



Yorba Linda Water District
Asset Management Plan Update

REPORT
2018 ASSET MANAGEMENT PLAN

FINAL | July 6, 2018



**Yorba Linda
Water District**

Yorba Linda Water District
Asset Management Plan Update

REPORT
2018 ASSET MANAGEMENT PLAN

FINAL | July 6, 2018



Contents

Section 1 - Introduction	1
1.1 Introduction and Background	1
1.2 Asset Management Plan Methodology	2
Section 2 - Summary of Assets	3
2.1 Asset Systems, Hierarchy, and Facilities	3
2.1.1 Asset Definition	7
2.1.2 Asset Hierarchy	7
2.2 Asset Replacement Cost Estimate	16
2.2.1 Replacement Cost Development Process	16
2.2.2 Estimated Asset Replacement Cost	16
2.3 Asset Installation Profile	17
Section 3 - Condition Assessment	21
3.1 Facilities and Equipment Condition and Remaining Life Assessment	21
3.1.1 Condition Assessment Process and Scoring	21
3.1.2 Condition Assessment Observations and Findings	24
3.2 Pipelines Condition and Remaining Life Assessment	33
3.2.1 Condition Assessment Process and Scoring	33
3.2.2 Condition Assessment and Remaining Useful Life Evaluation	38
Section 4 - Asset Risk Assessment	43
4.1 Risk Overview	43
4.2 Likelihood of Failure (LoF)	43
4.3 Consequence of Failure (CoF)	44
4.3.1 Facilities and Equipment	44
4.3.2 Pipelines	48
4.4 Risk Results	55
4.4.1 Facilities and Equipment	55
4.4.2 Pipelines	56

Section 5 - Financial Forecast	61
5.1 Forecast Overview	61
5.2 10-Year Capital Improvement Program Forecast	61
5.3 Long-Term (100-Year) Capital Improvement Program Forecast	64
5.4 Financial Analysis	71
5.4.1 District 5-Year Budget	71
5.4.2 25-Year Funding Outlook	72
5.4.3 10-Year Funding Outlook	72
5.4.4 Shortfall Analysis	73
5.4.5 Financial and Reserve Analysis Summary	76
Section 6 - Conclusions and Recommendations	76
6.1 Findings and Conclusions	76
6.2 Asset Management Improvement Recommendations	77
6.3 Asset Renewal Model Tool	78

Appendices

Appendix A	Condition Assessment Protocol
Appendix B	10-Year CIP Project Details

Tables

Table 2.1	Asset System Summary (as of November 2017)	9
Table 2.2	Facility List	9
Table 2.3	System Replacement Cost Estimate Summary	17
Table 2.4	Asset Installation Summary	18
Table 3.1	General Condition Scoring Descriptions	22
Table 3.2	Condition and Remaining Useful Life by Asset Type	23
Table 3.3	Pipeline Condition Criteria	33
Table 3.4	Pipeline Condition Scoring Descriptions	34
Table 3.5	Pipeline Remaining Useful Life Assumptions	37
Table 3.6	Pipeline System Condition and Remaining Life Results	38
Table 4.1	Facility CoF Scoring System	45

Table 4.2	Equipment Type CoF Scoring System	47
Table 4.3	Pipeline CoF Scoring System	48
Table 4.4	Pipeline CoF Score Summary	49
Table 4.5	Facilities and Equipment Risk Summary	55
Table 4.6	Pipeline Risk Summary	56
Table 5.1	10- Year CIP Summary Table (by System)	62
Table 5.2	100-Year Forecast Summary (\$ million)	64

Figures

Figure 2.1	District Service Area Map	5
Figure 2.2	Asset Hierarchy	8
Figure 2.3	Water System Map	11
Figure 2.4	Wastewater System Map	13
Figure 2.5	Water System Pipeline Composition	15
Figure 2.6	Wastewater System Pipeline Composition	15
Figure 2.7	Asset Replacement Cost Estimate by System	17
Figure 2.8	Asset Installation Profile	19
Figure 3.1	CCTV Inspection Data Map	35
Figure 3.2	Water Pipeline Condition Map	39
Figure 3.3	Wastewater Pipeline Condition Map	41
Figure 4.1	Facility and Equipment Consequence of Failure Score Summary	47
Figure 4.2	Water Pipeline CoF Map	51
Figure 4.3	Wastewater Pipeline CoF Map	53
Figure 4.4	Risk Matrix Categories	55
Figure 4.5	Water Pipeline Risk Map	57
Figure 4.6	Wastewater Pipeline Risk Map	59
Figure 5.1	10-Year CIP Forecast	62
Figure 5.2	Long-Term Funding Forecast	65
Figure 5.3	Water Pipeline Rehabilitation/Replacement Forecast Map	67
Figure 5.4	Wastewater Pipeline Rehabilitation/Replacement Forecast Map	69
Figure 5.5	Water & Sewer Combined Financial Forecast	71

Figure 5.6	25-Year Financial Forecast	72
Figure 5.7	10-Year Financial Forecast	73
Figure 5.8	Water Capital Replacement Fund	74
Figure 5.9	Sewer Capital Replacement Fund	74
Figure 5.10	Water Unrestricted Reserve Utilization	75
Figure 5.11	Sewer Unrestricted Reserve Utilization	75

Abbreviations

AACE	Association for the Advancement of Cost Engineering
AM	Asset Management
AMP	Asset Management Plan
Carollo	Carollo Engineers, Inc.
CCTV	Closed Circuit Television
CIP	Capital Improvements Program or Project
CMMS	Computerized Maintenance Management System
CoF	Consequence of Failure
ft	Feet
GIS	Geographic Information System
IIMM	International Infrastructure Management Manual
IS	Information Systems
LoF	Likelihood of Failure
LOS	Level of Service
LS	Lift Station
MG	Million Gallons
mgd	Million Gallons per Day
O&M	Operation and Maintenance
PACP	Pipeline Assessment Certification Program
PRS	Pressure Regulating Station
PS	Pump Station
psi	Pounds per Square Inch
R&R	Rehabilitation and Replacement
SCADA	Supervisory Control and Data Acquisition
YLWD / District	Yorba Linda Water District

Section 1

INTRODUCTION

This Asset Management Plan (AMP) is intended to guide the maintenance, repair, and replacement of the Yorba Linda Water District's (YLWD or District) infrastructure assets in a cost-effective manner. The District is transitioning out of a period of new construction and into the long term management and upkeep of its existing infrastructure. This updated AMP aligns the District's priorities in an efficient and cost-effective manner for the sustainable management of its infrastructure into the future. This section provides an introduction to Asset Management at the District and the methodology used in developing this AMP report.

1.1 Introduction and Background

The term Asset Management refers to a body of principles aimed at balancing risk while minimizing life cycle costs. Asset management principles reflect a holistic business approach. For the water and wastewater industry, this pertains to the physical assets of a utility: pipes, structures, equipment, etc. In simple terms, asset management encompasses:

- Risk management.
- Optimizing expenditures across capital, operations, and maintenance.
- Responsible planning for asset rehabilitation and replacement.
- Develop a scoring/rating system for maintenance staff to use to perform condition assessments.

Over recent years, the use of Asset Management has expanded as a result of aging infrastructure, a transitioning workforce, and reductions in state and federal grants. As a utility management tool, Asset Management has emerged as a potential solution to help overcome the severe infrastructure deficiencies in the United States.

In 2009, the District began its Asset Management program in order to validate its investments in its water and wastewater facilities. Moreover, the program was intended to serve as a communication tool, conveying strong environmental and fiscal stewardship on the part of the District staff to its Board, customers, and other utility stakeholders. The District identified a need to predict the cost and timing of repair and replacement projects, while minimizing the risk of failure of the assets. The program was also intended to provide a conduit for information sharing among District staff, while capturing valuable institutional knowledge from its engineering, planning, operations, and maintenance staff.

In 2010, the District completed its first AMP to show the needed investments in its water and wastewater assets. Since then, the District's AMP has served as a rational and transparent plan to guide the management of its assets. Since the last AMP, the District has acquired wastewater assets from the City of Yorba Linda, which have been incorporated into the updated AMP. Combined with new construction and recent replacements of existing assets, the District's updated AMP is intended to provide an updated forecast and analysis of the needs of its entire water and wastewater asset portfolio.

For this AMP update, the District decided to build upon the foundation that was started with the previous AMP, but also to expand the AMP scope to include additional assets. A few of the key changes to this AMP include:

- Incorporation of recently acquired Yorba Linda sewers.
- Expansion of the asset register to include information system (IS) Facilities, Supervisory Control and Data Acquisition (SCADA), Geographic Information System (GIS), and Administration and Operations Facilities.
- Utilization of closed circuit television (CCTV) data to assess sewer pipe condition.
- Inclusion of new condition data for certain facilities.

The intent of expanding the AMP scope is to provide more information to support the budget cycle and renewal planning.

1.2 Asset Management Plan Methodology

An AMP is a long-range planning document used to provide a rational framework for understanding the assets an organization owns, the services it provides, the risks it exposes, and the financial investments it requires. An AMP typically encompasses the current state (or condition) of the infrastructure assets, risk profile, and future capital needs to sustain the delivery of service to its customers. The results of an AMP are often used to drive the capital improvement plan and the financial plan, as well as identify opportunities to improve day-to-day operations of an organization.

For the preparation of this AMP, a risk-based asset renewal (or reinvestment) prioritization was developed for the District's assets. Risk corresponds to each discrete asset's potential to impact the District's service. The risk determinations associated with the District's facility and equipment assets are based on the results of the site visits and visual condition assessments. Below ground pipeline assets could not be visually assessed, so risk and the need for replacement were developed as a GIS-based model using the Innovyze® InfoMaster™ software. More detailed information on the condition and risk assessment processes are included in the following sections of this report.

Rehabilitation and replacement projects are created based on the results of the risk assessments. Near-term projects are added to a 10-year capital forecast to address the assets that pose the highest risk or are in need of immediate attention. An additional 100-year capital forecast is also developed to estimate the long-term funding requirements of all District assets. These two forecasts allow the District to budget the necessary capital dollars for near-term rehabilitation and replacement projects, and adjust annual contributions to reserve funds to support longer term needs. Final implementation and timing of the Capital Improvements Program or Project (CIP) projects for asset renewal will be confirmed by District management through detailed asset investigations, coordination with future capacity expansion projects, and priority-based scheduling of projects.

The report is organized into six sections, which are described below:

- **Section 1 - Introduction:** Provides an introduction to Asset Management at the District and the methodology used to create this AMP report.
- **Section 2 - Summary of Assets:** Summarizes the District's infrastructure assets including their estimated replacement cost.
- **Section 3 - Condition Assessment:** Describes the condition of the assets (equipment, facilities, and pipelines) and the process used to perform the condition assessment.
- **Section 4 - Risk Assessment:** Evaluates the risks associated with the District's assets
- **Section 5 - Financial Forecast:** Presents the funding needed to sustain the assets in both near and long-term planning horizons, and the impact on the cash flows.
- **Section 6 - Conclusions and Recommendations:** Summarizes the findings of the AMP report and presents recommendations for future AMPs.

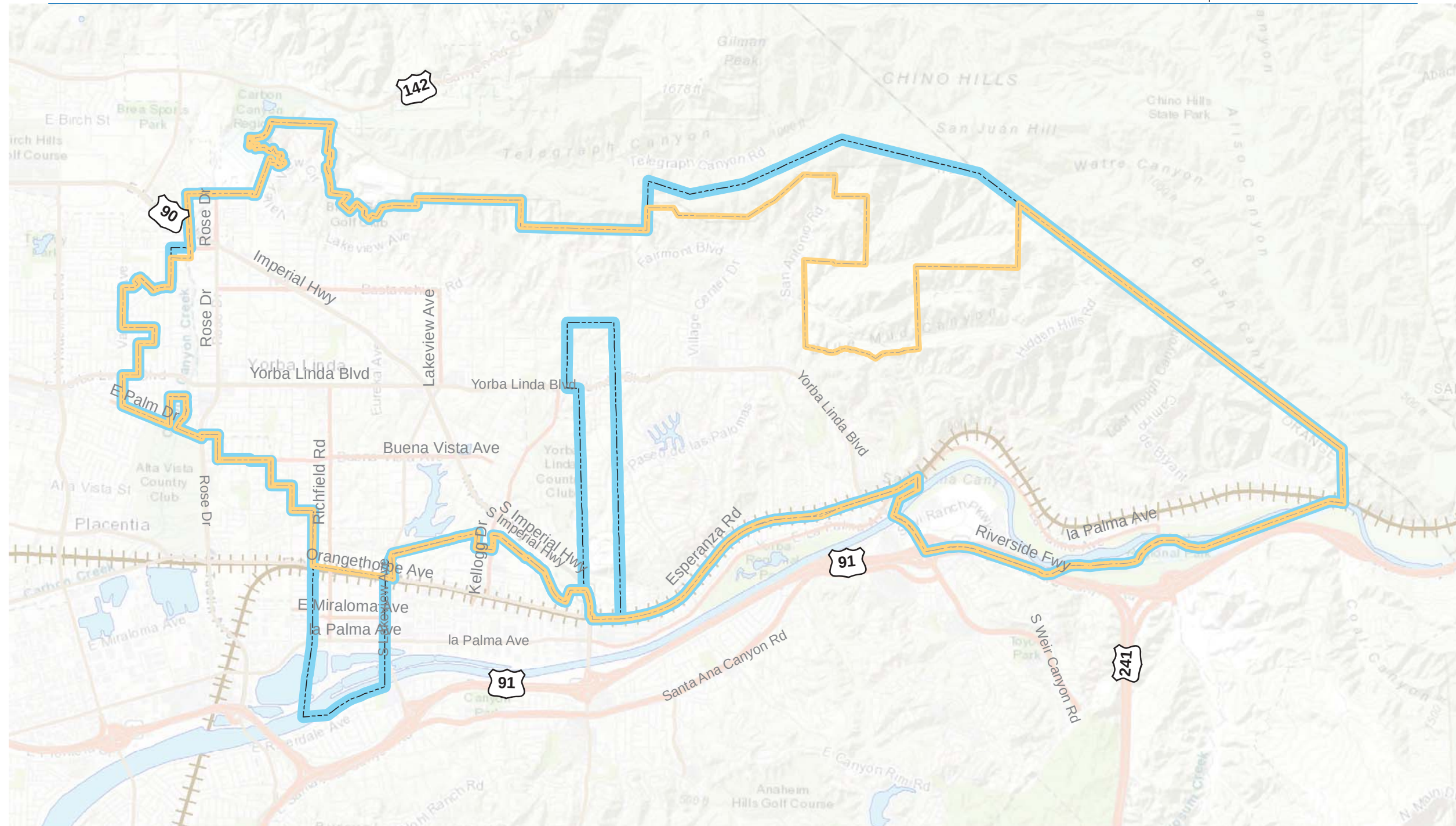
Section 2

SUMMARY OF ASSETS

This section summarizes the District's infrastructure assets included in the AMP and describes their extent, hierarchy, estimated replacement cost, and installation profile. The overall intent of this section is to summarize the assets the District owns and manages.

2.1 Asset Systems, Hierarchy, and Facilities

The District owns and manages both water and wastewater (sewer) systems that serve the cities of Yorba Linda, portions of Brea, Anaheim and Placentia, and small unincorporated areas in the County of Orange. The District's total asset register includes more than 56,000 individual assets ranging from a single water pipeline to a buried concrete reservoir. Figure 2.1 shows a map of the District water and wastewater service areas. More information about the assets included in the AMP is presented in the following subsections.



Legend

- Water System Boundary
- Sewer System Boundary
- Highway
- Principal Arterial
- + + Railroad
- Major Arterial

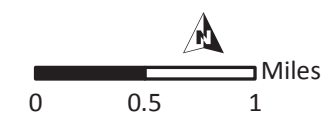


Figure 2.1 District Service Area Map

2.1.1 Asset Definition

A key step in developing an AMP is defining what is considered to be an asset. Certain assets are obvious, such as a segment of pipe or a building. However, other more complex assemblages of assets allow a more discretionary determination to delineate what is considered the asset or assets to be included in the AMP. For example, a vertical turbine pump can be viewed as a single asset (the entire pump unit) or as three separate assets (pump column and bowls, pump head, and motor). Typical asset definitions consider the item's replacement cost, expected life, purpose or function, and criticality to operation.

The determination of what is considered an asset was developed during a workshop with District staff on October 24, 2017. The project team reviewed available asset information from GIS and the previous AMP project to determine what was to be included in this AMP. The following bullets highlight the noteworthy decisions made with regard to the asset definition:

- A pump unit is a single asset that comprises the pump and motor components.
- Water distribution pipelines and customer meters are the only assets of the water distribution system. Components that are not classified as assets in the AMP include: fire hydrants, system valves, control valves, air vacuum valves, blow-off valves, fittings, service lines, and sampling stations.
- Sewer collection pipelines, lift station force mains, and manholes are the only assets of the wastewater collection system. Components that are not classified as assets in the AMP include: service laterals, cleanouts, chimneys, fittings, and grease interceptors.
- Interconnections and source connections were considered to be single assets. The valve, flow meter, and all other components are rolled into a single unit.
- Pressure Regulating Stations assets were separated into individual assets for each pressure reducing valve and for the structure they are contained in (building or buried vault).
- Mobile equipment was added as a new set of assets for this AMP. This includes trucks, vactors, trailers, and backhoes.
- A single asset was added to each facility to represent the site and grounds. This asset represents the various site components such as pavement and fencing and are not included as individual assets.

The asset definition can change over time as the District updates how it manages its assets. During the course of this project, the District began separating assets into smaller components for maintenance, replacement, and financial reporting. Future AMPs may consider the updated list of assets as well as fire hydrants and valves as individual assets should the District need to budget for individual maintenance or replacement of these assets.

2.1.2 Asset Hierarchy

An asset hierarchy provides a structured framework for organizing and grouping the District's full list of assets. The purpose of organizing assets into a hierarchy is to help group similar assets and aggregate information throughout the AMP. The District's hierarchy groups assets to visually illustrate the focus areas that were used to analyze the assets during this project. The basic hierarchy is shown in Figure 2.2.

The hierarchy divides the assets into three primary systems: water, wastewater, and support systems. Within each primary category are subcategories to separate the assets into two categories: Facilities and Equipment or Pipeline Systems (Distribution or Collection). The assets each of these subcategories are described below:

- Pipelines (Distribution and Collection) - the pipelines and appurtenances (such as meters and manholes) that deliver water and collect wastewater from its customers. This infrastructure is primarily buried.
- Facilities and Equipment - the facilities and their equipment that store and/or convey the water/wastewater or support the District's primary operations. These facilities include water booster pump stations, reservoirs, wells, pressure regulating stations, sewer lift stations, and the District's operations center. This infrastructure is primarily above ground, with the exception of the buried wells and reservoirs.

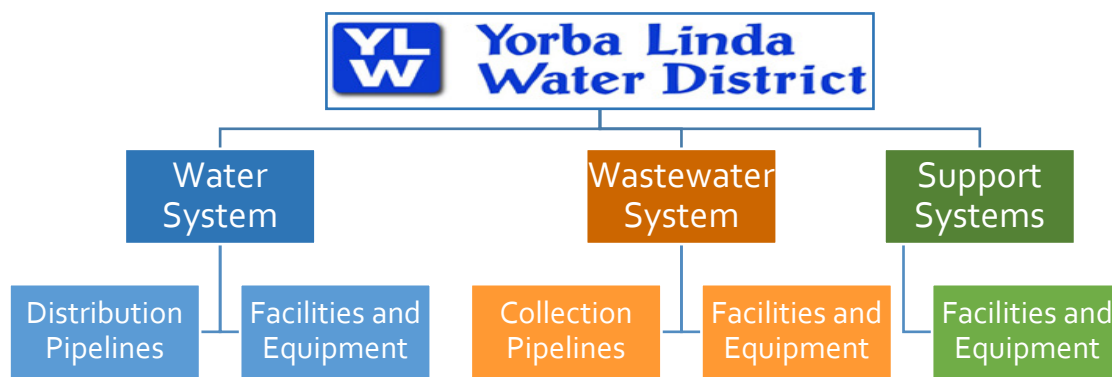


Figure 2.2 Asset Hierarchy

Within these subcategories, and not shown in the figure, are groupings of assets by facility or asset type (e.g., pump stations, reservoirs, water pipelines, or manholes). A summary of assets included within each system and subcategory is shown in Table 2.1 and a complete list of facilities/sites is included in Table 2.2. Figure 2.3 and Figure 2.4 include maps of the water and wastewater systems. A complete listing of all assets is included in the asset management model. The figures and tables represent the assets as of November 2017.

Table 2.1 Asset System Summary (as of November 2017)

System	Pipelines (Distribution and Collection)	Facilities and Equipment
Water	352 miles of water pipelines (ranging in size from 2-inch to 39-inch in diameter), including 3,983 fire hydrants 25,407 customer meters	14 storage reservoirs 12 booster pump stations 11 production wells 46 pressure regulating stations 4 imported water connections 10 emergency interconnections
Wastewater	266 miles of sewer pipelines (ranging in size from 4-inch to 24-inch in diameter) 0.3 miles of pressurized force main (4-inch diameter) 6,153 manholes	2 lift stations
Support		- Administration/Operations Buildings - Richfield chemical facilities - Fleet and mobile equipment - IT Infrastructure (servers, SCADA)

Table 2.2 Facility List

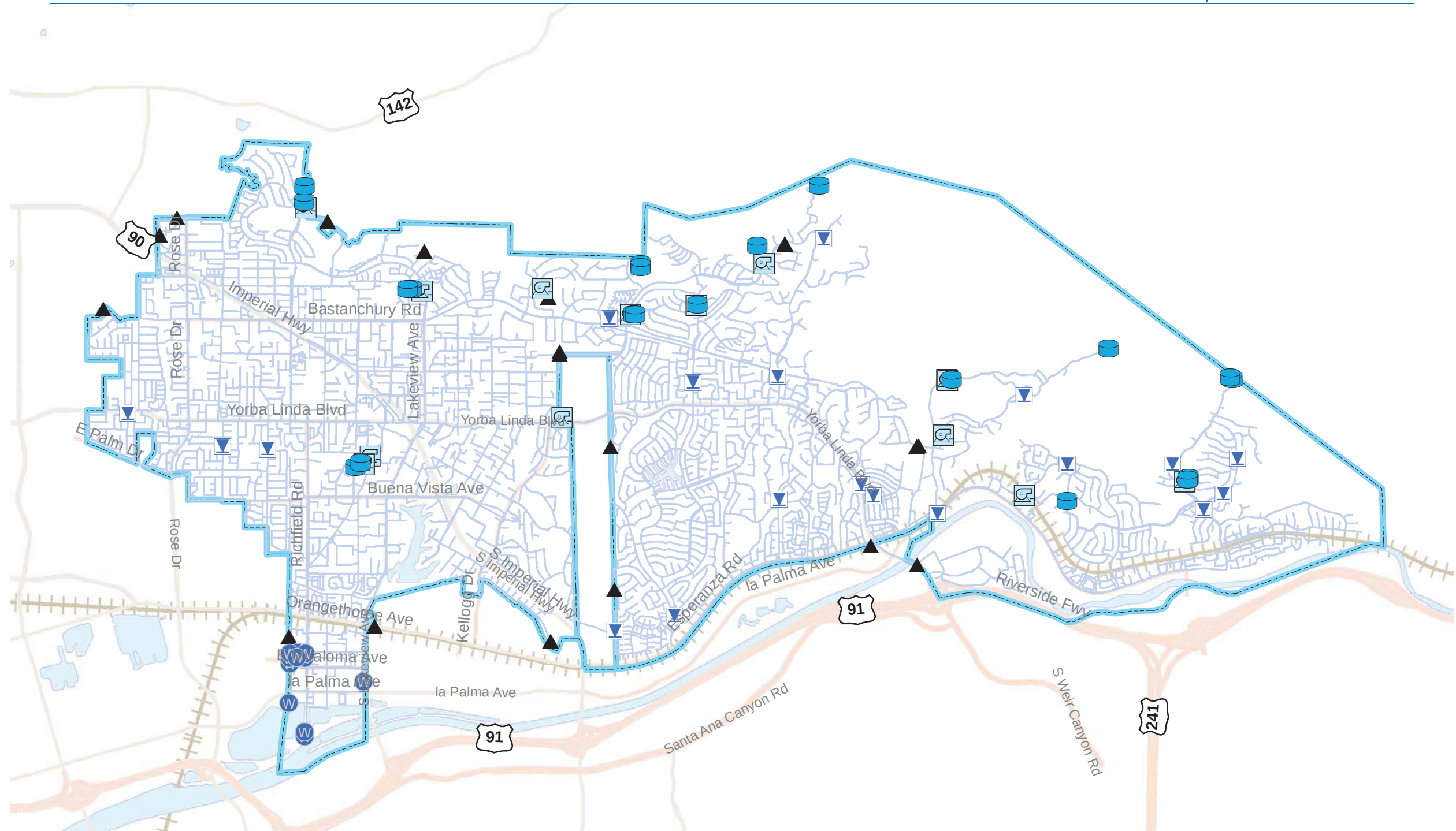
System	Facility Type	Facilities	
Water	Booster Pump Stations (12)	- Box Canyon BPS - Elk Mountain BPS - Fairmont BPS - Hidden Hills BPS - Highland BPS - Lakeview BPS	- Paso Fino BPS - Santiago BPS - Springview BPS - Timber Ridge BPS - Valley View BPS - Yorba Linda BPS
Water	Storage Reservoirs (14)	- Bryant Ranch Reservoir - Camino de Bryant Reservoir - Chino Hills Reservoir - Elk Mountain Reservoir - Fairmont Reservoir - Gardenia Reservoir - Hidden Hills Reservoir	- Highland Reservoir - Lakeview Reservoir - Little Canyon Reservoir - Quarter Horse Reservoir - Santiago Reservoir - Springview Reservoir - Valley View Reservoir
Water	Production Wells (11)	- Well No. 1 - Well No. 5 - Well No. 7 - Well No. 10 - Well No. 11 - Well No. 12	- Well No. 15 - Well No. 18 - Well No. 19 - Well No. 20 - Well No. 21

Table 2.2 Facility List (continued)

System	Facility Type	Facilities	
Water	Pressure Regulating Stations (46)	• Adobe	• Oakvale
		• Applecreek	• Paseo Del Prado
		• Box Canyon	• Platte
		• Brentwood	• Red Pine
		• Bryant #1	• San Antonio #1
		• Bryant #2	• San Antonio #2
		• Citation	• Stone Canyon
		• Clydesdale	• Stonehaven
		• Cornell	• Sumac
		• Cresthill	• Sunwood
		• Del Rey	• Timber Ridge
		• Dominguez	• Trailside
		• Fairmont	• Trentino
		• Hidden Hills #1	• Van Buren
		• Hidden Hills #2	• Villa Valente
		• Hidden Oaks	• Village Center
		• Jefferson	• Wagon Wheel
		• Kilt	• Walnut
		• Kodiak #1	• Willowbrook
		• Kodiak #2	• Yorba Linda
		• La Palma	• Tiburon ⁽¹⁾
		• Lakeview	• Foxtail ⁽¹⁾
		• Mission Hills	• Hamer ⁽¹⁾
Water	Import Water Connections (4)	• OC-36 (Raw Water)	• OC-66
		• OC-51	• OC-89
Water	Emergency Inter-connections (10)	• City of Anaheim (#12)	• GSWC-YL System (Rifle Range Rd.)
		• City of Anaheim (#14)	• GSWC-YL System (Crestknoll Dr.)
		• City of Anaheim (#15)	• GSWC-YL System (East End Ave.)
		• City of Brea (Tolbert Ave.)	• GSWC-Placentia System (Lemke)
		• City of Brea (Vesuvius Dr.)	• GSWC-Placentia System (Maria Ave.)
Wastewater	Lift Stations (2)	• Green Crest LS	• Lakeview LS
Support	Richfield Base	• Building 1 (Operations Building)	• Building 2 (Mechanic/Meter Shop/Water Quality Lab)
		• Building 3 (Warehouse)	• Building 4 (Administrative Office)

Notes:

(1) Denotes PRS sites planned for abandonment.

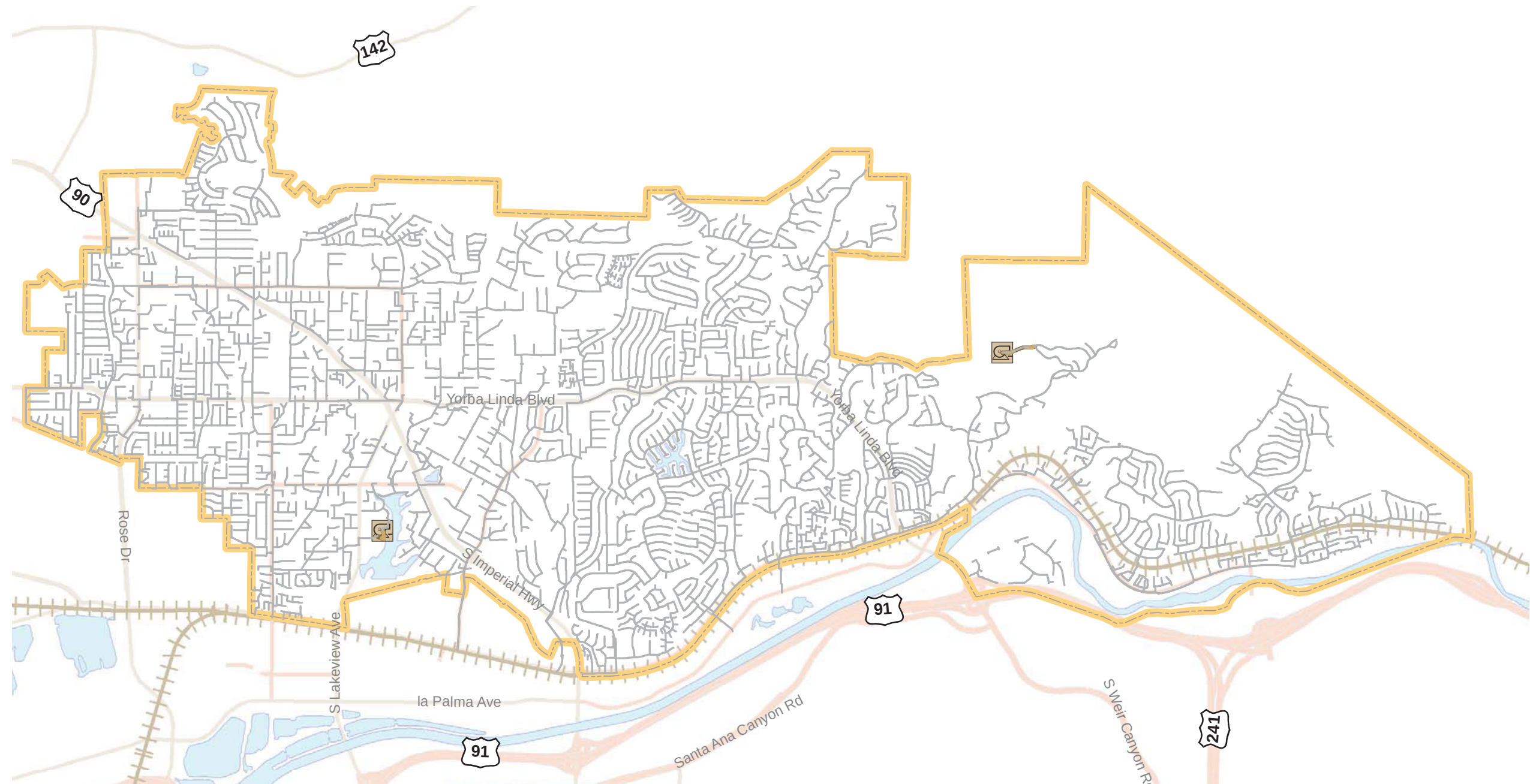


Legend

- | | | |
|----------------------|-------------------------|--------------------|
| Tank | Pressure Relief Station | Principal Arterial |
| Production Well | Intertie | Major Arterial |
| Booster Pump Station | Water System Boundary | Railroad |
| Water Pipelines | Highway | |



Figure 2.3 Water System Map



Legend

- | | |
|-----------------------|--------------------|
| Gravity Main | Highway |
| Force Main | Principal Arterial |
| Lift Station | Major Arterial |
| Sewer System Boundary | Railroad |

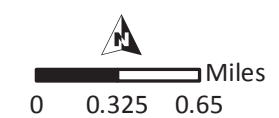


Figure 2.4 Wastewater System Map

Figure 2.5 and Figure 2.6 illustrate the distribution of materials and sizes of water and wastewater pipelines. A more detailed breakdown of length of materials is shown in Table 3.5. Both systems are primarily comprised of 6 or 8-inch diameter pipelines. The water system pipelines vary in size up to a maximum of 39-inches in diameter and include 10 different types of materials, with the majority being asbestos cement.

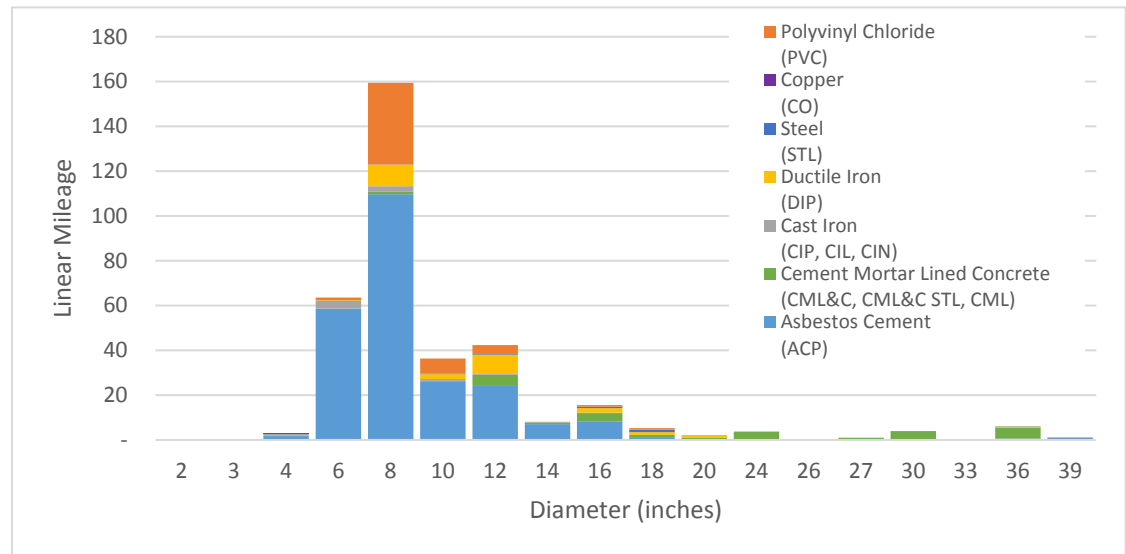


Figure 2.5 Water System Pipeline Composition

The wastewater system pipelines are primarily vitrified clay (VCP) and have a maximum diameter of 24-inches.

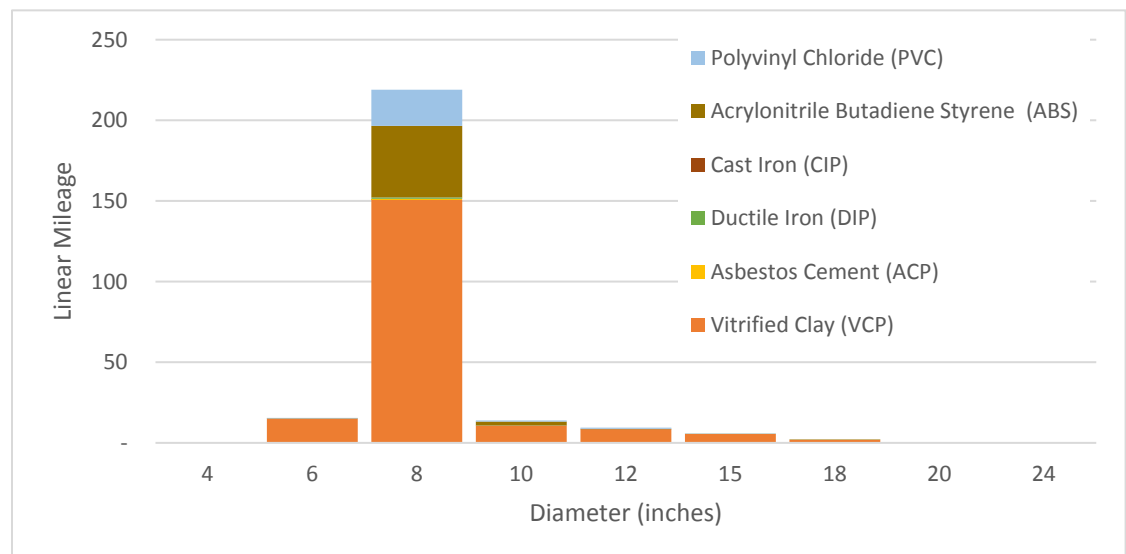


Figure 2.6 Wastewater System Pipeline Composition

2.2 Asset Replacement Cost Estimate

The asset replacement cost estimate is an integral part of an AMP, especially for developing budget projections. The replacement cost of each asset is used instead of the installation or purchase cost because the AMP is focused on future funding needs, not the funding history. The purpose of calculating the replacement cost is so that the District understands how much it will eventually cost to replace all assets. This number provides context to the CIP budget in comparison to the overall cost of the system.

2.2.1 Replacement Cost Development Process

To create the replacement cost estimate, all District assets were assigned an estimated replacement cost in today's dollars (2018). The estimated replacement costs are considered "project costs" which include the cost of the asset, the cost to design the asset (if applicable), and the cost to construct or install the asset. Costs were estimated using contractor bids from recent District projects, vendor quotes for similar equipment, data used in the previous Asset Management Plan, and Carollo's cost estimating library. It should be noted that the asset replacement costs are Class 5 planning level estimates, per the Association for the Advancement of Cost Engineering (AACE) International definitions.

The cost estimates use asset data and various assumptions to develop the costs for each asset. For example, pipelines used a cost per linear foot that varied by diameter, pump costs varied by rated flow or horsepower, reservoir costs varied by capacity, and some types of assets used a default estimate. The District provided bids for recent projects and financial records. When available, historical asset values were escalated to 2018 dollars using the Engineering News Record (ENR) Construction Cost Index (CCI). The cost of assets included in near-term CIP projects were reviewed and adjusted to best represent the total cost of the project. The replacement costs of each asset are included in the asset management model.

2.2.2 Estimated Asset Replacement Cost

The total estimated replacement cost of the District's assets is \$1.07 billion. This includes the replacement of all assets in the asset register. The breakdown of replacement cost amongst the three asset systems is shown in Figure 2.7 and information about each facility type is shown in Table 2.3.

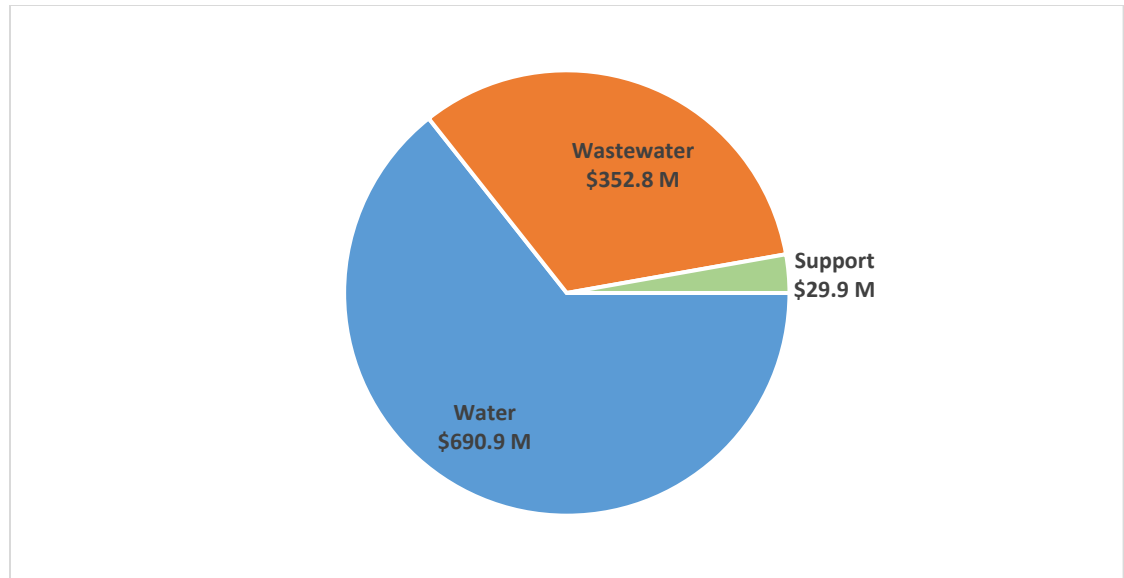


Figure 2.7 Asset Replacement Cost Estimate by System

Table 2.3 System Replacement Cost Estimate Summary

System	Pipelines (Distribution and Collection)	Facilities and Equipment
Water	• Distribution pipelines - \$420 M • Meters - \$11 M	• Storage reservoirs - \$189 M • Booster pump stations - \$28 M • Production wells - \$31 M • Pressure regulating stations - \$12 M • Imported connections and emergency interconnections - \$0.4 M
	• Collection pipelines - \$290 M • Force mains - \$0.3 M • Manholes - \$62 M	• Lift stations - \$1 M
Support		• Richfield base ops. center - \$25 M • Fleet and mobile equipment - \$5 M

Notes:

(1) Values represent full project costs that include design and construction. Values shown in 2018 dollars.

As illustrated by the pie chart, the water system accounts for nearly two-thirds of the total replacement cost at roughly \$700 million. The pipeline systems make up nearly three-quarters of the total replacement cost, with the facilities and equipment as the remainder.

2.3 Asset Installation Profile

The asset installation profile provides insight into the age of the system as a whole. The profile is an aggregation of the installation year and replacement cost for all assets. The profile illustrates the current replacement cost of the assets in the years they were installed, dating back to the earliest asset installation. It does not represent the actual capital investment that took place in any given year. The replacement cost is represented in the graph because it is the only common metric between all types of assets.

The installation profile is shown in Figure 2.8 and Table 2.4 illustrates the replacement value of the assets installed in each decade dating back to the 1920s.

Table 2.4 Asset Installation Summary

Decade	Asset Age Range (years)	Asset Installation Replacement Cost ⁽¹⁾	Percentage of Total Replacement Cost
1920s	89-98	\$0.4 M	< 1%
1930s	79-88	\$3 M	< 1%
1940s	69-78	\$2 M	< 1%
1950s	59-68	\$7 M	1%
1960s	49-58	\$130 M	12%
1970s	39-48	\$213 M	20%
1980s	29-38	\$291 M	27%
1990s	19-28	\$110 M	10%
2000s	9-18	\$231 M	22%
2010s	1-8	\$83 M	8%

Notes:

(1) Cost represents 2018 replacement cost estimates of each asset installed in each year. Value does not represent the actual expenditures in a given year.

The District's oldest asset was installed in 1925 and is approaching 95 years in age. The 1960s are the earliest decade with significant asset installations. The installations increased in the 1970s and 1980s, dropped in the 1990s, and picked up again in the 2000s. Asset installations dropped off dramatically in the early 1990s and late 2000s, which corresponds with economic recessions.

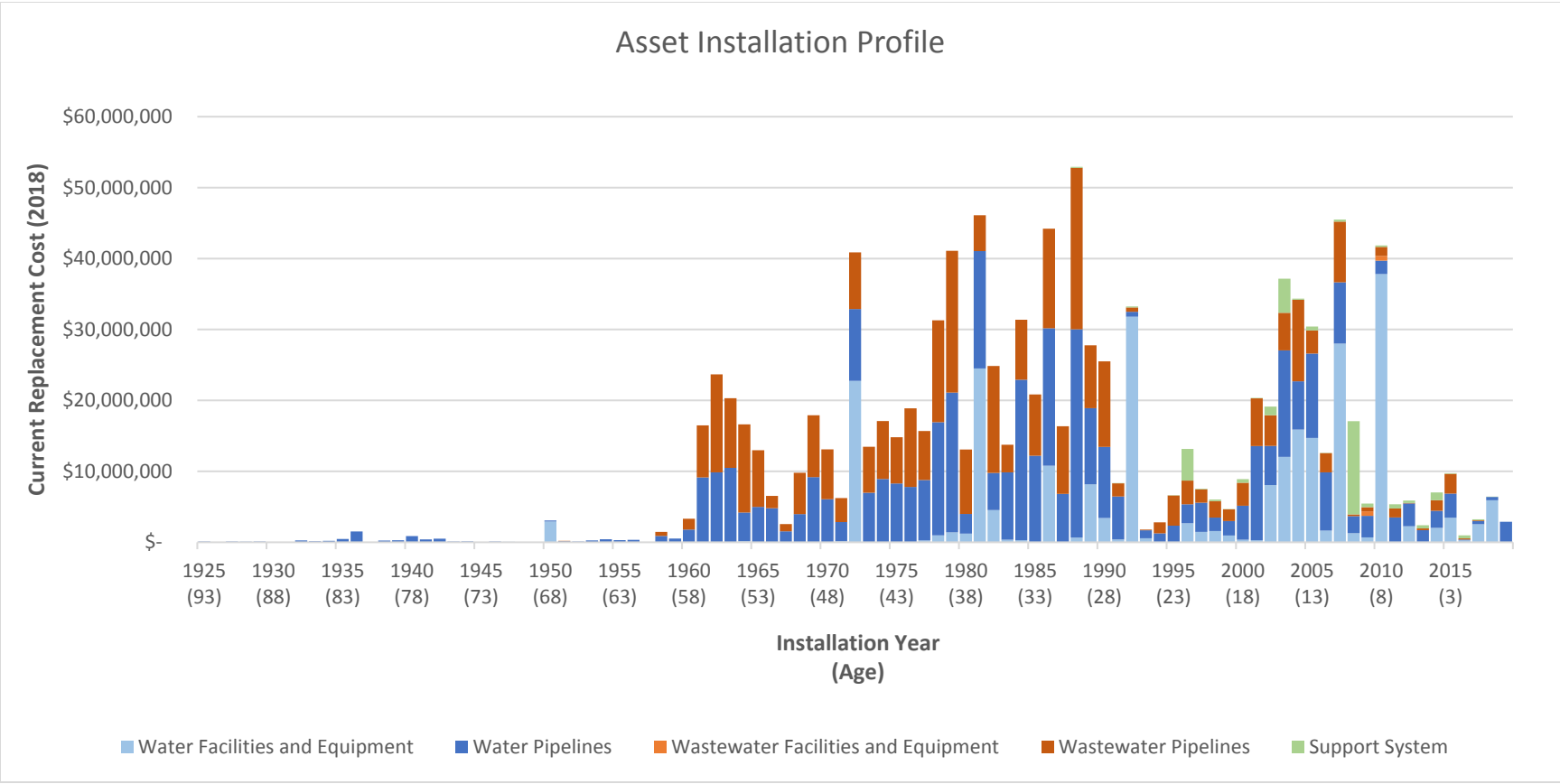


Figure 2.8 Asset Installation Profile

Section 3

CONDITION ASSESSMENT

This section describes the condition of the assets (equipment, facilities, pipelines, and appurtenances) and the process used to perform the assessments. The intent of this section is to explain the current state of the assets.

This section is separated into two condition assessment processes. The first half of the section covers the visual condition assessment of the facilities and equipment assets, while the second half covers the GIS evaluation of the water and wastewater pipelines.

3.1 Facilities and Equipment Condition and Remaining Life Assessment

A condition assessment was performed on the majority of District facilities to assess the visual condition of the assets at each site. This section summarizes the methodology and results of the visual condition assessment that was conducted on November 30, 2017 and December 1, 2017. This section also contains descriptions, observations, and recommendations for each of the assessed sites.

3.1.1 Condition Assessment Process and Scoring

A condition assessment protocol (CAP or protocol) defines the process for evaluating asset condition. The purpose of a CAP is to standardize the condition assessment process so that assessment results are consistent between sites and to make the process repeatable for District staff to use. The CAP was developed through a workshop with District staff on November 11, 2017. During the workshop, staff reviewed and discussed various scoring types and definitions that could be used in the field. The full CAP is included for reference in Appendix A.

The site visits consisted of a visual condition assessment conducted by a multi-disciplinary engineering team accompanied by District staff. Throughout the assessment, the Carollo team asked questions of the District staff to capture anecdotal maintenance and performance history since maintenance records for individual asset were not available. This information was especially useful for assets that were not visible or readily accessible, such as buried reservoirs or the underground portion of the District's wells. The condition assessment also considered other sources of available information, such as reservoir dive reports and pump efficiency test results.

3.1.1.1 Condition Descriptions

The condition of each asset was evaluated using a one-through-five scoring system. One represents the best condition assets, while five represents the worst condition assets. The purpose of the score is to provide a common scale to rate all assets so they can be compared relative to one another.

The definition of each score was customized to fit the various types of assets at each facility. The CAP in Appendix A includes the scoring definitions for each type of asset. For reference, Table 3.1 provides the general description of the condition associated with each score.

Table 3.1 General Condition Scoring Descriptions

Condition Score	General Description ⁽¹⁾
1 (Best)	New or Excellent Condition • Only normal maintenance required • Fully functional
2	Minor Defects Only • Minor maintenance required (5%) • Fully functional
3	Moderate Deterioration • Moderate maintenance required (10% – 20%) • Function not significantly affected
4	Significant Deterioration • Significant renewal / upgrade required (20%-40%) • Functions as needed but is unreliable
5 (Worst)	Severe Deterioration • Over 50% of asset requires replacement • Barely functional for current conditions

Notes:

(1) Asset-specific score definitions are included in the CAP in Appendix A.

3.1.1.2 Remaining Useful Life Assumptions

The remaining useful life of each asset was evaluated based on the original useful life expected for each type of asset, or the assessed condition of each asset depending on the information available. Table 3.2 shows the assumed condition based on remaining useful life for each type of asset. These assumptions were used to determine the rehabilitation or replacement timing for assets that were assessed and assigned a condition score. In specific cases where the age of an asset exceeded the original useful life for that type of asset, the condition-based remaining useful life was adjusted to account for the potential obsolescence and reliability issues associated with operating the equipment.

For assets and sites that were not seen during the site visit and for fleet equipment, the remaining useful life was assumed to be the original useful life minus the age of the asset.

Table 3.2 Condition and Remaining Useful Life by Asset Type

Asset Type	Original Useful Life (Years)	Remaining Useful Life Based on Condition Score (Years)				
		Condition Score	1	2	3	4
Civil and Structural Assets						
Building	50	50	35	20	10	5
Reservoir ⁽²⁾	100	100	75	50	25	10
Concrete Structure	50	50	35	20	3	1
Steel Structure (e.g., canopy)	25	25	15	10	2	1
PRS Vault	50	50	35	20	3	1
Well Casing	50	50	30	15	5	1
Site Conditions ⁽³⁾	50	50	30	20	2	1
Mechanical Assets						
Water Booster Pump	20	20	15	10	3	1
Wastewater Submersible Pump	20	20	15	10	3	1
Well Pump	40	40	25	10	5	1
Pressure Regulating Valve	25	25	20	10	3	1
Reservoir Valve	35	35	25	5	2	1
Chemical Equipment	15	15	10	5	2	1
Chemical Tanks	15	15	10	5	2	1
Engine	40	40	30	15	5	1
General Mechanical	20	20	15	10	3	1
Electrical and Instrumentation Assets						
IT Equipment	20	20	15	10	5	1
Variable Frequency Drive	30	30	15	10	5	1
Switchboard / MCC	30	30	15	10	5	1
Main SCADA	15	15	12	8	4	1
Remote SCADA	20	20	15	10	5	1
Flow Meter	15	15	10	7	2	1
Instrumentation	15	15	10	7	2	1
General Electrical	30	30	15	10	2	1
Fleet and Mobile Equipment						
Backhoe/Forklift	15			n/a ⁽¹⁾		
CCTV Truck	15			n/a ⁽¹⁾		
Dump Truck	15			n/a ⁽¹⁾		
Trailer	20			n/a ⁽¹⁾		
Truck	10			n/a ⁽¹⁾		
Vactor	20			n/a ⁽¹⁾		

Notes:

(1) These assets were not visually assessed and condition scores were not assigned.

(2) All District reservoirs are buried concrete.

(3) Site Conditions represents pavement, fencing, yard piping, and other components of the site not represented as individual assets.

3.1.2 Condition Assessment Observations and Findings

The condition assessment team visited more than 40 of the District's facilities including booster pump stations, reservoirs, source connections, wells, and the Richfield Base. The results of the condition assessment were used along with other sources of information such as reservoir dive reports, anecdotal information from District staff, and the District's planned CIP to determine the necessary rehabilitation and replacement timing and needs. Limited operation and historical maintenance information was available for individual assets, therefore the input from District staff was relied upon to provide additional insight into condition.

The following sections describe the main findings from each site visited during the condition assessment.

3.1.2.1 Booster Pump Stations

The condition assessment team visited 11 of the District's 12 booster pump stations (BPSs). The sections below include a brief description and summary of the findings for each of the BPS sites.

Fairmont BPS

The Fairmont BPS is currently under construction and was therefore not assessed. However, the pump station and its assets are included in the AMP's analyses, and were assumed to have an installation year of 2018 and a condition score of one, since all the items are newly constructed or installed.

Box Canyon BPS

The Box Canyon BPS includes two electric vertical turbine pumps and associated valves and electrical equipment enclosed by a block wall. The roof over the majority of the station is open steel fencing, with a solid metal roofing material installed over most of the electrical equipment to protect it from the elements.

In general, the assets at this site were found to be in fair to good condition with the exception of pump 2. The pump showed typical wear for an asset of its type and age, but District staff indicated that the pump is very inefficient due to being in a difficult application where the suction and discharge head on the pump fluctuates significantly, and needs to be replaced. Additionally, plywood has been installed as a temporary cover on a section of the roof that is over some electrical components. Staff indicated that they would like to remove the plywood and extend the metal roof to cover all of the electrical equipment.

Elk Mountain BPS

The Elk Mountain BPS includes three electric vertical turbine pumps and associated valves and electrical equipment enclosed in a subgrade concrete vault. The roof over the majority of the station is open steel grating, with a solid metal roofing material installed over the electrical equipment to protect it from the elements.

The vault, including the steel grating and roofing material, along with the greater site are in good condition. The majority of the mechanical assets are approaching 20 years in age and are in fair condition with the expected level of wear visible. Due to their age, it is expected that the pumps and other mechanical components will need to be rehabbed or replaced within the next ten years. The surge tank was more recently replaced and is in good condition.

Hidden Hills BPS

The Hidden Hills BPS includes four electric vertical turbine pumps and associated valves and electrical equipment fully enclosed in a block building with a steel roof.

Overall the mechanical, electrical, and structural assets were found to be in fair to good condition. Pumps motors 1, 2, and 3 were installed in the 2007/2008 time frame and show normal wear for their age including some corrosion due to water leakage at the seal, and some cracked concrete at the base. Pump 4 and the electrical equipment are older, but still operational and in fair condition.

Based on their age and condition, the pumps and electrical components will likely require rehabilitation in the next ten years. Additionally, the District has noted that the pumps at this station will need to be upsized within the ten year timeframe to meet anticipated demands.

Highland BPS

The Highland BPS is a complex pump station that includes three electric vertical turbine pumps as well as two natural gas motor driven vertical turbine pumps and associated valves and electrical equipment. All of the equipment is fully enclosed in a block building with a steel roof. Additionally, the site includes a backup generator housed in a separate block building, an older storage building that previously housed chemical equipment, and a large steel surge tank.

The main pump station building, pumps and other mechanical equipment, and electrical equipment were installed or constructed in 2010 and are in good condition. The assessment did not indicate the need for major rehabilitation of these assets within the next ten years. The emergency generator is slightly older, having been installed in 2003, and may require some minimal rehab within the next ten years.

Lakeview BPS

The Lakeview BPS is a complex pump station that includes three electric vertical turbine pumps, one natural gas motor driven vertical turbine pump, and associated valves and electrical equipment. Additionally, the site has a chemical system consisting of a hypochlorite generation system, chemical storage tanks, metering pumps, and chlorine residual analyzers. All of the equipment is fully enclosed in a block building with a steel roof.

The main pump station building, pumps and other mechanical equipment, electrical equipment, and chemical system were installed or constructed in 2007 and are in good condition. The assessment did not indicate the need for major rehabilitation of these assets within the next ten years. It is expected that the chemical systems will require rehabilitation in the next ten years as they reach the end of their expected useful life. Additionally, the district indicated that work will be performed to modify the piping at the station to address water age and quality issues at the adjacent Lakeview reservoir.

Paso Fino BPS

The Paso Fino BPS includes two electric vertical turbine pumps, one natural gas motor driven vertical turbine pump, and associated valves and electrical equipment, the equipment is fully enclosed in a block building with a steel roof.

The building, electric pumps, electrical system, and the site were originally constructed or installed in 2004 and are in good condition with minimal visible wear. The natural gas pump and propane tank were installed in 2009 and are also in good condition. The assessment did not indicate the need for major rehabilitation of these assets within the next ten years.

Santiago BPS

The Santiago BPS includes three electric vertical turbine pumps and associated valves and electrical equipment enclosed in a subgrade concrete vault. Additionally a natural gas engine driven pump is located above grade, with the engine enclosed in a steel cabinet. The roof over the majority of the concrete vault is open steel grating, with a solid metal roofing material installed over the electrical equipment to protect it from the elements.

The vault, including the steel grating and roofing material, along with the greater site are in fair condition. The mechanical and electrical assets are operational and in fair condition but have surpassed their expected useful life and show moderate wear including significant corrosion at the mechanical seals. Due to their age and condition, it is expected that pumps 3 and 4, other mechanical components, and the electrical systems will need to be rehabilitated or replaced within the next ten years. Pumps 1 and 2 were replaced in 2010 and will not require rehabilitation or replacement within the next ten years.

Springview BPS

The Springview BPS includes three electric vertical turbine pumps and associated valves and electrical equipment enclosed in a subgrade concrete vault. The roof over the majority of the concrete vault is open steel grating, with a solid metal roofing material installed over the electrical equipment to protect it from the elements.

The vault, including the steel grating and roofing material, along with the greater site are in fair condition. The mechanical assets are operational and in fair condition and show moderate wear including moderate corrosion at the mechanical seals. The pumps will reach the end of their expected useful life within the next ten years. The motor control center (MCC) is in fair condition but has surpassed its expected useful life having been installed in 1979 when the station was initially constructed. Due to their age and condition, it is expected that the pumps and other mechanical components as well as the electrical systems will need to be rehabilitated or replaced within the next ten years. The District plans to upsize the pump capacities during replacement.

Timber Ridge BPS

The Timber Ridge BPS includes three electric vertical turbine pumps, one natural gas motor driven vertical turbine pump, and associated valves and electrical equipment. The electric pumps and associated equipment is fully enclosed in a block building with a steel roof. The natural gas pump is located outside the building with the engine enclosed in a steel cabinet.

The building and the greater site are in good condition. The mechanical assets are operational and in fair condition but will reach the end of their expected useful life within the next ten years. The MCC is in fair condition but nearing its expected useful life having been installed in 1986 when the station was initially constructed. Due to their age and condition, it is expected that the pumps and other mechanical components as well as the electrical systems will need to be rehabilitated or replaced within the next ten years. Within the near future, the District plans to replace the natural gas pump with a new engine driven pump enclosed in a new pump house because the current pump has significant deterioration.

Valley View BPS

The Valley View BPS includes two electric vertical turbine pumps, one natural gas motor driven vertical turbine pump, and associated valves and electrical equipment, the equipment is fully enclosed in a block building with a steel roof.

The building, electric pumps, electrical system, and the site were originally constructed or installed in 2003 and are in good condition with minimal visible wear. The assessment did not indicate the need for major rehabilitation of these assets within the next ten years.

Yorba Linda BPS

The Yorba Linda BPS includes three electric vertical turbine pumps and associated valves and electrical equipment. The equipment is fully enclosed in a block building with a steel roof.

The building, pumps, electrical system, and the site were originally constructed or installed in 2014 and are in very good condition with minimal visible wear. The assessment did not indicate the need for major rehabilitation of these assets within the next ten years.

3.1.2.2 Reservoirs

The district's system includes 14 buried concrete reservoirs. The condition assessment focused on the reservoir components and assets that were visible from the surface, the assessment team did not enter any of the reservoirs. Available reservoir dive reports provided by the District were reviewed to help determine the condition score assigned to each reservoir.

Fairmont Reservoir

The Fairmont reservoir was not visited due to the ongoing construction at the adjacent Fairmont BPS during the assessment, however it was found to be in fair condition based on a review of the December 2016 dive report. Notably, the report suggested that the District repair the duckbill nozzle on the north side of the baffle wall in the east bay as further degradation could obstruct the inlet sections to the east bay.

Bryant Ranch Reservoir

The Bryant Ranch Reservoir has a capacity of 2.3 million gallons and was constructed in 1986. Based on the condition assessment and review of the December 2016 dive report, the reservoir was found to be in good condition with the exception of the site fence. The steel fence surrounding the site is severely corroded and in need of replacement.

Camino de Bryant Reservoir

The Camino de Bryant Reservoir has a capacity of 3.2 million gallons and was constructed in 1992. A recent dive report was not available for this reservoir, based on the condition assessment the assets visible at the surface were found to be in good condition. Dive reports for other District reservoirs of a similar age indicated good condition.

Chino Hills Reservoir

The Chino Hills Reservoir has a capacity of 0.5 million gallons and was constructed in 1989. A recent dive report was not available for this reservoir, based on the condition assessment the assets visible at the surface were found to be in good condition. Dive reports for other District reservoirs of a similar age indicated good condition. Though not a condition issue, staff did note that the access gate is owned and controlled by a private home owner.

Elk Mountain Reservoir

The Elk Mountain Reservoir has a capacity of 6.0 million gallons and was constructed in 1992. A recent dive report was not available for this reservoir, based on the condition assessment the assets visible at the surface were found to be in fair condition. Dive reports for other District reservoirs of a similar age indicated good condition. One notable issue at the site is the concrete staircase leading from the parking area to the top of the reservoir, several stairs are missing treads and are uneven posing a potential safety concern.

Gardenia Reservoir

The Gardenia Reservoir has a capacity of 1.98 million gallons and was constructed in 2002. Based on the condition assessment and review of the November 2015 dive report, the reservoir was found to be in good condition.

Hidden Hills Reservoir

The Hidden Hills Reservoir has a capacity of 2.0 million gallons and was constructed in 2010. Based on the condition assessment and review of the December 2016 dive report, the reservoir was found to be in good to excellent condition. Though not a condition issue, it was noted that there is no bollard protection for the programmable logic controller (PLC) cabinets. Staff also noted that the inlet piping needs to be reconfigured for water quality reasons.

Highland Reservoir

The Highland Reservoir has a capacity of 6.0 million gallons and was constructed in 2010. Based on the condition assessment and review of the October 2017 dive report, the reservoir was found to be in good condition. Additionally, staff noted that the fencing along the east side of the entrance road is still the temporary fencing from when the site was constructed, and may be inside the District's property line.

Lakeview Reservoir

The Lakeview Reservoir has a capacity of 8.0 million gallons and was constructed in 2007. A recent dive report was not available for this reservoir, based on the condition assessment the assets visible at the surface were found to be in good condition. Dive reports for other District reservoirs of a similar age indicated good condition. The site retaining wall should be monitored for stability as it was noted that the retaining wall and swale at west side has cracking and a joint has opened up, the wall at southwest corner has opened up with swale cracking, and that the south wall has a 1 to 2 inch transverse offset at the top of the wall.

Little Canyon Reservoir

The Little Canyon Reservoir has a capacity of 0.88 million gallons and was constructed in 1982. Based on the condition assessment and review of the December 2016 dive report, the reservoir was found to be in good condition. However, this reservoir has the greatest deficit and expansion is recommended by District Staff.

Quarter Horse Reservoir

The Quarter Horse Reservoir has three basins with a combined capacity of 7.27 million gallons. Basin 1 and 2 were completed in 2004 and basin 3 in 2005. Based on the condition assessment and review of the October 2015 dive report, the reservoir was found to be in good condition.

Santiago Reservoir

The Santiago Reservoir has a capacity of 1.1 million gallons and was constructed in 1989. Based on the condition assessment and review of the December 2016 dive report, the reservoir was found to be in good condition.

Springview Reservoir

The Springview Reservoir has a capacity of 8.0 million gallons and was constructed in 1981. Based on the condition assessment and review of the December 2016 dive report, the reservoir was found to be in good condition.

Valley View Reservoir

The Valley View Reservoir has a capacity of 1.98 million gallons and was constructed in 2003. Based on the condition assessment and review of the November 2015 dive report, the reservoir was found to be in good condition.

3.1.2.3 Wells

The District currently operates 11 electric and natural gas powered groundwater production wells. Each of the wells was visited during the site assessment. The site assessment focused only on the above ground assets at each of the well sites, the condition scores assigned to each of the wells were formulated from determined information provided by staff, the time since each well's last major rehab, the design and current production capacity of each well, and other operational information.

Well Number 1

Well Number 1 is a natural gas engine driven well with a design capacity of 1,800 gallons per minute (GPM) and a current operating capacity of 1,800 GPM. The well and well pump were rehabilitated in 2017 and are in excellent condition. The other equipment at the site was not rehabilitated or replaced at that time and is in fair to good condition. The condition assessment did not indicate the need for major rehabilitation of these assets within the next ten years.

Well Number 5

Well Number 5 is a natural gas engine driven well with a design capacity of 2,300 GPM and a current operating capacity of 1,760 GPM. The well was originally constructed in 1950, the current well pump, building, engine, and other ancillary equipment was installed in 1996. Staff indicated that the pump, appurtenances, and angle drive were rehabilitated in 2010, however significant corrosion and coating failures are present on the pump head, at the mechanical seal, and on the angle drive. Concrete spalling is visible at the waste discharge and is beginning to form on the pump pad. Due to their age and condition, it is expected that the well and well pump will require further rehabilitation or replacement within the next ten years.

Well Number 7

Well Number 7 is a natural gas engine driven well with a design capacity of 2,200 GPM and a current operating capacity of 1,750 GPM. The well was originally constructed in 1950, the current well pump, building, engine, and other ancillary equipment was installed in 1996. Significant corrosion and coating failures are present on the pump head and the angle drive. Severe concrete spalling and cracking is present on the pedestal and surrounding base. During the assessment District Staff indicated that they plan to rehabilitate this well in 2018.

Well Number 10

Well Number 10 is an electric motor driven well with a design capacity of 1,800 GPM and a current operating capacity of 1,600 GPM. The site was originally constructed between 1991 and 1993. The equipment at the site was found to be in fair condition showing typical wear for its age. The condition assessment did not indicate the need for major rehabilitation of these assets within the next ten years.

Well Number 11

Well Number 11 is an electric motor driven well with a design capacity of 1,600 GPM and a current operating capacity of 1,100 GPM. The site was originally constructed in 1990 and the well pump was rehabbed in 2009. Currently, the District uses this well as a backup for well 20 and it is typically only run once per quarter to meet Title 22 requirements. The equipment at the site was found to be in fair condition showing typical wear for its age. The condition assessment did not indicate the need for major rehabilitation of the well or pump within the next ten years, however the electrical and control systems will reach the end of their expected useful life in 2028.

Well Number 12

Well Number 12 is an electric motor driven well with a design capacity of 1,200 GPM and a current operating capacity of 1,140 GPM. The site was originally constructed in 1996 and the well and well pump were rehabbed in 2010. The equipment at the site was found to be in fair condition with most assets showing typical wear for their age. Some cracked and spalled concrete was noted on the pump pedestal and the pad. The condition assessment did not indicate the need for major rehabilitation of the well or pump within the next ten years.

Well Number 15

Well Number 15 is an electric motor driven well with a design capacity of 1,200 GPM and a current operating capacity of 1,150 GPM. The site was originally constructed between 1997 and 1999 and the well pump was rehabbed in 2017. The equipment at the site was found to be in fair condition with most assets showing typical wear for their age. The condition assessment did not indicate the need for major rehabilitation of the well or pump within the next ten years.

The chemical systems at the site including the hypochlorite tanks, chemical feed pumps, and chlorine residual analyzer are nearing the end of their expected useful lives and will require rehabilitation or replacement within the next ten years.

Well Number 18

Well Number 18 is a natural gas engine driven well with a design capacity of 2,200 GPM and a current operating capacity of 2,290 GPM. The site was constructed between 2003 and 2005, and the visible equipment is in fair to good condition. The condition assessment did not indicate the need for major rehabilitation of this site within the next ten years.

Well Number 19

Well Number 19 is an electric motor driven well with a design capacity of 2,100 GPM and a current operating capacity of 1,900 GPM. The site was constructed between 2005 and 2007, and the visible equipment is in good condition. The condition assessment did not indicate the need for major rehabilitation of this site within the next ten years.

Well Number 20

Well Number 20 is an electric motor driven well with a design capacity of 3,000 GPM and a current operating capacity of 2,800 GPM. The site was constructed in 2010, and the visible equipment is in good condition. The condition assessment did not indicate the need for major rehabilitation of the well components at this site within the next ten years.

The chemical system attributed to Well Number 20 includes two chemical tanks installed in 1999, and a chlorine generator, chemical feed pumps, and chlorine residual analyzer installed in 2015. Though the system is in good condition, District staff indicated that the equipment is undersized, and that plans are in place to augment or upsize the system.

Well Number 21

Well Number 21 is an electric motor driven well with a design capacity of 3,000 GPM and a current operating capacity of 3,000 GPM. The site was constructed in 2017, and the visible equipment is in excellent condition. The condition assessment did not indicate the need for major rehabilitation of the well components at this site within the next ten years.

3.1.2.4 Source Connections

The District maintains four source water connections to the Metropolitan Water District of Southern California (MWD). Three of the source connections were visited during the site assessment, OC-36, OC-66, and OC-89. The mechanical assets at each of the visited sites were in good condition, showing typical wear for their age. Minimal replacement of instrumentation at each of the sites may be necessary within the next ten years as the equipment reaches the end of its expected useful life.

Some concrete delamination and cracking was observed on the floor of the OC-89 vault. Also, staff noted the need to provide better access to the OC-36 connection as the hill leading to the entrance to the cage is a dirt slope.

3.1.2.5 Sewer Lift Stations

The District operates two wastewater lifts stations, each of which was visited during the site assessment.

Green Crest LS

The Green Crest lift station is located in a cul-de-sac below the street. It includes two submersible pumps in a wet well, a valve vault, and associated valves and electrical equipment. The lift station was fully rehabbed in 2010 and the assessment did not indicate the need for major rehabilitation of these assets within the next ten years, except for the electrical and PLC panel, which will require upgrades within the next several years.

Lakeview LS

The Lakeview lift station is located in the Yorba Linda Lakebed Park. It includes two submersible pumps in a wet well, a valve vault, and associated valves and electrical equipment. The lift station was refurbished in 2009 and the assessment did not indicate the need for major rehabilitation of these assets within the next ten years. A steep slope is located close to the station which could cause some debris to wash onto the station in a heavy rain event, however staff indicated that upcoming development near the site will likely result in the slope being removed or modified. As the development expands, the station may be modified to handle more flow or completely eliminated.

3.1.2.6 Richfield Base

In addition to the operations center and several wells, the facilities at the Richfield Base include electrical systems, backup power and propane systems, and chemical treatment systems.

Electrical Systems

A central switchboard and MCC that includes an automated transfer switch serves the chemical processes and the wells at the Richfield base. The equipment was originally installed in 1996 and is in fair condition. It is expected that the equipment will require rehabilitation or replacement within the next ten years as it reaches the end of its expected useful life.

Backup Power and Propane Systems

The backup generator and two propane tanks were installed in 1996 and are in fair condition. It is expected that the equipment will require rehabilitation within the next ten years to ensure adequate reliability as it reaches the end of its expected useful life.

Chemical Treatment Systems

The chemical treatment systems at the Richfield base include chlorine generation equipment, one brine tank, two hypochlorite tanks, chemical feed pumps, chlorine residual analyzers, and associated ancillary equipment. All of the equipment was installed in 2003 with the exception of the chemical feed pumps 3 and 4 motors which were replaced in the beginning of 2018. Most of the equipment is in fair condition showing typical wear for its age.

During the assessment, District staff indicated that the brine tank and hypochlorite tanks have been recoated several times and will likely require replacement within the next five years. Additionally, several of the other assets including the chlorine generation equipment, chemical feed pumps 1 and 2, and the chlorine residual analyzers will reach the end of their expected useful life within the next ten years, and will require rehabilitation or replacement.

3.1.3 Condition Assessment Results

In general, the facility and equipment assets are in good condition. The assessment only found a few assets that received a score of 4 (significant deterioration) and no assets received a score of 5 (severe deterioration). The following bullets breakdown the results of the condition scores for the more than 400 facility and equipment assets observed in the visual condition assessments.

- **Condition 1 (New or Excellent Condition)** - 15 percent of the assets were found to be in new or excellent condition. Most of these assets were at the Fairmont and Yorba Linda booster pump stations.
- **Condition 2 (Minor Defects Only)** - 52 percent of observed assets were found to have only minor defects.
- **Condition 3 (Moderate Deterioration)** - 32 percent of observed assets were found to have moderate deterioration. These assets may be in need of maintenance activities, but do not need rehabilitation or replacement in the near future.
- **Condition 4 (Significant Deterioration)** - Four assets (one percent) were observed to be have significant deterioration that requires renewal or upgrades. These assets are components of the chemical treatment system at Richfield Base, Pump 2 at Box Canyon BPS, the large natural gas pump at Timber Ridge, and the well and pump at Well No. 7.
- **Condition 5 (Severe Deterioration)** - No assets were found to have severe deterioration.

The fact that there are very few condition 4 and condition 5 assets observed during the condition assessments indicates that District staff is doing a good job maintaining the assets. However, not all assets were observed. The pressure regulating stations, interconnections, submersible lift station pumps, and fleet vehicles were not observed during the assessments. The estimated remaining life of these assets is based on a typical life estimate.

3.2 Pipelines Condition and Remaining Life Assessment

A condition assessment was performed on the pipeline assets using the District's GIS records. No site visits or visual condition assessment were performed. This section summarizes the methodology and results of the pipeline condition assessment.

3.2.1 Condition Assessment Process and Scoring

The District's GIS data served as the basis for the condition assessment of the pipeline assets. The GIS data contained information about each pipe segment, including their location, which was used to estimate the condition and remaining life of each segment.

The GIS data was imported into a GIS-based modeling program, Innovyze® InfoMaster™, for evaluation. Additional information was loaded into the model to assist in the evaluation of the pipelines. This information included CCTV inspection data, locations of leaks and breaks, locations of repairs, and water pressure at various points in the system. Separate models were set up for water and wastewater pipe evaluations. The models evaluated each segment of pipe against the criteria shown in Table 3.3.

Table 3.3 Pipeline Condition Criteria

Criteria	Water Pipeline Criteria	Sewer Pipeline Criteria
Leaks and Repairs	Leaks Data - The location of leaks were tagged to the nearest pipeline(s). Each leak reduced the remaining life of the pipeline by 10 years.	Planned Repairs - Staff identified pipelines for repair based on CCTV observations. These segments were assumed to have no remaining life (Condition 5).
Operational Data	System Pressures - Areas of high pressure reduced the remaining life as follows: • Condition 5 = > 200 psi • Condition 4 = 150-200 psi • Condition 3 = 120-150 psi	CCTV Inspection Data - The quick score from CCTV data were used to reduce the remaining asset life as follows: • Condition 5 = 1 grade-5 defect or more than 2 grade-4 defects • Condition 4 = 1 or 2 grade-4 defects or more than 1 grade-3 defect. • Condition 3 = 1 grade-3 defect or more than 2 grade-2 defects.
Age	Age - the age of the pipelines was compared to the useful life estimate shown in Table 3.5 and remaining life ranges in Table 3.4.	Age - the age of the pipelines was compared to the useful life estimate shown in Table 3.5 and remaining life ranges in Table 3.4.

Notes:

(1) Values represent full project costs that include design and construction. Values shown in 2018 dollars.

The models assigned a condition score to each of the pipe segments based on the worst result from any of these criteria. The condition score was used to determine how much remaining life the pipeline had left using the ranges shown in Table 3.4.

Table 3.4 Pipeline Condition Scoring Descriptions

Condition Score	Remaining Life Range
1 (Best)	More than 50 years
2	31 - 50 years
3	16 - 30 years
4	6 - 15 years
5 (Worst)	5 years or less

Notes:

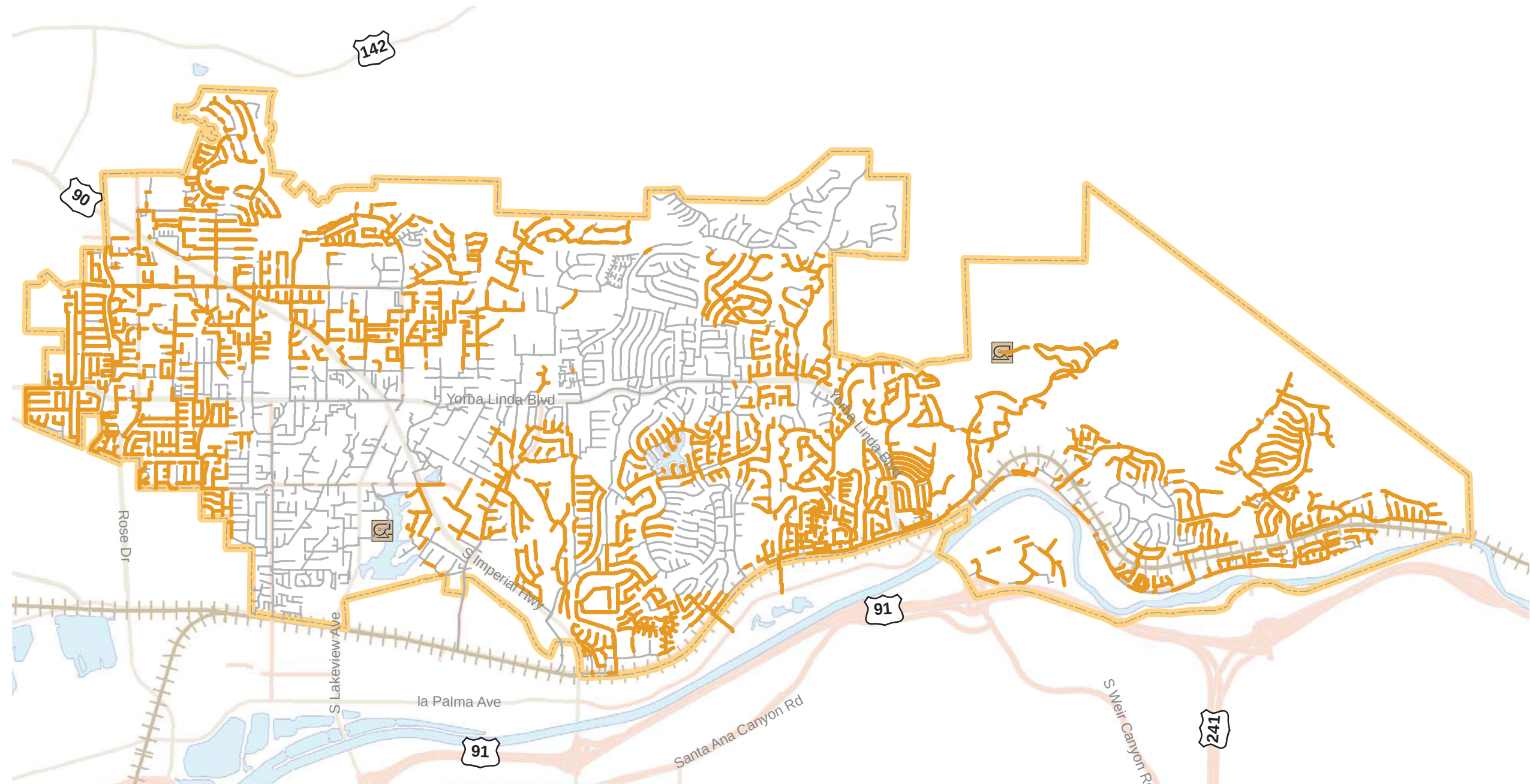
(1) Remaining life range is an estimate based on typical service life and criteria shown in Table 3.3.

3.2.1.1 CCTV Data Summary

The District performs regular NASSCO standardized CCTV inspections of their wastewater collection pipelines. Observations from the CCTV crew are coded in a database, which were linked back to the inspected pipelines.

The District provided CCTV inspection data for 2011 to 2016. This data was loaded into InfoMaster™ and linked to the appropriate pipe segments. The map in Figure 3.1 shows the pipelines with CCTV inspection data.

Of the 266 miles of wastewater pipelines, just over half (150 miles, 56 percent) linked to a CCTV inspection record. The District has inspected the entire system using CCTV, however, small errors in the pipeline naming or how the CCTV is recorded can cause compatibility issues when trying to link the data together. The District is continuously collecting more CCTV data, which can be used in future evaluations of the system.



Legend

- | | |
|---|--|
| — Mains with CCTV Data | — Highway |
| — Gravity Main | — Principal Arterial |
|  Lift Station | — Major Arterial |
|  Sewer System Boundary | — Railroad |

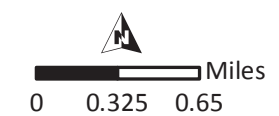


Figure 3.1 CCTV Inspection Data Map

The data from each inspection was analyzed for specific defects and summarized into a four digit "quick score." The four digits of the quick score represent the severity of the defects found on the pipe and the number of times they occur. CCTV defects are graded on a one to five scale with one being the best and five being the worst. Examples of the worst rated defects found in the CCTV data include:

- Hole in pipe
- Infiltration gushing
- Severe offset joints
- Multiple fractures
- Pipe deformation
- Severe separated joint

The quick score for each pipe was used to estimate the remaining life for the pipeline.

3.2.1.2 Useful Life Assumptions

The original useful life is the estimated amount of time from when the pipeline was installed to when it needs to be replaced. The remaining useful life of each asset was evaluated based on the original useful life for each type of asset and the asset's age. The criteria in Table 3.3 further adjust the useful life and remaining useful life for each pipe segment. The original useful lives shown in Table 3.5 were developed during a workshop with District staff. The lives are estimated based on the District staff experience and knowledge of the District's pipeline assets.

Table 3.5 Pipeline Remaining Useful Life Assumptions

Asset Type	Original Useful Life (Years) ⁽¹⁾	Length of Pipe (miles)	Percentage of Length
Water Distribution Pipes		352 miles	
Asbestos Cement (ACP)	70	238	68%
Cement Mortar Lined Concrete (CMLC) ⁽²⁾	75	26	7%
Cast Iron (CIP or CIL)	65	8	2%
Unlined Cast Iron (CIN)	65	1	< 1%
Ductile Iron (DIP)	70	14	4%
1985 to 1999 Ductile Iron ⁽³⁾	30	11	3%
Steel (STL)	80	4	1%
Copper (CO)	80	< 1	< 1%
Polyvinyl Chloride (PVC)	85	50	14%
Wastewater Collection Pipes		266 miles	
Vitrified Clay (VCP)	100	195	55%
Asbestos Cement (ACP)	50	< 1	< 1%
Ductile Iron (DIP)	50	1	< 1%
Cast Iron (CIP)	50	< 1	< 1%
Acrylonitrile Butadiene Styrene (ABS)	90	47	13%
Polyvinyl Chloride (PVC)	90	24	7%
Other Pipeline Asset Types			
Force mains	50	0.3 miles	n/a
Manholes	75	6,153 assets	n/a
Water Meters	25	25,407 assets	n/a

Notes:

- (1) Useful life estimates based on District input and estimates used by peer agencies.
- (2) CMLC includes all pipes of similar designation in the data (CML&C, CML&C STL, and CML)
- (3) District has experienced numerous failures of Ductile Iron Pipe (DIP) installed between 1985 and 1999.

The condition of the force mains, manholes, and water meters was based on the age of the assets and the remaining life estimate ranges in Table 3.4.

3.2.2 Condition Assessment and Remaining Useful Life Evaluation

The results of the pipeline condition assessment are shown in Table 3.6, Figure 3.2, and Figure 3.3. The table shows the percentage of the assets that fall into each condition score and remaining life range.

Table 3.6 Pipeline System Condition and Remaining Life Results

Condition Score ⁽¹⁾	Condition 1 (> 50 years)	Condition 2 31-50 years)	Condition 3 (16-30 years)	Condition 4 (6-15 years)	Condition 5 (≤ 5 years)
Water Pipelines	20% (70 miles)	30% (104 miles)	33% (115 miles)	13% (45 miles)	5% (17 miles)
Water Meters ⁽²⁾	0%	0%	6%	18%	75%
Wastewater Pipelines	15% (41 miles)	76% (202 miles)	5% (14 miles)	3% (7 miles)	1% (2 miles)
Force mains	0%	0%	69% (0.2 miles)	31% (0.1 miles)	0%
Manholes	23%	52%	25%	< 1%	0%

Notes:

(1) Remaining life ranges per Table 3.4.

(2) Approximately 39 percent of water meters do not have available installation year data. The assumption was made that the installation of these meters mirrored the distributed of known meter installations.

Overall, the pipeline systems are in good condition, with the exception of the water meters. The water pipelines have the most assets rated condition 4 or 5. Figure 3.2 shows these lines are mostly concentrated on the west side of the service area, except for a group of ductile iron pipelines on the eastern side. The District is planning further research and corrosion testing on these ductile iron pipelines to determine if more cathodic protection is needed or if the waterlines need to be replaced. This analysis assumes they need to be replaced, but the District may determine an alternative solution based on the results of its investigations.

With such a short life expectancy compared to the other types of pipeline assets, the meters are all considered condition 3 or greater. In general, nearly three quarters of the District's water meters are already beyond their expected useful life. The District is in the process of implementing an automatic meter infrastructure (AMI) system, which is one possible solution to address these meter conditions as part of a larger AMI installation and meter replacement program.

In contrast, the wastewater pipelines are predominately rated condition 2, with small stretches of condition 4 or 5 pipes scattered throughout the service area (as seen in Figure 3.3). Force mains are condition 3 or 4, based on age.

The condition scores are further developed in the risk assessment covered in the following section.

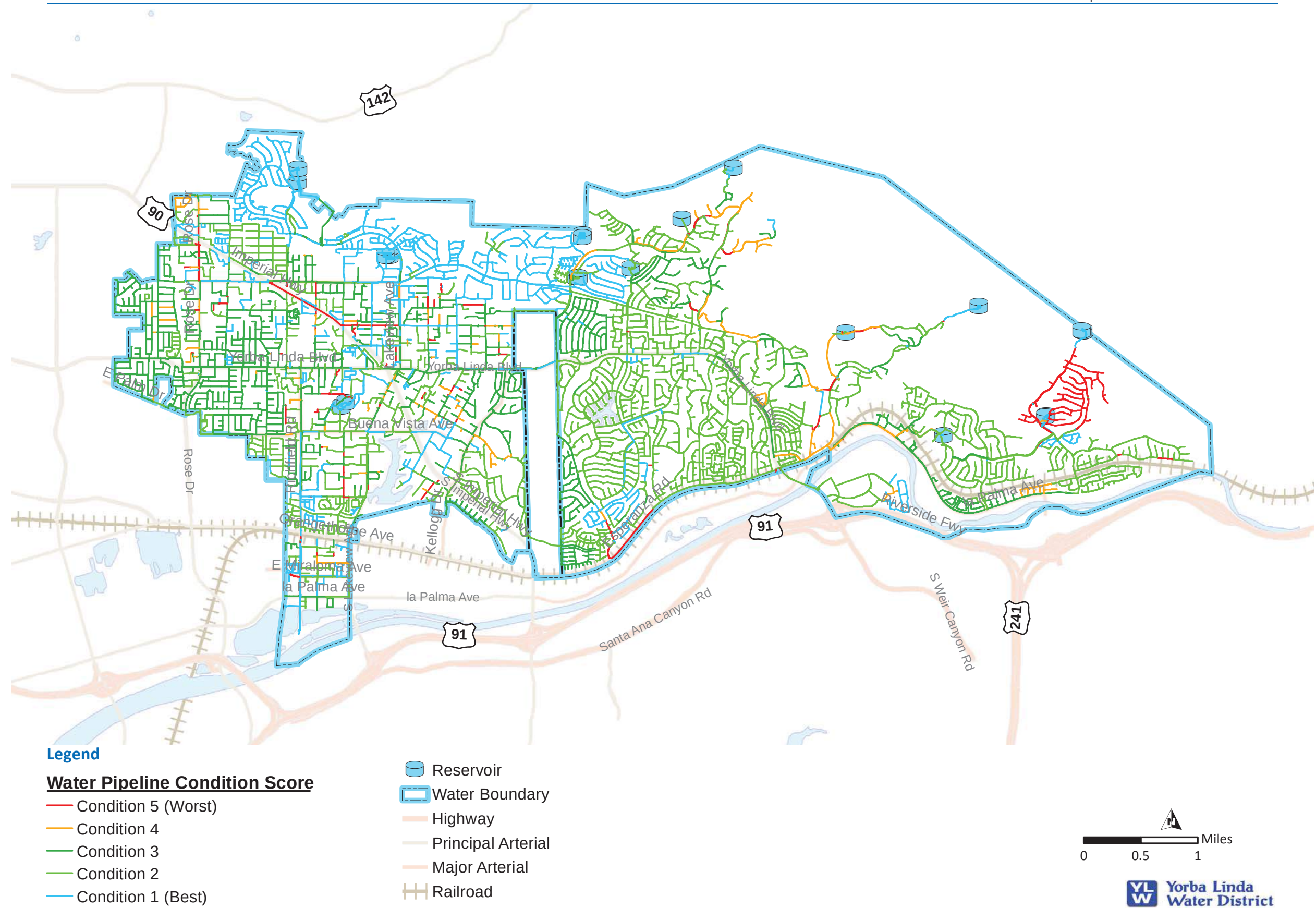
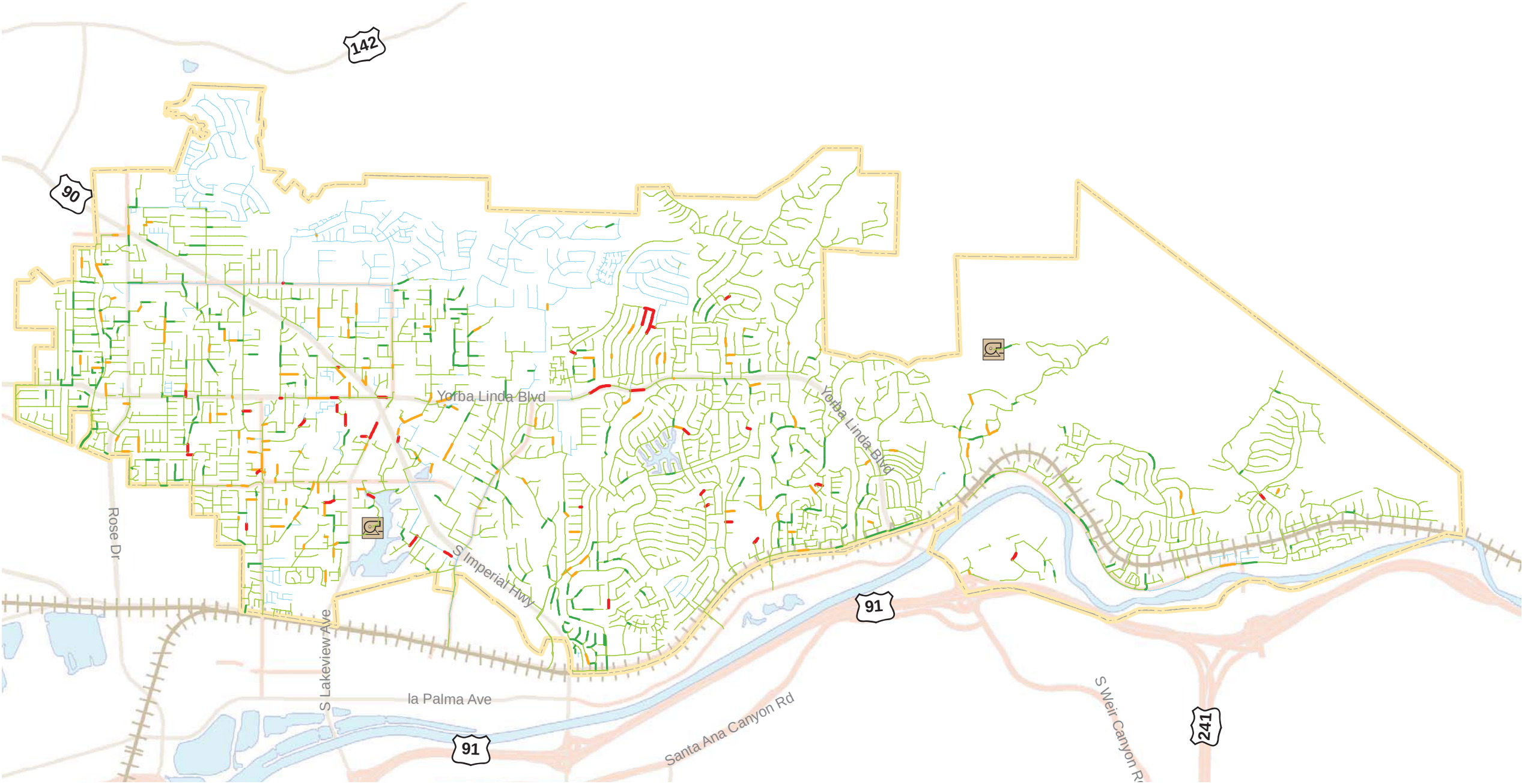


Figure 3.2 Water Pipeline Condition Map



Legend

Gravity Main Condition Score

- LoF 1 (Low)
- LoF 2 (Low-Med)
- LoF 3 (Medium)
- LoF 4 (Med-High)
- LoF 5 (High)

- Lift Station
- Sewer System Boundary
- Highway
- Principal Arterial
- Major Arterial
- Railroad

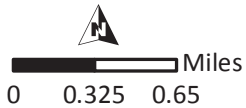


Figure 3.3 Wastewater Pipeline Condition Map

Section 4

ASSET RISK ASSESSMENT

This section evaluates the risks associated with the District's assets, building on the condition evaluations of the previous section and the consequence of failure of the assets failing. The intent of this section is to provide a transparent assessment of prioritized risk associated with the assets of the system and provide a method to prioritize different types of functional assets.

4.1 Risk Overview

Risk is a key element of asset management. It is used to prioritize budgets and resources in a transparent and consistent way. A risk assessment is designed to address one or more of the following:

- Identify assets representing risks an organization isn't willing to tolerate
- Promote efficient use of resources by defining a method to rank assets
- Prioritize inspection, cleaning, and preventive maintenance schedules
- Develop risk management and mitigation strategies

The risk of an asset is a measure of the impact of asset failure on the overall system. By quantifying and assessing the risk of failure or inability of an asset to meet its intended function or achieve its service goals, projects can be selected and implemented to mitigate the risk.

Just as risk is expressed economically as the product of cost and chance, risk is calculated in asset management as the product of the likelihood of failure (LoF) and consequence of failure (CoF).

$$Risk = LoF \times CoF$$

At a minimum, assets with higher risk ratings must be closely monitored and targeted for corrective or preventive action, including maintenance, rehabilitation, or replacement. The following sections describe the methodology used to produce LoF, CoF, and risk scores for the District assets.

The risk assessment in this AMP covers the facilities and equipment, water pipelines, and wastewater pipelines. The risk assessment does not cover individual meters, manholes, or fleet assets.

4.2 Likelihood of Failure (LoF)

The LoF is a measure of the probability that an asset will fail or degrade to a point where it is not meeting its required level of service. The LoF is expressed by a number from one to five, where one is the least likely to fail and five is the most likely.

The condition and remaining useful life evaluations from the previous section are the main factors used to determine the LoF. Additionally, the influences of non-condition factors are taken into consideration in determining the LoF. These other factors may include:

- **Operational Requirements** – If an asset of system is regularly operated above its design capacity, or operated more frequently than originally intended, it may fail prematurely.

- **Obsolescence** – The lack of readily available maintenance service, technical support, or replacement parts may drive the need to abandon an asset before the end of its expected useful life. This issue most often affects electrical and instrumentation equipment.
- **Maintenance** – Assets that require excessive maintenance may need to be replaced to avoid increased costs or downtime. Also, assets that are inadequately or improperly maintained may fail prematurely.
- **Environmental** – These factors include whether an asset is protected from the elements by a building or other enclosure, or if it is exposed to risks from nearby vehicle traffic, steep slopes, trees, etc.

These additional factors were considered during the visual condition assessments of the facility and equipment assets and contribute to the LoF score. They are described in more detail in the CAP in Appendix A.

4.3 Consequence of Failure (CoF)

The consequence of failure (CoF) is a value assigned to each asset that attempts to quantify the impacts if that asset were to fail. Two methods were used to evaluate the CoF. The first method was used for facilities and equipment assets. The second method was used for water and wastewater pipelines.

4.3.1 Facilities and Equipment

For the AMP risk analysis, a CoF was assigned to each asset based on two components: facility and equipment type. This two-component method was used because it follows the logic used by most staff when they consider the most critical assets. When asked which assets are the most critical to the system, answers typically focus on a particular type of equipment, such as pump or SCADA, or types of facilities, such as a particular reservoir. This scoring system follows a similar logic by combining scores based on an asset type and the specific where it is located.

CoF scores for each of the facilities were developed in collaboration with District operations and engineering staff. Each facility was assigned a CoF score between 1 and 5, with 1 being the least critical (lowest consequences in the event of a failure) and 5 being the most critical (highest consequence in the event of a failure). The CoF scores assigned to each facility are shown in Table 4.1.

The CoF scores for 87 District water, wastewater, and support facilities were assigned as follows:

- **CoF 5** - 20 facilities comprised of 7 reservoirs, 5 booster pump stations, 4 pressure regulating stations, 2 lift stations, 1 imported water connection, and the Richfield Base operations center.
- **CoF 4** - 24 facilities comprised of 8 pressure regulating stations, 6 production wells, 5 booster pump stations, 3 reservoirs, and 2 imported water connections.
- **CoF 3** - 22 facilities comprised of 14 pressure regulating stations, 4 reservoirs, 2 production wells, and 2 booster pump stations.
- **CoF 2** - 14 facilities comprised of 12 pressure regulating stations and 2 production wells.
- **CoF 1** - 7 facilities comprised of 5 pressure regulating stations, 1 production well, and 1 import water connection.

Table 4.1 Facility CoF Scoring System

COF Rank	Wells	Booster Pump Stations	Reservoirs	Pressure Reducing Stations		Source Connections	Other	Sewer Lift Stations
5 SEVERE		Fairmont Hidden Hills Santiago Timber Ridge Paso Fino	Chino Hills Little Canyon Camino de Bryant Quarter Horse Hidden Hills Santiago Fairmont	Lakeview Timber Ridge San Antonio #1 Hidden Hills #2		OC-66	Richfield Base	Green Crest Lakeview
#	0	5	7	4		1	1	2
4 HIGH	Well No. 18 Well No. 20 Well No. 21 Well No. 1 Well No. 5 Well No. 7	Yorba Linda Lakeview Elk Mountain Springview Box Canyon	Gardenia Springview Elk Mountain	Bryant #2 Applecreek Cresthill Del Rey	Trailside Hidden Hills #1 Box Canyon Kilt	OC-51 OC-89		
#	6	5	3	8		2	0	0
3 MODERATE	Well No. 10 Well No. 19	Highland Valley View	Valley View Bryant Ranch Highland Lakeview	Brentwood Hidden Oaks Mission Hills Paseo Del Prado Cornell Jefferson Bryant #1	Platte Villa Valente Yorba Linda Adobe La Palma San Antonio #2 Fairmont			
#	2	2	4	14		0	0	0

Table 4.1 Facility CoF Scoring System (continued)

COF Rank	Wells	Booster Pump Stations	Reservoirs	Pressure Reducing Stations		Source Connections	Other	Sewer Lift Stations
2 MINOR	Well No. 12 Well No. 15			Van Buren Stonehaven Sunwood Red Pine Clydesdale Village Center	Kodiak #1 Kodiak #2 Oakvale Citation Dominguez Trentino			
#	2	0	0	12		0	0	0
1 LOW	Well No. 11			Willowbrook Stone Canyon Sumac	Walnut Wagon Wheel	OC-36		
#	1	0	0	5		1	0	0

The second CoF score for each asset is determined by the equipment type. This CoF score was assigned to each asset based on how essential the equipment type is to the core function of a facility. For example, pumps received an equipment CoF score of 5 (highest consequence of failure) since the core function of a booster pump station is pumping water. In contrast, pressure reducing valves installed at the pumps received an equipment CoF of 3, since they can be bypassed, removed, or disengaged if they fail, without impacting the core function of the facility. The CoF scores assigned to each type of equipment are shown in Table 4.2.

Table 4.2 Equipment Type CoF Scoring System

Asset Type	Equipment CoF	Asset Type	Equipment CoF
Water Pump	5	Chemical Equipment	4
Electrical	5	Remote SCADA	4
Engine	5	Pressure Regulating Valve	3
Building	5	Concrete Structure	3
Well Casing	5	PRS Vault	3
Well Pump	5	Instrumentation	3
Reservoir	5	PRV - Pump	3
Main SCADA	5	Office Furniture/Equipment	3
IT Equipment	5	Valve	2
Wastewater Pump	5	Site Conditions	1

The overall CoF score for each asset was calculated based on the average of the facility CoF and the equipment type CoF. For example, a water pump (5) at the Fairmont BPS (5) receives an overall score of 5, while a concrete vault for a PRS (3) at the Trentino PRS (2) received an overall CoF score of 2.5.

Figure 4.1 shows the distribution of the CoF scores for all facility and equipment assets. High CoF assets represent the critical equipment types at the critical facilities. Roughly 10 percent of the total asset count classifies as high CoF. About a third of all assets are considered medium-high CoF. These assets are critical equipment types at less critical facilities, or vice versa.

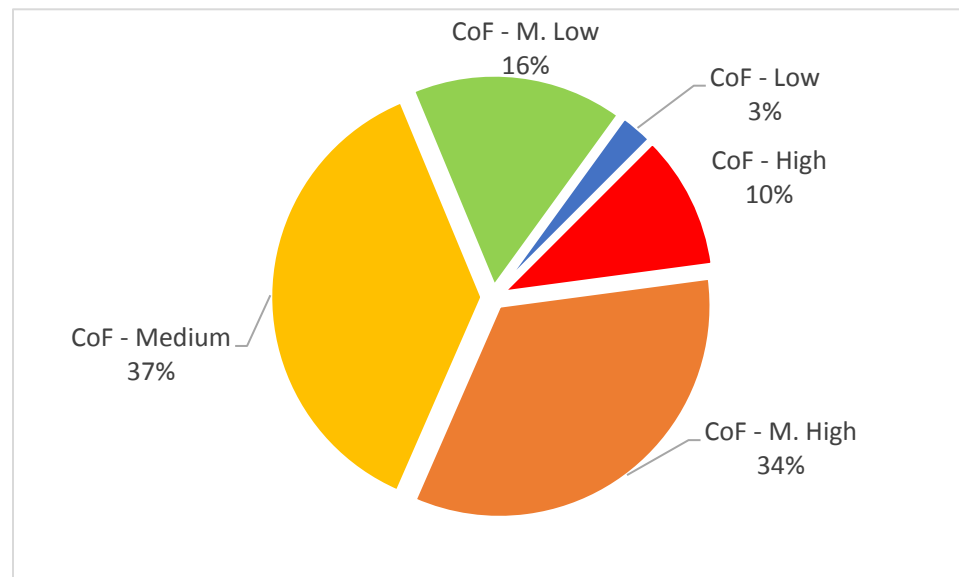


Figure 4.1 Facility and Equipment Consequence of Failure Score Summary

4.3.2 Pipelines

The CoF for the pipelines was assigned to each pipe segment based on the following four components:

- **Pipe Diameter** - Larger pipelines convey more flow, so a break or stoppage in one of these lines would have a greater impact.
- **Streets Type** - The type of street that a pipe is under is related to the impact it will have.
- **Water Bodies** - Pipelines located near a body of water will have an environmental impact and, in the case of a sewer spill, can result in a fine. Pipelines that cross water bodies can be single points of failure if the system isn't looped.
- **Critical Facilities** - Pipelines near critical facilities, such as hospitals, could cause a major disturbance to their operations.

Using the InfoMaster™ model, each pipeline in the water and wastewater system was evaluated in each of these four components. A one to five scoring system was developed for each of these components. Table 4.3 breaks down the scores for the water and wastewater pipelines.

Table 4.3 Pipeline CoF Scoring System

CoF Component	Method	Water Pipelines	Wastewater Pipelines
Pipe Diameter	<i>Based on pipe diameter</i>	• CoF 5 - 25-39 inches • CoF 4 - 15-24 inches • CoF 3 - 11-14 inches • CoF 2 - 7-10 inches • CoF 1 - < 7 inches	• CoF 5 - 18-24 inches • CoF 4 - 13-17 inches • CoF 3 - 9-12 inches • CoF 2 - 6-8 inches • CoF 1 - < 6 inches
Street Type	<i>Based on the Caltrans street functional classification using a 50 foot buffer in GIS</i>	• CoF 5 - Railroad or Freeway • CoF 4 - Principal Arterials • CoF 3 - Minor Arterials • CoF 2 - Major Collector • CoF 1 - Local Road	
Water Bodies	<i>Based on distance from nearest body of water</i>	• CoF 5 - < 100 feet • CoF 4 - 100-200 feet • CoF 3 - 200-300 feet • CoF 2 - 300-500 feet • CoF 1 - > 500 feet	
Critical Facilities	<i>Based on a buffer of 75 feet around the facility</i>	• CoF 5 - Hospital or Emergency Response (Police and Fire) • CoF 4 - City Hall, Civic Building, or School • CoF 3 - Post Office or Library • CoF 2 - Hotels • CoF 1 - All Other Facilities	

The overall CoF score for each pipeline was based on the maximum score of all four components. The miles of pipeline that fell into each CoF score is shown in Table 4.4.

Table 4.4 Pipeline CoF Score Summary

CoF Score	Water Pipes	Wastewater Pipes
5 (High)	16 miles	7 miles
4 (Medium-High)	54 miles	25 miles
3 (Medium)	54 miles	26 miles
2 (Low-Medium)	175 miles	209 miles
1 (Low)	53 miles	< 1 mile

Figure 4.2 and Figure 4.3 are maps of the water and wastewater pipeline CoF results.

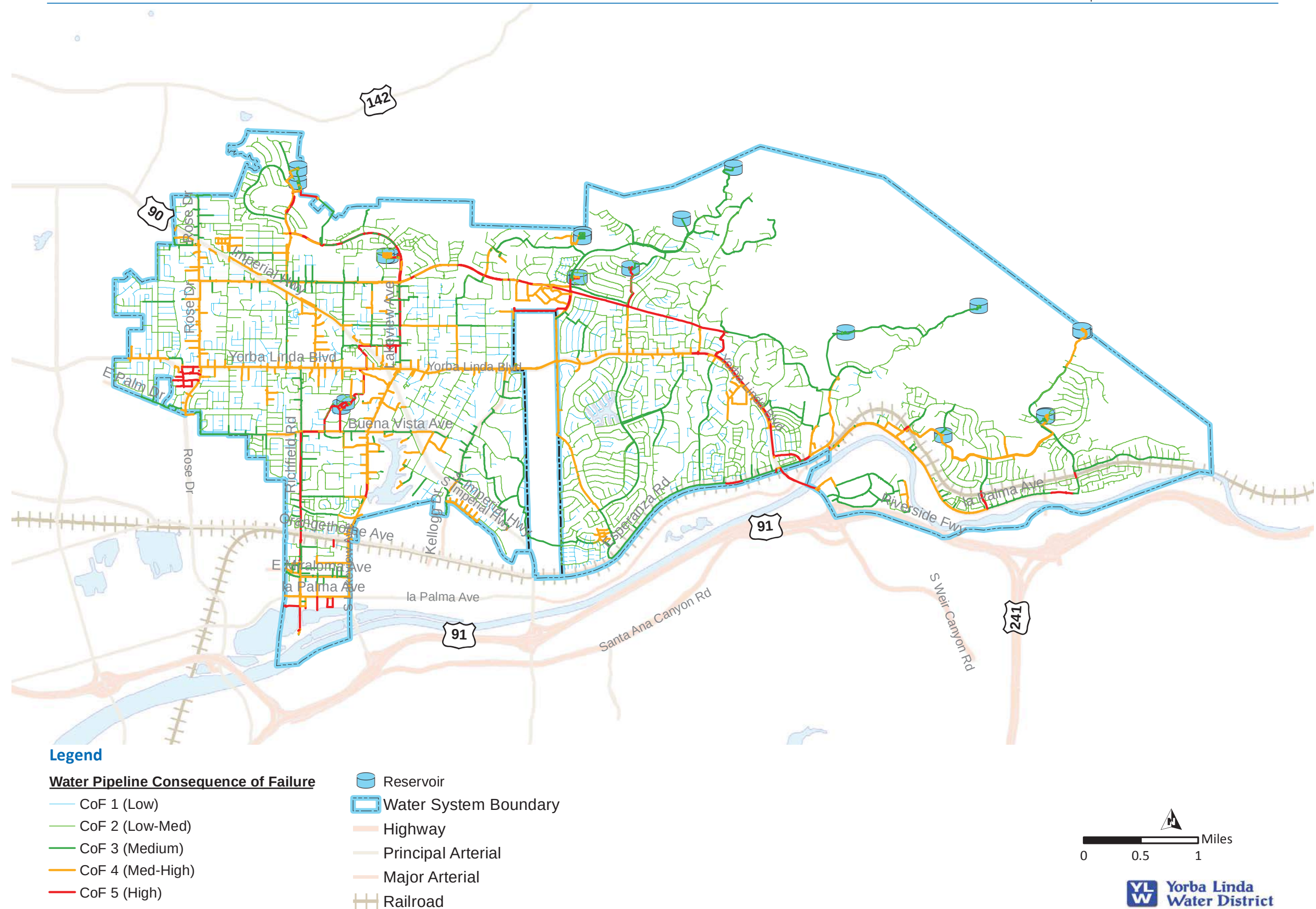
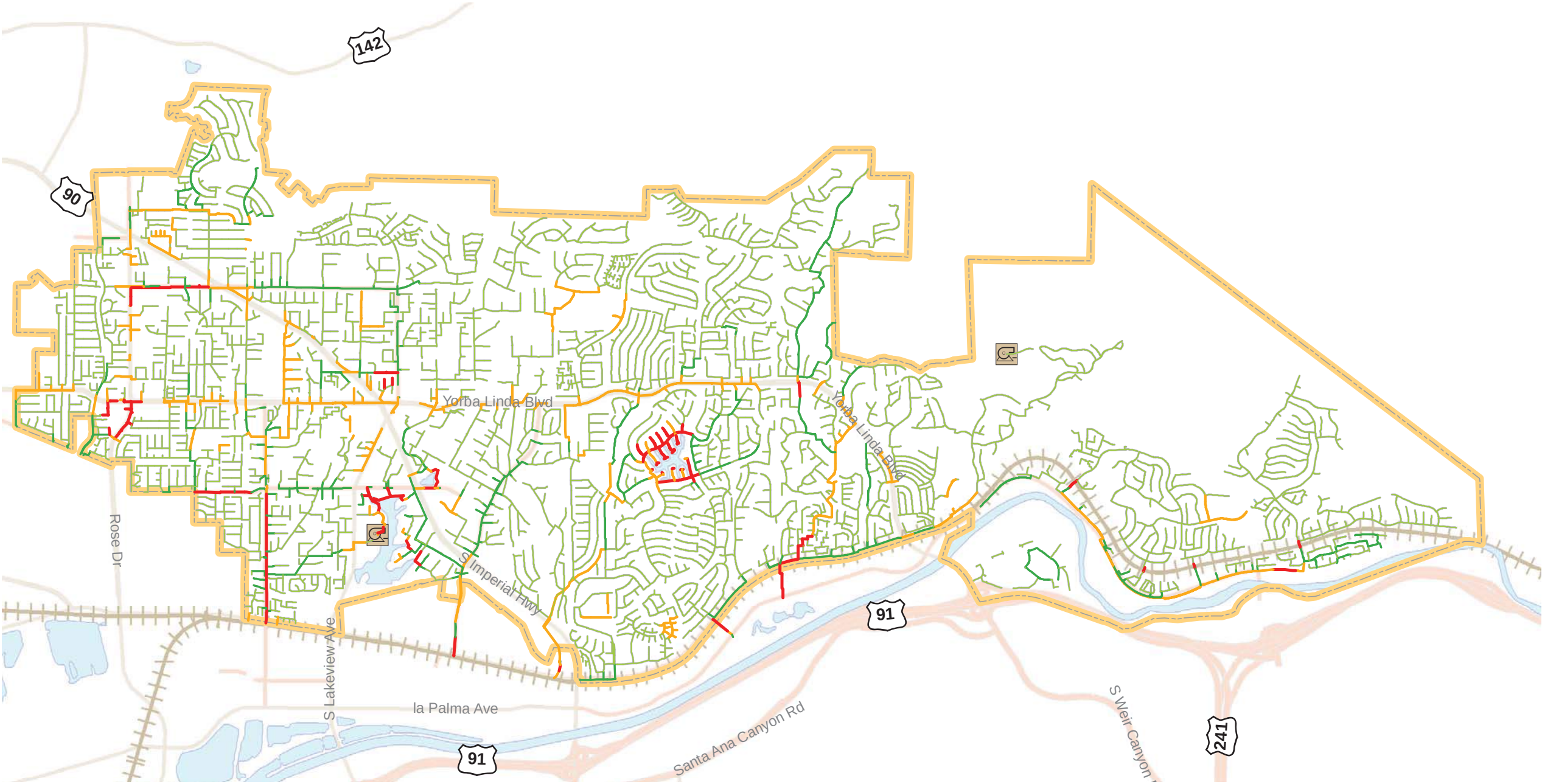


Figure 4.2 Water Pipeline CoF Map



Legend

Gravity Main Consequence of Failure

- CoF 1 (Low)
- CoF 2 (Low-Med)
- CoF 3 (Medium)
- CoF 4 (Med-High)
- CoF 5 (High)

- Lift Station
- Sewer System Boundary
- Highway
- Principal Arterial
- Major Arterial
- Railroad

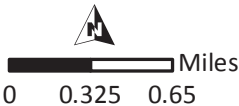


Figure 4.3 Wastewater Pipeline CoF Map

4.4 Risk Results

The risk that each asset represents is based on the combination of the LoF and CoF scores. Assets with the highest risk should be targeted for replacement, repair, or further inspection. Alternatively, redundancy or mitigation strategies can be implemented to reduce the risk of asset failure.

Risk is evaluated in two ways: raw score and risk categories. The raw score is the numeric value of multiplying the LoF and CoF. This score is based on a 1 to 25 scale (LoF 1-5 x CoF 1-5). Risk categories are based on the risk matrix shown in Figure 4.4.

	Low LoF (1)	M. Low LoF (2)	Medium LoF (3)	M. High LoF (4)	High LoF (5)
High CoF (5)			Med.-High	High Risk	
M. High CoF (4)					
Medium CoF (3)	Low-Med.		Medium		
M. Low CoF (2)					
Low CoF (1)	Low Risk				

Figure 4.4 Risk Matrix Categories

The following sections summarize the risk results for facilities and equipment assets followed by the pipeline assets.

4.4.1 Facilities and Equipment

The number of assets that fell into each risk category is shown in Table 4.5. Overall, less than ten percent of assets fell into the medium-high risk category and no assets were considered high risk.

Table 4.5 Facilities and Equipment Risk Summary

Risk Category	Number of Assets	Percentage of Assets
High	0	0%
Medium-High	31	7%
Medium	197	29%
Low-Medium	348	63%
Low	21	1%

Notes:

- (1) Risk categories defined by Figure 4.4.
- (2) Does not include Fleet vehicles.

The 31 medium-high risk assets were located at the 12 facilities listed below (number of assets shown in parenthesis).

- **Santiago BPS (7)** - Booster pumps 3&4, VFDs 1-3, MCC, and switchboard
- **Hidden Hills BPS (5)** - Booster pumps 1-4 and MCC
- **Timber Ridge BPS (5)** - Booster pumps 1-4 and MCC
- **Richfield Base (4)** - Water softening system, switchboard, breaker panel, and automatic transfer switch.

- **Fairmont Reservoir (2)** - Reservoir and cathodic protection system
- **Well No. 7 (2)** - Well and well pump
- **Box Canyon BPS (1)** - Booster pump 2
- **Camino de Bryant Reservoir (1)** - Reservoir
- **Chino Hills Reservoir (1)** - Reservoir
- **Little Canyon Reservoir (1)** - Cathodic protection system
- **Green Crest Lift Station (1)** - Electrical panel
- **Hidden Hills PRV Station (3)** - Three valves

Only 9 of the 31 assets received a risk score of 16 (LoF 4 and CoF 4), while the remainder received a risk score of 15 (LoF 3, CoF 5). These 9 assets were the well and well pump at Well No. 7, the well pump at Well No. 5, Booster Pump No. 2 and Box Canyon BPS, the electrical panel at the Green Crest lift station, the valves at the Hidden Hills #2 PRV station, and the water softening system at Richfield Base.

4.4.2 Pipelines

The miles of pipeline that fell into each risk category are shown in Table 4.6.

Table 4.6 Pipeline Risk Summary

Risk Category	Water Pipes	Wastewater Pipes
High	4 miles	1 mile
Medium-High	27 miles	3 miles
Medium	74 miles	15 miles
Low-Medium	199 miles	216 miles
Low	48 miles	31 mile

Notes:

(1) Risk categories defined by Figure 4.4.

Figure 4.5 and Figure 4.6 are maps of the water and wastewater pipeline CoF results.

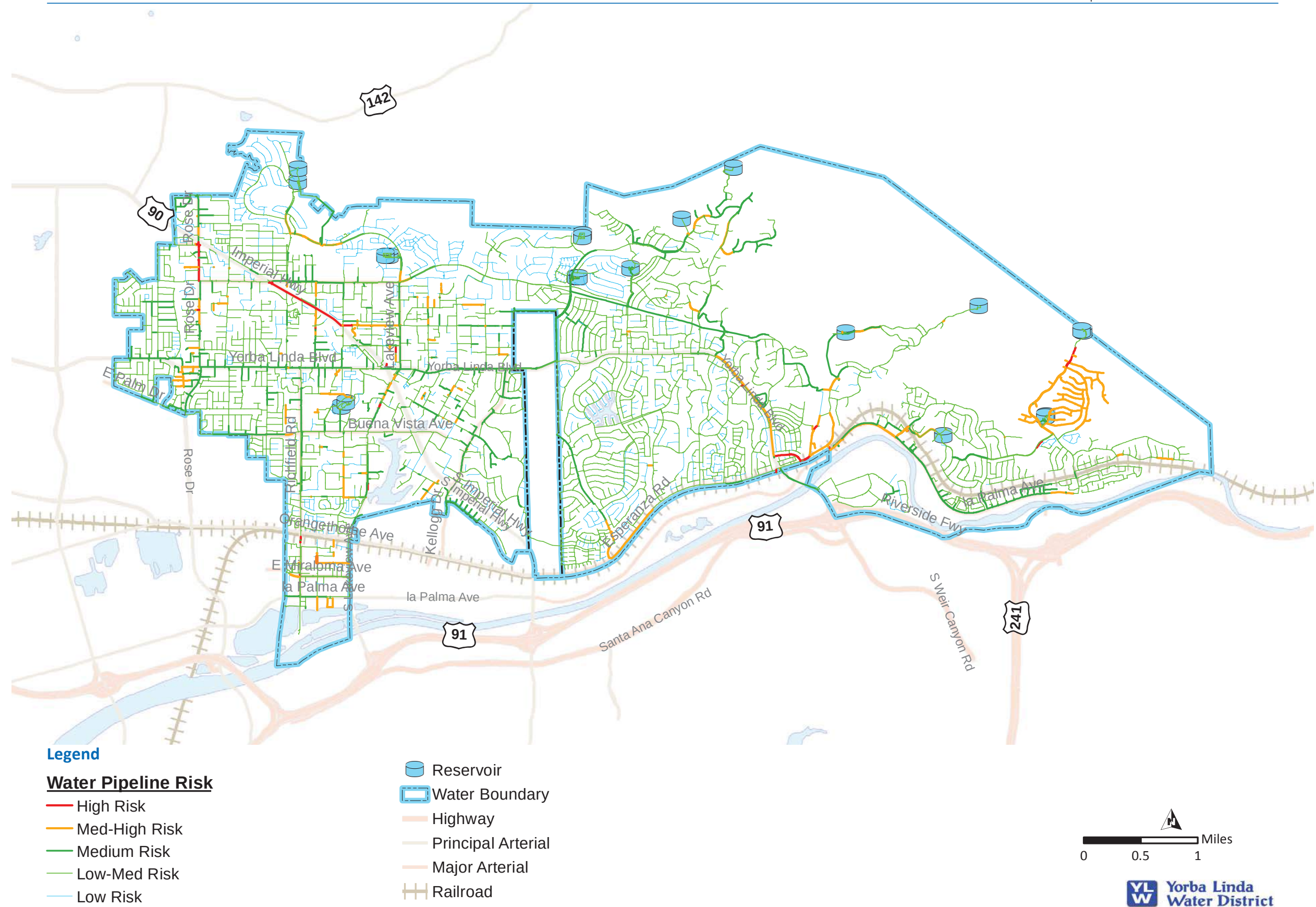
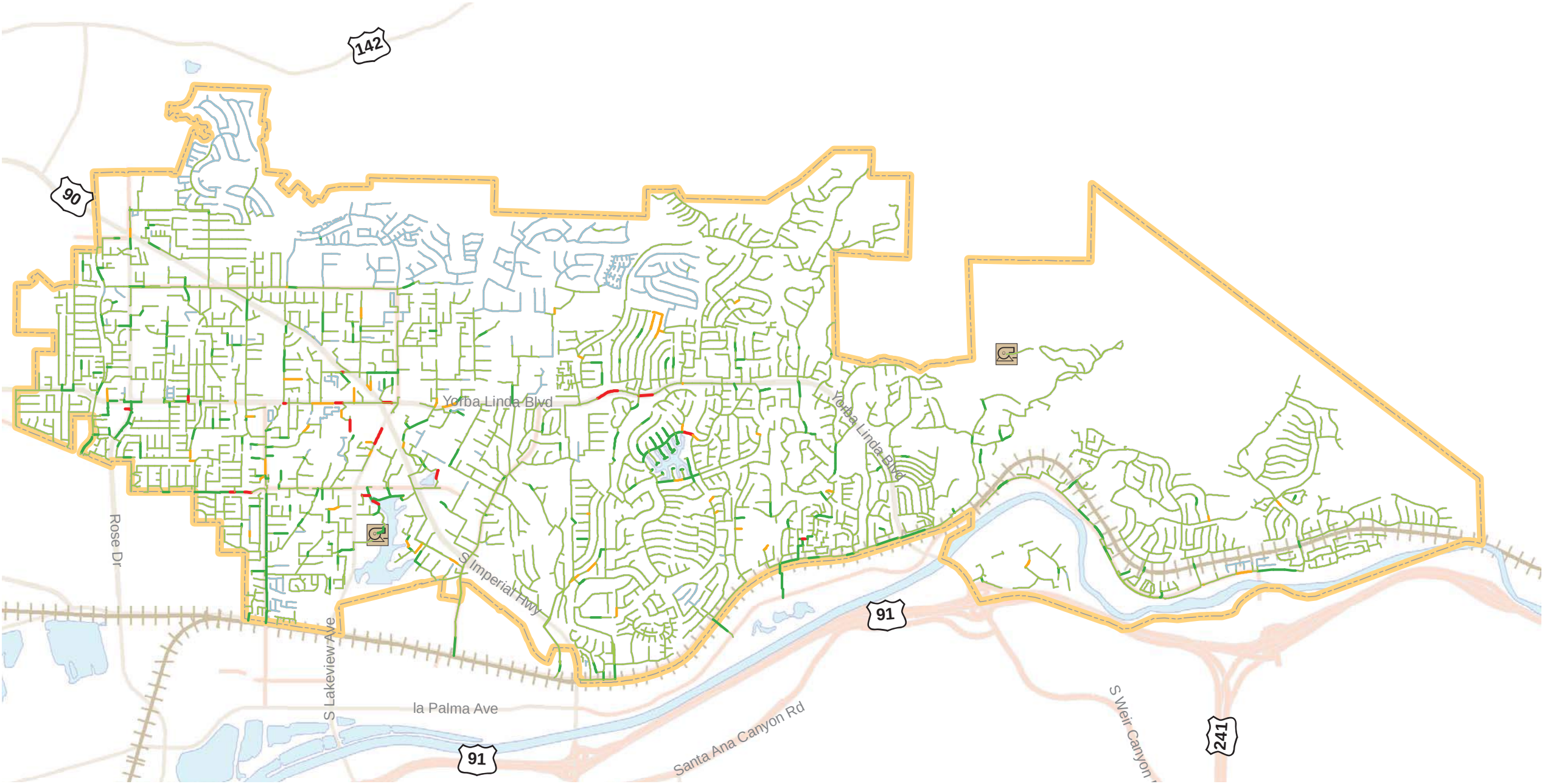


Figure 4.5 Water Pipeline Risk Map



Legend

Gravity Main Risk

- High Risk
- Med-High Risk
- Medium Risk
- Low-Med Risk
- Low Risk

- Lift Station
- Sewer System Boundary
- Highway
- Principal Arterial
- Major Arterial
- Railroad

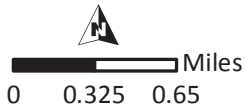


Figure 4.6 Wastewater Pipeline Risk Map

Section 5

FINANCIAL FORECAST

This section presents the funding needed to sustain the District's assets in both near and long-term planning horizons and the impact on the District's cash flows.

5.1 Forecast Overview

A primary outcome of the Asset Management Plan Update project is an updated 10-year CIP forecast. The CIP encompasses the replacement and renewal of existing infrastructure assets. The CIP does not include operations and maintenance budgets, office supplies, or future assets (such as pipelines or facilities to serve new customers).

The forecast in this section is based on the asset information summarized in the previous sections. This forecast was developed using fundamental asset management principals with a risk-based approach, developed through a series of workshops with District staff. The forecast is based on the individual asset data and estimated replacement costs from the previous sections. The timing of each asset replacement was estimated using a combination of on-site condition assessments, CCTV inspection results, leak and break information, installation years, and typical design life estimates. The estimated replacement timing was adjusted to consider the consequence of that asset failing through an asset risk analysis.

A near-term, 10-year CIP was put together based on a detailed review of asset risk and condition. The near-term CIP is presented as packaged projects that incorporate findings from the site visits and input from District staff.

A long-term, 100-year CIP forecast was developed based on the results of the Asset Management model. The model forecasts the replacement of all assets over the next 100 years to provide insight into the general level of funding needed to sustain the District's assets.

The impact of these funding forecasts on the District's finances is discussed in section 5.4.

5.2 10-Year Capital Improvement Program Forecast

The 10-year CIP consist of 30 projects totaling \$55,560,000. This CIP contains a combination of pipeline, facilities, and equipment assets. The 10-year total equates to an annual average of \$5,556,000. The graph of the 10-year CIP forecast is shown in Figure 5.1 and a breakdown of the CIP by system is shown in Table 5.1.

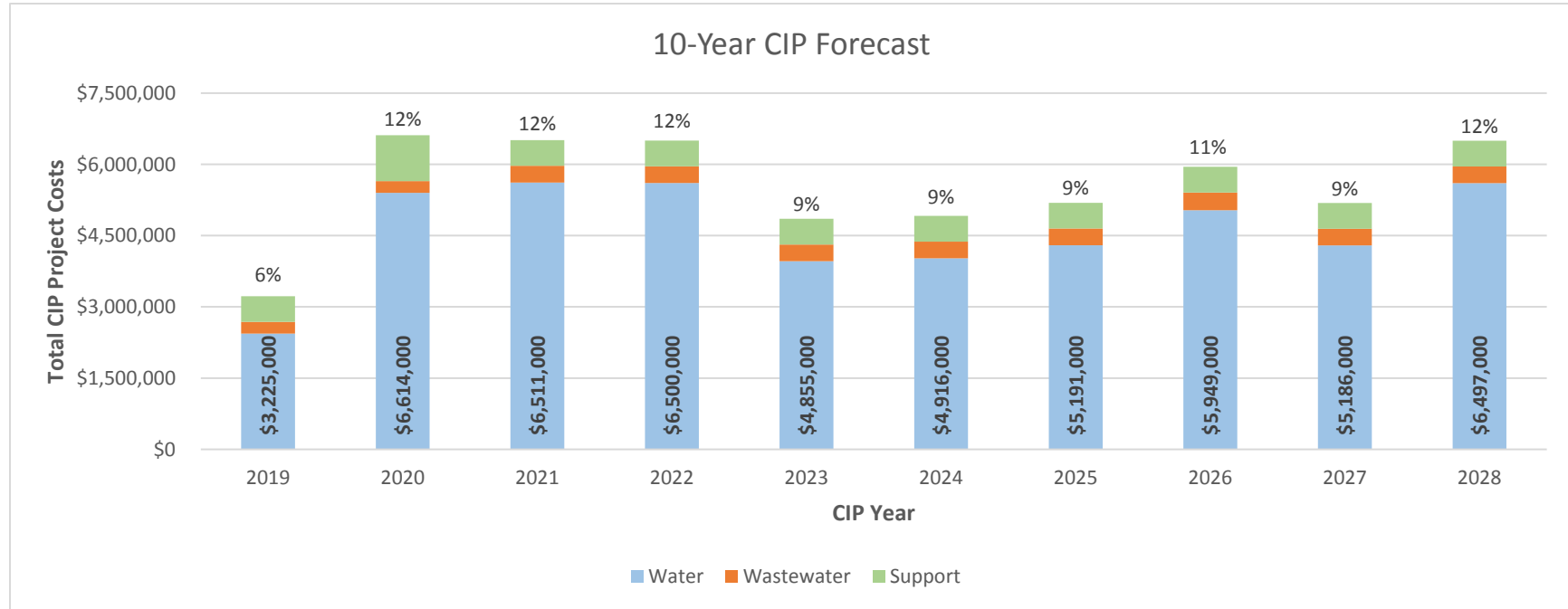


Figure 5.1 10-Year CIP Forecast

Notes: Percentage shown above the bars in the figure represents the percentage of the 10-year CIP for the year.

Table 5.1 10- Year CIP Summary Table (by System)

System	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	TOTAL
Water	\$2.44 M	\$5.4 M	\$5.62 M	\$5.61 M	\$3.96 M	\$4.02 M	\$4.3 M	\$5.04 M	\$4.29 M	\$5.6 M	\$46.29 M
Wastewater	\$0.25 M	\$0.25 M	\$0.35 M	\$0.35 M	\$0.35 M	\$0.35 M	\$0.35 M	\$0.37 M	\$0.35 M	\$0.35 M	\$3.32 M
Support	\$0.54 M	\$0.97 M	\$0.54 M	\$0.54 M	\$0.54 M	\$0.54 M	\$0.54 M	\$0.54 M	\$0.54 M	\$0.54 M	\$5.84 M
TOTAL	\$3.23 M	\$6.61 M	\$6.51 M	\$6.5 M	\$4.86 M	\$4.92 M	\$5.19 M	\$5.95 M	\$5.19 M	\$6.5 M	\$55.45 M

Notes:

Values show in millions of dollars. Estimated costs shown in 2018 dollars. No escalation has been applied to projects occurring in future years. Costs rounded to the nearest \$1,000.

The 33 projects that make up the CIP are listed below by system. The projects are ordered based on the year that they are estimated to occur. Descriptions of these projects, their estimated costs, and the year they are recommended, including maps of the pipelines, are included in Appendix B.

- Water Projects:

High Risk Pipeline Replacements	\$5,867,000	2019-2023
Box Canyon BPS Pump 2 Replacement	\$63,000	2019
Well No. 7 Rehabilitation	\$631,000	2019
Bryant Ranch Fencing	\$90,000	2019
Annual Customer Meter Replacement Program	\$9,323,000	2020-2028
Ductile Iron Pipe Replacement Program	\$11,456,000	2020-2028
Santiago BPS Rehabilitation	\$868,000	2020
Applecreek PRS	\$268,000	2020
Well No. 20 Chemical System Replacement and Upsizing	\$303,000	2020
Timber Ridge BPS Rehabilitation	\$1,502,000	2021
Lakeview BPS Repiping	\$154,000	2021
Dominguez PRS	\$278,000	2022
Richfield Base Chemical System R&R	\$1,221,000	2022
Well No. 15 Chemical System R&R	\$146,000	2022
Medium-High Risk Pipeline Replacements	\$6,024,000	2024-2028
Paseo Del Prado PRS	\$275,000	2025
Elk Mountain Rehabilitation	\$741,000	2026
Springview BPS Rehabilitation	\$272,000	2026
Stone Canyon PRS	\$68,000	2027
Sumac PRS	\$68,000	2027
Willowbrook PRS	\$134,000	2027
Hidden Hills BPS Capacity Improvements	\$500,000	2028
Oakvale PRS	\$280,000	2028
Lakeview BPS Chemical System R&R	\$361,000	2028
Well No. 5 Rehabilitation	\$440,000	2028
Miscellaneous Water System Asset Replacements	\$4,796,000	2019-2028
Water Projects Subtotal	\$46,129,000	

- Wastewater Projects:

High Risk Sewer Pipe Relining	\$480,000	2019-2020
Medium-High Risk Sewer Pipe Relining	\$2,758,000	2021-2028
Manhole Replacements	\$20,000	2026
Miscellaneous Wastewater System Asset Replacements	\$60,000	2019-2028
Water Projects Subtotal	\$3,318,000	

- Support Projects:

Vehicle Replacement Program	\$3,640,000	2019-2028
Radio System Replacement	\$425,000	2020
Miscellaneous Support System Asset Replacements	\$1,773,000	2019-2028
Support Projects Subtotal	\$5,838,000	

5.3 Long-Term (100-Year) Capital Improvement Program Forecast

A long-term, 100-year CIP forecast was developed based on the results of the Asset Management model. The model forecasts the replacement of all assets over the next 100 years to provide insight into the general level of funding needed to sustain the District's assets. A 100-year planning horizon was chosen so all assets will experience at least one replacement during the period. Some assets will be replaced multiple times.

The long-term forecast is shown in Figure 5.2. The 100-year CIP total is just shy of \$1.3 billion, which equates to an annual average CIP funding of \$12.8 million. The results are shown in 2018 dollars, inflation or cost escalation has not been applied. A summary of the long-term funding forecast is shown in Table 5.2.

Table 5.2 100-Year Forecast Summary (\$ million)

Period	Total CIP	Annual Average	Water CIP	Wastewater CIP	Support CIP
2019-2028	\$55.4	\$5.5	\$46.3	\$3.3	\$5.8
2029-2038	\$98.4	\$9.8	\$80.1	\$9.9	\$8.4
2039-2048	\$157.3	\$15.7	\$137.0	\$15.4	\$5.0
2049-2058	\$185.3	\$18.5	\$131.5	\$29.0	\$24.8
2059-2068	\$90.8	\$9.1	\$62.9	\$20.4	\$7.6
2069-2078	\$103.1	\$10.3	\$53.5	\$45.3	\$4.3
2079-2088	\$126.3	\$12.6	\$99.0	\$20.2	\$7.1
2089-2098	\$109.5	\$11.0	\$95.4	\$5.2	\$8.9
2099-2108	\$174.3	\$17.4	\$143.0	\$9.4	\$21.8
2109-2118	\$174.7	\$17.5	\$157.0	\$10.8	\$6.9
100-Year Total	\$1,275.3	\$12.8	\$1,005.8	\$168.9	\$100.7

Notes:

(1) All values shown are in million 2018 dollars. No inflation or escalation has been applied.

Maps of the long-term pipeline replacements and rehabilitations are included in Figure 5.3 and Figure 5.4.

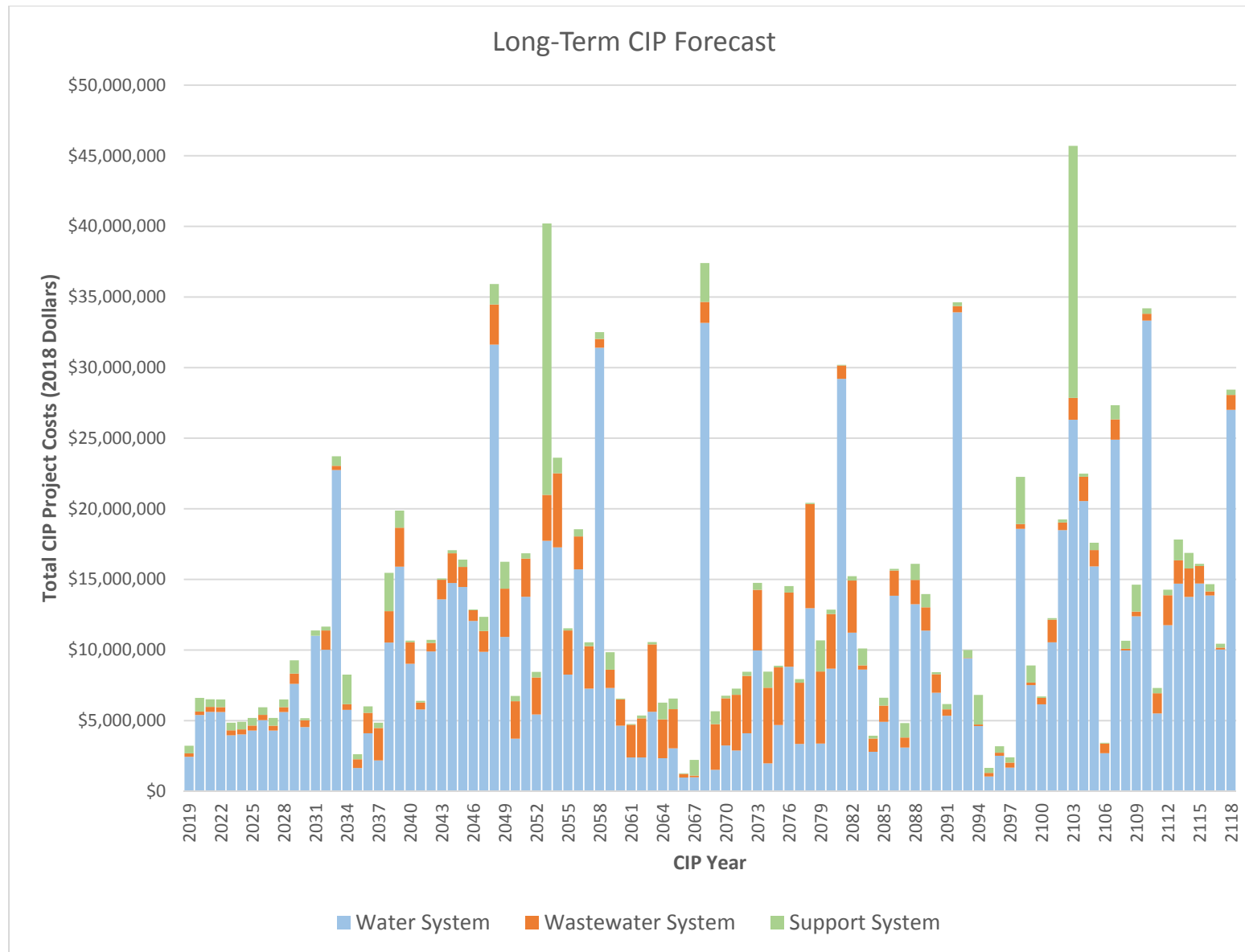


Figure 5.2 Long-Term Funding Forecast

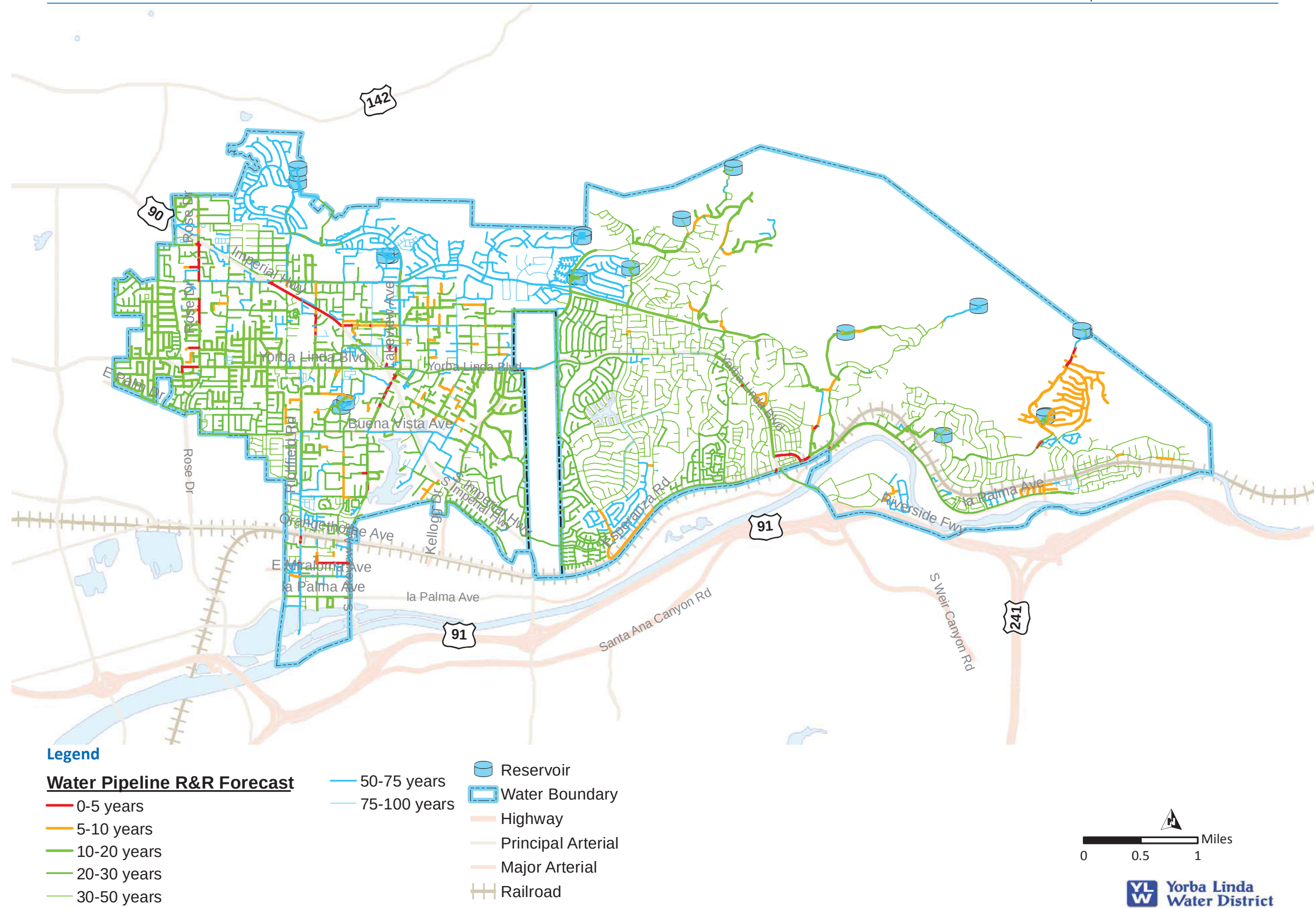
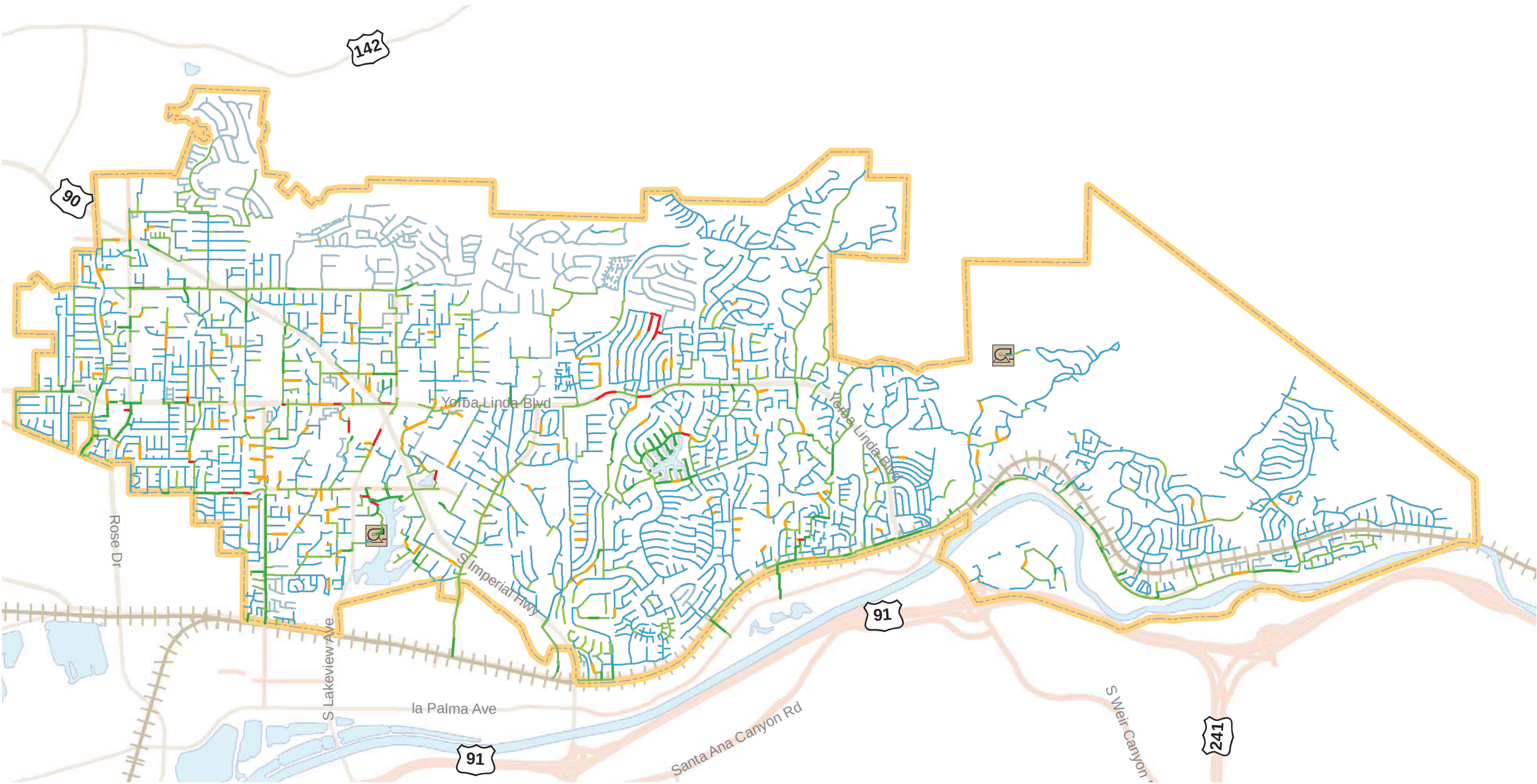


Figure 5.3 Water Pipeline Rehabilitation/ Replacement Forecast Map



Legend

Gravity Main R&R Forecast

- 0-5 years
- 5-10 years
- 10-20 years
- 20-30 years
- 30-50 years

- 50-75 years
- 75-100 years
- Lift Station
- Sewer System Boundary
- Highway
- Principal Arterial
- Major Arterial
- Railroad

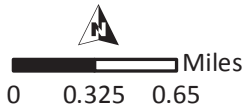


Figure 5.4 Wastewater Pipeline Rehabilitation/Replacement Forecast Map

5.4 Financial Analysis

In parallel with the District, Carollo developed a coordinated funding and financial plan to address the results of the AMP. This forecast does not formalize or approve the AMP, but rather works to define the necessary annual funding contributions that would substantiate the availability of funds for rehabilitation and replacement.

Towards this effort, a cash-flow and reserves funding analysis was developed, with the goal of identifying the ability of existing rate revenues to fund the annual projects identified in the AMP. This section identifies the current reserve levels, assumed future free cash-flow levels, assumptions used in the analysis, results of the analysis, and reserve and rate funding recommendations.

In 2015, the District worked with Raftelis Financial Consultants (RFC) to develop a Water and Sewer Rate Study (Rate Study). As part of the Rate Study, a financial plan was developed for the water and sewer enterprises to provide financial sufficiency, to meet operation and maintenance (O&M) costs, and to ensure sufficient funding for capital refurbishment and replacement (R&R) needs. The Rate Study developed and proposed rates that would fund forecasted expenditures through FY 2020. However, given the persistent drought and stakeholder feedback, the rate increases were curtailed.

5.4.1 District 5-Year Budget

This high-level financial forecast is based on the District's FY 2018 Annual Budget. The District's Budget includes forecasted expenditures and revenues for the 5-year period of FY 2018 – FY 2022. Revenues are forecasted to exceed (cash) expenses in all years. This excess cash flow is used to fund capital projects, replenish reserves, and provide necessary debt coverage. However, when depreciation (a non-cash expense) is included, the District is looking a loss of \$1.6M in FY 2018, increasing annually until it reaches a loss of \$3.5M in FY 2022. Figure 5.5 illustrates these values.

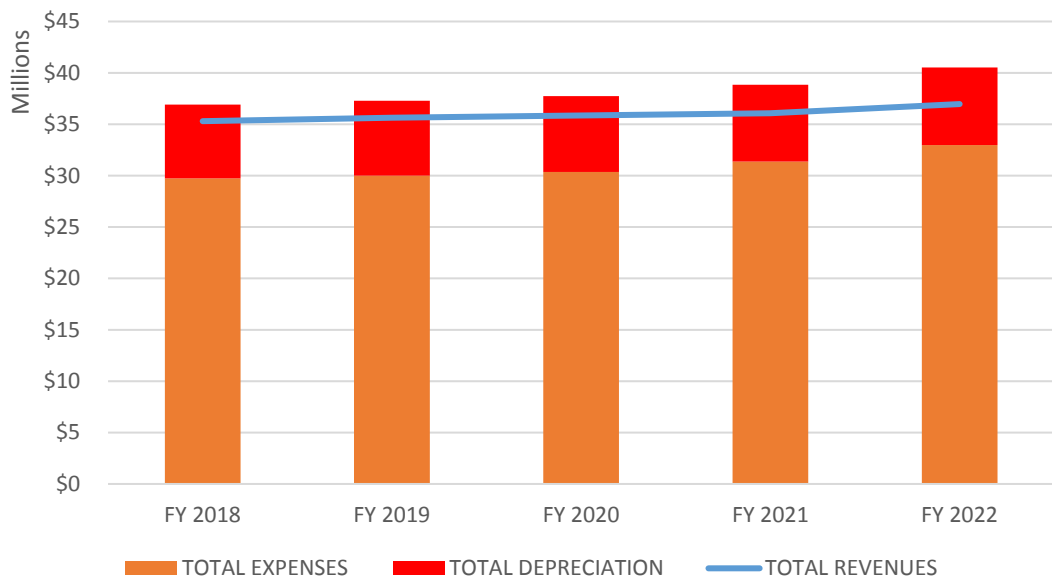


Figure 5.5 Water & Sewer Combined Financial Forecast

5.4.2 25-Year Funding Outlook

Utilizing the 25-year scheduled CIP in the AMP, Carollo created an extended financial forecast of the Water and Sewer systems to determine whether existing cash flow are sufficient to cover the planned CIP. The combined annual CIP defined in the AMP exceeds that of depreciation. This is expected as depreciation reflects the original value allocated over a tangible asset's useful life, and not the replacement value of the asset, which tends to be higher due to inflation.

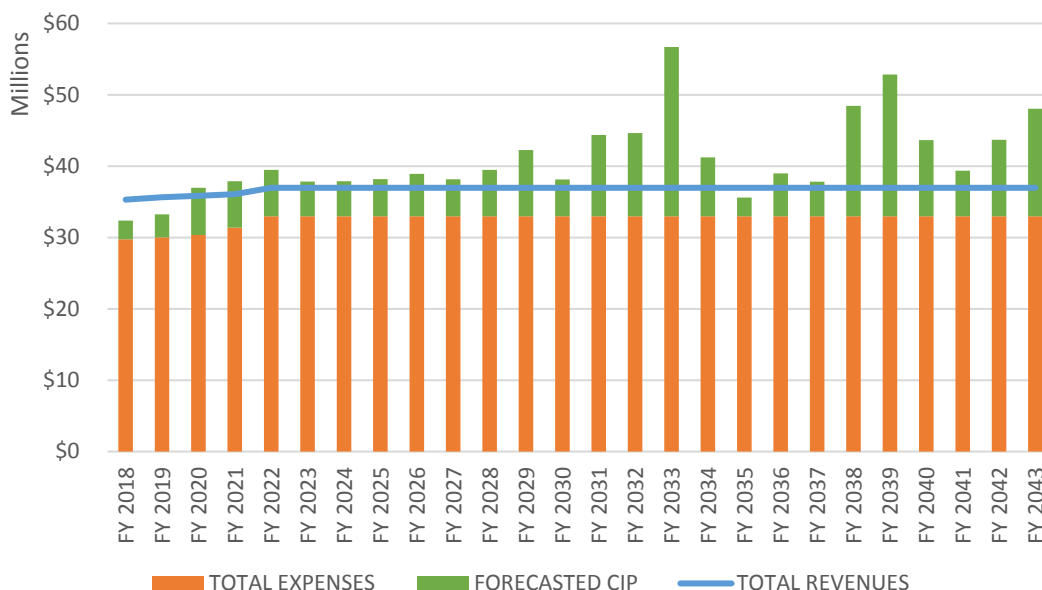


Figure 5.6 25-Year Financial Forecast

The 25 year AMP (Water and Sewer) is roughly \$217M, which exceeds available cash flow (\$104M) by approximately \$113M. The forecast does not assume any increase to revenues or expenditures outside of those forecasted by the District in the 5-year budget. Similarly the costs defined in the AMP are presented in current (2018) dollars. In order to fully fund forecasted \$113M shortfall, the District would need to increase annual revenues by over \$4.5M.

5.4.3 10-Year Funding Outlook

Much of this under funding is back loaded. Only 25 percent of the 25-year CIP is forecasted in years 1 to 10, while nearly 75 percent of the forecasted CIP cost occurs in years 11 to 25. When analyzed over the first 10 years, the District has a \$11.7M shortfall and the District would need to increase annual revenues by \$1.2M. This is shown in Figure 5.7.

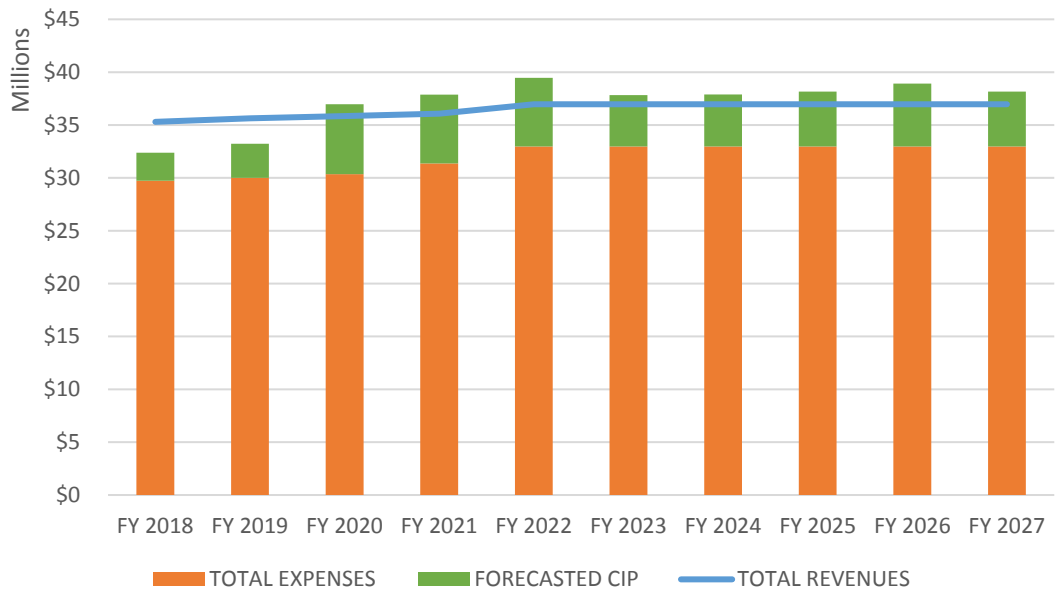


Figure 5.7 10-Year Financial Forecast

5.4.4 Shortfall Analysis

The District may elect to utilize reserves on hand to fund the proposed projects in FY19 through FY20. It is recommended that the District utilize the 2015 Rate Study to determine the financing needs and funding options going forward; which may include rate increases.

The District maintains various Board Designated Reserves for both their water and sewer divisions. While unrestricted, these reserves consist of Operating, Emergency, and Capital Replacement reserve funds. In addition, the District maintains a Rate Stabilization Reserve for Water. Resolution No. 17-31 (effective August 26, 2017) sets target reserve fund balances as well as fund minimums.

As the need for revenue increases is driven primarily by CIP, ideally the Capital Replacement fund plus any free cash flow would be sufficient to cover these expenses. As it can be seen below in Figure 5.8 and Figure 5.9 the water capital replacement fund is forecasted to be completely depleted by FY 2025 while the sewer capital replacement fund is forecasted to continue to grow over the course of the next 10 years. This indicates that the identified funding shortfall is squarely within the water division. However, Figure 5.9 shows that the sewer capital reserve is forecasted to be completely depleted by FY 2039.

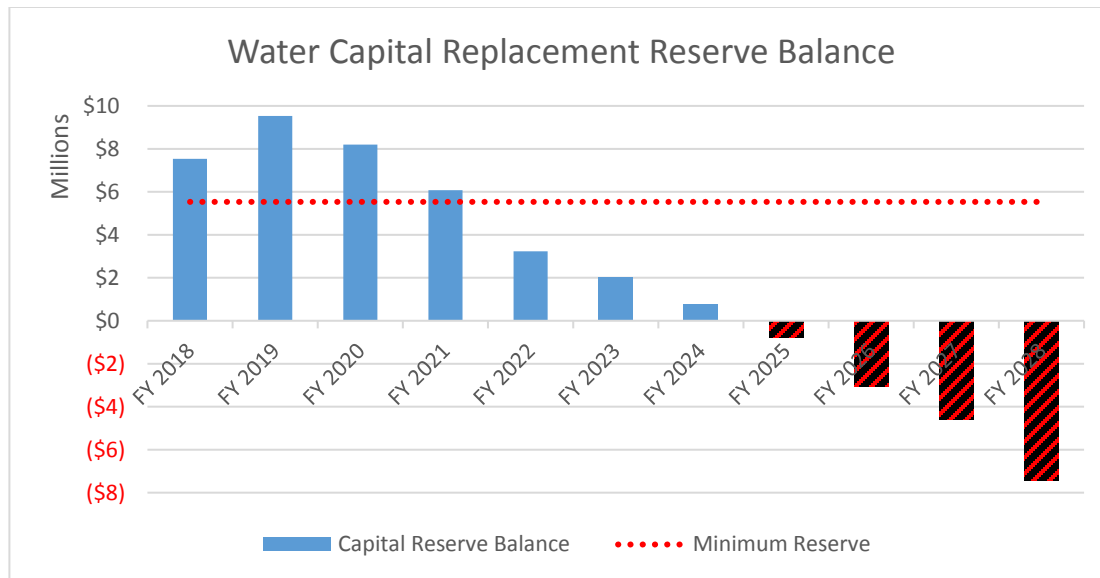


Figure 5.8 Water Capital Replacement Fund

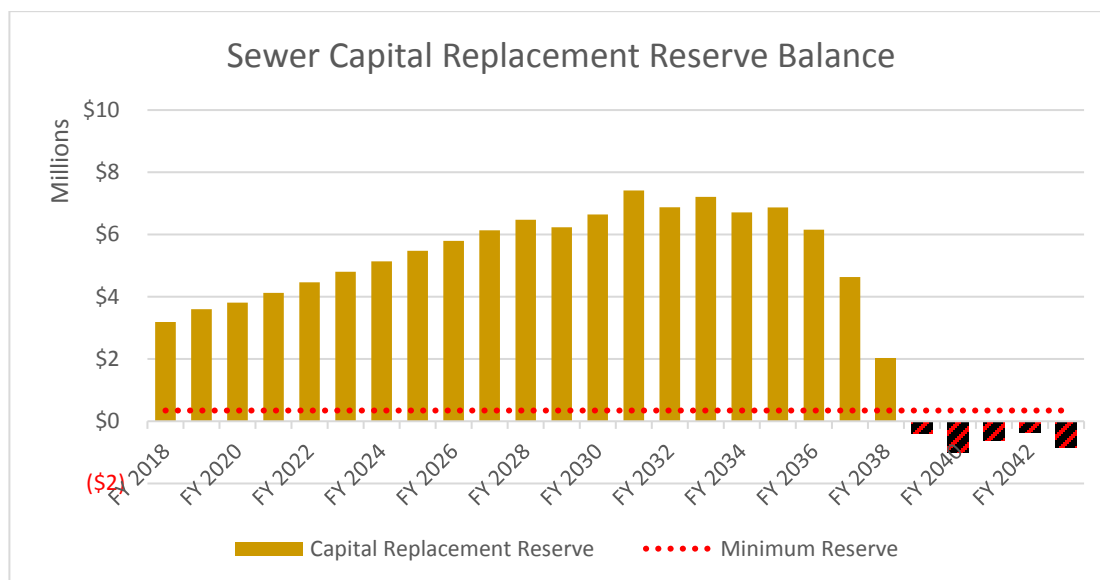


Figure 5.9 Sewer Capital Replacement Fund

While the Capital Replacement Fund for water provides full funding of the Water CIP through 2019 before dropping below the Board designated minimum (as stated in Resolution No. 17-31), the District could utilize these reserves fully and other unrestricted reserves to mitigate the need for future increases. Figure 5.10 shows that the district can maintain its overall minimum reserves target through FY 2028 if the Emergency and Rate Stabilization funds were used to offset the negative Capital Replacement balance. However, this will result in unfunded capital in FY 2029 and 2030. This analysis assumes that the Rate Stabilization Reserve and the Capital

Replacement Reserve can be completely used, while the Operating Reserve and the Emergency Reserve cannot drop below their minimum balance.

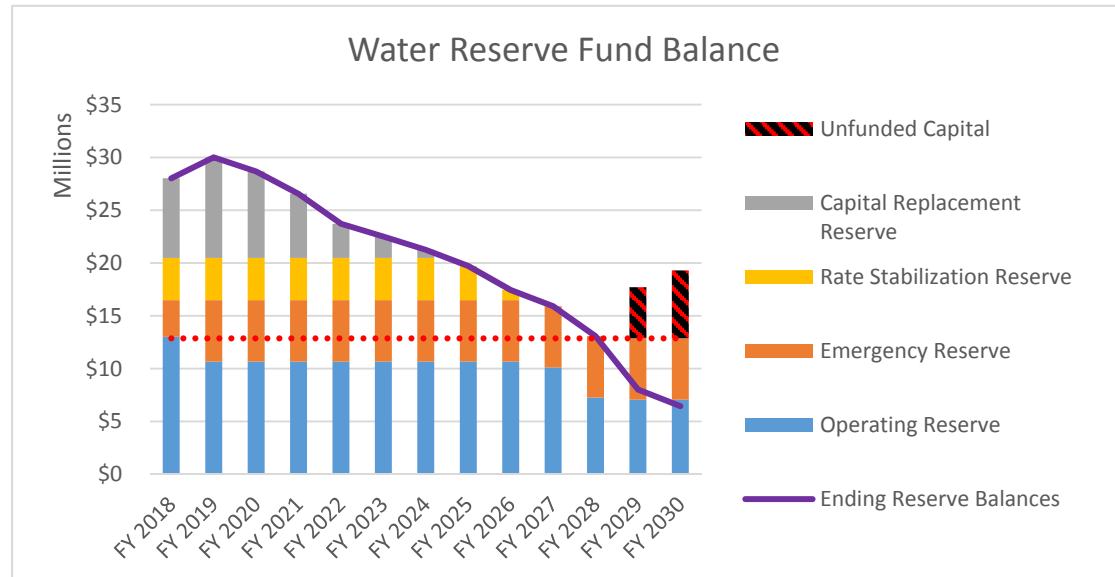


Figure 5.10 Water Unrestricted Reserve Utilization

The Capital Replacement Fund for sewer tells a much different story. While the fund will continue to increase through FY 2030, after this point the fund will be depleted and completely used by FY 2039. At that point, the minimal balance in the Operating and Emergency reserve funds can be applied, but it is insufficient to offset the unfunded capital in FY 2038. The 25-year Sewer Reserve fund balance is shown in Figure 5.11.

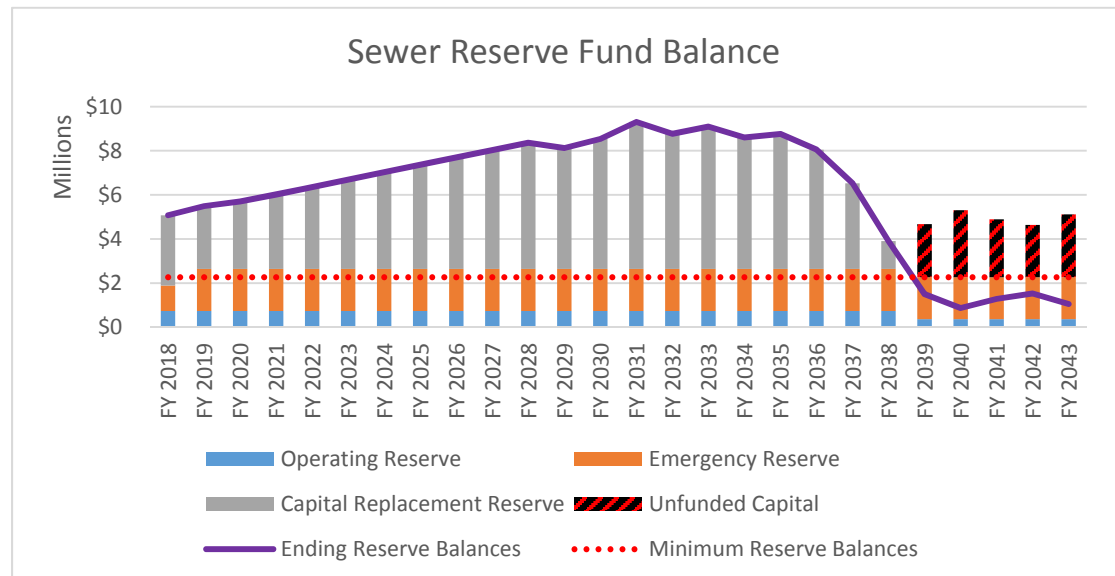


Figure 5.11 Sewer Unrestricted Reserve Utilization

Beyond the 10 year time horizon, the District would need to raise both Water and Sewer rates in order to continue funding the proposed CIP in this AMP. It is likely that increases will be required prior to the above time window as inflationary pressures will likely cause expenditures to increase beyond what is forecasted.

5.4.5 Financial and Reserve Analysis Summary

The financial forecast provides a high-level review of the funding options available to support the forecasted CIP in this AMP. Currently, the District's forecasted cash flow is not sufficient enough to cover all of the system depreciation costs, let alone the rehabilitation and replacement costs forecasted. While existing reserves are available to cover a portion of this deficit, the shortfall increases significantly after year ten and further reserves or additional revenues would be necessary.

Based on the needs identified in the AMP, it is recommended that the District consider utilizing existing Capital Replacement Reserves, and take the short-term opportunity to best determine an appropriate roadmap for rate increases to mitigate the impacts on rate payers, as well as the effect on the District's current and desired rating from bond rating agencies. As a majority of the AMP funding needs are outside of first 10-years, it also enables the District to continue monitoring and adjusting the forecast for future R&R needs.

Section 6

CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the findings of the AMP report and presents recommendations for future AMPs.

6.1 Findings and Conclusions

This AMP is a long-range planning document used to provide a rational framework for understanding the assets the District owns, the services it provides, the risks it exposes, and the financial investments it requires. The following are some key findings and conclusions presented in this report.

- The District's portfolio of assets covers water, wastewater, and support systems. This include 352 miles of water pipelines, 266 miles of sewer pipelines, 37 water distribution and storage facilities, 2 sewer lift stations, and an operations center. Table 2.1 on Page 9 summarizes the District's assets.
- The District's assets are estimated to have a replacement cost of \$1.07 billion in 2018 dollars. Figure 2.7 on page 17, shows the distribution of asset replacements costs by system.
- A visual condition assessment of the assets at 40 District facilities was performed as part of this project. The vast majority of the assets were found to be in good to fair condition. Less than one percent of assets were observed to be in poor condition.

- A review of the District's pipelines was performed using a GIS-based computer model. The model was used to assess pipeline conditions and evaluate remaining life. The model results identified 19 miles of water and wastewater pipelines in poor condition based on a combination of leaks, repairs, CCTV inspections, and age.
- A risk assessment was performed to look for assets that pose a risk to the District's system. The results of the assessment identified 5 miles of pipe that pose a high risk to the District. An additional 31 assets and 30 miles of pipe were identified as medium-high risk.
- A 10-year and 100-year CIP forecast was created using the condition and risk information created in this report. The 10-year CIP forecast is estimated at \$55M and contains 33 projects. The 100-year CIP forecast total is \$1.3B, which equates to \$12.8M per year. A graph of the 100-year CIP forecast is shown in Figure 5.2 on page 65.
- A financial review found that the District's current forecasted cash flow is not sufficient to cover all of the system depreciation costs, let alone the asset rehabilitation and replacement costs forecasted in the AMP. While existing unrestricted reserves are sufficient to cover this deficit for the next ten years, the deficit increases significantly after year ten and further reserves would be unavailable to cover the deficit. It is recommended that the District establish a long term financial plan and raise rates to meet its future financial needs.

6.2 Asset Management Improvement Recommendations

An AMP is a snapshot of the District's assets. Over time the assets change and so does the information about them. As asset data improves and computer system technology advances, so does the ability to improve the AMP analyses. Below are some recommendations for future improvements to the AMP and the District's Asset Management Program.

- Develop and implement a formal Condition Assessment Protocol (CAP). The CAP included in Appendix A describes the framework used by the Carollo team during the condition assessments. Moving forward, District staff should implement a way to rate and record the condition of the assets on a regular basis. As District staff visit each site for operations and maintenance activities, they are able to collect information and store it in the CMMS for use in future planning efforts.
- Leverage the CMMS to implement a formal Work Order and Maintenance Program. The CMMS can be used to schedule and record work orders for the assets. A formal program would allow the District to track what work is being done and store that information in the CMMS. Historical work order information can be used for various analyses, including asset lifecycles and rehabilitation and replacement cost estimating.
- Establish Key Performance Indicators (KPIs) and Performance Metrics. The District may already have some metrics related to overall financial performance, however, establishing asset-level KPIs and metrics can improve overall operations and maintenance performance. Asset performance metrics can be used in addition to physical condition to evaluate asset condition and likelihood of failure.
- Refine the definition of an asset. This AMP expanded the definition of an asset to include items that were not in the previous AMP. Looking to the next AMP, additional assets that could be considered include: fire hydrants, valves (all or only critical), electrical motors, and site assets such as fencing and pavement.

6.3 Asset Renewal Model Tool

As part of this AMP project, a model was developed that includes all of the District's assets. This model served as the basis for the results shown in this report. The District is provided with a copy of this tool at the conclusion of this project.

Appendix A

CONDITION ASSESSMENT PROTOCOL



PROJECT MEMORANDUM

ASSET MANAGEMENT PLAN (AMP) UPDATE

Date: 03/29/2018

Project No.: 10849A.00

Yorba Linda Water District

Prepared By: Alex Bugbee

Reviewed By: David Baranowski, Dan Baker

Subject: Condition Assessment Protocol – Final

Purpose

The purpose of this project memorandum (memo) is to summarize the Condition Assessment Protocol (CAP) developed for the AMP Update project. A draft version of the CAP was presented to Yorba Linda Water District (YLWD) staff to review and comment on prior to Carollo performing the field assessments. The revised approach was then used to perform the field assessments.

Condition Assessment Protocol

The CAP sets a standard practice for completing assessments of assets and facilities. It intends to create a consistent and repeatable process in order to provide adequate and accurate data for the asset management plan (AMP) to be developed in this study, and to serve as a reference in possible future updates to the plan to be completed by YLWD staff.

Condition Assessment Approach / Methodology

The condition assessment approach defines the process for identifying and evaluating assets, and outlines the information that was collected for each asset to develop the AMP.

Visual Condition Assessments

The field effort consisted of a visual condition assessment conducted by a multi-disciplinary engineering team accompanied by YLWD staff. The Carollo team asked questions of the designated guides throughout the assessment to capture anecdotal maintenance and performance history. While completing the assessments, the team also verified design and sizing criteria for assets (as needed) and noted typical condition parameters, which can be used to standardize the procedure for future assessments. The condition of each asset was evaluated using a one-through-five scoring system.

Information Collected

The information that was prepared for, or collected during, the condition assessment for each asset can be broken into three major categories:

1. Asset Identification Information
2. Asset Condition Information
3. Additional Information Needed for the AMP

These three categories are further described below.

PROJECT MEMORANDUM

Asset Identification Information

Identifying information is necessary to accurately track each of YLWD's assets within the AMP and throughout the analysis. Much of this information was prepared prior to the condition assessments and confirmed in the field. Missing information will also be gathered during the condition assessment if it is readily available or evident. Table 1 below shows the identifying information that was collected for each asset.

Table 1: Asset Identification Information	
Facility/Site:	<i>Name of Facility or Site</i>
Asset Name:	<i>Name from Asset Registry</i>
Assessment Discipline:	<i>Mechanical, Structural, Electrical</i>
Asset Type:	<i>Water or Wastewater Pump Unit, PRV, Engine, Chemical Tank, Reservoir, Building, etc.</i>
Attributes:	<i>Examples include HP, size, capacity, TDH, flow rate, etc</i>
Asset Description:	<i>Qualitative description of what the asset is and/or does</i>

Asset Condition Information

Asset condition information should include a condition score for each asset as well as a description of the observations that produced that score. The electronic inspection forms that were developed for the assessments include fields for overall asset condition score, a field for a general description of the condition, and several fields to note the presence of specific condition issues or information for each asset discipline, and descriptions of each. The following tables summarize the type of information that was collected for assets within each discipline, where applicable. Definitions of the condition scores are included at the end of this memo for various asset types.

Table 2: Mechanical Asset Condition Information					
Condition Score:	1	2	3	4	5
Condition Comments:	Overall description of condition				
Condition Elements:					
Corrosion:	Y/N	Description of location and extent			
Water Leakage:	Y/N	Description of number of leaks and amount of water leaking			
Coating Failed or Degraded:	Y/N	Description of location and extent			
Seals Failed or Degraded:	Y/N	Description of location and severity of failures or degradation			
Noise/Vibration/Heat:	Y/N	Description of abnormal noise vibration or heat			
Oil/Lubricant Leakage:	Y/N	Description of extent of oil/lubricant leakage			

PROJECT MEMORANDUM

Table 3: Structural Asset Condition Information

Condition Score:	1	2	3	4	5
Condition Comments:	Overall description of condition				
<u>Condition Elements:</u>					
Corrosion or damage of Structural Members:	Y/N	Description of location and extent			
Leaks:	Y/N	Description of number of leaks and amount of water leaking			
Coating or Lining Failed or Degraded:	Y/N	Description of location and extent of degradation			
Cracks or Spalling:	Y/N	Description of location and severity of cracks or spalling			
Deformation:	Y/N	Description of location and extent of deformation			
Foundation or Support Issues:	Y/N	Description of issues such as settling or erosion			
Dive Report or Inspection	Y/N	Report results or recommendations, if available			

Table 4: Electrical Asset Condition Information

Condition Score:	1	2	3	4	5
Condition Comments:	Overall description of condition				
<u>Condition Elements:</u>					
Cabinet Corrosion:	Y/N	Description of location and extent			
Dusty/Dirty Internals:	Y/N	Description of location and extent			
Abnormal Heat or Noise:	Y/N	Description of location or source and extent			
Parts or Service Unavailable:	Y/N	Description of specific parts or services that are difficult to source or not available			
Thermal Imaging/Arcflash Study:	Y/N	Report results or recommendations, if available			

PROJECT MEMORANDUM

Additional Information

In addition to asset identifiers, attributes, and condition information, the CAP includes additional categories of information that are used to inform the AMP. The factors may influence the likelihood that an asset will fail, or the consequences if it fails. While some of this information was evident at the sites, much of it came from conversations with YLWD staff during the assessments. Table 5 presents examples of the type the additional information that was collected or noted during the condition assessment.

Table 5: Additional Information for AMP

Operational Requirements:	Information about how the equipment is being operated and whether it is meeting requirements such as: <i>Does the equipment operate outside of its design capacity?</i> <i>Is there adequate redundancy?</i>
Obsolescence:	Obsolescence can limit the useful life of otherwise functional assets: <i>Are repair parts readily available?</i> <i>Does the manufacturer still provide support?</i>
Maintenance:	Information about the maintenance procedures being performed on the asset: <i>Are the PM's that are being performed adequate and is the maintenance interval correct?</i> <i>Is the excessive unplanned maintenance.</i>
Environmental Factors:	Conditions on or around the site that could impact the assets: <i>Is equipment protected from the elements?</i> <i>Is there risk from nearby trees, slopes, vehicle traffic, etc.</i>
Criticality:	<i>Implications if an asset fails:</i> <i>Could an isolated failure lead to significant downstream consequences?</i> <i>Do the conditions of other assets or operational nuances increase the criticality?</i> <i>Could a failure damage nearby homes or businesses?</i>

PROJECT MEMORANDUM

Score Definitions

As a component of the AMP, detailed score definitions for condition scores of 1 (excellent condition) through 5 (very poor condition) have been developed for each easily distinguished asset type and for general mechanical, general structural, and general electrical scores. The definitions lay out the types of issues and the severity of those issues that correspond to each condition score for each type of asset. Table 6 shows the general description of each condition score, asset and discipline specific score definitions are included in the attached tables.

Table 6: General Condition Descriptions

Condition Score	General Description
1	<u>New or Excellent Condition</u> -Only normal maintenance required -Fully functional
2	<u>Minor Defects Only</u> -Minor maintenance required (5%) -Fully functional
3	<u>Moderate Deterioration</u> -Moderate maintenance required (10% – 20%) -Function not significantly affected
4	<u>Significant Deterioration</u> -Significant renewal / upgrade required (20%-40%) -Functions as needed but is unreliable
5	<u>Severe Deterioration</u> -Over 50% of asset requires replacement -Barely functional for current conditions

Condition Score	General Condition Description	Asset Class				
		Mechanical General	Pump Units - Water	Pump Unit - Wastewater	Pressure Regulating Valve	Engine
		All mechanical assets not covered by specific score definitions. Also used for Chemical Equipment (Chemical feed and metering pumps, chlorine generators, containment structures, small tanks).	Water Pumps (Motor, pump, piping, isolation valves, ancillary equipment) Well Pumps (Motor, pump, piping, ancillary equipment)	Submersible Wastewater Pumps (pump, piping, valves, ancillary equipment)	All Pressure Regulating Valves (isolation valves, piping, ancillary equipment) Includes dedicated PRV sites and PRVs at pump stations	Pump Engines, drives included with pump asset Emergency Generators
1	<u>New or Excellent Condition</u> -Only normal maintenance required -Fully functional	<u>New or Excellent Condition</u> -Only normal maintenance required -No evidence of leakage -No Corrosion -No unusual noise from rotating components	<u>New or Excellent Condition</u> -Only normal maintenance required -No evidence of leakage -No Corrosion -No abnormal vibration or heat	<u>New or Excellent Condition</u> -Only normal maintenance required -No evidence of leakage -No Corrosion -No abnormal vibration or heat	<u>New or Excellent Condition</u> -Only normal maintenance required -No evidence of leakage -No Corrosion -Gages and controls fully functional (if installed)	<u>New or Excellent Condition</u> -Only normal maintenance required -Some aging or wear may be visible
2	<u>Minor Defects Only</u> -Minor maintenance required (5%) -Fully functional	<u>Minor Defects Only</u> -Minimal surface corrosion -Normal vibration or heat	<u>Minor Defects Only</u> -Minimal surface corrosion -Normal vibration or heat	<u>Minor Defects Only</u> -Minimal surface corrosion -Intact coatings on rails and pump outlet piping	<u>Minor Defects Only</u> -Minimal Surface Corrosion -No current leakage	<u>Minor Defects Only</u> -Minor signs that maintenance has been completed -Very minimal vibration or excess noise
3	<u>Moderate Deterioration</u> -Moderate maintenance required (10% – 20%) -Function not significantly affected	<u>Moderate Deterioration</u> -Minimal leakage, drip -Slight to moderate motor vibration and/or heat -Slight oil leakage or seepage (where applicable)	<u>Moderate Deterioration</u> -Minimal leakage, drip -Slight to moderate motor vibration or heat -Slight oil leakage, noise, or vibration from drive (where applicable)	<u>Moderate Deterioration</u> -Minimal leakage, drip -Some degradation of coatings on rails and/or pump outlet piping	<u>Moderate Deterioration</u> -Minimal leakage, drip -Isolation valves require moderate effort to operate	<u>Moderate Deterioration</u> -Some surface corrosion present -Some abnormal vibration -Some noise but not from bearings -May show slight oil seepage at bearings or gaskets
4	<u>Significant Deterioration</u> -Significant renewal / upgrade required (20%-40%) -Functions as needed but is unreliable	<u>Significant Deterioration</u> -Surface corrosion (in need of coating) -Moderate leakage (stream from 1 location) -Missing minor parts or ancillary equipment -Moderate oil leakage -Damage of structural supports	<u>Significant Deterioration</u> -Surface corrosion (in need of coating) -Moderate leakage (stream from 1 location) -Missing minor parts or ancillary equipment -Moderate oil leakage, noise, or vibration from drive (where applicable) -Damage of structural supports	<u>Significant Deterioration</u> -Surface corrosion (in need of coating) -Moderate leakage (stream from 1 location) -Moderate degradation of coatings on rails and pump outlet piping -Missing minor parts or ancillary equipment -Damage of structural supports	<u>Significant Deterioration</u> -Surface corrosion (in need of coating) -Moderate leakage (stream from 1 location) -Missing minor parts or ancillary equipment -Damage of structural supports -Isolation valves not 100% operable or require significant effort	<u>Significant Deterioration</u> -Surface corrosion (in need of coating) -Moderate vibration -Moderate noise (possibly from bearings) -Oil leakage at bearings or gaskets
5	Severe Deterioration -Over 50% of asset requires replacement -Barely functional for current conditions	<u>Severe Deterioration</u> -Severe corrosion -Significant leakage (stream from more than 1 location) -Significant vibration and/or heat -Oil leakage in multiple areas -Significant damage or corrosion of structural supports	<u>Severe Deterioration</u> -Severe corrosion -Significant leakage (stream from more than 1 location) -Significant motor vibration and/or heat -Severe oil leakage, noise, or vibration from drive (where applicable) -Significant damage or corrosion of structural supports	<u>Severe Deterioration</u> -Severe corrosion -Significant leakage, stream from more than 1 location -Significant Damage or corrosion of structural supports	<u>Severe Deterioration</u> -Severe corrosion -Significant leakage, stream from more than 1 location -Moderate damage or corrosion of structural supports -Isolation valves inoperable or failed	<u>Severe Deterioration</u> -Severe Corrosion -Significant vibration -Significant noise, possible from bearings -Oil leakage at multiple bearings and/or gaskets

Condition Score	General Condition Description	Asset Class			
		Structural - General	Structural - Steel	Structural - Concrete	Well
		All structural assets not covered by the specific asset categories	Metal buildings, enclosures, canopies, decks, stairs	Reservoirs, buildings, vaults	Well head, seals, base, ancillary equipment (Condition of below ground components noted if information is provided.)
1	<u>New or Excellent Condition</u> -Only normal maintenance required -Fully functional	<u>New or Excellent Condition</u> -No signs of wear -No deterioration or damage -No cracking, corrosion, or erosion	<u>New or Excellent Condition</u> -No signs of wear -No deterioration or damage -No cracking, corrosion, or erosion	<u>New or Excellent Condition</u> -No signs of wear -No deterioration or damage -No cracking, corrosion, or erosion	<u>New or Excellent Condition</u> -No evidence of leakage -No Corrosion -No damage or wear to sanitary seal -No separation of concrete at pump head
2	<u>Minor Defects Only</u> -Minor maintenance required (5%) -Fully functional	<u>Minor Defects Only</u> -Minor wear -No signs of deterioration or damage -Few areas of very minor cracking	<u>Minor Defects Only</u> -Minor wear -No signs of deterioration or damage	<u>Minor Defects Only</u> -Minor wear -No signs of deterioration or damage	<u>Minor Defects Only</u> -Normal signs of wear
3	<u>Moderate Deterioration</u> -Moderate maintenance required (10% – 20%) -Function not significantly affected	<u>Moderate Deterioration</u> -Loss of protective coating in some locations -Small areas of corrosion -Some deterioration, but no signs of damage to the structure or supporting structure	<u>Moderate Deterioration</u> -Loss of protective coating in some locations -Small areas of surface corrosion -Some deterioration, but no signs of damage to the structure or supporting structure	<u>Moderate Deterioration</u> -Loss of protective coating or lining in some locations -Small areas of cracking or spalling -Some deterioration, but no signs of damage to the structure or supporting structure	<u>Moderate Deterioration</u> -Some surface corrosion -Well produces at desired capacity
4	<u>Significant Deterioration</u> -Significant renewal / upgrade required (20%-40%) -Functions as needed but is unreliable	<u>Significant Deterioration</u> -Broken components or accessories -Significant deterioration or notable damage to the structure -Major cracks that appear to affect the structure -Evidence of past leakage	<u>Significant Deterioration</u> -Broken components or accessories -Significant deterioration or notable damage to the structure -Major cracks that appear to affect the structure -Evidence of past leakage	<u>Moderate Deterioration</u> -Broken components or accessories -Significant deterioration or notable damage to the structure -Major cracks that appear to affect the structure -Evidence of past leakage	<u>Significant Deterioration</u> -Significant surface corrosion -Subsurface conditions may impact production capacity -Wear/degradation visible at seals -Damage to concrete at base of pump
5	Severe Deterioration -Over 50% of asset requires replacement -Barely functional for current conditions	<u>Severe Deterioration</u> -Severe cracking, breaks, or corrosion -Leaking -Complete loss of protective coating -Major erosion or foundation settlement -In need of replacement	<u>Severe Deterioration</u> -Severe cracking, breaks, or corrosion -Leaking -Complete loss of protective coating -Major erosion or foundation settlement -In need of replacement	<u>Severe Deterioration</u> -Severe cracking, breaks, or corrosion -Leaking -Complete loss of protective coating or lining -Major erosion or foundation settlement -In need of replacement	<u>Severe Deterioration</u> -Severe corrosion -Not producing at desired capacity -Wear/degradation evident at seals -Damage to concrete at base of pump

Condition Score	General Condition Description	Asset Class	
		Instrumentation	Electrical
		All instrumentation, including flow meters, telemetry, and analyzers	All electrical equipment, including MCCs, VFDs, and control panels
1	<u>New or Excellent Condition</u> -Only normal maintenance required -Fully functional	<u>New or Excellent Condition</u> -Less than 5 years old	<u>New or Excellent Condition</u> -New cabinet -Equipment less than 5 years old
2	<u>Minor Defects Only</u> -Minor maintenance required (5%) -Fully functional	<u>Minor Defects Only</u> -Minor wear -All indicators in good working order -Calibrated recently or per normal PM	<u>Minor Defects Only</u> -Minor wear of panels, cabinets, and support structure
3	<u>Moderate Deterioration</u> -Moderate maintenance required (10% – 20%) -Function not significantly affected	<u>Moderate Deterioration</u> -Moderate wear or deterioration -Some indicators not working, but all critical indications fully functional	<u>Moderate Deterioration</u> -Minor dust or dirt on electrical components inside cabinet -Minor corrosion on cabinet or supports
4	<u>Significant Deterioration</u> -Significant renewal / upgrade required (20%-40%) -Functions as needed but is unreliable	<u>Significant Deterioration</u> -Significant wear or corrosion -Local indicator issues, but transmitting correctly -All critical indications not properly functioning -More than a year since last calibration	<u>Significant Deterioration</u> -Difficult to get replacement parts -Abnormal heat or noise -Damage to cabinet or supports -Excessive dirt on electrical components inside cabinet
5	<u>Severe Deterioration</u> -Over 50% of asset requires replacement -Barely functional for current conditions	<u>Severe Deterioration</u> -Broken -Unable to measure or transmit -Unserviceable, unable to get parts -Does not meet NEC standards	<u>Severe Deterioration</u> -Unserviceable, unable to get parts -Severe corrosion on cabinet or supports -Holes in cabinet -Excessive heat or noise

PROJECT MEMORANDUM

Electronic Inspection Forms

The electronic inspection forms that were used during the condition assessment were created using the Tap Forms database application for iOS. The application allows for forms to be created that include dropdown menus with fields for each of the asset attributes, condition factors, and other information; as well as the ability to take and store photos of each asset. The information from the forms was then exported to Microsoft Excel and incorporated into the AMP model. Several screenshots of the Tap Forms database that was used for the AMP are included for reference below. The forms include all categories and fields for each asset, however, only those applicable to each specific asset were used during the assessment.

Screenshot 1 – Asset Identification and Attributes

The screenshot displays the Tap Forms database application interface on an iOS device. The top status bar shows the time as 3:59 PM and 100% battery. The app's header bar is blue with a white back arrow, a magnifying glass icon, a star icon, a clock icon, and the text 'Yorba Linda 2017 AMP'. To the right of the header are icons for a folder, a gear (settings), and a document with a checkmark. The main content area is a white form with a blue border. It contains the following fields:

Process	Box Canyon BPS
Asset ID	Box Canyon BPS: Booster Pump 1
▼ Asset Identification	
Facility	Box Canyon BPS
Organization	YLWD
Asset Name	Booster Pump 1
Asset Type	Pump - Water
Assessment Discipline	
▼ Asset Attributes	
Installation Year	2013
Capacity/Size	
Manufacturer	
Model	
Description	ELEC

PROJECT MEMORANDUM

Screenshot 2 – Condition Score

▼ Condition	
Condition	2 - Good 
Condition Notes	Minimal Corrosion on coupler, quiet, no leaks
Audio Notes	 duration: 0:00
Safety Issues	

Screenshot 3 – Photos

▼ Photos	
Photo1	
Photo2	

PROJECT MEMORANDUM

Screenshot 4 – Structural Comments

▼ Structural	
Structural Comments	
Str Dimensions	
Str Materials	
Roofing Type	
Spalling Concrete	✓ ⋮ ≡
Cracks	✓ ⋮ ≡
Structure Corrosion/ Damage	✓ ⋮ ≡
Member Corrosion/ Damage	✓ ⋮ ≡
Outdoor Coating Degradation	✓ ⋮ ≡
Interior Coating/Lining Degradation	✓ ⋮ ≡
Leaks	✓ ⋮ ≡
Further Structural Analysis	✓ ⋮ ≡

PROJECT MEMORANDUM

Screenshot 5 – Mechanical Comments

▼ Mechanical		
Mechanical Comments		
Flow	2000	
HP	25	
TDH		
Capacity/Size		
Corrosion	II - Minimal:	✓ ☰
Water Leakage	I - Normal/No Issues	✓ ☰
Coating Degradation	II - Minimal:	✓ ☰
Excessive Noise	I - Normal/No Issues	✓ ☰
Vibration Issues	I - Normal/No Issues	✓ ☰
Running Hot		✓ ☰
Seals Failed/Degraded		✓ ☰
Oil/Lubricant Leakage		✓ ☰

PROJECT MEMORANDUM

Screenshot – 6 Electrical, Instrumentation, and Control Comments

▼ EI&C	
EI&C Comments	
EI&C Type	
Cabinet Corrosion	
Dirty/Dusty Internals	
Abnormal Noise	
Abnormal Heat	
Parts and Service Availability	
Other EI&C Studies Completed	

Screenshot 7 – Civil Comments

▼ Civil	
Civil Comments	
Stability/Settling Issues	
Access Issues	
Grading/Drainage Issues	
Resurfacing Needed	
Sealing Needed	

PROJECT MEMORANDUM

Screenshot 8 – Site Security Comments

▼ Site Security	
Security Comments	
Walls/Fencing	✓ ≡
Cameras	✓ ≡
Alarm System	✓ ≡

Screenshot 9 – Additional Information

▼ Additional Information	
Operational Requirements	
Obsolescence	
Maintenance	
Environmental Factors	
Criticality	
Drawing	>

Appendix B

10-YEAR CIP PROJECT DETAILS

The 10-year CIP forecast shown above is the aggregation of projects developed using the asset data and risk analysis performed in this project. The list of 33 projects along with a description of the project, the total project cost, and estimated timing and project duration are shown in Tables B.1, B.2, and B.3 (one table per asset system).

Table B.1 10-Year Water CIP Project Information

Water Project Title	Project Description	Estimated Cost ⁽¹⁾	Start Year ⁽²⁾	Duration (years) ⁽²⁾
<u>Pipeline Projects</u>				
High Risk Pipeline Replacements	<i>Replacement of 3.8 miles of High risk pipelines throughout the District. Replacements are grouped into four phases based on geography.</i>	\$5,867,000	2019	5
Medium-High Risk Pipeline Replacements	<i>Replacement of 6.1 miles of Medium-High risk pipelines throughout the District. Replacements are grouped into four phases based on geography.</i>	\$6,169,000	2024	5
Ductile Iron Pipe Replacement Program	<i>Program to replace 10.3 miles of DIP installed between 1985 and 1999.</i>	\$11,457,000	2020	9
Annual Customer Meter Replacement Program	<i>Program to replace existing meters with new advanced meter reading technology.</i>	\$9,323,000	2020	9
<u>Booster Pump Station Projects</u>				
Box Canyon BPS Pump 2 Replacement	<i>Replace Pump 2 (40 HP) due to condition and efficiency concerns. Extend metal roof to cover new equipment.</i>	\$63,000	2019	1
Elk Mountain Rehabilitation	<i>Rehabilitate or replace pumps and valves, pumps installed in 1998 and are beyond expected useful life. Repair concrete stairs to top of reservoir.</i>	\$741,000	2026	1
Santiago BPS Rehabilitation	<i>Rehabilitate or replace pumps 3 and 4 and valves. Add Vehicle restriction to top of pump station.</i>	\$868,000	2020	1
Springview BPS Rehabilitation	<i>Rehabilitate or replace pumps and valves, pumps installed in 1998 and are nearing end of expected useful life.</i>	\$272,000	2026	1

Table B.1 10-Year Water CIP Project Information (continued)

Water Project Title	Project Description	Estimated Cost ⁽¹⁾	Start Year ⁽²⁾	Duration (years) ⁽²⁾
Timber Ridge BPS Rehabilitation	<i>Rehabilitate or replace electric pumps and valves, pumps installed in 1999 and are nearing end of expected useful life. Also includes a new engine driven pump in a pump house for \$900,000 (based on Ugly List).</i>	\$1,502,000	2021	1
Hidden Hills BPS Capacity Improvements	<i>Replace pumps to increase capacity to meet future demands, existing pumps are will be nearing end of expected useful life in 2028.</i>	\$500,000	2028	1
Lakeview BPS Repiping	<i>Repiping is needed to deliver flow to the reservoir and then to the pump station to improve water quality.</i>	\$154,000	2021	1
<u>Pressure Reducing Station Projects</u>				
Applecreek PRS Rehab or Replacement	<i>Rehabilitate or replace station and valve(s) based on age.</i>	\$268,000	2020	1
Dominguez PRS Rehab or Replacement	<i>Rehabilitate or replace station and valve(s) based on age.</i>	\$278,000	2022	1
Paseo Del Prado PRS Rehab or Replacement	<i>Rehabilitate or replace station and valve(s) based on age.</i>	\$275,000	2025	1
Oakvale PRS Rehab or Replacement	<i>Rehabilitate or replace station and valve(s) based on age.</i>	\$280,000	2028	1
Stone Canyon PRS Rehab or Replacement	<i>Rehabilitate or replace station and valve(s) based on age.</i>	\$68,000	2027	1
Sumac PRS Rehab or Replacement	<i>Rehabilitate or replace station and valve(s) based on age.</i>	\$68,000	2027	1
Willowbrook PRS Rehab or Replacement	<i>Rehabilitate or replace station and valve(s) based on age.</i>	\$134,000	2027	1
<u>Chemical System Projects</u>				
Richfield Base Chemical System R&R	<i>Rehabilitate or replace chlorine generator, rectifiers, hypo tanks, brine tank, and associated instrumentation and controls.</i>	\$1,221,000	2022	1
Lakeview BPS Chemical System R&R	<i>Rehabilitate or replace chlorine generator, hypo tanks, and associated instrumentation and controls.</i>	\$361,000	2028	1
Well No. 15 Chemical System R&R	<i>Rehabilitate or replace feed system, hypo tanks and associated instrumentation and controls.</i>	\$146,000	2022	1

Table B.1 10-Year Water CIP Project Information (continued)

Water Project Title	Project Description	Estimated Cost ⁽¹⁾	Start Year ⁽²⁾	Duration (years) ⁽²⁾
Well No. 20 Chemical System Replacement and Upsizing	<i>Replace and upsize chemical systems to provide additional treatment capacity.</i>	\$303,000	2020	1
<u>Well Projects</u>				
Well No. 5 Rehabilitation	<i>Rehabilitate well and well pump. Add bollards to protect valves, well head, and pump. Well internals are assumed to be OK, but well head needs to be rehabilitated.</i>	\$440,000	2028	1
Well No. 7 Rehabilitation	<i>Rehabilitate well, replace well pump, and instrumentation and controls. Install bollards to protect well head, pump, and valves.</i>	\$631,000	2019	1
<u>Reservoir Projects</u>				
Bryant Ranch Fencing	<i>Replace approx. 600 feet of fencing which is heavily corroded.</i>	\$90,000	2019	1
<u>Other</u>				
Miscellaneous Water System Asset Replacements	<i>Miscellaneous replacements of water system assets at various sites. These replacements are typically single assets or too small to constitute a project.</i>	\$4,856,000	2019	10

Notes:

- (1) Estimated costs shown in 2018 dollars. No escalation has been applied to projects occurring in future years. Costs are rounded to the nearest \$1,000.
- (2) Estimated start year and duration are based on planning level assumptions.

Table B.2 10-Year Wastewater CIP Project Information

Wastewater Project Title	Project Description	Estimated Cost ⁽¹⁾	Start Year ⁽²⁾	Duration (years) ⁽²⁾
High Risk Sewer Pipe Relining	<i>Relining of highest risk pipelines throughout the District. Replacements are grouped into two phases based on geography.</i>	\$479,944	2019	2
Medium-High Risk Sewer Pipe Relining	<i>Relining of pipelines in the second tier of risk and the oldest pipelines throughout the District. Replacements are grouped into three phases based on geography.</i>	\$2,758,165	2021	8
Manhole Replacements	<i>Forecasted manhole replacements based on age</i>	\$20,000	2026	1
Miscellaneous Wastewater System Asset Replacements	<i>Miscellaneous replacements of wastewater system assets at lift stations too small to constitute a project.</i>	\$60,000	2019	10

Notes:

- (1) Estimated costs shown in 2018 dollars. No escalation has been applied to projects occurring in future years. Costs are rounded to the nearest \$1,000.
- (2) Estimated start year and duration are based on planning level assumptions.

Table B.3 10-Year Support System CIP Project Information

Support System Project Title	Project Description	Estimated Cost ⁽¹⁾	Start Year ⁽²⁾	Duration (years) ⁽²⁾
Vehicle Replacement Program	<i>Ongoing replacements of fleet vehicles and mobile equipment</i>	\$3,640,000	2019	10
Radio System Replacement	<i>Radio system assets flagged for replacement based on age and condition</i>	\$425,000	2020	1
Miscellaneous Support System Asset Replacements	<i>Miscellaneous replacements of support system assets at Richfield Base. These replacements are single assets or too small to constitute a project.</i>	\$1,773,000	2019	10

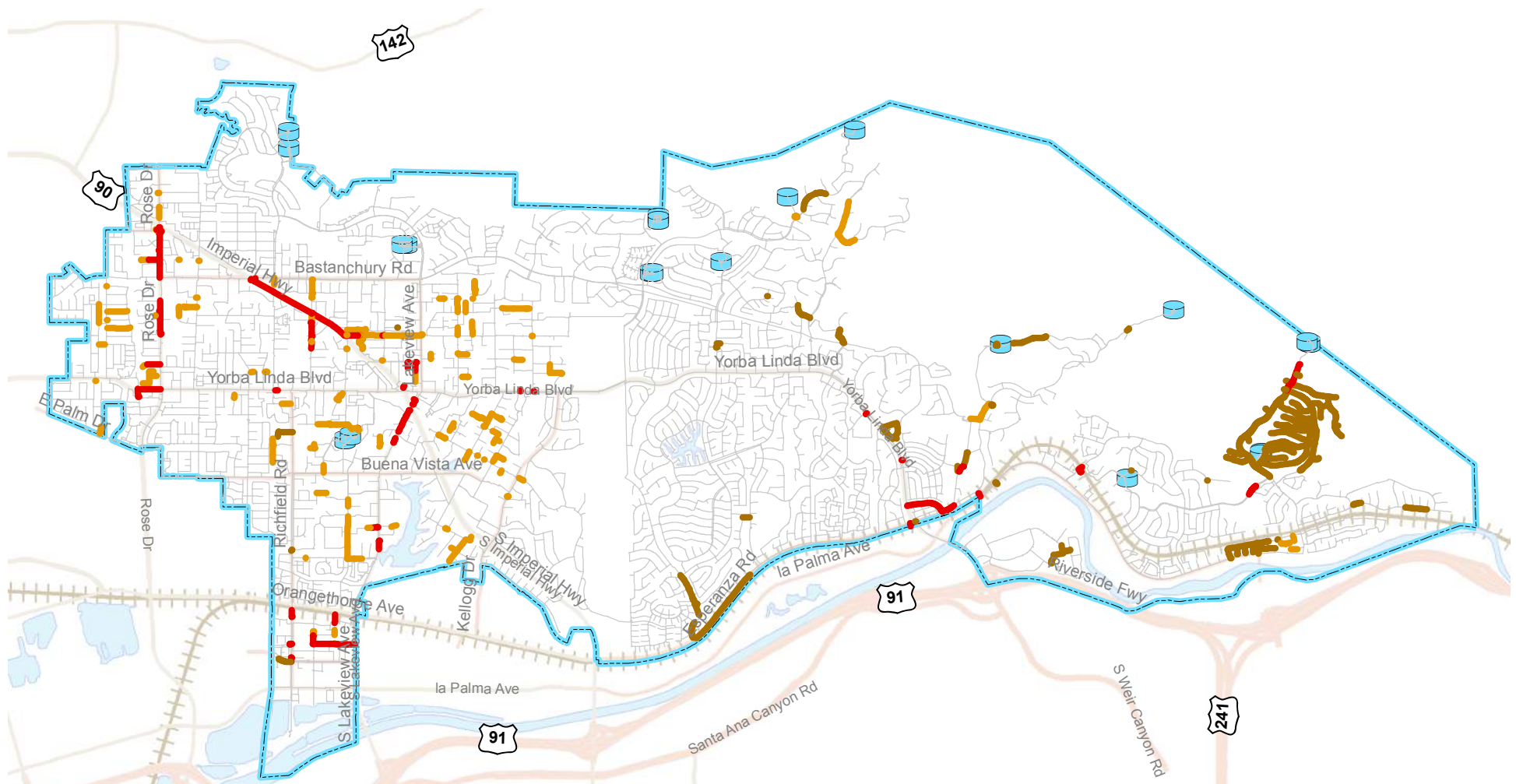
Notes:

- (1) Estimated costs shown in 2018 dollars. No escalation has been applied to projects occurring in future years. Costs are rounded to the nearest \$1,000.
- (2) Estimated start year and duration are based on planning level assumptions.

APPENDIX B1

10-Year CIP: YLWD Water Pipeline System

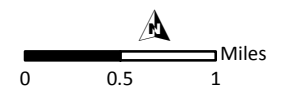
Water Main 10-Year CIP Map



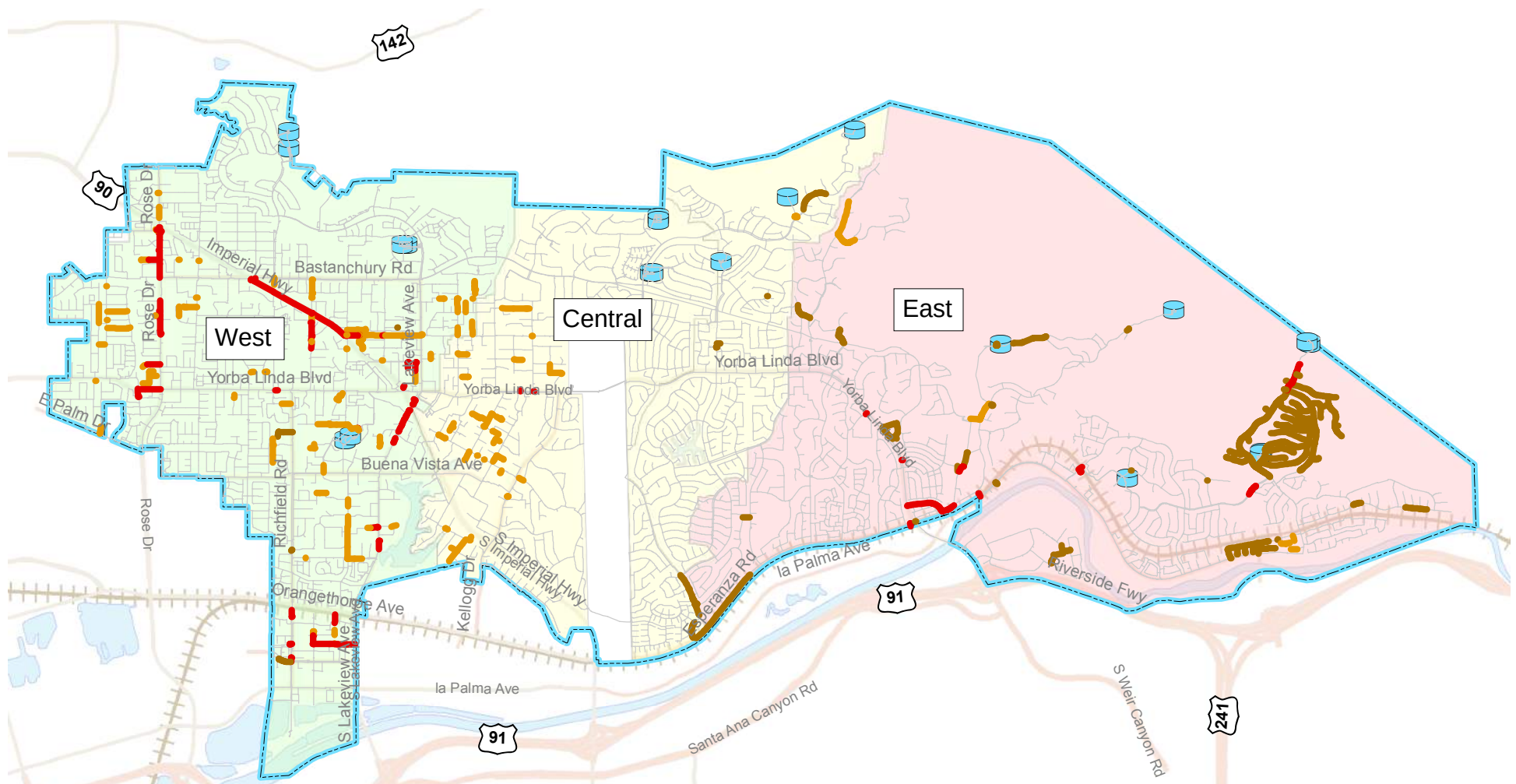
Legend

- Water Mains
- 0-5 Year Replacements or Repairs
- 5-10 Year Replacements or Repairs
- 1985-1999 DIP Replacements

- Reservoir
- Water Boundary
- Highway
- Principal Arterial
- Major Arterial
- Railroad



Water Main 10-Year CIP Map

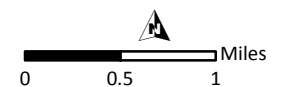


Legend

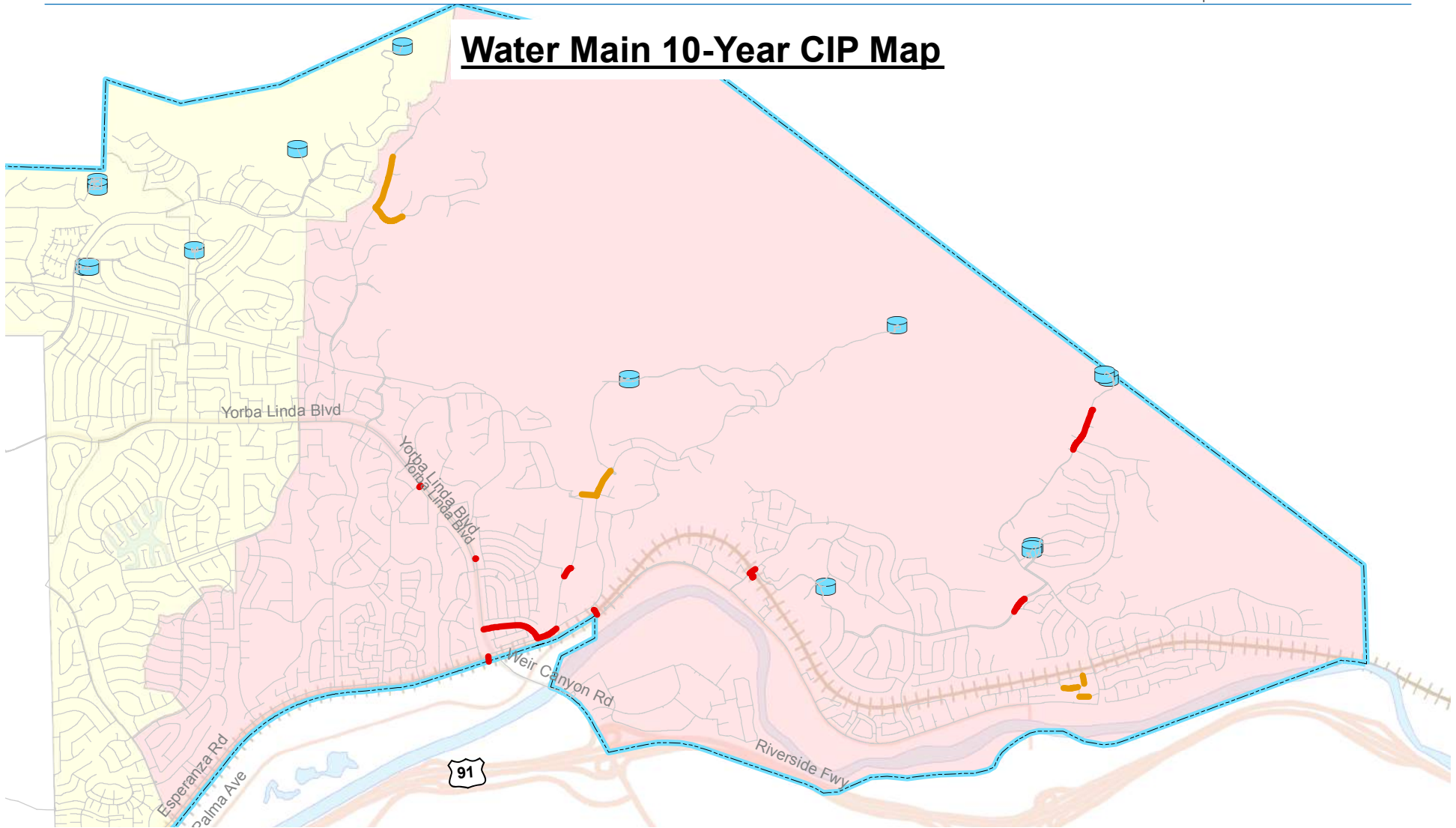
- Water Mains
- 0-5 Year Replacements or Repairs
- 5-10 Year Replacements or Repairs
- 1985-1999 DIP Replacements

- Reservoir
- Central
- East
- West
- Water Boundary

- Highway
- Principal Arterial
- Major Arterial
- Railroad



Water Main 10-Year CIP Map

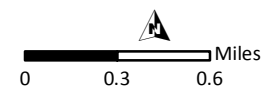


Legend

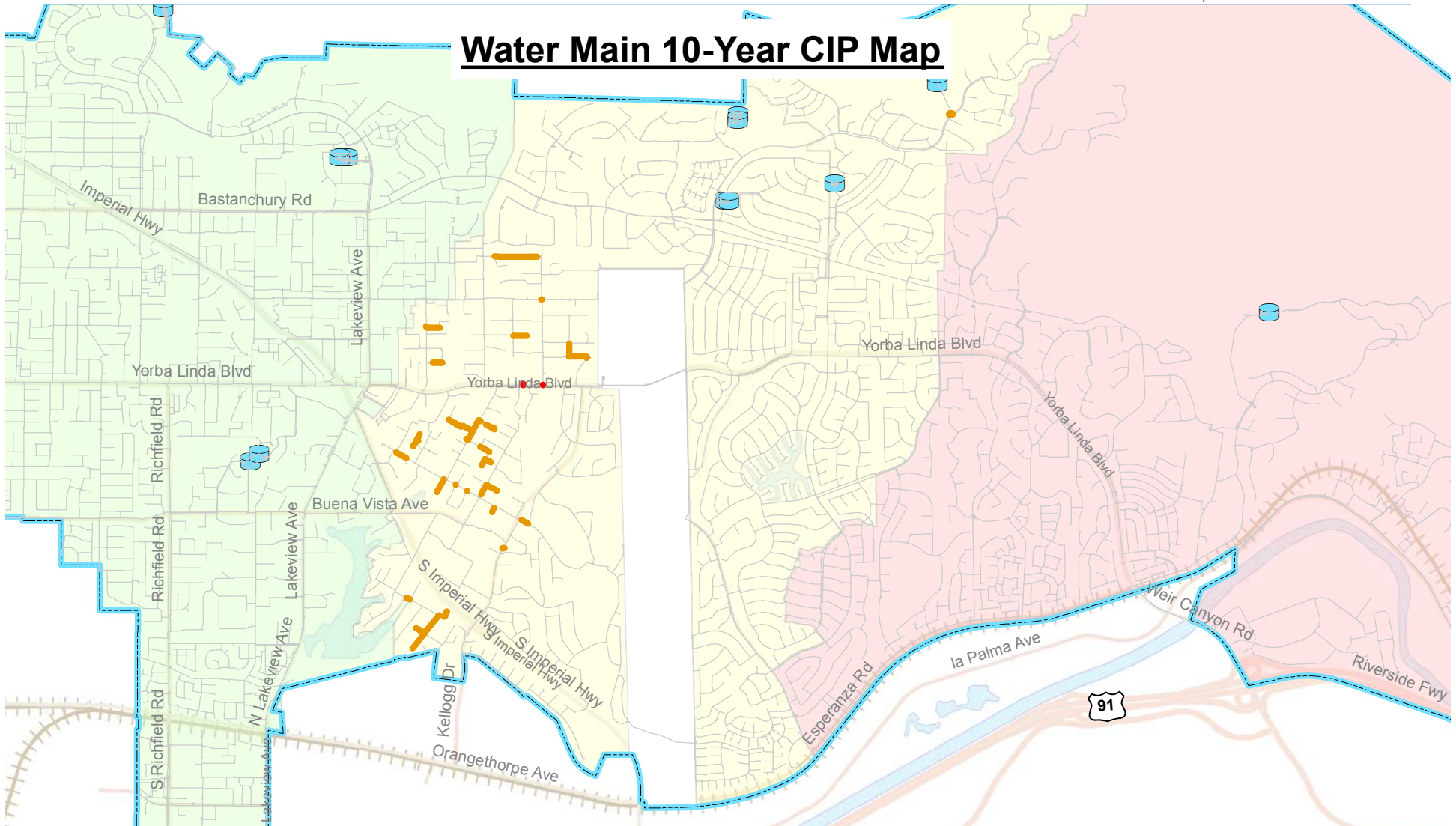
- Water Mains
- 0-5 East
- 5-10 East

- Reservoir
- Central
- East
- Water Boundary
- Highway

- Principal Arterial
- Major Arterial
- Railroad



Water Main 10-Year CIP Map

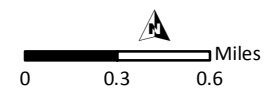


Legend

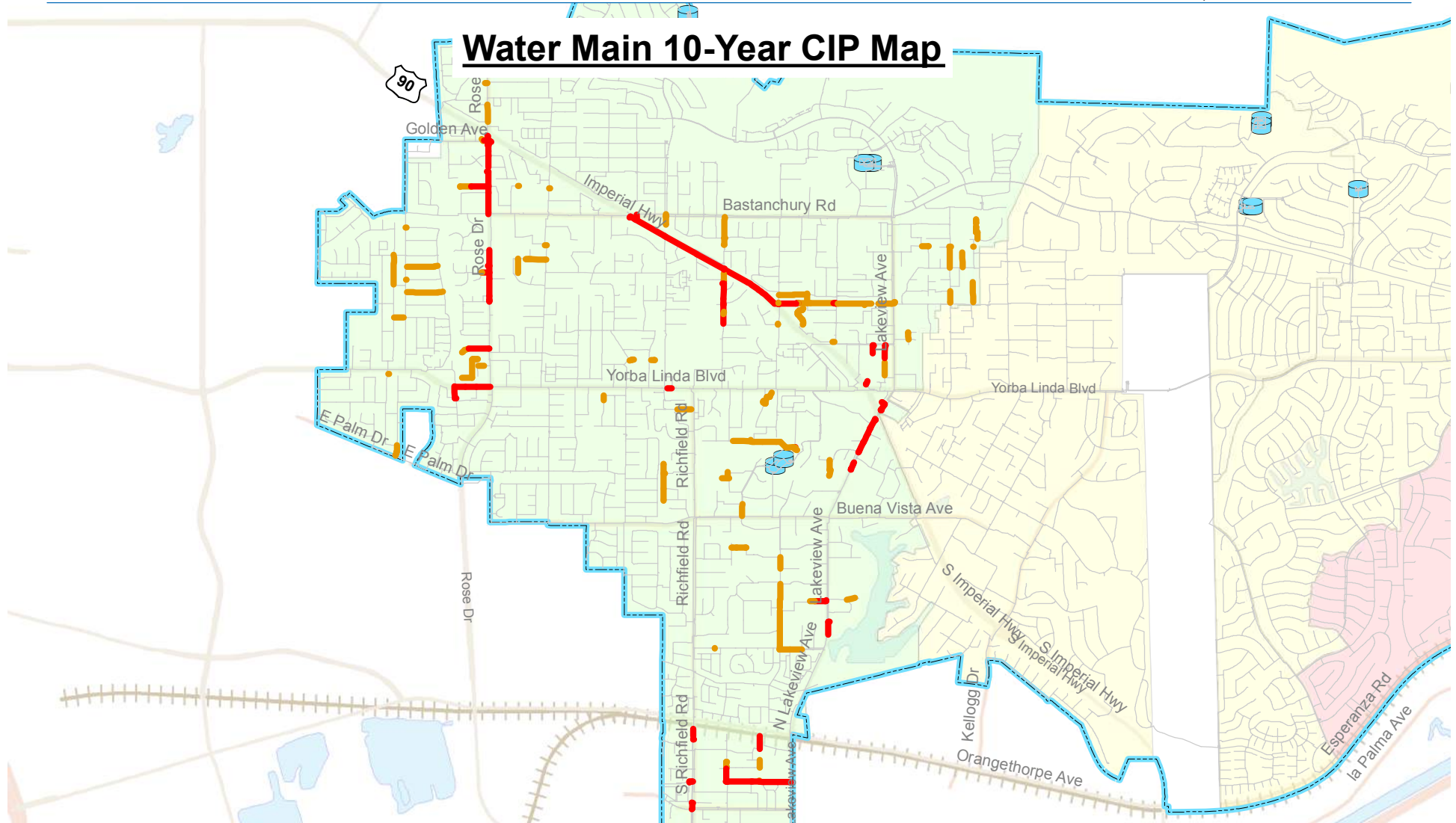
- Water Mains
- 0-5 Central
- 5-10 Central

- Reservoir
- Central
- East
- West
- Water Boundary

- Highway
- Principal Arterial
- Major Arterial
- Railroad



Water Main 10-Year CIP Map

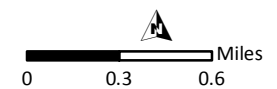


Legend

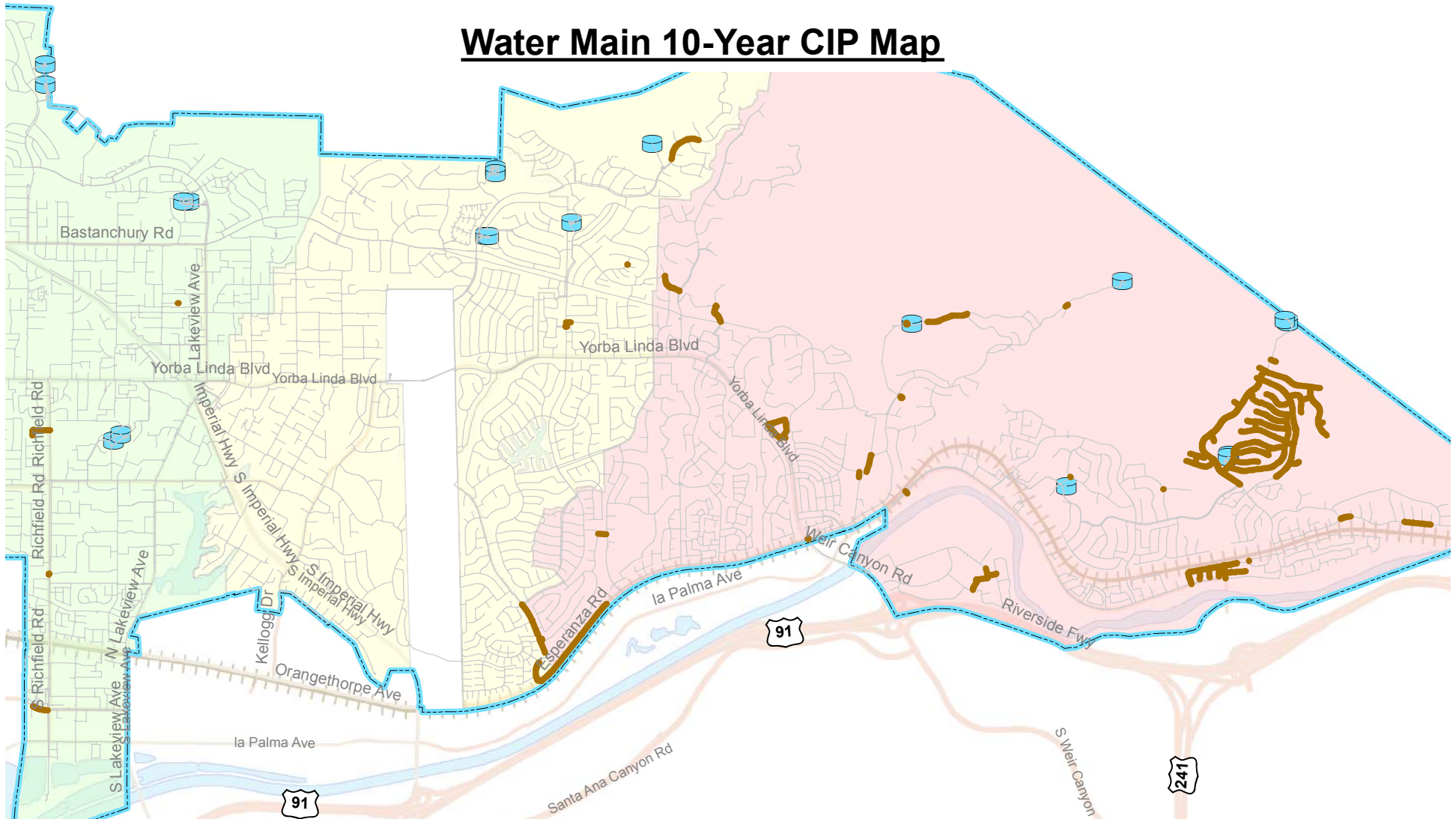
- Water Mains
- 0-5 West
- 5-10 West

- Reservoir
- Central
- East
- West
- Water Boundary

- Principal Arterial
- Major Arterial
- Railroad



Water Main 10-Year CIP Map

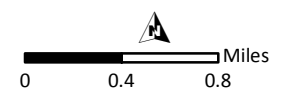


Legend

- Water Mains
- 1985-1999 DIP Replacements

- Reservoir
- Central
- East
- West
- Water Boundary

- Highway
- Principal Arterial
- Major Arterial
- Railroad



Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
0-5 Year Pipe Replacements							
East							
211116664-451116177	12	DIP_1985-99	1989	15	5	5	High
451116177-211116665	12	DIP_1985-99	1989	107	5	5	High
451321002-211321008	16	DIP_1985-99	1990	6	5	4	High
211321010-451321002	16	DIP_1985-99	1990	370	5	4	High
211117020-211217199	12	DIP_1985-99	1988	240	5	4	High
211217199-451217055	12	DIP_1985-99	1988	1	5	4	High
451217055-211217200	12	DIP_1985-99	1988	8	5	4	High
451321003-211321010	16	DIP_1985-99	1990	15	5	4	High
211321045-451321010	16	DIP_1985-99	1991	267	5	4	High
211321030-451321012	16	DIP_1985-99	1990	15	5	4	High
451321010-211321030	16	DIP_1985-99	1991	15	5	4	High
451120040-451120014	8	DIP_1985-99	1988	385	5	4	High
451321012-451321003	16	DIP_1985-99	1990	340	5	4	High
481216001-211216388	4	DIP_1985-99	1990	2	5	4	High
211216389-481216001	4	DIP_1985-99	1990	1	5	4	High
211316290-451316078	8	DIP_1985-99	1987	15	5	4	High
451316078-211316288	8	DIP_1985-99	1987	27	5	4	High
211117076-211117103	24	CMLC	1984	119	4	5	High
211117075-211117076	24	CMLC	1984	19	4	5	High
211117132-211117129	27	CMLC	1995	495	4	5	High
211116490-211117132	27	CMLC	1981	1371	4	5	High
211118067-281118002	12	CMLC	1993	28	4	5	High
211118066-281118001	12	CMLC	1993	33	4	5	High
211218258-211218268	24	STL	1986	159	4	5	High
281118001-461118001	16	CMLC	1993	10	4	5	High
281118002-461118002	12	CMLC	1993	10	4	5	High
Central							
451312044-211312113	4	CIP	1964	22	5	4	High
211312112-451312044	4	CIP	1964	15	5	4	High
211312128-451312057	10	ACP	1963	15	5	4	High
West							
210909315-210909327	26	STL	1928	161	5	5	High
211310270-211310065	4	CIP	1966	287	5	5	High
210909534-450909166	26	STL	1928	7	5	5	High
210909534-210909326	26	STL	1928	6	5	5	High
211607220-211607176	6	CIL	1942	128	5	4	High
451607090-211607220	8	CIL	1942	89	5	4	High
211409344-211409276	8	CIN	1959	145	5	4	High
211409276-451409069	8	CIN	1959	65	5	4	High
211507105-211507109	8	CIL	1942	12	5	4	High
211407251-211407370	8	CIL	1954	401	5	4	High
211409072-451409019	18	STL	1936	4	5	4	High
451409018-211409072	18	STL	1936	4	5	4	High
211409072-211410245	18	STL	1936	1410	5	4	High
211409020-211409072	18	STL	1936	700	5	4	High
451507022-211507106	6	CIL	1954	15	5	4	High
451407081-211407376	8	CIL	1954	15	5	4	High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211407374-451407081	8	CIL	1954	15	5	4	High
211407372-211407373	8	CIL	1954	8	5	4	High
211407370-211407372	8	CIL	1954	87	5	4	High
211507132-451507029	10	CIL	1942	15	5	4	High
211509320-211509254	8	CIP	1936	64	5	4	High
451410087-211410280	18	STL	1941	15	5	4	High
451307026-211307132	6	CIL	1956	15	5	4	High
451307026-211307125	6	CIL	1956	454	5	4	High
211407117-451407023	8	CIL	1954	15	5	4	High
451407023-211407118	8	CIL	1954	15	5	4	High
451507029-211507108	10	CIL	1942	108	5	4	High
211507106-211507105	8	CIL	1942	25	5	4	High
451509102-211509419	16	CIP	1935	34	5	4	High
211508283-451509102	16	CIP	1935	762	5	4	High
211607176-211607175	6	CIL	1942	90	5	4	High
451607078-211607174	6	CIP	1933	2	5	4	High
211607176-451607078	6	CIP	1933	3	5	4	High
451607076-211607132	8	CIP	1933	64	5	4	High
451607077-211607173	6	CIP	1933	64	5	4	High
211607175-211607171	6	CIL	1942	42	5	4	High
451409019-211409073	18	STL	1936	4	5	4	High
211409071-451409018	18	STL	1936	6	5	4	High
211409399-451409103	8	CIN	1959	95	5	4	High
451409103-211409344	8	CIN	1959	211	5	4	High
211508283-211508266	16	CIP	1925	130	5	4	High
451508123-211508282	16	CIP	1925	15	5	4	High
211508266-451508123	16	CIP	1925	15	5	4	High
451509105-211409020	18	STL	1936	833	5	4	High
211407374-211407373	8	CIL	1954	8	5	4	High
451409116-211409446	8	CIL	1959	10	5	4	High
211409444-451409116	8	CIL	1959	153	5	4	High
451409102-211409399	8	CIN	1959	23	5	4	High
211409446-451409102	8	CIN	1959	10	5	4	High
211507027-451607108	8	CIL	1942	256	5	4	High
451607108-211607221	8	CIL	1942	15	5	4	High
211607221-451607090	8	CIL	1942	15	5	4	High
211607174-451607077	6	CIP	1933	29	5	4	High
211607130-211607132	8	CIP	1933	13	5	4	High
451508128-211509320	16	CIP	1936	39	5	4	High
211508283-451508128	16	CIP	1936	16	5	4	High
211607171-451607074	6	CIL	1942	72	5	4	High
451210057-211210142	12	DIP_1985-99	1994	15	5	4	High
211210054-451210057	12	DIP_1985-99	1994	234	5	4	High
211210017-451210017	12	DIP_1985-99	1994	216	5	4	High
211507216-451507061	10	CIL	1942	44	5	4	High
451507005-211507026	8	CIP	1942	15	5	4	High
211507028-451507005	8	CIP	1942	15	5	4	High
451507028-211507132	10	CIL	1942	13	5	4	High
211607172-451607076	8	CIP	1933	18	5	4	High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211607173-211607172	8	CIP	1933	34	5	4	High
211607172-451607079	8	CIP	1933	29	5	4	High
451607079-211607180	8	CIP	1933	59	5	4	High
451310207-211310535	12	DIP_1985-99	1992	55	5	4	High
211310530-451310207	12	DIP_1985-99	1992	20	5	4	High
451210008-211210017	12	DIP_1985-99	1994	113	5	4	High
211210024-451210008	12	DIP_1985-99	1994	15	5	4	High
451210009-211210024	12	DIP_1985-99	1994	15	5	4	High
451210017-211210054	12	DIP_1985-99	1994	15	5	4	High
450809091-210809141	16	DIP_1985-99	1990	126	5	4	High
210809139-450809091	16	DIP_1985-99	1990	17	5	4	High
210809141-210809142	16	DIP_1985-99	1990	4	5	4	High
210809142-210809140	16	DIP_1985-99	1990	9	5	4	High
211310611-451210009	12	DIP_1985-99	1992	199	5	4	High
211310611-211310612	12	DIP_1985-99	1992	14	5	4	High
451410078-211410255	18	STL	1936	8	5	4	High
211410253-451410078	18	STL	1936	9	5	4	High
211410253-211410252	18	STL	1936	18	5	4	High
211410248-451410075	6	CIP	1938	10	5	4	High
451410075-451410074	6	CIP	1938	20	5	4	High
451010023-211010079	8	ACP	1944	14	5	4	High
211010076-451010023	8	ACP	1944	15	5	4	High
211010078-211010108	4	CIL	1944	276	5	4	High
211310535-211310534	12	DIP_1985-99	1992	11	5	4	High
211310581-451310219	12	DIP_1985-99	1992	13	5	4	High
211310448-451310171	6	CIL	1937	15	5	4	High
211310582-211310581	12	DIP_1985-99	1992	5	5	4	High
211310612-211310615	12	DIP_1985-99	1992	15	5	4	High
211310615-211310614	12	DIP_1985-99	1992	15	5	4	High
211210230-211210237	10	ACP	1934	181	5	4	High
211410256-211410255	18	STL	1936	6	5	4	High
341410004-451410087	18	STL	1941	16	5	4	High
211410277-341410004	18	STL	1941	17	5	4	High
451409123-211409507	8	CIL	1959	219	5	4	High
210909481-210909480	16	STL	1942	14	5	4	High
210909480-210909483	16	STL	1942	12	5	4	High
211410252-211410245	18	STL	1936	501	5	4	High
211507028-211507109	8	CIL	1942	302	5	4	High
451310219-211310534	12	DIP_1985-99	1992	144	5	4	High
451210021-211210075	20	STL	1934	3	5	4	High
211210076-451210021	20	STL	1934	3	5	4	High
211210082-211210076	20	STL	1934	6	5	4	High
211210082-451210024	20	STL	1927	2	5	4	High
211407176-211407118	8	CIL	1954	156	5	4	High
211407176-211407251	8	CIL	1954	140	5	4	High
211410632-211410280	18	STL	1936	5	5	4	High
211410280-211410673	18	STL	1941	4	5	4	High
211410673-211410633	18	STL	1941	4	5	4	High
211409276-211409270	6	CIL	1956	28	5	4	High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
451407040-211407176	6	CIL	1947	166	5	4	High
210809017-450809014	16	STL	1939	9	5	4	High
450809014-210809372	16	STL	1939	4	5	4	High
211309164-451309140	16	ACP	1961	98	5	4	High
211407118-211507438	8	CIL	1954	364	5	4	High
211110305-211110304	6	CIL	1959	7	5	4	High
451110096-211110300	6	CIL	1959	246	5	4	High
211110305-451110096	6	CIL	1959	16	5	4	High
211507108-211507106	8	CIL	1942	15	5	4	High
211507101-451507022	6	CIL	1954	376	5	4	High
451507061-451507028	10	CIL	1942	439	5	4	High
451310171-211310315	6	CIL	1937	69	5	4	High
450809009-210809011	16	STL	1939	8	5	4	High
210809010-450809009	16	STL	1939	10	5	4	High
210809011-210809013	16	STL	1939	40	5	4	High
210810002-450810003	16	STL	1940	291	5	4	High
450809028-210809040	16	STL	1940	154	5	4	High
210809043-210810002	16	STL	1940	334	5	4	High
450809020-210909481	16	STL	1942	291	5	4	High
210809040-210809043	16	STL	1940	96	5	4	High
210809027-450809020	16	ACP	1942	9	5	4	High
210809027-450809021	16	STL	1939	26	5	4	High
450809023-210809036	16	STL	1940	530	5	4	High
210809030-450809023	16	STL	1940	8	5	4	High
450809021-210809030	16	STL	1939	8	5	4	High
210809036-450809028	16	STL	1940	34	5	4	High
210809374-210809027	16	STL	1939	12	5	4	High
211307427-211307426	8	ACP	1964	30	4	5	High
211307381-211307388	12	ACP	1961	313	4	5	High
211307367-211307425	8	ACP	1964	247	4	5	High
211307425-211307426	8	ACP	1964	20	4	5	High
211310058-211310059	4	CIL	1966	6	4	5	High
211310065-211310066	4	CIP	1966	10	4	5	High
211310068-211310065	4	CIP	1966	15	4	5	High
211310068-211310067	4	CIP	1966	10	4	5	High
211310057-211310056	4	CIL	1966	10	4	5	High
211310058-211310057	4	CIL	1966	15	4	5	High
210909373-210909339	10	STL	1963	291	4	5	High
451307208-211307381	12	ACP	1961	254	4	5	High
211307372-451307208	12	ACP	1961	231	4	5	High
451310041-211310057	4	CIL	1966	15	4	5	High
451310111-451310041	4	CIL	1966	168	4	5	High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
5-10 Year Pipe Replacements							
East							
451615095-211615273	12	DIP	2003	722	5	3	Med-High
211217016-211217017	12	CMLC	1988	285	5	3	Med-High
451616049-451615095	12	DIP	2003	511	5	3	Med-High
211615323-451616048	12	DIP	2003	310	5	3	Med-High
451616048-451616042	12	DIP	2003	322	5	3	Med-High
211217018-451317039	12	CMLC	1979	666	5	3	Med-High
211217017-211217018	12	CMLC	1988	52	5	3	Med-High
211615273-211615271	8	DIP	2003	21	5	2	Med-High
451615090-211615323	8	DIP	2003	78	5	2	Med-High
211615271-451615090	8	DIP	2003	55	5	2	Med-High
Central							
211615112-211615114	12	CMLC	1985	7	5	3	Med-High
211615114-211615117	12	CMLC	1985	7	5	3	Med-High
451615109-211615361	12	CMLC	1985	24	5	3	Med-High
211615429-211615385	12	DIP	2012	18	5	3	Med-High
211615386-211615117	12	CMLC	1985	2	5	3	Med-High
211615391-211615104	12	CMLC	1985	4	5	3	Med-High
211615117-211615392	12	CMLC	1985	1	5	3	Med-High
211615104-211615387	12	CMLC	1985	3	5	3	Med-High
211615387-211615112	12	CMLC	1985	21	5	3	Med-High
211111179-451111069	8	ACP	1932	7	5	3	Med-High
211111177-211111179	8	ACP	1932	10	5	3	Med-High
451111069-211111181	8	ACP	1932	8	5	3	Med-High
451111071-211111182	8	ACP	1932	10	5	3	Med-High
211111181-451111071	8	ACP	1932	15	5	3	Med-High
451615111-481615002	8	CMLC	1985	1	5	2	Med-High
211615379-451615111	8	CMLC	1985	1	5	2	Med-High
211615365-211615364	8	CMLC	1985	6	5	2	Med-High
211615364-211615098	8	CMLC	1985	3	5	2	Med-High
211615373-211615365	8	CMLC	1985	5	5	2	Med-High
451615106-211615373	8	CMLC	1985	3	5	2	Med-High
281615001-461615001	8	CMLC	1985	2	5	2	Med-High
461615001-451615103	8	CMLC	1985	3	5	2	Med-High
451615103-211615365	8	CMLC	1985	2	5	2	Med-High
461615002-281615002	8	CMLC	1985	2	5	2	Med-High
211615098-211615379	8	CMLC	1985	2	5	2	Med-High
211615379-211615382	8	CMLC	1985	3	5	2	Med-High
211615385-451615033	8	DIP	2012	5	5	2	Med-High
451615116-211615430	8	DIP	2012	2	5	2	Med-High
211615112-211615432	4	CMLC	1985	1	5	2	Med-High
211615114-211615431	6	CMLC	1985	1	5	2	Med-High
451615113-261615002	10	DIP	2012	5	5	2	Med-High
211615388-451615113	10	DIP	2012	1	5	2	Med-High
211615428-211615388	10	DIP	2012	1	5	2	Med-High
211615430-211615428	8	DIP	2012	1	5	2	Med-High
211011007-211011006	8	CIP	1959	81	5	2	Med-High
211011005-211011006	8	CIP	1959	18	5	2	Med-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211211213-211211214	10	CIP	1962	3	5	2	Med-High
341211001-451211028	6	CIP	1929	15	5	2	Med-High
211211340-211211388	8	CIL	1940	251	5	2	Med-High
451211075-351211011	6	CIL	1955	324	5	2	Med-High
211211297-451211075	6	CIL	1955	15	5	2	Med-High
211211137-451211030	8	CIP	1932	15	5	2	Med-High
211211137-341211001	6	CIP	1929	15	5	2	Med-High
211211215-211211214	10	CIP	1962	9	5	2	Med-High
451211038-211211213	10	CIP	1962	239	5	2	Med-High
211211161-451211038	10	CIP	1962	15	5	2	Med-High
211211090-451211020	6	CIL	1955	15	5	2	Med-High
451412040-211412147	8	CIP	1929	6	5	2	Med-High
211112033-211112037	10	ACP	1958	182	5	2	Med-High
451412040-211412148	8	CIP	1929	15	5	2	Med-High
451211030-211211090	8	CIP	1961	209	5	2	Med-High
451211020-211211037	6	CIL	1955	239	5	2	Med-High
211211415-351111001	4	CIL	1956	112	5	2	Med-High
211211447-211211334	6	CIP	1956	7	5	2	Med-High
211211337-211211448	6	CIP	1956	7	5	2	Med-High
451211028-211211431	6	CIP	1929	10	5	2	Med-High
211211137-211211453	6	CIP	1929	10	5	2	Med-High
211211090-211311360	8	CIP	1932	288	5	2	Med-High
211311360-451311143	6	CIP	1941	31	5	2	Med-High
451311143-211311491	6	CIP	1941	22	5	2	Med-High
281615003-451615105	4	CMLC	1985	2	5	1	Med-High
451615105-451615104	4	CMLC	1985	3	5	1	Med-High
451615104-211615373	4	CMLC	1985	2	5	1	Med-High
451615102-461615002	6	CMLC	1985	3	5	1	Med-High
211615364-451615102	6	CMLC	1985	2	5	1	Med-High
211011077-451011026	6	CIL	1946	15	5	1	Med-High
211311379-451311043	6	ACP	1948	15	5	1	Med-High
211011129-211011153	4	CIP	1927	413	5	1	Med-High
211011130-211011129	6	CIL	1946	18	5	1	Med-High
211011131-211011130	6	CIL	1946	24	5	1	Med-High
451011045-351011004	6	CIL	1955	216	5	1	Med-High
451011026-211011131	6	CIL	1946	500	5	1	Med-High
451211061-351211005	6	CIL	1956	132	5	1	Med-High
211211236-451211061	6	CIL	1956	15	5	1	Med-High
211011131-451011045	6	CIL	1955	15	5	1	Med-High
211011084-211011083	4	CIP	1935	6	5	1	Med-High
451011029-211011084	4	CIP	1935	8	5	1	Med-High
211011082-451011029	4	CIP	1935	12	5	1	Med-High
211011083-351011003	4	CIP	1935	112	5	1	Med-High
211211119-211211062	4	CIL	1953	148	5	1	Med-High
211211112-211211119	4	CIL	1953	164	5	1	Med-High
211211048-431211001	4	CIL	1941	29	5	1	Med-High
211211036-211311348	6	CIL	1955	326	5	1	Med-High
211211037-211211036	6	CIL	1955	49	5	1	Med-High
451211025-211211119	4	ACP	1953	30	5	1	Med-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211211340-451211093	6	CIL	1955	15	5	1	Med-High
211412006-211412005	6	CIP	1935	7	5	1	Med-High
211211121-451211025	4	ACP	1953	15	5	1	Med-High
451312006-211312020	6	CIL	1958	295	5	1	Med-High
211412007-211412006	6	CIP	1935	88	5	1	Med-High
451312033-211312090	6	CIN	1940	6	5	1	Med-High
211312011-451312006	6	CIL	1958	15	5	1	Med-High
211312086-211312078	6	CIN	1940	380	5	1	Med-High
211312078-211312077	6	CIN	1940	6	5	1	Med-High
211312079-451312018	6	CIN	1927	262	5	1	Med-High
211312091-451312033	6	CIN	1940	5	5	1	Med-High
211312086-211312091	6	CIN	1940	21	5	1	Med-High
211311405-211311404	6	CIN	1948	19	5	1	Med-High
211211048-211211051	6	CIP	1941	45	5	1	Med-High
211412005-451412002	6	CIP	1935	58	5	1	Med-High
451412002-451412001	6	CIP	1935	427	5	1	Med-High
451412001-211411136	6	CIP	1935	403	5	1	Med-High
451211093-211211351	6	CIL	1955	271	5	1	Med-High
211411484-211411602	6	CIP	1929	7	5	1	Med-High
211411494-211411600	6	CIL	1943	10	5	1	Med-High
211211236-351211008	6	CIL	1956	165	5	1	Med-High
211211446-211211048	6	CIP	1941	179	5	1	Med-High
451311043-211311405	6	CIN	1956	181	5	1	Med-High
451311043-211311405	6	CIN	1956	8	5	1	Med-High
451211046-211211192	6	CIL	1956	15	5	1	Med-High
211211452-451211046	6	CIL	1956	203	5	1	Med-High
211211451-211211454	6	CIL	1956	12	5	1	Med-High
211411604-211411494	6	CIL	1943	256	5	1	Med-High
451411131-211411604	6	CIL	1943	14	5	1	Med-High
West							
211207100-451207038	8	ACP	1962	247	5	3	Med-High
211607089-451607041	8	CIP	1933	15	5	3	Med-High
451509062-451509091	8	CIP	1936	171	5	3	Med-High
451509063-451509062	8	CIP	1936	40	5	3	Med-High
211607013-451607002	4	CIP	1938	37	5	3	Med-High
451607073-211607169	6	CIL	1942	12	5	3	Med-High
451607074-211607168	6	CIL	1942	15	5	3	Med-High
211607168-451607073	6	CIL	1942	6	5	3	Med-High
211607168-211607166	6	CIL	1942	47	5	3	Med-High
211509268-451509063	8	CIP	1936	15	5	3	Med-High
211410260-211410264	14	CIL	1941	71	5	3	Med-High
211410319-211410309	12	CIL	1940	152	5	3	Med-High
211410264-211410277	14	CIL	1941	533	5	3	Med-High
211410257-451410080	14	CIL	1941	14	5	3	Med-High
451410099-211410328	12	CIL	1940	306	5	3	Med-High
211410340-451410099	12	CIL	1940	22	5	3	Med-High
451410080-211410260	14	CIL	1941	205	5	3	Med-High
211511467-211511466	14	CIP	1961	151	5	3	Med-High
211410256-211410257	14	CIL	1941	7	5	3	Med-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211511481-211511478	14	CIP	1926	10	5	3	Med-High
211410342-211410343	12	CIL	1940	8	5	3	Med-High
211410340-211410342	12	CIL	1940	28	5	3	Med-High
211309355-341309005	6	ACP	1963	322	5	3	Med-High
211210074-211210075	12	CIP	1934	28	5	3	Med-High
211210075-451210022	12	CIP	1934	7	5	3	Med-High
451210022-211210080	12	CIP	1934	1	5	3	Med-High
211210092-211210086	12	CIL	1931	48	5	3	Med-High
451607041-211607117	8	CIP	1933	373	5	3	Med-High
451410103-211410344	12	CIL	1940	7	5	3	Med-High
211410602-451410103	12	CIL	1940	5	5	3	Med-High
211410343-211410603	12	CIL	1940	3	5	3	Med-High
211511487-211511553	14	CIN	1926	10	5	3	Med-High
211511556-211511481	14	CIN	1926	8	5	3	Med-High
211511561-211511467	14	CIP	1926	9	5	3	Med-High
211511478-211511558	14	CIP	1926	5	5	3	Med-High
211210515-211210092	12	CIL	1931	5	5	3	Med-High
211410674-211410309	12	CIL	1940	600	5	3	Med-High
451410092-211410674	12	CIL	1940	7	5	3	Med-High
211509312-211509346	8	CIN	1936	8	5	3	Med-High
211509346-211509345	8	CIN	1936	19	5	3	Med-High
451409069-211409277	8	CIN	1959	15	5	2	Med-High
451110101-211110321	4	ACP	1963	189	5	2	Med-High
211409177-451409041	8	CIN	1936	11	5	2	Med-High
341407010-451407099	8	ACP	1961	217	5	2	Med-High
451407063-341407007	6	ACP	1963	827	5	2	Med-High
211507266-451507075	6	ACP	1963	15	5	2	Med-High
211209129-451209044	10	CIP	1938	202	5	2	Med-High
211209121-211209124	8	CIP	1932	411	5	2	Med-High
211407194-451407046	6	ACP	1963	9	5	2	Med-High
211409277-451409041	8	CIN	1936	141	5	2	Med-High
211508130-451508056	8	ACP	1942	15	5	2	Med-High
451508056-211508132	8	ACP	1942	15	5	2	Med-High
450909120-210909450	10	ACP	1942	3	5	2	Med-High
210909449-450909120	10	ACP	1942	3	5	2	Med-High
211509443-451509116	8	CIN	1936	2	5	2	Med-High
451509116-211509442	8	CIN	1936	2	5	2	Med-High
211409444-211409450	8	CIL	1959	7	5	2	Med-High
451509091-211509322	8	CIP	1936	15	5	2	Med-High
211408020-451408006	6	CIP	1932	15	5	2	Med-High
211010008-211110294	6	CIL	1953	187	5	2	Med-High
211010133-451010036	8	CIP	1934	5	5	2	Med-High
210909453-450909151	8	ACP	1934	166	5	2	Med-High
451410133-211410446	6	CIP	1938	10	5	2	Med-High
211410445-451410133	6	CIP	1938	15	5	2	Med-High
451010036-211010139	8	CIP	1934	5	5	2	Med-High
211010139-451010038	6	CIL	1953	5	5	2	Med-High
211010145-211010149	8	CIP	1934	276	5	2	Med-High
451410059-211410190	6	CIP	1959	15	5	2	Med-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
451410062-451410059	6	CIP	1959	628	5	2	Med-High
211110279-211110296	6	CIL	1951	348	5	2	Med-High
450909151-210909500	8	ACP	1934	15	5	2	Med-High
211411461-451411118	8	ACP	1952	15	5	2	Med-High
211110213-211110238	6	CIL	1929	262	5	2	Med-High
211010091-211010041	6	CIL	1953	464	5	2	Med-High
451010038-211010140	6	CIL	1953	48	5	2	Med-High
451209044-211210030	10	CIP	1938	318	5	2	Med-High
211210030-211210031	10	CIP	1938	82	5	2	Med-High
211411092-211511479	10	CIL	1939	472	5	2	Med-High
211411585-211411267	10	CIP	1939	256	5	2	Med-High
211411551-211411585	10	PVC	1939	3	5	2	Med-High
341310001-211310641	6	ACP	1963	45	5	2	Med-High
451109023-211209421	8	ACP	1962	277	5	2	Med-High
211411594-351411006	6	CIP	1959	467	5	2	Med-High
451410074-211410247	6	CIP	1938	10	5	2	Med-High
211508351-211508360	10	ACP	1932	43	5	2	Med-High
211509442-211509491	8	CIN	1936	148	5	2	Med-High
211209124-211209125	8	CIP	1932	16	5	2	Med-High
211209126-211209129	10	CIP	1932	47	5	2	Med-High
451209042-211209126	10	CIP	1932	15	5	2	Med-High
211509345-211509443	8	CIN	1936	453	5	2	Med-High
211409450-451409123	8	CIL	1959	49	5	2	Med-High
210909449-210909483	10	ACP	1942	138	5	2	Med-High
211311003-451411119	8	ACP	1952	10	5	2	Med-High
451411118-451411119	8	ACP	1952	146	5	2	Med-High
451408006-211408018	6	CIP	1932	331	5	2	Med-High
211010140-211010091	6	CIL	1953	369	5	2	Med-High
211010139-211010145	8	CIP	1934	234	5	2	Med-High
210809042-450809030	8	STL	1934	12	5	2	Med-High
450809030-210809040	8	STL	1934	10	5	2	Med-High
211210031-211210071	10	CIP	1938	190	5	2	Med-High
211210074-211210072	10	CIP	1938	157	5	2	Med-High
211210072-211210071	10	CIP	1938	11	5	2	Med-High
451209041-211209123	4	CIN	1925	15	5	1	Med-High
211209124-451209041	4	CIN	1925	15	5	1	Med-High
211309059-211309058	6	CIN	1937	63	5	1	Med-High
211309322-211309325	4	CIL	1952	19	5	1	Med-High
451109061-211109233	6	CIL	1953	15	5	1	Med-High
211109239-451109061	6	CIL	1953	95	5	1	Med-High
211308187-211308188	6	CIP	1963	101	5	1	Med-High
211209391-211209392	6	CIP	1950	15	5	1	Med-High
211309315-211309318	4	CIL	1952	26	5	1	Med-High
211309313-211309315	4	CIL	1952	25	5	1	Med-High
451309102-211309326	4	CIL	1952	13	5	1	Med-High
211309325-451309102	4	CIL	1952	13	5	1	Med-High
351309001-451309016	4	CIN	1937	15	5	1	Med-High
211307122-211307125	6	CIL	1956	98	5	1	Med-High
211307313-211307309	6	CIL	1954	235	5	1	Med-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211307188-211307186	6	CIL	1954	23	5	1	Med-High
211307190-211307188	6	CIL	1954	20	5	1	Med-High
211307191-211307190	6	CIL	1954	7	5	1	Med-High
211307194-211307191	6	CIL	1947	62	5	1	Med-High
451309016-211309059	4	CIN	1937	14	5	1	Med-High
451309101-211309326	4	CIL	1952	15	5	1	Med-High
211209348-211209391	6	CIP	1950	260	5	1	Med-High
211109245-211109248	6	CIL	1955	14	5	1	Med-High
211109244-211109245	6	CIL	1955	9	5	1	Med-High
211109240-211109244	6	CIL	1955	203	5	1	Med-High
211109239-211109240	6	CIL	1953	8	5	1	Med-High
211209256-451209073	6	CIL	1950	15	5	1	Med-High
451209073-211209255	6	CIL	1950	15	5	1	Med-High
211307678-451307039	6	CIL	1947	15	5	1	Med-High
451307039-211307194	6	CIL	1947	15	5	1	Med-High
211307122-351307005	6	CIL	1956	86	5	1	Med-High
451407020-211407075	6	ACP	1963	711	5	1	Med-High
211307191-211307189	6	CIL	1947	15	5	1	Med-High
211507095-211507094	4	CIN	1925	15	5	1	Med-High
211508121-431508001	4	ACP	1935	25	5	1	Med-High
451410081-211410207	6	CIL	1941	176	5	1	Med-High
211410207-451410062	6	CIP	1959	15	5	1	Med-High
451607002-431607001	4	CIP	1938	13	5	1	Med-High
451210067-211210179	6	CIL	1956	15	5	1	Med-High
451408002-211408007	4	CIL	1943	15	5	1	Med-High
211408115-451408002	4	CIL	1943	312	5	1	Med-High
211410207-451410063	6	CIL	1941	15	5	1	Med-High
451410105-211410358	4	CIP	1951	15	5	1	Med-High
211310361-211310265	4	CIP	1929	301	5	1	Med-High
211410308-211410309	6	CIL	1945	6	5	1	Med-High
451511165-211511384	6	ACP	1944	150	5	1	Med-High
451410105-351410010	4	CIP	1951	154	5	1	Med-High
451410127-211410407	4	CIP	1951	15	5	1	Med-High
211410407-211410358	4	CIP	1951	42	5	1	Med-High
451410063-211410209	6	CIL	1941	15	5	1	Med-High
211410312-211410308	6	CIL	1945	8	5	1	Med-High
451411027-351411001	6	ACP	1939	336	5	1	Med-High
451511153-211511384	6	CIL	1944	12	5	1	Med-High
211511379-451511153	6	CIL	1944	17	5	1	Med-High
211210224-211210277	6	CIL	1956	15	5	1	Med-High
211210179-211210224	4	CIL	1956	203	5	1	Med-High
211210277-211210278	6	CIL	1956	25	5	1	Med-High
211410260-451410081	6	CIL	1941	14	5	1	Med-High
341410009-451410127	4	CIP	1951	15	5	1	Med-High
451410138-341410009	4	CIP	1951	254	5	1	Med-High
211009269-211009560	4	CO	1927	10	5	1	Med-High
211307665-451307200	6	DIP	1962	7	5	1	Med-High
211307186-211307313	6	CIL	1954	414	5	1	Med-High
211209255-211209348	6	CIL	1950	350	5	1	Med-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
451407042-211407010	6	ACP	1962	680	5	1	Med-High
451410116-211410312	6	CIL	1945	12	5	1	Med-High
211410676-451410116	6	CIL	1945	12	5	1	Med-High
211210278-351210008	4	CIL	1956	137	5	1	Med-High
211309315-451309101	4	CIL	1952	48	5	1	Med-High
211209278-451209079	4	ACP	1941	17	5	1	Med-High
451209079-211209282	4	ACP	1941	22	5	1	Med-High
211209279-211209280	4	CIN	1941	133	5	1	Med-High
211209280-211209278	4	CIN	1941	12	5	1	Med-High
211407173-451407040	6	CIL	1947	23	5	1	Med-High
211511355-211511360	6	CIL	1944	71	5	1	Med-High
211511355-211511360	6	CIL	1944	12	5	1	Med-High
211511379-211511382	6	CIL	1944	118	5	1	Med-High
211511379-211511382	6	CIL	1944	12	5	1	Med-High
211308392-451308174	6	ACP	1962	109	5	1	Med-High
211509491-211509521	4	CIN	1936	10	5	1	Med-High
211209225-211209255	6	CIL	1950	206	5	1	Med-High
211209226-211209225	6	CIL	1950	15	5	1	Med-High
211110300-211110298	6	ACP	1963	104	5	1	Med-High
431209001-211209278	4	CIN	1941	128	5	1	Med-High
211309326-211309274	4	CIL	1952	134	5	1	Med-High
211310479-211310482	4	CIL	1952	104	5	1	Med-High
211309274-211310479	4	CIL	1952	61	5	1	Med-High
211507101-211507100	4	CIN	1925	15	5	1	Med-High
211507095-211507101	4	CIN	1925	256	5	1	Med-High
451307071-211307263	6	ACP	1962	131	5	1	Med-High
211408015-451408123	6	ACP	1932	40	5	1	Med-High
211408013-211408015	6	ACP	1932	18	5	1	Med-High
211408532-451408123	6	ACP	1932	9	5	1	Med-High
451408122-211408018	6	ACP	1932	52	5	1	Med-High
211408532-451408122	6	ACP	1932	9	5	1	Med-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
Ductile Iron Pipe Replacements							
East							
451116164-211116611	8	DIP	1985	16	5	2	Medium-High
211116613-451116164	8	DIP	1985	11	5	2	Medium-High
211217200-451217056	12	DIP	1988	15	5	3	Medium-High
451217056-211217170	12	DIP	1988	210	5	3	Medium-High
211222221-451222046	12	DIP	1988	15	5	3	Medium-High
451222046-211222227	12	DIP	1988	249	5	3	Medium-High
211222227-451222049	12	DIP	1988	15	5	3	Medium-High
211219217-451219064	8	DIP	1988	17	5	2	Medium-High
211217197-211217196	12	DIP	1988	164	5	3	Medium-High
451222036-211222156	12	DIP	1988	306	5	3	Medium-High
211222237-451222052	12	DIP	1988	15	5	3	Medium-High
451222052-211222246	12	DIP	1988	243	5	3	Medium-High
211220030-451220006	8	DIP	1988	15	5	2	Medium-High
451220049-211222237	12	DIP	1988	240	5	3	Medium-High
451419018-211419063	12	DIP	1988	17	5	3	Medium-High
211419008-451419018	12	DIP	1988	82	5	3	Medium-High
211217170-211217128	12	DIP	1988	278	5	3	Medium-High
211217128-211217129	12	DIP	1988	6	5	3	Medium-High
211417052-211417053	8	DIP	1988	3	5	2	Medium-High
211417063-211417062	8	DIP	1988	3	5	2	Medium-High
211417053-421417001	8	DIP	1988	7	5	2	Medium-High
211417064-281417004	8	DIP	1988	2	5	2	Medium-High
451417021-211417064	6	DIP	1988	2	5	1	Medium-High
211417059-211417065	8	DIP	1988	1	5	2	Medium-High
211417065-211417063	8	DIP	1988	1	5	2	Medium-High
211417061-211417066	6	DIP	1988	1	5	1	Medium-High
211417066-451417021	6	DIP	1988	1	5	1	Medium-High
211417058-211417059	8	DIP	1988	39	5	2	Medium-High
451417026-211417059	8	DIP	1988	7	5	2	Medium-High
281417004-451417026	8	DIP	1988	4	5	2	Medium-High
451321033-211321095	8	DIP	1989	15	5	2	Medium-High
211321095-451321031	8	DIP	1989	15	5	2	Medium-High
211321043-211321042	12	DIP	1989	9	5	3	Medium-High
211321159-451321058	8	DIP	1989	15	5	2	Medium-High
451321031-211321159	8	DIP	1989	470	5	2	Medium-High
451220001-451220002	8	DIP	1989	30	5	2	Medium-High
211220024-451220001	8	DIP	1989	487	5	2	Medium-High
211117037-451117021	8	DIP	1989	15	5	3	Medium-High
211221048-451221020	8	DIP	1989	15	5	2	Medium-High
211221123-451221049	8	DIP	1989	15	5	2	Medium-High
211321128-211321129	8	DIP	1989	121	5	2	Medium-High
451221026-211221058	8	DIP	1989	15	5	2	Medium-High
451220002-451321058	8	DIP	1989	689	5	2	Medium-High
211221036-451221014	8	DIP	1989	15	5	2	Medium-High
211321127-211321128	8	DIP	1989	77	5	2	Medium-High
451321041-211321127	8	DIP	1989	21	5	2	Medium-High
451321032-211321104	8	DIP	1989	107	5	2	Medium-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211321129-451321059	8	DIP	1989	121	5	2	Medium-High
211220020-451220008	8	DIP	1989	3	5	2	Medium-High
351220001-211220027	8	DIP	1989	214	5	2	Medium-High
211220020-211220024	8	DIP	1989	88	5	2	Medium-High
211321095-451321032	8	DIP	1989	15	5	2	Medium-High
451321057-351320001	8	DIP	1989	203	5	2	Medium-High
211321163-451321060	8	DIP	1989	311	5	2	Medium-High
211321162-211321163	8	DIP	1989	30	5	2	Medium-High
451321059-211321162	8	DIP	1989	7	5	2	Medium-High
211321104-451321041	8	DIP	1989	13	5	2	Medium-High
211220027-451220012	8	DIP	1989	17	5	2	Medium-High
211221019-451221008	8	DIP	1989	15	5	2	Medium-High
211121013-451121003	12	DIP	1989	15	5	3	Medium-High
451321016-451321033	8	DIP	1989	482	5	2	Medium-High
211321042-451321016	8	DIP	1989	9	5	2	Medium-High
451221020-451221003	8	DIP	1989	586	5	2	Medium-High
451220026-211220072	8	DIP	1989	14	5	2	Medium-High
451220007-211220020	8	DIP	1989	10	5	2	Medium-High
211220019-451220007	8	DIP	1989	10	5	2	Medium-High
451221028-451221016	8	DIP	1989	559	5	2	Medium-High
451221008-211221016	8	DIP	1989	160	5	2	Medium-High
211221016-451221005	8	DIP	1989	15	5	2	Medium-High
451221031-451221028	8	DIP	1989	396	5	2	Medium-High
211221070-451221031	8	DIP	1989	15	5	2	Medium-High
451221015-451221026	8	DIP	1989	199	5	2	Medium-High
211221036-451221015	8	DIP	1989	15	5	2	Medium-High
451221016-211221036	8	DIP	1989	15	5	2	Medium-High
451221014-351221003	8	DIP	1989	226	5	2	Medium-High
211221058-451221025	8	DIP	1989	15	5	2	Medium-High
451221027-211221058	8	DIP	1989	15	5	2	Medium-High
451220012-211220024	8	DIP	1989	3	5	2	Medium-High
451220024-211220070	8	DIP	1989	9	5	2	Medium-High
211220072-451220024	8	DIP	1989	15	5	2	Medium-High
211321159-451321057	8	DIP	1989	15	5	2	Medium-High
451221094-451221027	8	DIP	1989	572	5	2	Medium-High
211117053-451117021	8	DIP	1989	78	5	3	Medium-High
451221005-451321060	8	DIP	1989	526	5	2	Medium-High
451221049-451221094	8	DIP	1989	349	5	2	Medium-High
451221003-351221001	8	DIP	1989	356	5	2	Medium-High
451221025-351221005	8	DIP	1989	429	5	2	Medium-High
211317202-461317001	8	DIP	1989	5	5	2	Medium-High
211317201-211317196	12	DIP	1989	5	5	3	Medium-High
211317200-211317201	12	DIP	1989	5	5	3	Medium-High
211317199-211317200	12	DIP	1989	5	5	3	Medium-High
211317199-451317061	12	DIP	1989	4	5	3	Medium-High
211317196-211317195	12	DIP	1989	5	5	3	Medium-High
211317195-211317198	12	DIP	1989	7	5	3	Medium-High
211317198-211317151	14	DIP	1989	2	5	3	Medium-High
451317061-211317203	4	DIP	1989	4	5	1	Medium-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
451317061-211317191	4	DIP	1989	3	5	1	Medium-High
451321054-211321150	8	DIP	1990	15	5	2	Medium-High
451221053-211221161	8	DIP	1990	15	5	2	Medium-High
211221156-451221050	8	DIP	1990	5	5	2	Medium-High
211221158-211221156	8	DIP	1990	213	5	2	Medium-High
451221067-211221158	8	DIP	1990	7	5	2	Medium-High
211221161-451221068	8	DIP	1990	10	5	2	Medium-High
211321140-211321139	8	DIP	1990	16	5	2	Medium-High
211321043-451321015	12	DIP	1990	15	5	3	Medium-High
341321002-211321140	8	DIP	1990	94	5	2	Medium-High
341321003-451321054	8	DIP	1990	255	5	2	Medium-High
451321053-341321003	8	DIP	1990	14	5	2	Medium-High
211321147-451321053	8	DIP	1990	17	5	2	Medium-High
211321138-451321024	10	DIP	1990	371	5	2	Medium-High
211321046-451321019	10	DIP	1990	54	5	2	Medium-High
451321024-211321046	10	DIP	1990	578	5	2	Medium-High
451220033-451220062	8	DIP	1990	383	5	2	Medium-High
211220090-451220033	8	DIP	1990	15	5	2	Medium-High
451220031-211220142	8	DIP	1990	238	5	2	Medium-High
211220084-451220031	8	DIP	1990	15	5	2	Medium-High
451220030-211220084	8	DIP	1990	15	5	2	Medium-High
211220026-451220011	8	DIP	1990	7	5	2	Medium-High
211221048-451221022	8	DIP	1990	15	5	2	Medium-High
451221051-211221122	8	DIP	1990	57	5	2	Medium-High
451221050-211221122	8	DIP	1990	10	5	2	Medium-High
211221122-451221065	8	DIP	1990	100	5	2	Medium-High
451221065-211221154	8	DIP	1990	15	5	2	Medium-High
451220016-451220030	8	DIP	1990	213	5	2	Medium-High
211220056-451220016	8	DIP	1990	15	5	2	Medium-High
211220093-211220092	8	DIP	1990	9	5	2	Medium-High
211220088-211220086	8	DIP	1990	24	5	2	Medium-High
211220144-211220142	8	DIP	1990	99	5	2	Medium-High
211220148-211220144	8	DIP	1990	107	5	2	Medium-High
211321117-341321002	8	DIP	1990	189	5	2	Medium-High
451418005-451418024	8	DIP	1990	419	5	2	Medium-High
451221006-451221021	8	DIP	1990	172	5	2	Medium-High
211221016-451221006	8	DIP	1990	15	5	2	Medium-High
211221123-451221051	8	DIP	1990	15	5	2	Medium-High
451221052-211221123	8	DIP	1990	15	5	2	Medium-High
451321048-451321043	8	DIP	1990	582	5	2	Medium-High
211321143-451321048	8	DIP	1990	15	5	2	Medium-High
451321049-451321046	10	DIP	1990	113	5	2	Medium-High
451321045-211321138	8	DIP	1990	3	5	2	Medium-High
211321139-451321045	8	DIP	1990	3	5	2	Medium-High
451220062-211220196	8	DIP	1990	6	5	2	Medium-High
211221161-451221067	8	DIP	1990	10	5	2	Medium-High
451221068-451221079	8	DIP	1990	528	5	2	Medium-High
451221091-211221224	8	DIP	1990	40	5	2	Medium-High
211221226-451221091	8	DIP	1990	10	5	2	Medium-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211417024-351417002	8	DIP	1990	33	5	2	Medium-High
451418009-451418005	8	DIP	1990	417	5	2	Medium-High
211418020-451418009	8	DIP	1990	15	5	2	Medium-High
451221079-211221195	8	DIP	1990	15	5	2	Medium-High
451321043-351321004	8	DIP	1990	255	5	2	Medium-High
451321063-211321143	10	DIP	1990	15	5	2	Medium-High
211321010-451321004	8	DIP	1990	15	5	2	Medium-High
451321019-211321045	10	DIP	1990	8	5	2	Medium-High
211220027-211220026	8	DIP	1990	6	5	2	Medium-High
351221002-451321052	8	DIP	1990	353	5	2	Medium-High
451321052-211321147	8	DIP	1990	15	5	2	Medium-High
211221018-451321063	10	DIP	1990	325	5	2	Medium-High
211321044-211321043	12	DIP	1990	4	5	3	Medium-High
211321045-211321044	10	DIP	1990	4	5	2	Medium-High
451321046-211321138	10	DIP	1990	15	5	2	Medium-High
211321143-451321049	10	DIP	1990	15	5	2	Medium-High
211321147-451321050	8	DIP	1990	15	5	2	Medium-High
451321004-351321002	8	DIP	1990	142	5	2	Medium-High
211220199-451220066	12	DIP	1990	10	5	3	Medium-High
451221009-211221019	8	DIP	1990	15	5	2	Medium-High
211221018-451221009	8	DIP	1990	15	5	2	Medium-High
211221019-451221010	8	DIP	1990	15	5	2	Medium-High
451221010-211221076	8	DIP	1990	377	5	2	Medium-High
211220060-211220019	8	DIP	1990	638	5	2	Medium-High
451220020-211220060	8	DIP	1990	15	5	2	Medium-High
211220093-451220020	8	DIP	1990	290	5	2	Medium-High
451220019-211220088	8	DIP	1990	81	5	2	Medium-High
211220060-451220019	8	DIP	1990	15	5	2	Medium-High
210914102-450914038	12	DIP	1990	15	5	3	Medium-High
211321144-211321117	8	DIP	1990	54	5	2	Medium-High
451221080-351221009	8	DIP	1990	266	5	2	Medium-High
211221195-451221080	8	DIP	1990	15	5	2	Medium-High
211221195-451221078	8	DIP	1990	15	5	2	Medium-High
451221033-451221052	8	DIP	1990	359	5	2	Medium-High
211221070-451221033	8	DIP	1990	15	5	2	Medium-High
450914004-210914013	12	DIP	1990	15	5	3	Medium-High
211221076-451221035	8	DIP	1990	15	5	2	Medium-High
211220056-351220002	8	DIP	1990	214	5	2	Medium-High
451220017-211220056	8	DIP	1990	15	5	2	Medium-High
211220086-451220017	8	DIP	1990	178	5	2	Medium-High
211220090-211220092	8	DIP	1990	17	5	2	Medium-High
451220032-211220090	8	DIP	1990	15	5	2	Medium-High
211220148-451220032	8	DIP	1990	149	5	2	Medium-High
451221032-211221070	8	DIP	1990	15	5	2	Medium-High
451221022-451221032	8	DIP	1990	177	5	2	Medium-High
451221021-211221048	8	DIP	1990	15	5	2	Medium-High
451220066-451221003	12	DIP	1990	585	5	3	Medium-High
451321050-211321144	8	DIP	1990	105	5	2	Medium-High
450914082-210914278	12	DIP	1990	15	5	3	Medium-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
210914175-450914082	12	DIP	1990	326	5	3	Medium-High
450914053-210914174	12	DIP	1990	17	5	3	Medium-High
210914173-450914053	12	DIP	1990	15	5	3	Medium-High
210914097-210914102	12	DIP	1990	157	5	3	Medium-High
450914017-210914097	12	DIP	1990	250	5	3	Medium-High
210914174-210914175	12	DIP	1990	44	5	3	Medium-High
210914171-210914173	12	DIP	1990	25	5	3	Medium-High
351220003-211220084	8	DIP	1990	265	5	2	Medium-High
451220006-211220034	8	DIP	1990	11	5	2	Medium-High
451220006-211220019	8	DIP	1990	3	5	2	Medium-High
451221034-211221073	8	DIP	1990	13	5	2	Medium-High
211221076-451221034	8	DIP	1990	8	5	2	Medium-High
211221075-451221036	8	DIP	1990	12	5	2	Medium-High
211221077-451221053	8	DIP	1990	419	5	2	Medium-High
451221036-211221077	8	DIP	1990	7	5	2	Medium-High
451221035-211221077	8	DIP	1990	37	5	2	Medium-High
471221002-451221096	6	DIP	1990	7	5	1	Medium-High
451221096-211221239	6	DIP	1990	4	5	1	Medium-High
211221241-211221075	8	DIP	1990	10	5	2	Medium-High
211221239-211221241	8	DIP	1990	4	5	2	Medium-High
211221245-451221099	4	DIP	1990	2	5	1	Medium-High
481221001-211221244	4	DIP	1990	5	5	1	Medium-High
451221099-481221001	4	DIP	1990	2	5	1	Medium-High
211221250-211221252	8	DIP	1990	10	5	2	Medium-High
210914173-210914515	12	DIP	1990	42	5	3	Medium-High
210914515-210914507	12	DIP	1990	4	5	3	Medium-High
210914507-210914503	8	DIP	1990	3	5	2	Medium-High
450914121-470914001	8	DIP	1990	7	5	2	Medium-High
210914503-450914121	8	DIP	1990	2	5	2	Medium-High
210914517-210914514	4	DIP	1990	4	5	2	Medium-High
480914001-210914517	4	DIP	1990	1	5	2	Medium-High
450914122-480914001	4	DIP	1990	2	5	2	Medium-High
210914513-450914122	4	DIP	1990	2	5	2	Medium-High
451220011-211220023	8	DIP	1990	5	5	2	Medium-High
470914001-450914118	8	DIP	1990	4	5	2	Medium-High
450914118-210914506	8	DIP	1990	5	5	2	Medium-High
210914506-210914510	8	DIP	1990	3	5	2	Medium-High
210914510-210914516	12	DIP	1990	3	5	3	Medium-High
210914516-450914054	12	DIP	1990	28	5	3	Medium-High
450914054-210914174	12	DIP	1990	15	5	3	Medium-High
451321015-211321039	12	DIP	1990	89	5	3	Medium-High
451221103-211221249	8	DIP	1990	4	5	2	Medium-High
211221252-451221103	8	DIP	1990	3	5	2	Medium-High
211221249-471221004	8	DIP	1990	4	5	2	Medium-High
451418024-211417024	8	DIP	1990	326	5	2	Medium-High
451221078-211221226	8	DIP	1990	531	5	2	Medium-High
211321083-451321027	10	DIP	1991	15	5	2	Medium-High
351321003-451321029	8	DIP	1991	250	5	2	Medium-High
211321083-451321028	10	DIP	1991	15	5	2	Medium-High

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
451321027-341321001	10	DIP	1991	684	5	2	Medium-High
451321018-211321043	12	DIP	1991	14	5	3	Medium-High
451221060-211221145	8	DIP	1991	15	5	2	Medium-High
451221063-451221060	8	DIP	1991	413	5	2	Medium-High
451221046-211220070	8	DIP	1991	653	5	2	Medium-High
451321055-211321150	10	DIP	1991	15	5	2	Medium-High
451321028-451321055	10	DIP	1991	267	5	2	Medium-High
451220010-211321045	12	DIP	1991	2239	5	3	Medium-High
451221071-211221172	8	DIP	1991	10	5	2	Medium-High
451221059-451221071	8	DIP	1991	187	5	2	Medium-High
211221145-451221059	8	DIP	1991	15	5	2	Medium-High
211321150-451321065	10	DIP	1991	321	5	2	Medium-High
211321084-211321083	10	DIP	1991	10	5	2	Medium-High
451321029-211321084	8	DIP	1991	10	5	2	Medium-High
211221145-451221058	8	DIP	1991	15	5	2	Medium-High
451220026-451221069	8	DIP	1991	442	5	2	Medium-High
211221172-351221007	8	DIP	1991	55	5	2	Medium-High
451114131-451114133	10	DIP	1991	245	5	2	Medium-High
211321028-451321008	8	DIP	1991	8	5	2	Medium-High
451321009-451321018	12	DIP	1991	254	5	3	Medium-High
211321029-451321009	12	DIP	1991	16	5	3	Medium-High
451221076-351221008	8	DIP	1991	357	5	2	Medium-High
451321008-351321001	8	DIP	1991	183	5	2	Medium-High
451221038-351221004	8	DIP	1991	117	5	2	Medium-High
451321022-451321013	10	DIP	1991	636	5	2	Medium-High
341321001-451321022	10	DIP	1991	82	5	2	Medium-High
211321029-211321028	10	DIP	1991	7	5	2	Medium-High
451321011-211321029	10	DIP	1991	4	5	2	Medium-High
211321030-451321011	10	DIP	1991	4	5	2	Medium-High
451321013-211321030	10	DIP	1991	15	5	2	Medium-High
451220042-451220050	8	DIP	1991	203	5	2	Medium-High
451220050-211220160	8	DIP	1991	15	5	2	Medium-High
451221082-451220051	8	DIP	1991	365	5	2	Medium-High
211220127-451220044	8	DIP	1991	15	5	2	Medium-High
451220025-451220043	8	DIP	1991	211	5	2	Medium-High
211220072-451220025	8	DIP	1991	15	5	2	Medium-High
451220043-211220127	8	DIP	1991	15	5	2	Medium-High
211220127-451220042	8	DIP	1991	15	5	2	Medium-High
211221080-451221037	10	DIP	1991	15	5	2	Medium-High
451321065-211221080	10	DIP	1991	553	5	2	Medium-High
451220067-211220199	8	DIP	1991	15	5	2	Medium-High
211220160-451220067	8	DIP	1991	242	5	2	Medium-High
211220160-451220051	8	DIP	1991	15	5	2	Medium-High
451221064-451221087	8	DIP	1991	617	5	2	Medium-High
211221154-451221064	8	DIP	1991	15	5	2	Medium-High
211221154-451221063	8	DIP	1991	15	5	2	Medium-High
451221087-451221084	8	DIP	1991	668	5	2	Medium-High
451221084-451221082	8	DIP	1991	353	5	2	Medium-High
451220044-451221076	8	DIP	1991	370	5	2	Medium-High

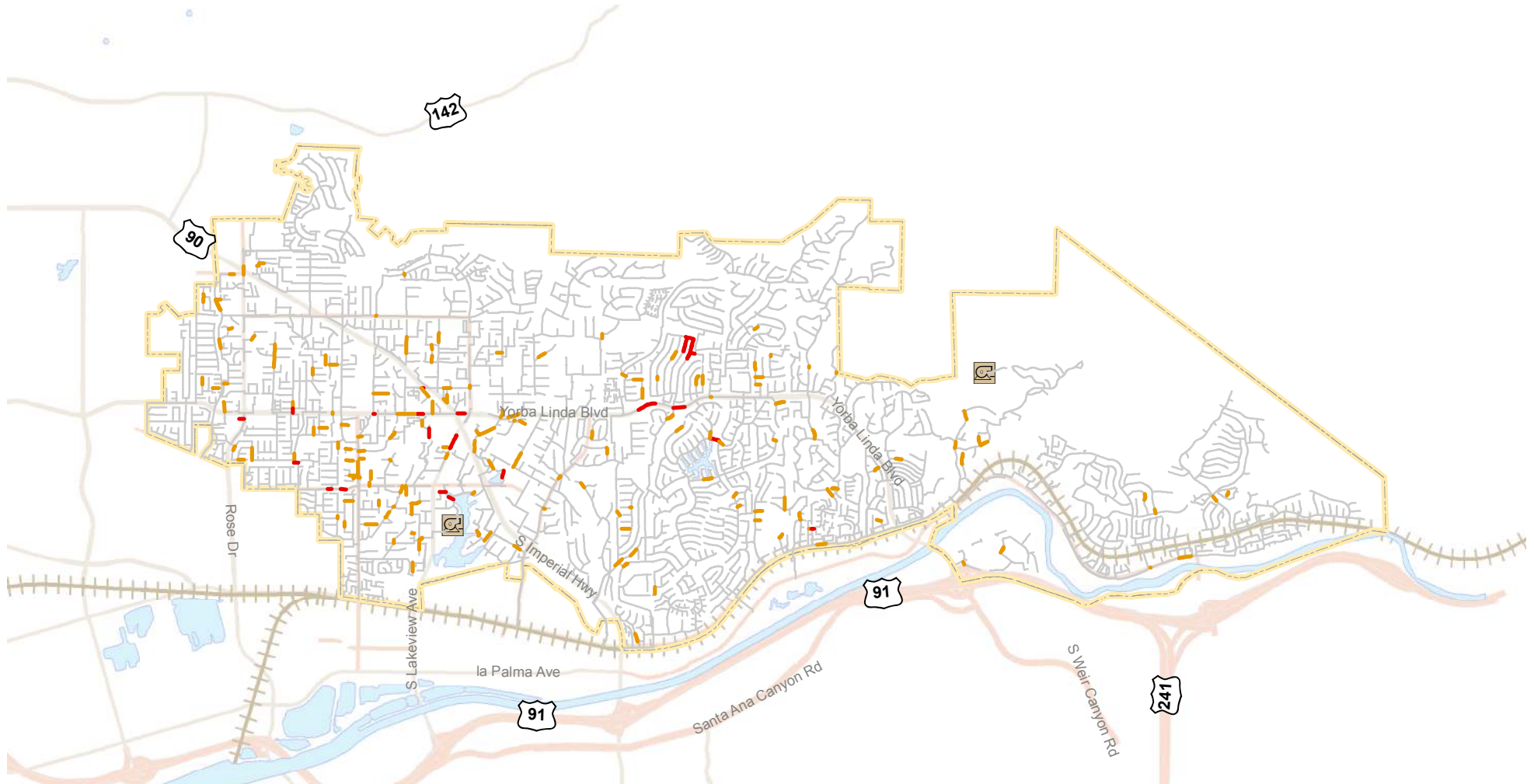
Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
211221080-451221038	8	DIP	1991	15	5	2	Medium-High
451221037-351221006	10	DIP	1991	410	5	2	Medium-High
450914113-450914046	12	DIP	1991	1756	5	3	Medium-High
210914139-450914047	12	DIP	1991	15	5	3	Medium-High
450914046-210914139	12	DIP	1991	15	5	3	Medium-High
451221058-341221001	8	DIP	1991	258	5	2	Medium-High
451221069-211221172	8	DIP	1991	532	5	2	Medium-High
450914047-211014440	12	DIP	1991	1146	5	3	Medium-High
211220023-451220010	12	DIP	1991	3	5	3	Medium-High
211220150-211220023	12	DIP	1991	1213	5	3	Medium-High
211220153-211220150	12	DIP	1991	17	5	3	Medium-High
341221001-451221046	8	DIP	1991	254	5	2	Medium-High
210914176-450914055	12	DIP	1992	15	5	3	Medium-High
450914055-210914175	12	DIP	1992	15	5	3	Medium-High
451117009-211217196	12	DIP	1995	59	4	4	Medium-High
451117051-211117116	8	DIP	1995	276	4	4	Medium-High
211117065-451117030	8	DIP	1995	113	4	4	Medium-High
211117064-451117027	8	DIP	1995	15	4	4	Medium-High
451117028-211117064	12	DIP	1995	15	4	4	Medium-High
451117010-451117028	12	DIP	1995	592	4	4	Medium-High
451117027-451117051	8	DIP	1995	255	4	4	Medium-High
211117020-451117009	12	DIP	1995	15	4	4	Medium-High
211117065-211117066	8	DIP	1995	14	4	4	Medium-High
451117052-351117002	8	DIP	1995	15	4	4	Medium-High
211117066-451117031	8	DIP	1995	15	4	4	Medium-High
211117116-211117118	8	DIP	1995	11	4	4	Medium-High
451117030-211117064	8	DIP	1995	15	4	4	Medium-High
211117020-451117010	12	DIP	1995	15	4	4	Medium-High
211117068-451117052	8	DIP	1995	133	4	4	Medium-High
211117066-211117068	8	DIP	1995	53	4	4	Medium-High
451117031-211117067	8	DIP	1995	15	4	4	Medium-High
211415082-211415028	10	DIP	1998	691	5	2	Medium-High
451216008-211216048	8	DIP	1996	142	4	2	Medium
211216051-211216031	8	DIP	1996	98	4	2	Medium
211216031-451216010	8	DIP	1996	70	4	2	Medium
211216048-211216047	8	DIP	1996	29	4	2	Medium
451216050-211216074	8	DIP	1996	87	4	2	Medium
451216031-211216074	8	DIP	1996	9	4	2	Medium
211216116-451216031	8	DIP	1996	107	4	2	Medium
211216073-211216116	8	DIP	1996	76	4	2	Medium
211216071-211216073	8	DIP	1996	67	4	2	Medium
211216074-451216033	8	DIP	1996	9	4	2	Medium
451216033-211216079	8	DIP	1996	153	4	2	Medium
451216024-211216051	8	DIP	1996	76	4	2	Medium
211216079-451216024	8	DIP	1996	168	4	2	Medium
451216010-451216008	8	DIP	1996	283	4	2	Medium
211216047-451216021	8	DIP	1996	122	4	2	Medium
451216021-211216071	8	DIP	1996	255	4	2	Medium
211018090-211018110	12	DIP	1997	64	4	3	Medium

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
451018058-211018090	12	DIP	1997	15	4	3	Medium
211018096-451018058	12	DIP	1997	328	4	3	Medium
211018089-211018090	12	DIP	1997	15	4	3	Medium
451018094-211018126	12	DIP	1997	15	4	3	Medium
451018064-451018063	12	DIP	1997	245	4	3	Medium
211018099-451018064	12	DIP	1997	15	4	3	Medium
451018063-211018094	12	DIP	1997	15	4	3	Medium
451018060-211018094	12	DIP	1997	15	4	3	Medium
211018094-451018061	12	DIP	1997	15	4	3	Medium
210914013-450914017	12	DIP	1997	15	4	3	Medium
451014112-450914004	12	DIP	1997	503	4	3	Medium
211014397-451014112	12	DIP	1997	15	4	3	Medium
211018080-451018060	12	DIP	1997	205	4	3	Medium
451018061-211018096	12	DIP	1997	53	4	3	Medium
211018110-451018094	12	DIP	1997	244	4	3	Medium
451020048-451020050	8	DIP	1998	257	4	2	Medium
351020004-451020069	8	DIP	1998	12	4	2	Medium
451020081-451020082	8	DIP	1998	75	4	3	Medium
211020164-451020055	8	DIP	1998	15	4	2	Medium
451020036-451020053	8	DIP	1998	190	4	2	Medium
451020046-211020151	8	DIP	1998	15	4	2	Medium
451020044-451020046	8	DIP	1998	245	4	2	Medium
211020151-451020048	8	DIP	1998	15	4	2	Medium
211020151-451020047	8	DIP	1998	15	4	2	Medium
451020050-211020158	8	DIP	1998	15	4	2	Medium
451020051-211020158	8	DIP	1998	15	4	2	Medium
211020232-451020081	8	DIP	1998	12	4	2	Medium
211020137-211020232	8	DIP	1998	231	4	2	Medium
451020082-211020234	8	DIP	1998	15	4	3	Medium
211020164-451020054	8	DIP	1998	16	4	2	Medium
451020053-211020164	8	DIP	1998	14	4	2	Medium
451020039-211020135	8	DIP	1998	5	4	2	Medium
451020072-211020217	8	DIP	1998	16	4	3	Medium
451020069-451020051	8	DIP	1998	254	4	2	Medium
211020125-451020037	8	DIP	1998	15	4	2	Medium
451020035-211020125	8	DIP	1998	15	4	2	Medium
211020125-451020036	8	DIP	1998	15	4	2	Medium
211020145-451020044	8	DIP	1998	15	4	2	Medium
451020042-211020145	8	DIP	1998	15	4	2	Medium
211020145-451020043	8	DIP	1998	15	4	2	Medium
451020068-351020003	8	DIP	1998	13	4	2	Medium
451020047-451020068	8	DIP	1998	236	4	2	Medium
211020158-451020035	8	DIP	1998	159	4	2	Medium
451020037-451020039	8	DIP	1998	366	4	2	Medium
451020055-451020057	8	DIP	1998	302	4	2	Medium
211415028-211415031	10	DIP	1998	9	4	2	Medium
211020138-451020042	8	DIP	1998	291	4	2	Medium
211020137-211020138	8	DIP	1998	35	4	2	Medium
451020067-351020002	8	DIP	1998	12	4	2	Medium

Pipe ID	Diameter (inches)	Pipe Class	Installation (year)	Length (feet)	LoF	CoF	Risk Category
451020043-451020067	8	DIP	1998	236	4	2	Medium
451021059-351021005	8	DIP	1998	15	4	2	Medium
451020057-451021059	8	DIP	1998	286	4	2	Medium
211415207-211415197	12	DIP	1998	174	4	3	Medium
211415209-211415207	12	DIP	1998	8	4	3	Medium
211415197-211415202	12	DIP	1998	19	4	3	Medium
211415317-211415316	12	DIP	1998	4	4	3	Medium
211415202-211415307	12	DIP	1998	362	4	3	Medium
211415168-211415170	12	DIP	1998	15	4	3	Medium
451415051-211415209	12	DIP	1998	7	4	3	Medium
211415168-451415051	12	DIP	1998	8	4	3	Medium
451020054-451020072	8	DIP	1998	131	4	3	Medium
Central							
451414105-211414518	8	DIP	1985	41	5	2	Medium-High
451414104-451414105	8	DIP	1985	92	5	2	Medium-High
211615006-211615015	12	DIP	1986	338	5	3	Medium-High
451615013-211615040	12	DIP	1986	15	5	3	Medium-High
211615004-451615013	12	DIP	1986	268	5	3	Medium-High
211615006-211615004	12	DIP	1986	25	5	3	Medium-High
211414719-211414723	8	DIP	1986	12	5	2	Medium-High
211414723-451414154	8	DIP	1986	3	5	2	Medium-High
451414154-211414715	8	DIP	1986	3	5	2	Medium-High
211414715-471414003	8	DIP	1986	4	5	2	Medium-High
471414003-451414157	8	DIP	1986	3	5	2	Medium-High
211414724-211414720	8	DIP	1986	12	5	2	Medium-High
451414157-211414724	8	DIP	1986	2	5	2	Medium-High
211615040-211615381	12	DIP	1986	515	5	3	Medium-High
211515221-451515069	8	DIP	1988	15	5	2	Medium-High
210914426-450914113	12	DIP	1991	32	5	3	Medium-High
210914426-450914111	12	DIP	1991	95	5	3	Medium-High
450914111-210914425	12	DIP	1991	15	5	3	Medium-High
210914425-210914331	12	DIP	1991	559	5	3	Medium-High
211014396-211014397	12	DIP	1997	47	4	3	Medium
West							
210809132-450809085	12	DIP	1990	15	5	3	Medium-High
450809075-210809118	12	DIP	1990	15	5	3	Medium-High
450809078-450809075	12	DIP	1990	197	5	3	Medium-High
450809085-450809078	12	DIP	1990	218	5	3	Medium-High
210809140-210809138	16	DIP	1996	4	4	4	Medium-High
211109026-211109085	16	DIP	1998	295	4	4	Medium-High
211009176-211009238	8	DIP	1995	54	4	3	Medium
351410007-451410072	8	DIP	1995	25	4	2	Medium
451209050-211209176	8	DIP	1997	169	4	2	Medium
451209048-351209005	8	DIP	1997	15	4	2	Medium
211209171-451209048	8	DIP	1997	125	4	2	Medium
211209171-211209176	8	DIP	1997	37	4	2	Medium
211209195-451209055	8	DIP	1997	15	4	3	Medium
451209055-451209050	8	DIP	1997	312	4	3	Medium

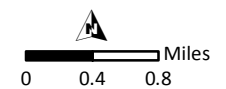
10-Year CIP: YLWD Wastewater Pipeline System

Gravity Sewer 10-Year CIP Map

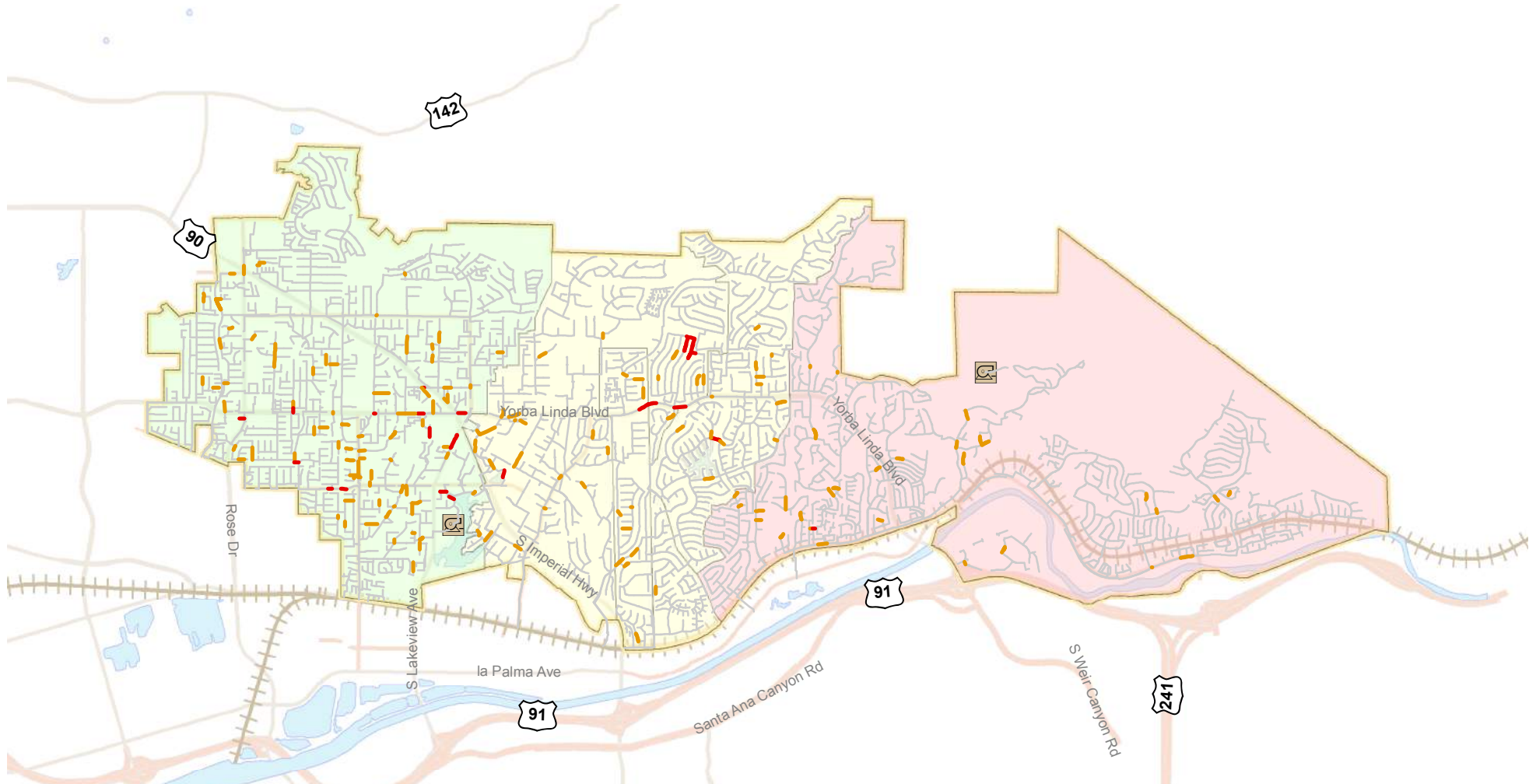


Legend

- | | | |
|------------------------------------|-----------------------|----------|
| — Gravity Main | Lift Station | Railroad |
| — 0-5 Year Replacement or Repairs | Sewer System Boundary | |
| — 5-10 Year Replacement or Repairs | — Highway | |
| | — Principal Arterial | |
| | — Major Arterial | |

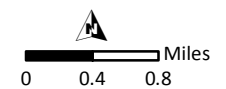


Gravity Sewer 10-Year CIP Map

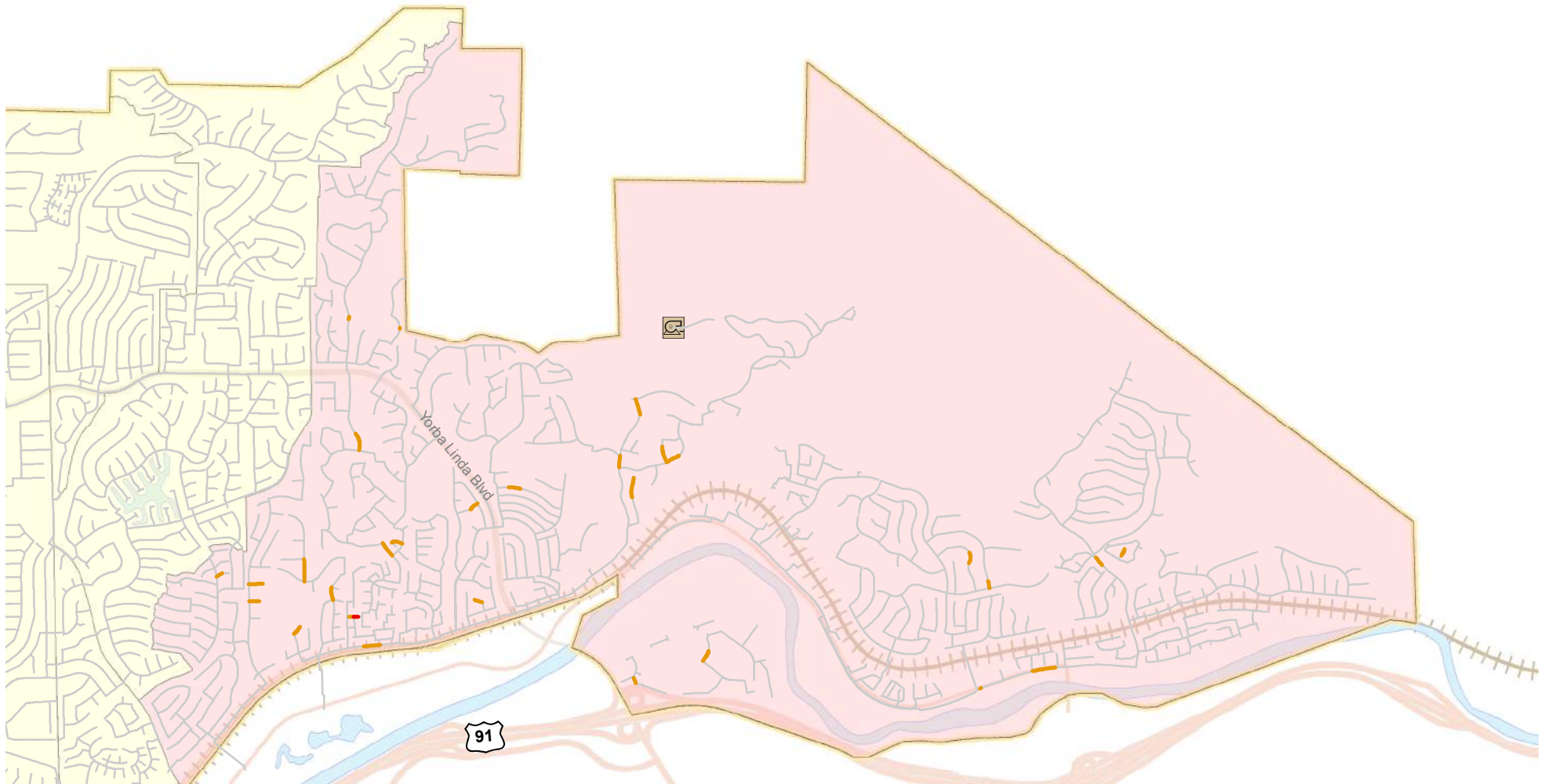


Legend

- | | | |
|----------------------------------|-----------------------|--------------------|
| — Gravity Main | Lift Station | Highway |
| 0-5 Year Replacement or Repairs | Sewer System Boundary | Principal Arterial |
| 5-10 Year Replacement or Repairs | Central | Major Arterial |
| | East | Railroad |
| | West | |



Gravity Sewer 10-Year CIP Map

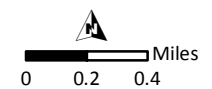


Legend

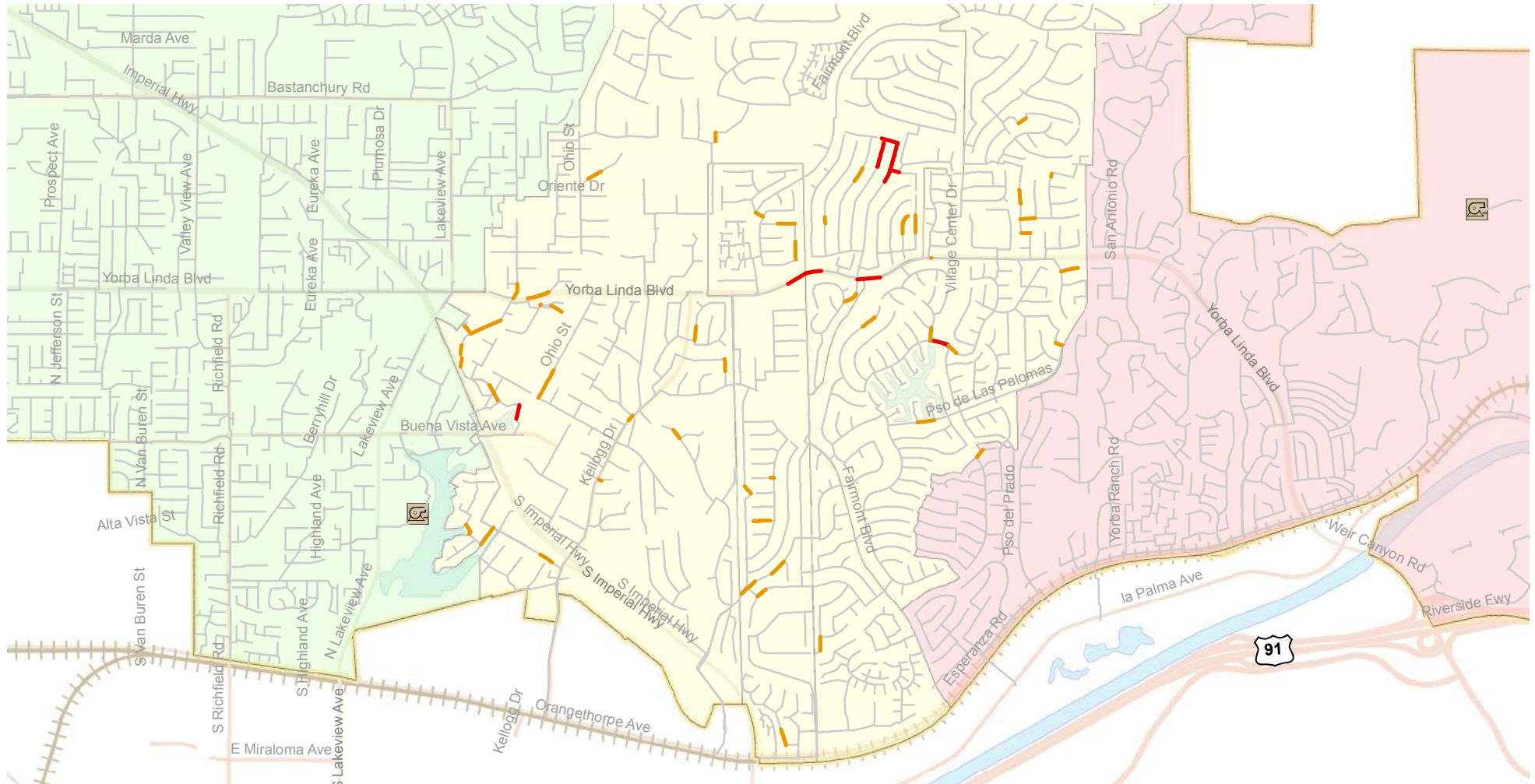
- Gravity Main
- 0-5 East
- 5-10 East

- Lift Station
- Sewer System Boundary
- Central
- East
- West

- Highway
- Principal Arterial
- Major Arterial
- Railroad



Gravity Sewer 10-Year CIP Map

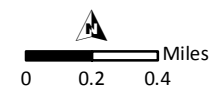


Legend

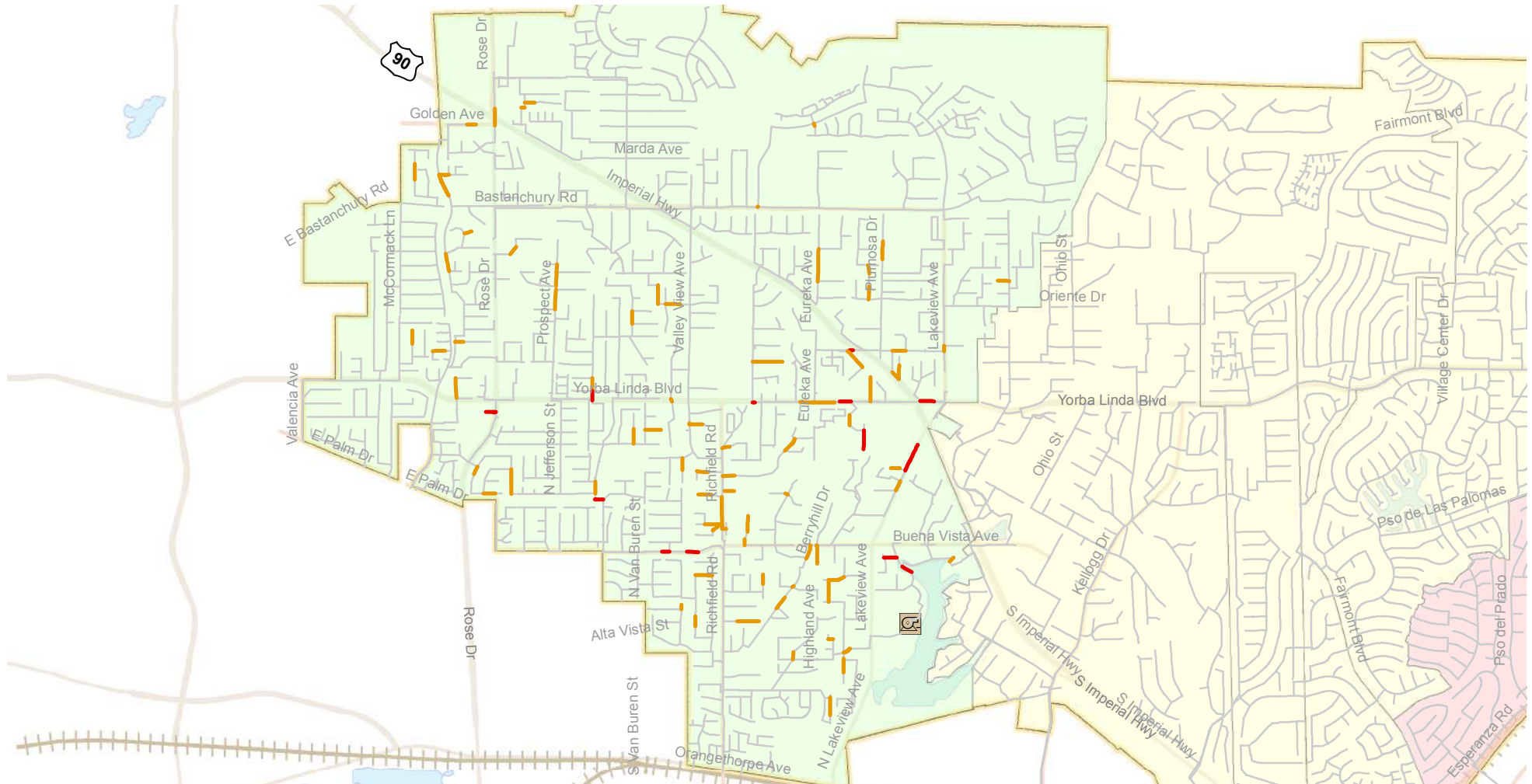
- Gravity Main
- - - 0-5 Central
- - - 5-10 Central

- Lift Station
- Sewer System Boundary
- Central
- East
- West

- Highway
- Principal Arterial
- Major Arterial
- Railroad



Gravity Sewer 10-Year CIP Map

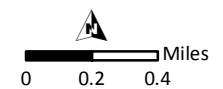


Legend

- Gravity Main
- 0-5 West
- 5-10 West

- Lift Station
- Sewer System Boundary
- Central
- East
- West

- Highway
- Principal Arterial
- Major Arterial
- Railroad



Pipe ID	Diameter (inches)	Material	Installation (year)	Length (feet)	LoF	CoF	Risk Category
0-5 Year Pipe Replacements							
East							
611115070-611115069	18	VCP	1977	95	4	5	High
Central							
611313028-611313050	8	VCP	1969	402	5	4	High
611313030-611313028	8	VCP	1969	351	5	4	High
611313056-611313078	10	VCP	1982	469	5	4	High
611413026-611413046	8	ACP	1969	276	5	2	Med-High
611414005-611413026	8	ACP	1969	190	5	2	Med-High
611413011-611413026	8	ACP	1969	286	5	2	Med-High
611413009-611414001	8	ACP	1969	342	5	2	Med-High
611414001-611413011	8	ACP	1969	286	5	2	Med-High
611413008-611413025	8	ACP	1970	250	5	2	Med-High
611413010-611413008	8	ACP	1970	260	5	2	Med-High
611214019-611214017	10	VCP	1986	390	4	5	High
611211053-611211062	12	VCP	2004	288	4	5	High
West							
611110024-611110026	12	VCP	1976	227	5	5	High
611310013-611310012	10	VCP	1962	70	5	4	High
611309030-611309031	8	VCP	1964	56	5	4	High
611310064-611310062	6	VCP	1965	290	5	4	High
611308039-611308038	10	VCP	1962	191	5	4	High
611310054-611310053	8	VCP	1964	239	5	4	High
611210003-611310077	8	VCP	1988	381	5	4	High
611210006-611210015	8	VCP	1980	589	5	4	High
601208236-611208049	10	CIP	1962	12	5	3	Med-High
611208049-611208050	12	CIP	1962	167	5	3	Med-High
611109007-611109008	18	VCP	1962	231	4	5	High
611109002-611109003	18	VCP	1962	153	4	5	High
611110008-611110010	8	VCP	1976	261	4	5	High
611307078-611307080	6	VCP	1965	215	4	5	High

Pipe ID	Diameter (inches)	Material	Installation (year)	Length (feet)	LoF	CoF	Risk Category
5-10 Year Pipe Replacements							
East							
611018022-611018007	10	VCP	1985	263	5	3	Med-High
611015006-611015002	8	VCP	1979	199	5	2	Med-High
611114071-611114068	8	PVC	1987	140	5	2	Med-High
611121008-611121038	8	ABS	1988	219	5	2	Med-High
611114087-611114085	8	VCP	1979	221	5	2	Med-High
611115022-611115011	8	VCP	1978	249	5	2	Med-High
601020202-601020201	15	DIP	1982	20	4	4	Med-High
611020043-611020040	15	VCP	1988	500	4	4	Med-High
611120028-611120029	8	ABS	1988	160	4	4	Med-High
601415139-601415138	10	DIP	1979	56	4	3	Medium
601415289-601415287	10	DIP	1979	23	4	3	Medium
611315065-611215016	12	VCP	1979	390	4	3	Medium
611015031-611015024	10	VCP	1978	361	4	3	Medium
611317018-611317031	8	VCP	1979	351	4	2	Medium
611121020-611121019	8	PVC	1990	162	4	2	Medium
611120004-611120022	8	ABS	1988	237	4	2	Medium
611114081-611114078	8	VCP	1979	310	4	2	Medium
611115066-611115069	8	VCP	1977	104	4	2	Medium
611116080-611116081	8	VCP	1979	174	4	2	Medium
611017013-611017010	8	VCP	1985	122	4	2	Medium
611217011-611217010	8	VCP	1982	256	4	2	Medium
611217027-611217026	8	VCP	1982	443	4	2	Medium
611217018-611217019	8	VCP	1982	359	4	2	Medium
611216051-611216050	8	PVC	1985	207	4	2	Medium
611115020-611115023	8	VCP	1978	348	4	2	Medium
611216034-611216032	8	PVC	1985	259	4	2	Medium
611115033-611115060	8	VCP	1982	296	4	2	Medium
611115014-611115028	8	VCP	1979	495	4	2	Medium
611218006-611217019	8	VCP	1982	315	4	2	Medium
Central							
611214022-611214019	10	VCP	1986	221	5	3	Med-High
611011004-611011007	8	VCP	1958	436	5	3	Med-High
611211012-611211011	12	VCP	2004	179	5	3	Med-High
611011030-611011031	12	VCP	2005	299	5	3	Med-High
611413049-611413063	8	VCP	1973	179	5	2	Med-High
611113026-611113027	8	VCP	1969	70	5	2	Med-High
611514084-611514081	8	ABS	1980	190	5	2	Med-High
611215003-611215005	8	ABS	1980	140	5	2	Med-High
611114049-611114048	8	PVC	1987	193	5	2	Med-High
610913021-610913005	8	VCP	1970	287	5	2	Med-High
611013026-611012057	15	VCP	1972	246	4	4	Med-High
611013027-611013026	15	VCP	1972	133	4	4	Med-High
611013019-611013029	15	VCP	1972	358	4	4	Med-High
601314037-601314036	10	CIP	1979	10	4	4	Med-High

Pipe ID	Diameter (inches)	Material	Installation (year)	Length (feet)	LoF	CoF	Risk Category
5-10 Year Pipe Replacements							
611311037-611311046	8	VCP	1982	451	4	4	Med-High
611311036-611311045	8	VCP	1970	161	4	4	Med-High
611311035-611311036	8	VCP	1971	158	4	4	Med-High
611512042-611412004	8	VCP	2007	182	4	4	Med-High
611111036-611111035	6	VCP	1976	57	4	3	Medium
611212075-611212073	10	VCP	2007	126	4	3	Medium
611313070-611313069	12	VCP	1976	300	4	3	Medium
611211001-611211010	12	VCP	2004	188	4	3	Medium
611211030-611211048	12	VCP	2004	371	4	3	Medium
611313008-611313027	8	VCP	1969	373	4	2	Medium
611413065-611413064	8	VCP	1969	358	4	2	Medium
611113048-611113049	8	VCP	1968	332	4	2	Medium
611112043-611113033	8	VCP	1968	205	4	2	Medium
611013043-611013042	8	VCP	1970	221	4	2	Medium
610813008-610813027	8	VCP	1964	345	4	2	Medium
611313082-611313081	6	VCP	1982	306	4	2	Medium
611414092-611414093	8	VCP	1979	184	4	2	Medium
601415078-601415077	8	CIP	1979	58	4	2	Medium
611414065-611414091	8	VCP	1979	291	4	2	Medium
611414094-611414090	8	VCP	1979	305	4	2	Medium
611315009-611315031	8	VCP	1979	356	4	2	Medium
611414021-611414020	8	VCP	1970	392	4	2	Medium
611311065-611211004	8	VCP	1976	211	4	2	Medium
611311058-611311055	8	VCP	1996	252	4	2	Medium
611311051-611311050	8	VCP	2004	21	4	2	Medium
611212032-611212033	8	VCP	1964	250	4	2	Medium
611312085-611212011	8	VCP	1965	297	4	2	Medium
611413024-611413042	8	VCP	1970	333	4	2	Medium
611413069-611413070	8	VCP	1969	131	4	2	Medium
611212081-611112010	8	VCP	1961	223	4	2	Medium
611411042-611411061	8	VCP	1978	308	4	2	Medium
611414019-611414022	8	VCP	1970	350	4	2	Medium
611211018-611211055	8	VCP	1975	654	4	2	Medium
611311069-611211004	8	VCP	1970	675	4	2	Medium
611214079-611214075	10	VCP	1979	349	3	5	Med-High
611314066-611214017	8	VCP	1978	262	3	5	Med-High
611111048-611011002	8	VCP	1958	178	3	5	Med-High
611011002-611011001	8	VCP	1958	59	3	5	Med-High
West							
611208035-611208048	12	VCP	1962	250	5	3	Med-High
611509053-611509052	8	VCP	2006	19	5	3	Med-High
611209076-611209078	8	VCP	1978	187	5	3	Med-High
611309066-601309184	8	VCP	1989	329	5	2	Med-High
611210011-611210013	6	VCP	1976	191	5	2	Med-High
611110018-611110030	8	VCP	1974	334	5	2	Med-High

Pipe ID	Diameter (inches)	Material	Installation (year)	Length (feet)	LoF	CoF	Risk Category
5-10 Year Pipe Replacements							
611310075-611310068	8	VCP	1979	221	5	2	Med-High
611109070-611109087	8	VCP	1969	198	5	2	Med-High
611209075-611209076	8	VCP	1978	11	5	2	Med-High
611309059-611309068	8	VCP	1966	268	5	2	Med-High
611310019-611310042	6	VCP	1965	296	4	4	Med-High
611310038-611310056	8	VCP	1965	500	4	4	Med-High
611309024-611309023	8	CIP	1981	59	4	4	Med-High
651410001-611410009	8	VCP	1973	111	4	4	Med-High
611310042-611310041	8	VCP	1965	199	4	4	Med-High
611307040-611307053	6	VCP	1966	413	4	4	Med-High
611607008-611607012	8	VCP	1970	353	4	4	Med-High
611209053-631209012	15	VCP	1962	562	4	4	Med-High
611309006-611309003	8	VCP	1971	607	4	4	Med-High
611310052-611310050	8	VCP	1964	418	4	4	Med-High
611210014-611210025	8	VCP	1976	219	4	4	Med-High
611310050-611309041	8	VCP	1962	290	4	4	Med-High
611510064-651410001	8	VCP	1963	262	4	4	Med-High
611110016-611110004	6	VCP	1977	376	4	3	Medium
611310037-611310011	8	VCP	1965	453	4	3	Medium
611110002-611110003	8	VCP	1976	79	4	3	Medium
611010007-611010008	10	VCP	1976	153	4	3	Medium
611209083-611209079	6	VCP	1978	88	4	3	Medium
611410078-611310025	8	VCP	1962	115	4	3	Medium
611308022-611308039	10	VCP	1962	266	4	3	Medium
611209084-611109018	6	CIP	1978	131	4	3	Medium
611209037-611209036	8	VCP	1989	248	4	3	Medium
631209012-611209079	12	VCP	1962	88	4	3	Medium
611209078-631209012	8	DIP	1975	28	4	3	Medium
611209015-611209013	10	VCP	1962	157	4	3	Medium
611607011-611607010	8	VCP	1985	182	4	3	Medium
611309044-611309059	10	VCP	1964	19	4	3	Medium
611310020-611310017	8	VCP	1962	272	4	3	Medium
611109069-611109068	8	VCP	1989	88	4	2	Medium
611409035-611409037	8	VCP	1964	312	4	2	Medium
611610038-611610037	8	VCP	2007	59	4	2	Medium
611109042-611109061	8	VCP	1962	200	4	2	Medium
611010014-611010015	8	VCP	1974	283	4	2	Medium
611109031-611109033	8	VCP	1970	350	4	2	Medium
611110030-611110041	8	VCP	1974	452	4	2	Medium
611407088-611407087	8	VCP	1961	280	4	2	Medium
611209031-611209006	8	VCP	1961	246	4	2	Medium
611408037-611408052	8	VCP	1973	412	4	2	Medium
611010038-611010030	6	VCP	1976	362	4	2	Medium
611209066-611209085	6	VCP	1978	319	4	2	Medium
611507018-611507031	8	VCP	1966	473	4	2	Medium

Pipe ID	Diameter (inches)	Material	Installation (year)	Length (feet)	LoF	CoF	Risk Category
5-10 Year Pipe Replacements							
611010003-611010006	6	VCP	1977	102	4	2	Medium
611410006-611410023	8	VCP	1973	182	4	2	Medium
611408036-611408047	8	VCP	1964	394	4	2	Medium
611207064-611207065	8	VCP	1969	221	4	2	Medium
631207001-611207045	8	VCP	1969	134	4	2	Medium
611308077-611208017	8	VCP	1961	315	4	2	Medium
611408001-611408021	8	VCP	1979	168	4	2	Medium
611507019-601507085	8	VCP	1975	204	4	2	Medium
611207065-631207001	8	VCP	1969	159	4	2	Medium
611407014-611407033	8	VCP	1966	370	4	2	Medium
611608054-611608052	8	DIP	1989	199	4	2	Medium
611408021-611408020	8	VCP	1973	290	4	2	Medium
611507001-611507016	8	VCP	1966	325	4	2	Medium
611109065-611109064	8	DIP	1976	38	4	2	Medium
611307118-611307121	8	VCP	1973	256	4	2	Medium
611410022-611410042	8	VCP	1963	264	4	2	Medium
611507069-611507068	6	VCP	1976	147	4	2	Medium
611407101-611407099	6	VCP	1977	166	4	2	Medium
611408063-611408062	8	VCP	1963	264	4	2	Medium
611207038-611207039	8	VCP	1969	177	4	2	Medium
611009021-611009038	8	VCP	1974	153	4	2	Medium
611209050-611209051	6	VCP	1976	278	4	2	Medium
611309057-611308078	8	VCP	1962	340	4	2	Medium
611411033-611411034	8	VCP	1963	234	4	2	Medium
611209073-611209077	6	VCP	1975	291	4	2	Medium
611209033-611209034	8	VCP	1997	237	4	2	Medium
611410002-611410018	8	VCP	1972	677	4	2	Medium
611207062-611207061	8	VCP	1969	250	4	2	Medium
611109093-611109091	8	VCP	1975	456	4	2	Medium
611508050-611407022	8	VCP	1970	197	4	2	Medium
611209092-611209055	8	VCP	1963	195	4	2	Medium
611608051-611608050	8	CIP	1979	79	4	2	Medium
611110003-611110001	8	VCP	1976	207	4	2	Medium
611109063-611109080	8	VCP	1976	280	4	2	Medium
611209057-611209058	6	VCP	1977	57	4	2	Medium
611110058-611111001	8	VCP	1978	117	3	5	Med-High