Water Utility

Introduction

The City of Apple Valley is committed to delivering safe, clean drinking water to the community in a water system that will meet the needed demand and supply water for fire suppression. The City routinely updates its water supply plan, water rates and capital improvement plan to ensure that the plans are current, relevant and effective to meet the City's needs into the future. The plans serve as guides for construction, operation and maintenance of the municipal water system.

Apple Valley completed a Water Supply and Distribution Plan in October 2002 and a DNR Water Emergency and Conservation Plan in October 2006 (Amended in March 2008), which were reviewed in conjunction with the 2030 Comprehensive Plan.

Metropolitan Council requires that the City submit a Water Supply Plan as part of the 2040 comprehensive plan update. In addition, all public water suppliers in Minnesota that operate a public water distribution system, serve more than 1,000 people and/or all cities in the seven-county metropolitan area, must have a water supply plan approved by the Department of Natural Resources (DNR). To obtain more detail about Apple Valley's existing and future water supply, see the 2018 Minnesota DNR Water Supply Plan, which is included as an Appendix to this Comprehensive Plan.

Water Use

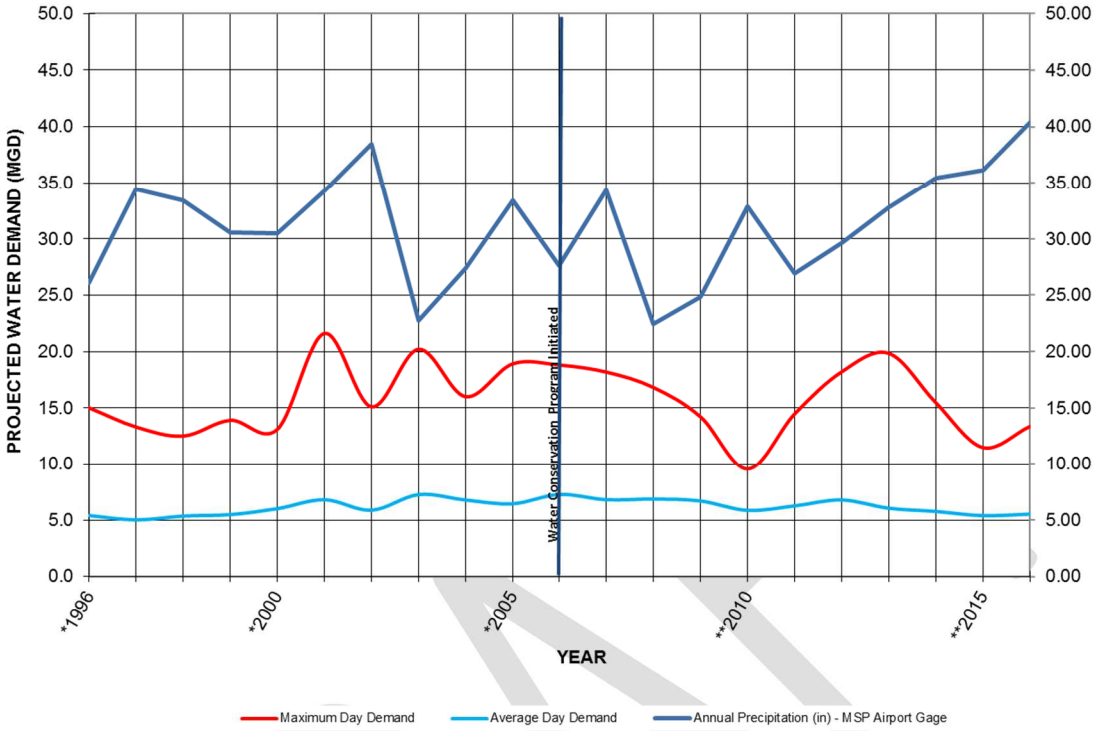
Historical Water Use

Growth has not occurred as rapidly as projected in previous plans such as the Water Emergency and Conservation Plan (2006) or the City's Comprehensive Plan (2009). Previous plans projected the 2016 population served to be 66,641 people and the reported 2016 population served was approximately 50,350 people. However, future growth and increased population and resulting water demand is anticipated, as addressed in a following section.

Water use in Apple Valley from 1996 to 2016 is described in Figure 9.W1. More detailed information is provided in the current and previous DNR Water Supply Plans.

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Figure 9.W1 historical Water Demand 1996 through 2016



Some key water demand factors to note include:

Average Daily Demand: The average daily demand (total annual demand divided by 365) has begun to exhibit a downward trend over the last decade. The past 5-year average is 5.9 MGD, which is a decrease from the 5-year average of 6.6 MGD reported in the 2006 DNR Water Supply Plan.

Maximum Daily Demand: Maximum daily demand over the past decade does not appear to be exhibiting an upward or downward trend. Maximum day demand generally occurs during a summer month when precipitation is at its lowest amount and irrigation is at its highest amount. Annual precipitation data from the Minneapolis-St. Paul Airport can be an indicator, but does not always correlate to maximum day demand.

Peaking Factor: The water demand peaking factor is the ratio of the average maximum day to the average day. The DNR has set a goal of reducing the average 10-year peaking factor to less than 2.6. Apple Valley achieved this goal with a 10-year average peaking factor of 2.5 for 2007-2016. This was improvement over the previous peaking factor from 1996 – 2006, which was 2.8.

Residential Per Capita Water: The DNR has set a goal of reducing the residential per capita water demand to less than 75 gallons per capita per day (gpcd). The City's recent 5-year average equaled this goal of 75 gpcd, which was an improvement over the previous 5-year average of 91 gpcd reported in the 2006 plan.

Total Per Capita Water Demand: Total per capita water demand for Apple Valley has begun to exhibit a downward trend since the adoption of the City's 2006 Water Conservation Plan. Over the last decade, the average total per capita water demand is 122.6 gpcd, which is a decline from the average of 135.8 gpcd reported in the 2006 plan.

Unaccounted (Non-revenue) Loss: Unaccounted for water use is the volume of water withdrawn from all source water minus the volume of water delivered. The 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. The DNR has set a goal of reducing unaccounted for water to less than 10%. Apple Valley's exceeds this goal with a recent 5-year average unaccounted for water of 9.3%. This was an improvement over the previous 5-year average of 12% reported in the 2006 plan.

Large Volume Water Users: The ten largest water users are shown in Table 9.W1. These customers account for approximately 10% of the annual consumption of water.

Table 9.W1 Large Volume Users

Customer	Gallons per Year	% Total Annual Use
Minnesota Zoo	64,686,000	3.53%
Cedar Knolls Mobile Homes	33,086,000	1.81%
Eastview High School Sprinkler A	15,952,000	0.87%
Cobblestone Lake Master Association	15,868,000	0.87%
Kingston Green Apartments	15,581,000	0.85%
Eastview High School Sprinkler B	9,630,000	0.53%
Quarry Point Park Athletic Complex Sprinkler	8,096,000	0.44%
Apple Valley Estates LP	7,030,000	0.38%
Uponor	6,404,000	0.35%
Paradise Car Wash	5,792,000	0.32%

Water Demand Projections

The projected annual water demand through 2040 is summarized in Table 9-W2. The Metropolitan Council provided the projected populations for the years 2020, 2030 and 2040. The population projections for all other years were extrapolated. The difference between the total

population and population served is based on estimates provided in the Metropolitan Council "Thrive MSP 2040" forecast.

Over the last decade, the total per capita water demand has exhibited an average annual reduction of 2.5%. The projected total per capita demand in 2017 is based on the average total per capita demand over the last ten years. This is equal to 122.6 gpcd. The City considered reducing the total per capita demand estimate in the projections, but decided to keep it steady at the 10 year average rate of 122.6 gpcd due to the uncertainty of the water usage requirements of future residential, commercial and industrial land use development.

The projected average day demand is equal to the total per capita per day times the projected population. This is then divided by one million to get the average day demand in MGD.

The maximum day demand is based on the average annual peaking factor over the last ten years, which is 2.5. For each year the average day demand is multiplied by the peaking factor to obtain the maximum day demand in MGD.

Table 9.W2. 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	51,713	50,629	122.6	6.2	15.2
2018	52,975	52,079	122.6	6.4	15.7
2019	54,238	53,530	122.6	6.6	16.1
2020	55,500	54,980	122.6	6.7	16.5
2021	55,870	55,399	122.6	6.8	16.6
2022	56,240	55,818	122.6	6.8	16.8
2023	56,610	56,237	122.6	6.9	16.9
2024	56,980	56,656	122.6	6.9	17.0
2025	57,350	57,075	122.6	7.0	17.2
2030	59,200	59,170	122.6	7.3	17.8
2040	63,600	63,520	122.6	7.8	19.1

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

The 2030 Comprehensive Planning effort projected significantly high water demands due to greater population projections and higher per capita water use projections. The comparison between previous planning effort projections and the current ones are summarized in Table 9.W3.

Table 9.W3. 2030 and 2040 Comprehensive Plan Comparison

Year	Population Served	Average Day Demand (MGD)	Max Day Demand (MGD)
Previous 2030 Projection	71,200	9.70	24.20
Current 2030 Projection	59,170	7.30	17.80
Current 2040 Projection	63,520	7.80	19.10

Existing & Future Water System

The existing and future water system for the City of Apple Valley (Figures 9.W2, 9.W3 and 9.W4) consists of wells, a water treatment plant (WTP), storage facilities, booster station and watermain ranging from 6 inch to 24 inch diameter located in three (3) pressure zones. Each component and its adequacy for the future based on the 2040 population projections and land use map is described in more detail in the following sections.

Water Sources

Groundwater Wells

The City's twenty wells ranging from 487 to 1127 feet deep draw drinking water from the Jordan, Prairie Du Chien - Jordan and Mt. Simon groundwater aquifers (See Table 9.W4 and Figure 9.W4). Five of these wells in the Jordan and Mt. Simon aquifers are available only for emergency use.

Table 9.W4. Water Supply Wells

Well No.	Unique Well No.	Year Installed	Capacity (gpm)	Well Depth (Feet)	Geologic Unit	Status
1	205824	1963	600	520	Jordan	Emergency Only
2	205825	1964	900	530	Jordan	Emergency Only
3	205812	1962	1,000	584	Jordan	Emergency Only
4	205820	1971	1,200	504	Jordan	Active
5	207677	1974	1,300	487	Jordan	Active

Well No.	Unique Well No.	Year Installed	Capacity (gpm)	Well Depth (Feet)	Geologic Unit	Status
6	127263	1976	1,200	507	Jordan	Active
7	127277	1977	1,250	494	Jordan	Active
8	127297	1979	1,300	506	Jordan	Active
9	151561	1981	1,200	515	Jordan	Active
10	151563	1982	1,200	502	Jordan	Active
11	191943	1985	1,400	493	Jordan	Active
12	449257	1989	1,400	494	Jordan	Active
13	433284	1989	1,500	516	Jordan	Active
14	509056	1990	900	1120	Mt. Simon	Emergency Only
15	519955	1993	900	1127	Mt. Simon	Emergency Only
16	205823	2000	1,300	510	Prairie du Chien - Jordan	Inactive
17	603075	2001	1,800	513	Jordan	Active
18	674495	2004	1,800	515	Jordan	Active
19	731113	2006	1,600	510	Jordan	Active
20	778046	2011	1,900	495	Jordan	Active

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The total capacity of Apple Valley's active wells and emergency wells is 24,350 gpm (35 MGD). The firm capacity of the system, which assumes the largest well out of service, is 22,350 gpm (32 MGD). The firm capacity without emergency wells is 18,150 gpm (26 MGD). To meet the needs of the system, firm capacity should equal or exceed the maximum day demand in accordance with AWWA (American Water Works Association) recommendations. The current wells will meet the 2040 projected maximum demand of 19.1 MGD.

The locations for future Wells No. 21, 22, 23 and 24 were selected at the time of the last comprehensive plan in 2006 when greater increase in population and water demand were

expected. As indicated above, these wells are not expected to be needed by 2040. However, they will remain in the City's plan and continue to be evaluated.

Emergency Interconnections

Five Interconnections with adjacent distribution systems have been established (See Table 9.W5) and can be used for emergency and auxiliary water supply.

Table 9.W5 Emergency Interconnections

Other Water Supply System Owner	Capacity (GPM & MGD)
BURNSVILLE – COUNTY RD 11	174 TO 347 GPM, 0.25 TO 0.5 MGD (8-INCH)
ROSEMOUNT – EVERMOOR PARKWAY	347 GPM, 0.5 MGD TO 1.5 MGD (12-INCH)
ROSEMOUNT – DIAMOND PATH	347 GPM, 0.5 MGD (8-INCH)
ROSEMOUNT – DOVE TRAIL	347 GPM, 0.5 MGD (8-INCH)
LAKEVILLE – GRANADA AVENUE	347 GPM, 0.5 MGD (8-INCH)

All five (5) emergency interconnections are subject to water availability. They are utilized only with prior authorization and coordination with the requesting city.

Under emergency conditions, Apple Valley could provide water to the communities of Burnsville, Rosemount, and Lakeville. Water supply capacity will be dependent on available WTP capacity above the current daily water demand during the emergency. When an emergency connection is implemented, it is recommended to monitor pressure upstream at the nearest hydrant to gauge the amount of flow through the connection point to maintain adequate pressure within the distribution system.

Rosemount, Lakeville, and Burnsville are all able to supply water to Apple Valley. To utilize the interconnections, each City would need to evaluate their system needs to ensure adequate water for domestic and fire use.

Water Source Alternatives

Apple Valley's access to surface water is through an emergency connection with the City of Burnsville. The City of Burnsville treats both water from the Kramer Quarry (gravel mining operation) along the Minnesota River in addition to groundwater. A plan for additional surface water treatment has not been completed and is not considered practical.

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Figure 9.W2 Water Distribution System

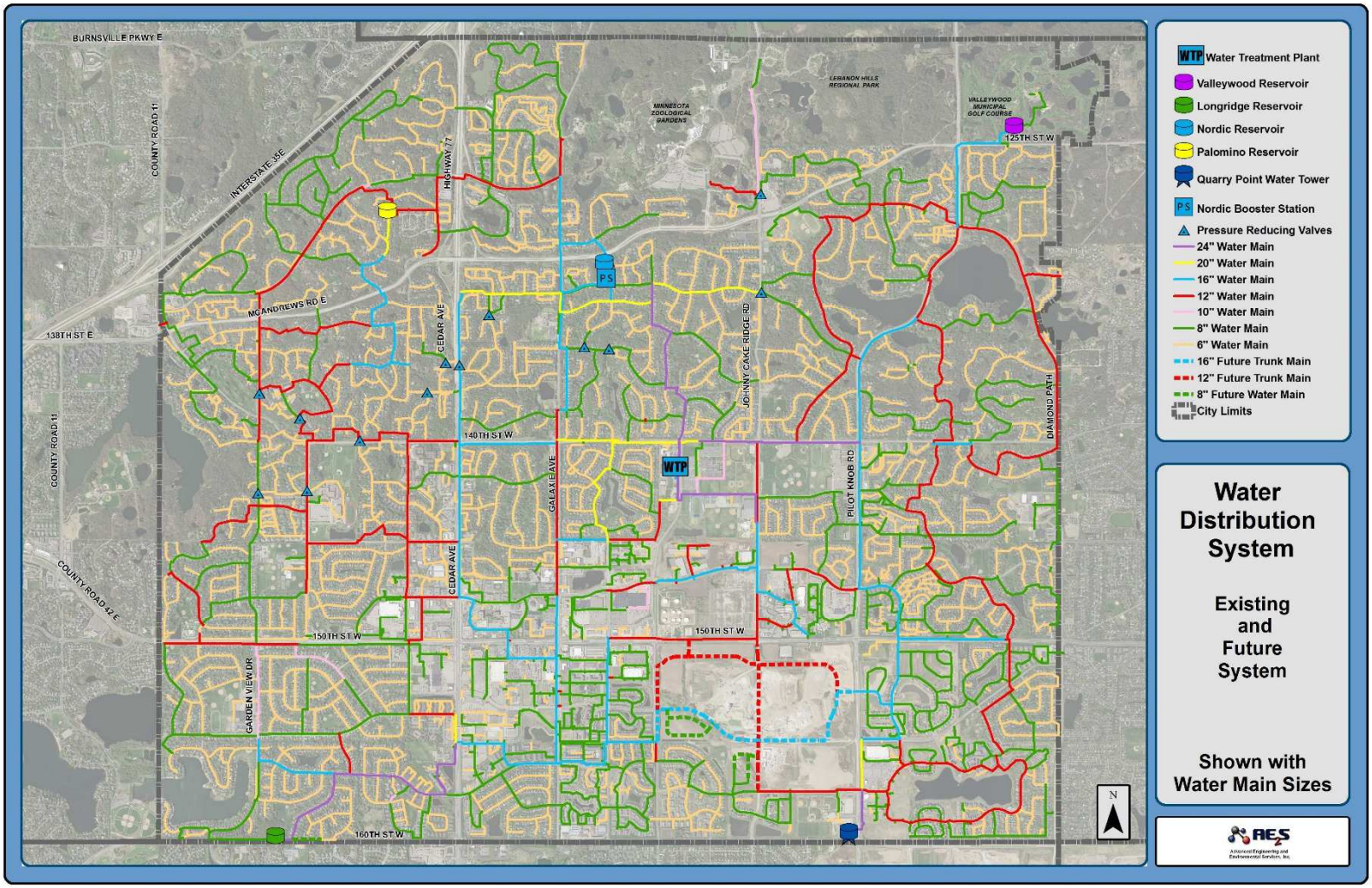


Figure 9.W3 Pressure Zones & Interconnects

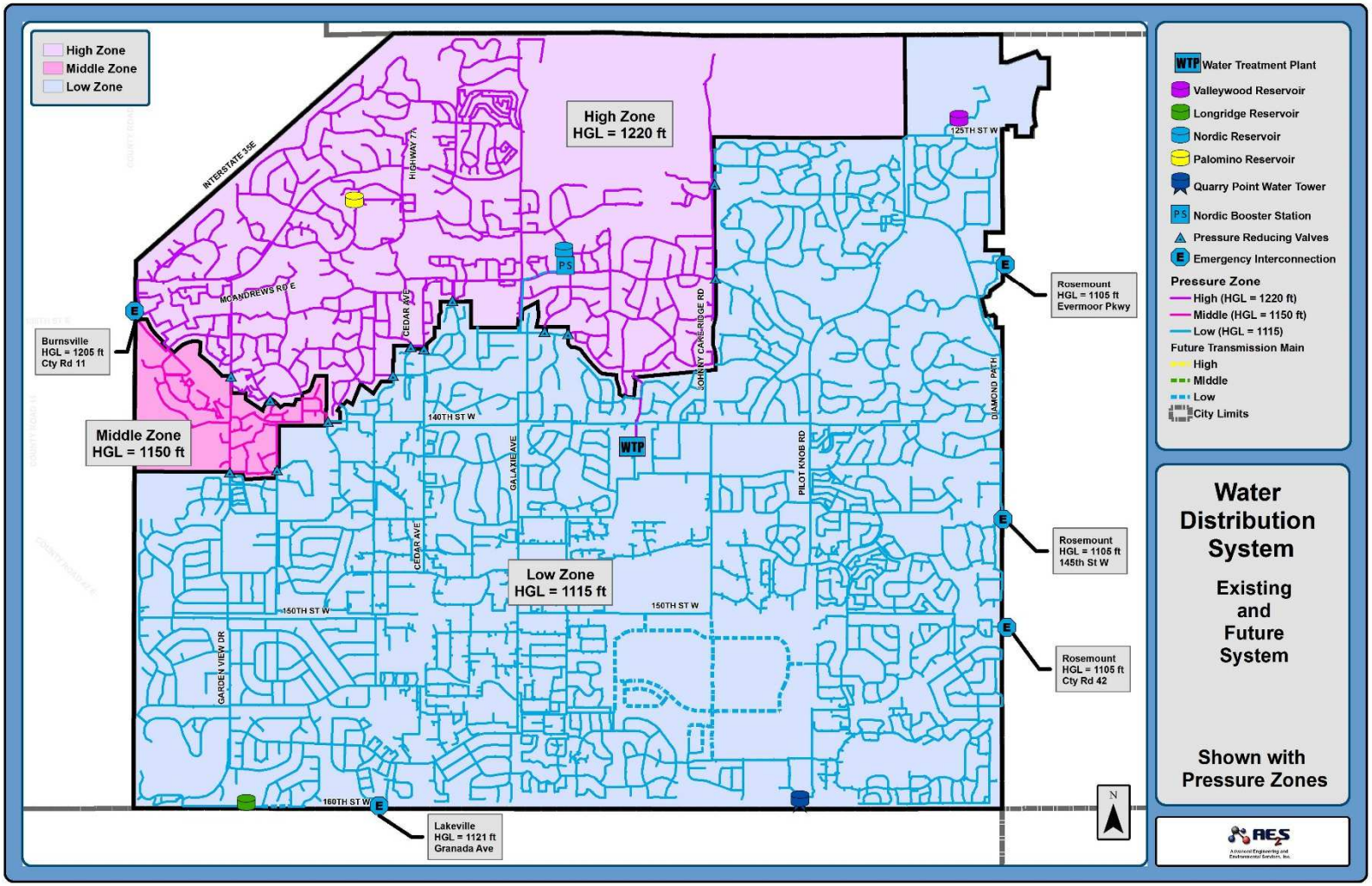
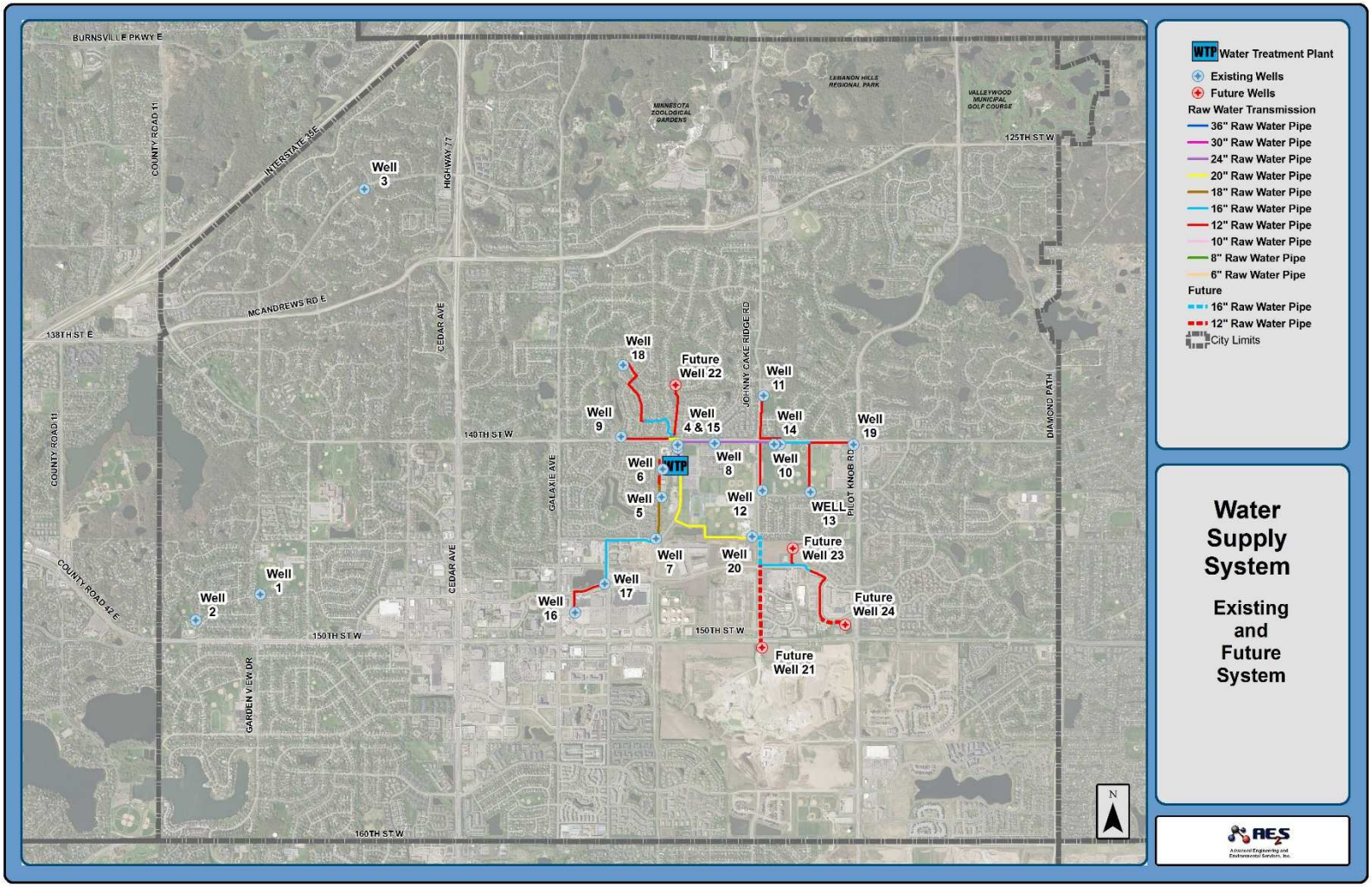


Figure 9.W4 Water Supply Wells



Water Treatment

The water treatment plant (WTP) was originally designed and constructed in 1988 to treat 12 MGD. In 1997, a filter bypass line was added so a portion of the flow could be diverted around the filter cells if usage was expected to exceed the design capacity. The bypass water was blended with the treated water prior to the chemical addition of chlorine and fluoride. By utilizing the bypass and increasing the backwashing frequency, it was possible to produce more than the designed 12 MGD. Under ideal circumstances, a maximum of 19 to 20 MGD was processed at the WTP. To ensure that the filter bypass water did not adversely impact the treated water quality, a maximum 20% bypass capacity was recommended, limiting the total plant capacity to 16.25 MGD.

In 2015, Apple Valley expanded and upgraded the WTP. The expansion added four filter cells and two backwash tanks increasing the total plant capacity to 24.4 MGD. The 24.4 MGD assumes the WTP is functional at 100% capacity with the twelve filter cells and at the recommended 20% bypass capacity.

Currently, 17 of the City's 20 wells feed into the WTP. Water from the wells is initially treated with chlorine and sodium permanganate ($NaMnO_4$). These chemicals are used as oxidants to bring the iron and manganese out of suspension so they can be filtered out in the filter cells. The water then flows through approximately 30 inches of sand media, where the iron and manganese (no longer in suspension) are trapped on top of the media. The filtered water is then treated with chlorine and fluoride prior to flowing to the clearwell for storage until needed. From the clearwell, water flows by gravity to the pumping chamber and is pumped to the distribution system and reservoirs.

Well 16 has been offline since 2013 and is currently listed as inactive status. The water supply can be further augmented by utilizing emergency backup wells (Wells 1, 2 and 3) which pump water directly into the distribution system and are not treated by the WTP. These emergency wells have individual chlorine feed systems. Wells 14 and 15 are also considered emergency backup wells but feed into the WTP. They are both constructed in the Mt. Simon aquifer and the City is restricted from utilizing them to meet water demand.

The projected maximum water demand in 2030 and 2040 is 17.8 MGD and 19.1 MGD respectively. Current treatment capacity without the filter bypass is 18 MGD and 24.4 MGD with the filter bypass limited to 20% of the total plant capacity. Bypassing is initiated at approximately 16 to 17 MGD in anticipation of higher demands. The current water treatment plant is therefore capable of meeting the projected demands. Much of the demand can be met without bypassing the filters. However, during some of the maximum demand days a portion will need to be bypassed.

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Water Storage

Apple Valley stores water in six existing storage structures as summarized in Table 9.W6. Usable storage is defined as the storage available while still maintaining a sufficient residual pressure within the distribution system. For Apple Valley, this is when the storage water level is within 40 feet of the high-water level in the reservoirs or towers. A water storage analysis was conducted to evaluate the ability of the existing storage to meet equalization, fire and emergency storage, which are defined as follows:

Equalization Storage – Capacity to meet peak hour demands while operating at a constant flow.

Fire Storage – Capacity to meet fire demands.

Emergency Storage – Capacity to meet demands during a supply or transmission pipeline outage.

Based on the future water demand projects and an average water demand of 7.8 MGD and maximum day demand of 19.1 MGD needed in 2040, the current storage facilities will continue to meet equalization storage needs, provide adequate fire flow capacity and provide emergency storage.

Table 9.W6 Water Storage

Structure Name	Type of Structure	Storage Capacity (Gallons)	Available/Usable Storage Capacity (Gallons)
Longridge Reservoir	Ground Storage	4,000,000	3,000,000
Palomino Reservoir	Ground Storage	3,300,000	1,320,000
Nordic Reservoir	Ground Storage	2,000,000	1,290,000
Valleywood Reservoir	Ground Storage	2,000,000	1,220,000
Quarry Point Tower	Elevated storage	1,500,000	1,500,000
Water Treatment Plant Clearwell	Other - Clearwell	2,000,000	1,500,000
Total	NA	14,800,000	9,830,000

Distribution System Hydraulic Analysis

The water distribution system consists of watermain ranging in size from 6 inch to 24 inch in diameter (Figure 9.W2) and located throughout the city. The distribution system is divided into three pressure zones (Figure 9.W3) to provide appropriate pressures to residents.

The City's hydraulic model of the distribution system was updated and calibrated in 2017. It is used as a dynamic tool for development and redevelopment planning and used to support policymakers with multi-million dollar decisions to address infrastructure needs. The hydraulic model will be continuously updated and evolve in response to the changes made within the distribution system as well as in response to changes with water system demands.

The performance of a finished water distribution system is judged by its ability to deliver the required flows (customer demands and fire-fighting needs) while maintaining adequate system pressures and water quality. Meeting these requirements, in part, depends on the components within the existing system including transmission and distribution piping, elevated water towers and ground storage reservoirs.

Analysis of pressures throughout the distribution system based on maximum day demand of 19.1 MGD are shown in Figure 9.W5. Ten States Standards recommends water pressures between 35 psi and 80 psi. A majority of the system falls within a desired level of service of 50 to 80 psi. Near pressure zone boundaries, the system could be analyzed to determine the ability to expand the upper pressure zone without exceeding 80 to 100 psi. When pressure exceeds 80 psi a pressure reducing valve is required per the State Plumbing Code.

There are a few small areas were pressures range from 30 to 40 psi near ground storage reservoirs or near the edge of a pressure zone boundary. In areas near ground storage reservoirs, individual in-house boosters would be recommended for areas with limited amount of homes effected by low pressures. In these few areas where the water pressure is lower, the water pressure/psi and flow is adequate for domestic use and fire protection.

Available fire analysis is shown in Figure 9.W6. Overall, the system can provide a minimum of 500 gpm of available fire flow throughout the system. A majority of the water system can provide at least 1,500 gpm or more of available fire flow at a residual pressure of 20 psi. An available fire flow of 1,500 gpm is typically adequate for a majority of facilities within the system. Facilities needing fire flow greater than 1,500 gpm are typically in commercial and industrial land use areas along major street corridors that typically are served by 12-inch and greater water transmission pipelines.

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Figure 9.W5 Future System Static Pressures

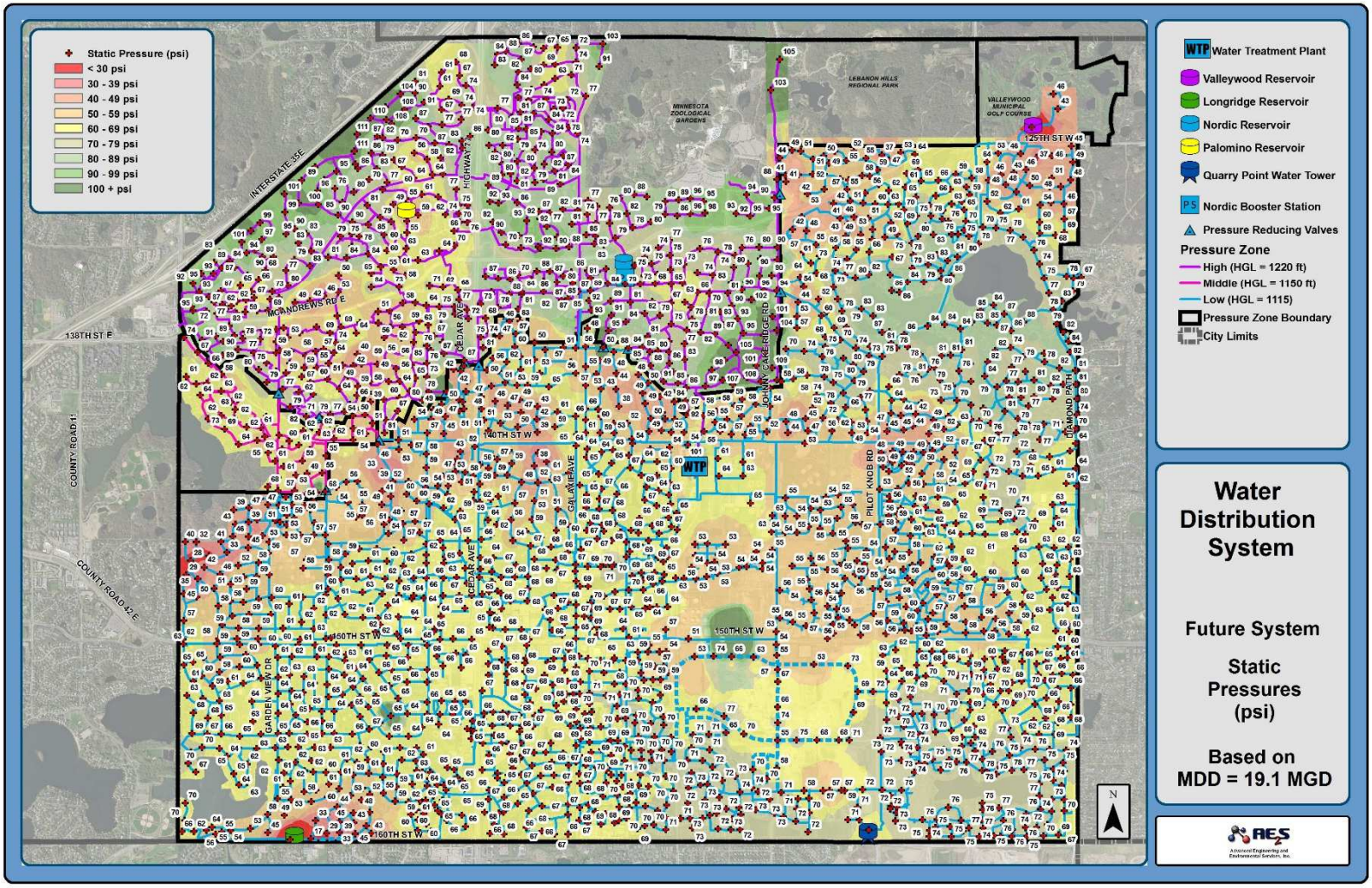
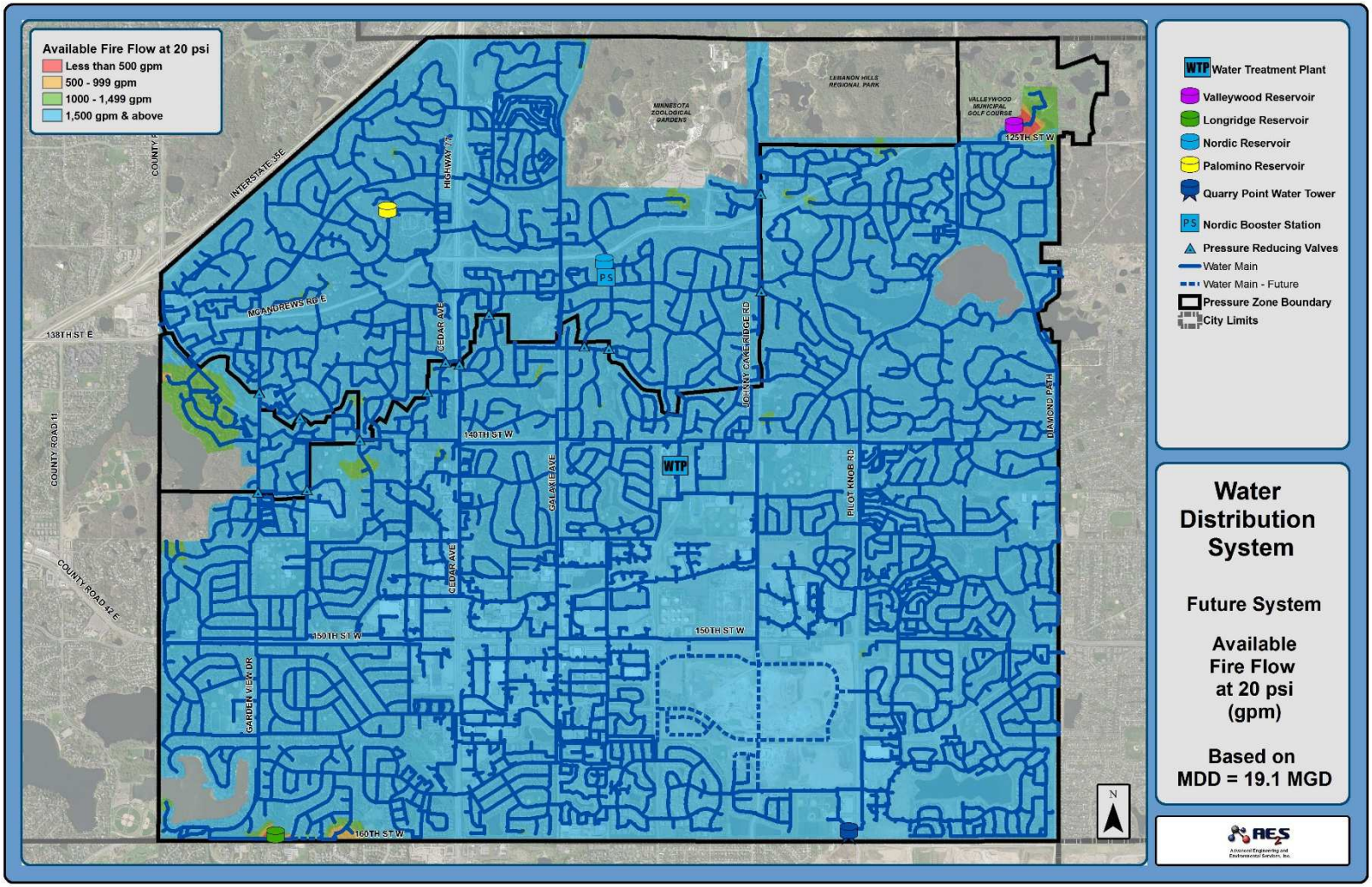


Figure 9.W6 Future System Available Fire Flow



Emergency Response Plan

Water emergencies can occur because 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.

The City has adopted a Federal Emergency Response Plan that was certified in December 2014. In addition, the current City's DNR Water Supply Plan contains water supply protection measures, including, but not limited to, a plan for prioritizing water use, reducing demand and implementing emergency water connections.

Source Water Protection

Wellhead Protection

Wellhead protection is a means to safeguard public supply wells by preventing contaminants from entering the area that contributes water to the well or wellfield over a period of time. In 2004, the City completed a Wellhead Protection Plan (WHPP) in accordance with Minnesota rules, Chapter 4720.5200 and updated their plan in 2009. The area from which water is supplied to the City wells is identified as the Wellhead Protection Area (WHPA). The area around it, which is to be protected and managed, is defined as the Drinking Water Supply Management Area (DWSMA). These areas are delineated in the Plan and were approved by the Minnesota Department of Health on December 16, 2009.

The City's wells are considered susceptible to contamination from activities at the land surface. The plan provides management strategies that the City has developed to address the vulnerability rating of the aquifer and to protect the water supply, including, but not limited to:

- Public education programs on wellhead protection
- Proactive management of existing, unsealed and unused wells
- Proactive management of other potential sources of contamination
- Monitoring of well water levels and possible contaminants

Water Conservation Plan

Recent Conservation Efforts

The City implemented a Water Conservation Plan in 2006 through the DNR Water Emergency and Conservation Plan (Amended in March 2008). The plan addressed both conservation on the supply side (leak detection and repairs, metering), as well as on the demand side (reductions in usage).

Tracking Success

Results of conservation efforts are measured based on the water demand, water losses and peak demand trends. The residential per capita per day values, peaking factor and unaccounted for water values have each shown a downward trend since conservation efforts were implemented in 2006. The residential per capita demand has been reduced from an average of 91 gpcd in 2006 to 75 gpcd currently. The peaking factor has been reduced from an average of 2.8 in 2006 to 2.5 currently. Unaccounted water has been reduced from an average of 12% in 2006 to 9% currently.

Conservation Strategies for the Future

An update Water Conservation Plan is included in the 2018 Minnesota Department of Natural Resources (DNR) Water Supply. (See Appendix to this Comprehensive Plan) The City plans to continue the water conservation techniques employed over the last 10 years and annually evaluate and expand them as appropriate. A meter replacement program is currently underway and it is anticipated that all meters will be replaced by 2020. The City employs conservation billing strategies for water and rates are evaluated annually.

Capital Improvement Plan & Preventative Maintenance

The City is committed to capital reinvestment of the Water Utility to achieve the goals and policies set forth and maintain the long-term sustainability of the Utility. A Capital Improvement Plan (CIP) is in place to cover expansion (if needed), repair and maintenance of the water system and is updated annually.

As discussed in this plan, the capacity of current wells, water treatment plant and storage facilities meet the future demands based on the 2040 population projections and land use map. If significant changes were to occur, such as the addition of a large water user, the water plan and resulting CIP would need to be updated.

The current water treatment plant is meeting all state and federal government regulations related to water quality. Although not anticipated, the future planning efforts and CIPs would also need to be adjusted if a currently unregulated water constituent becomes regulated,, existing regulations become more stringent, source water contamination or substance(s) identified. .

Future CIP projects will explore and identify ways to improve the water system, such as investigating lower pressure areas and evaluating the benefit of increasing watermain size during reconstruction projects.

Preventative maintenance is extremely important in the life of a water supply and distribution system. Preventative maintenance is scheduled as follows:

- Production wells pulled every 7 years.
- Water treatment plant (WTP) high service pumps pulled every 8 years.
- Leak detection one-third of the water system plus on cast iron pipe, PVC, overlay areas, etc. - annual inspections.

- Valve operation program - scheduled as time permits.
- Hydrant flushing and inspection program - semi- annual program spring and fall
- Reservoir maintenance: warranty inspection at 2 years, touch up repairs at 10 to 12 years, total reconditioning at 20 to 25 years. Cathodic protection at selected sites - annual check.
- Valve, meter, equipment, etc. upgrades and replacements are budgeted and scheduled as necessary.

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