

Internal Monitoring Report

Policy #: O-2A Water Quantity

Monitoring Frequency: Annually

Date: October 24, 2017

I certify that the following information is true.

Policy Language:

Current and future customers will receive water that meets or exceeds industry-accepted levels of service for fire protection and pressure.

This includes:

- 1. Water delivered to hydrants at proper flow rates for fire protection.*
- 2. Water delivered to the customer tap at a pressure that meets industry-accepted low, high, and emergency operation criteria.*
- 3. Water used for outdoor irrigation under drought-free conditions.*

General Manager's interpretation and its justification:

This Outcomes policy requires that the Utility budget for, fund, prioritize, plan for, design, and construct the necessary system improvements to provide adequate water quantity to all areas of the system. The attached Level of Service Memo, developed as part of the East Side Water Supply project, establishes minimum standards for system supply, pressure, and fire protection capacity. These standards guide system component design, evaluation, and expansion. The Level of Service Memo is being updated and further refined as a part of the 2016 Master Plan update and the development of the Asset Management Program. A copy of the approved 2017 - 6 year capital budget (2017-2022) outlining planned capital projects to address identified deficiencies and growth areas is attached for your information and use.

Actual system performance is measured against the Utility's established level of service. Data is obtained using the Utility's Supervisory Control and Data Acquisition (SCADA) system and from information derived from the Utility's distribution system computer model. Using the Utility Master Plan as a guide, the capital project list is reviewed and updated based on current system characteristics, operational records, and project priorities. From that analysis the annual capital budget is developed and implemented.

A major update of the eastern half of the 2006 Water Master Plan was completed as part of the East Side Water Supply project in 2012. This update included Pressure Zones 3, 4,

5 and 6E. A full update of the 2006 Madison Water Utility Master Plan is currently under contract and scheduled to be completed in early 2018. The current update will implement water use statistics based on AMI data and build future water demand projections for long term planning based on updated census and development data. Using the Utility water distribution system computer model, deficiencies in supply, pressure, and fire protection capacity will be identified and projects will be developed to mitigate those deficiencies.

Working closely with GHD, a consultant hired to develop a Strategic Asset Management Plan for the Utility, Utility staff is evaluating data collection methodology, business case analysis, and capital project planning. The Strategic Asset Management plan will lead to the development of an Asset Management Program for Madison Water Utility. MWU is working with GHD to complete a pilot project to further refine the asset management program. It is expected that fully implementing the program will be a 3 to 5 year effort.

Other sources of data that will be used for this monitoring report will be consumer complaints and other records maintained by the Utility.

Data directly addressing the General Manager's interpretation:

1. *Water delivered to hydrants at proper flow rates for fire protection.*

Minimum required fire flow capacity is established in Table 5 of the attached Level of Service memo. Results from fire flow field tests are compared to these criteria based on land zoning to identify areas of deficiency with respect to available fire flow capacity.

Last year, the Insurance Services Office (ISO) gave the City a rating of 1 as a result of a 2016 fire fighting system evaluation. This analysis includes the Fire Department, the Water Utility, and the 911 system.

Figure 5-8 from the 2006 Water Master Plan (attached) illustrates system wide fire flow capacity compared to system requirements. Fire flow capacity for the east side of the system was also evaluated as part of the 2012 ESWS study and Figure B12 from that report is attached. These documents provide a graphical representation of the fire flow capacity across the system as determined by the Utility's distribution system computer model. Figure 5-8 identifies general geographical areas of fire flow deficiency. Since 2006, MWU has developed and implemented capital improvement projects to mitigate identified areas of fire flow deficiency. The 2016 Water Master Plan update will revise and update the fire flow capacity map and refine the capital project list to mitigate any additional identified deficiencies.

The Utility's Capital Improvement Program (CIP) identifies and develops projects that will mitigate the identified fire flow deficiency areas. These projects require significant capital investment and are typically budgeted for and implemented over the course of several years. We have reported to the Board on many of these projects in previous reports as the projects were developed and implemented.

Areas of fire flow deficiency identified in the 2006 Water Master Plan and 2012 ESWS plan and mitigated in the Utility's Capital Improvement Program include but are not necessarily limited to: 1) Arbor Hills neighborhood; 2) Pressure Zone 4; 3) Lake View Zone 5; and 4) North Sherman Avenue commercial area. Details of each project area follow:

Arbor Hills:

Identified Need: Water was supplied to the Arbor Hills Neighborhood through a single 8" diameter pipe. This situation resulted in reliability issues and low fire flow capacity that did not meet the minimum level of service.

Identified Project Alternative: Review of several alternatives resulted in the recommendation to construct a 2,000 gpm booster pumping station and 16-inch transmission main between Zones 6 & 7 in the Arbor Hills area.

Project Status:

A pumping station and pipeline have been completed and are operational.

Phase 7: 2018: Planned construction of approximately 2000 feet of 12-inch transmission main under the new bike path from Fish Hatchery Road to North Avenue. This project will complete the connection between Booster Pumping Station 118 and Well 18 and be the last phase of the Arbor Hills project.

Results:

The Cannonball pipeline and BPS 118 system accomplished two main objectives. It allows the transfer of water between Pressure Zone 6 and Pressure Zone 7 and back again. Secondly, the new facility significantly improves fire protection capacity and reliability of drinking water supply to the Arbor Hills area.

Pressure Zone 4:

Identified Need: Pressure Zone 4 was fed by a single well, Well 9, and had a significant lack of redundancy and reliability. Well 9 is located in the north part of Zone 4 resulting in limited fire protection capacity to the southern portions of the Zone.

Identified Project Alternative: Construct a second well, pumping station and reservoir within Zone 4 to provide redundancy and improve fire protection. This work will bring the southern portion of Pressure Zone 4 into compliance with Utility level of service standards.

Project Status:

Well 31 has been drilled and developed. A 1.5 million gallon ground level reservoir has been constructed on the site.

Construction: The Well 31 and treatment facility was successfully bid in 2018 and is under construction. It is anticipated that the facility will be fully operational in late spring 2018.

In future years, hydraulic capacity will be improved with selected pipeline projects. This additional hydraulic capacity will permit Well 31 to be fully utilized and provide operational flexibility in the SE corner of the system.

Results:

When completed, Well 31 will provide the required additional fire flow capacity and water supply redundancy to Zone 4 and bring it into compliance with the established utility level of service.

Lake View and Northport Drive Area Zone 5 and 6E:

Identified Need: Zone 5 and the north end of Zone 6E had a storage deficiency that resulted in fire flow capacity deficiencies. Fire flow capacity deficiencies were identified in Zone 6E around Northport Drive in the Green Avenue/Troy Drive area and on Packers Avenue and near the airport. In Zone 5 fire flow deficiencies have been identified around the Dane County Human Services building and throughout the Zone 5 residential area.

Identified Project Alternative: To mitigate these fire flow capacity deficiencies the 2006 Water Master Plan indicated the need for additional storage in Zones 5 and 6E. A two zone reservoir was constructed in 2016 that replaced the undersized Lake View Reservoir that served Zone 5 and provided a new reservoir for Zone 6E. The overall plan also calls for an upgrade to the existing pumping station in the Lake View Park area in 2020 and for several pipe capacity improvement projects. These improvements will bring the fire flow capacity and reliability of the supply system for Zones 5 & 6E into compliance with Utility standards.

Project Status:

A dual zone reservoir to serve Zones 5 and 6E was completed at the end of 2016. The upper 300,000 gallon reservoir replaced an aging 55,000 gallon structure that

has served the area since 1938. The new Zone 5 tank provides the necessary fire flow capacity and emergency backup supply for the area. The larger reservoir allows Zone 5 to be expanded improving service to residents on the top of the hill.

The lower tank has a capacity of 1,000,000 gallons for Zone 6E. The lower reservoir provides additional emergency water storage capacity, pressure stability, and operational flexibility.

A new larger pipeline connecting Northport Drive with the new Zone 6E reservoir and the pumping station feeding Zone 5 was completed in late 2017. This additional hydraulic capacity benefits reservoir operations.

In 2020 the existing water pumping station that fills the upper Zone 5 reservoir will be upgraded. This upgrade will improve fire protection capacity and pump station capacity and reliability.

Hydraulic upgrades to the distribution system on Lake View Avenue and Sherman Avenue are scheduled for 2020. These improvements will improve capacity, reliability, and service to the area.

Results:

Replacing and enlarging the Zone 5 reservoir, adding a 1.0 million gallon reservoir to Zone 6E, constructing a new 16" connection to Zone 6E, and upgrading the pumping station improved overall water system operation and reliability.

North Sherman Avenue commercial area:

Identified Need: A fire capacity deficiency has been identified in the commercial area around North Sherman Avenue, the Aberg Avenue area and around the old Oscar Meyer plant.

Identified Project Alternative: Fire flow deficiencies in the North Sherman commercial area will be addressed with planned hydraulic improvements to the distribution system.

Project Status: Well 7 was reconstructed and upgraded in 2015. The pumping station at Well 7 provides a capacity of approximately 3 million gallons per day for normal operation and 3,500 gpm for fire protection. Well 7 now has a 500,000 ground level reservoir and a standby generator to provide reliable drinking water supply to the area.

To improve distribution system hydraulics and fire fighting capacity, water transmission main projects will be developed to move water east, south, and

north from Well 7. Pipe replacement projects that will upsize key pipe segments will increase capacity and mitigate the identified fire flow deficiencies.

Results:

Upgrading Well 7 with a filtration system and VFD driven booster pumps improved water quality, station capacity, and provides operational flexibility to the system. Well 7 is situated in the north central area of Pressure Zone 6E and provides an excellent hydraulic location for water supply to the north and east sides. Replacing key pipe segments will result in improved system hydraulics and will maximize the benefit of upgrading Well 7.

Hydrant and Valve Maintenance and Testing: The Utility currently replaces, retires, installs, and maintains approximately 9,025 hydrants in the system. During 2016 the Utility inspected and serviced 4,001 hydrants as a part of the routine maintenance of the system. Utility crews also service and maintain 15,046 system valves. During 2016 Utility crews inspected 4,200 system valves as a part of routine maintenance of the system.

The Utility works closely with Madison Fire Department to ensure fire fighting capacity meets current and future needs. Hydrant flow testing is performed as requested on fire hydrants and recorded in the GIS database. During 2016 Utility crews completed 71 requested hydrant flow tests were requested and completed. Flow tests are also conducted by Utility crews during the course of routine maintenance and flushing operations.

The Utility's unidirectional flushing program systematically operates and exercises the majority of the Utility's hydrants annually. During 2016 approximately 376 miles of pipe was flushed unidirectionally and the Utility conventionally flushed 1,467 hydrants. Some spot flushing is also conducted in response to complaints and water quality concerns. This program of hydrant maintenance and testing meets and exceeds WDNR requirements.

I report non-compliance with mitigation projects ongoing, budgeted, and scheduled.

2. *Water delivered to the customer tap at a pressure that meets industry-accepted low, high, and emergency operation criteria.*

During 2016, a total of 41 complaints referencing pressure were received by the Utility. The majority of these complaints were the result of service interruptions or minor adjustments in system operation.

Pressure planning and design criteria for Madison Water Utility are established in Table 2 of the attached Level of Service Memo. A query of the system indicated that of approximately 8,930 fire hydrants with static pressure readings, approximately

0.15% of the hydrants were below 35 psi and 3% were 100 psi or higher. For areas with pressures greater than 100 psi, customer owned pressure reducing valves may be used on individual services to reduce pressures to acceptable levels.

High pressure areas are evaluated as to the feasibility of moving them to a lower pressure zone or creating another pressure sub-zone using system pressure reducing valves as opportunities come up. Maintaining adequate fire flow in the area will remain a prime objective in considering any changes to pressure zone boundaries.

Significant areas of chronic low pressure have been successfully mitigated on the east side along I-90 and in the Bunker Hill area. The remaining few areas with low pressure are typically small and are located on the tops of hills or ridges and would be difficult to move to other pressure zones.

I report non-compliance with mitigation projects in progress and scheduled.

3. *Water used for outdoor irrigation under drought-free conditions*

During the 2017 reporting period, Madison Water Utility was not required to and did not issue any irrigation restrictions due to water supply limitations within the system.

I report compliance.

Attachments:

1. 2017 City of Madison Water Utility approved capital budget
2. January 10, 2011 Level of Service Memo
3. 2006 Master Plan Fire Flow Capacity Map Figure 5-8
4. Figure B12 – 2012 East Side Maximum Day Fire Flow Availability

City of Madison: 2017 Capital Budget
Capital Improvement Plan

Executive Budget

Agency: Water Utility

Project Summary

	2017	2018	2019	2020	2021	2022
Booster Pump Station 109 (Spaanem Ave)	81,000	1,725,960	617,000	-	-	-
Booster Station #106 Reconstruction	-	-	818,000	-	-	-
BPS 129 Reconstruction	-	-	131,000	2,484,840	574,000	-
Far West Elevated Reservoir	4,011,000	-	-	-	1,309,000	-
Lakeview Reservoir Reconstruction	858,000	-	60,000	1,759,800	-	-
Paterson St Remodel	4,325,000	-	-	-	-	-
Pump Station Improvements	877,000	1,000,300	1,070,600	1,196,900	1,010,200	1,061,600
Unit Well 12 Conversion to a Two Zone W	102,000	2,373,280	1,017,120	-	-	-
Unit Well No. 8 Reconstruction	50,000	110,000	-	-	-	-
Voc Air Stripper At Well 18	-	-	-	-	5,000	255,000
Water Mains - New	1,000,000	1,100,000	1,924,000	2,067,000	2,222,000	2,391,000
Water Mains Replace Rehab Improve	8,500,000	10,000,000	10,730,000	11,522,000	12,129,000	12,776,000
Water Utility Facility Improvements	168,000	235,000	1,120,000	660,000	617,000	1,341,000
Well 19 Iron/Manganese Filter	-	678,800	2,974,400	-	-	-
Well 28 Iron and Manganese Filter	-	-	-	107,660	2,632,320	1,107,660
Well 30 Iron and Manganese Filter	-	-	-	-	330,000	2,200,000
Well 7 Area Hydraulic Improvements	-	-	-	842,000	-	-
Zone 4 Fire Flow Supply Augment	5,512,500	-	271,000	697,000	-	-
Zones 7 & 8 Supply: Whitney Way	-	-	-	65,000	555,000	1,134,000
Total	\$ 25,484,500	\$ 17,223,340	\$ 20,733,120	\$ 21,402,200	\$ 21,383,520	\$ 22,266,260

Changes from 2016 CIP

Project	Change
Booster Pump Station 109 (Spaanem Ave)	Project added to CIP
Booster Station #106 Reconstruction	Project budget decreased
BPS 129 Reconstruction	Project added to CIP
Far West Elevated Reservoir	Project completion deferred 1 year
Lakeview Reservoir Reconstruction	Project construction deferred 2 years
Pump Station Improvements	Program budget increased
Unit Well No. 8 Reconstruction	Project deferred 2 years; beyond 2017 CIP
Water Mains Replace Rehab Improve	Program budget decreased
Water Utility Facility Improvements	Program budget decreased
Well 19 Iron/Manganese Filter	Project deferred 2 years
Well 28 Iron and Manganese Filter	Project added to CIP
Well 29 Filter Capacity Expansion	Project eliminated from CIP
Well 30 Iron and Manganese Filter	Project added to CIP
Well 7 Area Hydraulic Improvements	Project added to CIP
Zone 4 Fire Flow Supply Augment	Project deferred 1 year and total cost increased
Zones 7 & 8 Supply: Whitney Way	Project deferred 1 year and total cost reduced

City of Madison: 2017 Capital Budget Expense & Funding Schedule

Executive Budget

Agency: **Water Utility**

2017 CIP by Expenditure Type

	2017	2018	2019	2020	2021	2022
Water Network	25,484,500	17,223,340	20,733,120	21,402,200	21,383,520	22,266,260
Total	\$ 25,484,500	\$ 17,223,340	\$ 20,733,120	\$ 21,402,200	\$ 21,383,520	\$ 22,266,260

2017 CIP by Funding Source

	2017	2018	2019	2020	2021	2022
Municipal Capital Participate	-	-	131,000	2,484,840	574,000	-
Revenue Bonds - Capitalized	16,984,500	7,223,340	9,872,120	7,395,360	8,680,520	9,490,260
Sale Property/Capital Asset	8,500,000	10,000,000	10,730,000	11,522,000	12,129,000	12,776,000
Total	\$ 25,484,500	\$ 17,223,340	\$ 20,733,120	\$ 21,402,200	\$ 21,383,520	\$ 22,266,260

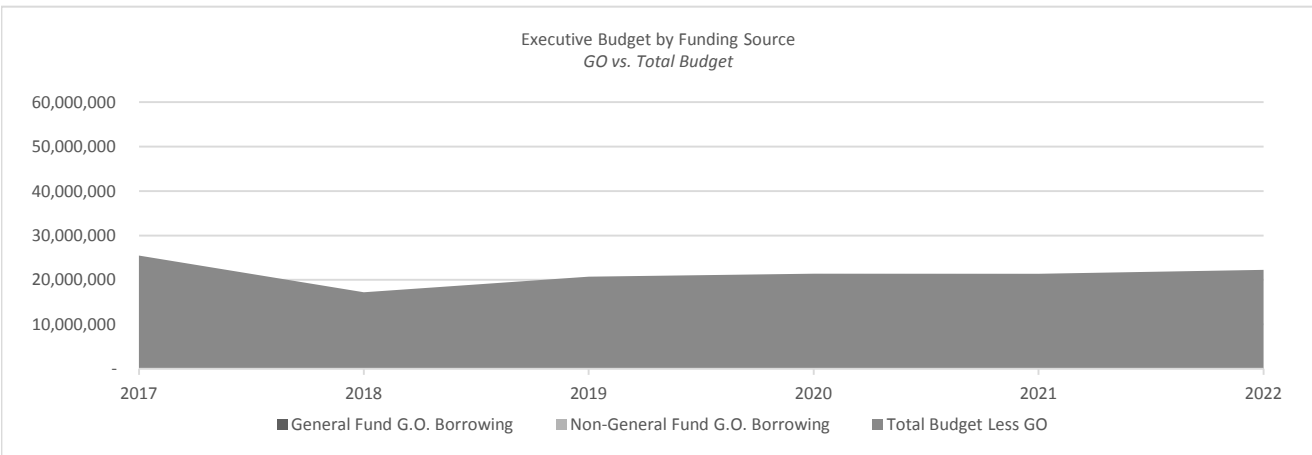
Borrowing Summary

Borrowing Schedule

	2017	2018	2019	2020	2021	2022
General Fund G.O. Borrowing	-	-	-	-	-	-
Non-General Fund G.O. Borrowing	-	-	-	-	-	-
Total	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

Annual Debt Service

General Fund G.O. Borrowing	-	-	-	-	-	-
Non-General Fund G.O. Borrowing	-	-	-	-	-	-



City of Madison: 2017 Capital Budget

Project Summary

Executive Budget

Agency: Water Utility

Project: Arbor Hills Fire Flow Supply **Project #:** 10435

Project Description:

This project is for the final phase of construction for booster pump station #118. The project will construct pipeline that will allow for full functionality of the booster pump station.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	642,000	-	-	-	-	-	-
Total	\$ 642,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

Project: Asset Management System **Project #:** 17097

Project Description:

This project is for developing a city-wide asset management program. The project includes a software system where specific program area functions will be configured to meet the needs of Public Works agencies.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	200,000	-	-	-	-	-	-
Total	\$ 200,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

Project: Booster Pump Station 109 (Spaanem Ave) **Project #:** 28

Project Description:

This project will provide a booster pumping station for Madison's east side to improve operational functionality and reliability to the water supply system.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	81,000	1,725,960	617,000	-	-	-
Total	\$ -	\$ 81,000	\$ 1,725,960	\$ 617,000	\$ -	\$ -	\$ -

Project: Booster Station #106 Reconstruction **Project #:** 10444

Project Description:

This project will provide hydraulic capacity improvements at booster pump station 106.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	880,000	-	-	818,000	-	-	-
Total	\$ 880,000	\$ -	\$ -	\$ 818,000	\$ -	\$ -	\$ -

Project: BPS 129 Reconstruction **Project #:** 30

Project Description:

This project constructs a new booster pump station. The goal of the project is to increase water transfer capacity from Zone 6E to Zone 3. Construction is planned for 2020.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Municipal Capital Participate	-	-	-	131,000	2,484,840	574,000	-
Total	\$ -	\$ -	\$ -	\$ 131,000	\$ 2,484,840	\$ 574,000	\$ -

Project: Far West Elevated Reservoir **Project #:** 10445

Project Description:

This project will construct a reservoir on Madison's far west side. The goal of the project is to reduce pressure on the High Point Reservoir to ensure adequate supply for regular usage and to meet minimum fire flow needs. The project was called for in the 2006 Water Master Plan.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	194,000	4,011,000	-	-	-	1,309,000	-
Total	\$ 194,000	\$ 4,011,000	\$ -	\$ -	\$ -	\$ 1,309,000	\$ -

Project: Lakeview Reservoir Reconstruction **Project #:** 10439

Project Description:

This project will continue reconstruction efforts at Lakeview Reservoir.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	1,121,000	858,000	-	60,000	1,759,800	-	-
Total	\$ 1,121,000	\$ 858,000	\$ -	\$ 60,000	\$ 1,759,800	\$ -	\$ -

Project: Paterson St Remodel **Project #:** 10442

Project Description:

This project funds a renovation of the Water Utility Operations Center at Paterson Street. Construction began in 2015 and will be completed in 2017. The reconstructed space will address existing space limitations and improve employee safety.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	4,325,000	-	-	-	-	-
Total	\$ -	\$ 4,325,000	\$ -	\$ -	\$ -	\$ -	\$ -

Project: Pump Station Improvements **Project #:** 10446

Project Description:

This project includes improvements to pump stations, pressure reducing valve (PRV) stations, well improvements, and tasks recommended by the Water Utility Master Plan.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	148,000	877,000	1,000,300	1,070,600	1,196,900	1,010,200	1,061,600
Total	\$ 148,000	\$ 877,000	\$ 1,000,300	\$ 1,070,600	\$ 1,196,900	\$ 1,010,200	\$ 1,061,600

Project: Unit Well 12 Conversion to a Two Zone Well **Project #:** 32

Project Description:

This project will convert Well 12 to a two zone well. The goal of the project is to maximize operational flexibility and reliability to the west side supply system. Construction is planned for 2018 and 2019.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	719,000	102,000	2,373,280	1,017,120	-	-	-
Total	\$ 719,000	\$ 102,000	\$ 2,373,280	\$ 1,017,120	\$ -	\$ -	\$ -

Project: Unit Well No. 8 Reconstruction **Project #:** 10944

Project Description:

The project upgrades and replaces Well 8. The project scope includes installation of a filter for iron and manganese to address current water quality issues at Well 8. Construction is scheduled for 2018.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	25,000	50,000	110,000	-	-	-	-
Total	\$ 25,000	\$ 50,000	\$ 110,000	\$ -	\$ -	\$ -	\$ -

Project: Voc Air Stripper At Well 18 **Project #:** 12016

Project Description:

This project will construct a volatile organic compound (VOC) air stripper at Well 18. Recent water quality analysis has shown increasing VOC levels in the water supply in the well area. Construction is planned in 2022, with the location being fully operational in 2022.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	-	-	-	-	5,000	255,000
Total	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 255,000

Project: Water Mains - New **Project #:** 10856

Project Description:

This project installs new water mains to help strengthen the existing distribution system, improve pressures, improve fire protection, allow transfer of water from pressure zone to pressure zone, and serve the growing Madison area. Newly installed mains will include hydraulic improvements consistent with the Water Utility Master Plan.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	200,000	1,000,000	1,100,000	1,924,000	2,067,000	2,222,000	2,391,000
Total	\$ 200,000	\$ 1,000,000	\$ 1,100,000	\$ 1,924,000	\$ 2,067,000	\$ 2,222,000	\$ 2,391,000

Project: Water Mains Replace Rehab Improvements **Project #:** 10432

Project Description:

This program replaces and upgrades existing water mains. Assessment of an aging infrastructure indicates the Utility must replace or rehabilitate over 400 miles of pipe in over a 40 year period to renew and maintain the system. This program works in conjunction with the timing of several Engineering - Major Streets Reconstruction Streets projects.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Sale Property/Capital Asset	-	8,500,000	10,000,000	10,730,000	11,522,000	12,129,000	12,776,000
Total	\$ -	\$ 8,500,000	\$ 10,000,000	\$ 10,730,000	\$ 11,522,000	\$ 12,129,000	\$ 12,776,000

Project: Water Utility Facility Improvements **Project #:** 10440

Project Description:

This project provides for miscellaneous project repair, improvements to Utility facilities, and security improvements.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	200,000	168,000	235,000	1,120,000	660,000	617,000	1,341,000
Total	\$ 200,000	\$ 168,000	\$ 235,000	\$ 1,120,000	\$ 660,000	\$ 617,000	\$ 1,341,000

Project: Well 19 Iron/Manganese Filter **Project #:** 10448

Project Description:

This project constructs an iron and manganese filter at Well 19 to address existing water quality issues. This well is located in the west UW-Madison campus area. Construction is planned for 2019.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	115,000	-	678,800	2,974,400	-	-	-
Total	\$ 115,000	\$ -	\$ 678,800	\$ 2,974,400	\$ -	\$ -	\$ -

Project: Well 28 Iron and Manganese Filter **Project #:** 33

Project Description:

This project constructs an iron and manganese filter at Well 28. The goal of the project is to address existing water quality standards. Construction is planned for 2021 and 2022.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	-	-	-	107,660	2,632,320	1,107,660
Total	\$ -	\$ -	\$ -	\$ -	\$ 107,660	\$ 2,632,320	\$ 1,107,660

Project: Well 30 Iron and Manganese Filter **Project #:** 34

Project Description:

This project constructs an iron and manganese filter at Well 30. The goal of the project is to address existing water quality standards. Planning will begin in 2021; construction is planned for 2022.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	-	-	-	-	330,000	2,200,000
Total	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 330,000	\$ 2,200,000

Project: Well 7 Area Hydraulic Improvements **Project #:** 31

Project Description:

This project will provide for hydraulic capacity improvements to the distribution system at Well 7. The goal of the project is to provide for the full capacity of the updated well which was constructed in 2015. Construction is planned for 2020.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	-	-	-	842,000	-	-
Total	\$ -	\$ -	\$ -	\$ -	\$ 842,000	\$ -	\$ -

Project: Zone 4 Fire Flow Supply Augment **Project #:** 10434

Project Description:

This project will construct unit Well 31 to correct a significant system deficiency in the southeast corner of the system identified by the Water Utility Master Plan. The well house, filter, and booster pump station will be constructed in 2017. The well will be finished and fully operational in 2018.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	5,512,500	-	271,000	697,000	-	-
Total	\$ -	\$ 5,512,500	\$ -	\$ 271,000	\$ 697,000	\$ -	\$ -

Project: Zones 7 & 8 Supply: Whitney Way **Project #:** 10438

Project Description:

This project constructs an additional well to serve Madison's west side. Construction of the new location is in anticipation of continued growth to Madison's west side. Planning and design is scheduled to begin in 2020, with the new well being functional in 2024.

Project Budget by Funding Source

	Reauth	2017	2018	2019	2020	2021	2022
Revenue Bonds - Capitalized	-	-	-	-	65,000	555,000	1,134,000
Total	\$ -	\$ -	\$ -	\$ -	\$ 65,000	\$ 555,000	\$ 1,134,000

City of Madison: 2017 Capital Budget

2017 Appropriation

Executive Budget

Agency: Water Utility

2017 Appropriation

Executive Budget

	Request	Executive	GO Borrowing	Other	Total
Booster Pump Station 109 (Spaanem Ave)	81,000	81,000	-	81,000	81,000
Unit Well 12 Conversion to a Two Zone Well	102,000	102,000	-	102,000	102,000
Water Mains Replace Rehab Improve	8,500,000	8,500,000	-	8,500,000	8,500,000
Zone 4 Fire Flow Supply Augment	4,212,500	5,512,500	-	5,512,500	5,512,500
Lakeview Reservoir Reconstruction	858,000	858,000	-	858,000	858,000
Water Utility Facility Improvements	168,000	168,000	-	168,000	168,000
Paterson St Remodel	2,235,000	4,325,000	-	4,325,000	4,325,000
Far West Elevated Reservoir	2,732,000	4,011,000	-	4,011,000	4,011,000
Pump Station Improvements	877,000	877,000	-	877,000	877,000
Water Mains - New	1,000,000	1,000,000	-	1,000,000	1,000,000
Unit Well No. 8 Reconstruction	50,000	50,000	-	50,000	50,000
Total	\$ 20,815,500	\$ 25,484,500	\$ -	\$ 25,484,500	\$ 25,484,500

Reauthorized Appropriation

	GO Borrowing	Other	Total
Arbor Hills Fire Flow Supply	-	642,000	642,000
Asset Management System	-	200,000	200,000
Booster Station #106 Reconstruction	-	880,000	880,000
Far West Elevated Reservoir	-	194,000	194,000
Lakeview Reservoir Reconstruction	-	1,121,000	1,121,000
Pump Station Improvements	-	148,000	148,000
Unit Well 12 Conversion to a Two Zone Well	-	719,000	719,000
Unit Well No. 8 Reconstruction	-	25,000	25,000
Water Mains - New	-	200,000	200,000
Water Utility Facility Improvements	-	200,000	200,000
Well 19 Iron/Manganese Filter	-	115,000	115,000
Total	\$ -	\$ 4,444,000	\$ 4,444,000

TOTAL 2017 APPROPRIATION

\$ - \$ 29,928,500 \$ 29,928,500



LEVEL OF SERVICE MEMO

Madison Water Utility
Madison, Wisconsin
119 East Olin Avenue
Madison, WI 53713

Black & Veatch Corporation
B&V Project 169092.0100
B&V File 41.0800

Black & Veatch Corporation
225 E. Mason Street, Suite 801
Milwaukee, Wisconsin 53202

January 10, 2011

TABLE OF CONTENTS

1. Background.....	1
2. Unit Wells.....	1
3. Pressure	1
4. Pipelines.....	2
5. Booster Pump Stations and Storage.....	3
6. Fire Fighting criteria	3

TABLES

Table 1 – Unit Well Planning and Design Criteria	1
Table 2 – Pressure Planning and Design Criteria	2
Table 3 – Pipeline Planning and Design Criteria.....	2
Table 4 – Booster Pump Station and Storage	3
Table 5 – Fire Fighting Planning and Design Criteria ⁽¹⁾	4

1. BACKGROUND

Criteria for evaluating the performance of existing facilities and for designing future facilities is a combination of regulations established by the Wisconsin Department of Natural Resources (DNR), Madison Water Utility (MWU) service level goals, and industry standards. Often the DNR establishes a minimum level of service, which is exceeded by MWU goals. Planning and Design Criteria are generally guidelines and provide a framework in which to evaluate the performance of the existing system and evaluate recommended facilities to serve future growth or changes in the distribution system.

2. UNIT WELLS

Criteria established for the unit wells include well capacity and emergency power/pumping. They are summarized in Table 1.

Table 1 – Unit Well Planning and Design Criteria

Criteria	Guideline
Well Capacity	For each pressure zone served by a well the well capacity must meet all of the following: <ul style="list-style-type: none"> • Average run time on unit wells less than 12 hours during the average day demand (ADD). • Total capacity of wells at least 115% of the maximum day demand (MDD). • Firm capacity (largest well in the zone out of service) of wells at least 100% of MDD. For pressure zones 6E and 6W, firm capacity shall be based on two wells out of service. ⁽¹⁾
Emergency Operation	Emergency power generation (or engine powered pump capacity) to meet at least the ADD.
Notes: ⁽¹⁾ Alternate guidelines for pressure zones 6E and 6W based on their size and importance.	

3. PRESSURE

Pressure criteria are established for low, high and emergency operations. The low pressure criterion is established to provide customers with adequate pressures for normal operation of residential and commercial fixtures including irrigation systems. The high pressure criterion is established to protect fixtures and pipelines from undue stress. Customers with normal operating pressures over 90 psi may consider installing a pressure reducing valve (PRV) on their service to protect indoor fixtures. MWU will reimburse 50 percent of the cost of the PRV for customers with normal pressures over 110 psi and 100 percent of the cost of the PRV for pressures over 125 psi. The emergency operating criterion is established to prevent negative system pressures during emergency and fire flow events. Table 2 summarizes the pressure criteria.

Table 2 – Pressure Planning and Design Criteria

Criteria	Guideline
Minimum Pressure Peak Demands	
Non-emergency	40 psi
Emergency	20 psi (at any point in the pressure zone)
Preferred Operating Pressure	50 – 90 psi
Maximum Operating Pressure	<125 psi (everywhere) <100 psi (expansion areas)

4. PIPELINES

Pipeline criteria are established for velocity, pipe roughness, minimum sizing, and pipe material. Velocity criteria are used to minimize system headlosses due to pipe size or roughness and to minimize the impact of transients in the distribution system. A roughness criterion is generally assumed or measured and is used for hydraulic model calibration and evaluation. Minimum sizing is used to ensure adequate capacity for fire protection. Table 3 summarizes planning and design criteria for pipelines.

Table 3 – Pipeline Planning and Design Criteria

Criteria	Guideline
Maximum Velocity	
Maximum Hour during MDD	< 5 fps
Fire during MDD	< 10 fps
Hazen-Williams Roughness Coefficient (C)	
Existing Pipes	125 ⁽¹⁾
High Density Polyethylene (HDPE) (new)	150 ⁽²⁾ (horizontal directional drilling only)
Ductile Iron (new, cement lined)	140 ⁽²⁾
Pipe Diameter ⁽³⁾	
General Grid Considerations	16-inch minimum diameter on 1 mile grid 12-inch minimum diameter on 0.5 mile grid (Larger diameter or closer spacing may be required based on use or zoning).
Arterial Collector Roads	12-inch minimum diameter
ICI Areas	10-inch minimum diameter
Residential Areas	8-inch minimum diameter (6-inch may be permitted for residential dead-end lines that are less than 200 feet in length with a fireflow requirement less than 1000 gpm).
Pipe Material	Ductile Iron Class 52 or greater ⁽⁴⁾
Notes:	
(1) From the 2006 IDSE hydraulic model calibration	
(2) WAC NR 811.70	
(3) MWU Planning Guidelines	
(4) HDPE is permitted for directional drilling or slip lining only (minimum pressure class 160 psi).	

5. BOOSTER PUMP STATIONS AND STORAGE

Pump station and storage criteria are designed to ensure adequate capacity for maximum hour, fireflow, or emergency demands. Table 4 summarizes planning and design guidelines for booster pump stations and storage.

**Table 4 – Booster Pump Station and Storage
 Planning and Design Criteria**

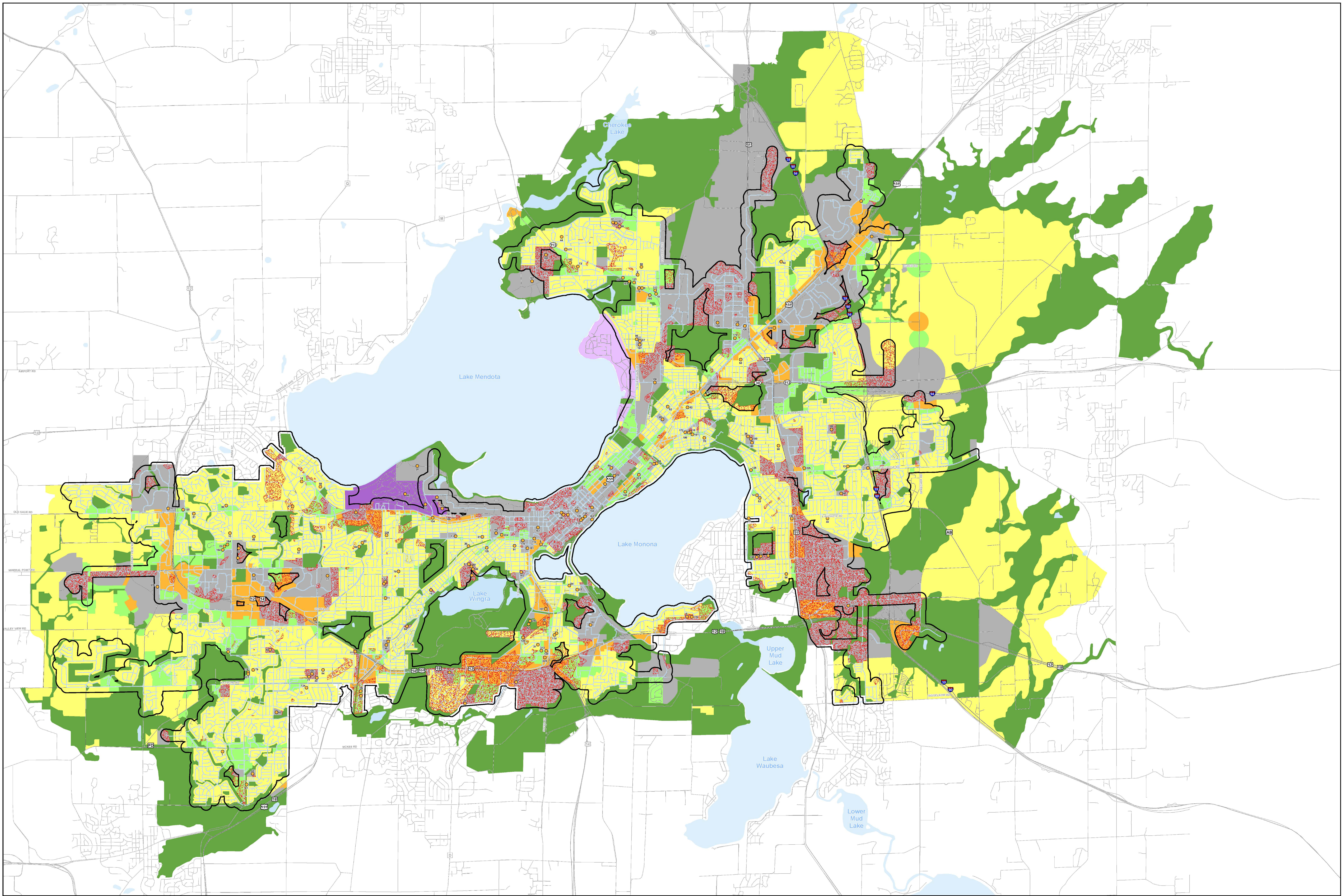
Criteria	Guideline
Booster Pump Stations	
Capacity	Firm Capacity (largest pump out of service) able to meet either: <ul style="list-style-type: none"> • MDD for pressure zones with equalization storage • Maximum hour plus fireflow for pressure zones without equalization storage.⁽¹⁾
Storage	
Volume	Every pressure zone be able to meet both of the following: <ul style="list-style-type: none"> • 12 hour supply at ADD⁽²⁾ • Fire flow plus equalization storage
Equalization storage	Volume required to deliver difference between maximum hour demand (MHD) and MDD for each pressure zone (normally 15 – 30% of MDD)
Fire Storage	Fire flow goal X fire duration (see Table 5 for fire flow and duration recommendations)
Notes: ⁽²⁾ Pressure zone 11 is the only existing pressure zone without equalization storage. ⁽³⁾ Emergency reserve	

6. FIRE FIGHTING CRITERIA

Projected water demands are developed from existing water demands and the anticipated impact of growth and conservation on the demand. Table 5 summarizes the fire flow goals and durations.

Table 5 – Fire Fighting Planning and Design Criteria⁽¹⁾

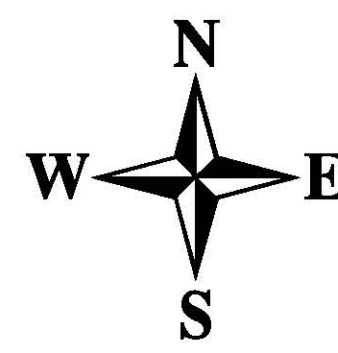
Land Use	Fire Flow Goal (gpm)	Fire Duration⁽²⁾ (hrs)	Hydrant Spacing (feet)
Low Density Residential (LDR), Neighborhood Planning Area (NPA), Traditional Neighborhood Development (TND)	1,000	2	400
Medium Density Residential (MDR), Neighborhood Mixed Use (NMU)	2,000	2	375
High Density Residential (HDR), Community Mixed Use (CMU), General Commercial (GC)	2,500	2	360
Regional Mixed Use (RMU), Regional Commercial (RC), Employment (E), Special Institutional (SI), Downtown (D), Campus (C), Airport (SP), Industrial (I)	3,500	3	300
Notes: ⁽¹⁾ Fire flow in addition to MDD. ⁽²⁾ <i>Distribution System Requirements for Fire Protection, AWWA M31, 1989</i>			



Legend

- Practical limit of Fire Flow delivery
- Area of deficient Fire Flow capacity
- Public Gathering & Services Facility (with Facility ID Number - see Table)
- Existing Pipeline
- Major roads
- Minor Roads

- Minimum Fire Flow Service Criteria**
- 3,500 gpm
 - 2,500 gpm
 - 2,000 gpm
 - 1,000 gpm
 - 0 gpm - Parks
 - 0 gpm - Village of Maple Bluff
 - 0 gpm - Village of Shorewood Hills
 - Water body



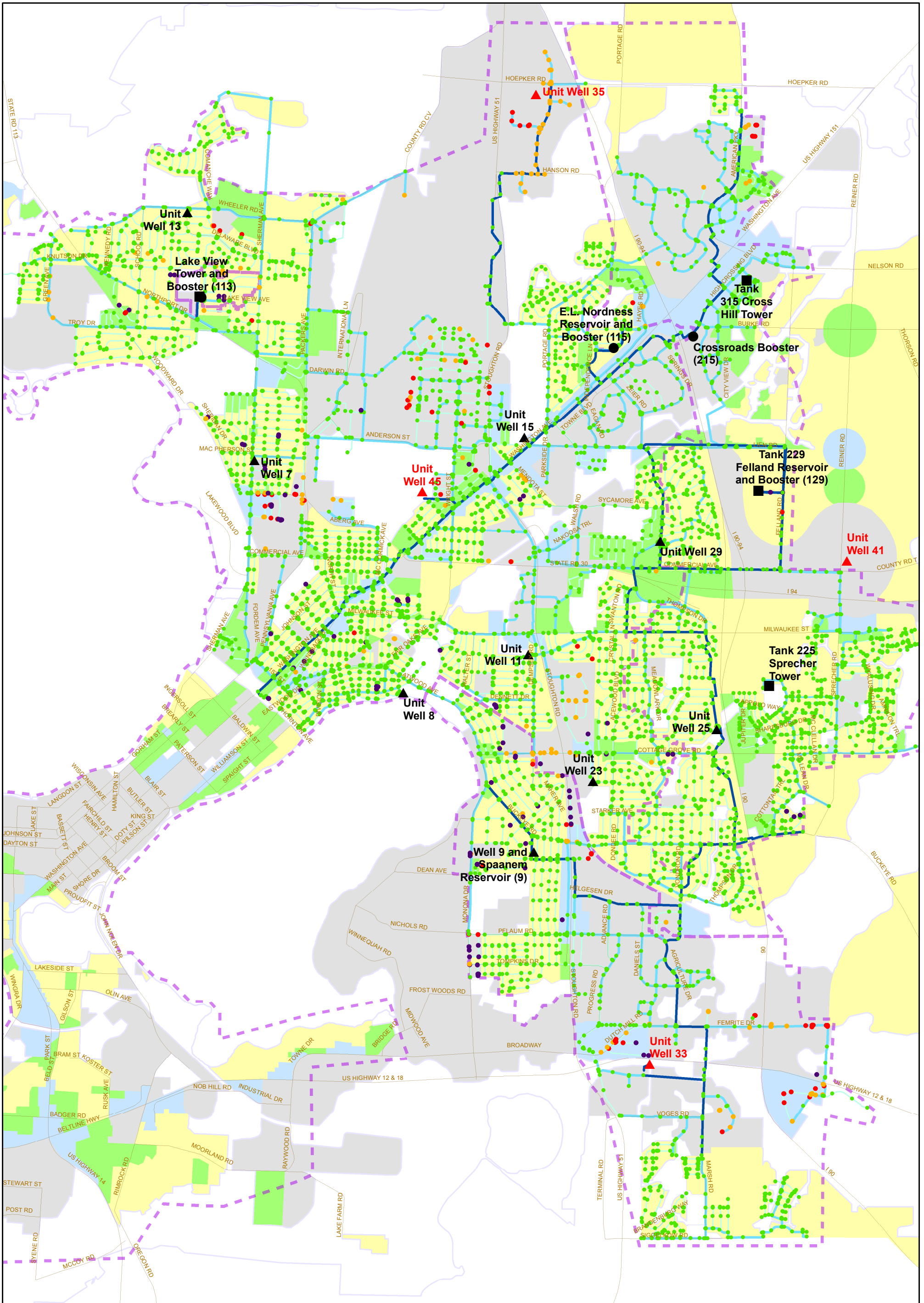
1:35,000



File: C:\PROJECTS\Madison_WI_87269_411110_GIS\ProjectFiles\FireFlow\FireFlowScenario\FireFlow_Scenario_Summer.mxd
 Version: 1
 By: DJW
 Date: Nov 17, 2006

Figure 5-8 - Fire Flow Analysis
 Madison Water Utility Planning Area
 Water Master Plan Update
 B&V PN 138101.3120





NOTE: Available fire flow based on the demand at hour 85 of a Maximum 10-Day scenario and is equivalent to Maximum Day demand.

0 0.5 1 Miles

Legend

<p>Pipe Diameter</p> <ul style="list-style-type: none"> — 8 inch or less — 10 - 14 inch — 16 inch and greater 	<p>Fire Flow Criteria</p> <ul style="list-style-type: none"> 0 gpm 1,000 gpm 2,000 gpm 2,500 gpm 3,500 gpm 	<p>Junction Fire flow Category</p> <ul style="list-style-type: none"> ● Available Flow > Criteria ● Available Flow 75% - 99% Criteria ● Available Flow 50% - 74% Criteria ● Available Flow < 50% Criteria 	<ul style="list-style-type: none"> Floating Storage Booster Pump Station ▲ Well Pressure Zone Boundary Streets
--	---	--	---

Figure B12
2015 East Side
Maximum Day
Fire Flow Availability