FINAL

BEAVER WATER DISTRICT 2023 WATER MASTER PLAN

Chapter 1 – Executive Summary

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PREPARED FOR

Beaver Water District

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Beaver Water District

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Introduction

The Beaver Water District (BWD) is required to prepare a master plan at least every ten years for compliance with the Arkansas Department of Health (ADH) regulations. The last comprehensive master plan was conducted in 2015 to assess population projections, water demands, evaluate water treatment infrastructure, and develop a comprehensive Capital Improvements Program (CIP). An updated master plan was conducted in 2019 specifically to evaluate demands, project timing, and update CIP costs.

Since then, BWD's four wholesale Customer Cities (Bentonville, Rogers, Springdale, and Fayetteville) and corresponding service areas has experienced significant growth and corresponding increases in water demands. This accelerated growth coupled with recent volatility in market pricing has driven the need for re-evaluation of the population, demands, regulations, improvements, timing, costs, and current improvements schedule to establish a current master plan and CIP for future planning. These comprehensive improvements are summarized as the 2023 Water Master Plan.

Population and Demand Projections

Historical census population data from 1980 through 2020, as well as more recently adopted annual growth projections from the Northwest Arkansas Planning Commission (NWARPC), were used to establish population and corresponding water demand projections through 2045 for the four wholesale Customer Cities and their corresponding service areas. Population projections from 2020 through 2045 were extrapolated using the NWARPC growth projections, which were adopted from the 2045 Northwest Arkansas Regional Transportation Plan. The historical data and population projections for BWD's service area are shown in Figure 1-1 along with a comparison to the NWARPC projections from 2015 highlighting the increasing population in the more recent projections.

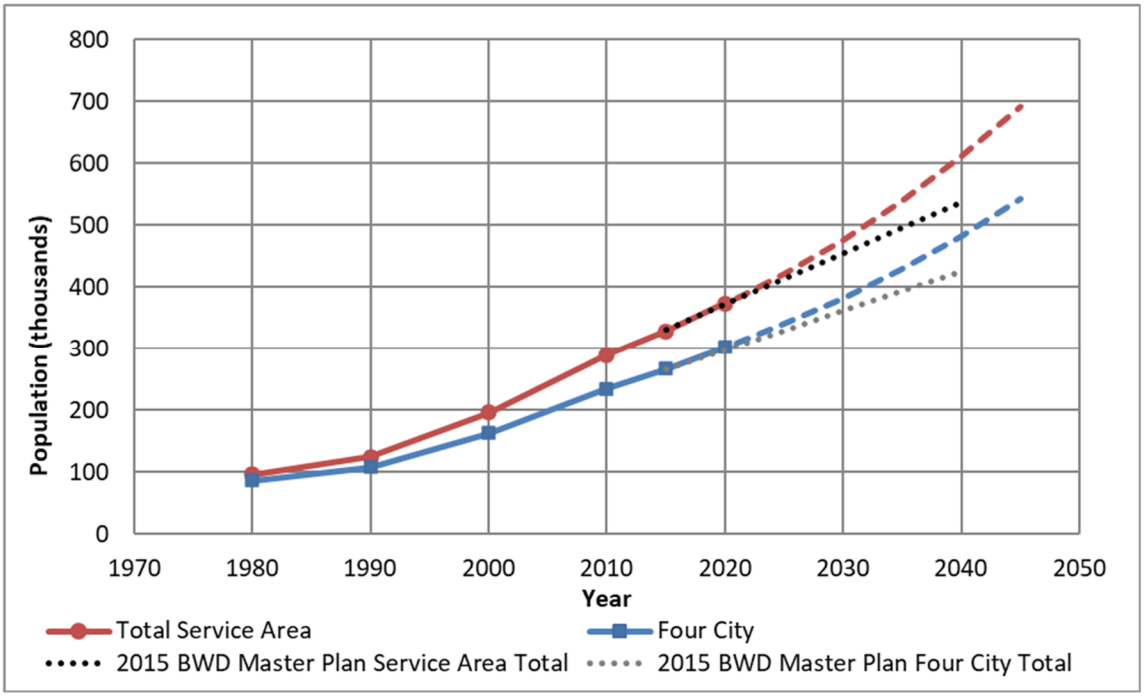

Figure 1-1. Population Comparison from Current Study to 2015 Study

The NWARPC data and projections were from 2020 which lagged the start of this master planning effort in 2022. Based on observation of development and evaluation of actual operational data and water demands, it is apparent that population in at least Bentonville and Fayetteville are exceeding that of the current NWARPC projections. For these two cities, a manual adjustment on current population was conducted by assuming a constant gallons per capita day (gpcd) from 2020 using a known census to calculate an adjusted current population for 2022. From this data a growth rate from 2020 to 2022 of 5.9% was established and was projected out through 2025. All growth rates after 2025 were assumed to follow the rates of the NWARPC for the BWD service area of 2.5%.

Historical data from the 2015 master plan study, in conjunction with updated usage data since then, were used to examine historical water demand statistics. The historical water analysis included average day demands, maximum day demands, peak factors (ratio of maximum day demand per year to that year's average day demand), and usage on a gallons per capita per day (gpcd) basis. These statistics were developed and evaluated for each of the four Customer Cities and for BWD overall.

To establish water demand projections, a population-based approach was used to estimate average day water demand projections, in which the population projection values were multiplied by their corresponding per capita usage values. As expected, current average day demand projections are higher than the 2015 projections based on the acceleration in regional population growth.

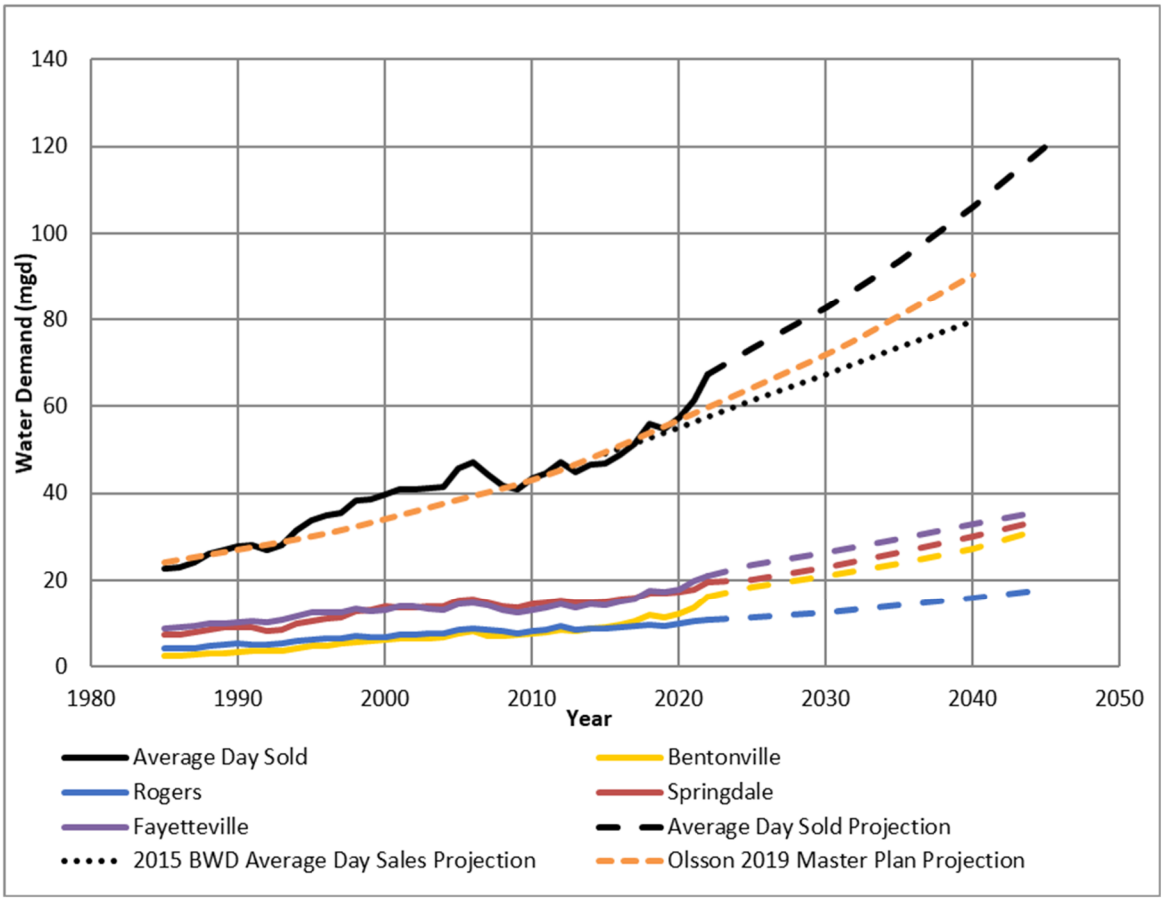

Figure 1-2. BWD Average Day Production Projection

Maximum day demand projections are the most critical data point as these establish the need for facility expansions. The overall projected maximum day demands for BWD were determined by multiplying the projected average day demand by the design peak factor of 1.74. The design peak factor is representative of the 95th percentile peak factor based on the last 20 years of operational data. This was actually a decrease from the 1.90 design peak factor in the 2015 Master Plan. The resulting projected maximum day demands are listed in Table 1-1 and represented graphically in Figure 1-3.

TABLE 1-1. MAXIMUM DAY DEMAND PROJECTED VALUES

Year	Bentonville	Rogers	Springdale	Fayetteville	BWD Total Sales
2022	24.1	19.7	28.7	32.7	103
2025	36.3	23.0	36.2	47.7	128
2030	41.3	25.8	41.4	53.4	144
2035	47.0	28.9	47.3	59.8	163
2040	53.6	32.4	54.1	67.0	185
2045	63.1	36.5	61.4	73.1	209

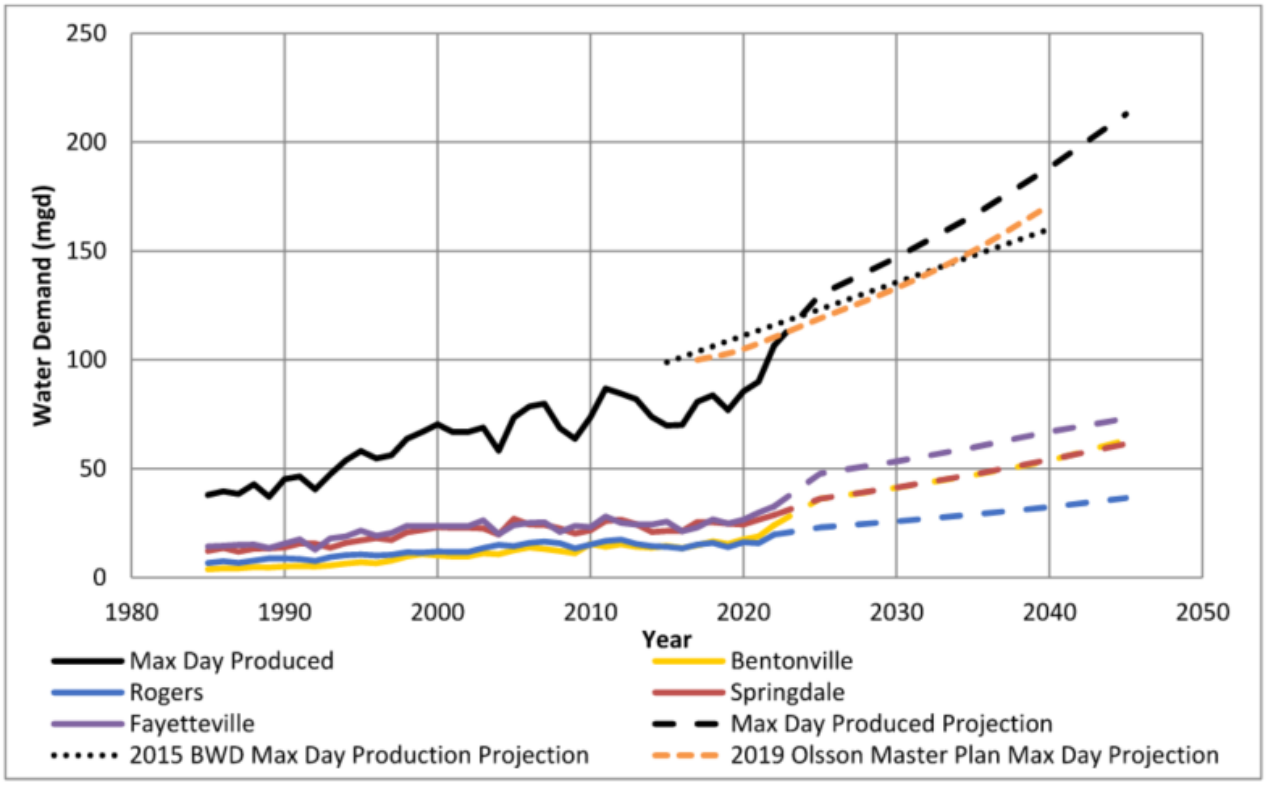

Figure 1-3. BWD Max Day Production Projection

Process Overview and Regulatory Review

The existing BWD treatment infrastructure consists of three individual WTPs drawing surface water from Beaver Lake. Each WTP uses a conventional treatment process that consists of coagulation and

flocculation followed by sedimentation, pH adjustment, filtration using dual-media gravity filters, and disinfection of filtered water through the clearwell. A simplified illustration of the conventional treatment process is illustrated in Figure 1-4.

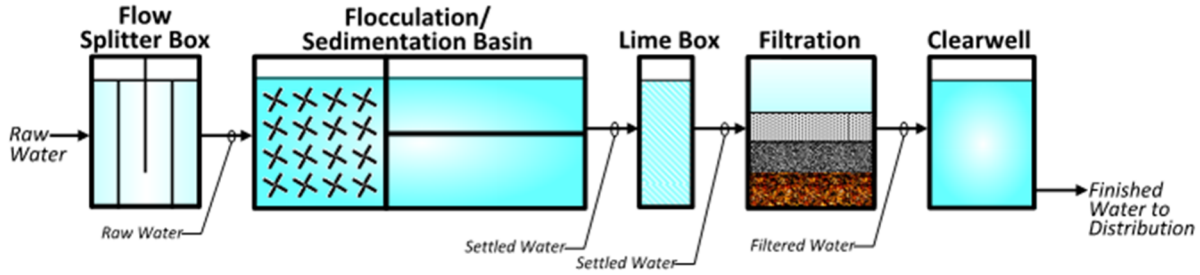

Figure 1-4. BWD Conventional Treatment Process

REGULATORY REVIEW

BWD is required to meet the drinking water regulations established through ADH and as adopted from the Environmental Protection Agency (EPA). A review of operational water quality data for the last 5 years was evaluated in regard to the regulatory requirements. BWD is in compliance with all regulatory requirements and is expected to continue in compliance with current drinking water regulations as summarized in Table 1-2.

TABLE 1-2. SUMMARY OF CURRENT DRINKING WATER REGULATIONS AND ANTICIPATED COMPLIANCE

Regulation	Compliance Status	Future Compliance
Surface Water Treatment Rule (SWTR)	☑	Expected
Long Term 2 Enhanced Surface Water Treatment Rule (LT2)	☑	Expected
Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage II DBPR)	☑	Continued Monitoring
Arsenic Rule	☑	Expected
Lead and Copper Rule Revisions	☑	Continued Monitoring
Radionuclides Rule	☑	Expected
Phase I VOCs	☑	Expected
Phase II VOCs, SOCs, and IOCs	☑	Expected
Phase V VOCs, SOCs, and IOCs	☑	Expected
Revised Total Coliform Rule	☑	Expected
Filter Backwash Recycle Rule	Not Currently Applicable	Continued Monitoring

A few specific topics as it relates to those items noted for continued monitoring along with some items of potential future regulation are addressed below.

- **Disinfection Byproducts (DBPs)** – BWD's use of chlorine dioxide has provided a continued measurable reduction in the formation of DBPs consisting of trihalomethanes (THMs) and haloaceitc acids (HAAs). Specifically, since the use of chlorine dioxide was implemented in 2013, there has been an overall decrease in total THMs and HAAs. Similar observations were noted in the 2015 Master Plan. BWD maintains a more stringent internal treatment goal for TTHMs and HAA5 relative to the ADH maximum contaminant levels (MCLs) for these contaminants from a locational running annual average (LRAA) perspective. The continued use of chlorine dioxide coupled with continued monitoring is recommended to help minimize the formation of DBPs and to maintain compliance with the Stage II DBPR.
- **Lead & Copper** – While compliance with the updated Lead and Copper Rule (LCR) is less impactful to BWD directly as a wholesale provider, continued coordination with the Customer Cities along with monitoring of corrosion indices including the finished water Langelier Saturation Index (LSI) and chloride-to-sulfate mass ratio (CSMR) is recommended to help indicate whether the finished water could potentially promote leaching of lead or copper from distribution and service lines.
- **PFAS (Potential Future Regulation)** – EPA proposed in March 2023 to impose a national primary drinking water regulation (NPDWR) limit on six per- and polyfluoroalkyl substances (PFAS). If finalized, additional monitoring would be required and possible treatment if PFAS levels are found to exceed the limits. Because the proposed limits have not been finalized and adopted, immediate action is not required. Water quality testing at BWD has found no measurable PFAS. If the proposed PFAS limits are implemented and detection above potential regulatory limits is determined, granular activated carbon (GAC) would be the recommended treatment technology. The associated costs for implementation are presented in Chapter 7.
- **Taste & Odor** – BWD has historically experienced taste and odor (T&O) issues on a periodic basis predominantly from 2-methylisoborneol (MIB) and geosmin in the raw water which produce musty and earthy odors. T&O events are typically present from late-summer to mid-fall. While the most recent trends in T&O data are not indicative of significant events as noted in the 2000's, these are highly dependent on lake quality considerations and the ability to predict future levels is uncertain. Concepts and costs have been developed for potential implementation of treatment with ozone to help mitigate T&O events along with providing some other potential process improvements and efficiencies.

Facilities Assessment

An updated facility asset assessment was performed for major facility assets to provide an independent review of the asset condition and anticipated remaining useful life.

For this evaluation, assets were identified as equipment with a value of approximately $10,000 or more. For each evaluated asset, a condition rating value and age factor were assigned according to prescribed rating systems for each parameter. The condition rating value was on a scale from 1 to 5 based on visual inspection of equipment condition and maintenance history, where 1 represents equipment in excellent

working condition and 5 reflects equipment that effectively does not function. The age factor relates an asset's current age compared to its anticipated remaining expected useful life. Combinations of these factors were the basis for a matrix developed for an expected life adjustment factor (ELAF).

For each type of equipment a baseline life expectancy value was assigned according to industry averages and engineering judgement. After establishing each asset's installation date or last major rehabilitation, its ELAF was applied against the baseline life expectancy to establish an adjusted replacement date (ARD) for each asset. The primary focus of the evaluation was to establish the ARD because it reflects the asset's estimated remaining useful life as derived from the equipment's actual condition and age. After completing the evaluation, 79 assets across the main process areas were identified as reaching their ARD by 2028. These assets were evaluated and grouped into several future rehabilitation projects:

- Croxton WTP constructed in the early 1990's will have numerous assets reaching the end of their useful life in this planning period and a singular project is proposed to include replacement of most of the mechanical, chemical feed, and electrical equipment within the facility. This project is anticipated to be conducted in the early 2030's.
- The Steele WTP filter complex was constructed in two phases in the 1960's and rehabilitated in the 2000's. However, due the overall age, differing filter configuration, and limited hydraulic capacity, it is proposed to construct a replacement filter complex similar to the Croxton and Expansion filters in the early 2030's rather than a further rehabilitation of this facility.
- Solids Handling facilities will require equipment replacements due to age and condition, but are also required based on necessary capacity improvements. These improvements were evaluated wholistically.

Capacity Evaluation

The water demand projections developed were analyzed with the existing facility capacity to determine the timing and size of proposed improvements. The following summarizes the major facilities evaluated.

RAW WATER INTAKES & PIPELINE FACILITIES

To ensure the capacity of the raw water intakes and transmission piping are adequate the for the increased demands, the following improvements are recommended.

- **South Intake** – The older of the two intakes, three of the existing smaller pumps should be replaced to match the size and capacity of the five adjacent larger pumps. Having eight equal-capacity pumps at the South Intake, combined with the recommendation of installing an interconnect between the existing transmission pipelines, could allow a firm capacity of 90 MGD from the South Intake.
- **North Intake** – At the North Intake, installation of five new pumps (in addition to the five existing pumps) is recommended to support the firm pumping capacity requirements for the planning period. The new pumps at the North Intake are needed prior to rehabilitation of the South Intake to ensure sufficient capacity is available during the South Intake rehabilitation work.
- **Raw Water Transmission** – Currently 36-inch, 48-inch, and 60-inch transmission mains are utilized to convey water to the treatment plant with an approximate maximum capacity of 140

MGD. A new 72-inch transmission pipeline from the North Intake is recommended to provide additional capacity from the South and North Intakes. This pipeline is slightly oversized to provide additional resiliency in the event one of the other pipelines is out of service.

WATER TREATMENT PLANTS

Based on the projected water demands and the current 140 MGD rated capacity of the existing WTPs, an expansion is required to be constructed and operational in 2028. Capacity expansion of 40, 60, & 80 MGD were considered as depicted in Figure 1-5. Expanding treatment infrastructure by 40 MGD would satisfy demands through approximately 2038 at which time a second expansion would be required. Further, this would not provide sufficient capacity to take Croxton WTP or Steele filters offline for rehabilitation projects. A 60 MGD expansion could serve demands until approximately 2042, similarly requiring a second expansion, and would not align with the buildout capacity of the raw water facilities (220 MGD). An 80 MGD expansion is recommended as it would satisfy demands through the planning period, match buildout capacity of the raw water facilities, provide operational flexibility regarding proposed facility rehabilitation projects, and realize the greatest economy of scale in construction costs.

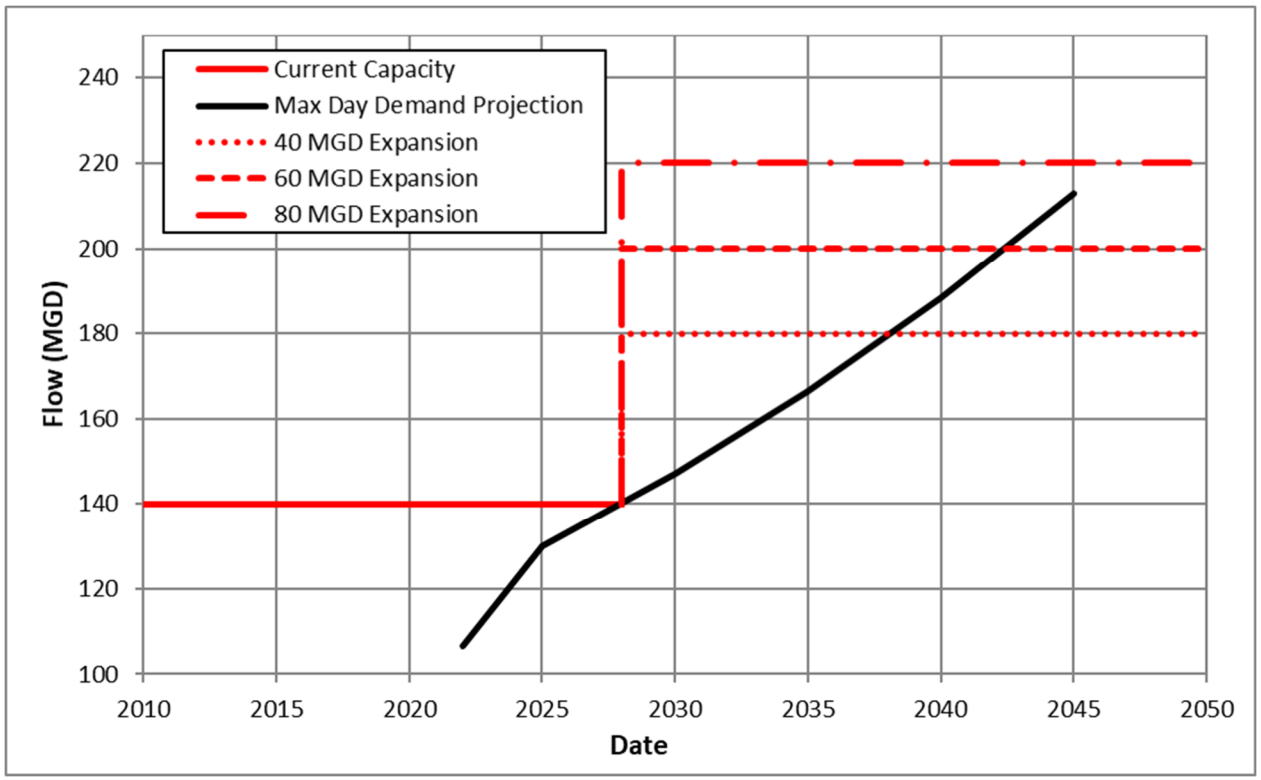

Figure 1-5. Required Treatment Plant Capacity Expansion

The proposed 80 MGD treatment plant expansion is expected to be configured similarly to the existing facilities as far as the sedimentation basins and filters. Other provisions included with this work are a new raw water flow split structure, chemical feed storage and feed facilities, operations building, backwash equalization, solids clarifier and gravity thickener, switching station 1 relocation, and miscellaneous sitework and yard piping.

CLEARWELL AND DISINFECTION

Expansion of the treatment infrastructure will also require added clearwell storage in order to maintain the regulatory requirement of at least 10% storage capacity relative to the treatment capacity. Further considerations regarding disinfection requirements support added storage in excess of the 10% minimum storage requirements. Specifically, during cold winter months, achieving adequate disinfection will benefit from having additional finished water storage in excess of the 10% requirement. An additional 16 million gallons (MG) of finished water storage is recommended.

HIGH SERVICE PUMPING

Each Customer City is expected to own and manage storage tanks within their systems to provide sufficient usable storage volumes to meet or exceed their respective Average Day Demand (ADD) plus fire flows. BWD is expected to maintain sufficient pumping capacity to meet the Maximum Day Demand (MDD) for each Customer City. Maximum hour demands are expected to be met by a combination of BWD's max day pumping capacity and each City's water storage capacity.

Analysis of the high service pumping capacities to meet MDD was performed for the treated water pump stations (TWPSs) that serve each Customer City. The nature and timing of capacity improvements depend on the projected demands for each City and completion and connection to the Western Corridor Pump Station (WCPS). Springdale is scheduled to begin using the WCPS in 2026 and Fayetteville in 2027. Bentonville is beginning planning and could begin using the WCPS as early as 2027. Rogers is projected to need a connection to WCPS in approximately 2036.

Several pump improvements at the existing TWPS are recommended to meet capacity demands in the short term until WCPS is complete and the Cities can connect.

ON-SITE POWER GENERATION

Assessment of the existing power generation facilities identified that the current infrastructure can accommodate average day power demands through 2028 until the plant expansion is operational. Afterwards, an estimated 4 megawatts (MW) of additional power will be necessary to support average day demands through the duration of the planning period.

SOLIDS HANDLING FACILITIES

In the mid 2000's, BWD implemented clarification and mechanical dewatering facilities to handle the process residual waste streams. In 2020, improvements were made to remove the WTP Filter to Waste flows from the dewatering process and recycle this flow to the head of the treatment plant in order to extend the capacity of the existing facilities. Liquid from the solids handling process is ultimately discharged and dewatered solids are either land-applied or disposed of at a landfill.

An evaluation of the existing facilities from both a condition and capacity perspective included recommendations for a second dedicated clarifier to handle high-turbidity events, a second solids holding tank, replacement and upsizing of the three existing centrifuges that will be reaching the end of their useful life, replacement of the dewatered solids conveyance system and construction of a larger dewatered solids storage area.

Capital Improvement Plan

Based on the analyses and recommendations prepared in this master plan study, a Capital Improvement Plan (CIP) was developed to address the increased facility capacity needs, meet water quality requirements, and address capital replacements. The CIP projects identified in this study are recommended to be completed during the course of the current planning period by the Service Year summarized in Table 1-3. For each project, an opinion of probable project costs (OPPC) is prepared in current 2023 dollars meeting a Class 4 estimate as defined by the American Association of Cost Engineers (AACE) Cost Estimate Classification System. In addition to the estimated construction costs, a 30% project contingency is included for all projects which is standard at this conceptual level. An additional 15% is included for engineering.

TABLE 1-3. CAPITAL IMPROVEMENT PLAN PROJECT SUMMARY

Project	Type	Service Year	Probable Project Cost (2023 Dollars)
North Intake Pumps	Capacity	2026	$13.0M
South Intake Pumps and Rehabilitation	Capacity	2029	$17.5M
Raw Water Transmission Main	Capacity	2026	$33.4M
80 MGD Plant Expansion	Capacity	2028	$282.8M
16 MG Clearwell Expansion	Capacity	2027	$40.8M
SS1A Generators	Capacity	2028	$10.0M
High Service Pump Replacements	Capacity	Varies	$3.4M
WCPS – Bentonville	Capacity	2027	$5.2M
WCPS – Rogers	Capacity	2036	$5.2M
WCPS – Fayetteville Expansion	Capacity	2040	$1.8M
Croxton Plant Rehabilitation	Condition	2030	$52.6M
Steele Filter Replacement	Condition	2032	$35.9M
Solids Handling Modifications	Condition/Capacity	2028	$37.5M
Subtotal			**$539.1M**

Additional CIP projects were identified primarily related to potential water quality considerations. However, these do not have a specified completion timeline because they are subject to potential future regulations or water quality changes. These CIP projects and their estimated OPPC are summarized in Table 1-4.

TABLE 1-4. POTENTIAL CAPITAL IMPROVEMENT PLAN PROJECT SUMMARY

Project	Type	Year	Probable Project Cost (2023 Dollars)
Ammonia Facilities	Water Quality	Unspecified	$2.9M
UV Facilities	Water Quality	Unspecified	$51.1M
Ozone Facilities	Water Quality	Unspecified	$75.7M
Granular Activated Carbon Facilities	Water Quality	Unspecified	$144.6M
Subtotal			**$274.3M**