

Capital Improvement Plan for the City of Manitou Springs' Potable Water System

In developing the Water Master Plan, and subsequently the Capital Improvement Plan (CIP), the water system was divided into seven sections: Manitou Reservoir, French Creek Diversion Structure, Water Treatment Plant, a new Potable Water Storage Tank, Mesa Tank, Crystal Hills Tank, and the Distribution System itself. The following holds a brief discussion of these seven sections along with cost estimates for improvements.

It must be noted that the costs provided in this CIP was developed predesign. In other words, designs were not performed for the items presented and, therefore, drawings and specifications are not available for detailed cost estimates. Rather, these costs were based on current market and local projects with similar scope. The costs do not account for changes in the construction market as well as variations in labor rates, material costs, gas prices, etc.

Manitou Reservoir

The Manitou Reservoir is the City's primary source of raw water storage. The main tributary feeding the reservoir is North French Creek. Two other, un-named creeks feed the reservoir as well. The City also receives water from the South French Creek, which merges with the North French Creek downstream of the Manitou Dam.

The improvement items listed in the Water Master Plan (WMP) provide a means to maintain the original volume of the reservoir, better understand the volume exchange within the reservoir, and improve or verify current conditions of the reservoir infrastructure.

The items for the reservoir improvements were not considered the highest priority of the whole water distribution system. Therefore, the first year, 2018, funds were not expended on the reservoir. Improvements will be performed from 2019 to 2023. One item, survey control points, was listed twice in this CIP, the purpose for this lies behind the State Dam Inspection recommendations. These recommendations call for regularly surveying the dam for movement.

Also, both alternatives for downstream sediment control were placed in the CIP. This will allow the City to implement both alternatives or choose one of the two. Both alternatives may be desired because, over the past few years, rainfall has caused significant sediment to flow from the South French Creek to the water treatment plant. Limited access causes issues with installing sediment control in this area. Hydroseeding will only be available with hikers or helicopters, since road construction is not allowed in this area. For the same reason, contours will have to be constructed by hand.

The following shows the items and cost estimates in the CIP for the Manitou Reservoir. Full sheets showing the details of the CIP are provided in Appendix A of this report.

Manitou Reservoir		
<i>Item</i>		<i>Cost</i>
Sediment Mitigation		\$ 1,500,000
New Flume - South French Creek		\$ 250,000
New Flume - Unnamed Tributary		\$ 150,000
Re-Establish Middle Flume		\$ 250,000
Staff Gage		\$ 100,000
Inlet Transmitter at dam outlet pipe		\$ 15,000
Extend butterfly valve operator		\$ 10,000
Dive Inspection		\$ 5,000
Control Wall Concrete Repair		\$ 30,000
Survey Control Points		\$ 2,500
Downstream sediment control - Hydroseeding (ALT 1)		\$ 30,000
Downstream sediment control - Contour Swales (ALT 2)		\$ 20,000
	Subtotal	\$ 2,362,500

French Creek Diversion Structure

The French Creek Diversion Structure diverts water from French Creek either into the raw water pipeline, which flows to Manitou Springs' Water Treatment Plant; or into French Creek for downstream users. The priority of this structure is the integrity of the existing concrete dam. Recent inspections revealed delamination and spalling of the concrete on this dam. The CIP repairs these damaged spots early in the ten-year period, allowing other repairs to be delayed to after higher priority WMP repairs. Other improvements, including the addition of level transmitters, increased capacity and flow meters will be installed in the year 2020.

French Creek Diversion Structure		
<i>Item</i>		<i>Cost</i>
Repair Concrete Reservoir Dam		\$ 10,500
Level Transmitter		\$ 10,000
Increase Capacity and Improve Sediment Removal		\$ 1,500,000
Silt Filter on French Creek - Just Upstream of Diversion Structure		\$ 500,000
Install turbidimeter		\$ 50,000
Install Flow Meter		\$ 100,000
Survey		\$ 10,000
Increase Security of Site		\$ 200,000
	Subtotal	\$ 2,380,500

Another improvement include the addition of a silt filter just upstream of the diversion structure. This silt filter will be after the confluence of South French Creek and North French Creek and after the steep drop off.

Access to the silt filter is easiest at the diversion structure and can be installed within Manitou Springs' property lines, minimizing permitting issues and increasing maintenance access.

Priority for the diversion structure is higher than that of Manitou Reservoir because of the concern of high turbidity and the need to reduce that turbidity to maintain the water treatment plant. This CIP recommends improvements made by 2020.

Water Treatment Plant

The water treatment plant is a vital aspect to any water distribution system. During the development of the WMP, several improvements were made to the plant to provide an improved and more reliable process. Such improvements include valve actuator replacement, new flow meters, back-up computers and power surge protection.

Water Treatment Plant	
Item	Cost
Valve Actuators and Mag meters on the influent of filters	\$ 24,000
Water Sampling Station at Cliff Dwelling	\$ 15,000
Backup Computer for Water Treatment Plant	\$ 10,000
Power surge protection	\$ 25,000
New roof for generator shed	\$ 150,000
Replace the Air Scour Pipe/filter	\$ 250,000
Install a Filter-to-Waste Pipe	\$ 50,000
Replace Valves	\$ 25,000
Install Ultrasonic Level Sensors	\$ 200,000
New Jar Testing Unit (4 jars)	\$ 25,000
Spare PLC	\$ 50,000
Add Baffles in the Clearwell	\$ 500,000
Actuator on Clearwell Line Leaving the Plant	\$ 50,000
Rebuild Filters	\$ 1,500,000
Clearwell Improvements	\$ 64,000
Subtotal	\$ 2,938,000

Other improvements to the plant were considered third priority, with adding a new potable water tank/rehabilitate Mesa Tank as the highest priority and French Creek Diversion as the secondary priority. French Creek Diversion was considered a higher priority than the water treatment plant because of the potential of increased sediment

with every rainfall event. If French Creek Diversion is mitigated to contain the sediment, the impact to the water treatment plant is significant.

While these are to be performed between 2021 and 2023, one item could be advanced to an earlier year – that being “Replace Air Scour/Filter.” This item should be replaced soon; however, due to the other higher priority items, this is scheduled to be performed in 2021.

New Tank

This is the highest priority of the CIP. The installation of this tank will enable the Mesa Tank to be taken off line for much needed repairs. This tank is preferred to be buried or partially buried to minimize aesthetic obstructions and will be connected to the system through Mesa Avenue, just downstream of the water treatment plant. The CIP includes costs for engineering and geotechnical reviews. It also includes costs to connect to the system. This tank will not be connected in series to the Mesa Tank to help improve water distribution and minimize water age.

Another aspect of this project – although listed as part of the distribution section of this CIP – is the increase of capacity for

New Tank	
New Water Tank	\$ 3,000,000
Bury the Tank	\$ 1,162,500
Pipeline to connect Tank to Distribution System	\$ 362,700
Engineering, Geotechnical review, piping	\$ 500,000
Subtotal	\$ 5,025,200

WM1289. This is the pipe from the water treatment plant to Walton Vault. This pipe needs to be increased from a 6-inch pipe to a 14-inch pipe to contain the capacity and demand of the system during maintenance shutdown of the Mesa Tank.

Mesa Tank

Since the Mesa Tank has never been taken offline for a full inspection and structural repairs, this shares the highest priority with the installation of a New Tank. However, since the New Tank must be on line to successfully take the Mesa Tank off line without shutting off the entire City water system, the installation of the New Tank is a requirement prior to maintenance of the Mesa Tank. Since the proposed 2018 budget (including French Creek Dam rehabilitation, construction of a new water tank and distribution pipe repairs) exceeds \$5 million, the shutdown and maintenance of the Mesa Tank is proposed to be the following year, 2019.

Mesa Tank		
<i>Item</i>		<i>Cost</i>
Coating Tank Interior		\$ 877,200
Structural Repair		\$ 1,000,000
cathodic protection		\$ 20,000
Survey bottom of tank		\$ 2,500
Repaint Tank Exterior		\$ 250,000
Replace hatch seal		\$ 10,000
Valve Replacement in Radio Room		\$ 250,000
Pave Access Road		\$ 65,000
Walton Vault Rehab		\$ 25,000
	Subtotal	\$ 2,499,700

This shut down will encompass coating the interior of the tank, structural repairs, adding cathodic protection, surveying the bottom of the tank (to determine future movement of the tank base), repaint the exterior of the tank,

replace the hatch seal, replacing the valves in the radio room, pave the access road and rehabilitate the Walton Vault. Specifically, since the valves in the radio room and the Walton Vault cannot be rehabilitated without the installation of the New Tank, these items will be included in the scope of work for the Mesa Tank Rehab.

Crystal Hills Tank

Crystal Hills Tank is also a priority; however, since this tank can be taken offline using current operational protocol, it is less of a priority than that of the construction of the New Tank and the maintenance of the Mesa Tank. Still, due to the issues of high water age and the resulting water quality, this should be performed in the first two years. Water age causes water quality degradation. Therefore, it should be addressed as soon as possible.

The portion of the repairs that must be performed to remediate the water age issue include the interior tank water age improvements, adding the pipe loop to improve water age and installing the chlorine sensor. Since the tank will be offline for these repairs and to minimize

Crystal Hills Tank		
<i>Item</i>		<i>Cost</i>
Improved Security		\$ 50,000
Retaining Wall		\$ 250,000
Scour Protection on Sutherland Creek		\$ 150,000
Replace hatch seal		\$ 10,000
Paint interior and access ladder		\$ 459,600
Add electrical to Crystal Hills Tank		\$ 20,000
cathodic protection		\$ 15,000
Cl2 Sensor and Possibly a Cl2 Booster		\$ 750,000
Interior Tank Water Age Improvements		\$ 100,000
Add Pipe Loop to Improve Water Age		\$ 50,000
Gabion Wall Replacement		\$ 100,000
Pave Access Road		\$ 50,000
	Subtotal	\$ 2,004,600

future shut-down requirements, we also propose to replace the hatch seal and paint the interior. The other repairs do not require accessing the interior of the tank or causing additional tank shut-downs; therefore, they are proposed for the following year, 2020.

Distribution System Piping

One aspect of the Manitou Springs Water Distribution System that requires significant attention is the piping. Many of the pipes are either undersized, designated as “old,” or a combination of the two. This combination of issues requires the replacement of a vast majority of the distribution pipes. Due to the significant cost of the higher priority items of this CIP, most of the distribution pipe replacement should not be performed within the first few years. Instead, these items should be spread as evenly after the higher cost items are performed.

With this said, some of the pipes have been scheduled early, prior to and including 2020 to coincide with the repaving efforts and to minimize damage to newly paved roads. Since the Repaving CIP does not extend past 2020, a separate priority was developed for the remaining pipes. This priority is placed on a Zone-by Zone replacement effort.

The water distribution system is divided into 10 zones, labelled A through J. All zones, with exception to Zone J, require significant replacement. Therefore, to minimize impacts on the residents and to eliminate multi-year road construction, the replacement priority was zone to zone. We started on the west side of the City and proposed to replace all of Zone A piping first. Zone B is scheduled the second year and so forth. We followed this with the remaining pipes with one exception: Manitou Avenue. We wanted to replace pipes on Manitou Avenue all at once to minimize multi-year shut-downs.

The distribution portion shown in the CIP is significant and shows the Pipe ID (assigned by an engineering firm prior to this contract), the street location of the pipe, and the intersections marking the approximate limits of each pipe. This CIP is presented in Appendix A of this report.