

CAPITAL IMPROVEMENT/REPLACEMENT/REHABILITATION PROGRAM PROJECTS (CIRRP)

Over the last approximately eight years, the Blue Mountain Water District (BMWD) has embarked on the planned and necessary Capital Improvement/Replacement/Rehabilitation Program (CIRRP). At that time (about 2017), the BMWD and its facilities were approaching 40 years of age and the necessity of this program was highlighted by the failure of one of the Water Treatment Plant (WTP) Clearwell booster pumps. This pump was approximately 40 years old and had over 25,000 hours of service, so the BMWD certainly received a great value from it. However, it was apparent that a planned replacement program was in order for all of the major equipment and a review of the remaining facilities was appropriate. This CIRRP was a result of that review and involved both needed replacement of aged equipment and upgrades and enhancements to the components of the original system. In keeping with the BMWD tradition of significant Board volunteer efforts with BMWD projects, these projects also received significant volunteer efforts and therefore cost savings (but which have not been quantified).

Clearwell Booster Pump Replacements – As mentioned above, the two Clearwell booster pumps were the first equipment replacement to be accomplished. With over 25,000 hours of service, BMWD received an excellent service from these pumps, but new pumps were necessary. The original pump manufacturer of 40 years ago had discontinued offering these pumps, but through some research and multiple calls and inquiries, BMWD was able to contact the pump manufacturer that had purchased the general design plans for these pumps and amazingly had the original design plans that were specifically designed for the BMWD pumps for both the Clearwell and PS 2 booster pumps! BMWD ordered two new booster pumps for the WTP Clearwell at a cost of \$27,000 in 2017 and they were installed by Water Utility Service (WUS).

Pumping Station #2 Booster Pump Replacements – Since BMWD had fortunately located the pump manufacturer for the PS #2 pumps, and the PS#2 pumps were

40 years old, replacement pumps were ordered at a cost of \$23,400 in 2019 and they were installed by WUS.

Water Storage Enhancement – 100,000 Gallon Tank – For several years, BMWD discussed the need for additional treated water storage. The BMWD had nearly doubled the number of taps since its inception (which increased water demand) and, because of the system's age, all the storage tanks required cleaning, inspection and possibly repairs. In order to accomplish this, the BMWD would need more gravity storage to allow for continuous water service during these activities. BMWD's original design included 20,000 gallons of storage at PS#2 for the Low pressure zone; 50,000 gallons of storage for the Middle pressure zone (which could also serve the Low zone through a Pressure Reducing Valve (PRV)) and 10,000 gallons of storage (a buried steel pressure tank) for the High pressure zone (Westridge). However, the High zone tank does not function by gravity alone and the water must be pumped into it and stored under pressure (provided by the PS#3 pumps). Additionally, the WTP Clearwell contains 20,000 gallons of storage but it requires pumping for the water to be used by the Low pressure zone only. Therefore, the High zone tank and the WTP Clearwell are not considered gravity storage. This meant that the BMWD had 70,000 gallons of gravity storage which could be available during power outages, fires and tank cleaning and repair projects. All of BMWD storage tanks are buried. The two house fires that occurred in BMWD used approximately 40,000 - 50,000 gallons each. Typical daily water use in BMWD ranges from 16,000 to 22,000 gallons per day so emergency storage for power outages and tank work with 70,000 gallons of gravity storage would last about 3-4 days. This amount is likely enough for a power outage but not enough for a tank project which could take 5 – 10 days. Based on these factors and the estimated costs of constructing the storage tanks, it was decided that 100,000 gallons of additional storage would meet the requirements for BMWD. The next decision needed to be the location of the tank. After several locations were investigated (Westridge, PS#2, 50,000 gallon tank), the 50,000 gallon tank (middle zone) location was chosen based on being the lowest cost and the ease of integrating it into the system. The project was eligible for a low interest loan from the Colorado Water Resource and Power Authority. This entailed an extensive program of project design and BMWD financial reviews and approvals by numerous Local, County and State Agencies and included a Ballot issue within

BMWD. Once all of the approvals and permits and financing were obtained, the project was competitively bid and awarded to the lowest qualified bidder. The selected contractor did an excellent and professional job constructing the tank and appurtenances. The project spanned 3 years and the cost totaled \$1,084,900. A significant amount of cost was saved by the volunteer work of all Board members. The project included cleaning and inspecting the existing and adjacent 50,000 gallon tank. The project was a success and the additional gravity storage allowed other needed projects to be planned and completed.

Pumping Station #3 pump replacements – The original PS#3 pumps were constant speed, relatively high pressure (250 psi) pumps that pumped water from the Middle pressure zone to the High Zone Tank. The High Zone Tank is a 10,000 gallon steel pressure tank that is buried on the top of Westridge. The tank is pressurized by the PS#3 pumps and an air compressor located at the buried tank in the buried tank vault. The tank contains a 3000 gallon operating buffer to prevent the PS#3 pumps from turning off and on too frequently. This would burn out motors rapidly (the PS#3 pump motors are originals). The PS#3 pumps required replacement for two main reasons. The first reason was that they were over 40 years old like the other BMWD booster pumps (however they had less hours since they pumped less water); and the second reason, and perhaps the more important reason, was that the High Zone pressure tank needed to be connected to the pumps in order to maintain the correct pressure in the High Pressure Zone. If the High Zone Tank failed, the PS#3 pumps would need to either be manually operated or operated on a timer to maintain reasonably constant pressures without the tank. Operating in this way would only work temporarily and not work very well. The life of a buried steel tank is limited (some say 50 years maximum) but it depends on the conditions of the tanks original design, quality of manufacture, quality of the installation and the type of soil it is buried in. Fortunately, the BMWD High Zone Tank has lasted for 46 years without any known issues and we believe that its design, manufacture and installation are of high quality. The soil it is buried in was tested as non-corrosive and the tank has a thick coating and is protected cathodically, so BMWD believes it could last a very long time. However, a tank failure would require another 3 year tank project to replace it and operating the PS#3 pumps without the tank for that long would be difficult and expensive. The decision was made to replace the pumps with variable speed

pumps (VFD) that can be controlled to provide a constant pressure without being connected to the High Zone pressure tank, so if the tank were to fail, it would not interrupt service or operations. The VFD technology was not readily available nor cost effective when the original system was designed. The PS#3 pumps had to operate while the new pumps were installed so it took some ingenuity to install the new pumps while keeping one of the PS#3 pumps operating. The control panel for the new pumps required a small expansion of the PS#3 structure. The design, construction and installation of this project was done by BMWD contractors and volunteers. This project spanned two years and the cost was \$131,200.

Water Meter Replacements – The residential water meters in the BMWD are installed below ground in meter pits. The original meters had to be read manually by removing the two lids (one on the surface and another frost lid below) and reading the meter register and recording the water use. It was originally done on a quarterly basis by volunteer Board members and took 5-6 hours. Improvements were made to the meter reading process by adding remote readers to eliminate the need to open the meter pits. This only reduced the meter reading time to 4-5 hours and continued to be read voluntarily by Board members on a quarterly basis. The meters measured the water use by mechanical means called a nutating disc and its accuracy was the standard for the industry. Some meters failed and were replaced but generally the meters have lasted for the 40 years in service. However, as the water system got older, so did residential water lines which connected the meter to the houses. The number of leaks began to increase and water losses increased. With the increase of rates and use of an inverted rate structure (the more you use the higher the unit cost); some leaks resulted in very high water bills since the leaks were generally not discovered until the meters were read (which only occurred quarterly or sometimes longer). The BMWD purchased sophisticated leak detection equipment (cost of \$4000) which helped find system leaks once discovered but the long intervals between meter readings to find the leaks became the main issue. In addition to the 40 year old age of the meters, discrepancies between the WTP meter and the residential meters and the time and cost it took to read the meters frequently pointed toward a need to look at newer technologies. This resulted in the decision to replace all meters with the newer and technologically advanced ultrasonic water meters which could store

and transmit water use data and be read by either driving by or collecting the information remotely by computer. The time to read all the meters was reduced to a half hour or less and allows for monthly or more frequent readings, discovering leaks earlier and more accurately accounting for the water use. The meters also store 90 days of water use data which is extremely helpful in finding leaks, even very small ones. BMWWD's contract operator, ORC, installed the meters. This project spanned three years and the meters cost \$63,200.

Mission Control Operation enhancement – The original BMWWD design uses electro-mechanical automation with electrodes and buried control cables between facilities to operate well pumps, WTP equipment, booster pumps, and monitor water tank levels. Alarms that report malfunctions were done by a telephone dialer device over land lines. This had worked very well since BMWWD has reliable maintenance by WUS to proactively keep all the electro-mechanical devices working. However, the telephone dialer technology is outdated and does not provide meaningful information for our contract operators, ORC, to monitor and control the system efficiently. The mission control system allows for web-based information on the detailed status of the water system components that allows the operators to remotely “see” what is going on without being physically present. This saves time and money and increases the system reliability. This has been incrementally phased in over the last 8 years. The systems were installed by WUS and ORC and cost \$28,500.

Well 12 drilling and pump installation enhancement – The BMWWD was fortunate to have geologists that lived in the valley at the time of the District formation that volunteered to assist the initial Board with their expertise. The geologists theorized that the Dakota sandstone formation on the east slope of the BMWWD hogback would be highly fractured from the Rocky Mountain upthrust and faulting which resulted in the Dakota formation being overturned toward the east. They expected that these fracture zones would be filled with water from nearby Coal Creek to the north. BMWWD drilled two test holes in 1977 into the Dakota sandstone which were successful for obtaining a water supply for the District. The sustainable rate of these two wells were too low to serve the entire District, so several more wells were required. Approximately 12 potential well sites were mapped by the geologists and the District began adding wells as needed over the years. Since the wells were small volume, residential type well drilling methods

were used due to the significantly lower costs than using the more expensive commercial well drilling techniques. This approach was all that was needed at the time and all the BMWD could afford. This meant, however, that the wells were only able to reach the top of the aquifer which ranged from 400 – 600 feet deep. The BMWD always monitored the water levels in the aquifer and immediately recognized that the District was “mining” the water. The geologists calculated that only 30-40% of the water used was being recharged. Data showed that the recharge that was recorded only occurred weeks after major rain or snow events. Rather than being solely dependent upon the uncertain major rain and snow events that recharged the top of the aquifer, it was decided to investigate ways to recharge the aquifer artificially to increase water supply. After significant geological investigations and discussions with water engineers, it was decided that a deep well (which could be achieved using the commercial well drilling methods) was the best approach. This well would be drilled through the entire depth of the aquifer which was 300-400 feet deeper than the existing wells. It was believed that the deeper zones of the Dakota aquifer would yield significant amounts of stored water. The project was initiated in 2020 and the well was successfully drilled in 2023 to the target depth and did indeed discover another fracture zone with significant water as hoped. This was a major success for BMWD since it revealed much needed information about our aquifer’s size and extent and water storage volumes. The uncertainty of supply was reduced so that the constant question about developing alternative water supplies was answered as being unnecessary. The investigations into alternative water supplies revealed that the costs of an alternative supply would be easily in excess of 2-3 million dollars and would take a minimum of 10 years. While the cost of this project was higher than the other wells drilled, it was a bargain at \$573,500 compared to the “alternative water supply options”.

Well pump replacements – BMWD has 12 wells drilled in the Dakota Sandstone aquifer. The aquifer has proven to be fairly resilient with regard to water quantity (as described above) but has always had water quality issues and contains constituents which requires removal by treatment before it can be delivered to the residents. One of the main water quality issues is the presence of iron dissolved in the water. This iron is removed in the WTP prior to delivery to the residents but its presence in the wells creates issues for the submersible well

pumps by precipitating and coating the pump impellers. This buildup eventually reduces the pumping rate and volume of the wells resulting in the necessity of the pumps to be replaced. These replacements have been ongoing throughout the life of the BMWD, but over the last 8 years has cost \$57,400.

Water storage tank rehabilitations – BMWD recently inspected the water storage tanks at the WTP (Clearwell) and PS#2. Both inspections indicated that major rehabilitations were required after 45 years of service. Each rehabilitation project required sandblasting, patching, appurtenant repairs and recoating. With the completion of the new 100,000 gallon gravity storage tank, and since these projects required approximately 10 days to complete, BMWD was able to complete the rehabilitation of these structures without water interruption or the major expense of hauling water. ORC oversaw the projects which were completed by a specialty contractor. The WTP Clearwell rehabilitation cost was \$40,700 and PS#2 rehabilitation cost was \$61,500. These facilities can be considered fully rehabilitated and should provide another 20 years without major issues. Inspections of all BMWD buried concrete tanks take place every 5 years.

Major WTP maintenance projects – BMWD has always provided required normal maintenance of facilities and also preventative maintenance on an ongoing basis. Periodically, the maintenance tasks are large and more costly such as water treatment media replacement and disposal. The WTP has three ion exchange media filters which remove iron, radium and uranium from the well water before delivery to the residents. The major item for BMWD is iron removal since it is present in all the wells (at varying concentrations) and the raw water level of iron is higher than allowable drinking water standards. It is removed to levels below the allowable drinking water standards. The iron is not a health parameter but an aesthetic parameter since it will stain clothes and plumbing fixtures. The iron removal media has been replaced several times over the last 35 years of its operation and was most recently replaced in 2023 at a cost of \$20,000. Two of the wells have varying but small amounts of radium in concentrations above the allowable standards for drinking water. Since those wells are only used in rare circumstances, radium removal is not always required but due to an abundance of caution, the radium removal unit is used when those wells are used. The radium removal media was replaced in 2024 at a cost of \$15,000. Several of the wells have varying but small amounts of uranium in concentrations less than those

allowable in drinking water, but due to an abundance of caution, BMWD has been removing all uranium in any well used since the early 1990's. After 30 plus years of service, the uranium removal media required replacement. Since the District purchased the replacement media 30 years ago, this media was just installed by ORC in 2024 at minimal cost. However, since the spent uranium removal media had been accumulating small amounts of uranium for over 30 years, it contained levels too high for conventional disposal and had to be taken as a hazardous waste to a radiological waste disposal facility in Texas. The testing, removal, packaging, transport and disposal fees cost \$54,500 in 2024.

Facility Building Hardening – BMWD is currently embarking on a project to protect its above ground facilities from fire threats. Besides the ongoing brush and grass cutting measures, BMWD will provide “hardening” of the structures with fire resistive exterior coatings and other appropriate measures. These facilities include the WTP, PS#2 and PS#3. BMWD is pursuing grant monies that may be available for this and will likely accomplish this in the next year or two.

SUMMARY

The BMWD water system has been in operation for 45 years. The recent implementation of the Capital Improvement/Replacement/Rehabilitation Program (CIRRP) has restored the BMWD system to nearly the original system condition. The system will always require maintenance and periodic upgrades and may encounter forced regulatory mandates, but the goal of the CIRRP was to proactively make improvements in a planned way, as opposed to emergency situations, that will keep BMWD functioning well into the future. The total cost of the program to date has been \$2,244,800. The total original cost of the system that the CIRRP updated was slightly less than \$1,000,000 (in 1980 dollars). For the CIRRP implementation, BMWD was able to secure a low interest, 20 year loan for \$800,000 with the remaining amount that was spent coming from reserves that were built up over the years for this very purpose. With these major expenditures largely behind us, BMWD intends to rebuild its reserves for future needs.