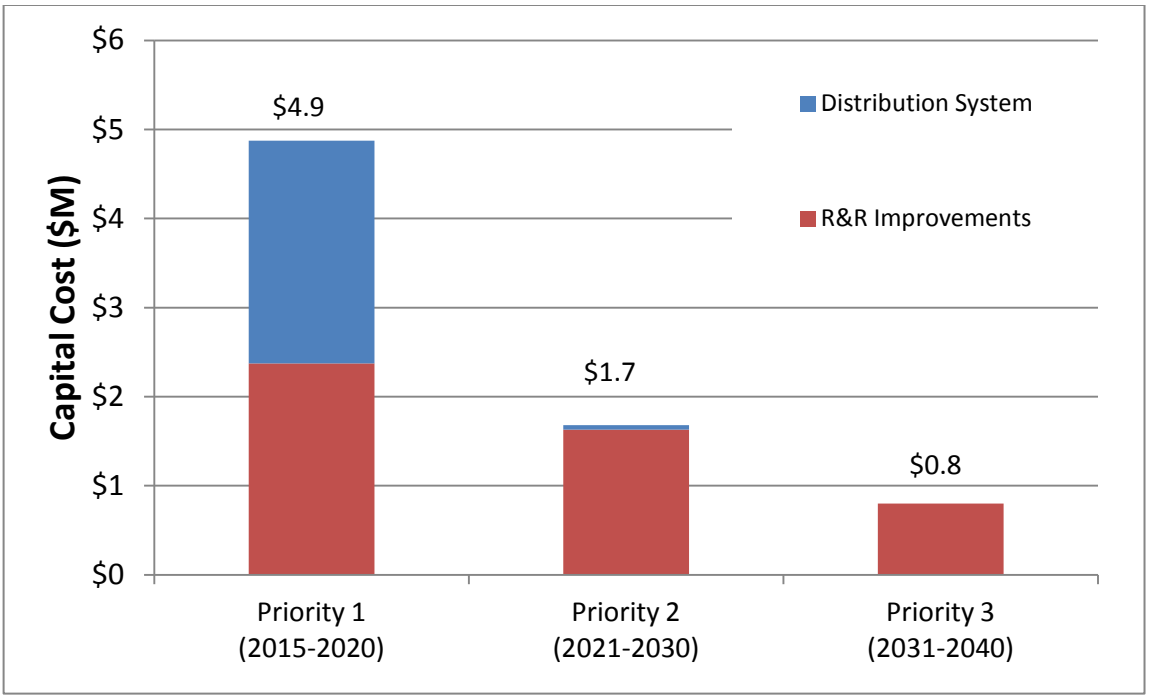

Figure 9.2 Wholesale Zone CIP by Improvement Type and Phase

As shown in Figure 9.2, projects for Priority 1 and Priority 2 phases are a combination of Distribution and R&R Improvements. Distribution System improvements are planned for the CIP during the Priority 3 phase between years 2031 and 2040.

Table 9.7 Wholesale Zone Detailed CIP for Distribution System Improvements (Draft)
East Orange County Water District

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Map ID	Project Category	Project Description	Priority (1-3)	Existing Diameter (in)	Replacement Diameter (in)	Length[1] (ft)	Quantity	Unit	Unit Construction Cost	Construction Cost[2]	Total Project Cost[2,3]	Retail System CIP	Wholesale System CIP	Top Priority (2015-2016)	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)
WZ Distribution System Improvements																	
WZ D-1	Insufficient Conveyance Capacity	Replace 12" along Newport Blvd with 16"	1	n/a	16"	n/a	5,200	n/a	$290	$1,508,000	$2,500,000	$0	$2,500,000	$0	$2,500,000	$0	$0
WZ D-2	Reliability	Replace valve at Newport Intertie (due to cavitation)	2	n/a	n/a	n/a	1	Valve	$50,000	$50,000	$50,000	$0	$50,000	$0	$0	$50,000	$0
WZ Condition Assessment Projects - Total				**n/a**	**n/a**	**0**			**n/a**	**$ 1,558,000**	**$ 2,550,000**	**$ -**	**$2,550,000**	**$0**	**$2,500,000**	**$50,000**	**$0**

1) Pipeline lenghts are rounded up to nearest 100 feet.
2) Cost estimates are rounded up to nearest $1,000.
3) Total Project Cost include a 65% markup to account for construction cost contingency, engineering, construction management, legal, and other costs.

Table 9.8 Wholesale Zone Detailed CIP for R&R Improvements (Draft)
East Orange County Water District

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Map ID	Project Category	Project Description	Priority (1-3)	Existing Diameter (in)	Replacement Diameter (in)	Length[1] (ft)	Quantity	Unit	Unit Construction Cost	Construction Cost[2]	Total Project Cost[2,3]	Retail System CIP	Wholesale System CIP	Top Priority (2015-2016)	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)
WZ Repair & Rehabilitation (R&R) Improvements																	
WZ RR-1	R&R - Reservoirs	Repair Peters Canyon (6 MG) Reservoir Roof	1	n/a	n/a	n/a	1	Roof Repair only	$767,700	$768,000	$1,273,000	$0	$1,273,000	$1,273,000	$1,273,000	$0	$0
WZ RR-2	R&R - Reservoirs	Add'l Seismic Retrofit of Peters Canyon (6 MG) Reservoir (with RR-1 complete)	2	n/a	n/a	n/a	1	Seisimc Reservoir Retrofit	$500,000	$500,000	$829,000	$0	$829,000	$0	$0	$829,000	$0
WZ RR-3	R&R - Reservoirs	Install Corrosion Protection System for 11.5 MG Andes Reservoir (ASAP due to recent recoating)	1	n/a	n/a	n/a	1	Corrosion System	$60,000	$60,000	$100,000	$0	$100,000	$100,000	$100,000	$0	$0
WZ RR-4	R&R - Pipes	Install Corrosion Protection Systems for Wholesale Zone	1	various	tbd	n/a	5	Corrosion System	$50,000	$250,000	$415,000	$0	$415,000	$0	$415,000	$0	$0
WZ RR-5	R&R - Pipes	Accoustic Field Condition Assessments WZ (1 mi/year)	1-3	various	tbd	n/a	1	miles of accousting testing	$30,000	$750,000	$750,000	$0	$750,000	$0	$150,000	$300,000	$300,000
WZ RR-6	R&R - Pipes	Other Field Condition Assessments WZ (method TBD)	1-3	various	tbd	n/a	1	LS/year	$50,000	$1,250,000	$1,250,000	$0	$1,250,000	$0	$250,000	$500,000	$500,000
WZ RR-7	R&R - Pump Stations	OC-70 PS - Corrosion improvements for instrumentation (To be funded by MWDSC)	1	n/a	n/a	n/a	1	PS retrofit	$10,000	$10,000	$10,000	$0	$10,000	$0	$10,000	$0	$0
WZ RR-8	R&R - Pressure Reducing Stations	All Wholesale PRS - Pipe Support R&R	1	n/a	n/a	n/a	2	PRS pipeline retrofit	$25,000	$50,000	$50,000	$0	$50,000	$0	$50,000	$0	$0
WZ RR-9	R&R - Pressure Reducing Stations	Orange Knoll PRS - Replace with above grade PRS	1	n/a	n/a	n/a	1	PRS retrofit	$60,000	$60,000	$60,000	$0	$60,000	$0	$60,000	$0	$0
WZ RR-10	R&R - Pressure Reducing Stations	Ethelbee PRS - Flowmeter Rehab and Corrosion Repairs	1	n/a	n/a	n/a	1	PRS retrofit	$65,000	$65,000	$65,000	$0	$65,000	$0	$65,000	$0	$0
WZ R&R Projects - Total				**n/a**	**n/a**	**n/a**			**n/a**	**$ 3,763,000**	**$ 4,802,000**	**$ -**	**$4,802,000**	**$1,373,000**	**$2,373,000**	**$1,629,000**	**$800,000**

1) Pipeline lenghts are rounded up to nearest 100 feet.
2) Cost estimates are rounded up to nearest $1,000.
3) Total Project Cost include a 65% markup to account for construction cost contingency, engineering, construction management, legal, and other costs.

Appendix A

PROJECT PRIORITIZATION MATRIX

Capital Improvement Project - Project Prioritization Matrix

Project #	Wholesale Zone	Project Description	Risk/ High Consequence of Failure	Asset Age	Hydraulic Issue	Area of Corrosive Soil	(Operational) Reliability	Hot-Spot Issue Addressed	Topo Significance	Total Score
Distribution System Improvements										
WZ D-1	Wholesale	Replace 12" along Newport Blvd with 16"	1				1			**2**
WZ D-2	Wholesale	Replace valve at Newport Intertie (due to cavitation)					1			**1**
Repair & Rehabilitation (R&R) Improvements										
WZ RR-1	Wholesale	Repair Peter's Canyon (6 MG) Reservoir Roof	1	1			1			**3**
WZ RR-2	Wholesale	Add'l Seismic Retrofit of Peter's Canyon (6 MG) Reservoir (with RR-1 complete)		1			1			**2**
WZ RR-3	Wholesale	Install Corrosion Protection System for 11.5 MG Andres Reservoir (ASAP due to recent recoating)	1	1						**2**
WZ RR-4	Wholesale	Install Corrosion Protection Systems for Wholesale Zone		1						**1**
WZ RR-5	Wholesale	Acoustic Field Condition Assessments WZ (1 mi/year)		1						**1**
WZ RR-6	Wholesale	Other Field Condition Assessments WZ (method TBD)		1						**1**
WZ RR-7	Wholesale	OC-70 PS - Corrosion improvements for instrumentation (To be funded by MWDSC)		1						**1**
WZ RR-8	Wholesale	All Wholesale PRS - Pipe Support R&R		1						**1**
WZ RR-9	Wholesale	Orange Knoll PRS - Replace with above grade PRS		1						**1**
WZ RR-10	Wholesale	Ethelbee PRS - Flowmeter Rehab and Corrosion Repairs		1						**1**
			3	**10**	**0**	**0**	**4**	**0**	**0**	**17**

EAST ORANGE COUNTY WATER DISTRICT

RETAIL ZONE SYSTEM
WATER MASTER PLAN

TECHNICAL MEMORANDUM NO. 2B
WATER SYSTEM ANALYSIS &
CAPITAL IMPROVEMENT PROGRAM

DRAFT
June 2015

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EAST ORANGE COUNTY WATER DISTRICT

PETERS CANYON WATER TREATMENT PLANT
FEASIBILITY STUDY AND MASTER PLANS

TECHNICAL MEMORANDUM
NO. 2B
WATER SYSTEM ANALYSIS AND CAPITAL IMPROVEMENT PROGRAM

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

RETAIL ZONE WATER SYSTEM ANALYSIS & CAPITAL IMPROVEMENT PROGRAM

1.0 INTRODUCTION

This technical memorandum (TM) summarizes the water system analysis and capital improvement plan (CIP) recommendations for the Retail Zone of East Orange County Water District (EOCWD or District).

The TM starts with a summary of the District's historical water demands and future water demand projections for retail. Subsequently, the water supply analysis and distribution system analysis for the Retail Zone is described. The recommendations to address system deficiencies, as well as major rehabilitation and replacement (R&R) improvements are compiled and summarized in a phased CIP. The findings presented in this memorandum will be combined with the findings from Technical Memorandum No. 1 - Water Facilities Condition Assessment to develop the District's Retail Zone Master Plan Report.

1.1 Overview

EOCWD was formed in December 1961 and currently operates under the County Water District Law. The District is an independent Special District governed by its Board of Directors elected by the voters within the District. Initially the District was formed to provide wholesale imported water to retail agencies within its boundaries.

In July 1985, EOCWD incorporated the County of Orange Waterworks District No. 8 (OWWD#8) which became known as EOCWD's Retail Zone. The original EOCWD became known as the Wholesale Zone. EOCWD provides water to a population of approximately 100,000 throughout the Wholesale Zone and Retail Zone service areas.

EOCWD receives its water from both the Lower Santa Ana River Groundwater basin, managed by Orange County Water District (OCWD) and imported water from Metropolitan Water District of Southern California (Metropolitan) through the Municipal Water District of Orange County (MWDOC). EOCWD's Retail Zone pumps groundwater from two active wells located within its service area and receives imported water treated at the Diemer Filtration Plant delivered through three imported water connections.

1.2 Service Areas

EOCWD operates as a wholesale supplier servicing central Orange County. The District's wholesale system service encompasses an area of approximately 10,000 acres is shown on Figure 1.1. The District's Retail Zone lies within the unincorporated community of Panorama Heights in the central portion of the wholesale system, as depicted on Figure 1.2

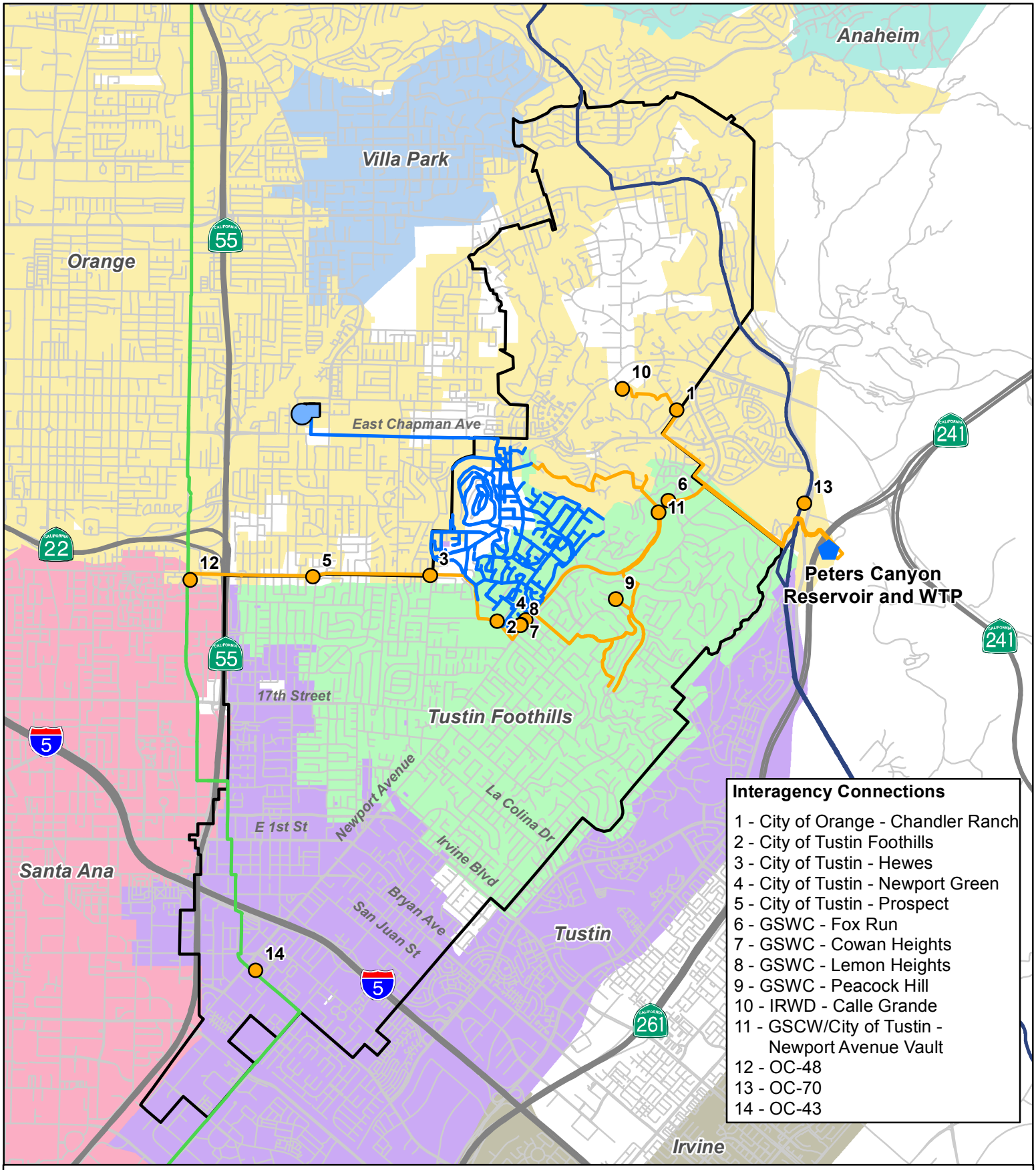

Figure 1.1
Wholesale and Retail Zone Overview
East Orange County Water District

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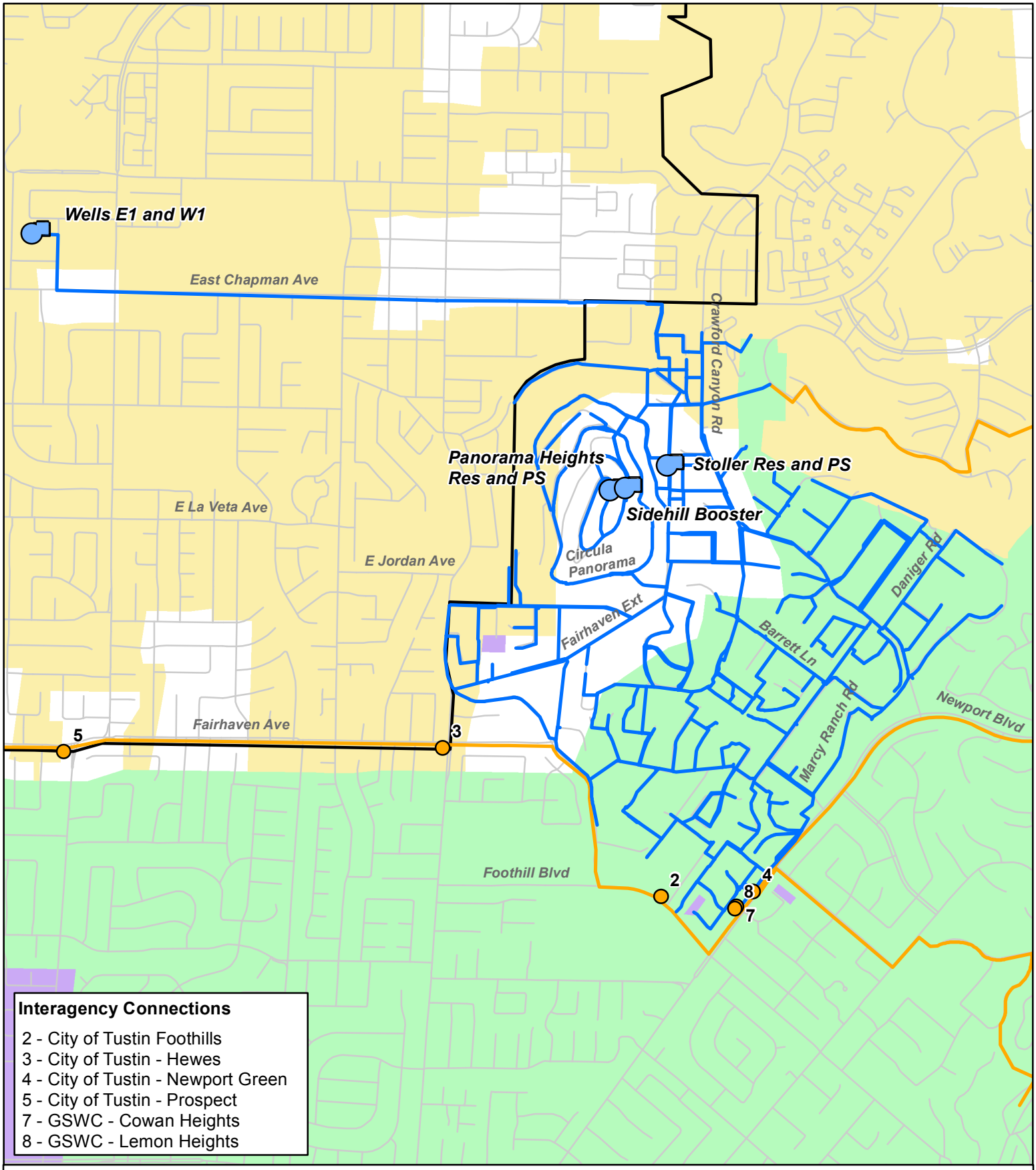

Figure 1.2
Retail Zone Overview
East Orange County Water District

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As shown on Figure 1.1, the District's Wholesale Zone includes the City of Tustin, a portion of the City of Orange, and adjoining unincorporated communities of North Tustin, East Tustin, Red Hill, Lemon Heights, Cowan Heights, Orange Park Acres, and Panorama Heights. EOCWD lies east of the Costa Mesa (55) Freeway, north of the Santa Ana (5) Freeway, west of Jamboree Road, and south of Santiago Canyon Road.

As shown on Figure 1.2, the District's Retail Zone lies within the unincorporated community of Panorama Heights in the central portion of the Wholesale Zone. It is generally bounded on the west by Hewes Avenue, on the south by Foothill Boulevard, on the east by Newport Boulevard, and Crawford Canyon Road, and on the north by Chapman Avenue.

2.0 WATER DEMAND AND SUPPLY SOURCES

This section describes the development of water demand projections to be used for the Retail Zone Water Master Plan Update.

2.1 Retail Zone

EOCWD's Retail Zone is mostly built-out with little room for new housing other than in-fill on currently vacant lots; therefore, the water demand is not anticipated to increase through the planning period. Currently, the Retail Zone has approximately 1,200 connections with 95 percent of these connections belonging to single family residential customers. The District's sole commercial customer is the Orange Country Mining Restaurant. The institutional/governmental customers include El Modena Park and Panorama Elementary School, and the agricultural customer is Sierra Farms. Historical demands and projected demands from the 2010 UWMP are presented in Table 2.1.

Table 2.1 Retail Zone System Demands
Retail Zone Water Master Plan
East Orange County Water District

Retail Zone	Historical Demand (afy)	Long-Term Demand (afy)
Imported Water	243	418
Groundwater	830	682
Retail Zone Total	**1,073**	**1,100**

The District's Retail Zone water supply source is either imported water through the Wholesale Zone or water that is pumped from groundwater wells. The historical water demand for the Retail Zone is 1,073 afy, comprised of 243 afy of imported water and 830 afy of groundwater. Because there is no expected growth in the District's Retail Zone, it was assumed that the demand projected in the 2010 UWMP will remain constant through the planning horizon. This is a conservative planning approach given that water demand

may decline in the future due to continued conservation measures in response to the ongoing drought.

The projected water demand for the Retail Zone is therefore 1,100 afy, with 418 afy supplied through imported water and 682 afy supplied through groundwater production. The decrease in groundwater supply is based on an assumed percentage of groundwater available to meet the total demand for the Retail Zone system. The source water blend is typically 62 percent groundwater and 38 percent imported water, which will remain roughly the same through the planning horizon.

Local groundwater pumped from the Lower Santa Ana River Groundwater Basin is managed by Orange County Water District (OCWD); however, the basin is not adjudicated. The amount of water each agency is allowed to pump out of the basin each year is based on the Basin Production Percentage (BPP) established by OCWD. The BPP depends on groundwater conditions, availability of recharge supplies, and basin management objectives and historically has ranged from 60 to 80 percent. For planning purposes in the 2010 UWMP, is was assumed that the BPP would remain constant at 62 percent, a conservative estimate.

The peaking factors to determine MDD and PHD based on the long-term projected demand (or ADD) of 1,100 afy or 1.0 mgd are presented in Table 2.2.

Table 2.2 Peaking Factors
Retail Zone Water Master Plan
East Orange County Water District

Retail Zone	Average Day Demand (mgd)	MDD/ADD Peaking Factor	Maximum Day Demand (mgd)	PHD/MDD Peaking Factor	Peak Hour Demand (gpm)
Imported Water	0.4	2.0	0.8	1.7	944
Groundwater	0.6	2.0	1.2	1.7	1,417
Total	**1.0**	**2.0**	**2.0**	**1.7**	**2,361**

As shown in Table 2.2, the ADD is approximated at 1.0 mgd. The MDD to ADD peaking factor is determined to equal 2.0; therefore, the total MDD for the Retail Zone system in 2.0 mgd. A peaking factor of 1.7 is applied to the MDD to determine the PHD of 2,361 gpm for the Retail Zone system. As discussed previously, 62 percent of the Retail Zone demands are supplied from groundwater and the remaining 38 percent is supplied from imported water through the District's Wholesale Zone.

3.0 EXISTING SYSTEM

3.1 Wholesale and Retail Zone Layout

The District's water distribution system is comprised of two separate systems, named; the Wholesale Zone and the Retail Zone. The Wholesale Zone conveys imported water from Metropolitan through MWDOC connections to the EOCWD member agencies. The Retail Zone conveys either imported water or groundwater to the District's retail customers, which are mostly residential as described in the previous section. The entire system consists of approximately 60 miles of pipeline. A schematic of the entire EOCWD distribution system is shown on the hydraulic profile on Figure 3.1. This technical memorandum focuses on the Retail Zone.

3.2 Description of Existing Facilities

The following sections describe the Retail Zone in more detail.

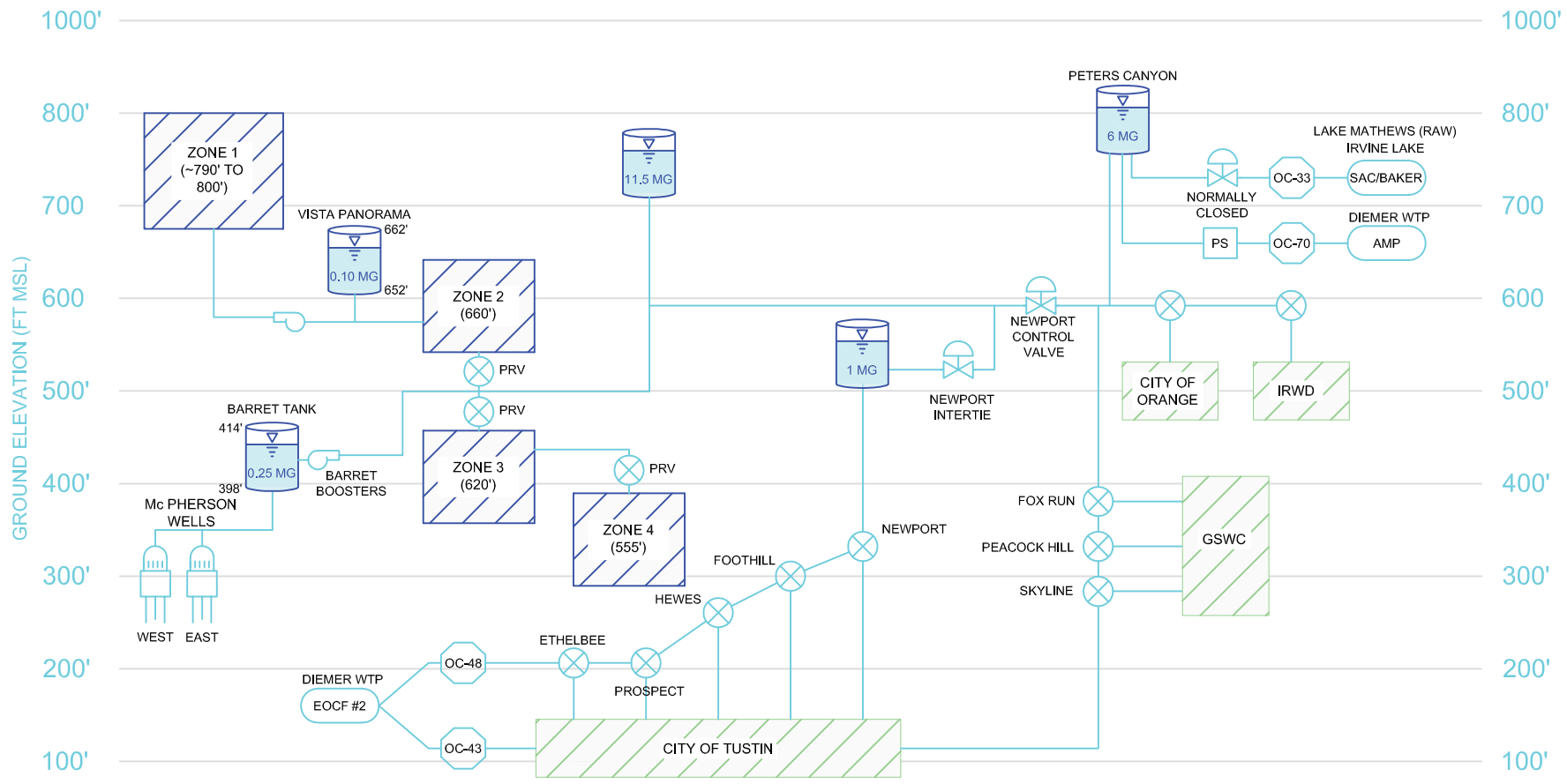
3.2.1 Retail Zone

The Retail Zone is supplied with water from either the Wholesale Zone (imported water) or two groundwater wells. The groundwater wells, East Well and West Well, are located at the McPherson Well Field and pump water from the Lower Santa Ana Groundwater Basin. Storage capacity in the Retail Zone is provided by the 11.5 MG Reservoir, the Vista Panorama 0.10 MG Reservoir, and the Barret 0.25 MG Reservoir. In addition, there are three PRS and four booster pump stations within the Retail Zone system. The Retail Zone Facilities supply water to four pressure zones (Zones 1, 2, 3, and 4) and are shown on Figure 3.2.

The primary source of water for the Retail Zone is from the Wholesale Zone through the shared 11.5 MG Reservoir which is also connected to the 736 pressure zone in the Wholesale Zone system. A 16-inch diameter pipeline conveys water from the 11.5 MG Reservoir to PRS facilities located at Barret Reservoir. The Barret Reservoir site includes the reservoir, two booster pumps, and two PRS facilities. The second source of water for the Retail Zone system is from groundwater that is pumped to the Barret Reservoir through a 14-inch pipeline. The two booster pumps at Barret Reservoir pump water to the upstream side of the two PRS facilities located at the site. One PRS with a 135 pounds per square inch (psi) setting serves Zone 2 which also fills the Vista Panorama Reservoir. The second PRS has two valves, which serve Zone 3. The 6-inch diameter valve is set to deliver water at 100 psi, while the 10-inch diameter valve is set to deliver water at 90 psi. Approximately 89 percent of the District's total Retail Zone demand is located within Zone 3.

Zone 1 is a small hydropneumatic zone that is served by a pump station located at the Vista Panorama Reservoir site. Zone 4 is located in the southeast portion of the Retail Zone and is served through Zone 3 with a PRS at a pressure setting of 110 psi.

C:\pw_working\projectwise\bhawes\d0324205\Figure 1_EOCWD Hydraulic Profile



LEGEND

FACILITIES

- Groundwater Well
- Reservoir (1.0 MG) — Volume Inside Tank; HWL= High Water Level (ft msl)
- Booster Pumping Station
- Pressure Regulating Station
- Interagency Connector
- OC-XX — Imported Water Connection
- Imported Water Feeders
- ZONE (HGL) — Pressure Zone; HGL: Hydraulic Grade Line For Zone
- NAME — Wholesale Agency Systems

Figure 3.1
Hydraulic Profile
East Orange County Water District

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To East and West Wells

Chapman Ave

Chapman Ave

West View Dr

Barret Reservoir
Zone 2 PRS
Zone 3 PRS

To 11.5 MG Reservoir

Vista Panorama Reservoir

Hewes St

Crawford Canyon Rd

Fowler Ave

Newport Blvd

Foothill Blvd

Hewes Ave

Zone 4 PRS

Newport Ave

Arroyo Ave

Legend

- Pressure Reducing Station
- Storage Reservoirs
- Streets

Zones

- 1
- 2
- 3
- 4

Pipes By Diameter

- < 6-inches
- 6-inch
- 8-inch
- 10-inch
- 12-inch
- 14 to 18 Inches
- 20 to 24-inches
- > 24-inches

N

0 490 980 Feet

Figure 3.2
Retail Zone Facilities
East Orange County Water District

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A summary of the Retail Zone Facilities is provided in Table 3.1.

Table 3.1 Retail Zone Facilities
Retail Zone Water Master Plan
East Orange County Water District

Groundwater Wells				
Facility Name	**From**	**To**	**Pumping Head (ft)**	**Capacity (gpm)**
Mc Pherson East Well	OC Basin	Barret Tank	500	1,000
Mc Pherson West Well	OC Bain	Barret Tank	500	600
Reservoirs				
Facility Name	**Zone HGL (ft)**	**Height (ft)**	**Diameter (ft)**	**Volume (MG)**
Barret Tank	414	16	52	0.25
Vista Panorama	662	10	46.5	0.1
Booster Pumping & Pressure Reducing Stations				
Facility Name	**From**	**To**	**Upstream HGL (ft)**	**Downstream HGL (ft)**
Barret PS	Barret Tank	11.5 MG Reservoir Pipeline	414	736
Barret Tank Zone 2 PRS	11.5 MG Reservoir Pipeline	Zone 2	736	660
Barret Tank Zone 3 PRS	11.5 MG Reservoir Pipeline	Zone 3	736	620
Zone 4 PRS	Zone 3	Zone 4	620	555

3.2.1.1 Retail Zone Demands by Pressure Zone

The Retail Zone demands used for hydraulic modeling analysis are summarized in Table 3.2. These demands are based on the demand projections described in the Section 2 and are separated by pressure zone. The demands were allocated to demand nodes throughout the distribution system.

As shown in Table 3.2, Zone 3 has the greatest Retail Zone demand with approximately 615 gpm for ADD and 1,230 for MDD conditions. This accounts for approximately 88 percent of the total demand for the Retail Zone. The total MDD and PHD used for the hydraulic analysis was 1,389 gpm and 2,361 gpm, respectively.

Table 3.2 Hydraulic Modeling Demands Retail Zone Water Master Plan East Orange County Water District				
Pressure Zone No (HGL in ft)	**Average Day Demand (gpm)**	**Maximum Day Demand (gpm)**	**Peak Hour Demand (gpm)**	**Fraction of Total Retail Zone Demand (%)**
1 (790)	22	45	76	3
2 (660)	46	92	156	7
3 (620)	615	1,230	2,090	88
4 (555)	11	23	38	2
Total	**695**	**1,389**	**2,361**	**100**

4.0 DISTRICT IDENTIFIED POTENTIAL ISSUES

This section presents the pipelines that District Operations staff identified with potential issues. The potential issues refer to problematic areas within the District's Retail Zone where pipelines are either undersized, located in "hot" soils, experiencing frequent breakages, or a combination of all three. Some of these identified potential issues occur on pipelines that are critical to water delivery. Table 4.1 provides a summary of the identified potential issues and Figure 4.1 maps each location.

As shown in Table 4.1, the majority of the identified potential issues are located on 4-inch diameter pipeline segments that are less than 1,000 feet in length. Two replacement projects of undersized 4-inch diameter pipe along Fowler Avenue total approximately 2,600 feet. Projects with Map IDs 10 and 11 are replacement of an 8-inch diameter pipeline with several service laterals that has experienced multiple breaks in the past.

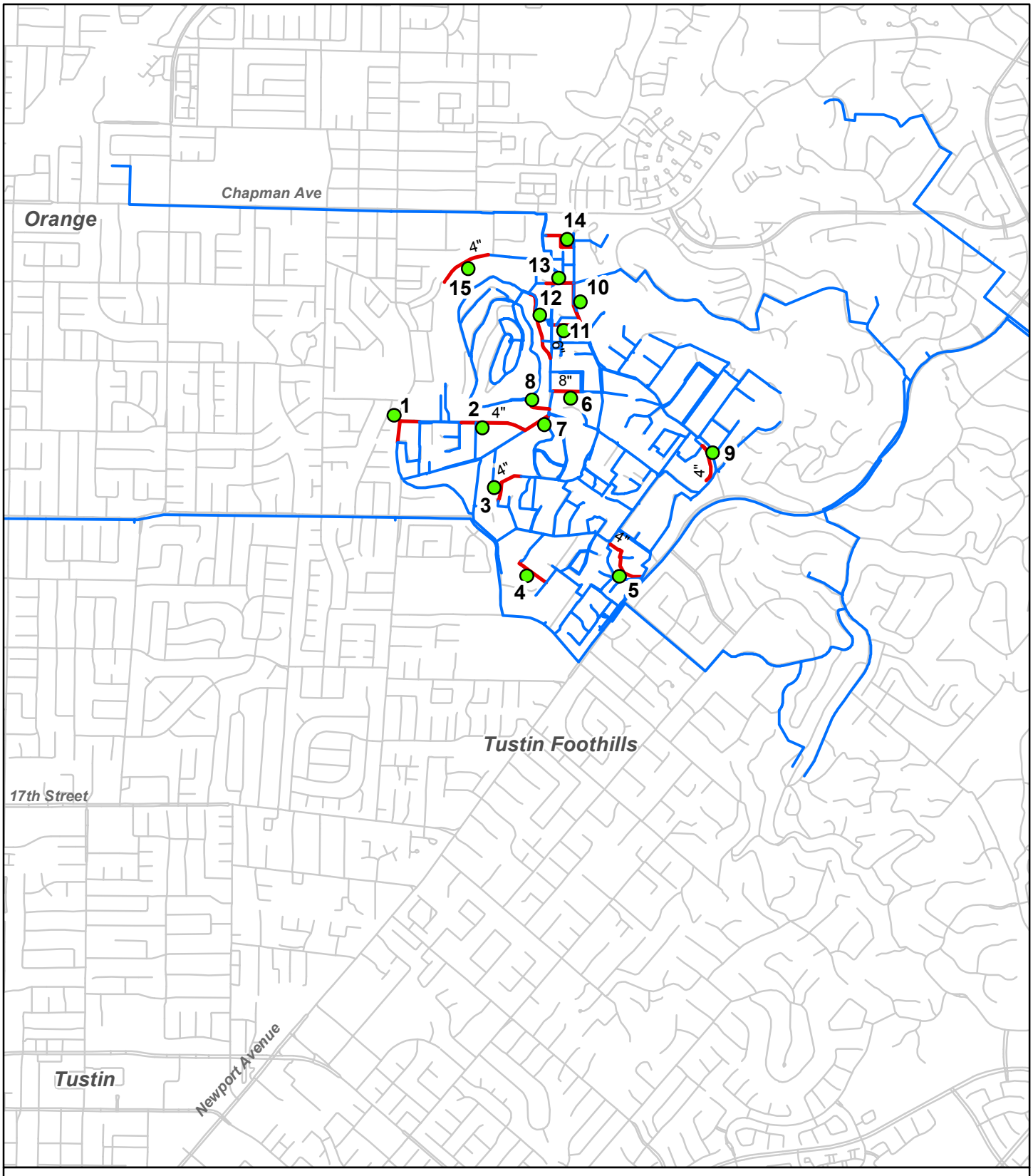

Figure 4.1
Retail Zone
District Identified Potential Issues
East Orange County Water District

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Table 4.1	District Identified Potential Issues Retail Zone Water Master Plan East Orange County Water District	
Map ID	**Description**	**Length (ft)**
1	Replace undersized 4" pipeline along Fowler Ave & S. Hewes St	1,500
2	Replace undersized 4" pipeline along Fowler Ave & Charmaine Ln	1,100
3	Replace 4" pipeline along Via Aventura due to hot soil	700
4	Replace undersized 4" pipeline along XX Driveway due to hot soil	600
5	Replace undersized 4" pipeline along Kiersy Place	900
6	Replace 8" pipeline on Fairhaven Extension due to extensive repairs	500
7	Replace 6" pipeline along Fairhaven Extension due to hot soil	500
8	Upsize 4" pipeline along Fairhaven Extension and Circula Panorama for future PRS	500
9	Replace undersized 4" pipeline along Pine Canyon Road	700
10	Relocate services along 8" pipeline in Crawford Canyon Road due to main breaks	n/a
11	Repair coupling for service laterals on Crawford Canyon Road	500
12	Upsize 6" pipeline to 12" pipeline along Circula Panorama for future PRS	500
13	Repair 8" pipeline along Stoller Lane	500
14	Install future connection at E. Los Arboles Avenue	600
15	Replace undersized 4" pipeline along E. Smiley Drive	300

5.0 AGE-BASED ANALYSIS

This section presents the findings from a pipeline age analysis that was performed on the District's available GIS-based pipeline data. The age analysis was used to help identify the estimated pipeline replacements that will be needed through the 2040 planning period.

5.1 Existing Retail Zone System

Based on available GIS data, the District's Wholesale and Retail Zones have a combined total of approximately 37 miles of pipeline. The Retail Zone accounts for approximately 24 miles of the total pipe. Pipe materials for the Retail Zone vary and are listed in Table 5.1.

Table 5.1 Pipeline Material Distribution Retail Zone Water Master Plan East Orange County Water District		
Pipeline Material	**Retail Zone (Miles)**	**Percent of Retail Zone (%)**
Asbestos Concrete	10.4	43%
Concrete	0	0%
Ductile Iron	3.5	15%
Galvanized	0.1	<1%
PVC	5.4	22%
Steel Mortar Coated	4.7	20%
Unknown	0	0%
Total	**24.1**	**100%**

Note:
(1) Data based on EOCWD pipeline geodatabase.

As shown in Table 5.1, approximately 43 percent of the pipe in the Retail Zone is asbestos concrete. The second and third most frequently used pipe material is polyvinyl chloride (PVC) pipe and steel mortar coated pipe, which represent approximately 22 and 20 percent of the Retail Zone, respectively. Approximately 3.5 miles, or 15 percent, of the Retail Zone pipes are ductile iron.

The installation years for the pipes in the Retail Zone are presented in Table 5.2.

Table 5.2 Pipeline Age Distribution Retail Zone Water Master Plan East Orange County Water District		
Pipeline Installation Decade	**Retail Zone (Miles)**	**Percent of Retail Zone (%)**
1950-1959	5	21%
1960-1969	1.7	7%
1970-1979	5.5	23%
1980-1989	3.6	15%
1990-1999	6.8	28%
Other	1.6	7%
Total	**24.2**	**100%**

Note:
(1) Data based on EOCWD pipeline geodatabase

Approximately five miles of the Retail Zone was installed in the 1950s, while the majority of the Retail Zone expansion occurred from the 1970s through the 1990s. This span of three decades added approximately 16 miles, or 66 percent, of the total pipe in the Retail Zone. Since the 1990s, only an additional 1.6 miles of pipe have been added to the Retail Zone.

The distribution of pipeline diameters for the Retail Zone is summarized in Table 5.3.

Table 5.3 Pipeline Diameter Distribution
Retail Zone Water Master Plan
East Orange County Water District

Pipeline Diameter (inches)	Retail Zone (Miles)	Percent of Retail Zone (%)
3”	3.1	13%
4”	0.1	<1%
5”	4.4	18%
6”	10.1	41%
8”	0.2	1%
10”	1.7	7%
12”	3.4	14%
14”	0.3	1%
16”	0	0%
18”	0	0%
20”	0	0%
21”	0	0%
24”	0	0%
27”	0.1	<1%
45”	0.1	<1%
Unknown	0.9	4%
Total	**24**	**100%**

Note:
(1) Data based on EOCWD pipeline geodatabase

As shown in Table 5.3, 6-inch diameter pipelines represent the largest percentage of the Retail Zone accounting for approximately 10 miles, or 41 percent, of the total 24 miles.

5.2 Analysis Methodology

The age replacement analysis consisted of using pipeline age and material data from EOCWD’s GIS database to estimate when pipelines in the distribution system will require replacement.

Remaining useful life (RUL) can be estimated, in years, using a single assumed pipe age (based on pipe material) or can be based on a range of years, referred to as a pipe material's replacement period (RP). The analysis developed four pipe replacement forecasts. These are:

- Fixed replacement age
- Full Replacement Period
- 50 percent of full replacement period
- 25 percent of full replacement period

The approach using four forecasts was used in order to determine the effect of adopting various smoothing functions (replacement curves) across the replacement horizon. The calculation of the replacement period (RP) for each of these four methods is graphically depicted on Figure 5.1 and described in more detail in the text following the figure.

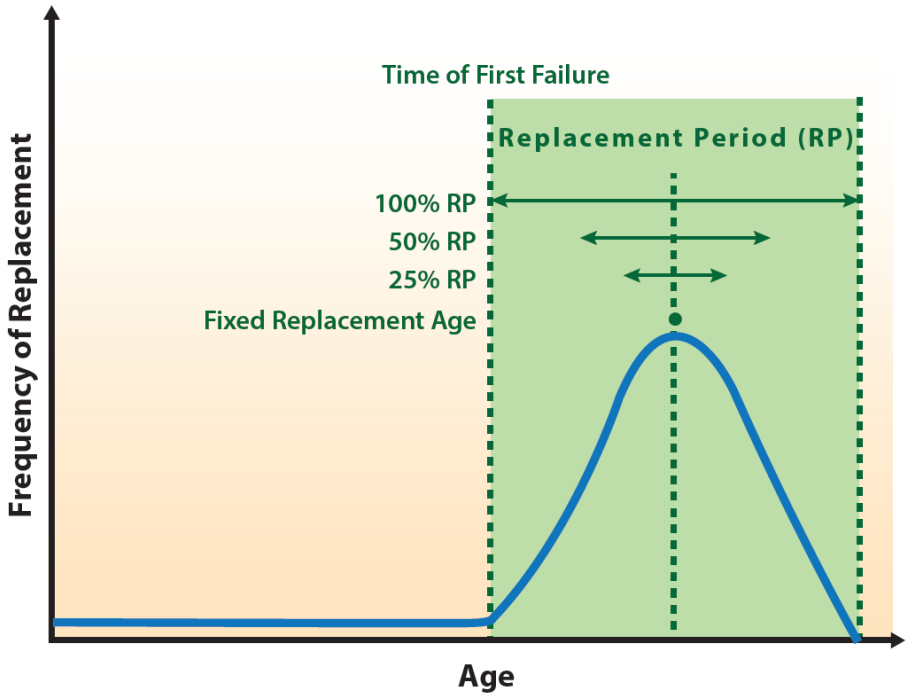


Figure 5.1 Pipeline Age Analysis Model

Several key assumptions are associated with the replacement forecast. The primary assumption is that each pipe material has an average age of failure. This is a critical assumption because soil and water corrosivity, bedrock stability, tree roots, construction methods, and other factors all contribute to the age of failure.

For the fixed replacement age analysis, the average age of failure was simply added to the year of installation in order to determine a year of failure and replacement. For the analyses utilizing a replacement period, each material was assigned a time to first failure, followed by a replacement period. It was assumed that each pipe will require replacement during its replacement period. For example, asbestos concrete is assumed to have a time to first failure of 60 years. The replacement curve extends from year 60 to year 120, based on a replacement period of 60 years. It is assumed, therefore, that all asbestos concrete pipes will fail sometime between 60 and 120 years from their installation date.

A spreadsheet model was used to calculate each of the four replacement forecasts for every pipeline in the system. This model is called the below ground asset management (BAM) model. The BAM model assumes that the failure distribution during the replacement period follows a normal distribution pattern, typically expressed as a bell curve. For the fixed replacement age calculations, the mean of the replacement curve was used.

As shown in Figure 5.1, no pipe replacement is anticipated until the time to first failure. For replacement period forecasts, pipe failure is calculated to occur during the replacement period, represented by the curve in Figure 5.1. For the fixed replacement age analysis, replacement is assumed based on the average useful life, and therefore equals install year plus the average of the replacement period.

The pipe material age assumptions for each pipe material are shown below in Table 5.4.

Table 5.4 Pipeline Replacement Period Assumptions
Retail Zone Water Master Plan
East Orange County Water District

Material	Average Life (Years)	First Failure (Years)	Replacement Period (Years)	50% Replacement Period[(1)] (Years)	25% Replacement Period[(2)] (Years)
Asbestos Concrete	90	60	60	30	15
Ductile Iron	75	50	50	25	13
PVC	115	70	90	45	23
Galvanized	50	40	20	10	5
Steel	80	70	20	10	5
Steel Mortar	100	70	60	30	15
Concrete	80	70	20	10	5

Notes:
(1) A replacement period equal to one half of the normal replacement period. Average lifespan is assumed to be unchanged, therefore is increased to account for the smaller replacement period.
(2) A replacement period equal to one quarter of the normal replacement period.

As shown in Table 5.4, an average pipe lifespan is assumed to range from 75 years for ductile iron pipe materials, to 115 years for PVC pipes. These age based failure rates are based on American Water Works Association (AWWA) research and data, but are often adjusted to account for location specific variables.

The exact replacement period range for each material is fully detailed in Table 5.5.

Table 5.5 Pipeline Replacement Period Methods
Retail Zone Water Master Plan
East Orange County Water District

Material	Fixed Replacement Age (Years)	100% Replacement Period (Years)	50% Replacement Period (Years)	25% Replacement Period (Years)
Asbestos Concrete	90	60-120	75-105	82.5-97.5
Ductile Iron	75	50-100	62.5-87.5	68.8-81.3
PVC	115	70-160	92.5-137.5	103.8-126.3
Galvanized	50	40-60	45-55	47.5-52.5
Steel	80	70-90	75-85	77.5-82.5
Steel Mortar	100	70-130	85-115	92.5-107.5
Concrete	80	70-90	75-85	77.5-82.5

As shown in Table 5.5, the 25 percent replacement period method assumes considerably shorter replacement windows compared to the 50 percent and 100 percent replacement period methods. This was the variable used to control the smoothness of the replacement forecast.

5.3 Results

5.3.1 Fixed Replacement Age Method

The projected pipeline replacements needed, assuming that all the pipes in the system will require replacement at the end of the estimated average life of material, is shown in Figure 5.2. The estimated life of material corresponds to the Fixed Replacement Age column in Table 5.4 (column 2).

As shown in Figure 5.2, this approach to pipe replacement yields a very “spiky” forecast of pipeline replacement needs. There is only 0.1 mile of replacement identified before year 2040, which is the planning horizon of this water master plan. The remaining 23.3 miles of pipeline are all projected to require replacement after year 2040, a significant number of replacements in 2051, 2065 and 2067.

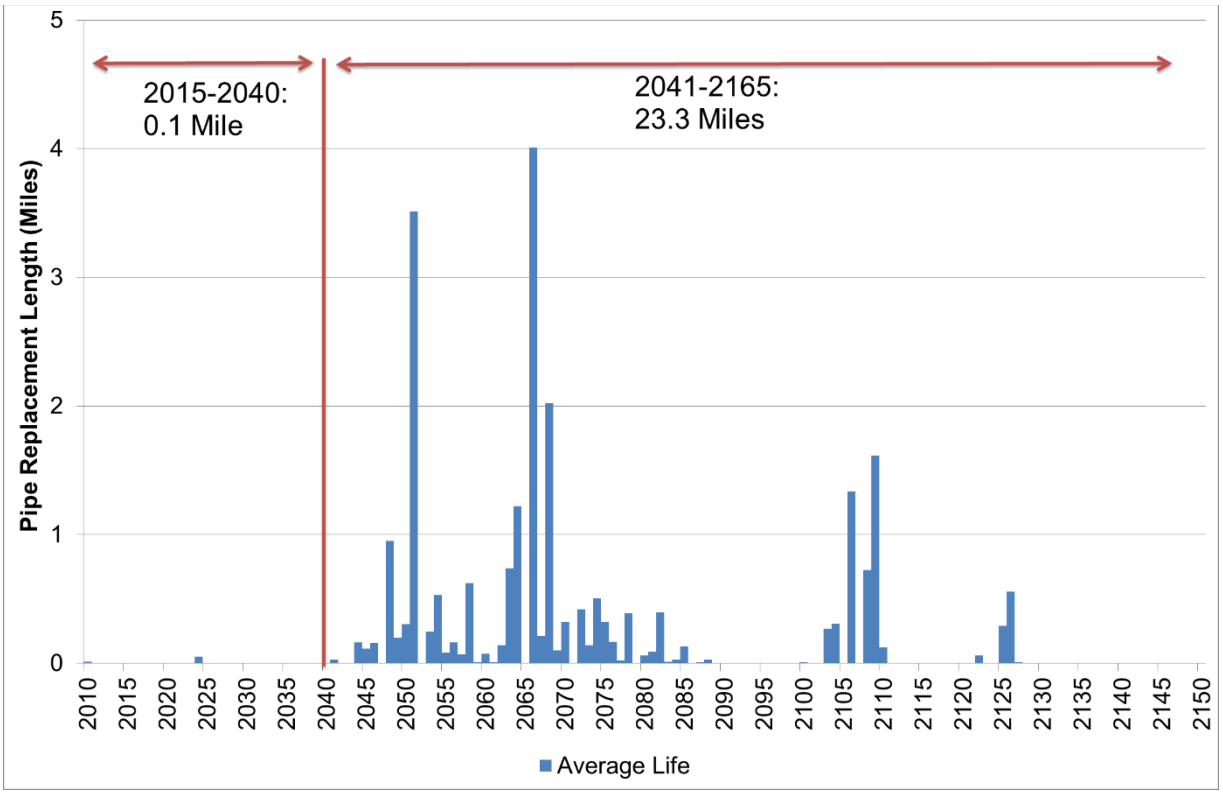


Figure 5.2 Pipeline Age Replacement - Fixed Age

5.3.2 Full Replacement Period

The projected pipeline replacements requirements, assuming that all pipes in the system will require replacement sometime during the full (or 100 percent) replacement period, is shown in Figure 5.3. In this forecast, the lifespan of each pipeline was generated by adding a randomly distributed value (in years) from 100 percent of the corresponding replacement period listed in Table 5.5 to the age at first failure.

As shown in Figure 5.3, the use of the full replacement period results in a longer and less uneven replacement forecast. With this method, 3.1 miles of replacements are identified before year 2040, while the remaining 20.3 miles of pipeline are all projected to require replacement after year 2040. Due to the smoothing effect of utilizing the full replacement period, the maximum length of replacement is also reduced from 4 miles to less than 1.5 miles in a single year.

The assumption that all pipelines of a given material will require replacement over a range of years instead of a uniform, exact average life has the effect of spreading replacement out across the planning horizon. In utilizing the full (100 percent) replacement period, replacements will occur continually beginning in roughly year 2020 and continue through year 2150.

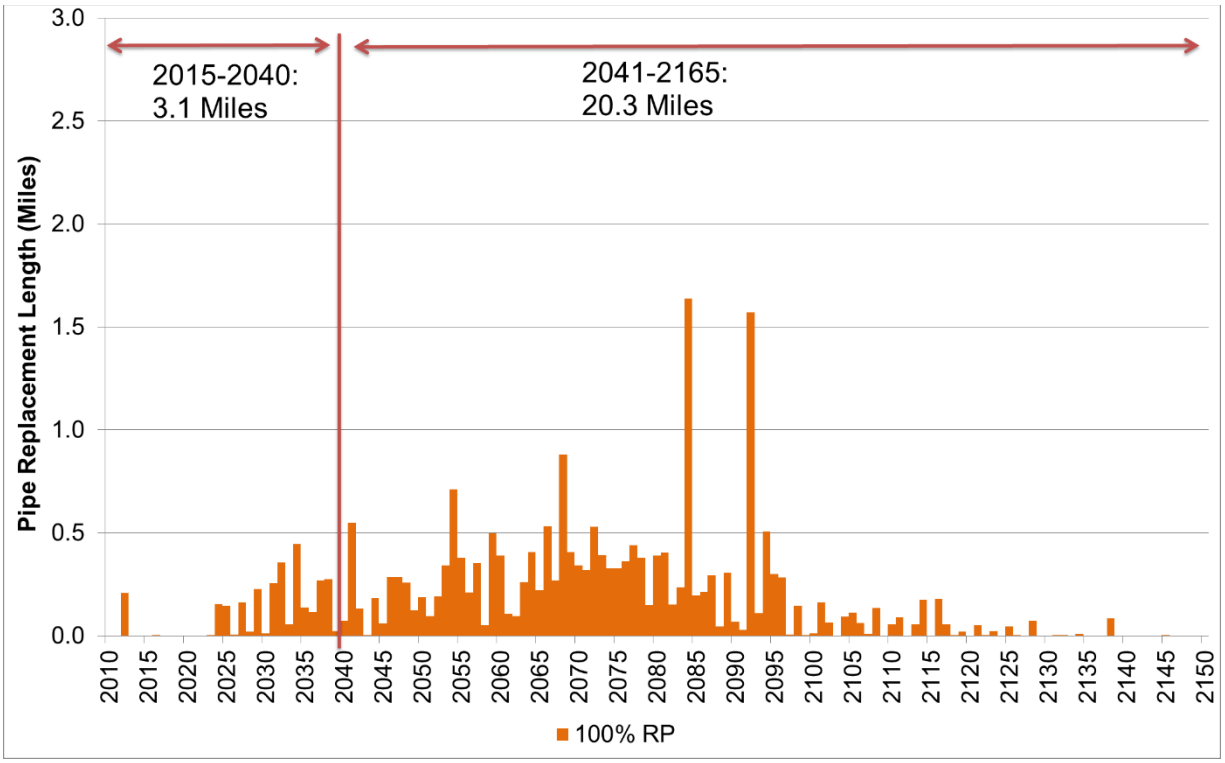


Figure 5.3 Pipeline Age Replacement - Full Replacement Curve

5.3.3 50 Percent Replacement Period

The projected pipeline replacements requirements, assuming that all pipes in the system will require replacement sometime during half (or 50 percent) of the full replacement period, is shown in Figure 5.4. In this forecast, the lifespan of each pipeline was generated by adding a randomly distributed value (in years) from 50 percent of the corresponding replacement period listed in Table 5.5 to the age at first failure.

As shown in Figure 5.4, the use of the half the replacement period results in a shorter and more uneven replacement forecast than the full replacement forecast method. With this method, about 2.3 miles of replacements are identified before year 2040, while the remaining 21.1 miles of pipeline are all projected to require replacement after year 2040. Due to the smoothing effect of utilizing half of the full replacement period, the maximum length of replacement is also reduced from 4 miles to approximately 1.5 miles in a single year compared to the fixed replacement method.

The assumption that all pipelines of a given material will require replacement over a range of years instead of a uniform, exact average life has the effect of spreading replacement out across the planning horizon. In utilizing the half of the full (or 50 percent) replacement period, replacements will occur continually beginning in roughly year 2035 and continue through year 2140.

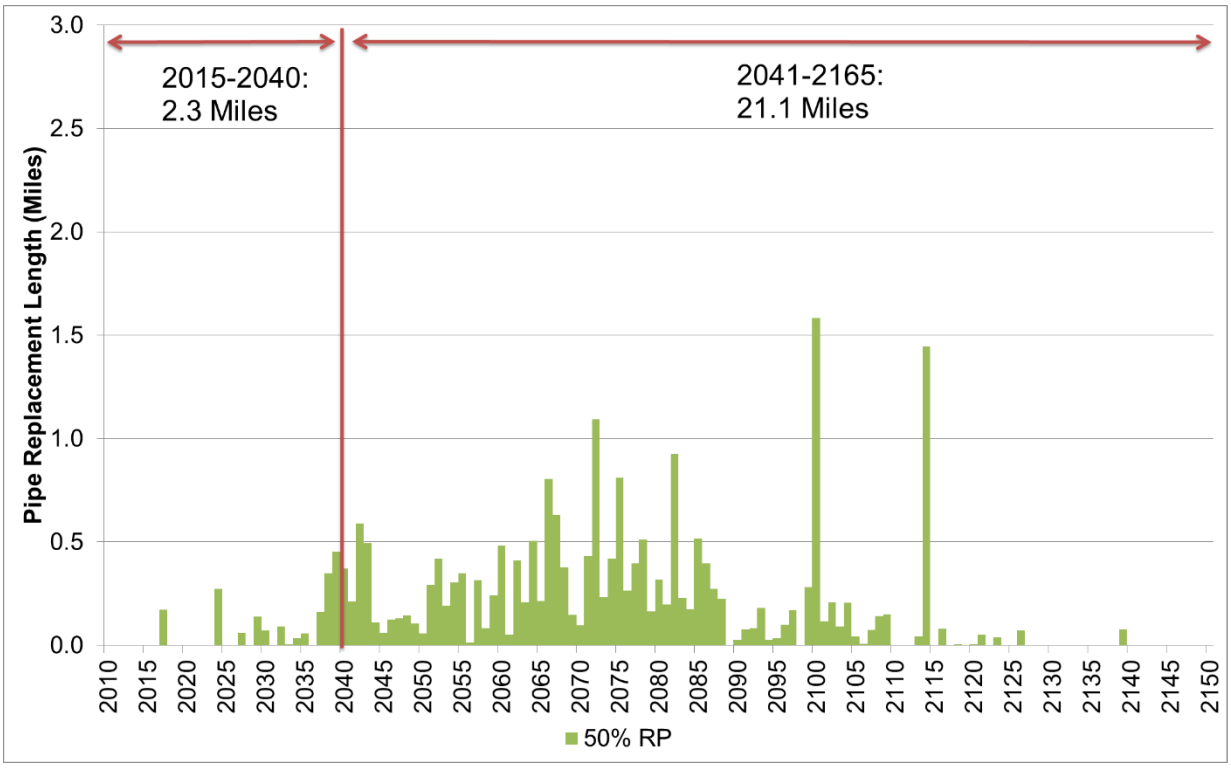


Figure 5.4 Pipeline Age Replacement - Half Replacement Curve

5.3.4 25 Percent Replacement Period

The projected pipeline replacements requirements, assuming that all pipes in the system will require replacement sometime during one quarter (or 25 percent) of the full replacement period, is shown in Figure 5.5. In this forecast, the lifespan of each pipeline was generated by adding a randomly distributed value (in years) from 25 percent of the corresponding replacement period listed in Table 5.5 to the age at first failure.

As shown in Figure 5.5, the use of 25 percent of the full replacement period results in a similar replacement forecast than the 50 percent replacement forecast method. With this method, about 1.6 mile of replacements are identified before year 2040, while the remaining 21.8 miles of pipeline are all projected to require replacement after year 2040. Due to the smoothing effect of utilizing only 25 percent of the full replacement period, the maximum length of replacement is also higher than at almost 3 miles miles in a single year when compared to the 50 percent replacement method.

The assumption that all pipelines of a given material will require replacement over a range of years instead of a uniform, exact average life has the effect of spreading replacement out across the planning horizon. In utilizing only 25 percent of the full replacement period, replacements will occur continually beginning in roughly year 2030 and continue through year 2130.

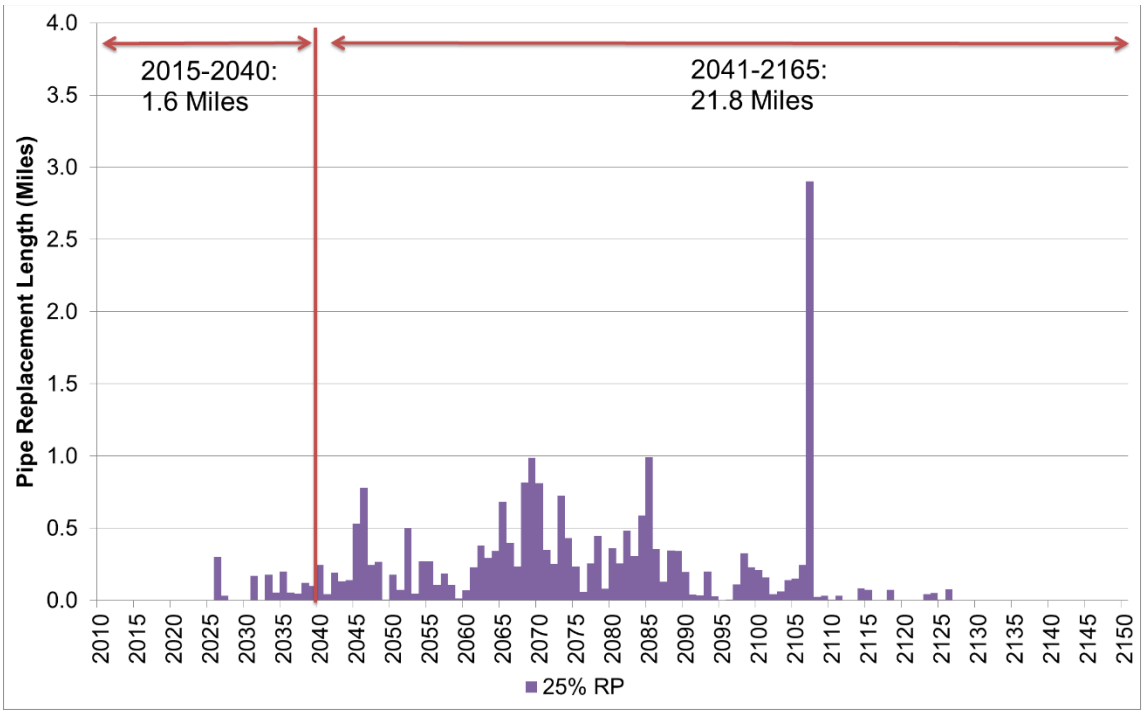


Figure 5.5 Pipeline Age Replacement - Quarter Replacement Curve

5.3.5 Pipeline Age Replacement Summary

The greatest concentration of pipeline replacement under all methods begins in 2040 and goes until about 2075. The full replacement period forecast projects replacements to begin slightly earlier in year 2025, while the fixed age forecast predicts a few specific years with very high replacement rates. The selection of the method will mostly impact the number of pipeline replacements that will fall within the planning horizon of this water master plan. As discussed, the total replacement length before 2040 ranges from 0.1 mile (Fixed Age), to 1.6 miles (25 percent RP), to 2.3 miles (50 percent RP) and 3.1 miles (100 percent RP).

6.0 HYDRAULIC EVALUATION CRITERIA

This section presents the planning criteria and methodologies for the hydraulic analysis used to evaluate the existing and future Retail Zone system.

The Retail Zone was evaluated under a range of normal and emergency operating conditions. The normal operating conditions are: ADD, PHD, MDD, and MDD plus Fire Flow.

Hydraulic evaluation criteria are required to determine the performance of the District's water system under the range of operating conditions as discussed above to identify system deficiencies and improvement projects to address them. Under each operating condition, the capacities and performance of the water system are compared with the evaluation criteria to determine which pipelines or water facilities need to be upgraded or replaced. The evaluation criteria for water systems consist of the following categories:

- System Pressure
- Pipeline Velocity

A list of recommended criteria used in the evaluation of the District's Retail Zone is presented in Table 6.1. Detailed descriptions for each evaluation criterion are provided in the following subsections.

6.1 System Pressures

Minimum system pressures are evaluated under two different conditions: PHD and MDD plus fire flow. Maximum system pressures are evaluated under ADD. The minimum pressure criterion for normal PHD conditions is 40 pounds per square inch (psi), while the minimum pressure criterion under MDD with fire flow conditions is 20 psi. The pressure analysis is limited to demand nodes, because only locations with service conditions need to meet such pressure requirements. Lower pressures are only acceptable for junctions at water system facilities and on transmission mains. However, no pressure shall be less than 5 psi to avoid potential contamination through groundwater intrusion.

Maximum system pressures are evaluated under the ADD scenario. The maximum pressure criterion for normal ADD conditions is 80 psi for service connections without individual pressure-reducing valves. In areas where the maximum pressure exceeds 80 psi, individual pressure-reducing valves are required on service connections; however, the system pressure shall generally not exceed 150 psi.

Table 6.1 Potable Water System Evaluation Criteria Retail Zone Water Master Plan East Orange County Water District		
Description	**Value**	**Units**
Maximum Pressure		
Without individual pressure regulator at meter	90	psi
With individual pressure regulator at meter	150	psi
Minimum Pressure		
Peak Hour Demand (PHD)	40	psi
Maximum Day Demand (MDD) + Fire Flow	20	psi
Pipeline Criteria		
Maximum Velocity with PHD	5	fps
Maximum Velocity with MDD + Fire Flow	10	fps
Hazen-Williams C-factor		
Pipelines equal or less than 12-inch diameter	120	n/a
Pipelines greater than 12-inch diameter	130	n/a
Minimum Size for Pipeline Replacement	8	Inches
Fire Flow Requirements(1)		
Residential	1,500	gpm for 2 hours
Commercial	3,000	gpm for 3 hours
Schools	3,000	gpm for 4 hours
Park and Open Space	1,000	gpm for 1 hour
Storage Volume		
Operational	30% of MDD	MG
Fire Fighting Storage	Max. Fire Flow demand x duration	MG
Emergency Storage	100% of MDD	MG
Pump Station Capacity(2)		
Zones with gravity storage	Meet MDD + Fire Flow with largest unit out-of-service by pressure zone	gpm
Zones without gravity storage	Meet PHD + Fire Flow with largest unit out-of-service by pressure zone	gpm

6.2 Pipeline Velocities

Pipeline velocities are evaluated using two different maximum velocity criteria for selected flow conditions under the demand scenarios. For transmission and distribution pipelines, a maximum velocity of 5 feet per second (fps) and 10 fps were used for peak hour demand conditions and MDD plus fire flow, respectively. Fire hydrant laterals are excluded from these criteria, as higher velocities are acceptable. Ideally, all transmission and distribution pipelines should have maximum velocities less than 8 fps in order to minimize headloss; however, higher velocities in existing pipelines is not, by itself, sufficient justification for pipeline replacement.

7.0 HYDRAULIC EVALUATION

This section presents the findings and improvement recommendations based on the hydraulic analysis performed for the Retail Zone under the future demand conditions. The hydraulic model scenarios were run to identify system deficiencies and proposed improvements were added to the model to correct the deficiencies.

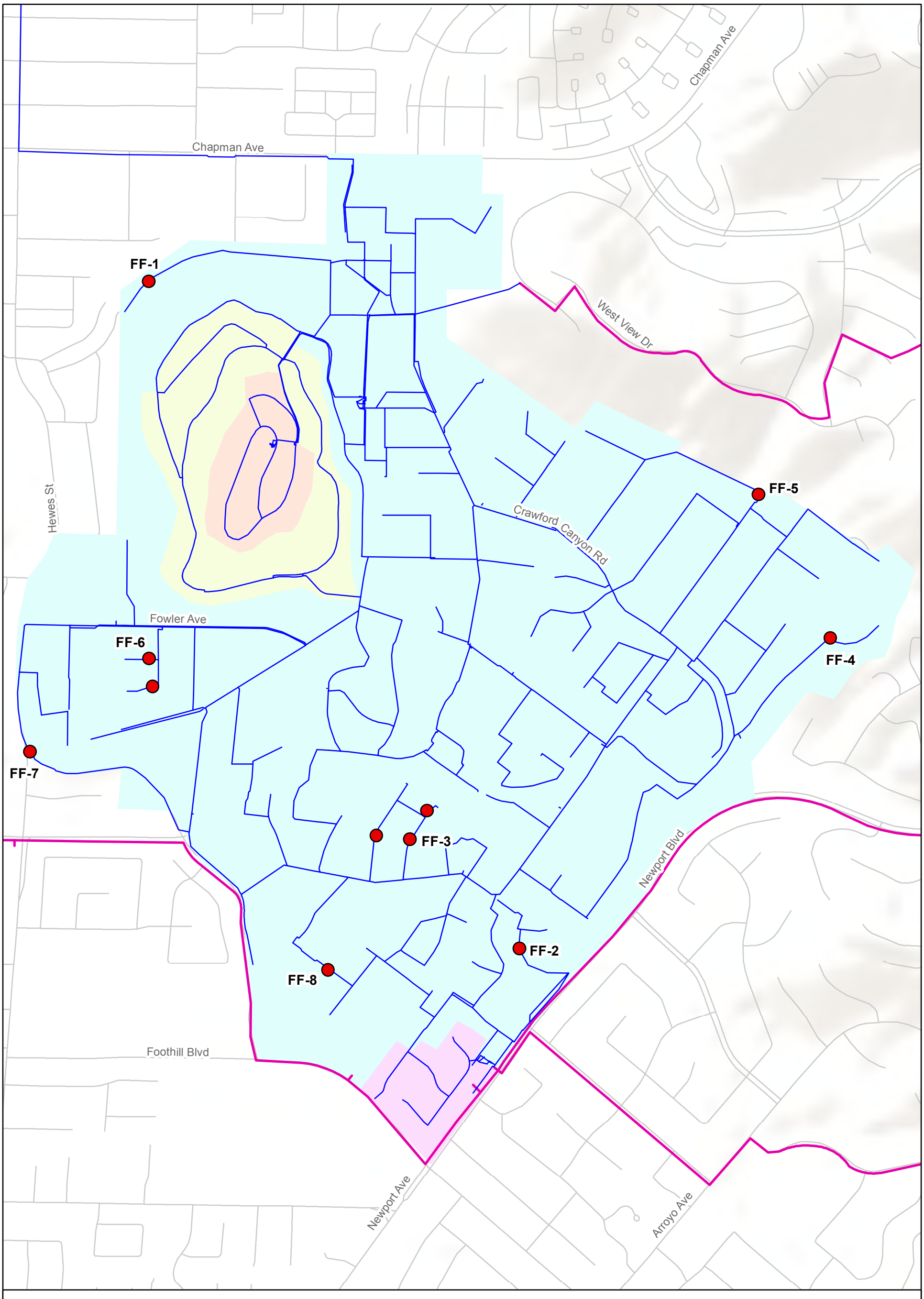
7.1 Retail Zone Analysis

The Retail Zone was analyzed using both the PHD and MDD plus fire flow demand conditions. For the PHD condition, there were three pipelines with segments that had flow velocities that exceeded the evaluation criteria of 5 fps.

Two of these pipeline segments are located in Zone 2 and are used to convey water from Vista Panorama Reservoir within Circula Panorama Drive. Both pipelines are 6-inch diameter pipelines that were constructed in the 1950s. The flow velocities in both pipelines reached 6.8 fps; however, there were no resulting low pressures. It is not recommended that these pipelines be replaced due to the flow velocity criteria, but they should be replaced with 12-inch diameter pipes when necessary due to the age of pipeline.

The third pipeline segment with flow velocity exceeding 5 fps is located on the downstream side of the Zone 3 PRS. This pipeline showed a flow velocity of 5.2 fps during PHD conditions. Since this flow velocity is just slightly above the maximum allowed during PHD, it is not recommended that the pipeline be replaced. The results of the PHD condition simulations are shown on Figure 7.1.

Under the MDD plus fire flow demand condition, multiple fire hydrant locations were determined to be deficient based on the available fire flow. A majority of these hydrants failing fire flow were as a result of small diameter pipes leading to the fire hydrant. Therefore, many of these deficient hydrants can be fixed by increasing the diameter of the pipeline leading up to the hydrant. A summary of the proposed improvements is provided in Table 7.1. The locations of the deficient fire hydrants are shown on Figure 7.2.



Legend

- Hydrants with < 1500 gpm Fire Flow

Pipes By Type

- NonEOCWD
- Potable
- Transmission
- Streets

Zones

- 1
- 2
- 3
- 4

N

0 500 1,000 Feet

Figure 7.1
Retail Zone
Hydraulic Analysis - Hydrants Failing Fire Flow
East Orange County Water District

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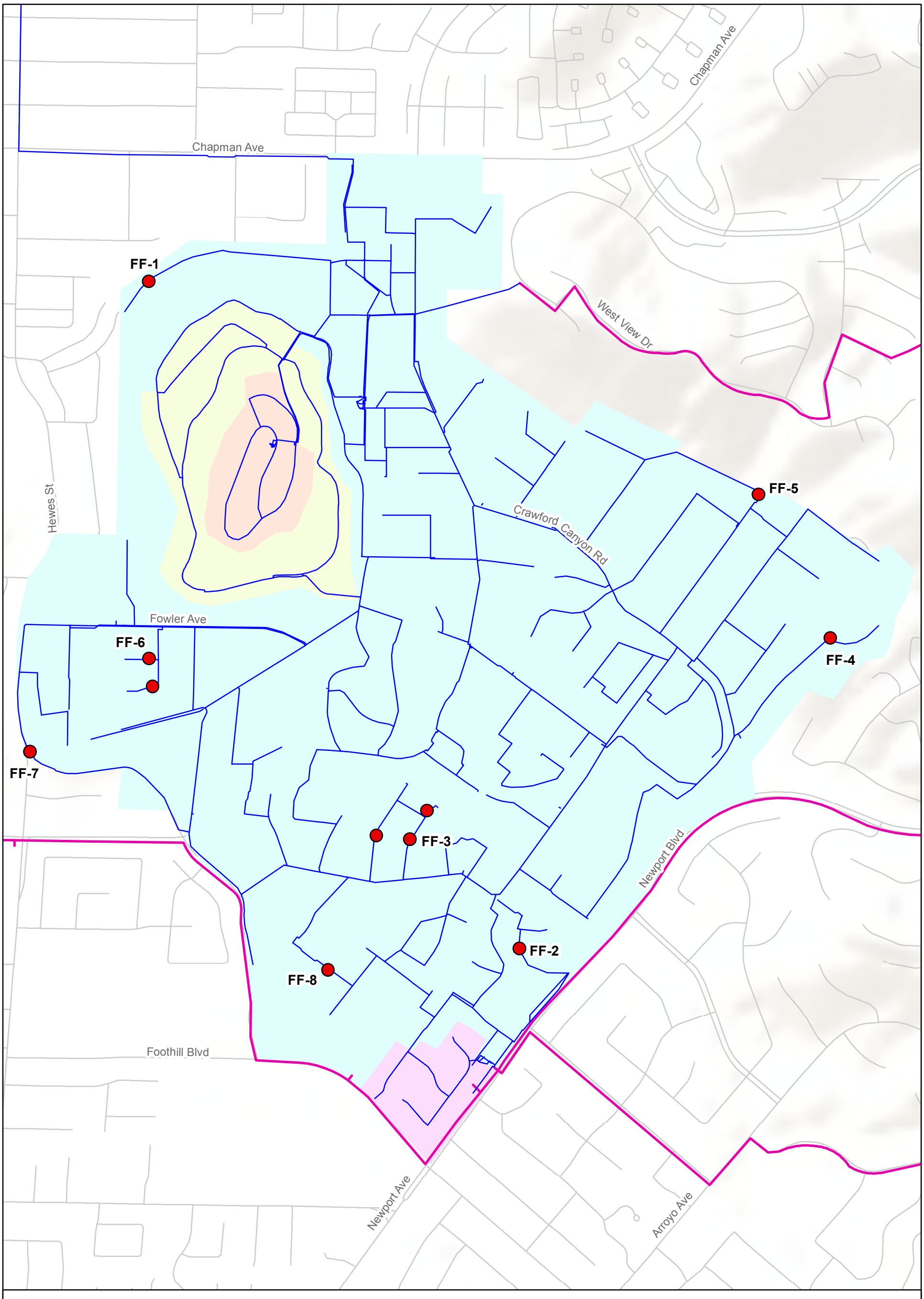

Legend

- Hydrants with < 1500 gpm Fire Flow

Pipes By Type

- NonEOCWD
- Potable
- Transmission
- Streets

Zones

- 1
- 2
- 3
- 4

N

0 500 1,000 Feet

Figure 7.2
Retail Zone
Hydraulic Analysis - Hydrants Failing Fire Flow
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The improvements listed in Table 7.1 will resolve all fire flow issues except one hydrant located in the northeast section of the Retail Zone. The low pressures experienced at this hydrant are due to the high elevation rather than high headloss in the pipeline.

Table 7.1 Fire Flow Improvements
Retail Zone Water Master Plan
East Orange County Water District

Map ID	Location	Available Fire Flow (gpm)	Existing Diameter (in)	Replacement Diameter (in)	Length of Pipe (feet)	Notes
FF-1	Smiley Drive	<1,000	4	8	1,500	Along Smiley Drive
FF-2	Kiersy Place	<1,000	4	8	500	Along Kiersy Place
FF-3	Springwood Dr and Villa Rose Dr	<1,500	4	8	1,000	Along Springwood and Villa Rose
FF-4	Crawford Canyon and Daniger Dr	<1,500	6	8	700	Along Crawford Canyon and Daniger Dr
FF-5	Easement from Willis Ln and El Roy Dr	<1,500	4	8	1,700	From end of Willis Ln and El Roy Dr
FF-6	Charmaine Ln and Fowler St	<1,500	6	n/a	n/a	Relocate services along Fowler St and connect with Charmaine Ln
FF-7	Hewes Ave	<1,500	4	8	1,700	Along Hewes Ave
FF-8	Easement from St. Marks Dr and El Roy Dr	<1,500	4	8	1,700	From end of St. Marks Dr and El Roy Dr

8.0 SUMMARY OF RECOMMENDATIONS

The recommendations for capital improvements are summarized in this section. Detailed cost estimates for each of these recommendations are included in the Capital Improvement Program (CIP) of this technical memorandum (see Section 9.0). The CIP is divided into three main priority phases: 2015-2020, 2021-2030, and 2031-2040. Within the 2015-2020 period certain "top priority" projects were identified as those projects needing to take place in fiscal year 2015/2016.

A project prioritization matrix was used to determine the project phasing in the CIP. Seven individual categories were included in the prioritization matrix as follows:

- Risk or Consequence of Failure
- Asset Age
- Hydraulic Issues
- Corrosive Soils
- Operational Reliability
- District Known Potential Issues
- Topography Significance

If applicable, each project was given a score of 1 for the individual category. The category scores were summed to determine a total priority score for each project. Based on the analysis of the Retail Zone water systems, the improvements and associated total priority ranking scores are summarized in Table 8.1. The higher the score, the more urgent the project.

Table 8.1 Retail Zone Improvements & Priority Scores
Retail Zone Water Master Plan
East Orange County Water District

Map ID	Description	Total Priority Score
RZ H-1	Replace undersized 4" pipeline along Fowler Ave and S Hewes St	1
RZ H-2	Replace undersized 4" pipeline along Fowler Ave and Charmaine Ln (1,100 linear feet). Replaced with FF-7.	1
RZ H-3	Replace 4" along Via Aventura due to hot soil	2
RZ H-4	Replace 4" along XX Driveway due to hot soil	2

Table 8.1	Retail Zone Improvements & Priority Scores Retail Zone Water Master Plan East Orange County Water District	
Map ID	**Description**	**Total Priority Score**
RZ H-5	Replace undersized 4" along Kiersy Place	1
RZ H-6	Repair 8" along Fairhaven Extension	1
RZ H-7	Replace 6" along Fairhaven Extension due to hot soil	2
RZ H-8	Upsize 4" along Fairhaven Ext and Circula Panorama for future PRS	1
RZ H-9	Replace undersized 4" pipeline along Pine Canyon Rd	1
RZ H-10	Relocate services along 8" along Crawford Canyon Rd due to main breaks, hot soil and age	4
RZ H-11	Repair coupling for service lateral on Crawford Canyon Rd	4
RZ H-12	Upsize 6" to 12" along Circula Panorama for future PRS (overlay with RZ-1)	2
RZ H-13	Repair 8" pipeline along Stoller Ln	3
RZ H-14	Install future connection on E Los Arboles Ave	1
RZ H-15	Replace undersized 4" pipeline along E Smiley Dr	3
RZ FF-1	Fire flow improvement along Smiley Dr (upsize 4" to 8")	3
RZ FF-2	Fire flow improvement along Kiersy Place (upsize 4" to 8")	1
RZ FF-3	Fire flow improvement along Springwood Dr and Villa Rose Dr (upsize 4" to 8")	1
RZ FF-4	Fire flow improvement along Crawford Canyon Rd and Daniger Drive (upsize 6" to 8")	1
RZ FF-5	Fire flow improvement from end of Willis Ln and El Roy Dr (upsize 4" to 8")	2
RZ FF-6	Fire Flow Improvement: Relocate services along Fowler St and connection w/Charmaine Ln	3
RZ DEV-1	Fire flow improvement at the end of St. Marks Dr (upsize 4" to 8") (to be funded by developer)	1
RZ D-1	Upsize 6" to 8" along Fairhaven Extension to resolves hydraulic bottleneck between Stoller and SW portion or RZ	3
RZ D-2	Shift services from 3.5" to new 8" South of Stoller PS to Circular Panorama to resolve hydraulic bottleneck between Stoller and SW portion or RZ	1

Table 8.1	Retail Zone Improvements & Priority Scores Retail Zone Water Master Plan East Orange County Water District	
Map ID	**Description**	**Total Priority Score**
RZ D-3	Install new 12" pipeline on Circular Panorama (partial overlay with H-12) from Stoller Ln to Fairway Ext.	2
RZ D-4	Install new 12" PRS for second supply to RZ from the east. Replace existing 6" PRS feeding Zone 2 with a 12" PRS.	2
RZ D-5	Install new 16" pipeline for second supply to RZ from the east	1
RZ D-6	Install new PRS for second supply to RZ from the east	1
RZ RR-1	Seismic Retrofit of Vista Panorama Reservoir (150,000 gal)	2
RZ RR-2	Acoustic Field Condition Assessments RZ (1 mi/year)	1
RZ RR-3	Other Field Condition Assessments RZ (method TBD)	1
RZ RR-4	Age Replacements (2" to 8" by 2020)	2
RZ RR-5	Age Replacements (4" to 8" by 2030)	2
RZ RR-6	Age Replacements (4"-8" to 8" by 2040)	2
RZ RR-7	Age Replacements (12" by 2040)	1
RZ RR-8	In-line Valve Replacement Program (500 valves in system)	2
RZ RR-9	New South Well (excl. land acquisition)	2
RZ RR-10	Replace East Well (excl. land acquisition)	2
RZ RR-11	Install Corrosion Protection Systems at Barret PS	1
RZ RR-12	Barret PS - Repair and reinstall Pump No. 1	1
RZ RR-13	Barret PS -Repair and reinstall Two-way Flow Meter	1
RZ RR-14	Barret PS - Fix piping configuration (12" feed 6" valve). TBD	1
RZ RR-15	Daniger PS -Repair minor areas of corrosion	1
RZ RR-16	Vista PS -Hydropneumatic tank repair and seismic bracing	2
RZ RR-17	All PS -Corrosion Mitigation Project	1
RZ RR-18	All Retail PRS - Pipe Support R&R	1
RZ RR-19	All PRS -Corrosion Mitigation Project	1
RZ RR-20	Vista PRS - Vault Modification w/ventilation	1

9.0 CAPITAL IMPROVEMENT PROGRAM

This section presents the recommended CIP for the Retail Zone of EOCWD. The proposed CIP presents improvement projects based on the system evaluations discussed in the previous sections and through discussions with District staff. The planning horizon for this CIP is year 2040. The CIP is divided into three phases, Priority 1 through 2020, Priority 2 is 2021 through 2030, and Priority 3 is 2031 through 2040.

This section starts with a summary of the cost estimating assumptions, followed by the Retail Zone CIP.

9.1 Cost Estimating Assumptions

The cost estimates presented in this CIP are opinions developed from bid tabulations, cost curves, information obtained from previous studies, and Carollo Engineers, Inc. (Carollo) experience on other similar projects. The costs are based on an Engineering News Record Construction Cost Index (ENR CCI) 10981 (Greater Los Angeles Index, June 2015).

The construction costs are representative of system facilities under normal construction conditions and schedules. Costs have been estimated for public works construction.

9.2 Cost Estimating Accuracy

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as preliminary alignment generation, investigation of alternative routings, and detailed utility and topography surveys.

The Association for the Advancement of Cost Engineering (AACE) defines an Order of Magnitude Estimate, deemed appropriate for master plan studies, as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within plus 50 percent to minus 30 percent. This section presents the assumptions used in developing order of magnitude cost estimates for recommended facilities.

9.3 Capital Cost Development

Capital costs developed for this CIP are estimated by multiplying the estimated construction cost with various mark-ups. The various cost components used in the development of capital cost estimates are described below.

9.3.1 Baseline Construction Cost

This is the total estimated construction cost, in dollars, of the proposed improvement projects. Baseline construction costs were calculated by multiplying the estimated number

of units by the unit cost, such as length of pipeline times the average cost per lineal foot of pipeline. The majority of unit construction costs used for this CIP are presented in Section 9.3.4.

9.3.2 Estimated Construction Cost

Contingency costs must be reviewed on a case-by-case basis because they will vary considerably with each project. Consequently, it is appropriate to allow for uncertainties associated with the preliminary layout of a project. Such factors as unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are a few of the items that can increase project costs for which it is wise to make allowances in preliminary estimates. To assist the District in making financial decisions for these future construction projects, contingency costs will be added to the planning budget as percentages of the total construction cost, divided into two categories: Estimated Construction Cost and Capital Improvement Cost.

Since knowledge about site-specific conditions of each proposed project is limited at the master planning stage, a 30 percent contingency was applied to the Baseline Construction Cost to account for unforeseen events and unknown conditions. This contingency accounts for unknown site conditions such as poor soils, unforeseen conditions, environmental mitigations, and other unknowns and is typical for master planning projects. The Estimated Construction Cost for the proposed wastewater, potable water, and recycled water system improvements consists of the Baseline Construction Cost plus the 30 percent construction contingency.

9.3.3 Capital Improvement Cost

Other project construction contingency costs include costs associated with engineering, construction phase professional services, and project administration. Engineering services associated with new facilities include preliminary investigations and reports, Right of Way (ROW) acquisition, foundation explorations, preparation of drawings and specifications during construction, surveying and staking, sampling of testing material, and start-up services. Construction phase professional services cover such items as construction management, engineering services, materials testing, and inspection during construction. Finally, there are project administration costs, which cover such items as legal fees, environmental/California Environmental Quality Act (CEQA) compliance requirements, financing expenses, administrative costs, and interest during construction.

The cost of these items can vary, but for the purpose of this study, it is assumed that the other project contingency costs will equal approximately 27.5 percent of the Estimated Construction Cost.

As shown in the following sample calculation of the capital improvement cost, the total cost of all project construction contingencies (construction, engineering services, construction management, and project administration) is approximately 65.8 percent of the baseline

construction cost. Calculation of the 65.8 percent is the overall mark-up on the baseline construction cost to arrive at the capital improvement cost. It is not an additional contingency.

Example:

Baseline Construction Cost	**$1,000,000**
Construction Contingency (30%)	$300,000
Estimated Construction Cost	**$1,300,000**
Engineering Cost (10%)	130,000
Construction Management (10%)	130,000
Project Administration (7.5%)	$97,500
Capital Improvement Cost	**$1,657,500**

9.3.4 Unit Construction Cost

Due to the large number of types of projects presented in this CIP, there are many unit construction costs utilized. The following unit construction costs are presented below:

- Pipeline Cost (see Table 9.1)
- Pump Station Cost (see Table 9.2)
- Reservoir Cost (see Table 9.3)
- Pressure Reducing Stations (see Table 9.4)
- Major Miscellaneous Items (see Table 9.5)

Table 9.1 Unit Construction Costs - Pipelines
Retail Zone Water Master Plan
East Orange County Water District

Pipe Size (inches)	Unit Construction Cost[(1)] ($/LF)
6"	$155
8"	$170
10"	$210
12"	$220
16"	$290
20"	$365
24"	$415
30"	$435

Notes:
(1) ENR Greater Los Angeles Index, June 2015 = 10981.
(2) District Staff requested that a unit cost of $250/LF be used for projects that may require granite rock trenching excavation ("Hot Spot" Projects H-3, H-8, and H-13).

Table 9.2 Unit Construction Costs – Pump Stations Retail Zone Water Master Plan East Orange County Water District	
Station Size (HP)	**Unit Construction Cost ($/HP)**
100 hp	$5,000
200 hp	$4,000
300 hp	$3,500

Table 9.3 Unit Construction Costs – Reservoir Storage Retail Zone Water Master Plan East Orange County Water District	
Volume (MG)	**Unit Construction Cost ($/MG)**
<1	$2.00
1 to 3	$1.50
3 to 5	$1.25
5 to 10	$1.00

Table 9.4 Unit Construction Costs – Pressure Reducing Stations Retail Zone Water Master Plan East Orange County Water District	
Type	**Unit Construction Cost ($/PRS)**
Small (1-2 valves <8")	$100,000
Medium (2-3 valves 8" and up)	$200,000
Large (3-4 valves 12" and up)	$300,000
Rehab and Repair	variable

It should be noted that these unit costs, along with some project specific unit costs, are listed in the detailed summary CIP tables presented at the end of this Chapter. A summary of unit cost assumptions for major miscellaneous items is presented in Table 9.5. Consistent with typical master planning cost estimating, pipeline materials are not specified at this time. Storage reservoirs are assumed to be steel cylindrical tanks as concrete reservoirs are typically more costly. Pump station costs are based on total horsepower. For conservative planning purposes, no differentiation is made between new pump stations or pump station upgrades, as the condition of existing pump stations that require upgrades can vary greatly.

Table 9.5 Unit Construction Costs – Major Miscellaneous Items Retail Zone Water Master Plan East Orange County Water District		
Type	**Specific Location (if applicable)**	**Unit Construction Cost ($/unit)**
Roof Replacement	6 MG Reservoir	$800,000
Seismic Retrofit	6 MG Reservoir	$500,000
Seismic Retrofit	Vista Panorama	$100,000
Corrosion Protection System	Andes Reservoir	$60,000
Corrosion Protection Systems	Large Diameter Pipes (WZ)	$50,000
Corrosion Protection Systems	Small Diameter Pipes (RZ)	$60,000
New Well	New Well - Drilling only	$1,200,000
	New Well - Equipping	$300,000
	New Well - Total	$1,500,000
New Valve at PRS	Replace valve(s) at Newport Intertie PRS	$50,000
Gate Valves (500 total)	In-line valve replacements	$5,000
Pipelines	Acoustic Testing (per mile)	$20,000

9.4 Retail Zone

The improvement projects included in the Retail Zone CIP include the following project categories:

- Hot Spot Pipeline Projects
- Fire Flow Improvement Projects
- Distribution System Improvements
- Rehabilitation and Replacements (R&R)

A detailed list of Retail Zone CIP projects with project descriptions, sizing, and cost estimating information is provided at the end of this section in Tables 9.7 through 9.11. The locations of these recommended improvements are depicted on Figure 9.1, while a summary of these projects is listed below by phase.

Priority 1 Projects (2015 - 2020)

The Priority 1 projects have a combined cost of $6.4 million as shown in Table 9.6. As listed in Tables 9.7 through 9.11, the Priority 1 projects include:

- RZ H-1 (Replace undersized 4-inch diameter pipeline along Fowler Ave and S. Hewes St)
- RZ H-7 (Replace 6-inch diameter pipeline along Fairhaven Extension due to hot soil)
- RZ H-10 (Relocate services along 8-inch diameter in Crawford Canyon Road due to main breaks)
- RZ H-11 (Repair coupling for service laterals on Crawford Canyon Road)
- RZ H-13 (Repair 8-inch diameter pipeline along Stoller Lane)
- RZ H-14 (Install future connection on E. Los Arboles Avenue)
- RZ H-15 (Replace undersized 4-inch diameter pipeline along E. Smiley Avenue)
- RZ FF-1 (Fire flow improvement along Smiley Drive)
- RZ FF-2 (Fire flow improvement along Kiersy Place)
- RZ FF-6 (Relocate services along Fowler Street and connect with Charmaine Lane)
- RZ D-2 (Shift services from 3.5-inch diameter to new 8-inch diameter south of Stoller PS to Circula Panorama)
- RZ D-3 (Install new 12-inch diameter pipeline on Circula Panorama from Stoller Ln to Fairway Ext.)
- RZ D-4 (Install new 12-inch diameter pipeline for second supply to RZ from East)
- RZ RR-1 (Seismic Retrofit of Vista Panorama Reservoir)
- RZ RR-2 (Acoustic Field Condition Assessments of RZ)
- RZ RR-3 (Other Field Condition Assessment of RZ)
- RZ RR-4 (Various Age Replacements 2-inch diameter to 8-inch diameter)
- RZ RR-8 (Inline Valve Replacement Program)
- RZ RR-9 (New South Well)
- RZ RR-11 (Install Corrosion Protection System at Barret PS)

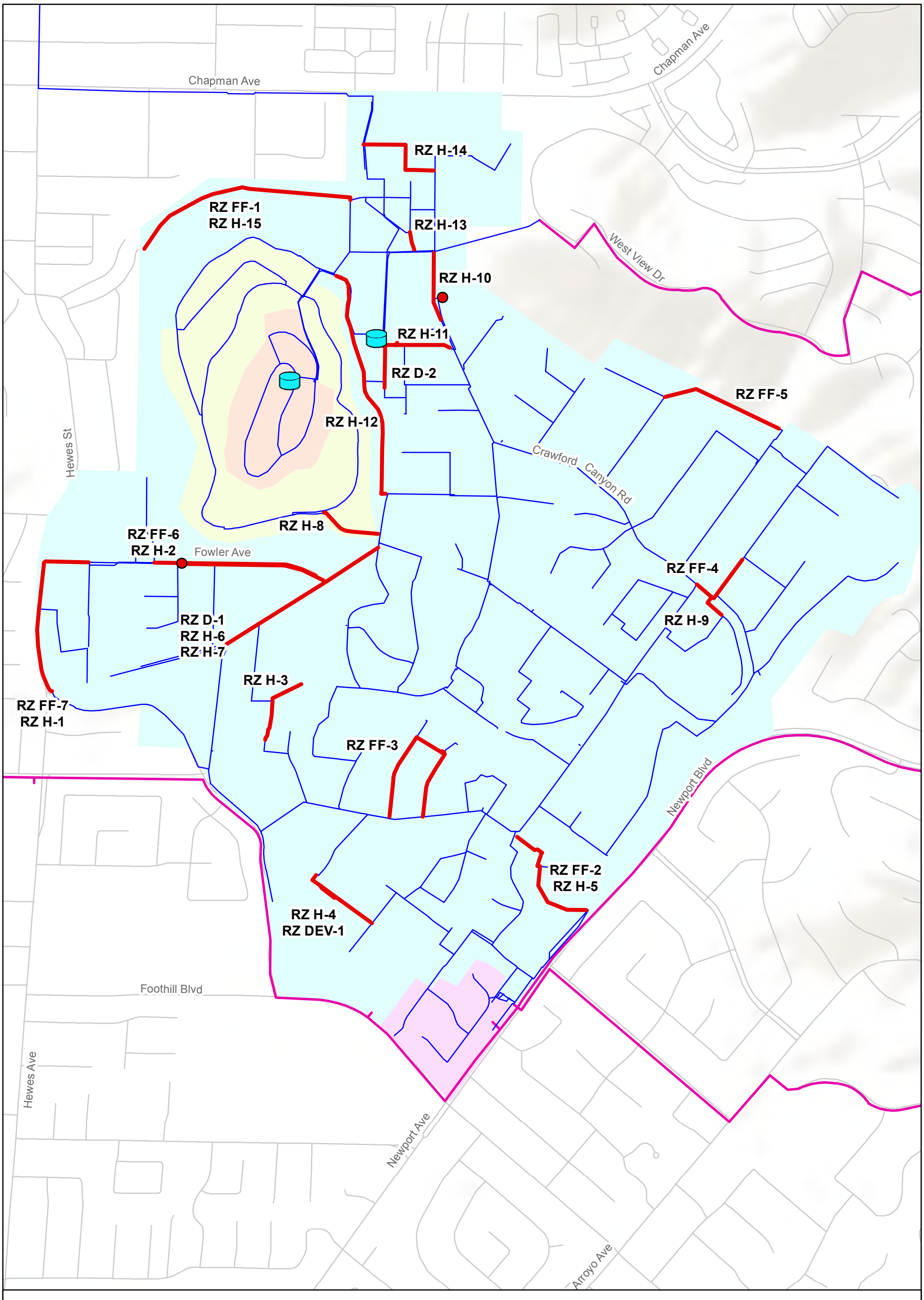

Figure 9.1
Retail Zone
Capital Improvement Program
East Orange County Water District

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- RZ RR-12 (Repair Pump No. 1 at Barret PS)
- RZ RR-13 (Repair Two-way Flowmeter at Barret PS)
- RZ RR-14 (Fix piping configuration at Barret PS)
- RZ RR-15 (Repair Corrosion at Daniger PS)
- RZ RR-16 (Repair hydropneumatic tank and install seismic bracing at Vista PS)
- RZ RR-17 (Corrosion Mitigation Program at all PS)
- RZ RR-18 (Pipe Support at all RZ PRS)
- RZ RR-19 (Corrosion Mitigation Program at all PRS)
- RZ RR-20 (Vault Modification at Vista PRS)
- RZ DEV-1 (Fire flow improvement at St. Marks Drive - Developer Funded)

Priority 2 Projects (2021 - 2030)

As shown in Table 9.6, the Priority 2 projects have a combined cost of $6.2 million. The Priority 2 projects listed in Tables 9.7 through 9.11 include:

- RZ H-3 (Replace undersized 4-inch diameter pipeline along Via Aventura)
- RZ H-4 (Replace 4-inch diameter pipeline along XX Driveway)
- RZ H-5 (Replace undersized 4-inch diameter pipeline along Kiersy Place)
- RZ H-6 (Replace 8-inch diameter pipeline along Fairhaven Extension)
- RZ H-8 (Upsize 4-inch diameter pipeline along Fairhaven Extension and Circula Panorama)
- RZ H-9 (Replace undersized 4-inch diameter pipeline along Pine Canyon Road)
- RZ FF-3 (Fire flow improvement along Springwood Drive and Villa Rose Drive)
- RZ FF-3 (Fire flow improvement along Daniger Drive and Crawford Canyon Road)
- RZ FF-5 (Fire flow improvement at end of Willis Lane and El Roy Drive)
- RZ D-1 (Upsize 6-inch to 8-inch diameter pipeline along Fairhaven Extension)
- RZ RR-2 (Acoustic Field Condition Assessments of RZ)
- RZ RR-3 (Other Field Condition Assessment of RZ)

- RZ RR-5 (Various Age Replacements 4-inch diameter to 8-inch diameter)
- RZ RR-8 (Inline Valve Replacement Program)
- RZ RR-10 (Replace East Well)

Priority 3 Projects (2031 - 2040)

The Priority 3 projects have a combined cost of $5.0 million as shown in Table 9.6. As listed in Tables 9.7 through 9.11, the Priority 3 projects include:

- RZ D-5 (Install new 16-inch diameter pipeline for second supply to RZ from the east)
- RZ D-6 (Install new PRS for second supply to RZ from the east)
- RZ RR-2 (Acoustic Field Condition Assessments of RZ)
- RZ RR-3 (Other Field Condition Assessment of RZ)
- RZ RR-6 (Various Age Replacements 4-inch diameter to 8-inch diameter)
- RZ RR-7 (Various Age Replacements 12-inch diameter)
- RZ RR-8 (In-line Valve Replacement Program)

The Retail Zone CIP is presented by improvement category and phase in Table 9.6.

Table 9.6 Retail Zone CIP by Improvement Type and Phase
Retail Zone Water Master Plan
East Orange County Water District

Improvement Category	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)	Capital Cost ($M)
Hot Spot Projects	$1.2	$1.3	$0.0	$2.5
Fire Flow Improvements[1]	$0.7	$1.0	$0.0	$1.7
Distribution System	$0.5	$0.1	$1.1	$1.7
R&R Improvements	$4.0	$3.9	$3.9	$11.8
Total	**$6.4**	**$6.2**	**$5.0**	**$17.7**
Average ($M/yr)	$1.3	$0.6	$0.5	$0.7

Note:
A detailed breakdown of all CIP projects is presented in Tables 9.7 through 9.11.
(1) RZ DEV-1 is a fire flow improvement project that will be developer funded. It is included in this table as a Priority 1 Project under Fire Flow Improvements at an estimated cost of $103,000.

As shown in Table 9.6, the total recommended Retail Zone CIP is $17.7 million, with $6.4 allocated to the next five years, $6.2 for 2021 through 2030, and $5.0 million for 2031 through 2040. This equates to an average expenditure of nearly $0.7 million/year.

The projected costs allocated for each priority year of the CIP are shown by improvement type in Figure 9.2.

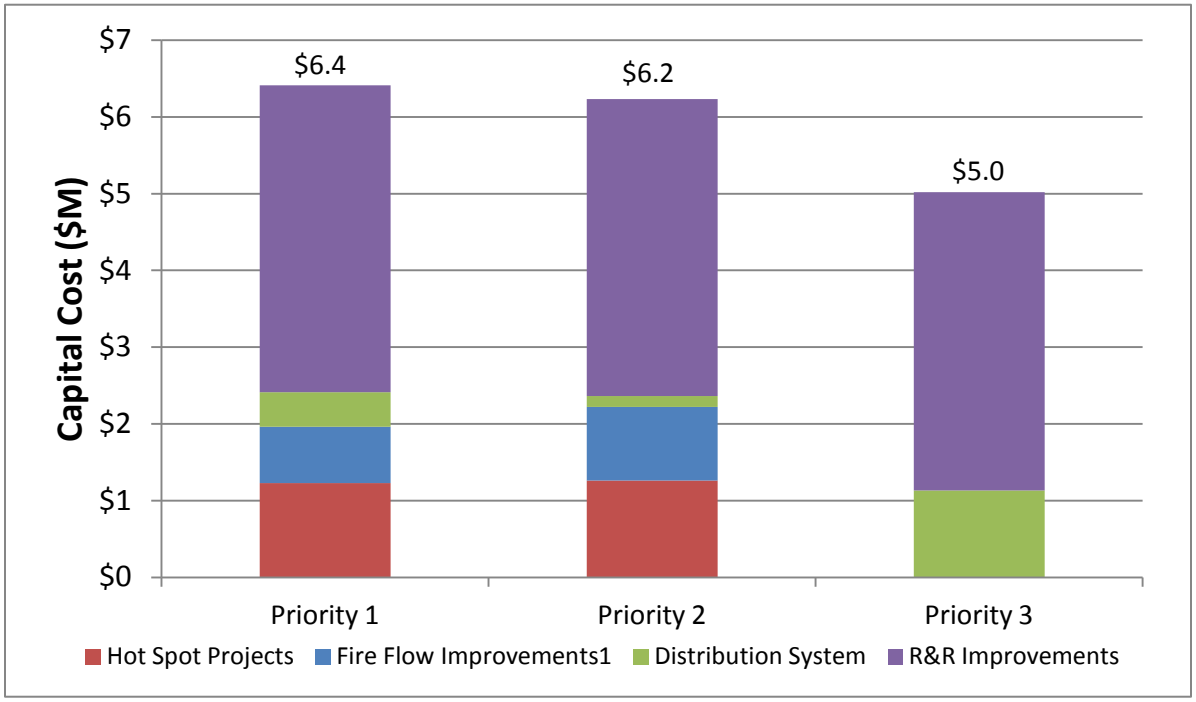

Figure 9.2 Retail Zone CIP by Improvement Type and Phase

As shown in Figure 9.2, the majority of projects for all three phases are R&R Improvements. All Hot Spot Projects and Fire Flow Improvements are planned to be completed during the first two priority phases. The majority of Distribution System improvements are planned for the CIP during the Priority 3 phase, between years 2031 and 2040.

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Table 9.7 Retail Zone Detailed CIP for Hot Spot Pipeline Projects (Draft)
East Orange County Water District

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Map ID	Project Category	Project Description	Priority (1-3)	Existing Diameter (in)	Replacement Diameter (in)	Length[1] (ft)	Quantity	Unit	Unit Construction Cost	Construction Cost[2]	Total Project Cost[2,3]	Retail System CIP	Wholesale System CIP	Top Priority (2015-2016)	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)
RZ Hot Spot Pipeline Projects																	
RZ H-1	Hot Spot	Replace undersized 4" pipeline along Fowler Ave and S Hewes St	1	4	8"	1,500	n/a	n/a	$170	$255,000	$423,000	$423,000	$0	$0	$423,000	$0	$0
RZ H-2	Hot Spot	Replace undersized 4" pipeline along Fowler Ave and Charmaine Ln (1,100 lft). Replaced with FF-7.	1	4	8"	0	n/a	n/a	$170	$0	$0	$0	$0	$0	$0	$0	$0
RZ H-3	Hot Spot	Replace 4" along Via Aventura due to hot soil	2	4	8"	700	n/a	n/a	$250	$175,000	$291,000	$291,000	$0	$0	$0	$291,000	$0
RZ H-4	Hot Spot	Replace 4" along XX Driveway due to hot soil	2	4	8"	600	n/a	n/a	$170	$102,000	$170,000	$170,000	$0	$0	$0	$170,000	$0
RZ H-5	Hot Spot	Replace undersized 4" along Kiersy Place	2	4	8"	900	n/a	n/a	$170	$153,000	$254,000	$254,000	$0	$0	$0	$254,000	$0
RZ H-6	Hot Spot	Repair 8" along Farihaven Extension	2	8	8"	500	n/a	n/a	$170	$85,000	$141,000	$141,000	$0	$0	$0	$141,000	$0
RZ H-7	Hot Spot	Replace 6" along Fairhaven Extension due to hot soil	1	6	8"	500	n/a	n/a	$170	$85,000	$141,000	$141,000	$0	$0	$141,000	$0	$0
RZ H-8	Hot Spot	Upsize 4" along Fairhaven Ext and Circula Panorama for future PRS	2	4	8"	500	n/a	n/a	$250	$125,000	$208,000	$208,000	$0	$0	$0	$208,000	$0
RZ H-9	Hot Spot	Replace undersized 4" pipeline along Pine Canyon Rd	2	4	8"	700	n/a	n/a	$170	$119,000	$198,000	$198,000	$0	$0	$0	$198,000	$0
RZ H-10	Hot Spot	Relocate services along 8" along Crawford Canyon Rd due to main breaks	1	8	8"	n/a	6	number of services	$2,000	$12,000	$20,000	$20,000	$0	$20,000	$20,000	$0	$0
RZ H-11	Hot Spot	Repair coupling for service lateral on Crawford Canyon Rd	1	12	12"	500	n/a	n/a	$220	$110,000	$183,000	$183,000	$0	$0	$183,000	$0	$0
RZ H-12	Hot Spot (same as H-8?)	Upsize 6" to 12" along Circula Panorama for future PRS (overlay with RZ D-1)	1	6	12"	0	n/a	n/a	$220	$0	$0	$0	$0	$0	$0	$0	$0
RZ H-13	Hot Spot	Repair 8" pipeline along Stoller Ln	1	8	8"	500	n/a	n/a	$250	$125,000	$208,000	$208,000	$0	$208,000	$208,000	$0	$0
RZ H-14	Hot Spot	Install future connection on E Los Arboles Ave	1	8	8"	600	n/a	n/a	$170	$102,000	$170,000	$170,000	$0	$0	$170,000	$0	$0
RZ H-15	Hot Spot	Replace undersized 4" pipeline along E Smiley Dr	1	4	8"	300	n/a	n/a	$170	$51,000	$85,000	$85,000	$0	$0	$85,000	$0	$0
RZ Hot Spot Projects - Total				**n/a**	**n/a**	**7,800**			**n/a**	**$1,499,000**	**$2,492,000**	**$2,492,000**	**$0**	**$228,000**	**$1,230,000**	**$1,262,000**	**$0**

1) Pipeline lenghts are rounded up to nearest 100 feet.
2) Cost estimates are rounded up to nearest $1,000.
3) Total Project Cost include a 65% markup to account for construction cost contingency, engineering, construction management, legal, and other costs.

Table 9.8 Retail Zone Detailed CIP for Fire Flow Improvement Projects (Draft)
East Orange County Water District

carollo Engineers...Working Wonders With Water™

Map ID	Project Category	Project Description	Priority (1-3)	Existing Diameter (in)	Replacement Diameter (in)	Length[1] (ft)	Quantity	Unit	Unit Construction Cost	Construction Cost[2]	Total Project Cost[2,3]	Retail System CIP	Wholesale System CIP	Top Priority (2015-2016)	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)
RZ Fire Flow Improvement Projects																	
RZ FF-1	Insufficient FF Capacity	Fire flow improvement along Smiley Dr (upsize 4" to 8")	1	4"	8"	1,500	n/a	n/a	$170	$255,000	$423,000	$423,000	$0	$0	$423,000	$0	$0
RZ FF-2	Insufficient FF Capacity	Fire flow improvement along Kiersy Place (upsize 4" to 8")	1	4"	8"	500	n/a	n/a	$170	$85,000	$141,000	$141,000	$0	$0	$141,000	$0	$0
RZ FF-3	Insufficient FF Capacity	Fire flow improvement along Springwood Dr and Villa Rose Dr (upsize 4" to 8")	2	4"	8"	1,000	n/a	n/a	$170	$170,000	$282,000	$282,000	$0	$0	$0	$282,000	$0
RZ FF-4	Insufficient FF Capacity	Fire flow improvement along Crawford Canyon Rd and Daniger Drive (upsize 6" to 8")	2	6"	8"	700	n/a	n/a	$170	$119,000	$198,000	$198,000	$0	$0	$0	$198,000	$0
RZ FF-5	Insufficient FF Capacity	Fire flow improvement from end of Willis Ln and El Roy Dr (upsize 4" to 8")	2	4"	8"	1,700	n/a	n/a	$170	$289,000	$480,000	$480,000	$0	$0	$0	$480,000	$0
RZ FF-6	Insufficient FF Capacity	Fire Flow Improvement: Relocate services along Fowler St and connection w/Charmaine Ln	1	6"	n/a	n/a	16	number of services	$2,000	$32,000	$54,000	$54,000	$0	$54,000	$54,000	$0	$0
RZ Fire Flow Projects - Total				**n/a**	**n/a**	**5,400**			**n/a**	**$ 950,000**	**$ 1,578,000**	**$ 1,578,000**	**$0**	**$54,000**	**$618,000**	**$960,000**	**$0**

1) Pipeline lenghts are rounded up to nearest 100 feet.
2) Cost estimates are rounded up to nearest $1,000.
3) Total Project Cost include a 65% markup to account for construction cost contingency, engineering, construction management, legal, and other costs.

Table 9.9 Retail Zone Detailed CIP for Distribution System Improvements (Draft)
East Orange County Water District

carollo Engineers...Working Wonders With Water™

Map ID	Project Category	Project Description	Priority (1-3)	Existing Diameter (in)	Replacement Diameter (in)	Length[1] (ft)	Quantity	Unit	Unit Construction Cost	Construction Cost[2]	Total Project Cost[2,3]	Retail System CIP	Wholesale System CIP	Top Priority (2015-2016)	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)
RZ Distribution System Improvements																	
RZ D-1	Insufficient Conveyance Capacity	Upsize 6" to 8" along Fairhave Extenstion to resolves hydraulic bottleneck between Stoller and SW portion or RZ	2	6"	8"	500	n/a	n/a	$170	$85,000	$141,000	$141,000	$0	$0	$0	$141,000	$0
RZ D-2	Insufficient Conveyance Capacity	Shift services from 3.5" to new 8" South of Stoller PS to Circular Panorama to resolve hydraulic bottleneck between Stoller and SW portion or RZ	1	3.5"	8"	500	n/a	n/a	$170	$85,000	$141,000	$141,000	$0	$0	$141,000	$0	$0
RZ D-3	Reliability Improvement - Option 1	Install new 12" pipeline on Circular Panorama (partial overlay with H-12) from Stoller Ln to Fairway Ext.	1	n/a	12"	400	n/a	n/a	$220	$88,000	$146,000	$146,000	$0	$146,000	$146,000	$0	$0
RZ D-4	Reliability Improvement - Option 1	Install new 12" PRS for second supply to RZ from the east. Replace existing 6" PRS feeding Zone 2 with a 12" PRS.	1	n/a	n/a	n/a	1	PRS	$100,000	$100,000	$166,000	$166,000	$0	$166,000	$166,000	$0	$0
RZ D-5	Reliability Improvement - Option 2	Install new 16" pipeline for second supply to RZ from the east	3	n/a	16"	2,300	n/a	n/a	$290	$667,000	$1,106,000	$1,106,000	$0	$0	$0	$0	$1,106,000
RZ D-6	Reliability Improvement - Option 2	Install new PRS for second supply to RZ from the east	3	n/a	n/a	n/a	1	PRS	$15,000	$15,000	$25,000	$25,000	$0	$0	$0	$0	$25,000
RZ Condition Assessment Projects - Total				**n/a**	**n/a**	**3,700**			**n/a**	**$ 1,040,000**	**$ 1,725,000**	**$ 1,725,000**	**$0**	**$312,000**	**$453,000**	**$141,000**	**$1,131,000**

1) Pipeline lenghts are rounded up to nearest 100 feet.
2) Cost estimates are rounded up to nearest $1,000.
3) Total Project Cost include a 65% markup to account for construction cost contingency, engineering, construction management, legal, and other costs.

Table 9.10 Retail Zone Detailed CIP for R&R Improvement Projects (Draft)
East Orange County Water District

carollo Engineers...Working Wonders With Water™

Map ID	Project Category	Project Description	Priority (1-3)	Existing Diameter (in)	Replacement Diameter (in)	Length[1] (ft)	Quantity	Unit	Unit Construction Cost	Construction Cost[2]	Total Project Cost[2,3]	Retail System CIP	Wholesale System CIP	Top Priority (2015-2016)	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)
RZ Repair & Rehabilitation (R&R) Improvements																	
RZ RR-1	R&R - Reservoirs	Seismic Retrofit of Vista Panorama Reservoir (150,000 gal)	1	n/a	n/a	n/a	1	Seisimc Reservoir Retrofit	$100,000	$100,000	$166,000	$166,000	$0	$166,000	$166,000	$0	$0
RZ RR-2	R&R - Pipes	Accoustic Field Condition Assessments RZ (1 mi/year)	1-3	various	tbd	n/a	1	miles of accousting testing	$20,000	$500,000	$500,000	$500,000	$0	$0	$100,000	$200,000	$200,000
RZ RR-3	R&R - Pipes	Other Field Condition Assessments RZ (method TBD)	1-3	various	tbd	n/a	12	valves/year	$5,000	$1,500,000	$1,500,000	$1,500,000	$0	$0	$300,000	$600,000	$600,000
RZ RR-4	R&R - Pipes	Age Replacements (2" to 8" by 2020)	1	2"	8"	100	n/a	n/a	$170	$17,000	$29,000	$29,000	$0	$0	$29,000	$0	$0
RZ RR-5	R&R - Pipes	Age Replacements (4" to 8" by 2030)	2	4"	8"	300	n/a	n/a	$170	$51,000	$85,000	$85,000	$0	$0	$0	$85,000	$0
RZ RR-6	R&R - Pipes	Age Replacements (4"-8" to 8" by 2040)	3	=<8"	8"	8,800	n/a	n/a	$170	$1,496,000	$2,480,000	$2,480,000	$0	$0	$0	$0	$2,480,000
RZ RR-7	R&R - Pipes	Age Replacements (12" by 2040)	3	12"	12"	300	n/a	n/a	$220	$66,000	$110,000	$110,000	$0	$0	$0	$0	$110,000
RZ RR-8	R&R - Pipes	In-line Valve Replacement Program (500 valves in system)	1-3	n/a	n/a	n/a	10	valves/year	$5,000	$1,250,000	$1,250,000	$1,250,000	$0	$0	$250,000	$500,000	$500,000
RZ RR-9	R&R - Wells	New South Well (excl. land acquisition)	1	n/a	n/a	n/a	1	well replacements	$1,500,000	$1,500,000	$2,487,000	$2,487,000	$0	$0	$2,487,000	$0	$0
RZ RR-10	R&R - Wells	Replace East Well (excl. land acquisition)	2	n/a	n/a	n/a	1	well replacements	$1,500,000	$1,500,000	$2,487,000	$2,487,000	$0	$0	$0	$2,487,000	$0
RZ RR-11	R&R - Pump Stations	Install Corrosion Protection Systems at Barret PS	1	various	tbd	n/a	1	Corrosion System	$60,000	$60,000	$100,000	$100,000	$0	$0	$100,000	$0	$0
RZ RR-12	R&R - Pump Stations	Barret PS - Repair and reinstall Pump No. 1	1	n/a	n/a	n/a	1	PS retrofit	$25,000	$25,000	$25,000	$25,000	$0	$0	$25,000	$0	$0
RZ RR-13	R&R - Pump Stations	Barret PS -Repair and reinstall Two-way Flow Meter	1	n/a	n/a	n/a	1	Flowmeter retrofit	$5,000	$5,000	$5,000	$5,000	$0	$0	$5,000	$0	$0
RZ RR-14	R&R - Pump Stations	Barret PS - Fix piping configuration (12" feed 6" valve). TBD	1	n/a	n/a	n/a	1	PS retrofit	$25,000	$25,000	$25,000	$25,000	$0	$0	$25,000	$0	$0
RZ RR-15	R&R - Pump Stations	Daniger PS -Repair minor areas of corrosion	1	n/a	n/a	n/a	1	PS retrofit	$10,000	$10,000	$10,000	$10,000	$0	$0	$10,000	$0	$0
RZ RR-16	R&R - Pump Stations	Vista PS -Hydropneumatic tank repair and seismic bracing	1	n/a	n/a	n/a	1	PS retrofit	$60,000	$60,000	$60,000	$60,000	$0	$60,000	$60,000	$0	$0
RZ RR-17	R&R - Pump Stations	All PS -Corrosion Mitigation Project	1	n/a	n/a	n/a	5	PS corrosion control projects	$25,000	$125,000	$125,000	$125,000	$0	$0	$125,000	$0	$0
RZ RR-18	R&R - Pressure Reducing Stations	All Retail PRS - Pipe Support R&R	1	n/a	n/a	n/a	4	PRS pipeline retrofit	$25,000	$100,000	$100,000	$100,000	$0	$0	$100,000	$0	$0
RZ RR-19	R&R - Pressure Reducing Stations	All PRS -Corrosion Mitigation Project	1	n/a	n/a	n/a	6	PRS corrosion control projects	$25,000	$150,000	$150,000	$150,000	$0	$0	$150,000	$0	$0
RZ RR-20	R&R - Pressure Reducing Stations	Vista PRS - Vault Modification w/ventilation	1	n/a	n/a	n/a	1	PRS retrofit	$65,000	$65,000	$65,000	$65,000	$0	$0	$65,000	$0	$0
RZ R&R Projects - Total				**n/a**	**n/a**	**n/a**			**n/a**	**$ 8,605,000**	**$ 11,759,000**	**$ 11,759,000**	**$0**	**$226,000**	**$3,997,000**	**$3,872,000**	**$3,890,000**

1) Pipeline lenghts are rounded up to nearest 100 feet.
2) Cost estimates are rounded up to nearest $1,000.
3) Total Project Cost include a 65% markup to account for construction cost contingency, engineering, construction management, legal, and other costs.

Table 9.11 Retail Zone Detailed CIP for Developer Funded Projects (Draft)
East Orange County Water District

carollo Engineers...Working Wonders With Water™

Map ID	Project Category	Project Description	Priority (1-3)	Existing Diameter (in)	Replacement Diameter (in)	Length[1] (ft)	Quantity	Unit	Unit Construction Cost	Construction Cost[2]	Total Project Cost[2,3]	Retail System CIP	Wholesale System CIP	Top Priority (2015-2016)	Priority 1 (2015-2020)	Priority 2 (2021-2030)	Priority 3 (2031-2040)
RZ Developer Funded Projects																	
RZ DEV-1	Insufficient FF Capacity	Fire flow improvement at the end of St. Marks Dr (upsize 4" to 8") (to be funded by developer)	1	4"	8"	400	n/a	n/a	$170	$68,000	$113,000	$113,000	$0	$0	$113,000	$0	$0
RZ Developer Funded Projects - Subtotal				**n/a**	**n/a**	**400**			**n/a**	**$ 68,000**	**$ 113,000**	**$ 113,000**	**$0**	**$0**	**$113,000**	**$0**	**$0**

1) Pipeline lenghts are rounded up to nearest 100 feet.
2) Cost estimates are rounded up to nearest $1,000.
3) Total Project Cost include a 65% markup to account for construction cost contingency, engineering, construction management, legal, and other costs.

Appendix A

PROJECT PRIORITIZATION MATRIX

Capital Improvement Project - Project Prioritization Matrix

Project #	Retail Zone	Project Description	Risk/ High Consequence of Failure	Asset Age	Hydraulic Issue	Area of Corrosive Soil	(Operational) Reliability	Hot-Spot Issue Addressed	Topo Significance	Total Score
Hot Spot Pipeline Projects										
RZ H-1	Retail	Replace undersized 4" pipeline along Fowler Ave and S Hewes St						1		**1**
RZ H-2	Retail	Replace undersized 4" pipeline along Fowler Ave and Charmaine Ln (1,100 linear feet). Replaced with FF-7.						1		**1**
RZ H-3	Retail	Replace 4" along Via Aventura due to hot soil				1		1		**2**
RZ H-4	Retail	Replace 4" along XX Driveway due to hot soil				1		1		**2**
RZ H-5	Retail	Replace undersized 4" along Kiersy Place						1		**1**
RZ H-6	Retail	Repair 8" along Fairhaven Extension						1		**1**
RZ H-7	Retail	Replace 6" along Fairhaven Extension due to hot soil				1		1		**2**
RZ H-8	Retail	Upsize 4" along Fairhaven Ext and Circula Panorama for future PRS						1		**1**
RZ H-9	Retail	Replace undersized 4" pipeline along Pine Canyon Rd						1		**1**
RZ H-10	Retail	Relocate services along 8" along Crawford Canyon Rd due to main breaks	1					1		**2**
RZ H-11	Retail	Repair coupling for service lateral on Crawford Canyon Rd	1					1		**2**
RZ H-12	Retail	Upsize 6" to 12" along Circula Panorama for future PRS (overlay with RZ-1)					1	1		**2**
RZ H-13	Retail	Repair 8" pipeline along Stoller Ln	1					1	1	**3**
RZ H-14	Retail	Install future connection on E Los Arboles Ave						1		**1**
RZ H-15	Retail	Replace undersized 4" pipeline along E Smiley Dr			1	1		1		**3**
Improvement Projects										
RZ FF-1	Retail	Fire flow improvement along Smiley Dr (upsize 4" to 8")			1	1		1		**3**
RZ FF-2	Retail	Fire flow improvement along Kiersy Place (upsize 4" to 8")			1					**1**
RZ FF-3	Retail	Fire flow improvement along Springwood Dr and Villa Rose Dr (upsize 4" to 8")			1					**1**
RZ FF-4	Retail	Fire flow improvement along Crawford Canyon Rd and Daniger Drive (upsize 6" to 8")			1					**1**
RZ FF-5	Retail	Fire flow improvement from end of Willis Ln and El Roy Dr (upsize 4" to 8")	1		1					**2**
RZ FF-6	Retail	Fire Flow Improvement: Relocate services along Fowler St and connection w/Charmaine Ln	1		1			1		**3**
RZ DEV-1	Retail	Fire flow improvement at the end of St. Marks Dr (upsize 4" to 8") (to be funded by developer)			1					**1**
Distribution System Improvements										
RZ D-1	Retail	Upsize 6" to 8" along Fairhaven Extension to resolves hydraulic bottleneck between Stoller and SW portion or RZ	1		1			1		**3**
RZ D-2	Retail	Shift services from 3.5" to new 8" South of Stoller PS to Circular Panorama to resolve hydraulic bottleneck between Stoller and SW portion or RZ			1					**1**
RZ D-3	Retail	Install new 12" pipeline on Circular Panorama (partial overlay with H-12) from Stoller Ln to Fairway Ext.			1			1		**2**
RZ D-4	Retail	Install new 12" PRS for second supply to RZ from the east. Replace existing 6" PRS feeding Zone 2 with a 12" PRS.	1				1			**2**
RZ D-5	Retail	Install new 16" pipeline for second supply to RZ from the east								
RZ D-6	Retail	Install new PRS for second supply to RZ from the east								
Repair & Rehabilitation (R&R) Improvements										
RZ RR-1	Retail	Seismic Retrofit of Vista Panorama Reservoir (150,000 gal)		1			1			**2**
RZ RR-2	Retail	Acoustic Field Condition Assessments RZ (1 mi/year)		1						**1**
RZ RR-3	Retail	Other Field Condition Assessments RZ (method TBD)		1						**1**
RZ RR-4	Retail	Age Replacements (2" to 8" by 2020)		1	1					**2**
RZ RR-5	Retail	Age Replacements (4" to 8" by 2030)		1	1					**2**
RZ RR-6	Retail	Age Replacements (4"-8" to 8" by 2040)		1	1					**2**
RZ RR-7	Retail	Age Replacements (12" by 2040)		1						**1**
RZ RR-8	Retail	In-line Valve Replacement Program (500 valves in system)		1			1			**2**
RZ RR-9	Retail	New South Well (excl. land acquisition)		1			1			**2**
RZ RR-10	Retail	Replace East Well (excl. land acquisition)		1			1			**2**
RZ RR-11	Retail	Install Corrosion Protection Systems at Barret PS		1						**1**
RZ RR-12	Retail	Barret PS - Repair and reinstall Pump No. 1		1						**1**
RZ RR-13	Retail	Barret PS -Repair and reinstall Two-way Flow Meter		1						**1**
RZ RR-14	Retail	Barret PS - Fix piping configuration (12" feed 6" valve). TBD		1						**1**
RZ RR-15	Retail	Daniger PS -Repair minor areas of corrosion		1						**1**
RZ RR-16	Retail	Vista PS -Hydropneumatic tank repair and seismic bracing	1	1						**2**
RZ RR-17	Retail	All PS -Corrosion Mitigation Project		1						**1**
RZ RR-18	Retail	All Retail PRS - Pipe Support R&R		1						**1**
RZ RR-19	Retail	All PRS -Corrosion Mitigation Project		1						**1**
RZ RR-20	Retail	Vista PRS - Vault Modification w/ventilation		1						**1**
			8	**20**	**14**	**5**	**6**	**19**	**1**	**73**