Internal Monitoring Report

Policy #: O-2C Reliability **Date**: November 28, 2017

Policy Language:

The Water Utility General Manager shall not cause or allow conditions, procedures, or decisions that prevent Madison Water Utility from meeting its obligation to provide current and future generations of customers within City of Madison and its authorized service areas with reliable water service that is consistent in its availability and quality.

Accordingly, the General Manager shall not cause or allow conditions, procedures, or decisions that:

1. Assure that residents experience only minimal unplanned service interruptions.
2. Provide residents with adequate notice of planned service interruptions.
3. Provide residents with adequate notice in the case of planned maintenance work that would significantly reduce water flow or pressure, and/or cause water discoloration.

General Manager's interpretation and its justification:

Madison Water Utility shall budget for, fund, prioritize, plan for, and construct the necessary system improvements to replace and sustain the Utility's infrastructure both now and into the future. The Utility shall build in the necessary system redundancy, shall maintain all components of the system, and shall develop operational procedures to ensure reliable water service to all points in the system. To achieve this objective, the Utility will develop, routinely update, and implement long term facility and system comprehensive and master plans to identify system needs and funding opportunities. The Utility's maintenance program will be proactive and preventative to maximize component reliability, efficiency, and life cycle costs within the system. The Utility shall also establish work scheduling protocols and notification procedures that will minimize the impact to consumers during maintenance and repair work.

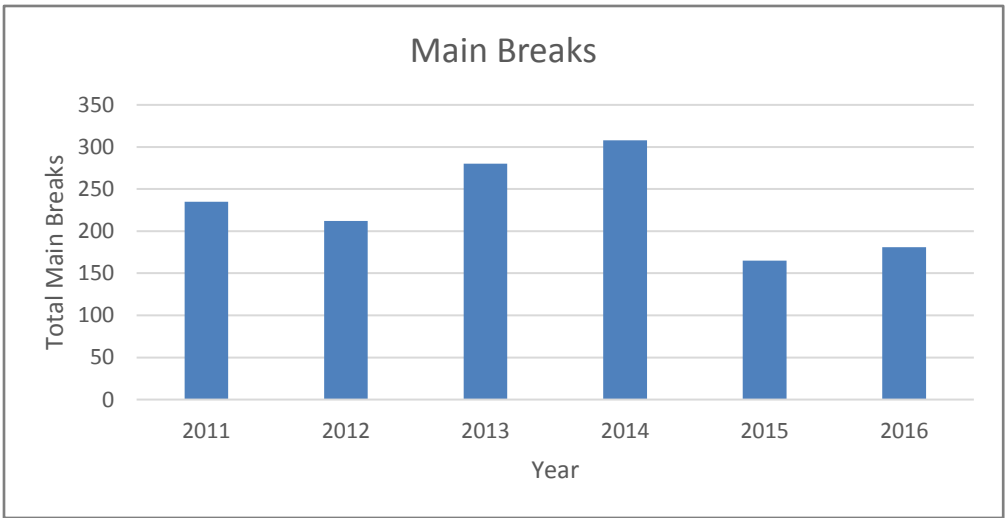
Data directly addressing the General Manager's interpretation:

1. *Assure that residents experience only minimal unplanned service interruptions.*

Planned Infrastructure Renewal: To reduce the risk of unplanned service interruptions, the Utility shall budget for, fund, prioritize, and construct the necessary system improvements to replace and sustain the Utility's infrastructure.

For the period from 2011 to 2016 Madison Water Utility (MWU) experienced an average of 230 water main breaks per year. This average break rate is approximately 26.5 breaks per 100 miles of water main per year. There is no published universally accepted standard for annual main breaks due to variance in construction and climatic conditions. However, a commonly used goal for a well maintained system is no more than 20 breaks per 100 miles per year. This would result in a goal of no more than 178 main breaks in the Madison system per year for the Utility's 890 miles of pipeline. To reach this goal the Utility embarked on a program to replace or rehabilitate a majority of its aging water main system. In 2006, MWU identified over 400 miles of pipe that was in need of replacement. MWU set a goal of replacing 10 miles of pipe per year for 40 years to update the system. In October of this year, the Utility celebrated the 100th mile of main replacement since 2006 so we are well on our way to reaching our goal.

During the last 12 months since 11-1-2016, MWU experienced 191 main breaks. This is 21.5 main breaks per 100 miles for the 12-month period. The number of main breaks is dependent upon freezing weather. The 2016/2017 winter was mild and helped to keep the number of main breaks low. Main breaks by year since 2011 is presented in the following chart.



In 2005 Madison Water Utility completed its first Infrastructure Management Plan. That Plan evaluated the condition of all facilities both buried and above ground

and laid out a plan to systematically work through renewal of the system over the next 40 years. To continue to build on this and to maximize the value of all assets, the Utility is developing an Asset Management Program. The Asset Management Strategic Plan was completed in 2017 and an Asset Management Pilot study is currently being prepared.

The 2005 Infrastructure Management Plan recommended that the Utility invest a minimum of $9 million per year (2005 dollars) for pipe replacement and $2.5 million per year (2005 Dollars) for facility upgrade and renewal. In 2007 the Capital Improvement Program was significantly increased for water main replacement to start working toward this goal. To lessen the impact on water rates, the Utility elected to ramp up the infrastructure replacement funding over the course of 13 years to the year 2020. This goal would result in a funding goal of $14 million for pipe rehabilitation and replacement and $3.9 million for facility rehabilitation in the year 2020. For 2017, the Utility budgeted $9.5 million for pipeline replacement and relining. This is down approximately 20% from the $11.7 million budgeted in 2016 due to a concern about the total rising bond debt. For the year 2017, the Utility budgeted approximately $1.05 million for facility renewal and upgrades. The focus of the infrastructure renewal program over the past 10 years has been on pipeline renewal.

MWU engineering staff develop and implement the Capital Improvement Program based on the approved annual Capital Budget. Pipe replacement projects are identified and developed in conjunction with City Engineering based on operational criteria, maintenance history, and staff recommendations.

Utility engineers work closely with City Engineering to coordinate water main replacement projects with proposed street projects. Coordinating water projects with street work saves the Utility pavement restoration costs and minimizes disruption to neighborhoods. Pipe segments are selected for replacement based on their break history, hydraulic capacity, age, and material. The Utility is currently replacing approximately 7 to 8 miles of pipe per year. $8.6 million has been budgeted for pipe replacement in 2018.

In an effort to repair system pipelines at lower cost and thus increase the impact of the total annual capital budget, a pipe lining program was started by MWU engineering staff in 2011. Working closely with Wisconsin DNR engineers, MWU successfully piloted and constructed the first water main lining project in the State of Wisconsin in the fall of 2011. Each year the program continues to grow as the Utility learns how to manage and process water main lining work. The cost of this operation, which rehabilitates the main to full pressure and structural capacity, is approximately 2/3 the cost of full replacement. It is expected that as competition for water main lining work increases in Wisconsin, the cost of lining will go down. MWU is just completing the lining of over 14,000 feet of water main in west side

neighborhoods. The pipe lining budget for 2018 has been established at $1.0 million.

Copies of the 2017 and 2018 Executive Capital budget are attached for information and use.

Redundancy and Reliability: The Utility shall build in the necessary system redundancy, shall maintain all components of the system, and shall develop operational procedures to ensure reliable water service to all points in the system.

Using master planning, utility engineering standard practices, and regulatory requirements through the decades, a system of redundant pumping stations, standby power generators, and gravity storage reservoirs has been developed and constructed throughout the Madison Water Utility system. The 890 miles of pipe link the twenty-two operating wells to feed the nine pressure zones. Pressure zones are established and defined using topographic conditions and isolation valves in the system piping. In the event of an emergency, these zone isolation valves could be opened to move water from a higher zone to lower zone and maintain service. Pumping redundancy is designed and constructed into the system. If a pump in the system has a mechanical failure and is removed from service, pumping systems still have the capacity to meet anticipated system demands. With the exception of Pressure Zone 11, all pressure zones have a minimum of one gravity fed reservoir that provides emergency water supply. With the completion of the Blackhawk Reservoir in 2018, an elevated 1.0 million gallon tank, Pressure Zone 11 will be eliminated when it is assimilated into Pressure Zone 10. All system storage reservoirs are designed and sized to provide up to 12 hours of emergency supply based on the annual average demand. Reservoirs are also sized to provide firefighting capacity and peak demand supply.

The Utility currently has access to 15 standby power generators, 9 owned by MGE and 6 owned by the Utility. A seventh Utility owned generator will be installed at new Well 31 in 2018. The 9 generators owned and maintained by MGE would each power a well facility providing reliable water supply to the system. For new facilities not equipped with a generator, electric transfer switches have been installed that will allow the connection of a portable generator. The Utility does not currently own a portable standby generator and intends to rent or lease a generator if needed.

Comprehensive Planning: The Utility will develop, routinely update, and implement long term facility and system comprehensive and master plans to identify system needs and funding opportunities.

In 1964 MWU developed its first Water Master Plan to evaluate system needs, plan for the future, and establish projects needed to provide a reliable and robust water system, to expand the system to growing areas and to budget for those improvements. The most recent planning efforts by the Utility are 1) the 2006 update to the Water Master Plan and 2) the 2012 East Side Water Supply Project. These documents identify capital project needs based on system wide hydraulic analysis, water quality issues, identified deficiencies, and projected growth patterns.

The Water Master Plan establishes a list of capital projects necessary to meet the MWU established level of service. Level of service and key performance indicators are being further developed as a part of the Asset Management Program to optimize existing facilities and to work toward a fully redundant and reliable water supply and distribution system. A copy of the current level of service criteria is attached for information and use.

Utility engineering staff are working with SEH Inc. to update the MWU Water Master Plan. This work will utilize data from the AMI system to update and recalibrate the distribution system hydraulic computer model. Current and future water demand scenarios are being developed to evaluate the system using the distribution system computer model. Using the model with projected water demands will identify any deficiencies in the system. Projects will be developed to effectively mitigate identified deficiencies. Business case analysis will be used to prioritize and rank projects for the MWU Capital Improvement Program. The prioritized projects will be listed in the annual capital budget. It is anticipated that the update of the Water Master Plan will be completed by the spring of 2018.

MWU staff is working with GHD to develop the MWU asset management program. A system of asset condition assessment and rehabilitation or replacement planning will be developed to track utility assets and plan for restoration. This deliberate system of data collection and analysis will result in data driven decision making based on business case analysis and reduction in risk. The asset management program will be developed and refined over the next 3 to 5 years.

c) *Maintenance and Repair Programs: The Utility's maintenance program will be proactive and preventative to maximize component reliability, efficiency, and life cycle costs within the system.*

Wells, booster pumping stations, and reservoirs are routinely inspected, serviced, and maintained. System operation is monitored and recorded by the Utility SCADA system and by routine daily inspections by Utility Rounders. Well pumps are scheduled for removal, inspection, and rebuilding or replacing every 10 years. System reservoirs are inspected and cleaned every 5 to 10 years. MWU budgeted

$1.05 million in 2017 for existing facility maintenance projects, and upgrades/additions.

The MWU Asset Management Program will use a system of inspection, evaluation, and preventative maintenance procedures to maximize return on investment of all assets. To track investment in operating and maintaining MWU assets, a Computerized Maintenance Management System (CMMS) is being developed and implemented. This system will record all repair work and track maintenance operations providing operational data on the system.

Minimizing unplanned Service Interruptions: Notification and management

Unplanned service outages are typically due to water main breaks or mechanical breakdowns. When an outage occurs, MWU repair crews respond to the area and contact impacted customers in person and inform them of the situation and the expected length of the outage. When a water main break is identified, valves will be closed to minimize the impact of the break to the smallest area possible. Crews work with impacted customers to the greatest extent possible to minimize the service disruption and will modify the repair work as needed. When water service is restored, utility crews check with area residents to make sure that there are no further complications resulting from the water outage.

For the year 2017 up to November 1st there have been 141 main breaks. During this time, an average of 12 customers are out of water for approximately 3.5 hours during each break. Of course each break is unique and may require more time to complete repairs.

I report compliance.

2. *Provide residents with adequate notice of planned service interruptions.*

Planned service interruptions are necessary in the vicinity of pipe line replacement projects, valve and hydrants repairs, and many other maintenance and construction operations. Procedures established in construction contracts set the requirements for working with customers to minimize the disruption of their water service. Similar procedures are utilized by MWU crews during the various maintenance procedures that they perform throughout the year.

Prior to starting any planned work that will require an interruption of service; customers are individually notified. Either the contractor or a Water Utility employee contacts all impacted residents and explains the need for the work and the expected duration of the water outage. Contractors provide residents a minimum of 2 working days' notice of any planned service interruptions during their work. Planned service interruptions are typically 4 to 6 hours in length. If

the resident is unnecessarily inconvenienced by the planned outage, the work crew will modify the work plan to accommodate the customer to the greatest extent possible. When the work is completed and water service has been restored, customers are notified and asked to flush their services to minimize the risk of problems.

Due to the interconnected nature of the system, service interruptions due to maintenance of wells, pump stations, and reservoirs are rare and localized in nature. If an interruption of service due to work on a well, pumping station or reservoir is unavoidable, those impacted customers are notified by post card or door hanger a minimum of 7 to 10 days in advance of the planned interruption. The Utility's electronic listserv is also used to notify area residents. Planned service interruptions are kept to no more than 4 to 8 hours. During the past year there were no planned service interruptions due to work at a well, pump station or reservoir.

Consumers generally accept the inconvenience of water service interruption when proper notification is provided. Complaints resulting from planned service interruptions are generally caused by delays in re-establishing water service. Utility field personnel are diligent in minimizing the impacts of such delays. If a re-establishment of service is delayed, impacted customers will be notified of the additional delay as soon as possible.

I report compliance.

3. *Provide residents with adequate notice in the case of planned maintenance work that would significantly reduce water flow or pressure, and/or cause water discoloration.*

When a facility is taken out of service for planned maintenance work, the operation of other Water Utility facilities is modified to ensure that water service is not interrupted and pressures are stable. The water distribution system is interconnected and allows operating wells to provide service to all parts of a pressure zone.

In the event that the removal of a facility from service has the potential of reducing water capacity and/or pressure and poses the risk of water discoloration, those impacted customers are notified by post card a minimum of 7 to 10 days in advance of the planned interruption. The Utility may also use other electronic means such as social media and email listserv to notify area residents of an anticipated reduction in service.

Starting in the fall of 2016, three large east side reservoirs, High Crossing, Bunker Hill, and Spaanem Avenue, were taken out of service one by one for painting.

Madison Fire Department was notified of these outages and pump operations were modified to accommodate the reservoir work. There were no interruptions of service during this work.

Since 2006, MWU has conducted annual unidirectional flushing of the system to maintain water quality and reduce the risk of colored water events. The annual unidirectional flushing program has a goal of flushing up to 500 miles of the system from April to November. Routine unidirectional flushing and cleaning of the distribution system does cause a temporary reduction in water pressure and flow. Flushing operations also include the risk of causing water discoloration. Residents are notified of routine flushing operations in their neighborhood by yard signs, phone calls and an electronic listserv. Annual flushing schedules are published and posted on the Utility web page in the spring and a detailed schedule is maintained throughout the flushing work. Complaints received during the flushing operation are minimal.

I report compliance.

Attachments

1. 2017 Approved Water Utility Capital Budget
2. 2018 Water Utility Capital Budget
3. 2011 Level of Service Memo