

Internal Monitoring Report

Policy # O-2E Sustainability
Frequency: Twice a year

Date: January 28, 2020

Policy Language:

Madison residents will benefit from a sustainably managed ground water supply to ensure that water is available to protect public health, and to maintain and improve the economy and environment in Madison, now and in the future. Sustainability encompasses many aspects of Utility operations, including the environmental benefits of reducing energy use, preserving groundwater levels, and sustaining flows in lakes, streams, and springs. The financial sustainability of the Water Utility is also a significant consideration: future generations of Utility customers, while benefitting from infrastructure renewal, will bear the cost of incurring long-term debt.

Accordingly,

1. Aquifers and wells will be monitored and the data evaluated to identify trends in water levels and potential contaminants.
2. Appropriate city, county, state and federal agencies will be called upon to enforce all pollution control and prevention measures within their authority, in order to protect water quality in the well head protection area of each unit well.
3. The adopted Conservation Plan shall be monitored and evaluated regarding progress to fulfill its goals. Plan goals should include reductions in energy use, avoiding the cost of additional wells, and minimizing complications related to over-pumping the groundwater system.
4. To prevent over pumping and improve redundancy, the Utility's service level for capacity planning shall be 50% utilization for each unit well. Therefore, the Utility shall strive to limit the average pumpage to 50% of the annual rated capacity of each well. This can be achieved through water conservation, water supply system expansion, and operating procedures.
5. The Utility shall track the carbon footprint of Utility operations using quantitative tools (for example, energy intensity analysis) so that sustainability may be considered in planning for water treatment facilities, distribution system improvements, and other infrastructure projects.

General Manager's interpretation and its justification:

This policy prescribes certain activities intended to ensure the long term environmental, public health, and economic sustainability of Madison's water supply. Our actions relating to these objectives are detailed below.

Data directly addressing the General Manager's interpretation:

1. Aquifers and wells will be monitored and the data evaluated to identify trends in water levels and potential contaminants.

Aquifer Levels

The water levels in the aquifers beneath Madison continue to be monitored on a routine basis. A deep groundwater monitoring well located in the basement of the State Capitol has provided water levels since 1946. A review of the monthly data indicates levels continue to vary on a seasonal basis, a direct result of demand (COM pumping) and recharge (precipitation.)

As in past years, summer water levels were lower than those experienced during the winter. Levels in 2019 were an average of 7 feet lower during the summer months. Overall, aquifer levels appear to be increasing or rebounding with an increase of approximately 20 feet since 2005. This is a good indication that the local aquifers are in the process of rebounding/recovering to pre-pumping levels. Recent data suggest that this rebound might be slowing or leveling off. However, levels recorded in late 2018 and throughout 2019 were significantly higher than in past years. It will be interesting to see if these levels continue to rise in the near future. The water levels beneath the central part of our city during the last 30 years are displayed in Figure 1.

Water Levels - Water Utility Wells

As expected, static and pumping water levels in many of the Utility's supply wells varied throughout the year. Variations, however, were significantly less than those experienced during past years (i.e., 2012) when we were subject to extremely hot and dry summer conditions. Water levels in the Utility's wells continue to fluctuate seasonally and are greatly influenced by both pumping and precipitation events. A review of the recent water level data indicates that, with the exception of several wells, many of the water levels (static and pumping) are increasing as winter demands decrease. The increase in water levels is minor and similar to those experienced last year. Sufficient water levels in all of the wells appear to be sustainable for the near future.

Total precipitation during 2019 was well above average. Madison received 46.4 inches of precipitation from January through December, 2019 which is about 12.0 inches more (34.9% more) than the annual average of 34.4 inches. It is anticipated that precipitation amounts in the Madison area will continue to be above average into the near future. This is important to note as the aquifers are recharged to a great extent by precipitation events.

Madison Kipp Corporation/UW #8 Sentinel Well

The Madison Kipp Corporation (MKC) continues to operate its groundwater extraction and treatment system at its Waubesa Street site. The remedial system is being utilized to remove volatile organic compound (VOC) mass and hydraulically contain VOC contaminated groundwater present in the upper bedrock aquifer beneath the site.

The Utility continues to work with MKC, their consultant, the WDNR, and the WGNHS on the area's groundwater contamination issues. Groundwater at and adjacent to the facility continues to be monitored routinely for VOCs. The most recent groundwater results from the April and October 2019 samplings indicate that PCE levels in the groundwater between the site source and UW 8 remain relatively constant. The southeastern extent of the plume appears stable with the edge approximately 600 horizontal feet from UW 8. Levels within the extraction well's zone of contribution are stable or continue to decrease (improve).

The sentinel well planned for the UW 8 area has been postponed because of budgetary constraints. This deep monitoring well was to be installed at a location between the Madison Kipp Corporation groundwater contaminant plume and UW 8. Initial sampling would have

provided MWU with deep groundwater quality information immediately north of the unit well. Subsequent routine sampling would have provided an early warning for any migrating contaminants. It is hopeful that this well can be installed in the near future.

UW 29 Sentinel Well

Water from the sentinel well located between UW 29 and the Sycamore Landfill continues to be monitored for both inorganic and volatile organic compounds on a semi-annual basis. Sampling is typically conducted in April and October of each year with 21 samplings conducted to date.

The October 2019 sampling indicates that the migration of contaminants from the Sycamore Landfill is not a significant threat to water quality at Unit Well 29 at this time. Unit Well 29 continues to pump at half capacity on a 24/7 basis, supplying approximately a half billion gallons of water to Madison in 2019.

UW 14 - Chloride Study

The investigation into the elevated chloride levels at Well 14 continues. The monitoring activities of the two water table monitoring wells located in Spring Harbor Park were concluded in 2019. The data collected to date, which includes chloride and sodium concentrations, was compiled and potential sources determined.

The Utility is planning to conduct some bore hole sampling at the well site later this year. Water from the bore hole will be sampled and analyzed at various intervals or depths utilizing a packer and pump sampling system. If the chloride entry points can be determined, a remedial option might be devised to restrict these areas within the well. A project page and email distribution list have been developed to keep neighbors and customers up to date on any future progress.

UW 15 - PFAS Removal

UW 15 has been out of service since March of 2019 because of PFAS concerns. The Utility is reviewing possible remedial options that might be applicable at this site. This well is a very important component in our system as it supplied approximately 1 million gallons per day to Zone 6E.

UW 19 - Radium Removal Study

A pilot scale test to remove iron, manganese and radium was recently completed at UW 19. The conclusions and results of this study will be utilized in designing the appropriate filter system for this site. The construction of the filter system has been postponed until the year 2025.

UW 27 - Radium Study

This study, including the groundwater monitoring well, has been put on hold until the

appropriate funds become available

UW 31 – GE Health care site

The WDNR continues to monitor the groundwater monitoring and remedial activities associated with the GE Health care site, a contaminated site located to the northeast of UW 31. There are no new updates to report for this site, which has elevated levels of PCE in its groundwater. To date, no TCE or any other volatile organic compounds have been detected at UW 31, which is located over 6000 feet from the source of the TCE contamination.

2. Appropriate city, county, state and federal agencies will be called upon to enforce all pollution control and prevention measures within their authority...

As previously mentioned, the Utility continues to work with the Mayor's office and the WDNR in monitoring the remediation of the PCE contaminated groundwater at the Madison Kipp site. At the request of the WDNR, the Madison Water Utility, City Engineering, and Public Health continue to review the remedial strategies and plans proposed by MKC and their consultants. The Utility continues to remind the WDNR of the City's plans to upgrade UW 8 with an iron and manganese filter.

MWU is also working with the appropriate agencies regarding the PFAS contamination identified in the soil and groundwater at the TRUAX National Guard facility, located to the northwest of UW 15.

3. The adopted Conservation Plan shall be monitored and evaluated regarding progress to fulfill the goal of a 20% reduction per capita residential use of water by 2020...

MWU pumped a total of **8,973,120,000 gallons** of water to the distribution system during 2019. This is approximately 2.7% less than the 9,222,670,000 gallons pumped last year - 2018.

	2019	2018
<u>Average Day:</u>	24,584,000 gpd	25,268,000 gpd
<u>Max Day:</u>	31,900,000 gpd on July 16	34,750,000 gpd on May 30
<u>Min Day:</u>	15,910,000 gpd on December 25	17,600,000 gpd on November 23

As mentioned earlier in this report, precipitation for the year was well above average. In addition, rainfall events occurred on a regular basis limiting the number of heavy pumpage days.

Residential consumption in gallons per capita by year:

1980–2000 81.5 *

2002–2007	71.8 *		
2008	69.8 *		
2009	67.8 *		
2010	65.0 *		
2011	65.2 *		
2012	70.3 *		
2013	61.0 *		
2014	62.2 *		
2015	60.9 *	55.0 **	
2016	55.4 *	46.7 **	51.4 ***
2017	55.4 *	46.0 **	51.1 ***
2018	53.0 *	44.3 **	48.9 ***
2019	50.8 *	43.1 **	47.1 ***

Goal: 2020 58.0 *

* Average per-person daily consumption for Single family only (includes duplexes).

** Average per-person daily consumption for multi-family residents only (includes apartments).

*** Average per-person daily consumption for **all** Madison residents - includes people living in both single-family homes and apartments.

4. *To prevent over pumping and improve redundancy, the Utility’s service level for capacity planning shall be 50% utilization for each unit well...*

Our service level for capacity planning is 50% utilization and system expansion is being planned to accomplish this level. The Utility continues to propose and build additional booster stations and new well facilities to help achieve this goal. In addition, variable speed drives (VFDs) are being added to existing motors/pumps each year to optimize system flows.

Overall, utilization rates for the wells during 2019 were very similar to those experienced in 2018. Through December 31, 2019, five different wells exceeded the annual 50% utilization rate (wells 11, 12, 14, 18, and 30.) Actual utilization rates for 2019 are depicted in Table 1.

- Although still above 50%, the rates at two of the wells (11 and 12) were reduced this year by increasing the pumpage at adjacent well sites. We will continue to increase pumpage at the adjacent sites to lessen the usage of 11 and 12 even more in 2020.
- Unfortunately, the utilization rate at 18 increased to 56.7 % this year. The specific capacity at this well continues to decrease resulting in the need to pump it longer. The formation pores within the borehole are likely becoming plugged with deposits and need rehabilitation. This procedure is expensive and is being budgeted for.
- Rates at the other two well sites (14 and 30) cannot be lessened without improvements to the Utility’s infrastructure. Well repair/reconstruction projects and the necessary use of seasonal wells on a year round basis continue to significantly influence individual well

rates.

The addition of VFDs on the deep wells at a number of its sites has allowed the Utility to directly minimize the utilization rates of these wells. In addition, the VFDs help in lowering the Utility's electrical usage/costs by lowering drawdowns in the wells. Nine deep wells currently have VFDs - 7, 15, 17, 23, 25, 26, 29, 30, and 31. VFDs are planned for the deep wells at 6, 13, and 14 in 2020.

Indirectly, VFDs on booster pumps have also allowed us to minimize deep well pumping at some sites. MWU recently installed VFDs on the booster pumps at Wells 6 and 17. The booster pumps at well sites 9, 14 and 27 are scheduled to have VFDs installed on their booster pumps in 2020.

MWU has recently automated the operations at a number of its well sites utilizing its SCADA system. Certain wells and boosters now operate on a time basis, insuring that a certain amount of run time/volume is produced on a daily basis. This, where implemented, has allowed us to control utilization rates significantly. We will continue to expand the automated operations where possible in the near future.

MWU is currently planning/working on several construction projects that will affect utilization rates:

- The construction of a booster station 109 at the UW 9 well site. This will allow the transfer of water from Zone 4 (surplus water) to Zone 6E (deficient water at times.) Utilization rates will increase at wells 9 and 31 while decreasing at wells 7 and 11. This project is planned to be completed in late 2020.
- The reconstruction of UW 12, making it a two zone well, will reduce utilization rates in the far west pressure zones (UW 12, UW 20, and UW 26). This project is scheduled for 2024
- The construction of Booster Station 129 on the Far East side of the city. The addition of this facility will reduce utilization rates at UW 25, the only well site located in Zone 3. This project is scheduled for 2025.
- The construction of a new well on the far west side of the city. The project would lower the utilization rates for all of the wells located in Zone 8. It is projected to occur in 2025.

5. The Utility shall track the carbon footprint of Utility operations using quantitative tools (for example, energy intensity analysis) so that sustainability may be considered in planning...

Prior to 2018, the City of Madison (COM) calculated the carbon footprint of all of its departments every two years. The Water Utility is currently in the process of determining its own carbon foot print for 2019 with the intent to calculate it on an annual basis. The software to complete the calculations has been obtained and data is being collected. We hope to have results for the next report in July of 2020.

Graduate Student Energy Research

Our 11th MWU sponsored Graduate Student, Tara Hawes, will be continuing the energy conservation research on our pumping operations. The overall objectives of this energy conservation research project include: 1) identifying pumping operation protocols and schedules that will optimize energy conservation; 2) identifying projects with the highest potential for energy reduction; 3) evaluating ways to reduce energy costs through off-peak pumping; 4) evaluating, recommending, and demonstrating energy conservation projects; and 5) laying the framework for system operational optimization.

Building on the work completed by Adam Luthin, Tara is analyzing energy requirements and pumping schedules for Pressure Zone 6E, the east side of the system. This work intends to build an optimized pump operating schedule that would allow the pump operators to make an efficient pump selection for the east side. It is expected that energy and cost savings similar to the west side could be realized within Zone 6E. Ideally, protocols developed will guide further optimization of operations and additional opportunities for energy conservation throughout the system.

I report compliance.

Attachments:

Aquifer Water Levels Graph
Unit Well Capacity Table