City of Carroll

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MEMO TO: Mike Pogge-Weaver, City Manager MSP-W

FROM: Randall M. Krauel, Director of Public Works RMK

DATE: May 23, 2018

SUBJECT: Water Distribution Modeling and Evaluation Report

An Iowa Department of Natural Resources Water Supply Sanitary Survey noted two items in the water distribution system for which they are requiring a plan of action to address. The two items noted include an area of lower water pressure and areas of lower chlorine residuals.

The City contracted with JEO Consulting Group, Inc. (JEO) to perform water distribution system modeling and evaluation. JEO has completed a Water Distribution Modeling and Evaluation Report and Technical Memorandum. The Report and Memorandum are fairly technical. Complete copies can be provided for review on request. The Report and Memorandum are summarized as follows:

A. Objectives

1. Develop a water system model for use in evaluation of existing hydraulic conditions and planning for future conditions.

2. Explore alternative solutions to low pressure areas and water age correlated to chlorine residuals.

B. Conclusions and Recommendations.

1. System Pressure Conclusions

"The City system is well-looped and has generally good water pressure throughout during normal operating conditions. During normal operating conditions, modeled pressures in the system ranged from 38 psi to over 100 psi. It is noted that the northwest area contains the lowest pressures in the system due to the elevation of this area."

"During an extreme occurrence, where peak hour demands coincide with both pumps turned off, the pressure in the northwest area drops significantly. The modeled pressures in the northwest area drop as low as 22 psi. The drop in pressure during this extreme event is caused by higher demands in the system and by the friction losses in the 8" water tower pipe."

2. Pressure Improvements

"It is recommended to take an incremental approach to improving the pressures in the system. The first step is to replace the 8-inch main that leads into the water tower. This will decrease pressure loss in the system during high demand, pump off conditions. The second step, if needed, is to isolate the northwest area and create a separate pressure zone."

"It is recommended to replace the 8-inch watermain that feeds the water tower with a new 16-inch DIP watermain in the near future. The total length of main is approximately 250 feet, making this a relatively low-cost alternative to increase pressures. The increased main sizes improve the capacity of these mains, reducing pressure losses during high demand periods. The modeled pressure improvement during an extreme event will be approximately 5 psi."

The estimated construction cost of this recommendation is $160,600.

"The second alternative, if pressures in the northwest area do not meet minimum pressures, is to construct a new pressure zone, including isolation of the area, constructing new mains to loop the system, and construct a booster pump station. The booster pump station will be sized to meet domestic demands. A Pressure Reducing Valve (PRV) and bypass line will be included to provide higher flows, if needed (i.e., fire flow event). A later phase for the pressure zone would include the construction of a water tower or ground level storage tank."

The estimated construction of this recommendation ranges from $909,800 to $1,841,100.

3. Water Age Conclusions

"The water age within the City System does not appear to have many dead-end areas, or areas where water usage does not create proper turnover in the system. There are only a few locations where closed valves or dead-end lines cause the oldest water ages. Additionally, the northeast residential area does show some of the longer water ages, due to multiple mains and lower water usage. This area also experiences older water drawn through the distribution system loop south of the school during a high demand period, increasing the peak water age."

"It does not appear that water age is a major contributing factor to the low chlorine residuals outlined in the sanitary survey. Chlorine & Chloramine decay rates, water chemistry, and pipe biofilm may all contribute to the low chlorine residuals found in the system."

4. Water Quality Recommendations

"The first recommendation is to open the valves north of the high service pump station. This allows water to flow through the center of the system, in a more direct route to the water tower. While modeling does not show a measurable impact at the tower, improved looping through the system will impact the water quality immediately to the north of the booster pump

station. At the same time as this alternative, chlorine residuals at three locations in the system should be measured to evaluate the impact opening the valves has on the system."

"A hydrodynamic mixing system is recommended next to keep a consistent water age and chlorine residual in the tower. The mixing system will promote a consistent quality in the tank, so that during periods of high demand, when the tank level draws down, the water supplied by the tower is of consistent quality."

The estimated construction cost of this recommendation ranges from $50,000 to $75,000.

"If desired, further analysis of the chemical composition and chlorine decay rate in the finished water can be performed to provide additional data on the water quality in the system. Using this data, combined with the water age maps, can help to provide further insight into the water quality of the system. Additional monitoring of chlorine residuals, both in the system and storage tanks, as well as measurement of tank levels can help provide more data from which to determine possible causes and solutions."

RECOMMENDATION: Mayor and City Council consideration and acceptance of the Water Distribution Modeling and Evaluation Report and Technical Memorandum.

The Report recommendations will be proposed for programming into capital budgeting.

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