WATER SUPPLY


HISTORIC
HASTINGS
Home of the Raiders
AAA State Champs 2011
Hastings High School SOFTBALL
2008 Section Champions
State 7th place
2009 Conference Champions
Section Champions
State 3rd place
2010 Conference Champions
Section Champions
State 3rd place
2011 Conference Champions
Section Champions
State Champions
HOME OF THE
HASTINGS
Raiders

CHAPTER
12

Chapter 12: Water Supply

The City of Hastings Water System Study details the existing conditions and future needs for the City's water supply system. The Water System Study, prepared by Stantec Consulting Services, provides a description of the existing water system, describes water demands, evaluates the existing water system and provides a proposed future water system evaluation.

Water System Study

City of Hastings

June 28, 2018

Prepared for:

City of Hastings

Prepared by:

Stantec Consulting Services

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WATER SYSTEM STUDY PURPOSE AND OBJECTIVES

The City of Hastings Water System Study project was conducted to develop an updated hydraulic model and an improvement plan to meet future water system needs. The Water System Study is based on the future land use provided in the 2040 City Comprehensive Plan and the future population projections provided by the Metropolitan Council. The project updated the City hydraulic model to include recent water main improvements and updated water demands to match the existing City water use.

EXISTING WATER SYSTEM

The City of Hastings water system includes water supply, treatment, distribution, and storage to meet the water demands of the utilities' customers. The utility operates six groundwater wells to supply water and maintains three water tanks in the distribution system to sustain water system pressures and provide water during emergencies. The water distribution system contains approximately 110 miles of water main. Due to the large variations in ground elevation in the City of Hastings, the water system operates multiple pressure zones to provide adequate water system pressures to all customers.

For evaluation of the water system, existing average day, maximum day, and peak hour water demands were used. The recommended design average day demand is 2.5 million gallons per day (MGD) based on water pumpage since 2012. The highest maximum day pumpage exceeded 7.0 MGD in 2005 and 2006 but has averaged approximately 5.7 MGD since 2012. The design maximum day demand ratio is recommended to be 2.6 with the calculated design maximum day demand of 6.5 MGD. The peak hour demand is the maximum hour of water demand which occurs on the maximum day. The recommended design peak hour ratio is 1.6 with a calculated peak hour demand of 7,225 gallons per minute (gpm).

PROJECTED COMMUNITY GROWTH

To project future water demand, future community growth projections are needed. Two methods for determining future water demands were completed. Future water demand was calculated on a per capita basis in the *Water Supply Plan* based on Metropolitan Council's population projections. An evaluation of future developable land from the 2040 Comprehensive Plan was also conducted to determine future demand based on land use.

The Metropolitan Council's population projection is 28,800 for 2040. The total water use per person of approximately 110 gallons per capita per day (gpcd) and maximum day demand ratio of 2.6 were used for future demand projections. The average day demand for a population of 28,800 is 3.17 MGD and the maximum day demand is 8.24 MGD. The future maximum day demand is an approximately 27 percent increase from existing demand.

The 2040 Comprehensive Plan determined the limits for future development and future water demands were projected per acre. Full development of the approximately 2,700 acres of land for future water use will result in a City population that exceeds the Metropolitan Council 2040 population of 28,800. The average day demand for the fully developed plan is 4.42 MGD and the maximum day demand is 11.5 MGD. The fully developed demand is a 77 percent increase in the maximum day demand. The future peak hour demand is 12,800 gpm.

EXISTING WATER SYSTEM EVALUATION

Current water supply and storage capacity exceeds recommended need. Firm water supply capacity is approximately 8.64 MGD, greater than the design maximum day demand of 6.5 MGD. The existing total water storage capacity of 2.75 MG exceeds the recommended water storage volume of 1.95 – 2.5 MG. Existing supply and storage capacity for each individual pressure zone exceeds recommendations also.

A hydraulic analysis of the Hastings water supply and distribution system was conducted using the hydraulic model. Water system pressures range from 40 to 100 psi during average day demand conditions. Under peak hour demand conditions, a small area of higher elevations will have pressure at 35 psi. Fire Flows within the water system range from approximately 450 gpm to well over 3,500 gpm. The lowest available fire flows exist at dead end water mains and on small diameter water mains. Available fire flows greater than 3,500 gpm are available throughout the majority of the trunk water system. Fire flow availability should be reviewed with Fire Officials based on occupancy use and building construction.

PROPOSED FUTURE WATER SYSTEM EVALUATION

Additional water supply, storage, and trunk water mains are proposed to support future growth as detailed in the City Comprehensive Plan. Additional water supply capacity is required to meet future water demands; two new water supply wells are recommended to be constructed. Additional water storage is also required; two new elevated tanks are recommended. A 1.0 MG tower should be constructed in the Main Pressure Zone and a 0.5 MG tower for the new High Pressure Zone. Based on population growth projections, the existing supply capacity will be adequate for the 28,800 population, but additional water storage is required.

A hydraulic analysis of the proposed future Hastings water supply and distribution system was conducted using the hydraulic model. Throughout nearly the entire water system pressures continue to range from 40 to 100 psi during average day demand conditions. Under peak hour demand conditions, a small area of higher elevations will have pressure at 34 – 35 psi.

Fire Flows within the water system range from approximately 450 gpm to well over 3,500 gpm. The lowest available fire flows exist on dead end and small diameter water mains. Continued looping of dead end water mains and replacement of old, small diameter water mains where higher fire flows are required will improve available fire flow. Available fire flows greater than 3,500 gpm are available at nearly all locations throughout the proposed trunk water system.

1.0 INTRODUCTION

1.1 PURPOSE AND OBJECTIVES

The City of Hastings Water System Study project was conducted to develop an updated hydraulic model and an improvement plan to meet future water system needs. The Water System Study is based on the future land use provided in the 2040 City Comprehensive Plan and the future population projections provided by the Metropolitan Council. The project updated the City hydraulic model to include recent water main improvements and updated water demands to match the existing City water use. The proposed future water system includes improvements to support the future growth detailed in the Comprehensive Plan. The previous *Comprehensive Water System Plan* was completed by Stantec in March 2010 with a separate *2013 Update to the 2010 Comprehensive Water System Plan* completed in May 2013.

The purpose of this report is to provide an updated plan to meet the near-term and future water supply needs for the City of Hastings water system. The primary objective of the project was to update the hydraulic model and create a Water System Study with demand projections based on Metropolitan Council's 2040 population projection and the City of Hastings 2040 Comprehensive Plan. Specific objectives are as follows:

- **Create an updated water system hydraulic model** based on the water utility GIS to incorporate all available water system data and recent water demand data.
- **Reallocate water demands** to the updated hydraulic model based on actual 2016 customer consumption to provide an accurate water demand allocation.
- **Determine the future water demands** expected within the planning boundary and the supply and storage facilities required to meet these demands.
- **Analyze the existing and future system** and provide water system pressure and available fire flow figures.
- **Optimize supply, storage, and distribution combinations** to develop an economical and efficient proposed future water system.

2.0 EXISTING WATER SYSTEM

The City of Hastings water system includes water supply, treatment, distribution, and storage to meet the water demands of the utilities' customers. The utility operates six groundwater wells to supply water and maintains three water storage tanks in the distribution system to sustain water system pressures and provide water during emergencies. The City operates a nitrate removal water treatment plant and a booster station for transfer of water between the two pressure zones. Figure 1 illustrates the existing water distribution system from the hydraulic model.

2.1 WATER SUPPLY AND TREATMENT

The City of Hastings operates six active groundwater wells spread across the City. City wells are pumped at approximately 1,200 gallons per minute (gpm). The total raw water supply capacity is 7,200 gpm (10.37 million gallons per day (MGD)) based on all wells operational. The total firm capacity is 6,000 gpm (8.64 MGD) with the largest well out of service. To calculate firm capacity, it is recommended that the largest well be considered out of service to account for emergency repairs and regular well maintenance.

Table 1 details the six wells with unique id, well aquifer, depth in feet (ft), date well drilled, inner casing diameter in inches (in), and current operational capacity.

Table 1 – Existing Groundwater Supply Wells

Source	Unique ID	Aquifer	Well Depth	Well Drilled	Casing Diameter	Operational Capacity
Well 3	206333	Jordan	290 ft	1956	16 in	1,200 gpm
Well 4	207993	Jordan	497 ft	1961	16 in	1,200 gpm
Well 5	207639	Jordan	355 ft	1970	24 in	1,200 gpm
Well 6	207643	Jordan	330 ft	1972	24 in	1,200 gpm
Well 7	509053	Jordan	285 ft	1989	24 in	1,200 gpm
Well 8	686266	Jordan	280 ft	2006	24 in	1,200 gpm

Water treatment is accomplished by simple chemical addition at each well and the removal of nitrates by ion exchange from Wells 3 and 5. Fluoride is added to the well water to prevent tooth decay prior to delivering it to the water distribution system. The raw water supplied by all six groundwater wells contains elevated levels of nitrates; however, no wells exceed the maximum contaminate level for nitrates to date. The Water Treatment Plant constructed in 2007 removes nitrates from Wells 3 and 5, the two wells with the highest nitrate level.

The City maintains a water booster station at the Water Treatment Plant. Three pumps deliver water to the Main Pressure Zone from the Low Pressure Zone and its ground storage reservoir. Three pressure reducing valve stations can transfer water to the Low Pressure Zone, if needed.

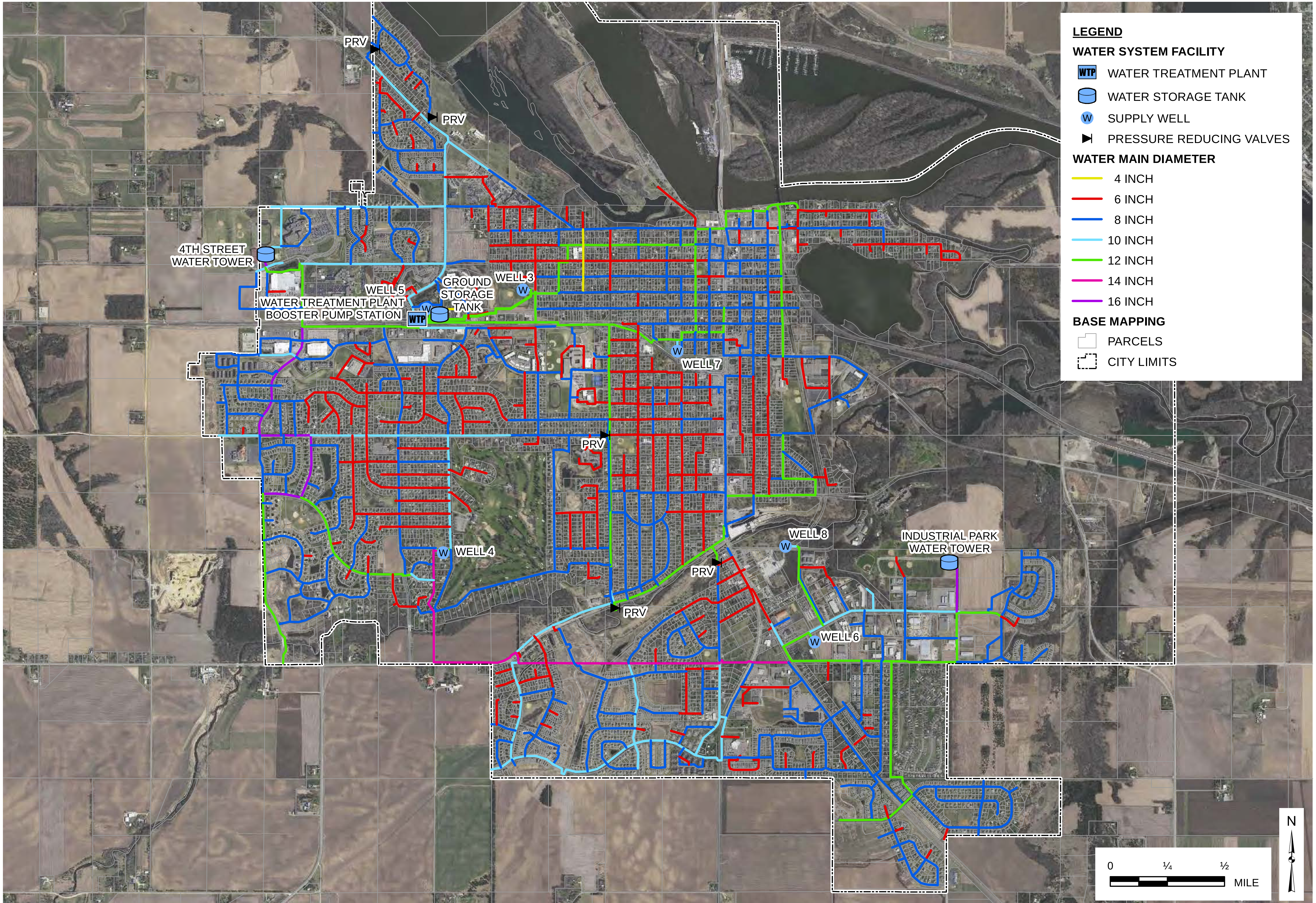

FIGURE 1 - EXISTING WATER SYSTEM

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2.2 WATER DISTRIBUTION SYSTEM

The distribution system consists of trunk water mains (primarily 10 inches or larger in diameter), lateral water mains, service pipes, valves, hydrants, and all appurtenances to convey water from the supply sources and storage reservoirs to the point of demand. Typically, a network of large distribution mains extending from the water supply sources to the storage facilities located throughout the city form the core of the system.

The modeled water distribution system contains approximately 27 miles of trunk water main ranging in diameter from 10 inches to 16 inches out of a total of over 110 miles of total water main. The trunk water system is illustrated on Figure 2. Due to the large variations in ground elevation in the City of Hastings, the water system operates three pressure zones to provide adequate water system pressures to all customers.

The Low Pressure Zone serves customers at lower elevations in the east portion of the City, north of the Vermillion River. The Main Pressure Zone serves customers are higher elevations around the west and south portion of the City. A small third pressure zone serves customers in the Riverdale/Eagle Bluff neighborhood. The different pressure zones are illustrated in Figure 2; supply and storage details on each pressure zone are included in Table 2.

Table 2 – Water System Pressure Zones

Pressure Zone	Water Supply	Water Storage	Approximate Hydraulic Grade
Main Pressure Zone	Wells, Booster Station	1.75 MG	1,016 ft
Low Pressure Zone	Wells, (3) PRV Stations	1.0 MG	902 ft
Reduced Pressure Zone	(2) PRV Stations	-	930 ft

2.3 WATER STORAGE

Water storage in the system is also an important factor for ensuring reliability of service during emergencies resulting from loss of power, temporary outages of water supply facilities, and from sudden demands for firefighting. Water storage allows these fluctuations in water demands to be met without having additional supply pumping capacity, which would typically be held in reserve. The City of Hastings maintains two elevated storage tanks and a ground reservoir, as detailed in Table 3. The ground storage tank is located at an elevation high enough to act as elevated water storage for the Low Pressure Zone. The total water storage capacity is 2.75 MG.

Table 3 – Existing Water Storage

Tank	Pressure Zone	Capacity	High Water Level	Head Range
4th Street Tower	Main	0.75 MG	1,016 ft	40.0 ft
Industrial Park Tower	Main	1.0 MG	1,016 ft	40.0 ft
Ground Storage Tank	Low	1.0 MG	902 ft	41.5 ft

FIGURE 2 - EXISTING TRUNK WATER SYSTEM AND PRESSURE ZONES

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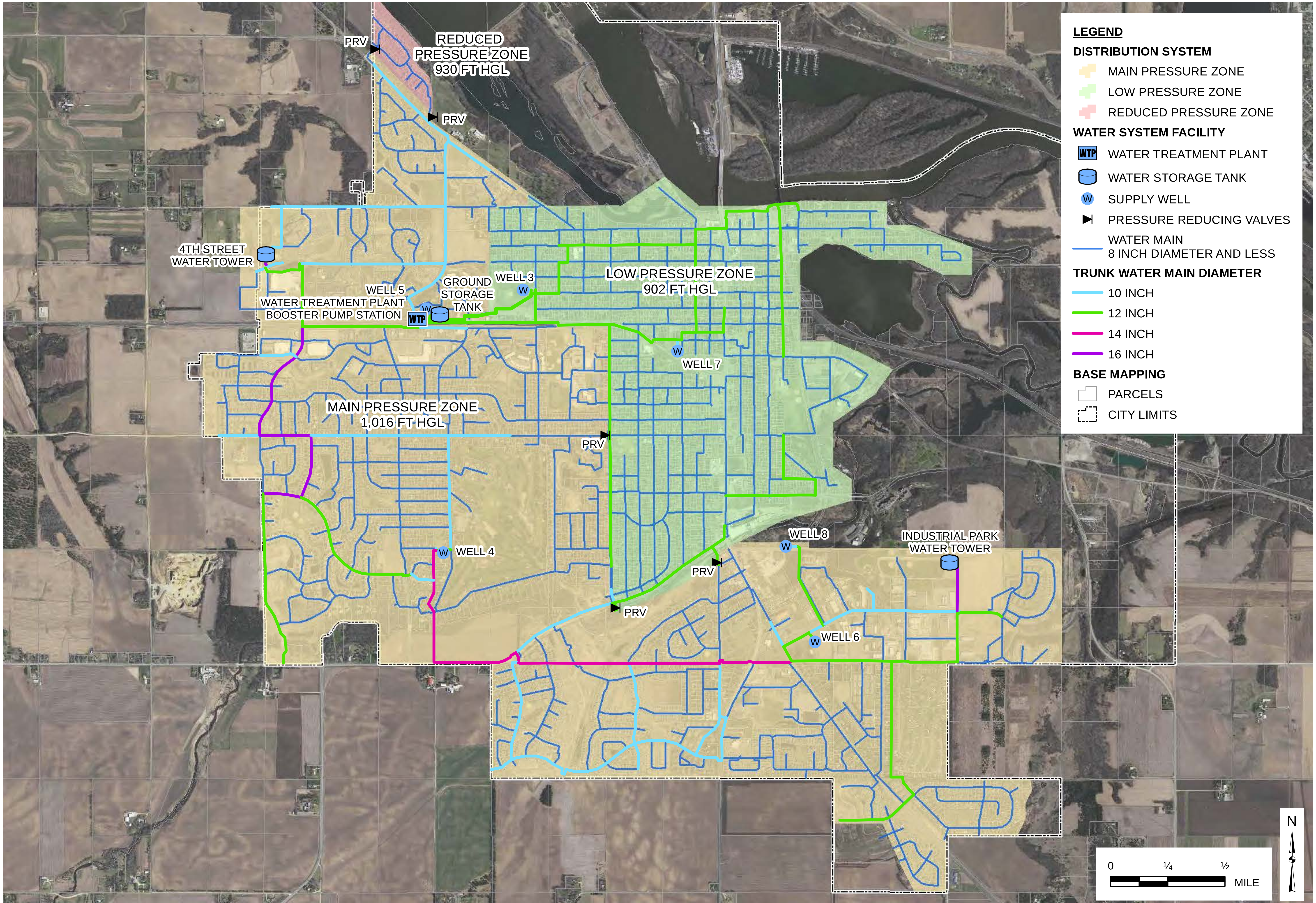

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3.0 WATER DEMANDS

Capacity requirements for the three water system components of supply, storage, and distribution are dictated by the demands placed upon them for production and distribution. The design of the water supply and distribution system improvements is based on estimates of the future water demands.

Water demand (both average and peak) is affected by many factors including population, population distribution, commercial and industrial activity, water quality, water rates, climate, soil conditions, economic level of the community, sewer availability, water pressures, and the condition of the water system. However, the most important factor is land use, which encompasses residential and non-residential development. Future land use data and industry standard water demands were used to estimate water demands for future service areas.

3.1 VARIATIONS IN WATER USE

The rate of water consumption will typically vary over a wide range during different periods of the year and during different hours of the day. Several characteristic demand periods are recognized as being critical factors in the design and operation of a water system. The system must be designed to provide satisfactory service at all times.

The average day demand is equal to the total annual pumpage divided by the number of days in the year. The average day demand is used in estimating future revenues and operating costs such as power and chemical requirements. The principal significance of the average day demand is as an aid in estimating maximum day and peak hour demands.

The maximum day demand is the critical factor in the design of certain elements of the water system. The principal items affected by the maximum day demand are raw water supply facilities and water storage requirements. Daily demand rates are expressed in million gallons per day (MGD).

The peak demands upon the water system are encountered during short periods of time on days of maximum consumption. These short period demands are referred to as hourly demands, which seldom extend over a period of more than four to six hours, during hot summer mornings or evenings when the domestic and sprinkling load is the greatest. The peak hour consumption rates impose critical demands on the distribution system. Hourly demand rates are expressed in gallons per minute (gpm).

The water supply facilities must be adequate to supply water near the maximum day demand. Sufficient water storage should be provided to meet hourly demands in excess of the water supply capacity. The total capacities should also include reserves for operation, future growth, industrial development, and fire protection.

3.2 EXISTING WATER SYSTEM DEMAND

Historical water use, current water use trends, and water demand variations were all evaluated to determine water demands for evaluation of the existing system. Additionally, an analysis of past water consumption characteristics was reviewed with population and land use growth projections for future water use.

3.2.1 Historical Water Use

Annual pumpage and sales data was reviewed from 2005 through 2016 from data provided in the City of Hastings *Water Supply Plan* in Appendix A. A summary of the historical pumpage and sales data is included in Table 4. The highest water pumpage over the last twelve years was in 2006 – 2008 when over one billion gallons of water was pumped. Total pumpage and water sales have decreased slightly over the last twelve years despite annual variations. Total water pumped decreased to approximately 850 MGY in 2015 and 2016.

Table 4 – Historical Water Use Data

Year	Water Pumped	Residential Water Sold	Non-Residential Water Sold	Other Uses	UFW %	Average Day Demand	Maximum Day Demand
2005	923	647	179	61	4%	2.53	7.10
2006	1,031	726	273	23	1%	2.82	7.44
2007	1,036	710	195	30	10%	2.84	7.33
2008	1,029	718	188	12	11%	2.82	6.64
2009	995	695	178	16	11%	2.73	6.86
2010	862	570	254	12	3%	2.36	5.30
2011	869	623	153	18	9%	2.38	5.14
2012	997	774	112	24	9%	2.73	6.18
2013	932	631	168	20	12%	2.55	6.31
2014	900	529	152	18	22%	2.47	5.52
2015	848	538	131	16	19%	2.32	4.95
2016	856	601	140	62	6%	2.35	5.38

Water sales have decreased slightly over the last twelve years. Total water sales have varied between 685 MGY in 2015 and over 1,000 MGY in 2006. Over the last five years, total water sales have averaged 783 MGY. Since 2012, residential water sales are approximately 615 MGY and accounted for roughly 78 percent of all water sales. Individual non-residential customers can account for a large portion of water sales. Since 2012, unaccounted for water (UFW), i.e. water lost, has averaged approximately 14 percent. As an industry standard, it is recommended the percentage of unaccounted for water should be maintained below 10 percent. The ongoing meter replacement program will improve water sales accuracy and thus improve UFW percent.

3.2.2 Existing Design Demands

For evaluation of the City of Hastings water system, existing average day, maximum day, and peak hour water demands were used. The average water pumpage since 2012 is approximately 2.5 MGD. Therefore, the recommended existing design average day demand is 2.5 MGD. The highest maximum day pumpage exceeded 7.0 MGD in 2005 - 2007 but has averaged approximately 5.7 MGD since 2012. To determine the design maximum day demand, a review of the maximum to average day ratios is required.

Since 2005, the maximum to average day pumpage ratio has varied between 2.13 in 2015 and 2.81 in 2005. In 2007, the maximum day ratio was approximately 2.6 times average day. For a conservative evaluation of the water system and to estimate future infrastructure needs, the design maximum day demand ratio must not be exceeded. For this study, the existing design maximum day demand ratio is recommended to be 2.6 with the calculated maximum day demand of 6.5 MGD.

The peak hour demand is the maximum hour of water demand which occurs on the maximum day. Peak hour demands typically occur in the morning or evening when residential and irrigation water use increase. Peak hour ratios typically range from 1.4 to 2.0 times maximum day demand. A higher percentage of industrial or commercial water use decreases the peak, since industrial usage does not fluctuate significantly from hour to hour. An industry standard time of day demand curve from the American Water Works Association (AWWA) is illustrated in Figure 3. It is recommended an industry standard, design peak hour ratio of 1.6 be used.

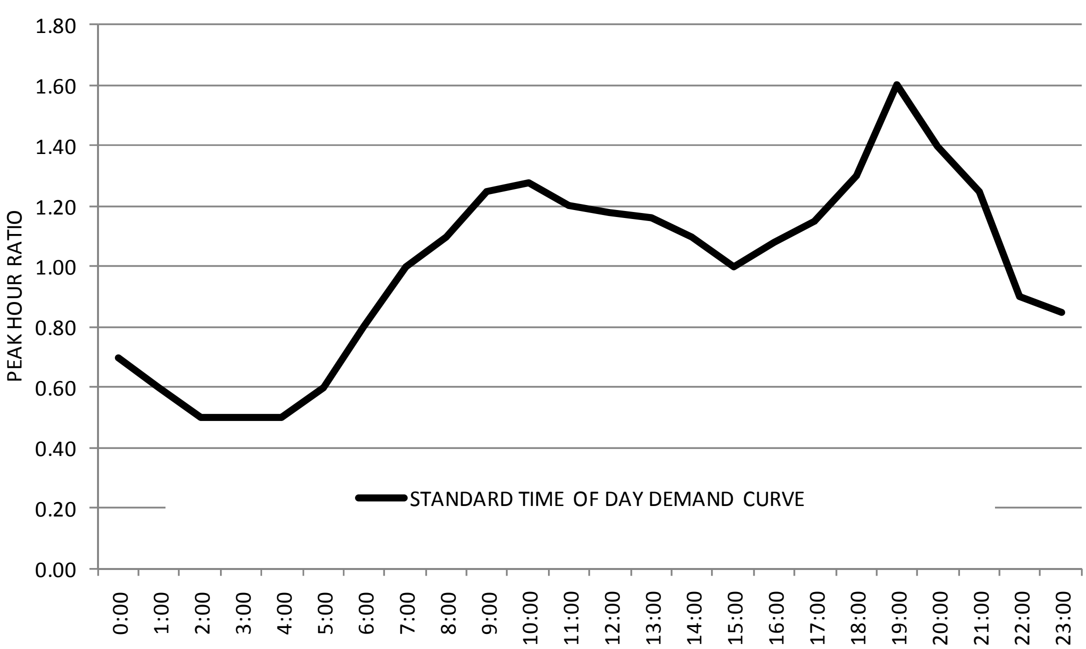

Figure 3 – Time of Day Demand Curve

The design existing water demands for this study are summarized in Table 5. The average day demand was based on evaluation of the average total pumpage over the last five years. As discussed, the maximum day and peak hour ratios were determined based on Hastings water demand trends and typical industry standards.

Table 5 – Existing Design Water Demand

Average Day Demand	Maximum Day Demand	Peak Hour Demand
2.5 MGD	6.5 MGD[1]	7,225 gpm[2]

[1] Maximum day demand design factor equal to 2.6.
[2] Peak hour demand design factor equal to 1.6.

3.3 PROJECTED COMMUNITY GROWTH

To project future water demand, future community growth projections are needed. Two methods for determining future water demands were completed. Future water demand was calculated on a per capita basis in the *Water Supply Plan* based on Metropolitan Council's population projections. An evaluation of future developable land was also conducted to determine future demand based on land use. The City of Hastings 2040 Comprehensive Plan provides future land use.

3.3.1 Water Use by Population Projections

The Metropolitan Council's future population projections are included in the *Thrive MSP 2040* Plan and are required to be used in the City's *Water Supply Plan*. The Plan projected 2030 population is 26,000 and the 2040 population is 28,800 for the City of Hastings. The total water use per person was determined to be approximately 110 gallons per capita per day (gpcd) since 2010. The calculated maximum day demand is based on the *Water Supply Plan* average day and the maximum day demand ratio determined for this study of 2.6. Additional details are provided in the *Water Supply Plan*, included as Appendix A.

Table 6 – Future Water Requirements by Population

Year	Population	Projected Total Per Capita Water Use	Projected Average Day Demand	Calculated Maximum Day Demand
2017	22,770	110 gpcd	2.50 MGD	6.50 MGD
2020	23,286	110 gpcd	2.56 MGD	6.65 MGD
2030	26,000	110 gpcd	2.86 MGD	7.45 MGD
2040	28,800	110 gpcd	3.17 MGD	8.24 MGD

The future 2040 maximum day demand of 8.24 MGD is an approximately 27 percent increase from the existing design demand.

3.3.2 Water Use by Land Use Projections

The City of Hastings 2040 Comprehensive Plan determined the parcels and acres available for development. Figure 4 illustrates the future land use as provided in the City Comprehensive Plan and several areas within the City limits which are currently vacant. The total acres for future development were calculated from the Comprehensive Plan and illustrated vacant parcels. Table 7 provides acres for development along with projected water use. Future growth outside the existing city limits was reduced by 20 percent to determine net acres for development. Existing vacant parcels within the existing city limits were not reduced. Water demands were projected per acre of developable land based on historical water use, current water use trends, future planning efforts, and industry standards.

Water demand requirements of 1,500 gpd/ac for industrial and commercial land uses are projected to cover anticipated growth within the City of Hastings. Demand projections should be reviewed if a large, wet industry locates in the water system or major changes in water use are planned at existing industrial customers.

Table 7 – Future Development Acres and Water Requirements by Land Use

Land Use Type	Total Acres	Net Acres	Water Demand (gpd/ac)	Average Day Water Demand
Low Density Residential	1,642.2	1,346.1	650	0.875 MGD
Medium Density Residential	484.1	417.9	900	0.376 MGD
High Density Residential	117.8	96.9	1,200	0.116 MGD
Mixed Use	3.5	3.5	1,500	0.005 MGD
Business Park	153.4	122.7	1,500	0.184 MGD
Commercial	166.6	135.2	1,500	0.203 MGD
Industrial	98.4	98.4	1,500	0.148 MGD
Institutional	13.5	10.8	1,500	0.016 MGD
Total	2,680 AC	2,232 AC	-	1.92 MGD

Full development of the approximately 2,700 acres of land for future water use will result in a City population that exceeds the Metropolitan Council 2040 population of 28,800. It is common that the future comprehensive planning includes areas that ultimately will not be developed during the planning period. To plan future water system improvements, full development of the 2040 land use in the City Comprehensive Plan will be used and corresponding water demands applied.

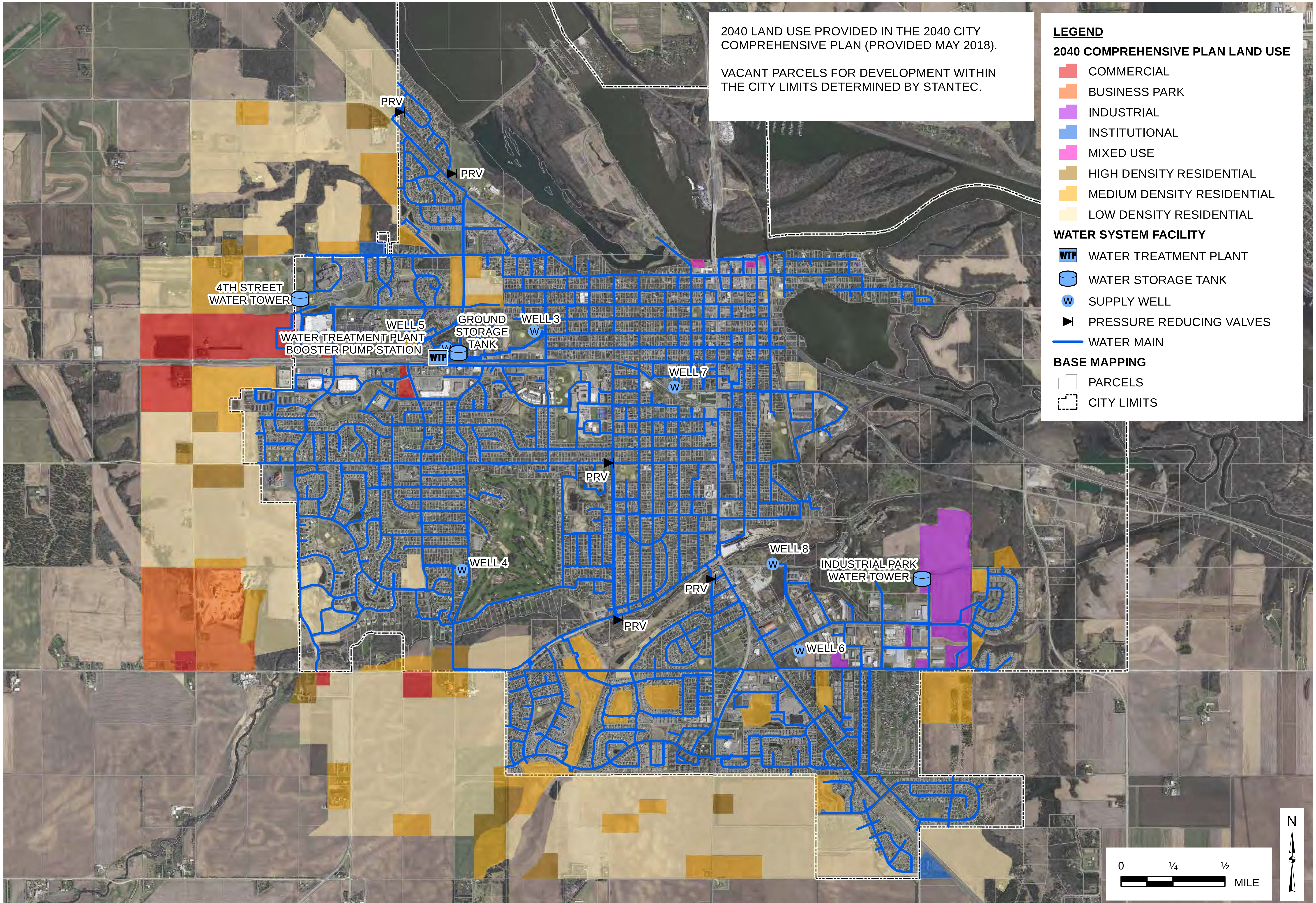

FIGURE 4 - 2040 FUTURE LAND USE FOR GROWTH

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3.4 PROJECTED WATER SYSTEM DEMAND

Based on the existing demand conditions and projected growth estimates the design water demands are summarized in Table 8. Future average day demand is based on full development of the 2040 Comprehensive Plan as included in Table 7. Future maximum day and peak hour demand factors were based on design demand factors determined to be 2.6 and 1.6 for existing and future evaluation.

Table 8 – Water Demand Projections for Future Growth

Demand Condition	Existing Design Water Demand	Future Design Water Demand
Average Day Demand	2.5 MGD	4.42 MGD
Maximum Day Demand	6.5 MGD[1]	11.5 MGD[1]
Peak Hour Demand	7,225 gpm[2]	12,800 gpm[2]

[1] Maximum day demand design factor equal to 2.6
[2] Peak hour demand design factor equal to 1.6.

4.0 EXISTING WATER SYSTEM EVALUATION

4.1 HYDRAULIC MODEL

An updated computer hydraulic model was developed to represent the current water system. A hydraulic model of nearly all water mains 6 inch and larger was created using WaterCAD V8i software from Bentley Systems, Inc. The hydraulic model performs hydraulic analysis based the Hazen-Williams energy loss formula and the Hardy Cross procedure. The hydraulic model includes well supply, booster pumps, water mains, water storage, and pressure reducing valves. The hydraulic model is used for deficiency analysis, operation reviews, emergency planning, and long term planning. Field testing and model calibration was not part of this project.

All water main was reviewed and included from the most up to date GIS mapping available. Water system facilities were reviewed and modeled to provide water supply and water storage in the hydraulic model. 2016 water sales, pumpage, actual metered water usage was reviewed and applied to the hydraulic model. Water demands for the top water users, accounting for over 15 percent of total water sales, were manually added to the hydraulic model and the remaining demands were allocated based on customer land use categories.

4.2 WATER SYSTEM HYDRAULIC EVALUATION

Municipal water systems are typically designed with a minimum pressure of 35 psi at all locations in the service area under normal operating conditions. Minnesota Administrative Rules require minimum pressures be available to plumbing fixtures within buildings. When water system pressures exceed 80 psi, the Minnesota Plumbing Code requires installation of a pressure reducing valve on the water service. Water systems are also required to be designed and operated to maintain 20 psi residual pressure throughout the water system during emergency operation (e.g. firefighting conditions).

4.2.1 Water System Pressure

A hydraulic analysis of the Hastings water supply and distribution system was conducted using the hydraulic model. The existing average day water system pressure was calculated with a total distribution system demand of 2.5 MGD. The average day water system pressures are illustrated in Figure 5 with Well 4 operating and water tank levels 5 ft below overflow. Average water system pressures range between 40 and 100 psi for nearly all customers. Water system pressures are lower on the trunk water mains near the Water Treatment Plant. These trunk water mains serve the Low Pressure Zone and do not contain customer services.

The peak hour water demand pressures are illustrated in Figure 6 with Wells 4, 5, and 7 operating, one pump operating at the Booster Station, and water tank levels 10 ft below overflow. During the peak water demands when water pressures are at the lowest, pressures at a few locations, with higher ground elevations, drop to approximately 34 psi.

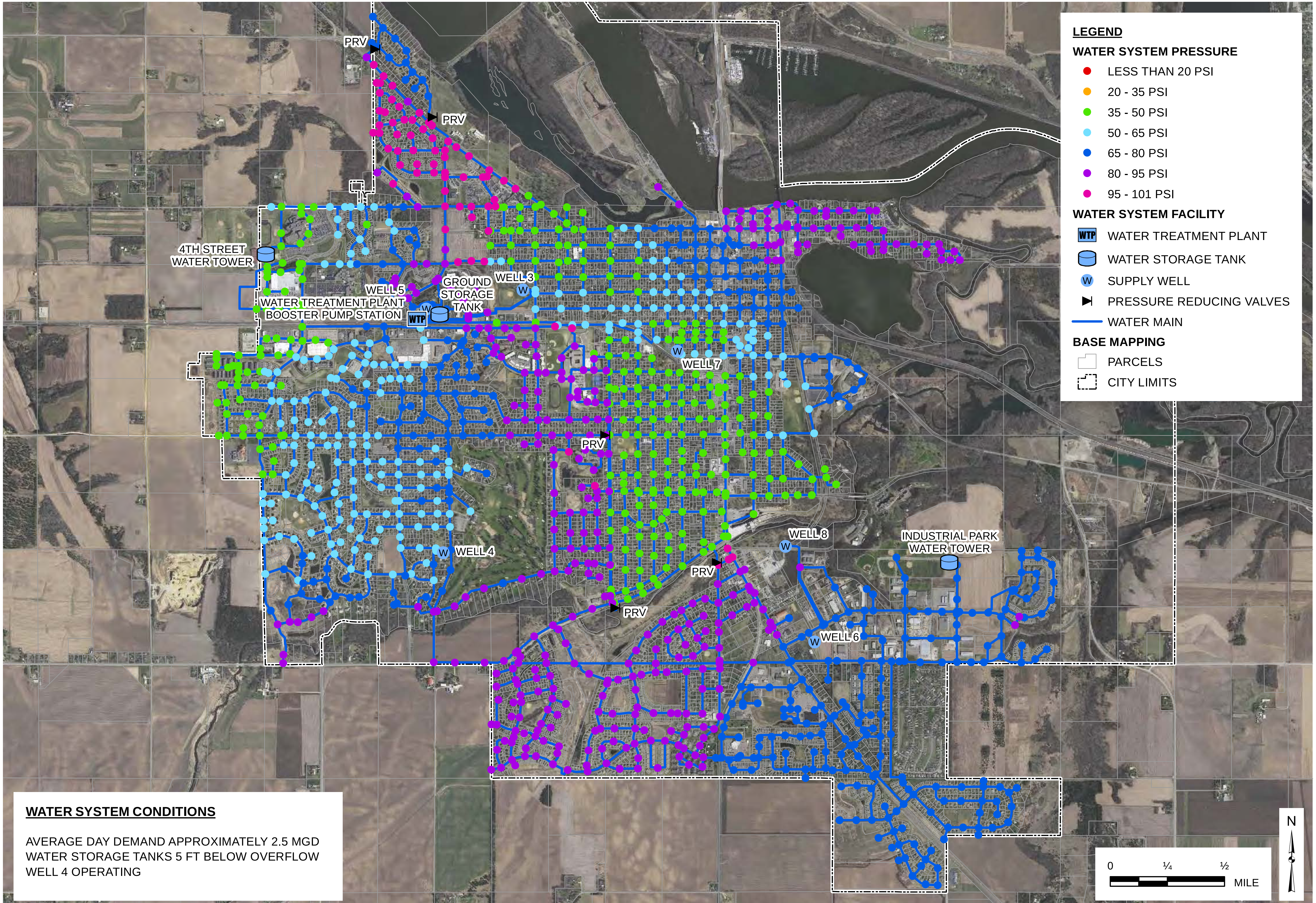

FIGURE 5 - AVERAGE DAY WATER SYSTEM PRESSURE

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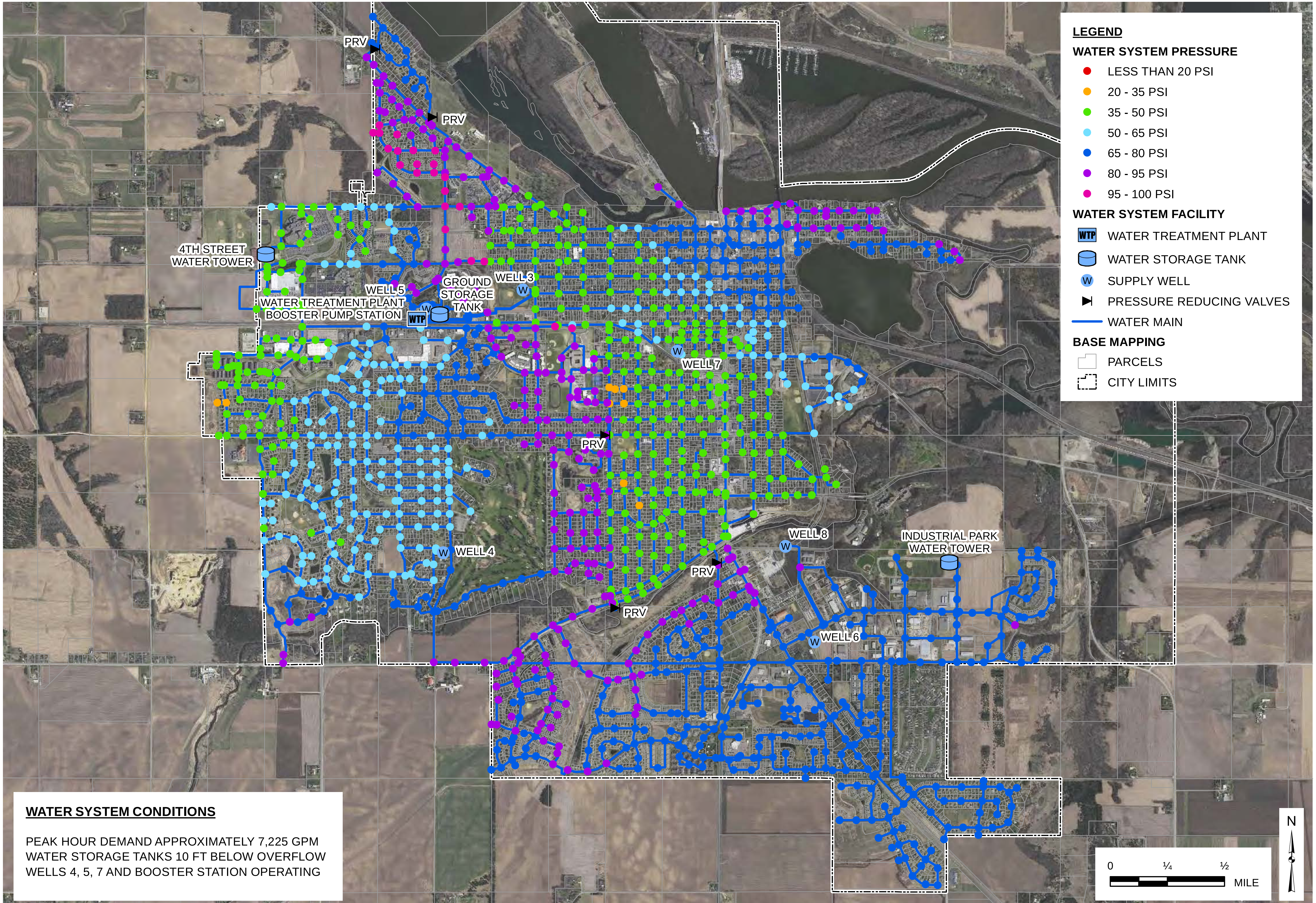

FIGURE 6 - PEAK HOUR WATER SYSTEM PRESSURE

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4.2.2 Water System Fire Flow

The hydraulic model was used to determine the approximate available fire flow while maintaining 20 psi within the distribution system. Required fire flows at each location depend on the land use type and building construction. It is recommended that fire flow requirements are reviewed with staff and Fire Officials to determine if the existing fire flows are adequate. Fire flow recommendations should be based on the 2040 Comprehensive Plan land use. Typical recommended fire flows by land use are listed below:

- Park, Open Space – 500 gpm
- Low Density Residential – 1,000 gpm
- Medium Density Residential and Commercial – 2,500 gpm
- High Density Residential, Industrial, and Public/Institutional – 3,500 gpm

The approximate available fire flow results while maintaining 20 psi throughout the water system are illustrated in Figure 7. Fire flow evaluations were conducted under existing maximum day demand conditions with a design demand of approximately 6.5 MGD. The hydraulic model was evaluated with Wells 4, 5, and 7 operating, one pump operating at the Booster Station, and water tank levels 10 ft below overflow.

Fire Flows within the water system range from approximately 450 gpm to well over 3,500 gpm. The lowest available fire flows exist at water main dead ends and on small diameter water mains. Available fire flow below 500 gpm occurs at the end of a long, dead end, 6 inch water main on Florence Ave. and on the Low Pressure Zone pipe on Hwy 55 where ground elevations are highest. Available fire flows greater than 3,500 gpm are available throughout the majority of large diameter water mains which make up the trunk water system. Continued looping of dead end water mains and replacement of old, small diameter water mains where higher fire flows are required will improve available fire flow.

Fire flow requirements based on land use are not always as accurate as desired and therefore fire flow availability should be reviewed with Fire Officials based on occupancy use and building construction. For example, a large commercial facility may be better classified as industrial or institutional for firefighting purposes. A large commercial facility may require a higher fire flow than the commercial land use dictates, due to the size, construction, and use of the facility. Industrial or institutional buildings are assigned a fire flow as high as 3,500 gpm, but the facility may contain fire sprinklers, in which case fire flow requirement may be as low as 1,500 gpm.

4.2.3 Water System Headloss and Velocity

High velocity or headloss in water mains are indicators of potential capacity problems. Velocities greater than 5 feet per second (fps) and headlosses of 10 ft per 1,000 ft or greater during peak demands may contribute to low pressures and reduced fire flows. No water mains in the distribution system were identified to have velocities greater than 5 fps or 10 ft per 1,000 ft headlosses during all existing demand conditions.

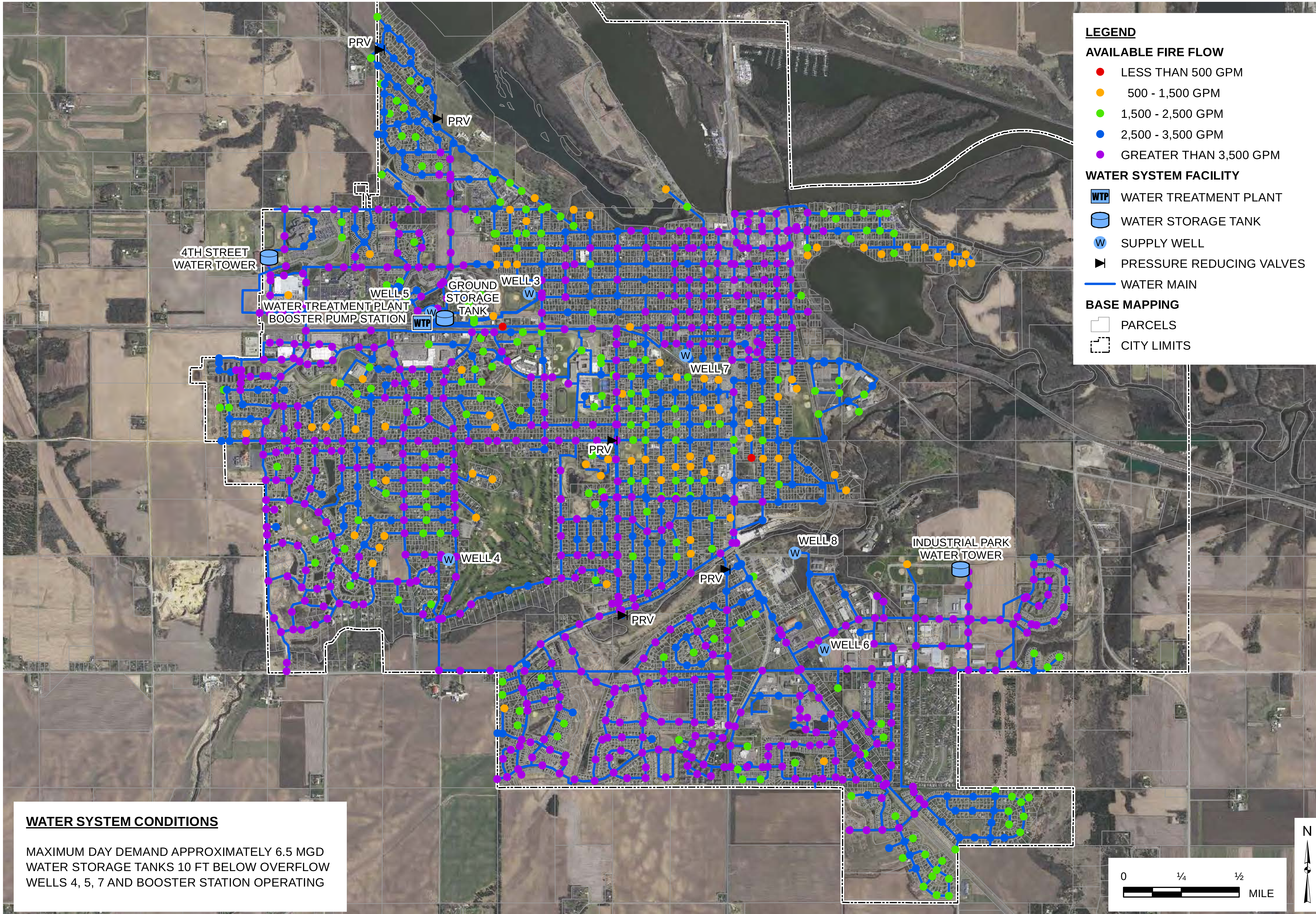

FIGURE 7 - MAXIMUM DAY FIRE FLOW AVAILABILITY

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V:\1938\active\193804063\GIS\Projects\Fig 7 - Fire Flow.mxd

4.3 SUPPLY – STORAGE EVALUATION

Supply capacity, storage volume, and distribution system capacity are interrelated. Water storage acts as additional supply sources during peak periods when the primary supply source is incapable of meeting the total demand. Therefore, water storage facilities stabilize the peaks in water demand and allow the system to produce water at a lower, more uniform rate. The system must also be capable of conveying water from the supply source to water storage without allowing the development of high pumping heads and high pressures in the system during low usage periods. There are an infinite number of combinations of supply and storage that can be used to meet peak water demands. An economical system can be obtained through an analysis of supply and storage needs.

For the majority of communities, the ideal combination of supply and storage is found when the supply equals 100 percent of the maximum day demand. This is consistent with the recommendations in both *Recommended Standards for Water Works* by Great Lakes Upper Mississippi River Board and American Water Works Association *Manual of Practice M32 - Distribution Network Analysis for Water Utilities*. The Hastings water system is currently capable of supplying the design maximum day demand of 6.5 MGD.

The amount of storage required in the water system can be determined from maximum day and peak hour demands, fire flow requirements, and operational needs. Up to 20 percent of the total maximum day demand accounts for hourly fluctuations and should be provided by storage facilities. In addition, approximately10 percent of the total maximum day demand is required to account for fire flow needs, unusual demands on the system, and operational parameters. The storage volume includes a fire flow volume of 3,500 gpm sustained for 3 hours with additional operational space for pump operation or off peak pumping. It is recommended the Hastings water system maintain at least 30 percent of maximum day demand or approximately 1.95 MG of water storage. *Recommended Standards for Water Works* recommends another approach for determining needed water storage, which is to have storage equal to the average day demand. The 2.75 MG of water storage in the existing three tanks exceeds these recommendations. Water supply and storage meet requirements of the water system as detailed in Table 9.

Table 9 – Existing Water Supply and Storage Recommendations

Water System Component	Existing Firm Capacity	Recommended Capacity	Additional Capacity
Water Supply	8.64 MGD	6.5 MGD	NONE
Water Storage	2.75 MG	1.95 – 2.5 MG	NONE

An analysis of water supply and storage by individual pressure zone was also completed. Three wells serve each pressure zone and the booster station supplies the Main Pressure Zone from the ground reservoir. The Main Pressure Zone has two elevated storage tanks and the ground storage tank is at a high enough elevation to serve the Low Pressure Zone by gravity. Existing supply and storage capacity for each individual pressure zone exceeds recommendations.

4.4 EXISTING WATER SYSTEM EVALUATION SUMMARY

A hydraulic analysis of the Hastings water supply and distribution system was conducted using the hydraulic model. Water system pressures range from 40 to 100 psi during average day demand conditions. Under peak hour demand conditions, a small area of higher elevations will have pressure at 35 psi. No water mains were identified to have velocities greater than 5 fps or 10 ft per 1,000 ft headlosses during existing evaluations.

Fire Flows within the water system range from approximately 450 gpm to well over 3,500 gpm. The lowest available fire flows exist at dead end water mains and on small diameter water mains. Continued looping of dead end water mains and replacement of old, small diameter water mains where higher fire flows are required will improve available fire flow. Available fire flows greater than 3,500 gpm are available throughout the majority of the large diameter water mains which make up the trunk water system.

Supply and storage requirements for the water system are shown in Table 9. Current water supply and storage capacity exceeds recommended need. Firm water supply capacity is approximately 8.64 MGD, greater than the design maximum day demand of 6.5 MGD. The existing total water storage capacity of 2.75 MG exceeds the recommended water storage volume of 1.95 – 2.5 MG. Existing supply and storage capacity for each individual pressure zone also exceeds recommendations.

5.0 PROPOSED FUTURE WATER SYSTEM EVALUATION

5.1 PROPOSED FUTURE WATER SYSTEM IMPROVEMENTS

The proposed future water system is detailed in this section to include all recommendations and subsequent evaluations. The proposed trunk water system is illustrated in Figure 8 and water system improvements are detailed in the sections below. Additional water supply, storage, and trunk water mains are proposed to serve the future growth detailed in the City Comprehensive Plan. Proposed trunk water mains were designed to provide an economical and sensible water system to support future growth and provide satisfactory service to all water customers.

To meet the future design maximum day water demand of 11.5 MGD, based on the City Comprehensive Plan, additional water supply and storage is required. To determine the approximate timing of future water system improvements with the 2040 population of 28,800, additional water storage not additional supply is required by 2040. Improvements in this section are based on full development of the City Comprehensive Plan. A new pressure zone will be required to serve the higher elevations west of the existing water system. The proposed future water system improvements are explained in detail throughout this section.

5.2 SUPPLY – STORAGE EVALUATION

Current firm capacity from the six Hastings wells is 8.64 MG; therefore, an additional 2.86 MGD is needed to meet the 11.5 MGD future maximum day demand. Two new wells will provide the water required based on the new well yield to be approximately 1,200 gpm similar to the existing wells. The proposed future total capacity is 13.8 MGD and the firm capacity is 12.1 MGD with one well out of service. Well 9 is planned for Wallin Park on Northridge Drive based on a previous well siting study. A similar study should be conducted to to determine the best locations for the future Well 10.

Future water storage capacity is recommended to be between 3.45 and 4.42 MG based on 30 percent of maximum day and average day demand, respectively. The existing water storage volume of 2.75 MG does not meet the future proposed water system need. Additional water storage is recommended. Table 10 summarizes the future water system water supply and storage requirements for the entire water system.

Table 10 – Proposed Future Water Supply and Storage Recommendations

Water System Component	Existing Firm Capacity	Recommended Capacity	Additional Capacity
Water Supply	8.64 MGD	11.5 MGD	2.8 MGD
Water Storage	2.75 MG	3.45 – 4.42 MG	0.70 - 1.67 MG

Further analysis is required to review supply and storage requirements for each pressure zone.

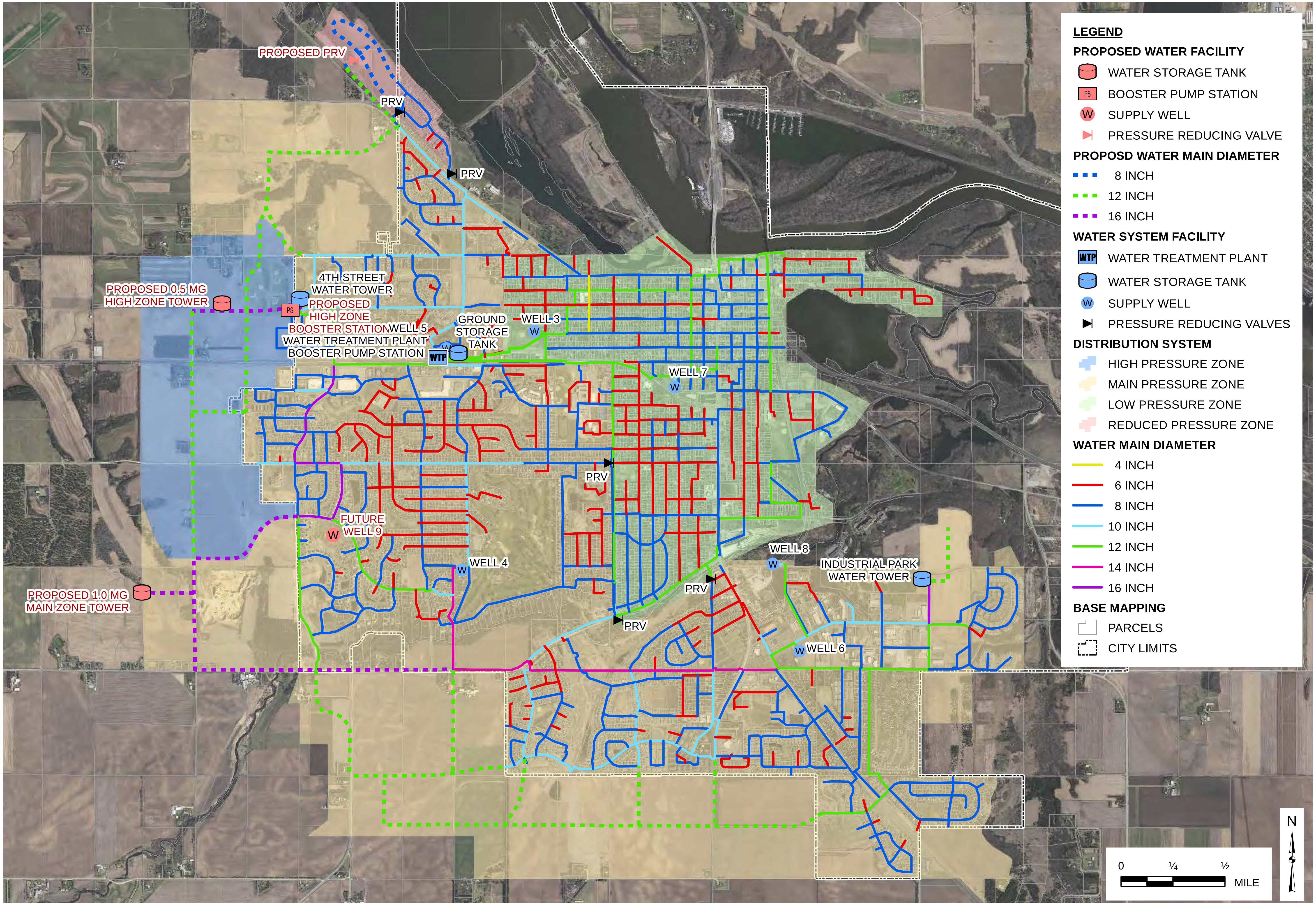

FIGURE 8 - PROPOSED FUTURE TRUNK WATER SYSTEM

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Further analysis is required to review supply and storage requirements for each pressure zone to ensure future water supply is properly located and storage is properly distributed. Table 11 provide a breakdown of supply and storage needs by pressure zone. Future water storage was located for evaluation purposes at high elevation areas near commercial and business growth.

Table 11 – Proposed Future Water Supply and Storage Required by Pressure Zone

Pressure Zone	Future Supply Required	Future Storage Required	Additional Water Facilities
Main Pressure Zone	8.05 MGD	2.4 – 3.1 MG	(2) Supply Wells & 1.0 MG Storage
Low Pressure Zone	2.24 MGD	0.7 – 0.9 MG	NONE
High Pressure Zone	1.21 MGD	0.4 – 0.5 MG	Booster Station & 0.5 MG Storage

5.2.1 Future Proposed High Pressure Zone

The future High Pressure Zone is required to provide sufficient water pressure for future development west of the existing system as illustrated on Figure 8. The existing western edge of the Main Pressure Zone experiences pressures of approximately 35 psi during peak hour demands; therefore, portions of the existing system would benefit from being included in the High Pressure Zone when development allows.

The High Pressure Zone would initially be served by a small booster station and hydropneumatic tank to provide stable pressures, storage, and pump control. The station could be designed to be bypassed for large fire flows to be fed by the Main Pressure Zone. Fire flows at these higher elevations will be less than adjacent locations at a lower elevation. Depending on the rate of growth, type of development, and the water demands; it is recommended that a fire booster station or elevated water storage be constructed. It is recommended the new booster station be constructed near the existing 4th Street water tower and a new 0.5 MG water tower be constructed for the High Pressure Zone.

5.2.2 Future Supply and Storage Timing

To assist with timing of future water supply and storage facilities, a supply and storage evaluation was completed based on the 2040 population of 28,800. Based on the per capita water demand calculations presented previously, the population of 28,800 creates an average day demand of 3.17 MGD and a maximum day demand of 8.24 MGD.

The existing firm water supply capacity of 8.64 MGD is sufficient to supply a population of 28,800. The recommended water storage capacity for a population of 28,800 is 2.5 – 3.17 MG. Therefore, additional water storage is required to serve this 2040 population. Location of the future water storage will depend on where development occurs and the timing of growth for the High Pressure Zone. An evaluation of the future water storage need for the water system as a whole and the Main Pressure Zone was completed. Additional water storage is recommended for the Main Pressure Zone between 2030 and 2035. Trigger charts to determine the timing of additional water storage are included in Appendix B.

5.3 WATER SYSTEM HYDRAULIC EVALUATION

Future improvements are designed with a minimum pressure of 45 psi at all locations in the service area under all normal operating conditions. Water systems are required to be designed and operated to maintain 20 psi residual pressure throughout the water system during emergency operations. Future water system growth was designed to provide adequate pressure and fire flow along trunk water mains. Trunk water mains were evaluated to keep velocities below 5 fps and headlosses below 10 ft per 1,000 ft.

Additional trunk water mains are required to move water from the water supply to future growth. The backbone of the proposed trunk water system is formed by existing large diameter trunk mains and proposed 12 inch and 16 inch water mains to complete the required trunk mains. Two new wells and two new elevated tanks are proposed to meet future storage requirements. A new High Pressure Zone is required to serve higher ground elevations to the west.

5.3.1 Water System Pressure

A hydraulic analysis of the proposed future Hastings water supply and distribution system was conducted using the hydraulic model. The average day water system pressure was calculated with a total system demand of 4.42 MGD. The average day water system pressure is illustrated in Figure 9. The hydraulic model was evaluated with Wells 4, 5, and 7 operating, one pump operating at the Booster Station, and water tank levels 5 ft below overflow. Water pressures throughout the water system remain between 40 and 100 psi for nearly all customers. Water system pressures along the proposed trunk water system are between 50 and 100 psi; consistent with the existing system.

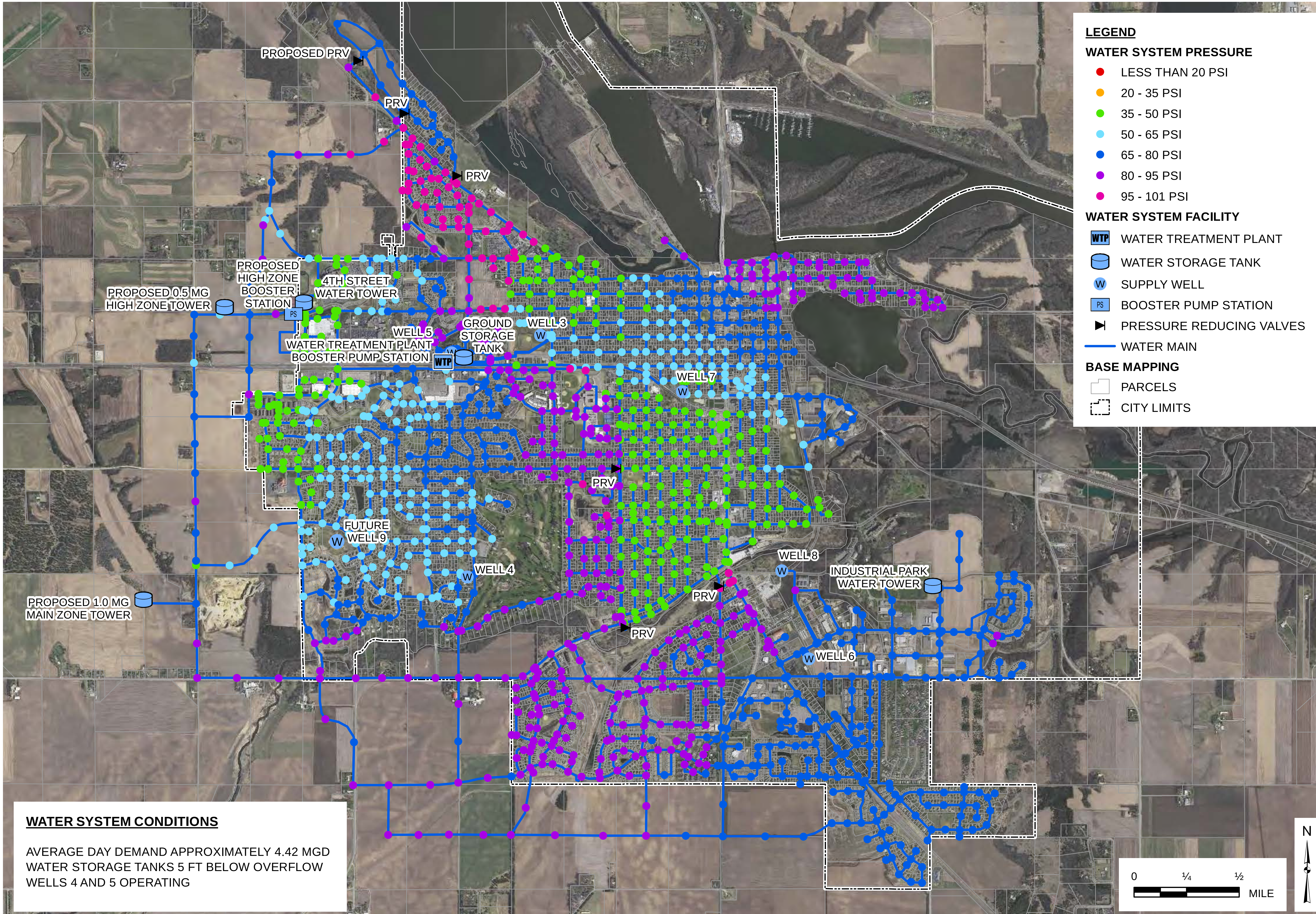
The peak hour water system pressure was calculated with a future demand of 12,800 gpm and the results are illustrated in Figure 10. The hydraulic model was evaluated with all existing wells operating, one pump operating at the existing Booster Station, and water tank levels 10 ft below overflow. During the peak water demands when water pressures are at the lowest, pressures at a few locations, with higher ground elevations, drop to approximately 34 psi. The area of low pressure in the Main Pressure Zone near O'Connell Dr. and Sunset Dr. could be incorporated into the future High Pressure Zone. The surrounding neighborhood west of General Sieben Dr. should be evaluated to determine the best location for the future pressure zone boundary.

5.3.1.1 Pressure Zone Modifications

The *Comprehensive Water System Plan* completed in March 2010 included a recommendation to increase the hydraulic grade of the Low Pressure Zone and modify the location of the pressure zone boundary between the Main and Low Pressure Zones. The recommendations would reduce the number of customers with pressure below 50 psi and above 90 psi. The proposed water system improvements included a new elevated tank in the Low Pressure Zone, conversion of the ground storage tank to water treatment plant clearwell storage, a new booster station, and creation of a new River Pressure Zone for customers at the lowest elevations. This recommendation is still valid; reducing the number of customers with pressure at the edges of the pressure range. However, this recommendation comes at a substantial capital cost and was not further evaluated at this time. Refer to the 2010 report for additional details.

FIGURE 9 - PROPOSED AVERAGE DAY WATER SYSTEM PRESSURE

CITY OF HASTINGS



WATER SYSTEM CONDITIONS

AVERAGE DAY DEMAND APPROXIMATELY 4.42 MGD
WATER STORAGE TANKS 5 FT BELOW OVERFLOW
WELLS 4 AND 5 OPERATING

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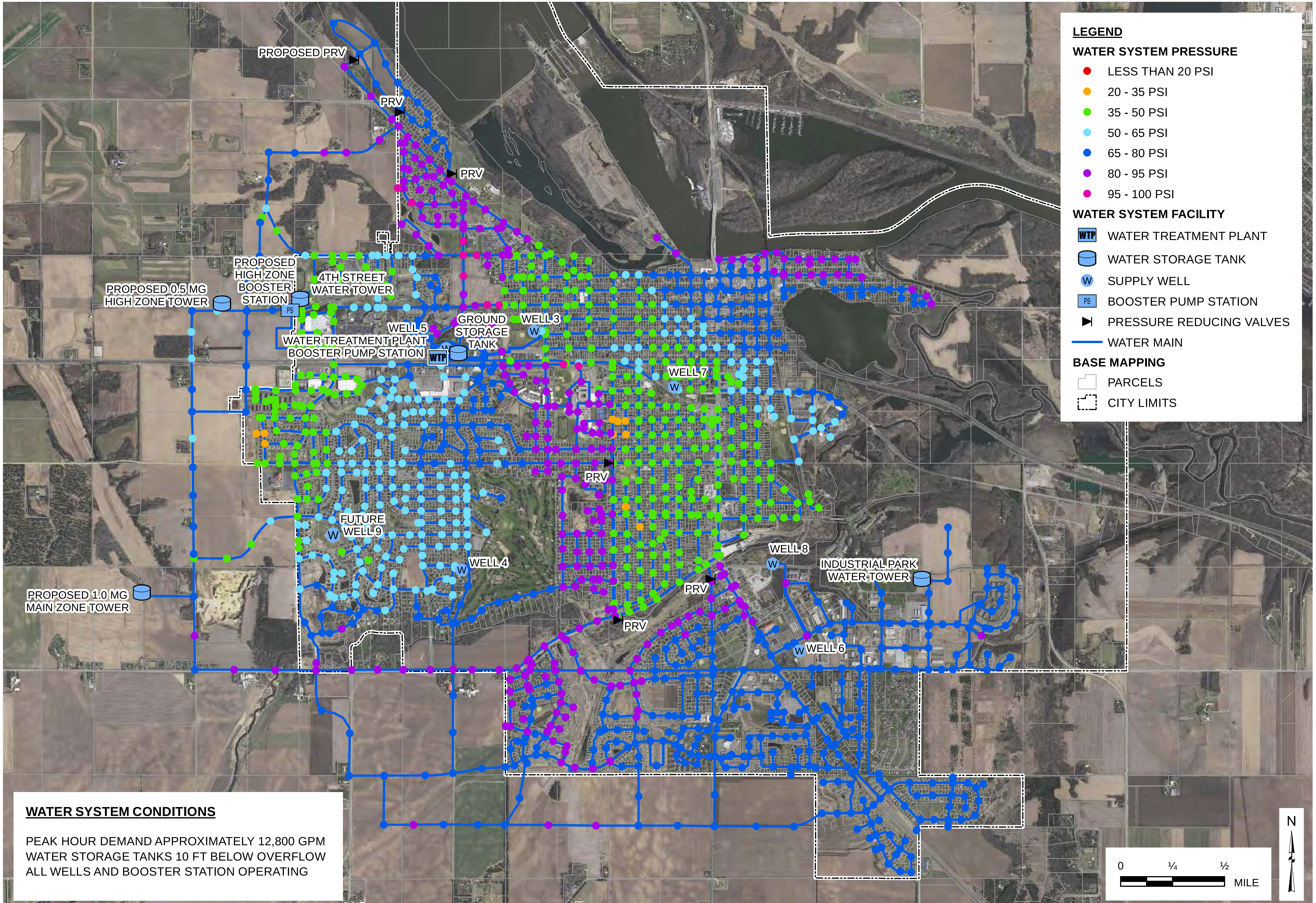

FIGURE 10 - PROPOSED PEAK HOUR WATER SYSTEM PRESSURE

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5.3.2 Water System Fire Flow

The hydraulic model was used to determine the approximate available fire flow while maintaining 20 psi within the distribution system. The approximate future available fire flow results are illustrated in Figure 11. Fire flow evaluations were conducted under future maximum day demand conditions with a design demand of approximately 11.5 MGD. The model operations include all existing wells operating, one pump operating at the existing Booster Station, and water tank levels are 10 ft below overflow.

Fire Flows within the proposed trunk water system range from approximately 2,850 gpm to well over 3,500 gpm. If additional fire flow capacity is required within the existing water system, it is recommended that water main upsizing and looping be included with any future street reconstruction project. One example is the long, dead end water main on Sibley St. and Florence St., which should be looped to provide higher available fire flow. Available fire flows greater than 3,500 gpm are available throughout the majority of large diameter water mains which make up the trunk water system.

5.3.3 Water System Headloss and Velocity

High velocity or headloss in water mains are indicators of potential capacity problems and may contribute to low pressures and reduced fire flows. High velocities and headlosses may also occur during periods of increased flow into and out of the water towers. No water mains in the distribution system were identified to have velocities greater than 5 fps or 10 ft per 1,000 ft headlosses during all existing demand conditions. However, one 10 inch pipe section has velocity approaching 5 fps. The existing 16 inch water main from the 4^{th} Street water tower should be extended to the existing 12 inch water main, replacing the short section of 10 inch water main on 4^{th} Street W.

5.3.4 Water System Replacement and Rehabilitation

As water systems age, it is important that a proactive water main replacement/rehabilitation program is implemented. Many water utilities plan to replace a small percentage of the water system each year. Hastings has been replacing aging infrastructure as street reconstruction projects occur. Review and inspection of old, critical water mains may identify water mains in need of replacement; preventing major failures or untimely breaks.

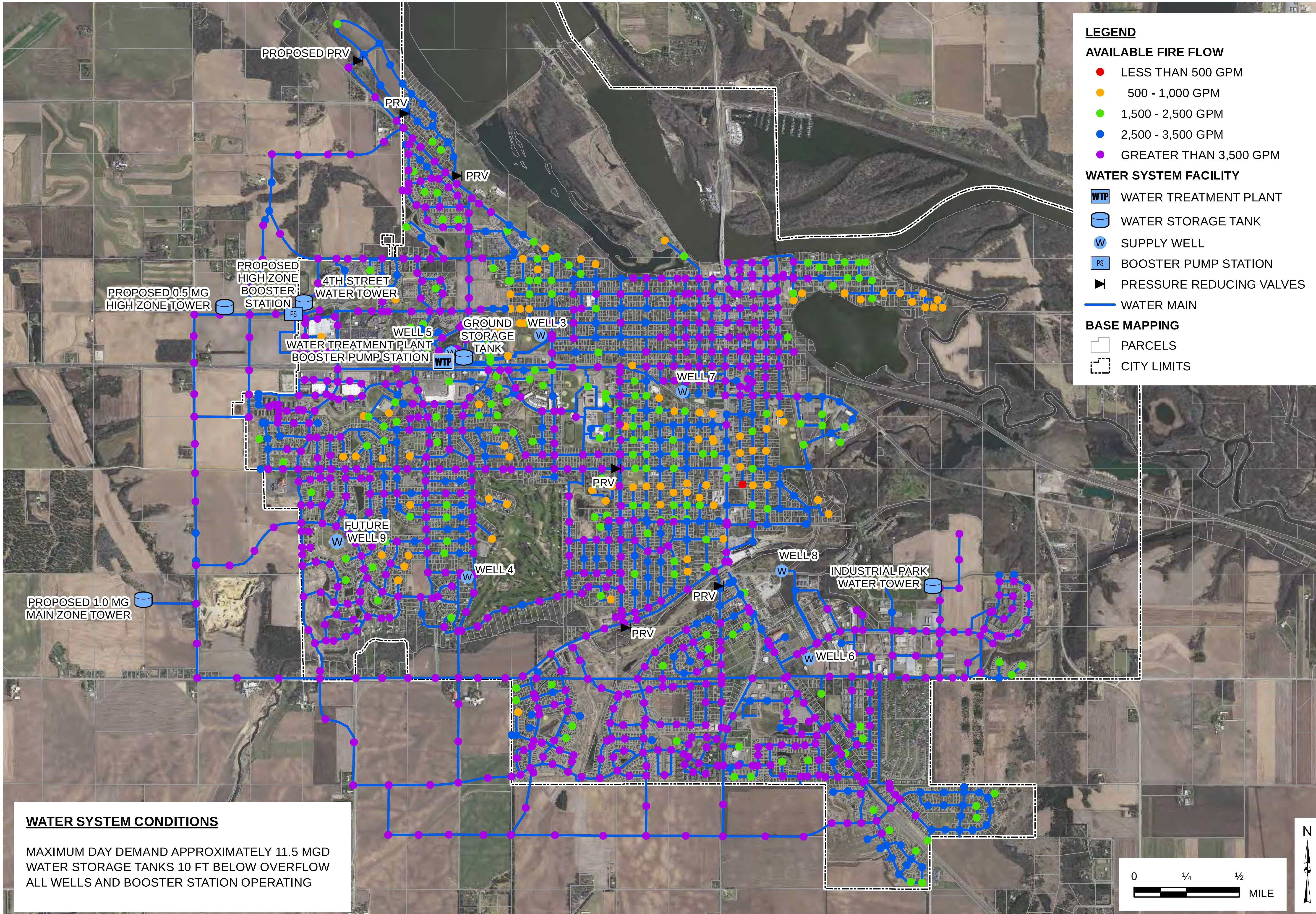

FIGURE 11 - PROPOSED MAXIMUM DAY FIRE FLOW AVAILABILITY

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5.4 PROPOSED FUTURE WATER SYSTEM EVALUATION SUMMARY

Supply and storage requirements are provided in Tables 10 and 11. Additional water supply capacity is required to meet future maximum day water demands of 11.5 MGD. To meet the future water supply, two new water supply wells are recommended to be constructed. The future water storage need is 3.45 – 4.42 MG. Therefore, additional water storage is required; two new elevated tanks are recommended. A 1.0 MG tower should be constructed in the Main Pressure Zone and a 0.5 MG tower for the new High Pressure Zone. Based on population growth projections, the existing supply capacity will be adequate for the 28,800 population, but additional water storage is required. The proposed future trunk distribution system is illustrated in Figure 8.

A hydraulic analysis of the proposed future Hastings water supply and distribution system was conducted using the hydraulic model. Throughout nearly the entire water system pressures continue to range from 40 to 100 psi during average day demand conditions. Under peak hour demand conditions, a small area of higher elevations will have pressure at 34 – 35 psi. No water mains in the distribution system were identified to have velocities greater than 5 fps or 10 ft per 1,000 ft headlosses during all demand conditions. However, one pipe section has velocity approaching 5 fps. The existing 16 inch water main from the 4th Street water tower should be extended to the 12 inch pipe, replacing a small section of 10 inch pipe on 4th Street W.

Fire Flows within the water system range from approximately 450 gpm to well over 3,500 gpm. The lowest available fire flows exist on dead end and small diameter water mains. The City will continue to loop dead end water mains and replace old, small diameter water mains where higher fire flows are required to improve available fire flow. One example is the long, dead end water main on Sibley St. and Florence St., which once looped will have higher available fire flow. Available fire flows greater than 3,500 gpm are available at nearly all locations throughout the proposed trunk water system. Fire flow availability should be reviewed with Fire Officials based on occupancy use and building construction.

Appendix A WATER SUPPLY PLAN

Since 1857
Hastings
MINNESOTA

City of Hastings
Local Water Supply Plan

Formerly called Water Emergency & Water Conservation Plan

MNDNR

TABLE OF CONTENTS

Complete Table 1 with information about the public water supply system covered by this WSP.

Table 1. General information regarding this WSP

Requested Information	Description
DNR Water Appropriation Permit Number(s)	**1975-6194**
Ownership	☒ Public or ☐ Private
Metropolitan Council Area	☒ Yes or ☐ No (and county name)
Street Address	**1225 Progress Drive**
City, State, Zip	**Hastings, MN 55033**
Contact Person Name	Nick Egger
Title	Public Works Director
Phone Number	651-480-6185
MDH Supplier Classification	Municipal

PART 1. WATER SUPPLY SYSTEM DESCRIPTION AND EVALUATION

The first step in any water supply analysis is to assess the current status of demand and availability. Information summarized in Part 1 can be used to develop Emergency Preparedness Procedures (Part 2) and the Water Conservation Plan (Part 3). This data is also needed to track progress for water efficiency measures.

A. Analysis of Water Demand

Complete Table 2 showing the past 10 years of water demand data.

- Some of this information may be in your Wellhead Protection Plan.
- If you do not have this information, do your best, call your engineer for assistance or if necessary leave blank.

If your customer categories are different than the ones listed in Table 2, please describe the differences below:

Note: The City of Hastings does not have separate lawn irrigation meters for most properties. In the Water Used for Non-Essential column, we took the difference between January's pumpage vs May, June, July, August, September for each year (per instructions from Carmelita Nelson of MnDNR).

City of Hastings

Local Water Supply Plan 2016

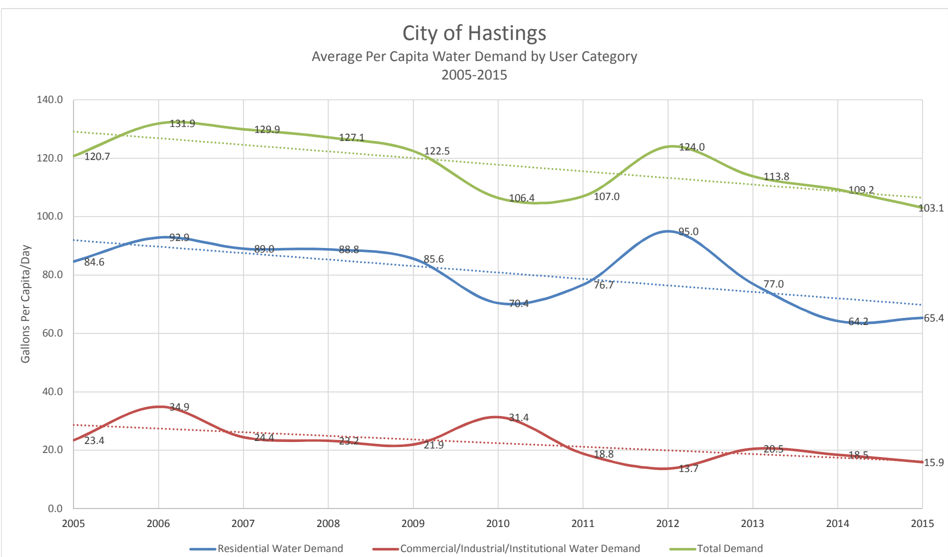
Table 2 Historic Water Demand

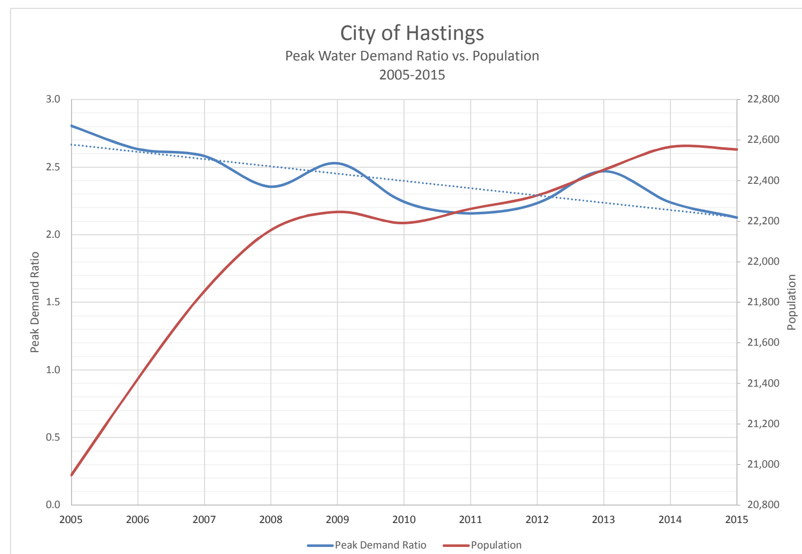
Year	Pop. Served *	Population Growth Percentage Over Prior Year	Total Connections	Residential Water Delivered (MG)	C/I/I Water Delivered (MG)	Water used for Non-essential (MG)	Wholesale Deliveries (MG)	Total Water Delivered (MG)	Total Water Pumped (MG)	Water Supplier Services	Percent Unmetered/ Unaccounted	Average Daily Demand (MGD)	Max. Daily Demand (MGD)	Peak Ratio	Date of Max. Demand	Residential Per Capita Demand (GPCD)	C/I/I Water Demand (GPCD)	Non-Essential Water (GPCD)	Total per capita Demand (GPCD)
2005	20,948	2.79%	7,241	647	179	229	0	888	923	61	3.8%	2.53	7.10	2.81	7/16/2005	84.6	23.4	30.0	120.7
2006	21,422	2.26%	7,395	726	273	335	0	1,023	1,031	23	0.8%	2.83	7.44	2.63	7/10/2006	92.9	34.9	42.8	131.9
2007	21,855	2.02%	7,419	710	195	231	0	980	1,036	30	5.4%	2.84	7.33	2.58	8/3/2007	89.0	24.4	29.0	129.9
2008	22,156	1.38%	7,437	718	188	324	0	918	1,029	12	10.8%	2.82	6.64	2.36	7/2/2008	88.8	23.2	40.1	127.1
2009	22,246	0.41%	7,421	695	178	293	0	873	995	16	12.3%	2.73	6.89	2.53	7/20/2009	85.6	21.9	36.1	122.5
2010	22,191	-0.25%	7,427	570	254	194	0	793	862	12	7.9%	2.36	5.30	2.24	8/30/2010	70.4	31.4	24.0	106.4
2011	22,261	0.32%	7,458	623	153	224	0	793	869	18	8.8%	2.38	5.14	2.16	7/9/2011	76.7	18.8	27.6	107.0
2012	22,327	0.30%	7,490	774	112	342	0	887	997	24	8.8%	2.77	6.18	2.23	7/10/2012	95.0	13.7	42.0	124.0
2013	22,453	0.56%	7,533	631	168	248	0	799	932	20	14.3%	2.55	6.31	2.47	8/3/2013	77.0	20.5	30.3	113.8
2014	22,566	0.50%	7,587	529	152	203	0	700	900	18	22.0%	2.47	5.52	2.24	8/14/2014	64.2	18.5	24.6	109.2
2015	22,554	-0.05%	7,615	538	131	155	0	685	848	16	19.0%	2.32	4.95	2.13	8/5/2015	65.4	15.9	18.8	103.1

Population Figures from US Census Data Estimates

Averages																			
2005-2009	21,725	1.24%	7,383	699	203	282	0	936	1,003	28	6.6%	2.75	7.08	2.58		88.2	25.6	35.6	126.4
2010-2015	22,392	0.33%	7,518	611	162	228	0	776	901	18	13.5%	2.48	5.57	2.25		74.8	19.8	27.9	110.6
2005-2014	22,043	0.77%	7,441	662	185	262	0	865	957	23	9.5%	2.63	6.38	2.42		82.4	23.1	32.6	119.3
2005-2015	22,089	0.70%	7,457	651	180	253	0	849	947	23	10.3%	2.60	6.25	2.40		80.9	22.4	31.4	117.8

MG = Million Gallons **MGD** = Million Gallons/Day **GPCD** = Gallons per Capita/Day





Complete Table 3 by listing the top 10 water users by volume, from largest to smallest. For each user, include information about the category of use (residential, commercial, industrial, institutional, or wholesale), the amount of water used in gallons per year, the percent of total water delivered, and the status of water conservation measures.

Table 3. Large volume users

Customer	Use Category (Residential, Industrial, Commercial, Institutional, Wholesale)	Amount Used (Gallons per Year)	Percent of Total Annual Water Delivered	Implementing Water Conservation Measures? (Yes/No/Unknown)
1. REGINA MEDICAL COMPLEX	PUBLIC	14,620,000	2.13%	UNKNOWN
2. THREE RIVERS MOBILE HOME PARK	RESIDENTIAL	14,193,000	2.07%	UNKNOWN
3. HASTINGS COOP CREAMERY	COMMERCIAL	10,845,000	1.58%	UNKNOWN
4. DAKOTA COUNTY JAIL	INSTITUTIONAL	7,356,000	1.07%	UNKNOWN
5. MET COUNCIL ENVIRONMENTAL SERVICES	INDUSTRIAL	6,922,000	1.01%	UNKNOWN
6. CEMSTONE PRODUCTS	COMMERCIAL	4,576,000	.67%	UNKNOWN
7. CAPREIT RESIDENTIAL MGMT	RESIDENTIAL	3,656,000	.53%	UNKNOWN
8. CLUBS OF SOUTH PINES	RESIDENTIAL	2,166,000	.32%	UNKNOWN
9. VALLEY MANOR APARTMENTS	RESIDENTIAL	2,110,000	.31%	UNKNOWN
10. PARK RIDGE APARTMENTS	RESIDENTIAL	2,095,000	.31%	UNKNOWN

B. Treatment and Storage Capacity

Complete Table 4 with a description of where water is treated, the year treatment facilities were constructed, water treatment capacity, the treatment methods (i.e. chemical addition, reverse osmosis, coagulation, sedimentation, etc.) and treatment types used (i.e. fluoridation, softening, chlorination, Fe/MN removal, coagulation, etc.). Also describe the annual amount and method of disposal of treatment residuals. Add rows to the table as needed.

Table 4. Water treatment capacity and treatment processes

Treatment Site ID (Plant Name or Well ID)	Year Constructed	Treatment Capacity (GPD)	Treatment Method	Treatment Type	Annual Amount of Residuals	Disposal Process for Residuals	Do You Reclaim Filter Backwash Water?
Treatment Plant #1	2006	2,300,000	Ion Exchange	Nitrates	NA	NA	No
Total	NA	2,300,000	NA	NA	NA	NA	No

Complete Table 5 with information about storage structures. Describe the type (i.e. elevated, ground, etc.), the storage capacity of each type of structure, the year each structure was constructed, and the primary material for each structure. Add rows to the table as needed.

Table 5. Storage capacity, as of the end of the last calendar year

Structure Name	Type of Storage Structure	Year Constructed	Primary Material	Storage Capacity (Gallons)
1 West 4th Street	Elevated storage	1985	Steel	750,000
2 Industrial Park	Elevated storage	1997	Steel	1,000,000
3 Ground Storage	Ground storage	1998	Steel	1,000,000
Total	NA	NA	NA	2,750,000

Treatment and storage capacity versus demand

It is recommended that total storage equal or exceed the average daily demand.

Discuss the difference between current storage and treatment capacity versus the water supplier's projected average water demand over the next 10 years (see Table 7 for projected water demand):

With average daily demand falling slowly but steadily, plans for added storage on the City's system have been pushed back in anticipation that this trend will continue. Average daily demand for 2010-2015 was approximately 2.48MGD, leaving more than 250,000 in excess storage capacity. The City currently forecasts constructing its next storage facility in the mid to late 2020's, depending on continual review of usage vs. existing capacity.

C. Water Sources

Complete Table 6 by listing all types of water sources that supply water to the system, including groundwater, surface water, interconnections with other water suppliers, or others. Provide the name of each source (aquifer name, river or lake name, name of interconnecting water supplier) and the Minnesota unique well number or intake ID, as appropriate. Report the year the source was installed or established and the current capacity. Provide information about the depth of all wells. Describe the status of the source (active, inactive, emergency only, retail/wholesale interconnection) and if the source facilities have a dedicated emergency power source. Add rows to the table as needed for each installation.

Include copies of well records and maintenance summary for each well that has occurred since your last approved plan in **Appendix 1.**

Table 6. Water sources and status

Resource Type (Groundwater, Surface water, Interconnection)	Resource Name	MN Unique Well # or Intake ID	Year Installed	Capacity (Gallons per Minute)	Well Depth (Feet)	Status of Normal and Emergency Operations (active, inactive, emergency only, retail/wholesale interconnection))	Does this Source have a Dedicated Emergency Power Source? (Yes or No)
Groundwater	Well #3	206333	1956	1200	290	Active	Yes
Groundwater	Well #4	207993	1961	1200	497	Active	No
Groundwater	Well #5	207639	1970	1200	355	Active	Yes
Groundwater	Well #6	207643	1972	1200	330	Active	Yes
Groundwater	Well #7	509053	1989	1200	285	Active	no
Groundwater	Well #8	686266	2006	1200	280	Active	Yes

Limits on Emergency Interconnections

Discuss any limitations on the use of the water sources (e.g. not to be operated simultaneously, limitations due to blending, aquifer recovery issues etc.) and the use of interconnections, including capacity limits or timing constraints (i.e. only 200 gallons per minute are available from the City of Prior Lake, and it is estimated to take 6 hours to establish the emergency connection). If there are no limitations, list none.

None. Surrounded by townships without municipal water supplies, the City of Hastings does not have any emergency interconnections.

D. Future Demand Projections – *Key Metropolitan Council Benchmark*

Water Use Trends

Use the data in Table 2 to describe trends in 1) population served; 2) total per capita water demand; 3) average daily demand; 4) maximum daily demand. Then explain the causes for upward or downward trends. For example, over the ten years has the average daily demand trended up or down? Why is this occurring?

The City has not yet begun its Comprehensive Planning process for 2040. Absent a new and thorough analysis on land use and population growth for that period, for the purposes of this document the City must make preliminary projections on water usage for the years 2017-2025 based on recent trendlines and suppositions of the City's growth rate during the next period. Per the 2010 Comprehensive plan, figures of 125 total gpcd average use and 319 total gpcd peak use were used to make estimates for 2030 projected demand. However, population growth is about 0.5% annually (from approximately 21,450 to 22,560) since 2006, and water demand is on a slowly declining trajectory. Each customer category trend, as well as that of non-essential water, has been in slow decline. In our view, the decline is attributable to enhanced social consciousness for water conservation, changes in plumbing codes requiring low-flow fixtures and rain sensors on irrigation systems, the City's escalator rate for summer water usage, and investments by business facilities in more efficient uses of water.

Use the water use trend information discussed above to complete Table 7 with projected annual demand for the next ten years. Communities in the seven-county Twin Cities metropolitan area must also include projections for 2030 and 2040 as part of their local comprehensive planning.

Projected demand should be consistent with trends evident in the historical data in Table 2, as discussed above. Projected demand should also reflect state demographer population projections and/or other planning projections.

Table 7. Projected annual water demand

Year	Projected Total Population	Projected Population Served	Projected Total Per Capita Water Demand (GPCD)	Projected Average Daily Demand (MGD)	Projected Maximum Daily Demand (MGD)
2017	22770	22720	110	2.50	6.12
2018	22940	22890	110	2.52	6.17
2019	23112	23062	110	2.54	6.22
2020	23286	23236	110	2.56	6.26
2021	23460	23410	110	2.58	6.31
2022	23636	23586	110	2.59	6.36
2023	23814	23764	110	2.61	6.40
2024	23992	23942	110	2.63	6.45
2025	24172	24122	110	2.65	6.50
2030	26000	26000	110	2.86	7.01
2040	28000	28000	110	3.08	7.55

GPCD – Gallons per Capita per Day **MGD** – Million Gallons per Day

Projection Method

Describe the method used to project water demand, including assumptions for population and business growth and how water conservation and efficiency programs affect projected water demand:

Given the trends over the last 10 years, an assumed average population growth rate of 0.75%, average consumption rate of 110gpcd, and peak consumption of 285gpcd were used as conservative but realistic estimates to complete Table 7. The peak factor used is approximately 2.45.

E. Resource Sustainability

Monitoring – *Key DNR Benchmark*

Complete Table 8 by inserting information about source water quality and quantity monitoring efforts. List should include all production wells, observation wells, and source water intakes or reservoirs. Add rows to the table as needed. Find information on groundwater level monitoring program at: http://www.dnr.state.mn.us/waters/groundwater_section/obwell/index.html

Table 8. Information about source water quality and quantity monitoring

MN Unique Well # or Surface Water ID	Type of monitoring point	Monitoring program	Frequency of monitoring	Monitoring Method
206333 Hastings Well No. 3	☒ production well ☐ observation well ☐ source water intake ☐ source water reservoir	☒ routine MDH sampling ☒ routine water utility sampling ☐ other	☐ continuous ☐ hourly ☒ daily ☒ monthly ☐ quarterly ☐ annually	☒ SCADA ☒ grab sampling ☐ steel tape ☐ stream gauge
207993 Hastings Well No. 4	☒ production well ☐ observation well ☐ source water intake ☐ source water reservoir	☒ routine MDH sampling ☒ routine water utility sampling ☐ other	☐ continuous ☐ hourly ☒ daily ☒ monthly ☐ quarterly ☐ annually	☒ SCADA ☒ grab sampling ☐ steel tape ☐ stream gauge
207639 Hastings Well No. 5	☒ production well ☐ observation well ☐ source water intake ☐ source water reservoir	☒ routine MDH sampling ☒ routine water utility sampling ☐ other	☐ continuous ☐ hourly ☒ daily ☒ monthly ☐ quarterly ☐ annually	☒ SCADA ☒ grab sampling ☐ steel tape ☐ stream gauge
207643 Hastings Well No. 6	☒ production well ☐ observation well ☐ source water intake ☐ source water reservoir	☒ routine MDH sampling ☒ routine water utility sampling ☐ other	☐ continuous ☐ hourly ☒ daily ☒ monthly ☐ quarterly ☐ annually	☒ SCADA ☒ grab sampling ☐ steel tape ☐ stream gauge
509053 Hastings Well No. 7	☒ production well ☐ observation well ☐ source water intake ☐ source water reservoir	☒ routine MDH sampling ☒ routine water utility sampling ☐ other	☐ continuous ☐ hourly ☒ daily ☒ monthly ☐ quarterly ☐ annually	☒ SCADA ☒ grab sampling ☐ steel tape ☐ stream gauge
686266 Hastings Well No. 8	☒ production well ☐ observation well ☐ source water intake ☐ source water reservoir	☒ routine MDH sampling ☒ routine water utility sampling ☐ other	☐ continuous ☐ hourly ☒ daily ☐ monthly ☐ quarterly ☒ annually	☒ SCADA ☒ grab sampling ☐ steel tape ☐ stream gauge
Wallin Park	☐ production well ☒ observation well	☐ routine MDH sampling	☐ continuous ☐ hourly ☐ daily	☐ SCADA ☐ grab sampling ☒ steel tape

MN Unique Well # or Surface Water ID	Type of monitoring point	Monitoring program	Frequency of monitoring	Monitoring Method
	☒ source water intake ☐ source water reservoir	☐ routine water utility sampling ☐ other	☐ monthly ☐ quarterly ☒ annually	☐ stream gauge

Water Level Data

A water level monitoring plan that includes monitoring locations and a schedule for water level readings must be submitted as **Appendix 2**. If one does not already exist, it needs to be prepared and submitted with the WSP. Ideally, all production and observation wells are monitored at least monthly.

Complete Table 9 to summarize water level data for each well being monitored. Provide the name of the aquifer and a brief description of how much water levels vary over the season (the difference between the highest and lowest water levels measured during the year) and the long-term trends for each well. If water levels are not measured and recorded on a routine basis, then provide the static water level when each well was constructed and the most recent water level measured during the same season the well was constructed. Also include all water level data taken during any well and pump maintenance. Add rows to the table as needed.

Provide water level data graphs for each well in **Appendix 3** for the life of the well, or for as many years as water levels have been measured. See DNR website for Date Time Water Level http://www.dnr.state.mn.us/groundwater/hydrographs.html

Table 9. Water level data

Unique Well Number or Well ID	Aquifer Name	Seasonal Variation (Feet)	Long-term Trend in water level data	Water level measured during well/pumping maintenance
206333 Hastings Well No. 3	Jordan		☐ Falling ☒ Stable ☐ Rising	4/8/2016: 69.2 MM/DD/YY:____ MM/DD/YY:____
207993 Hastings Well No. 4	Jordan		☐ Falling ☒ Stable ☐ Rising	2/18/2016: 134.1 MM/DD/YY:____ MM/DD/YY:____
207639 Hastings Well No. 5	Jordan		☐ Falling ☒ Stable ☐ Rising	MM/DD/YY:____ MM/DD/YY:____ MM/DD/YY:____
207643 Hastings Well No. 6	Jordan		☐ Falling ☒ Stable ☐ Rising	10/19/2014:117.1 MM/DD/YY:____ MM/DD/YY:____
509053 Hastings Well No. 7	Jordan		☐ Falling ☒ Stable ☐ Rising	MM/DD/YY:____ MM/DD/YY:____ MM/DD/YY:____
686266 Hastings Well No. 8	Jordan		☐ Falling ☒ Stable ☐ Rising	MM/DD/YY:____ MM/DD/YY:____ MM/DD/YY:____

Potential Water Supply Issues & Natural Resource Impacts – *Key DNR & Metropolitan Council Benchmark*

Complete Table 10 by listing the types of natural resources that are or could be impacted by permitted water withdrawals. If known, provide the name of specific resources that may be impacted. Identify what the greatest risks to the resource are and how the risks are being assessed. Identify any resource protection thresholds – formal or informal – that have been established to identify when actions should be taken to mitigate impacts. Provide information about the potential mitigation actions that may be taken, if a resource protection threshold is crossed. Add additional rows to the table as needed. See glossary at the end of the template for definitions.

Some of this baseline data should have been in your earlier water supply plans or county comprehensive water plans. When filling out this table, think of what are the water supply risks, identify the resources, determine the threshold and then determine what your community will do to mitigate the impacts.

Your DNR area hydrologist is available to assist with this table.

For communities in the seven-county Twin Cities metropolitan area, the *Master Water Supply Plan Appendix 1 (Water Supply Profiles*, provides information about potential water supply issues and natural resource impacts for your community.

Table 10. Natural resource impacts

Resource Type	Resource Name	Risk	Risk Assessed Through	Describe Resource Protection Threshold*	Mitigation Measure or Management Plan	Describe How Changes to Thresholds are Monitored
☐ River or stream		☐ Flow/water level decline ☐ Degrading water quality trends and/or MCLs exceeded ☐ Impacts on endangered, threatened, or special concern species habitat or other natural resource impacts ☐ Other: _____	☐ GIS analysis ☐ Modeling ☐ Mapping ☐ Monitoring ☐ Aquifer testing ☐ Other: ___		☐ Revise permit ☐ Change groundwater pumping ☐ Increase conservation ☐ Other	
☐ Calcareous fen		☐ Flow/water level decline ☐ Degrading water quality trends and/or MCLs exceeded ☐ Impacts on endangered,	☐ GIS analysis ☐ Modeling ☐ Mapping ☐ Monitoring ☐ Aquifer testing ☐ Other: ___		☐ Revise permit ☐ Change groundwater pumping ☐ Increase conservation ☐ Other	

Resource Type	Resource Name	Risk	Risk Assessed Through	Describe Resource Protection Threshold*	Mitigation Measure or Management Plan	Describe How Changes to Thresholds are Monitored
		threatened, or special concern species habitat or other natural resource impacts ☐ Other: ______				
☐ Lake		☐ Flow/water level decline ☐ Degrading water quality trends and/or MCLs exceeded ☐ Impacts on endangered, threatened, or special concern species habitat or other natural resource impacts ☐ Other: ______	☐ GIS analysis ☐ Modeling ☐ Mapping ☐ Monitoring ☐ Aquifer testing ☐ Other: ___		☐ Revise permit ☐ Change groundwater pumping ☐ Increase conservation ☐ Other	
☐ Wetland		☐ Flow/water level decline ☐ Degrading water quality trends and/or MCLs exceeded ☐ Impacts on endangered, threatened, or special concern species habitat or other natural resource impacts ☐ Other: ______	☐ GIS analysis ☐ Modeling ☐ Mapping ☐ Monitoring ☐ Aquifer testing ☐ Other: ___		☐ Revise permit ☐ Change groundwater pumping ☐ Increase conservation ☐ Other	
☐ Trout stream		☐ Flow/water level decline ☐ Degrading water quality trends and/or MCLs exceeded ☐ Impacts on endangered, threatened, or special concern species habitat	☐ GIS analysis ☐ Modeling ☐ Mapping ☐ Monitoring ☐ Aquifer testing ☐ Other: ___		☐ Revise permit ☐ Change groundwater pumping ☐ Increase conservation ☐ Other	

Resource Type	Resource Name	Risk	Risk Assessed Through	Describe Resource Protection Threshold*	Mitigation Measure or Management Plan	Describe How Changes to Thresholds are Monitored
		or other natural resource impacts ☐ Other: _____				
☒ Aquifer		☐ Flow/water level decline ☒ Degrading water quality trends and/or MCLs exceeded ☐ Impacts on endangered, threatened, or special concern species habitat or other natural resource impacts ☐ Other: _____	☐ GIS analysis ☐ Modeling ☐ Mapping ☐ Monitoring ☒ Aquifer testing ☐ Other: ___		☐ Revise permit ☐ Change groundwater pumping ☐ Increase conservation ☒ Other	
☐ Endangered, threatened, or special concern species habitat, other natural resource impacts		☐ Flow/water level decline ☐ Degrading water quality trends and/or MCLs exceeded ☐ Impacts on endangered, threatened, or special concern species habitat or other natural resource impacts ☐ Other: _____	☐ GIS analysis ☐ Modeling ☐ Mapping ☐ Monitoring ☐ Aquifer testing ☐ Other: ___		☐ Revise permit ☐ Change groundwater pumping ☐ Increase conservation ☐ Other	

* Examples of thresholds: a lower limit on acceptable flow in a river or stream; water quality outside of an accepted range; a lower limit on acceptable aquifer level decline at one or more monitoring wells; withdrawals that exceed some percent of the total amount available from a source; or a lower limit on acceptable changes to a protected habitat.

Wellhead Protection (WHP) and Surface Water Protection (SWP) Plans

Complete Table 11 to provide status information about WHP and SWP plans.

The emergency procedures in this plan are intended to comply with the contingency plan provisions required in the Minnesota Department of Health's (MDH) Wellhead Protection (WHP) Plan and Surface Water Protection (SWP) Plan.

Table 11. Status of Wellhead Protection and Surface Water Protection Plans

Plan Type	Status	Date Adopted	Date for Update
WHP	☐ In Process ☒ Completed ☐ Not Applicable	WHP Part I Adopted 2003 WHP Part II Adopted 2007 and amended in 2011	Anticipated update due in 2020.
SWP	☐ In Process ☒ Completed ☐ Not Applicable	Incorporated within WHP plan document, with periodic updates.	See above.

F. Capital Improvement Plan (CIP)

Please note that any wells that received approval under a ten-year permit, but that were not built, are now expired and must submit a water appropriations permit.

Adequacy of Water Supply System

Complete Table 12 with information about the adequacy of wells and/or intakes, storage facilities, treatment facilities, and distribution systems to sustain current and projected demands. List planned capital improvements for any system components, in chronological order. Communities in the seven-county Twin Cities metropolitan area should also include information about plans through 2040.

The assessment can be the general status by category; it is not necessary to identify every single well, storage facility, treatment facility, lift station, and mile of pipe.

Please attach your latest Capital Improvement Plan as **Appendix 4**.

Table 12. Adequacy of Water Supply System

System Component	Planned action	Anticipated Construction Year	Notes
Wells/Intakes	☐ No action planned - adequate ☐ Repair/replacement ☒ Expansion/addition	2025 or later	As demand increases FIRM capacity needs.
Water Storage Facilities	☐ No action planned - adequate ☒ Repair/replacement ☒ Expansion/addition	2019 & 2021 2020-2025 or later	Repaint elevated water towers Construct new tower
Water Treatment Facilities	☒ No action planned - adequate ☐ Repair/replacement ☐ Expansion/addition		

System Component	Planned action	Anticipated Construction Year	Notes
Distribution Systems (pipes, valves, etc.)	☐ No action planned - adequate ☒ Repair/replacement ☒ Expansion/addition	Continuous	Replacing oldest parts of system in conjunction with street reconstruction projects. Expansions via development.
Pressure Zones	☐ No action planned - adequate ☐ Repair/replacement ☒ Expansion/addition	2025 or later	Upon construction of next storage facility
Other: Treatment Plant No. 2	☐ No action planned - adequate ☐ Repair/replacement ☒ Expansion/addition	Tentative	Only if necessary if Nitrate levels escalate to MCL on Wells 6 & 8.

Proposed Future Water Sources

Complete Table 13 to identify new water source installation planned over the next ten years. Add rows to the table as needed.

Table 13. Proposed future installations/sources

Source	Installation Location (approximate)	Resource Name	Proposed Pumping Capacity (gpm)	Planned Installation Year	Planned Partnerships
Groundwater	Wallin Park	Aquifer	1500	2025 or later	N/A
Surface Water					
Interconnection to another supplier					

Water Source Alternatives - *Key Metropolitan Council Benchmark*

Do you anticipate the need for alternative water sources in the next 10 years? Yes ☐ No ☒

For metro communities, will you need alternative water sources by the year 2040? Yes ☐ No ☒

If you answered yes for either question, then complete table 14. If no, insert NA.

Complete Table 14 by checking the box next to alternative approaches that your community is considering, including approximate locations (if known), the estimated amount of future demand that could be met through the approach, the estimated timeframe to implement the approach, potential partnerships, and the major benefits and challenges of the approach. Add rows to the table as needed.

For communities in the seven-county Twin Cities metropolitan area, these alternatives should include approaches the community is considering to meet projected 2040 water demand.

Table 14. Alternative water sources

Alternative Source Considered	Source and/or Installation Location (approximate)	Estimated Amount of Future Demand (%)	Timeframe to Implement (YYYY)	Potential Partners	Benefits	Challenges
☐ Groundwater	NA					
☐ Surface Water	NA					
☐ Reclaimed stormwater	NA					
☐ Reclaimed wastewater	NA					
☐ Interconnection to another supplier	NA					

Part 2. Emergency Preparedness Procedures

The emergency preparedness procedures outlined in this plan are intended to comply with the contingency plan provisions required by MDH in the WHP and SWP. Water emergencies can occur as a result of vandalism, sabotage, accidental contamination, mechanical problems, power failings, drought, flooding, and other natural disasters. The purpose of emergency planning is to develop emergency response procedures and to identify actions needed to improve emergency preparedness. In the case of a municipality, these procedures should be in support of, and part of, an all-hazard emergency operations plan. Municipalities that already have written procedures dealing with water emergencies should review the following information and update existing procedures to address these water supply protection measures.

A. Federal Emergency Response Plan

Section 1433(b) of the Safe Drinking Water Act, (Public Law 107-188, Title IV- Drinking Water Security and Safety) requires community water suppliers serving over 3,300 people to prepare an Emergency Response Plan.

Do you have a federal emergency response plan? Yes ☐ No ☒

If yes, what was the date it was certified? *The City*'s *Vulnerability Assessment in 2003 Wellhead Protection Plan satisfied the ERP requirement.*

Complete Table 15 by inserting the noted information regarding your completed Federal Emergency Response Plan.

Table 15. Emergency Preparedness Plan contact information

Emergency Response Plan Role	Contact Person	Contact Phone Number	Contact Email
Emergency Response Lead	MARK PEINE	(651) 248-3108	MPEINE@HASTINGSMN.GOV
Alternate Emergency Response Lead	ERIC KRAMER	(651) 295-7893	EKRAMER@HASTINGSMN.GOV

B. Operational Contingency Plan

All utilities should have a written operational contingency plan that describes measures to be taken for water supply mainline breaks and other common system failures as well as routine maintenance.

Do you have a written operational contingency plan? Yes ☐ No ☒

At a minimum, a water supplier should prepare and maintain an emergency contact list of contractors and suppliers. ***(See attached emergency contacts list in appendices).***

C. Emergency Response Procedures

Water suppliers must meet the requirements of MN Rules 4720.5280 . Accordingly, the Minnesota Department of Natural Resources (DNR) requires public water suppliers serving more than 1,000 people to submit Emergency and Conservation Plans. Water emergency and conservation plans that have been approved by the DNR, under provisions of Minnesota Statute 186 and Minnesota Rules, part 6115.0770, will be considered equivalent to an approved WHP contingency plan.

Emergency Telephone List

Prepare and attach a list of emergency contacts, including the MN Duty Officer (1-800-422-0798), as **Appendix 5**. A template is available at www.mndnr.gov/watersupplyplans

The list should include key utility and community personnel, contacts in adjacent water suppliers, and appropriate local, state and federal emergency contacts. Please be sure to verify and update the contacts on the emergency telephone list and date it. Thereafter, update on a regular basis (once a year is recommended). In the case of a municipality, this information should be contained in a notification and warning standard operating procedure maintained by the Emergency Manager for that community. Responsibilities and services for each contact should be defined.

Current Water Sources and Service Area

Quick access to concise and detailed information on water sources, water treatment, and the distribution system may be needed in an emergency. System operation and maintenance records should be maintained in secured central and back-up locations so that the records are accessible for emergency purposes. A detailed map of the system showing the treatment plants, water sources, storage facilities, supply lines, interconnections, and other information that would be useful in an emergency should also be readily available. It is critical that public water supplier representatives and emergency response personnel communicate about the response procedures and be able to easily obtain this kind of information both in electronic and hard copy formats (in case of a power outage).

Do records and maps exist? Yes ☒ No ☐

Can staff access records and maps from a central secured location in the event of an emergency?

Yes ☒ No ☐

Does the appropriate staff know where the materials are located?

Yes ☒ No ☐

Procedure for Augmenting Water Supplies

Complete Tables 16 – 17 by listing all available sources of water that can be used to augment or replace existing sources in an emergency. Add rows to the tables as needed.

In the case of a municipality, this information should be contained in a notification and warning standard operating procedure maintained by the warning point for that community. Municipalities are encouraged to execute cooperative agreements for potential emergency water services and copies should be included in **Appendix 6**. Outstate Communities may consider using nearby high capacity wells (industry, golf course) as emergency water sources.

WSP should include information on any physical or chemical problems that may limit interconnections to other sources of water. Approvals from the MDH are required for interconnections or the reuse of water.

Table 16. Interconnections with other water supply systems to supply water in an emergency

Other Water Supply System Owner	Capacity (GPM & MGD)	Note Any Limitations On Use	List of services, equipment, supplies available to respond
NONE.			

GPM – Gallons per minute MGD – million gallons per day

Table 17. Utilizing surface water as an alternative source

Surface Water Source Name	Capacity (GPM)	Capacity (MGD)	Treatment Needs	Note Any Limitations On Use
NONE.				

If not covered above, describe additional emergency measures for providing water (obtaining bottled water, or steps to obtain National Guard services, etc.)

The City addresses this in its overall Emergency Operations Plan. The City may provide staffing to deliver potable water (including bottled form) for health/life safety means during an emergency, calling upon National Guard services if necessary. The City also has mutual aid agreements with nearby communities for requesting assistance in this area.

Allocation and Demand Reduction Procedures

Complete Table 18 by adding information about how decisions will be made to allocate water and reduce demand during an emergency. Provide information for each customer category, including its priority ranking, average day demand, and demand reduction potential for each customer category. Modify the customer categories as needed, and add additional lines if necessary.

Water use categories should be prioritized in a way that is consistent with Minnesota Statutes 103G.261 (#1 is highest priority) as follows:

1. Water use for human needs such as cooking, cleaning, drinking, washing and waste disposal; use for on-farm livestock watering; and use for power production that meets contingency requirements.
2. Water use involving consumption of less than 10,000 gallons per day (usually from private wells or surface water intakes)
3. Water use for agricultural irrigation and processing of agricultural products involving consumption of more than 10,000 gallons per day (usually from private high-capacity wells or surface water intakes)
4. Water use for power production above the use provided for in the contingency plan.
5. All other water use involving consumption of more than 10,000 gallons per day.
6. Nonessential uses – car washes, golf courses, etc.

Water used for human needs at hospitals, nursing homes and similar types of facilities should be designated as a high priority to be maintained in an emergency. Lower priority uses will need to address water used for human needs at other types of facilities such as hotels, office buildings, and manufacturing plants. The volume of water and other types of water uses at these facilities must be carefully considered. After reviewing the data, common sense should dictate local allocation priorities to protect domestic requirements over certain types of economic needs. Water use for lawn sprinkling, vehicle washing, golf courses, and recreation are legislatively considered non-essential.

Table 18. Water use priorities

Customer Category	Allocation Priority	Annual Average Daily Demand (GDP)	Short-Term Emergency Demand Reduction Potential (GPD)
Residential	1	1,695,000	MINIMAL
Hospital Facilities	1	40,000	MINIMAL
Commercial/Industrial/Institutional	2	449,500	150,000
Non-Essential (Irrigation/Wholesale/Recreational)	6	630,000	630,000
TOTAL	NA	2,500,000	

GPD – Gallons per Day

Tip: Calculating Emergency Demand Reduction Potential

The emergency demand reduction potential for all uses will typically equal the difference between maximum use (summer demand) and base use (winter demand). In extreme emergency situations, lower priority water uses must be restricted or eliminated to protect priority domestic water requirements. Emergency demand reduction potential should be based on average day demands for customer categories within each priority class. Use the tables in Part 3 on water conservation to help you determine strategies.

Complete Table 19 by selecting the triggers and actions during water supply disruption conditions.

Table 19. Emergency demand reduction conditions, triggers and actions (Select all that may apply and describe)

Emergency Triggers	Short-term Actions	Long-term Actions
☒ Contamination ☒ Loss of production ☒ Infrastructure failure ☒ Executive order by Governor ☐ Other: ______________	☐ Supply augmentation through ____ ☒ Adopt (if not already) and enforce a critical water deficiency ordinance to penalize lawn watering, vehicle washing, golf course and park irrigation & other nonessential uses. ☐ Water allocation through____ ☒ Meet with large water users to discuss their contingency plan.	☐ Supply augmentation through ____ ☒ Adopt (if not already) and enforce a critical water deficiency ordinance to penalize lawn watering, vehicle washing, golf course and park irrigation & other nonessential uses. ☐ Water allocation through____ ☒ Meet with large water users to discuss their contingency plan.

Notification Procedures

Complete Table 20 by selecting trigger for informing customers regarding conservation requests, water use restrictions, and suspensions; notification frequencies; and partners that may assist in the notification process. Add rows to the table as needed.

Table 20. Plan to inform customers regarding conservation requests, water use restrictions, and suspensions

Notification Trigger(s)	Methods (select all that apply)	Update Frequency	Partners
☒ Short-term demand reduction declared (< 1 year)	☒ Website ☒ Email list serve ☒ Social media (e.g. Twitter, Facebook) ☐ Direct customer mailing, ☒ Press release (TV, radio, newspaper), ☒ Meeting with large water users (> 10% of total city use) ☒ Other: Text Message Alert	☐ Daily ☒ Weekly ☐ Monthly ☐ Annually	• MDH • MnDNR • Dakota County • Mutual Aid
☒ Long-term Ongoing demand reduction declared	☒ Website ☒ Email list serve ☒ Social media (e.g. Twitter, Facebook) ☒ Direct customer mailing, ☒ Press release (TV, radio, newspaper), ☒ Meeting with large water users (> 10% of total city use) ☒ Other: Text Message Alert	☐ Daily ☐ Weekly ☒ Monthly ☐ Annually	• MDH • MnDNR • Dakota County • Met Council
☒ Governor's critical water deficiency declared	☒ Website ☒ Email list serve ☒ Social media (e.g. Twitter, Facebook) ☒ Direct customer mailing, ☒ Press release (TV, radio, newspaper), ☒ Meeting with large water users (> 10% of total city use) ☒ Other: Text Message Alert	☒ Daily ☒ Weekly ☒ Monthly ☐ Annually	• MDH • MnDNR • Dakota County • Governor's Office • Met Council

Enforcement

Prior to a water emergency, municipal water suppliers must adopt regulations that restrict water use and outline the enforcement response plan. The enforcement response plan must outline how conditions will be monitored to know when enforcement actions are triggered, what enforcement tools will be used, who will be responsible for enforcement, and what timelines for corrective actions will be expected.

Affected operations, communications, and enforcement staff must then be trained to rapidly implement those provisions during emergency conditions.

Important Note:

Disregard of critical water deficiency orders, even though total appropriation remains less than permitted, is adequate grounds for immediate modification of a public water supply authority's water use permit (2013 MN Statutes 103G.291)

Does the city have a critical water deficiency restriction/official control in place that includes provisions to restrict water use and enforce the restrictions? (This restriction may be an ordinance, rule, regulation, policy under a council directive, or other official control) Yes ☒ No ☐

If yes, attach the official control document to this WSP as **Appendix 7**.

If no, the municipality must adopt such an official control within 6 months of submitting this WSP and submit it to the DNR as an amendment to this WSP.

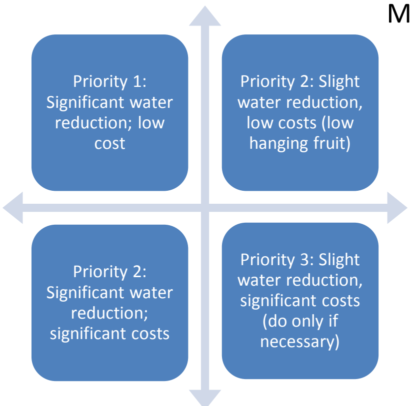
Irrespective of whether a critical water deficiency control is in place, does the public water supply utility, city manager, mayor, or emergency manager have standing authority to implement water restrictions? Yes ☒ No ☐

If yes, cite the regulatory authority reference: MN Statutes, Section 12.29.

If no, who has authority to implement water use restrictions in an emergency?

The Mayor has executive authority under MN Statutes, Section 12.29 to declare an emergency for up to three days without confirmation of the City Council. The three-day period would be used to evaluate the anticipated extent of the declaration and determine whether it requires extension, for which the City Council would convene an emergency special meeting to make the extended declaration.

PART 3. WATER CONSERVATION PLAN



Minnesotans have historically benefited from the state's abundant water supplies, reducing the need for conservation. There are however, limits to the available supplies of water and increasing threats to the quality of our drinking water. Causes of water supply limitation may include: population increases, economic trends, uneven statewide availability of groundwater, climatic changes, and degraded water quality. Examples of threats to drinking water quality include: the presence of contaminant plumes from past land use activities, exceedances of water quality standards from natural and human sources, contaminants of emerging concern, and increasing pollutant trends from nonpoint sources.

There are many incentives for conserving water; conservation:

- reduces the potential for pumping-induced transfer of contaminants into the deeper aquifers, which can add treatment costs
- reduces the need for capital projects to expand system capacity
- reduces the likelihood of water use conflicts, like well interference, aquatic habitat loss, and declining lake levels
- conserves energy, because less energy is needed to extract, treat and distribute water (and less energy production also conserves water since water is use to produce energy)
- maintains water supplies that can then be available during times of drought

It is therefore imperative that water suppliers implement water conservation plans. The first step in water conservation is identifying opportunities for behavioral or engineering changes that could be made to reduce water use by conducting a thorough analysis of:

- Water use by customer
- Extraction, treatment, distribution and irrigation system efficiencies
- Industrial processing system efficiencies
- Regulatory and barriers to conservation
- Cultural barriers to conservation
- Water reuse opportunities

Once accurate data is compiled, water suppliers can set achievable goals for reducing water use. A successful water conservation plan follows a logical sequence of events. The plan should address both conservation on the supply side (leak detection and repairs, metering), as well as on the demand side (reductions in usage). Implementation should be conducted in phases, starting with the most obvious and lowest-cost options. In some cases one of the early steps will be reviewing regulatory constraints to water conservation, such as lawn irrigation requirements. Outside funding and grants may be available for implementation of projects. Engage water system operators and maintenance staff and customers in brainstorming opportunities to reduce water use. Ask the question: "How can I help save water?"

Progress since 2006

Is this your community's first Water Supply Plan? Yes ☐ No ☒

If yes, describe conservation practices that you are already implementing, such as: pricing, system improvements, education, regulation, appliance retrofitting, enforcement, etc.

If no, complete Table 21 to summarize conservation actions taken since the adoption of the 2006 water supply plan.

Table 21. Implementation of previous ten-year Conservation Plan

2006 Plan Commitments	Action Taken?
Change water rates structure to provide conservation pricing. ***In 2007, the City of Hastings instituted a seasonal rate escalator for water volumes used beyond winter averages. In July 2017, the City will implement a four-tiered consumption rate structure with escalating multipliers on each rate tier.***	☒ Yes ☐ No
Water supply system improvements (e.g. leak repairs, valve replacements, etc.) ***The City of Hastings annually incorporates water system repairs and replacements into its street improvement program, along with other stand-alone system improvement, replacement and upgrade projects. A leak detection program will be implemented in 2017.***	☒ Yes ☐ No
Educational efforts ***The City of Hastings uses its website, social media platforms, quarterly newsletter, and occasional tours for public education and outreach regarding water use and public works items in general.***	☒ Yes ☐ No
New water conservation ordinances ***In July 2017, the City will implement a four-tiered consumption rate structure with escalating multipliers on each rate tier. There are no additional conservation ordinance revisions currently being considered.***	☐ Yes ☒ No
Rebate or retrofitting Program (e.g. for toilet, faucets, appliances, showerheads, dish washers, washing machines, irrigation systems, rain barrels, water softeners, etc.	☐ Yes ☒ No
Enforcement ***Enforcement of the Odd-Even lawn irrigation ban is a lower priority of the City's many duties and obligations.***	☒ Yes ☐ No
Describe other	☐ Yes ☐ No

What are the results you have seen from the actions in Table 21 and how were results measured?

The City of Hastings is experiencing a slow but declining trend in total water use despite population growth and added service connections to the system. Results have been a decrease in total GPCD, with residential GPCD falling to 74.8 for the period from 2010-2015.

A. Triggers for Allocation and Demand Reduction Actions

Complete table 22 by checking each trigger below, as appropriate, and the actions to be taken at various levels or stages of severity. Add in additional rows to the table as needed.

Table 22. Short and long-term demand reduction conditions, triggers and actions

Objective	Triggers	Actions
Protect surface water flows	☐ Low stream flow conditions ☐ Reports of declining wetland and lake levels ☐ Other: _______________	☐ Increase promotion of conservation measures ☐ Other: _____________

Objective	Triggers	Actions
Short-term demand reduction (less than 1 year	☒ Extremely high seasonal water demand (more than double winter demand) ☐ Loss of treatment capacity ☒ Lack of water in storage ☒ State drought plan ☐ Well interference ☐ Other: ______________	☒ Adopt (if not already) and enforce the critical water deficiency ordinance to restrict or prohibit lawn watering, vehicle washing, golf course and park irrigation & other nonessential uses. ☐ Supply augmentation through ____ ☐ Water allocation through____ ☒ Meet with large water users to discuss user's contingency plan.
Long-term demand reduction (>1 year)	☒ Per capita demand increasing ☒ Total demand increase (higher population or more industry)Water level in well(s) below elevation of _____ ☐ Other: ______________	☒ Develop a critical water deficiency ordinance that is or can be quickly adopted to penalize lawn watering, vehicle washing, golf course and park irrigation & other nonessential uses. ☐ Enact a water waste ordinance that targets overwatering (causing water to flow off the landscape into streets, parking lots, or similar), watering impervious surfaces (streets, driveways or other hardscape areas), and negligence of known leaks, breaks, or malfunctions. ☒ Meet with large water users to discuss user's contingency plan. ☒ Enhanced monitoring and reporting: audits, meters, billing, etc.
Governor's "Critical Water Deficiency Order" declared	☐ Describe	☐ Describe

B. Conservation Objectives and Strategies – *Key benchmark for DNR*

This section establishes water conservation objectives and strategies for eight major areas of water use.

Objective 1: Reduce Unaccounted (Non-Revenue) Water loss to Less than 10%

The Minnesota Rural Waters Association, the Metropolitan Council and the Department of Natural Resources recommend that all water uses be metered. Metering can help identify high use locations and times, along with leaks within buildings that have multiple meters.

It is difficult to quantify specific unmetered water use such as that associated with firefighting and system flushing or system leaks. Typically, water suppliers subtract metered water use from total water pumped to calculate unaccounted or non-revenue water loss.

Is your ten-year average (2005-2014) unaccounted Water Use in Table 2 higher than 10%?

Yes ☐ No ☒

What is your leak detection monitoring schedule? (e.g. monitor 1/3rd of the city lines per year)

The City of Hastings will begin a leak detection program in 2017, monitoring ½ of its lines for leaks each year.

Water Audits - are intended to identify, quantify and verify water and revenue losses. The volume of unaccounted-for water should be evaluated each billing cycle. The American Water Works Association (AWWA) recommends that ten percent or less of pumped water is unaccounted-for water. Water audit procedures are available from the AWWA and MN Rural Water Association www.mrwa.com . Drinking Water Revolving Loan Funds are available for purchase of new meters when new plants are built.

What is the date of your most recent water audit?__2016__

Frequency of water audits: ☒ **yearly (part of annual DNR reporting)** ☐ **other (specify frequency)**
Leak detection and survey: ☐ **every year** ☒ **every other year** ☐ **periodic as needed**
Year last leak detection survey completed: _N/A____

If Table 2 shows annual water losses over 10% or an increasing trend over time, describe what actions will be taken to reach the <10% loss objective and within what timeframe

The City is beginning a leak detection program in 2017 to inventory integrity of the system and address leakage on its system in a targeted manner. The City is also entering its second year of a multi-year meter replacement program, which will improve accuracy and very likely have substantive effect on reducing un-accounted for water.

Metering -AWWA recommends that every water supplier install meters to account for all water taken into its system, along with all water distributed from its system at each customer's point of service. An effective metering program relies upon periodic performance testing, repair, maintenance or replacement of all meters. AWWA also recommends that water suppliers conduct regular water audits to ensure accountability. Some cities install separate meters for interior and exterior water use, but some research suggests that this may not result in water conservation.

Complete Table 23 by adding the requested information regarding the number, types, testing and maintenance of customer meters.

Table 23. Information about customer meters

Customer Category	Number of Customers	Number of Metered Connections	Number of Automated Meter Readers	Meter testing intervals (years)	Average age/meter replacement schedule (years
Residential	7,117	7,117	7,117		___ / ___
Irrigation meters	192	192	192		___ / ___
Institutional	0	0	0		___ / ___
Commercial	457	457	457		___ / ___
Industrial	11	11	11		___ / ___
Public facilities	31	31	31		___ / ___
Other	0	0	0		___ / ___
TOTALS	7,808	7,808	7,808	NA	City-wide meter replacement ongoing, to approximately 2025.

For unmetered systems, describe any plans to install meters or replace current meters with advanced technology meters. Provide an estimate of the cost to implement the plan and the projected water savings from implementing the plan.

Meter replacement program is expected to take 10-12 years total, with final implementation cost of $3.5M. Anticipated water savings of several hundred thousand gallons from gained meter accuracy.

Table 24. Water source meters

	Number of Meters	Meter testing schedule (years)	Number of Automated Meter Readers	Average age/meter replacement schedule (years
Water source (wells/intakes)	6	N/A		___ / ___

Objective 2: Achieve Less than 75 Residential Gallons per Capita Demand (GPCD)

The 2002 average residential per capita demand in the Twin Cities Metropolitan area was 75 gallons per capita per day.

Is your average 2010-2015 residential per capita water demand in Table 2 more than 75? Yes ☐ No ☒

What was your 2010 – 2015 five-year average residential per capita water demand? 74.8 g/person/day

Describe the water use trend over that timeframe:

The water use trend has been slowly declining.

Complete Table 25 by checking which strategies you will use to continue reducing residential per capita demand and project a likely timeframe for completing each checked strategy (Select all that apply and add rows for additional strategies):

Table 25. Strategies and timeframe to reduce residential per capita demand

Strategy to reduce residential per capita demand	Timeframe for completing work
☒ Revise city ordinances/codes to encourage or require water efficient landscaping.	2025
☒ Revise city ordinance/codes to permit water reuse options, especially for non-potable purposes like irrigation, groundwater recharge, and industrial use. Check with plumbing authority to see if internal buildings reuse is permitted	2025
☒ Revise ordinances to limit irrigation. Describe the restricted irrigation plan: Consider time of day restrictions.	2025
☐ Revise outdoor irrigation installations codes to require high efficiency systems (e.g. those with soil moisture sensors or programmable watering areas) in new installations or system replacements.	
☒ Make water system infrastructure improvements	Ongoing
☒ Offer free or reduced cost water use audits) for residential customers.	Partner with energy companies to inform the public about their programs. Timeframe unknown.

Strategy to reduce residential per capita demand	Timeframe for completing work
☒ Implement a notification system to inform customers when water availability conditions change.	2025
☐ Provide rebates or incentives for installing water efficient appliances and/or fixtures indoors (e.g., low flow toilets, high efficiency dish washers and washing machines, showerhead and faucet aerators, water softeners, etc.)	
☐ Provide rebates or incentives to reduce outdoor water use (e.g., turf replacement/reduction, rain gardens, rain barrels, smart irrigation, outdoor water use meters, etc.)	
☐ Identify supplemental Water Resources	
☒ Conduct audience-appropriate water conservation education and outreach.	Look to partner with Hastings School District and Community Education – early 2020's.
☐ Describe other plans	

Objective 3: Achieve at least a 1.5% per year water reduction for Institutional, Industrial, Commercial, and Agricultural GPCD over the next 10 years or a 15% reduction in ten years.
Complete Table 26 by checking which strategies you will use to continue reducing non-residential customer use demand and project a likely timeframe for completing each checked strategy (add rows for additional strategies).

Where possible, substitute recycled water used in one process for reuse in another. (For example, spent rinse water can often be reused in a cooling tower.) Keep in mind the true cost of water is the amount on the water bill PLUS the expenses to heat, cool, treat, pump, and dispose of/discharge the water. Don't just calculate the initial investment. Many conservation retrofits that appear to be prohibitively expensive are actually very cost-effective when amortized over the life of the equipment. Often reducing water use also saves electrical and other utility costs. Note: as of 2015, water reuse, and is not allowed by the state plumbing code, M.R. 4715 (a variance is needed). However several state agencies are addressing this issue.

Table 26. Strategies and timeframe to reduce institutional, commercial industrial, and agricultural and non-revenue use demand

Strategy to reduce total business, industry, agricultural demand	Timeframe for completing work
☐ Conduct a facility water use audit for both indoor and outdoor use, including system components	
☒ Install enhanced meters capable of automated readings to detect spikes in consumption	Ongoing, full system integration by approx. 2025.
☐ Compare facility water use to related industry benchmarks, if available (e.g., meat processing, dairy, fruit and vegetable, beverage, textiles, paper/pulp, metals, technology, petroleum refining etc.)	
☐ Install water conservation fixtures and appliances or change processes to conserve water	
☐ Repair leaking system components (e.g., pipes, valves)	
☐ Investigate the reuse of reclaimed water (e.g., stormwater, wastewater effluent, process wastewater, etc.)	
☒ Reduce outdoor water use (e.g., turf replacement/reduction, rain gardens, rain barrels, smart irrigation, outdoor water use meters, etc.)	Procure literature targeting business irrigation users – by 2025.
☐ Train employees how to conserve water	

Strategy to reduce total business, industry, agricultural demand	Timeframe for completing work
☐ Implement a notification system to inform non-residential customers when water availability conditions change.	
☐ Rainwater catchment systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, industrial processes, water features, vehicle washing facilities, cooling tower makeup, and similar uses shall be approved by the commissioner. Proposed plumbing code 4714.1702.1 http://www.dli.mn.gov/PDF/docket/4714rule.pdf	
☐ Describe other plans:	

Objective 4: Achieve a Decreasing Trend in Total Per Capita Demand

Include as **Appendix 8** one graph showing total per capita water demand for each customer category (i.e., residential, institutional, commercial, industrial) from 2005-2014 and add the calculated/estimated linear trend for the next 10 years.

Describe the trend for each customer category; explain the reason(s) for the trends, and where trends are increasing.

Each customer category trend, as well as that of non-essential water, has been in slow decline. In our view, the decline is attributable to enhanced social consciousness for water conservation, changes in plumbing codes requiring low-flow fixtures and rain sensors on irrigation systems, the City's escalator rate for summer water usage, and investments by business facilities in more efficient uses of water.

Objective 5: Reduce Peak Day Demand so that the Ratio of Average Maximum day to the Average Day is less than 2.6

Is the ratio of average 2005-2014 maximum day demand to average 2005-2014 average day demand reported in Table 2 more than 2.6? Yes ☐ No ☒

Calculate a ten year average (2005 – 2014) of the ratio of maximum day demand to average day demand: 2.42

The position of the DNR has been that a peak day/average day ratio that is above 2.6 for in summer indicates that the water being used for irrigation by the residents in a community is too large and that efforts should be made to reduce the peak day use by the community.

It should be noted that by reducing the peak day use, communities can also reduce the amount of infrastructure that is required to meet the peak day use. This infrastructure includes new wells, new water towers which can be costly items.

Objective 6: Implement a Conservation Water Rate Structure and/or a Uniform Rate Structure with a Water Conservation Program

Water Conservation Program

Municipal water suppliers serving over 1,000 people are required to adopt demand reduction measures that include a conservation rate structure, or a uniform rate structure with a conservation program that achieves demand reduction. These measures must achieve demand reduction in ways that reduce water demand, water losses, peak water demands, and nonessential water uses. These measures must be approved before a community may request well construction approval from the Department of

Health or before requesting an increase in water appropriations permit volume (*Minnesota Statutes*, section 103G.291, subd. 3 and 4). Rates should be adjusted on a regular basis to ensure that revenue of the system is adequate under reduced demand scenarios. If a municipal water supplier intends to use a Uniform Rate Structure, a community-wide Water Conservation Program that will achieve demand reduction must be provided.

Current Water Rates

Include a copy of the actual rate structure in **Appendix 9** or list current water rates including base/service fees and volume charges below.

Volume included in base rate or service charge: __0__ gallons or ____ cubic feet ___ other

Frequency of billing: ☐ Monthly ☐ Bimonthly ☒ Quarterly ☐ Other: __________________

Water Rate Evaluation Frequency: ☒ every year ☐ every ___ years ☐ no schedule

Date of last rate change: _2017____

Table 27. Rate structures for each customer category (Select all that apply and add additional rows as needed)

Customer Category	Conservation Billing Strategies in Use *	Conservation Neutral Billing Strategies in Use **	Non-Conserving Billing Strategies in Use ***
Residential	☐ Monthly billing ☒ Increasing block rates (volume tiered rates) – ***Effective July 2017*** ☐ Seasonal rates ☐ Time of use rates ☐ Water bills reported in gallons ☐ Individualized goal rates ☐ Excess use rates ☐ Drought surcharge ☐ Use water bill to provide comparisons ☐ Service charge not based on water volume ☐ Other (describe)	☐ Uniform ☒ Odd/even day watering	☐ Service charge based on water volume ☐ Declining block ☐ Flat ☐ Other (describe)
Commercial/ Industrial/ Institutional	☐ Monthly billing ☒ Increasing block rates (volume tiered rates) – ***Effective July 2017*** ☐ Seasonal rates ☐ Time of use rates ☐ Water bills reported in gallons ☐ Individualized goal rates ☐ Excess use rates ☐ Drought surcharge ☐ Use water bill to provide comparisons ☐ Service charge not based on water volume	☐ Uniform	☐ Service charge based on water volume ☐ Declining block ☐ Flat ☐ Other (describe)

Customer Category	Conservation Billing Strategies in Use *	Conservation Neutral Billing Strategies in Use **	Non-Conserving Billing Strategies in Use ***
	☐ Other (describe)		
☐ Other			

*** Rate Structures components that may promote water conservation:**

- **Monthly billing:** is encouraged to help people see their water usage so they can consider changing behavior.
- **Increasing block rates (also known as a tiered residential rate structure):** Typically, these have at least three tiers: should have at least three tiers.
  - The first tier is for the winter average water use.
  - The second tier is the year-round average use, which is lower than typical summer use. This rate should be set to cover the full cost of service.
  - The third tier should be above the average annual use and should be priced high enough to encourage conservation, as should any higher tiers. For this to be effective, the difference in block rates should be significant.
- **Seasonal rate:** higher rates in summer to reduce peak demands
- **Time of Use rates:** lower rates for off peak water use
- **Bill water use in gallons:** this allows customers to compare their use to average rates
- **Individualized goal rates:** typically used for industry, business or other large water users to promote water conservation if they keep within agreed upon goals. **Excess Use rates**: if water use goes above an agreed upon amount this higher rate is charged
- **Drought surcharge:** an extra fee is charged for guaranteed water use during drought
- **Use water bill to provide comparisons**: simple graphics comparing individual use over time or compare individual use to others.
- **Service charge or base fee that does not include a water volume** – a base charge or fee to cover universal city expenses that are not customer dependent and/or to provide minimal water at a lower rate (e.g., an amount less than the average residential per capita demand for the water supplier for the last 5 years)
- **Emergency rates** -A community may have a separate conservation rate that only goes into effect when the community or governor declares a drought emergency. These higher rates can help to protect the city budgets during times of significantly less water usage.

****Conservation Neutral****

- **Uniform rate**: rate per unit used is the same regardless of the volume used
- **Odd/even day watering** –This approach reduces peak demand on a daily basis for system operation, but it does not reduce overall water use.

***** Non-Conserving *****

- **Service charge or base fee with water volume:** an amount of water larger than the average residential per capita demand for the water supplier for the last 5 years
- **Declining block rate:** the rate per unit used decreases as water use increases.
- **Flat rate:** one fee regardless of how much water is used (usually unmetered).

Provide justification for any conservation neutral or non-conserving rate structures. If intending to adopt a conservation rate structure, include the timeframe to do so:

Odd/Even Irrigation Ordinance to manage peak demands. The City adopted a rate structure change and new rates on May 15, 2017 for implementation starting in with July 2017 quarterly billing. All water used in April, May, & June 2017 will be billed at the new rates.

Objective 7: Additional strategies to Reduce Water Use and Support Wellhead Protection Planning

Development and redevelopment projects can provide additional water conservation opportunities, such as the actions listed below. If a Uniform Rate Structure is in place, the water supplier must provide a Water Conservation Program that includes at least two of the actions listed below. Check those actions that you intent to implement within the next 10 years.

Table 28. Additional strategies to Reduce Water Use & Support Wellhead Protection

☒	Participate in the GreenStep Cities Program, including implementation of at least one of the 20 "Best Practices" for water
☐	Prepare a master plan for smart growth (compact urban growth that avoids sprawl)
☐	Prepare a comprehensive open space plan (areas for parks, green spaces, natural areas)
☐	Adopt a water use restriction ordinance (lawn irrigation, car washing, pools, etc.)
☒	Adopt an outdoor lawn irrigation ordinance
☐	Adopt a private well ordinance (private wells in a city must comply with water restrictions)
☐	Implement a stormwater management program
☐	Adopt non-zoning wetlands ordinance (can further protect wetlands beyond state/federal laws-for vernal pools, buffer areas, restrictions on filling or alterations)
☐	Adopt a water offset program (primarily for new development or expansion)
☐	Implement a water conservation outreach program
☐	Hire a water conservation coordinator (part-time)
☐	Implement a rebate program for water efficient appliances, fixtures, or outdoor water management
☐	Other

Objective 8: Tracking Success: How will you track or measure success through the next ten years?

Tracking success will be possible by monitoring use trends among user categories, documenting known implementations of conservation-impacting infrastructure or equipment implements made by private property owners through development and redevelopment projects, solicitation of interest levels in water conservation practices by the public, and easily gained metrics from social media outreach and website traffic.

Tip: The process to monitor demand reduction and/or a rate structure includes:

a) The DNR Hydrologist will call or visit the community the first 1-3 years after the water supply plan is completed.
b) They will discuss what activities the community is doing to conserve water and if they feel their actions are successful. The Water Supply Plan, Part 3 tables and responses will guide the discussion. For example, they will discuss efforts to reduce unaccounted for water loss if that is a problem, or go through Tables 33, 34 and 35 to discuss new initiatives.
c) The city representative and the hydrologist will discuss total per capita water use, residential per capita water use, and business/industry use. They will note trends.
d) They will also discuss options for improvement and/or collect case studies of success stories to share with other communities. One option may be to change the rate structure, but there are many other paths to successful water conservation.
e) If appropriate, they will cooperatively develop a simple work plan for the next few years, targeting a couple areas where the city might focus efforts.

A. Regulation

Complete Table 29 by selecting which regulations are used to reduce demand and improve water efficiencies. Add additional rows as needed.

Copies of adopted regulations or proposed restrictions or should be included in **Appendix 10** (a list with hyperlinks is acceptable).

Table 29. Regulations for short-term reductions in demand and long-term improvements in water efficiencies

Regulations Utilized	When is it applied (in effect)?
☒ Rainfall sensors required on landscape irrigation systems ***City Code, Chapter 150.11 – Irrigation System Requirements***	☒ Ongoing ☐ Seasonal ☐ Only during declared Emergencies
☒ Water efficient plumbing fixtures required ***City Code, Chapter 150.01 – MN State Building & Plumbing Codes Adopted***	☒ New development ☒ Replacement ☐ Rebate Programs
☒ Critical/Emergency Water Deficiency ordinance ***To be considered. Timeline TBD.***	☒ Only during declared Emergencies
☒ Watering restriction requirements (time of day, allowable days, etc.) ***City Code, Chapter 51.05 – Water Conservation***	☒ Odd/even ☐ 2 days/week ☐ Only during declared Emergencies
☐ Water waste prohibited (for example, having a fine for irrigators spraying on the street)	☐ Ongoing ☐ Seasonal ☐ Only during declared Emergencies
☐ Limitations on turf areas (requiring lots to have 10% - 25% of the space in natural areas)	☐ New development ☐ Shoreland/zoning ☐ Other
☒ Soil preparation requirement s (after construction, requiring topsoil to be applied to promote good root growth) ***To be considered. Timeline TBD.***	☒ New Development ☒ Construction Projects ☐ Other
☒ Tree ratios (requiring a certain number of trees per square foot of lawn) ***City Code, Chapter 154.06***	☒ New development ☒ Shoreland/zoning ☐ Other
☐ Permit to fill swimming pool and/or requiring pools to be covered (to prevent evaporation)	☐ Ongoing ☐ Seasonal ☒ Only during declared Emergencies
☒ Ordinances that permit stormwater irrigation, reuse of water, or other alternative water use (Note: be sure to check current plumbing codes for updates)	☒ Describe ***Stormwater reuse for irrigation to be considered. Timeline TBD.***

B. Retrofitting Programs

Education and incentive programs aimed at replacing inefficient plumbing fixtures and appliances can help reduce per capita water use, as well as energy costs. It is recommended that municipal water suppliers develop a long-term plan to retrofit public buildings with water efficient plumbing fixtures and appliances. Some water suppliers have developed partnerships with organizations having similar conservation goals, such as electric or gas suppliers, to develop cooperative rebate and retrofit programs.

A study by the AWWA Research Foundation (Residential End Uses of Water, 1999) found that the average indoor water use for a non-conserving home is 69.3 gallons per capita per day (gpcd). The average indoor water use in a conserving home is 45.2 gpcd and most of the decrease in water use is related to water efficient plumbing fixtures and appliances that can reduce water, sewer and energy costs. In Minnesota, certain electric and gas providers are required (Minnesota Statute 216B.241) to fund programs that will conserve energy resources and some utilities have distributed water efficient showerheads to customers to help reduce energy demands required to supply hot water.

Retrofitting Programs

Complete Table 30 by checking which water uses are targeted, the outreach methods used, the measures used to identify success, and any participating partners.

Table 30. Retrofitting programs (Select all that apply)

Water Use Targets	Outreach Methods	Partners
☐ Low flush toilets, ☐ Toilet leak tablets, ☐ Low flow showerheads, ☐ Faucet aerators;	☐ Education about ☐ Free distribution of ☐ Rebate for ☐ Other	☐ Gas company ☐ Electric company ☐ Watershed organization
☐ Water conserving washing machines, ☐ Dish washers, ☐ Water softeners;	☐ Education about ☐ Free distribution of ☐ Rebate for ☐ Other	☐ Gas company ☐ Electric company ☐ Watershed organization
☒ Rain gardens, ☒ Rain barrels, ☒ Native/drought tolerant landscaping, etc.	☒ Education about ☐ Free distribution of ☐ Rebate for ☐ Other	☐ Gas company ☐ Electric company ☒ Watershed organization

Briefly discuss measures of success from the above table (e.g. number of items distributed, dollar value of rebates, gallons of water conserved, etc.):

This is difficult to measure based on what information that the City has available to it on the programs on which we partner.

C. Education and Information Programs

Customer education should take place in three different circumstances. First, customers should be provided information on how to conserve water and improve water use efficiencies. Second, information should be provided at appropriate times to address peak demands. Third, emergency notices and educational materials about how to reduce water use should be available for quick distribution during an emergency.

Proposed Education Programs

Complete Table 31 by selecting which methods are used to provide water conservation and information, including the frequency of program components. Select all that apply and add additional lines as needed.

Table 31. Current and Proposed Education Programs

Education Methods	General summary of topics	#/Year	Frequency
Billing inserts or tips printed on the actual bill			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Consumer Confidence Reports	As required annually by MDH.	1	☒ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Press releases to traditional local news outlets (e.g., newspapers, radio and TV)			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Social media distribution (e.g., emails, Facebook, Twitter)	Reminder of Odd/Even watering ordinance and promotion of smart irrigation.	1	☐ Ongoing ☒ Seasonal ☐ Only during declared emergencies
Paid advertisements (e.g., billboards, print media, TV, radio, web sites, etc.)	Among topics discussed during in-depth interviews with local radio station.	1-2	☐ Ongoing ☒ Seasonal ☐ Only during declared emergencies
Presentations to community groups			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Staff training			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Facility tours	Tours of water treatment plant as requested.	1-2	☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Displays and exhibits			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Marketing rebate programs (e.g., indoor fixtures & appliances and outdoor practices)			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Community news letters	Reminder of Odd/Even watering ordinance and promotion of smart irrigation.	1	☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Direct mailings (water audit/retrofit kits, showerheads, brochures)			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies

Education Methods	General summary of topics	#/Year	Frequency
Information kiosk at utility and public buildings			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Public service announcements			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Cable TV Programs			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Demonstration projects (landscaping or plumbing)			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
K-12 education programs (Project Wet, Drinking Water Institute, presentations)	Upon request	1	☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Community events (children's water festivals, environmental fairs)			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Community education classes			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Water week promotions			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Website (include address:)			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Targeted efforts (large volume users, users with large increases)			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Notices of ordinances			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Emergency conservation notices			☐ Ongoing ☐ Seasonal ☐ Only during declared emergencies
Other:			☐ Ongoing ☐ Seasonal

Education Methods	General summary of topics	#/Year	Frequency
			☐ Only during declared emergencies

Briefly discuss what future education and information activities your community is considering in the future:

The City will explore very **low cost/ free** tools and offerings by third parties to assist us with further promotion of water conservation to enhance education of the public about how usage habits drive the efforts and costs the community must put into ensuring continually reliable and sustainable water service.

Part 4. ITEMS FOR METROPOLITAN AREA COMMUNITIES

Minnesota Statute 473.859 requires WSPs to be completed for all local units of government in the seven-county Metropolitan Area as part of the local comprehensive planning process.

Much of the information in Parts 1-3 addresses water demand for the next 10 years. However, additional information is needed to address water demand through 2040, which will make the WSP consistent with the Metropolitan Land Use Planning Act, upon which the local comprehensive plans are based.

This Part 4 provides guidance to complete the WSP in a way that addresses plans for water supply through 2040.

A. Water Demand Projections through 2040

Complete Table 7 in Part 1D by filling in information about long-term water demand projections through 2040. Total Community Population projections should be consistent with the community's system statement, which can be found on the Metropolitan Council's website and which was sent to the community in September 2015.

Projected Average Day, Maximum Day, and Annual Water Demands may either be calculated using the method outlined in *Appendix 2* of the *2015 Master Water Supply Plan* or by a method developed by the individual water supplier.

B. Potential Water Supply Issues

Complete Table 10 in Part 1E by providing information about the potential water supply issues in your community, including those that might occur due to 2040 projected water use.

The *Master Water Supply Plan* provides information about potential issues for your community in *Appendix 1 (Water Supply Profiles).* This resource may be useful in completing Table 10.

You may document results of local work done to evaluate impact of planned uses by attaching a feasibility assessment or providing a citation and link to where the plan is available electronically.

C. Proposed Alternative Approaches to Meet Extended Water Demand Projections

Complete Table 12 in Part 1F with information about potential water supply infrastructure impacts (such as replacements, expansions or additions to wells/intakes, water storage and treatment capacity, distribution systems, and emergency interconnections) of extended plans for development and redevelopment, in 10-year increments through 2040. It may be useful to refer to information in the community's local Land Use Plan, if available.

Complete Table 14 in Part 1F by checking each approach your community is considering to meet future demand. For each approach your community is considering, provide information about the amount of future water demand to be met using that approach, the timeframe to implement the approach, potential partners, and current understanding of the key benefits and challenges of the approach.

As challenges are being discussed, consider the need for: evaluation of geologic conditions (mapping, aquifer tests, modeling), identification of areas where domestic wells could be impacted, measurement and analysis of water levels & pumping rates, triggers & associated actions to protect water levels, etc.

D. Value-Added Water Supply Planning Efforts (Optional)

The following information is not required to be completed as part of the local water supply plan, but completing this can help strengthen source water protection throughout the region and help Metropolitan Council and partners in the region to better support local efforts.

Source Water Protection Strategies

Does a Drinking Water Supply Management Area for a neighboring public water supplier overlap your community? Yes ☐ No ☒

If you answered no, skip this section. If you answered yes, please complete Table 32 with information about new water demand or land use planning-related local controls that are being considered to provide additional protection in this area.

Table 32. Local controls and schedule to protect Drinking Water Supply Management Areas

Local Control	Schedule to Implement	Potential Partners
☐ None at this time		
☐ Comprehensive planning that guides development in vulnerable drinking water supply management areas		
☐ Zoning overlay		
☐ Other:		

Technical assistance

From your community's perspective, what are the most important topics for the Metropolitan Council to address, guided by the region's Metropolitan Area Water Supply Advisory Committee and Technical Advisory Committee, as part of its ongoing water supply planning role?

☒ Coordination of state, regional and local water supply planning roles
☐ Regional water use goals
☐ Water use reporting standards
☐ Regional and sub-regional partnership opportunities
☐ Identifying and prioritizing data gaps and input for regional and sub-regional analyses
☐ Others: ____

GLOSSARY

Agricultural/Irrigation Water Use - Water used for crop and non-crop irrigation, livestock watering, chemigation, golf course irrigation, landscape and athletic field irrigation.

Average Daily Demand - The total water pumped during the year divided by 365 days.

Calcareous Fen - Calcareous fens are rare and distinctive wetlands dependent on a constant supply of cold groundwater. Because they are dependent on groundwater and are one of the rarest natural communities in the United States, they are a protected resource in MN. Approximately 200 have been located in Minnesota. They may not be filled, drained or otherwise degraded.

Commercial/Institutional Water Use - Water used by motels, hotels, restaurants, office buildings, commercial facilities and institutions (both civilian and military). Consider maintaining separate institutional water use records for emergency planning and allocation purposes. Water used by multi-family dwellings, apartment buildings, senior housing complexes, and mobile home parks should be reported as Residential Water Use.

Commercial/Institutional/Industrial (C/I/I) Water Sold - The sum of water delivered for commercial/institutional or industrial purposes.

Conservation Rate Structure - A rate structure that encourages conservation and may include increasing block rates, seasonal rates, time of use rates, individualized goal rates, or excess use rates. If a conservation rate is applied to multifamily dwellings, the rate structure must consider each residential unit as an individual user. A community may have a separate conservation rate that only goes into effect when the community or governor declares a drought emergency. These higher rates can help to protect the city budgets during times of significantly less water usage.

Date of Maximum Daily Demand - The date of the maximum (highest) water demand. Typically this is a day in July or August.

Declining Rate Structure - Under a declining block rate structure, a consumer pays less per additional unit of water as usage increases. This rate structure does not promote water conservation.

Distribution System - Water distribution systems consist of an interconnected series of pipes, valves, storage facilities (water tanks, water towers, reservoirs), water purification facilities, pumping stations, flushing hydrants, and components that convey drinking water and meeting fire protection needs for cities, homes, schools, hospitals, businesses, industries and other facilities.

Flat Rate Structure - Flat fee rates do not vary by customer characteristics or water usage. This rate structure does not promote water conservation.

Industrial Water Use - Water used for thermonuclear power (electric utility generation) and other industrial use such as steel, chemical and allied products, paper and allied products, mining, and petroleum refining.

Low Flow Fixtures/Appliances - Plumbing fixtures and appliances that significantly reduce the amount of water released per use are labeled "low flow". These fixtures and appliances use just enough water to be effective, saving excess, clean drinking water that usually goes down the drain.

Maximum Daily Demand - The maximum (highest) amount of water used in one day.

Metered Residential Connections - The number of residential connections to the water system that have meters. For multifamily dwellings, report each residential unit as an individual user.

Percent Unmetered/Unaccounted For - Unaccounted for water use is the volume of water withdrawn from all sources minus the volume of water delivered. This value represents water "lost" by miscalculated water use due to inaccurate meters, water lost through leaks, or water that is used but unmetered or otherwise undocumented. Water used for public services such as hydrant flushing, ice skating rinks, and public swimming pools should be reported under the category "Water Supplier Services".

Population Served - The number of people who are served by the community's public water supply system. This includes the number of people in the community who are connected to the public water supply system, as well as people in neighboring communities who use water supplied by the community's public water supply system. It should not include residents in the community who have private wells or get their water from neighboring water supply.

Residential Connections - The total number of residential connections to the water system. For multifamily dwellings, report each residential unit as an individual user.

Residential Per Capita Demand - The total residential water delivered during the year divided by the population served divided by 365 days.

Residential Water Use - Water used for normal household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Should include all water delivered to single family private residences, multi-family dwellings, apartment buildings, senior housing complexes, mobile home parks, etc.

Smart Meter - Smart meters can be used by municipalities or by individual homeowners. Smart metering generally indicates the presence of one or more of the following:

- Smart irrigation water meters are controllers that look at factors such as weather, soil, slope, etc. and adjust watering time up or down based on data. Smart controllers in a typical summer will reduce water use by 30%-50%. Just changing the spray nozzle to new efficient models can reduce water use by 40%.
- Smart Meters on customer premises that measure consumption during specific time periods and communicate it to the utility, often on a daily basis.
- A communication channel that permits the utility, at a minimum, to obtain meter reads on demand, to ascertain whether water has recently been flowing through the meter and onto the premises, and to issue commands to the meter to perform specific tasks such as disconnecting or restricting water flow.

Total Connections - The number of connections to the public water supply system.

Total Per Capita Demand - The total amount of water withdrawn from all water supply sources during the year divided by the population served divided by 365 days.

Total Water Pumped - The cumulative amount of water withdrawn from all water supply sources during the year.

Total Water Delivered - The sum of residential, commercial, industrial, institutional, water supplier services, wholesale and other water delivered.

Ultimate (Full Build-Out) - Time period representing the community's estimated total amount and location of potential development, or when the community is fully built out at the final planned density.

Unaccounted (Non-revenue) Loss - See definitions for "percent unmetered/unaccounted for loss".

Uniform Rate Structure - A uniform rate structure charges the same price-per-unit for water usage beyond the fixed customer charge, which covers some fixed costs. The rate sends a price signal to the customer because the water bill will vary by usage. Uniform rates by class charge the same price-per-unit for all customers within a customer class (e.g. residential or non-residential). This price structure is generally considered less effective in encouraging water conservation.

Water Supplier Services - Water used for public services such as hydrant flushing, ice skating rinks, public swimming pools, city park irrigation, back-flushing at water treatment facilities, and/or other uses.

Water Used for Nonessential Purposes - Water used for lawn irrigation, golf course and park irrigation, car washes, ornamental fountains, and other non-essential uses.

Wholesale Deliveries - The amount of water delivered in bulk to other public water suppliers.

Acronyms and Initialisms

AWWA – American Water Works Association

C/I/I – Commercial/Institutional/Industrial

CIP – Capital Improvement Plan

GIS – Geographic Information System

GPCD – Gallons per capita per day

GWMA – Groundwater Management Area – North and East Metro, Straight River, Bonanza,

MDH – Minnesota Department of Health

MGD – Million gallons per day

MG – Million gallons

MGL – Maximum Contaminant Level

MnTAP – Minnesota Technical Assistance Program (University of Minnesota)

MPARS – MN/DNR Permitting and Reporting System (new electronic permitting system)

MRWA – Minnesota Rural Waters Association

SWP – Source Water Protection

WHP – Wellhead Protection

APPENDICES TO BE SUBMITTED BY THE WATER SUPPLIER

Appendix 1: Well records and maintenance summaries – see Part 1C

Appendix 2: Water level monitoring plan – see Part 1E

Appendix 3: Water level graphs for each water supply well - see Part 1E

Appendix 4: Capital Improvement Plan - see Part 1E

Appendix 5: Emergency Telephone List – see Part 2C

Appendix 6: Cooperative Agreements for Emergency Services – see Part 2C

Appendix 7: Municipal Critical Water Deficiency Ordinance – see Part 2C

Appendix 8: Graph showing annual per capita water demand for each customer category during the last ten-years – see Part 3 Objective 4

Appendix 9: Water Rate Structure – see Part 3 Objective 6

Appendix 10: Adopted or proposed regulations to reduce demand or improve water efficiency – see Part 3 Objective 7

Appendix 11: Implementation Checklist – summary of all the actions that a community is doing, or proposes to do, including estimated implementation dates – see www.mndnr.gov/watersupplyplans

Appendix 1: Well records and maintenance summaries

Unique No. 00206333

County Name Dakota

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 1031

Update Date 1996/07/24

Entry Date 1989/12/27

Township Name	Township	Range	Dir	Section	Subsection
	115	17	W	28	BCACDD

Well Name HASTINGS 3

Contact's Name HASTINGS 3

HASTINGS MN

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
CLAY			0	9
SAND & GRAVEL			9	79
SAND & CLAY			79	103
HARDPAN			103	107
CLAY	BLUE		107	137
HARDPAN			137	169
CLAY	BLUE		169	176
HARDPAN			176	197
SANDROCK (JORDAN)			197	267
SANDSTONE	GREY		267	299

Well Depth 299 ft. Depth Completed 299 ft. Date Well Completed 1956/09/20

Drilling Method Cable Tool

Drilling Fluid

Well Hydrofractured? ☐ Yes ☐ No From ft. to ft.

Use Community Supply (municipal)

Casing Drive Shoe? ☐ Yes ☐ N

Hole Diameter 0 in. to 299 ft

Casing Diameter Weight(lbs/ft)

24 in. to 197 ft

16 in. to 208 ft

Screen N Make Type

Open Hole From 208 ft. to 299 ft.

Static Water Level 67 ft. from Land surface Date 1956/08/23

PUMPING LEVEL (below land surface)

115.08 ft. after hrs. pumping 1000 g.p.m.

Well Head Completion

Pitless adapter mfr Model

Casing Protection ☐ 12 in. above grade

☐ At-grade(Environmental Wells and Borings ONLY)

Grouting Information Well grouted? ☑ Yes ☐ No

Material	From	To (ft.)	Amount(yds/bags)
G	0	208	0

Nearest Known Source of Contamination

ft. direction type

Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed

Mfr name

Model HP 0 Volts

Drop Pipe Length ft. Capacity g.p.m

Type

Any not in use and not sealed well(s) on property? ☐ Yes ☐ No

Was a variance granted from the MDH for this Well? ☐ Yes ☐ No

Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 62012

License Business Name Keys Well Co.

Name of Driller

REMARKS, ELEVATION, SOURCE OF DATA, etc.

M.G.S. NO. 146. GWQ NO. 0215.

USGS Quad Hastings Elevation 778

Aquifer: CJDN Alt Id: 75-6194

Report Copy

HE-01205-06 (Rev. 9/96)

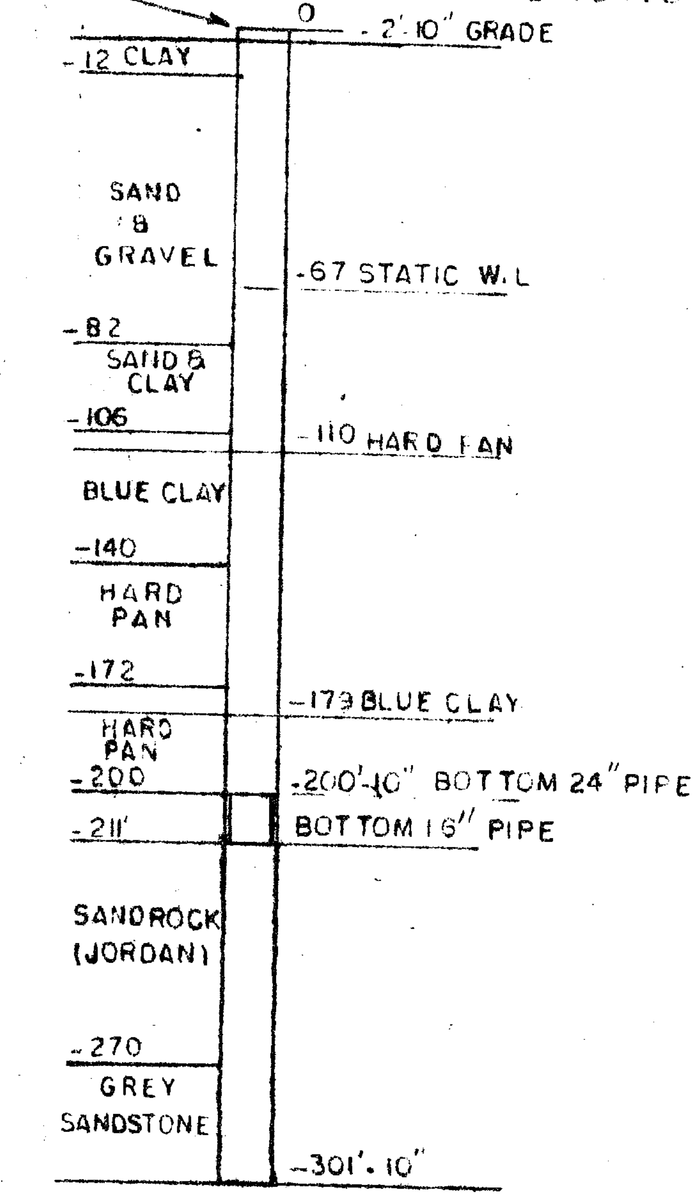
WELL#3

24"X16" WELL - 301'-10" DEEP

STATIC WL 67'

200'-10"- 24" PIPE - 211'-16" LINER GROUTED IN WITH 211' SACKS OF CEMENT

778.95



TEST

521 G.P.M. 23.5" D.D. 1 HR.
660 G.P.M. - 32' D.D. 11/2 HR.
818 G.P.M. 37' D.D. 81/2 HR.
950 G.P.M. 43' D.D. 11/2 HR.
1007 G.P.M. - 45' 2" D.D 21/2 HR.
1200 G.P.M. - 57' 4" D.D 41/2 HR 191/2 HR.

CLEAR & SAND FREE AT 831 G.P.M.

BLASTED 50# BOMBS AT 245' AND 265'

N.W. CORNER 6TH & STATE

WELL - HASTINGS, MINN.

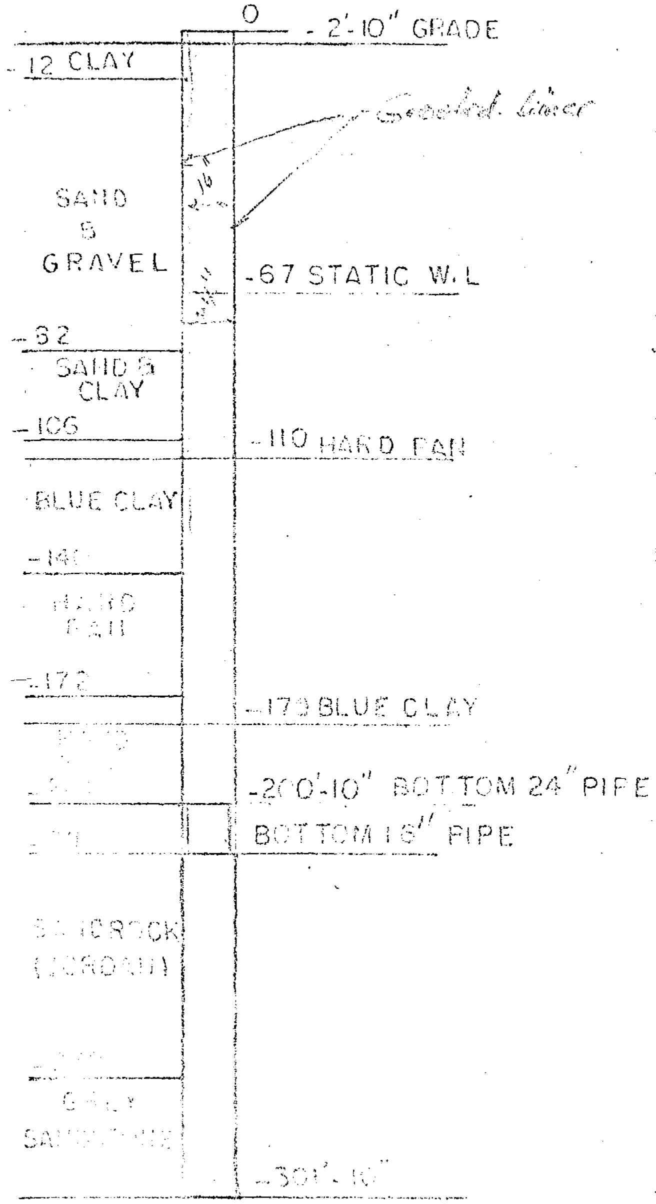
TOLTZ, KING, DUVALL, ANDERSON
AND ASSOCIATES, Inc.
ENGINEERS & ARCHITECTS

COM 3765 10-2-56 G.E.R.

24" X 16" WELL - 301'-10" DEEP

STATIC W/L 67'

200'-10" - 24" PIPE - 211 - 16" LINER GROUTED IN WITH 2[illegible] SACKS OF CEMENT



TEST

531 G.P.M. - 23'-6" D.D. 1 HR.
680 G.P.M. - 32' D.D. 1 1/2 HR.
[illegible]18 G.P.M. - 37' D.D. 3 1/2 HR.
[illegible]50 G.P.M. - 43' D.D. 1 1/2 HR.
1007 G.P.M. - 49'-2" D.D. 2 1/2 HR.
1200 G.P.M. - 57'-4" D.D 4 1/2 HR

CLEAR & SAND FREE AT [illegible]

BLASTED 50# BOMBS AT [illegible]

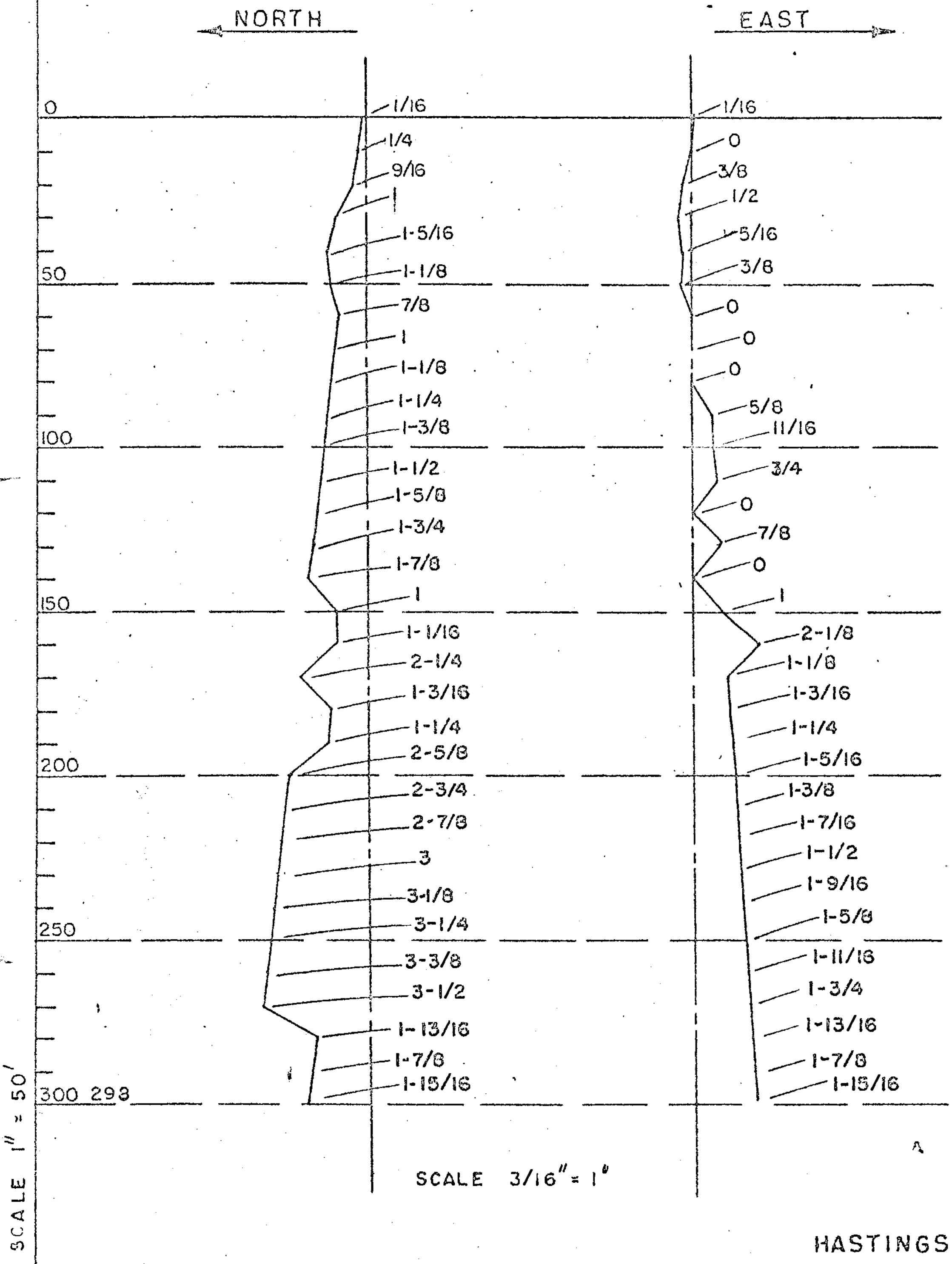
N.W. CORNER 6TH & STATE

WELL - [illegible], MINN.

PLUMBNESS AND
ALIGNMENT TEST
16" CASING INNER LINER

WELL #3

(2)



WELL
HASTINGS, MINN.

TOLTZ, KING, DUVALL, ANDER
AND ASSOCIATES, INC.
ENGINEERS &
ST. PAUL MINN.

8-3-61 COM. 4377A

Unique No. 00207993

County Name Dakota

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 1031

Update Date 1996/07/24

Entry Date 1989/12/27

Township Name	Township	Range	Dir	Section	Subsection
	115	17	W	32	DABBBA

Well Name HASTINGS 4

Contact's Name HASTINGS 4

HASTINGS MN 55033

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
SAND & GRAVEL			0	36
SANDY YELLOW CLAY			36	56
SHAKOPEE-ONEOTA DOLO			56	290
YELLOW SANDSTONE			290	341
FINE SANDSTONE W/SHAL	GRAY		341	360
YELLOW SANDSTONE			360	385
GRAY SANDSTONE SHALE			385	398
ST. LAWRENCE SHALE			398	400

Well Depth 400 ft. **Depth Completed** 400 ft. **Date Well Completed** 1961/08/30

Drilling Method Cable Tool

Drilling Fluid

Well Hydrofractured? ☐ Yes ☐ No
From ft. to ft.

Use Community Supply (municipal)

Casing **Drive Shoe?** ☐ Yes ☐ N

Hole Diameter
0 in. to 400 ft

Casing Diameter **Weight(lbs/ft)**

24 in. to 58 ft

16 in. to 314 ft

Screen N

Make Type

Open Hole From 314 ft. to 400 ft.

Static Water Level 138 ft. from Land surface Date 1961/08/30

PUMPING LEVEL (below land surface)

189 ft. after hrs. pumping 1200 g.p.m.

Well Head Completion

Pitless adapter mfr Model

Casing Protection ☐ 12 in. above grade

☐ At-grade(Environmental Wells and Borings ONLY)

Grouting Information Well grouted? ☑ Yes ☐ No

Material	From	To (ft.)	Amount(yds/bags)
G	0	314	0

Nearest Known Source of Contamination

ft. direction type

Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed

Mfr name

Model HP 0 Volts

Drop Pipe Length ft. Capacity g.p.m

Type

Any not in use and not sealed well(s) on property? ☐ Yes ☐ No

Was a variance granted from the MDH for this Well? ☐ Yes ☐ No

Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 27118

License Business Name Tri-state Well Co.

Name of Driller

REMARKS, ELEVATION, SOURCE OF DATA, etc.

COUNTRY ESTATES BLK 5 LOT 1.

USGS Quad Vermillion Elevation 863

Aquifer: CJDN Alt Id: 75-6194

Report Copy

Well # 4

File

LOG

WATER WELL-DRILLED JULY 1961-HASTINGS, MINNESOTA
DRILLED BY TRI-STATE DRILLING CO.

867.3 TOP OF PIPE

861.3 PLATFORM LEVEL

0

2.9 GROUT

SAND & GRAVEL

35

SANDY YELLOW CLAY

56

59-24" CIP CASING

LIMESTONE & SHALE

70

LIMESTONE & SHALE-TRACE OF SANDSTONE

124

LIMESTONE & SOME SHALE

165

LIMESTONE, SHALE & BROWN SHALE

180

LIMESTONE & SHALE WITH HARD SEAMS

235

LIMESTONE, SHALE, CREVASSED BRICKLY

260

LIMESTONE, SHALE-BREAKING INTO HOLE

290

295

LIMESTONE & SANDSTONE

305

SANDSTONE

312-16" CASING - GROUT

YELLOW SANSTONE

341

HARD GREY SANDSTONE & SHALE

360

YELLOW SANSTONE

385

390

GREY SANDSTONE

400

398

GREY SANDSTONE

SHALE

STATIC WATER LEVEL 138.0'
PUMP SETTING 867.0
TOTAL HEAD 315'
SPECIFIED HEAD 327'
PUMPING AT 600 G.P.M. WATER LEVEL 162'

TOLTZ, KING, DUVALL, ANDERSON, AND ASSOCIATES, INC.
ENGINEERS & ARCHITECTS
ST. PAUL MINN.

COM. 4377A

7-27-1961

T.W. - G.F.R. 8-1961

Prints mailed To W. Erickson 5-10-62.

Unique No. 00207639 County Name Dakota	MINNESOTA DEPARTMENT OF HEALTH **WELL AND BORING RECORD** *Minnesota Statutes Chapter 1031*	Update Date 1996/07/24 Entry Date 1989/12/27

Township Name	Township	Range	Dir	Section	Subsection
	115	17	W	29	ACDDCD

Well Name HASTINGS 5

Contact's Name HASTINGS 5
55 HY
HASTINGS MN

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
SAND AND CLAY			0	8
SHAKOPEE			8	10
SHAKOPEE			10	264
JORDAN			264	275
JORDAN			275	353
SANDROCK AND SHALE			353	355
SHALE			355	355

Well Depth 355 ft. **Depth Completed** 355 ft. **Date Well Completed** 1970/09/04

Drilling Method Cable Tool

Drilling Fluid

Well Hydrofractured? ☐ Yes ☐ No
From ft. to ft.

Use Community Supply (municipal)

Casing **Drive Shoe?** ☐ Yes ☐ N

Hole Diameter
0 in. to 356 ft

Casing Diameter **Weight(lbs/ft)**
30 in. to 26 ft
24 in. to 277 ft

Screen N
Make Type

Open Hole From 277 ft. to 356 ft.

Static Water Level 147 ft. from Land surface Date 1970/09/04

PUMPING LEVEL (below land surface)
213 ft. after hrs. pumping 1200 g.p.m.

Well Head Completion
Pitless adapter mfr Model
Casing Protection ☐ 12 in. above grade
☐ At-grade(Environmental Wells and Borings ONLY)

Grouting Information Well grouted? ☑ Yes ☐ No

Material	From	To (ft.)	Amount(yds/bags)	
G	0	277	33	Y

Nearest Known Source of Contamination
ft. direction type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Mfr name
Model HP 0 Volts
Drop Pipe Length ft. Capacity g.p.m
Type

Any not in use and not sealed well(s) on property? ☐ Yes ☐ No

Was a variance granted from the MDH for this Well? ☐ Yes ☐ No

REMARKS, ELEVATION, SOURCE OF DATA, etc.
M.G.S. NO. 583.

USGS Quad Vermillion Elevation 860
Aquifer: MTPL Alt Id: 75-6194

Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 62012
License Business Name Keys Well Co.
Name of Driller

Report Copy

HE-01205-06 (Rev. 9/96)

Unique No. 00207643 County Name Dakota	MINNESOTA DEPARTMENT OF HEALTH **WELL AND BORING RECORD** *Minnesota Statutes Chapter 1031*	Update Date 1996/07/24 Entry Date 1989/12/27

Township Name	Township	Range	Dir	Section	Subsection
	115	17	W	34	CDDBBA

Well Name HASTINGS 6

Contact's Name HASTINGS 6
316 HY
HASTINGS MN

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
SAND AND CLAY			0	8
SAND			8	33
GRAVEL			33	40
SAND			40	64
GRAVEL AND LIME CHUNK			64	84
LIME AND SAND			84	93
LIME AND SAND			93	102
SHAKOPEE LIME			102	229
JORDAN SANDSTONE			229	330
JORDAN SANDSTONE			330	332

Well Depth 332 ft. Depth Completed 332 ft. Date Well Completed 1972/02/28

Drilling Method Cable Tool

Drilling Fluid

Well Hydrofractured? ☐ Yes ☐ No
From ft. to ft.

Use Community Supply (municipal)

Casing Drive Shoe? ☐ Yes ☐ N

Hole Diameter
0 in. to 332 ft

Casing Diameter Weight(lbs/ft)
30 in. to 98 ft
24 in. to 240 ft

Screen N Open Hole From 240 ft. to 332 ft.
Make Type

Static Water Level 125 ft. from Land surface Date 1972/02/28

PUMPING LEVEL (below land surface)
241 ft. after hrs. pumping 1650 g.p.m.

Well Head Completion
Pitless adapter mfr Model
Casing Protection ☐ 12 in. above grade
☐ At-grade(Environmental Wells and Borings ONLY)

Grouting Information Well grouted? ☑ Yes ☐ No

Material	From	To (ft.)	Amount(yds/bags)	
G	0	240	0	S

Nearest Known Source of Contamination
ft. direction type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Mfr name
Model HP 0 Volts
Drop Pipe Length ft. Capacity g.p.m
Type

Any not in use and not sealed well(s) on property? ☐ Yes ☐ No

Was a variance granted from the MDH for this Well? ☐ Yes ☐ No

Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 62012
License Business Name Keys Well Co.
Name of Driller

REMARKS, ELEVATION, SOURCE OF DATA, etc.
M.G.S. NO. 750.

USGS Quad Hastings Elevation 835
Aquifer: MTPL Alt Id: 75-6194

Report Copy

HE-01205-06 (Rev. 9/96)

WELL RECORD

KEYS WELL DRILLING COMPANY

WATER PRODUCERS

SAINT PAUL, MINNESOTA

Owner CITY OF HASTINGS   Date Completed February 28, 1972

Location Highway 316 - 1/2 Mile So. of U. S. 61   Driller Floyd C. O'Brien

Well No. 6   Size 30" x 24"   Total Depth 332'   Type Sandstone

DRILLERS LOG

From	To	Formation
0'	8'	Sand and Clay
8'	33'	Sand
33'	40'	Gravel
40'	64'	Sand
64'	84'	Gravel and Lime Chunks
84'	102'	Lime and Sand
102'	229'	Shakopee Lime
229'	332'	Jordan Sandstone
' to	'	
' to	'	
' to	'	
' to	'	
' to	'	
' to	'	

WELL MATERIALS

98 ' of 30 " diameter of Outer Casing

142 ' of 29 " diameter of Open Hole

240 ' of 24 " diameter of Inner Casing

88 ' of 23 " diameter of Open Hole

0 ' to 244' Mix grout 434 (yds.) (Sacks)

____ ' ____ " diameter ____ Screen

RECORD OF TEST PUMPING

Static Water Level 125 ft. from platform

GPM	D.D.	Hours
1200	82'5"	7-1/2
1650	116'5"	4
1700	Broke suction	

Remarks: Bailed 170 yds. sandstone.

Dynamite - 250#

PERMANENT PUMP DATA

Mfg. ____ Type ____ Serial No. ____

Capacity ____ GPM ____ TDH

Motor Make ____ Type ____

____ H. P. ____ Volts ____ Ph. ____ RPM

____ ft. ____ in Col. pipe ____ in. Shaft

____ ft. ____ in Bowls ____ Stages ____ Type

____ ft. ____ in suction pipe & ____

____ ft. Total Length of Pump

____ ft. ____ in. drop pipe & ____ No. Cable

____ ft. ____ in. air line

____ in. Pitless ____ ft. bury ____ in outlet ____

Unique No. 509053
County Name Dakota

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 1031

Update Date
Entry Date 2002/03/01

Township Name	Township	Range	Dir	Section	Subsection	Well Depth	Depth Completed	Date Well Completed
	115	17	W	28		285 ft.	285 ft.	1989/10/09

Well Name HASTINGS 7

Well Owner's Name HASTINGS 7
ASHALAND ST
HASTINGS MN

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
SAND AND GRAVEL			0	56

Drilling Method Cable Tool

Drilling Fluid
Well Hydrofractured? ☐ Yes ☐ No
Fro ft. to ft.

Use Community Supply (municipal)

Casing Drive Shoe? ☐ Yes ☐ N

Hole Diameter
in. t 142 ft
in. t 285 ft

Casing Diameter Weight(lbs/ft)
30 in. t 63 ft
24 in. t 205 ft

Screen N
Make

Open Hole From 205 ft. to 285 ft.
Type

Static Water Level 84 ft. from Land surface Date 1989/10/09

PUMPING LEVEL (below land surface)
123 ft. after 2 hrs. pumping 1000 g.p.m.

Well Head Completion
Pitless adapter mf Model
Casing Protection ☑ 12 in. above grade
☐ At-grade(Environmental Wells and Borings ONLY)

Grouting Information Well grouted? ☑ Yes ☐ No

Material	From	To (ft.)	Amount(yds/bags)	
G	0	205	66	Y

Nearest Known Source of Contamination
ft. direction type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Mfr nam
Mode HP Volts
Drop Pipe Length ft. Capacity g.p.m
Type

Any not in use and not sealed well(s) on property? ☐ Yes ☐ No

Was a variance granted from the MDH for this Well? ☐ Yes ☐ No

USGS Quad Hastings Elevation
Aquifer: Alt Id: 75-6194

Well CONTRACTOR CERTIFICATION Lic Or Reg. No. 62012
License Business Name Keys Well Co.
Name of Driller RUSSELL, J.

Report Copy

HE-01205-06 (Rev. 9/96)

TOTAL P.02

WELL RECORD

KEYS WELL DRILLING COMPANY
WATER PRODUCERS
SAINT PAUL, MINNESOTA

Owner: City of Hastings — Date Completed: 10/9/89

Location: 9th and Ashland St. Hastings, MN — Driller: Jim Russell

Well No. 7 — Size 30 x 24 — Total Depth 285 — Type Jordan

DRILLERS LOG

From (')	To (')	Formation
0	56	Sand and gravel
56	57	Limerock
57	59	Sand
59	62	Limerock (broken)
62	65	Limerock (Hard)
65	66	Sand
66	75	Limerock
75	78	Sandstone
78	195	Limerock
195	283	Sandrock
283	285	Limerock

PERMANENT PUMP DATA

Mfg. Peerless Type turb Serial No. ____

Capacity 1200 GPM 312 TDH

Motor Make GE Type VHS

150 H. P. 460 Volts 3 Ph. 1760 RPM

220 ft. 10 in Col. pipe 1 1/2 in. Shaft

7 ft. 12 in Bowls 5 Stages MB Type

10 ft. 12 in suction pipe & Steamer

237 ft. Total Length of Pump

____ ft. ____ in. drop pipe & ____ No. Cable

____ ft. ____ in. air line

____ in. Pitless ____ ft. bury ____ in outlet ____

WELL MATERIALS

63 ' of 30 " diameter of Outer Casing

142 ' of 29 " diameter of Open Hole

205 ' of 24 " diameter of Inner Casing

80 ' of 23 " diameter of Open Hole

0 ' to 205 Mix grout 66 (yds.) (Sacks)

____ ' ____ " diameter ____ Screen

RECORD OF TEST PUMPING

Static Water Level 84 ft. from top of pipe

GPM	D.D.	Hours
1000	39	2
1200	56	2
1300	82	5
1400	77	9
1600	87	7
1800	94-6	8

Remarks:

Total pump hours 51 Hours

blated 150# dynamite and bailed out

260 yds and loose sandrock and air development 23 hours

1st Test- (before development)

935 GPM. 78-6' dd. (3"/16 sand)

Well #8

WELL LOCATION

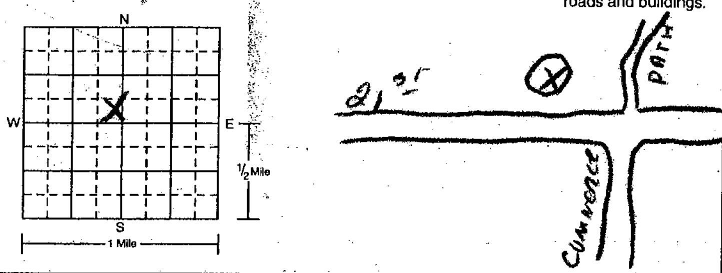
County Name: Dakota

Township Name	Township No.	Range No.	Section No.	Fraction
..stings	115	17	34	SE SE NW ¼

House Number, Street Name, City, and Zip Code of Well Location: 21st & Commerce Dr.

or Fire Number:

Show exact location of well in section grid with "X". Sketch map of well location. Showing property lines, roads and buildings.



MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

MINNESOTA UNIQUE WELL NO. 686266

WELL DEPTH (completed): 280 ft.

Date Work Completed: 6/06

DRILLING METHOD: ☒ Cable Tool ☐ Auger ☐ ☐ Driven ☐ Rotary ☐ Dug ☐ Jetted

DRILLING FLUID: Water

WELL HYDROFRACTURED? ☐ YES ☒ NO FROM ____ ft. to ____ ft.

USE: ☐ Domestic ☐ Irrigation ☐ Environ. Bore Hole ☐ Monitoring ☒ Community PWS ☐ Noncommunity PWS ☐ Dewatering ☐ Heating/Cooling ☐ Industry/Commercial ☐ Remedial ☐

CASING: ☒ Steel ☐ Plastic; Drive Shoe? ☒ Yes ☐ No; ☐ Threaded ☒ Welded ☐

HOLE DIAM.

CASING DIAMETER		WEIGHT	HOLE DIAM.
30 in. to	27 ft.	118.76 lbs./ft.	30 in. to 280 ft.
24 in. to	188 ft.	94.71 lbs./ft.	in. to ft.
in. to	ft.	lbs./ft.	in. to ft.

PROPERTY OWNER'S NAME: City of Hastings

Property owner's mailing address if different than well location address indicated above.

101 E 4th St.
Hastings, MN 55033

SCREEN ____ Make ____ Type ____ Slot/Gauze ____ Set between ____ ft. and ____ ft.

OPEN HOLE from 188 ft. to 280 ft.

Diam. ____ Length ____ FITTINGS: ____

STATIC WATER LEVEL: 90 ft. ☒ below ☐ above land surface; Date measured 6/19/06

PUMPING LEVEL (below land surface): 155 ft. after 8 hrs. pumping 1200 g.p.m.

WELL OWNER'S NAME

Well owner's mailing address if different than property owner's address indicated above.

WELL HEAD COMPLETION: ☐ Pitless adapter manufacturer ____ Model ____; ☒ Casing Protection ☒ 12 in. above grade; ☐ At-grade (Environmental Wells and Borings ONLY)

GROUTING INFORMATION: Well grouted? ☒ Yes ☐ No

Grout Material ☒ Neat cement ☐ Bentonite ☐ Concrete ☐ High Solids Bentonite

from 0 to 188 ft. 36.5 ☒ yds. ☐ bags
from ____ to ____ ft. ☐ yds. ☐ bags
from ____ to ____ ft. ☐ yds. ☐ bags

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Drift	Black	S	0	3
Limestone	Yellow	H	3	178
Sandstone	Yellow	M	178	273
Shale	Grey	H	273	280

Use a second sheet, if needed

NEAREST KNOWN SOURCE OF CONTAMINATION: 150 feet N direction River type

Well disinfected upon completion? ☒ Yes ☐ No

PUMP: ☒ Not installed Date installed ____
Manufacturer's name ____
Model number ____ HP ____ Volts ____
Length of drop pipe ____ ft. Capacity ____ g.p.m.
Type: ☐ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☒ Yes ☐ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No TN# ____

REMARKS, ELEVATION, SOURCE OF DATA, etc.

Well #8

Job #2005125

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Keys Well Drilling Company — 1347
Licensee Business Name — *Lic. or Reg. No.*

George H Keys — 7/14/06
Authorized Representative Signature — *Date*

John Allan — 7/14/06
Name of Driller — *Date*

IMPORTANT - FILE WITH PROPERTY PAPERS
WELL OWNER COPY

686266

HE-01205-07 (Rev. 2/99)

IC# 140-0020

City of Hastings
Well Data

	Year Built
Well #3	10/1956
Well #4	1961
Well #5	1970
Well #6	1972
Well #7	10/1989
Well #8	6/2006

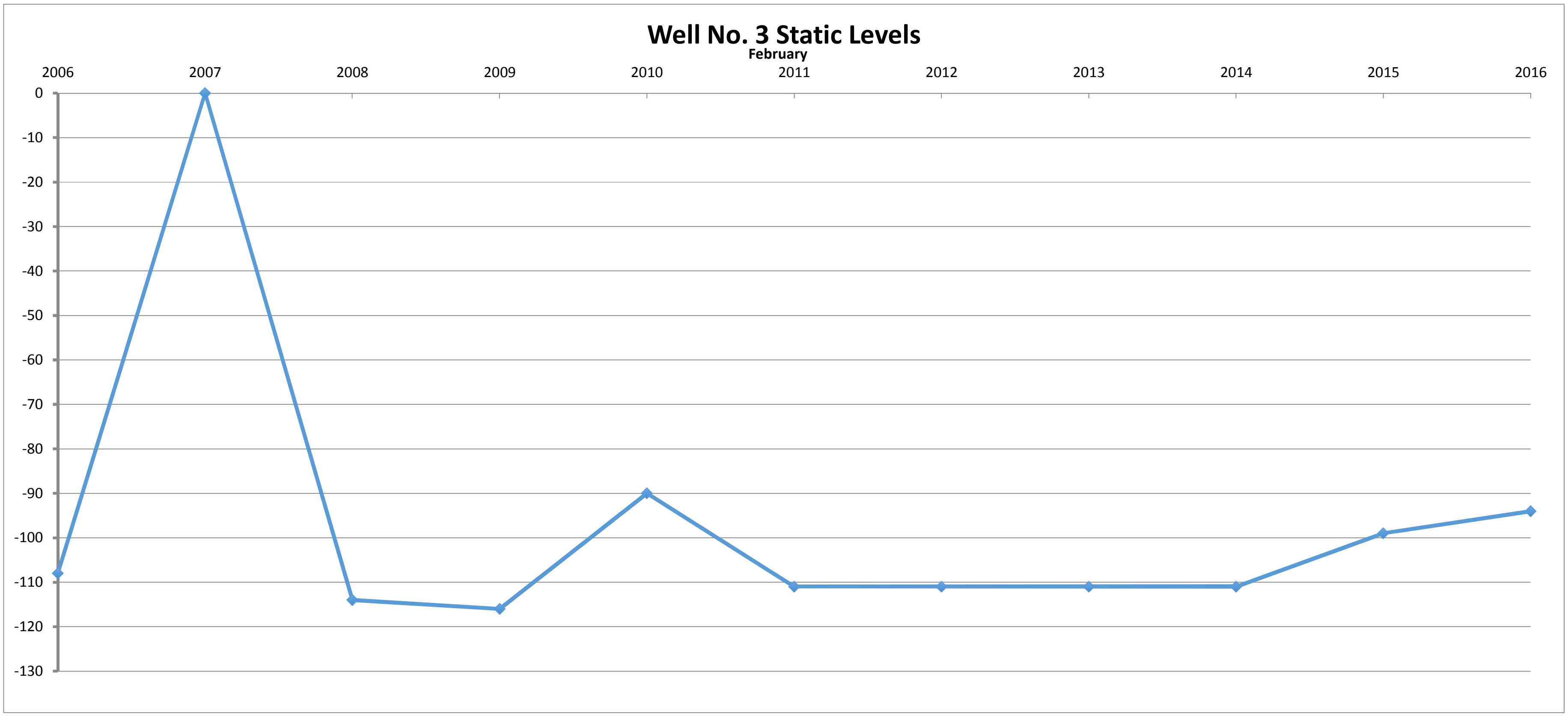
	Rebuilt Pumps	
Well #3	1/1993	
Well #4	3/1995	
Well #5	1995	2007
Well #6	3/2004	10/2014
Well #7	1/2005	
Well #8	-	

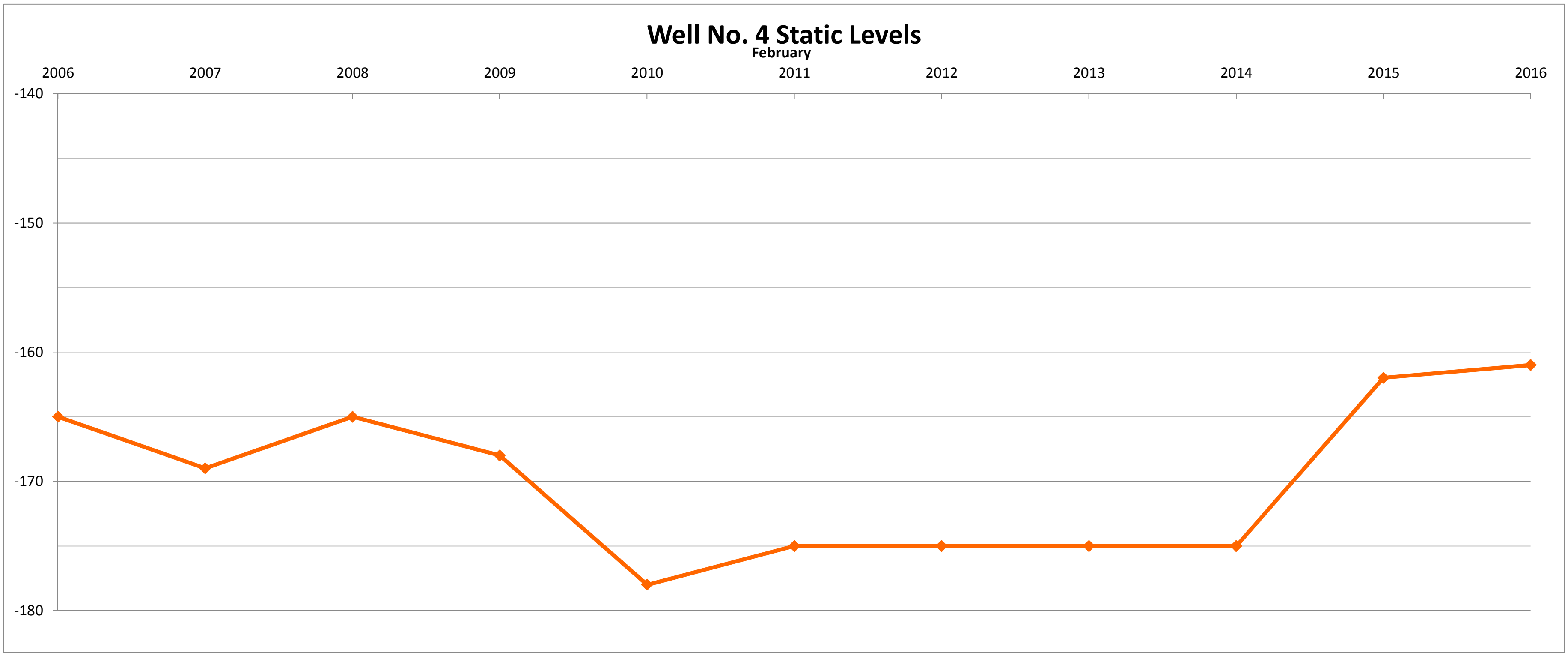
Appendix 2: Water level monitoring plan

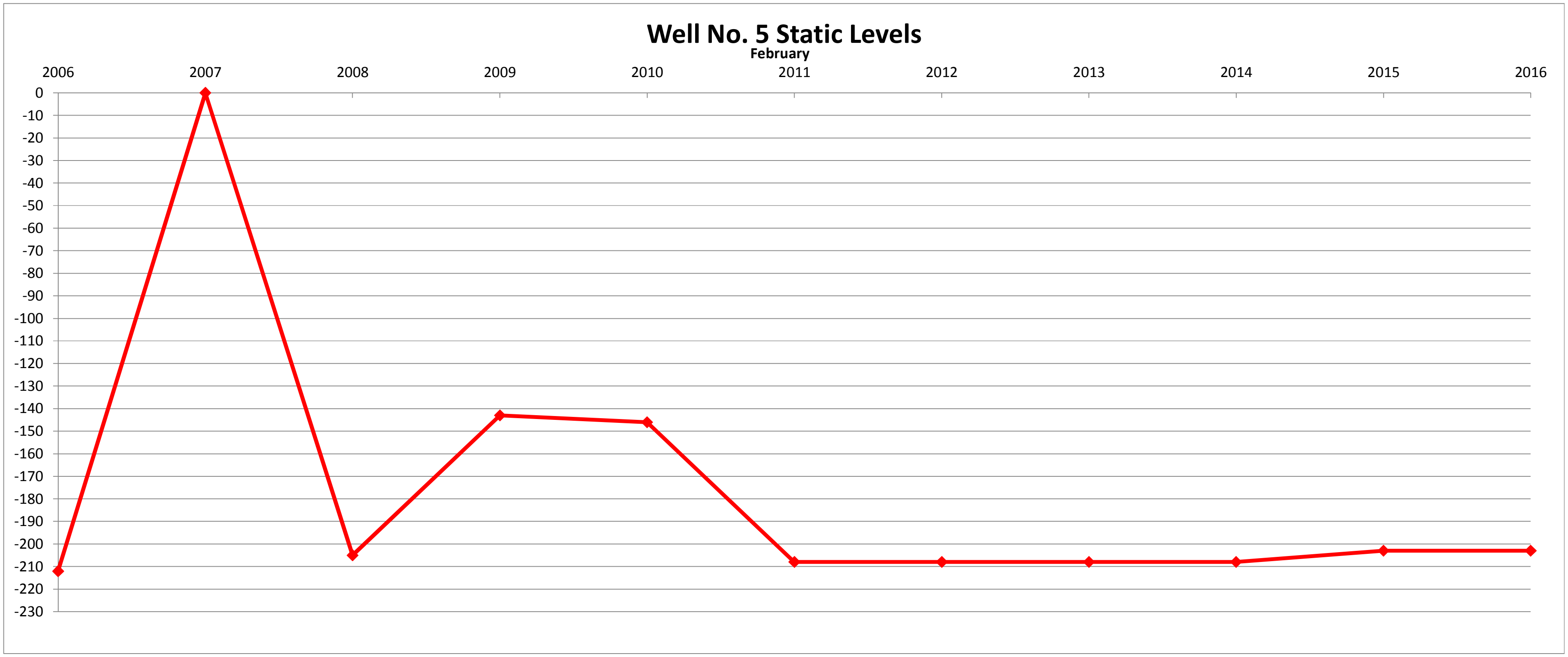
Appendix 3: Water level graphs for each water supply well

City of Hastings Well Static Level Data

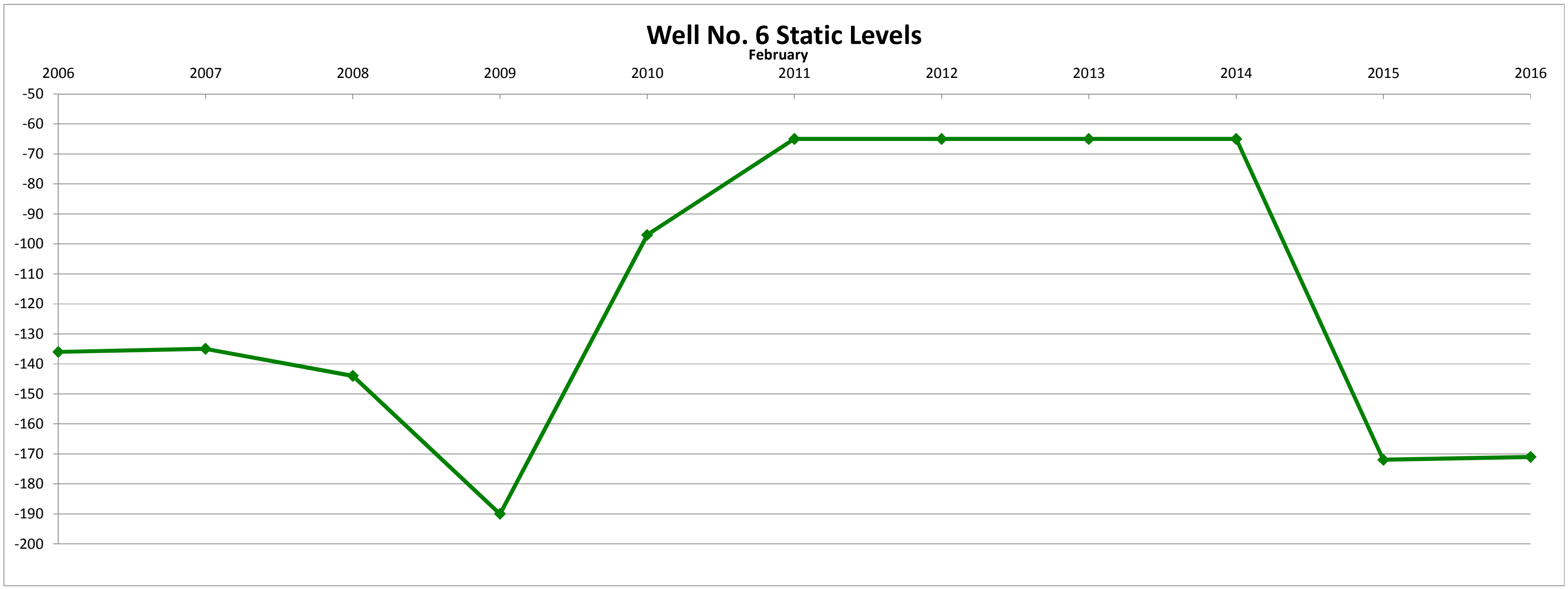
Flatline segments indicate reading transducer malfunction/failure and should not be taken as valid.



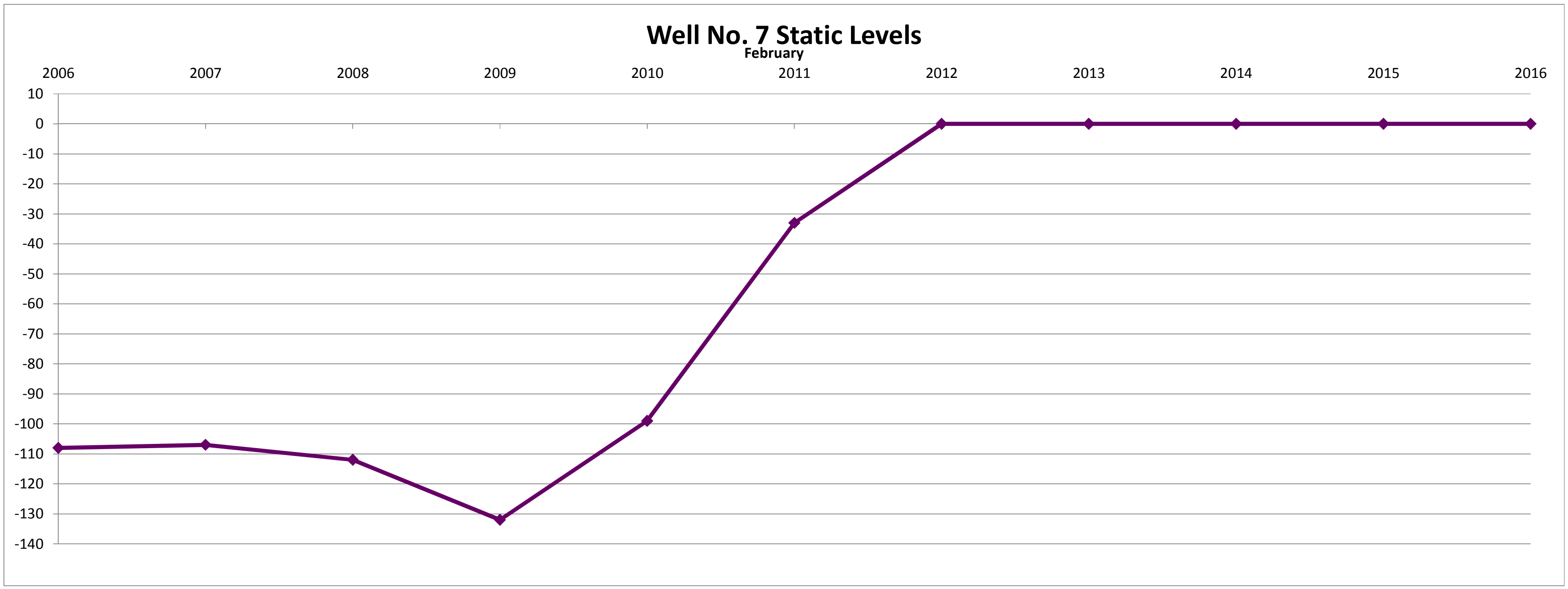

Well No. 4 Static Levels
February
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
-140
-150
-160
-170
-180

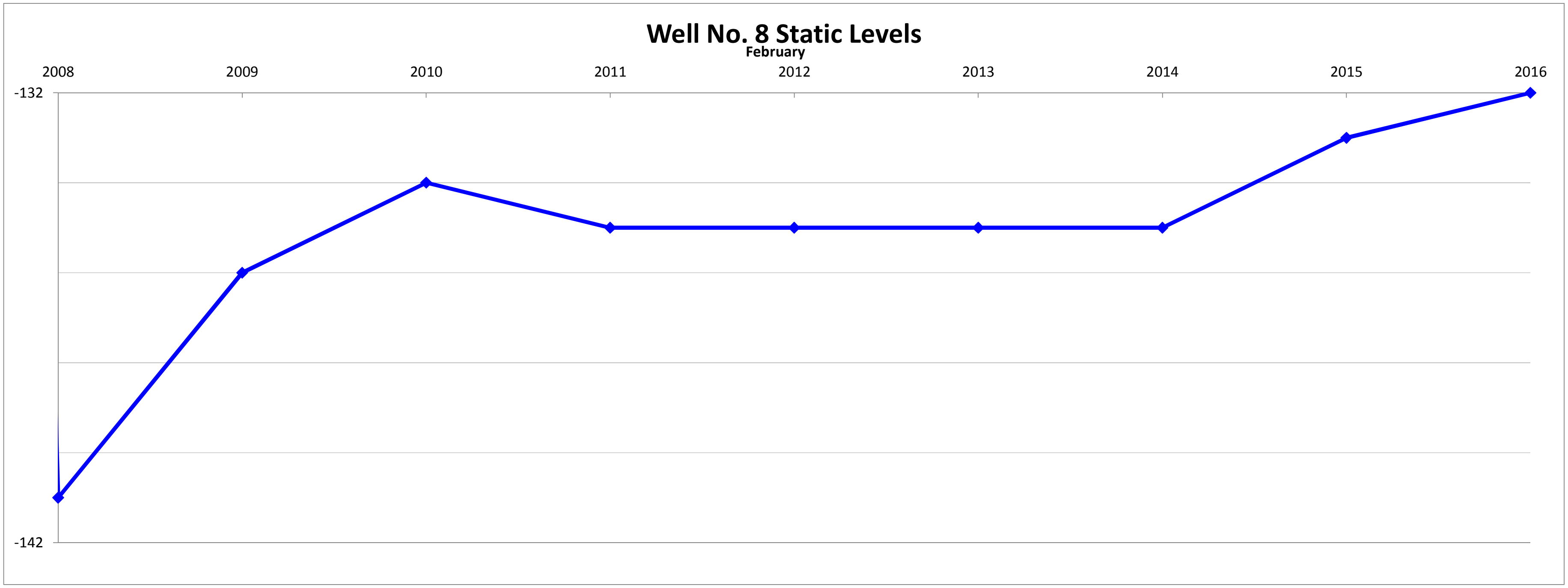


Well No. 5 Static Levels
February
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
-230



Well No. 6 Static Levels
February
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200


Well No. 7 Static Levels
February
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140



Well No. 8 Static Levels
February
2008
2009
2010
2011
2012
2013
2014
2015
2016
-132
-142

Appendix 4: Capital Improvement Plan

CITY OF HASTINGS

2017-2026 CAPTIAL IMPROVEMENT PLAN - MAJOR CAPITAL ITEMS

WATER SYSTEM CAPITAL	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
WELL & PUMP HOUSE NO. 9									$ 1,725,000	
ELEVATED STORAGE TANK - LOW SERVICE AREA (1.0 MG)										$ 2,800,000
PRESSURE REDUCING STATION (RIVER SERVICE AREA)										$ 210,000
BOOSTER STATION										
TEST WELLS									$ 63,500	$ 65,000
TREATMENT PLANT NO. 2										
REPAINTING OF EXISTING TOWERS		$ 1,416,250		$ 1,498,750						
FINISH 2030 WATER SYSTEM COMPREHENSIVE PLAN UPDATES	$ 25,000									
WATER SYSTEM TOTALS	**$ 25,000**	**$ 1,416,250**	**$ -**	**$ 1,498,750**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,788,500**	**$ 3,075,000**

*Note: Trunk Watermain from 10th Street to 15th Street Included in "CIP Cost Estimate" Spreadsheet

SANITARY SEWER SYSTEM CAPITAL	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
FUTURE CAPTIAL IMPROVEMENTS TO BE FUNDED BY DEVELOPMENT										
FINISH 2030 SANITARY SEWER SYSTEM COMPREHENSIVE PLAN UPDATES	$ 25,000									
SANITARY SEWER SYSTEM TOTALS	**$ 25,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

OTHER	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
TOTALS	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

CITY OF HASTINGS
2017-2026 CAPTIAL IMPROVEMENT PLAN - MAJOR MAINTENANCE ITEMS

WATER SYSTEM MAINTENANCE	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
PULL AND REHABILITATE 6 WELLS	$ 93,750	$ 96,563	$ 99,375	$ 102,188		$ 107,813		$ 113,438		
REPLACE 6 WELL MOTORS	$ 11,000	$ 11,330	$ 11,660	$ 11,990		$ 12,650		$ 13,310		
REPLACE RESIN AT WATER TREATMENT PLANT				$ 583,000						
WATER METER REPLACEMENT PROGRAM	$ 500,000	$ 515,000	$ 530,000	$ 545,000	$ 560,000	$ 575,000	$ 590,000			
REPLACE WELL PORTABLE EMERGENCY GENERATOR				$ 55,000						
REPLACE 3 VFD'S AT PUMP HOUSES	$ 10,000	$ 10,300	$ 10,600							
INSTALL AC UNITS IN 3 PUMP HOUSES	$ 10,000	$ 10,300	$ 10,600							
ADD AN ADDITIONAL SCADA COMPUTER FOR REDUNDANCY	$ 6,000									
CONDUCT A WATER LEAK DETECTION SURVEY (NEW INITIATIVE)	$ 7,500		$ 7,950		$ 8,400		$ 8,850		$ 9,075	
WATER SYSTEM TOTALS	**$ 638,250**	**$ 643,493**	**$ 670,185**	**$ 1,297,178**	**$ 568,400**	**$ 695,463**	**$ 598,850**	**$ 126,748**	**$ 9,075**	**$ -**

SANITARY SEWER SYSTEM MAINTENANCE	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
SANITARY SEWER LINING PROGRAM (COLLECTION SYSTEM)	$ 368,000	$ 189,520	$ 195,040	$ 200,560	$ 206,080	$ 211,600	$ 217,120	$ 222,640	$ 228,160	$ 233,680
REBUILD 4 LIFT STATION CONTROL PANELS	$ 12,100		$ 12,826			$ 13,915		$ 14,641		
REPLACE STATIONARY LIFT STATION BACKUP GENERATOR				$ 41,965						
REPLACE TOWABLE BACKUP GENERATOR					$ 43,120					
REPLACE LIFT STATION PUMPS (14 TOTAL)	$ 4,000	$ 4,120	$ 4,240	$ 4,360	$ 4,360	$ 4,480	$ 9,200	$ 9,440	$ 9,680	$ 9,920
SANITARY SEWER SYSTEM TOTALS	**$ 384,100**	**$ 193,640**	**$ 212,106**	**$ 246,885**	**$ 253,560**	**$ 229,995**	**$ 226,320**	**$ 246,721**	**$ 237,840**	**$ 243,600**

Appendix 5: Emergency Telephone List

Emergency Telephone List – Water Emergencies

Emergency Response Team	Name	Work Telephone	Alternate Telephone
Emergency Response Lead	Mark Peine	651-480-6185	651-248-3108
Alternate Emergency Response Lead	Eric Kramer	651-480-6185	651-295-7893
Water Operator	Duty Person	651-248-3271	
Alternate Water Operator	Dave Dube	651-319-6347	
Public Communications	Lee Stoffel	651-480-2350	651-388-6607
State and Local Emergency Response Contacts	**Name**	**Work Telephone**	**Alternate Telephone**
State Incident Duty Officer	Minnesota Duty Officer	800/422-0798 Out State	651/649-5451 Metro
County Emergency Director	BJ Battig	651-438-4703	(651) 438-4532
National Guard	Minnesota Duty Officer	800/422-0798 Out State	651/649-5451 Metro
Mayor/Board Chair	Paul Hicks	651/296/2314	651/437-8866 (H)
Fire Chief/Ambulance	Mike Schutt	651/480-6150	651/775-5547 (C)
Sheriff	Dakota County	651/437-4211	651/438-4710
Police Chief	Bryan Schafer	651/480-2300	612-366-3652 (C)
Hospital	Regina Medical Center	651/480-4100	
Doctor or Medical Facility	Allina Medical Clinic	651/438-1800	
State and Local Agencies	**Name**	**Work Telephone**	**Alternate Telephone**
MDH District Engineer	Bassam Banat	651-643-2105	
MDH	Drinking Water Protection	651/201-4700	
State Testing Laboratory	Minnesota Duty Officer	800/422-0798 Out State	651/649-5451 Metro
MPCA	Charly Wojtysiak	651-296-7228	
DNR Area Hydrologist	Jennie Skancke	651-259-5790	
County Water Resources	Jill Trescott	952-891-7019	
Utilities	**Name**	**Work Telephone**	**Alternate Telephone**
Electric Company	Xcel Energy	800-895-2999	
	Dakota Electric	651-463-6201	1-800-430-9722

Gas Company	CenterPoint Energy	612-372-5050	800-296-9815
Telephone Company	CenturyLink	651-409-9180	800/788-3600
Gopher State One Call	Utility Locations	800/252-1166	651-454-0002
Highway Department	Mark Fischbach	651-437-2109	651-775-0324
Mutual Aid Agreements	**Name**	**Work Telephone**	**Alternate Telephone**
Neighboring Water System	N/A		
Emergency Water Connection	N/A		
Materials	HD Supply	952-937-9666	
	MN Pipe	651-463-6090	
Technical/Contracted Services/Supplies	**Name**	**Work Telephone**	**Alternate Telephone**
MRWA Technical Services	MN Rural Water Association	800/367-6792	
Well Driller/Repair	Keys Well Drilling(Jeff)	651-646-7871	612-801-2334
Pump Repair	Keys Well Drilling(Jeff)	651-646-7871	612-801-2334
Electrician	Mark Woodward	651-480-6185	651-248-1766
Plumber	Swanson Plumbing	651-437-9215	
Backhoe	DSM Excavation	651-480-1355	
Chemical Feed	DPC	651-437-1333	
Meter Repair	Midwest testing L.L.C.	612-910-1245	
Generator	Ziegler	952-888-4121	800-352-2812
Valves	HD Supply	952-937-9666	
Pipe & Fittings	HD Supply	952-937-9666	
Water Storage			
Laboratory	Pace Labs	612-607-1700	
Engineering firm			
Communications	**Name**	**Work Telephone**	**Alternate Telephone**
News Paper	Hastings Star Gazette	651-437-6153	
Radio Station	KDWA	651-437-1460	
School Superintendent	Tim Collins	651-437-6111	

Property & Casualty Insurance	League of MN Cities Insurance	(651) 215-4067	
Critical Water Users	**Name**	**Work Telephone**	**Alternate Telephone**
Hospital Critical Use:			
Nursing Home Critical Use:			
Public Shelter Critical Use:			

Appendix 6: Cooperative Agreements for Emergency Services

Appendix 7: Municipal Critical Water Deficiency Ordinance

City of Hastings Ordinances, Chapter 51.05 Part G.2

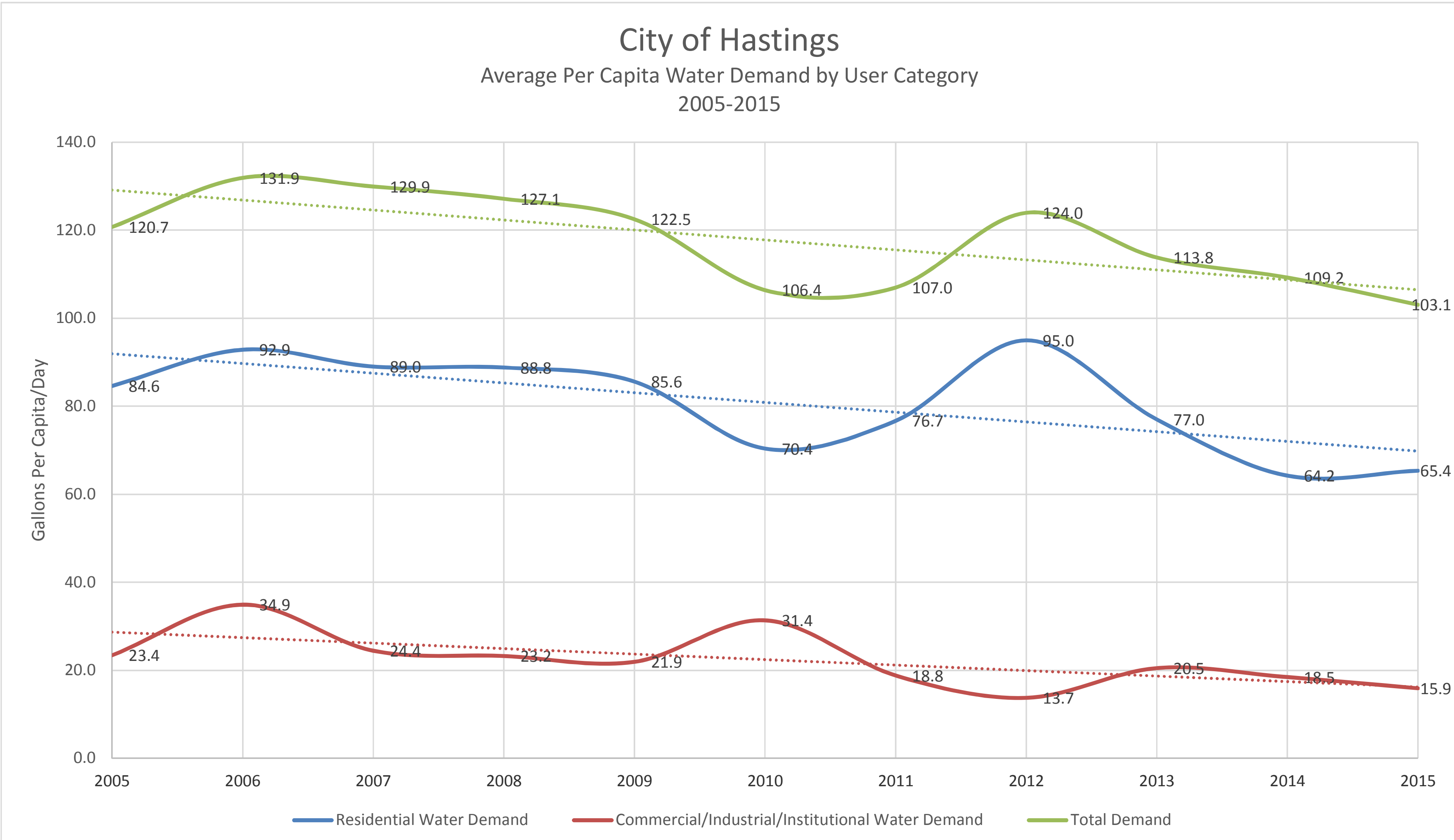
(G) *Water conservation.*

(1) *Lawn sprinkling.* It is unlawful for the owner or occupant of any property to sprinkle a lawn, wash a motor vehicle or to accomplish any non-essential use not involving private or public sanitation or health when the same is prohibited in accordance herewith.

(2) Water emergency. After 24-hours' notice following broadcast by local radio stations, or immediately after hand-delivered special notice that a water emergency exists, it is unlawful for the owner or occupant of any property to use water for sprinkling a lawn, washing a motor vehicle, or any other non-essential use not involving private or public sanitation or health. The water emergency shall continue until further notice by local radio station or newspaper.

(3) Ban. From May 15 to September 1 of each year, an odd/even lawn sprinkling ban shall be in effect for all lawn sprinkling systems supplied by water from the City of Hastings water utility. Properties with even numbered addresses may sprinkle lawns only on days with even numbered dates. Properties with odd numbered addresses may sprinkle only on days with odd numbered dates. A 1-week exemption from the odd/even sprinkling ban may be granted for newly planted sod, grass or landscaping upon registering for the exemption and recommendation of the Hastings Utility Department. Other exemptions may be granted upon evaluation and recommendation of the Hastings Utility Superintendent. The utility billing address will establish the permitted odd or even day for sprinkling for homeowners associations with both odd and even residences.

Appendix 8: Graph showing annual per capita water demand for each customer category during the last ten-years



City of Hastings
Average Per Capita Water Demand by User Category
2005-2015
Gallons Per Capita/Day
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
120.7
131.9
129.9
127.1
122.5
106.4
107.0
124.0
113.8
109.2
103.1
84.6
92.9
89.0
88.8
85.6
70.4
76.7
95.0
77.0
64.2
65.4
23.4
34.9
24.4
23.2
21.9
31.4
18.8
13.7
20.5
18.5
15.9
Residential Water Demand
Commercial/Industrial/Institutional Water Demand
Total Demand

Appendix 9: Water Rate Structure

City of Hastings Ordinances, Chapter 34.03 – Amended by Hastings City Council on May 15, 2017

Water Rates (effective for July 2017 quarterly billing)	
Base Charges	
5/8" & ¾" Meters	$15.09
1.0" Meter	$37.71
1.25" & 1.5" Meters	$75.43
2.0" Meter	$120.68
3.0" Meter	$226.28
4.0" Meter	$490.26
6.0" Meter	$1,055.95
Irrigation Base Charges	
5/8" & ¾" Meter	$30.18
1.0" Meter	$75.42
1.25" & 1.5" Meter	$150.86
2.0" Meter	$241.36
3.0" Meter	$452.56
4.0" Meter	$980.52
6.0" Meter	$2111.90
Water Consumption (applies year round)	
Residential Users	
0 – 15,999 gallons	$.91/1,000 gallons
16,000 – 30,999 gallons	$1.18/1,000 gallons
31,000 – 60,999 gallons	$1.89/1,000 gallons
61,000 gallons and above	$3.59/1,000 gallons
Other Users	
0 – 15,999 gallons	$.91/1,000 gallons
16,000 – 75,999 gallons	$1.18/1,000 gallons
76,000 – 200,999 gallons	$1.89/1,000 gallons
201,000 gallons and above	$3.59/1,000 gallons

Appendix 10: Adopted or proposed regulations to reduce demand or improve water efficiency

The City of Hastings has adopted the following regulations to improve water efficiency and promote a reduction in demand:

City Ordinances, Chapter 150.01 A, and 154.01, Part B.21– Adoption of MN State Building and Plumbing Codes:

(A) *Building Code.* The 2015 Minnesota State Building Code, established pursuant to Chapter 326B as they may be amended from time to time, 1 copy of which is on file in the office of the City Clerk, is hereby adopted as the building code for the City of Hastings. The code is hereby incorporated in this chapter as completely as if set out in full.
(B) *Administration required.* The following chapters of the 2015 Minnesota State Building Code are adopted without change by the City of Hastings:

(1) 1300 - Minnesota State Building Code;
(2) 1301 - Building Official Certification;
(3) 1302 - Construction Approvals;
(4) 1303 - Minnesota Provisions of the State Building Code;
(5) 1303 - Window Fall Prevention Provisions;
(6) 1305- Adoption of the 2000 International Building Code;
(7) 1307 – Elevators and Related Devices;
(8) 1309 - Adoption of 2012 International Residential Code;
(9) 1311 - Adoption of the 2012 International Existing Building Code and Amendments
(10) 1315 - Adoption of the 2014 National Electrical Code;
(11) 1322 - Residential Energy Code; -2012 International Energy Conservation Code;
(12) 1323 - Commercial Energy Code - 2012 International Energy Conservation Code;
(13) 1325 - Solar Energy Systems;
(14) 1335 - Flood proofing Regulations;
(15) 1341 - Minnesota Accessibility Code;
(16) 1346 - Adoption of the 2012 International Mechanical and Fuel Gas Code;
(17) 1350 - Manufactured Homes;
(18) 1360 - Prefabricated Buildings;
(19) 1361 - Industrialized/Modular Buildings;
(20) 1370 - Storm Shelters (Manufactured Home Parks);
(21) 4715 - Minnesota Plumbing Code; and
(22) International Building Code Appendix J (Grading).

City Ordinances, Chapter 150.11 – Adoption of Irrigation System Ordinance, including reference to requirement for operable rain sensors:

(A) *Permit required.* An irrigation permit issued by the Building Department is required prior to the installation of all turf and landscaping irrigation systems. The Building Department will conduct an inspection to review the proper installation of a backflow prevention device in accordance with Minnesota Health Department standards, and the installation of a rain sensor device in accordance with M.S. § 103G.298, as it may be amended from time to time.
(B) *Permit fee.* The irrigation permit fee shall be as set by resolution adopted by the City Council.
(C) *Installation standards.* All new and existing outdoor meter installations are required to be sheltered by a protective box that meets the standards established by the Public Works Department and adopted by the City Council. All irrigation system installations within the public right-of-way

shall be installed as outlined in the Public Works Department irrigation installation guidelines. All property owners are solely responsible for repairing, replacing, or relocating irrigation system installations as needed within the public right-of-way. (Ord. 545, passed 3-6-2006) Penalty, see § 10.99

City Ordinance, Chapter 154.06F – Subdivision regulation requirements for tree planting in new development and redevelopment projects:

(F) *Tree plantings.*

(1) *Tree requirements.* A street/boulevard tree shall be required for every 50 linear feet of street frontage in a subdivision. One front yard tree shall also be required for every lot in the subdivision. The subdivider shall submit a tree plan indicating the location and species of trees. Only those varieties of trees approved by the City Forester will be used. The minimum size shall measure 1 and 1/2 inches in diameter at ground line. No trees shall be planted within 30 feet of the intersection of curb lines on corner lots.

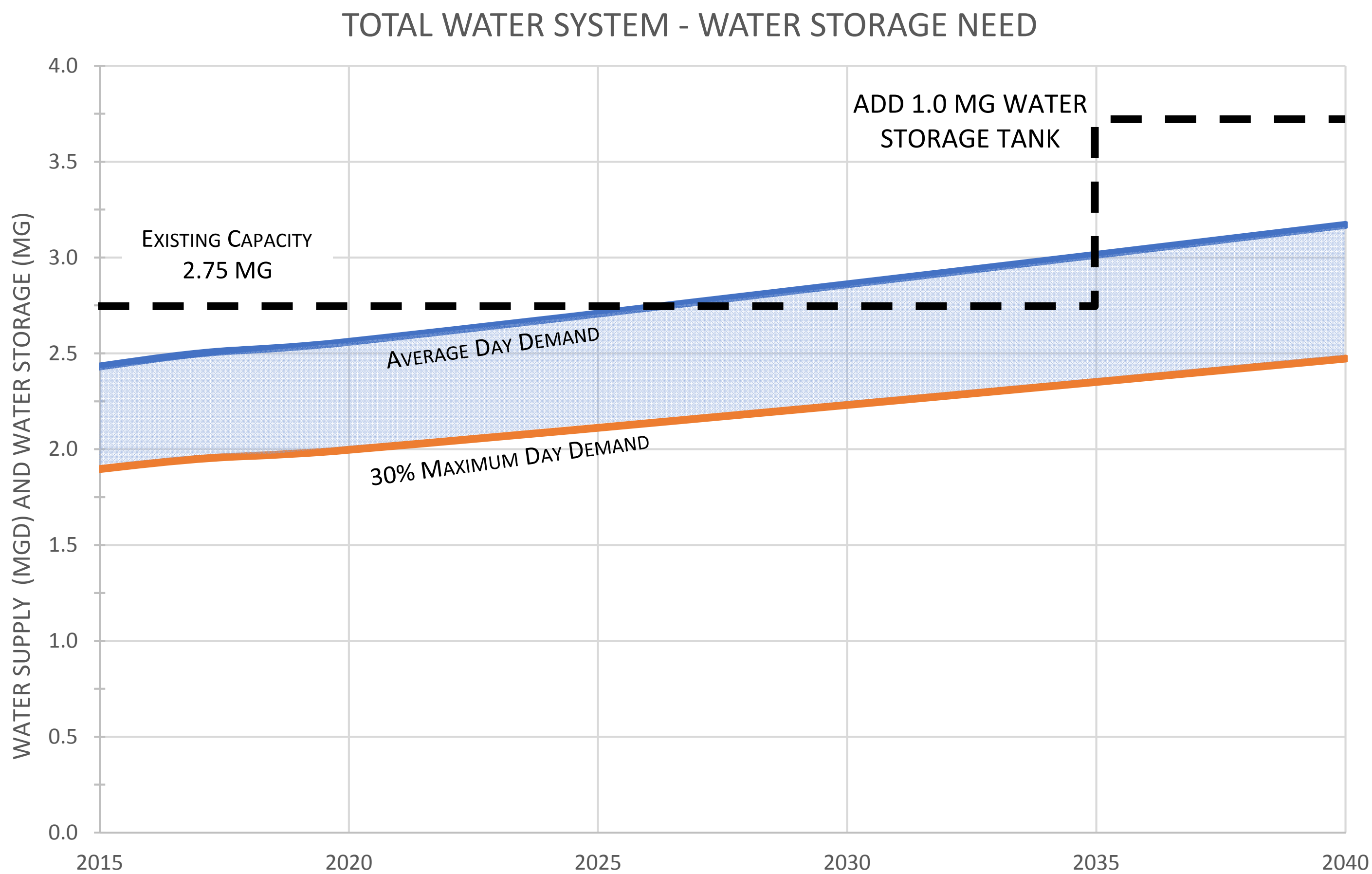
(2) *Time of tree planting.* The front yard tree and boulevard trees as identified on the approved tree plan shall be planted prior to a residence receiving a certificate of occupancy. If it is not practical to plant trees because of inclement weather, the builder or owner shall provide a cash escrow, bond, or letter of credit in the amount of 125% of the estimated cost of the tree(s) and installation.

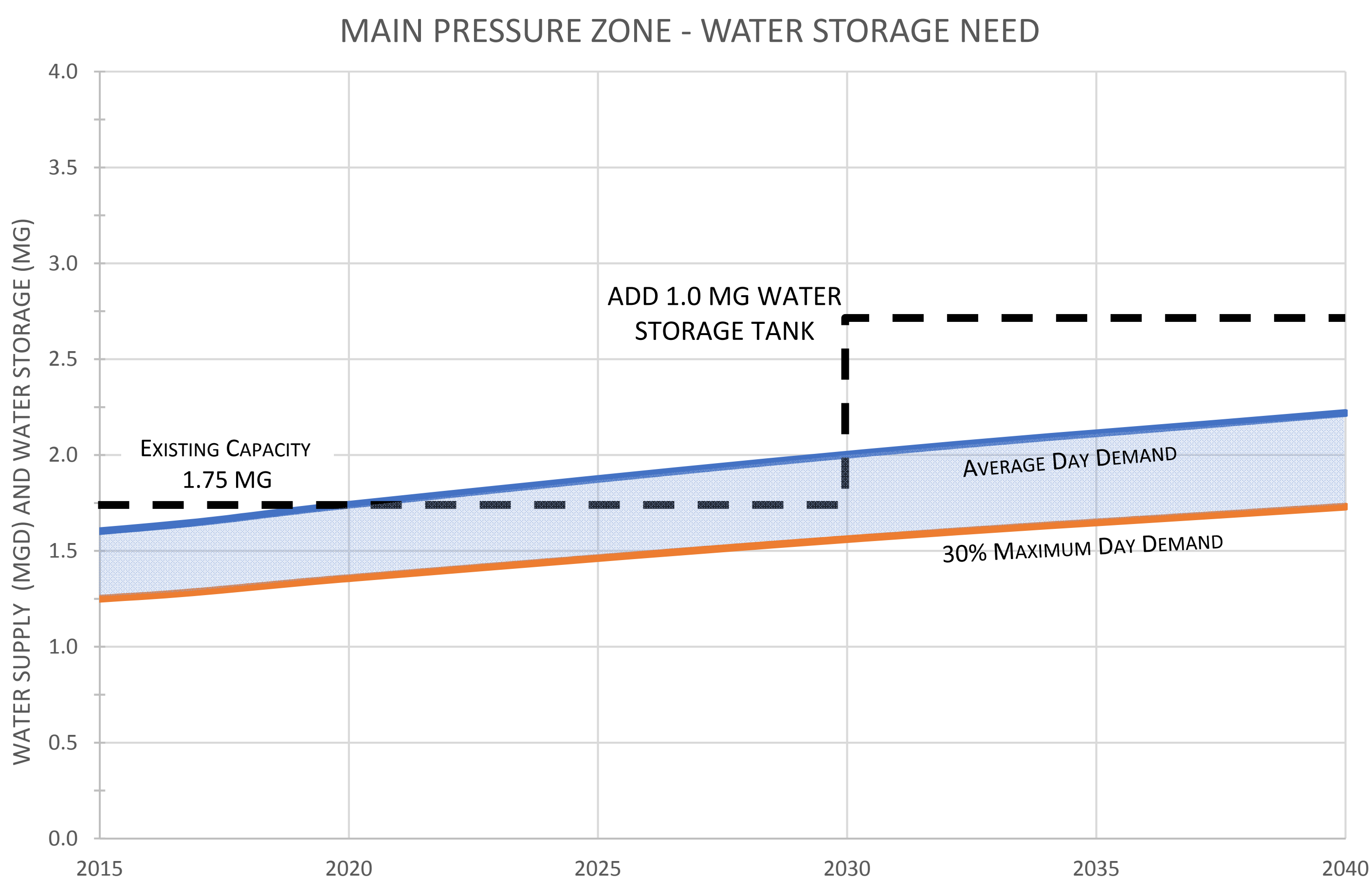
(3) *Front yard trees.* The front yard trees shall be planted on private property 5 to 15 feet inside the property line and not in the utility and drainage easement, side strip or boulevard. No trees shall be planted within 30 feet of the intersection of curb lines on corner lots.

Appendix 11: Implementation Checklist – summary of all the actions that a community is doing, or proposes to do, including estimated implementation dates

Water Conservation Action	Implementation Date
Metering	Currently in effect, with ongoing replacement of all meters through mid-2020's.
Fixed Base Meter Data Acquisition & Real-time usage interface	At end of meter replacement program – mid-2020's.
Leak Detection (bi-annual)	2017
Conservation Rate Structure	Currently in effect with seasonal escalator rate for water use beyond winter quarter. City is presently conducting a rate study and considering transition to a tiered rate structure.
Odd/Even Irrigation Ban	Currently in effect.
Lawn Irrigation System Ordinance	Currently in effect.
Irrigation Ban During Peak Hours	Consideration by 2025.
Enhance Ordinance requirements to promote efficient water use in new development projects.	Future consideration.
Conservation-focused multimedia outreach and public service announcements	Currently in effect, with consideration for enhancements ongoing.
Voluntary Water Audits	Consideration by 2025.
Use data and comparison information in water bills	Consideration by mid-2020's in conjunction with fixed base meter reading system.
Study plausibility of stormwater reuse for public property irrigation.	Consideration by 2025.

Appendix B WATER STORAGE TRIGGER CHART


TOTAL WATER SYSTEM - WATER STORAGE NEED
WATER SUPPLY (MGD) AND WATER STORAGE (MG)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2015
2020
2025
2030
2035
2040
ADD 1.0 MG WATER STORAGE TANK
EXISTING CAPACITY 2.75 MG
AVERAGE DAY DEMAND
30% MAXIMUM DAY DEMAND


MAIN PRESSURE ZONE - WATER STORAGE NEED
WATER SUPPLY (MGD) AND WATER STORAGE (MG)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2015
2020
2025
2030
2035
2040
ADD 1.0 MG WATER STORAGE TANK
EXISTING CAPACITY 1.75 MG
AVERAGE DAY DEMAND
30% MAXIMUM DAY DEMAND