



PUBLIC WORKS DEPARTMENT

MAYOR: Lauren McLean | DIRECTOR: Stephan Burgos

MEMO

TO: Mayor and Council
FROM: Steve Burgos, Public Works Director
CC: Courtney Washburn, Chief of Staff
DATE: 8/4/2020
RE: Water Renewal Utility Plan: Infrastructure Condition and Capacity

EXECUTIVE SUMMARY

This memo is the second in a series of six memos that Water Renewal Services will deliver to Boise City Council to provide background information on the elements that comprise the Water Renewal Utility Plan. City council action on the recommended plan will be requested once all background materials have been delivered. The following summarizes the current utility infrastructure condition and capacity to reliably treat Boise's used water, then considers future needs as Boise grows and utility drivers change.

Boise's Water Renewal Services manages approximately \$2 billion in water renewal infrastructure, including five facilities and approximately 1,000 miles of collection system pipelines, making the system the largest municipal asset. This infrastructure provides collection and conveyance of used water where it can be treated and reintroduced into the environment while also allowing resource recovery. While the city has historically kept steady investment in and maintenance of the overall system, the condition and capacity of the infrastructure necessitates further investment to continue to meet the expectations of our community. Stakeholder feedback has consistently shown that providing reliable water renewal services and providing sufficient capacity for growth are baseline expectations for our community.

The city's water renewal facilities have varying levels of remaining useful life expectancy, with some requiring repair and replacement today, while others have 20 years or more of useful life remaining. The city estimates investments between \$380 - \$580 million over the next 20 years will be needed to replace aging assets in the existing water renewal system.

Capacity for our water renewal facilities is driven by three key areas:

- Water quality regulations
- Community growth (population and economic)

- System resiliency (ability to address changing conditions from routine maintenance activities to extreme events)

To support future population growth, future economic opportunities and achieve increasingly stringent water quality regulations, the city estimates needing between \$240 - \$350 million over the next 20 years for increasing capacity.

Regardless of whether the recommended approach within the Water Renewal Utility Plan is approved, significant investment is needed in existing infrastructure to maintain system performance and provide capacity for the future. Where and how we elect to build this capacity will have a significant influence on how we manage our renewed water in the future.

Simply maintaining the current level of reliability and service that our community expects will require nearly \$800 million over the next 20 years to address the combined condition and capacity needs. These investments will support our current and growing needs, along with innovative and sustainable solutions for the future.

INTRODUCTION

Even with responsible planning, Boise now faces challenges related to funding, regulations, and a fast-growing community that will require significant capital investment in the water renewal system.

The water renewal system has an estimated replacement value of \$2 billion, including the water renewal facilities and collections system infrastructure. The utility's infrastructure is aging, with some assets at or near the end of their useful life. This increases the risk of failure for these assets.

Water Renewal Services is also tasked with providing enough capacity to transport and treat used water. Currently, the system collects and renews approximately 36 million gallons per day of used water – enough water to cover a football field 64 feet deep with water every single day. That amount of water is expected to increase by 35 percent by 2040 with population and economic growth. In addition, increasingly stringent water quality regulations put additional pressure on treatment capacity as systems designed to meet a regulatory requirement in the past need to be retrofitted to meet future regulations.

The purpose of this memo is to summarize the condition and capacity constraints faced by the city's water renewal system and the anticipated investments needed to address those challenges. The following sections describe the condition of the city's water renewal infrastructure and the current and expected capacity needs to provide an estimate of anticipated investment over the next 20 years.



BACKGROUND

Water Renewal System Condition

Used water treatment and conveyance requires robust infrastructure and technology that must withstand exposure to harsh conditions and continuous use for decades. These conditions cause the system to degrade over time (see Figure 1). Boise's water renewal system has, thus far, experienced low levels of infrastructure failure as a result of continued investment and maintenance. However, maintaining the aging water renewal system today and into the future will become more challenging.



Figure 1 - Examples of degrading water renewal infrastructure. Left degrading concrete at the Lander Street Water Renewal Facility. Right degrading pipe in the collection system

Boise has spent decades investing in and building the water renewal system we use today. The two water renewal facilities, Lander Street and West Boise, were constructed in 1949 and 1976, respectively. The Twenty Mile South Biosolids Application Site (purchased in 1994), Utilities Maintenance Facility (built in 2002), and the Dixie Drain Phosphorus Removal Facility (constructed in 2015), also support the utility's overall mission. The approximately 1,000 miles of pipe and 29 lift stations that deliver used water to these facilities were installed as Boise expanded, with some originally installed in 1891.

Water Renewal Services has performed condition and risk assessments as part of the Water Renewal Utility Plan development. These assessments investigate the mechanical, structural, and electrical integrity of our existing infrastructure to inform the likelihood of equipment and asset failure. Risk assessments were also performed to identify infrastructure that have "high consequence of failure" within the collection system and at the water renewal facilities. Altogether, these assessments have better informed Water Renewal Services' investment decisions to focus funding on the most critical infrastructure projects, which are identified by prioritizing assets that are both critical to continued system performance and have deteriorating condition resulting in the highest risk.

Water Renewal System Capacity

Providing sufficient water renewal capacity is fundamental to continued prosperity and quality of life in Boise. Water renewal treatment capacity describes the ability of our water renewal system to both:

- Move water, referred to as the flow, through the system, and
- Remove the constituents or material, referred to as the loading, that come with the used water

Water renewal utilities require substantial capital investment in infrastructure and treatment facilities to meet the services that our community expects. These facilities are designed and constructed in phases, which can extend over many years. Understanding the real capacity of these facilities is essential to maximizing the return on these investments and minimizing the costs to ratepayers. In addition, knowing the performance efficiency relative to the available capacity will help to maintain reliability while also determining regulatory, public health, and financial risks.

The capacity of the water renewal system changes over time. This change in capacity is driven by the following key factors:

- *Level of Treatment and Existing Infrastructure* – Water quality regulations have and will continue to become more stringent over time. As the regulations for the quality of the renewed water increase, the capacity of the existing treatment facilities will decrease (see Figure 2 - Increasingly Stringent Regulatory Requirements reduce treatment capacity in key treatment processes below). For example, the city today is facing new, more stringent regulations for phosphorus and nitrogen treatment that place treatment capacity pressures on the existing water renewal system. Figure 2 shows conceptually how treating for different constituents in the same tankage decreases the overall treatment capacity; notice how the amount of the tank dedicated to biochemical oxygen demand (BOD) decreases moving from left to right.

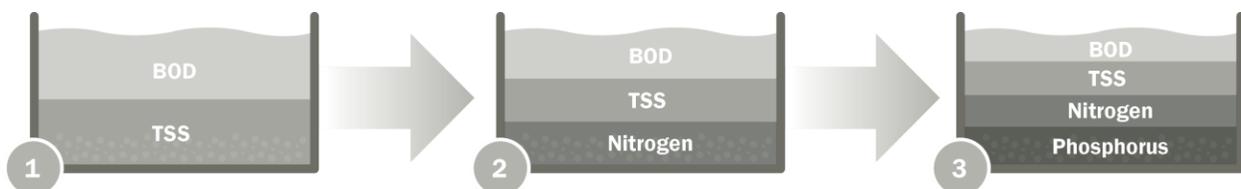


Figure 2 - Increasingly Stringent Regulatory Requirements reduce treatment capacity in key treatment processes

BOD – biochemical oxygen demand
TSS – total suspended solids

- *Community Growth and Economic Activity* - Boise's local economy, residents, industrial and commercial businesses will require additional capacity as the community grows. As an example, a growing brewery producing more beer will create more used water requiring conveyance and treatment by the utility. Industries looking to move into the Boise area often are interested in knowing the condition, funding and plans related to water renewal services and this is often one of the key components in selecting areas to start or expand. Additional use from an expanding resident base, such as new apartments, developments or subdivisions also increases the amount of treatment capacity required. Thoughtful and strategic investments in our water renewal infrastructure can be a catalyst for additional economic growth.
- *System Resiliency* – The city is committed to providing a resilient water renewal system, one that can accommodate everything from routine maintenance activities to extreme events. These events include the effects of climate change, such as the extreme snow event of 2017 which increased the overall system flows by nearly 80 percent in less than 24 hours and maintained high flows for several months. The need for this prudent system resiliency will only increase over time and may result in the need to add capacity. Stakeholder feedback has shown support for investing in the system to maintain resiliency.

In order to evaluate the existing performance and capacity of the system, the city conducted capacity assessments at both the Lander Street and West Boise Water Renewal Facilities. These assessments allow us to understand which specific processes at which facility can be upgraded to achieve the most efficient capacity gains. This approach identifies specific capacity limitations with the most constraining process defining the performance and overall capacity. The results of this work can be used to determine which processes should be targeted as priorities for upgrade to unlock additional capacity at the facilities to meet current and future needs.

ANALYSES:

Condition

The critical infrastructure components typically have an estimated useful life of 10 - 100 years depending on the asset. The condition and risk assessments determined that the water renewal facilities' remaining useful life is unique to each asset. Lander Street is the oldest water renewal facility in the system and is at the end of its useful life. The Lander Street Phase 1 projects to replace and upgrade some of these aging assets are currently underway. The West Boise facility, which currently has a rehabilitation project underway and ongoing condition assessments, will require a major replacement effort within the next 20 years. The Twenty Mile South Biosolids Application Site and Dixie Drain facilities, both relatively "newer" assets compared to Lander Street and West Boise, are continuously evaluated for condition and replacement timing and costs.



City staff have also been assessing the condition of the collection system, including small-diameter pipe, large-diameter pipe and lift stations. The condition data for small-diameter pipe systems show that 20% (approximately 200 miles) is near the end of its useful life. The condition data for large-diameter pipe systems show that 50% (approximately 30 miles) of the system is nearing the end of its useful life (needing rehabilitation or replacement within the next 10 years). The condition data also demonstrates that three of the regional lift stations (see Figure 3 below) are near the end of their useful lives.



Figure 3 - Regional Lift Station showing one of three pumps. This lift station is critical to the water renewal system and pumps over one million gallons of used water a day and has been in service for over 30 years.

In addition to these targeted replacement projects, the overall system requires continued repair and replacement in order to maintain system performance, create a more robust system to accommodate public needs and avoid costly emergency repairs.

Capacity

The city currently collects and renews approximately 36 million gallons per day of used water during the periods of peak flow. Based on anticipated population and economic growth, the amount of used water the utility will need to collect, convey and clean is expected to increase by over 35 percent by 2040. The city has been proactive in planning for future growth and maintains reserve capacity within the system. However, accommodating the expected increase in demand will still require increasing the water renewal system capacity by approximately 20 percent in the treatment systems.

Additionally, the system's current capacity is challenged with regulatory pressures such as new, more stringent regulations for phosphorus and nitrogen. As the regulations for the quality of the renewed water increase, the capacity of the existing treatment facilities will decrease. The combined pressures of population growth and increasingly stringent water quality regulations are the primary factors for the water renewal system's capacity investments.

The city's system-wide capacity evaluation has demonstrated that capacity constraints can largely be attributed to treatment capacity limitations (what it takes to treat the water) and are less driven by lack of flow capacity (what it takes to get the water from point A to point B). The collection system today has sufficient capacity to convey future flow projections through 2040, although some minor investments are necessary for specific pipes to slightly increase flow conveyance capacity.

Through the evaluation process, the city has identified the need to expand treatment capacity at its water renewal facilities. The city has already begun work to expand capacity at the Lander Street facility, but additional investments are anticipated across the system.

FINDINGS:

Condition

Maintaining the city's existing infrastructure is a core responsibility of Water Renewal Services. By investing in water renewal infrastructure, the city can increase system reliability and maintain rate affordability. Delaying the repair and replacement of infrastructure poses a higher risk of system failure and emergency repairs, which can negatively impact affordability for ratepayers, impact environmental and public health, and put our ability to proactively invest in future system needs at risk. Asset investment is also necessary to ensure infrastructure resiliency for unforeseen events related to climate change.

The results of the condition assessments and planning indicate the city should expect to spend between \$380 - \$580 million over the next 20 years to maintain the existing water renewal assets. This equates to an average investment of approximately \$20 - \$30 million



annually. Water Renewal Services is working to establish a predictable spending pattern that replaces assets when replacement is essential for public health and quality of life. Table 1 summarizes the estimated investments for each of the facilities.

Table 1. Projected Condition Investments for Water Renewal System Facilities	
Facility	Expected 20-Year Investment ¹
Collection System	\$130M - \$195M
Lander Street Water Renewal Facility	\$145M - \$225M
West Boise Water Renewal Facility	\$100M - \$150M
Twenty Mile South Farm	\$4M - \$6M
Dixie Drain	\$1M - \$4M
TOTAL²	\$380M - \$580M

¹ All costs presented as 2020 dollars.

² Total expected cost rounded to the nearest \$10M

The condition assessment and asset management strategies implemented to date have supported the goal of predictable spending by providing accurate asset data to inform funding decisions. As shown in Table 1, the Lander Street facility, followed by the collection system, are projected to require the most investment to address future condition issues. Regardless of whether the recommended approach from the Water Renewal Utility Plan is ultimately approved, significant investment is needed in existing infrastructure to maintain system performance and reliability.

Capacity

Water Renewal Services has evaluated the system capacity pressures and identified strategies to manage capacity moving forward. As described previously, the water renewal system's treatment capacity is more limited than its flow conveyance capacity. Therefore, the investments for capacity are anticipated to be greater for the water renewal facilities than they are for the collections system infrastructure. Collectively, the water renewal system will require an investment of between \$240 - \$350 million over the next 20 years. This equates to an average investment of approximately \$12 - \$17.5 million annually. Table 2 outlines the anticipated investments for each of the key facilities.



Table 2. Projected Capacity Investments for Water Renewal System Facilities	
Facility	Expected 20-Year Investment ¹
Collection System	\$8M - \$12M
West Boise Water Renewal Facility	\$20M - \$30M
Lander Street Water Renewal Facility	\$54M - \$82M
Existing or New Water Renewal Facilities	\$158M - \$226M
TOTAL²	\$240 - \$350M

¹ All costs presented as 2020 dollars.

² Total expected cost rounded to the nearest \$10M

These capacity investments are needed regardless of whether the recommended approach is adopted by the city. However, where the city decides to build new capacity requires consideration of factors including geography and location of the end user because these factors can influence cost. Building capacity closer to where the water may ultimately be used is more cost effective. For example, constructing treatment capacity closer to the expected area of use for recycled water reduces the cost of conveyance for the recycled water. Similarly, investments in the collection system can be reduced by locating water renewal facilities closer to where used water is produced. Both factors will be further discussed in future briefings.

CONCLUSION:

Water Renewal Services' review of the current condition and existing capacity of the system clearly identified the need to invest in the utility for the future.

Water Renewal Services has incorporated thorough condition and risk assessments as part of the planning effort to mitigate impacts from aging infrastructure. Through these assessments, the city has identified that the Lander Street Water Renewal Facility and collections system will need the most near-term investments to address aging and deteriorating infrastructure. Water Renewal Services has also evaluated the system capacity pressures and identified strategies to manage capacity moving forward. The city's investments for capacity, which are mainly needed for treatment capacity, are anticipated to be greater for the water renewal facilities than they are for the collections system infrastructure.

Over the next 20 years, the city's water renewal system will require an investment of between \$380 - \$580 million to replace aging water renewal assets and \$240 - \$350 million to address future capacity needs. Collectively, these condition and capacity investments are needed regardless of whether the Water Renewal Utility Plan is adopted by the city. However, strategic deployment of these investments can further enable a shift in the products and services provided by the utility. Water Renewal Services is proposing a proactive and prudent investment strategy to address these



issues moving forward. This strategy, which is described in the Water Renewal Utility Plan, will enable Boise to continue to be a leader and innovator in the management of renewed water while meeting the challenges of today.

REFERENCE DOCUMENTS:

The following documents related to this topic are available upon request:

- *Technical Memorandum T-06 Collection System Capacity Assessment*
- *Technical Memorandum T-07 Lander Street Water Renewal Facility Capacity Assessment*
- *Technical Memorandum T-08 West Boise Water Renewal Facility Capacity Assessment*
- *Technical Memorandum UM-05 Asset Management Approach*
- *Technical Memorandum UM-06 Field Condition Assessment Report*
- *Technical Memorandum UM-07 Collection System Desktop Assessment*
- *Technical Memorandum UM-08 Treatment Facility Desktop Assessment Report*

RECOMMENDED OR REQUESTED ACTION:

INFORMATION ONLY.

