ASSET MANAGEMENT PLAN

2011

Albuquerque Bernalillo County
Water Utility Authority

Acknowledgement

The Albuquerque Bernalillo County Water Utility Authority (Water Authority) asset management plan was completed with the combined efforts of many members of the management, engineering, operations, and maintenance staff. Contributions were made through workshops, interviews, assistance in development and review of the asset management plan.

The Water Authority asset management plan was prepared, reviewed, and finalized under the guidance of the asset management steering committee. The efforts of the steering committee should be acknowledged.

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Executive Summary

The purpose of this asset management plan is to document the current state (e.g., asset inventory, valuation, condition, risk) of assets and to project the long-range asset renewal (rehabilitation and replacement) requirements for the Albuquerque Bernalillo County Water Utility Authority (Water Authority). An asset management plan is a long-range planning document used to provide a rational framework for understanding and planning of the asset portfolio. This 2011 Asset Management Plan consolidates the Water Authority's asset information into a structured framework and uses it to provide a justifiable basis to support long-term organization, operations, and asset management decisions.

It should be noted, the Water Authority has started preparing a set of 10-year asset management plans for various asset classes (i.e., small diameter pipes, large diameter pipes, wastewater treatment plant). The 10-year plans are designed to provide a higher confidence level through incorporation of detailed field data (i.e., condition assessment). The 10-year plans are generated to provide the Water Authority with a more accurate understanding of the short and intermediate-term renewal requirements. In contrast, this long-range, 100-year, asset management plan is developed to assist the Water Authority in understanding and preparing for asset renewal requirements beyond the 10-year horizon. This asset management plan incorporates the results from the 10-year plans to develop a comprehensive renewal outlook.

The key components of the 2011 Asset Management Plan are:

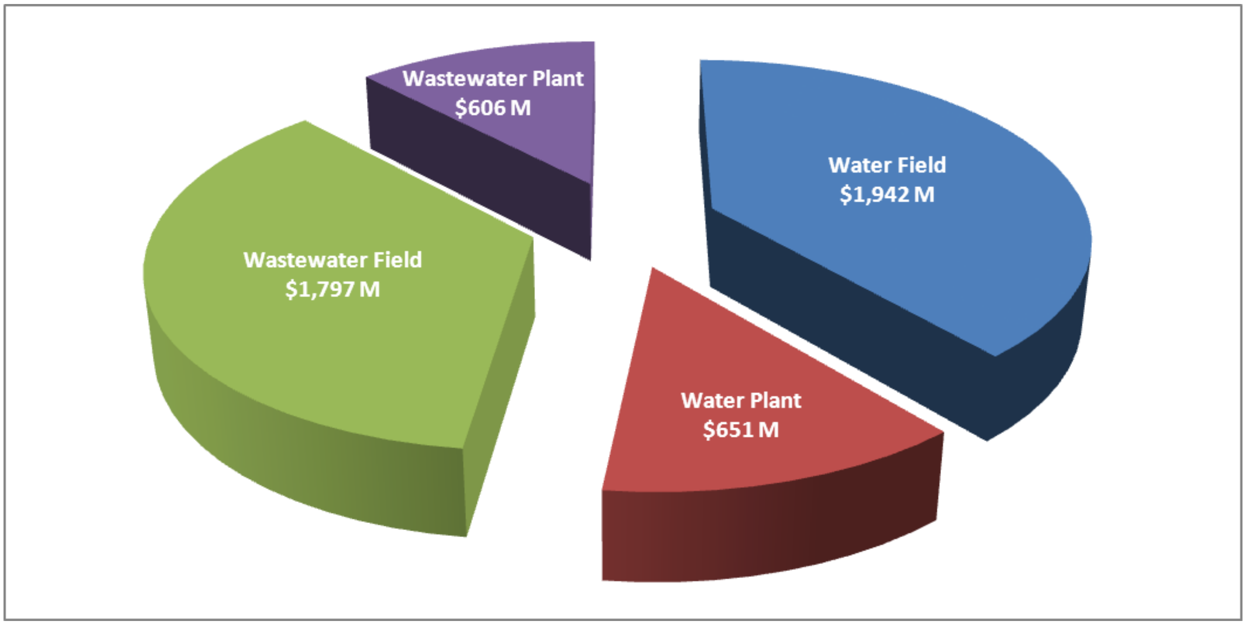
- Assets and Lifecycle Management Plan (Chapter 2) - provides information on the state of the assets. This section identifies the assets owned, presents their current status, and estimates the current replacement value.
- Asset Management Practices (Chapter 3) - outlines the plans for managing the assets, including useful lives, renewal timing, and estimated renewal costs.
- Future Demand (Chapter 4) - identifies factors influencing future demand, anticipated changes in customer expectations, and impacts of demand changes on asset utilization.
- Performance Measurement (Chapter 5) - documents the current and future service measures, based on environmental, economic, and social sustainability factors.
- Business Risk Exposure (Chapter 6) – presents the asset risk profile, based on likelihood and consequence associated with asset failure.
- Financial Summary (Chapter 8) – provides the 100-year renewal (rehabilitation and replacement) projection for treatment, collection, and distribution system assets. It also provides funding scenarios to help assess and determine an appropriate funding strategy to meet the projected renewal needs.

Detailed information can be found by referencing the appropriate sections. Key findings of the 2011 Asset Management Plan are summarized below.

Asset Valuation

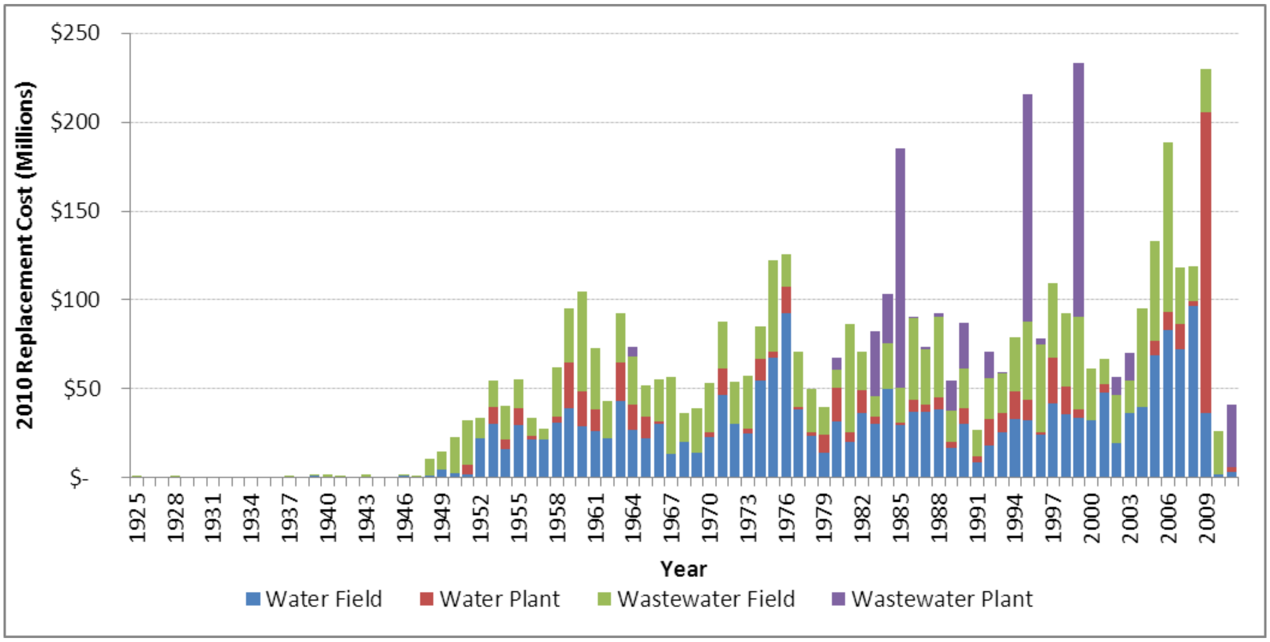
Asset valuations are an integral part of asset management. Based on the currently available asset data, the estimated value of the Water Authority's collection, distribution, and treatment assets is approximately $5 billion. A breakdown of the total valuation, based on major system (water field, water plant, wastewater field, wastewater plant), is provide in Figure ES-1 below.

Figure ES-1 2010 Water Authority System Valuation



The historical asset valuation profile provides insight into when large portions of the current asset portfolio were installed and when they will require renewal investment. The historical asset valuation profile for the Water Authority's total system is presented in Figure ES-2. The valuation represented in the figure is expressed in today's estimated replacement costs. It does not represent the actual capital investment that took place in any given year.

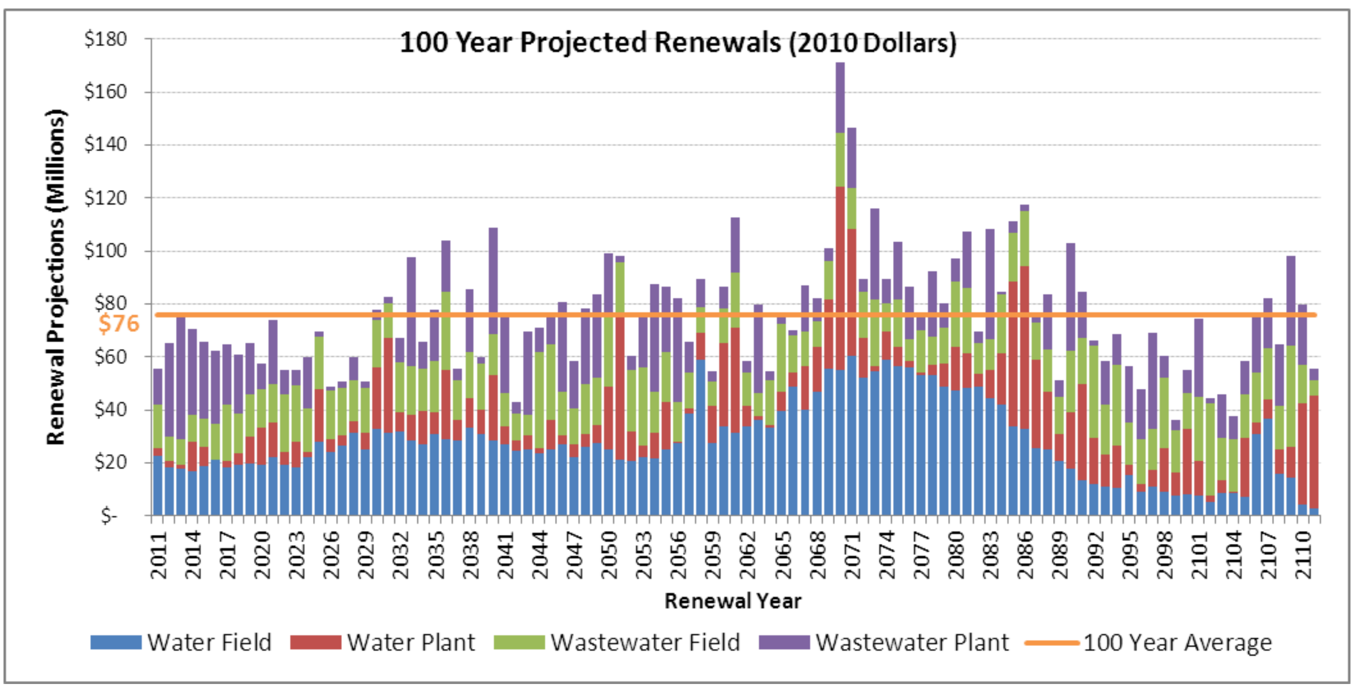
Figure ES-2 Water Authority Total System Historical Asset Valuation Profile



100-Year Asset Renewal Requirements

The Water Authority's 100-year renewal funding requirement is presented in Figure ES-3. The costs in the figure represent today's replacement costs for the assets. Inflation was not used due to the dramatic effect it has on costs in year 100 versus year 1. Based on the analysis, it is estimated that the Water Authority will need to invest $76 million per year to fully fund the projected 100-year renewal requirements. The renewal requirements for each system (water field, water plant, wastewater field, wastewater plant) are differentiated by color to identify the estimated funding requirement for each system.

Figure ES-3 Water Authority 100-year Renewal Funding Requirement (All Assets)



Funding scenarios were performed to determine a feasible funding scheme that will accommodate the projected 100-year renewal funding requirements versus the current $41 million capital budget. The six scenarios performed were as follows:

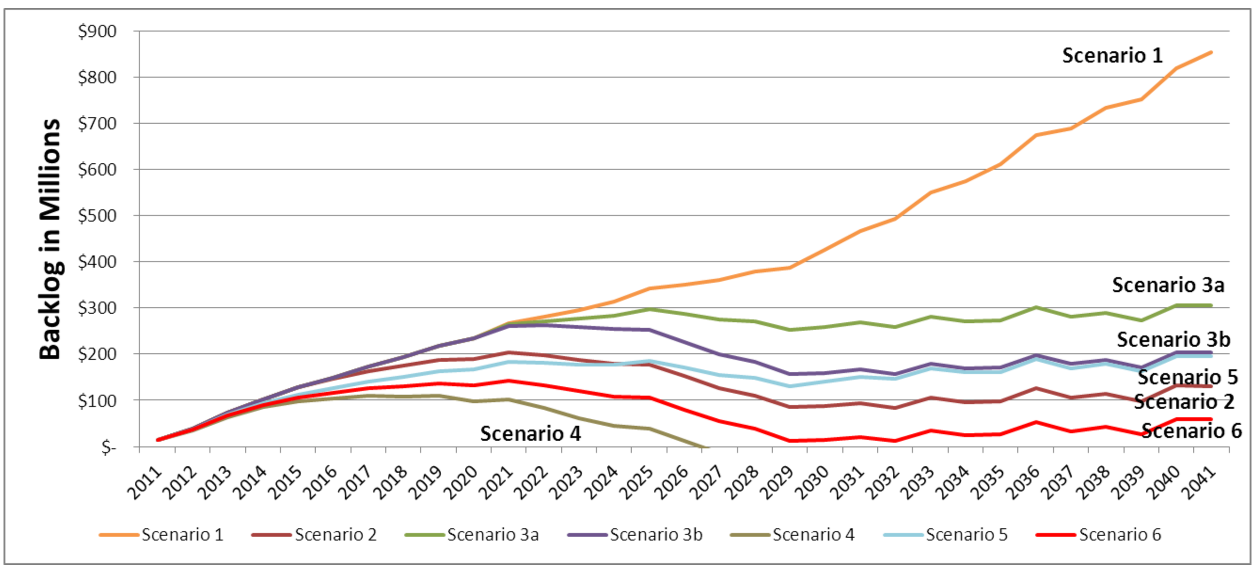
1. Scenario 1 - Fixed funding of $41 million for the first 10 years.
2. Scenario 2 - Fixed funding of $41 million for the first 5 years and then ramp up the funding by $3 million per year for next 10 years.
3. Scenario 3a - Fixed funding of $41 million for the first 10 years and then ramp up the funding by $3 million per year for next 10 years.

   Scenario 3b – Fixed funding of $41 million for the first 10 years and then ramp up the funding by $6 million per year for next 5 years.
4. Scenario 4 - Fixed funding of $41 million for the first year, then ramp up the funding by $3 million per year for next 12 years.
5. Scenario 5 - Fixed funding of $41 million for the first year, then ramp up the funding by $1.5 million per year for next 23 years.
6. Scenario 6 - Fixed funding of $41 million for the first year, then ramp up the funding by $2.25 million per year for next 16 years.

The results of the scenario analyses are presented in Figure ES-4 below. The following conclusions can be made from the scenario analyses:

- Backlog of asset renewal will continue to escalate if the Water Authority does not increase the current capital budget of $41 million.
- Investments at earlier stages are more effective in decreasing the backlog over time.
- Prioritized risk-based decision-making process can help to manage the risk level of the overall risk profile of the backlog or deferred renewals.

Figure ES-4 Scenario Results



Recommendations for Asset Management Improvement

The following high-level recommendations are made to help improve the Water Authority's asset management practices. The Water Authority should:

- Document business process flows and capture critical asset data and processes

- Continue the inventorying of plant assets and develop an asset hierarchy down to an appropriate level
- Review high risk assets and develop management strategies to promote efficiency to lower risk
- Identify assets where additional maintenance or rehabilitation would cost effectively extend lives
- Continue to improve the asset management plan on a biannual basis
- Conduct Board-level workshop to further their understanding of the asset management plan and future funding needs

1. Introduction

1.1 Background

With growing concerns over deteriorating infrastructure, limited budgets, increasing regulatory requirements, and an aging workforce, Albuquerque Bernalillo County Water Utility Authority (Water Authority) is actively engaged in refining and strengthening its asset management processes and practices. As part of this effort, the Water Authority contracted GHD to enhance its asset management program.

The Water Authority's asset management program improvement efforts focused on the seven core elements of asset management *(*Figure 1-1): *Lifecycle Processes and Practices, Information Systems, Data and Knowledge, People, Commercial Tactics, Organization,* and *Asset Management Plan*. Balance of these core elements is required to develop a successful and sustainable asset management program.

Figure 1-1 Seven Core Elements of Asset Management

For each core element, the Water Authority accomplished the following:

1. *Lifecycle Processes and Practices* – Enhanced the efficiency, transparency, and consistency of the business decision-making process.
2. *Information Systems* – Increased the system integration, functionality, and support capabilities.
3. *Data and Knowledge* – Captured, organized, and documented asset information.
4. *People* – Provided a platform for managing and sharing information and knowledge.
5. *Commercial Tactics* – Focused on effective delivery of projects and services.
6. *Organization* – Established sound, strategic support for asset management practices.
7. *Asset Management Plan* – Documented the current state of the Water Authority's assets and future requirements.

An asset management plan is a long-range planning document used to provide a rational framework for understanding the assets an organization owns, services it provides, risks it exposes, and financial investments it requires. The Water Authority developed the asset management plan to better understand its long-range asset renewal (rehabilitation and replacement) funding requirements and to document current business practices with respect to asset management. The asset management plan is intended to become a living document to be updated by the Water Authority and continually refined as part of an annual ongoing asset management and business improvement processes.

The Water Authority has traditionally performed many of these tasks across the organization; however, the results of this work have not been consolidated into one concise document. As such, it should be noted, the Water Authority has started a program of preparing a set of 10-year asset management plans for various asset classes (small diameter pipes, large diameter pipes, wastewater treatment plant). These plans are based on much more detailed evaluations (i.e., condition assessment), providing a more rigorous understanding of the current conditions, which can be translated into action plans.

Smith Engineering developed a 10-year asset management plan for small diameter pipes. Carollo Engineers developed a 10-year asset management plan for large diameter wastewater pipes. Brown and Caldwell helped to develop a decade plan that identified capital projects for the wastewater treatment plant over the next 10 years. The results of these 10-year plans were incorporated in the 2011 Asset Management Plan to develop a comprehensive plan.

The Water Authority developed the 2011 Asset Management Plan under the policies, ordinances, and guidelines identified in Appendix A.

1.2 Asset Management Plan

As the first version of the Water Authority's asset management plan, the focus was on developing and identifying areas for enhancement. As more data becomes available and the asset management processes and practices mature, the next versions of the asset management plan will incorporate a more refined implementation of each core process.

1.2.1 What is an asset management plan?

An asset management plan is a long-range planning document used to provide a rational framework for the following:

- Identifying assets the Water Authority owns and manages
- Defining current and proposed levels of service
- Forecasting future financial commitments required
- Analyzing the business risk exposure
- Linking business objectives and service levels

An asset management plan consolidates and documents information currently available for infrastructure assets and service delivery programs. An asset management plan is a written representation of the intended asset management programs for the infrastructure assets.

1.2.2 Why is an asset management plan needed?

Some infrastructure assets are beginning to reach maturity. Aging assets are reaching a time in which they are beginning to fail, and in some cases, failing with significant consequences. In years past, there were far fewer assets to manage. Assets were often visible and younger. However, with the rapid development of communities, the number of assets required to meet the growing demand has increased exponentially. As a result, assets could no longer be managed effectively relying on the historical management practices. Operation and maintenance (O&M) staff are often faced with having to manage in a reactive mode. In order to improve management practices, asset management helps to answer the following five core questions of asset management:

1. What is the current state of my assets?
2. What is my required sustained level of service?
3. Which assets are critical to sustained performance?
4. What are my best O&M and CIP investment strategies?
5. What is the best long-term funding strategy?

An asset management plan is intended to answer the preceding questions. An asset management plan enables the organization to have the information required to make the right decision, at the right time, at the right cost, for the right reason.

By implementing core asset management processes, the Water Authority will gain knowledge of the assets owned, the remaining useful life to manage, the amount of investment required, and the business risk it faces. The asset management plan will provide the Water Authority with a foundation to promote sustainable management practices.

1.2.3 How can an asset management plan be applied?

The following points list the key benefits of an asset management plan:

- **Road map for future asset commitments.** Develop a funding model to estimate the revenues required to manage infrastructure at the established levels of service.
- **Effective use of existing funds.** Optimize the use of current funds to achieve the best value from both capital improvement programs and operations and maintenance budgets.
- **Future asset requirements.** Identify future long-term projects and strategies to deliver the most cost-effective service option from a life cycle asset management perspective.
- **Risk identification.** Identify future business risks impacting the organization from both a level of service and cost of service perspectives.

Developing an asset management plan will require the Water Authority to complete and master the following activities:

- Identify assets where rehabilitation or replacement will be cost effective.
- Understand and manage critical assets.
- Focus maintenance efforts using risk.
- Optimize its maintenance and capital needs to reduce the life cycle cost of ownership.
- Understand the long-term future renewal, rehabilitation and replacement expenditure requirements of the organization and assist in the development of plans to mitigate the various expenditure peaks.

1.2.4 2011 Asset Management Plan outline

The Water Authority's asset management plan was developed based on the five fundamental questions of asset management presented above. Figure 1-2 below presents the core processes (10-step process) used to develop the asset management plan with respect to the five fundamental questions of asset management.

Figure 1-2 Core Processes for Asset Management Plan Development

The outline and a brief description of each chapter of the Water Authority's asset management plan is presented below.

Executive Summary emphasizes the key issues contained in the body of the asset management plan.

Chapter 1: Introduction defines asset management plan and explains the purpose of developing the plan. The chapter also introduces the Water Authority and documents the background and vision of Water Authority's asset management program.

Chapter 2: Lifecycle Management Plan provides the information on state of the assets. This chapter identifies the assets owned, presents the current status, and estimates the replacement value.

Chapter 3: Asset Management Practices outlines the plans for managing the assets (management strategies) including useful lives, renewal timing, condition trigger, and estimated renewal costs.

Chapter 4: Future Demand identifies factors influencing future demand, anticipated changes in customer expectations, and impact of changes in demand on asset utilization

Chapter 5: Levels of Service documents the current and future levels of service based on Triple Bottom Line (Environment, Economic, and Social) factors.

Chapter 6: Business Risk Exposure details the business risk exposure the assets present to the Water Authority and provides the results of risk mapping

Chapter 7: Plan for Improvement and Monitoring documents the plan for monitoring the performance of the asset management plan including any improvements necessary.

Chapter 8: Financial Summary lists the capital projects generated from previous chapters and presents the 100-year capital renewal funding requirements for the Water Authority. It also includes scenario analysis to help determine a sustainable funding scheme to meet the projected renewal needs.

References & Appendices will include any reference documents necessary to support the asset management plan.

1.3 Albuquerque Bernalillo County Water Utility Authority

The Water Authority is responsible for providing quality water in sufficient quantity, collecting and treating wastewater to acceptable standards, performing professional utility planning and engineering services, and providing customer services to all customers and stakeholders. The Water Authority operates and maintains assets including water treatment plants, water pump stations, reservoirs, wells, water lines, wastewater reclamation plants, a soil amendment facility, sewage lift stations, odor control facilities, sanitary sewer lines, reuse water pump stations, reservoirs, and reuse water lines.

1.3.1 History

The New Mexico Legislature adopted legislation creating the Albuquerque Bernalillo County Water Utility Authority (Water Authority) in June 2003 to develop a regional water utility to further communication and cooperation between the City of Albuquerque (City) and Bernalillo County (County) on water and sewer services. All functions, appropriations, monies, records, equipment and other real and personal property pertaining to the Water/Sewer System were transferred to the Water Authority from the City and County. Under the provisions of the legislation, the Water/Sewer System was transferred to the Water Authority in December 2003, after the New Mexico Public Regulation Commission completed an audit of the Water/Sewer System.

1.3.2 Organization

The Water Authority is a political subdivision of the state, and is governed by an eight-member Governing Board consisting of three Albuquerque City Councilors, three Bernalillo County Commissioners, the Mayor of Albuquerque, and a non-voting member from the Village of Los Ranchos de Albuquerque.

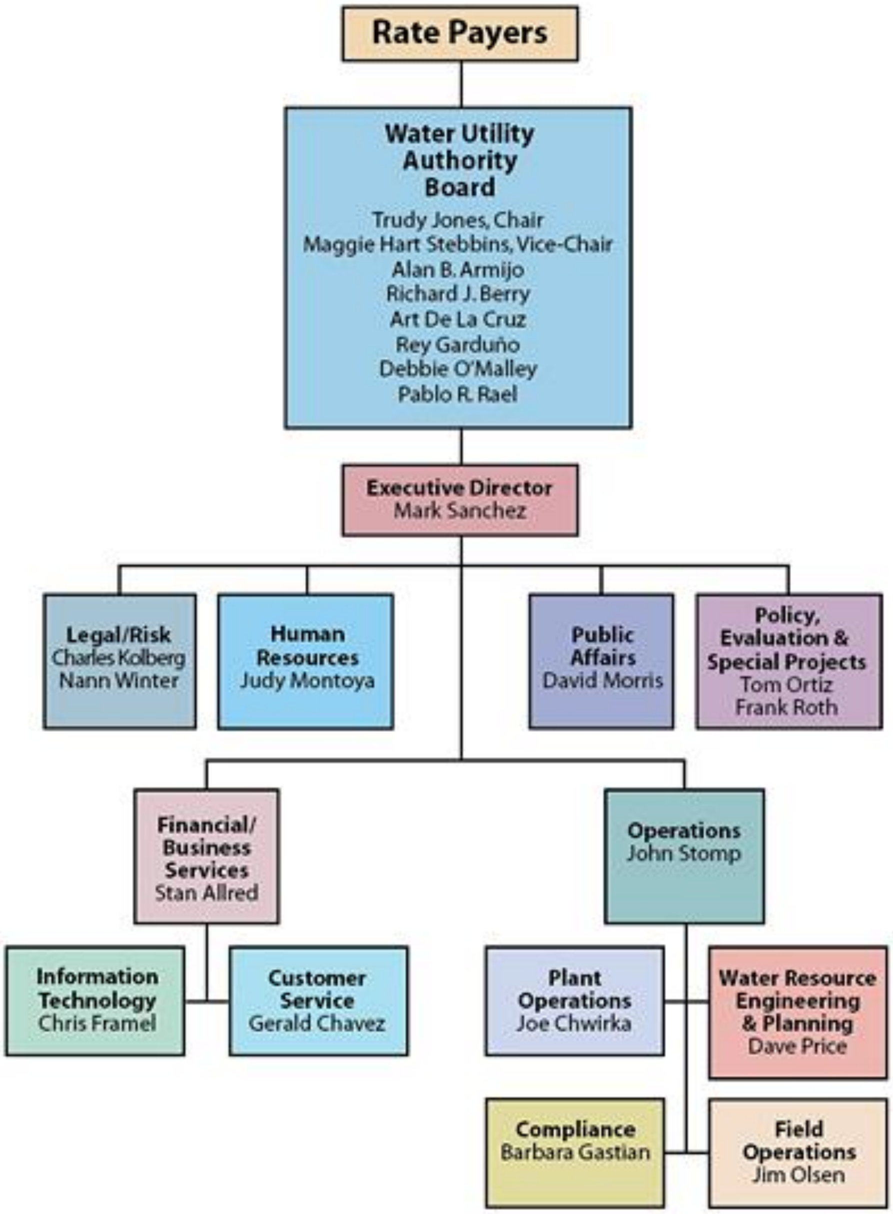
The Water Authority has:

- 605 employees
- 200,000 customer accounts, representing some 550,000 water users
- 102 active wells, with several groundwater treatment facilities
- 3,000+ miles of water supply pipeline
- 90 million gallon per day surface water treatment plant
- 2,400+ miles of sewer collector pipeline
- 76 million gallon per day wastewater reclamation plant
- Reclaimed water systems
- 62 water storage reservoirs (potable and reuse)
- More than $5 billion in collection and distribution physical assets (not including vehicles and heavy equipment)
- Bond ratings: Standard & Poor's - AAA; Moody's – Aa3; Fitch - AA (positive outlook)
- $172 million operating budget (FY 2011)
- $47.5 million capital budget (FY 2011)

- $1.1 billion in water rights

Figure 1-3 presents the current organization chart for the Water Authority.

Figure 1-3 Water Authority Organization Chart



1.3.3 Service Area and Facilities

Water System

The Water Supply System Plan and the Sanitary Sewer System Master Plans were established in 1982.

Major water system assets:

- San Juan-Chama Drinking Water Treatment Plant
- Adjustable diversion dam, intake structure and raw water pump station on the Rio Grande
- 102 active groundwater supply wells
- 62 water supply reservoirs, providing a combination of surface and ground water
- 3,130 miles of water supply pipeline
- 5 MGD arsenic removal treatment plant

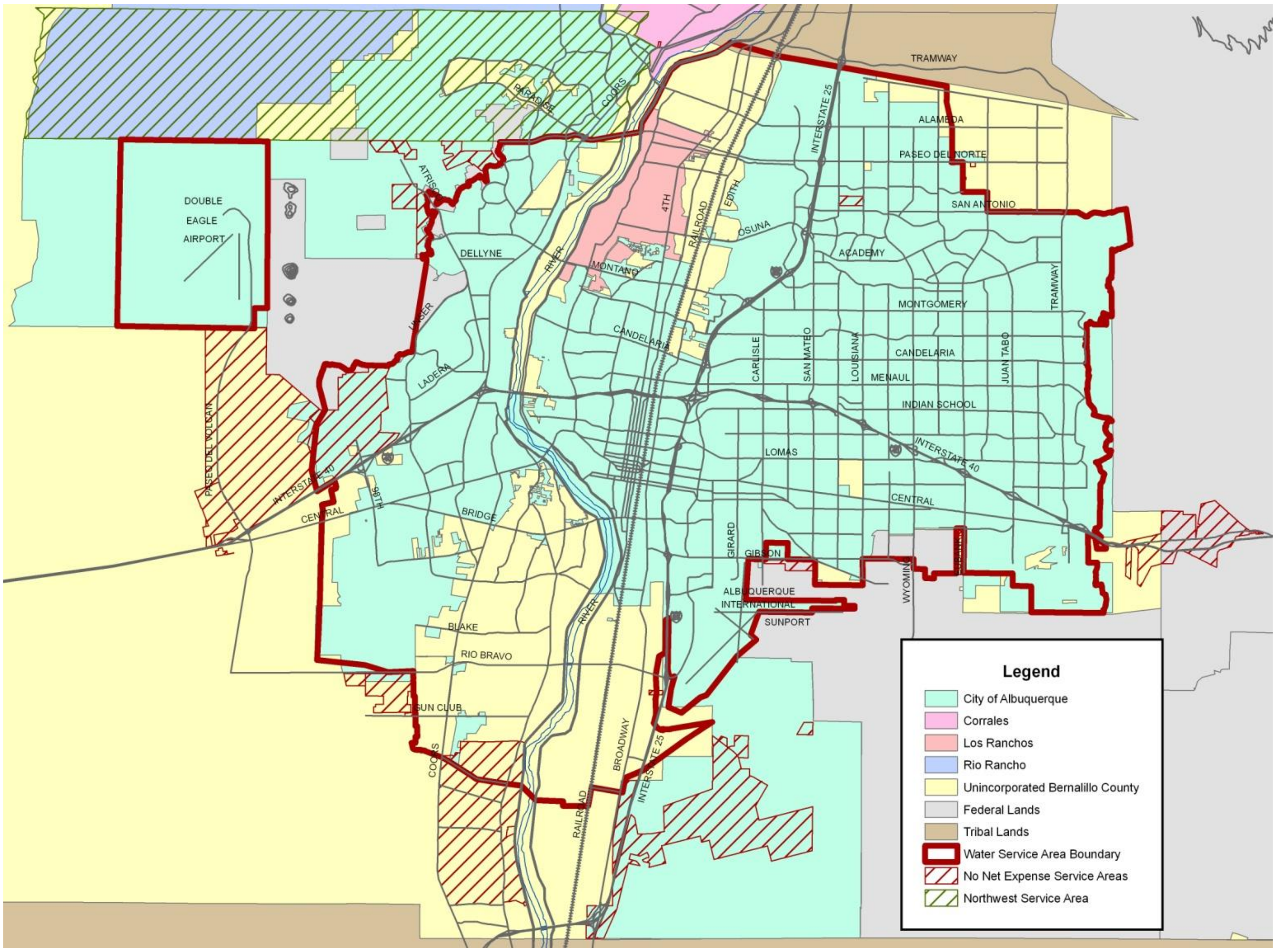
The water system provides water services to approximately 550,000 residents comprising approximately 88% of the residents of Bernalillo County, New Mexico. About one-third of unincorporated County residents are customers of the water system. Service is provided to approximately 200,000 accounts. Approximately 88% of the water sales are for residential uses. Up until December 2008, ground water from the middle Rio Grande basin aquifer was the Water Authority's only source of supply used for the Drinking water system. Now, the Water Authority is using a combination of ground water and surface water from its newly completed Surface Water Treatment Plant which treats imported Colorado River water (San Juan-Chama water) from the Rio Grande for potable water use. The new treatment plant has the capacity to produce 92 MGD and can be expanded to 120 MGD. The San Juan-Chama Drinking Water Project is part of the Water Authority's strategic plan to provide for a safe and sustainable water supply through conservation and the conjunctive use of surface water, reclaimed water, and shallow and deep groundwater.

The ground water supply is produced from 102 wells located throughout the metropolitan area. Total well production capacity is approximately 294 MGD. Maximum historical peak day demand is 214 MGD. Ground storage reservoirs that hold both surface and ground water provide for fire, peak hour, and uphill transfer storage. Water is distributed from higher to lower elevations through a 115-foot vertical height pressure zone to provide minimum static pressures of 50 psi for consumers. There are 62 reservoirs located throughout the service area, with a total reservoir storage capacity of 236 million gallons that serve the main Water Authority system. These reservoirs are interconnected by over 3,000 miles of pipelines and are situated at various locations east and west of the service area to provide multiple sources of supply to customers and for operating economies.

The water system takes advantage of the unique topography of the Water Authority's service area, which allows ground level storage while simultaneously providing system pressure by gravity. Control of the water system is provided by remote telemetry units distributed throughout the System for control from a central control facility. The water system Service Area is approximately 167 square miles (Figure 1-4).

Any extension of service outside the Service Area would incur "no net expense" to the Water Authority's customers in that that revenue generated from any expansion or improvement of the System shall be sufficient to support the costs of the water and/or wastewater facilities being expanded or improved. In addition, the new developments outside the water service area are required to pay a water supply charge for acquisition of future water supplies. In 2007, the Water Authority adopted a set of guiding principles for utility development and planning. Some of the major policies include: balancing water use with renewable supply, not subsidizing development outside the service by current Water Authority customers, linking land use with infrastructure, ensuring that system expansion is concurrent with infrastructure service levels, protecting valued environmental and cultural resources of the region, and utilizing asset management principles for evaluating and considering rehabilitating, replacing or acquiring new assets.

Figure 1-4 Water System Service Area Map

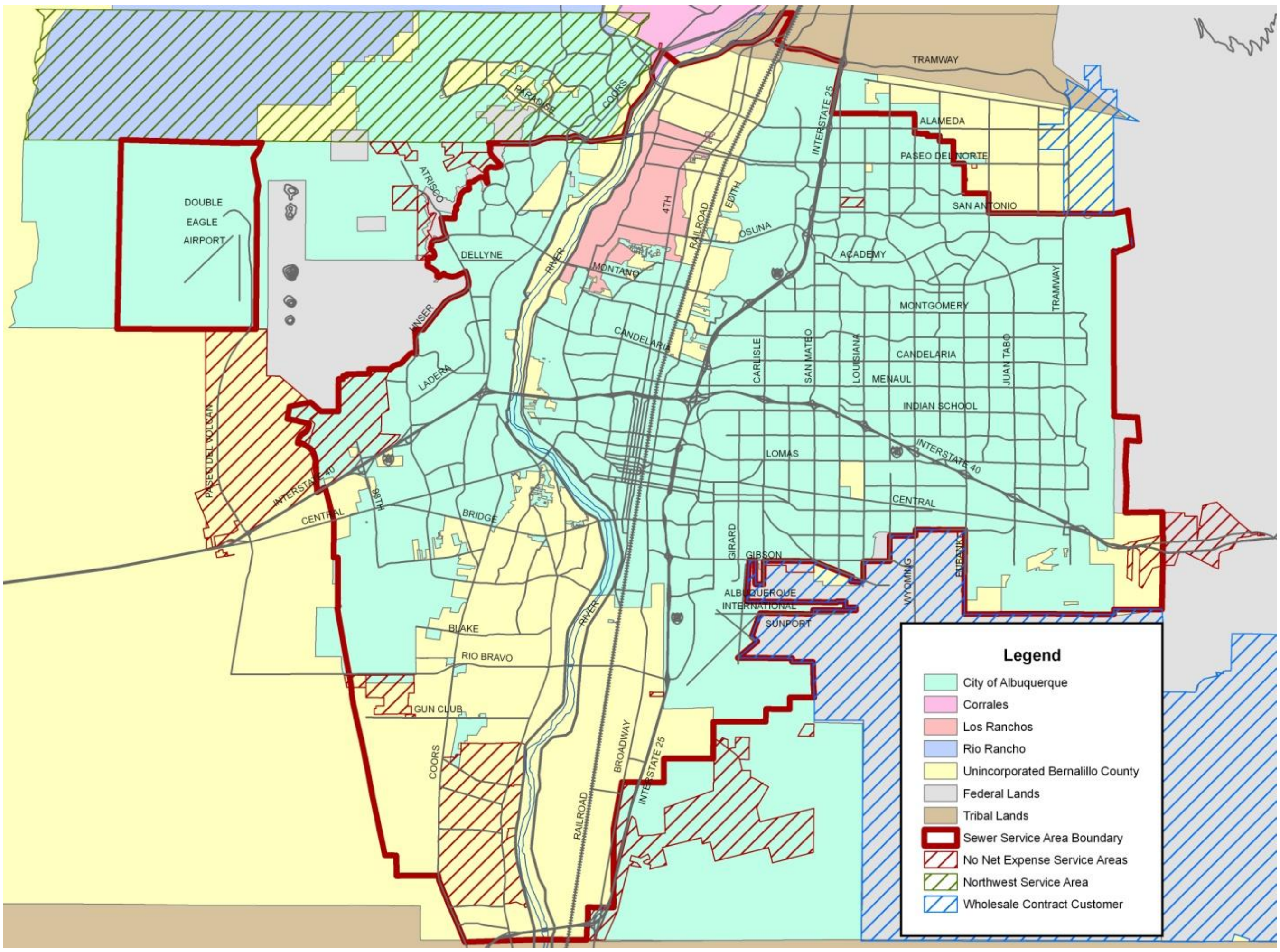


In May 2009, the Water Authority acquired New Mexico Utilities, Inc., a private utility in the northwest section of Bernalillo County. Now referred to as the Northwest Service Area, these customers have been incorporated into the water system and pay the same rates as current customers. The new rates reflect the cost of providing a sustainable long-term supply via the San Juan-Chama Drinking Water Project, and the cost of conservation programs designed to ensure the long-term water future in Albuquerque and Bernalillo County.

Wastewater System

The wastewater system consists of small diameter collector sewers, sewage lift stations, and large diameter interceptor sewers conveying wastewater flows to the Southside Water Reclamation Plant. The treatment plant provides preliminary screening, grit removal, primary clarification and sludge removal, advanced secondary treatment including ammonia and nitrogen removal, final clarification, and effluent chlorination and dechlorination prior to discharge to the Rio Grande. Treatment plant capacity is based upon overall 76 MGD hydraulic capacity. However, capacity deficiency at the chlorination/dechlorination, anaerobic digestion, and dewatered sludge handling facilities needs to be addressed to bring these facilities to the 76 MGD plant hydraulic capacity. The existing chlorination/dechlorination system is being replaced by ultraviolet light disinfection in Spring 2011. Existing flows at the plant are about 54 MGD. The wastewater system service area is approximately 303 square miles (Figure 1-5).

Figure 1-5 Wastewater System Service Area Map



The secondary service area designates Wholesale-Special Contracts. These contract customers are responsible for a collection system beyond the point where their respective wastewater discharges into the Water Authority's interceptors.

Major wastewater system Assets:

- Southside Water Reclamation Plant
- 35 Lift Stations
- 10 Vacuum Stations
- 2,400 miles of collection pipeline

Any extension of service outside the service area would incur “no net expense” to the Water Authority’s customers in that revenue generated from any expansion or improvement of the System shall be sufficient to support the costs of the water and/or wastewater facilities being expanded or improved.

In 2007, the Water Authority adopted a set of guiding principles for utility development and planning. Some of the major policies included:

- Promoting reuse
- Reducing odor
- Improving treatment capacity
- Improving capacity in the collection system
- Not subsidizing development outside the service by current Water Authority customers
- Linking land use with infrastructure
- Ensuring that system expansion is concurrent with infrastructure service levels
- Protecting valued environmental and cultural resources of the region
- Utilizing asset management principles for evaluating and considering rehabilitating, replacing or acquiring new assets

2. Assets and Lifecycle Management Plan

The lifecycle management plan provides a snapshot of the current state of the Water Authority assets. This chapter documents what assets are owned by the Water Authority, how they are organized, how old they are, and their estimated worth. This information is the basis for the foundation of the asset management plan. This information is used to project the long-range renewal (rehabilitation and replacement) forecasting, which provides the basis for future budgeting and asset management decision making.

2.1 Asset Register

Understanding the current state of the assets requires consolidating information about the assets owned and managed in a central location (asset register). An asset register records all of the organization's managed assets and the associated key attributes required to support asset management decisions. It also forms links between all asset-related applications and supports the structure in which the information systems enable the assessment of the assets as individual components, composite assets, or groups of assets. The asset register forms the basis for the asset hierarchy, valuation, risk assessment, and long-range renewal forecasting.

All asset data provided by the Water Authority was consolidated into a single database, the asset register. All consolidated assets were divided into four major systems: water field, water plant, wastewater field, and wastewater plant. The following sections summarize the assets contained in each system and document the management strategies used to develop the asset management plan.

During the asset consolidation process, data gaps were identified and mitigations strategies were developed to fill in the critical gaps. More information on the data gap mitigation strategies is presented in Section 3.3 of the asset management plan.

2.1.1 Water Field

The water field system consists of linear assets related to the distribution of potable and reuse water. Table 2-1 lists the asset classes that make up the water field system.

Table 2-1 Water Field System Asset Classes

Potable	Reuse
Pipes	Pipes
Hydrants	Hydrants
Valves	Valves
Manholes	Manholes
San Juan-Chama Distribution Pipes	

The inventory of the water field asset classes, based on the available data from the Water Authority, is summarized in Table 2-2.

Table 2-2 Water Field System Inventory

Asset Class		Inventory
Potable	Water Pipes (≤ 12 inch)	2,651 miles
	Water Pipes (> 12 inch)	414 miles
	Water Valves	37,965
	Water Hydrants	16,100
	Water Manholes	128
	San Juan-Chama Distribution Pipes	37 miles
Reuse	Reuse Pipes (≤ 12 inch)	10 miles
	Reuse Pipes (> 12 inch)	18 miles
	Reuse Valves	155
	Reuse Hydrants	5
	Reuse Manholes	9

The water field system is comprised mostly of potable water pipes. Table 2-3 further differentiates the potable water pipe information by pipe material and size. This table summarizes the GIS information made available to develop the asset management plan. The GIS pipe data did not include pipes not owned by the Water Authority and pipes that were decommissioned or no longer in service.

The Water Authority's water pipe system includes the following material types:

- Asbestos cement (AC)
- Cast iron (CI)
- Concrete cylinder (CCYL)
- Corrugated metal (CMP)
- Copper line (CPRLN)
- Ductile iron (DIP)
- Galvanized steel (GSP)
- Linear wrapped steel (LWS)
- Polyvinyl chloride (PVC)
- Reinforced concrete (RCP)
- Steel (STL)
- Unknown (UNK)

Table 2-3 Potable Water Pipe Inventory

Diameter (inch)	AC	CCYL	CI	CMP	CPRLN	DIP	GSP	LWS	PVC	RCP	STL	UNK	Total (ft)	Total (miles)
1	317	61	725		105	1,228	2,526	137	1,640		954	252	7,946	1.5
2	1,907	247	74,078		253	102	8,871	146	7,194		4,089	37	96,923	18.4
3	47		2,254						2,696			23	5,020	1
4	49,644	1,614	236,682			6,414		4,474	113,509	160	67,301	186	479,982	90.9
5	121		109					8,644	837		6,606		16,317	3.1
6	1,352,029	6,742	3,936,344	62		66,510	1,297	5,046	3,144,888	128	106,335	6,749	8,626,130	1,633.7
8	209,727	1,336	220,295			51,209	352	3,053	1,733,358	932	40,591	3,698	2,264,551	428.9
10	191,424	7,102	244,758			49,372	37	743	773,668	44	18,810	2,308	1,288,266	244
11											1,974		1,974	0.4
12	135,605	11,462	494,069			73,980	15	1,155	467,235	952	24,038	3,644	1,212,154	229.6
13			2,313					5,896			2,539		10,747	2
14	71,903	29,638	75,455			63,439			40,495	1,044	5,432	45	287,450	54.4
15			462	159						705	1,537		2,862	0.5
16	11,499	286,033	129,860			79,603		23	30,100	467	26,087	2,860	566,533	107.3
18	4,952	59,967	17,885			41,415			8,734	3,698	3,891	844	141,442	26.8
20	3,993	103,015	49,531			36,388		1,261	24,709	1,251	33,596	2,746	256,489	48.6
21			31							1,609			1,640	0.3
22			29						203		6,780	40	7,052	1.3
24	3,735	223,020	59,133	97		80,331		2,881	48,147	2,875	5,617	97	425,933	80.7
30	1,063	79,865	42,425			27,722		19	1,613	3,872	805		157,383	29.8
36	1,127	207,831	12,558	149		11,855			3,955	6,702	3,566	43	247,787	46.9
42	2,138	55,536	945			2,924			298	2,904	76	85	64,905	12.3
48		9,643	3,835			753				40			14,271	2.7
54		615									500		1,115	0.2
62									85				85	0
Total (ft)	2,041,231	1,083,724	5,603,775	466	357	593,244	13,097	33,477	6,403,363	27,381	361,123	23,656	16,184,954	3,065.3
Total (miles)	386.6	205.3	1,061.3	0.1	0.1	112.4	2.5	6.3	1,212.8	5.2	68.4	4.5	3,065.3	

2.1.2 Water Plant

The water plant system represents assets related to the production, treatment, pumping and storage of potable and reuse water (vertical assets). Table 2-4 below presents the asset classes that make up the water plant system.

Table 2-4 Water Plant System Asset Classes

Potable	Reuse
Reservoirs	Reservoirs
Pump Stations	Pump Stations
Wells	
San Juan-Chama Drinking Water Plant	
Diversion Dam, Intake Structure, Fish Passage	
Raw Water Pump Station	
Groundwater Treatment Facilities	

The inventory of the water plant assets is summarized in Table 2-5. This inventory is based on the available data from the Water Authority,

Table 2-5 Water Plant System Inventory

Asset Class		Inventory
Potable	Reservoirs	58
	Pump Stations	39
	Wells	102
	San Juan-Chama Drinking Water Plant	21*
	Diversion Dam, Intake Structure, Fish Passage	1**
	Raw Water Pump Station	1**
	Groundwater Treatment Facilities	6
Reuse	Reservoirs	4
	Pump Stations	6

** This number (21) represents the high-level processes and facilities listed in the itemized bid document (SJC Cost Breakdown). Individual asset data below the process/facility were not available.*

*** Diversion Dam, Intake Structure, Fish Passage and Raw Water Pump Station were not in the asset database. The Water Authority requested that they be added to the future renewal analysis. Detailed asset information for these assets are currently not recorded.*

2.1.3 Wastewater Field

The wastewater field system consists of linear assets related to the collection of sewage. Table 2-6 lists the asset classes that make up the wastewater field system.

Table 2-6 Wastewater Field System Asset Classes

Wastewater Field	
Wastewater Pipes	Lift Stations
Manholes	Odor Stations
Air Vac Pits	Buffer Tanks

The inventory of the wastewater field assets, based on the available data from the Water Authority, is summarized in Table 2-7.

Table 2-7 Wastewater Field System Inventory

Asset Class		Inventory
Wastewater Field	Pipes (> 12 inch)	248 miles
	Pipes (≤ 12 inch)	2,161 miles
	Manholes	46,583
	Lift Stations	45
	Odor Stations	16
	Buffer Tanks	29
	Air Vac Pits	3,129

Based on the GIS data made available for wastewater pipes, Table 2-8 below provides a detailed inventory of collection pipe by pipe material and size. The wastewater pipe inventory excludes pipes not owned by the Water Authority and pipes no longer in service.

Water Authority's wastewater pipe system includes the following material types:

- Asbestos cement (AC)
- Cast iron (CI)
- Concrete (CP)
- Ductile iron (DIP)
- Fiberglass
- Polyethylene (POL)
- Polyvinyl chloride (PVC)
- Polyethylene (PE)
- Reinforced concrete (RCP)
- T-LOCK lined reinforced concrete (RCP T-LOCK)
- Steel (STL)
- Vitrified clay (VCP)
- Unknown (UNK)

Table 2-8 Wastewater Pipe Inventory

Diameter (inch)	AC	CI	CP	DIP	Fiber glass	POL	PVC	RCP	RCP T-LOCK	VCP	UNK	PE	STL	Total (ft)	Total (miles)
1							2,511							2,511	0.5
2							24,727							24,727	4.7
3	77	96					99,877				49			100,098	19.0
4	952	3,769		1,889			369,412			665	274	576		377,537	71.5
6	16,270	1,811		4,969			298,573			318	2,717			324,659	61.5
7			1,153							389				1,541	0.3
8	94,276	33,279	1,944,376	62,238		580	4,124,278	4,696		3,383,273	45,810	2,252		9,695,268	1,836.2
10	11,120	2,716	31,459	1,622	4,545		214,623	505		70,884	2,700			340,176	64.4
12	158	7,323	141,455	4,682			206,562	8,349		172,601	1,618	644	485	543,877	103.0
14							1,294							1,294	0.2
15	5,204		14,942	2,241			97,988	38,813		70,099				229,287	43.4
16	10,842	1,889		996			1,786							15,513	2.9
18	902		11,681	6,333	2,977		89,724	73,463		53,436	460			238,977	45.3
20		580	719	143			74	1,720		463				3,697	0.7
21	8,455		9,212	65			36,356	39,159		24,268				117,516	22.3
24	7,351	2,371	3,208	8,494		5,182	99,564	37,132		22,838	725			186,865	35.4
27			406				11,952	19,893			1,245			33,496	6.3
30	6,912	1,712	771	9,330	375		6,552	24,278		549				50,478	9.6
33							3,455	5,865				206		9,526	1.8
34							55							55	0.0
36	3,014	1,660	1,024	170		2,013	15,039	66,022		1,747	3,756	1,900		96,343	18.2
40								178						178	0.0
42		1,400	789	334		7,559	2,503	39,136	3,053				138	54,913	10.4
48			1,669				16,886	102,127	3,226		200	15,547		139,655	26.4
52		80												80	0.0
54							1,328	49,444	4,818					55,589	10.5
60							1,666	20,704						22,370	4.2
66							526	1,851	1,293					3,670	0.7
72		91			3,039		98	38,270		31				41,529	7.9
78								8,258						8,258	1.6
Total (ft)	165,534	58,777	2,162,865	103,506	10,935	15,334	5,727,409	579,861	12,390	3,801,562	59,554	21,124	623	12,719,683	2,409.0
Total (miles)	31.4	11.1	409.6	19.6	2.1	2.9	1,084.7	109.8	2.3	720.0	11.3	4.0	0.1	2,409.0	

2.1.4 Wastewater Plant

The wastewater plant system consists of vertical assets related to the treatment of sewage. Table 2-9 lists the asset classes that make up the wastewater plant system. The asset classes for the wastewater plant were developed around the major treatment processes.

Table 2-9 Wastewater Plant System Asset Classes

Wastewater Plant Areas
Support Facilities
Preliminary Treatment
Primary Treatment
Activated Sludge
Combined Effluents
Residuals Handling

The inventory of the wastewater plant assets is summarized in Figure 2-10. The Water Authority completed an inventory of all Wastewater Plant assets in Jan 2010. It is the Water Authority's intent to use the updated wastewater plant inventory information to enhance future iterations of the asset management plan.

Table 2-10 Wastewater Plant System Inventory

Asset Class		Inventory
Wastewater Plant Areas	Support Facilities	15
	Preliminary Treatment	4
	Primary Treatment	6
	Activated Sludge	10
	Combined Effluents	6
	Residuals Handling	26

A list of assets within each asset class is presented in Table 2-11.

Table 2-11 Wastewater Plant System Inventory

Support Facilities		
Flow Metering Facilities	Process Flow Structures	Misc. Yard Structures
Water Quality Laboratory	Laboratory Equipment	Vehicle Maint. Facility
Engineering Trailer	Admin/Tech Services	Div.Office/Line Maint.
Training Building	Maintenance Building	Control Building
Vactor Building		Misc. Storage Bldgs/Pads
Preliminary Treatment		
Lift Station No. 11	Prelim Treatment Facility	
Odor Control for PTF	Ferrous Chloride Facility	
Primary Treatment		
Primary Clarifiers 1-4	Primary Clarifiers 5-8	Primary Pump Stations 1 & 2
Primary Sludge PS #3	Septage Receiving Facility	Odor Control Facilities
Activated Sludge		
Activated Sludge	Aeration Basins 1-6	Aeration Basins 7-8
Aeration Basins 9-14	Final Clarifiers 1-4	Final Clarifiers 5-8
Final Clarifiers 9-12	New Final Clarifiers	S Aeration Blower Building
N Blower/Chem Building		
Combined Effluents		
Chlorination Facility	Chlorine Contact	Reaeration
Dechlorination	Effluent Outfall	Effluent Reuse Facility
Residuals Handling		
Sludge Blending Facility	Blended Sludge PS	Blended Sludge Tank Odor Control
Sludge Thickening (DAF)	DAF Odor Control	Dewatering Facility Odor Control
Digesters 1-5	Digesters 6-10	Digesters 11-14
Gas Storage Facility	Gas Compression Facility	Cogeneration Facility Expansion
Gas Flare	Cogeneration Facility	Sludge Dewatering Facility
Sludge Drying Beds	Septage Handling Facility	Soils Amendment Facility
SAF Equipment	Elec/Control Structures	Pavement/Roads
Landscaping	Diversion Channel	Elec/Control Systems
Site Improvements	Yard Piping	

2.2 Asset Hierarchy

An asset hierarchy provides a structured framework for organizing the assets in the asset register. A hierarchy must have a structured relationship (parent-child) allowing consistent roll-up / roll-down of data. The hierarchy will allow the Water Authority to easily locate an asset and amalgamate data (e.g., valuation, risk, remaining life) required to support asset management decisions.

Figure 2-1 captures the Water Authority's high-level asset hierarchy. At the highest level the Water Authority's asset hierarchy is divided into plants and field. The next level in the hierarchy further differentiates the plants and field into water and wastewater systems. From there, the assets are categorized in to the four major systems (water plant, wastewater plant, water field, wastewater field). Within a system, assets are further differentiated by asset type (e.g., potable, reuse), processes (e.g., preliminary, secondary), facilities (support facilities), and asset classes (e.g., pipes, valves, meters).

The Water Authority is working towards completing the asset inventory for its asset systems. As this process is completed, and supporting data becomes available, the Water Authority intends to further enhance and/or drill down the asset hierarchy in more detail.

Figure 2-1 Water Authority Asset Hierarchy

- Albuquerque Bernalillo Water Utility Authority
  - ABCWUA PLANTS
    - Water Plant
      - -Potable
        - Reservoirs
        - Pump Stations
        - Wells
      - -Reuse
        - Reservoirs
        - Pump Stations
      - -San Juan Chama Surface Water Plant
        - SCADA
        - Yard Piping
        - Grit Removal
        - Settled Water Storage Basin
        - Pre-sedimentation Pump Station
        - Settle Water Pump Station
        - Rapid Mix Facility
        - Flocculation-Sedimentation Facility
        - Ozone Facility
        - Ozone Contractors
        - Filtration Facility
        - Finished Water Drop Box
        - Finished Water Storage Tanks
        - Finished Water Pump Station
        - Backwash EQ
        - Gravity Thickeners
        - Solids Drying Beds
        - Chemical Building
        - Administration Building
      - -Diversion Dam, Intake Structure, Fish Passage
      - -Raw Water Pump Station
    - Wastewater Plant
      - -Support Facilities
        - Flow Metering Facilities
        - Process Flow Structures
        - Misc. Yard Structures
        - Water Quality Laboratory
        - Laboratory Equipment
        - Vehicle Maintenance Facility
        - Engineering Trailer
        - Admin/Tech Services
        - Div. Office/Line Maintenance
        - Training Building
        - Maintenance Building
        - Control Building
        - Vactor Building
        - Resident Engineering Trailer
      - -Preliminary Treatment
        - Lift Station No. 11
        - Prelim Treatment Facility
        - Odor Control for PTF
        - Ferrous Chloride Facility
      - -Primary Treatment
        - Primary Clarifiers 1-4
        - Primary Clarifiers 5-8
        - Primary Pump Stations 1 & 2
        - Primary Sludge PS #3
        - Septage Receiving Facility
        - Odor Control Facilities
      - -Activated Sludge
        - Activated Sludge
        - Aeration Basins 1-6
        - Aeration Basins 7-8
        - Aeration Basins 9-14
        - Final Clarifiers 1-4
        - Final Clarifiers 5-8
        - Final Clarifiers 9-12
        - New Final Clarifiers
        - S Aeration Blower Building
        - N Blower/Chemical Building
      - -Combined Effluents
        - Chlorination Facility
        - Chlorine Contact
        - Re-aeration
        - Dechlorination
        - Effluent Outfall
        - Effluent Reuse Facility
      - -Residuals Handling
        - Sludge Blending Facility
        - Blended Sludge PS
        - Blended Sludge Tank Odor Control
        - Sludge Thickening (DAF)
        - DAF Odor Control
        - Digesters 1-5
        - Digesters 6-10
        - Digesters 11-14
        - Sludge Dewatering Facility
        - Dewatering Facility Odor Control
        - Gas Compression Facility
        - Gas Storage Facility
        - Gas Flare
        - Cogeneration Facility
        - Cogeneration Facility Expansion
        - Sludge Drying Beds
        - Septage Handling Facility
        - Soils Amendment Facility
        - SAF Equipment
        - Electrical/Control Structures
        - Pavement/Roads
        - Landscaping
        - Diversion Channel
        - Electrical/Control Systems
        - Site Improvements
        - Yard Piping
  - ABCWUA FIELD
    - Water Field
      - -Potable
        - Pipe
        - Valve
        - Hydrant
        - Manhole
        - Operational Meter
      - -Reuse
        - Pipe
        - Valve
        - Hydrant
        - Manhole
      - -San Juan Chama Distribution Pipe
    - Wastewater Field
      - -Pipe
      - -Valve
      - -Manhole
      - -Lift Station
      - -Odor Station
      - -AirVac Pit
      - -Buffer Tank

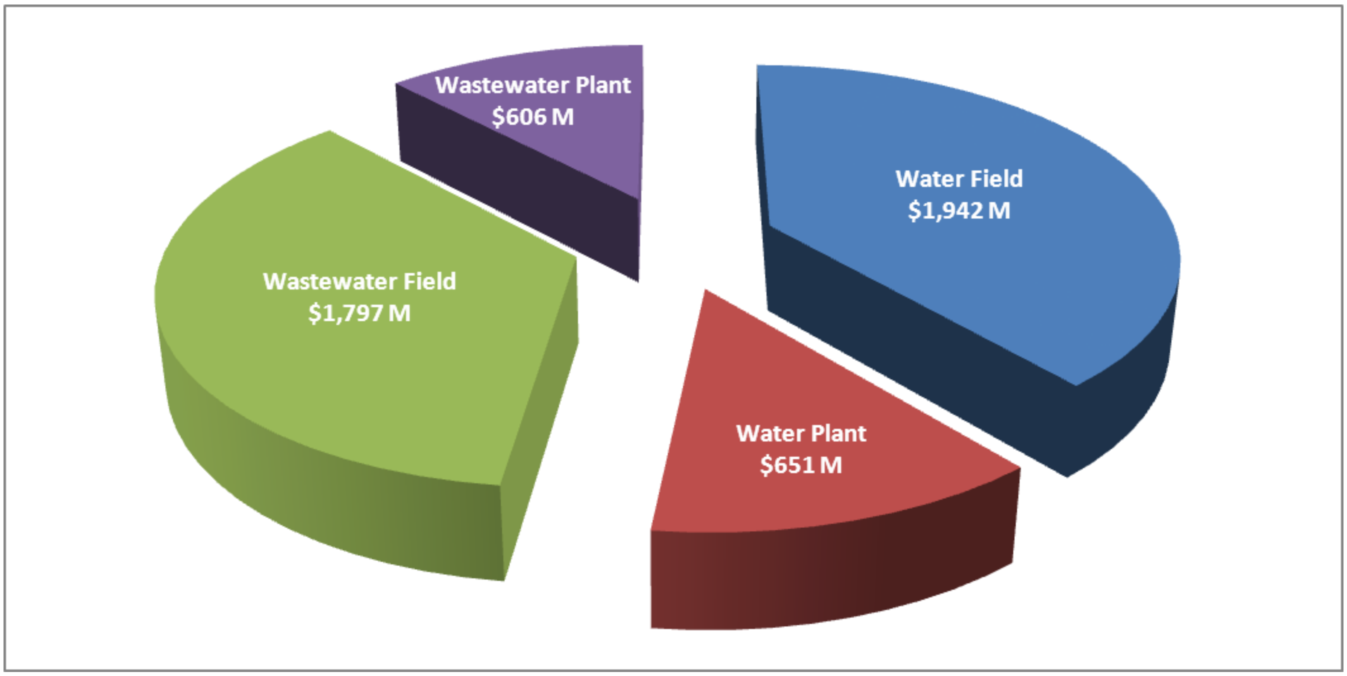
2.3 Asset Valuation

Asset valuations are an integral part of asset management. The valuation process provides asset managers with the knowledge of estimated current replacement costs to support their budgetary planning, identify high value assets, and gain understanding into the total value of the assets at all levels of the hierarchy. Using the estimated current replacement costs, future renewal forecasts can be created and the lowest lifecycle cost can be tracked against the assets.

All assets in the asset register were assigned an estimated replacement cost. The value was estimated based on what it might cost to replace the asset in today's dollar. For many assets, pricing attributes (e.g., size, type, specification) were not available to determine a detailed valuation. At times, attribute assumptions were made to best estimate the current replacement value of the asset.

A summary of the Water Authority's asset valuation is provided below. Based on the inventory summarized in Section 2.1 and the estimated replacement cost of each asset, the total, year 2010, valuation of the Water Authority's collection and distribution system is approximately $5.0 billion. Figure 2-2 presents a breakdown of total valuation based on the four asset systems (water field, water plant, wastewater field, and wastewater plant). The estimated valuation for each system is $1.9 billion, $651 million, $1.8 billion, and $606 million, respectively.

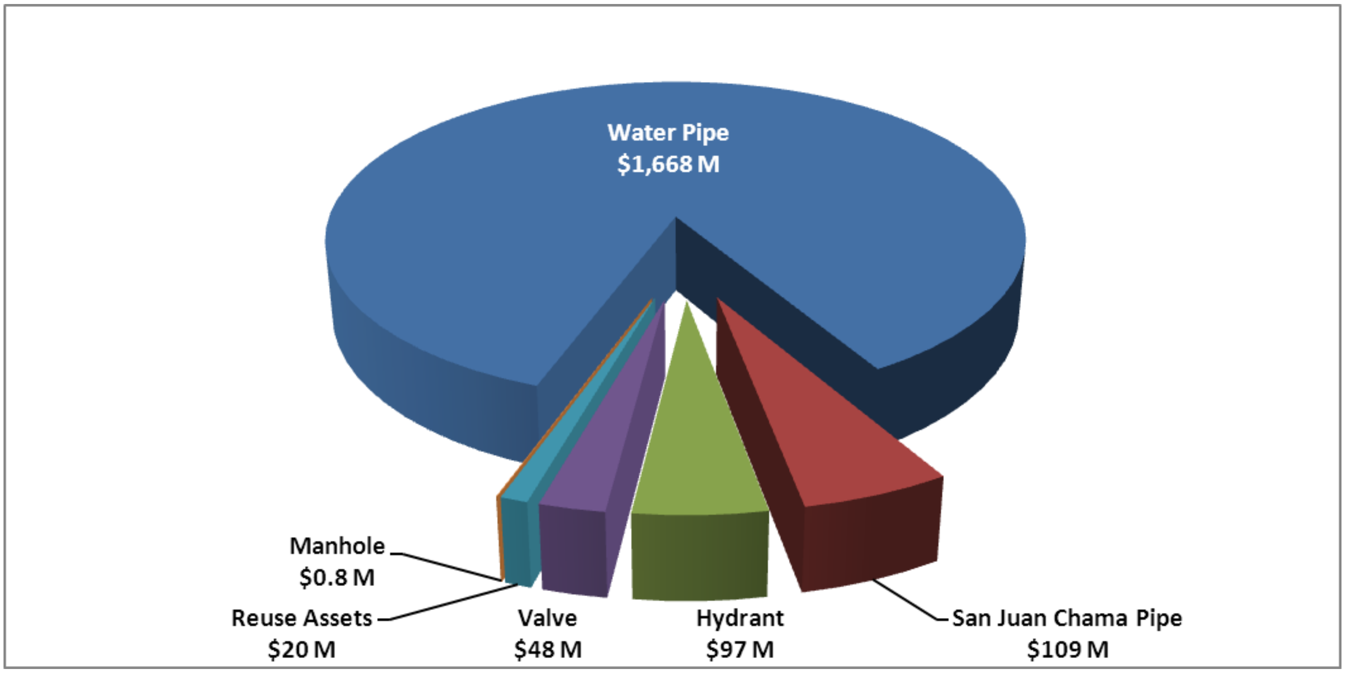
Figure 2-2 Water Authority Asset Valuation



Water Field

Water field assets consisted of pipes, hydrants, meters, valves, and manholes for potable and reuse water distribution and transmission. The estimated value of the water field system is $1.9 billion dollars. The 3,130 miles of pipe alone are valued at nearly $1.8 billion, comprising more than 93% of the systems total valuation. Asset classes (Table 2-1), excluding pipes, make up the remaining 7% of the total value. Figure 2-3 below provides a further breakdown of water field asset valuation categorized by asset classes.

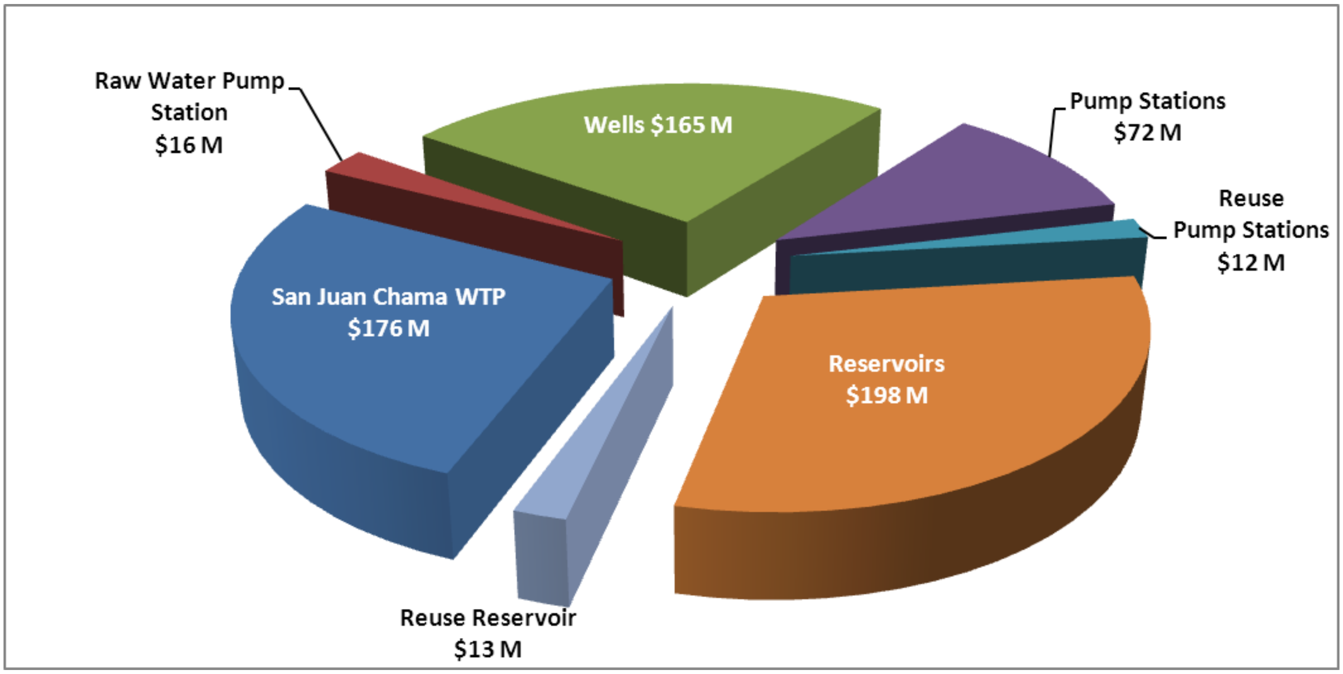
Figure 2-3 Water Field Asset Valuation



Water Plant

Water plant system assets consisted of reservoirs, pump stations, wells, the surface water plant, and two other plant-related structures. The total valuation for water plant assets is estimated to be $651 million. 30% of the total water plant system represented the 62 potable and reuse reservoirs, 25% of the total value was represented by the 102 wells, surface water plant was 24%, and the remaining 21% was composed of other asset classes presented in Table 2-4.

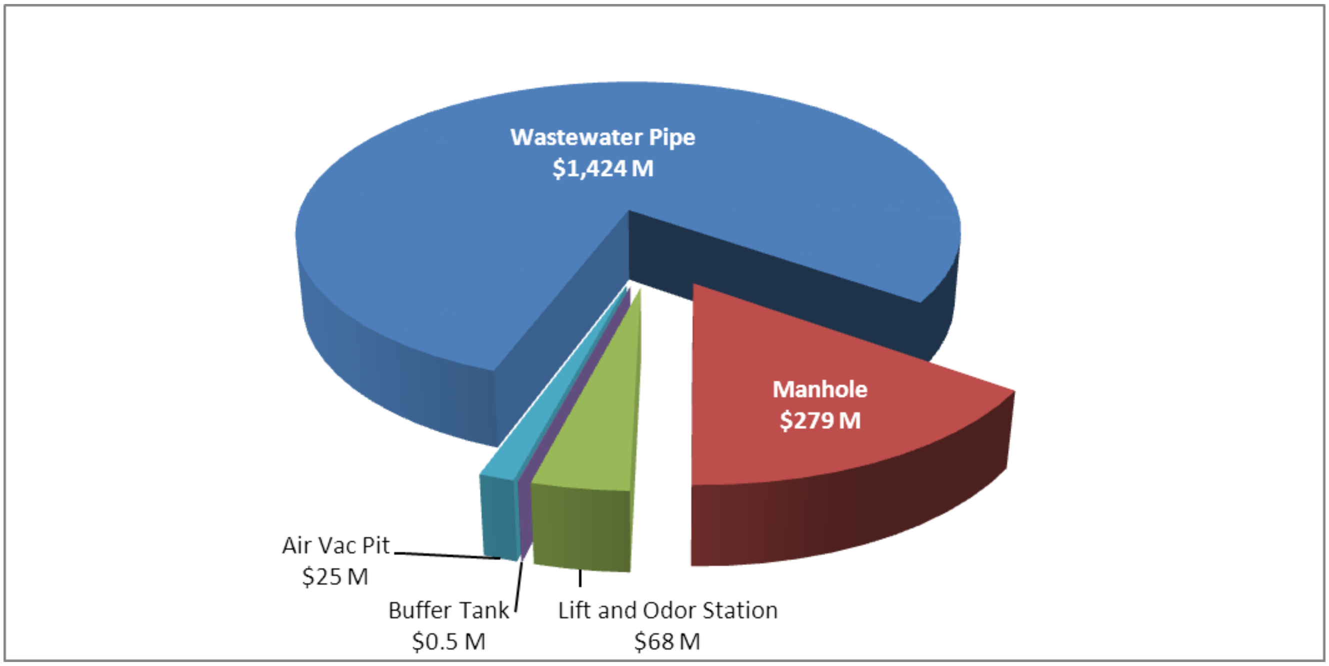
Figure 2-4 Water Plant Asset Valuation



Wastewater Field

The wastewater field system is comprised of pipes, manholes, valves, lift and odor stations, air vac pits, and buffer tanks. The estimated worth of the wastewater field system is $1.8 billion. The breakdown of the $1.8 billion of the wastewater field system (Figure 2-5) is shown below, the bulk of which is comprised of 2,409 miles of pipe, accounting for more than 75% of the wastewater field system's total valuation. The remaining 25% is made up of the other asset classes listed in Table 2-6.

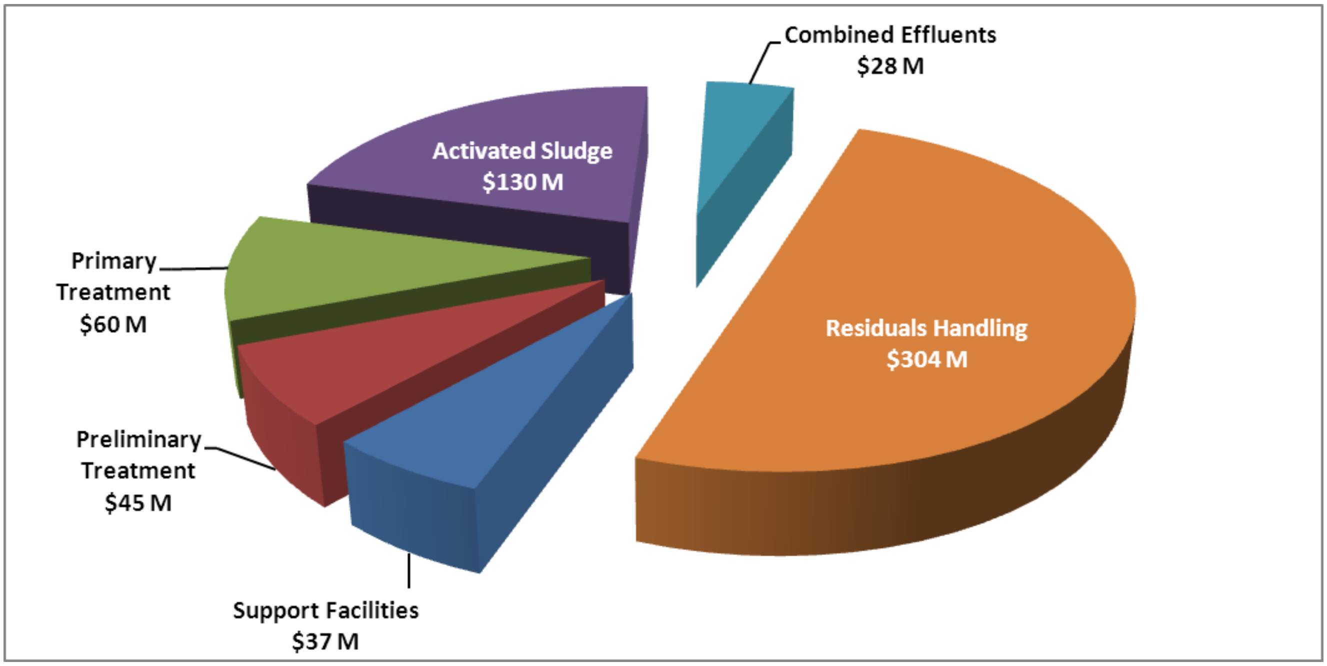
Figure 2-5 Wastewater Field Asset Valuation



Wastewater Plant

The estimated total valuation for the wastewater plant system is estimated to be roughly $606 million. The wastewater plant system represents the Southside Water Reclamation Plant. The plant was broken down into major processes and facilities. 50% of the valuation was the 26 items that make up the residuals handling area. Figure 2-6 below summarizes the plant valuation distribution.

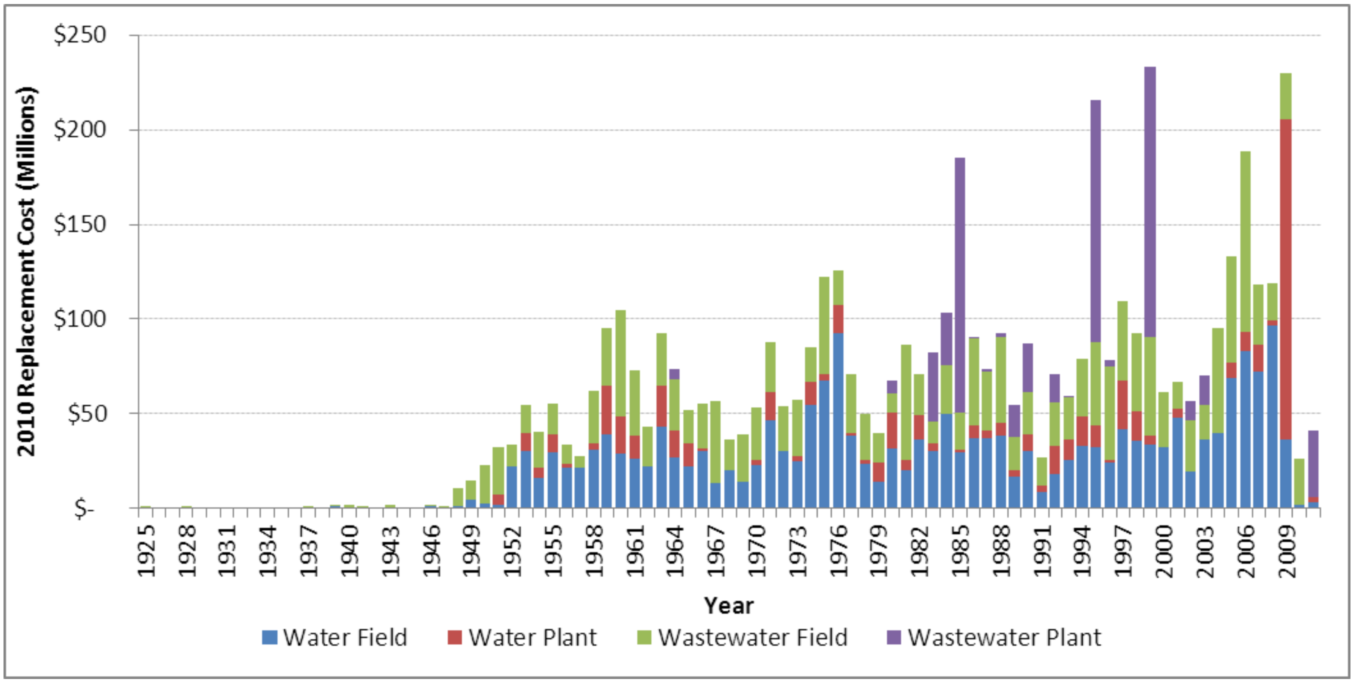
Figure 2-6 Wastewater Plant Asset Valuation



2.4 Historical Asset Valuation Profile

The historical asset valuation profile provides insight into when large portions of assets were installed and when they will require renewal investment. The profile can show installation trends which may coincide with events in history (e.g., economic recessions, heightened government spending). The historical asset valuation profile for the Water Authority's total system is presented in Figure 2-7.

Figure 2-7 Water Authority Total System Historical Asset Valuation Profile



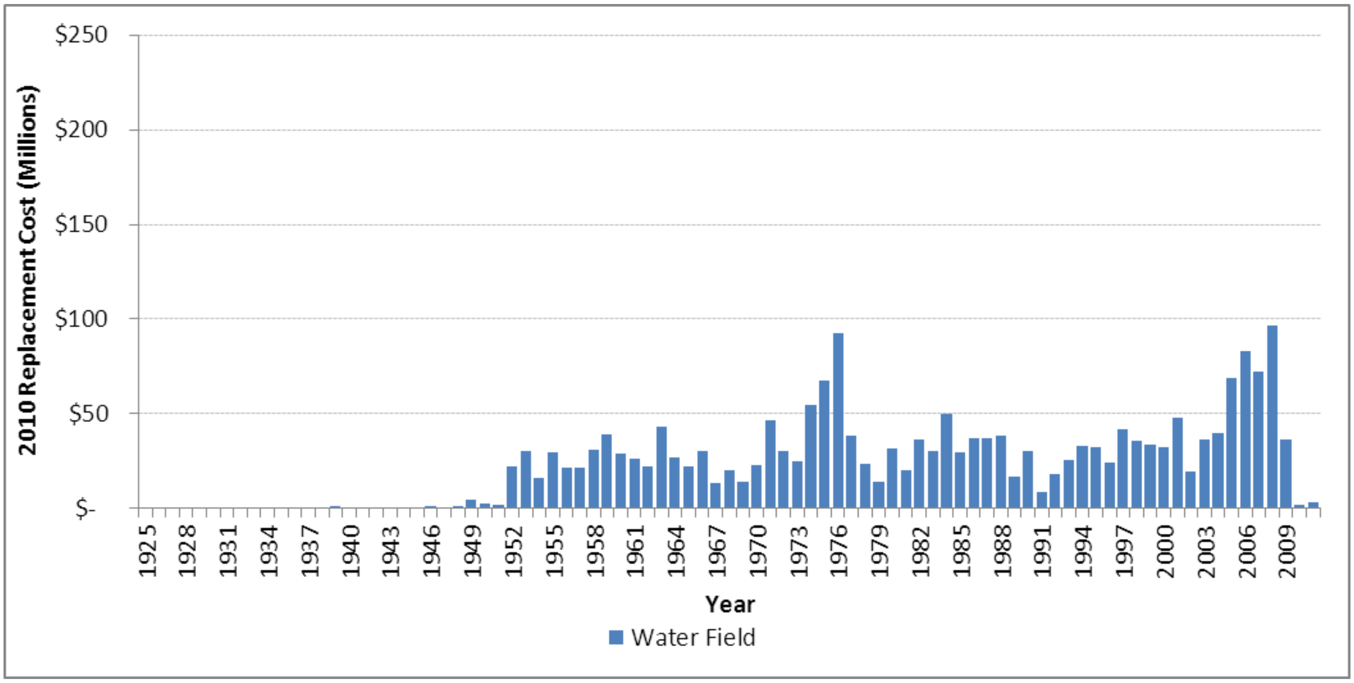
The valuation represented in the figure is expressed in today's estimated replacement costs. It does not represent the actual capital investment that took place in any given year. As the figure illustrates, construction of the Water Authority's assets initiated in the early-1900s. Roughly, every 10 years, the profile shows solid development and installation of assets. Both water and wastewater pipes dominate the profile. This domination by pipes aligns with our expectation, as the replacement costs are primarily dominated by pipes. This profile also hints that pipes installed in the 1950s are nearing the end of their useful life and should require renewal capital investment in coming years to replace or extend the life of the assets.

Details of the historical profile for each system (i.e., water field, water plant, wastewater field, wastewater plant) are presented below.

Water Field

Figure 2-8 provides insight into the historical valuation profile of water field assets. Based on the presented profile, major investments in water field assets started in the early-1950s and continue through today, with valuation peaks during the mid-1970s and the late-2000s. Based on the information in the figure, a significant portion of the system is greater than 35 years old. Using each pipe type's expected useful life, these older pipes are expected to require renewal activity in coming years to prolong the life of the assets.

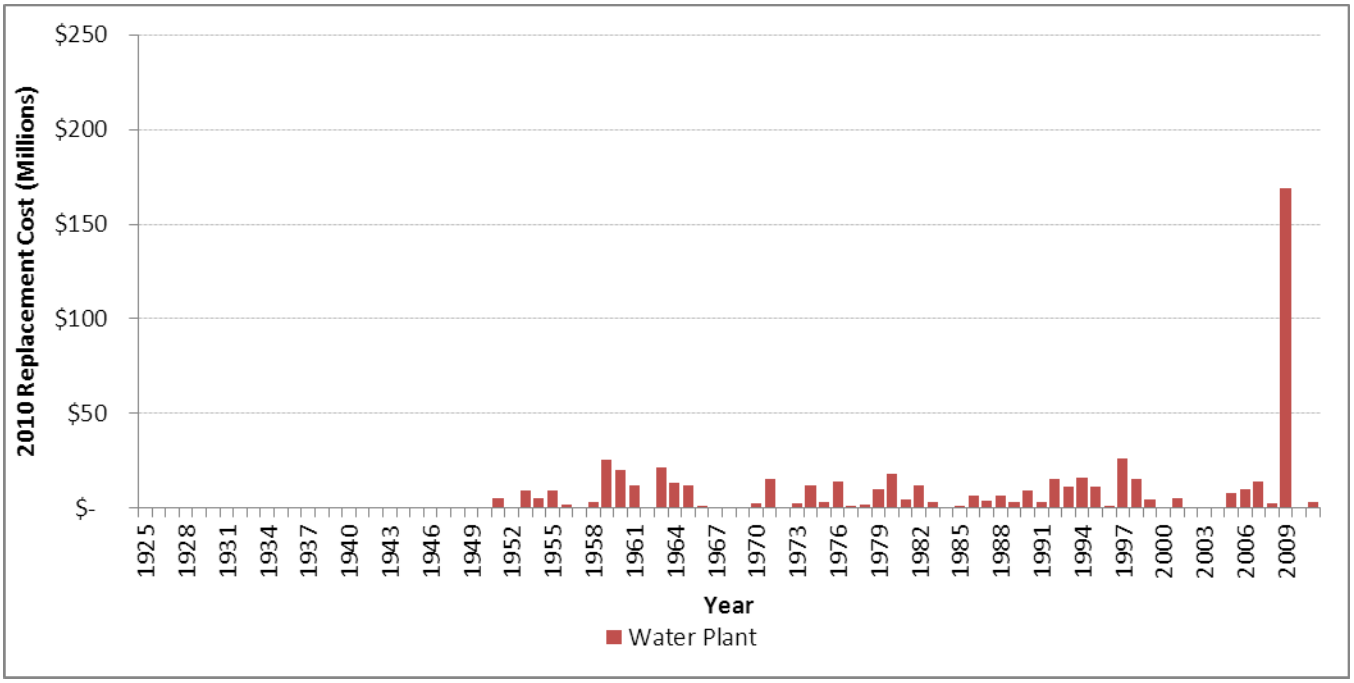
Figure 2-8 Water Field Historical Valuation Profile



Water Plant

The water plant system consists of two distinct valuation portions: San Juan-Chama Drinking Water Plant and the wells, reservoirs, booster pumping stations. Figure 2-9 presents the historical asset valuation profile for the water plant system. Reservoirs and wells, starting in 1951, were consistently added to the system. Reservoir and well installations have peaks in periods from the late-1950s to early-1960s, mid-1970s to early-1980s, early-1990s, and mid-2000s. This trend correlates with the water field system asset profile shown in Figure 2-8. The $175 million spike in 2009 represents the construction of the San Juan-Chama Drinking Water Plant. Unlike field system assets, which have useful lives near 100 years, plant system assets generally have shorter lives and these installed in the 1950s and 1960s should be due for renewal in the coming years (e.g., wells, reservoirs).

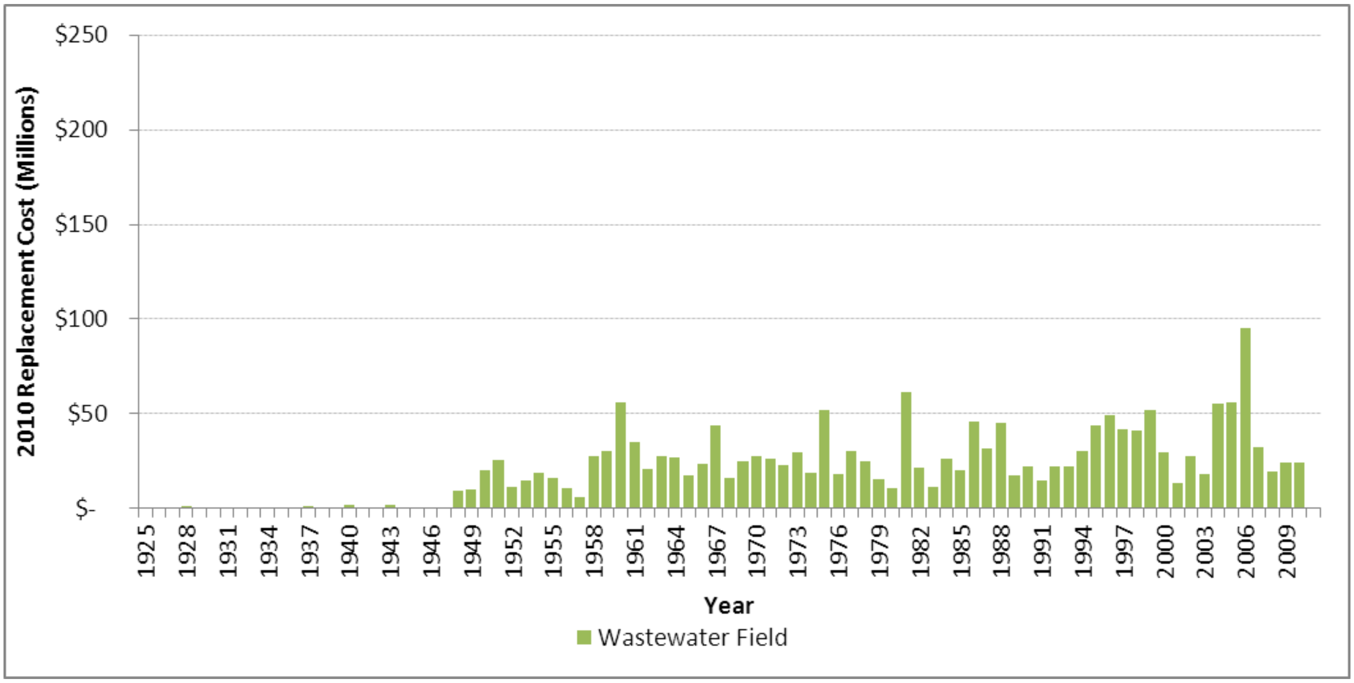
Figure 2-9 Water Plant Historical Valuation Profile



Wastewater Field

Figure 2-10 shows the historical valuation profile for the wastewater field system. Staring in the late-1940s, the Water Authority began a large installation of its wastewater pipes. Various spikes occur throughout the decades, with major portions of the system being installed in the 1960s, mid-1980s, late-1990s, and mid-2000s. Similar to the water field system, the wastewater field system assets (e.g., pipes) have relatively long useful lives and are not in need of replacement. However, wastewater pipes are more prone to rehabilitation activities, and wastewater pipes will undergo one or more rehabilitation activities to prolong the life of the pipe between replacements. The figure suggests that some assets may be in need of rehabilitation in coming years. The need for rehabilitation work will be identified and represented in the renewal forecast figures presented in Section 8.

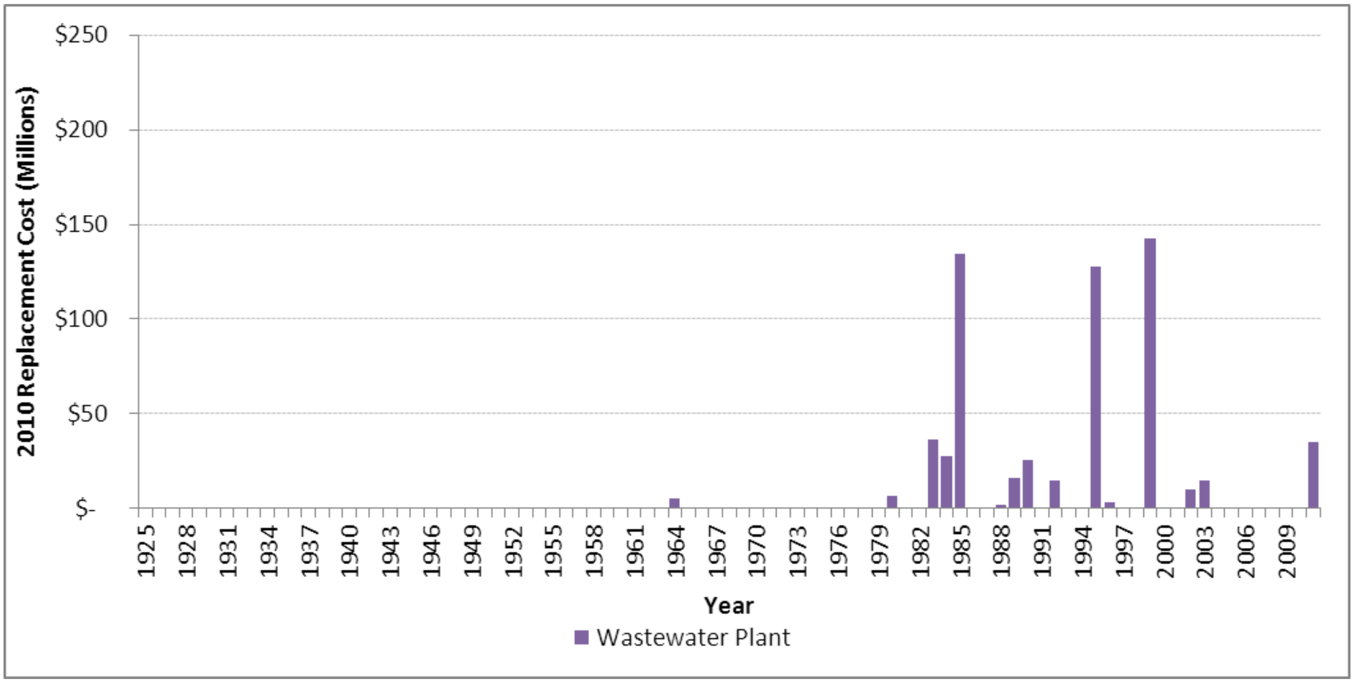
Figure 2-10 Wastewater Field Historical Valuation Profile



Wastewater Plant

The wastewater plant system assets were grouped at a process level, based on available data and the accuracy of the data in the CMMS. Grouping at a high level resulted in large portions of the plant system having the same installation year. This is illustrated in Figure 2-11. Large spikes can be observed in 1985, 1995, and 1999. The peaks highlighted in Figure 2-11 will level off, and be spread out, as the Water Authority completes its asset inventory and data cleanup process for the wastewater plant system. With the typical wastewater plant asset useful life ranging from 20 to 30 years, it can be expected that assets installed in the mid-1980s are nearing the end of their useful life and will require significant capital investment in the near future.

Figure 2-11 Wastewater Plant Historical Valuation Profile



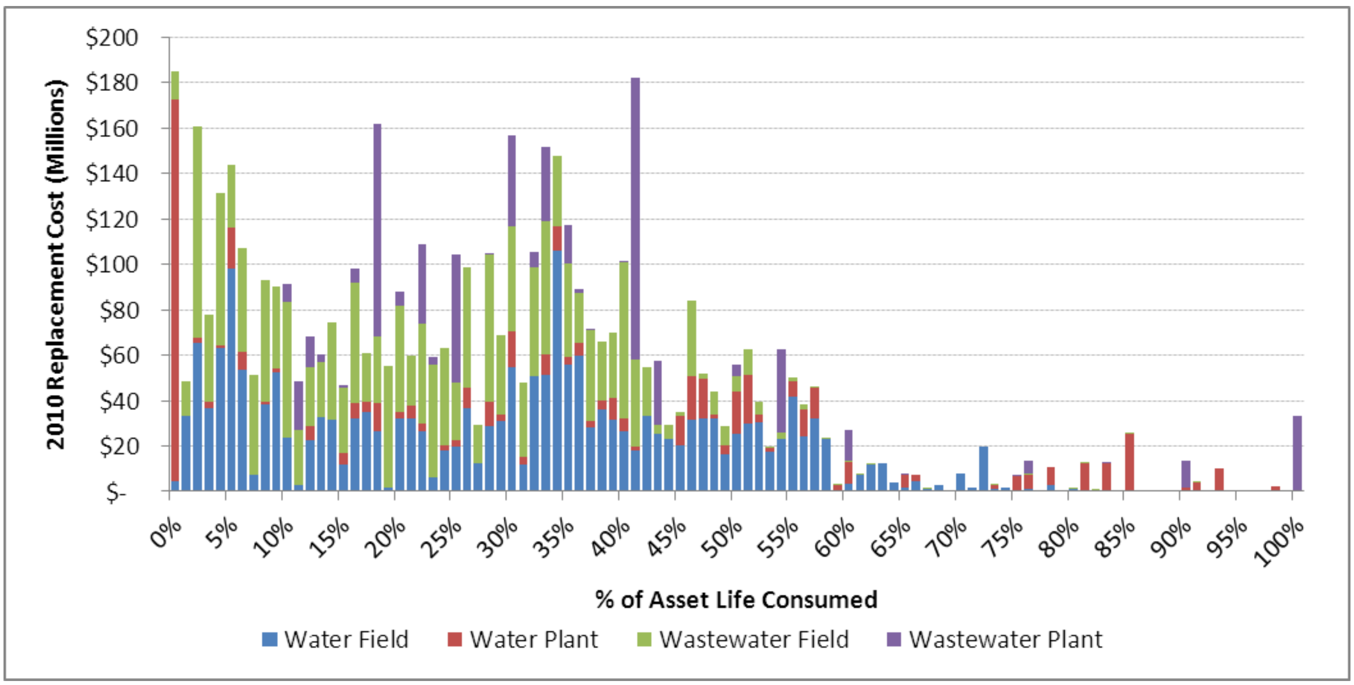
2.5 Current Asset Profile

Unlike the historical valuation profile, this section focuses on an assessment of the current state of the Water Authority's assets through consumption profiles. A consumption profile provides the Water Authority with the overall knowledge of what portions of the system's total valuation is nearing the end of its useful life and in need of renewal.

Consumption profile figures are developed based on each asset's age, condition, and expected useful life. For example, a new asset will be 0% consumed, whereas, an asset identified as 100% consumed indicates the asset has reached the end of its useful life. Similarly, assets with shorter expected useful lives will be consumed more quickly, compared to assets with long useful lives.

The Water Authority's total system consumption profile is presented in Figure 2-12. Each system (water field, water plant, wastewater field, wastewater plant) is represented in its respective color. The figure shows a large water plant system spike at 0% consumption, this represents the construction of the new San Juan-Chama Drinking Water Plant. From the figure, it can be approximated, that the overall bulk of the Water Authority assets are 30% consumed. The relatively low consumption profile is a reflection of the long (100 year or greater) useful lives of the pipes. The spike of 100% consumption represents roughly $60 million in overdue renewal activities, mostly from the wastewater plant and water field systems (i.e., steel water pipe). More detail can be seen from the consumption profile graphs for each system.

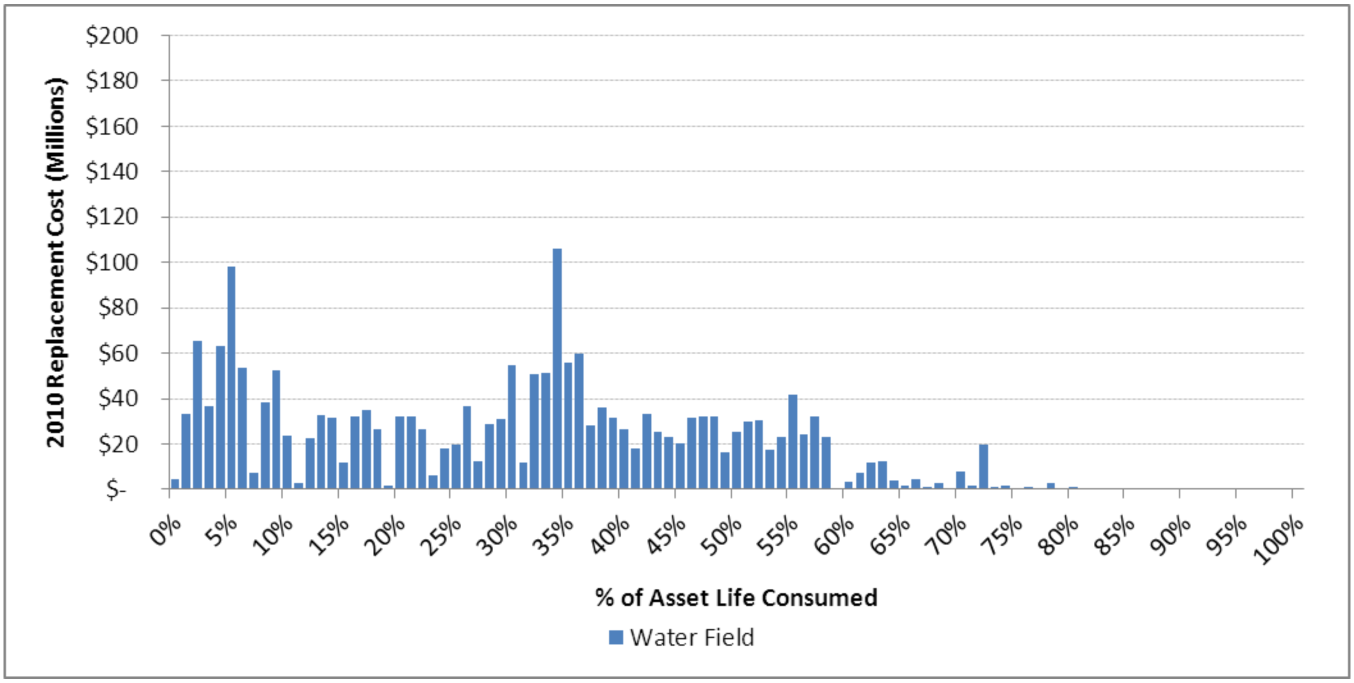
Figure 2-12 Water Authority Asset Consumption Profile



Water Field

The water field system asset consumption profile is presented in Figure 2-13. The profile portrays only a small percentage of water field assets are nearing the end of their useful lives. The roughly $40 million spike at 100% consumption is made up of steel pipes ($19.6 million) and small valves ($10.75 million). From the profile, it can be concluded that the water field system is roughly 30 to 40 percent consumed, on average.

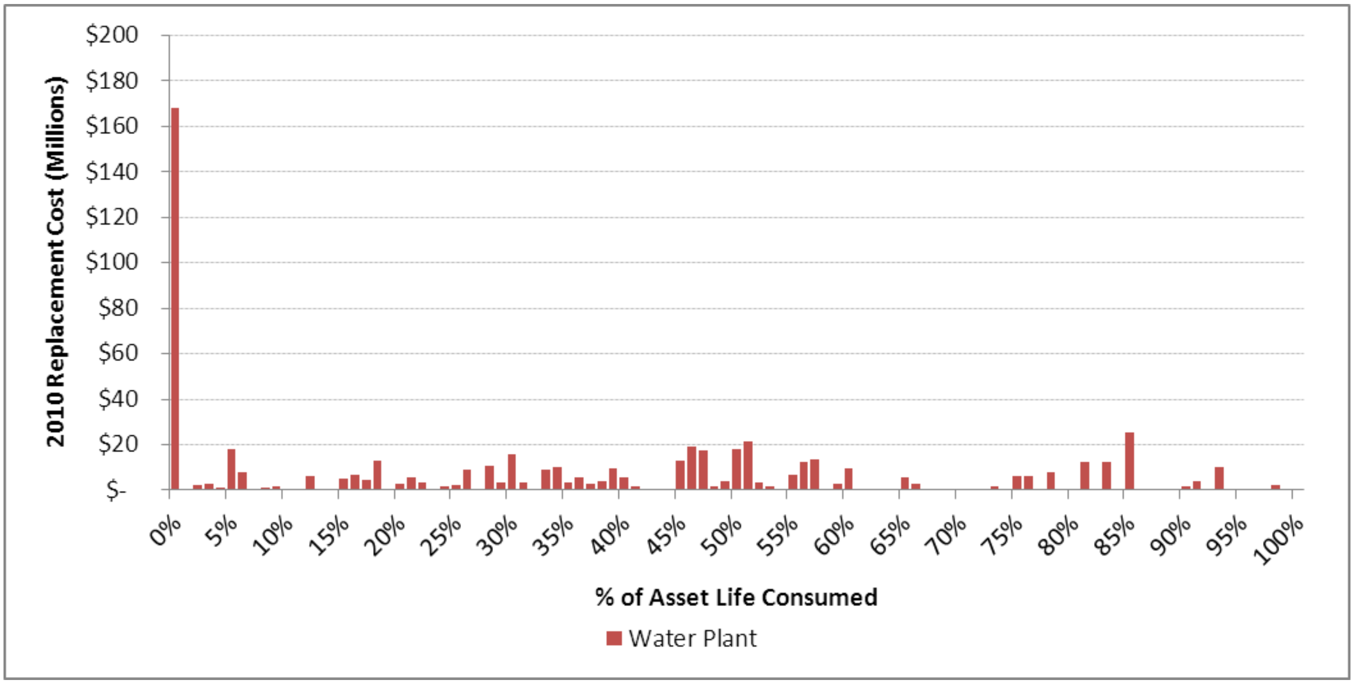
Figure 2-13 Water Field Asset Consumption Profile



Water Plant

Figure 2-14 provides the consumption profile for the water plant system assets. As explained above, the 0% spike of $165 million is dominated by the San Juan-Chama Drinking Water Plant constructed in 2009. There are numerous wells and reservoirs that are over 80% consumed and will require renewal investment in the near future.

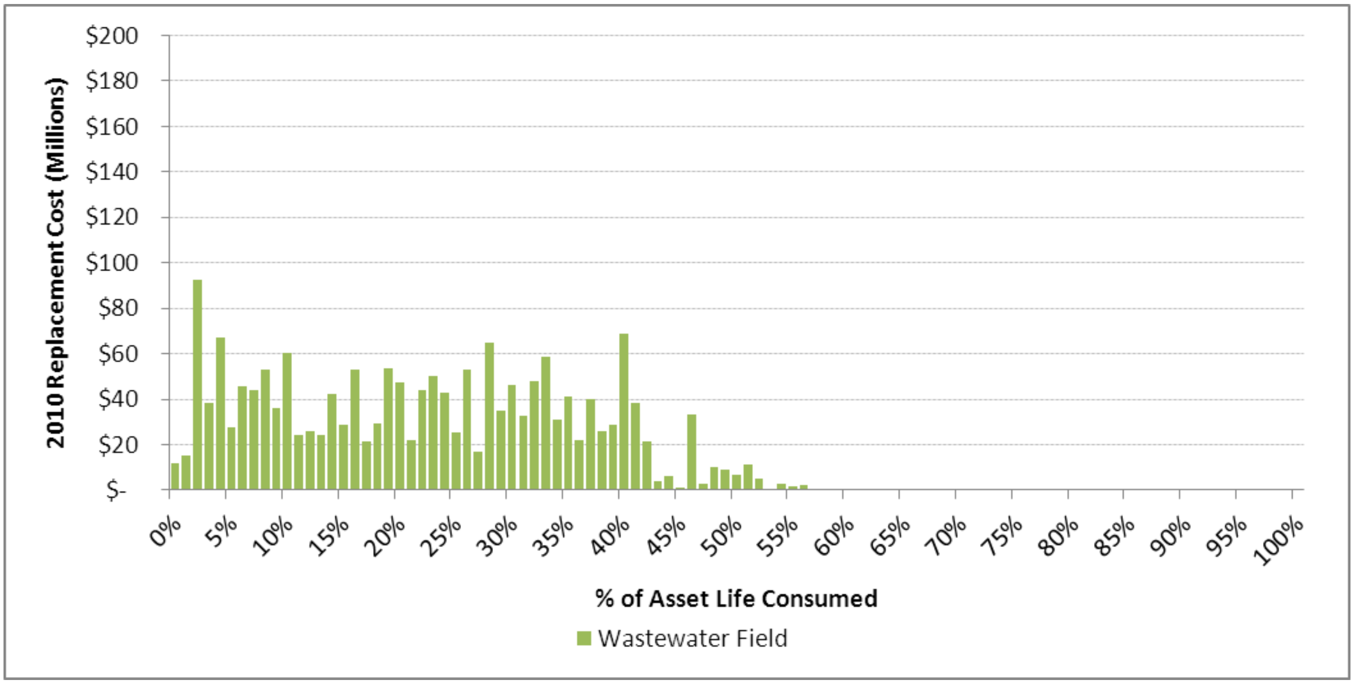
Figure 2-14 Water Plant Asset Consumption Profile



Wastewater Field

The results of the wastewater field system asset consumption profile (Figure 2-15) revealed a similar characteristic to water field assets (Figure 2-13). Due to the long useful lives estimated for wastewater pipes, hardly any assets are more than 55% consumed. Wastewater pipes are typically rehabilitated before they are replaced. Although the consumption profile suggests that the pipes will not require replacement in the near future, it does not present the need to rehabilitate the pipes at some point during their lives. The need for rehabilitation, and its estimated capital value, will be presented and discussed in Section 8.

Figure 2-15 Wastewater Field Asset Consumption Profile

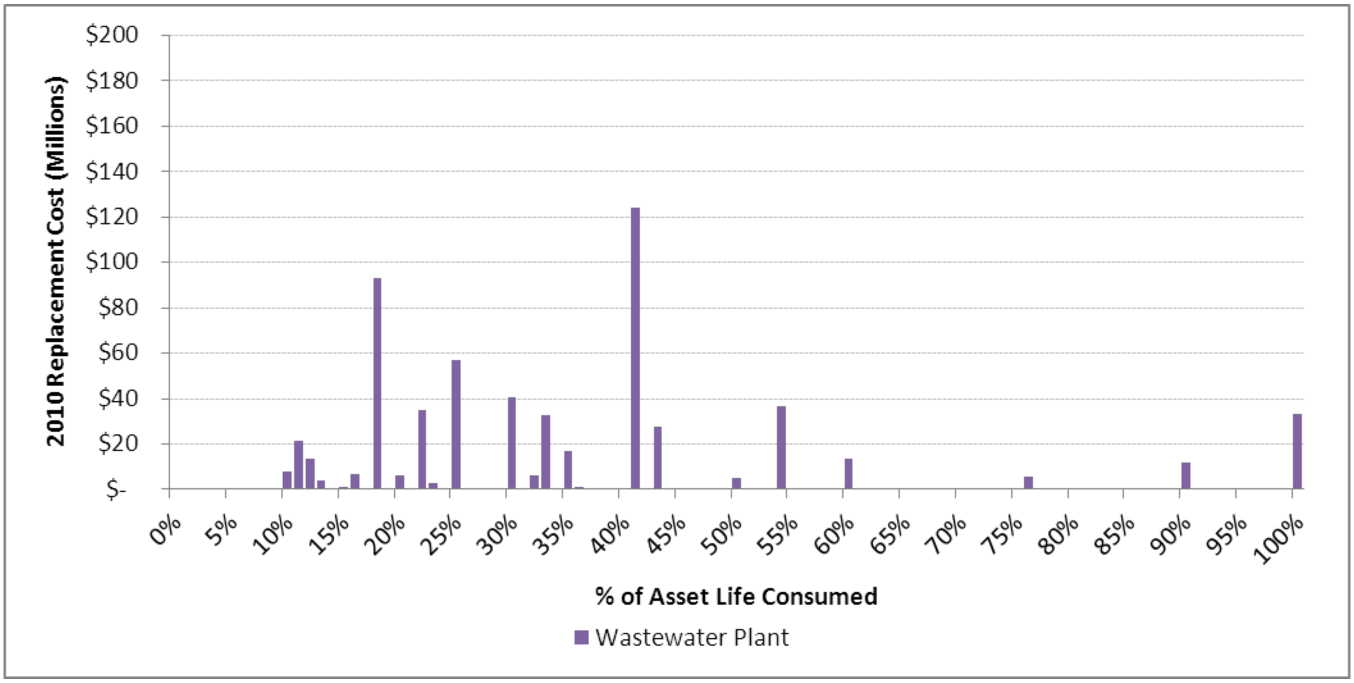


Wastewater Plant

The wastewater plant system consumption profile is shown in Figure 2-16. The noticeable, discrete spikes in the profile are a result of assets grouped, and analyzed, at a high-level. Again, as the Water Authority completes its asset inventory and data cleanup process, the consumption graph will take on a more distributed profile.

In general, most of the wastewater plant assets are about 30 to 40% consumed. As shown in the figure, the 90 to 100% consumed assets are composed of digesters, preliminary treatment facility, and primary pump station along with other areas of the wastewater treatment plant. The replacement cost for these assets is estimated to be $40 million. Further investigation should be performed to verify the condition of these consumed assets.

Figure 2-16 Wastewater Plant Asset Consumption Profile



2.6 Asset Summary Sheets

Asset summary sheets provide a snapshot of information about an asset, or group of assets, in order to summarize what is the asset, what state it is in, the levels of service it provides, and the risk it presents to the Water Authority.

The asset summary sheets center around the water and wastewater plant assets analyzed in the asset management plan. Summary pages are included for portions of the treatment processes of the Southside Water Reclamation Plant, the San Juan-Chama Drinking Water Plant, and the ground water wells, reservoirs, and pump stations. The asset summary sheets can be found in Appendix C.

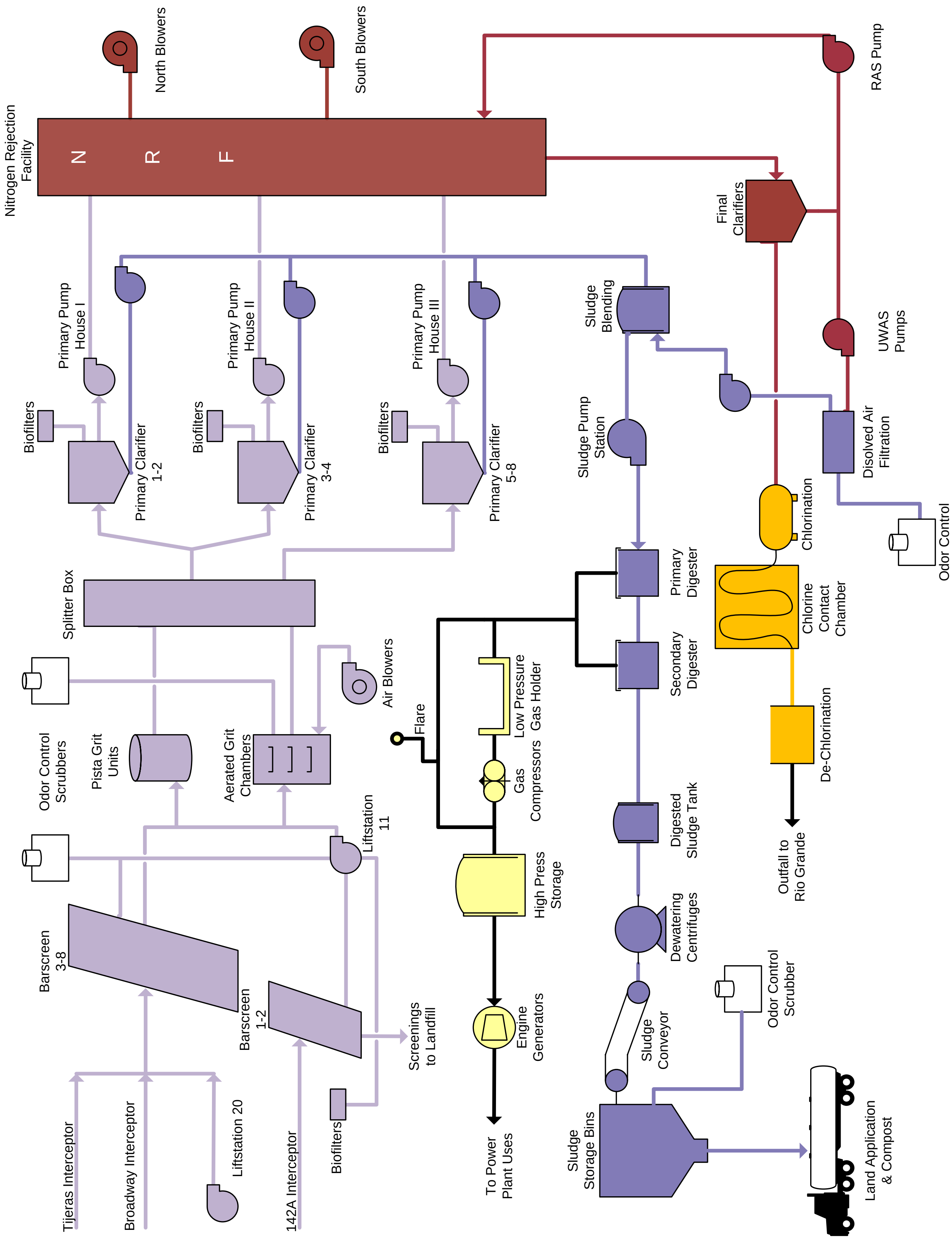
The basic structure of the asset summary sheets is explained below:

- **Asset Profile** – Describes the assets, its primary functions, and relevant recent history.
- **Demand Profile and Performance** – Describes the design values for assets in terms of minimum, maximum, peak or average flow requirements, and current performance where available. In some cases, actual data is not obtainable. In these instances, the charts show a value To Be Determined (TBD) or left bank. This data is anticipated to be collected by the Water Authority and input in future asset management plans.
- **Risk Profile** – Provides a summary of the risk profile of the assets based on their probabilities and consequences of failure. Where available, the assets were risk ranked based on the risk methodology explained in the asset management plan.
- **Key Issues for Further Investigation** – Collates issues from the Demand Performance and Risk Profile based on operations and maintenance staff member comments. If TBD is indicated, then this information is expected to be available during the next update of the asset management plan.
- **Asset Consumption Profile** – Describes the current stage of an asset's life based on its current condition and expected life. This profile serves as a snapshot of how consumed a process or group of assets is. If TBD is indicated, then this information is expected to be available during the next update of the asset management plan.

The flow of information should be developed to maintain key issues for further investigation and inform the current capital program and investment profile.

To better visualize the areas of the Southside Water Reclamation Plant, a process flow diagram is provided in Figure 2-17.

Figure 2-17 Southside Water Reclamation Plant Process Flow Diagram



2.7 Recommended Next Steps

This section provides recommendations to improve the confidence level for asset valuation and consumption profile. The recommended actions are:

- Inventory of vertical assets –The San Juan-Chama Drinking Water Plant currently lacks asset data to provide an in-depth analysis of future renewal requirement analysis. Assets are identified at high-levels (i.e., process) in the asset hierarchy. When the asset inventory process is complete for the plant, it is recommended that the Water Authority rerun the future renewal requirement analysis to enhance the results.
- Asset valuations – All assets are assigned a replacement value. The more accurate the estimated replacement cost, the better the estimated renewal funding requirement. It is recommended that the Water Authority carefully evaluate the estimated replacement costs and, where needed, improve the confidence level to enhance the quality of the overall valuation. This process may require a new undertaking for each iteration of the Water Authority's asset management plan.

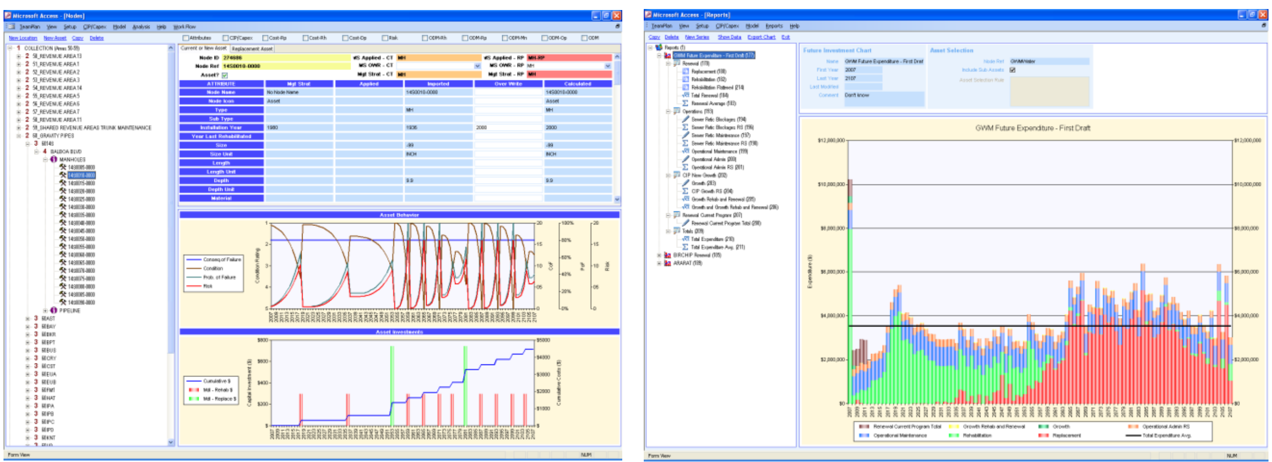
3. Asset Management Practices

The asset management practices section introduces the data, assumptions, and tool used to develop the Water Authority's asset management plan. The asset management plan development tool consolidates asset data, organizes the data in an asset hierarchy, and determines the timing of renewal activities for each asset in the register. For every year, the assets requiring renewal activity are identified and amalgamated to project the renewal funding requirements. Details of the data, assumptions, and tool used are provided below.

3.1 Asset Management Plan Development Tool

The Water Authority's asset management plan was developed using GHD's asset management tool, Total Enterprise Asset Management Plan (TeamPlan). TeamPlan is designed to facilitate the creation of an asset management plan through data consolidation and analysis. It is built around the core asset management processes (identified in Chapter 1), and has the ability to fully incorporates lifecycle costing and optimal decision-making methodologies. Figure 3-1 presents a sample view of two of TeamPlan's screens.

Figure 3-1 TeamPlan Screen Shot



The TeamPlan tool can be used to make decisions at any level in the asset hierarchy. The following key management features add to TeamPlan's flexibility:

- **Asset Attributes.** For any asset, TeamPlan users can create and capture unlimited number of attributes at any level in the asset hierarchy.
- **Management Strategies**. TeamPlan users can make assumptions about data to fill missing gaps and enter formulas to calculate replacement costs and risk.
- **Scenario Modeling.** TeamPlan's reporting module enables various scenarios to be saved and analyzed at user-defined levels within the asset hierarchy.

TeamPlan assists the organization in improving the knowledge of the assets owned and facilitates the decision-making process. It can calculate the future expenditure profile of the Water Authority, including capital, operations, and maintenance costs. TeamPlan can identify assets approaching the end of their useful life and include them in CIP projects. TeamPlan can help optimize the management strategies by including intervention points based on risk, cost, and/or condition.

3.2 Data Sources

The asset management plan was developed using the following Water Authority data sources. The name of the database and brief descriptions of the stored data are summarized below.

- Geographic Information System (GIS)
  - Asset attributes (e.g., install year, size, length, material, slope)
  - Land use data
- Condition rating data
  - CCTV score data
- Previous collapse data
- Delphi data
  - Known areas / pipes with structural and operational problems
  - Known areas with high consequence of failure
  - Expected lives and renewal strategies for various asset classes
- Previous risk model
  - Very high-level risk assessment work
- SSO records
  - Backups, overflows, and property damage
- Restaurant data
  - Fat, oil, grease data
  - Restaurant location data
- Work order data
  - SSO
  - Rehabilitation
- Pipe cleaning frequency data
- Pipe slope data
- Staff input
  - Information tracked down and recorded on various spreadsheets. This information includes missing installation years for various assets, capacities, and structure materials. This also includes mitigation strategies to close data gaps.

3.3 Data Cleanup

Initial inspection of the data revealed numerous gaps required to be filled in order to produce valid results. Several key data attributes were often missing and/or inconsistent in asset record sets. Working with key members of the Water Authority's staff, the data attributes were populated and the gaps were filled.

The data cleansing process required a coordinated effort between Water Authority's asset management plan development team, key members of the GIS staff, and GHD. The diligent efforts of the Water Authority asset management plan development team and the GIS team should be recognized.

Following sub sections summarize the assumptions used to clean up the data.

3.3.1 Wastewater pipe data (57,984 records, totaling 16,184,954 linear feet)

Installation year

517 records, totaling 99,642 feet had no installation year. In order to close the installation year gaps, a mitigation strategy was developed to assume and apply reasonable installation years to those assets. The strategy called for determining the average installation year based on location of the asset (Map Page). An average installation year for the asset class is calculated and used to fill the like assets with missing install year, which accounted for less than 1% of the total.

Where location information could not be linked to a Map Page, installation years ranging from 1950 to 1960 were distributed evenly. These assets only accounted for pipes with length totaling less than 500 feet.

Material

59,554 feet of pipe had no material or was designated with unknown (UN) material. There pipes were consolidated and was assigned to an asset class titled unknown. The unknown material asset class received a conservative useful life to help highlight the renewal need of these assets sooner. The unknown material asset class accounted for less than 1% of the total.

3.3.2 Water pipe data (112,958 records, totaling 12,719,683 linear feet)

Installation year

2,127 records, totaling 249,677 feet had no installation year. In order to close the gaps in installation year, the mitigation strategy was developed to apply reasonable installation years to these assets. This was done by dividing the assets with installation years into Map Pages and calculating the average installation year for each group, based on the total length of each installation year. All pipes missing installation years were applied the average year for that Map Page. The remaining records without installation years totaled less than 10,000 feet (less than 2% of the total) and was evenly distributed between 1950 and 1960.

Material

23,657 feet of pipe had no material or was designated as Unknown (or UN). These pipes were left without a material and were assigned an asset class. This class was assigned a conservative useful life when analyzed for renewal requirements, historical valuation, and consumption profile. The unknown material asset class accounted for less than 1% of the total.

3.3.3 Water and wastewater field data

In addition to water and wastewater pipe assets, the Water Authority provided GIS data for other water and wastewater field assets. Lists of the assets classes provided for water and wastewater field are documented in Section 2.1. These additional water and wastewater field assets contained fewer fields than the pipe databases and, therefore, did not require as detailed of data cleaning or assumptions. However, the installation year of every asset was required prior to the renewal funding requirements analysis. Any invalid installation years (i.e., 0) were corrected based on the following logic:

1. Average installation year for all assets for a given class in the same Map Page.
2. All remaining assets of a given class were evenly distributed between the years 1950 and 1960.

This logic proved useful in closing the installation year gap; however, more accurate geospatial techniques could be applied with more confidence in the results.

3.3.4 Water and wastewater plant data

Water and wastewater plant data came from three primary data locations: plant process bids item spreadsheets, GIS locations, and the Water Authority reports.

The asset data information for the Southside Water Reclamation Plant and the San Juan-Chama Drinking Water Plant came primarily from bid and costs tracking spreadsheets. Additional data was gathered from engineering and operations staff with close knowledge of the plants. This data provided information at the process level and included aggregated costs and installation years.

GIS information provided installation, as well as, limited capacity and material information for wells, reservoirs, pump stations, and lift and odor stations. More than 50% of these assets were missing installation years. These years were tracked down one-by-one by Water Authority staff until the list of wells, reservoirs, pump stations, and lift and odor stations was 100% complete. Replacement costs for each asset were calculated based on the capacity or, if the capacity could not be found, was taken from historical reports or costs for a similar asset.

The wastewater plant assets included in the risk assessment was taken from the CMMS. This information was not a comprehensive list of wastewater plant assets, over 60% of the 7,000 assets were valued at less than $5,000. 43% of the size or capacity information was complete and 99% of the installation years were complete. The missing installation years were defaulted to 1950.

3.4 Management Strategies

The Water Authority owns and manages a large number of assets. Therefore, it is almost impossible to manage all the assets at the individual asset level. Management strategies provide the flexibility to manage a single asset or a group of assets in a customized way. Management strategies can group similar assets in order to assign management attributes (e.g., useful life, condition, risk) and make decisions (e.g., rehabilitation, replacement) in a consistent way. For example, if the Water Authority is experiencing an unusually large amount of maintenance required for pipe segments located in a certain area, a management strategy can be developed to group those pipe segments into a separate class and provide the necessary attention required (e.g., repair, condition assessment, lining) to effectively manage the assets.

Management strategies enable the Water Authority to establish useful lives, set renewal triggers, and track lifecycle costs for groups of similar assets. The following are the core attributes of the renewal management strategies:

- Useful life (e.g., physical effective life, maximum potential life)
- Renewal trigger (e.g., condition, risk, age, capacity, level of service)
- Type of renewal activity (e.g., repair, rehabilitate, replace)
- Cost of renewal activity

An asset management plan utilizes the renewal management strategies to track the timing and cost of renewal activities. For each asset, the renewal activities are tracked and consolidated. All renewal activities are aggregated on a yearly basis. For each year, renewal activities are listed and a budget is generated to develop the long-range renewal funding requirement forecast.

The following sections describe the core elements of management strategies and present the established renewal management strategies for the Water Authority.

3.4.1 Renewal Management Strategies and Useful Lives

Renewal management strategies reflect the Water Authority's current asset management practices. Management strategies were developed through workshops with key members of the engineering, operations, and maintenance staff. The general strategy to replacement, refurbishment, and renewal timing is summarized by individual classes of assets. These strategies incorporate the knowledge of Water Authority staff about the trends of these assets. Where individual asset records are not available, the assets strategies were set at the process of facility level. While this is an acceptable method to model assets, it leads to discrete values in certain analyses due to the groupings of assets. The following strategies are applied to the individual assets and asset groups, based on specific asset criteria, and used to produce each asset's replacement profile over the planning horizon.

The most influential asset attribute is the timing until failure. Depending on the purpose, an asset's life can be defined in three distinctive ways:

1. Physical effective life
2. Maximum potential life
3. Effective economic life

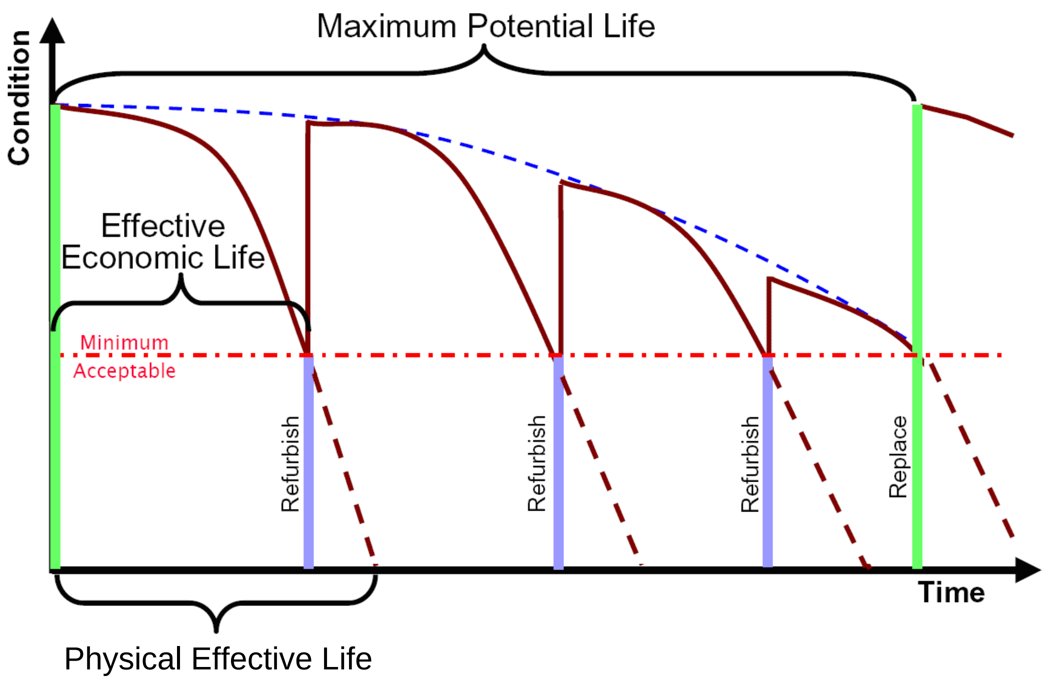
Physical effective life is the time from installation to replacement with only routine maintenance activities being performed. Essentially, it is the expected life of an asset with no rehabilitation activity to extend the life of the asset (e.g., run-to-fail).

Maximum potential life is the time from installation to replacement with maintenance and rehabilitation activities taking place in order to restore the condition and to prolong the asset's life.

Effective economic life of an asset is defined as the time from when the asset is new to the time of first rehabilitation.

Figure 3-2 illustrates the various lifecycle intervention points for a single asset. Some assets may have no intervention points and are simply run-to-fail. Other assets may have several technically feasible interventions prior to replacement at the end of the assets' life. This minimum acceptable performance condition can be based on a number of different criteria, including an asset or a system's level of service, physical condition, performance capacity, or financial efficiency. The minimum acceptable condition can change based on the asset's type, location, purpose, and risk to a system or process. The distinction of the three useful lives is clearly illustrated.

Figure 3-2 Useful Lives



Estimated asset lives are used to influence the condition of the assets and, consequently, the timing of asset renewals. Both physical effective life and maximum potential life were determined through workshops with Water Authority staff. The factors considered during the workshop were:

- Historic failure history
- Historic construction practices
- Location and operational environmental
- Level of quality of installed assets
- Operations and maintenance history

Through the workshops, certain assets (i.e., specific pipe materials) were identified to have large ranges in useful lives. These assets were given a varying useful lives, assigned to the individual assets based on statistical methods to distribute the asset renewals in a more realistic fashion. Table 3-1 summarizes the asset classes and their distribution parameters.

Table 3-1 Distributed Asset Life Parameters

Asset Class	Useful Life (Years)	Minimum Life	Maximum Life
Water Pipe – Cast Iron	75	45	105
Water Pipe – Concrete Cylinder	100	60	140
Wastewater Pipe – Concrete	40	15	65
Wastewater Pipe – Polyvinyl Chloride	100	30	170
Wastewater Pipe – Vitrified Clay	90	30	120

Table 3-2 through Table 3-5 summarize the useful life, rehab period, allowed rehabs, and rehab costs used to develop the asset management plan for each asset class.

Table 3-2 Water Field Management Strategies

Asset Class	Useful Life (Years)	Number of Rehabs	Rehab Period (Years)	Rehab Cost (% of Replacement Cost)
Water Pipe – Unknown Material	50	0	N/A	N/A
Water Pipe – Unknown Material - Large	80	0	N/A	N/A
Water Pipe – Asbestos Cement	100	0	N/A	N/A
Water Pipe – Cast Iron	70	0	N/A	N/A
Water Pipe – Cast Iron – Large	75	0	N/A	N/A
Water Pipe – Concrete Cylinder	80	0	N/A	N/A
Water Pipe – Concrete Cylinder – Large	100	0	N/A	N/A
Water Pipe – Ductile Iron	65	0	N/A	N/A
Water Pipe – Ductile Iron – Large	100	0	N/A	N/A
Water Pipe – Steel (includes Galvanized)	50	0	N/A	N/A
Water Pipe – Polyvinyl Chloride (PVC)	75	0	N/A	N/A
Water Pipe – Polyvinyl Chloride (PVC) - Large	100	0	N/A	N/A
Water Pipe – Reinforced Concrete	75	0	N/A	N/A
Water Pipe – Linear Wrapped Steel	50	0	N/A	N/A
Water Pipe – Other	50	0	N/A	N/A
Water Hydrant	50	0	N/A	N/A
Water Manhole	75	0	N/A	N/A

Asset Class	Useful Life (Years)	Number of Rehabs	Rehab Period (Years)	Rehab Cost (% of Replacement Cost)
Water Valve - < 6 Inch	15	0	N/A	N/A
Water Valve – 6 -15 Inch	30	0	N/A	N/A
Water Valve - > 15 Inch	50	0	N/A	N/A

Table 3-3 Water Plant Management Strategies

Asset Class	Useful Life (Years)	Number of Rehabs	Rehab Period (Years)	Rehab Cost (% of Replacement Cost)
Reservoir	100	3	25	15%
Pump Station	60	2	20	10%
Well	60	5	10	5%
Well – High Arsenic	60	5	10	15%
Groundwater Treatment Facilities	20	3	5	20%
SCADA/FICS	30	5	5	5%
Filtration Facility	60	11	5	5%
Gravity Thickeners	50	6	8	10%
Yard Piping	25	2	10	10%
Grit Removal - RW - Presedimentation PS	30	2	10	15%
Ozone Contractors	40	3	10	15%
Backwash EQ	40	3	10	10%
Rapid Mix Facility	60	5	10	5%
Floc - Sed Facility	60	5	10	15%
Finished Water Storage Tanks	50	4	12	10%
Predsedimentation Pump Station	60	2	20	40%
Settle Water Pump Station	60	2	20	40%
Finished Water Pump Station	60	2	20	40%
Chemical Building	60	2	20	20%
Administration Building	60	2	20	20%
Settled Water Storage Basin	50	1	25	20%
Finished Water Drop Box	50	1	25	15%
Ozone Facility	60	1	30	20%
Solids Drying Beds	60	1	30	20%
Diversion Dam, Intake Structure, Fish Passage	60	2	20	40%
Raw water pump station	60	2	20	40%

Table 3-4 Wastewater Field Management Strategies

Asset Class	Useful Life (Years)	Number of Rehabs	Rehab Period (Years)	Rehab Cost (% of Replacement Cost)
Wastewater Pipe – Unknown Material	40	0	N/A	N/A
Wastewater Pipe – Unknown Material - Large	60	0	N/A	N/A
Wastewater Pipe – Asbestos Cement	40	0	N/A	N/A
Wastewater Pipe – Asbestos Cement – Large	65	0	N/A	N/A
Wastewater Pipe – Cast Iron	80	0	N/A	N/A
Wastewater Pipe – Concrete	40	0	N/A	N/A
Wastewater Pipe – Concrete – Large	75	0	N/A	N/A
Wastewater Pipe – Ductile Iron	80	0	N/A	N/A
Wastewater Pipe – Fiberglass / HOBAS	150	0	N/A	N/A
Wastewater Pipe – Polyethylene	100	0	N/A	N/A
Wastewater Pipe – Polyvinyl Chloride	100	0	N/A	N/A
Wastewater Pipe – Reinforced Concrete	75	0	N/A	N/A
Wastewater Pipe – Reinforced Concrete (T-LOCK Lined)	90	0	N/A	N/A
Wastewater Pipe – Vitrified Clay	90	0	N/A	N/A
Wastewater Pipe – Vitrified Clay – Large	150	0	N/A	N/A
Wastewater Pipe – Steel	40	0	N/A	N/A
Wastewater Pipe – Steel - Large	80	0	N/A	N/A
Wastewater Pipe - Other	60	0	N/A	N/A
Wastewater Manhole	100	1	60	25%
Lift Station	60	2	20	40%
Air Vac Pit	30	5	5	20%
Buffer Tank	75	0	N/A	N/A

Table 3-5 Wastewater Plant Management Strategies

Asset Class	Useful Life (Years)	Number of Rehabs	Rehab Period (Years)	Rehab Cost (% of Replacement Cost)
ACTUATOR	20	0	N/A	N/A
ACTUATOR MOTOR	20	0	N/A	N/A
AERATOR	15	2	5	20%
ALARM	20	0	N/A	N/A
AUGER	30	5	5	20%
BASIN	60	0	N/A	N/A
BUILDING	60	3	15	20%
BOILER	30	2	10	20%
BLOWER	30	2	10	20%
BASKET	10	0	N/A	N/A
CENTRIFUGE	15	2	5	20%
CHAMBER	20	1	10	20%
CHLORINATOR	20	0	N/A	N/A
CHILLER	30	2	10	20%
COMPRESSOR	20	3	5	20%
CONVEYOR	20	3	5	20%
COOLER	10	0	N/A	N/A
COOLING TOWER	30	2	10	20%
CRANE	30	5	5	20%
DEHUMIDIFIER	20	3	5	20%
DOOR	30	0	N/A	N/A
ELECTRICAL EQUIPMENT	20	1	10	20%
ENGINE	30	5	5	20%
EVAPORATOR	20	0	N/A	N/A
EXCHANGER	30	2	10	20%
EXTINGUISHER	5	0	N/A	N/A
EYEWASH	20	0	N/A	N/A
FAN	20	0	N/A	N/A
FLAME ARRESTOR	30	5	5	20%
FILTER	30	2	10	20%
GATE	30	2	10	20%
GENERATOR	30	5	5	20%
GOVENOR	20	3	5	20%
GRINDER	20	3	5	20%
GEARBOX	20	3	5	20%
HOIST	30	5	5	20%
HEATER	20	0	N/A	N/A
HVAC	15	2	5	20%
HYDRANT	30	0	N/A	N/A

Table 3-5 Wastewater Plant Management Strategies (continued)

Asset Class	Useful Life (Years)	Number of Rehabs	Rehab Period (Years)	Rehab Cost (% of Replacement Cost)
HYDRAULIC UNIT	30	2	10	20%
INJECTOR	20	3	5	20%
INSTRUMENTATION	20	0	N/A	N/A
LAB EQUIPMENT	20	0	N/A	N/A
LIGHTING	20	0	N/A	N/A
LOUVER	30	0	N/A	N/A
MANAGER	20	0	N/A	N/A
MCC - MOTOR CONTROL CENTER	30	2	10	20%
METER	20	0	N/A	N/A
MANHOLE	100	1	60	20%
MIXER	30	2	10	20%
MOTOR	20	0	N/A	N/A
MOTOR - Large (20+ HP)	20	3	5	20%
PACK	5	0	N/A	N/A
PUMP	30	0	N/A	N/A
PUMP - CHEMICAL	10	0	N/A	N/A
PUMP - GRIT / SLUDGE	15	2	5	20%
PUMP - REUSE	30	2	10	20%
PLANT PIPE	60	1	30	20%
PRECIPITATOR	30	2	10	20%
RADIATOR	30	0	N/A	N/A
REFRIGERATOR	20	0	N/A	N/A
SAMPLER	10	0	N/A	N/A
SPRINKLER SYSTEM	20	0	N/A	N/A
STACK	30	0	N/A	N/A
SULPHONATOR	20	0	N/A	N/A
SWAMP COOLER	10	0	N/A	N/A
TELEMETRY	20	1	10	20%
TANK	30	0	N/A	N/A
TRUCK	30	0	N/A	N/A
TRAILER	30	0	N/A	N/A
TRANSFORMER	30	0	N/A	N/A
TRANSMITTER	20	0	N/A	N/A
TOWER	30	1	15	20%
VFD - VARIABLE FREQUENCY DRIVE	20	1	10	20%
VALVE	30	0	N/A	N/A
CHECK VALVE	30	0	N/A	N/A
ISOLATION VALVE	30	0	N/A	N/A
RELIEF VALVE	30	0	N/A	N/A

3.5 Recommended Next Steps

The recommended steps pertaining to this section, to further enhance the asset management plan, are as follows:

1. Review and revise useful lives on regular basis. Renewal activities are mostly based on useful lives of assets. The better the useful life estimation, the higher the confidence in the future renewal projection.
2. Review and enhance management strategies on regular basis. Management strategies allow for customization of asset classes. Adding details (e.g., risk, condition, lifecycle cost) allows a more detailed renewal projection analysis. Separate management strategies should be added to a group of asset with different/individual deterioration behavior. Keep in mind that developing too many management strategies will force the modeling process to get lost in the details. A balanced approach should be considered.

4. Future Demand

4.1 Water Resources Management Strategy

In 2007, the Water Authority updated its Water Resources Management Strategy recommending the continued need to shift from sole reliance on the aquifer to renewable supplies (i.e., San Juan-Chama Drinking Water Project). The strategy was to design a safe and sustainable water supply for customers through the year 2060 and beyond.

The Water Resources Management Strategy drives the Water Authority's long-range water supply plan for the metropolitan area. The purpose of the strategy is to provide a safe and sustainable water supply for the metropolitan area by:

1. Determining and utilizing existing water resources the Water Authority owns

2. Planning for future water supplies

3. Making the best management decisions

This section describes the Water Authority's strategy for using the existing supplies to provide a safe and sustainable water supply.

4.2 Water Resources

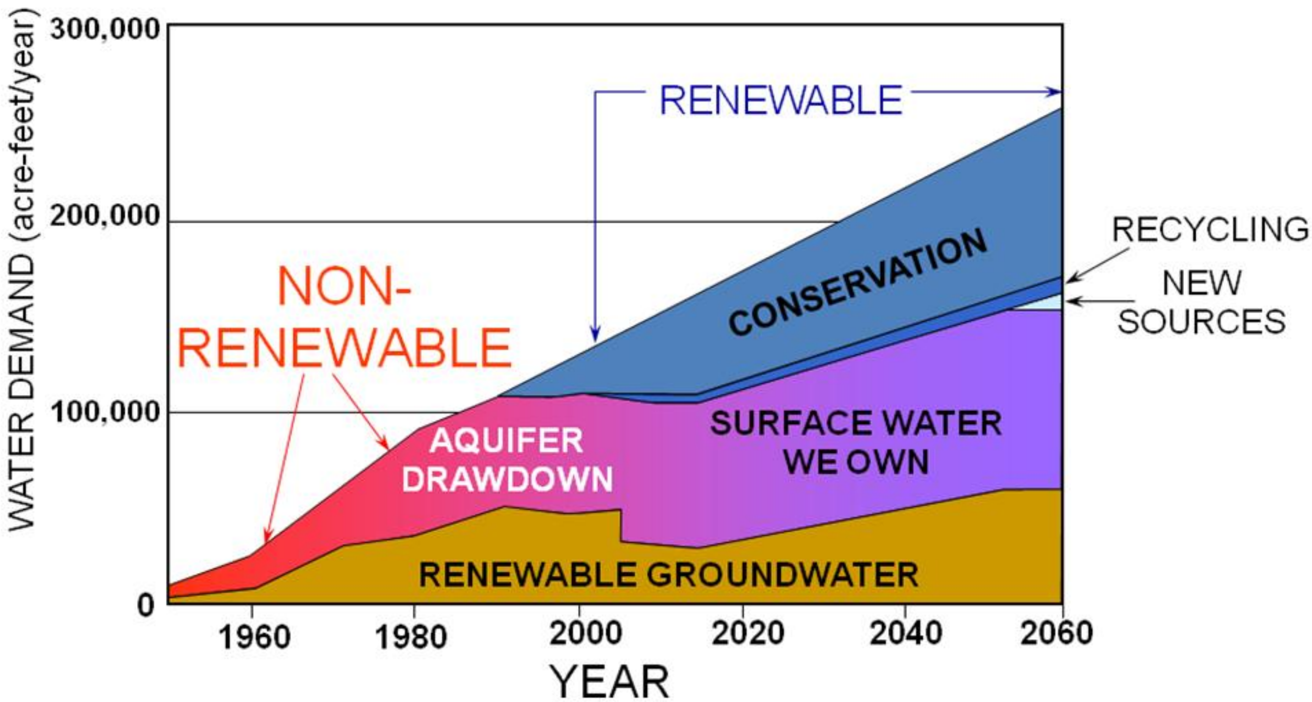
Water resources available to the Water Authority include vested and acquired consumptive use water rights of native Rio Grande water of about 26,000 ac-ft/yr and San Juan-Chama consumptive use rights of 48,200 ac-ft/yr. These consumptive use rights, combined with return flow credits from the Water Authority's discharge of treated wastewater may be used to offset the effects of groundwater diversions on the Rio Grande. The return flow credits allow the Water Authority to divert roughly double the permitted consumptive use amounts. Most of the water is diverted directly from the Rio Grande for both potable and non-potable uses by the Water Authority's Drinking Water Project and the North I-25 reclamation and reuse system.

The Water Authority's main groundwater diversion permit allows the diversion of up to 155,000 ac-ft/yr and a permit recently acquired from New Mexico Utilities Inc. allows the diversion of up to 10,000 ac-ft/yr. All of the Water Authority's permits are administered by the New Mexico Office of the State Engineer. The vested and acquired rights are subject to adjudication and priority administration under New Mexico water law. Because of the enormity of work and cost, an adjudication of Middle Rio Grande water rights is not likely to occur in the near future. Though a priority call has not occurred historically in the Middle Rio Grande Basin, the Water Authority's water rights may not be fully available in any extremely water-short year in the future.

4.3 Water Supply and Demand

The water rights and return flow credits described above are expected to provide sufficient quantities of water to satisfy offset requirements on the Rio Grande and meet water demands through about 2050 given currently projected future water use. Over time, depending on the water source used to meet demands the amount of required offset and water rights mix will vary. This variability presents the Water Authority with opportunities to optimize use of their water resources and extend their current resources to meet demands into the future.

Figure 4-1 Water Budget



4.3.1 Short-Term Water Rights Plan for Initial Implementation of Drinking Water Project

Hydrologic analyses completed for the New Mexico Office of the State Engineer hearing for the San Juan-Chama Drinking Water Project demonstrated that the Water Authority will have sufficient water rights available for initial implementation of the project. The initial period, known as the "hump" period refers to a critical time period over which the Water Authority must have sufficient water rights available and reserved for offsetting residual and ongoing effects to the Rio Grande. The Water Authority's current water rights holdings, plus the water it is owed through the previously mentioned borrowing and payback arrangements will provide sufficient offsets during the "hump" period. Because groundwater pumping and associated effects will gradually diminish over time, the Water Authority is expected to have sufficient water rights to operate the Drinking Water Project over the 40-year planning period. The Water Authority has discontinued the practice of leasing back purchased water rights in order to help ensure that adequate water rights will be available during the "hump" period.

4.3.2 Long-Term Water Rights Needs

As described in the Environmental Impact Statement and hearing documents for the Drinking Water Project, the Water Authority's current water rights holdings will be adequate to operate the project for the next 50 years. Additional water rights will need to be acquired to accommodate future growth and expansion of service. This analysis is based on hydrologic assumptions following the historical record. If the hydrology in the next 50 years does not in some way mimic the past history, then some minor or major adjustments will be necessary. The long-term water rights analysis is intended to evaluate these issues and propose alternative water acquisition programs.

4.4 Use of Ground Water

The aquifer is no longer the primary source of supply except during droughts and peak times during the summer. The use of the aquifer will be limited to provide the opportunity for natural and manmade recharge to create and maintain a ground water drought reserve. As population increases over time, ground water use will increase, but the Water Authority's policies are to find and utilize additional renewable supplies such that ground water use is limited to the amount of recharge. In the next couple of decades following implementation of the Drinking Water Project, ground water use will be substantially less (except during droughts) thereby allowing natural recharge in combination with the Water Authority's aquifer storage and recovery projects.

Since not all demands for water can be supplied from surface water sources at the present time due to permit and capacity limitations of the surface water treatment plant, a portion of water supply must be comprised of groundwater. Locations in the Albuquerque area that may be favorable for drilling future wells will need to be evaluated. Existing Water Authority wells in use are in various states of serviceability. Wells that are aging or are impacted by arsenic will require replacement in the future. A business risk evaluation of the groundwater wells shows that the Water Authority will need to be prepared for the potential failure of or end of serviceable life of a well. The decision analysis process used to select general locations for new wells will need to include the following considerations and general guidelines:

- Avoid areas with high levels of arsenic
- Target areas with high conductivity
- Avoid locating wells within the Critical Management Areas
- Select locations close to demand centers
- Avoid areas of known contamination
- Preferentially seek property owned by the Water Authority
- Avoid locations where significant interference with existing wells will occur

4.5 San Juan-Chama Drinking Water Project

One of the primary components of the strategy was the implementation of the Drinking Water Project. The project, which was completed in October 2008, began operation in late 2008. The project includes a river diversion south of the Alameda Bridge, a raw-water pump station located near the diversion, a 6-mile raw water conveyance line, and a 90 MGD water treatment plant located in northeast Albuquerque. From the water treatment plant, drinking-quality water is distributed in new and existing transmission mains and distribution lines throughout the Water Authority service area.

The Drinking Water Project is operated conjunctively with Water Authority groundwater wells. Surface water will initially provide the majority of annual water demands. Water Authority wells will be operated during summer to meet peak demands, and during periods of drought when river flows, are low. During periods of drought, the project will be shut down or operate at below capacity due to curtailed diversions intended to prevent the river from drying up (going intermittent) between the point of diversion and the Southside Water Reclamation Plant outfall.

4.6 Reclamation and Reuse Projects

To facilitate conjunctive use of available water resources and enhance water conservation and recycling efforts, the Water Authority has implemented two water reuse and reclamation projects to supply non-potable water for large turf and industrial needs in the northeast heights and north valley areas. Another reuse and reclamation project is under construction to reuse water effluent for industrial and irrigation needs in the southeast heights and south valley. The Water Authority is committed to additional reuse projects to provide non-potable water for irrigation and other uses on the westside and southwest mesa areas.

4.7 Aquifer Storage and Recovery

The Water Authority implemented a small scale pilot aquifer storage and recovery project in the Bear Canyon Arroyo. The purpose of the project was to land apply San Juan-Chama water to the surface of an unlined arroyo to allow for infiltration of the water into the aquifer. Artificial recharge is a vital component of the Water Resources Management Strategy. To further this goal and build on the successful implementation of the Bear Canyon Recharge Demonstration Project, the Water Authority has decided to implement a large scale surface recharge project. The Large Scale Recharge Project is being designed to recharge up to 22,000 acre-feet of water per year. Once the facilities are constructed, the proposed, full scale, demonstration project will be operated for two years, which is the time required to collect necessary data for compliance with New Mexico Office of the State Engineer regulations. The Water Authority will recharge water and store water in the aquifer to establish a drought reserve.

4.8 Recommended Next Steps

Recommended next steps for this section are:

- Continue implementing policy recommendations from the Water Resources Management Strategy.
- Implement an full-scale Aquifer Storage and Recovery program beginning with the necessary pilot studies needed to supplement the current activities, permitting phase such that the project can be implemented with the San Juan-Chama Drinking Water Project is operational.
- Over time, build and operate additional water reuse and recycling projects to provide irrigation and industrial water to larger areas in the southeast and westside of metropolitan Albuquerque.
- Investigate the feasibility of desalination as a future water source considering financial, energy and environmental factors.
- Evaluate and examine the use of the very deep aquifer (greater than 3,000 feet below ground surface).

5. Performance Measurement

The levels of service are a subset of the larger body of standards called performance measures. Performance management starts with these measurements and is an articulation of how much, how well, and the impact of what the organization does for their customers. Performance management uses these measurements to steer the organization toward defined levels of output and to deliver the defined services at the lowest lifecycle cost.

Performance management involves defining mission, programs, services and products, and levels of service. These must be measurable and incorporated into the business plan. To be most effective, levels of service, which address performance at the organizational level, must be tied to performance of assets at the asset unit level. This is accomplished by defining asset functionality for each asset unit (e.g., a lift station pump may have a minimum functionality requirement of 900 gallons per minute around the clock) where the aggregate of the individual asset functioning results in meeting – or failing to meet – the target levels of service.

This chapter documents the mission, performance plan, and levels of service for the Water Authority.

5.1 Mission

The established mission of the Water Authority is to:

- Assure responsive customer service
- Provide a reliable, high quality, affordable and sustainable water supply, wastewater collection treatment, and reuse systems
- Support a healthy, environmentally sustainable, and economically viable community

5.2 Five-Year Goals and the Performance Plan

The Water Authority adopted the Budget Ordinance, which requires a performance plan to be developed and linked to the adopted Five-Year Goals. The Water Authority's Five-Year Goals are based around the American Water Works Association's QualServe business model, which characterizes the work of the water and wastewater utility around five business units as follows:

1. Customer Services
2. Business Planning and Management
3. Organization Development
4. Water Supply and Operations
5. Wastewater Collection and Operations

The Water Authority's Five-Year Goals are documented in Figure 5-1.

The performance plans also document the Water Authority's actions in comparison to other utilities. These comparisons relate the Water Authority to other combined water / wastewater utilities, utilities with populations greater than 500,000, and utilities located in the western United States. There comparisons include the information in this asset management plan to help benchmark the Water Authority's capital spending and renewal / replacement ratio for water pipeline and distribution, water facility and pumping, wastewater pipeline and collection, and wastewater facility and pumping.

Figure 5-1 Water Authority's Five-Year Goals

Customer Services

Provide quality customer service by communicating effectively, billing accurately, and delivering water and wastewater services efficiently based on understanding the needs and perceptions of the customers and the community at large.

Water Supply & Operations

Provide a reliable, safe, affordable, and sustainable water supply by transitioning to renewable supplies and minimizing long-term environmental impacts on the community and natural resources while ensuring the ability of the community to grow in a responsible manner.

Organization Development

Sustain a well informed, trained, motivated, safe, organized, and competitive work force to effectively meet the expectations of the customers, community, and the Board in accordance with adopted policies and mandates.

Business Planning & Management

Maintain a well planned, managed, coordinated, and financially stable utility by continuously evaluating and improving the means, methods, and models used to deliver services.

Wastewater Collection & Operations

Provide reliable, safe and affordable wastewater collection, treatment and reuse systems to protect the health of the Middle Rio Grande Valley by safeguarding the regional watershed, minimizing environmental impacts, and returning quality water into the Rio Grande for downstream users.

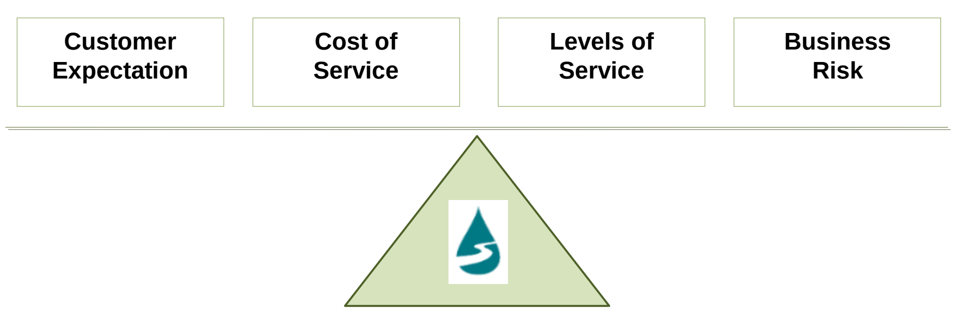
The Water Authority's Budget Ordinance also requires the performance plan contain measures to assist in developing water and wastewater annual operating and capital budgets, as well as allocating and prioritizing resources. The performance targets enable the Water Authority to improve its operational efficiency, implement quality improvement processes, and enhance decision-making.

The American Water Works Association's QualServe Benchmarking Performance Indicators Survey was utilized to develop the Performance Plan. The survey provides utilities with an opportunity to collect and track data from already identified and tested performance measures. The most recent survey data was compiled in 2007 by the American Water Works Association from over 200 different utilities. The Water Authority's year-to-year performance is tracked against the most recent survey data compiled in 2007.

5.3 Levels of Service

Levels of service are defined as the standard and quality of a provided service. Levels of service assist in establishing performance goals and asset management strategies. As illustrated in Figure 5-2, the key objective of asset management is to balance the levels of service, cost of service, customer expectation, and risk. With high customer expectation, the Water Authority can lower business risk but the cost of service will be high. With a lower cost of service, the Water Authority will need to assume more risk as part of delivering the services. Often, a balance can be achieved by negotiating with customers regarding the levels of service expectations.

Figure 5-2 Asset Management Model



Level of Service is a set of outputs the Water Authority intends to provide. Upon delivery to the customer, the level of service is measured. Understanding what to measure establishes the relationship between the levels of service and the cost to provide the service. Once established, this relationship can be evaluated in consultation with customers to determine the optimum service the customers are willing to pay for. At this balanced point, the Water Authority can develop management strategies to deliver services at the lowest lifecycle cost.

Defined levels of service can be used to:

- Inform customers of the proposed services to be offered
- Develop asset management strategies to deliver the required levels of service
- Measure performance against the defined levels of service
- Identify costs and benefits associated with service delivery
- Enable customers to assess the suitability, affordability and equity of the services offered

The current levels of service may not be measured in terms of cost and/or quality; however, it is important to begin the process of documentation. Determining and documenting levels of service enables the gap between the service provided and the service sought by customers to be quantified and strategies devised to close the gap.

5.3.1 Current and Future Levels of Service

The Water Authority developed the current and future levels of service based on its Performance Plan. Table 5-1 presents the Water Authority’s current and future levels of service and their measurable indicators. The levels of service are a subset of the larger body of standards called performance measures. Performance measures are a key part of public utility management. The Water Authority uses performance measures, performance targets, and the customer opinion surveys to develop its levels of service or levels of output, and to deliver the defined services at the lowest lifecycle cost.

In quantifying its performance, the Water Authority has begun to balance its performance with the levels of service, cost of service, customer expectations, and business risk. As a part of the asset management plan, the Water Authority has developed its levels of service to coincide with its performance measures at the Five-Year Goal level. At this time, the Water Authority has developed levels of service for three of the goal areas, which includes Water Supply & Operations, Wastewater Collection & Operations, and Customer Services.

To be most effective, levels of service, which address performance at the organizational level, must be tied to performance at the asset unit level. This is accomplished by defining asset functionality for each asset unit where the aggregate of the individual asset functioning results in meeting – or failing to meet – the target levels of service. For example, a lift station pump may have a minimum functionality requirement of 900 gallons per minute around the clock. As the Water Authority is currently in the process of developing its asset management program, they have elected not to develop levels of service to the asset unit level at this time. The decision was made to manage the levels of service at a Five-Year Goal level until the Water Authority matures in its asset management knowledge to gain more benefit from the process.

Table 5-1 Water Authority's Levels of Service (2009)

Core Values	Strategic Outcomes	Customer LOS	Technical LOS	Performance Measure Description	Performance Measure Inputs	Performance Measure (Current-2010)	Performance Measure Target (2011)
Water Quality	Provide safe and reliable drinking water to our customers 100% of the time	Meet all health-related drinking water standards 100% of the time	Meet all health-related drinking water standards 100% of the time	Drinking Water Compliance Rate	Number of days in full compliance	100% in compliance	100% in compliance
Water Efficiency	Improve water use efficiency and reduce distribution water loss	Reduce system-side leaks	Inspect 500 miles of water pipeline per year	Distribution System Water Loss	Volume of water distributed, volume billed, volume unbilled but authorized	11.5%	11.2%
Water Efficiency	Improve water use efficiency and recover lost revenue	Replace/Repair stopped meters within 60 days of notification	Replace/Repair stopped meters within 90 days of notification				
Water Mgmt Effectiveness	Improve the condition and reliability of the water distribution system and reduce emergency repairs and water supply interruptions	No more than 3 leaks per pipeline segment (valve to valve)	Less than or equal to 5 leaks per pipeline segment (valve to valve); Replace at least 2 miles of steel pipeline per year	Water Distribution System Integrity	Number of leaks per 100 miles of distribution piping	31	29

Table 5-1 Water Authority's Levels of Service (2009) continued

LOS #	Goal Area	Core Values	Strategic Outcomes	Customer LOS	Technical LOS	Performance Measure Description	Performance Measure Inputs	Performance Measure (Current-2010)	Performance Measure Target (2011)
2.1	Wastewater Collection	Collection Effectiveness	Improve the condition and reliability of the collection system and reduce customer complaints	No dry-weather overflows per year	Less than 30 dry-weather overflows per year for entire collection system	Sewer Overflow Rate	Number of sewer overflows per 100 miles of gravity collection piping	1.3	1.2
2.2	Wastewater Collection	Collection Effectiveness	Improve the condition and capacity of the collection system and minimize catastrophic failures	No more than 5 failures per 100 miles of collection system piping	Less than or equal to 11 failures per 100 miles of collection system piping	Collection System Integrity	Number of collection system failures each year per 100 miles of collection system piping	11.5	11.0
2.3	Wastewater Treatment	Wastewater Quality	Minimize environmental impacts to the river by returning high quality water to the river	No compliance violations	Less than or equal to 5 standard non-compliance days per year	Wastewater Treatment Effectiveness Rate	Percent of time each year that an individual wastewater treatment facility is in full compliance with applicable effluent quality requirements	95.0%	96.0%

Table 5-1 Water Authority's Levels of Service (2009) continued

LOS #	Goal Area	Core Values	Strategic Outcomes	Customer LOS	Technical LOS	Performance Measure Description	Performance Measure Inputs	Performance Measure (Current-2010)	Performance Measure Target (2011)
3.1.1	Customer Service	Effective Customer Care	Improve customer satisfaction with service delivery	Knowledge and ability to resolve issue 90% of the time	Respond to billing-related complaints 90% of the time within 72 hours; Reduce call wait time to less than 1 minute, 90% of the time	Customer Service Complaints	Number of customer service complaints per 1,000 customer accounts	14	13
3.1.2	Customer Service	Effective Customer Care	Improve customer satisfaction with service delivery	Knowledge and ability to resolve issue 90% of the time	Respond within 24 hours for technical quality-related complaints	Technical Quality Complaints	Number of technical quality complaints per 1,000 customer accounts	7	6
3.2	Customer Service	Effective Customer Care	Improve billing accuracy to minimize customer complaints	Error-free bill	Less than 2,000 error-driven billing adjustments per year	Billing Accuracy	Number of error-driven billing adjustments per 10,000 bills generated during the year	14	13
3.4.1	Customer Service	Effective Customer Care	Reduce water supply interruptions and provide reliable water service to meet customer expectations of full water service all of the time	8 hours or less of interrupted service	Restore service within 8 hours	Planned Disruptions of Water Service	Number of customers impacted by planned disruption of service per 1,000 customer accounts per year	<4 hrs: 1.40 4-12 hrs: .75 >12 hrs: .13	<4 hrs: 1.30 4-12 hrs: .50 >12 hrs: .09
3.4.2	Customer Service	Effective Customer Care	Reduce water supply interruptions and provide reliable water service to meet customer expectations of full water service all of the time	8 hours or less of interrupted service	Restore service within 1 hour	Unplanned Disruptions of Water Service	Number of customers impacted by unplanned disruption of service per 1,000 customer accounts per year	<4 hrs: 0.30 4-12 hrs: 0.17 >12 hrs: 0.03	<4 hrs: 0.25 4-12 hrs: 0.12 >12 hrs: 0.03

5.4 Recommended Next Steps

The levels of service should be updated annually at the beginning of each fiscal year to coincide with current fiscal year Performance Plan. The Water Authority should evaluate the technical and customer levels of services to determine if changes are necessary.

The key objective of asset management is to match the levels of service with customer and stakeholder expectations. Understanding these attributes enables a relationship to be established between levels of service and cost of service. In order to determine the cost of service, the Water Authority will need to establish performance indicators and measurements at multiple levels of the asset hierarchy. These performance measures should be developed down through the asset hierarchy to the specific performance levels of the individual assets. This linkage assures the assets are meeting the intended levels of service and helps to identify critical assets with respect to delivery of service.

6. Business Risk Exposure

In an effort to optimize the use of financial and staff resources, the Water Authority decided to perform a risk assessment of its water and wastewater assets. The Water Authority intends to use risk to understand the criticality of each asset, prioritize the use of its limited resources and budget, and gain an understanding of future renewal (rehabilitation and replacement) work. Specifically, the objectives of the Water Authority's risk assessment are to:

- Identify assets representing the greatest risk to the organization
- Promote efficient use of resources such as capital and operational expenditures and staff hours
- Highlight assets requiring detailed condition assessment or renewal
- Prioritize an inspection, cleaning, and preventative maintenance schedule
- Develop and apply appropriate management strategies based on risk

The risk assessment was performed for the water pipes, wastewater pipes, and wastewater treatment plant assets. A high-level risk assessment was performed by Water Authority staff at the facility level (e.g., wells, reservoirs) for the water plant system.

The San Juan-Chama Drinking Water Plant (SJCDWP) was new construction, and assessed in its entirety at very low risk without aid of GHD's assessment. Using an internal spreadsheet model, the ground water system data was modeled at a primary facility level (wells, pump stations, and reservoirs). This data was collected, valued, and assessed for risk by Water Authority staff. Each facility is priority ranked by risk utilizing the internal model. The collection of detailed data on the ground water system and SJCDWP assets and entering of this data into the Water Authority's database is an ongoing effort with an expected completion date of mid-2011. Because the internal model differs from most of the analysis presented herein, the results and risk ranking are provided in the Appendix B.

The Water Authority's objective is to holistically, and conjunctively, assess risk for the Water Plant system. Since this internal risk model lacks the capability to generate specific future renewal funding projections, the Water Authority is planning more detailed work to fill in noteworthy gaps. Upon completion of the ground water system collection phase, the data will be integrated with SJCDWP asset data to prepare a detailed 10-year Water Plant asset management plan.

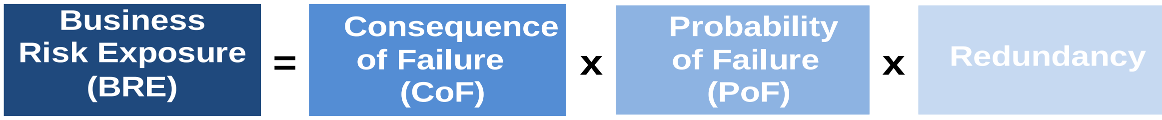
Details of the business risk exposure assessment methodology and results can be found in the Business Risk Exposure – Risk Mapping Technical Memorandum.

6.1 Methodology

Risk is often considered the likelihood or timing of failure, however, in asset management, risk considers not only the timing of failure, but also the impact of failure. While an asset may be likely to fail, if it is of low consequence (or impact) of failure it will be managed differently than an asset with a high consequence (or impact) of failure, which must be managed in a way to prevent failure from ever occurring. This can be accomplished through more rigorous maintenance and/or adding redundancy in the system.

Consistent to the teachings of asset management, GHD refers to this definition of risk as business risk exposure. Business risk exposure is comprised of three major components: probability of failure, consequence of failure, and redundancy. Probability of failure measures an asset's likelihood of failure. Consequence of failure evaluates the direct and indirect impacts of a failure. Redundancy, where available, helps to decrease the overall risk exposure. Figure 6-1 presents the business risk exposure methodology.

Figure 6-1 Business Risk Exposure Methodology



Probability of Failure

Probability of failure provides insight to the timing of an asset failure. From an asset management perspective, an asset fails in one of four ways:

- Physical Mortality – failure due to age or structural collapse
- Level of Service – failure to deliver the service expectations
- Capacity – failure to meet the flow requirements
- Financial Efficiency – failure to provide the lowest lifecycle cost

Probability of failure measures the timing of failure driven by the imminent failure mode (one of the four modes presented above).

Consequence of Failure

Consequence of failure measures the impact of a failure from a Triple Bottom Line perspective (Environment, Economic, and Social).

Redundancy

Where available, redundancy is used to offset the business risk exposure rating.

Business Risk Exposure Rating

Business risk exposure rating is measured by using a numerical value or by assigning the risk cost to the organization. The Water Authority risk assessment used a numerical value for representing risk.

6.2 Wastewater Pipes

In the case of wastewater pipes, two failure modes were considered: structural (physical mortality) and operational (level of service). Structural probability of failure considers the likelihood of failure caused by the structural collapse of a pipe. Operational probability of failure considers the likelihood of failure due to blockage of a pipe. The remaining two failure modes, capacity and financial efficiency, did not have sufficient data to allow for an individual asset's likelihood of failure to be calculated.

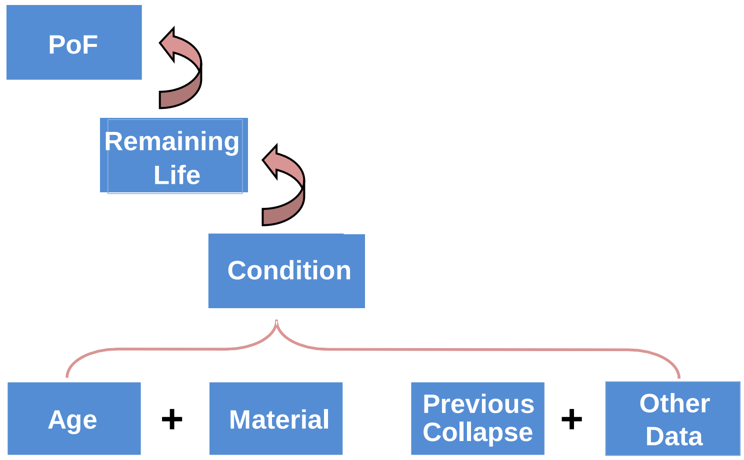
6.2.1 Structural probability of failure

The following data were used to calculate the structural probability of failure:

- Condition data
- Previous collapse data
- Pipe age

Figure 6-2 presents the structural probability of failure methodology.

Figure 6-2 Structural Probability of Failure Methodology



The highest priority was given to the condition data since it is the most accurate representation of the asset's current condition. When condition data was not available, any previous collapse data was used to estimate the asset's condition. Where no information leading to the condition of the pipe was available, a deterioration modeling process, based on age and pipe material (Figure 6-3), was used to calculate the percent of life consumed and to estimate the asset's condition. The deterioration modeling was only used when no condition or previous collapse data was available.

Figure 6-3 Condition vs. Remaining Useful Life

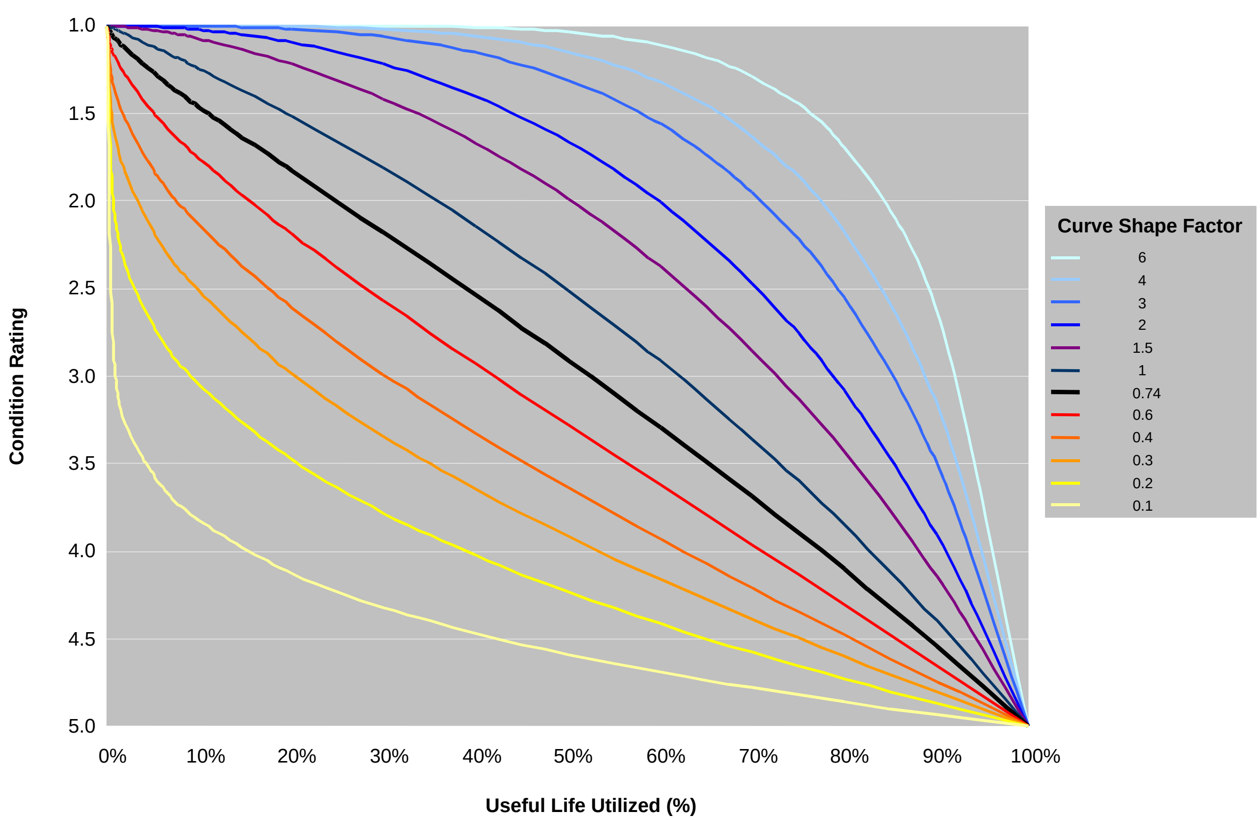
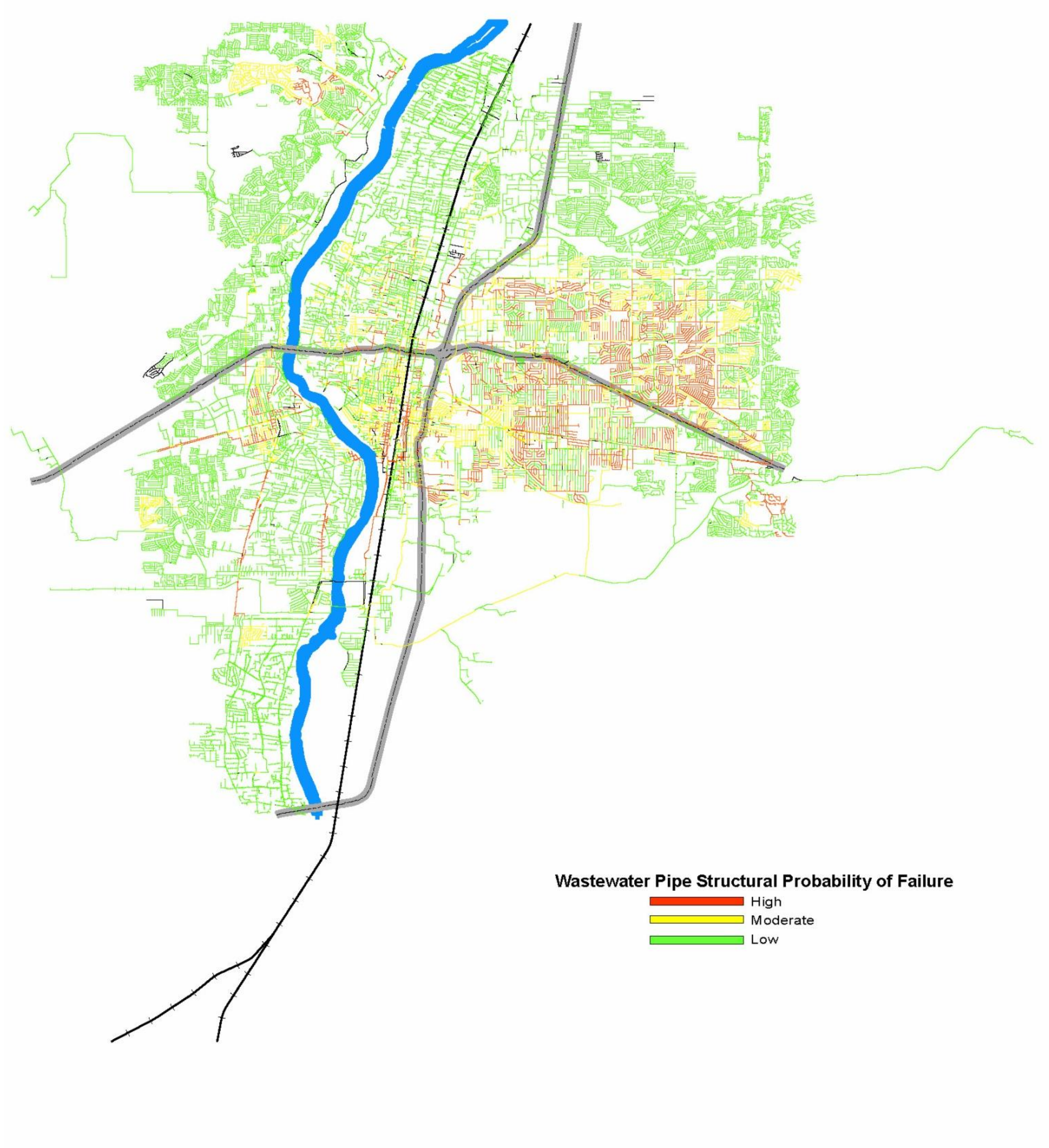


Table 6-1 summarizes the results of the structural probability of failure assessment. The results of the assessment were categorized into low (green), medium (yellow), and high (red). The scales were established during a workshop with Water Authority staff. The assessment indicates most of the Water Authority's wastewater pipes have low structural probability of failure (i.e., ratings of 1, 2, or 3). The assessment also indicates approximately 11% (272 miles) require immediate attention (i.e., rating of 10). These pipes will require rehabilitation or replacement in the near future. Field verification and/or condition assessment should be performed for validation.

Table 6-1 Wastewater Pipe Structural Probability of Failure Results

Structural PoF	Record Count	Total Length (ft)	Total Length (miles)	% of Total Length
1	26,058	4,944,109	936	39%
2	11,890	2,751,842	521	22%
3	6,720	1,488,084	282	12%
4	4,762	1,206,910	229	9%
5	1,075	290,316	55	2%
6	481	139,715	26	1%
7	733	181,508	34	1%
8	981	240,502	46	2%
9	187	44,471	8	1%
10	5,092	1,437,595	272	11%

Figure 6-4 Wastewater Pipe Structural Probability of Failure Results



6.2.2 Operational probability of failure

The purpose of the operational probability of failure assessment is to highlight pipe segments prone to blockage. The methodology relied on the use of work order history, pipe size, pipe locations, zoning, and restaurant proximity. Various weights were assigned to each contributing factor to identify likely areas of blockage. Details of the operational probability of failure methodology can be found in the Business Risk Exposure Technical Memorandum. The following data were used to calculate the operational probability of failure:

- Overflow records
- Restaurant data
- Pipe cleaning frequency
- Pipe size
- Pipe slope
- Work order history

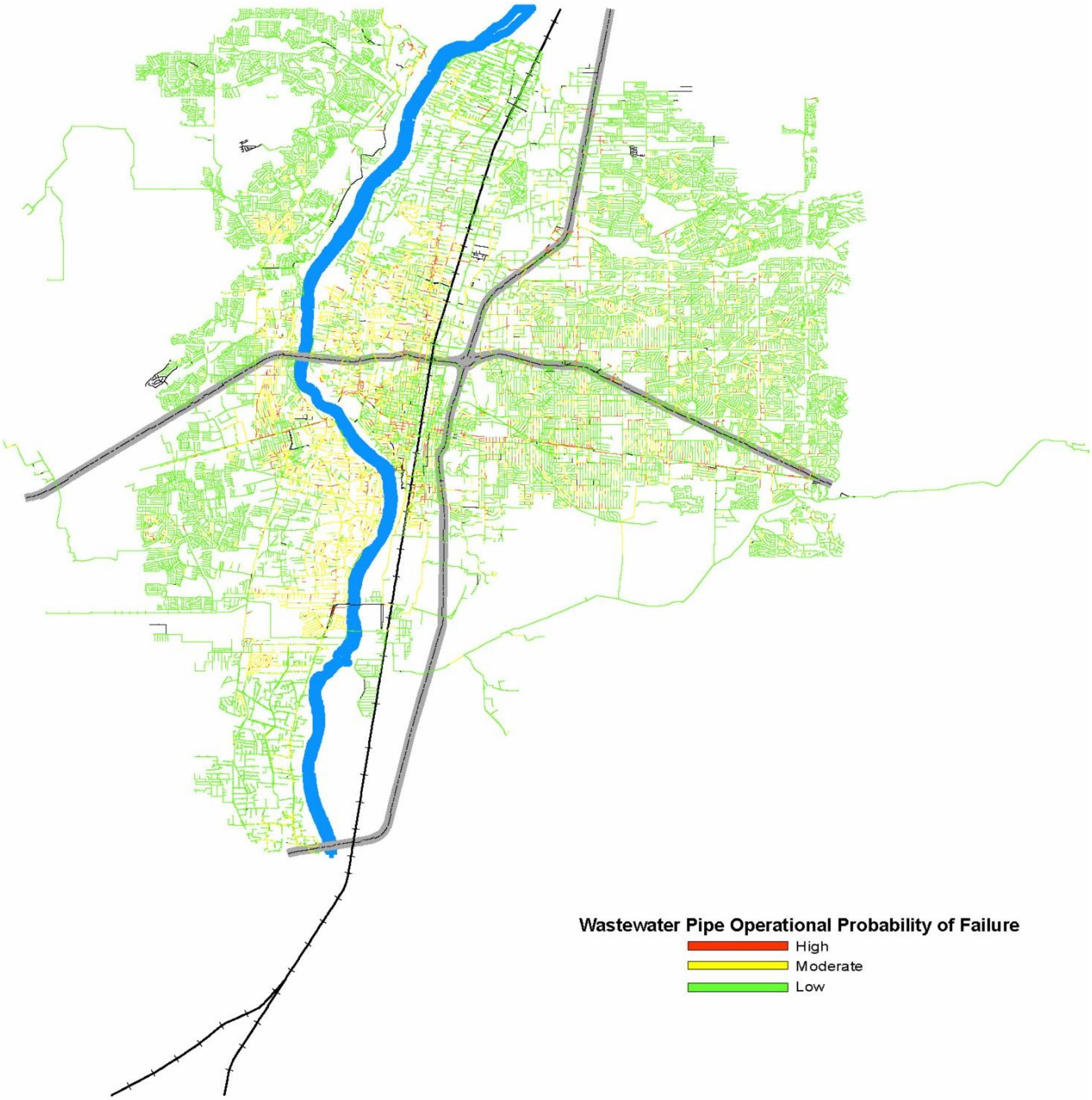
Table 6-2 summarizes the results of the operational probability of failure assessment. The assessment results were categorized into low (green), medium (yellow), and high (red). The scales were established during a workshop with Water Authority staff. The results indicate 95% of pipes were not prone to operational failure. The results did indicate roughly 5% (PoF 8, 9, and 10) of the total pipes were prone to blockage. These pipes should be further investigated and preventive management strategies or cleaning schedules be assigned to prevent future failures.

Table 6-2 Wastewater Pipe Operational Probability of Failure Results

Operational PoF	Record Count	Total Length (ft)	Total Length (miles)	% of Total Length
1	9,674	1,885,154	357	15%
2	34,744	7,666,552	1,452	60%
3	1,936	311,180	59	2%
4	2,639	581,670	110	5%
5	1,033	285,398	54	2%
6	3,740	905,039	171	7%
7	2,072	515,904	98	4%
8	915	230,354	44	2%
9	355	101,575	19	1%
10	871	242,225	46	2%

The results of the operational probability of failure assessment were introduced as a GIS layer and mapped (Figure 6-5). Locations of high and medium operational probability of failure correlate to business or densely populated areas. These findings were consistent with the perceptional knowledge of the Water Authority's field and engineering staff.

Figure 6-5 Wastewater Pipe Operational Probability of Failure Results



6.2.3 Consequence of failure

The consequence of failure measures direct and indirect impacts of a failure. The impact of a failure was considered from a Triple Bottom Line perspective (Economic, Environment, and Social). The factors used to measure consequence of failure were:

- Interstate / Railroad – This factor was used to highlight areas where an impact of failure would result in high social and economic consequence.
- Land Use – This factor considers the zoning or the use of the land at the location of the pipe. The location has a huge impact on the social, economic, and environmental consequence. This factor was used to highlight rivers, water channels, business, residential, school, hospital, etc.
- Interceptor mains –The greater the size of the pipe, the greater the potential for environmental and economic damage due to the larger wastewater volume flowing through the pipe.
- Force mains –A failure of force main will release large volumes of wastewater and disrupt in the overall collection system operation.
- Traffic – The higher the traffic volume, the higher the social and economic consequence.
- Overflow records – The overflow records were divided into three categories: Backups (less than 50 gallons), Overflows (greater than 50 gallons), and Property Damage (spill resulted in property damage). Each spill had health and safety concerns and resulted in economic, environment, and social consequences.

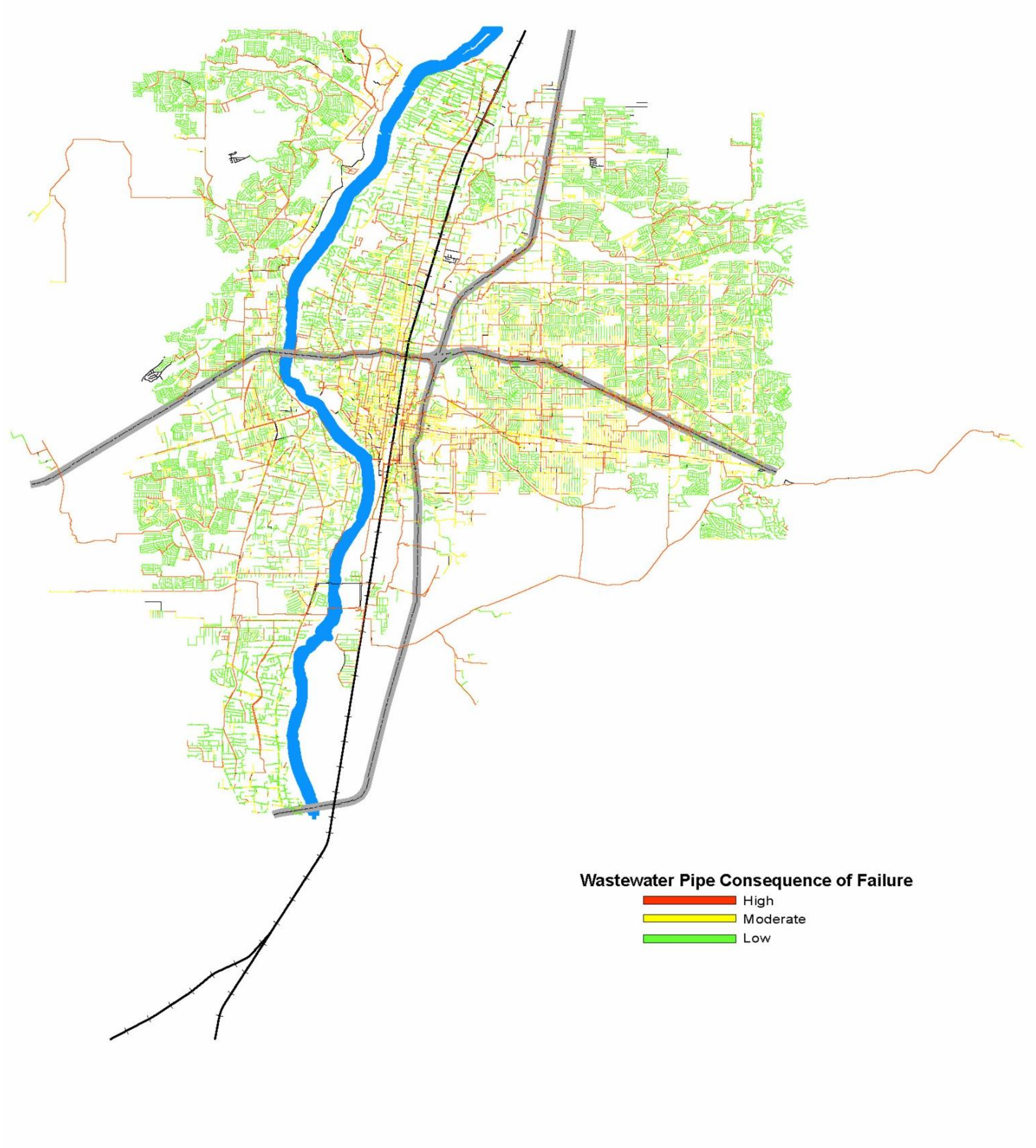
Table 6-3 summarizes the results of the consequence of failure assessment. The assessment results were categorized into low (green), medium (yellow), and high (red). The scales were established during a workshop with Water Authority staff. The results indicate 55% of the total length of pipe represents low consequence. Conversely, 24% of the total length of pipes represents high consequence. Management strategies should be developed for pipes with high consequence to prevent failure.

Table 6-3 Wastewater Pipe Consequence of Failure Results

CoF	Record Count	Total Length (feet)	Total Length (miles)	% of Total Length
1 -3	901	187,354	35	1%
4	34,336	6,835,911	1,295	54%
5	4,785	1,159,746	220	9%
6	4,670	1,091,388	207	9%
7	1,518	384,814	73	3%
8	1,703	402,586	76	3%
9	831	208,722	40	2%
10+	9,235	2,454,525	465	19%

The results of the consequence of failure assessment were introduced as a GIS layer and mapped (Figure 6-6). As expected, the areas of high consequence were near high traffic, railroads, and environmentally sensitive areas.

Figure 6-6 Wastewater Pipe Consequence of Failure Results



6.2.4 Business Risk Exposure Assessment

The business risk exposure assessment is comprised of three major components: probability of failure, consequence of failure, and redundancy. In this assessment, the redundancy data was not available on an individual pipe basis, and as a result, was not incorporated into the model.

Structural Business Risk Exposure

The structural probability of failure scores (Figure 6-4) and the consequence of failure scores (Figure 6-6) were multiplied together to generate the structural business risk exposure scores. The business risk exposure results were introduced as a GIS layer and mapped (Figure 6-7).

The structural probability of failure identified 326 miles of pipes with a high likelihood of failure. Following the business risk exposure concept and the consequence of failure factor, the 326 miles of pipes were broken down into the three consequence of failure categories, as shown in Table 6-4.

From an asset management perspective and based on this analysis, only 77 miles should be considered for immediate renewal. Additionally, a renewal decision for 150 miles of high structural probability of failure pipe can be deferred due to a low impact of failure. Assuming an estimated replacement cost of $125 per linear foot, the 150 miles of pipe equates to $99 million in replacement costs.

Figure 6-7 Wastewater Pipe Structural Business Risk Exposure Results

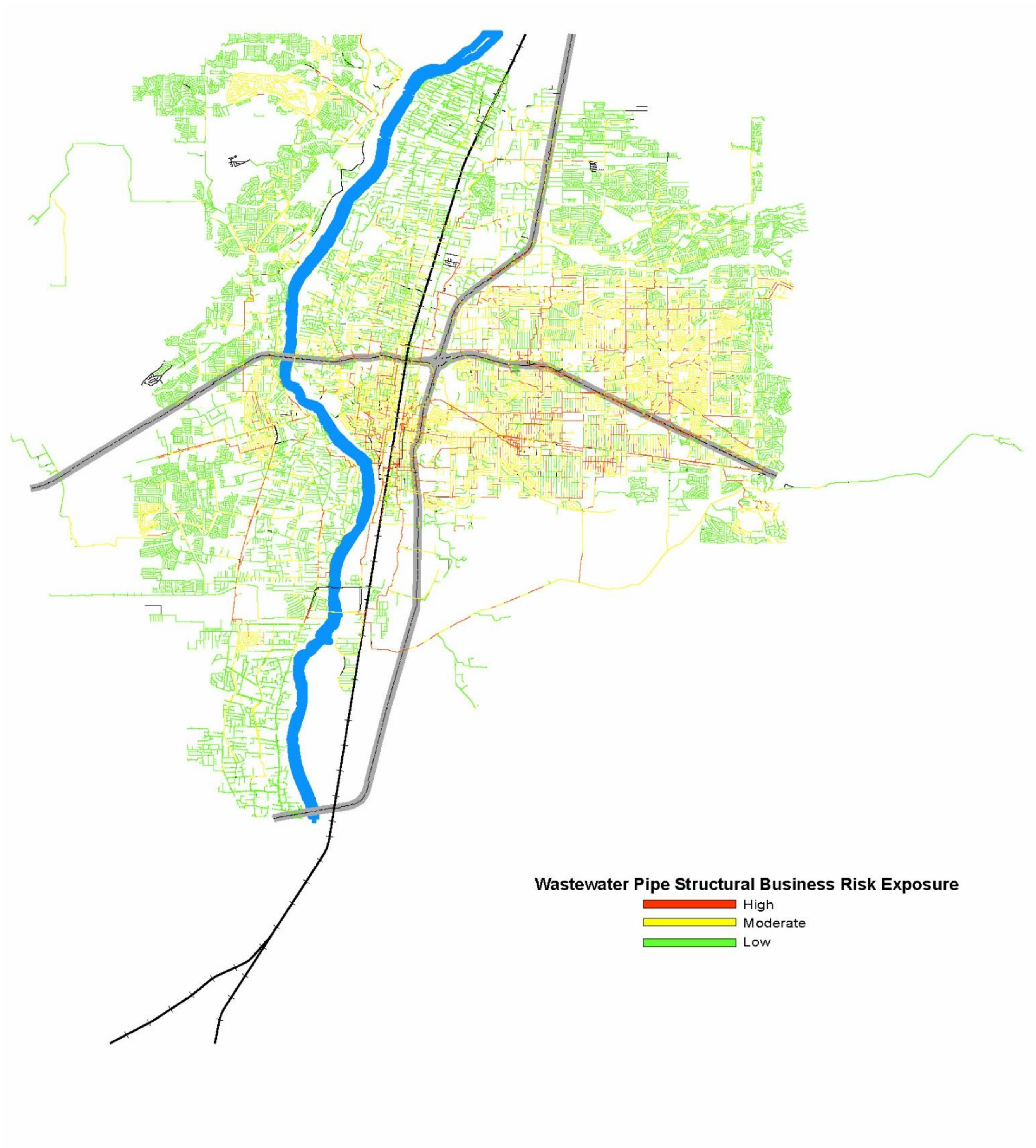


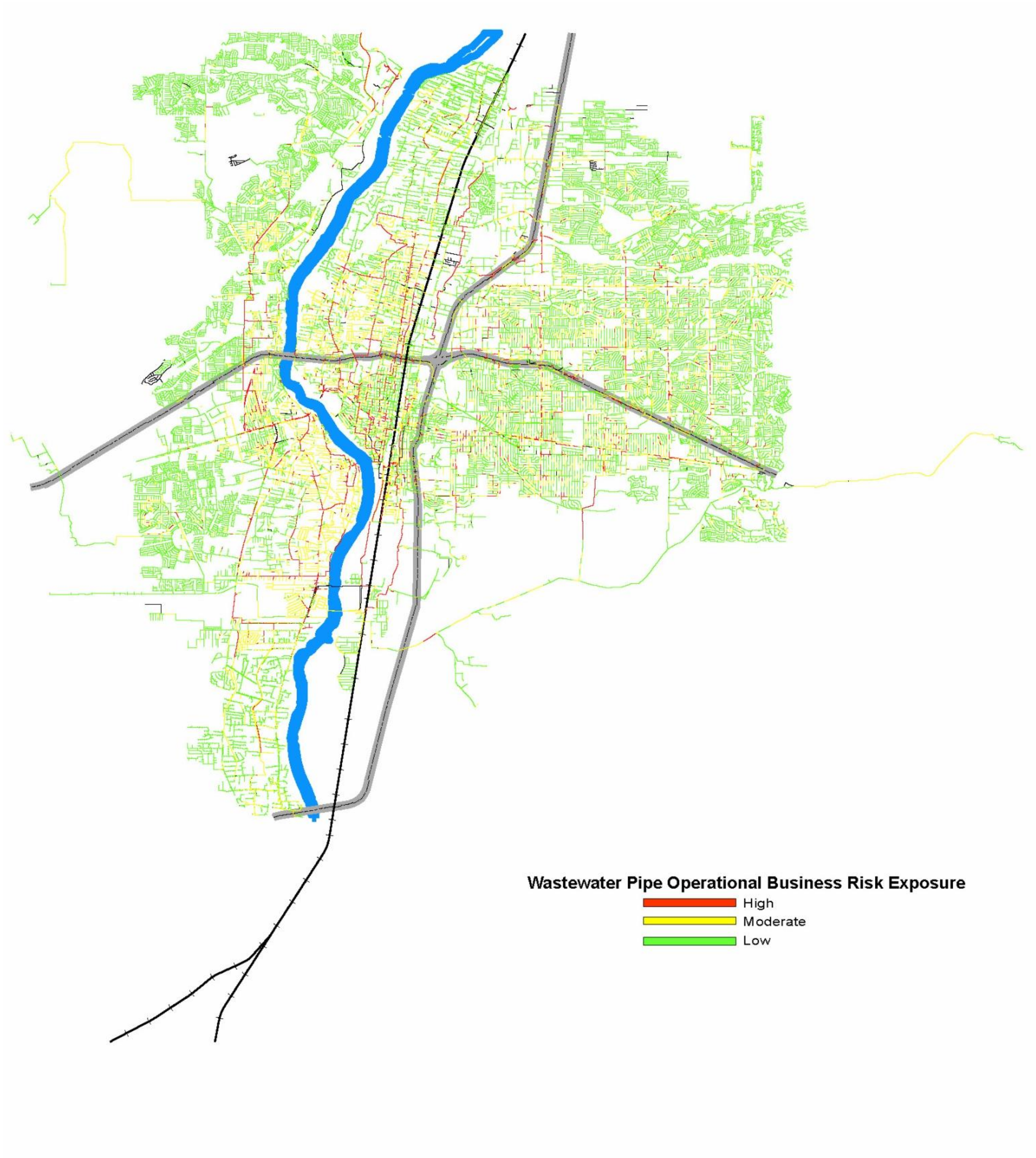
Table 6-4 High Structural Probability of Failure Risk Breakdown

Structural Probability of Failure (PoF)	Consequence of Failure (CoF)
High Structural PoF 14% of total length of wastewater collection pipe or 326 miles	High CoF 24% or 77 miles
	Medium CoF 30% or 99 miles
	Low CoF 46% or 150 miles

Operational Business Risk Exposure

The operational probability of failure scores (Figure 6-5) and the consequence of failure scores (Figure 6-6) were multiplied together to generate the operational business risk exposure scores. The business risk exposure results were introduced as a GIS layer and mapped (Figure 6-8).

Figure 6-8 Wastewater Pipe Operational Business Risk Exposure Results



The operational business risk exposure helps prioritize cleaning or maintenance activities. The results of the business risk exposure assessment should be used to enhance cleaning and maintenance strategies. Prioritizing limited resources to focus on pipes with high business risk exposure reduces the likelihood of overflows.

6.3 Water Pipes

Two failure modes, structural (physical mortality) and operational (level of service), were considered in the assessment of probability of failure. Structural probability of failure considers the likelihood of failure caused by the structural collapse of a pipe. Operational probability of failure considers the likelihood of failure due to blockage of a pipe. The remaining two failure modes, capacity and financial efficiency, did not have sufficient data to allow for an individual asset's likelihood of failure to be calculated.

6.3.1 Structural probability of failure

The following data were used to calculate the structural probability of failure:

- Pipe age
- Pipe tap data (number of taps per segment)
- Land use (pipes through landfills)

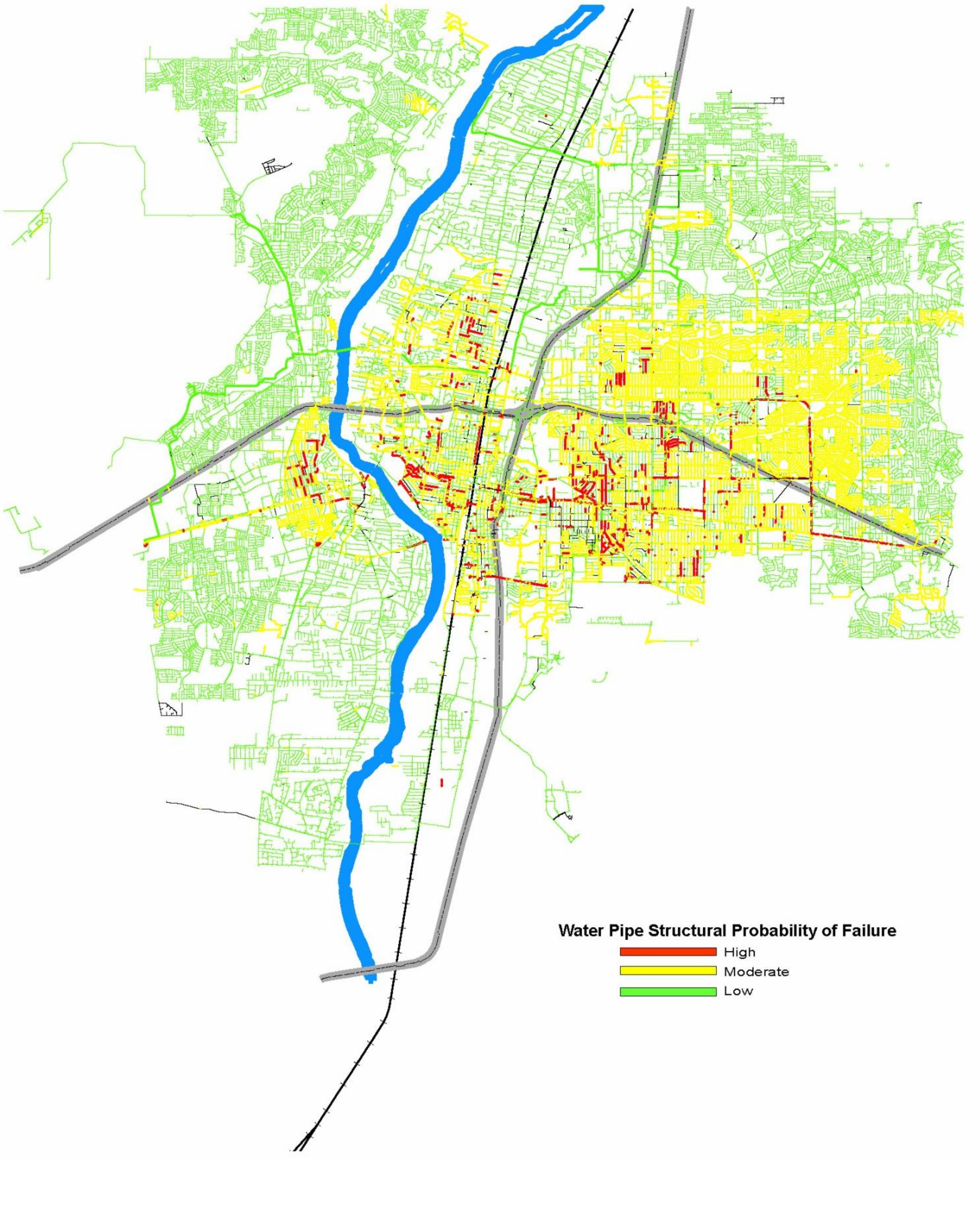
No condition data was available to estimate the remaining useful life. A deterioration modeling process, based on age and pipe material was used to calculate the percent of life consumed and estimate the asset's condition. During the workshop, members of the Water Authority's field and engineering staff noted that pipes tapped more than 25 times in a single segment or passing through a landfill were more likely to fail. This information was incorporated into the structural probability of failure scoring methodology.

Table 6-5 summarizes the results of the structural probability of failure assessment. The results of the assessment were categorized into low (green), medium (yellow), and high (red). The scales were established during a workshop with Water Authority staff. The assessment indicates most of the Water Authority's water pipes have low structural probability of failure (i.e., ratings of 1, 2, or 3). Only 3% (95 miles) of the Water Authority's water pipes require immediate attention (i.e., rating of 10). These pipes will require rehabilitation or replacement in the very near future. Field verification and/or condition assessment should be performed for validation.

Table 6-5 Water Pipe Structural Probability of Failure Results

Structural PoF	Record Count	Total Length (ft)	Total Length (miles)	% of Total Length
1	31,706	4,238,720	803	26%
2	46,028	6,570,824	1245	40%
3	14,644	2,296,064	435	14%
4	15,715	2,495,535	473	15%
5	907	107,410	20	1%
6	326	42,887	8	1%
7	342	34,463	7	0%
8	167	12,731	2	0%
9	293	21,020	4	0%
10	2,807	467,058	89	3%

Figure 6-9 Water Pipe Structural Probability of Failure Results



The results of the structural probability of failure assessment were introduced as a GIS layer and mapped (Figure 6-9). Locations of medium to high structural probability of failure pipes were concentrated in the older sections of the city. These findings were consistent with the perceptual knowledge of the Water Authority's field and engineering staff.

6.3.2 Operational probability of failure

The purpose of the operational probability of failure assessment is to highlight pipe segments prone to leakage. The following data were used to calculate the operational probability of failure:

- Leak data
- Pressure zone

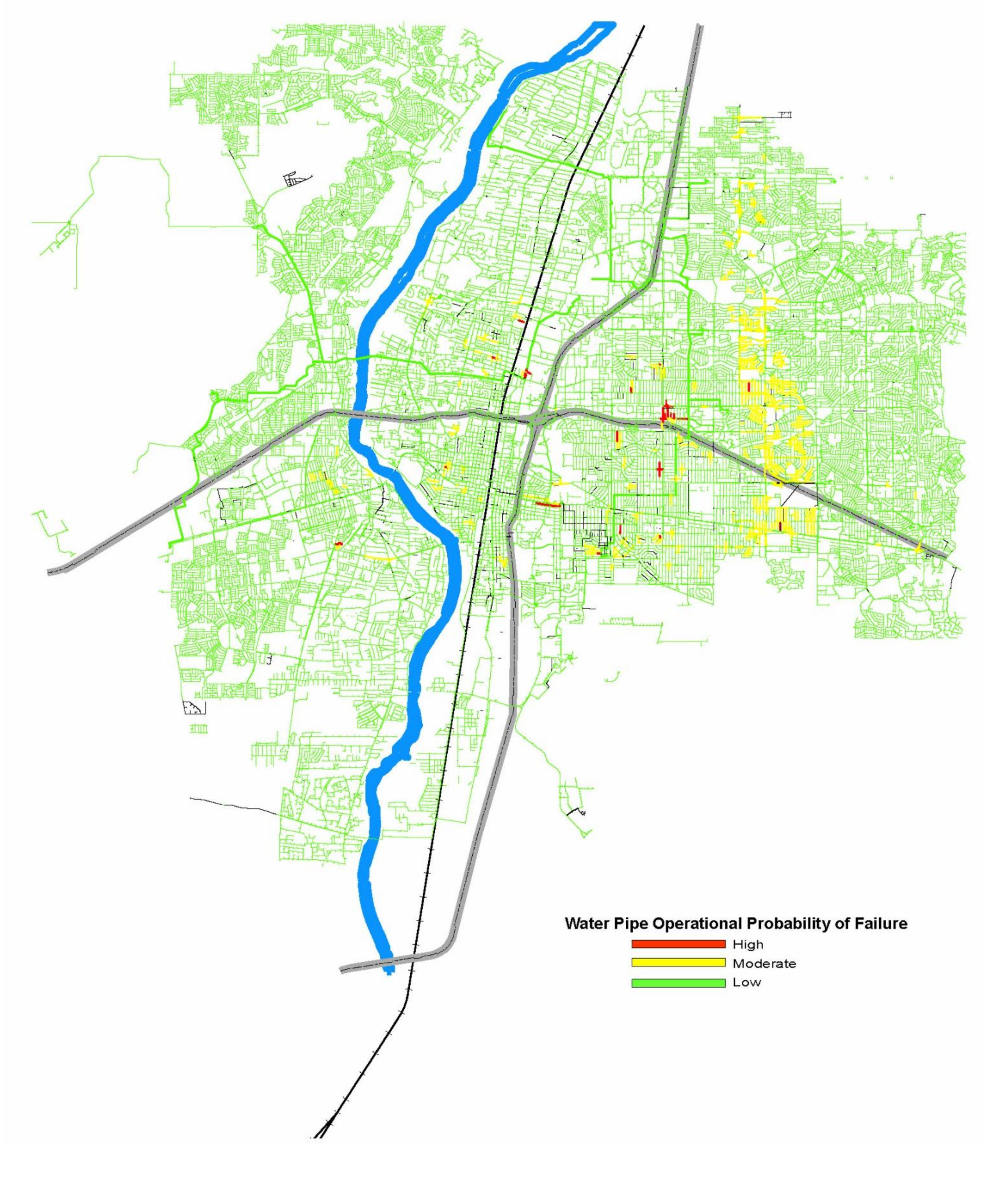
Table 6-6 summarizes the results of the operational probability of failure assessment. The assessment results were categorized into low (green), medium (yellow), and high (red). The scales were established during a workshop with Water Authority staff. The results indicate 97% of pipes were not prone to operational failure. The results indicated very few pipes (less than 1%) (PoF 8, 9, and 10) were prone to leakage. These pipe segments (32,824 feet) should be assessed for leaks to develop the proper management strategy.

Table 6-6 Water Pipe Operational Probability of Failure Results

Operational PoF	Record Count	Total Length (ft)	Total Length (miles)	% of Total Length
1	84,585	11,457,778	2,170	70%
2	13,677	2,230,797	422	14%
3	12,155	2,035,554	386	13%
4	1,147	208,955	40	1%
5	1,182	304,478	58	2%
6	0	0	0	0%
7	58	16,325	3	0%
8	105	26,910	5	0%
9	0	0	0	0%
10	26	5,914	1	0%

The results of the operational probability of failure assessment were introduced as a GIS layer and mapped (Figure 6-10).

Figure 6-10 Water Pipe Operational Probability of Failure Results



6.3.3 Consequence of Failure

The consequence of failure measures direct and indirect impacts of a failure. The impact of a failure was considered from a Triple Bottom Line perspective (Economic, Environment, and Social). The factors used to measure consequence of failure were:

- Interstate / Railroad – This factor was used to highlight areas where an impact of failure would result in high social and economic consequence.
- Land Use – This factor considers the zoning or the use of the land at the location of the pipe. The location has a huge impact on the social, economic, and environmental consequence. This factor was used to highlight rivers, water channels, business, residential, school, hospital, etc.
- Transmission mains – The greater the size of the pipe, the greater the potential for environmental and economic damage due to the larger volume of water flowing through the pipe.
- Traffic – The higher the traffic volume, the higher the social and economic consequence.

Table 6-7 summarizes the results of the consequence of failure assessment. The assessment results were categorized into low (green), medium (yellow), and high (red). The scales were established during a workshop with Water Authority staff. The results indicate 63% of the total length of pipe represents a low consequence.

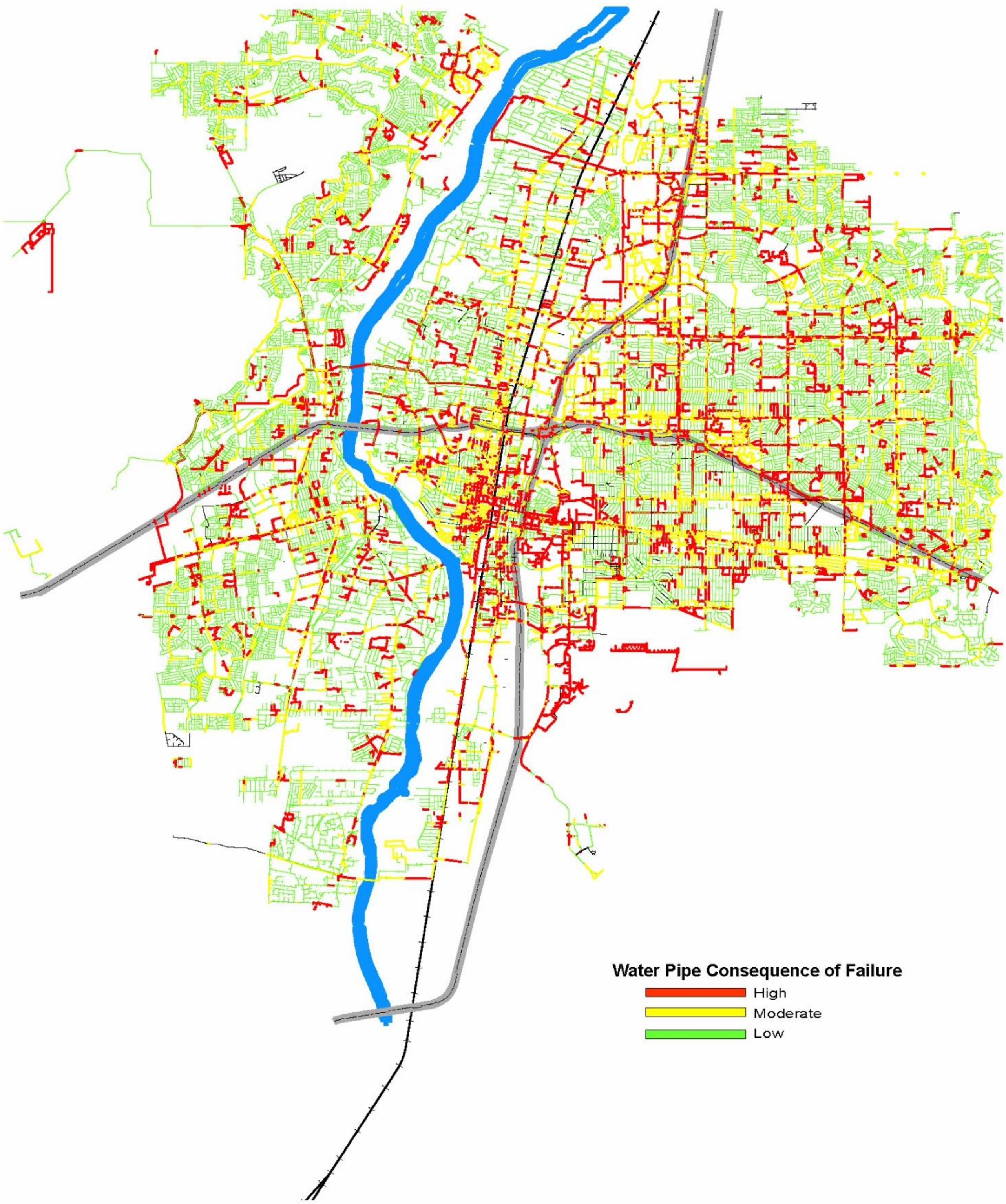
Conversely, 18% of the total pipe length represents a high consequence. Management strategies should be developed for pipes with high consequence to prevent failure.

Table 6-7 Water Pipe Consequence of Failure Results

CoF	Record Count	Total Length (ft)	Total Length (miles)	% of Total Length
1	10,083	1,429,895	271	9%
2	45,842	6,261,840	1186	39%
3	4,658	707,599	134	4%
4	13,855	1,808,834	343	11%
5	8,167	1,165,777	221	7%
6	10,562	1,478,545	280	9%
7	2,520	459,344	87	3%
8	11,113	1,500,440	284	9%
9	1,923	446,651	85	3%
10+	4,212	1,027,788	195	6%

The results of the consequence of failure assessment were introduced as a GIS layer and mapped (Figure 6-11). As expected, the areas of high consequence were near high traffic, major roads and intersections, railroads, and environmentally sensitive areas.

Figure 6-11 Water Pipe Consequence of Failure Results



6.3.4 Business Risk Exposure Assessment

Structural Business Risk Exposure

The structural probability of failure scores and the consequence of failure scores were multiplied together to generate the structural business risk exposure scores. The business risk exposure results were introduced as a GIS layer and mapped (Figure 6-12).

The structural probability of failure identified 68 miles of pipes as high likelihood of failure. Following the business risk exposure concept and the consequence of failure factor, the 68 miles of pipes were broken down into the three consequence of failure categories, as shown in Table 6-8. From an asset management perspective and based on this analysis, only 33 miles should be considered for immediate renewal. Additionally, a renewal decision for 39 miles of high structural probability of failure pipe can be deferred due to a low impact of failure. Assuming an estimated replacement cost of $125 per linear foot, the 39 miles of pipe equates to $25.7 million in replacement costs.

Table 6-8 High Structural Probability of Failure Risk Breakdown

Structural Probability of Failure (PoF)	Consequence of Failure (CoF)
High Structural PoF 3% of total length of water distribution pipe or 95 miles	High CoF 35% or 33 miles
	Medium CoF 24% or 23 miles
	Low CoF 41% or 39 miles

Operational Business Risk Exposure

The operational probability of failure scores (Figure 6-10) and the consequence of failure scores (Figure 6-11) were multiplied together to generate the operational business risk exposure scores. The business risk exposure results were introduced as a GIS layer and mapped (Figure 6-13).

Figure 6-12 Water Pipe Structural Business Risk Exposure Results

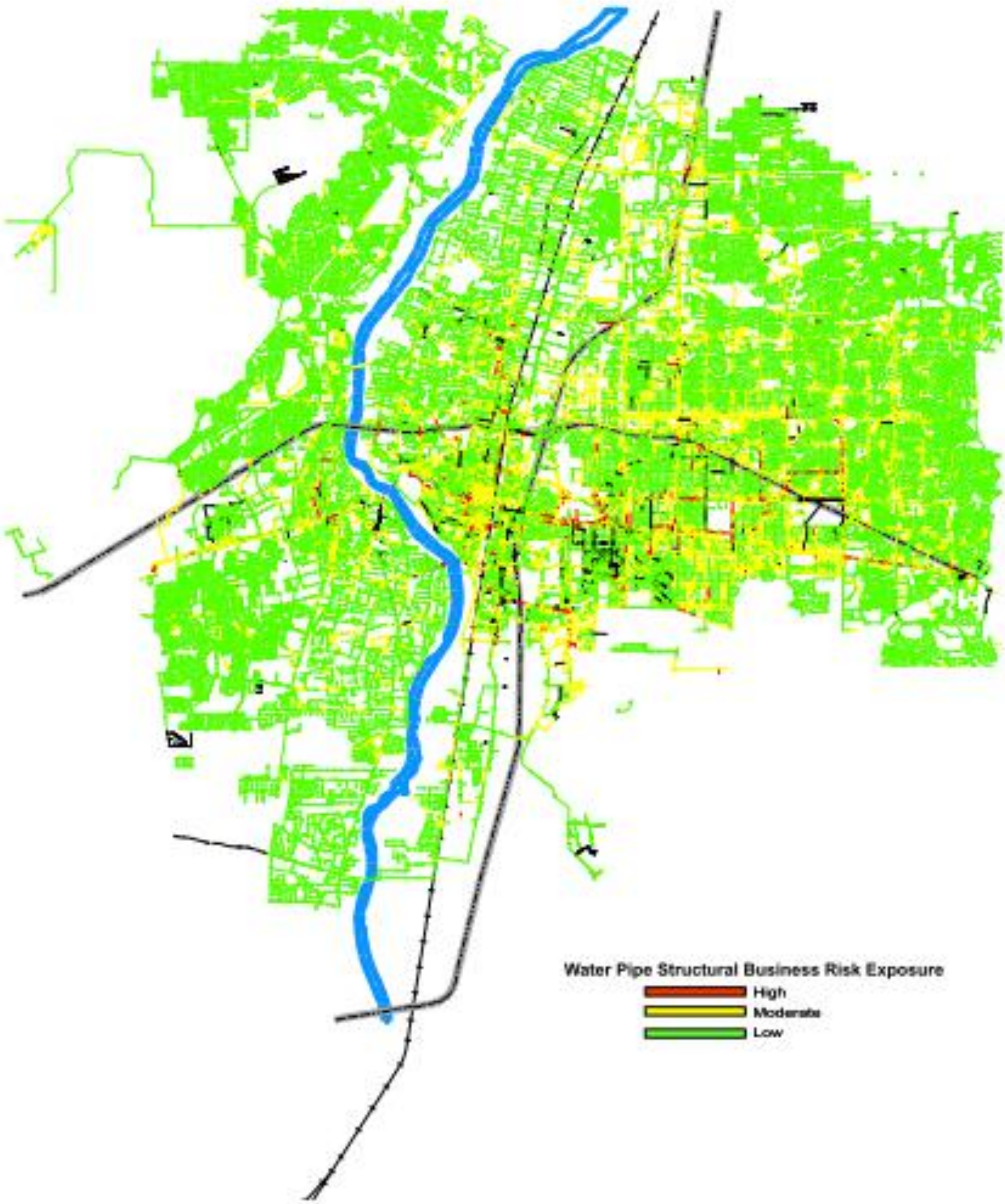
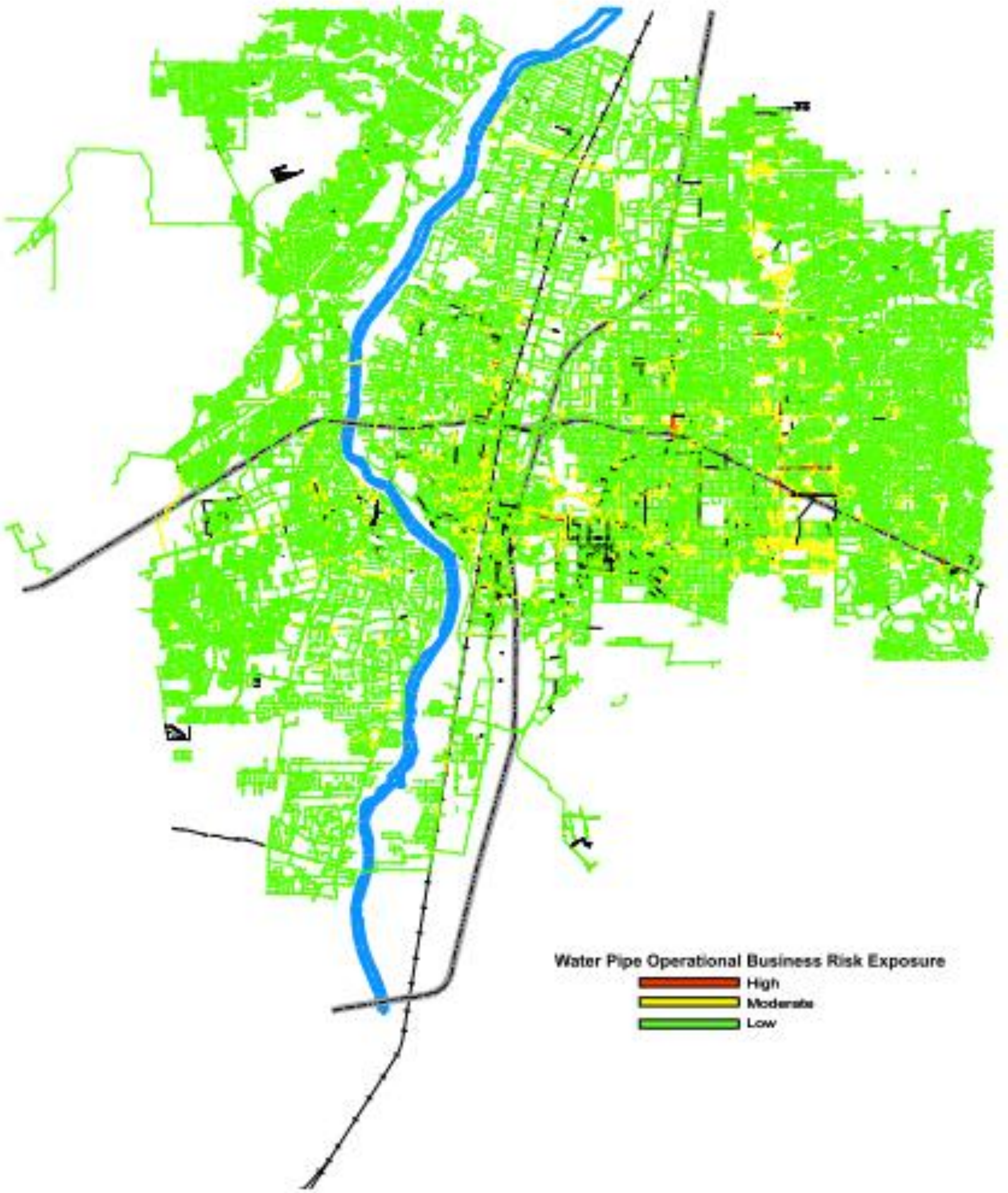


Figure 6-13 Water Pipe Operational Business Risk Exposure Results



6.4 Wastewater Treatment Plant Assets

The business risk exposure methodology was applied to the wastewater treatment plant, lift station, odor station, vacuum station, and storm station assets.

6.4.1 Probability of Failure

The following data were used to calculate the probability of failure:

- Asset Age
- Operating Environment
- Asset class
- Historical Data

In order to estimate the condition and, thus, the remaining useful life of an asset, a deterioration modeling process, based on age and asset class, was used to calculate the percent of life consumed and estimate the asset's condition. Additionally, a probability of failure rating scale was established and presented to members of the Water Authority's operations and maintenance staff. Using this scale, the staff members rated the probability of failure for each asset in the registry.

Two probability of failure scores were compared and the worse score of the two was used for the assessment. This represented a more conservative approach toward the business risk exposure assessment.

To further enhance the probability of failure scoring methodology, an operating environment factor was introduced. The Water Authority staff recognized a strong correlation between the operating environment and the useful life of the asset. For example, an asset located in a non-ventilated room with exposure to hydrogen sulfide (H_2S) deteriorated much faster than a similar asset located in a different area of the plant.

6.4.2 Consequence of Failure

The failure impact was considered from a plant process and system disruption perspective. The factors were developed and distributed to the members of the Water Authority's operations and maintenance staff. Using the provided rating scale, a consequence of failure score was assigned for each asset in the asset registry.

Treatment plants often have redundancies designed into the process. Redundancies work to help reduce the overall business risk exposure to the organization. Where available, redundancy was incorporated into the business risk exposure model.

6.4.3 Business Risk Exposure Assessment

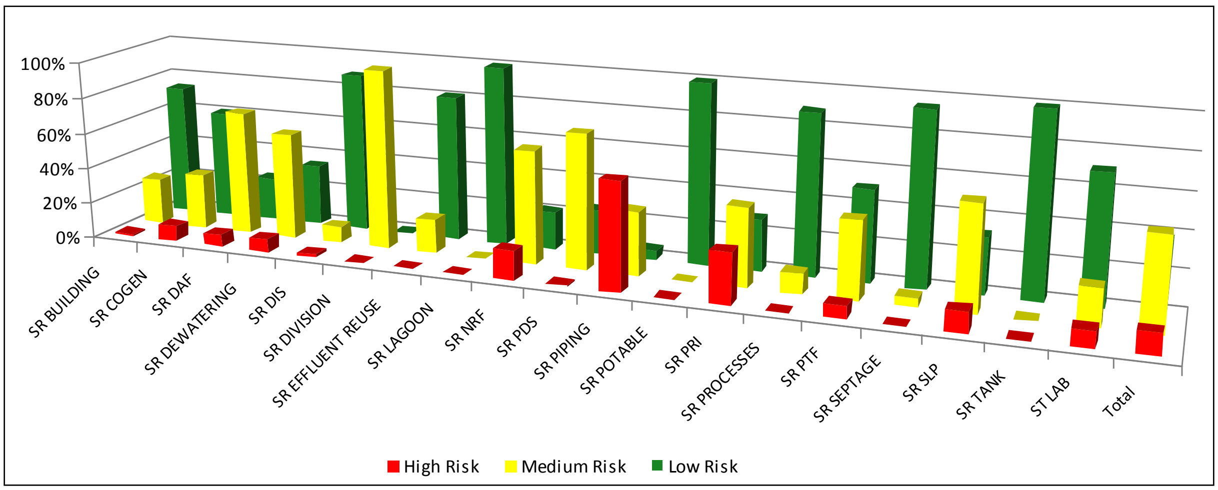
The results of the business risk exposure assessment are presented in Figure 6-14 and Figure 6-15 for the Southside Water Reclamation Plant. A total of 7,008 assets were in the Southside Water Reclamation asset register. Based on the assessment, 11% of the total assets were found to be of high risk, 51% were found to be medium risk, and 38% were identified as being low risk. Figure 6-14 presents the total number of assets in each risk score.

Figure 6-14 Southside Water Reclamation Plant Business Risk Exposure Assessment Results by Asset

Probability of Failure										
11	5	79	138	101	78	9	19	19	33	1
10	238	426	916	481	105	83	281	234	100	217
9	8	18	70	31	2	5	50	41	5	35
8	82	174	124	57	139	25	170	133	17	61
7	17	5	24	3	6	4	54	11	4	14
6	45	56	134	7	58	15	98	16	26	56
5	54	58	83	30	8	22	53	14	3	36
4	73	29	266	39	51	40	34	5	10	20
3	1	20	177	60	34	32	23	29	22	20
2	9	6	18	8	7	3	6	2	6	18
1	31	5	74	0	1	1	0	0	4	0
Total number of asset: 7008	1	2	3	4	5	6	7	8	9	10
	Consequence of Failure									

A more detailed risk assessment profile is presented in Figure 6-15. The results are categorized based on locations in the plant. The distribution of risk is shown as low (green), medium (yellow), and high (red).

Figure 6-15 Southside Water Reclamation Plant Business Risk Exposure



Based on the results, the two areas of the plant with a large percentage of high risk assets are SR PIPING and SR PRI (Primary Treatment).

The results of the business risk exposure assessment are presented in Figure 6-16, Figure 6-17, and Figure 6-18 for the lift, odor, vacuum, and storm stations. A total of 2,013 assets were in the station asset registers. Based on the assessment, 7% of the total assets were found to be of high risk, 42% were found to be medium risk, and 51% were identified as being low risk. Figure 6-16 presents the total number of assets in each risk score.

Figure 6-16 Lift, Odor, Vacuum, Storm Station Business Risk Exposure Assessment Results by Asset

Probability of Failure										
11	0	73	2	0	0	1	38	0	1	15
10	0	16	3	4	7	6	131	1	3	18
9	0	59	2	1	0	3	121	4	3	16
8	0	45	62	7	0	23	65	14	3	22
7	2	6	20	42	0	2	25	17	9	9
6	1	22	32	5	0	6	87	20	5	27
5	4	29	43	17	0	26	27	6	6	14
4	2	6	32	5	0	14	41	9	3	13
3	0	60	279	70	0	22	30	5	16	44
2	0	48	4	0	0	0	10	2	4	15
1	0	0	0	0	0	0	0	0	0	1
Total number of asset: 2013	1	2	3	4	5	6	7	8	9	10
	Consequence of Failure									

A more detailed risk assessment profile is presented in Figure 6-17 and Figure 6-18. The results are categorized based on locations in the station. The distribution of risk is shown as low (green), medium (yellow), and high (red).

Figure 6-17 Lift Station Business Risk Exposure Assessment Results by Location

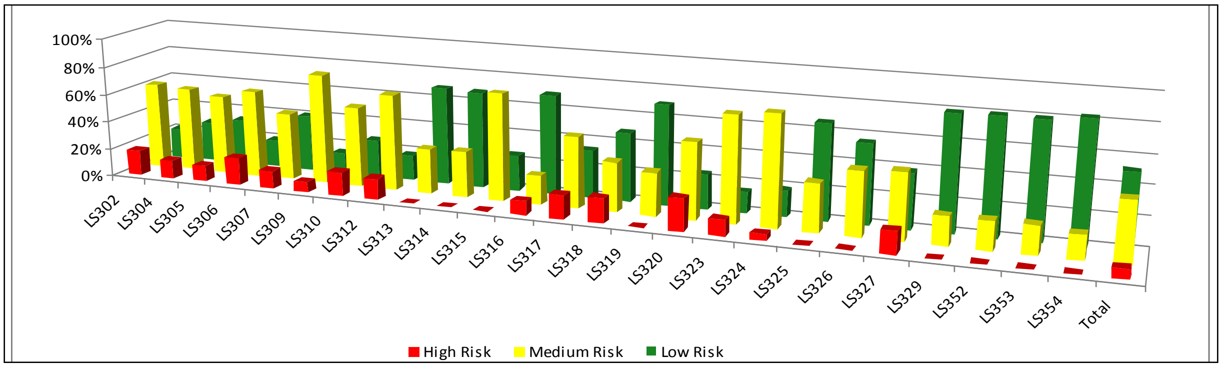
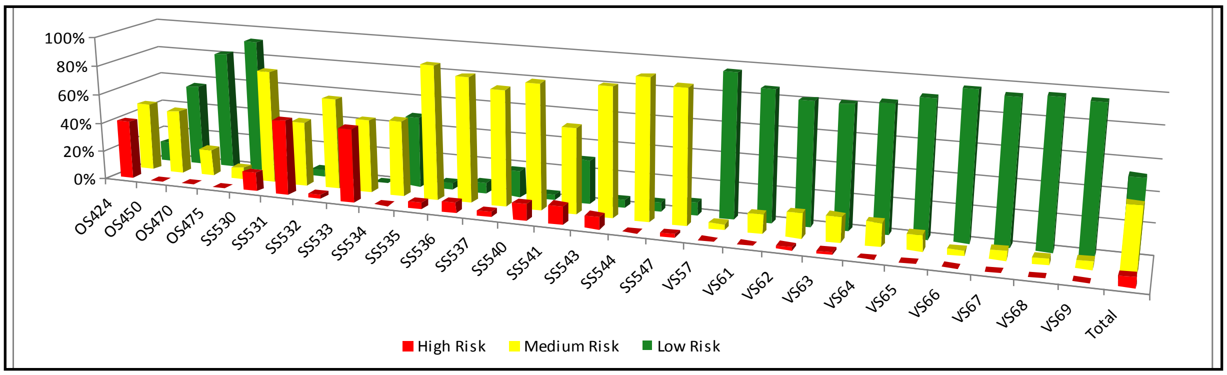


Figure 6-18 Odor, Vacuum, Storm Station Business Risk Exposure Assessment Results by Location



Based on the results, the stations with a large percentage of high risk assets are SS 533, SS 531, OS 424, and LS 320. Two stations worthy of specific note, based on their capacity and importance to the overall system, are LS320 and LS324. LS324, the West Bank Lift Station, was installed in 1986 with no major rehabilitations on record. This station has 5% of its assets in the high risk zone, 76% in the medium risk zone, and 19% in the low risk zone. This is one of the older stations and should probably be looked at for more detailed condition assessment. LS320, the Isleta Lift Station, was installed in 1982 and had portions of it rehabilitated in 2010, which should greatly reduce its risk profile. It appears that the rehabilitation information was not updated in the CMMS, as 23% of its assets are in the high risk zone, 53% are in the medium risk zone, and 24% are in the low risk zone. If the rehabilitation date cannot be verified, this lift station is also a candidate for a detailed condition assessment.

6.5 Risk-Based Management Strategies

Often times, a renewal decision is made solely on the assessment of an asset's probability of failure. Introducing the concept of the consequence of failure adds a new perspective to the renewal decision making process. An asset with high probability of failure, but low consequence of failure should have less priority than an asset in similar condition, but with a higher consequence of failure. Without the combination of the two factors (business risk exposure), the renewal decision making process is not optimized.

Based on the business risk exposure assessment, a risk based management strategy should be created. The optimized risk mitigation strategy is graphically illustrated in Figure 6-19. The first priority is to focus on assets in the red area of the figure, followed by assets in the yellow and green areas. A sample risk based management strategy is presented in Table 6-9.

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Figure 6-19 Risk Based Management Strategy Chart

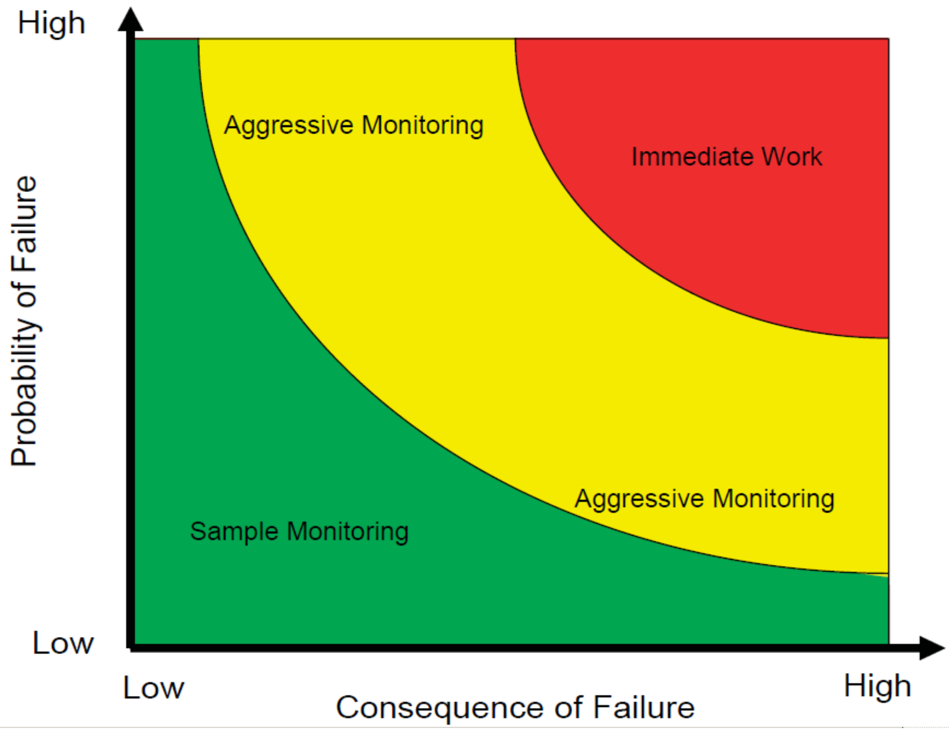


Table 6-9 Sample Risk-Based Management Strategies

Risk Rating	Probability of Failure		Consequence of Failure
	Structural	Operational	
High	◗ Verify the structural condition with field data ◗ Consider capital project development – Replacement – Rehabilitation ◗ Non-asset solution	◗ Verify the condition with field data ◗ Implement the appropriate operational option	◗ Develop an emergency response program with appropriate mitigation measures
Medium	◗ Monitor the structural condition ◗ Consider future capital project options	◗ Monitor the operational condition ◗ Consider long-term capital options	◗ Develop appropriate mitigation measures
Low	◗ Sample monitoring of similar pipe segments	◗ Sample monitoring	◗ Develop appropriate mitigation measures

6.6 Recommended Next Steps

It is recommended the Water Authority use the results from the business risk exposure to help prioritize assets for capital projects, condition assessment (CCTV), and cleaning schedules. The wastewater pipes with high structural probability of failure should be flagged for CCTV condition assessments. Of these assets, the ones with high consequence of failure scores should be the first priority for CCTV. In addition, the wastewater pipes with high operational probability of failure should be considered for more frequent cleanings and inspections.

Short-term water pipe replacements should take place on the pipes with high business risk exposure scores.

Information about the water plant system assets should be collected in order to perform a risk analysis of the Water Authorities wells, reservoirs, pump stations, and surface water plant.

The wastewater risk results can be used to prioritize renewal activities at the Southside Water Reclamation Plant. These results are directly related to the current condition, assessed by the Water Authority. More aggressive maintenance strategies should be considered for high risk assets. For high consequence assets, system redundancy and / or asset renewal should be considered to manage the risk.

Risk-based budgeting and management strategies should be developed and enhanced on regular basis. Risk assessments should be performed on a regular basis to further enhance the confidence of the results and to document the improvements to the performance of the asset management program.

7. Improvement Plan

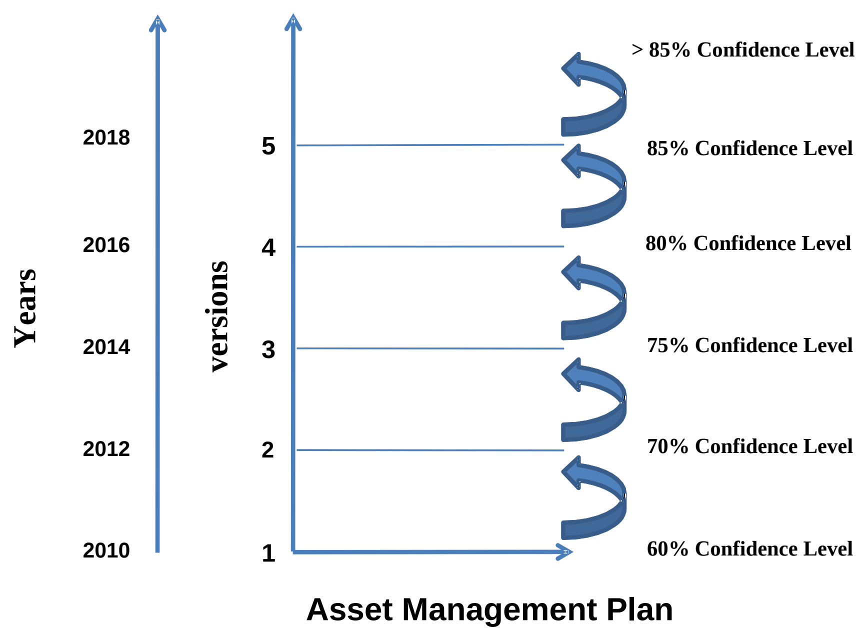
7.1 Confidence Level Rating

The confidence level rating is used, not only to measure the current practice, but also to identify and prioritize future improvements. The confidence level rating provides a measure by which the Water Authority can track the improvement of the asset management plan and the associated management decisions.

In developing a first iteration asset management plan, an organization will seldom have perfect data to support the asset portfolio. As illustrated in Figure 7-1, asset management is a process of continuous improvement. The Water Authority can make improvements to the asset management plan as the quantity and quality of data improves. The Water Authority realizes data was not available across all asset types, classes, and systems and may not be as accurate as desired. Through the asset management plan development process, the Water Authority gained a better understanding of their data gaps and developed mitigation plans to improve the overall data quality. Any assumed data will be superseded by actual data when it becomes available.

The confidence level varies over the planning horizon, as the planning period extends (short-range vs. long-range), the accuracy of the predictions decreases. For example, the confidence level for a 10-year projection will be much higher than for a projection for 80 to 100 years. It is important to have a high confidence level in early years (years 1 through 10), as the asset management plan will form the basis for future capital and operational investment programs.

Figure 7-1 Continuous Improvement Process



The Water Authority's 2011 Asset Management Plan received a confidence level rating of 69 percent. This score is in the upper end of the expected range for a first iteration asset management plan. This can be attributed to the Water Authority's diligent improvement efforts (three years) in data collection and data quality control processes.

For the next version, GHD recommends the Water Authority strive for a confidence level rating of 75 percent. Ultimately, with a mature asset management program, the Water Authority can expect to have confidence level rating of at least 85 percent.

7.1.1 Methodology and Assessment

The confidence level rating is based on the following key elements. These key elements play a critical role in the accuracy of the future renewal funding requirements projection and the acceptance of the asset management plan.

1. **Asset Inventory** – Measures the completeness of the asset data (Did the asset register include all the assets the Water Authority owns?)
2. **Data Quality** – Measures the quality and completeness of the data attributes used to develop the asset management plan (*How many data assumptions were used to complete the asset management plan?*)
3. **Asset Hierarchy** – Measures the quality of the asset hierarchy used to develop the asset management plan (*How effective and efficient is the asset hierarchy used to develop the asset management plan?*)
4. **Asset Valuation** – Measures the accuracy of the estimated replacement costs of the assets and systems (*How accurate is the estimated replacement cost of the asset?*)
5. **Management Strategies** – Measures the accuracy of the management strategies and renewal strategies used in the asset management plan (*How representative is the useful life? How many times does an asset get refurbished?*).
6. **Business Risk Exposure** – Measures the accuracy of the risk assessment performed (*Is the risk assessment representative of the actual risks facing the organization?*).
7. **Levels of Service** – Measures the quality and efforts of developing the levels of service to track the performance of the asset management program (*Were the levels of service identified across all major asset systems? Do the levels of service link to actual asset performance?*).
8. **Future Demand** – Measures the quality and completeness of the identified factors that can affect the Water Authority (Does the future demand identify factors that can influence the delivery of the levels of service for all major asset systems?)
9. **Staff Participation** – Captures the staff involvement in developing the asset management plan (*During the development phase, were key members of the Water Authority staff involved?*).
10. **Staff Buy-In** – Estimates the staff confidence / acceptance in the quality of the asset management plan (*Are the staff accepting the results of the asset management plan?*). For example, an asset management plan may have a low confidence level, yet have a high staff buy-in, or vice-versa.

Each confidence level rating element listed above is assigned a weighting factor. The weighting factor quantifies the criticality of the key element, with respect to the overall accuracy and quality of the asset management plan. For example, the weighting of Future Demand is much lower than Data Quality, since Future Demand identifies the possible factors influencing the delivery of the levels of service and does not directly impact the accuracy of the future renewal funding requirement projections.

The confidence level rating elements were measured across the major Water Authority systems (i.e., water field, water plant, wastewater field, wastewater plant). A secondary weighting adjusts the importance of the systems with respect to one another within the same key element. For the Water Authority, the four systems were all weighted equally. A rating score of 1 (worst) to 10 (best) was assigned to each confidence level rating element for each system. The results of the confidence level rating assessment are presented below.

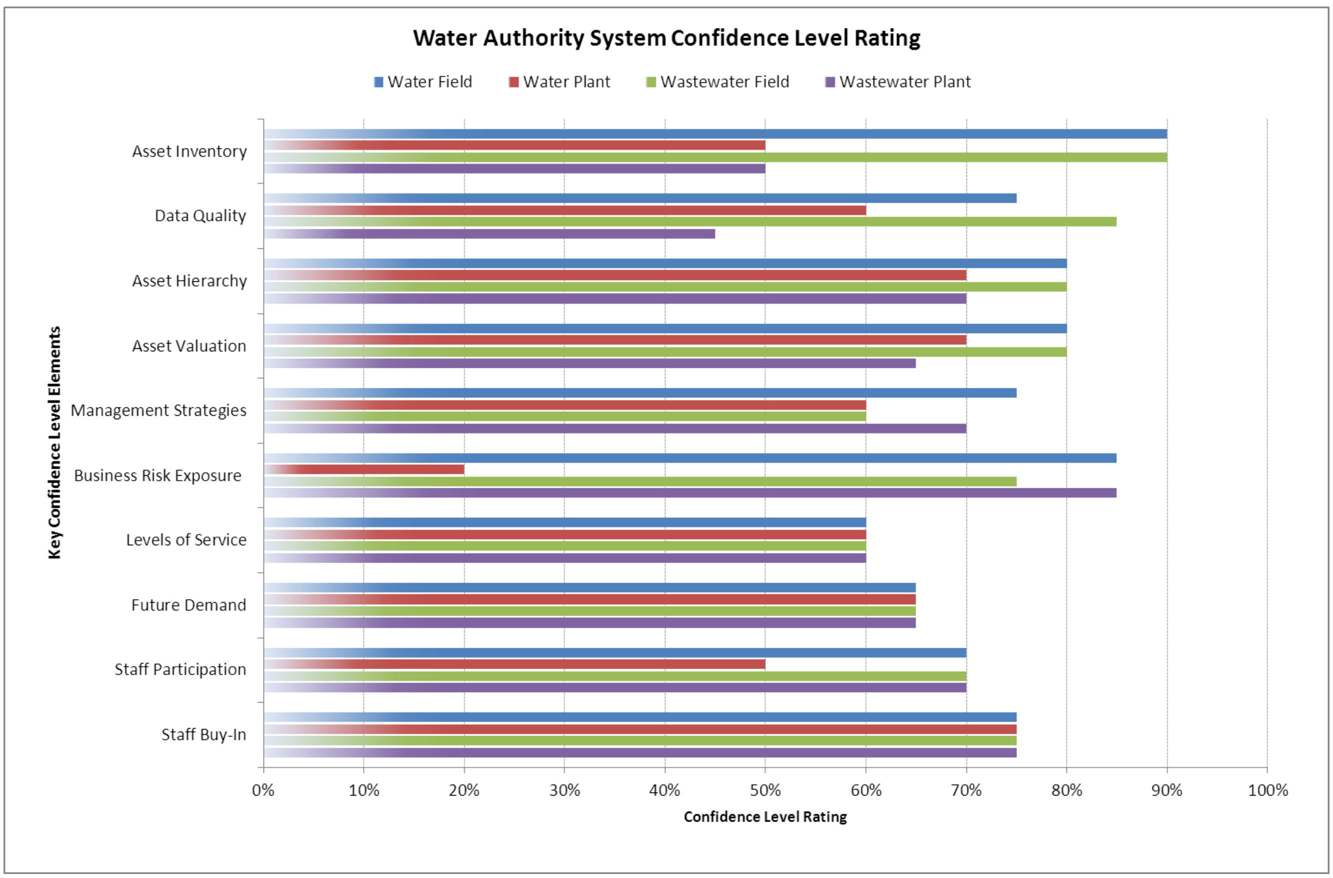
Table 7-1 presents the results of the confidence level rating assessment completed for the Water Authority's 2011 Asset Management Plan. The table provides the confidence level rating for each key element, its weighting, and the weighted confidence level rating.

Table 7-1 Confidence Level Rating for the 2011 Asset Management Plan

Key Confidence Level Elements	Confidence Level Rating	Primary Weighting	Weighted Confidence Level Rating
Asset Inventory	70%	15%	10.5%
Data Quality	66%	15%	9.9%
Asset Hierarchy	75%	5%	3.8%
Asset Valuation	74%	15%	11.1%
Management Strategies	66%	20%	13.3%
Business Risk Exposure	66%	10%	6.6%
Levels of Service	60%	2.5%	1.5%
Future Demand	65%	2.5%	1.6%
Staff Participation	65%	5%	3.3%
Staff Buy-In	75%	10%	7.5%
TOTALS		**100%**	**69%**

Figure 7-2 presents the system confidence level rating results for each key element. This figure can be used to track the performance of each key element for each major system. In general, the data availability and quality for the field systems is much better than the plant systems. The Water Authority already recognizes this and is working to improve the data for both water and wastewater plant system assets.

Figure 7-2 2011 Asset Management Plan Confidence Level Rating Score by Major System



7.2 Improvement Plan

In order to improve the asset management program and its associated processes, the Water Authority should focus on the following key management activities to manage data issues and identify cost savings opportunities.

- Documenting business data flows and capturing critical data and processes.

  At the current stage, the Water Authority has very few business processes documented or standardized. The business processes should include the definitions and allocations of responsibility of the asset management program to individuals or groups in order to enable the asset management program development.

  Currently the Water Authority has more than 140 asset classes listed in the asset management plan. Some of these classes have overlap or duplication with other classes and the quantity of data was inconsistent between classes. GHD recommends the Water Authority re-evaluate and refine the current asset classes to capture all assets across the system.

  Data standards should be established and applied to each asset class. Using a standardized list of data attributes for each asset class enables consistent data capturing, and assures that data required for decision-making is available.

- Documenting facility assets down to an appropriate level.

  From the asset valuation and business risk exposure analyses, it was discovered that approximately 70% of the Wastewater Plant inventory was composed of assets with a value of less than $5,000. The focuses of the inventory concentrated on smaller assets. In order to strengthen the quality of the Wastewater Plant asset register, it is recommended that the Water Authority revisit the asset listings to ascertain the inclusion of high value and / or critical assets. Also, the asset register should be filtered to only include assets as defined by the Water Authority’s asset definition policy.

- Reviewing assets with the highest risk.

  Business risk exposure enables the Water Authority to assess and manage the risks the assets present to the organization. In cooperation with the Water Authority, GHD developed business risk exposure for the collection and distribution systems, and the wastewater plant assets in the CMMS. All assets were evaluated in terms of probability and consequence of failure, enabling the assets to be ranked based on the risk they pose to the Water Authority. Appropriate risk-based management strategies were developed to minimize the business risk exposure and optimize the use of limited funds. In order to parallel this effort, a risk assessment of the water plant assets should commence to prioritize and optimize the management decisions for all Water Authority owned assets.

- Identifying assets where additional maintenance or rehabilitation would cost effectively extend lives.

  In developing the asset management plan, management strategy groups were established at the asset class level. These management strategy groups should be re-evaluated and refined to provide a more accurate representation of the future expenditure outlook in the asset management plan. Adjustments in the management strategy heavily influence the timing of the Water Authority’s future expenditure requirement.

  Processes for appropriate management strategies should be developed with associated roles and responsibilities. To improve day-to-day operations and maintenance, medium term rehabilitation maintenance, and long-term operations strategies, coordinated training effort on the asset management program should be conducted with operations and maintenance staff.

  These activities provide potential for the greatest long-term benefit to the Water Authority. Refining the current management focus may require reallocating funding and resources.

- Improving the asset management plan.

  This 2011 Asset Management Plan has been developed with a 69 percent confidence level rating. In order to continue momentum, the Water Authority should develop an updated asset management plan reflecting the results of implementing the recommended projects herein. The next plan iteration will have an increased confidence level rating with more accurate data and refined management strategies, resulting in improved confidence, for both short and long-term expenditure forecasting.

7.3 Recommended Next Steps

The following steps are recommended to further improve the quality and confidence level of the asset management plan:

1. Asset Inventory – As indicated in the confidence level rating assessment, the asset inventory and data quality for field assets far exceed the plant system assets. The Water Authority will need to continue to improve the asset inventory for the San Juan-Chama Drinking Water Plant and the Southside Water Reclamation Plant. Once the assets are identified and attributes are collected, they should be recorded and tracked in the CMMS. New, rehabilitated, or replaced asset information should be entered into the CMMS in a timely manner.
2. Asset Identification – The Water Authority currently has numerous plant assets in the CMMS, often these recorded assets do not fall within the Water Authority's definition of an asset (greater than $5,000 in replacement value and / or critical asset). From life-cycle cost perspective, it is more cost effective to run low cost, non-critical assets to failure, rather than generating work orders to manage them. The Water Authority should determine whether it wishes to continue to collect data and track these assets. .
3. Management Strategies – Management strategies are used to drive the renewal decisions. The initial asset management strategies were developed with key members of the Water Authority staff. Numerous assumptions were made based on experience and perceptions of asset deterioration behavior. Further justification will need to take place for management strategies to improve the accuracy of the projected renewal activities.
4. Project Justification – The asset management plan identifies potential renewal projects. It is recommended the Water Authority carefully review these identified projects before moving forward with capital investments. Business case evaluations should be adopted as a formal process and procedure of validating capital projects. This process will ensure the project's capital and lifecycle costs, risk, and alternative solutions are fully considered before making any capital investments. Business risk exposure should be used to help prioritize the project when subject to limited resources and funding.
5. Maintenance Review – Numerous wastewater plant system assets were found to be in poor condition. Using the business risk exposure results, critical and poor condition assets can be identified. Sound understanding of these assets will allow the operation and maintenance of these assets to more effectively manage the treatment, distribution, and collection systems. A lifecycle cost approach should be considered in the managing these assets. Preventative maintenance strategies should be developed for critical assets to prevent failures. Early failure prevention of a critical asset will typically yield cost savings.

8. Financial Summary

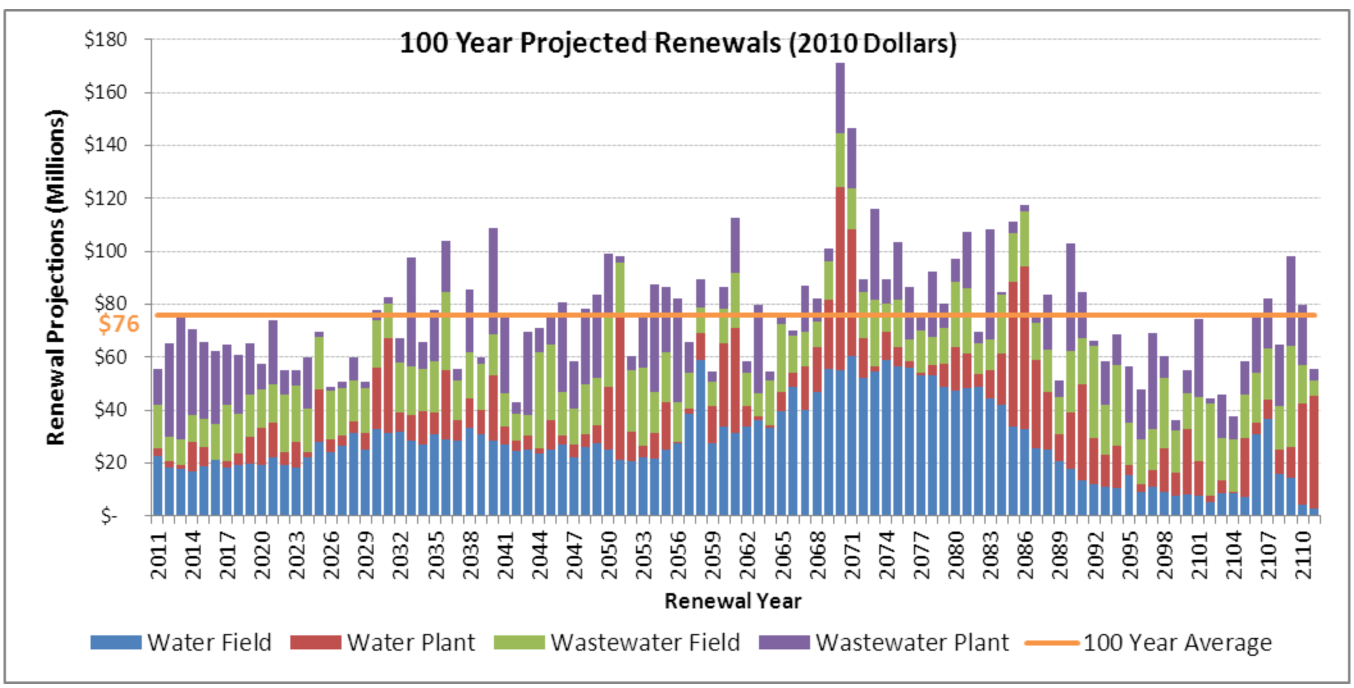
Using the asset data in the asset register (Section 2.1), asset valuation (Section 2.3), and management strategies (Section 3.4), a 100-year renewal projection was generated. A 100-year planning horizon was used to capture the full lifecycle of most assets. For proper asset management planning, a long-range planning horizon is required to fully capture the cyclic nature of the installation and replacement trends. A short-range (e.g., 5-year, 10-year) planning horizon often fails to consider the large capital requirement identified just beyond the analysis window. Due to the enormous capital requirements for infrastructure assets, without a long-range consideration, an organization will not be able to accommodate the renewal capital requirements.

The renewal investments identified in the 100-year renewal projections represent today's replacement costs for the assets. Inflation is not generally used in a 100-year planning horizon due to the drastic effect it has on costs/valuation when inflated over 100 years.

8.1 Long-Range Renewal Funding Requirement

The Water Authority's estimated 100-year renewal funding requirement is presented in Figure 8-1. Based on the results, it is estimated that the Water Authority will need to invest about $76 million per year to fully fund the projected renewal requirements. The $76 million represents the average dollar for the 100-year period. After the initial peak of around $75 million, the renewal needs starts to trickle downward until early 2030s. The greatest need starts to occur from year 2065 culminating in a $170 million peak is projected for year 2070 alone.

Figure 8-1 Water Authority 100-year Renewal Funding Requirement (All Assets)



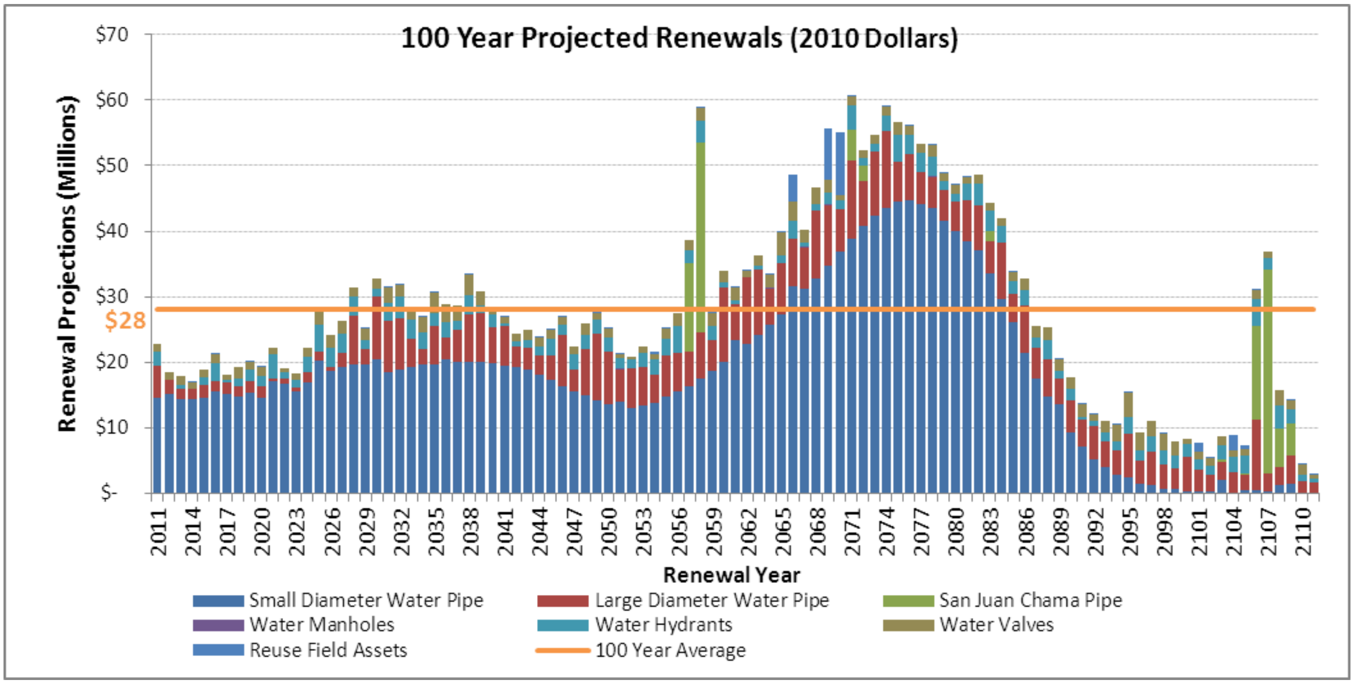
The annual renewal requirement was determined through consolidation of renewal requirements for each asset system (water field, water plant, wastewater field, wastewater plant). Additionally, the renewal requirement for the first ten years incorporates the results identified in the Small Diameter Pipe Asset Management Plan (Smith Engineering), the Large Diameter Pipe Asset Management Plan (Carollo Engineers), and the Decade Plan (Brown and Caldwell) for the wastewater treatment plant.

Where appropriate, the renewal results were *smoothed* using a statistical distribution to represent a more realistic need for renewal activities. *Smoothing* was performed by establishing a minimum and a maximum boundary and spreading using a statistical distribution. With this, all assets in the population fail by the time the maximum value is reached.

Water Field

The 100-year renewal funding requirement for all water field system assets is shown in Figure 8-2. The results indicate that the Water Authority will need to plan for approximately $28 million of renewals per year to sustain the life and condition of the assets based on the management strategies established. In the figure, various asset classes within the water field system are represented by different colors. Small diameter water pipes dominate the funding requirements in the figure.

Figure 8-2 Water Field 100-year Renewal Funding Requirement



The renewal budgets for the first ten years were driven by the funding requirements identified in the Small Diameter Pipe Asset Management Plan (Smith Engineering). In addition to the renewal needs of the small diameter pipes, needs for large diameter water pipes, hydrants, and valves were also projected and are relatively shown in the figure. The renewal need for the water field assets initially peak at $30 million in year 2028 and hold steady for a ten year period. The water field requirement really starts to build in 2050s. By year 2076, a projected renewal need of over $55 million is identified. It is only after 2090s where the projection for water field asset renewals significantly decreases.

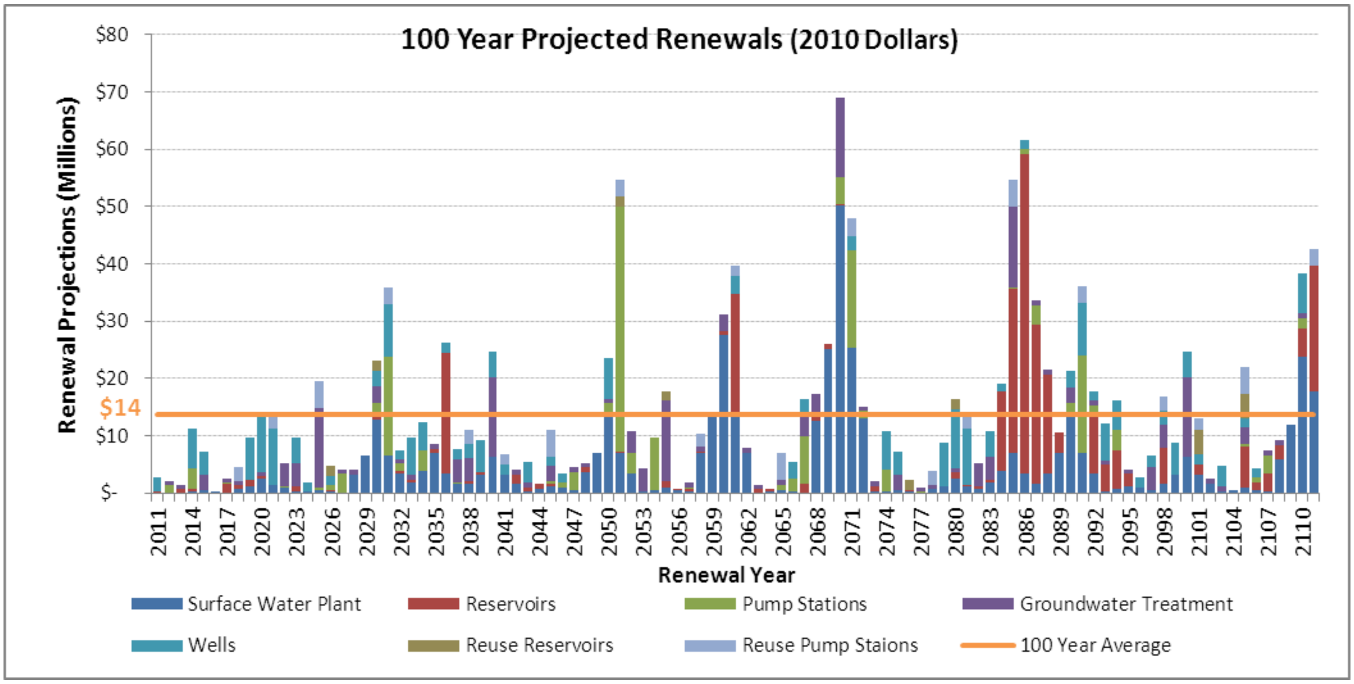
The green peaks in years 2057 and 2106 account for the need to refurbish the newly installed San Juan-Chama pipes.

Water Plant

The 100-year renewal funding requirement for the water plant system is shown in Figure 8-3. Based on the analysis, $14 million per year is required to sustain the assets, per the renewal management strategies. The renewal needs for the water plant assets were very cyclic. Peaks can be identified in the 2030s, early and late-

2050s, late-2060s, and mid-2080s. The high peaks centered around the late-2060s and the mid-2080s are driven by the need to replace assets at the San Juan-Chama Drinking Water Plant and reservoirs, respectively.

Figure 8-3 Water Plant 100-year Renewal Funding Requirement



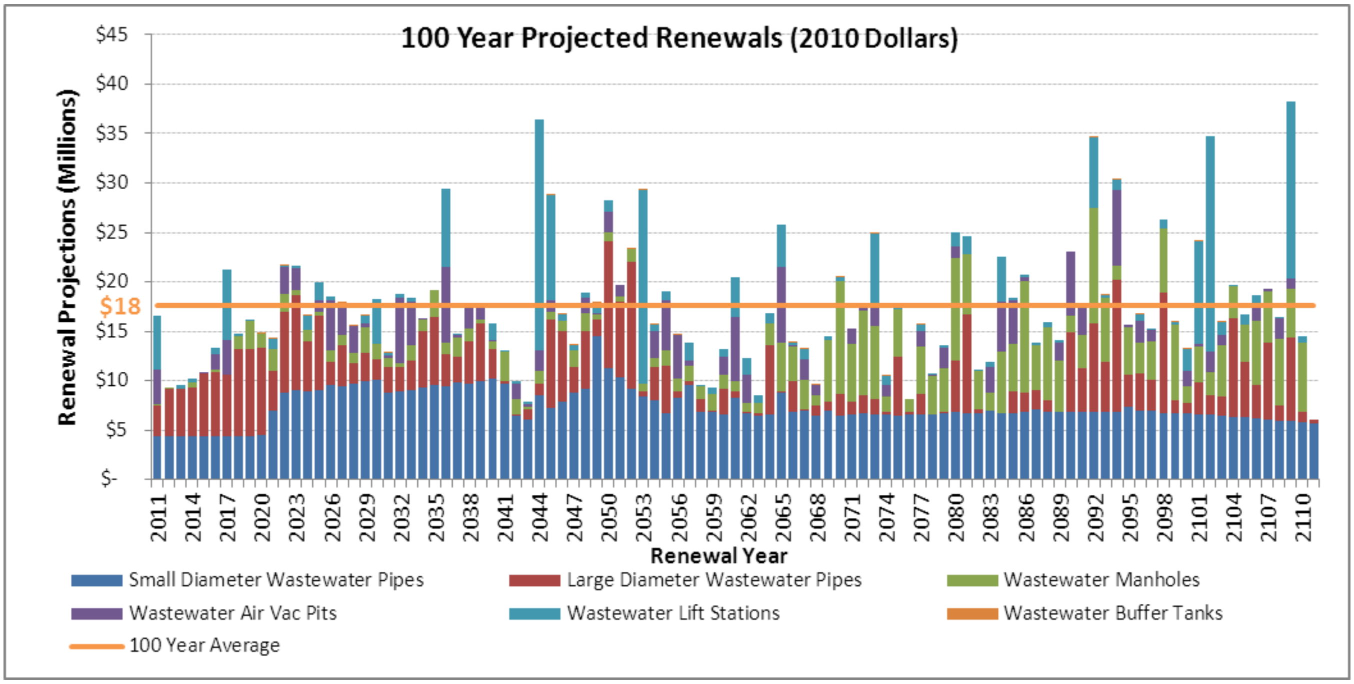
Due to the readiness of asset data, the management strategies for the surface water plant were established at the major process level. A more detailed inventory of plant assets will allow the renewal activities for the plant to be tracked at the asset level. This will help smooth out the 100-year analysis figure as more assets will be included in the asset population to provide a uniform result.

Wastewater Field

The 100-year renewal funding requirement for wastewater field system assets is shown in Figure 8-4. Based on the established management strategies for wastewater field system assets, it is projected that the Water Authority will need an average of $18 million per year to support the renewal activities. This analysis incorporates the funding requirements identified in the Small Diameter Pipe Asset Management Plan (Smith Engineering, shown in dark blue) and the Large Diameter Pipe Asset Management Plan (Carollo Engineers, shown in red). Along with the small and large diameter pipes, renewal needs for lift stations, air vac pits, buffer tanks, and manholes were also projected.

Outside the initial 10-year window, the need for the small diameter wastewater pipes is shown to be fairly constant, due to the smoothing of the initial discrete renewal results. The Water Authority staff felt it would be more appropriate and realistic to represent a uniform failure projection for dominant pipe materials (i.e., PVC, VCP). For example, the Water Authority is experiencing early failures, as early as 30 years after installation, for some PVC pipe segments, and may expect some segments to last as long as 170 years. Therefore, the renewal results were *smoothed* using a statistical distribution to represent a more realistic failure pattern. Conversely, for lift stations, discrete failures were used due to the fact that lift station assets were identified at the facility level.

Figure 8-4 Wastewater Field 100-year Renewal Funding Requirement



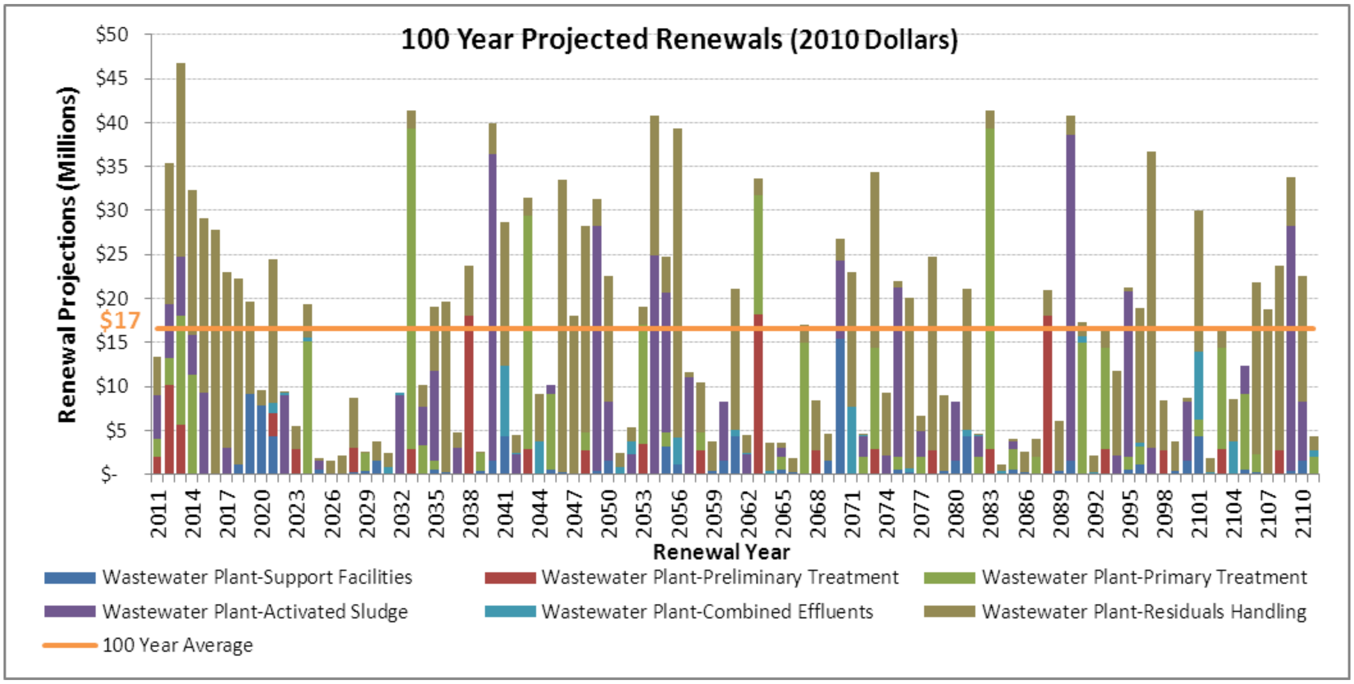
Wastewater Plant

The 100-year renewal funding requirement for the wastewater plant system is provided in Figure 8-5. The projection shows an average annual need of $17 million for the next 100 years. The Water Authority is currently making plans to rehabilitate the Southside Water Reclamation Plant. As such, for the first ten years the analysis incorporated the capital projects identified in the Decade Plan (Brown and Caldwell).

The figure represents the renewal needs of the plant based on high-level treatment processes and facilities. The funding needs incorporate both the need for asset replacement and rehabilitation. With the completion of the Decade Plan, the asset replacement needs at the wastewater treatment plant significantly decreases for eleven years, starting in 2022. After this eleven-year period, the renewal needs are expected to increase due to the short useful lives of many non-structural plant assets.

The Water Authority is currently performing the asset inventory for the wastewater treatment plant. Due to the readiness of asset data, the management strategies for the wastewater plant system assets were developed at the major process level. A more detailed inventory of plant assets will allow the renewal activities for the plant to be tracked at the asset level, and management strategies more appropriate for the actual assets can be applied to the analysis. This will help smooth out the 100-year analysis figure, as more assets will be included to help populate the voids in the figure. With the completion of the asset inventory process, the Water Authority will be more confident in the updated renewal requirements.

Figure 8-5 Wastewater Plant 100-year Renewal Funding Requirement



8.2 Funding Scenario Analyses

With the 100-year renewal funding requirement identified for all asset systems (water field, water plant, wastewater field, wastewater plant), the next focus became the feasibility to fund the projected renewal need. The Water Authority is currently funding $41 million for capital projects. However, the projected renewal need is identified to be $76 million. This funding gap is represented in Figure 8-6 below. The solid black line represents the current funding the solid blue line identifies the projected renewal need. The difference between the two lines is the funding gap.

Figure 8-6 100-year Renewal Funding Gap

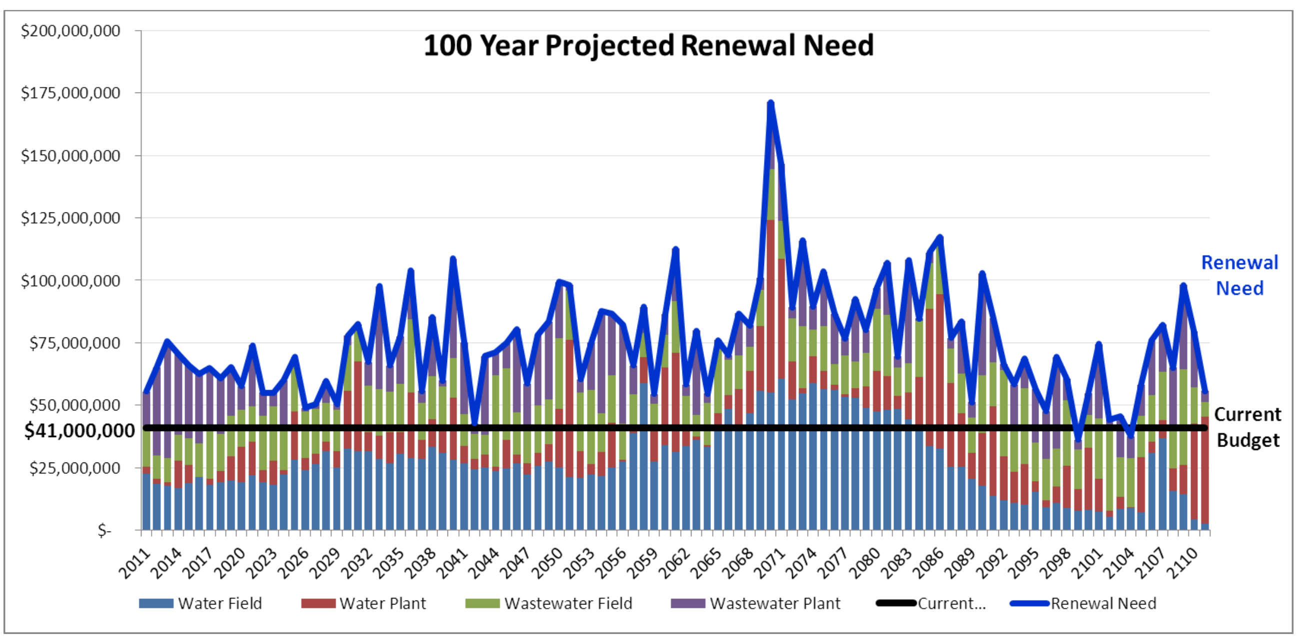
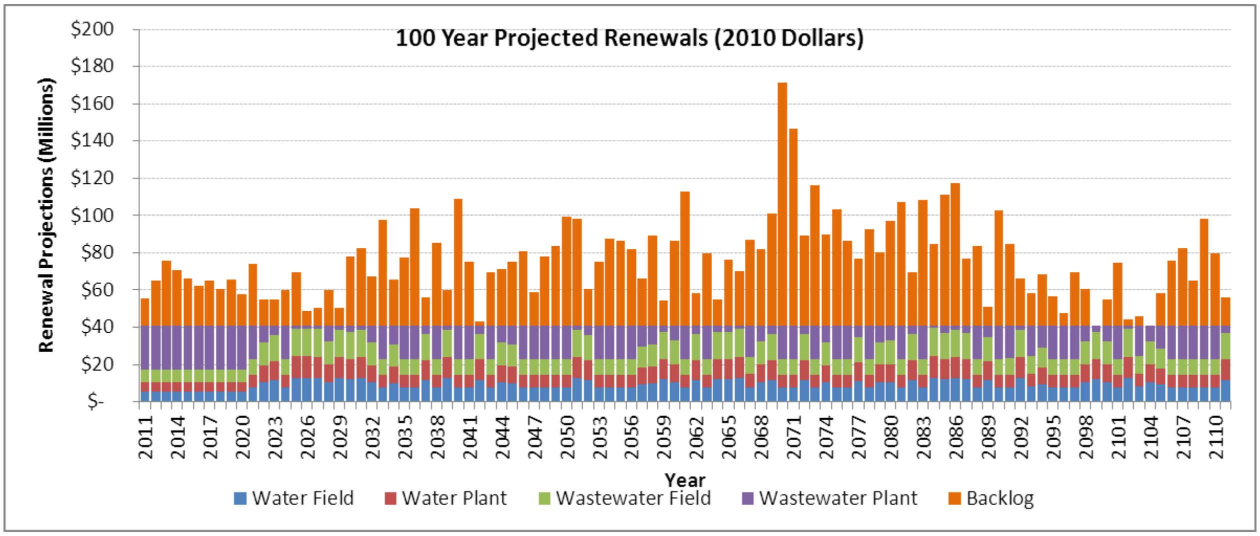


Figure 8-7 presents a visual impact of the backlog when the current funding of $41 million is continued for the next 100 years. In the figure, the orange represents the backlog or the unfunded portion of the renewal need. The distribution of the $41 million for the first ten years is driven by the Decade Plan, Small Diameter Pipe Asset Management Plan, and the Large Diameter Asset Management Plan. After the first ten years, the $41 million was distributed based on projected renewal needs.

Figure 8-7 Impact of Current Funding on Projected Renewal Need



In order to more closely evaluate the feasibility of addressing the funding gap, the Water Authority decided to perform funding scenario analyses to help identify a sustainable funding scenario to meet the projected renewal needs.

Six scenarios were developed to evaluate the impact of the funding with regards to the backlog of the renewal needs. The six scenarios performed were as follows:

1. Scenario 1 - Fixed funding of $41 million for the first 10 years.
2. Scenario 2 - Fixed funding of $41 million for the first 5 years and then ramp up the funding by $3 million per year for next 10 years.
3. Scenario 3a - Fixed funding of $41 million for the first 10 years and then ramp up the funding by $3 million per year for next 10 years.

   Scenario 3b – Fixed funding of $41 million for the first 10 years and then ramp up the funding by $6 million per year for next 5 years.
4. Scenario 4 - Fixed funding of $41 million for the first year, then ramp up the funding by $3 million per year for next 12 years.
5. Scenario 5 - Fixed funding of $41 million for the first year, then ramp up the funding by $1.5 million per year for next 23 years.
6. Scenario 6 - Fixed funding of $41 million for the first year, then ramp up the funding by $2.25 million per year for next 16 years.

All funding scenarios were develop to meet the projected $76 million renewal funding need requirement. Also, for the first ten years, wastewater plant capital costs were fixed at $24 million per year. This was as identified by the Decade Plan and is currently funded by the Water Authority. With the wastewater plant capital costs fixed, the distribution for wastewater field, water plant, and water field were 38%, 30%, and 32%, respectively. The established annual budget for each scenario is summarized in Table 8-1 below.

A backlog threshold limit of $300 million was also established. The Water Authority did not want to let the scenarios run beyond the $300 million backlog limit, as that will allow the backlog to extend beyond the Water Authority's feasible limit. Any scenario that produces a backlog beyond the $300 million limit forces the Water Authority to be in a perpetual reactive management mode and, therefore, was not considered.

Table 8-1 Scenario Annual Budgets

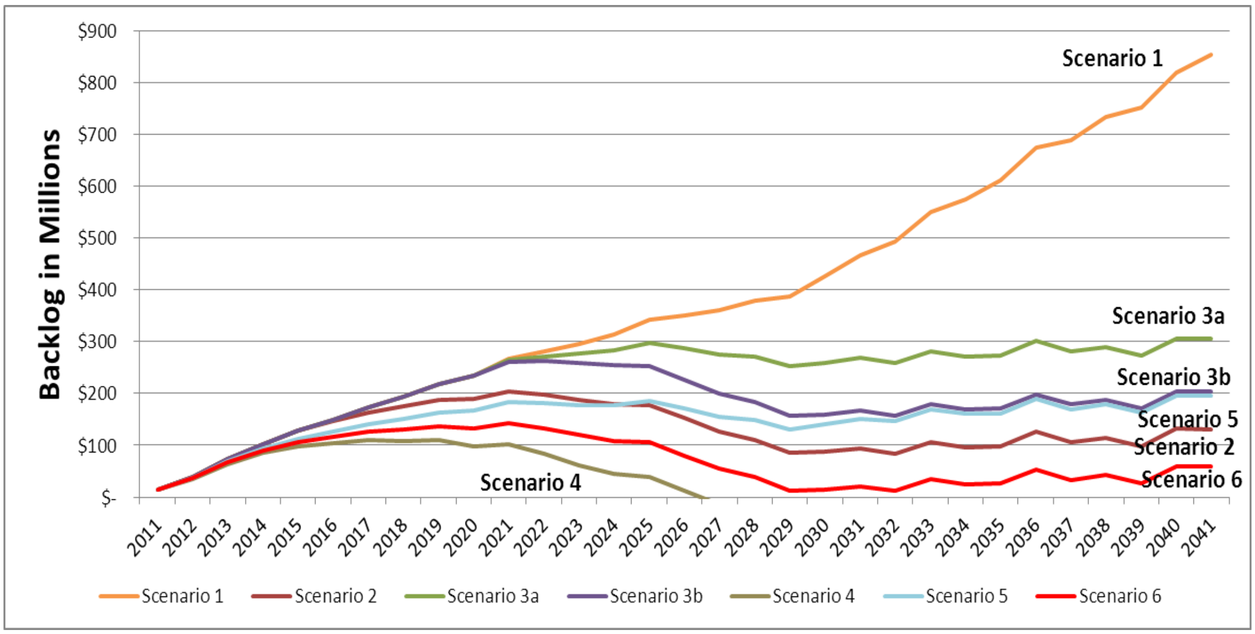
	Scenario 1	Scenario 2	Scenario 3a	Scenario 3b	Scenario 4	Scenario 5	Scenario 6
2011	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000
2012	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 44,000,000	$ 42,500,000	$ 43,250,000
2013	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 47,000,000	$ 44,000,000	$ 45,500,000
2014	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 50,000,000	$ 45,500,000	$ 47,750,000
2015	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 41,000,000	$ 53,000,000	$ 47,000,000	$ 50,000,000
2016	$ 41,000,000	$ 44,000,000	$ 41,000,000	$ 41,000,000	$ 56,000,000	$ 48,500,000	$ 52,250,000
2017	$ 41,000,000	$ 47,000,000	$ 41,000,000	$ 41,000,000	$ 59,000,000	$ 50,000,000	$ 54,500,000
2018	$ 41,000,000	$ 50,000,000	$ 41,000,000	$ 41,000,000	$ 62,000,000	$ 51,500,000	$ 56,750,000
2019	$ 41,000,000	$ 53,000,000	$ 41,000,000	$ 41,000,000	$ 65,000,000	$ 53,000,000	$ 59,000,000
2020	$ 41,000,000	$ 56,000,000	$ 41,000,000	$ 41,000,000	$ 68,000,000	$ 54,500,000	$ 61,250,000
2021	$ 41,000,000	$ 59,000,000	$ 44,000,000	$ 47,000,000	$ 71,000,000	$ 56,000,000	$ 63,500,000
2022	$ 41,000,000	$ 62,000,000	$ 47,000,000	$ 53,000,000	$ 74,000,000	$ 57,500,000	$ 65,750,000
2023	$ 41,000,000	$ 65,000,000	$ 50,000,000	$ 59,000,000	$ 76,000,000	$ 59,000,000	$ 68,000,000
2024	$ 41,000,000	$ 68,000,000	$ 53,000,000	$ 65,000,000	$ 76,000,000	$ 60,500,000	$ 70,250,000
2025	$ 41,000,000	$ 71,000,000	$ 56,000,000	$ 71,000,000	$ 76,000,000	$ 62,000,000	$ 72,500,000
2026	$ 41,000,000	$ 74,000,000	$ 59,000,000	$ 76,000,000	$ 76,000,000	$ 63,500,000	$ 74,750,000
2027	$ 41,000,000	$ 76,000,000	$ 62,000,000	$ 76,000,000	$ 76,000,000	$ 65,000,000	$ 76,000,000
2028	$ 41,000,000	$ 76,000,000	$ 65,000,000	$ 76,000,000	$ 76,000,000	$ 66,500,000	$ 76,000,000
2029	$ 41,000,000	$ 76,000,000	$ 68,000,000	$ 76,000,000	$ 76,000,000	$ 68,000,000	$ 76,000,000
2030	$ 41,000,000	$ 76,000,000	$ 71,000,000	$ 76,000,000	$ 76,000,000	$ 69,500,000	$ 76,000,000
2031	$ 41,000,000	$ 76,000,000	$ 74,000,000	$ 76,000,000	$ 76,000,000	$ 71,000,000	$ 76,000,000
2032	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 72,500,000	$ 76,000,000
2033	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 74,000,000	$ 76,000,000
2034	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 75,500,000	$ 76,000,000
2035	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000
2036	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000
2037	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000
2038	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000
2039	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000
2040	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000
2041	$ 41,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000	$ 76,000,000

The results of the scenario analyses are presented in Figure 8-8 below. From the figure, it is evident that the backlog of asset renewal will continue to escalate if the Water Authority does not increase the current capital budget of $41 million. Scenario 3a shows a backlog capping and maintaining at the $300 million limit. Scenarios 3b, 5, and 2 provide better results, but still never allow the Water Authority to catch up or delete the backlog. It is very interesting to note the difference in results between Scenario 3a and 3b. Although the ramp up duration is shorter for Scenario 3b, due to the higher rate of investment, the resulting effect on decreasing the backlog was much more dramatic. It can be noted that, due to time value of money, investments at earlier stages are more effective in decreasing the backlog over time.

It should be noted that Scenario 4 is successful in the complete elimination of backlog, however, the aggressive funding required to produce this results is not realistic based on the current budget and staff of the Water Authority. This scenario was created as a best-case situation to show what it would take to eliminate the backlog within the first 20 years.

It can be concluded that Scenario 6 produces a more realistic results than Scenario 4, which will keep the backlog at a minimum with a slightly more realistic budget increase. Although it will never be proactive in decreasing the backlog, it maintains the backlog at a minimum level. Through a prioritized risk-based decision-making process, the Water Authority should be able to manage the risk level. Details of each Scenario are presented below. After 50 years, this scenario can be revised to accommodate the large renewal need projected in 2070s.

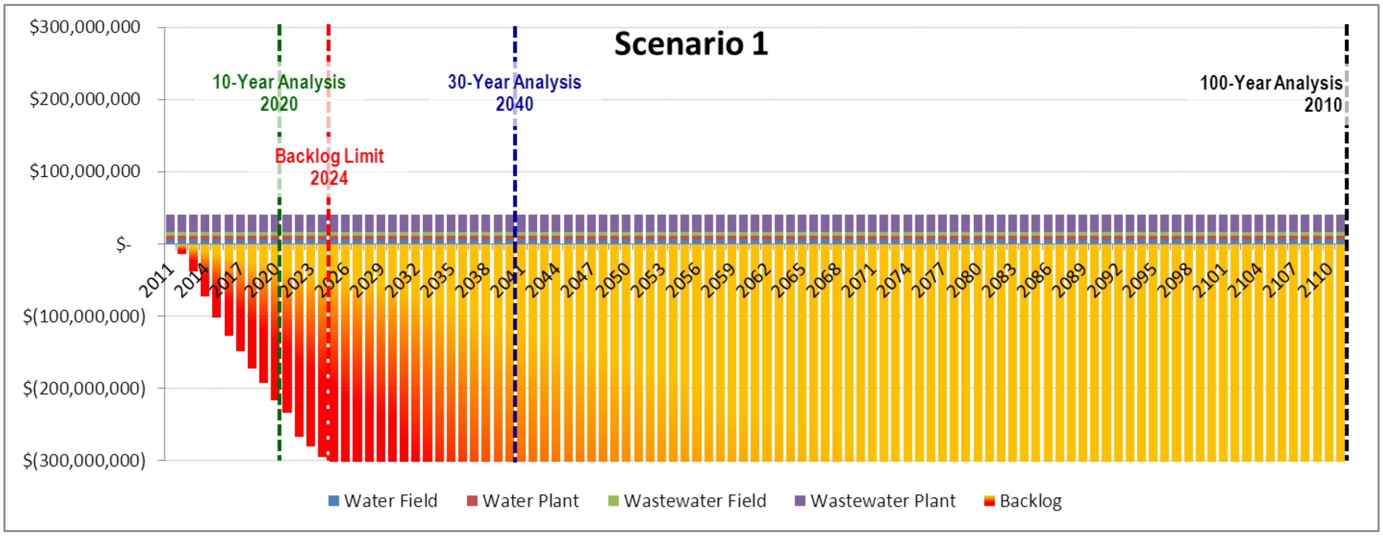
Figure 8-8 Scenario Results



8.2.1 Scenario 1

Scenario 1 represents a “current budget” or “status quo” approach. The Water Authority wanted to visually grasp the impact to the backlog when the funding was fixed at its current level of $41 million. As expected, the backlog continues to escalate with each year. By year 2025 (Figure 8-9), the backlog will reach the threshold limit of $300 million. The magnitude of the backlog after 30 years surpasses $850 million and continues to grow each year.

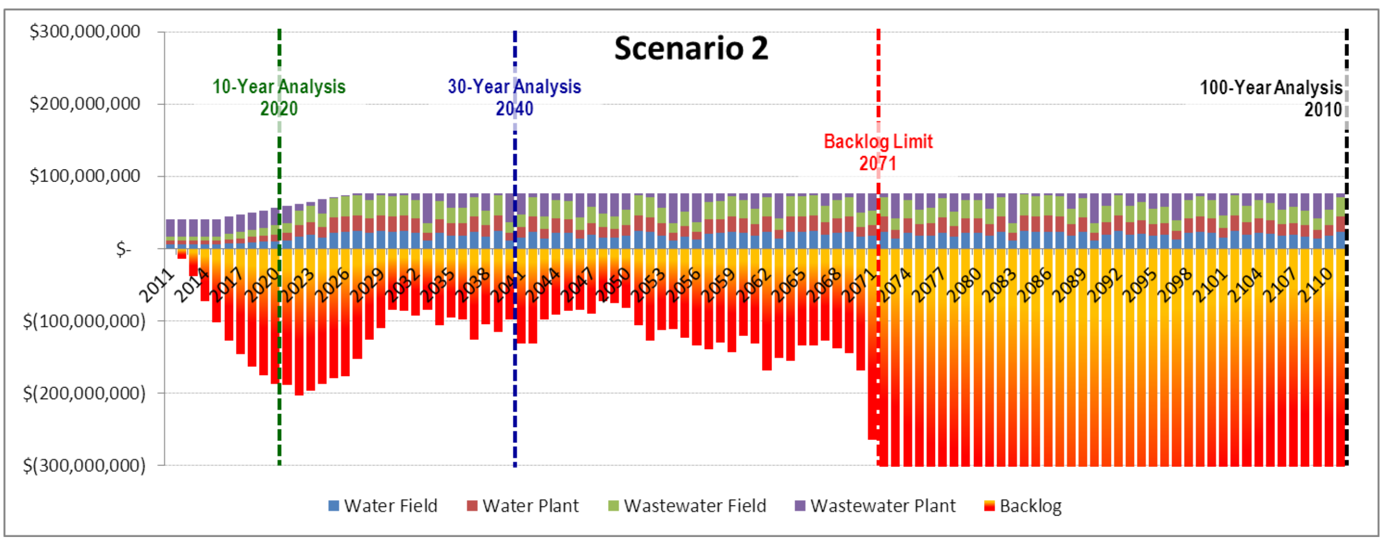
Figure 8-9 Scenario 1 Results



8.2.2 Scenario 2

Scenario 2 evaluated a case where the current funding of $41 million is maintained for the first five years. From the sixth year, the funding is increased at a rate of $3 million per year for the next ten years. The result of Scenario 2 (Figure 8-10) was promising, but still fell short of getting rid of the backlog. In the 30-year analysis the backlog drops to $100 million, but by year 2071, the backlog hits the threshold of $300 million and continues to grow to more than $300 million in the following years.

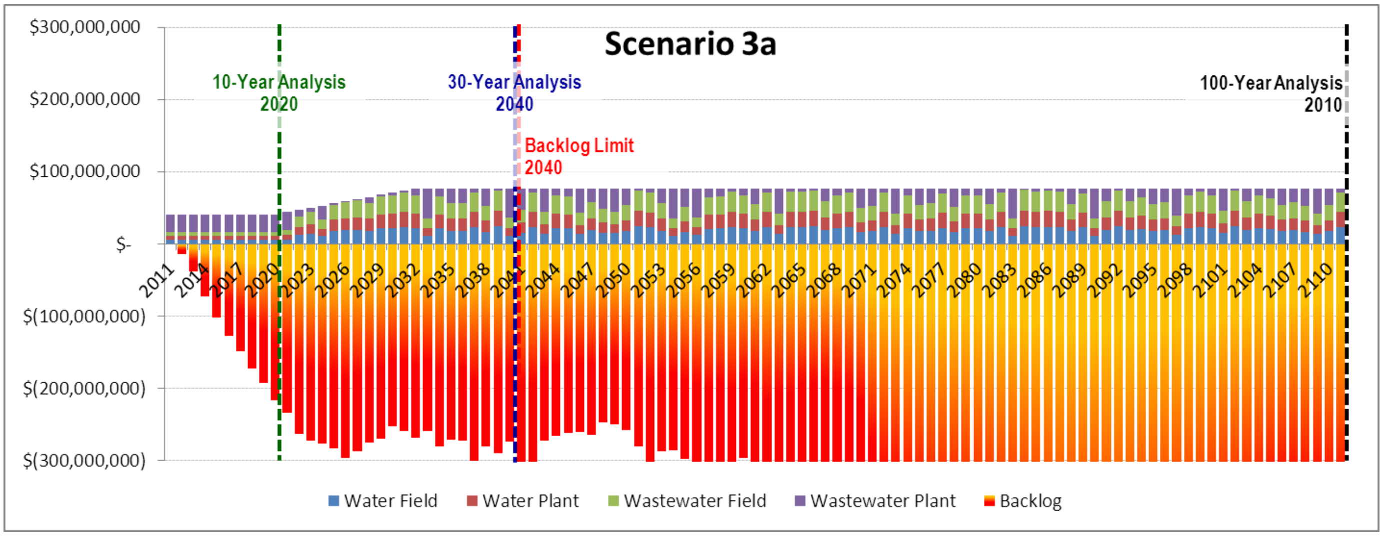
Figure 8-10 Scenario 2 Results



8.2.3 Scenario 3a

In Scenario 3a, the budget is fixed for the first ten years at $41 million. From the eleventh year, the budget is ramped up at a rate of $3 million for the next ten years. The results of this scenario are presented in Figure 8-11. This scenario reaches the $300 million threshold in year 2040 and continues to grow after year 2061. The investments are never enough to meet the projected renewal needs.

Figure 8-11 Scenario 3a Results

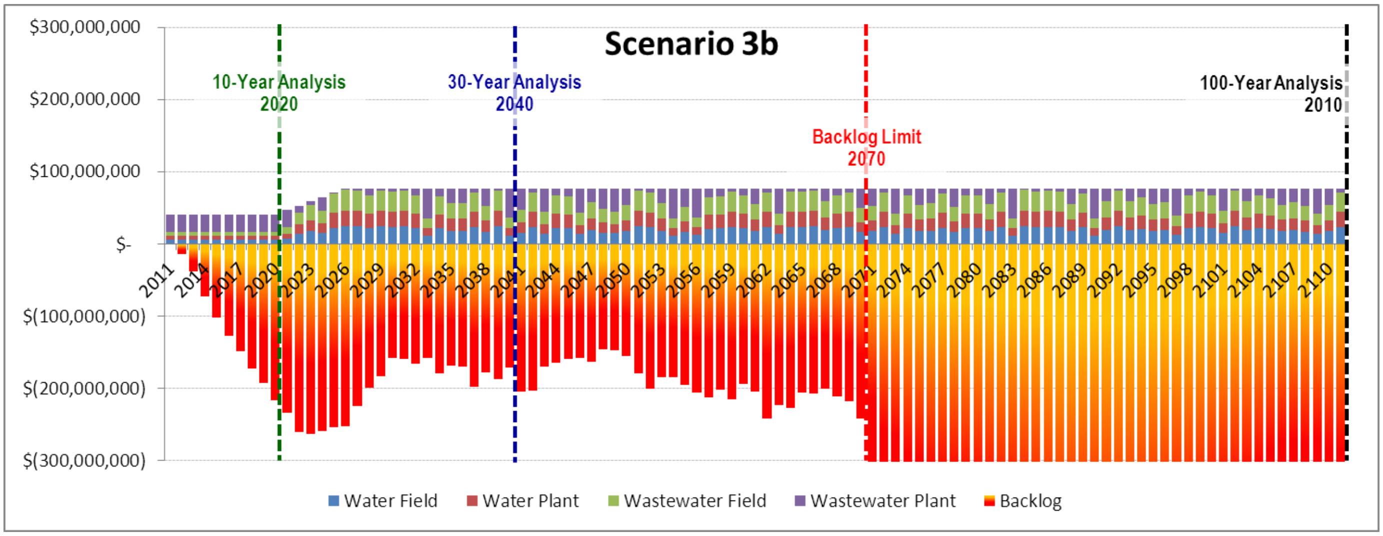


8.2.4 Scenario 3b

Scenario 3b fixes the budget at $41 million for the next ten years and escalates at a higher rate of $6 million, but in half the time as Scenario 3a. Although the results of Scenario 3b (Figure 8-12) are more promising than Scenario 3a, it still falls short of meeting the goal of eliminating the backlog. By the 30th year, the scenario maintains a backlog of roughly $200 million. The threshold of $300 million is realized at year 2070 and continues to grow beyond the limit in future years.

It should be noted that although the Scenario 3b had a shorter investment period when compared to Scenario 3a (5 years vs. 10 years) the impact to the backlog was more dramatic. More investments early on will be more effective in helping to decrease the backlog build up.

Figure 8-12 Scenario 3b Results

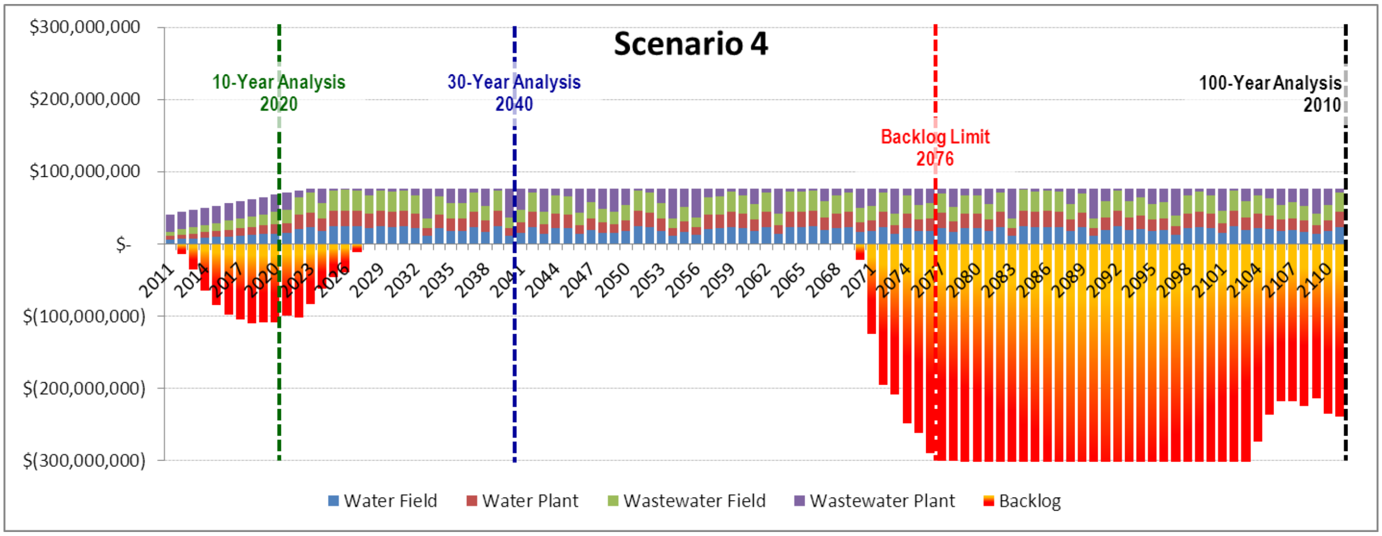


8.2.5 Scenario 4

Learning from Scenario 3, a more aggressive funding scenario was developed to completely eliminate the backlog. The funding in Scenario 4 increases at a rate of $3 million starting in the second year and continues until it reaches $76 million. The results of this scenario are shown in Figure 8-13 below. As expected, the impact to the backlog is dramatic. By year 2027, the backlog is completely depleted. It is not until year 2076 when the scenario reaches the backlog threshold of $300 million. In looking at the 100-year analysis, it can be concluded that another ramp up will need to take place around year 2065 to proactively meet the large renewal needs projected in 2070 and beyond.

The aggressive budget increases of Scenario 4 may be extremely difficult for the Water Authority to achieve. This scenario can be viewed as an explanation of the expenditures needed to greatly reduce, and at one time eliminate, the magnitude of deferred asset renewal activities.

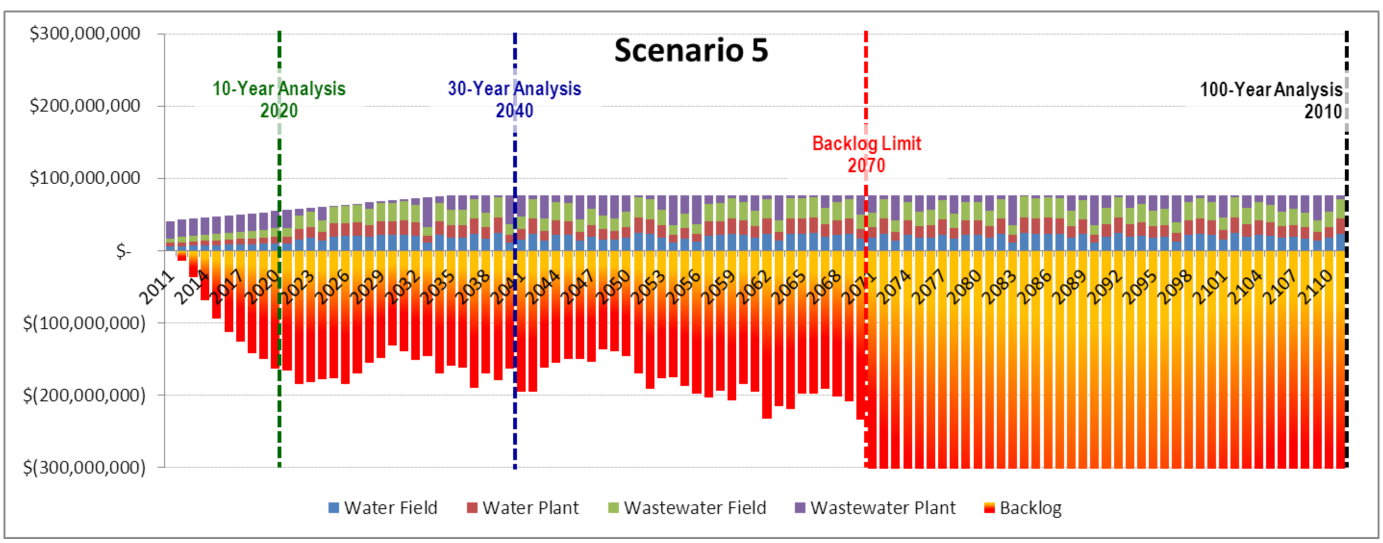
Figure 8-13 Scenario 4 Results



8.2.6 Scenario 5

Scenario 5 takes a less aggressive approach than Scenario 4. From the second year, the funding increases at a rate of $1.5 million per year until it reaching $76 million. The results (Figure 8-14) indicate the $1.5 million per year increase is not enough to meet the projected renewal needs. It never depletes the backlog and the threshold limit is reached in year 2070.

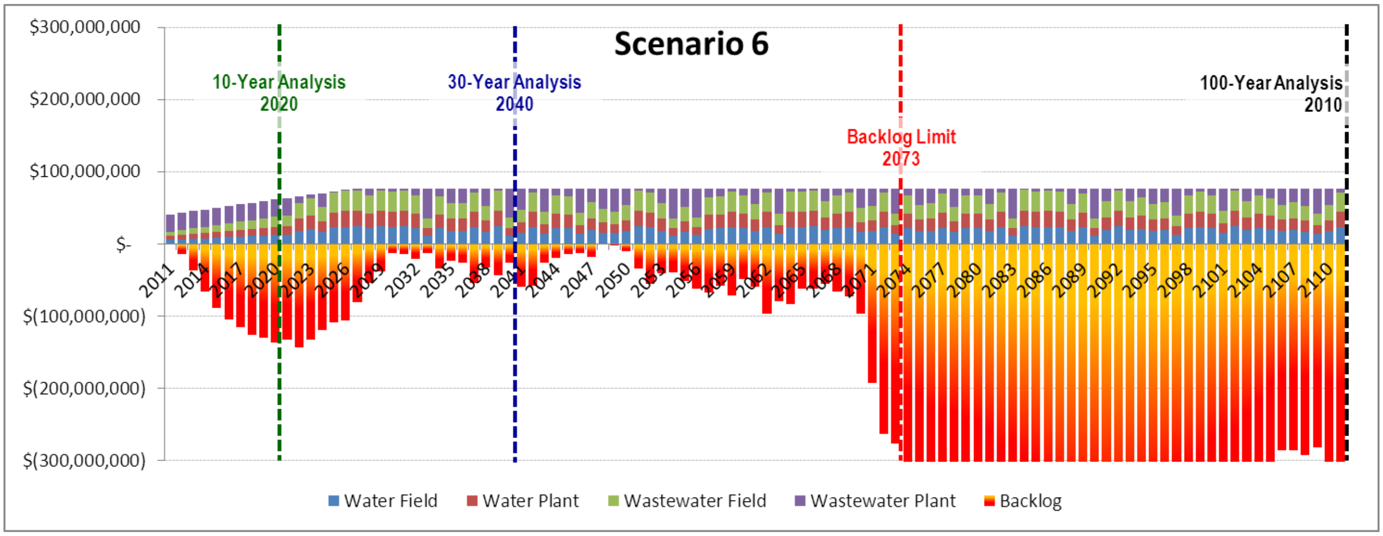
Figure 8-14 Scenario 5 Result



8.2.7 Scenario 6

Building upon Scenarios 4 and 5, Scenario 6 attempts to find the balance where the funding limit matches the backlog (or comes close to it). In this scenario, starting from the second year, the funding increases at a rate of $2.25 million until it reaches $76 million. Similar to Scenario 4, by the year 2030 (Figure 8-15), this scenario depletes the projected renewal backlog. From year 2031, the scenario maintains a backlog of under $100 million until 2069. In year 2073 it reaches the $300 million threshold and continues to be over the limit until 2105. Scenario 6 can form a basis for a potentially sustainable funding platform. It will require a more aggressive increase in funding starting from the mid-2060s. Overall, this scenario maintains a manageable backlog for the first 50 years and serves as a point for the Water Authority to evaluate a sustainable renewal budget.

Figure 8-15 Scenario 6 Results



8.3 Recommended Next Steps

It is recommended that the Water Authority use the future renewal funding requirement projections to help plan the budgetary requirements and work management plans for the short, mid, and long-term. Since the short-term projections were largely influenced by the 10-year AMPs and Decade Plan, they closely match the Water Authority's most accurate depiction of the true renewal needs for the next ten years. The mid-term budgetary needs will be largely influenced by what is funded or deferred in the initial ten years. These needs should be reevaluated in subsequent asset management plans over the next ten years. Long-term projections can be used to plan and establish future budgets and aid in the establishment of reserve funds to help pay for the future renewals. Where appropriate, these projected values can be incorporated to develop the user fees and rates for utility services.

The renewal projections can also be used to drive operation and maintenance decisions. A major way to reduce capital expenditures is to put more funds towards maintaining assets, rather than replacing them. Where the assets are called for renewal activity, the Water Authority should verify the condition of the asset and adjust the renewal timing. Once the condition of the assets is verified, it should then be used to update the management strategies and to project the future renewal needs. This iterative process improves the confidence level of the asset management plan and helps develop a proactive management culture.

In order to maintain a high confidence in the short, mid, and long-term funding requirements, it is recommended that the Water Authority update the future funding and budget requirements biannually. Continual improvement of the Water Authority's asset management program will produce increased efficiency in the day-to-day processes and practices within the utility and increased confidence in future renewal projections. New information and data should be available every two to three years to produce updated asset management plans and funding needs.

It is planned that within the next five years the Water Authority will complete a large sewer pipeline condition assessment. This assessment will record the condition for the majority of the wastewater interceptor system. This information will greatly increase the ability to predict the pipeline replacement needs. As better field information is collected, it should be recorded in the existing CMMS and used to produce future funding requirements. Using the field data, mathematical models can be created to predict asset renewal decisions, reducing the reliance on staff knowledge and predictions to drive future funding requirements.

Additional asset inventories of the plants will produce higher confidence in the results and knowledge of the condition of the existing plant systems. With wastewater plant construction planned for the coming years, it is recommended that the Water Authority require the creation and handover of asset inventories from contractors.

As the asset management program progresses, the Water Authority should consider linking the existing levels of service, business risk exposure assessment, scenario analyses, and funding projections to optimize capital spending and prioritize asset renewals. Doing so will reduce the risk profile of the asset portfolio while minimizing operating and capital costs of the Water Authority.

Appendix A

Asset Management Plan

(Policies, Ordinances, Guidelines)

Guiding Policy

Guiding Principle for Utility Development and Planning on Asset Management (R-07-6)

In an effort to guide capital decision making and reduce risk, the Water Authority should utilize asset management principles for evaluating and considering rehabilitating, replacing or acquiring new assets, including water rights.

Ordinances

Water and Sewer Rate Ordinance - Section 1-1-7(G)

The Water Authority shall continue to implement an asset management program to manage its capital infrastructure focusing on minimizing the total cost of designing, acquiring, operating, maintaining, replacing, and disposing of capital assets over their life cycle while achieving desired service levels. It will also allow the Water Authority to manage existing assets more effectively, make informed decisions on policy and budgetary matters, and plan for future needs.

Guidelines

Establishing a Comprehensive Asset Management Plan to Assist the Water Utility Authority in Managing Its Capital Assets and Plan for Future Needs (R-04-20)

The Water and Wastewater Utility shall develop a comprehensive asset management plan to manage its capital infrastructure focusing on minimizing the total cost of designing, acquiring, operating, maintaining, replacing, and disposing of capital assets over their life cycle while achieving desired service levels. The plan shall include the following basic elements:

A. Collecting and organizing detailed information on assets. An inventory of existing assets should include (1) descriptive information about the assets, including their age, size, construction materials, location, and installation date; (2) an assessment of the assets' condition, along with key information on operating, maintenance, and repair history, and the assets' expected and remaining useful life; and (3) information on the assets' value, including historical cost, depreciated value, and replacement cost.

B. Analyzing data to set priorities and make better decisions about assets. Utility managers should apply analytical techniques such as lifecycle cost analysis or risk/criticality assessment to identify significant patterns or trends in the data they have collected on capital assets, help assess risks and set priorities, and optimize decisions on maintenance, repair, and replacement of the assets.

C. Integrating data and decision making across the organization. Utility managers should ensure that the information collected within the organization is consistent, organized and fully integrated so that it is accessible to the people who need it. In addition, all managers should participate in key decisions which ensures that all relevant information gets considered and encourages managers to take an organization wide view when setting goals and priorities.

D. Linking strategy for addressing infrastructure needs to service goals, operating budgets, and capital improvement plans. The Utility's goals for its desired level of service—in terms of product quality standards, frequency of service disruptions, customer response time, or other measures—should be a major consideration in the Utility's strategy for managing its assets. Decisions on asset maintenance, rehabilitation, and replacement should be linked to the Utility's short- and long-term financial needs and reflected in the operating budget and capital improvement plan.

Appendix B

Ground Water System and San Juan-Chama Drinking Water Treatment Plant Asset Risk Assessment

Appendix C

Asset Summary Sheets

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